DCN 1011

ARMED FORCES RADIOBIOLOGY RESEARCH INSTITUTE
8901 WISCONSIN AVENUE
BETHESDA, MARYLAND 20889-5603

94-09-08 17:22 RCVD

8 September 1994

MEMORANDUM FOR DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING
THROUGH PRESIDENT, UNIFORMED SERVICES UNIVERSITY
OF THE HEALTH SCIENCES

SUBJECT: 1995 Base Realignment and Closure (BRAC) Laboratories Data Call

In response to your memo of 1 September 94, our response to question 2.1 did not include military workyears for FY93. Military workyears were not recorded since the remainder of the chart dealt with our appropriated funding which does not include military personnel. The 221 workyears shown in our response to question 3.3.1.1. includes both military and civilian workyears. Responses to question 2.1 have been increased to reflect both military and civilian workyears in FY86 - FY97. A revised page is attached.

Our reply to question 2.2 will change to the following: 297 (FY87) - 147 (FY97) = 150. All other information remains as stated in our original submission of 30 June 1994.

ROBERT L. BUMGARNER
CAPTAIN, MC, USN
Director

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ARMED FORCES RADIOBIOLOGY RESEARCH INSTITUTE (AFRRI)

Inventory:

1 page for certifications
1 page for cover sheet
10 pages for Questions 2.1 through 3.5.3
9 pages for Journal Articles
4 pages for pictures

94-08-31 12:39 RCVD

AFRRI BRAC DATA CERTIFICATION

I certify that, to the best of my knowledge, the data attached on the report dated 30 June 1994 are complete and accurate.

Robert L. Bumgarner MD

Robert L. Bumgarner
Captain, MC, USN
Director
Armed Forces Radiobiology
Research Institute

17 Aug 94
Date

I certify that, to the best of my knowledge, the data attached on the report dated 30 June 1994 are complete and accurate.

James A. Zimble, M.D.
President
Uniformed Services of The
Health Sciences

18 Aug 94
Date

I certify that, to the best of my knowledge, the data attached on the report dated 30 June 1994 are complete and accurate.

Edward D. Martin /for

Stephen C. Joseph, M.D., M.P.H.
Assistant Secretary of Defense for
Health Affairs

29 Aug 94
Date

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ARMED FORCES RADIOBIOLOGY RESEARCH INSTITUTE
8901 WISCONSIN AVENUE
BETHESDA, MARYLAND 20889-5603

30 June 1994

MEMORANDUM FOR DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING
THROUGH PRESIDENT, UNIFORMED SERVICES UNIVERSITY
OF THE HEALTH SCIENCES

SUBJECT: 1995 Base Realignment and Closure(BRAC) Laboratories
Joint Cross-Service Group Guidance Package

Attached is the completed questionnaire from the Armed Forces Radiobiology Research Institute(AFRRI). My point of contact on this package is Col John R. Sheehan, 301-295-0438.

ROBERT L. BUMGARNER
Captain, MC, USN
Director

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SECTION II: CAPACITY OF DOD COMPONENTS

2.1 Workload.

Information Required	Fiscal Years											
	86	87	88	89	90	91	92	93	94	95	96	97
Total Funds Programmed ($M)	14.5	15.9	15.0	15.5	16.2	16.3	18.1	17.5	14.3	13.3	13.1	11.6
Total Actual Funds ($M)	14.5	15.9	15.0	15.5	16.2	16.3	18.1	17.5				
Programmed Workyears	254	269	295	279	300	300	273	262	209	187	177	147
Actual Workyears	266	297	290	241	262	256	266	221				

* Total funds programmed and total actual funds include both direct and reimbursable funding.

2.2 Excess "Lab" Capacity -- Measured at the DOD Component Level

297 (FY 87) - 147 (FY 97) = 150

3.0 Mission: Human Systems (Ionizing Radiation)
- Elucidation/Diagnosis of Bioeffects

  • • Determine the mechanisms of radiation damage that will serve as the starting point for our efforts to assess, prevent and treat the acute (lethality, performance degradation) and long-term (cancer and hereditary) effects of ionizing radiation.

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SECTION II: CAPACITY OF DOD COMPONENTS

2.1 Workload.

Replaced by Page 1R

Information Required	Fiscal Years											
	86	87	88	89	90	91	92	93	94	95	96	97
Total Funds Programmed ($M)	14.5	15.9	15.0	15.5	16.2	16.3	18.1	17.5	14.3	13.3	13.1	11.6
Total Actual Funds ($M)	14.5	15.9	15.0	15.5	16.2	16.3	18.1	17.5				
Programmed Workyears	159	174	203	193	214	214	195	186	146	119	109	79
Actual Workyears	171	208	206	174	173	167	181	159				

* Total funds programmed and total actual funds include both direct and reimbursable funding.

2.2 Excess "Lab" Capacity -- Measured at the DOD Component Level

208 (FY 87) - 79 (FY 97) = 129

3.0 Mission: Human Systems (Ionizing Radiation)

- Elucidation/Diagnosis of Bioeffects

  • • Determine the mechanisms of radiation damage that will serve as the starting point for our efforts to assess, prevent and treat the acute (lethality, performance degradation) and long-term (cancer and hereditary) effects of ionizing radiation.

• • Examine the synergistic interactions between ionizing radiation and: 1) other battlefield toxins (e.g. biological/chemical weapons), and b) the treatment or prophylactic counter measures employed against these toxins.

• • Determine the impact of radiation type, method of exposure, dose rate and total dose on acute and long-term health effects. This research is targeted at the risks of: a) environmental exposures, and b) the exposure anticipated from military operations in fallout fields from a nuclear weapon's detonation or from reactor accidents.

- Radioprotective Drugs

• • Develop and test treatment strategies that can be used to harden the soldier by mitigating the acute (lethality and performance) and long-term affects (cancer and hereditary) of ionizing radiation prior to exposure.

• • The approaches initiated are based upon the mechanistic work accomplished above in Elucidation/Diagnosis of Bioeffects. The total "hardening" provided is tested both with and without post exposure treatment strategies.

- Risk Assessment

• • Perform experimental and theoretical research required to determine the risks (acute and long-term) of chronic and acute exposures to militarily relevant types of ionizing radiation.

• • Determine the health risks associated with militarily relevant sources of internal radiation (e.g. embedded depleted uranium fragments, internalized isotopes from fallout fields).

• • Develop definitive strategies for extrapolating animal data to man. These strategies will allow the extrapolation of available data to a wide range of relevant exposure scenarios and radiation types. This effort is based upon the experimental work done in each of the other JTCG sub elements.

• • Assess the feasibility of using ionizing radiation to neutralize biological and chemical weapons.

• • Develop biological dose-assessment methodologies that will allow the rapid determination of individual radiation exposure and an accurate assessment of the level of injury.

- Disaster Management

• • Provide emergency response teams that will deploy to the

sites of nuclear weapons accidents or other radiation incidents to provide medical and environmental restoration assistance.

• • Provide training to DOD, other federal, and NATO, personnel on the medical effects, casualty treatment, and emergency team procedures required to respond to radiation incidents.

• • Serve as experts on U.S. and NATO working groups dealing with assessment, treatment prophylaxis and protection standards for ionizing radiation.

• • Provide medical and health physics expertise for the Defense Nuclear Agency's and the Department of State's efforts to assist Former Soviet Union Nations in developing U.S.-comparable nuclear-reactor safety programs.

- Casualty Care

• • Evaluate the biological effects of ionizing radiation on those organ systems key to the survival of the soldier. This effort focuses on the hemopoietic and gastrointestinal systems and examines the effect of those radiation types, dose rates, and total doses anticipated on the battlefield or at the scene of a radiation emergency.

• • Determine treatment protocols for the types of combined injury anticipated on the battlefield. This includes radiation combined with trauma (burns and wounds), and chemical or biological stressors.

• • Treatment strategies are developed based upon Elucidation/Diagnosis of Bioeffects and include the administration of prophylaxis. Their impact on performance is considered in the evaluation of the treatments developed.

- Performance Management

• • Determine the effect of radiation exposure on individual and crew performance as a function of the type of radiation, radiation dose rate, and the time after exposure. This research will be extended from the acute exposures applicable to a weapons's detonation to the chronic exposures that are anticipated in fallout fields and in reactor accidents.

• • Evaluate the performance degrading effects of prophylactic compounds used to mitigate the effects of ionizing radiation.

• • Develop methodologies (e.g. training, pharmacologic) to mitigate the performance degrading effects of ionizing radiation.

3.1.1 Geographic/Climatological Features

There are no geographic or climatological features which are required. The features which enhance our mission capability include:

• All nuclear sources (reactor, cobalt and linear accelerator) are co-located in one facility in Bethesda, MD.

• Easy access to transportation hubs for national and international travel. This facilitates routine and emergency response team travel.

• Located in a major metropolitan area which provides ready access to the support services (supply, maintenance, other support) required for efficient mission accomplishment.

• Located in an area with several major universities and scientific institutions which provide a ready pool of qualified scientists and technicians for the work at AFRRI. We have easy access to their libraries and information retrieval systems.

3.1.2 Licenses & Permits

Nuclear Regulatory Commission (NRC) Licenses. All of these licenses are mission essential and without them, militarily relevant radiobiological research cannot be conducted. The specific licenses at AFRRI include:

• NRC License R-84. This license is required to operate AFRRI's TRIGA Mark-F nuclear reactor. The reactor is used as a source of neutron and mixed-field neutron and gamma radiation required to study militarily relevant radiobiological endpoints.

• NRC License 19-0833-02 Byproduct Materials, Board Scope License. This allows the receipt, use, generation, and disposal of radioactive materials used in our studies or generated by experiments conducted in the TRIGA reactor. This license also allows the use of a low dose rate neutron and gamma sources for instrumentation calibration, experimentation, and physics measurements in support of experimentation.

• NRC License 19-0833-03 Byproduct Materials Cobalt Irradiation. This allows the use of our high dose/high dose rate gamma irradiation facility used in the irradiation of a wide variety of model systems ranging from cells to non-human primates.

• Environmental Licenses. Disposal of hazardous material is managed through a support agreement with the National Naval Medical Center.

3.1.3 Environmental Constraints

Environmental constraints currently in force do not limit the scope of operation at AFRRI. The primary environmental constraint is the limitation on the amount of radioactive material that can be released into the air or into the sanitary sewage. To date, these restraints have not limited the experimentation at AFRRI.

3.1.4 Special Support Infrastructure

AFRRI has developed a robust infrastructure internally and with our surrounding community to support our radiobiology research mission. Specific items include:

- We have a radiation safety program that has been in existence since 1960 to monitor the safety of our use of radioisotopes and our radiation sources. The program is well resourced with the personnel, the equipment and, most importantly, the experience required to implement the AFRRI's diverse program.

- A personnel dosimetry program is in place to provide complete estimates of the internal and external exposures received by personnel at AFRRI.

- An environmental monitoring program in place monitors the impact on the environment.

- A modern radioisotope measurement laboratory is in place along with the capability to perform the required checks and calibration of radiation safety equipment.

3.1.5 Proximity To Mission-Related Organization

Common Support Functions	Name	Type of Organization	Distance (MI)	Workyears Performed by Your Activity	Workyears Funded by Your Activity
Human Systems	NIH	GOV	.5	2	2
"	USUHS	DOD	.1	1	1
"	WRAIR	DOD	2	0.5	0.5
"	DNA	DOD	30	0	6
"	NRL	DOD	20	3	0

• The National Institutes of Health (NIH). Specific areas of close collaboration include cancer induction, genetic instability, radioimmunoassay techniques, molecular biology, and physiology. A loss of proximity with NIH would complicate interactions between scientists and probably require more equipment purchases and/or termination of several projects.

• The Uniformed Services University of the Health Sciences (USUHS). Both AFRRI and USUHS routinely utilize unique facilities of the other organization and perform many scientific collaborations. Loss of proximity to USUHS would seriously curtail our progress in research areas related to testing of prophylactic drugs and toxicology.

• Walter Reed Army Institute of Research (WRAIR). A study of the role of heat shock proteins in the cellular response to radiation and a project that has demonstrated chemical protection of mammalian cells from nitrogen mustards have advanced because of the sharing of equipment and expertise available only at one institute or the other. A loss of proximity would complicate the interactions of investigators and significantly retard progress.

• Defense Nuclear Agency (DNA). AFRRI provides research support to DNA on counterproliferation activities and technical support for many other issues such as the DoD Radiation Experiments Command Center and occupational safety and health consultation. Lack of proximity to DNA would decrease our ability to provide immediate response to emergent requirements.

• Naval Research Laboratories (NRL). State of the art equipment available at the EPR facility at AFRRI has enabled scientists at NRL to complete their missions on low-temperature effects of compounds and trapping of free radicals. Alternately, ENDOR equipment at the NRL has enabled AFRRI scientists to analyze data giving a complete packet of research at the molecular level for scientific publication. Further, an active collaboration exists between NRL's Condensed Matter and Radiation Science Division and the AFRRI's Risk Assessment Program involving characterization of radiation quality effects. The effect of not having NRL nearby to AFRRI would be elimination of much of this fruitful interaction.

3.2 Personnel:

3.2.1 Total Personnel

Types of personnel	Number of Personnel			
	Government		On-Site FFRDC	On-Site SETA
	Civilian	Military	0	
Technical	67	28	0	0
Management (Supv)	31	11	0	0
Other	51	33	0	0

3.2.2 Education

Type of Degree/ Diploma	Number of Government Personnel by Type of Position		
	Technical	Management (Supv)	Other
High School or Less	15	6	48
Associates	0	0	10
Bachelor	28	2	17
Masters	12	11	7
Doctorate (include Med/Vet/etc.)	40	23	2

3.2.3 Experience

Type of Position	Years of Government and/or Military Service				
	Less than 3 years	3-10 years	11-15 years	16-20 years	More than 20 years
Technical	9	41	11	15	19
Management (Supv)	0	10	8	10	14
Total	9	51	19	25	33

3.2.4 Accomplishments During FY91-93

3.2.4.1 Patents Awarded

CSF	Disclosures	Awarded	Patent Titles (List)
Human Systems	0	0	0
(Ionizing Radiation)			
Total			

3.2.4.2 Number of Published Papers

CSF	Number Published	Paper Titles (List)
Human Systems	FY91 50	SEE ATCH LIST
(Ionizing Radiation)	FY92 43	"
	FY93 25	"
TOTAL	118	

3.3 Workload

3.3.1 FY93 Workload

3.3.1.1 Work Year and Lifecycle

"LAB"	Fiscal Year 1993 Actual			
	Civilian	Military	FFRDC	SETA
Science & Technology	149	72	0	0
Engineering Development	0	0	0	0
In-Service Engineering	0	0	0	0

3.3.1.2 Engineering Development By ACAT: N/A

3.3.1.3 In-Service Engineering: N/A

3.3.2 Projected Funding

3.3.2.1. Direct Funding

Human Systems (Ionizing Radiation)	13.3	12.1	11.6	10.1

974/50400.1103

3.3.2.2. Other Obligation Authority

CSF	FY94	FY95	FY96	FY97
Human Systems (Ionizing Radiation)	1.0	1.2	1.5	1.5

3.4 Facilities and Equipment

3.4.1 Major Equipment and Facilities (See Attached Photos)

Common Support Function	Major Facility or Equipment Description	Unique To			Replacement Cost ($K)
		DOD	Federal Gov't	U. S.	
Human Systems	Res. Animal Facility	See Note 1			9,700
Human Systems	TRIGA Reactor	See Note 2			16,200
Human Systems	Cobalt 60 Facility	See Note 3			5,800
Human Systems	Linear Electron Accelerator	See Note 4			14,700

Note (1) AFRRI animal facility uses the largest number of animals within DoD and is AAALAC accredited. Capacity is approximately 15,000 animals, from aquatics to primates. It is capable of caring for immunosuppressed animals, and supporting research which uses radioisotopes in animals. It has complete in-house, surgical, radiology & pathology support.

Note (2) The AFRRI TRIGA is only reactor configured for exposure of biological experiments and the only one adjacent to animal holding facilities.

Note (3) The AFRRI Cobalt Facility is the most powerful in DoD and the only one with adjacent animal facilities.

Note (4) The AFRRI LINAC is the most powerful in DoD & the only one with adjacent animal facilities.

3.5 Expansion Potential

3.5.1 Laboratory Facilities

Common Support Function	Facility or Equipment Description	Type of Space*	Space Capacity (KSF)		
			Current	Used	Excess
Human Systems	Laboratories	Technical	61.8	61.8	0
Human Systems	Lab Office	Administrative	34.3	34.3	0
Human Systems	Lab Support	Administrative	24.0	24.0	0

Note: Total does not equal gross S.F. Above figures are net S.F. Balance of space is radiological sources.

3.5.1.1 Capacity to Absorb Additional Workyears.

Due to programmed reduction in the AFRRI operating budget through FY 97, staffing will be reduced by approximately 129 from the maximum personnel that have been historically supported here. No facility modifications would be required to support these additional workyears. Most of these workyears would be absorbed in the performance management and risk assessment programs. The remainder would be spread throughout the institute-including support personnel.

3.5.1.2 Additional workyears that could be supported: 129

3.5.1.3 Impact of military construction programs programmed in the FY95 PBS. There are no projects in FY95 & no impact due to activities described under 3.5.1.1 & 3.5.1.2.

3.5.2 Land Use: 5 acres

3.5.3 Utilities

Utilities are furnished by the host command, NNMC. NNMC advised no capability to provide additional utilities.

AFRRI is fed by two 4/0 cables with a carrying capacity of 290 amps each (5636 KW). Each cable is approximately 32.4% loaded, leaving AFRRI an excess capacity of 392 amps (7618 kw).

ARMED FORCES RADIOBIOLOGY RESEARCH INSTITUTE
8901 WISCONSIN AVENUE
BETHESDA, MARYLAND 20889-5603

16 September 1994

MEMORANDUM FOR LABORATORY WORKING GROUP

SUBJECT: AFRRI Response to Requests For Clarification (RFC)

Attached is the revised input from AFRRI for Question 3.2.4.2. Question 3.3.1.2 does not apply to AFRRI.

JOHN R. SHEEHAN
Colonel, USAF, MSC
Chief of Staff

Attachment:
as stated

AFRRI/ISD

16 September 1994

MEMORANDUM FOR CHIEF OF STAFF

SUBJECT: Revised Input for BRAC Report Submission

The list of "peer reviewed" papers published by the AFRRI staff and distributed as reports for fiscal years 1991 through 1993 has been updated to reflect the month the scientific journal/society had them published. In a few instances, when it was impossible to determine a month, our best estimate is indicated (in brackets).

Common Support Functions	Number Published	Paper Titles
FY 91	50	attached
FY 92	43	attached
FY 93	25	attached
TOTAL	118	

These are titles of research published in scientific journals, taken from our historical and research reports, and do not include technical reports or book chapters. Determining the month of publication is extremely difficult as most journals publish on an irregular schedule and do not list the month of an issue's publication.

WILLIAM K. OWEN
Head, Information Services Department

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Journal Articles

FY91, 50

Arroyo CM, Carmichael AJ. ESR study of electron transfer reactions between γ-irradiated pyrimidines, adriamycin and oxygen. *Free Radical Biology and Medicine* 9:191-197, 1990. **SEP**

Arroyo CM, Carmichael AJ, Bouscarel B, Liang JH, Weglicki WB. Endothelial cells as a source of oxygen-free radicals An ESR study. *Free Radical Research Communications* 9(3-6):287-296, 1990.**JUL**

Fuciarelli AF, Wegher BJ, Blakely WF, Dizdaroglu M. Yields of radiation-induced base products in DNA: Effects of DNA conformation and gassing conditions. *International Journal of Radiation Biology* 58(3):397-415, 1990. **MAR**

Gruber DF, Farese AM. Bone marrow myelopoiesis in rats after 10%, 20%, or 30% thermal injury. *The Journal of Burn Care and Rehabilitation* 10(5):410-417, 1989. **SEP/OCT**

Gruber DF, O'Halloran KP, Farese AM. Aminophylline induced oxidative metabolism in isolated canine polymorphonuclear leukocytes. *Immunopharmacology and Immunotoxicology* 11(2&3):151-163, 1989. **JUN**

Gruber DF, O'Halloran KP, Farese AM. Xanthine oxidase potentiation of reactive oxygen intermediates in isolated canine peripheral neutrophils. *Journal of Biological Response Modifiers* 8:462-467, 1989. **OCT**

Held KD, Mirro J, Melder DC, Blakely WF, Oleinick NL, Chiu S-M. Radiation-induced binding of DNA from irradiated mammalian cells to hydroxyapatite columns. *Radiation Research* 123:268-274, 1990. **SEP**

Landauer MR, Davis HD, Walden TL. Behavioral and physiological effects of leukotriene C_4. *Prostaglandins, Leukotrienes and Essential Fatty Acids* 39:247-252, 1990. **APR**

Maier DM, Landauer MR. Onset of behavioral effects in mice exposed to 10 Gy ^{60}Co radiation. *Aviation, Space, and Environmental Medicine* 61:893-898, 1990. **OCT**

Patchen ML, MacVittie TJ, Solberg BD, Souza LM. Survival enhancement and hemopoietic regeneration following radiation exposure: Therapeutic approach using glucan and granulocyte colony-stimulating factor. *Experimental Hematology* 18:1042-1048, 1990. **OCT**

Brook I, Elliott TB, Ledney GD. Quinolone therapy of *Klebsiella pneumoniae* sepsis following irradiation: Comparison of pefloxacin, ciprofloxacin, and ofloxacin. *Radiation Research* 122:215-217, 1990. **MAY**

Browne D. Biomedical lessons from the Chernobyl Nuclear Power Plant accident. *The Journal of the U.S. Army Medical Department* 9/10:25-29, 1990. **SEP/OCT**

Elliott TB, Madonna GS, Ledney GD, Brook I. Combined therapy for postirradiation infection. *Microecology and Therapy* 19:105-108, 1989. **(DEC)**

Fitz TA, Contois DF, Liu YX, Watt DS, Walden TL Jr. Interaction of leukotriene C_4 and Chinese hamster lung fibroblasts (V79A03 cells) 1. Characterization of binding. *Prostaglandins* 40(4):417-429, 1990. **OCT**

Freschi JE, Livengood DR. Membrane current underlying muscarinic cholinergic excitation of motoneurons in lobster cardiac ganglion. *Journal of Neurophysiology* 62(4):984-995, 1989. **OCT**

Fuchs P, Krolak JM, McClain D, Minton KW. 18 S rRNA degradation is not accompanied by altered rRNA transport at early times following irradiation of HeLa cells. *Radiation Research* 121:67-70, 1990. **JAN**

Gerstenberg HM, Hansen JW, Coyne JJ, Zoetelief J. Calculations of the relative effectiveness of alanine for neutrons with energies up to 17.1 McV. *Radiation Protection Dosimetry* 31(1/4):85-89, 1990. **DEC**

Gruber DF, O'Halloran KP, D'Alesandro MM, Farese AM. Hypermetabolic priming of canine neutrophils by 7-S nerve growth factor. *American Journal of Veterinary Research* 51(6):921-923, 1990. **JUN**

Holobaugh PA, McChesney DC. Effect of anticoagulants and heat on the detection of tumor necrosis factor in murine blood. *Journal of Immunological Methods* 135:95-99, 1990. **OCT**

Holwitt EA, Koda E, Swenberg, CE. Enhancement of topoisomerase I-mediated unwinding of supercoiled DNA by the radioprotector WR-33278. *Radiation Research* 124:107-109, 1990. **OCT**

Jacobus JP, McNaughton JR. Development and testing of a new alpha radiac. *Nuclear Instruments and Methods in Physics Research* A299:162-165, 1990. **DEC**

Kandasamy SB, Howerton TC, Hunt WA. Reductions in calcium uptake induced in rat brain synaptosomes by ionizing radiation. *Radiation Research* 125:158-162, 1991. **FEB**

Madonna GS, Moore MM, Ledney GD, Elliott TB, Brook I. Combined therapy of septicemia with ofloxacin and/or synthetic trehalose dicorynomycolate (S-TDCM) in irradiated and wounded mice. *Microecology and Therapy* 19:135-139, 1989. **(DEC)**

Maier DM, Landauer MR, Davis HD, Walden TL. Effect of electron radiation on aggressive behavior, activity, and hemopoiesis in mice. *Journal of Radiation Research* 30:255-265, 1989. **SEP**

McCarthy KF, Hale ML. Further enrichment and analysis of rat CFU-s. *International Journal of Cell Cloning* 8:184:195, 1990. **MAY/JUN**

McClain DE, Trypus CA, May L. Effect of γ radiation on membrane fluidity of MOLT-4 nuclei. *Radiation Research* 123:263-267, 1990. **SEP**

McKinney LC, Gallin EK. Effect of adherence, cell morphology, and lipopolysaccharide on potassium conductance and passive membrane properties of murine macrophage J774.1 cells. *Journal of Membrane Biology* 116:47-56, 1990. **JUN**

Murphy PM, Gallin EK, Tiffany HL, Malech HL. The formyl peptide chemoattractant receptor is encoded by a 2 kilobase messenger RNA expression in *Xenopus* oocytes. *FEBS Letters* 261(2:353-357, 1990. **FEB**

Pellmar TC, Neel KL, Lee KH. Free radicals mediate peroxidative damage in guinea pig hippocampus in vitro. *Journal of Neuroscience Research* 24:437-444, 1989. **NOV**

Schwartz GN, Patchen ML, Neta R, MacVittie TJ. Radioprotection of mice with interleukin-1: relationship to the number of erythroid and granulocyte-macrophage colony-forming cells. *Radiation Research* 121:220-226, 1990. **FEB**

Brook I, Ledney GD. Oral ofloxacin therapy of *Pseudomonas aeruginosa* sepsis in mice after irradiation. *Antimicrobial Agents and Chemotherapy* 34(7):1387-1389, 1990. **JUL**

Chock SP, Rhee SG, Tang LC, Schmauder-Chock EA. Linking phospholipase A_2 to phospholipid turnover and prostaglandin synthesis in mast cell granules. *European Journal of Biochemistry* 195:707-713, 1991. **FEB**

Cockerham LG, Prell GD, Cerveny TJ, O'Brien M, Hampton JD. Effects of aminoguanidine on pre- and post-irradiation regional cerebral blood flow, systemic blood pressure and plasma histamine levels in the primate. *Agents and Actions* 32(3/4):237-244, 1991. **MAR**

Dubois A, Tarnawski A, Newell DG, Fiala N, Dabros W, Stachura J, Krivan H, Heman-Ackah LM. Gastric injury and invasion of parietal cells by spiral bacteria in rhesus monkeys: Are gastritis and hyperchlorhydria infectious diseases? *Gastroenterology* 100:884-891, 1991. **APR**

Elliott TB, Brook I, Stiefel SM. Quantitative study of wound infection in irradiated mice. *International Journal of Radiation Biology* 58(2):341 350, 1990. **FEB**

Liu YX, Contois DF, Watt DS, Walden TL Jr, Fitz TA. Interaction of leukotriene C_4 and Chinese hamster lung fibroblasts (V79A03 cells) 2. Subcellular distribution of binding and unlikely role of glutathione-S-transferase. *Prostaglandins* 40(4):431-443, 1990. **OCT**

Madonna GS, Ledney GD, Moore MM, Elliott TB, Brook I. Treatment of mice with sepsis following irradiation and trauma with antibiotics and synthetic trehalose dicorynomycolate (S-TDCM). *The Journal of Trauma* 31(3):316-325, 1991. **MAR**

Miller JH, Nelson JM, Ye M, Swenberg CE, Speicher JM, Benham CJ. Negative supercoiling increases the sensitivity of plasmid DNA to single-strand break induction by x-rays. *International Journal of Radiation Biology* 59(4):941-949, 1991. APR

Miller JH, Swenberg CE. Radical yields in DNA exposed to ionizing radiation: Role of energy and charge transfer. *Canadian Journal of Physics* 68:962-966, 1990. **SEP**

Murphy PM, Gallin EK, Tiffany HL. Characterization of human phagocytic cell receptors for C5A and platelet activating factor expressed in *Xenopus* oocytes. *The Journal of Immunology* 145:2227-2234, 1990. **OCT**

Neta R, Oppenheim JJ, Schreiber RD, Chizzonite R, Ledney GD, MacVittie TJ. Role of cytokines (interleukin 1, tumor necrosis factor, and transforming growth factor β) in natural and lipopolysaccharide-enhanced radioresistance. *The Journal of Experimental Medicine* 173:1177-1182, 1991. **MAY**

Patchen ML, MacVittie TJ, Williams JL, Schwartz GN, Souza LM. Administration of interleukin-6 stimulates multilineage hematopoiesis and accelerates recovery from radiation-induced hematopoietic depression. *Blood* 77(3):472-480, 1991. **FEB**

Rubin DB, Drab EA, Stone AM, Walden TL Jr, Hanson WR. The influence of exogenous eicosanoids on the radiation response of cultured bovine aortic endothelial cells. *Radiation Research* 125:41-47, 1991. **JAN**

Vaishnav Y, Holwitt E, Swenberg C, Lee H-C, Kan L-S. Synthesis and characterization of stereoisomers of 5,6-dihydro-5,6-dihydroxythymidine. *Journal of Biomolecular Structure & Dynamics* 8(5):935-951, 1991. **APR**

Gallin EK. Ion channels in leukocytes. *Physiological Reviews* 71(3):775-811, 1991. **JUL**

Mickley GA, Ferguson JL, Mulvihill MA, Nemeth TJ. Early neural grafts transiently reduce the behavioral effects of radiation-induced fascia dentata granule cell hypoplasia. *Brain Research* 550:24-34, 1991. **MAY**

Pellmar TC, Hollinden GE, Sarvey JM. Free radicals accelerate the decay of long-term potentiation in field CA1 of guinea-pig hippocampus. *Neuroscience* 44(2):353-359, 1991. **JUL**

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Ramakrishnan N, McClain DE, Catravas GN. Membranes as sensitive targets in thymocyte apoptosis. *International Journal of Radiation Biology* 63(6):693-701, 1993. **JUN**

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Colden-Stanfield M, Ratcliffe D, Cramer EB, Gallin EK. Characterization of influenza virus-induced leukocyte adherence to human umbilical vein endothelial cell monolayers. *The Journal of Immunology* 151(1):310-321, 1993. **JUL**

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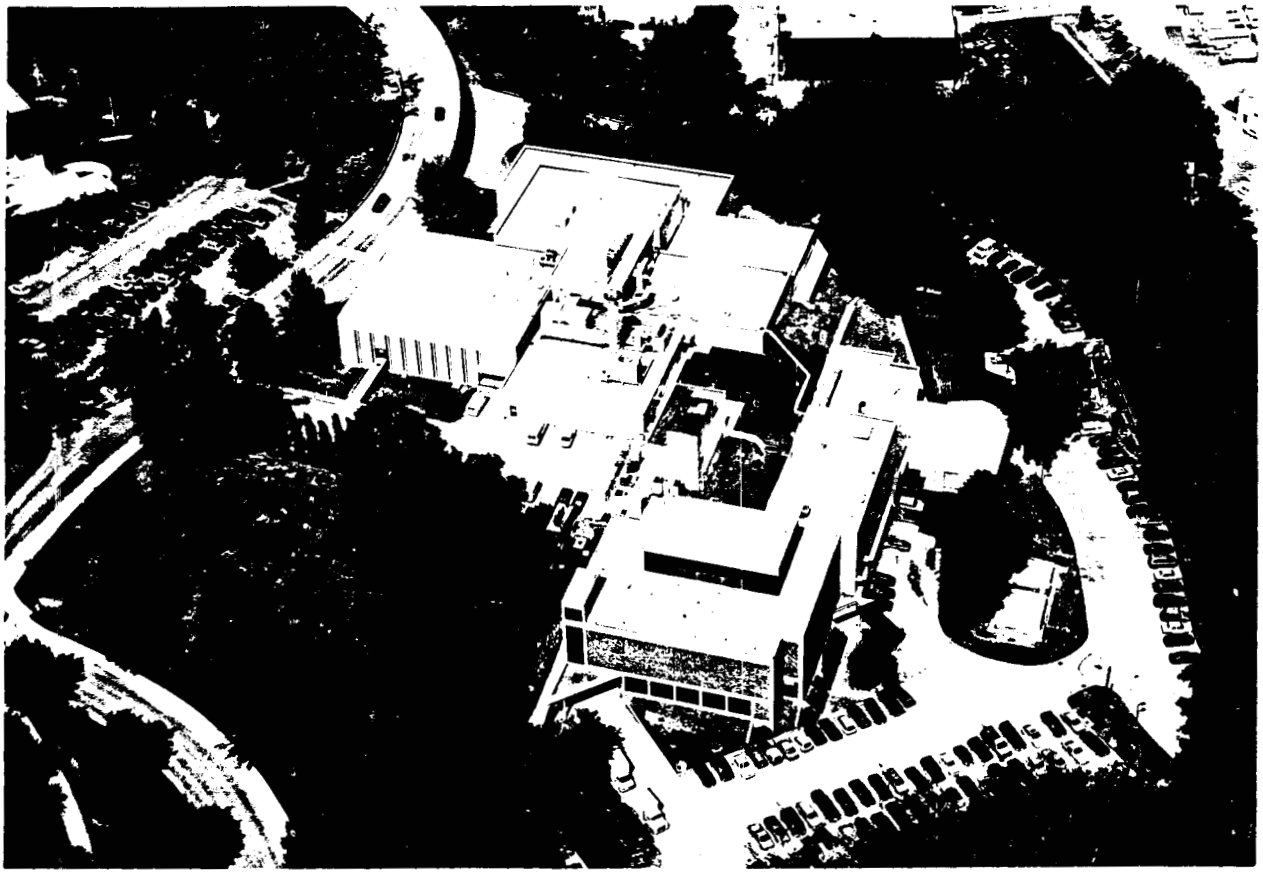
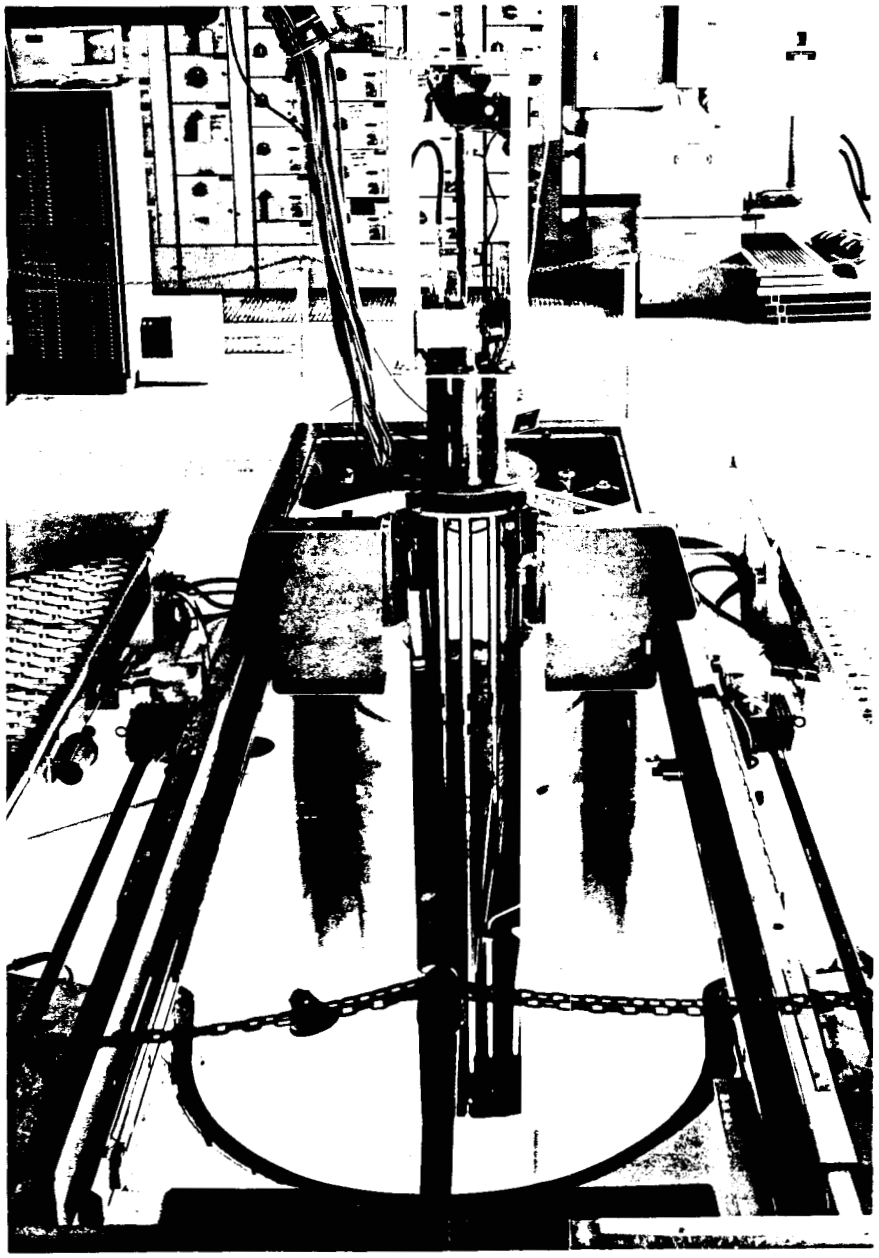
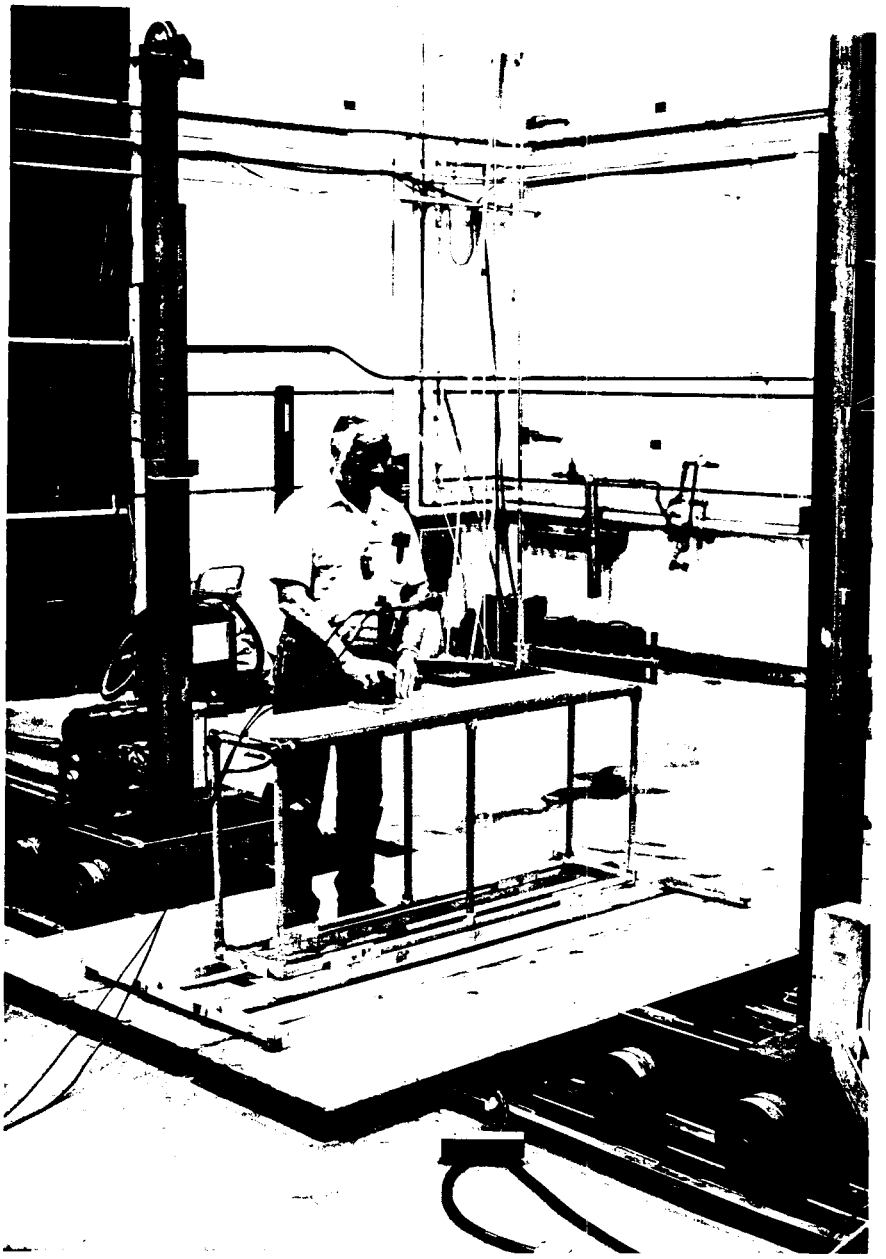


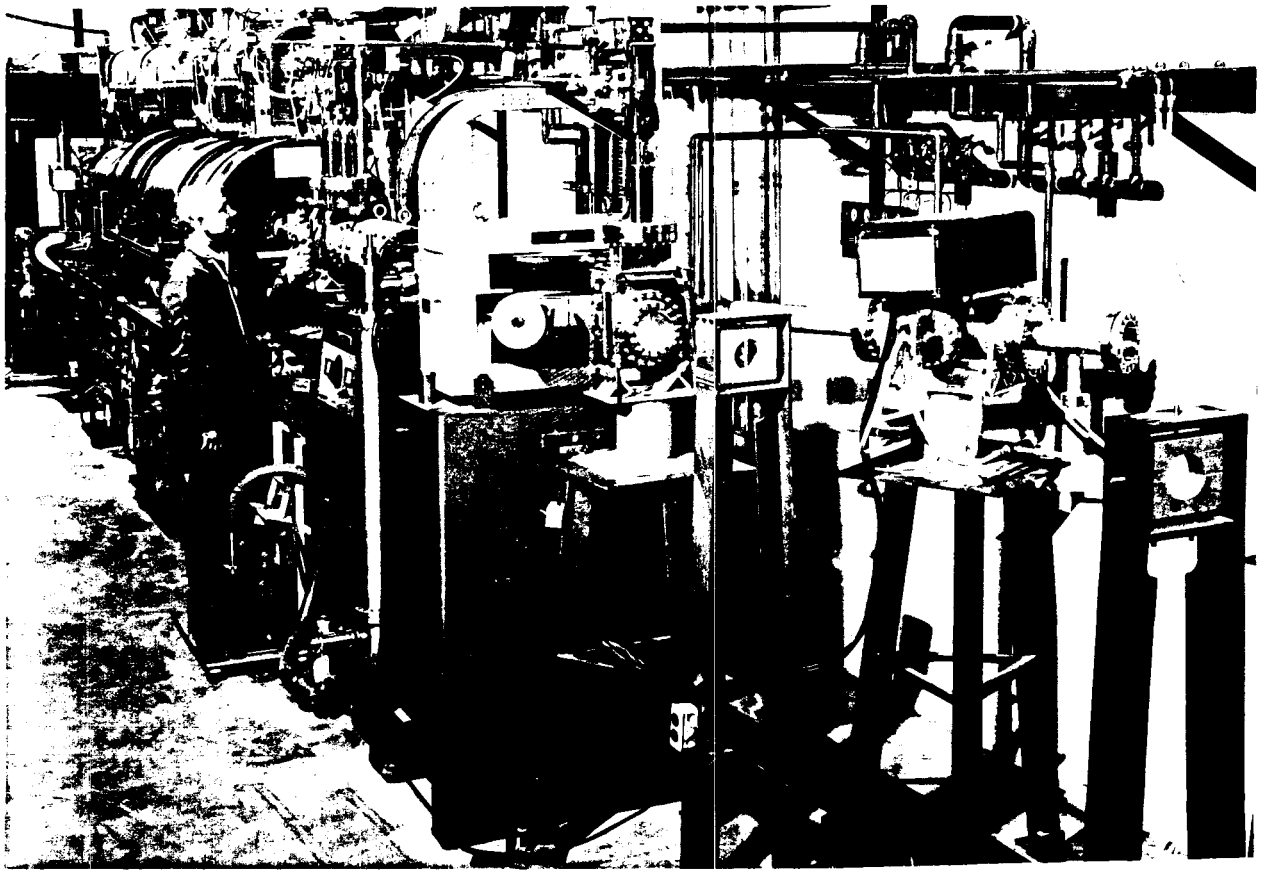
The Armed Forces Radiobiology Research Institute (AFRRI) complex at the National Naval Medical Center in Bethesda, Maryland, includes the 32,000-square-foot laboratory animal care facility in the foreground. AFRRI's animal care and use program is approved by the American Association for Accreditation of Laboratory Animal Care, a nonprofit corporation that sets standards for ethical, prudent care and use of such animals.



The support structure of AFRRI's Mark-F TRIGA, a medium-sized research reactor, is designed for a moveable core. The reactor can run at a steady state of 1 megawatt or pulse at up to 2,500 megawatts in about 0.1 second. Its gamma/neutron ratio can be varied from 1:20 to 20:1 by means of shields and absorbers placed in the dry exposure rooms. Operators can alter the energy of the neutron beam by moving the core, within its pool, in relation to the exposure room. Exposure rates can be varied from about 0.1 rad/minute to 100 thousand rads/minute/pulse.



Ernest Golightly, a physical science technician, sets up dosimetry in AFRRI's underground cobalt-60 facility, which can provide large, uniform gamma-ray fields at variable dose rates with flexible exposure configurations. The facility, which is built to hold 500-thousand-curie activity, is licensed by the Nuclear Regulatory Commission to operate at 400 thousand curies. The activity level at the end of June 1994 was 142 thousand curies.



AFRRI's linear accelerator (LINAC) provides a powerful, flexible source of high-energy electrons (up to 54 MeV), high-energy bremsstrahlung (x rays), and neutrons. The LINAC is used in radiobiology and radiochemistry studies as well as in those concerned with electromagnetic pulse and radiation.

Document Separator

U. S. ARMY LABORATORIES

BOOK NUMBER 1 OF 4

A. Army Research Laboratory, Adelphi Laboratory Center, MD
B. Army Research Laboratory, Aberdeen Proving Ground, MD
C. Army Research Laboratory, White Sands Missile Range, NM
D. Army Research Laboratory, NASA Langley, VA
E. Army Research Laboratory, NASA Lewis, OH
F. Natick Research, Development and Engineering Center, Natick, MA
G. Aviation, Research, Development, and Engineering Center, St. Louis, MO
H. Aeroflightdynamics Directorate, Moffett Field, CA
I. Aviation Applied Technology Directorate, Fort Eustis, VA
J. Edgewood Research, Development and Engineering Center, Aberdeen Proving Ground, MD
K. CECOM Research, Development and Engineering Center, Ft. Monmouth, NJ and Ft. Belvoir, VA

94-09-23 17:30 RCVD

ACTIVITY: Army Research Laboratory, Adelphi Laboratory Center, MD

Section II: Capacity of DOD Component

2.1 Workload

Information Required	Fiscal Years											
	86	87	88	89	90	91	92	93	94	95	96	97
Total Funds Programmed ($M)	-	-	-	-	-	-	-	158.9	131.7	119.2	110.8	107.6
Total Actual Funds ($M)	-	-	-	-	-	-	-	167.4	-	-	-	-
Programmed Workyears	-	-	-	-	-	-	-	1788	1627	1558	1462	1382
Actual Workyears	-	-	-	-	-	-	-	1734	-	-	-	-

2.2 Excess Lab Capacity: 1734 - 1382 = 352

Notes:
-ARL established FY93.
-Programmed funds are percentage estimates based on ARL total workyears for FY95-97.
-Funds data does not include reimbursable, SBIR, FAST, Explitation of Foreign Items, QRIP, Industrial Preparedness, or Armor/Anti-Armor funds. These funds are not "programmed," but received during the year of execution.
-Workyears include all government personnel (to incl reimbursable if applicable).
-The Adelphi Laboratory Center includes the Electronic Devices and Nuclear Weapons Effects common support functions within the totals.

ACTIVITY: ARL, ADELPHI LABORATORY CENTER, MD CSF: WEAPONS/Directed Energy

ction III: Capability of Activities to Perform Common Support Functions

3.0 Mission:

Perform research in survivability of military systems and equipment to existing and future directed energy threats and provide technology to enhance the lethality of advanced directed energy weaponry.

- Perform basic and applied research to develop technology to enhance the survivability of military systems in the high power radio frequency, high power microwave and directed energy weapons environments. This includes limiters, filters, shielding techniques and other hardening technologies. This program is the nucleus about which the national program was formed ten years ago and remains an international center of expertise in this technical area.

- Develop test methodologies for validating system hardness technologies in the high power radio frequency, high power microwave and directed energy weapons environments.

- Develop and update the HPM Hardening Design Guide to aid systems designers, PEOs/PMs and industry.

- Perform basic and applied research in high power radio frequency, high power microwave and directed energy warfare simulation and weaponry technologies; develop high power sources, power conditioners, and antennas and perform technology demonstrations of high power microwave and high power radio frequency weaponry components.

- Develop and demonstrate directed energy weapons technologies, to include sources, antennas, and mode converters; develop and simulate weapons and weaponry component concepts.

- Conduct basic and applied research to develop high power radio frequency and high power microwave propagation models for simulating the high power radio frequency and microwave battlefield environments.

- Develop and demonstrate ionizing and non-ionizing nuclear radiation and directed energy weapons simulation concepts.

- Develop test instrumentation and measurement methodologies for evaluating the performance of military components and systems in ionizing and non-ionizing nuclear radiation, high power radio frequency and microwave, and directed energy weapons simulated environments.

Only facility wihin the national HPM program to test ground based systems.

The high power microwave (HPM) Research Facility is unique because of the unsurpassed variety of useful sources and coverage of the spectrum available and the probes and instrumentation that have been developed. This facility supports programs involving all nine (9) research, development and engineering centers (RDEC) as well as the other services and other ARL directorates. Although all three services maintain high power microwave (HPM) directed energy programs, intensive coordination and Reliance agreements have not only eliminated duplication of effort, but also have enabled the sharing of assets, technologies, and facilities. For example, the Army provides generic hardening technology and design guidelines, the Air Force maintains the tri-service susceptibility effects database, and the Navy leads the development of HPM sources above 35 GHz. In addition, a national HPM program oversight committee (of which the Reliance directed energy panel is a subset) extends the coordination function to include ARPA, BMDO, DNA, and the Department of Energy National

›s. This group provides for interagency program planning and execution.

Interconnectivity with other common support functions.

Electronic Devices -- Pulsed power and SiC technologies.
Advanced Materials -- HPM curing of composite materials.
Other Weapons -- susceptibility assessments, and testing and hardening.
C4I -- Applied chaos theory and survivability of digital battlefield.

All nine Army R&D centers have asked for HPM/DE deliverables via the TPA process.

Classification restrictions prevent discussion of specific uses of HPM/DE.

3.1 Location.
3.1.1 Geographic/Climatological Features: None.
3.1.2 Licenses & Permits. The following licenses/permits are currently held at the ALC:

The Army Research Laboratory non-ionizing radiation safety committee reviews all HPM/DE operations.

National Pollution Discharge Elimination System (NPDES) Permit: The ALC currently operates under a NPDES permit from the State of Maryland for water entering Paint Branch Creek from storm water drains outside the Aurora Building (Building 500). The permit requires monitoring for oils and greases and the pH of the water tering the creek at this point.

Storm Water General Permit: The ALC currently operates under the State of Maryland general permit for stormwater runoff on the installation. Although there are no specific monitoring requirements required by this permit, a stormwater management plan must be maintained and certain "best management practices" must be implemented.

Oil Operations Permit: The ALC currently has an oil operations permit from the State of Maryland allowing us to operate using the mineral oil in the Aurora Facility (Building 500). This permit requires daily monitoring of the oil/water separator associated with the operations at the facility. Washington Suburban Sanitary Commission Permit (WSSC):

The ALC currently operates under a permit from the WSSC which regulates discharge limitations into the sanitary sewer. The permit sets limits on a variety of pollutant parameters and requires self-monitoring for a selection of those parameters.

Resource, Conservation and Recovery Act (RCRA) Hazardous Waste Storage Permit: The ALC is currently under a consent agreement with the State of Maryland to operate a hazardous waste storage facility. The ALC is expected is receive an official RCRA permit for this facility in 1994. Under this current consent agreement and the future permit, ALC can store hazardous waste in Building 104 whilea waiting transport off-site for disposal.

Waste Storage Permit: The ALC is currently under a consent agreement with the State of Maryland to operate a hazardous waste storage facility. The ALC is expected to receive an official RCRA permit for this facility in 94. Under this current consent agreement and the future permit, ALC can store hazardous waste in Building 104 whilea waiting transport off-site for disposal.

3.1.3 Environmental Constraints: There are no known environmental constraints to the current or enhanced mission scope, other than those described above dealing with permits and licenses.

3.1.4 Special Support Infrastructure: High Power Microwave (HPM)/Directed Energy (DE) Research Facility, HPM Injection Lab, Scale Model EMP Facility, DRAGON IREB generator

3.1.5 Proximity to Mission-Related Organizations:

Common Support Functions	Name	Type of Organization	Distance	Workyears Performed (by ARL for customer)	Workyears Funded (by ARL at customer)
Wpns/DE					
	CECOM @ CNVEO, Fort Belvoir	CGA	40 mi.	7	0
	CECOM @ Vint Hill Farms Station	CGA	60 mi.	3	0
	CECOM RDEC @ Ft Monmouth	CGA	200 mi.	2	0
	Missile RDEC	CGA	600 mi.	2	0
	University of Maryland, College Park	University	5 mi.	3	2

The close proximity of these organizations has greatly facilitated our ability to share assets, coordinate efforts d produce required deliverables.

Interactions with universities in the area have been critical in allowing us to attract and maintain an excellent technical staff. Separation from these universities which have strong programs in materials, physics, electrical engineering and mechanical engineering would be a significant detriment to our ability to attract quality personnel and to maintain the technical excellence of our staff. This is especially true for the University of Maryland which boasts a world class program in HPM/DE.

3.2 Personnel.

3.2.1 Total Personnel:

Types of Personnel	Number of Personnel: Government Civ	Government Mil	On-Site FFRDC	On-Site SETA
Technical	30	0	0	0
Management (Supv)	8	0	0	0
Other	7	0	0	0

:.2 Education:

Types of Degree/Diploma	Number of Personnel by Type of Position: Technical	Management (Spv)	Other
High School or Less	2	0	5
Associates	1	0	0
Bachelor	16	1	1
Masters	8	2	1
Doctorate	3	5	0

3.2.3 Experience:

Service Type of Position	Years of Government and/or Military: Less than 3 years	3-10 years	11-15 years	16-20 years	More than 20 years
Technical	1	9	6	3	11
Management (Supv)	1	1	0	1	5
Other	1	3	0	2	1
Total	3	13	6	6	17

3.2.4 Accomplishments During FY91-93.
?.4.1 Patents Awarded/Patent Disclosures

Common Support Function	Disclosures	Awarded	Patent Titles
Weapons/Directed Energy	2		-- Non-Obtrusive Missile Control Surface Monitor System -- Inductance/Resistance (L/R) Cable Shield Test Set
		4	--Pressure-Stabilized Radio Frequency Gasket --Variable Volume Flushing Device for Water Conservation --Microwave Projectile --Inductive Cable Resistance Tester
Total	2	4	

3.2.4.2 Papers in Peer Reviewed Journals: (Note: Classification considerations limit ability to submit to peer reviewed journals.)

Common Support Function	Number Published	Paper Titles
Weapons/Directed Energy	20	List Below:

"Spacetime Tangent Bundle with Torsion," Found. Phys. Lett. 6, 339, 1993 (31 pages).
Complex Spacetime Tangent Bundle," accepted for publication in Found. Phys. Lett. 6, 245, June 1993 (13 pages).

\n Optoelectric Attenuator for the Control of Microwave Circuits," Saddow, Thedreaz, Lee; IEEE ..icrowave and Guided Wave Letters, October 1993.
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--"Three Dimensional Finite Element Analysis of High Power Microwave Devices." Nicolas, Salon, Libelo; IEEE Transactions on Magnetics, vol. 29, no 2; March 1993.
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--"Finsler-Spacetime Tangent Bundle," Found. Phys. Lett. 5, 221, 1992 (28 pages).
--"Kahler Spacetime Tangent Bundle," Found. Phys. Lett. 5, 315, 1992 (22 pages).
--"Book Review: Finsler Geometry, Relativity and Gauge Theories," Found. Phys.,1992 (6 pages).
--"Differential Geometry of Spacetime Tangent Bundle," International Journal of Theoretical Physics 31, 575, 1992 (6 pages)
--"Modelisation 2D par Elements Finis de Phenomenes Micro-ondes en Milieu Ouvert," Nicolas, Conner, ..lon, Ruth, Libelo; J. Phys. III France 2; November 1992.
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--"Rapid Calculation of Near-Field Fluence of HPM Antennas," Hansen, Libelo; IEEE Transactions on Electromagnetic Compatibility, vol. 34, no. 3; August 1992.
--"Theory of Relativistic Backward Wave Oscillators with End Reflections," Levush, Bromborsky, et al; IEEE Trans. Plasma Sci. vol. 20, no. 3; 1992.
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3.3 Workload.
3.3.1 FY93 Workload.
3.3.1.1 Work Year and Lifecycle:

"Lab"	Fiscal Year 1993 Actual			
	Civilian	Military	FFRDC	SETA
Science & Technology	45			
Engineering Development				
In-Service Engineering				

3.3.1.2 Engineering Development by ACAT: None.
3.3.1.3 In-Service Engineering: None.

.2 Projected Funding.
.3.2.1 Direct Funding ($K): RDTE

Common Support Function	FY94	FY95	FY96	FY97
Weapons/Directed Energy	6,687	5,807	2,245	2,336

3.3.2.2 Other Obligation Authority:

Common Support Function	FY94	FY95	FY96	FY97
Weapons/Directed Energy	1,700	2,500	2,500	2,500

3.4 Facilities and Equipment: Equipment/facilities listed are wholly owned by WTD and utilized for the DE

Common Support Function	Major Facility or Equipment Description	Unique To: DOD	Federal Govt	U.S.	Replacement Cost($M)
Weapons/Directed Energy	HPM Research Facility	X	X	X	$31.0
	Scale Model Facility	X	X	X	$ 1.8
	Injection Lab				

The high power microwave (HPM) Research Facility is unique because of the unsurpassed variety of useful sources and coverage of the spectrum available, and the probes and instrumentation that have been developed. 'is facility supports programs involving all nine (9) research, development and engineering centers (RDEC) , well as the other services and other ARL directorates.

3.5 Expansion Potential.
3.5.1 Laboratory Facilities:

Common Support Function	Facility or Equipment Description	Type of Space	Space Capacity (KSF) Current	Used	Excess
Weapons	Bld 202/204	Administrative	15.0	15.0	0
		Technical	25.0	25.0	0
	Bldg 500	Administrative	1.0	1.0	0
		Technical	2.0	2.0	0
	Bldg 504	Administrative	0.0	0.0	0
		Technical	2.0	2.0	0

3.5.1.1 Capacity of activity to absorb similar workyears categorized in the same common support function: ALC facilities can be expanded vertically by building on top of buildings 202 and 204. This will allow additional workyears in Common Support Functions to be accommodated at ALC while preserving the current and future research missions of this site. Major construction will require Military Construction, Army funds in order to pand the site (See item 3.5.1.3 below).

.1.2 Capacity to absorb additional workyears, how many can be supported: Cannot be determined at this time. Should there be a requirement to take on additional workyears, laboratory space reallocations can be considered on a priority basis.

3.5.1.3 Impact of military construction program or other alteration projects programmed in FY95 PBS: The Adelphi Laboratory Center is currently programmed at $102M for BRAC 91 construction with work to begin in FY95. A $6.6M MCA R&D Computer Center project is conjuctively funded with the BRAC program. A $1.5M unspecified Minor MCA project is planned for FY94/95 to bulid a Scale Model Facility. These projects are intended to meet the FY97 end-state requirements of the Army Research Laboratory at Adephi under BRAC 91 and subsequent decisions. Directly related to this CSF is MCA project Adelphi Microwave Facility, $8.3M, which is in the MCA Long Range plan.

3.5.2 Land use: Buildable acres for additional laboratory/administrative support construction: In addition to all areas currently allocated for planned construction there are 18.39 acres of buildable acres at the Adelphi Laboratory Center (Blossom Point Research Facility, subinstallation to ALC, has 205 buildable acres). In addition to new sites there is the ability to add additional floors (3 acres) onto existing structures. Also, the Adelphi Laboratory Center is adjacent to the Naval Surface Warfare Center - White Oak, and the potential exists for expansion.

3.5.3 Utilities: The Adelphi Laboratory Center currently has excess capacity in all services. The installation will continue to have excess capacity upon completion of new construction and in-migration of functions/organizations under BRAC 91.

Section III: Capability of Activities to Perform Common Support Functions

This submission assumes implementation of BRAC 91 whereby the Electronics and Power Sources Directorate of the Army Research Laboratory is located at the Adelphi Laboratory Center (ALC) and programed BRAC construction is executed.

3.0 Mission: The Electronics and Power Sources Directorate(EPSD) serves as the lead Army Research Laboratory (ARL) organization, foremost technology authority, and central focal point for research, development and integration of advanced electronics and power sources technology to ensure U.S. military superiority through the year 2000 and beyond. Enabling electronic technologies are at the heart of practically every modern Army system and represent over 40% of their procurement cost. As ARL's electronics champion, EPSD provides the essential technology building blocks - i.e., the "eyes, ears, and brains" - for a wide range of Army applications, including reconnaissance, surveillance and target acquisition (RSTA), intelligence and electronic warfare (IEW), command and control (C2), communications, and platform/weapon control.

EPSD's major capabilities include:

o Nano/Optoelectronic/Photonic Devices - through basic research, focuses primarily on providing the essential technology building blocks for the Army's 6.2 thrust in teraflop processing, steerable radiators, IR image processing, and atomic level designer materials for land combat-oriented electronics and power source technologies.

o Microwave/Millimeter-wave/MIMIC Devices - focuses primarily on the specific microwave (μW), millimeter-wave (mmW), and terahertz device technologies required to Digitize the Battlefield and support Army smart weapon, intelligence and electronic warfare (IEW), and reconnaissance, surveillance and target acquisition (RSTA) modernization efforts.

o Optical Devices and Focal Plane Arrays - focuses primarily on enhancing the performance of the Army cooled infrared (IR) detectors through incremental and integration-oriented improvements, and developing a manufacturable uncooled IR technology to eliminate the need for expensive, miniature, cryogenic cooling systems.

o Advanced Sensors and Actuator Modules - leveraging expertise in semiconductor device, acoustic, optical, magnetic, and microelectromechanical (MEM) technologies focuses primarily on developing novel miniature components to perceive, image, and provide the Army with information to control its battlefield environment.

o Design, Simulation, Modeling, Concurrent Engineering, and Prototyping - focuses primarily on improving the quality,reliability, affordability, maintainability, testability, designability of electronic systems and prototyping specialized proof-of-concept electronic modules for the modernizing Army.

o Reliability and Manufacturing Science - focuses primarily on pervasive O&S cost reduction issues such as standardized procurement and quality control, and R&D of design optimization, modeling, simulation and virtual prototyping tools for system development and upgrade for the extremely large dollar volume of electronic components and batteries purchased each year by the Army.

o Acousto/Ferroelectronics - as the Defense Reliance lead lab for Frequency Control Devices, focuses primarily on developing low power, ultra-stable low-noise frequency sources and clocks required to Digitize the Battlefield, and advanced acoustic wave devices for super-sensitive chemical- biological sensors and

gistics inventory control/location of combat material.

o Display Devices - as the Defense Reliance lead laboratory for Display Components, focuses primarily on developing advanced, high performance, full-color display device technology essential for real-time situational awareness by the Warrior and enabling the force-multiplication imperative required by information intensive vehicular, airborne, ground-based and single soldier systems.

o Power Sources - focuses primarily on developing lightweight power technology required by all Army man-portable communication-electronics and target acquisition equipment with goals of saving significant Operating and Support (O&S) costs, increased operational performance, and achieving environmental improvements.

Interconnectivities:

EPSD has a close, synergistic linkage to other ARL Technology Directorates located at the ALC.

Sensors, Signatures, Signal and Information Processing Directorate (S3ID) - EPSD is developing advanced and novel infrared, microwave, millimeter wave, acoustic and optical sensing devices used by S3ID to significantly improve the soldier's situational awareness on the battlefield, heavily aid in target recognition, and insure positive combat identification. Advances in electronic materials and device structures are employed for greatly improved multi-spectral sensor protection.

Battlefield Environment Directorate (BED) - EPSD is developing advanced optical and quasi-optical technologies used by BED to measure and assess battlefield environmental conditions, improve the effectiveness Army weapon systems, and track the migration/diffusion of nuclear, biological, and chemical (NBC) agents.

Weapons Technology Directorate (WTD) - EPSD, in cooperation with WTD's Nuclear Weapon Effects (NWE) experts, is developing new, inherently radiation, electromagnetic, and high power microwave resistant electronic devices and packages to insure the survivability of Army systems and equipment on the modern battlefield.

Interconnectivities with CSFs:

In its role as the Army's main laboratory for electronics, and because electronics is a pervasive technology, EPSD interconnects with an unusually wide variety of other technologies and support functions, including most of the Product Functions and Pervasive Functions.

Product Functions -- Interconnectivity with the following functions is illustrated below by examples:

Air Vehicles - Flat-panel, full-color, daylight-readable displays for cockpit information; miniature, high-resolution active-matrix flat-panels for head-mounted displays; conformal antennas for microwave and millimeter-wave frequencies (radar and communications); and microelectromechanical devices (MEMS) for ice sensing; plus other avionics.

Weapons - Cooled and uncooled infrared focal plane arrays for missile seekers; MIMIC-device radaron-a-chip for Multi-Option Fuse Assembly (MOFA); reserve batteries for missiles and artillery shells; pulse power for electro-thermal- chemical (ETC) guns; MOS-Controlled Thyristors for missile testing (e.g., Hellfire); and long-life primary batteries to replace conventional reserve batteries.

Space Systems - UV-sensitive photodiodes for detecting UV-rich rocket plumes against warm-earth background; multifrequency, tunable IR detector arrays for terrain mapping/camouflage penetration; optically-controlled phased-array antennas and conformable antennas for ground/spacecraft applications; high-gain, low-noise microwave and millimeter-wave satellite communications; and precision clocks and oscillators for communications/navigation systems such as MILSTAR (SCOTT and SCAMP).

C4I Systems - Displays ranging in size from miniature, high-resolution types to large, command-center projection types, including three dimensions, for handling data fusion; fiber-optic control of microwave and millimeter-wave antennas for command-on-the-move; electronic modules for interoperability of Army radios with NATO-force radios; hardware description languages (VHDL and MHDL) for RASSP, MIMIC, ASEM, and other obsolescence-avoiding disciplines; oscillators and clocks for secure communication/position/navigation systems; primary and rechargeable batteries for man-portable communications; millimeter-wave camera for obscurant penetration; terahertz electronics for covert communications; and channelizers for capturing and sorting LPI signals.

Ground Vehicles - Batteries and electrochemical capacitors for tank starting, tank silent watch, and electric vehicle acceleration; displays for "virtual turret" and "transparent tank;" sensors and pulse-power activators for active protection ; power conditioners for electric vehicles; and stereo displays for drivers of robotic vehicles.

Clothing, Textiles, and Food - None

Chemical/Biological Defense - Surface Acoustic Wave (SAW) and microelectromechanical (MEM) devices for detection of specific organic toxins and/or viruses; and MEM pumps for antidote administration.

Pervasive Functions -- The connectivity of EPSD R&D topical areas with other pervasive functions is illustrated below by example:

Electronics Devices - This is EPSD's overarching business area.

Environmental Sciences - MEMS sensors for toxin/pollutant detection; multiwavelength IR detection for thermal surveys.

Infectious Diseases - SAW and MEM-devices for detection of specific viruses, with possible extension to detection of bacteria-vectored diseases.

Human Systems - MEM-device ultraminiature pumps for dispensing antitoxins, nutrients, etc.,; head-mounted displays for the individual soldier.

Manpower and Personnel - SAW tagging devices for personnel ID, including medical data and possible IFF.

Training Systems - Rechargeable, high-energy batteries to reduce logistics costs for man-portable systems; virtual reality displays.

Environmental Quality - See "Environmental Sciences," above.

Advanced Materials - MEMS, IR detectors, lasers, III-V semiconductors, high-temperature (e.g., SiC) semiconductors, quantum-well infrared photodiodes, superlattice materials, strained-layer materials (for spatial light modulators), and alternative piezoelectric materials (e.g., langasite) for frequency control and timing.

Civil Engineering - MEMS for strain sensors.

Combat Casualty Care - High-energy permanent magnets for non-cryogenic magnetic resonance imaging (fieldable MRI); and SAW tags for ID (see "Manpower and Personnel," above).

Combat Dentistry - Fieldable MRI, and MEM pumps (see "Infectious Diseases" and "Combat Casualty Care," above.).

Nuclear Weapons Effects - Radiation-hardened electronics (SOS, SOI).

Chemical Biological Defense - See "Environmental Science" and "Infectious Diseases," above.

3.1 Location.

3.1.1 Geographic/Climatological Features: None.

1.2 Licenses & Permits. The following licenses/permits are currently held at the ALC:

National Pollution Discharge Elimination System (NPDES) Permit: The ALC currently operates under a NPDES permit from the State of Maryland for water entering Paint Branch Creek from storm water drains outside the Aurora Building (Building 500). The permit requires monitoring for oils and greases and the pH of the water entering the creek at this point.

Storm Water General Permit: The ALC currently operates under the State of Maryland general permit for stormwater runoff on the installation. Although there are no specific monitoring requirements required by this permit, a stormwater management plan must be maintained and certain "best management practices" must be implemented.

The ALC currently operates under a permit from the WSSC which regulates discharge limitations into the sanitary sewer. The permit sets limits on a variety of pollutant parameters and requires self-monitoring for a selection of those parameters.

Resource, Conservation and Recovery Act (RCRA) Hazardous Waste Storage Permit: The ALC is currently under a consent agreement with the State of Maryland to operate a hazardous waste storage facility. The ALC is expected is receive an official RCRA permit for this facility in 1994. Under this current consent agreement and the future permit, ALC can store hazardous waste in Building 104 whilea waiting transport off-site for disposal.

3.1.3 Environmental Constraints: There are no known environmental constraints to the current or enhanced ission scope, other than those described above dealing with permits and licenses.

3.1.4 Special Support Infrastructure: The Electronics and Power Sources Directorate of ARL will be moving the Adelphi Laboratory Center from Fort Monmouth, NJ and Fort Belvoir, VA in FY97, joining a portion of the directorate already residing at Adelphi. As part of this BRAC 91 move, the Electronic Devices CSF will be housed in a new Physical Sciences Laboratory and existing laboratories.

3.1.5 Proximity to Mission-Related Organizations:

Common Support Functions	Name	Type of Organization	Distance	Workyears Performed	Workyears Funded
Electronic Devices	CERDEC (Ft.B)	Gov't	30 miles	43	42
	ARPA	Gov't	15 miles	23	7
	Johns Hopkins Unv	University	10 miles	2	2
	Unv of Maryland	University	5 miles	2	2
	NRL	Gov't	15 miles	.5	.5

*Note: Distance from ARL/Adelphi, MD is estimate

Maintenance of a balanced Army program in electronic devices will be strongly contingent upon the relationships between ARL, its customers and its correlate universities laboratories in the Adelphi area. Severing the close working relationships with CERDEC (Ft. Belvoir), ARPA (Alexandria, VA), Johns Hopkins University, University of Maryland, etc., would seriously impact the electronic devices posture of the Army. For example, Johns Hopkins is very strong in photonics and optical systems, etc. The open laboratory concept that has evolved entails ARL researchers "living" at the university's laboratory, working with their MBE machines, etc., while the university researchers spend time on-site at ARL. In addition, a good fraction of our staff pursues advanced degrees at these and other proximate universities. In the matter of customers such as CERDEC Night Vision and Electronics Sensors Directorate (NVESD) at Ft. Belvoir, proximity is very important because of the synergistic nature of the work. ARL provides expert support in material and detector characterizations and detector device processing of materials grown by NVESD for advanced night vision devices. In like manner, ARPA's considerable funding of our research efforts will be adversely impacted by dramatically increased distances because the day-to-day feedback that we maintain with our funding agencies will be lost.

3.2 Personnel.

3.2.1 Total Personnel:

Types of Personnel	Number of Personnel			
	Government		On-Site FFRDC	On-Site SETA
	Civ	Mil		
Technical	232	0	0	0
Management (Supv)	36	0	0	0
Other	55	0	0	0

3.2.2 Education:

Types of Degree/Diploma	Number of Personnel by Type of Position		
	Technical	Management (Spv)	Other
High School or Less	28	0	48
Associates	6	0	4
Bachelor	77	3	2
Masters	64	18	1
Doctorate	57	15	0

3.2.3 Experience:

Type of Position	Years of Government and/or Military Service				
	Less than 3 years	3-10 years	11-15 years	16-20 years	More than 20 years
Technical	2	100	40	9	81
Management (Supv)	1	5	0	0	30
Total	3	105	40	9	111

3.2.4 Accomplishments During FY91-93.

3.2.4.1 Patents Awarded/Patent Disclosures:

Common Support Function	Disclosures	Awarded	Patent Titles
Electronic Devices	327	120	List Attached

3.2.4.2 Papers in Peer Reviewed Journals:

Common Support Function	Number Published	Paper Titles
Electronic Devices	193	List Attached

3 Workload.

3.3.1 FY93 Workload.

3.3.1.1 Work Year and Lifecycle:

"Lab"	Fiscal Year 1993 Actual			
	Civilian	Military	FFRDC	SETA
Science & Technology	328	0	0	0
Engineering Development	0	0	0	0
In-Service Engineering	0	0	0	0

3.3.1.2 Engineering Development by ACAT: None.

3.3.1.3 In-Service Engineering: None.

3.3.2 Projected Funding.

3.3.2.1 Direct Funding ($K): RDTE

Common Support Function	FY94	FY95	FY96	FY97
Electronic Devices	35,120	33,568	32,088	31,479

3.3.2.2 Other Obligation Authority:

Common Support Function	FY94	FY95	FY96	FY97
Electronic Devices	54,473	62,128	62,297	62,238

3.4 Facilities and Equipment: Equipment/facilities listed are wholly owned by EPSD and utilized at 100% by the Electronics Devices CSF.

Common Support Functions	Major Facility or Equipment Description	Unique To: DOD	Federal Govt	U.S.	Replacement Cost ($K)
Electronic Devices					
	E-Beam Nano-lithography System	X			$1,612
	Glow Discharge Mass Spectrometer	X			$678
	Thermal Desorbtion Mass Spectrometer	X	X	X	$823
	Power Source Characterization/Measure. Sys.	X			$61
	Crystal Characterization/Test Sys.	X			$79
	Transmission Electron Microscope				$428

Microwave/Millimeter-wave Charac. System	X	$373
Finite Element Analysis System	X	$129
Magnetic Material/Device Charac. System	X	$212
Millimeter-wave/Photonic Prototyping Sys	X	$1,536
Microwave Network Analyzer	X	$577
Phosphor Deposition Sys	X	$614
Test/Charac. for Manportable Power Sources	X	$234
Uncooled IR Device Characterization System	X	$541
Reserve Battery Spin Test/Charac. System	X	$289
E-Beam Direct-Write Lithography System		$2,002
Electric Gun Pulser Test Bed		$1078
Non-Linear Optical Device/Material Charac. Sys		$925
Optical DSW Lithography System		$857
GEN II Molecular Beam Epitaxy System		$742
Quartz Crystal Fabrication Sys		$730
Design Automation Ctr		$701
High Power and Tunable Lasers		$679
GEN II Molecular Beam Epitaxy System		$669
Secondary Ion Mass Spectrometer w/Auger		$661
Quadrapole Secondary Ion Mass Spectrometer		$623
Reactive Ion Etcher		$617
Ion Accelerator System		$616
Magnetron Sputtering System		$562
Ion Implanter		$492
Optical Measurement/Characterization System		$486
Hi Res Scanning Auger Microprobe		$486
Hi Res Double Focus Secondary Ion Mass Spec		$479
VAX Computers		$452
Display Demonstration Systems		$394
VLSI Test Sys		$388
Picosecond Laser System		$386
Surface Acoustic Wave Device Char./Measure. Sys.		$381
Automated EPR Spectrometer		$354
Reactive Ion Etcher		$351
Scanning Electron Microscope w/EDAX		$335
Optical Characterization Sys		$320
Reactive Ion Beam Etcher		$306
Magnetron Sputtering Sys		$263
GEN 1.5 Molecular Beam Epitaxy System		$260
Scanning laser microscope		$251
Special Properties Display Test System		$238
Multichamber Vacuum Sputtering/Deposit. Sys		$236
Nano-scale Device Charac./Measure. Sys		$228
Short Term Display Test Bed		$216
Magnetron Sputtering System		$213
Reactive Ion Etcher		$206
Metalization/Deposition Sys		$202
Plasma Enhanced Chemical Vapor Deposition		$199
Bonder Hybrid Flip		$179

Device Characterization System	$177
Scanning Electron Microscope w/EDAX	$170
Scanning Electron Microscope w/EDAX	$170
CAD Workstations	$161
CADET Test Sys	$160
Scanning Electron Microscope w/EDAX	$145
Millimeter-wave Network Analyzer	$138
Transmission Electron Microscope	$136
Surface Particulate Analysis System	$134
E-Beam Metallization System	$133
Toxic Gas Monitoring Sys	$129
Adaptive EPR Spectrometer	$128
DC Parametric Test/Analysis System	$128
Plasma Enhanced Chemical Vapor Deposition	$117
Lab Computers	$115
Mask Aligner Infrar	$112
C,X-Band Test Reliability System	$92
LSI Test System	$84
Optical pattern generator	$84
Display Device Charac./Measure. System	$79
Adaptive EPR Spectrometer	$70
CAD System	$69
Electron Microscope	$69
Thin Film Laser Trimmer	$68
Laser Ablation System w/Safety Sys. Backup	$67
Ultra-low Noise Test System	$67
Vacuum Sputtering/Deposition Sys	$63
Module X-Ray Inspection Sys	$58
Dicing Saw Automatic	$58
Magnetron Enhanced Reactive Ion Etcher	$35
Rotary Motion Assm	$33
Reactive Ion Etcher	$28
Automated Resist Processing Sys	$19
Anechoic Test System	$12
Low Pressure CVD/Diffusion/Oxid Furnaces	$15

The new Physical Sciences Laboratory (under BRAC-91 construction) will house the majority of EPSD's electronic equipment assets. It is anticipated that EPSD's comprehensive device design, processing, characterization, and test facilities will be heavily shared with scientists and engineers (S&Es) from other ARL Technology Directorates located at ALC in many of the above described technology areas. For example, EPSD and S3ID are co-developing proof-of-principle multi-layer millimeter-wave sensor modules, cooled and uncooled infrared (IR) imaging arrays, and non-linear optical sensor protectors. EPSD and WTD are co-developing radiation hardened silicon carbide (SiC) and silicon-on-insulator (SOI) device structures. Conversely, EPSD will rely heavily on ALC's existing powerful computation assets to develop new methodologies and techniques for modeling and simulating advanced multi-mode electronic systems.

5 Expansion Potential.
5.1 Laboratory Facilities:

Common Support Function	Facility or Equipment Description	Type of Space	Space Capacity (KSF) Current	Used	Excess
Electronic Devices					
	Nano/Optoelectronic/Photonic Devices	Technical	20.3	20.3	0
	Microwave/Millimeter-wave/ MIMIC Devices	Technical	10.0	10.0	0
	Optical Devices and Focal Plane Arrays	Technical	17.0	17.0	0
	Advanced Sensor and Actuator Modules	Technical	3.0	3.0	0
	Design/Sim/Model/Concurrent Engineering & Prototyping	Technical	8.0	8.0	0
	Reliability & Manufacturing Science	Technical	3.4	3.4	0
	Acousto/Ferroelectronics	Technical	5.8	5.8	0
	Display Devices	Technical	3.5	3.5	0
	Power Sources	Technical	10.7	10.7	0
	Offices	Administrative	42.3	42.3	0

3.5.1.1 Capacity of activity to absorb similar workyears categorized in the same common support function: ALC facilities can be expanded vertically by building ontop of buildings 202 and 204. This will allow additional workyears in Common Support Functions to be accommodated at ALC while preserving the current and future research missions of this site. Major construction will require Military Construction, Army funds in order to expand the site.

3.5.1.2 If capacity to absorb additional workyears, how many can be supported: None. Cannot be determined at this time. Should there be a requirement to take on additional workyears, laboratory space reallocations can be considered on a priority basis.

3.5.1.3 Impact of military construction program or other alteration projects programmed in FY95 PBS: The Adelphi Laboratory Center is currently programmed at $102M for BRAC 91 construction with work to begin in FY95. This includes the $56.8M Physical Sciences Laboratory which encompasses the Electronic Devices CSF. A $6.6M MCA R&D Computer Center project is conjunctively funded with the BRAC program. These projects are intended to meet the FY97 end-state requirements of the Army Research Laboratory at Adelphi under BRAC 91 and subsequent decisions.

3.5.2 Land use: Buildable acres for additional laboratory/administrative support construction: In addition to all areas currently allocated for planned construction there are 18.39 acres of buildable acres at the Adelphi Laboratory Center (Blossom Point Research Facility, subinstallation to ALC, has 205 buildable acres). In addition to new sites there is the ability to add additional floors (3 acres) onto existing structures. Also, the Adelphi Laboratory Center is adjacent to the Naval Surface Warfare Center - White Oak, and the potential exists for expansion.

3.5.3 Utilities: Estimate of installation's capability to expand or procure additional utility services: The Adelphi Laboratory Center currently has excess capacity in all services. The installation will continue to have excess capacity upon completion of new construction and in-migration of functions/organizations under BRAC

3.2.4.1 PATENTS

PATENTS INCLUDING SIRS

TITLE: RECHARGEABLE LITHIUM-ORGANIC ELECTROLYTE BATTERY HAVING OVERCHARGE PROTECTION AND METHOD OF PROVIDING OVERCHARGE PROTECTION FOR A LITHIUM ORGANIC ELECTROLYTE BATTERY
INVENTOR(S): WISHVENDER R. BEHL
STATUTORY INVENTION REGISTRATION NO.TITLE NO.: H829 - PUBLISHED 10-02-90

TITLE: PLANAR MONOLITHIC SELF-OSCILLATING MIXER
INVENTOR(S): SAMUEL DIXON, JR.
STATUTORY INVENTION REGISTRATION NO.TITLE NO.: H832 - PUBLISHED 10-02-90

TITLE: CONNECTOR FOR SPLICING OPTICAL FIBERS
INVENTOR(S): HOWARD WICHANSKY
PATENT NO.: 4,964,689 - ISSUED 10-23-90

TITLE: REAL-TIME REJECTION CIRCUIT TO AUTOMATICALLY REJECT MULTIPLE INTERFERING HOPPING SIGNALS WHILE PASSING A LOWER LEVEL DESIRED SIGNAL
INVENTOR(S): WILLIAM J. SKUDERA, JR., STUART D. ALBERT
PATENT NO.: 4,965,581 - ISSUED 10-23-90

TITLE: MICROWAVE TRANSMISSION LINE AND METHOD OF MODULATING THE PHASE OF A SIGNAL PASSED THROUGH SAID LINE
INVENTOR(S): RICHARD A. NEIFELD
PATENT NO.: 4,967,167 - ISSUED 10-30-90

TITLE: HIGH POWER RF GENERATION WITH OPTICALLY ACTIVATED BULR GAAS DEVICES
INVENTOR(S): ANDERSON H. KIM, MAURICE WEINER, LAWRENCE J. BOVINO, ROBERT J. YOUMANS
STATUTORY INVENTION REGISTRATION NO.TITLE NO.: H843 - PUBLISHED 11-06-90

TITLE: METHOD OF MAKING A CATHODE FROM TUNGSTEN AND IRIDIUM POWDERS USING A STRONTIUM PEROXIDE CONTAINING MATERIAL AS THE IMPREGNANT
INVENTOR(S): LOUIS E. BRANOVICH, GERARD L. FREEMAN, BERNARD SMITH
STATUTORY INVENTION REGISTRATION NO.TITLE NO.: H849 - PUBLISHED 11-06-90

TITLE: METHOD OF INDICATING THE STATE OF CHANGE OF A BATTERY USING A LIGHT EMITTING DIODE (LED) CLOCK CONNECTED TO THE BATTERY
INVENTOR(S): CHARLES W. WALKER, JR.
STATUTORY INVENTION REGISTRATION NO.TITLE NO.: H 862 - PUBLISHED 12-04-90

TITLE: RECHARGEABLE LITHIUM BATTERY SYSTEM
INVENTOR(SL): STEVEN M. SLANE AND EDWARD J. PLICHTA
PATENT NO.: 4,983,476 - ISSUED 01-08-91

TITLE: NULL OFFSET VOLTAGE COMPENSATION FOR OPERATIONAL AMPLIFIERS
INVENTOR(S): LAWRENCE R. GROEHL
PATENT NO.: 4,983,926 - ISSUED 01-08-91

CSF: ELECTRONIC DEVICES ACTV: ARL, ADELPHI LABORATORY CENTER, MD

TITLE: METHOD OF SMOOTHING PATTERNED TRANSPARENT ELECTRODE STRIPES IN THIN FILM ELECTROLUMINESCENT DISPLAY PANEL MANUFACTURE
INVENTOR(S): ROBERT J. ZETO, EUGENE HRYCKOWIAN, DECEASED, BY LINDA V., EXECUTOR, DAVID C. MORTON, JOHN A. COSTELLO AND JOHN C. CONRAD
PATENT NO.: 4,986,876 - ISSUED 01-22-91

TITLE: MINIATURE POROUS ELECTRODE AND METHOD OF MAKING
INVENTOR(S): CHARLES W. WALKER, JR.
PATENT NO.: 4,988,588 - ISSUED 01-29-91

TITLE: METHOD OF MAKING A TRANSDUCER FROM A BOULE OF LITHIUM TETRABORATE AND TRANSDUCER SO MADE
INVENTOR(S): ARTHUR BALLATO, JOHN A. KOSINSKI
PATENT NO.: 4,990,818 - ISSUED 02-05-91

TITLE: HIGH RESOLUTION, WIDE BAND CHIRP-Z SIGNAL ANALYZER
INVENTOR(S): WILLIAM J. SKUDERA, JR. AND CHARLES E. KONIG
PATENT NO.: 4,994,740 - ISSUED 02-19-91

TITLE: ACOUSTIC CHARGE TRANSPORT PROCESSOR
INVENTOR(S): ARTHUR BALLATO
PATENT NO.: 4,994,772 - ISSUED 02-19-91

TITLE: ENHANCED MAGNETIC FIELD WITHIN ENCLOSED CYLINDRICAL CAVITY
INVENTOR(S): HERBERT A. LEUPOLD AND ERNEST POTENZIANI, II
PATENT NO.: 4,994,777 - ISSUED 02-19-91

TITLE: ADJUSTABLE TWISTER
INVENTOR(S): HERBERT A. LEUPOLD
PATENT NO.: 4,994,778 - ISSUED 02-19-91

TITLE: METHOD OF IDENTIFYING THE COMPOSITION OF A MATERIAL SAMPLE
INVENTOR(S): DONALD W. ECKART AND JOEL R. SHAPPIRIO
STATUTORY INVENTION REGISTRATION NO.TITLE NO.: H901- PUBLISHED 03-05-91

TITLE: SAW TRANSDUCER WITH IMPROVED BUS-BAR DESIGN
INVENTOR(S): ELIO A. MARIANI AND CLINTON S. HARTMANN
PATENT NO.: 4,999,535 - ISSUED 03-12-91

TITLE: LASER CONTROLLED SEMICONDUCTOR ARMATURE FOR ELECTROMAGNETIC LAUNCHERS
INVENTOR(S): LOUIS J. JASPER, JR., MAURICE WEINER AND LAWRENCE J. BOVINO
PATENT NO.: 5,005,462 - ISSUED 04-09-91

TITLE: METHOD OF MAKING A CATHODE FROM TUNGSTEN AND IRIDIUM POWDERS USING A REACTION PRODUCT FROM REACTING A GROUP III A METAL WITH BARIUM PEROXIDE AS AN IMPREGNANT
INVENTOR(S): LOUIS E. BRANOVICH, DONALD W. ECKART, BERNARD SMITH AND GERARD L. FREEMAN
PATENT NO.: 5,007,874 - ISSUED 04-16-91

CSF: ELECTRONIC DEVICES ACTV: ARL, ADELPHI LABORATORY CENTER, MD

TITLE: HIGH TEMPERATURE RECHARGEABLE MOLTEN SALT CELL
INVENTOR(S): EDWARD J. PLICHTA AND WISHVENDER K. BEHL
PATENT NO.: 5,011,750 - ISSUED 04-30-91

TITLE: MULTICOLOR INFRARED PHOTODETECTOR
INVENTOR(S): KWONG-KIT CHOI
PATENT NO.: 5,013,918 - ISSUED 05-07-91

TITLE: TRIANGULAR SECTION PERMANENT MAGNET STRUCTURE
INVENTOR(S): HERBERT A. LEUPOLD
PATENT NO.: 5, 014,028 - ISSUED 05-07-91

TITLE: METHOD OF MAKING A LONG LIFE HIGH CURRENT DENSITY CATHODE FROM ALUMINUM OXIDE AND TUNGSTEN OXIDE POWDERS
INVENTOR(S): LOUIS E. BRANOVICH, GERARD L. FREEMAN, DONALD W. ECKART AND BERNARD SMITH
PATENT NO.: 5,022,883 - ISSUED 06-11-91

TITLE: PERMANENT MAGNET FIELD SOURCES OF RADIAL ORIENTATION
INVENTOR(S): HERBERT A. LEUPOLD AND ERNEST POTENZIANI, II
PATENT NO.: 5,028,902 - ISSUED 07-02-91

TITLE: HIGH POWER PHOTOCONDUCTOR BULK GAAS SWITCH
INVENTOR(S): ANDERSON H. KIM, MAURICE WEINER, ROBERT J. YOUMANS, ROBERT J. ZETO, MICHELLE A. DORNATH-MOHR AND MELVIN J. WADE
ATENT NO.: 5,028,971 - ISSUED 07-02-91

TITLE: ELECTRON PARAMAGNETIC RESONANCE INSTRUMENT WITH SUPERCONDUCTIVE CAVITY
INVENTOR(S): LOUIS J. JASPER, JR.
PATENT NO.: 5,030,914 - ISSUED 07-09-91

TITLE: INFRARED HOT-ELECTRON TRANSISTOR
INVENTOR(S): KWONG-KIT CHOI
PATENT NO.: 5,031,013 - ISSUED 07-09-91

TITLE: PERMANENT MAGNET FIELD SOURCES OF CONICAL ORIENTATION
INVENTOR(S): HERBERT A. LEUPOLD AND ERNEST POTENZIANI, II
PATENT NO.: 5,034,715 - ISSUED 07-23-91

TITLE: HIGH TEMPERATURE RECHARGEABLE MOLTEN SALT BATTERY
INVENTOR(S): EDWARD J. PLICHTA AND WISHVENDER K. BEHL
PATENT NO.: 5,035,963 - ISSUED 07-30-91

TITLE: HETEROGENEOUS COMPOSITE AND METHOD OF MAKING
INVENTOR(S): WILLIAM L. WADE, JR., ROBERT J. MAMMONE AND MICHAEL BINDER
STATUTORY INVENTION REGISTRATION NO.TITLE NO.: H944- PUBLISHED 08-06/91

TITLE: METHOD OF PREPARING A QUARTZ SURFACE FOR SWEEPING
INVENTOR(S): JOHN G. GUALTIERI
TATUTORY INVENTION REGISTRATION NO.TITLE NO.: H952- PUBLISHED 08-06-91

CSF: ELECTRONIC DEVICES ACTV: ARL, ADELPHI LABORATORY CENTER, MD

TITLE: HIGH ENERGY PRODUCT RADIALLY ORIENTED TOROIDAL MAGNET AND METHOD OF MAKING
INVENTOR(S): HERBERT A. LEUPOLD
PATENT NO.: 5,041,419 - ISSUED 08-20-91

TITLE: METHOD OF SENSING CONTAMINATION IN THE ATMOSPHERE
INVENTOR(S): JOHN R. VIG
PATENT NO.: 5,042,288 - ISSUED 08-27-91

TITLE: HIGH TEMPERATURE MOLTEN SALT THERMAL CELL INCLUDING A TERNARY METAL SULFIDE CATHODE
INVENTOR(S): EDWARD J. PLICHTA AND WISHVENDER R. BEHL
PATENT NO.: 5,045,416 - ISSUED 09-03-91

TITLE: RADIAL TRANSMISSION LINE FOR WAVEFORM GENERATION AND POWER ACCUMULATION
INVENTOR(S): MAURICE WEINER, LAWRENCE J. BOVINO AND ANDERSON H. KIM
PATENT NO.: 5,047,621 - ISSUED 09-10-91

TITLE: OPEN CRYOGENIC MICROWAVE TEST CHAMBER
INVENTOR(S): THOMAS E. KOSCICA, RICHARD W. BABBITT, WILLIAM C. DRACH
PATENT NO.: 5,052,183 - ISSUED 10-01-91

TITLE: COMPENSATION FOR MAGNETIC NONUNIFORMITIES OF PERMANENT MAGNET STRUCTURES
INVENTOR(S): MANLIO G. ABELE, RAMESH CHANDRA, HENRY RUSINEK, ERNEST POTENZIANI, II, HERBERT A. LEUPOLD
PATENT NO.: 5,055,812 - ISSUED 10-08-91

TITLE: LOW-COST SAW PACKAGING TECHNIQUE
INVENTOR(S): ELIO A. MARIANI
PATENT NO.- 5,059,848 - ISSUED 10-22-91

TITLE: FABRICATION OF PERMANENT MAGNET TOROIDAL RINGS
INVENTOR(S): HERBERT A. LEUPOLD
PATENT NO.: 5,063,004 - ISSUED 11-05-91

TITLE: PERIODIC PERMANENT MAGNET STRUCTURE WITH INCREASED USEFUL FIELD
INVENTOR(S): JOHN P. CLARKE
REISSUE NO: RE.33,736 - ISSUED 11-05-91

TITLE: OPTICAL NON-LINEAR ARTIFICIAL DIELECTRICS
INVENTOR(S): R. R. SHURTZ, E. J. SHARP, AND J. E. MILLER
PATENT NO.: 5,063,418 - ISSUED 11-05-91

TITLE: CELL COMPARTMENT FOR BATTERY MATRIX
INVENTOR(S): JOHN A. CHISTOPULOS
STATUTORY INVENTION REGISTRATION NO.TITLE NO.: H985 - PUBLISHED 11-05-91

TITLE: THIN FILM THICKNESS MAPPING TECHNIQUE
INVENTOR(S): RICHARD G. SARTORE
STATUTORY INVENTION REGISTRATION NO.TITLE NO.: H993 - PUBLISHED 11-05-91

CSF: ELECTRONIC DEVICES ACTV: ARL, ADELPHI LABORATORY CENTER, MD

TITLE: NARROW BAND MICROSTRIP ISOLATOR
INVENTOR(S): RICHARD W. BABBITT, ADAM, RACHLIN, THOMAS E. KOSCICA
PATENT NO.: 5,068,627 - ISSUED 11-26-91

TITLE: DIPOLE FOR MAGNETIC FIELD COMPENSATION
INVENTOR(S): HERBERT A. LEUPOLD
PATENT NO.: 5,072,204 - ISSUED 12-10-91

TITLE: IMPROVED BROADBAND MULTI-LINE, OPTICAL POWER LIMITING
INVENTOR(S): E. J. SHARP, M. J. MILLER, W. W. CLARK, III, G. L. WOOD, G. L. SALAMO
PATENT NO.: 5,073,705 - ISSUED 12-17-91

TITLE: OPTICAL CONTROL OF A MICROWAVE SWITCH
INVENTOR(S): DANA J. STURZEBECHER, ARTHUR PAOLELLA
PATENT NO.: 5,073,717 - ISSUED 12-17-91

TITLE: OPTICAL CONTROL OF A MICROWAVE SWITCH
INVENTOR(S): ARTHUR PAOLELLA
PATENT NO.: 5,073,718 - ISSUED 12-17-91

TITLE: AEROGELS: THIN FILM DETECTOR AND METHOD OF MANFACTURE
INVENTOR(S): E. NELSON
PATENT NO.: 8,23,749 - ISSUED 12-18-91

TITLE: METHOD OF MAKING AN IMPROVED SCANDATE CATHODE
INVENTOR(S): LOUIS E. BRANOVICH, DONALD W. ECKART, GERARD L. FREEMAN, BERNARD SMITH
PATENT NO.: 5,074,818 - ISSUED 12-24-91

TITLE: VARIABLE INVERTED MICROSTRIP COAX TEST FIXTURE
INVENTOR(S): RICHARD W. BABBITT, THOMAS E. KOSCICA, ADAM RACHLIN
PATENT NO.: 5,075,630 - ISSUED 12-24-91

TITLE: ENHANCED MAGNETIC FIELD WITHIN ENCLOSED ANNULAR CAVITY
INVENTOR(S): HERBERT A. LEUPOLD, ERNEST POTENZIANI, II
PATENT NO.: 5,075,662 - ISSUED 12-24-91

TITLE: STEPPED MAGNETIC FIELD SOURCE
INVENTOR(S): HERBERT A. LEUPOLD
PATENT NO.:- 5,084,690 - ISSUED 01-28-92

TITLE: OPTICAL CONTROL CIRCUIT FOR A MICROWAVE MONOLITHIC INTEGRATED CIRCUIT
INVENTOR(S): ARTHUR PAOLELLA
PATENT NO.: 5,086,281 - ISSUED 02-04-92

TITLE: METHOD OF PREPARING A LUMBERED QUARTZ BAR FOR SWEEPING AND THEN SWEEPING SAID LUMBERED QUARTZ BAR
INVENTOR(S): JOHN G. GUALTIERI
PATENT NO.: 5,086,549 - ISSUED 02-11-92

CSF: ELECTRONIC DEVICES ACTV: ARL, ADELPHI LABORATORY CENTER, MD

TITLE: HIGH TEMPERATURE MOLTEN SALT BIPOLAR STACKED MODULE BATTERY
INVENTOR(S): EDWARD J. PLICHTA, WISHVENDER K. BEHL
PATENT NO.: 5,098,800 - ISSUED 03-24-92

TITLE: CONSTANT GAP CLADDED TWISTER
INVENTOR(S): HERBERT A. LEUPOLD
PATENT NO.: 5,099,217 - ISSUED 03-24-92

TITLE: DROP-IN MAGNETICALLY TUNABLE MICROSTRIP BANDPASS FILTER
INVENTOR(S): RICHARD W. BABBITT, ADAM RACHLIN, LOTHAR WANDINGER
PATENT NO.: 5,101,182 - ISSUED 03-31-92

TITLE: HIGH-FIELD, PERMANENT MAGNET FLUX SOURCE
INVENTOR(S): HERBERT A. LEUPOLD
PATENT NO.: 5,103,200 - ISSUED 04-07-92

TITLE: METHOD OF REDUCING THE SURFACE LEAKAGE ON A III-V SEMICONDUCTOR
INVENTOR(S): ROBERT A. LUX, RAVI KHANNA
STATUTORY INVENTION REGISTRATION NO.TITLE NO.: H1041 - PUBLISHED 04-07-92

TITLE: MAGNETIC CLADDING FOR USE IN PERIODIC PERMANENT MAGNET STACKS
INVENTOR(S): HERBERT A. LEUPOLD
PATENT NO.: 5,107,238 - ISSUED 04-21-92

TITLE: ELECTROCHEMICAL CELL THAT DELIVERS HIGH POWER PULSES
INVENTOR(S): CHARLES W. WALKER, JR.
STATUTORY INVENTION REGISTRATION NO.TITLE NO.: H1054 - PUBLISHED 05-05-92

TITLE: METHOD OF DEPOSITING A SUPERCONDUCTING FILM BY ELECTROPHORESIS
INVENTOR(S): ARTHUR TAUBER, ROBERT D. FINNEGAN, MICHELLE A. DORNATH MOHR, FRANK A. MCBRIDE
PATENT NO.: 5,110,767 - ISSUED 05-05-92

TITLE: SAW SLANTED ARRAY CORRELATOR WITH AMPLITUDE ERROR COMPENSATING POLYMER REFLECTIVE ARRAY GRATING
INVENTOR(S): ELIO A. MARIANI
PATENT NO.: 5,113,115 - ISSUED 05-12-92

TITLE: CRITICAL FIELD AND CONTINUITY TESTING METHOD AND DEVICE FOR SUPERCONDUCTING MATERIALS USING THE CHANGE IN INTERNAL AREA OF A SUPER- CONDUCTING LOOP
INVENTOR(S): HERBERT A. LEUPOLD
PATENT NO.: 5,113,135 - ISSUED 05-12-92

TITLE: ADJUSTABLE MAGNETIC FIELD SUPERCONDUCTING SOLENOID
INVENTOR(S): HERBERT A. LEUPOLD
PATENT NO.: 5,113,163 - ISSUED 05-12-92

TITLE: ELECTRODE FOR USE IN A HIGH TEMPERATURE RECHARGEABLE MOLTEN SALT BATTERY AND METHOD OF MAKING SAID ELECTRODE
INVENTOR(S): EDWARD J. PLICHTA, WISHVENDER K. BEHL
PATENT NO.: 5,114,432 - ISSUED 05-19-92

CSF: ELECTRONIC DEVICES ACTV: ARL, ADELPHI LABORATORY CENTER, MD

TITLE: METHOD OF PREPARING A SCANDATE CATHODE BY IMPREGNATING A POROUS TUNGSTEN BILLET WITH A3AL206 COATING THE TOP SURFACE WITH A MIXTURE OF SC6WO12,SC2(WO4)3, AND W IN A 1:3:2 MOLE RATIO, AND HEATING IN
INVENTOR(S): LOUIS E. BRANOVICH, GERARD L. FREEMAN, DONALD W. ECKART
PATENT NO.: 5,114,742 - ISSUED 05-19-92

TITLE: HIGH TEMPERATURE MOLTEN SALT ELECTRO-CHEMICAL CELL
INVENTOR(S): WISHVENDER K. BEHL, EDWARD J. PLICHTA
PATENT NO.: 5,114,805 - ISSUED 05-19-92

TITLE: MICROWAVE OSCILLATOR USING A RING RESONATOR AND OPERABLE AS A REMOTE TEMPERATURE SENSOR
INVENTOR(S): MICHAEL CUMMINGS, ROLAND CADOTTE, JR., ADAM RACHLIN
PATENT NO.: 5,115,210 - ISSUED 05-19-92

TITLE: SIMPLIFIED CLOCK DISTRIBUTION IN ELECTRONIC SYSTEMS
INVENTOR(S): DOUGLAS C. JOHNSON, ARNOLD BARD, PATRICK F. MCHUGH
PATENT NO.: 5,120,989 - ISSUED 06-09-92

TITLE: HEMISPHERICAL CLADDING FOR PERMANENT MAGNET SOLENOIDS
INVENTOR(S): HERBERT A. LEUPOLD
PATENT NO.- 5,126,713 - ISSUED 06-30-92

TITLE: LITHIUM ION RECHARGEABLE INTERCALLATION CELL
INVENTOR(S): STEVEN M. SLANE, DONALD L. FOSTER
STATUTORY INVENTION REGISTRATION NO.TITLE NO.: H1076 - PUBLISHED 07-07-92

TITLE: ELECTRONIC LIGHT BEAM SWITCH
INVENTOR(S): ARNOLD BARD, STANLEY KRONENBERG
STATUTORY INVENTION REGISTRATION NO.TITLE NO.: H1080 - PUBLISHED 07-07-92

TITLE: MONOLITHIC MILLIMETER-WAVE IMAGE GUIDE BALANCED MIXER
INVENTOR(S): SAMUEL DIXON, JR.
STATUTORY INVENTION REGISTRATION NO.TITLE NO.: H1081 - PUBLISHED 07-07-92

TITLE: AMPLITUDE ERROR COMPENSATED SAW REFLECTIVE ARRAY CORRELATOR
INVENTOR(S) ELIO A. MARIANI
PATENT NO.: 5,130,597 - ISSUED 07-14-92

TITLE: MAGNETIC FIELD SHAPER
INVENTOR(S): HERBERT A. LEUPOLD
PATENT NO.: 5,130,597 - ISSUED 07-14-92

TITLE: SAW REFLECTIVE ARRAY CORRELATOR WITH AMPLITUDE ERROR COMPENSATING POLYMER REFLECTIVE ARRAY GRATING
INVENTOR(S): ELIO A. MARIANI
PATENT NO.- 5,138,215 - ISSUED 08-11-92

TITLE: OPTICALLY INJECTION LOCKED RESONANT TUNNEL DIODE OSCILLATOR
INVENTOR(S): JAMES F. HARVEY, ROBERT A. LUX, THOMAS P. HIGGINS, ARTHUR PAOLELLA, DANA J.

STURZEBECHER
ATENT NO.: 5,144,261 - ISSUED 09-01-92

TITLE: SWITCHABLE SCAN ANTENNA ARRAY
INVENTOR(S): RICHARD A. STERN, RICHARD W. BABBITT
PATENT NO.: 5,144,320 - ISSUED 09-01-92

TITLE: LIGHT ACTIVATED HIGH POWER INTEGRATED PULSER
INVENTOR(S): ANDERSON H. KIN,, MAURICE WEINER, STEPHEN LEVY, ROBERT J. ZETO
PATENT NO.: 5,146,075 - ISSUED 09-08-92

TITLE: PHOTOCONDUCTIVE AVALANCHE GAAS SWITCH
INVENTOR(S): ANDERSON H. KIM, MAURICE WEINER, LOUIS J. JASPER, JR., ROBERT J. YOUMANS
PATENT NO.: 5,148,251 - ISSUED 09-15-92

TITLE: HIGH POWER, SOLID STATE RF PULSE GENERATORS
INVENTOR(S): LAWRENCE J. BOVINO, MAURICE WEINER, ANDERSON H. KIM
PATENT NO.: 5,153,442 - ISSUED 10-06-92

TITLE: TRIGGERING TECHNIQUE FOR MULTI-ELECTRODE SPARK GAP SWITCH
INVENTOR(S): LAWRENCE J. BOVINO, WILLIAM H. WRIGHT
PATENT NO.: 5,153,460 - ISSUED 10-06-92

TITLE: ACOUSTIC VIBRATOR WITH VARIABLE SENSITIVITY TO EXTERNAL ACCELERATION
INVENTOR(S): JOHN A. KOSINSKI
ATENT NO.: 5,153,476 - ISSUED 10-06-92

TITLE: RECHARGEABLE SOLID LITHIUM ION ELECTROCHEMICAL SYSTEM
INVENTOR(S): EDWARD J. PLICHTA, WISHVENDER K. BEHL
PATENT NO.: 5,154,990 - ISSUED 10-13-92

TITLE: FLEXIBLE SOLID ELECTROLYTE SEPARATOR FOR USE IN A HIGH TEMPERATURE ELECTROCHEMICAL CELL, METHOD OF MAKING THE SEPARATOR, AND ELECTROCHEMICAL CELL INCLUDING THE SEPARATOR
INVENTOR(S): EDWARD J. PLICHTA, WISHVENDER K. BEHL
PATENT N0: 5,154,991 - ISSUED 10-13-92

TITLE: OPTICALLY ACTIVATED SUB-NANOSECOND HYBRID PULSER
INVENTOR(S): ANDERSON H. KIM, MAURICE WEINER, ROBERT J. YOUMANS, ROBERT J. ZETO, LOUIS J. JASPER, JR.
PATENT NO. 5,155,352 - ISSUED 10-13-92

TITLE: BATTERY CONNECTOR AND METHOD
INVENTOR(S): BRUCE A. TESTA, ARNOLD BARD
PATENT NO.: 5,158,477 - ISSUED 10-27-92

TITLE: MICROSTRIP CIRCUIT WITH TRANSITION FOR DIFFERENT DIELECTRIC MATERIALS
INVENTOR(S): RICHARD W. BABBITT, RICHARD A. STERN
PATENT NO.: 5,160,904 - ISSUED 11-03-92

CSF: ELECTRONIC DEVICES ACTV: ARL, ADELPHI LABORATORY CENTER, MD

TITLE: OPTICAL CONTROL OF A MICROWAVE SWITCH
INVENTOR(S): DANA J. STURZEBECHER, ARTHUR PAOLELLA, THOMAS P. HIGGINS
PATENT NO.: 5,162,657 - ISSUED 11-10-92

TITLE: CANTILEVERED AIR-GAP TYPE THIN FILM PIEZOELECTRIC RESONATOR
INVENTOR(S): ELIO A. MARIANI, RAYMOND MCGOWAN
PATENT NO.: 5,162,691 - ISSUED 11-10-92

TITLE: METHOD OF ENHANCING THE ELECTRICAL CONDUCTIVITY OF INDIUM-TIN-OXIDE ELECTRODE STRIPES
INVENTOR(S): ROBERT J. ZETO, OTTO J. GREGORY, RICHARD C. PIEKARZ
PATENT NO.: 5,163,220 - ISSUED 11-17-92

TITLE: SWEEPING PHOTOREFLECTANCE SPECTROSCOPY
INVENTOR(S): MITRA DUTTA, HONGEN SHEN
PATENT NO.: 5,172,191 - ISSUED 12-15-92

TITLE: DETONATOR IGNITION CIRCUITRY
INVENTOR(S): CHRISTOPHER G. BRAUN
PATENT NO.: 5,173,570 - ISSUED 12-22-92

TITLE: MICROSTRIP-TO-INVERTED-MICROSTRIP TRANSITION
INVENTOR(S): RICHARD W. BABBITT, THOMAS E. KOSCICA, ADAM RACHLIN
PATENT NO.: 5,173,666 - ISSUED 12-22-92

TITLE: MICROSTRIP FERRITE CIRCULATOR FOR SUBSTRATE TRANSITIONING
INVENTOR(S): RICHARD A. STERN, RICHARD W. BABBITT
PATENT NO.: 5,177,456 - ISSUED 01-05-93

TITLE: OPTICALLY ACTIVATED HYBRID PULSER WITH PATTERNED RADIATING ELEMENT
INVENTOR(S): ANDERSON H. KIM, MAURICE WEINER, LOUIS J. JASPER, JR., THOMAS E. KOSCICA, ROBERT J. YOUMANS
PATENT NO.: 5,177,486 - ISSUED 01-05-93

TITLE: MICROSTRIP HIGH REVERSE LOSS ISOLATOR
INVENTOR(S): RICHARD A. STERN, RICHARD W. BABBITT
PATENT NO.: 5,180,997 - ISSUED 01-05-93

TITLE: SLOTTED MICROSTRIP ELECTRONIC SCAN ANTENNA
INVENTOR(S): RICHARD A. STERN, RICHARD W. BABBITT
PATENT NO.: 5,189,433 - ISSUED 02-23-93

TITLE: WIDE-RANGE MULTICOLOR IR DETECTOR
INVENTOR(S): DORAN D. SMITH, MITRA DUTTA, KWONG-KIT CHOI
PATENT NO.:. 5,198,659 - ISSUED 03-30-93

TITLE: METHOD OF TREATING THE SURFACE OF COMMERCIALLY AVAILABLE POLYMER FILMS
INVENTOR(S): WILLIAM L. WADE, JR., ROBERT J. MAMMONE, MICHAEL BINDER
STATUTORY INVENTION REGISTRATION NO.TITLE: H1164 - PUBLISHED 04-06-3

CSF: ELECTRONIC DEVICES ACTV: ARL, ADELPHI LABORATORY CENTER, MD

TITLE: OPTICAL MODULATOR BASED ON GAMMA -X VALLEY MIXING IN GAAS-ALAS
INVENTOR(S): MITRA DUTTA
PATENT NO.: 5,208,695 - ISSUED 05-04-93

TITLE: PLANAR FERRO-ELECTRIC PHASE
INVENTOR(S): RICHARD W. BABBITT, WILLIAM C. DRACH, THOMAS E. KOSCICA
PATENT NO.: 5,212,463 - ISSUED 05-18-93

TITLE: COLOR NIGHT VISION CAMERA SYSTEM
INVENTOR(S): YUE T. CHIU, PHILIP F. KRZYZKOWSKI, RICHARD P. TUTTLE
PATENT NO.: 5,214,503 - ISSUED 05-25-93

TITLE: METHOD OR CREATING X-RAYS FROM A PULSED LASER SOURCE USING A GASEOUS MEDIUM
INVENTOR(S): RICHARD A. NEIFELD
STATUTORY INVENTION REGISTRATION NO.TITLE: H1200 - PUBLISHED 06-01-93

TITLE: QUARTER WAVE HIGH VOLTAGE DC BLOCK COVERED WITH A POLYURETHANE INSULATING LAYER
INVENTOR(S): RICHARD W. BABBITT, WILLIAM C. DRACH, THOMAS E. KOSCICA
PATENT NO.: 5,216,395 - ISSUED 06-01-93

TITLE: MAGNETIC FIELD SOURCES FOR PRODUCING HIGH-INTENSITY VARIABLE FIELDS
INVENTOR(S): HERBERT A. LEUPOLD
PATENT NO.: 5,216,400 - ISSUED 06-01-93

TITLE: MAGNETIC FIELD SOURCES HAVING NON-DISTORTING ACCESS PORTS
INVENTOR(S): HERBERT A. LEUPOLD
PATENT N0: 5,216,401 - ISSUED 06-01-93

TITLE: METHOD OF TREATING A GALLIUM ARSENIDE SURFACE AND GALLIUM ARSENIDE SURFACE SO TREATED
INVENTOR(S): GARY J. GERARDI, EDWARD H. POINDEXTER, FANG RONG
PATENT N0: 5,219,797 - ISSUED 06-15-93

TITLE: OPTICALLY CONTROLLED RESONANT TUNNEL DIODE OSCILLATOR
INVENTOR(S): JAMES F. HARVEY, ROBERT A. LUX, THOMAS P. HIGGINS, ARTHUR PAOLELLA, DANA J. STURZEBECHER
PATENT NO.: 5,223,802 - ISSUED 06-29-93

TITLE: ULTRA-WIDEBAND HIGH POWER PHOTON-TRIGGERED FREQUENCY INDEPENDENT RADIATOR
INVENTOR(S): ANDERSON H. KIM, LEO D. DIDOMENICO, MAURICE WEINER, LOUIS J. JASPER, JR., ROBERT J. YOUMANS, THOMAS E. KOSCICA
PATENT NO.: 5,227,621 - ISSUED 07-13-93

TITLE: LOW-COST, LOW-NOISE, TEMPERATURE-STABLE, TUNABLE-DIELECTRIC RESONATOR OSCILLATOR
INVENTOR(S): MUHAMMAD A. MIZAN, RAYMOND C. MCGOWAN
PATENT NO.: 5,233,319 - ISSUED 08-03-93

TITLE: FLEXIBLE SOLID ELECTROLYTE FOR USE IN SOLID STATE CELLS AND SOLID STATE CELL INCLUDING SAID FLEXIBLE SOLID ELECTROLYTE
INVENTOR(S): EDWARD J. PLICHTA, WISHVENDER K. BEHL
PATENT NO.: 5,238,759 - ISSUED 08-24-93

CSF: ELECTRONIC DEVICES ACTV: ARL, ADELPHI LABORATORY CENTER, MD

TITLE: SAW TRANSDUCER WITH COPLANAR WAVEGUIDE TRANSITION
INVENTOR(S): ELIO A. MARIANI
PATENT NO.: 5,239,517 - ISSUED 08-24-93

TITLE: MICROSTRIP ELECTRONIC SCAN ANTENNA ARRAY
INVENTOR(S): RICHARD A. STERN AND RICHARD W. BABBITT
PATENT NO.: 5,243,354 - ISSUED 09-07-93

TITLE: MICROSTRIP FREQUENCY-SCAN ANTENNA
INVENTOR(S): RICHARD A. STERN, RICHARD W. BABBITT
STATUTORY INVENTION REGISTRATION NO.TITLE: H1230 - PUBLISHED 09-07-93

TITLE: PERIODIC PERMANENT MAGNET STRUCTURE FOR ACCELERATING CHARGED PARTICLES
INVENTOR(S): HERBERT A. LEUPOLD
PATENT NO.: 5,245,621 - ISSUED 09-14-93

PATENT DISCLOSURES

DOCKET NO: HDL-91-6 - 8-30-90
INVENTOR(S): B. PIEKARSKI, J. LANGAN, G. LUCEY
TITLE: SOLDERABILITY TESTER METHODOLOGY

DOCKET NO.: CECOM 4628 - 10-02-90
INVENTOR(S): HERBERT A. LEUPOLD
TITLE: AUTO COMPENSATION OF MAGNETIC IRREGULARITIES

DOCKET NO.: CECOM 4630 - 10-09-90
INVENTOR(S): CHRISTOPHER G. BRAUN
TITLE: A MOS-CONTROLLED-THYRISTOR (MCT)-BASED EXPLODING-BRIDGE-WIRE ADVANCED DETONATOR MODULE

DOCKET NO.: CECOM 4631 - 10-09-90
INVENTOR(S): CHRISTOPHER G. BRAUN
TITLE: A SCR-BASED EXPLODING-BRIDGE-WIRE DETONATOR MODULE WITH IMPROVED RELIABILITY AND NOISE IMMUNITY

DOCKET NO.: CECOM 4632 - 10-09-90
INVENTOR(S): HERBERT A. LEUPOLD
TITLE: SUPERCONDUCTOR-CLAD IRON FOR MAGNET CONSTRUCTION

DOCKET NO.: CECOM 4633 - 10-09-90
INVENTOR(S): HERBERT A. LEUPOLD
TITLE: A MAGIC RING MOTOR/GENERATOR

DOCKET NO.: CECOM 4634 - 10-11-90
INVENTOR(S): MICHAEL CUMMINGS, ROLAND CADOTTE, ADAM RACHLIN
TITLE: A LOW-COST, DISPOSABLE, UNMANNED REMOTE TEMPERATURE SENSOR

DOCKET NO.: CECOM 4635 - 10-11-90
INVENTOR(S): ADAM RACHLIN, ROLAND CADOTTE, MICHAEL CUMMINGS
TITLE: PLANAR METALLIC RING RESONATOR FOR HIGHLY STABLE GaAs FET OSCILLATOR

DOCKET NO.: CECOM 4636 - 10-11-90
INVENTOR(S): ANDERSON H. KIM, LOUIS J. JASPER, JR., MAURICE WEINER, ROBERT J. YOUMANS, ROBERT J. ZETO
TITLE: OPTICALLY ACTIVATED WAFER-SCALE PULSER FOR THE GENERATION OF HIGH POWER PULSES WITH A NANOSECOND PULSE WIDTH

DOCKET NO.: CECOM 4639 - 10-19-90
INVENTOR(S): ROBERT J. MAMMONE, MICHAEL BINDER
TITLE: METHOD OF INCREASING BULK CONDUCTIVITIES OF PVDF FILMS

DOCKET NO.: CECOM 4640 - 10-19-90
INVENTOR(S): HERBERT A. LEUPOLD
TITLE: TRIANGULAR MAGNETIC DIPOLE FIELD SOURCES IN WIGGLERS AND TWISTERS

DOCKET NO.: CECOM 4641 - 10-23-90
INVENTOR(S): CHRISTOPHER KANARIS, TERRILL B. ATWATER
TITLE: IMPROVED ALGORITHM FOR IMPEDANCE SPECTROSCOPY MEASUREMENTS

DOCKET NO.: CECOM 4642 - 10-29-90
INVENTOR(S): LOUIS E. BRANOVICH, DONALD W. ECKART, GERARD L. FREEMAN, BERNARD SMITH
TITLE: IMPROVED SCANDATE CATHODES

DOCKET NO: HDL-91-20 - 10-30-90
INVENTOR(S): G. LUCEY, J. WASYNCZUK, J. HWANG, R. CLOUGH
TITLE: COMPOSITE SOLDER

DOCKET NO.: CECOM 4643 - 11-08-90
INVENTOR(S): ROBERT A. LUX, RARI KHANNA
TITLE: A PROCESS FOR REDUCING SURFACE ELECTRICAL LEAKAGE IN GALLIUM ARSENIDE DEVICES

DOCKET NO.: CECOM 4644 - 11-15-90
INVENTOR(S): LOUIS E. BRANOVICH, DONALD W. ECKART, GERARD L. FREEMAN, BERNARD SMITH
TITLE: LANTHANIDE OXIDE TYPES FOR USE AS EMITTER MATERIALS WHEN COMBINED WITH TUNGSTEN OXIDE

DOCKET NO.: CECOM 4645 - 11-15-90
INVENTOR(S): ANDERSON H. KIM, MAURICE WEINER, LOUIS J. JASPER, JR., THOMAS KOSCICA, ROBERT J. YOUMANS
TITLE: OPTICALLY ACTIVATED MULTI-FREQUENCY HIGH POWER RF GENERATION UTILIZING A WAFER-SCALE SI-GaAs SUBSTRATE

DOCKET NO.: CECOM 4646 - 11-16-90
INVENTOR(S): ANDERSON H. KIM, ROBERT J. YOUMANS, MAURICE WEINER, ROBERT J. ZETO, LOUIS J. JASPER, JR.
TITLE: OPTICALLY ACTIVATED WAFER-SCALE PULSER WITH AlGaAs EPITAXIAL LAYERS

DOCKET NO.: CECOM 4648 - 11-26-90
INVENTOR(S): WILLIAM J. SKUDERA, JR.
TITLE: AN INTERFACE METHOD FOR ACHIEVING BOTH WIDE BAND-WIDTH AND HIGH RESOLUTION OF DOPPLER TYPE SIGNALS

DOCKET NO.: CECOM 4649 - 11-30-90
INVENTOR(S): LOUIS E. BRANOVICH, DONALD W. ECKART, GERARD L. FREEMAN
TITLE: LANTHANIDE OXIDE SERIES WITH MOLYBDENUM TRIOXIDE NEW CATHODE EMITTER MATERIALS

DOCKET NO.: CECOM 4650 - 12-05-90
INVENTOR(S): KWONG-KIT CHOI
TITLE: INFRARED HOT-ELECTRON TRANSISTOR WITH A SUPERLATTICE BASE

DOCKET NO.: CECOM 4651 - 12-05-90
INVENTOR(S): CHARLES W. WALKER, JR. STEVEN M. SLANE
TITLE: HIGH VOLTAGE LITHIUM RECHARGEABLE ELECTROCHEMICAL CELL WITH A THIN CONDUCTING POLYMER CATHODE AND ELECTROLYTE CONTAINING AN ALKYL-CARBONATE SOLVENT

CSF: ELECTRONIC DEVICES ACTV: ARL, ADELPHI LABORATORY CENTER, MD

DOCKET NO.: CECOM 4652 - 12-05-90
INVENTOR(S): JOHN R. VIG
TITLE: METHOD OF ENCLOSING A CRYSTAL OSCILLATOR

DOCKET NO.: CECOM 4654 - 12-13-90
INVENTOR(S): RICHARD W. NEIFELD
TITLE: LASER ABLATION BEAM SCANNER

DOCKET NO.: CECOM 4656 - 12-28-90
INVENTOR(S): SAMUEL DIXON, JR.
TITLE: MONOLITHIC MILLIMETER-WAVE IMAGE GUIDE BALANCED MIXER

DOCKET NO.: CECOM 4657 - 01-02-91
INVENTOR(S): LAWRENCE J. BOVINO, MAURICE WEINER, ANDERSON H. KIM
TITLE: HIGH POWER SOLID STATE RF PULSE GENERATORS

DOCKET NO.: CECOM 4658 - 01-04-91
INVENTOR(S): JOHN A. KOSINSKI, EDWARD R. BAIDY, ARTHUR BALLATO, OWEN P. LAYDEN
TITLE: MICROCIRCUIT PACKAGE WITH INTEGRATED ACOUSTIC ISOLATOR

DOCKET NO.: CECOM 4659 - 01-07-91
INVENTOR(S): CHARLES W. WALKER, JR.
TITLE: POLY 3-METHYLTHIOPHENE CATHODES FOR HIGH VOLTAGE PULSE POWER IN SULFUR DIOXIDE, THIONYL CHLORIDE, AND SULFURYL CHLORIDE BASED ELECTROLYTES

DOCKET NO.: CECOM 4661 - 01-15-91
INVENTOR(S): ROBERT RICHARD KYLE
TITLE: SYNCHRONOUS DETECTION PROCESS APPLIED TO A COMPRESSIVE RECEIVER

DOCKET NO.: CECOM 4663 - 01-15-91
INVENTOR(S): WILLIAM L. WADE, JR., ROBERT J. MAMMONE, MICHAEL BINDER
TITLE: METHOD FOR IMPROVING THE WATER WETTABILITY AND ADHESION OF VAPOR DEPOSITED ALUMINUM TO COMMERCIAL POLYMER FILMS

DOCKET NO.: CECOM 4664 - 01-31-91
INVENTOR(S): EDWARD J. PLICHTA, WISHVENDER K. BEHL
TITLE: FLEXIBLE TRANSITION METAL SULFIDE CATHODES FOR HIGH TEMPERATURE MOLTEN SALT ELECTROCHEMICAL CELLS AND METHOD OF MAKING SAID CATHODE

DOCKET NO.: CECOM 4665 - 01-31-91
INVENTOR(S): HERBERT A. LEUPOLD
TITLE: FIELD AUGMENTATION IN MAGIC SPHERES AND IGLOOS AND CYLINDRICAL EQUIVALENTS

DOCKET NO.: CECOM 4666 - 02-01-91
INVENTOR(S): HERBERT A. LEUPOLD
TITLE: NON-DISRUPTED ACCESS TO MAGIC SPHERE INTERIORS

DOCKET NO: NVESD 2959 - 02-04-91
INVENTOR(S): E. NELSON
TITLE: ION BEAM ETCHING OF METAL OXIDE CERAMICS

CSF: ELECTRONIC DEVICES ACTV: ARL, ADELPHI LABORATORY CENTER, MD

DOCKET NO.: CECOM 4667 - 02-05-91
INVENTOR(S): ROLAND CADOTTE, DANA J. STURZEBECHER, THOMAS P. HIGGINS
TITLE: OPTICALLY TUNED VOLTAGE CONTROLLED OSCILLATOR

DOCKET NO.: CECOM 4668 - 02-05-91
INVENTOR(S): CHRISTOPHER G. BRAUN
TITLE: A VOLTAGE INVERSION SCHEME FOR A MCT-BASED DETONATOR MODULE

DOCKET NO.: CECOM 4669 - 02-05-91
INVENTOR(S): CHRISTOPHER G. BRAUN
TITLE: A SAFETY AND TIMING MODULE TO SEQUENCE EVENTS ON MISSILES

DOCKET NO.: CECOM 4670 - 02-05-91
INVENTOR(S): EDWARD J. PLICHTA, WISHVENDER K. BEHL
TITLE: FLEXIBLE SOLID ELECTROLYTE SEPARATOR FOR HIGH TEMPERATURE ELECTROCHEMICAL CELLS AND METHOD OF MAKING SAID ELECTROLYTE SEPARATOR

DOCKET NO.: CECOM 4671 - 02-06-91
INVENTOR(S): LOUIS J. JASPER, JR.
TITLE: ELECTRON PARAMAGNETIC RESONANCE INSTRUMENT WITH SUPERCONDUCTIVE CAVITY

DOCKET NO.: CECOM 4674 - 02-15-91
INVENTOR(S): THANE SMITH
TITLE: PHOTOCONDUCTIVE SWITCH STRUCTURE FOR ON-WAFER Z-PARAMETER MEASUREMENTS OF MMICS

DOCKET NO.: CECOM 4675 - 02-15-91
INVENTOR(S): THOMAS P. HIGGINS, DANA J. STRUZEBECHER, ARTHUR PAOLELLA
TITLE: AN IMPROVED DIRECT OPTICAL INJECTION LOCKED FET OSCILLATOR

DOCKET NO.: CECOM 4676 - 02-27-91
INVENTOR(S): HERBERT A. LEUPOLD, ANUP TILAK
TITLE: A SIMPLE DIPOLAR CONFINED MAGNETIC FIELD SOURCE

DOCKET NO.: CECOM 4677 - 02-27-91
INVENTOR(S): MUHAMMAD A MIZAN, RAYMOND C. McGOWAN
TITLE: X-BAND BIPOLAR JUNCTION TRANSISTOR AMPLIFIER

DOCKET NO.: CECOM 4678 - 02-27-91
INVENTOR(S): LOUIS E. BRANOVICH, GERALD L. FREEMAN, DONALD W. ECKART
TITLE: PREPARATION OF IMPROVED SCANDATE AND SCANDATE TYPE CATHODES

DOCKET NO.: CECOM 4679 - 03-06-91
INVENTOR(S): MUHAMMAD A. MIZAN, RAYMOND C. McGOWAN
TITLE: LOW COST, LOW NOISE, TEMPERATURE STABLE, TUNABLE DIELECTRIC RESONATOR OSCILLATOR (DRO)

DOCKET NO.: CECOM 4680 - 03-14-91
INVENTOR(S): KWONG-KIG CHOI
TITLE: NEW MODES OF INFRARED HOT-ELECTRON TRANSISTOR OPERATION IN INFRARED RADIATION DETECTION

CSF: ELECTRONIC DEVICES ACTV: ARL, ADELPHI LABORATORY CENTER, MD

DOCKET NO.: CECOM 4681 - 03-19-91
INVENTOR(S): MICHAEL BINDER, ROBERT J. MAMMONE
TITLE: METHOD OF INCREASING ELECTRICAL BREAKDOWN VOLTAGES OF THIN POLYMER FILMS

DOCKET NO.: CECOM 4683 - 03-27-91
INVENTOR(S): STUART D. ALBERT, WILLIAM J. SKUDERA, JR.
TITLE: A FAST EQUIVALENT ADAPTIVE FILTER METHOD FOR INTERFERENCE REJECTION

DOCKET NO.: CECOM 4685 - 03-29-91
INVENTOR(S): ERIK LENZING, THOMAS E. KOSCICA
TITLE: CRYOGENIC CHAMBER FOR TESTING MICROWAVE CIRCUITS AND DEVICES

DOCKET NO.: CECOM 4686 - 04-02-91
INVENTOR(S): RICHARD W. BABBITT, THOMAS E. KOSCICA, WILLIAM C. DRACH
TITLE: PLANAR FERRO-ELECTRIC PHASE SHIFTER

DOCKET NO.: CECOM 4687 - 04-05-91
INVENTOR(S): JACQUES WAHIDE, CALVIN D. BATES
TITLE: HIGH SPEED EVALUATION OF SATURATION IN TRAVELING WAVE TUBE AMPLIFIERS

DOCKET NO.: CECOM 4688 - 04-05-91
INVENTOR(S): HERBERT A. LEUPOLD
TITLE: AXIAL GRADIENTS IN TRANSVERSE MAGNETIC FIELD SOURCES

DOCKET NO.: CECOM 4689 - 04-18-91
INVENTOR(S): ROLAND CADOTTE, JR., MICHAEL CUMMINGS, ADAM RACHLIN, RICHARD W. BABBITT
TITLE: MICROWAVE OSCILLATORS STABILIZED WITH A SUPERCONDUCTING RING RESONATOR OPERATING AS A REMOTE TEMPERATURE SENSORS

DOCKET NO.: CECOM 4691 - 04-23-91
INVENTOR(S): THOMAS E. KOSCICA, RICHARD W. BABBITT
TITLE: CIRCUIT FOR MEASURING CAPACITANCE AT ANY DC BIAS VOLTAGE

DOCKET NO.: CECOM 4692 - 04-23-91
INVENTOR(S): ROLAND CADOTTE, JR., THOMAS E. KOSCICA, MICHAEL CUMMINGS, ERIK LENZING
TITLE: MULTI-DIMENSIONAL COMPUTER INTERFACE DEVICE

DOCKET NO.: CECOM 4694 - 04-25-91
INVENTOR(S): ELIO A. MARIANI
TITLE: SAW TRANSDUCER WITH COPLANAR WAVEGUIDE TRANSITION

DOCKET NO.: CECOM 4695 - 04-26-91
INVENTOR(S): ARTHUR TAUBER, ROBERT D. FINNEGAN, MICHELLE A. DORNATH MOHR, FRANK A McBRIDE
TITLE: THICK FILM DEPOSITION OF HoBa2Cu3 ¯7-X (Ho-123) BY ELECTROPHORESIS

DOCKET NO.: CECOM 4696 - 04-30-91
INVENTOR(S): HERBERT A. LEUPOLD
TITLE: TOROIDAL PERMANENT MAGNET SOLENOID

CSF: ELECTRONIC DEVICES ACTV: ARL, ADELPHI LABORATORY CENTER, MD

DOCKET NO.: CECOM 4697 - 05-06-91
INVENTOR(S): ARTHUR TAUBER
TITLE: METHOD AND APPARATUS FOR FABRICATION OF HIGH Tc SUPERCONDUCTING WIRE

DOCKET NO.: CECOM 4698 - 05-08-91
INVENTOR(S): THOMAS P. HIGGINS, DANA J. STURZEBECHER, ROLAND CADOTTE, ARTHUR PAOLELLA
TITLE: AN INDIRECT OPTICALLY INJECTION LOCKED SELF-OSCILLATING DUAL GATE MESFET MIXER

DOCKET NO.: CECOM 4699 - 05-15-91
INVENTOR(S): THOMAS PODLESAK
TITLE: FAULT INDICATING WATER RESISTOR

DOCKET NO.: CECOM 4701 - 05-16-91
INVENTOR(S): RICHARD A. STERN, RICHARD W. BABBITT, THOMAS E. KOSCICA
TITLE: MILLIMETER WAVE FERRITE SWITCH UTILIZING A SUPERCONDUCTING SWITCHING COIL

DOCKET NO.: CECOM 4702 - 05-28-91
INVENTOR(S): LAWRENCE R. GROEHL
TITLE: CONNECTION INTERFACE BETWEEN SUPERCONDUCTORS AND NORMAL CONDUCTORS

DOCKET NO.: CECOM 4705 - 06-03-91
INVENTOR(S): MITRA DUTTA, HONGEN SHEN
TITLE: ALL OPTICAL MODULATION IN GaAs-AlAs MULTI QUANTUM WELLS EMBEDDED BY SIN+ STRUCTURE

DOCKET NO.: CECOM 4706 - 06-03-91
INVENTOR(S): MITRA DUTTA
TITLE: OPTICAL MODULATOR BASED ON p-x VALLEY MIXING IN GaAs-AlAs

DOCKET NO.: CECOM 4707 - 06-05-91
INVENTOR(S): WILLIAM J. SKUDERA, JR., VASILIOS ALEVIZAKOS
TITLE: A CIRCUIT FOR ACCURATELY MEASURING AoA OF BPSK SIGNALS

DOCKET NO.: CECOM 4710 - 06-06-91
INVENTOR(S): MITRA DUTTA, GERALD J. IAFRATE, KIT WOOK KIM, MICHAEL A. STROSCIO
TITLE: PHONON MODULATED SWITCH

DOCKET NO: HDL-92-6 - 6-10-91
INVENTOR(S): T. STEWART, M. AUSTIN, K. KIRCHNER, J. ADAMS
TITLE: TEST SPECIMEN FOR X-RAY LAMINOGRAPHY

DOCKET NO.: CECOM 4711 - 06-12-91
INVENTOR(S): JAMES F. HARVEY, ROBERT A. LUX, THOMAS P. HIGGINS, ARTHUR PAOLELLA, DANA J. STURZEBECHER
TITLE: OPTICALLY MODULATED RESONANT TUNNEL DIODE OSCILLATOR

DOCKET NO.: CECOM 4712 - 06-21-91
INVENTOR(S): JAMES F. HARVEY, ROBERT A. LUX, THOMAS P. HIGGINS, DANA J. STURZEBECHER, ARTHUR PAOLELLA
TITLE: OPTICALLY INJECTION LOCKED RESONANT TUNNEL DIODE OSCILLATOR

CSF: ELECTRONIC DEVICES ACTV: ARL, ADELPHI LABORATORY CENTER, MD

DOCKET NO: C2NVEO 2984 - 06-27-91
INVENTOR(S): E. J. SHARP, G. L. WOOD, W. W. CLARK, III, AND G. J. SALAMO
TITLE: MUTUALLY PUMPED PHASE CONJUGATOR FOR REMOTE IDENTIFICATION

DOCKET NO.: CECOM 4713 - 07-08-91
INVENTOR(S): HERBERT A. LEUPOLD, GEORGE F. McLANE
TITLE: CONSTRUCTION OF MAGIC SPHERES AND IGLOOS

DOCKET NO.: CECOM 4716 - 07-18-91
INVENTOR(S): OWEN P. LAYDEN, EDWARD R. BAIDY
TITLE: ELECTROMAGNETIC INTERFERENCE (EMI) PROTECTED MULTICHIP PACKAGE EMPLOYING ISOLATION OF DC POWER LINE USING PIEZOELECTRIC POWER TRANSFER

DOCKET NO.: CECOM 4718 - 07-22-91
INVENTOR(S): THOMAS E. KOSCICA, RICHARD W. BABBITT, WILLIAM C. DRACH
TITLE: QUARTER WAVE DC HIGH VOLTAGE BLOCK AND PROCESS FOR MAKING THE SAME

DOCKET NO.: CECOM 4719 - 07-25-91
INVENTOR(S): BRUCE JETTE
TITLE: ELECTROCHEMICAL COULOMETER

DOCKET NO.: CECOM 4720 - 07-30-91
INVENTOR(S): THOMAS E. KOSCICA, WILLIAM C. DRACH
TITLE: METHOD OF SIZE REDUCTION AND ASSOCIATED MODEL FOR PLANAR MICROWAVE CIRCUITS

DOCKET NO.: CECOM 4722 - 08-01-91
INVENTOR(S): ANDERSON H. KIM, MAURICE WEINER, ROBERT J. YOUMANS, LOUIS J. JASPER, JR.
TITLE: PULSE SHARPENING USING AN OPTICAL PULSE

DOCKET NO.: CECOM 4723 - 08-08-91
INVENTOR(S): ELIO A. MARIANI
TITLE: TAPERED SAW TRANSDUCER WITH UNIDIRECTIONAL PROPERTIES

DOCKET NO.: CECOM 4724 - 08-13-91
INVENTOR(S): BERNARD LAVENE, ROBERT J. MAMMONE, MICHAEL BINDER
TITLE: METHOD OF INCREASING DIELECTRIC BREAKDOWN STRENGTHS IN POLYMER FILM CAPACITORS

DOCKET NO.: CECOM 4726 - 08-16-91
INVENTOR(S): ANDERSON H. KIM, MAURICE WEINER, THOMAS E. KOSCICA, LEO D. DiDOMENICO, LOUIS J. JASPER, JR.
TITLE: HIGH POWER PHOTON TRIGGERED ULTRA-WIDEBAND RF RADIATOR

DOCKET NO.: CECOM 4727 - 09-03-91
INVENTOR(S): LOUIS E. BRANOVICH, DONALD W. ECKART
TITLE: METHOD OF OBTAINING MAXIMUM ELECTRON EMISSION FROM ELECTRON DEFICIENT COMPOUNDS

DOCKET NO.: CECOM 4728 - 09-03-91
INVENTOR(S): MICHAEL F. TOMPSETT, RAPHAEL TSU
TITLE: A LIGHT EMITTING DIODE WITH ELECTROCHEMICALLY ETCHED POROUS SILICON

CSF: ELECTRONIC DEVICES **ACTV: ARL, ADELPHI LABORATORY CENTER, MD**

DOCKET NO.: CECOM 4729 - 09-09-91
INVENTOR(S): WILLIAM L. WADE, JR., ROBERT J. MAMMONE, MICHAEL BINDER
TITLE: METHOD OF INCREASING DIELECTRIC BREAKDOWN STRENGTHS OF MELT EXTRUDED POLYPROPYLENE FILMS

DOCKET NO.: CECOM 4730 - 09-09-91
INVENTOR(S): MICHAEL BINDER, ROBERT J. MAMMONE
TITLE: INCREASED BREAKDOWN STRENGTHS OF POLYPROPYLENE FILMS MELT EXTRUDED FROM SURFACE MODIFIED RESIN

DOCKET NO.: CECOM 4732 - 09-18-91
INVENTOR(S): WILLIAM J. SKUDERA, JR., ELIO A. MARIANI, STUART D. ALBERT
TITLE: AN EFFECTIVE WIDE DYNAMIC RANGE DETECTION CIRCUIT

DOCKET NO.: CECOM 4733 - 09-23-91
INVENTOR(S): ROBERT J. ZETO, OTTO J. GREGORY, RICHARD C. PIEKARZ
TITLE: METHOD OF ENHANCING THE ELECTRICAL CONDUCTIVITY OF TRANSPARENT ELECTRODE STRIPES IN THIN FILM ELECTROLUMINESCENT DISPLAYS

DOCKET NO.: CECOM 4734 - 09-23-91
INVENTOR(S): MITRA DUTTA, GERALD J. IAFRATE, HAROLD L. GRUBIN, KI WOOK KIM, MICHAEL A. STROSCIO
TITLE: METAL-ENCAPSULATED QUANTUM WIRE FOR ENHANCED CHARGE TRANSPORT

DOCKET NO.: CECOM 4735 - 10-07-91
INVENTOR(S): ANDERSON H. KIM, MAURICE WEINER, LOUIS J. JASPER, JR., ROBERT J. YOUMANS
TITLE: MONOLITHIC, HIGH POWER PHOTON TRIGGERED ULTRA-WIDEBAND RF RADIATOR

DOCKET NO.: CECOM 4737 - 10-18-91
INVENTOR(S): EDWARD J. PLICHTA AND WISHVENDER K. BEHL
TITLE: RECHARGEABLE SOLID STATE LITHIUM ION BATTERY SYSTEM

DOCKET NO.: CECOM 4738 - 10-22-91
INVENTOR(S): JAGADEESH PAMULAPATI, HONGEN SHEN, MITRA DUTTA
TITLE: A METHOD OF ETCHING POROUS SILICON USING PRE- PATTERNED SUBSTRATES

DOCKET NO.: CECOM 4739 - 10-29-91
INVENTOR(S): ARTHUR PAOLELLA and PETER R. HERCZFELD
TITLE: A VARIABLE GAIN OPTICAL DETECTOR FOR ARRAY APPLICATIONS

DOCKET NO: - 10-30-91 SUBMITTED
INVENTOR(S): G. LUCEY, M. TENCH
TITLE: METHOD OF FLUXLESS SOLDERING

DOCKET NO: - 10-30-91 SUBMITTED
INVENTOR(S): G. LUCEY, M. TENCH
TITLE: METHOD OF ACCELERATED AGING

DOCKET NO.: CECOM 4740 - 11-05-91
INVENTOR(S): ELIO A. MARIANI
TITLE: PLANAR TUNABLE YIG FILTER

CSF: ELECTRONIC DEVICES **ACTV: ARL, ADELPHI LABORATORY CENTER, MD**

DOCKET NO.: CECOM 4741 - 11-06-91
INVENTOR(S): JAMES F. HARVEY, ROBERT A. LUX, RAPHAEL TSU
TITLE: NEGATIVE DIFFERENTIAL RESISTANCE DEVICE BASED ON TUNNELING THROUGH MICROCLUSTERS

DOCKET NO.: CECOM 4742 - 11-06-91
INVENTOR(S): ANDERSON H. KIM, LEO DiDOMENICO, MAURICE WEINER, LOUIS J. JASPER, JR. AND ROBERT J. YOUMANS
TITLE: ULTRA-WIDEBAND HIGH POWER PHOTON TRIGGERED FREQUENCY INDEPENDENT RADIATOR

DOCKET NO.: CECOM 4743 - 11-12-91
INVENTOR(S): HERBERT A. LEUPOLD
TITLE: MAGIC CYLINDER WITH ARBITRARY SLIT POSITION FOR UV-X RAY TELESCOPES

DOCKET NO.: CECOM 4744 - 11-14-91
INVENTOR(S): KWONG-KIT CHOI
TITLE: VOLTAGE TUNABLE MULTI-COLOR INFRARED DETECTORS

DOCKET NO.: CECOM 4745 - 11-18-91
INVENTOR(S): ELIO A. MARIANI
TITLE: PLANAR MICROWAVE/MILLIMETER-WAVE PRESELECTION FILTER WITH TUNABLE NARROW BAND EXCISION

DOCKET NO.: CECOM 4746 - 11-18-91
INVENTOR(S): ELIO A. MARIANI
TITLE: MAGNETICALLY-TUNABLE BAND-REJECTION FILTER USING PLANAR MIC (MICROWAVE INTEGRATED CIRCUIT) CONFIGURATION

DOCKET NO.: CECOM 4747 - 11-19-91
INVENTOR(S): ANDERSON H. KIM, MAURICE WEINER, LOUIS J. JASPER, JR., ROBERT J. YOUMANS
TITLE: HIGH POWER, PHOTON TRIGGERED ULTRA-WIDEBAND RF RADIATOR WITH TWO OPPOSITE APERTURES

DOCKET NO.: CECOM 4748 - 11-20-91
INVENTOR(S): DORAN D. SMITH
TITLE: SINGLE ELECTRONICS DEVICES USING FULLERENES

DOCKET NO.: CECOM 4750 - 12-04-91
INVENTOR(S): THOMAS E. KOSCICA
TITLE: ACTIVE CIRCULATOR USING OPERATIONAL AMPLIFIERS

DOCKET NO.: CECOM 4751 - 12-04-91
INVENTOR(S): ANDERSON H. KIM, MAURICE WEINER, LOUIS J. JASPER, JR., ROBERT J. YOUMANS
TITLE: MONOLITHIC OPTICALLY ACTIVATED ULTRA-WIDEBAND FREQUENCY INDEPENDENT GENERATOR/RADIATOR

DOCKET NO.: CECOM 4752 - 12-04-91
INVENTOR(S): THOMAS E. KOSCICA, RICHARD W. BABBITT, WILLIAM C. DRACH
TITLE: PLANAR DIGITAL FERROELECTRIC PHASE SHIFTER

CSF: ELECTRONIC DEVICES ACTV: ARL, ADELPHI LABORATORY CENTER, MD

DOCKET NO.: CECOM 4756 - 12-17-91
INVENTOR(S): MICHAEL BINDER, ROBERT J. MAMMONE, BERNARD LAVENE
TITLE: POLYMER BASED FILM CAPACITOR WITH INCREASED DIELECTRIC BREAKDOWN STRENGTHS

DOCKET NO: NVESD 3003 - 12-18-91
INVENTOR(S): E. Nelson
TITLE: AEROGELS: THIN FILM DETECTOR AND METHOD OF MANUFACTURE

DOCKET NO.: CECOM 4757 - 12-18-91
INVENTOR(S): HERBERT A. LEUPOLD
TITLE: FIELD FREE CHAMBERS IN PERMANENT MAGNET SOLENOIDS

DOCKET NO.: CECOM 4758 - 12-24-91
INVENTOR(S): HONGEN SHEN, MITRA DUTTA, JAGADEESH PAMULAPATI
TITLE: USE OF UNIAXIAL STRESS IN SPATIAL LIGHT MODULATOR

DOCKET NO.: CECOM 4759 - 12-27-91
INVENTOR(S): HERBERT A. LEUPOLD
TITLE: MERIDONIAL IGLOO AND WIGWAM MAGNETIC FIELD SOURCES

DOCKET NO.: CECOM 4760 - 01-02-92
INVENTOR(S): THOMAS E. KOSCICA, WILLIAM C. DRACH
TITLE: HIGH VOLTAGE DIRECT CURRENT POWER SUPPLY WITH FEEDBACK CONTROL, OVER VOLTAGE, AND SHORT CIRCUIT PROTECTION

DOCKET NO.: CECOM 4761 - 01-02-92
INVENTOR(S): THOMAS P. HIGGINS, DANA J. STURZEBECHER
TITLE: AN OPTICALLY CONTROLLED MESFET OSCILLATOR USING A SECOND MESFET AS AN OPTICALLY SENSITIVE ELEMENT

DOCKET NO.: CECOM 4762 - 01-03-92
INVENTOR(S): MICHELLE A. DORNATH-MOHR, ARTHUR TAUBER, ROBERT D. FINNEGAN
TITLE: FABRICATION OF Y(1-x) Ca(x)Ba(2)Cu(4)0(8) AND Y(1)Ba(2) Cu4-xLix 08

DOCKET NO.: CECOM 4766 - 01-16-92
INVENTOR(S): RICHARD W. BABBITT, RICHARD A. STERN, ERNEST POTENZIANI, II
TITLE: PLANAR PERMANENT BIASING MAGNET FOR MICROWAVE CIRCULATORS

DOCKET NO.: CECOM 4767 - 01-16-92
INVENTOR(S): RICHARD W. BABBITT, THOMAS E. KOSCICA, WILLIAM C. DRACH
TITLE: MULTIPLE FERROELECTRIC PHASE SHIFTER

DOCKET NO.: CECOM 4768 - 01-27-92
INVENTOR(S): WILLIAM WILBER, ROLAND CADOTTE, JR., MICHAEL CUMMINGS, ADAM RACHLIN
TITLE: MAGNETIC FLUX-ENHANCED CONTROL LINE FOR FLUX FLOW TRANSISTOR

DOCKET NO.: CECOM 4769 - 01-27-92
INVENTOR(S): HERBERT A. LEUPOLD
TITLE: DETECTION AND COMPENSATION OF DEFECTS IN CYLINDRICAL MAGNETS

CSF: ELECTRONIC DEVICES ACTV: ARL, ADELPHI LABORATORY CENTER, MD

DOCKET NO.: CECOM 4770 - 01-28-92
INVENTOR(S): HERBERT A. LEUPOLD
TITLE: MAGNETIC RESISTORS

DOCKET NO.: CECOM 4771 - 01-29-92
INVENTOR(S): EDWARD J. PLICHTA, WISHVENDER K. BEHL
TITLE: FLEXIBLE SOLID STATE IONIC ELECTROLYTE PROCESS FOR USE IN SOLID STATE CELLS

DOCKET NO.: CECOM 4772 - 02-04-92
INVENTOR(S): MICHAEL CUMMINGS, ROLAND CADOTTE, JR., ADAM RACHLIN, RICHARD W. BABBITT
TITLE: DUAL CONTROL LINE FLUX FLOW MIXER

DOCKET NO.: CECOM 4773 - 02-05-92
INVENTOR(S): WILLIAM WILBER, AHMAD SAFARI, MILIND BEDAKAR
TITLE: PROCESS FOR GROWING FERROELECTRIC FILMS ON SILICON WITH SILICIDE BARRIER LAYER

DOCKET NO.: CECOM 4774 - 02-05-92
INVENTOR(S): WILLIAM WILBER, AHMAD SAFARI, MILLIND BEDAKAR
TITLE: THE USE OF $CoSi_2$ AND $NiSi_2$ FOR THE GROWTH OF FERROELECTRIC THIN FILMS ON SILICON

DOCKET NO.: CECOM 4775 - 02-06-92
INVENTOR(S): ERIK H. LENZING, CHARLES HECHTMAN
TITLE: HIGH TEMPERATURE SUPERCONDUCTING (HTS) MICROSTRIP OPTICAL PHASE SHIFTER

DOCKET NO.: CECOM 4776 - 02-06-92
INVENTOR(S): RAYMOND C. McGOWAN, ELIO A. MARIANI
TITLE: SENSITIVE, DUAL-CHANNEL FLEXURAL ACOUSTIC WAVE CHEMICAL SENSOR

DOCKET NO.: CECOM 4777 - 02-06-92
INVENTOR(S): BRUCE D. JETTE
TITLE: PASSIVE THERMAL RANGEFINDER

DOCKET NO.: CECOM 4778 - 02-11-92
INVENTOR(S): WILLIAM WILBER, STEVEN C. TIDROW, ARTHUR TAUBER
TITLE: TARGET DESIGN FOR INCREASING THE SIZE OF UNIFORM FILMS PREPARED BY LASER ABLATION

DOCKET NO.: CECOM 4779 - 02-11-92
INVENTOR(S): WILLIAM C. DRACH, RICHARD W. BABBITT, THOMAS E. KOSCICA
TITLE: METHOD FOR FABRICATING MICROWAVE FERROELECTRIC PHASE SHIFTER

DOCKET NO.: CECOM 4780 - 02-11-92
INVENTOR(S): MICHAEL CUMMINGS, ROLAND CADOTTE, JR., ADAM RACHLIN
TITLE: ULTRA BROADBAND WEAK LINK RF SWITCH

DOCKET NO.: CECOM 4781 - 02-11-92
INVENTOR(S): HERBERT A. LEUPOLD
TITLE: VARIABLE MAGNETIC RELUCTORS

CSF: ELECTRONIC DEVICES ACTV: ARL, ADELPHI LABORATORY CENTER, MD

DOCKET NO.: CECOM 4782 - 02-27-92
NVENTOR(S): WILLIAM C. DRACH, THOMAS E. KOSCICA, RICHARD W. BABBITT
TITLE: HIGH VOLTAGE VARACTOR

DOCKET NO.: CECOM 4783 - 02-27-92
INVENTOR(S): MITRA DUTTA, MICHAEL A. STROSCIO, VLADIMIR MITIN, REMVYDAS MICKEVICIUS
TITLE: NEGATIVE ABSOLUTE CONDUCTANCE (NAC) DEVICE

DOCKET NO.: CECOM 4784 - 02-27-92
INVENTOR(S): HERBERT A. LEUPOLD, ARTHUR TAUBER
TITLE: TEMPERATURE CONTROL OF B/H IN RELUCTORS

DOCKET NO.: CECOM 4785 - 02-27-92
INVENTOR(S): HERBERT A. LEUPOLD
TITLE: APERTURE SHAPING IN RING AND SPHERE DIPPLAR FIELD SOURCES

DOCKET NO: NVEOD 3007 - 02-28-92
INVENTOR(S): G. L. WOOD
TITLE: NONLINEAR AGILE FILTER

DOCKET NO.: CECOM 4786 - 03-09-92
INVENTOR(S): KENNETH A. JONES, HOWARD S. LEE
TITLE: SELECTIVE COMPOSITIONAL DISORDERING OF A GaAs BASED HETERO-STRUCTURE BY THE IN-DIFFUSION OF Au THROUGH A SINGLE CRYSTAL, EPITAXIALLY GROWN Ge FILM

DOCKET NO.: CECOM 4787 - 03-09-92
INVENTOR(S): GARY J. GERARDI, EDWARD H. POINDEXTER, FANG RONG
TITLE: METHOD OF TREATING GALLIUM ARSENIDE SURFACE AND GALLIUM ARSENIDE SURFACE SO TREATED

DOCKET NO.: CECOM 4788 - 03-16-92
INVENTOR(S): RICHARD A. STERN, RICHARD W. BABBITT, ADAM RACHLIN
TITLE: COMPACT MICROWAVE/MILLIMETER WAVE MICROSTRIP FERRITE CIRCULATOR

DOCKET NO.: CECOM 4789 - 03-16-92
INVENTORtS): LOUIS E. BRANOVICH, DONALD W. ECKART
TITLE: MODELS FOR SUPERCONDUCTORS, AND SUPERCONDUCTOR PRECURSORS

DOCKET NO.: CECOM 4790 - 03-16-92
INVENTOR(S): HERBERT A. LEUPOLD
TITLE: NON-DISTORTED ACCESS WITHOUT REMANENCE DROP

DOCKET NO.: CECOM 4791 - 03-16-92
INVENTOR(S): RICHARD G. SARTORE
TITLE: LINE WIDTH MEASUREMENTS ON COATED MICRO-ELECTRONIC DEVICES USING ENERGY DISPERSIVE X-RAY ANALYSIS

DOCKET NO.: CECOM 4792 - 03-18-92
'NVENTOR(S): KENNETH A. JONES, JOSEPH R. FLEMISH, ALOK TRIPATHI, VLADIMIR S. BAN
TITLE: METHOD FOR GROWING IN GaAsP HETEROSTRUCTURES OF VARYING COMPOSITIONS BY HCL MODIFIED

HYDRIDE VAPOR PHASE EPITAXY

DOCKET NO.: CECOM 4793 - 03-27-92
INVENTOR(S): ROBERT A. LUX, JAMES F. HARVEY
TITLE: INSTANT-ON MICROWAVE OSCILLATOR USING RESONANT TUNNELING DIODE

DOCKET NO.: CECOM 4794 - 03-27-92
INVENTOR(S): STEVEN A. MALONE, ARTHUR PAOLELLA, DANA J. STURZEBECHER
TITLE: OPTICAL ISOLATOR FOR PHOTONIC-MICROWAVE MONOLITHIC INTEGRATED CIRCUITS

DOCKET NO: NVL-3014 - 04-10-92
INVENTOR(S): M. J. FERRY, G. DAUNT, S. CHANDRA, M. STORM, ET AL.
TITLE: MICROLASER SEEDED OPTICAL PARAMETRIC OSCILLATOR

DOCKET NO.: CECOM 4797 - 04-16-92
INVENTOR(S): EDWARD J. PLICHTA, WISHVENDER K. BEHL
TITLE: HIGH CONDUCTIVITY ELECTROLYTE FOR A RECHARGEABLE ORGANIC ELECTROLYTE BATTERY AND THE CELL CONTAINING THE SAID ELECTROLYTE

DOCKET NO.: CECOM 4798 - 04-21-92
INVENTOR(S): MOHAMED IBRAHIM ABDALLA, LAWRENCE LATIMER HOPE, SANDRA L. SMITH
TITLE: SPUTTER ETCH PATTERNING OF TRANSPARENT CONDUCTORS USING METAL THIN FILM AS A MASK

DOCKET NO.: CECOM 4799 - 04-28-92
'NVENTOR(S): KWONG-KIT CHOI
ITLE: MULTICOLOR PHOTODETECTOR

DOCKET NO: NVESD 3015 - 04/30/92
INVENTOR(S): E. NELSON AND S. HORN
TITLE: POROUS SEMICONDUCTOR MATERIAL, FABRICATION TECHNIQUE AND USE AS A THERMOELECTRIC ELEMENT

DOCKET NO.: CECOM 4800 - 05-04-92
INVENTORfS): JAMES F. HARVEY, ROBERT A. LUX, CLARENCE G. THORNTON, ROBERT S. ZETO, HARDEV SINGH, MAURICE WEINER, TERENCE BURKE, LAWRENCE KINGSLEY
TITLE: FABRICATION TECHNIQUE FOR SILICON MICROCLUSTERS USING PULSED ELECTRICAL POWER

DOCKET NO: NVL-3016 - 05-08-92
INVENTOR(S): S. CHANDRA, G. DAUNT, M. J. FERRY
TITLE: HIGH BRIGHTNESS OPA ARRAY

DOCKET NO: NVL-3035 - 01-05-93
INVENTOR(S): M. J. FERRY
TITLE: CURTAIN INTERLOCK

DOCKET NO.: CECOM 4801 - 05-14-92
INVENTOR(S): LOUIS E. BRANOVICH, DONALD W. ECKART
TITLE: CHROMIUM INTERMEDIATES AND COMPOUNDS AS ELECTRON EMITTER MATERIAL

CSF: ELECTRONIC DEVICES ACTV: ARL, ADELPHI LABORATORY CENTER, MD

DOCKET NO.: CECOM 4802 - 05-18-92
INVENTOR(S): MICHAEL BINDER, ROBERT J. MAMMONE
TITLE: CAPACITOR WITH INCREASED ELECTRICAL BREAKDOWN STRENGTH AND METHOD OF FORMING THE SAME

DOCKET NO.: CECOM 4803 - 05-18-92
INVENTOR(S): HERBERT A. LEUPOLD
TITLE: FIELD-FREE CHAMBER IN EXTENDED PERMANENT MAGNET SOLENOIDS

DOCKET NO.: CECOM 4804 - 05-20-92
INVENTOR(S): LEO D. DiDOMENICO
TITLE: PHOTON TRIGGERED ULTRA-WIDE BAND RADIATOR WITH CHARGE RESERVOIR

DOCKET NO.: CECOM 4805 - 05-20-92
INVENTOR(S): LOUIS E. BRANOVICH, DONALD W. ECKART
TITLE: ELECTRON GENERATION THROUGH A SOLID MEDIA BY APPLICATION OF EQUILIBRIUM, TEMPERATURE AND OXYGEN DEFICIENT COMPOUNDS

DOCKET NO.: CECOM 4806 - 05-20-92
INVENTOR(S): LOUIS E. BRANOVICH, DONALD W. ECKART
TITLE: ELECTRON TRANSFER MECHANISM IN MULTI-VALENT COMPOUNDS WHICH ARE OXYGEN DEFICIENT COMPOUNDS

DOCKET NO.: CECOM 4807 - 05-20-92
INVENTOR(S): ROBERT A. LUX, JAMES F. HARVEY, ARTHUR TAUBER, STEVEN TIDROW
TITLE: FABRICATION OF POROUS SILICON MICROCLUSTERS AND CONTINUOUS FILAMENTS BY LASER ABLATION

DOCKET NO.: CECOM 4808 - 06-01-92
INVENTOR(S): JOSEPH R. FLEMISH, KENNETH A. JONES, VLADIMIR S. BAN
TITLE: A MERGED HYDRIDE ORGANOMETALLIC VAPOR PHASE EPITAXY REACTOR FOR THE GROWTH OF III-V SEMICONDUCTOR HETEROSTRUCTURES

DOCKET NO.: CECOM 4809 - 05-27-92
INVENTOR(S): DONALD W. ECKART, LOUIS E. BRANOVICH
TITLE: PREPARATION OF NEW HYBRIDCATHODE-SUPERCONDUCTOR FOR ELECTRON TRANSFER THROUGH OXYGEN DEFICIENT MATERIAL

DOCKET NO.: CECOM 4810 - 05-27-92
INVENTOR(S): DONALD W. ECKART, LOUIS E. BRANOVICH
TITLE: TRANSITIONAL MECHANISM FOR CATHODE INTERMEDIATES CONVERSION INTO SUPERCONDUCTOR MATERIAL

DOCKET NO.: CECOM 4811 - 06-02-92
INVENTOR(S): HERBERT A. LEUPOLD
TITLE: FIELD AUGMENTATION OF MAGIC SPHERES AND CYLINDERS

DOCKET NO.: CECOM 4812 - 06-02-92
INVENTOR(S): HERBERT A. LEUPOLD, ANUP TILAK
TITLE: ADJUSTABLE FIELD ENHANCED MAGIC SPHERES AND CYLINDERS

CSF: ELECTRONIC DEVICES ACTV: ARL, ADELPHI LABORATORY CENTER, MD

DOCKET NO.: CECOM 4813 - 06-10-92
INVENTOR(S): HERBERT A. LEUPOLD
TITLE: FIELD AUGMENTATION IN MAGIC SPHERES WITH IRON

DOCKET NO.: CECOM 4814 - 06-10-92
INVENTOR(S): JOHN A. KOSINSKI, YICHENG LU
TITLE: MMIC COMPATIBLE BURIED PIEZO-MICRORESONATOR

DOCKET NO.: CECOM 4815 - 06-10-92
INVENTOR(S): DONALD W. ECKART, LOUIS E. BRANOVICH
TITLE: ELECTRON TRANSFER ENHANCEMENT THROUGH DOPING SUPERCONDUCTING MATERIAL WITH CATHODE LIKE INTERMEDIATES

DOCKET NO.: CECOM 4816 - 06-10-92
INVENTOR(S): LOUIS E. BRANOVICH, DONALD W. ECKART
TITLE: HYBRID CONGERIES OF SUPERCONDUCTORS AND OXYGEN DEFICIENT MATERIALS FOR ELECTRON TRANSFER AND CONDUCTANCE

DOCKET NO.: CECOM 4817 - 06-22-92
INVENTOR(S): THOMAS P. HIGGINS, DANA J. STURZEBECHER, VLADIMIR GELNOVATCH TITLE: A PULSED, DIRECT OPTICALLY INJECTION LOCKED MESFET OSCILLATOR

DOCKET NO.: CECOM 4818 - 06-22-92
INVENTOR(S): BRUCE D. JETTE, VLADIMIR GELNOVATCH
TITLE: ELECTRONIC QUASI-PASSIVE IDENTIFICATION SYSTEM

DOCKET NO.: CECOM 4819 - 06-22-92
INVENTOR(S): WALTER R. BUCHWALD
TITLE: InP/InGaAsP OPTOELECTRONIC HIGH SPEED THYRISTOR

DOCKET NO.: CECOM 4823 - 06-25-92
INVENTOR(S): LOUIS E. BRANOVICH, DONALD W. ECKART
TITLE: OXYGEN TRANSFER BETWEEN PARENT AND DAUGHTER MOLECULES FOR SUPERCONDUCTOR PROPERTIES IN CATHODE LIKE MATERIALS

DOCKET NO.: CECOM 4824 - 06-25-92
INVENTOR(S): DONALD W. ECKART, LOUIS E. BRANOVICH
TITLE: ELECTRON CONDUCTANCE THROUGH GALLIUM OXIDE CONTAINING MEDIA

DOCKET NO.: CECOM 4825 - 06-25-92
INVENTOR(S): DANA J. STURZEBECHER, THOMAS P. HIGGINS, AFSHIN S. DARYOUSH
TITLE: SUBHARMONIC OPTICALLY INJECTION LOCKED OSCILLATOR WITH APPLIED PLL FOR USE AS A PHASE AND FREQUENCY COHERENT OSCILLATOR, A PHASE SHIFTER AND A SELF OSCILLATING MIXER

DOCKET NO.: CECOM 4826 - 06-30-92
INVENTOR(S): DANA S. BAILEY
TITLE: HIGH OVERTONE BULK ACOUSTIC RESONATOR (HBAR) ZINC OXIDE NON-STEP DESIGN

CSF: ELECTRONIC DEVICES ACTV: ARL, ADELPHI LABORATORY CENTER, MD

DOCKET NO.: CECOM 4827 - 07-13-92
INVENTOR(S): WILLIAM C. DRACH, THOMAS E. KOSCICA, RICHARD W. BABBITT
TITLE: LOW COST AUTOMATED SYSTEM FOR EVALUATING THE ELECTRICAL CHARACTERISTICS OF FERROELECTRIC MATERIALS

DOCKET NO.: CECOM 4828 - 07-13-92
INVENTOR(S): EDWARD J. PLICHTA, WISHVENDER K. BEHL
TITLE: HIGH TEMPERATURE RECHARGEABLE MOLTEN SALT CELL WITH CHROMIUM SULFIDE CATHODES

DOCKET NO.: CECOM 4829 - 07-13-92
INVENTOR(S): LOUIS E. BRANOVICH, DONALD W. ECKART, PAUL FISCHER
TITLE: NEW CONCEPTS IN ELECTRON STORAGE

DOCKET NO.: CECOM 4833 - 08-03-92
INVENTOR(S): MICHAEL BINDER, ROBERT J. MAMMONE, WILLIAM L. WADE, JR.
TITLE: IMPROVED CELL PERFORMANCE BY Gas PLASMA TREATMENT OF CARBON CATHODES

DOCKET NO.: CECOM 4834 - 08-05-92
INVENTOR(S): THOMAS E. KOSCICA
TITLE: FIELD EFFECT REAL SPACE TRANSISTOR

DOCKET NO.: CECOM 4835 - 08-11-92
INVENTOR(S): HERBERT A. LEUPOLD
TITLE: PERIODIC PERMANENT MAGNETIC STRUCTURE FOR ACCELERATING CHARGED PARTICLES

DOCKET NO.: CECOM 4838 - 08-17-92
INVENTOR(S): WILLIAM C. DRACH, THOMAS E. KOSCICA, RICHARD W. BABBITT
TITLE: COMPUTER CONTROLLED TEMPERATURE PLATE WITH QUICK MOUNT FIXTURE

DOCKET NO.: CECOM 4839 - 08-25-92
INVENTOR(S): HERBERT A. LEUPOLD
TITLE: END CAPS ON HOLLOW MAGNETS

DOCKET NO.: CECOM 4840 - 08-25-92
INVENTOR(S): WILLIAM C. DRACH
TITLE: METALLIC FIBER REINFORCED SOLDER (MFRS)

DOCKET NO.: CECOM 4841 - 08-28-92
INVENTOR(S): HERBERT A. LEUPOLD
TITLE: MAGNETIC FIELDS FOR CHIRON WIGGLERS

DOCKET NO.: CECOM 4842 - 08-28-92
INVENTOR(S): LOUIS E. BRANOVICH, DONALD W. ECKART, PAUL FISCHER
TITLE: MULTIPLE PLUS 4 AND PLUS 6 METAL OXIDES FOR CONDUCTION IN 2 SOLID MEDIUM

DOCKET NO.: CECOM 4843 - 09-15-92
INVENTOR(S): JING ZHAO, PETER A. ZAWADZKI, WILLIAM R. BAARCK, PETER C. NORRIS, RICHARD H. WITTSTRUCK, THOMAS R. AuCOIN
TITLE: ROTATING DISK REACTOR FOR DEPOSITION OF DIAMOND THIN FILMS

CSF: ELECTRONIC DEVICES ACTV: ARL, ADELPHI LABORATORY CENTER, MD

DOCKET NO.: CECOM 4844 - 09-18-92
INVENTOR(S): STEVEN A. MALONE, ARTHUR BALLATO
TITLE: MMJC COMPATIBLE LIGHTWAVE-MICROWAVE MIXING USING A GaAs MESFET

DOCKET NO.: CECOM 4847 - 09-21-92
INVENTOR(S): HERBERT A. LEUPOLD
TITLE: AUGMENTATION OF FIELD MOLDED MAGIC RINGS

DOCKET NO.: CECOM 4848 - 09-24-92
INVENTOR(S): ANDERSON H. KIM, ROBERT J. YOUMANS, MAURICE WEINER, LOUIS J. JASPER, JR., LAWRENCE E. KINGSLEY
TITLE: ELECTRONICALLY CONTROLLED FREQUENCY AGILE IMPULSE DEVICE

DOCKET NO.: CECOM 4849 - 09-24-92
INVENTOR(S): WILLIAM J. SKUDERA, JR.
TITLE: A SIGNAL RECREATION METHOD UTILIZING TAPPED DELAY LINES TO REPLACE THE CONVENTIONAL SAW HIGH LOSS INVERSE CHRIP-Z TRANSFORM CIRCUIT

DOCKET NO.: CECOM 4850 - 09-28-92
INVENTORIS): ARTHUR BALLATO, JOHN A. KOSINSKI, HONGEN SHEN, MITRA DUTTA, YICHENG LU JAGADEESH PAMULAPATI
TITLE: UNIAXIALLY STRAINED SEMICONDUCTOR MULTIPLE QUANTUM WELL SPATIAL LIGHT MODULATOR USING DIRECTION-DEPENDENT THERMAL EXPANSION COEFFICIENTS IN A HOST SUBSTRATE

DOCKET NO.: CECOM 4851 - 09-28-92
INVENTOR(S): MITRA DUTTA, HONGEN SHEN, JAGADEESH PAMULAPATI, YICHENG LU
TITLE: CREATION OF UNIAXIAL STRAIN IN SEMICONDUCTOR MULTIPLE QUANTUM WELL SPATIAL LIGHT MODULATOR BY BONDING TO A PRESTRESSING SUBSTRATE

DOCKET NO.: CECOM 4852 - 10-14-92
INVENTOR(S): EDWARD J. PLICHTA, WISHVENDER K. BEHL
TITLE: HIGH TEMPERATURE SOLID STATE RECHARGEABLE LITHIUM CELL

DOCKET NO.: CECOM 4853 - 10-14-92
INVENTOR(S): R. VICTOR GIFL, EDWARD R. GERTNER, L. O. BUBULAC
TITLE: MACRODEFECT ETCH

DOCKET NO.: CECOM 4854 - 10-27-92
INVENTOR(S): LOUIS E. BRANOVICH, DONALD W. ECKART
TITLE: OVERCOATING OF OXYGEN DEFICIENT SEMICONDUCTING MATERIALS WITH METAL AND METAL OXIDES TO PRODUCE HIGH CURRENT DENSITY CATHODES

DOCKET NO.: CECOM 4855 - 10-27-92
INVENTOR(S): LOUIS E. BRANOVICH, PAUL FISCHER, DONALD W. ECKART
TITLE: 2:1 MOLAR MIXTURES OF (+4) METAL OXIDES MO2 WITH +3 METAL OXIDES M12O3+O FOR CONDUCTIVES EMISSIVE MATERIALS

DOCKET NO.: CECOM 4856 - 10-27-92
INVENTOR(S): ERIK H. LENZING, ROLAND CADOTTE, JR., MICHAEL CUMMINGS
TITLE: SINE WAVE OR CIRCULAR WAVE HIGH DIRECTIVITY COUPLER

CSF: ELECTRONIC DEVICES ACTV: ARL, ADELPHI LABORATORY CENTER, MD

DOCKET NO.: CECOM 4857 - 10-27-92
NVENTOR(S): THOMAS E. KOSCICA, RICHARD W. BABBITT, WILLIAM C. DRACH
TITLE: SINGLE SUBSTRATE PLANAR DIGITAL FERROELECTRIC PHASE SHIFTER

DOCKET NO.: CECOM 4859 - 10-27-92
INVENTORIS): MITRA DUTTA, WEIMIN ZHOU, HONGEN SHEN, JAGADEESH PAMULAPATI
TITLE: TUNABLE HEAVY AND LIGHT HOLES COUPLED BANDS IN ASYMMETRIC VARIABLE STRAIN LAYER QUANTUM WELL SEMICONDUCTOR HETEROSTRUCTURE FOR NOVEL OPTO-ELECTRONIC DEVICES

DOCKET NO.: CECOM 4860 - 10-27-92
INVENTOR(S): ROBERT A. LUX, JAMES F. HARVEY, RAPHAEL TSU
TITLE: SILICON NANOSTRUCTURE LIGHT EMITTING DIODE

DOCKET NO.: CECOM 4861 - 10-27-92
INVENTOR(S): MADAN DUBEY, HONG LIANG CUI, CHARLES D. HECHTMAN, NORMAN H. HORING, GEORGE F. McLANE
TITLE: QUANTUM WELL OPTICAL WAVEGUIDE PHASE SHIFTER

DOCKET NO.: CECOM 4862 - 10-27-92
INVENTOR(S): ROLAND CADOTTE, JR., MICHAEL CUMMINGS
TITLE: ULTRA BROADBAND WEAK LINK RF VARIABLE ATTENUATOR

DOCKET NO: NVEOD 3053 - 10-30-92
INVENTOR(S): G. J. SALAMO, B. D. MONSON, M. J. MILLER, W. W. CLARK, III, G. L. WOOD AND E. J. SHARP
TITLE: BROADBAND OPTICAL LIMITER

DOCKET NO.: CECOM 4864 - 10-29-92
INVENTOR(S): MUHAMMAD A. MIZAN, THOMAS P. HIGGINS, DANA J. STURZEBECHER
TITLE: A FAST TURN-ON, TEMPERATURE STABLE, PULSED DIELECTRIC RESONATOR OSCILLATOR

DOCKET NO.: CECOM 4867 - 11-03-92
INVENTOR(S): ROBERT A. LUX, JAMES F. HARVEY, CHARLES D. MULFORD, JR., LOUIS C. POLI
TITLE: MICROELECTRONIC 3D BIPOLAR MAGNETOTRANSISTOR MAGNETOMETER

DOCKET NO.: CECOM 4868 - 11-03-92
INVENTOR(S): ROBERT A. LUX, JAMES F. HARVEY, CHARLES D. MULFORD, JR., LOUIS C. POLI
TITLE: MICROELECTRONIC 3D HALL MAGNETOMETER

DOCKET NO.: CECOM 4869 - 11-03-92
INVENTOR(S): ROLAND CADOTTE, JR., THOMAS P. HIGGINS, DANA J. STURZEBECHER, MICHAEL CUMMINGS
TITLE: OPTICALLY CONTROLLED GAIN OF A FLUX FLOW TRANSISTOR (FFT) AMPLIFIER

DOCKET NO.: CECOM 4872 - 11-09-92
INVENTOR(S): HERBERT A. LEUPOLD, ANUP TILAK
TITLE: FIELD AUGMENTED PERMANENT MAGNET STRUCTURES

DOCKET NO.: CECOM 4873 - 11-13-92
NVENTOR(S): ERIK H. LENZING, HARRY F. LENZING, CHARLES D. HECHTMAN
TITLE: HIGH POWER ULTRA BROADBAND ANTENNA (HUBA)

DOCKET NO.: CECOM 4874 - 11-13-92
INVENTOR(S): ARTHUR PAOLELLA, BAHRAM NABET
TITLE: AN N+FET WITH IMPROVED OPTICAL SENSITIVITY

DOCKET NO.: CECOM 4875 - 11-16-92
INVENTOR(S): MITRA DUTTA, WEIMIN ZHOU
TITLE: MODULATION DOPED QUANTUM WELLS WAVEGUIDE MODULATORS USING TUNABLE-ELECTRON-DENSITY BY WELL TO DEEP LEVEL CHARGE TRANSFER

DOCKET NO.: CECOM 4876 - 11-16-92
INVENTOR(S): ANDERSON H. KIM, ROBERT J. YOUMANS, MAURICE WEINER, LAWRENCE E. KINGSLEY
TITLE: MONOLITHIC, PHOTOCONDUCTIVE BIPOLAR PULSER UTILIZING A RADIAL TRANSMISSION LINE

DOCKET NO.: CECOM 4877- 11-20-92
INVENTOR(S): EDWARD J. PLICHTA, WISHVENDER K. BEHL
TITLE: HIGH TEMPERATURE MOLTEN SALT THERMAL CELL

DOCKET NO.: CECOM 4881 - 11-25-92
INVENTOR(S): CHARLES W. WALKER, JR.
TITLE: SOLID POLYMER ELECTROLYTE FOR A LITHIUM PRIMARY OR LITHIUM RECHARGEABLE ELECTROCHEMICAL CELL

DOCKET NO.: CECOM 4882 - 11-25-92
INVENTOR(S): DONALD W. ECKART, LOUIS E. BRANOVICH, PAUL FISCHER
TITLE: METHOD OF PREPARING NEA (NEGATIVE ELECTRON AFFINITY) CATHODES

DOCKET NO.: CECOM 4883 - 11-25-92
INVENTOR(S): LOUIS E. BRANOVICH, PAUL FISCHER, DONALD W. ECKART
TITLE: IRIDIUM METAL AND IRIDIUM OXIDE IN CATHODE-LIKE ENVIRONMENT

DOCKET NO: NVESD 3031 - 11-30-92
INVENTOR(S): E. NELSON
TITLE: ION BEAM ETCHING OF METAL OXIDE CERAMICS

DOCKET NO: NVESD 3032 - 12-03-92
INVENTOR(S): E. NELSON
TITLE: FABRICATION TECHNIQUE OF HIGH TEMPERATURE POLYMERS AND ANOSTRUCTURES

DOCKET NO.: CECOM 4884 - 12-16-92
INVENTOR(S): HERBERT A. LEUPOLD
TITLE: VARIABLE-TAPER MAGNETIC FIELD SOURCE

DOCKET NO.: CECOM 4885 - 12-16-92
INVENTOR(S): STEVE GOODNECK, MARTIN WYBOURNE, DORAN W. SMITH, JONG-CHING WU, CHRIS BERVEN
TITLE: MULTITERMINAL LATERAL HOT-ELECTRON TRANSISTOR

DOCKET NO.: CECOM 4886 - 12-16-92
INVENTOR(S): M. ROBERT MILLER
TITLE: AN ELECTROLUMINESCENT OPTICAL PUMP FOR LASERS

CSF: ELECTRONIC DEVICES ACTV: ARL, ADELPHI LABORATORY CENTER, MD

DOCKET NO.: CECOM 4887 - 12-16-92
INVENTOR(S): HERBERT A. LEUPOLD
TITLE: A TOROIDAL WIGGLER/UNDULATOR

DOCKET NO.: CECOM 4888 - 12-16-92
INVENTOR(S): HERBERT A. LEUPOLD
TITLE: A SPHERICAL WIGGLER/UNDULATOR

DOCKET NO.: CECOM 4889 - 12-16-92
INVENTOR(S): HERBERT A. LEUPOLD
TITLE: PERMANENT MAGNET AUGMENTED SPHERICAL WIGGLER

DOCKET NO.: CECOM 4890 - 12-17-92
INVENTOR(S): HERBERT A. LEUPOLD
TITLE: SOFT MAGNET SPHERE WIGGLER AUGMENTATION

DOCKET NO.: CECOM 4891 - 12-21-92
INVENTOR(S): HERBERT A. LEUPOLD
TITLE: A PERMANENT MAGNET ENHANCED TOROIDAL WIGGLER

DOCKET NO.: CECOM 4892 - 12-21-92
INVENTOR(S): HERBERT A. LEUPOLD
TITLE: AN IRON ENHANCED PERMANENT MAGNET WIGGLER

DOCKET NO.: CECOM 4893 - 12-21-92
INVENTOR(S): WEIMIN ZHOU, MITRA DUTTA
TITLE: MICRO-FOURIER-TRANSFORM SEMICONDUCTOR OPTICAL-WAVEGUIDE SPECTROMETER AND REMOTE SENSOR

DOCKET NO.: CECOM 4894 - 12-21-92
INVENTOR(S): JOHN A. KOSINSKI
TITLE: HPM-HARDENED MINE

DOCKET NO.: CECOM 4895 - 12-29-92
INVENTOR(S): ANDERSON H. KIM, ROBERT J. YOUMANS, LEO D. DiDOMENICO, MAURICE WEINER
TITLE: MONOLITHIC, PHOTOCONDUCTIVE ULTRA-WIDEBAND RF RADIATOR DRIVEN AT OUTER EDGE

DOCKET NO.: CECOM 4896 - 12-30-92
INVENTOR(S): HERBERT A. LEUPOLD
TITLE: MAGIC SPHERE ION BOTTLE

DOCKET NO.: CECOM 4897 - 01-11-93
INVENTOR(S): JOHN A. KOSINSKI, EDWARD R. BAIDY, ARTHUR BALLATO, OWEN P. LAYDEN
TITLE: MICROCIRCUIT PACKAGE WITH INTEGRATED ACOUSTIC ISOLATOR

DOCKET NO.: CECOM 4898 - 01-13-93
INVENTOR(S): EDWARD J. PLICHTA, WISHVENDER K. BEHL
TITLE: HIGH TEMPERATURE SOLID STATE THERMAL CELL

CSF: ELECTRONIC DEVICES ACTV: ARL, ADELPHI LABORATORY CENTER, MD

DOCKET NO.: CECOM 4900 - 01-22-93
INVENTOR(S): WILLIAM WILBER, MILIND BEDEKAR
TITLE: THE USE OF MGIN2O4 AS AN ELECTRODE FOR FERROELECTRIC DEVICES

DOCKET NO.: CECOM 4901 - 01-22-93
INVENTOR(S): DONALD W. ECKART, PAUL FISCHER, LOUIS E. BRANOVICH
TITLE: MIXED OXIDES OF IRIDIUM FOR NEGATIVE ELECTRON AFFINITY (NEA) CATHODES

DOCKET NO.: CECOM 4902 - 01-22-93
INVENTOR(S): DONALD W. ECKART, PAUL FISCHER, LOUIS E. BRANOVICH
TITLE: BARIUM ALLOYS IN THERMIONIC EMITTERS

DOCKET NO.: CECOM 4903 - 01-27-93
INVENTOR(S): WILLIAM J. SKUDERA, JR.
TITLE: A CIRCUIT FOR AUTOMATICALLY DIFFERENTIATING BETWEEN AND ACCURATELY MEASURING AOA OF BPSK AND CW TYPE SIGNALS

DOCKET NO.: CECOM 4904 - 01-29-93
INVENTOR(S): ROBERT J. MAMMONE, MICHAEL BINDER
TITLE: PROCESS OF MAKING POLYMER FILMS HAVING A CONDUCTIVITY GRADIENT ALONG THE THICKNESS

DOCKET NO.: CECOM 4905 - 02-03-93
INVENTOR(S): HERBERT A. LEUPOLD, JOHN T. REHBERG
TITLE: HIGH POWER ELECTRICAL MACHINERY

DOCKET NO.: CECOM 4906 - 02-03-93
INVENTOR(S): HERBERT A. LEUPOLD
TITLE: HIGH POWER ELECTRICAL MACHINERY WITH TOROIDAL PERMANENT MAGNETS

DOCKET NO.: CECOM 4908 - 02-03-93
INVENTOR(S): ANDERSON H. KIM, ROBERT J. YOUMANS, STEPHEN E. SADDOW, LOUIS J. JASPER, JR., MAURICE WEINER
TITLE: MONOLITHIC, PHOTOCONDUCTIVE SPIRAL ANTENNA DRIVEN BY QUASI-RADIAL LINE

DOCKET NO.: CECOM 4909 - 02-09-93
INVENTOR(S): THOMAS E. KOSCICA, RICHARD W. BABBITT WILLIAM C. DRACH
TITLE: REAL TIME CALIBRATOR FOR FERROELECTRIC PHASE SHIFTER

DOCKET NO.: CECOM 4910 - 02-10-93
INVENTOR(S): EDWARD J.-PLICHTA, WISHVENDER K. BEHL
TITLE: ELECTROCHEMICAL CELL COMPRISED OF A BILAYER ELECTROLYTE

DOCKET NO.: CECOM 4911 - 02-22-93
INVENTOR(S): TERENCE BURKE, MAURICE WEINER, JIAN H. ZHAO
TITLE: AN AlGaAs/GaAs-BASED OPTOTHYRISTOR FOR ULTRA HIGH POWER SWITCHING APPLICATION

DOCKET NO.: CECOM 4912 - 02-24-93
INVENTOR(S): STEVEN C. TIDROW, ARTHUR TAUBER, WILLIAM WILBER
TITLE: METHOD FOR GROWING REPEATABLE AND PROTECTED HIGH CRITICAL TEMPERATURE SUPERCONDUCTING MULTILAYER STRUCTURES

CSF: ELECTRONIC DEVICES ACTV: ARL, ADELPHI LABORATORY CENTER, MD

DOCKET NO.: CECOM 4913 - 02-24-93
NVENTOR(S): ARTHUR TAUBER, STEVEN C. TIDROW
TITLE: RARE-EARTH ALKALINE METAL TITANATES FOR USE AS BUFFER/DIELECTRIC LAYERS AND SUBSTRATES FOR GROWTH OF HIGH CRITICAL TEMPERATURE SUPERCONDUCTORS, FERROELECTRICS, PYROELECTRICS AND PIEZOELECTRICS

DOCKET NO.: CECOM 4914 - 02-25-93
INVENTOR(S): ELIO A. MARIANI, WILLIAM J. SKUDERA, JR.
TITLE: SURFACE ACOUSTIC WAVE (SAW) CHEMICAL MULTISENSOR ARRAY

DOCKET NO.: CECOM 4915 - 02-25-93
INVENTOR(S): HERBERT A. LEUPOLD
TITLE: FIELD CONFINEMENT TO AN AUGMENTED MAGIC SPHERE

DOCKET NO.: CECOM 4916 - 03-03-93
INVENTOR(S): ROLAND CADOTTE, JR.
TITLE: MULTI-LAYER WEAK LINK ABRISKOW VORTEX FLOW TRANSISTOR (AVFT) USING RARE-EARTH ALKALI TITANATES AS THE DIELECTRIC LAYER

DOCKET NO.: CECOM 4918 - 03-08-93
INVENTOR(S~: DONALD W. ECKART, LOUIS E. BRANOVICH, PAUL FISCHER
TITLE: IMPROVED OXIDE COATED CATHODES

DOCKET NO.: CECOM 4920 - 03-18-93
INVENTOR(S): MICHAEL BINDER, ROBERT J. MAMMONE, BERNARD LAVENE
TITLE: PERFORMANCE IMPROVEMENTS IN OIL FILLED FILM/FOIL CAPACITORS

DOCKET NO.: CECOM 4922 - 03-22-93
INVENTOR(S): THOMAS W. GRUDKOWSKI, ARTHUR BALLATO
TITLE: STABLE MONOLITHIC FREQUENCY SOURCES AND ACTUATORS

DOCKET NO.: CECOM 4923 - 03-22-93
INVENTOR(S): THOMAS W. GRUDKOWSKI, ARTHUR BALLATO
TITLE: HIGH TEMPERATURE MONOLITHIC SENSORS, OSCILLATORS, TRANSDUCERS, AND ACTUATORS

DOCKET NO.: CECOM 4924 - 03-30-93
INVENTOR(S): JOHN A. KOSINSKI, ARTHUR BALLATO, YICHENG LU
TITLE: CRYSTAL RESONATOR WITH MULTIPLE SEGMENTED LATERAL-FIELD EXCITATION (MUSLE) ELECTRODE(s)

DOCKET NO.: CECOM 4925 - 03-30-93
INVENTOR(S): ARTHUR PAOLELLA
TITLE: A SIMPLE OPTICAL DETECTOR FOR WAVELENGTH ANALYSIS

DOCKET NO.: CECOM 4927 - 04-05-93
INVENTOR(S): DONALD W. ECKART, PAUL FISCHER, LOUIS E. BRANOVICH
TITLE: REGENERATION OF SPENT CATHODES; APPLICATION OF $BaAl_2O_4$ AS AN EMITTER MATERIAL

CSF: ELECTRONIC DEVICES ACTV: ARL, ADELPHI LABORATORY CENTER, MD

DOCKET NO.: CECOM 4928 - 04-05-93
INVENTOR(S): DONALD W. ECKART, LOUIS E. BRANOVICH, PAUL FISCHER
TITLE: DIVALENT SUBSTITUTE FOR ELECTRON DEFICIENT SEMICONDUCTORS OF OXYGEN BY USE OF SULFUR, SELENIUM, TELLURIUM

DOCKET NO.: CECOM 4929 - 04-14-93
INVENTOR(S): JOHN A. KOSINSKI
TITLE: POLARIZATION-SENSITIVE SHEAR WAVE TRANSDUCER

DOCKET NO.: CECOM 4930 - 04-21-93
INVENTOR(S): PAUL MICHAELS, JR., RALPH ROMANO, WILLIAM OTTLY
TITLE: SWEEP JAMMER ALGORITHM

DOCKET NO.: CECOM 4931- 04-26-93
INVENTOR(S): EDWARD J. PLICHTA, WISHVENDER K. BEHL
TITLE: RECHARGEABLE HIGH TEMPERATURE SOLID STATE CELL

DOCKET NO.: CECOM 4932 - 04-29-93
INVENTOR(S): WILLIAM WILBER
TITLE: METHOD OF FABRICATION OF LOW THERMAL MASS INFRARED DETECTOR

DOCKET NO.: CECOM 4933- 04-29-93
INVENTOR(S): EDWARD J. PLICHTA, WISHVENDER K. BEHL
TITLE: METHOD OF MAKING A FLEXIBLE SOLID ELECTROLYTE FOR USE IN SOLID STATE CELLS, FLEXIBLE SOLID ELECTROLYTE SO MADE AND SOLID STATE CELL INCLUDING SAID FLEXIBLE SOLID ELECTROLYTE

DOCKET NO.: CECOM 4934 - 05-03-93
INVENTOR(S): DONALD W. ECKART, LOUIS E. BRANOVICH, PAUL FISCHER
TITLE: SUBSTITUTIONS FOR 1-2-3 SUPERCONDUCTORS

DOCKET NO.: CECOM 4935 - 05-03-93
INVENTOR(S): LOUIS E. BRANOVICH, DONALD W. ECKART, PAUL FISCHER
TITLE: IMPROVED ELECTRON TRANSFER IN 1-2-3 TYPE SUPERCONDUCTORS

DOCKET NO.: CECOM 4936 - 05-03-93
INVENTOR(S): ARTHUR TAUBER, STEVEN C. TIDROW
TITLE: GROWTH OF C AXIS ORIENTED HTSC ON GADOLINUM GALLIUM GARNET (GGG)

DOCKET NO: NVESD 3042 - 05-10-93
INVENTOR(S): E. NELSON AND S. HORN
TITLE: NANOPOROUS SEMICONDUCTOR MATERIAL AND FABRICATION TECHNIQUE FOR USE AS THERMOELECTRIC ELEMENTS

DOCKET NO.: CECOM 4938 - 05-12-93
INVENTOR(S): THOMAS E. KOSCICA, RICHARD W. BABBITT, WILLIAM D. WILBER
TITLE: THIN FILM FERROELECTRIC VARACTOR

CSF: ELECTRONIC DEVICES ACTV: ARL, ADELPHI LABORATORY CENTER, MD

DOCKET NO.: CECOM 4939 - 05-12-93
INVENTOR(S): YUE TONG CHIU
TITLE: ADAPTABLE DISPLAY INTERFACE

DOCKET NO.: CECOM 4940 - 05-12-93
INVENTOR(S): JOHN R. VIG, MARY A. HENDRICKSON, SALLY M. LOFFEY
TITLE: METHOD OF IMPROVING THE STABILITY OF A QUARTZ OSCILLATOR

DOCKET NO.: CECOM 4941 - 05-12-93
INVENTOR(S): JOHN R. VIG, MARY A. HENDRICKSON, SALLY M. LOFFEY
TITLE: METHOD OF DEPOSITING A STRONGLY ADHERING GOLD FILM ONTO OXIDE SUBSTRATES

DOCKET NO.: CECOM 4942 - 05-12-93
INVENTOR(S): LOUIS E. BRANOVICH, DONALD W. ECKART, PAUL FISCHER
TITLE: IMPROVED SUPERCONDUCTORS USING LaCuO2 AS AN ADDITIVE

DOCKET NO.: CECOM 4943 - 05-12-93
INVENTOR(S): DONALD W. ECKART, PAUL FISCHER, LOUIS E. BRANOVICH
TITLE: ADDITION OF CuLaO2 TO 1-2-3 SUPERCONDUCTORS

DOCKET NO.: CECOM 4944 - 05-12-93
INVENTOR(S): DONALD W. ECKART, PAUL FISCHER, LOUIS E. BRANOVICH
TITLE: PREPARATION OF A THERMIONIC CATHODE USING 112 (W04) 3 WITH BAMETAL

DOCKET NO.: CECOM 4945 - 05-12-93
INVENTOR(S): LOUIS E. BRANOVICH, PAUL FISCHER, DONALD W. ECKART
TITLE: USE OF BARIUM COPPER OXYGEN (BaCuO2) AS AN ELECTRONIC MATERIAL

DOCKET NO.: CECOM 4946 - 05-12-93
INVENTOR(S): DONALD W. ECKART, PAUL FISCHER, LOUIS E. BRANOVICH
TITLE: APPLICATIONS OF LaCuO2 AS AN ELECTRONIC MATERIAL

DOCKET NO.: CECOM 4947 - 05-12-93
INVENTOR(S): MICHAEL BINDER, ROBERT J. MAMMONE
TITLE: MODIFICATION OF ION CONDUCTING MEMBRANES

DOCKET NO.: CECOM 4948 - 05-13-93
INVENTOR(S): JAMES F. HARVEY, ROBERT A. LUX
TITLE: DOUBLE BARRIER RESONANT PROPAGATION FILTER

DOCKET NO: C2NVEO 3053 - 05-18-93
INVENTOR(S): G. J. SALAMO, B. D. MONSON, M. J. MILLER, W. W. CLARK, III, G. L. WOOD AND E. J. SHARP
TITLE: IMPROVED BROADBAND OPTICAL LIMITER

DOCKET NO.: CECOM 4949 - 05-20-93
INVENTOR(S): JIAN-PING ZHENG, RICHARD T. JOW, PETER J. CYGAN
TITLE: IMPROVEMENT OF THE BREAKDOWN STRENGTHS OF DIELECTRIC POLYMER FILMS

CSF: ELECTRONIC DEVICES ACTV: ARL, ADELPHI LABORATORY CENTER, MD

DOCKET NO.: CECOM 4950 - 06-08-93
INVENTOR(S): BRUCE D. JETTE, MARGARET L.A. MACVICAR, THOMAS W. ALTSHULER, PRADNYA V. NAGARKAR
TITLE: ELECTROCHEMICAL DEPOSITION OF SUPERCONDUCTORS

DOCKET NO.: CECOM 4951 - 06-08-93
INVENTOR(S): BRUCE D. JETTE
TITLE: ELECTROCHEMICAL COULOMETER AND METHOD

DOCKET NO.: CECOM 4952 - 06-17-93
INVENTOR(S): MICHELLE A. DORNATH MOHR, ROBERT D. FINNEGAN, ARTHUR TAUBER
TITLE: SUBSTITUTED HIGH TEMPERATURE SUPERCONDUCTOR OF ANY SHAPE AND METHOD OF MAKING THE SUPERCONDUCTOR

DOCKET NO.: CECOM 4953 - 06-18-93
INVENTOR(S): PAUL FISCHER, DONALD W. ECKART, LOUIS E. BRANOVICH
TITLE: ADDITION OF CUILaO2 AND CuBaO2+DI,2,3 SUPERCONDUCTOR MATERIALS

DOCKET NO.: CECOM 4954 - 06-18-93
INVENTOR(S): DONALD W. ECKART, PAUL FISCHER, LOUIS E. BRANOVICH
TITLE: ADDITION OF Cu2O TO 1,2,3 SUPERCONDUCTORS

DOCKET NO.: CECOM 4955 - 06-18-93
INVENTOR(S): LOUIS E. BRANOVICH, DONALD W. ECKART, PAUL FISCHER
TITLE: Le2CuO4/Ba METAL MIXTURE FOR SUPERCONDUCTOR MATERIAL

DOCKET NO.: CECOM 4956 - 06-25-93
INVENTOR(S): TERRILL ATWATER, RICHARD DRATLER
TITLE: A UNIAVERSAL INEXPENSIVE BATTERY STATE-OF-CHARGE INDICATOR

DOCKET NO.: CECOM 4957 - 07-13-93
INVENTOR(S): ARTHUR TAUBER, STEVEN C. TIDROW
TITLE: C-AXIS GROWTH OF HIGH TEMPERATURE SUPERCONDUCTORS (HTSC) ON GADOLINUM GALLIUM GARNET (GGG)

DOCKET NO.: CECOM 4958 - 07-13-93
INVENTOR(S): CHARLES W. WALKER, JR., EDWARD J. PLICHTA, WISHVENDER K. BEHL
TITLE: IMPROVED SOLID POLYMER ELECTROLYTE FOR RECHARGEABLE SOLID STATE POLYMER ELECTROCHEMICAL CELLS

DOCKET NO.: CECOM 4959 - 07-21-93
INVENTOR(S): DONALD W. ECKART, LOUIS E. BRANOVICH, PAUL FISCHER
TITLE: LaBa2Cu3O7 WITH Cu2O. POSSIBLE USE AS SUPERCONDUCTOR, BATTERY OR CAPACITOR

DOCKET NO.: CECOM 4960 - 07-21-93
INVENTOR(S): DONALD W. ECKART, PAUL FISCHER, LOUIS E. BRANOVICH
TITLE: LaBa2Cu2O5 AND LaBa2Cu3O6 AS SUPERCONDUCTOR MATERIAL MIXES

DOCKET NO.: CECOM 4961 - 07-21-93
INVENTOR(S): DONALD W. ECKART, PAUL FISCHER, LOUIS E. BRANOVICH
TITLE: ELECTRON APPLICATION FOR La, Ba2Cu2O5

CSF: ELECTRONIC DEVICES ACTV: ARL, ADELPHI LABORATORY CENTER, MD

DOCKET NO.: CECOM 4962 - 07-21-93
INVENTOR(S): DONALD W. ECKART, PAUL FISCHER, LOUIS E. BRANOVICH
TITLE: USE OF SILVER OXIDE (Ag2O) FOR SUPERCONDUCTOR APPLICATION

DOCKET NO.: CECOM 4964 - 07-27-93
INVENTOR(S): HERBERT A. LEUPOLD
TITLE: LIGHT WEIGHT MAGIC RINGS AND SPHERES WITH DISTORTION FREE ACCESS

DOCKET NO.: CECOM 4966 - 08-11-93
INVENTOR(S): HERBERT A. LEUPOLD, ERNEST POTENZIANI, II
TITLE: PERMANENT MAGNET STRUCTURE FOR USE IN ELECTRIC MACHINERY

DOCKET NO.: CECOM 4967 - 08-12-93
INVENTOR(S): DONALD W. ECKART, LOUIS CASAS, RICHARD T. LAREAU
TITLE: METHOD AND APPARATUS FOR MEASURING FILM THICKNESSES

DOCKET NO.: CECOM 4968 - 08-16-93
INVENTOR(S): DONALD W. ECKART, PAUL FISCHER, LOUIS E. BRANOVICH
TITLE: ELECTRON TRANSFER BETWEEN BARIUM IRIDATES AND BARIUM

DOCKET NO.: CECOM 4969 - 08-16-93
INVENTOR(S): LOUIS E. BRANOVICH, DONALD W. ECKART, PAUL FISCHER
TITLE: ADDITION OF IRIDIUM TO SCANDATE CATHODES

DOCKET NO.: CECOM 4970 - 08-16-93
INVENTOR(S): LOUIS E. BRANOVICH, DONALD W. ECKART, PAUL FISCHER
TITLE: HIGH CURRENT DENSITY CATHODES USING AlWO4 AND Ba METAL/Ba ALLOYS

DOCKET NO.: CECOM 4971 - 08-16-93
INVENTOR(S): LOUIS E. BRANOVICH, DONALD W. ECKART, PAUL FISCHER
TITLE: MODIFIED TUNGSTATE SCANDATE CATHODE FOR HIGH CURRENT DENSITY

DOCKET NO.: CECOM 4972 - 08-16-93
INVENTOR(S): PAUL FISCHER, DONALD W. ECKART, LOUIS E. BRANOVICH
TITLE: PREPARATION OF SEMICONDUCTOR TYPE MATERIAL USING Al AND Sc METALS FOR USE IN CATHODE MATERIALS

DOCKET NO.: CECOM 4973 - 08-16-93
INVENTOR(S): PAUL FISCHER, DONALD W. ECKART, LOUIS E. BRANOVICH
TITLE: ADDITION OF MERCUROUS OXIDE TO 1,2,3 SUPERCONDUCTORS

DOCKET NO.: CECOM 4974 - 08-16-93
INVENTOR(S): DONALD W. ECKART, PAUL FISCHER, LOUIS E. BRANOVICH
TITLE: PREPARATION OF FAST WARM UP CATHODE USING TUNGSTEN, ALUMINUM TUNGSTATE AND BARIUM METAL

DOCKET NO.: CECOM 4975 - 08-16-93
INVENTOR(S): DONALD W. ECKART, LOUIS E. BRANOVICH, PAUL FISCHER
TITLE: TOP LAYERING OF THERMIONIC CATHODES USING AlWO4 AND/OR ScW04 WITH Ba METAL

CSF: ELECTRONIC DEVICES ACTV: ARL, ADELPHI LABORATORY CENTER, MD

DOCKET NO.: CECOM 4976 - 08-16-93
INVENTOR(S): DONALD W. ECKART, LOUIS E. BRANOVICH, PAUL FISCHER
TITLE: BARIUM TITENATES AS ELECTRON EMITTERS

DOCKET NO.: CECOM 4978 - 08-16-93
INVENTOR(S): JAMES J. FOERSTER, RAYMOND C. McGOWAN, ROBERT C. LINDENMUTH
TITLE: DUAL-CHANNEL ACOUSTIC PLATE MODE MICRO-BALANCE DETECTOR OF BIOLOGICAL AND CHEMICAL AGENTS

DOCKET NO.: CECOM 4979 - 08-16-93
INVENTOR(S): WISHVENDER K. BEHL, EDWARD J. PLICHTA
TITLE: A HIGH TEMPERATURE OXYGEN SENSOR BASED ON AN ALL SOLID STATE GALVANIC CELL

DOCKET NO.: CECOM 4981 - 08-20-93
INVENTOR(S): CHARLES W. WALKER, JR.
TITLE: SOLID STATE RECHARGEABLE LITHIUM/POLYMER BATTERY

DOCKET NO.: CECOM 4982 - 08-20-93
INVENTOR(S): GERALD J. IAFRATE, MITRA DUTTA, HONGEN SHEN, MICHAEL A. STROSCIO, ARTHUR BALLATO
TITLE: HIGH CONTRAST MULTIPLE QUANTUM WELL LIGHT MODULATOR BASED ON PIEZOELECTRICALLY DRIVEN ANISOTROPIC OPTICAL ABSORPTION

DOCKET NO.: CECOM 4983 - 08-20-93
INVENTOR(S): GERALD J. IAFRATE, MITRA DUTTA, HONGEN SHEN, MICHAEL A. STROSCIO
TITLE: INFRARED IMAGING ARRAY BASED ON TEMPERATURE DRIVEN ANISOTROPIC OPTICAL ABSORPTION

DOCKET NO.: CECOM 4984 - 08-23-93
INVENTOR(S): ARYE ROSEN, ARTHUR PAOLELLA, PETER R. HERCZFELD, JOSEPH H. ABELES
TITLE: A MESFET PHOTODETECTOR WITH INTEGRATED GRATING FOR IMPROVED OPTICAL COUPLING

DOCKET NO.: CECOM 4985 - 09-15-93
INVENTOR(S): MILSON SILVA, PETER R. HERCZFELD, STEVEN A. MALONE, ARTHUR PAOLELLA
TITLE: COUPLED QUANTUM WELL OPTICAL INTENSITY MODULATOR FOR InP BASED OPTOELECTRONIC INTEGRATED CIRCUITS

DOCKET NO.: CECOM 4986 - 09-15-93
INVENTOR(S): MICHAEL BINDER, SOL GILMAN, ROBERT J. MAMMONE
TITLE: SERIES INTEGRATED MULTICELL ARRAY

DOCKET NO.: CECOM 4988 - 09-15-93
INVENTOR(S): LOUIS E. BRANOVICH, DONALD W. ECKART, PAUL FISCHER
TITLE: APPLICATION OF SEMICONDUCTORS TO SUPERCONDUCTORS FOR HIGHER TEMPERATURE OPERATIONS

DOCKET NO.: CECOM 4989 - 09-15-93
INVENTOR(S): PAUL FISCHER, DONALD W. ECKART, LOUIS E. BRANOVICH
TITLE: USE OF Cu2In2O5 AS A SUPERCONDUCTOR IN THE PRESENCE OF A III-V SEMICONDUCTOR

DOCKET NO.: CECOM 4990 - 09-15-93
INVENTOR(S): DONALD W. ECKART, LOUIS E. BRANOVICH PAUL FISCHER
TITLE: FORMATION OF HETEROJUNCTIONS ON OR NEAR CATHODE SURFACE FOR INCREASED EMISSION

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DOCKET NO.: CECOM 4991 - 09-15-93
INVENTOR(S): KAREN M. RENALDO, H. GEORGE HENRY, SUSAN P. SPURGEON
TITLE: RPL SOFTWARE ROUTINES FOR CREATING MEDIAN AND INTERQUARTILE RANGE (IQR) CONTROL CHARTS

DOCKET NO.: CECOM 4992 - 09-15-93
INVENTOR(S): JOHN S. MASON, DAVID B. PETERS
TITLE: SPINNER ALIGNMENT DISK

DOCKET NO.: CECOM 4993 - 09-15-93
INVENTOR(S): HARLAN C. CRAMER, H. GEORGE HENRY
TITLE: LIFT-OFF SILICON NITRIDE PASSIVATION OF THIN FILM RESISTORS ON GaAs MMICs

DOCKET NO.: CECOM 4994 - 09-16-93
INVENTOR(S): JAMES OLIVER BONDI
TITLE: MULTI-ACCESS/COLLISION-DETECT (MA/CD) SEMAPHORE PROGRAMMATION

DOCKET NO.: CECOM 4995 - 09-16-93
INVENTOR(S): RICHARD L. GULDI, DONALD A. ROGOWSKI
TITLE: PARTICLE COUNTER/MONITOR FOR IMPROVED PARTICLE SIZE DETERMINATION

DOCKET NO.: CECOM 4996 - 09-16-93
INVENTOR(S): PALLAB KUMAR CHATTERJEE
TITLE: AN INTEGRATED RELAY FOR PROGRAMMING RESTRUCTURABLE OR REDUNDANT ELEMENTS IN VLSI CIRCU

DOCKET NO.: CECOM 4997 - 09-16-93
INVENTOR(S): CLYDE FULLER, VIC SUTCLIFFE
TITLE: AN IMPROVED METHOD OF PROVIDING SLOPED SIDEWALLS ON INTERLEVEL OXIDE METAL CROSS-OVER ST
AND IN VIA SIDEWALLS

DOCKET NO.: CECOM 4998 - 09-16-93
INVENTOR(S): WILLIAM CHARLES ROGERS, CARLOS JUSTO HILDALGO
TITLE: FIVE BIT PLUS ONE CLOCKLESS COUNTER

DOCKET NO.: CECOM 4999 - 09-16-93
INVENTOR(S): NEAL S. STOLLON, JOHN L. HATCHER, LESLI DERRYBERRY
TITLE: GROUNDED THERMAL PAD FOR VLSI/VHSIC PACKAGING

DOCKET NO.: CECOM 5000 - 09-17-93
INVENTOR(S): HERBERT A. LEUPOLD
TITLE: MANUFACTURE OF DISTORTION FREE "MAGIC" RINGS AND SPHERES

DOCKET NO.: CECOM 5001 - 09-17-93
INVENTOR(S): HERBERT A. LEUPOLD
TITLE: SECTOR LAMINATION FOR DISTORTION-FREE ACCESS TO MAGNETIC FIELD SOURCES

DOCKET NO.: CECOM 5002 - 09-17-93
INVENTOR(S): HERBERT A. LEUPOLD
TITLE: ADJUSTABLE GRADIENT MAGIC SPHERE/RING

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DOCKET NO: ARL-94-1 - 09-19-93
INVENTOR(S): G. LUCEY
TITLE: HERMETIC SEALING PROCESS

DOCKET NO.: CECOM 5003 - 09-22-93
INVENTOR(S): MARK A. BATES, WILLIAM C. DRACH
TITLE: VOLTAGE TUNED FERROELECTRIC RESONANT OSCILLATOR

DOCKET NO.: CECOM 5004 - 09-28-93
INVENTOR(S): DONALD W. ECKART
TITLE: SUBSTRATE FREE, SINGLE CRYSTAL FERROELECTRIC FILMS FOR RAPID THERMAL RESPONSE

DOCKET NO: NVESD 3054 - 10-14-93
INVENTOR(S): E. J. SHARP, G. L. WOOD, R. J. ANDERSON, G. J. SALAMO
TITLE: PHOTOREFRACTIVE MOVING OBJECT CORRELATOR

DOCKET NO: - 10-30-93 SUBMITTED
INVENTOR(S): J. HWANG, G. LUCEY
TITLE: SOLDER MATERIALS WITH IMPROVED PERFORMANCE

3.2.4.2 PEER-REVIEWED PAPERS

TITLE	AUTHOR	DATE
A COMMENT TO ""A NEW PORTRAYAL OF ELEC TRON AND HOLE TRAPS IN AMOR- PHOUS SILICON NITRIDE"", (MANUSCRIPT), PUB: JOURNAL OF APPLIED PHYS- ICS, POC:M.HARMATZ."	WARREN, W, RONG, F, HARMATZ, M., KANICKI, J, IBM	11/14/90
"AN EPR STUDY OF THE ISOLATED ARSENIC ANTISITE IN ELECTRON-IRRADICA- TED GaAs: SYMMETRY AND METAST- E, WARREN, W.(SANDIA)"ABILITY, PUB: APPLIED PHYSICS LTRS, (MANUSCRIPT), POC: E. H. POINDEXTER.	RONG, F, BUCHWALD, W, HARMATZ, M, POINDEXTER,	05/31/91
"AN OBSERVATION ON QUARTZ RESONATOR AGING, PUB: IEEE TRANSACTIONS ON ULTRASONICS, FERROELECTRICS, AND FREQUENCY CONTROL, (MANUSCRIPT)."	KOSINSKI, J.0	6/19/91
"AUGMENTATION OF FIELD UNIFORMITY AND STRENGTH IN SPHERICAL AND CYLINDRICAL MAGNETIC FIELD SOURCES, PRES: 5TH. JOINT MMM-INTERMAG CONF., PITTSBURGH, PA., 18-21 JUN 91, (PAPER), PUB: JOURNAL OF APPLIED PHYSICS"	LEUPOLD, H, POTENZIANI II, E.	05/02/91
"AVALANCHE ELECTRON EMISSION CATHODE ARRAY, PUB: TRANSACTIONS ON ELECTRON DEVICES JOURNAL, (PREV CLRD OR PRES3RD VACUUM MICROELEC CONF, (ETDL #266)."	ZETO,R.J., JUNG, Y, ZHU,D,LU,Y., LALEVIC, B., RUTGERS U.	04/22/91
"CHARACTERIZATION OF HoBa2Cu3O7 ELECTROPHORETICALLY DEPOSITED FILMS ON YBa2Cu3O7 PELLETS, (MANUSCRIPT), PUB:JOURNAL OF APPLIED PHYSICS, POC: ERNEST POTENZIANI II"	MOHR-DORNATH, M, ECKART,D, FINNEGAN, R, POTENZIANI, E,WILBER,W,TAUBER,A.	09/12/91
"CHARGE TRAPPING CENTERS IN N-RICH SILICON NITRIDE THIN FILMS, PUB: ELECTRON DEVICE LETTERS, POC: E. POINDEXTER, (PAPER)."	WARREN,W, KANICKI,J, RONG, F, POINDEXTER, E,MCWHORTER,P.	09/12/91
"COMPARISON OF THE FREQUENCY RESPONSE OF THE GaAs MESFET AND THE PIN DIODE AS PHOTODETECTORS, PUB: MICROWAVE & GUIDED WAVE LETTERS - MTT, MANUSCRIPT."	PAOLELLA, A, HERCZFELD, P, MADJAR, A, DREXEL U, PHILA,	10/15/90
CONDUCTANCE OF LITHIUM BIS(TRIFLUOROMETHANESULFONE) IMIDE IN WATER, PROPYLENE CARBONATE, ACETONITRILE AND METHYL FORMATE AT 25 DEGREE CELCIUS, (MANUSCRIPT), PUB: JOURNAL OF SOLUTION CHEMISTRY."	SALOMON, MARK	09/16/91
"CORRELATION OF RAMAN AND PHOTOLUMINESCENCE SPECTRA OF POROUS SILICON(MANUSCRIPT), PUB: APPLIED PHYSICS LETTERS, POC: M. DUTTA."	TSU, R,. SHEN, H, DUTTA, M.	09/19/91

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COLOR IMAGING IN PHOTOREFRACTIVE CRYSTALS PUB: APPL. PHYS. B, B53:323 (1991)"	RABBANI, S.G., SHULTZ, J.L., SALAMO, G.J., SHARP, E.J., CLARK, W.W.III, MIL	09/30/91
"DETERMINATION OF THE COMPOSITION OF STRAINED InGaAsP LAYERS ON ImP SUBSTRATES USING PHOTOREFLECTANCE AND DOUBLE CRYSTAL X-RAY DIFFRAC- TOMETRY, PUB: JOURNAL OF APPLIED PH6YSICS, POC: KEN JONES"	FLEMISH, J, SHEN, H, JONES, K, DUTTA, M, BAN V., EPITAXX, INC.	08/09/91
"DIELECTRIC BREAKDOWN OF POLYVINLIDENE FLUORIDE AND ITS COMPARISONS WITH OTHER POLYMERS, (MANUSCRIPT), PUB: IEEE TRANSACTIONS ON ELEC- TRICAL INSULATION."	JOW, T. R., CYGAN, P.J.	09/30/91
"DIRECT OPTICAL INJECTION LOCKING OF A RESONANT TUNNEL DIODE OSCILLA-TOR, PUB: IEEE GUIDED WAVE LETTERS JOURNAL	STURZEBECHER, D, HARVEY, J, HIGGINS, T, PAOLELLA, A, LUX R.A.	08/09/91
"EFFECT OF SURFACE CONDITION ON THE SOLDERABILITY OF PRE-TINNED Cu SHEET, PUB: JOURNAL OF METALS"	SUNWOO A.J., HAYASHIGATANI, H., MORRIS JR, J.W., LUCEY, G.K.	06/06/91
"ELECTRIC-FIELD ENHANCED EMISSION PROCESSES OF A PUB: PHYSICAL REVIEW - (18-DEFECT IN GaAs(MANUSCRIPT), 22 MAR 91, CINCINNATI, OHIO)POC: E. POINDEXTER, (manuscript)."	GRIMMEISS, H,U, LUND, SWEDEN, BUCHWALD, W. RONG, F.POINDEXTER	03/05/91
"ELECTRICALLY DETECTED MAGNETIC RESONANCE OF A TRANSITION METAL RELA-TED RECOMBINATION CENTER IN Si p-n DIODES, (ABST. & MANUSCRIPT),PRESIEEE SEMICONDUCTOR INTERFACE SPECIALISTS CONF, DISNEYWORLD, FL,DEC 91PUB:ELECTRON DEVICE LETTERS, POC: E.POINDEXTER"	RONG,F,GERARDI,G,BUCHWALD,W, POINDEXTER,E,UMIOR,M,KEEBLE,D, WARREN,W.	09/12/91
"ELECTRODE-INDUCED NONUNIFORMITIES IN THE SWEEPING OF ALPHA QUARTZ, PUB: IEEE TRANSACTIONS ON ULTRASONICS, FERROELECTRICS AND FREQUENCY CONTROL,"	GUALTIERI, J., KOSINSKI, J.	11/30/90
"ELECTRON-LO-PHONON SCATTERING RATES IN SEMICONDUCTOR QUANTUM WELLS, (PAPER)PRES: AMERICAN PHYSICAL SOCIETY, NAHEIM, CA, 16 MAR 91, PUB:PHYSICAL REVIEW B PUBLICATION.	RUDIN, S, REINECKE, T., NRL WASH,D.C.	05/09/91
"EXPOSURE OF COMMERCIAL POLYMERS TO GAS PLASMA: WETTABILITY AND ADHESION STUDIES, PRES: POLYMER TECHNOLOGY CONF, PHILADELPHIA, PA, 3-5 JUN 91.,	WADE, W.L., Jr., MAMMONE, R.J., BINDER, M	02/25/91
TITLE	AUTHORS	DATE
PUB: JOURNAL OF POLYMER SCIENCE."		
"FABRICATION AND EVALUATION OF SUPERCOND8UCTING DEVICES, PUB: MICRO- WAVE JOURNAL, MAY 91 ISSUE, MANUSCRIPT."	BABBITT, R, LENZING, E, WILBER, W., RACHLIN,A	02/20/91
"FEMTOSECOND EXCITONIC BLEACHING RECOVERY IN THE OPTICAL STARK EFFECT OF GaAs/Al/sub x/Ga/sub 1-x/As MULTIPLE QUANTUM WELLS AND DIRECTIONAL COUPLERS, PUB: PHYSICAL REVIEW B"	LEE,S.G.,HARTEN,P.A.,SOKOLOFF,B, J.P.,JIN,R.,FLUEGEL, MEISSNER, K.E.,CHUANG,C	01/15/91

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FUTURISTIC SOLDERS: UTOPIA OR ULTIMATE PERFORMANCE, PUB: SURFACE MOUNT TECHNOLOGY"	HWANG, JENNIE S., LUCEY, G., J. CLOUGH, ROGER, MARSHALL, J	09/30/91
"HIGH DETECTIVITY InGaAs BASE OPERATED HOT-ELECTRON TRANSISTOR, PUB: APPLIED PHYSICS LETTERS, (MANUSCRIPT), POC: K.K.CHOI"	CHOI, K.K., FOTIADIS, L., LARA, TAYSING, M., CHANG,W., IAFRATE, G.	06/10/91
"HIGH RATE DISCHARGE OF POLY-3-METHYLTHIOPHENE CATHODES IN INORGANIC ELECTROLYTES, PUB: JOURNAL OF APPLIED ELECTROCHEMISTRY, (MANUSCRIPT)"	WALKER, C. W. JR.	03/18/91
"HIGH RATE MOLTEN SALT CELLS EMPLOYING BARIUM NICKEL SULFIDE CATHODESPUB: JOURNAL OF POWER SOURCES, (MANUSCRIPT)."	PLICHTA, E.J.	06/21/91
"IMPROVEMENTS IN ALUMINUM ADHESION AND BREAKDOWN VOLTAGES OF POLY- VINYLIDENE FLUORIDE FILMS FOLLOWING EXPOSURE TO GAS PLASMAS, PUB: POLYMERS FOR ADVANCED TECHNOLOGIES (MANUSCRIPT)."	MAMMONE, R, WADE, W, BINDER, M.	04/24/91
"INFRARED ABSORPTION AND PHOTOCONDUCTIVE GAIN OF QUANTUM WELL INFRA- RED PHOTODETECTORS, PUB: APPLIED PHYSICS LETTERS,POC: K.K. CHOI., (MANUSCRIPT)."	CHOI,K, FOTIADIS,L, LARA-TAYSING, M., CHANG,W., IAFRATE,G.	09/21/91
'MPROVED PHOTOREFRACTIVE TIME RESPONSE USING A CYLINDRICAL LENS PUB: APPL. OPT. 30:1847 (1991)	SALAMO, G.J., MONSON, B., CLARK, W.W.III, WOOD, G.L., SHARP, E.J., NEURGAO	09/30/91
"INTERVALLEY SCATTERING AND LATTICE RELAXATION IN DX CTRS PUB: SOLID STATE COMMUNICATIONS 78, NO. 7,	PASTORI-PARRAVICINI, G., RESCA, L.,GRAFT, R., LOHRMANN, D.	09/30/91
"LITHIUM RECHARGEABLE CELL WITH A POLY 3-METHYL-THIOPHENE CATHODE AND LiAsF6-DIMETHYLCARBONATE ELECTROLYTE, PUB: JOURNAL OF THE ELECTRO- CHEMICAL SOCIETY, MANUSCRIPT."	WALKER, C, SLANE, S.	02/12/91
"LOCALIZATION OF ELECTRONS BY ELECTRIC FIELD IN GaAs-A1As[-X COUPLED STRUCTURES, PUB:Journal of SURFACE SCIENCE, (MANUSCRIPT), POC;MITRA DUTTA."	DUTTA, M, SHEN, H, SMITH,D.D., CHOI, K.K., NEWMAN, P.G.	07/11/91
TITLE	AUTHORS	DATE
"LOW TEMPERATURE ELECTRON SPIN RESONANCE INVESTIGATIONS OF SILICON PARAMAGNETIC D EFECTS IN SILICON NITRIDE, PRES: AMERICAN PHYSICAL SOCIETY, CINCINNATI, OH, 18-22 MARCH 91, PUB:APPLIED PHYSICS LETTERSPOC: E. POINDEXTER, ABST,MANUSCRIPT."	WARREN,W,RONG,F.C.,POINDEXTER ,E,KANICKI,J,GERARDI,G.J.	11/06/90
"MICROELECTRONIC RELIABILITY/TEMPERATURE INDEPENDENCE, PUB: QUALITY &RELIABILITY ENGINEERING ITERNATIONAL. (MANUSCRIPT)."	HAKIM, E. B.	02/25/91

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"MICROWAVE TECHNOLOGY AND DEVICER RESEARCH IN THE ARMY OR STAYING AHEAD IN HIGH TECH, PUB: MICROWAVE JOURNAL"	PERLMAN, B. S.	04/22/91
"MODEL FOR MICROSTRIP OPEN END EFFECT AT A DIELECTRIC EDGE, PUB:IEEE MICROWAVE AND GUIDED WAVE LETTERS, PUB:IEEE MICROWAVE AND GUIDED WAVE LETTERS, (MANUSCRIPT)."	KOSCICA, THOMAS E.	06/04/91
"MONOLITHIC, PHOTOCONDUCTIVE IMPU7LSE GENERATOR USING A GaAs WAFER, PUB: APPLIED PHYSICS LETTERS, MANUSCRIPT."	KIM, A, ZETO, R, YOUMANS, R, KONDEK, C,WEINER, M, BRISKER, AGEE, & JASPER.	02/12/91
"MULTIAXIAL BEHAVIOR OF 63Sn-37Pb SOLDER, PUB: EIA JOURNAL"	LOW III, S.R., FIELDS, R.J.,. LUCEY, G.K	05/13/91
"ON THE WETTING OF THE INTERMETALLICS Cu6Sn5 AND Cu3Sn BY Pb-Sn ALLOYS, PUB: THE METAL SCIENCE OF JOINING"	CIESLAK, M.J., GUPTA, M.J. GLICKSMAN, M.J., PEREPEZKO, J.H.	09/30/91
PARAMAGNETIC POINT DEFECTS IN AMORPHOUS SILICON DIOXIDE AND AMORPHO-US SILICON NITRIDE THIN FILMS. I I: a-SiNx:H,(manuscript), PUB: JOURNAL OF THE ELECTRO-CHEMICAL SOCIETY, POC:ED POINDEXTER."	WARREN, W.L., POINDEXTER, E, RONG,F, KANICKI, J.	06/21/91
"PARAMAGNETIC POINT DEFECTS IN AMORPHOUS SILICON DIOXIDE AND AMOR- PHOUS SILICON NITRIDE THIN FILMS I: a-Sio2, PRES: ELECTROCHEMICAL SOCIETY, WASH,DC,7 MAY 91,(ABRIDGED FORM CLRD),PUB: JOURNAL OF THE ELECTROCHEMICAL SOCIETY."	POINDEXTER,E, WARREN, W., OFFENBERG,M W, ARMUTH-MULLER,W.	06/21/91
"PERMANENT MAGNET SOURCES FOR EXTENDED INTERACTION KLYSTRONS, PRES: 5TH JOINT MMM-INTERMAG CONF, PITTSBURGH, PA, 18-21 JUNE 1991, PUB: JOURNAL OF APPLIED PHYSICS, (PAPER)."	LEUPOLD, H, KOSA, L., MCLANE,G., TILAK, A, POTENZIANI II, E.	05/02/91
"PHOTOLUMINESCENCE FROM CARRIERS CONFINED AT AN AL/SUB X/GA/SUB 1-X/As/GaAs HETERO JUNCTION INTERFACE	BRADSHAW, J.L., CHOYKE, W.J., DEVATY, R.P., MESSHAM, R.L.	02/01/91
"PHOTOVOLTAGE AMPLIFICATION AND QUASI-PHOTO-VOLTAIC OPERATION OF AN INFRARED HOT-ELECTRON TRANSISTOR, PUB: APPLIED PHYSICS LETTERS, PAPER,"	CHOI, K. K., LARA-TAYSING, M, FOTIADIS, GEO CTR, & CHANG, W.	04/16/91

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"POLARIZED CATRHODOLUMINESCENCE STUDY OF UNIAXIAL AND BIAXIAL STRESS IN GaAs-Si, PUB: PHYSICAL REVIEW B, RAPID COMMUNICATIONS,MANUSCRIPT"	SHEN, H, DUTTA,M., RICH,D, ET AL., VERNON,S, DIXON, T.	01/28/91
"PREDICTED AND MEASURED PROPERTIES OF DOUBLY ROTATED, LITHIUM TETRA- BORATE RESONATORS, PUB: IEEE TRANSACTION ON ULTRASONICS, FERROELEC- TRICS, AND FREQUENCY CONTROL. (MANUSCRIPT).	KOSINSKI, J. BALLATO, A, LUKASZEK, T., MALLIKARJUN, S.	09/27/91
"PREPARATION OF BULK SAMPLES OF COPPER-TIN INTERMETALLIC COMPOUNDS, PUB: THE METAL SCIENCE OF JOINING"	SCHAEFER, R.J., BIANCANIELLO, F.S., JIGGETTS, R.D.	09/30/91
"PROGNOSTICATIONS FROM THE EDGE, PUB: MICROWAVE JOURNAL, MANUSCRIPT."	GELNOVATCH, V. G.	01/18/91
"PULSE POWER CHARACTERISTICS OF POLY 3-METJHYL-THIOPHENE CATHODES IN Li/SO2 RECHARGEABLE CELLS, PUB: JOURNAL OF POWER SOURCES,(PAPER)."	WALKER, C. W. Jr.	01/25/91
"PERFORMANCE ORIENTED STUDY IN LASER DAMAGE TO 1CT PHOTODETECTORS PUB: NATO IRIS (CLASSIFIED) 1991	SONSTROEM, J., GRAY, A.,W. MCKIEG,	09/30/91
"RAPID PLAN VIEW TEM SAMPLE PREPARATION FOR SEMICONDUCTOR GRAIN SIZE ANALYSIS, PUB: JOURNAL OF ELECTRON-MICROSCOPY TECHNIQUE,"	COLE, M., ZAKAR, E.	05/20/91
"RESIDUAL PHASE NOISE PERFORMANCE OF X-BAND GaAs FETs AT LIQUID NITROGEN TEMPERATURE, PUB: IEEE ELECTRONIC LETTERS, (MANUSCRIPT)."	MIZAN, M, McGOWAN, R.	02/08/91
"SPURIOUS SURFACE FINISH IMPROVEMENT OF THE EXTINCTION COEFFICIENT OFALPHA QUARTZ, PUB: IEEE TRANSACTIONS ON ULTRASONICS, FERROELECTRICS, AND FREQUENCY CONTROL (UFFC), (MANUSCRIPT)."	GUALTIERI, J, BLISNUK, K,	12/14/90
"STRUCTURAL IDENTIFICATION OF THE SILICON AND NITROGEN DANGLING BONDCENTERS IN SILICON NITRIDE, (MANUSCRIPT), PUB : JOURNAL OF APPLIED PHYSICS, POC:E.POINDEXTER."	WARREN, W., RONG, F, POINDEXTER, E,GERARDI, G, KANICKI, J.	12/18/90
"SUPERLATTICE BAND STRUCTURE PROBED BY TUNNELLING HOT-ELECTRON INJEC-TION, PUB:APPLIED PHYSICS LETTERS,"	CHOI, K.K., KUAN, C, TSUI, D (PRINCETON U)	09/24/91

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"SURFACE PROPERTIES OF COMMERCIAL POLYMER FILMS FOLLOWING VARIOUS GASPLASMA TREATMENTS, PUB: JOURNAL OF POLYMER SCIENCE, (MANUSCRIPT)."	WADE, W, MAMMONE, R., BINDER, M.	01/25/91
"THE GROWTH OF Cu-Sn INTERMETALLICS AT A PRE-TINNED COPPER-SOLDER INTERFACE, PUB: METALLURGICAL TRANSACTION"	SUNWOO, A.J., MORRIS JR, J.W., LUCEY, GEORGE	09/01/91
THE TIME CONSTANT IN PHOTOREFLECTANCE FROM GaAs, PUB: APPLIED PHYS- ICS LETTERS, (MANUSCRIPT),"	SHEN, H, DUTTA, M, LUX, R, BUCHWALD, W, FOTIADIS, L., SACKS, R.	01/28/91
THERMIONIC ASSISTED PHOTOCURRENT IN FAR IR GaAs/ A1xGal-xAs PHOTOCON DUCTIVE DETECTORS,(MANUSCRIPT), PUB: APPLIED PHYSICS LETTERS,"	BRADDOCK,W, CHOI,K,NEWMAN,P, EASTMAN, L., (CORNELL UNIV)	1/22/91
"UNCERTAINTY OF THE SYMMETRY OF THE EL-2 CENTER IN GaAs, (paper),PUB;APPLIED PHYSICS LETTERS, POC:E. POINDEXTER."	RONG,F, BUCHWALD,W. POINDEXTER,E,ZETO,RM And GERARDI,G,W.PATERSONCOL	02/05/91
"VACUUM ELECTRONICS IN TOMORROW'S STRATEGIC ARMY, PUB: MICROWAVE JOURNAL, (SEP ISSUE) 1991."	SMITH, BERNARD	08/15/91
"A RAMAN STUDY OF ORDERING IN GaInP,PUB: (PAPER), PHYSICAL REVIEW,POC:M. DUTTA."	GANT, T., DUTTA,M, EL-MASRY, N. BEDAIR, S, STROSCIO,M	10/21/91
"AN EPR STUDY OF SINGLE CRYSTAL YBa2Cu3O6+ xFOR x = 0.35 TO 0.45, PUB:APPLIED PHYSICS LETTER, (MANUSCRIPT)."	POINDEXTER, E., KEEBLE, D., VEAL, B.	4/3/92
"ANALYTIC DISPERSION RELATIONS NEAR THE GAMMA POINT IN STRAINED ZINC-BLENDS CRYSTALS, PUB: PHYSICAL REVIEW B"	BAHDER, T.B.	01/15/92
"ANNEALING EFFECTS ON HEAVILY C-DOPED GaAs FILM, PUB: JOURNAL OF ELECTROCHEMICAL SOCIETY, POC: K. A. JONES."	JONES K.,COLE,M,SCHAUER,S,YANG, L,MOERKIRK, R, HAN, W.,LEE,M, LU,Y	12/09/91
"CHANGE IN SIGN OF HALL COEFFICIENT AT EL2-EL2* TRANSITION IN SEMI- INSULATING SINGLE CRYSTAL GaAs CONTAINING CONTROLLED DEFECT CONCEN-TRATION, PUB: PHYSICAL REVIEW, (MANUSCRIPT)."	WEINER,M, BURKE, T. VEZZOLI, G.C., CHEN, M.F., LALEVIC,B	01/28/92
"COHERENT PULSE BREAKUP IN FEMTOSECOND PULSE PROPAGATION IN SEMICONDUCTORS, PUB: PHYSICA STATUS SOLIDI B"	PEYGHAMBARIAN, N., HARTEN, P.A., LEE, S.G.,KNORR, A., JIN, R., BROWN de CO	05/18/92

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"COMPARISON OF (111) AND (100) -GROWN GaAs-A1GaAs QUANTUM WELLS BY MAGNETOREFLECTANCE, (MANUSCRIPT), PUB: PHYSICAL REVIEW RAPID COMM-UNICATIONS."	ZHOU,W,SMITH,D,SHEN,H, PAMULAPATI,J,DUTTA,M,CHIN,A, BALLINGALL,J.	03/16/92
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"ILLUMINATION-DEPENDENT DYNAMIC RESISTANCE OF HG(1-X)CD(X)TE HETEROJUNCTION PHOTODIODES PUB: J. APPL. PHYSICS, VOL.74, NO. 9, 1993"	GRAFT, R., FISHER, T., GRAY, A., KENNERLY, S.	09/30/93
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"LINEWIDTH BROADENING FACTOR OF A MICROCAVITY SEMICONDUCTOR LASER, PUB: APPLIED PHYSICS LETTERS"	JIN, R., BOGGAVARAPU, D., KHITROVA, G., GIBBS, H.M., HU, Y.Z., KOCH, S.W.,	10/19/92
"LONG TERM AGING OF OSCILLATORS, PUB: TRANSACTIONS, IEEE ULTRASONICS, FERROELECTRICS, AND FREQUENY CONTROL SOCIETY."	FILLER, R, VIG, J.R.	11/12/92
"LOW DARK CURRENT INFRARED HOT-ELECTRON TRANSISTOR FOR 77K OPERATION,PUB: APPLIED PHYSICS LETTERS, POC: K.K. CHOI."	CHOI, K, TIDROW, M, LARA -TAYSING, M., CHANG, W, KUAN, C, FARLEY,C, CHANG,F"	04/05/93
"LOW DYDROGEN CONTENT SILICON NITRIDE FILMS FROM ELECTRON CYCLOTRON RESONANCE PLASMAS, PUB: JOURNAL OF APPLIED PHYSICS."	FLEMISH, J, PFEFFER,R	04/09/93
"MAGNETO-OPTICAL STUDIES OF TWO AND THREE DIMENSIONAL EXCITONS IN In GaAs/GaAs STRAINED QUANTUM WELLS, PUB:PHYSICAL REVIEW B- RAPID COM-MUNICATION, POC:M.DUTTA, (MANUSCRIPT)."	ZHOU,W,DUTTA,M,SMITH,D, PAMULAPATI,J,SHEN,H,NEWMAN, P,SACKS,R.	02/23/93

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TITLE	AUTHORS	DATE
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"OPTICAL NONLINEARITIES IN STRAINED-LAYER InGaAs/ GaAs MULTIPLE QUANTUM WELLS, PUB: APPLIED PHYSICS LETTERS"	JIN, R., OKADA, K., KHITROVA, G., GIBBS, H.M., PEREIRA, M., KOCH, S.W., PEY"	10/12/92
"OPTICAL PROPERTIES OF InP-BASED LATTICE MATCHED InGaAs QUANTUM WELLSPUB: IEE INSPEC DATA REVIEWS ON InGaAs QUANTUM WELLS.	PAMULAPATI, J, DUTTA, M.	03/31/93
"OPTICAL PROPERTIES OF PSEUDOMORPHIC InGaAs-GaAs HETEROSTRUCTURES ANDQUANTUM WELLS, PUB: IEE INSPEC DATA REVIEWS ON InGaAs."	DUTTA, M, PAMULAPATI, J.	03/31/93

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TITLE	AUTHORS	DATE
"OPTICAL STUDY OF AN n-TYPE MODULATION DOPED GaAs/A1As MULTIPLE QUAN-TUM WELLS STRUCTURE, LETTER."	DUTTA,M,PAMULAPATI,J, NEWMAN,P,SCHMIEDEDL,T,FU,L., LEE,S,YU,W,PETROU,A"	03/29/93
"OPTICALLY CONTROLLED OSCILLATORS FOR MILLIMETER-WAVE PHASED ARRAY ANTENNAS, PUB: MTT TRANSACTIONS."	STURZEBECHER, D, ZHOU, X, ZHANG, X, DARYOUSH, A	10/26/92
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"PIEZOELECTRIC MATERIAL CONSTANTS FOR SURFACE WAVE RESEARCH, PRES:7THEUROPEAN FREQUENCY AND TIME FORUM,, NEUCHATEL, SWITZERLAND, 16-18 MAR 93."	GUALTIERI, J, KOSINSKI, J, BALLATO, A.	03/31/93
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'PLASMONS LOCALIZED AT POINT CHARGES IN SEMI-CONDUCTOR QUANTUM WELLS, PUB: PHYSICAL REVIEW B."	RUDIN, S, REINECKE, T, NAVAL RES LAB	03/02/93
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"PRODUCTION VALIDATION OF SERA SOLDERABILITY TEST METHOD, PUB: SOLDERING AND SURFACE MOUNT TECHNOLOGY"	TENCH, D.M., KENDIG, M.W., ANDERSON, D.P., HILLMAN, D.D., LUCEY, G.K., GHER"	02/01/93
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"THE LixTiS2/TiS2/Li(1-x)CoO2, SOLID-STATE ROCKING CHAIR BATTERY, PUB: JOURNAL OF THE ELECTROCHEMICAL SOCIETY."	PLICHTA,E,BEHL,W,SALOMON,M, CROCE,F,PASSERINI, S,SCROSATI, B,SCHLEICH,D	10/16/92
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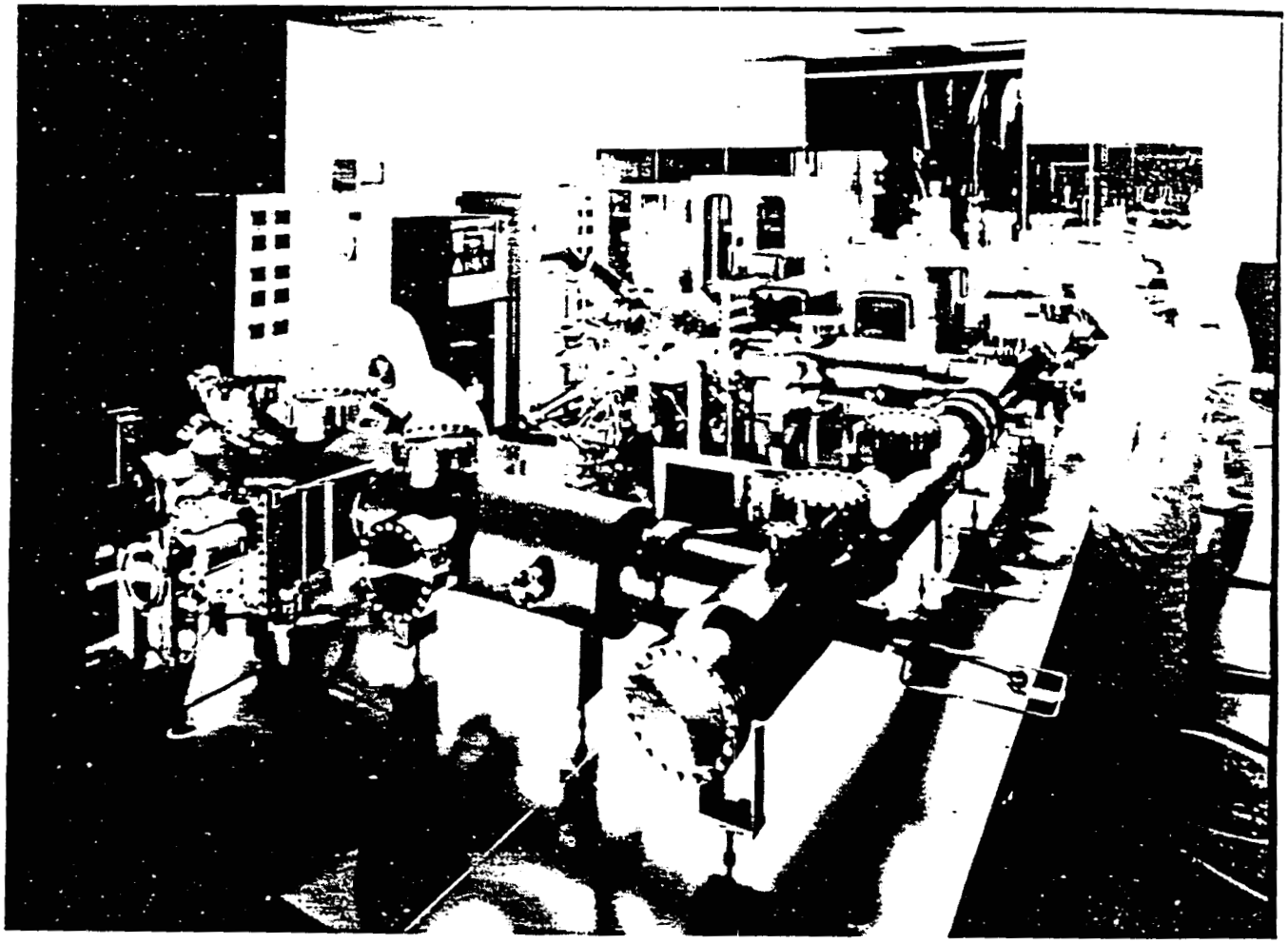
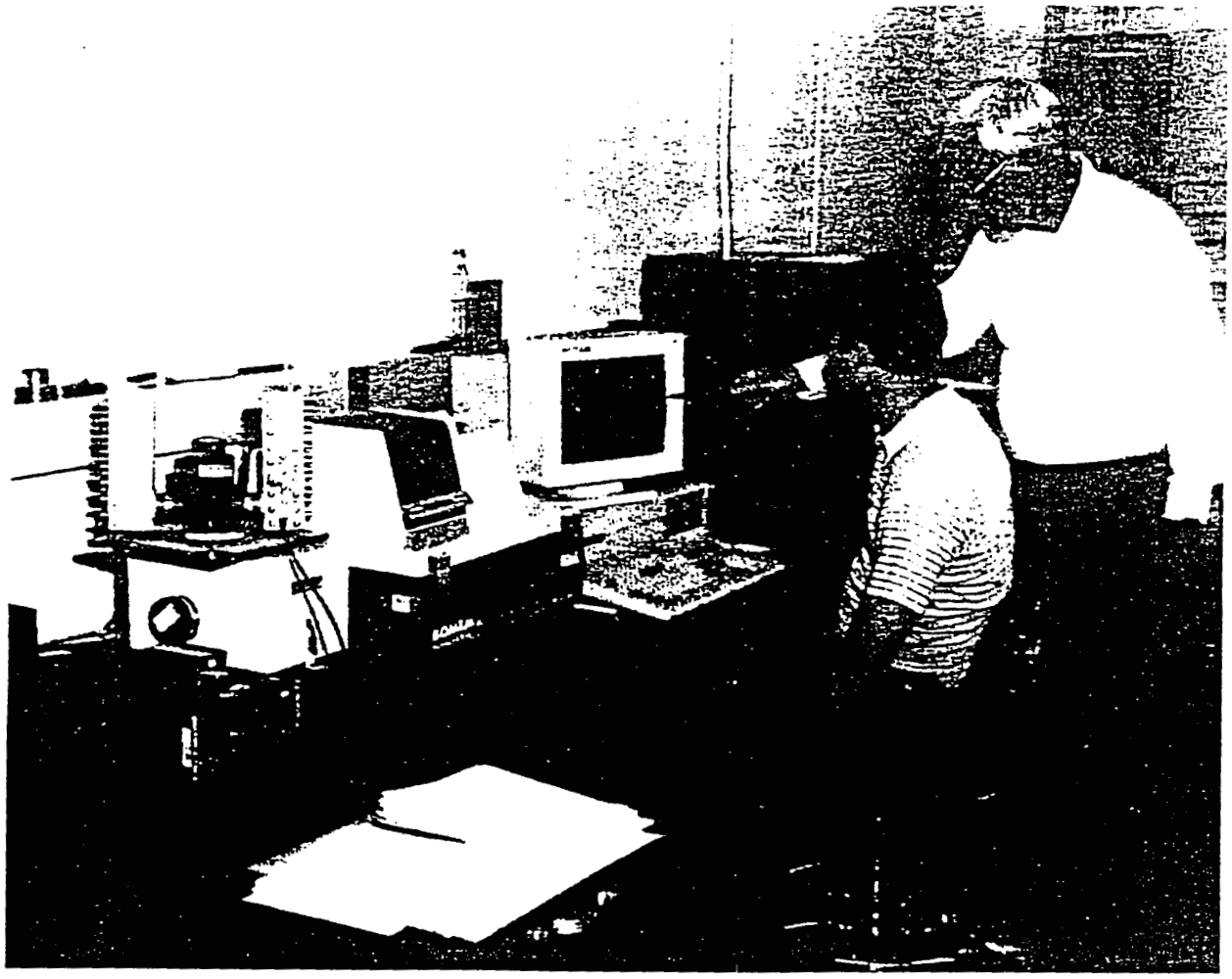


MERCURY CADMIUM TELLURIDE MOLECULAR BEAM EPITAXY

The system at NVESD consists of **three connected growth chambers**;

- 1 chamber for II-VI compounds - e.g., CdZnTe, HgCdTe
- 1 chamber for III-V compounds - e.g., GaAs, AlGaAs
- 1 chamber for IV type elements - e.g., Si

The idea is to grow HgCdTe detectors on Si substrates with a GaAs/AlGaAs buffer layer - without exposing the wafer to air at any time. (Special provisions are necessary to trap the extra Hg.)



DETECTOR EVALUATION FACILITY

The ARL **detector evaluation facility** is a custom built state-of-the-art laboratory for evaluating infrared detector characteristics such as dynamic resistance vs bias, noise spectra, spectral response, responsivity, quantum efficiency, detectivity, and optical area from 10 to 300 Kelvin. One of the unique features of this system is that data analysis and many of the measurements have been automated to reduce errors and testing costs. The system has been used to evaluate a variety of detectors such as p/n heterostructures, quantum wells, and resonant absorber structures. This versatile and automated detector array evaluation facility can perform parallel evaluation of 60 detectors simultaneously.

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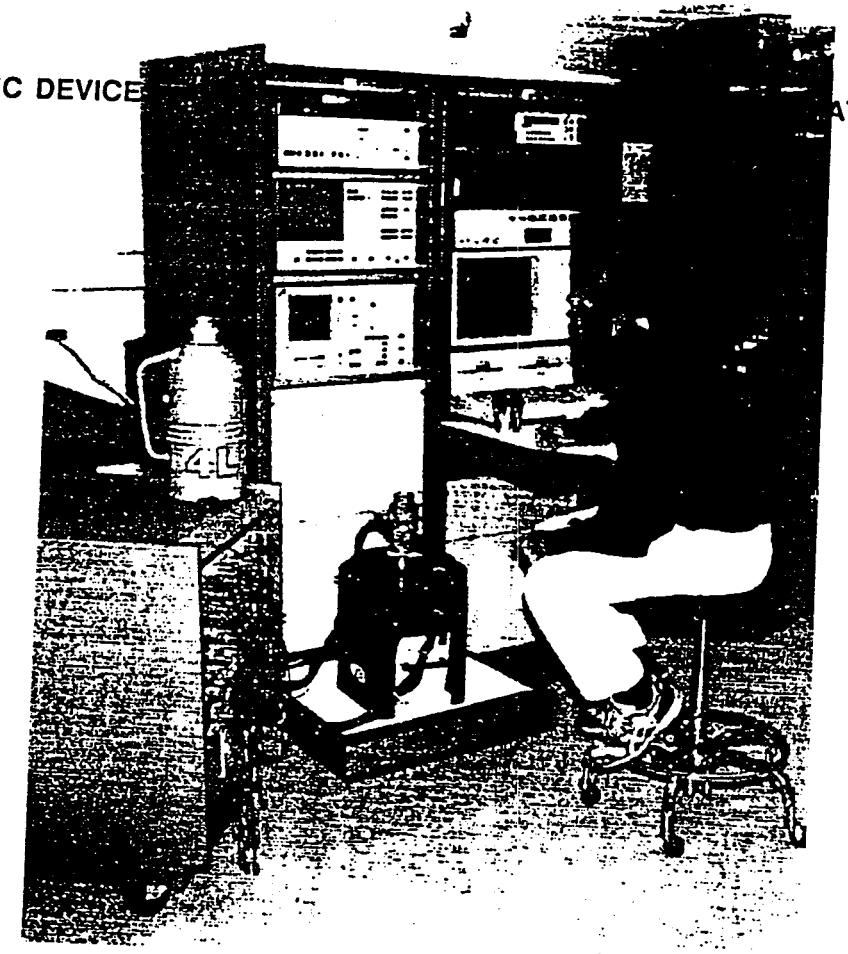

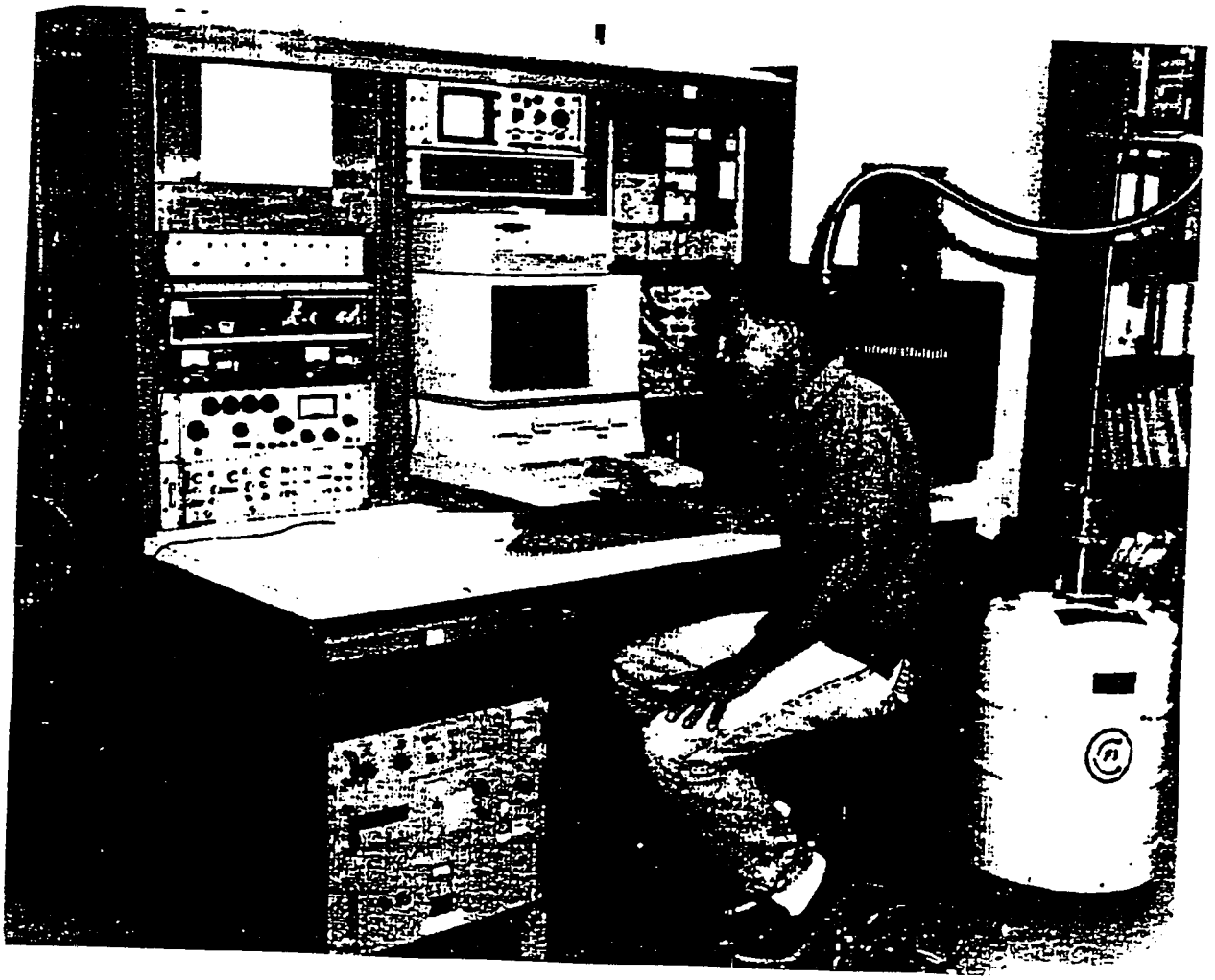

Pictures or drawings are not available.

LASER DIODE BAR BONDER

Capability: Can accurately place up to a 1 cm bar on a heatsink for bonding. Controls entire bonding process: heatsink temperatures, cover gas temperature, bonding load, bonding time, optional scrubbing time. Using this instrument, it is possible to accurately bond a laser diode array (bar) at the front edge of a heatsink, and to bond junction side down.

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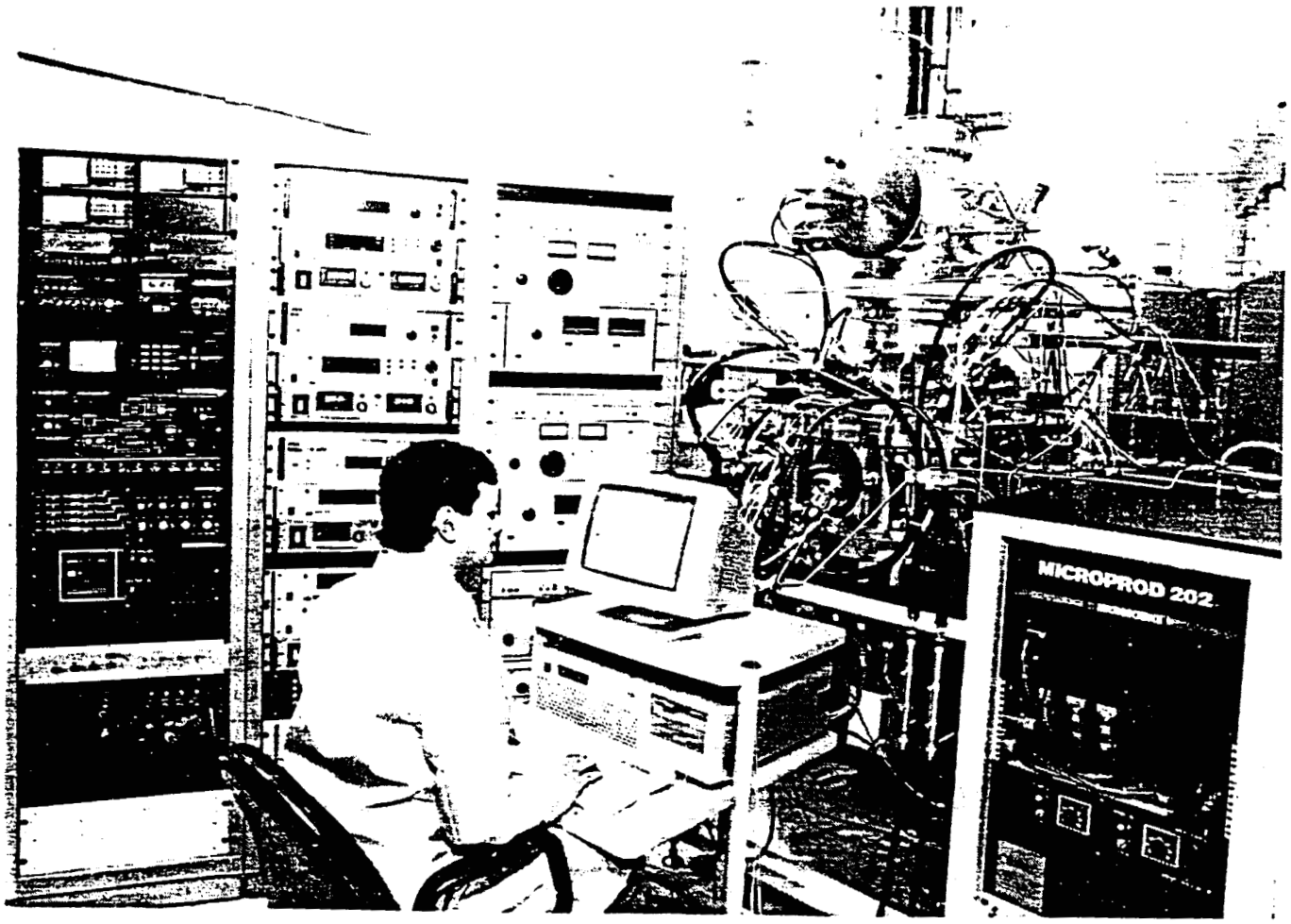
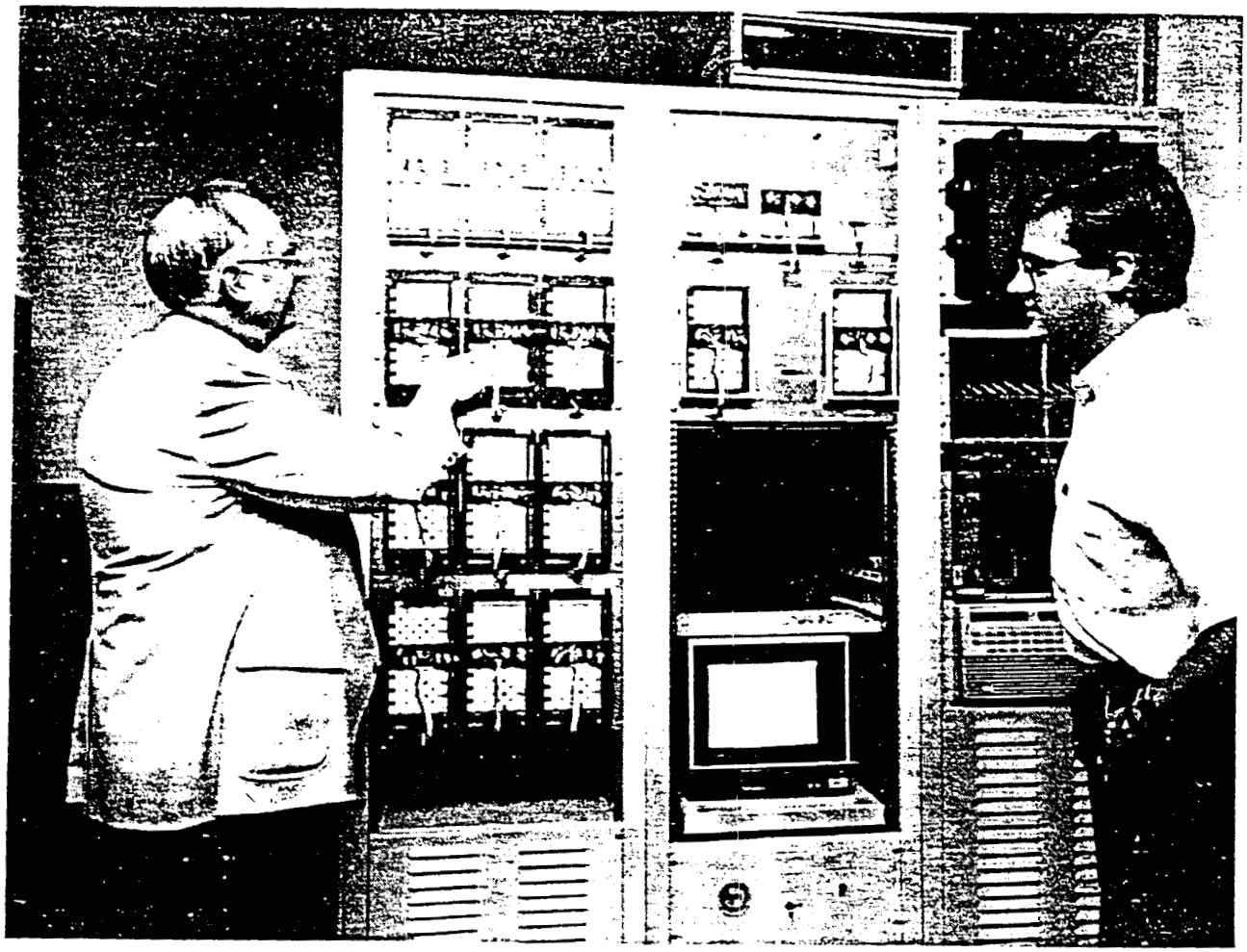


FLAT PANEL DISPLAY DEPOSITION EQUIPMENT

The **automated multi-source deposition system** supports research and development of phosphors for flat panel displays and other DoD critical technologies. It provides a unique capability to prepare samples of new materials and compounds that can be immediately tested, so process steps can then be iteratively adjusted when and where required (e.g., dopant percentage increments or decrements; variants of deposition thicknesses; length of anneal times, etc.). The facility is able to provide independent, unbiased tests, measurements and evaluations of electro-optics characteristics and performance parameters of samples of all display device technologies.



DISPLAY EVALUATION LABORATORY

The **Army's tri-Service Center for Display Technology Development** provides test beds and display device physics and characterization studies to system developers seeking to evaluate interactive display technologies and techniques from first-cut concepts to advanced development demonstration prototypes.

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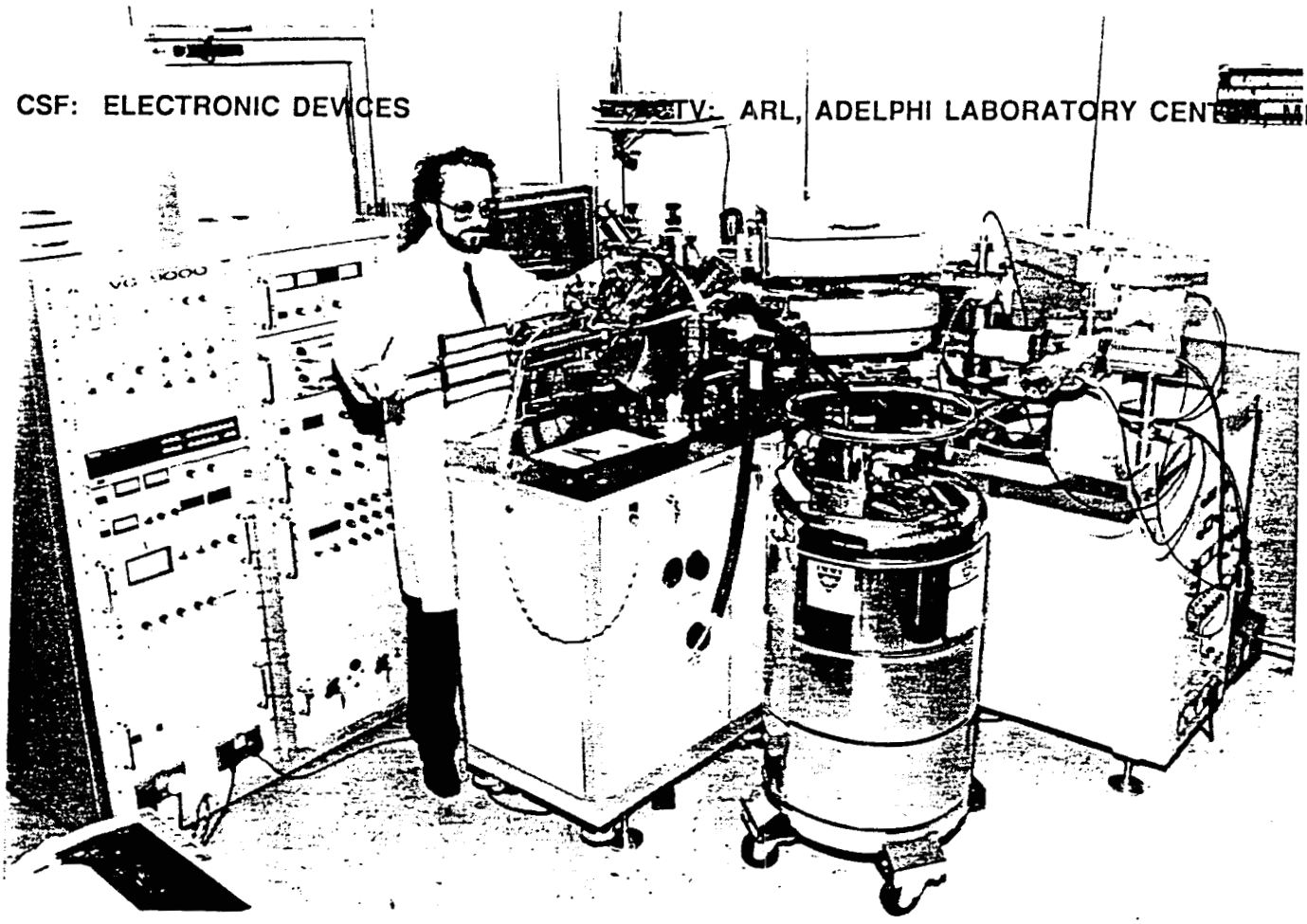

GLOW DISCHARGE MASS SPECTROMETER (VG9000)

This instrument is unique in its capability to chemically characterize bulk electronic materials semi-quantitatively **without standards for all** elements in the periodic table. It is also capable of parts-per-trillion elemental detection level for almost all elements. In addition, the instrument was specially designed to perform in UHV conditions (to enhance detection of light elements in semiconductors), provide LN_2 cooling of the sample/cell to prevent contaminant desorption, and include ultra-high mass resolution to separate all interfering species, hence increasing the overall accuracy and precision. We have utilized this instrument, and developed novel techniques, to characterize semi-insulating bulk GaAs wafers in support of several Army, Navy, and ARPA programs. In addition, this system has been used for Failure Analysis of military systems for all three tri-Service DoD organizations.

Other methods, like wet chemical techniques, which can analyze bulk wafers after dissolution, do not approach GDMS detection limits and introduce contaminants which add enormous error to the analysis.

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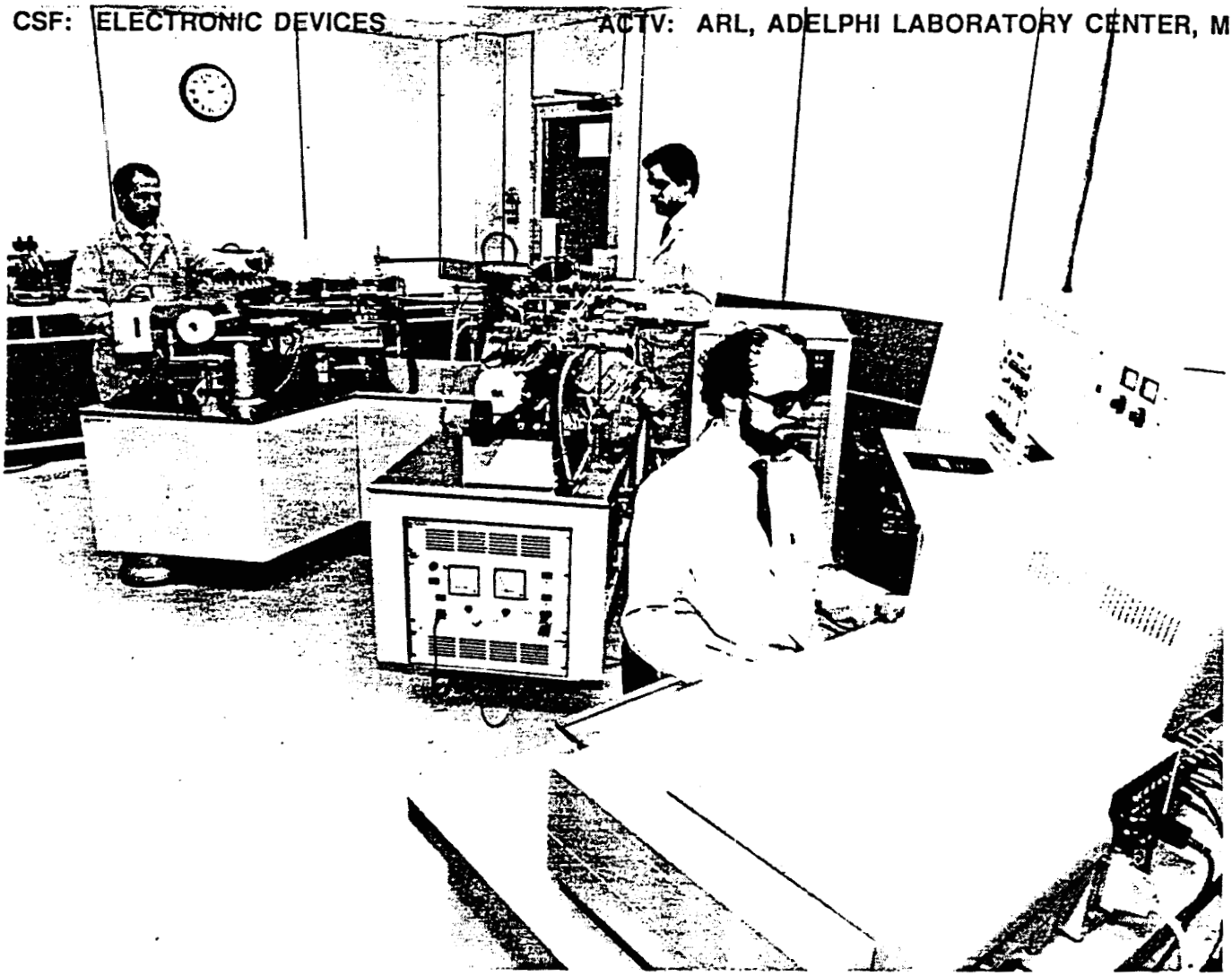
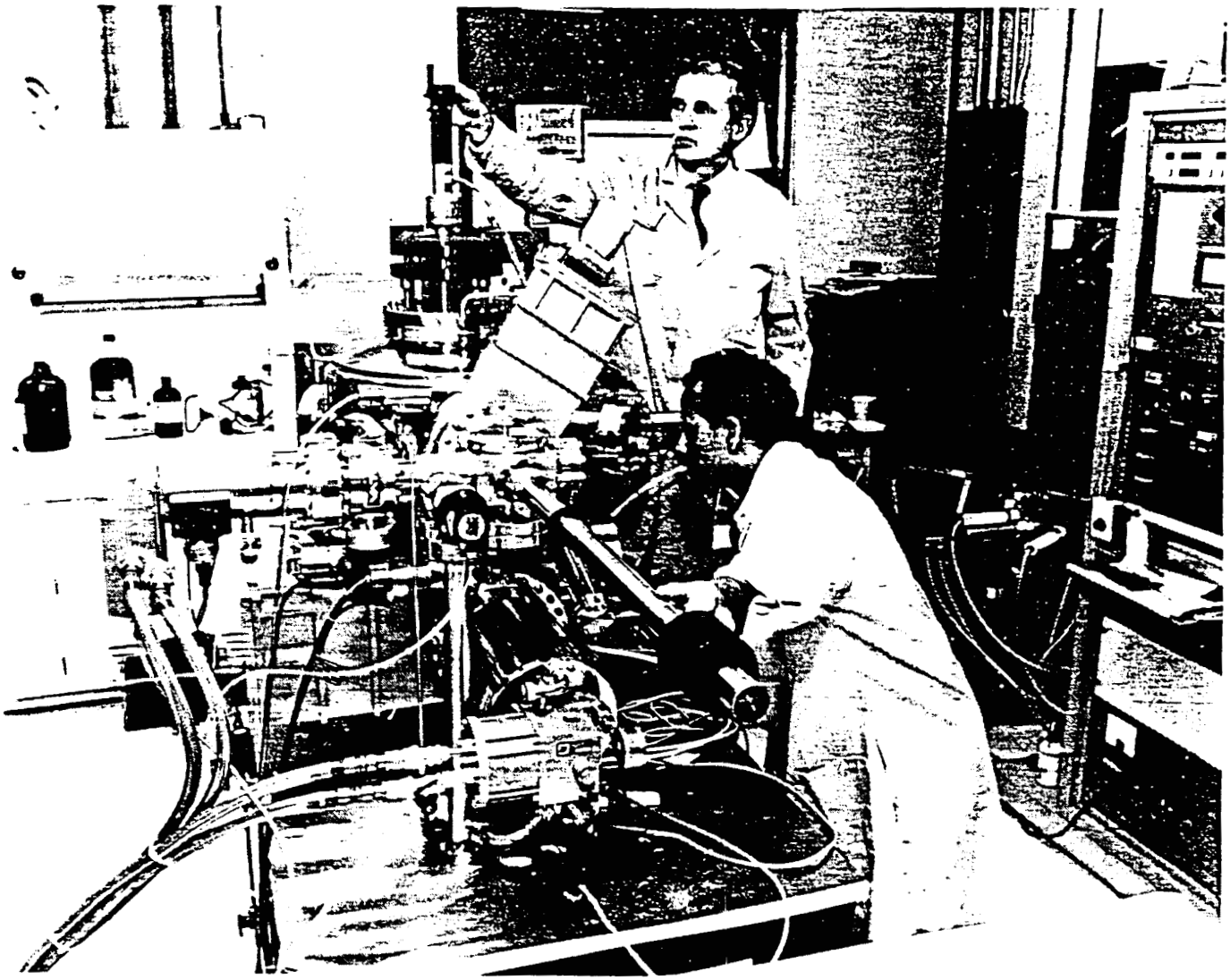


THERMAL DESORPTION MASS SPECTROMETER (KRATOS - TDMS/LDMS/GDMS)

This alpha-prototype instrument, which just passed acceptance certification on 8/9/93, was designed specially for thermal, laser, and glow discharge mass spectrometry. This UHV system includes a lamenated core magnet with properties of fast switching and high mass range, a triple-focusing mass spectrometer for ultra-high mass resolution (>50,000 m/Δm - FWHM) and ultra-sensitivity, and accurate temperature measuring PID system (accuracy to ±0.1°C).

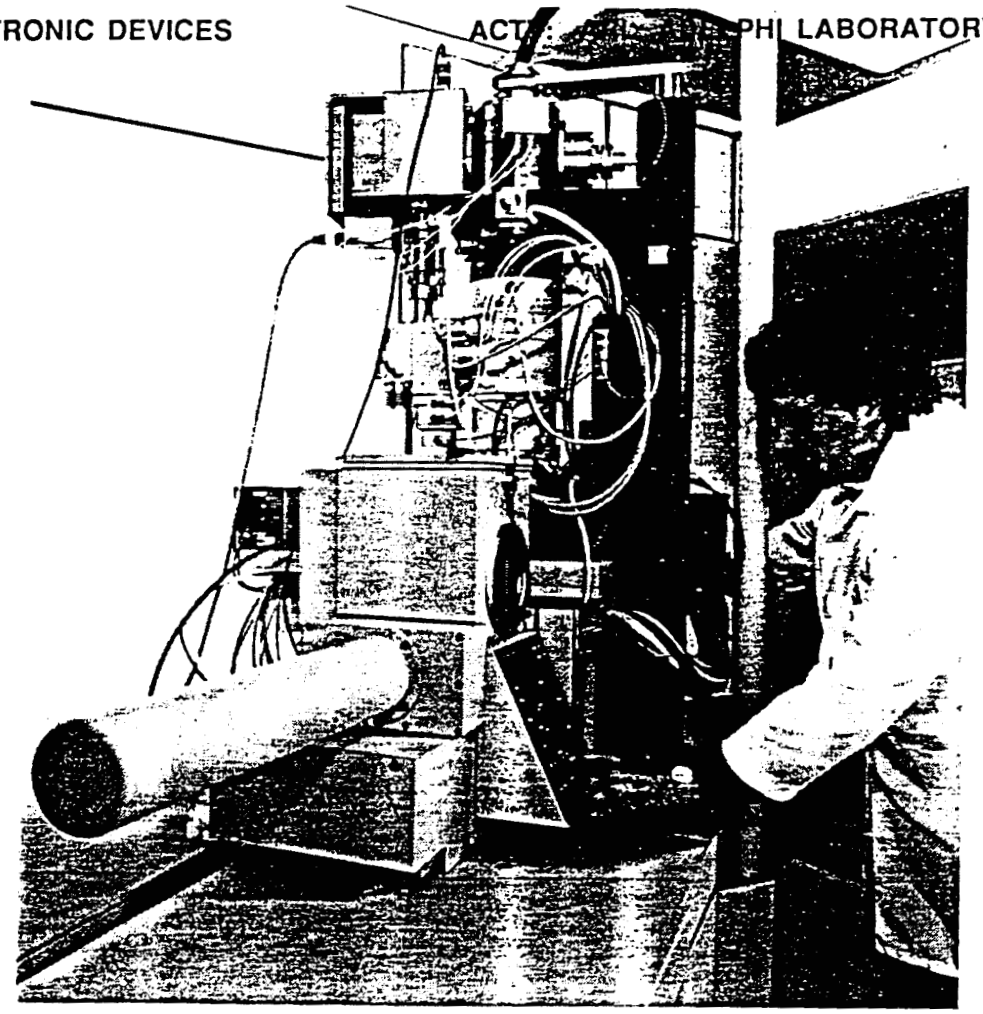
This world-unique system will be used to: (1) study chemical kinetic reactions and thermal properties of electronic materials, such as in the studies of quartz resonators, OMCVD-type reactions on GaAs surfaces, Buckminster-Fullerenes, etc., and (2) conduct thermal or laser experiments on surfaces to temperatures of over 2000°C while still maintaining UHV conditions.



ULTRA HIGH VACUUM ELECTRON BEAM DEPOSITION SYSTEM

This system is an alpha- prototype which contains unique features including:

- variable substrate temperature control during deposition) (25°C - 1000°C)
- acceptance of any slug shape and size up to 2 inch cross section
- deposition of **all** elements
- fast temperature gradient (from 50°C to 500°C in 3 minutes)
- simultaneous, multiple-element (10) deposition at variable rates (0.5 {ALE} - 100 A/sec)
- variable position (fixed: rotating) substrate susceptor.



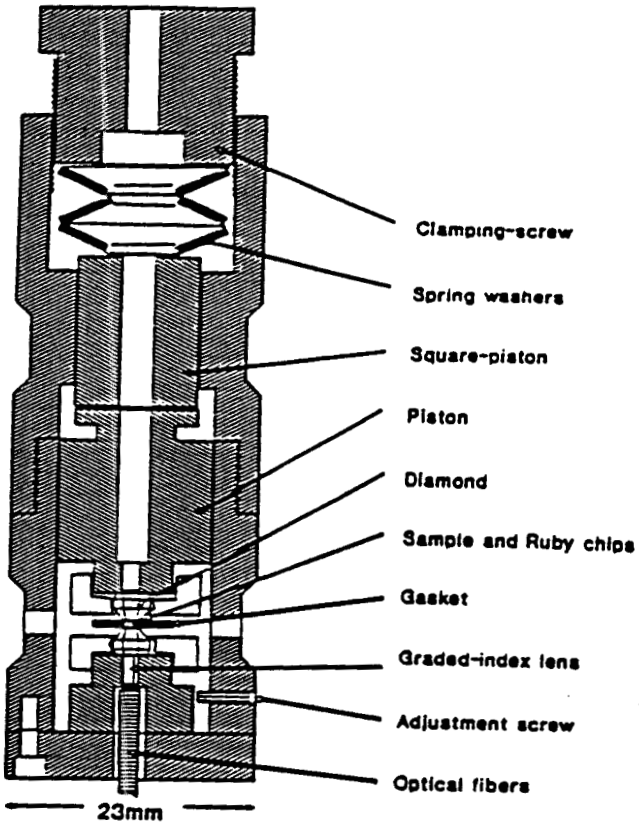
100KV ELECTRON-BEAM NANOLITHOGRAPHY SYSTEM

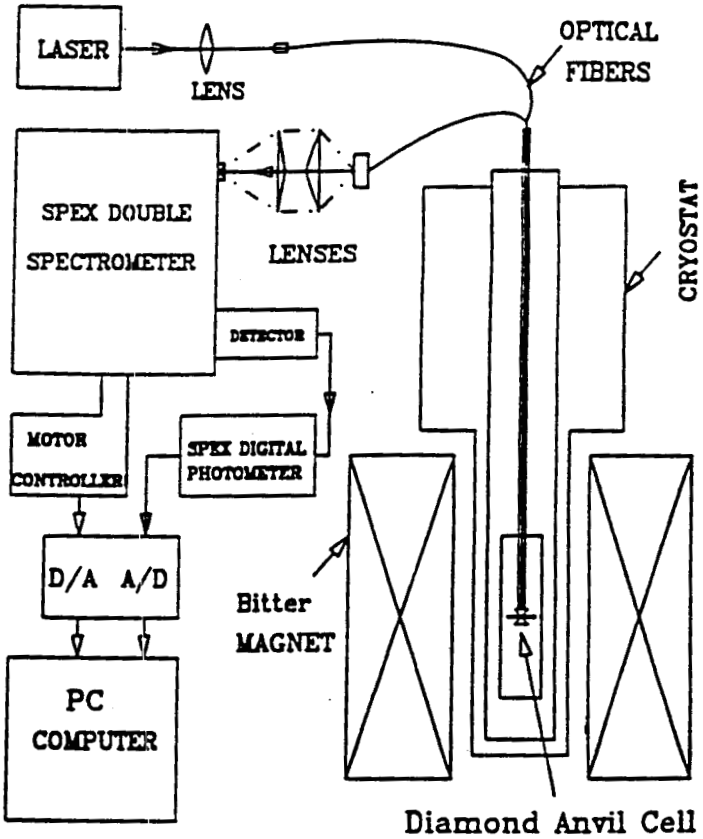
The **Leica EBPG5-HR electron-beam nanolithography system** is the only commercial system capable of operation at 100kV. The system has demonstrated 20 nm feature definition on bulk GaAs while maintaining a 5% feature size variation.

The high voltage (100kV) capability provides the unique capabilities to:

- Pattern closely-spaced features with sub -0.1 nm feature sizes, especially useful for very fine gratings.
- Pattern nanometer-scale features with large process latitude.
- Pattern thick (>10 nm) resists for MEMS, and magnetics applications.

The EBPG-5 system is also capable of patterning small gratings of arbitrary pitch with high resolution.





HIGH PRESSURE AND UNIAXIAL STRESS MAGNETIC FIELD SPECTROSCOPY

This unique technical capability combines optical measurement (photoluminescent (PL), PL-excitation, photoreflectance, etc.) with simultaneous applications of high magnetic field (up to 9 Tesla), high pressure (up to 70 Kbar) and cryogenics using a **diamond anvil cell** coupled with an optical fiber system.

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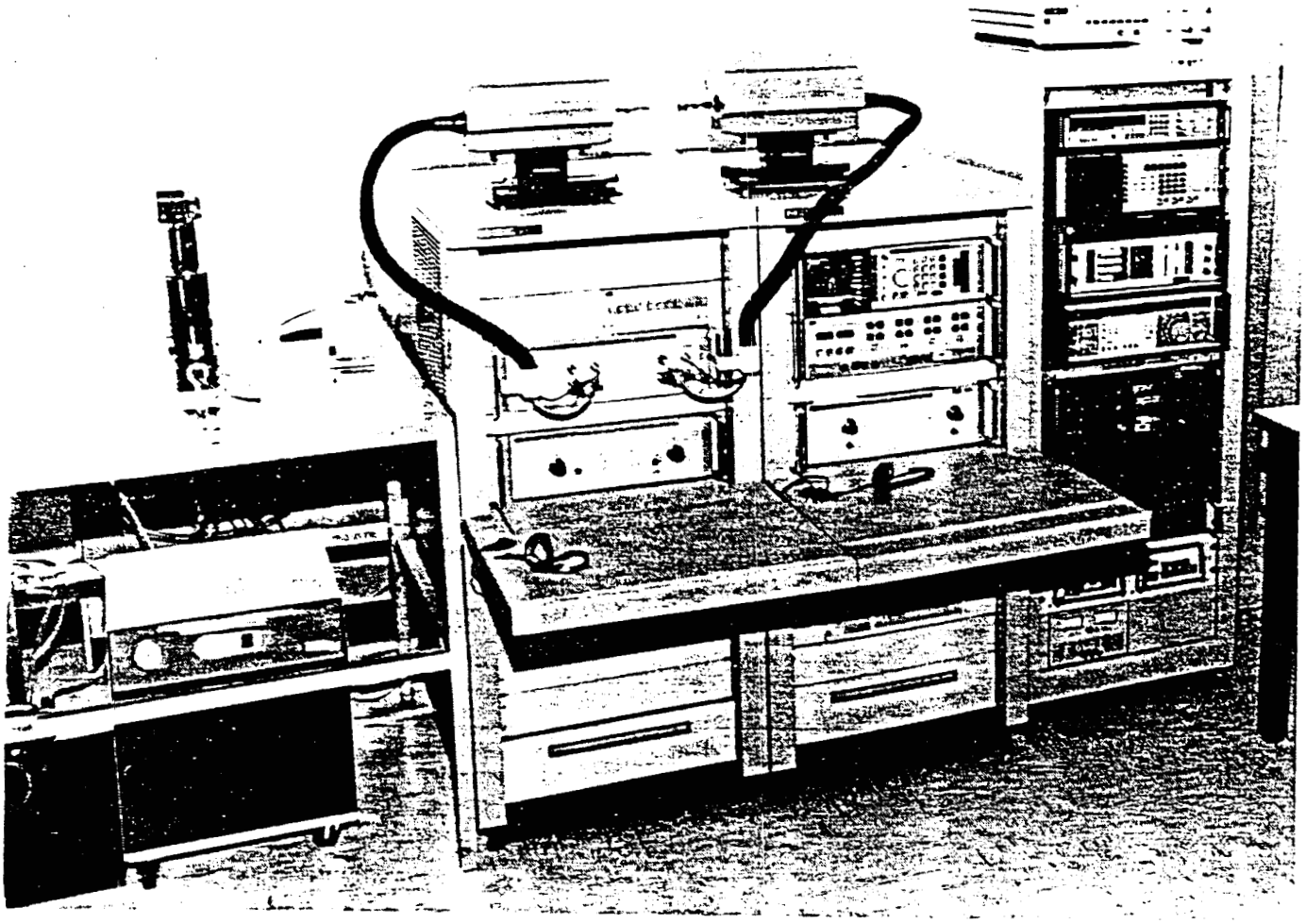
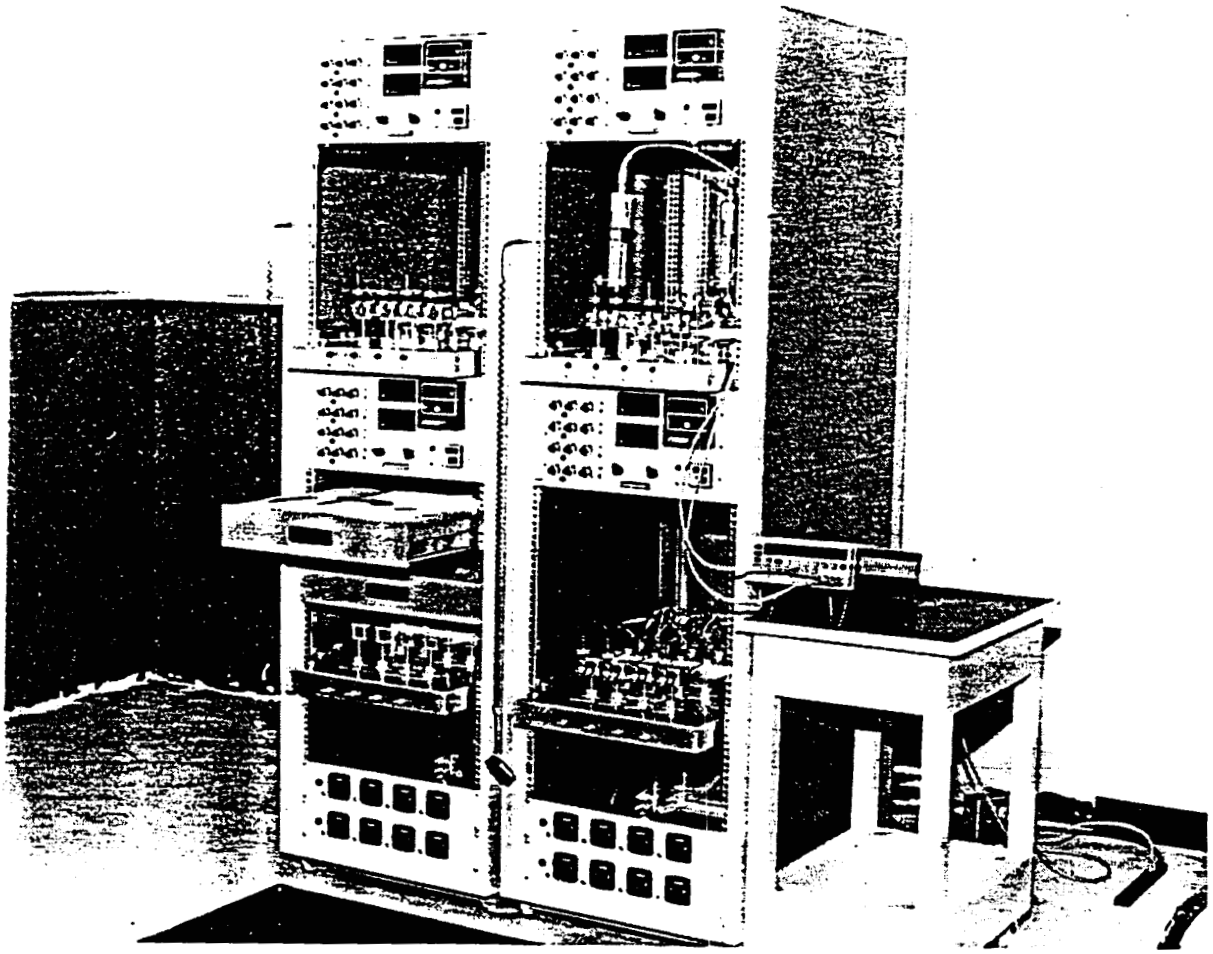


MMW QUASI-OPTICAL TEST FACILITIES

Full vector network analysis on one or two port devices can be performed up to 110 GHz. Multiple test sets allow for coaxial measurements (up to 50 GHz) and waveguide measurements using the millimeter-wave test set (covering 75-110 GHz). Additional facilities provide for special measurements of quasi-optical components such as grid arrays and special power combiners. This capability is being upgraded to cover the 180-220 GHz band.

Characterization of solid state MMW and quasi-optic devices above 60 GHz is predominantly done by the Army within DoD.

This facilities support the development of transceiver devices for use in missile defense and covert communications unique to Army mission need.



RF LIFE TEST CAPABILITY

This unique capability provides rf life testing from 5 GHz to 94 GHz. This facility is being used for the reliability assessment of millimeter/microwave monolithic integrated circuits (MIMIC). Three completed automated test stations cover frequency bands of C-Ku, Ka and W. EPSD is cooperating with the other services in evaluating devices and technologies for insertion in equipments being developed by each of the services.

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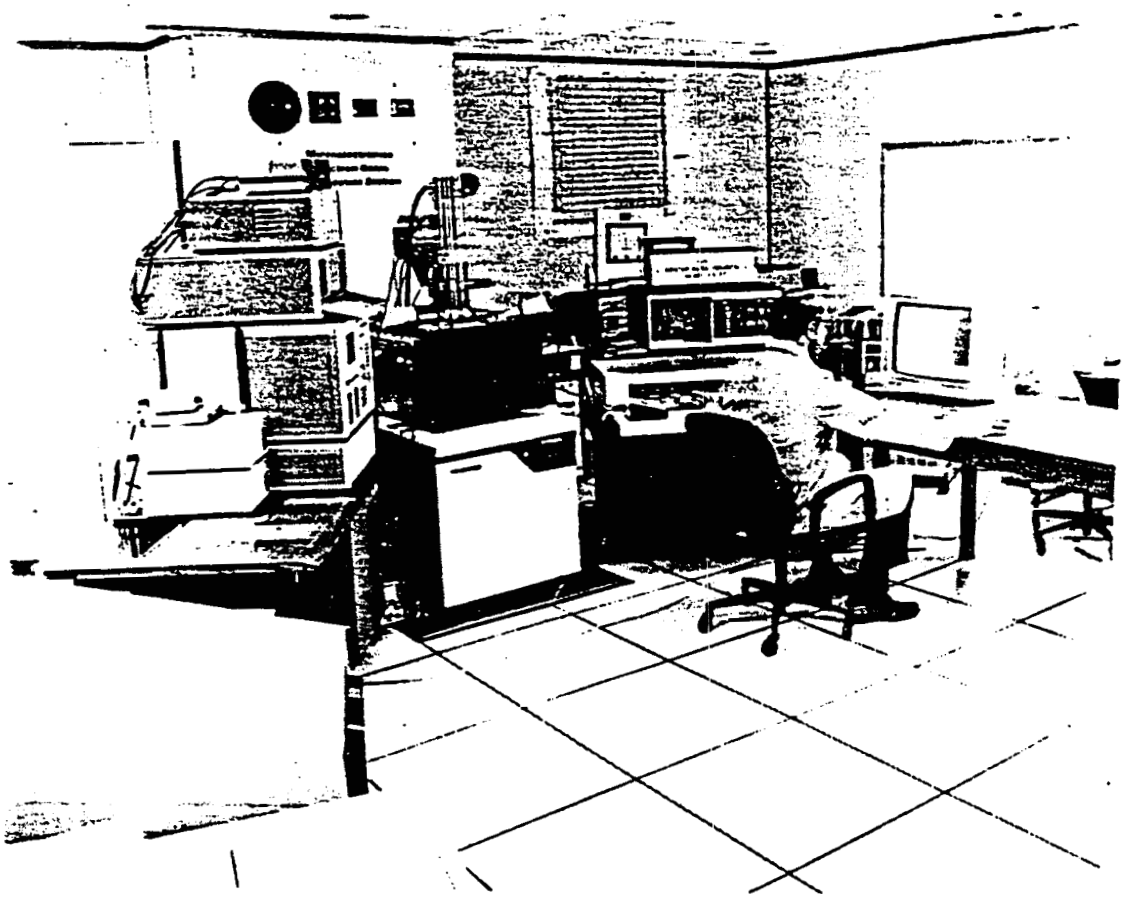

COMPUTER-AIDED DIAGNOSTIC ELECTRON BEAM TESTING (CADET)

The **CADET system** is a software development in ADA that integrates commercially available e-beam or other probing hardware, automated VLSI test equipment, CAD design databases (layout, test vectors, SPICE/functional simulations for internal nodes and navigational information), external simulations from internal or outside sources and analysis/comparision of measurement data. Measured results are directly comparable to results available from simulation in the **CADET system** for traditional failure analysis and more recently design verification/performance analysis. Process monitoring would be another application in a manufacturing environment.

The unique aspect of the **CADET system** is the integration accomplished through specialized ADA source code, allowing maintainable and portable software which transcends hardware and application barriers. In addition, the software can be easily adapted for new an emerging applications and equipments, including the emerging MCM technologies. The flexibility of this system allows **CADET** to be essentially independent of device technology and test instrumentation. Data can be output in ASCII format for analysis by other groups. Specially, device design groups can determine the accuracy of their simulation compared to measurements on actual fabricated devices using the **CADET system**.

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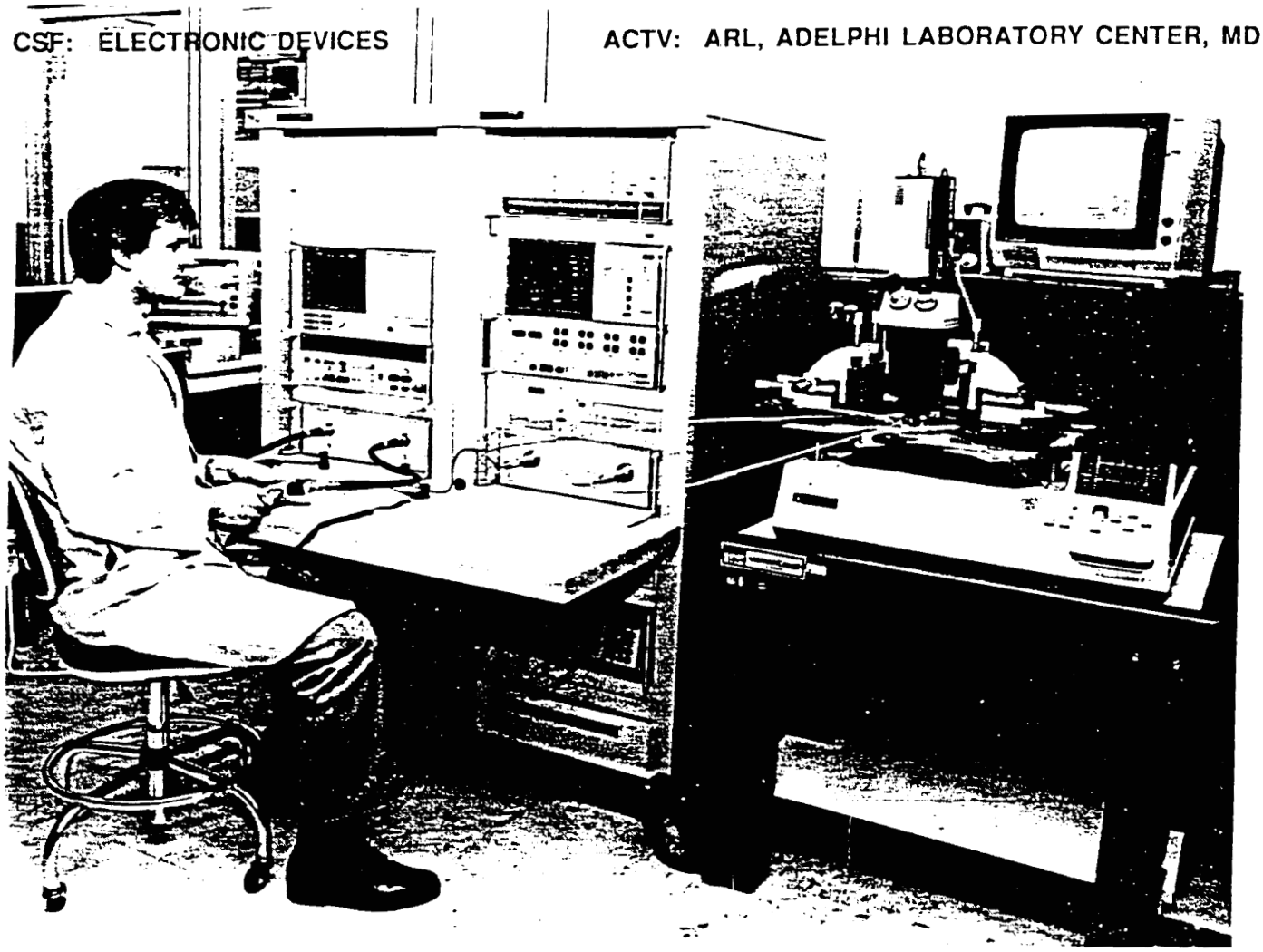

AUTOMATED MULTI-FUNCTION MICROWAVE/ MILLIMETER WAVE NETWORK ANALYSIS

An integrated **multi-function microwave test station** has been developed to perform DC, S-parameter (CS and Pulsed), Power, Noise Figure, and Spectral measurements. It provides a unique capability in verifying total device performance for dc to 50 GHz. Current methods require separate isolated tests to be performed for each test function. The above system has the capability to perform all measurements with only a single connection to the device under test (DUT) and requires only one initial calibration routine. The system hardware has been optimized for high throughput on-wafer microwave testing. However, using object oriented visual graphics programming, the test system can be software reconfigured to support on-wafer through module level test.

Measurements Supported

DC Parametric
Vector Network Analysis - CW (Amplitude and Phase, 45 MHz-50 GHz)
Vector Network Analysis - Pulsed (Amplitude and Phase, 2-20 GHz)
RF Power (DC-50 GHz)
Noise Figure (45 MHz-26.5 GHz)
Spectral Analysis (DC-26.6 GHz)

ACTIVITY: ARL, ALC, MD CSF: ENVIRONMENTAL SCIENCE

ction III: Capability of Activities to Perform Common Support Functions

3.0 Mission:

This submission assumes implementation of BRAC 91 whereby elements of the Battlefield Environment Directorate of the Army Research Laboratory will be located at the Adelphi Laboratory Center (ALC).

The mission of the ARL Battlefield Environment Directorate (BED) at White Sands Missile Range (WSMR) and the Adelphi Laboratory Center (ALC) is to: Own the weather by advancing our understanding of the atmosphere and its critical relationship to performance of Army systems and operations. Develop, acquire and integrate new technologies that enable Land Force Dominance.

o Advance the understanding of Land Warfare Atmospheric Effects, including the propagation of acoustic and electro-magnetic energy through the lower atmosphere and the impact of natural and man-made atmospheres on target and background signatures.

o Develop Land Warfare Atmospheric Measurements capabilities, including remote, passive/low signature, and in-situ atmospheric data.

o Incorporate realistic Land Warfare Atmospheric Simulation/Visualation effects into wargaming and training, to assess and analyze the impact of the atmosphere on combat materiel, tactics, and doctrine.

o Develop and exploit atmospheric data collection, digitization, processing and distribution systems, ·ding to horzontal integration of weather information to be used in Land Warfare Weather Decision Aids and Target Area Meteorology.

o Determine atmospheric susceptiblity due to boundary layer processes affecting transport and diffusion of nuclear/biological/chemical agents and pollutants.

Interconnectivity with other CSFs:

Weapons -- Provide weapon systems developers with the means to predict, simulate and visualize atmospheric effects restricting the ability of electro-optical systems to detect, identify, and lock onto targets under realistic battlefield conditions.

Chemical/Biological Warfare -- Develop, adapt and interface models and simulations that realistically portray the influence of the atmosphere and terrain on weapons performance and hazards from biological/chemical attacks.

Training -- Simulation and visualization research to create realism in training simulators and exercises via weather technology insertion in wargame models and training devices.

3.1 Location.

3.1.1 Geographic/Climatological Features: None.

3.1.2 Licenses and Permits: The following licenses/permits are currently held at the ALC:

Nuclear Regulatory Commission (NRC) or DA licenses forradiological materials:

NRC 19-17250-05: Licenses for possession and operation of a 46,000 curie C0-60 Irradiator facility. A very large and dangerous quantity of sealed Co-60 sources are stored at the bottom of an 11 foot deep pool of water. The sources are located on an elevator to raise the sources out of the water where they can be used to irradiate items of interest. When the sources are at pool bottom, the water provides the shielding necessary to protect personnel. When the sources are raised out of the pool, 3-5 feet thick concrete walls and a 3 foot thick roof protects personnel.

NRC 19-17250-01: Licenses the possession and use of 2 "curie" quantity sealed calibration sources.
SNM 348: Licenses the storage of 60 fission foils,being stored awaiting return to DOE for disposal.
NRC 19-17250-04: Licenses the possession and testing ofneutron irradiated hardware and electronics.

National Pollution Discharge Elimination System (NPDES) Permit: The ALC currently operates under a NPDES permit from the State of Maryland for water entering Paint Branch Creek from storm water drains outside the Aurora Building (Building 500). The permit requires monitoring for oils and greases and the pH of the water entering the creek at this point.

Storm Water General Permit: The ALC currently operates under the State of Maryland general permit for stormwater runoff on the installation. Although there are no specific monitoring requirements required by this permit, a stormwater management plan must be maintained and certain "best management practices" must be implemented.

Oil Operations Permit: The ALC currently has an oil operations permit from the State of Maryland allowing us operate using the mineral oil in the Aurora Facility (Building 500). This permit requires daily monitoring the oil/water separator associated with the operations at the facility. Washington Suburban Sanitary Commission Permit (WSSC):

The ALC currently operates under a permit from the WSSC which regulates discharge limitations into the sanitary sewer. The permit sets limits on a variety of pollutant parameters and requires self-monitoring for a selection of those parameters. Resource, Conservation and Recovery Act (RCRA) Hazardous Waste Storage Permit: The ALC is currently under a consent agreement with the State of Maryland to operate a hazardous waste storage facility. The ALC is expected to receive an official RCRA permit for this facility in 1994. Under this current consent agreement and the future permit, ALC can store hazardous waste in Building 104 whilea waiting transport off-site for disposal.

3.1.3 Environmental Constraints: There are no known environmental constraints to the current or enhanced mission scope, other than those described above dealing with permits and licenses.

3.1.4 Special Support Infrastructure: BED at ALC will have at its disposal current and future facilities such as the BED High Bay Facility and the Physical Sciences Laboratory being constructed under BRAC, and other in-place laboratory facilities and site utilities.

.5 Proximity to Mission-Related Organizations

Common Support Functions	Name	Type of Organization	Distance	Workyears Performed	Workyears Funded
Envi Science	Johns Hopkins	Unvi	20 miles	0	0
	Unvi of MD	Unvi	5 miles	0	0
	Penn State Unvi	Unvi	200 miles	0	0
	Univ of Mass	Unvi	250 miles	0	0

3.2 Personnel.

3.2.1 Total Personnel:

Types of Personnel	Number of Personnel			
	Government		On-Site FFRDC	On-Site SETA
	Civ	Mil		
Technical	48	2	0	0
Management (Supv)	3	0	0	0
Other	5	0	0	0
tal	56	2		

.2 Education

Types of Degree/Diploma	Number of Personnel by Type of Position		
	Technical	Management (Spv)	Other
High School or Less	0	0	1
Associates	0	0	2
Bachelor	11	0	1
Masters	23	1	1
Doctorate	14	2	0

3.2.3 Experience

Type of Position	Years of Government and/or Military Service				
	Less than 3 years	3-10 years	11-15 years	16-20 years	More than 20 years
Technical	2	12	7	16	11
Management (Supv)	0	0	0	2	1
Other	0	1	2	2	0
Total	2	13	9	20	12

2.4 Accomplishments During FY91-93

.4.1 Patents Awarded/Patent Disclosures: None

.4.2 Papers in Peer Reviewed Journals

Common Support Function	Number Published	Paper Titles
Environmental Science	4	Listed below

"Geometrical Representation of Gaussian Beams Propagating Through Complex Paraxial Systems", L.C. Andrews, W,B, Miller, and J.C. Ricklin, Applied Optics, Vol 32, No. 30, Oct 20, 1993.

"Remote Biodetection Method Using Circular Dichroism", David L. Rosen, Applied Spectroscopy, Vol 47, No. 11, pp 1887-1891, 1993.

"Lasing Emission From an Evaporating Layered Microdroplet", M. Essien, R.L. Armstrong, and J.B. Gillespie, Optics Letters, Vol 18, No. 10, pp 762-764, May 93.

"Log-Amplitude Variance and Wave Structure Function: A New Perspective for Gaussian Beams", W. B. Miller, L.C. Andrews, and J. C. Ricklin, Optical Society of America A, Vol 10, No. 4, Apr 93.

3.3 Workload.
3.3.1 FY93 Workload.
3.3.1.1 Work Year and Lifecycle:

"Lab"	Fiscal Year 1993 Actual			
	Civilian	Military	FFRDC	SETA
ience & Technology	56	2		
Engineering Development				
In-Service Engineering				

3.3.1.2 Engineering Development by ACAT: None.

3.3.1.3 In-Service Engineering: None.

3.3.2 Projected Funding.

3.3.2.1 Direct Funding:

Common Support Function	FY94	FY95	FY96	FY97
Environmental Science	0	0	6.9	6.9

3.3.2.2 Other Obligation Authority:

nmon Support Function	FY94	FY95	FY96	FY97
ıvironmental Science	0	0	1.4	1.6

ACTIVITY: ARL, ~~WSMR~~, NM ALC CSF: ENVIRONMENTAL SCIENCES

3.4 Facilities and Equipment

Common Support Function	Major Facility or Equipment Description	Unique To: DOD	Federal Govt	U.S.	Replacement Cost ($K)
Environmental Science	Real-Time Optical Simulator			X	$1.5
	Mobile-Imaging Spectroscopy Lab	X			$1.2
	Aeroso/Laser Energy Interaction Laboratory	X			$0.3
	Countermeasure Aerol Characterization Laboratory		X		$0.5
	Visualization Laboratory	X			$1.5

3.5 Expansion Potential.
3.5.1 Laboratory Facilities:

Common Support Function	Facility or Equipment Description	Type of Space	Space Capacity (KSF) Current	Used	Excess
Environmental Science		Administrative	6,368	6,368	0
		Technical	12,600	12,600	0
		Storage	250	250	0
		Utility	312	312	0

3.5.1.1 Capacity of activity to absorb similar workyears categorized in the same common support function: ALC facilities can be expanded vertically by building ontop of buildings 202 and 204. This will allow additional workyears in Common Support Functions to be accommodated at ALC while preserving the current and future research missions of this site. Major construction will require Military Construction, Army funds in order to expand the site.

3.5.1.2 Capacity to absorb additional workyears, how many can be supported: None. Cannot be determined at this time. Should there be a requirement to take on additional workyears, laboratory space reallocations can be considered on a priority basis.

3.5.1.3 Impact of military construction program or other alteration projects programmed in FY95 PBS: The Adelphi Laboratory Center is currently programmed at $102M for BRAC 91 construction with work to begin in FY95 -- a High Bay Facility for the BED is included in this project. A $6.6M MCA R&D Computer Center project is conjuctively funded with the BRAC program. A $1.5M unspecified Minor MCA project is planned for FY94/95 to bulid a Scale Model Facility. These projects are intended to meet the FY97 end-state requirements of the Army Research Laboratory at Adephi under BRAC 91 and subsequent decisions.

5.2 Land use: Buildable acres for additional laboratory/administrative support construction: In addition to areas currently allocated for planned construction there are 18.39 acres of buildable acres at the Adelphi Laboratory Center (Blossom Point Research Facility, subinstallation to ALC, has 205 buildable acres). In

dition to new sites there is the ability to add additional floors (3 acres) onto existing structures. Also, the Adelphi Laboratory Center is adjacent to the Naval Surface Warfare Center - White Oak, and the potential exists for expansion.

3.5.3 Utilities: The Adelphi Laboratory Center currently has excess capacity in all services. The installation will continue to have excess capacity upon completion of new construction and in-migration of functions/organizations under BRAC 91.3.5.1.1 Capacity of activity to absorb similar workyears categorized in the same common support function.

tion III: Capability of Activities to Perform Common Support Functions

3.0 Mission:

o Research into the nuclear electromagnetic pulse (EMP) environment and its effect through coupling on Army equipment.

o Experimental and computational simulation of EMP effects on Army equipment.
o Development of cost-effective EMP hardening technologies.

o Research into the effects of initial nuclear radiation on electronic components.

o Experimental simulation of initial nuclear radiation environments (gamma and gamma dot) to support research on the effects of initial nuclear radiation on military systems.
o Development of cost-effective test methodologies for determining nuclear survivability of advanced electronic systems.
o Transition of nuclear hardening technology to industry.
o Computational determination of radiation protection factors for armored vehicles.

The Army nuclear effects survivability technology base is unique in the military services and supports technology requirements in all three services. In addition, the Army and Navy laboratories have coordinated to provide customer services in this mission area to the Defense Nuclear Agency, ARPA and others. The three military services have coordinated this mission area through the Reliance process and have implemented ›stantial reductions in personnel, facilities and expenditures in the service laboratories as a result of this ›rdination and declining requirements for technology development to support future systems. The Air Force has terminated all efforts in this mission area. Between FY90 and FY93, the total service laboratory funding for all types of nuclear weapons effects activities conducted at ALC declined from $134.9M to $25.5M, while the number of personnel declined from 339 to 122. Approximately 35 Army employees at ALC are supported by Army mission funds, while the remaining 29 Army employees and 58 Navy employees are supported by customer funds.

Primary interconnectivity of the Army nuclear weapons effects (NWE) is with the Defense Nuclear Agency (DNA) as lead agency in the Reliance process. A significant portion of the funding for the Army program is provided by DNA. The NWE program conducted in Weapons Technology Directorate (WTD) at ARL also has vital links with programs in the Materials Directorate (MD), Electronics and Power Sources Directorate (EPSD), Survivability/Lethality Analysis Directorate (SLAD) and Sensors, Signatures, Signal and Information Processing Directorate (S3ID). Facilities within the Nuclear and Directed Energy Division also support other activities within WTD.

Links with MD are in the area of composite materials which are being studied for their electromagnetic shielding characteristics.

Synergism with EPSD is achieved through investigation of emerging electronics technologies for their susceptibility to ionizing radiation.

SLAD is a primary user of many technology tools developed in WTD.

›rk with S3ID is progressing in investigating the nuclear survivability of equipment being researched for ›attlefield digitization applications.

:connectivity with other common support functions consists of providing nuclear survivability technology incorporation into these products.

Air Vehicles/rotary/structures: Electromagnetic shielding of composite structures.

Weapons: Radiation survivability testing of microelectronics for Space and Strategic Missile Command/ Ballistic Missile Defense Office.

Space Systems/Satellites: Radiation survivability testing of microelectronics for Space and Strategic Missile Command/ Ballistic Missile Defense Office

C4I Systems/Fixed Ground Based C4I and Ground Mobile C4I: High altitude electromagnetic pulse (HEMP) hardening including electromagnetic shielding of composite structures and hardness assurance/hardness maintenance.

Ground Vehicles/tracked: Vehicle radiation shielding calculations, electromagnetic shielding of composite structures and international data exchanges.

Chemical/Biological Defense: EMP and radiation survivability of chemical and biological agent alarm systems.

3.1 Location.

.1 Geographic/Climatological Features: None.

.2 Licenses & Permits. The following licenses/permits are currently held at the ALC:

Nuclear Regulatory Commission (NRC) or DA licenses forradiological materials:

NRC 19-17250-05: Licenses for possession and operation of a 46,000 curie C0-60 Irradiator facility. A very large and dangerous quantity of sealed Co-60 sources are stored at the bottom of an 11 foot deep pool of water. The sources are located on an elevator to raise the sources out of the water where they can be used to irradiate items of interest. When the sources are at pool bottom, the water provides the shielding necessary to protect personnel. When the sources are raised out of the pool, 3-5 feet thick concrete walls and a 3 foot thick roof protects personnel.

NRC 19-17250-01: Licenses the possession and use of 2 "curie" quantity sealed calibration sources.
SNM 348: Licenses the storage of 60 fission foils,being stored awaiting return to DOE for disposal.
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Operations Permit: The ALC currently has an oil operations permit from the State of Maryland allowing us operate using the mineral oil in the Aurora Facility (Building 500). This permit requires daily monitoring of the oil/water separator associated with the operations at the facility. Washington Suburban Sanitary Commission Permit (WSSC):

The ALC currently operates under a permit from the WSSC which regulates discharge limitations into the sanitary sewer. The permit sets limits on a variety of pollutant parameters and requires self-monitoring for a selection of those parameters. Resource, Conservation and Recovery Act (RCRA) Hazardous

Waste Storage Permit: The ALC is currently under a consent agreement with the State of Maryland to operate a hazardous waste storage facility. The ALC is expected to receive an official RCRA permit for this facility in 1994. Under this current consent agreement and the future permit, ALC can store hazardous waste in Building 104 whilea waiting transport off-site for disposal.

3.1.3 Environmental Constraints: There are no known environmental constraints to the current or enhanced mission scope, other than those described above dealing with permits and licenses. Any new "radioactive materials" missions would most likely require new NRC licenses and any other new operations would have to operate so that the parameters required by the various

3.1.4 Special Support Infrastructure: NWE Semiconductor Research Facility, Optics Characterization Laboratory, Ferroelectric Materials Characterization Lab, ARACOR Research Facility, VLSI Testers, CO-60, High Intensity Flash X-Ray Facility Radiation Shielding Calculational Facility, EM Computation and Analysis Facility, Scale Model EMP Facility, Electromagnetic Instrumentation and Characterization boratory, EMP Component Response Test Stations, and Shielding Composites Characterization Facility. The urora Facility located at ALC is owned by the Defense Nuclear Agency (DNA) and operated by ARL Weapons Technology Directorate employees and contractors both funded by DNA (Aurora will be included in the DNA BRAC 95 submission).

3.1.5 Proximity to Mission-Related Organizations:

Common Support Functions	Name	Type of Organization	Distance	Workyears Performed	Workyears Funded
NWE	Defense Nuclear Agency	OGA	30 mi.	13	0
NWE	USANCA	OGA	30 mi.	0	0
NWE	Naval Surface Warfare Center	OGA	0 mi.	2	0
NWE	CSTA	OGA	70 mi.	0	1
NWE	University of Maryland, College Park	University	5 mi.	0	0

The proximity of the Defense Nuclear Agency and USANCA (U.S. Army Nuclear and Chemical Agency) have been essential for the proper coordination of an integrated nuclear weapons effects program which avoids duplication of effort both within the Army and within the DoD. A significant portion of ARL's nuclear weapons effects funding has come through the Defense Nuclear Agency. If these agencies were not nearby, significant increases in travel would be incurred to continue these coordinating functions. Furthermore, separation from USANCA which determines nuclear survivability criteria is likely to reduce our responsiveness to the needs of the field Army.

We have a consortium with NSWC to provide complete radiation simulation services to testers in the

,shington D.C. area. This has significantly decreased the operational cost of the suite of DNA simulators cated at Adelphi. This grouping of X-ray, gamma-ray and neutron simulators results in a unique capability in the Eastern United States.

Interactions with universities in the area have been critical in allowing us to attract and maintain an excellent technical staff. Separation from these universities which have strong programs in materials, physics, electrical engineering and mechanical engineering would be a significant detriment to our ability to attract quality personnel and to maintain the technical excellence of our staff.

3.2 Personnel.
3.2.1 Total Personnel:

Types of Personnel	Number of Personnel			
	Government		On-Site FFRDC	On-Site SETA
	Civ	Mil		
Technical	48	0	0	0
Management (Supv)	10	0	0	0
Other	6	0	0	0

3.2.2 Education:

Types of Degree/Diploma	Number of Personnel by Type of Position		
	Technical	Management (Spv)	Other
High School or Less	3	0	5
Associates	2	1	1
Bachelor	23	3	0
Masters	15	4	0
Doctorate	5	2	0

3.2.3 Experience:

Service Type of Position	Years of Government and/or Military				
	Less than 3 years	3-10 years	11-15 years	16-20 years	More than 20 years
Technical	1	12	14	4	17
Management (Supv)	0	0	0	0	10
Total	1	12	14	4	27

.4 Accomplishments During FY91-93.
2.4.1 Patents Awarded/Patent Disclosures

Common Support Function	Disclosures	Awarded	Patent Titles
Nuclear Weapons Effects	4		-- Bonding of Silicon Carbide Directly to a Semiconductor Substrate by Using Silicon To Silicon Bonding -- Bonding of Silicon Carbide with an Insulator on the Bottom to a Semiconductor Substrate with an Insulator on the Top -- Inductance/Resistance (L/R) Cable Shield Test Set -- An Apparatus for Determining Flaws of a Seam
		5	-- Apparatus and Method for Testing the Response of Cardiac Pacemakers to Electro-magnetic Interference -- Liquid-Pressurized Radio Frequency Interference Gasket -- Pressure-Stabilized Radio Frequency Gasket -- Inductive Cable Resistance Tester -- Silicon Shadow Mask Patent Applications in FY93 -- Double-Sided Wafer Alignment Technique -- Method and System for High Speed Photolithography
Total	4	5	

3.2.4.2 Papers in Peer Reviewed Journals:

Common Support Function	Number Published	Paper Titles
Nuclear Weapons Effects	35	List Below

1. "Effects of Simulated X-ray Lithography Exposures on Submicron-Channel MOSFETs", Proceedings of the Materials Research Society Symposium, Spring 1993.
2. "Response of Interface Traps During High Temperature Anneals", IEEE Transactions on Nuclear Science, NS-38, 1590, December 1991.
3. "Radiation Evaluation of Commercial Ferroelectric Nonvolatile Memories", IEEE Transactions on Nuclear Science, NS-38, 1410, December 1991.
4. "Displacement Damage Effects in SiC JFETs as a Function of Temperature", Proceedings of the 10th Space Nuclear Power and Propulsion Symposium, American Institute of Physics Conference Proceedings 930103, p. 609, January 1993.
5. "Silicon Carbide JFET Radiation Response", IEEE Transactions on Nuclear Science, NS-39, 1974, December 1992.
6. "Fast Decay Component of the Remanent Polarization in Thin-Film PZT Capacitors", Integrated Ferroelectrics, Vol. 1, p. 195, 1992.
7. "Neutron Irradiation Effects on PZT Thin-Films for Nonvolatile Memory Applications", IEEE Transactions on Nuclear Science, NS-38, 1078, December 1991.
"Microstructural Changes During Processing of Laser-Deposited Barium Titanate and PZT Thin Films", Materials Research Society Proceedings, 202, p. 241, 1991.

"Characterization of Lead Zirconate-Titanate Films by Pulsed Laser Deposition", Materials Research Society Proceedings, 230, 1991.
10. "Processing Microscope using Phase-Conjugate Illumination Generated by Self-Pumping in Barium Titanate", Ferroelectrics, Vol. 107, p.9, 1990.
11. "Radiation Effects in BESOI Structures with Different Insulating Layers", 1993 IEEE International SOI Conference Proceedings, October 1993.
12. "Time-Dependent Radiation-Inducted Charge Effects in Wafer-Bonded SOI Buried Oxides", IEEE Transactions on Nuclear Science, NS-39, 2103, December 1992.
13. "Photoconduction Measurements of the Charge Trapping and Transport Characteristics of Bond-and-Etch-Back Buried Oxides", IEEE Transactions on Nuclear Science, NS-39, 2139, December 1992.
14. "Trapping Characteristics of Radiation-Generated Charge in Silicon-on-Insulator Buried Oxides", Proceedings of the 1992 Army Science Conference, June 1992.
15. "Charge Buildup at High Dose and Low Fields in SIMOX Buried Oxides", IEEE Transactions on Nuclear Science, NS-38, 1234, December 1991.
16. "Hole Transport in SiO_2 and Reoxidized Nitrided SiO_2 Gate Insulators at Low Temperature", IEEE Transactions on Nuclear Science, NS-38, 1083, December 1991.
17. "Thermal Annealing of Trapped Holes in SIMOX Buried Oxides", IEEE Transactions on Nuclear Science, NS-38, 1240, December 1991.
18. "The Fast Decay Component of the Remanent Polarization in Thin-Film PZT Capacitors", Integrated Ferroelectrics, Vol. 3, Num. 2, 1993.
19. "Standardized Ferroelectric Capacitor Testing Methodology for Nonvolatile Semiconductor Memory Applications", Integrated Ferroelectrics, Vol. 3, 97, 1993.
20. "The Effect of Ionizing Radiation on Sol-Gel Ferroelectric PZT Capacitors", IEEE Transactions on Nuclear Science, NS-37, p. 1713, December 1990.
21. "Bremsstrahlung Risetime Shortening by Diode Geometry Reconfiguration", IEEE Transactions on Nuclear Science, NS-39, Num. 6, December 1992.
22. "In Situ Microwave Ionized Air Chemistry Measurements", IEEE Transactions on Nuclear Science, NS-39, Num. 6, December 1992.
23. "Aurora Tactical Source Region Upgrade - Four Drift Tubes", Journal of Radiation Effects - Research and Engineering, Vol. 11, Num. 1, P. 78, January 1993. (This is a controlled distribution technical journal for critical technologies and classified information)
24. "Electromagnetic Field and Cable Shield Response Measurements Inside an S-250 Shelter at Hermes III", Journal of Radiation Effects - Research and Engineering, Vol. 11, Num. 1, p. 122, January 1993.3.3
25. "Recent Developments and Performance of Wire-Mesh Gaskets with an Inflatable Core," Predictive Technology 1993, June 1993.
26. "A New Apparatus for Detecting Flaws of a Seam in a Shielded Enclosure," 1993 IEEE International Symposium on Electromagnetic Compatibility (93CH3310--), August 1993
27. "Preview of MIL-STD-188-125, VOL II (Transportable)," 1993 EMC/ESD International, April 1993.
28. "Decay of Remnant Polarization in Ferroelectric Films Using the Polarization-Dependent Photovoltaic Effect," Integrated Ferroelectronics 3, no. 3, p. 191, 1993.
29. "Ferroelectric and Dielectric Properties of Sol-gel and Excimer Laser-Deposited Lead Zirconate-Titanate and Barium Titanate Films," Integrated Ferroelectronics 3, no. 3, p. 191, 1993.
30. "Photovoltaics in Ferroelectric Films," Integrated Ferroelectronics, no. 2, p. 1, 1992.
31. "Photovoltaic Effect in Thin Ferroelectric Films," Materials Research Society Proceedings, 243, p. 27, 1992.
32. "Dielectric Constant and Hysteresis Loop Remnant polarization from 100 Hz to 2 Mhz for Thin Ferroelectric Films," Materials Research Society Proceedings, 243, p. 507, 1992.
33. "Post-Processing of PZT Thin Films," Materials Research Society Proceedings, 243, p. 519, 1992.
34. "Texturing and Dielectric Properties of Laser Deposited BaTi03 Thin Films Grown on Heated Substrate," Materials Research Society Proceedings, 243, p. 513, 1992.
35. "Microstructure and Ferroelectric Properties of Laser-Deposited Thin BaTi03 and Lead Zirconate-Titanate Films," Integrated Ferroelectric, 1, p. 230, 1992.

3.3 Workload.
3.3.1 FY93 Workload.
3.3.1.1 Work Year and Lifecycle:

"Lab"	Fiscal Year 1993 Actual			
	Civilian	Military	FFRDC	SETA
Science & Technology	64			
Engineering Development				
In-Service Engineering				

3.3.1.2 Engineering Development by ACAT: None.
3.3.1.3 In-Service Engineering: None.

3.3.2 Projected Funding.
3.3.2.1 Direct Funding ($K): RDTE

Common Support Function	FY94	FY95	FY96	FY97
Nuclear Weapons Effects	3,890	3,282	3,509	3,691

3.2.2 Other Obligation Authority:

Common Support Function	FY94	FY95	FY96	FY97
Nuclear Weapons Effects				
ARPA/OSD	450	200	200	200
Reimbursable	4,597	4,259	2,180	1,480
Direct Cite	2,100	2,000	2,000	2,000

3.4 Facilities and Equipment: Equipment/facilities listed are wholly owned by WTD and utilized for the NWE CSF at 100%.

Common Support Function	Major Facility or Equipment Description	Unique To: DOD	Federal Govt	U.S.	Replacement Cost($M)
Nuclear Weapons Effects					
	NWE Semiconductor Research Facility	X			$29.5
	Optics Characterization Laboratory				$1.2
	Ferroelectric Materials Characterization Lab	X	X	X	$0.5
	ARACOR Research Facility				$1.0
	VLSI Testers				$0.2
	CO-60				$0.6
	High Intensity Flash X-Ray Facility				$2.1
	Radiation Shielding Calculational Facility	X			$0.2
	EM Computation and Analysis Facility				$2.2
	Scale Model EMP Facility	X	X	X	$1.8

Electromagnetic Instrumentation and Characterization Laboratory	X	$2.0
EMP Component Response Test Stations		$0.5
Shielding Composites Characterization Facility	X	$0.5

The NWE Semiconductor Research Facility supports a synergistic function with EPSD.

The Scale Model EMP Facility is an important tool for use in determining the nuclear survivability of battlefield digitization concepts.

The EM Computation and Analysis Facility is being used to augment research on advanced weapons systems concepts such as Electric Gun and Electronic Armor. The Electromagnetic Instrumentation and Characterization Laboratory and Scale Model Facility are also used to support this research.

The Shielding Composites Characterization Facility has been specifically designed to test advanced composite materials in conjunction with Materials Directorate programs.

ARL also operates the Aurora Flash X-Ray Facility for the Defense Nuclear Agency.
WTD will make use of the SLAD out-of-lab EMP test facilities at APG.

3.5 Expansion Potential.
3.5.1 Laboratory Facilities:

mmon pport Function	Facility or Equipment Description	Type of Space	Space Capacity (KSF) Current	Used	Excess
Nuclear Weapons Effect					
	Bldg 202	Administrative	2.0	2.0	0
		Technical	5.0	5.0	0
	Bldg 204	Administrative	5.0	5.0	0
		Technical	4.0	4.0	0
	Bldg 403	Administrative	4.6	4.6	0
	(NWE Semiconductor Res Fac)	Utility	0.8	0.8	0
	Bldg 500	Administratiive	2.0	2.0	0
	(AURORA Facility run for DNA)	Technical	27.0	27.0	0
		Utility	3.0	3.0	0
	Bldg 504	Administrative	0.3	0.3	0
	(HIFX and Co-60)	Technical	6.2	6.2	0
		Utility	0.6	0.6	0
	Scale Model EMP Facility	Technical	15.0	15.0	0

.1.1 Capacity of activity to absorb similar workyears categorized in the same common support function:
.LC facilities can be expanded vertically by building ontop of buildings 202 and 204. This will allow additional

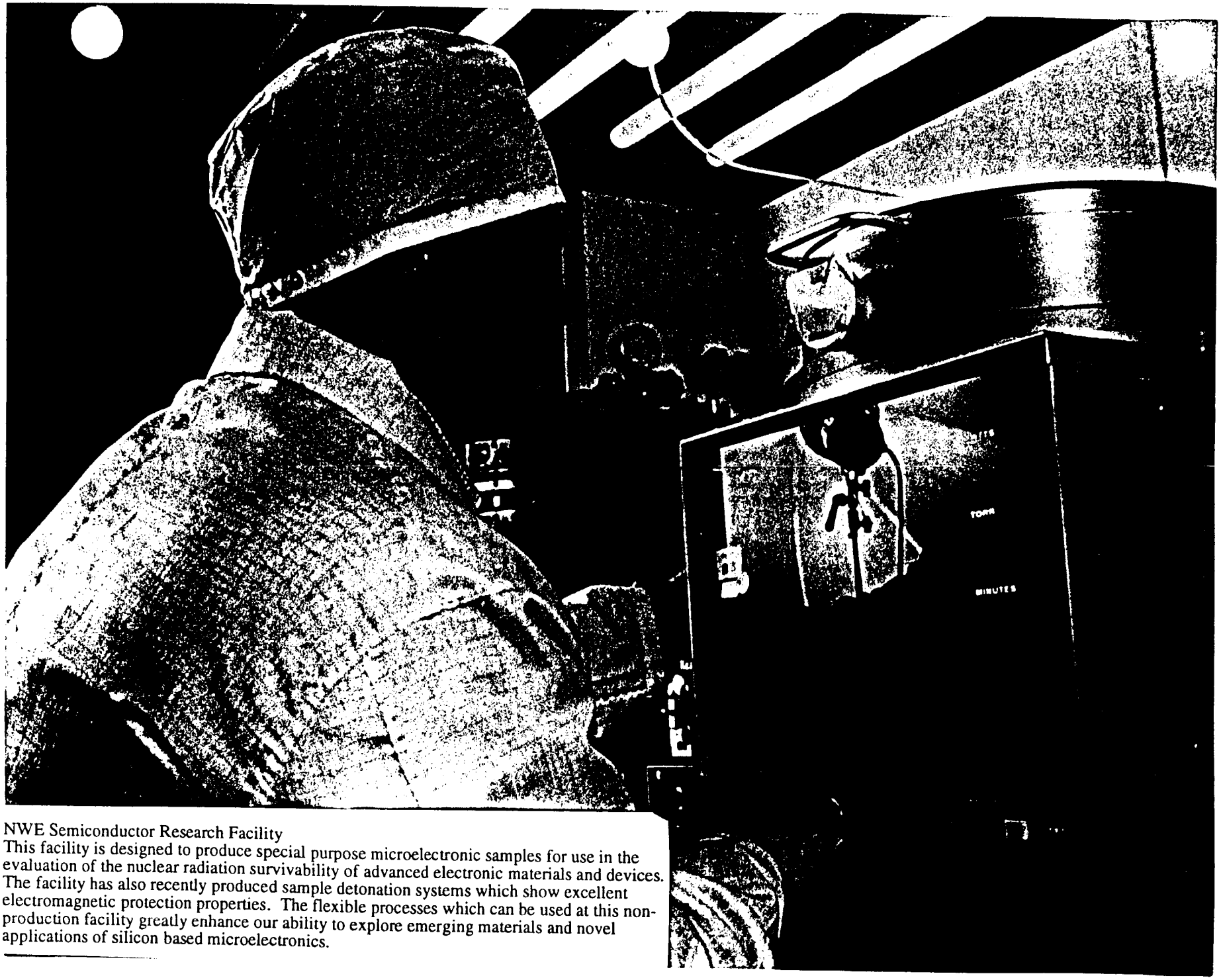
kyears in Common Support Functions to be accommodated at ALC while preserving the current and future esearch missions of this site. Major construction will require Military Construction, Army funds in order to expand the site.

3.5.1.2 Capacity to absorb additional workyears, how many can be supported: None. Cannot be determined at this time. Should there be a requirement to take on additional workyears, laboratory space reallocations can be considered on a priority basis.

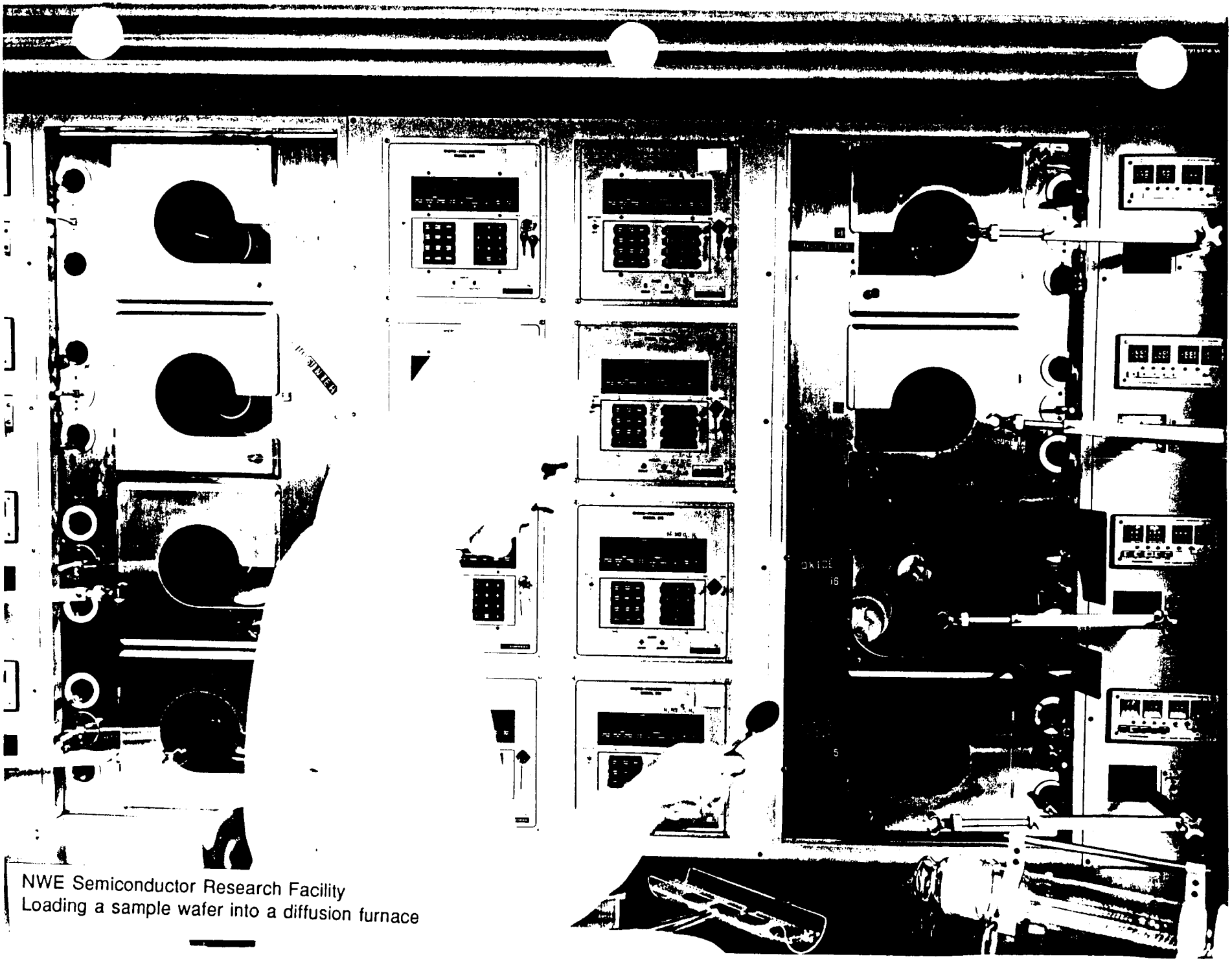
3.5.1.3 Impact of military construction program or other alteration projects programmed in FY95 PBS: The Adelphi Laboratory Center is currently programmed at $102M for BRAC 91 construction with work to begin in FY95. A $6.6M MCA R&D Computer Center project is conjuctively funded with the BRAC program. A $1.5M unspecified Minor MCA project is planned for FY94/95 to bulid a Scale Model Facility. These projects are intended to meet the FY97 end-state requirements of the Army Research Laboratory at Adephi under BRAC 91 and subsequent decisions.

3.5.2 Land use: Buildable acres for additional laboratory/administrative support construction: In addition to all areas currently allocated for planned construction there are 18.39 acres of buildable acres at the Adelphi Laboratory Center (Blossom Point Research Facility, subinstallation to ALC, has 205 buildable acres). In addition to new sites there is the ability to add additional floors (3 acres) onto existing structures. Also, the Adelphi Laboratory Center is adjacent to the Naval Surface Warfare Center - White Oak, and the potential exists for expansion.

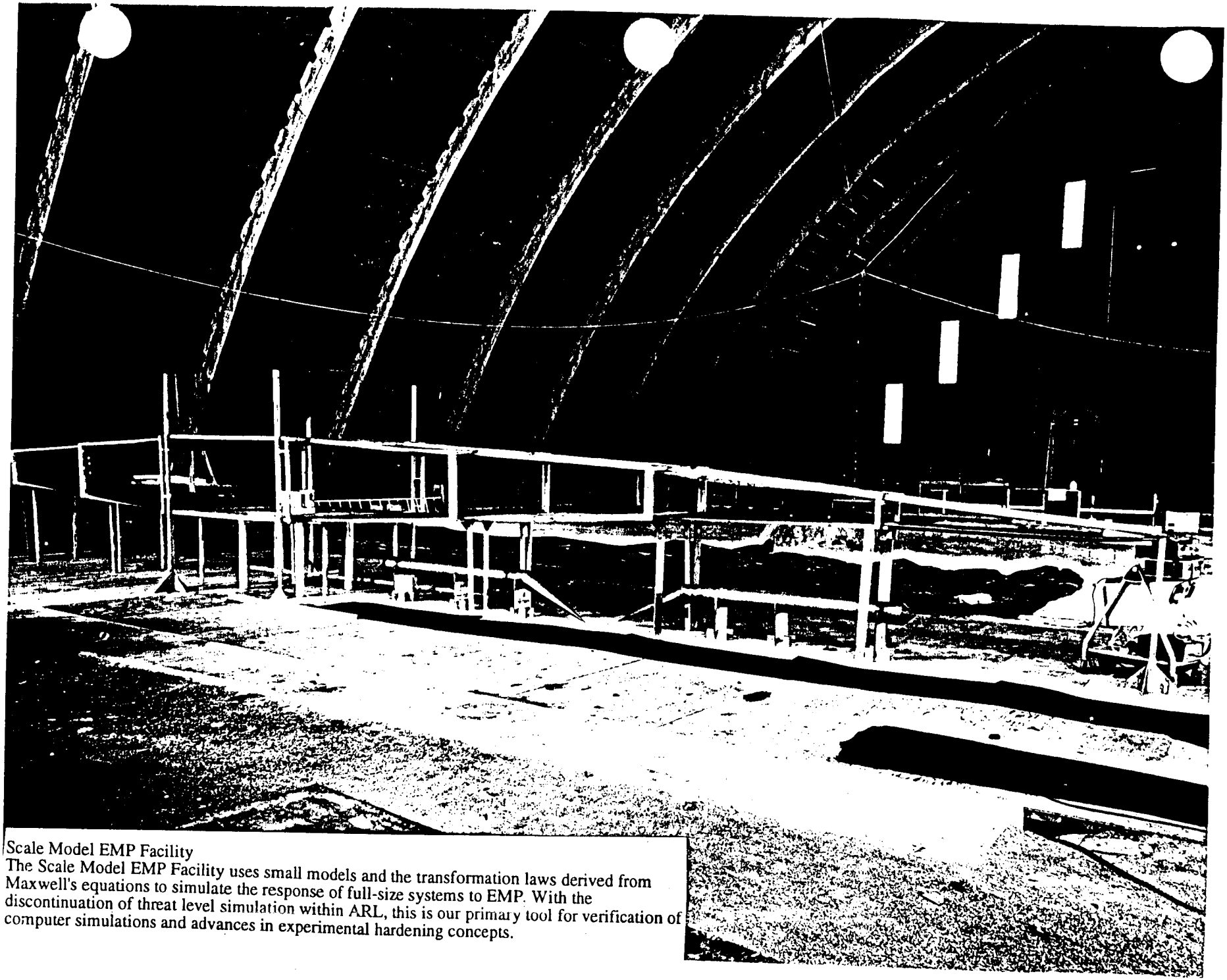
3.5.3 Utilities: The Adelphi Laboratory Center currently has excess capacity in all services. The installation 'll continue to have excess capacity upon completion of new construction and in-migration of ,nctions/organizations under BRAC 91.



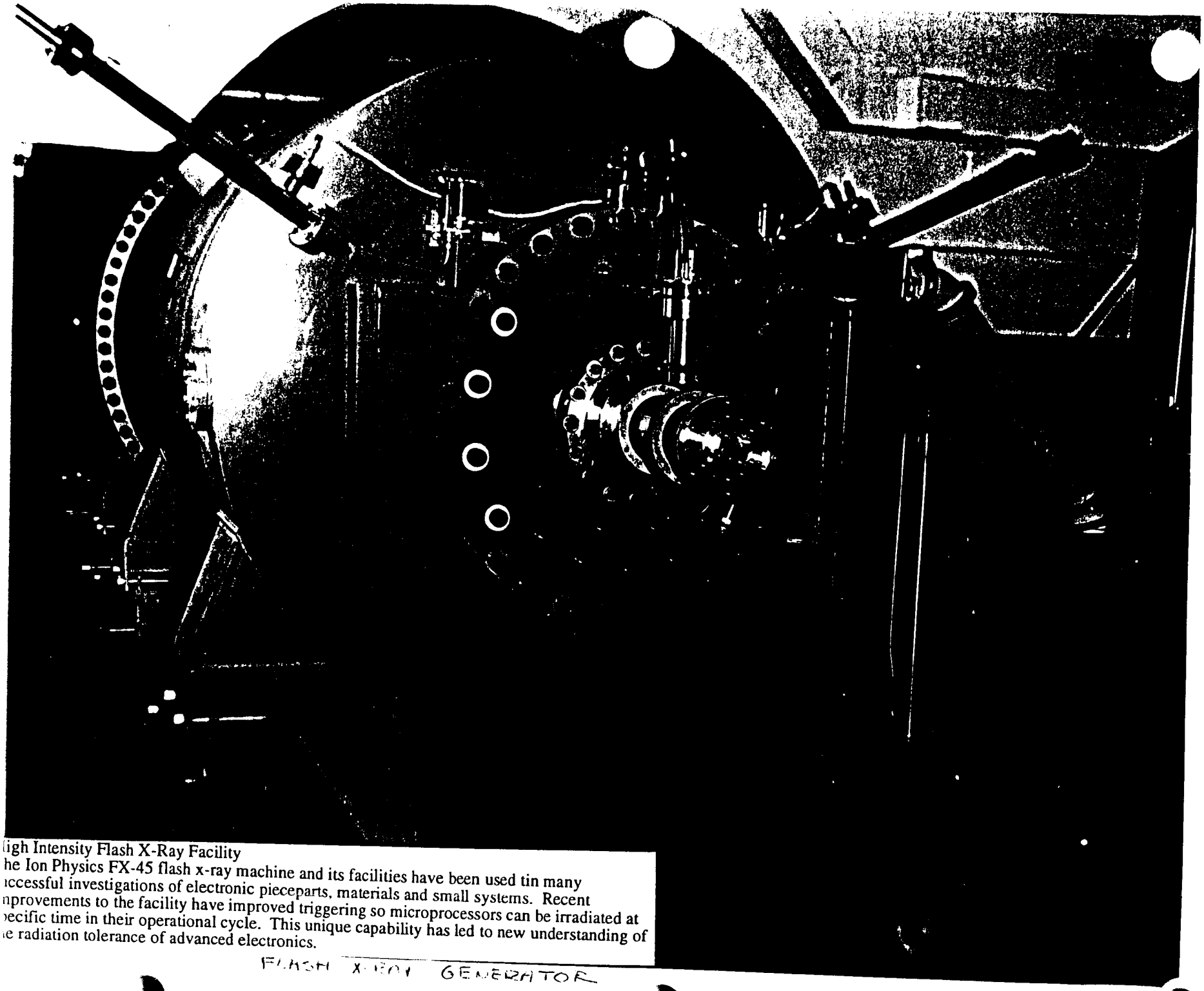
NWE Semiconductor Research Facility
This facility is designed to produce special purpose microelectronic samples for use in the evaluation of the nuclear radiation survivability of advanced electronic materials and devices. The facility has also recently produced sample detonation systems which show excellent electromagnetic protection properties. The flexible processes which can be used at this non-production facility greatly enhance our ability to explore emerging materials and novel applications of silicon based microelectronics.



NWE Semiconductor Research Facility
Loading a sample wafer into a diffusion furnace

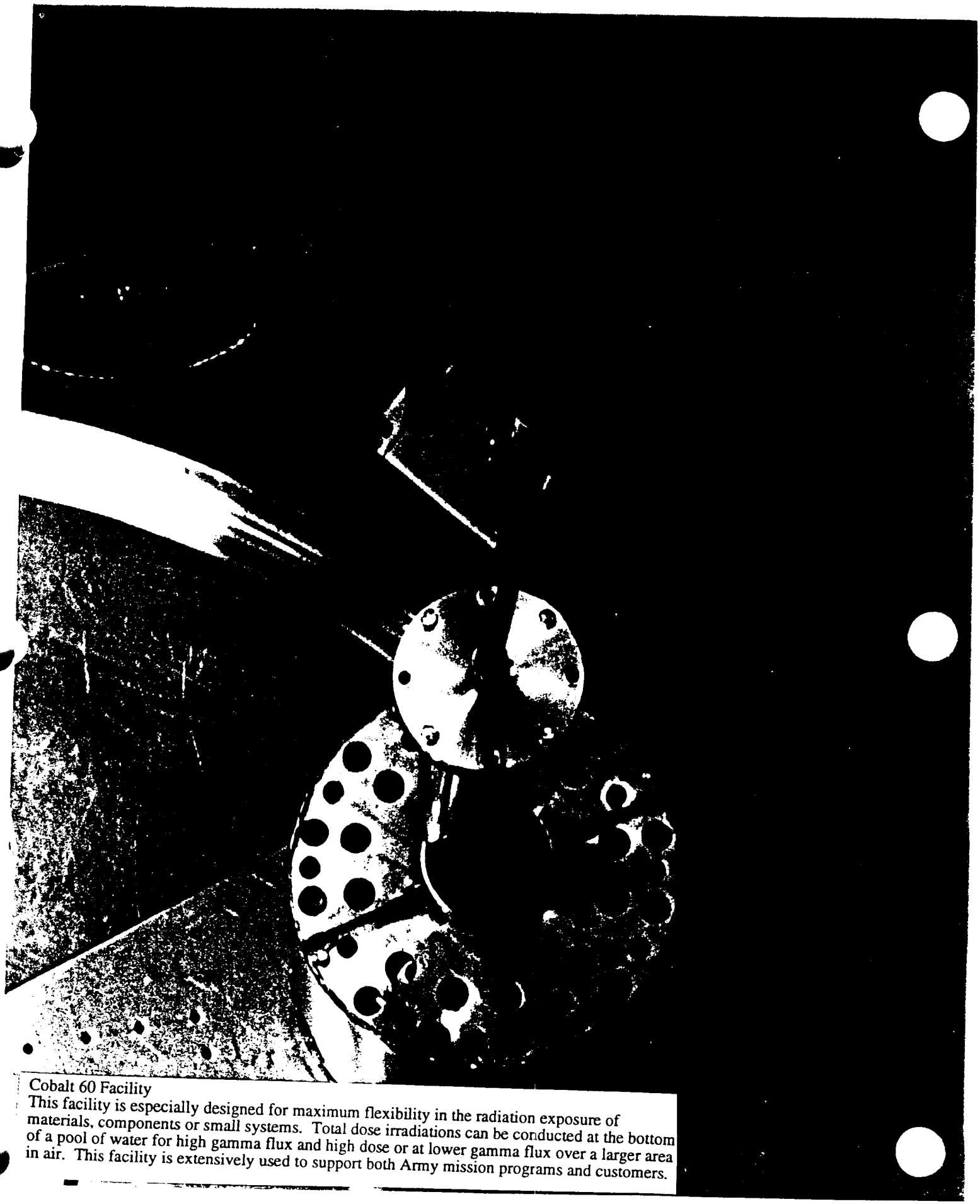


Scale Model EMP Facility
The Scale Model EMP Facility uses small models and the transformation laws derived from Maxwell's equations to simulate the response of full-size systems to EMP. With the discontinuation of threat level simulation within ARL, this is our primary tool for verification of computer simulations and advances in experimental hardening concepts.



ıigh Intensity Flash X-Ray Facility
he Ion Physics FX-45 flash x-ray machine and its facilities have been used tin many
ıccessful investigations of electronic pieceparts, materials and small systems. Recent
nprovements to the facility have improved triggering so microprocessors can be irradiated at
ɔecific time in their operational cycle. This unique capability has led to new understanding of
ıe radiation tolerance of advanced electronics.

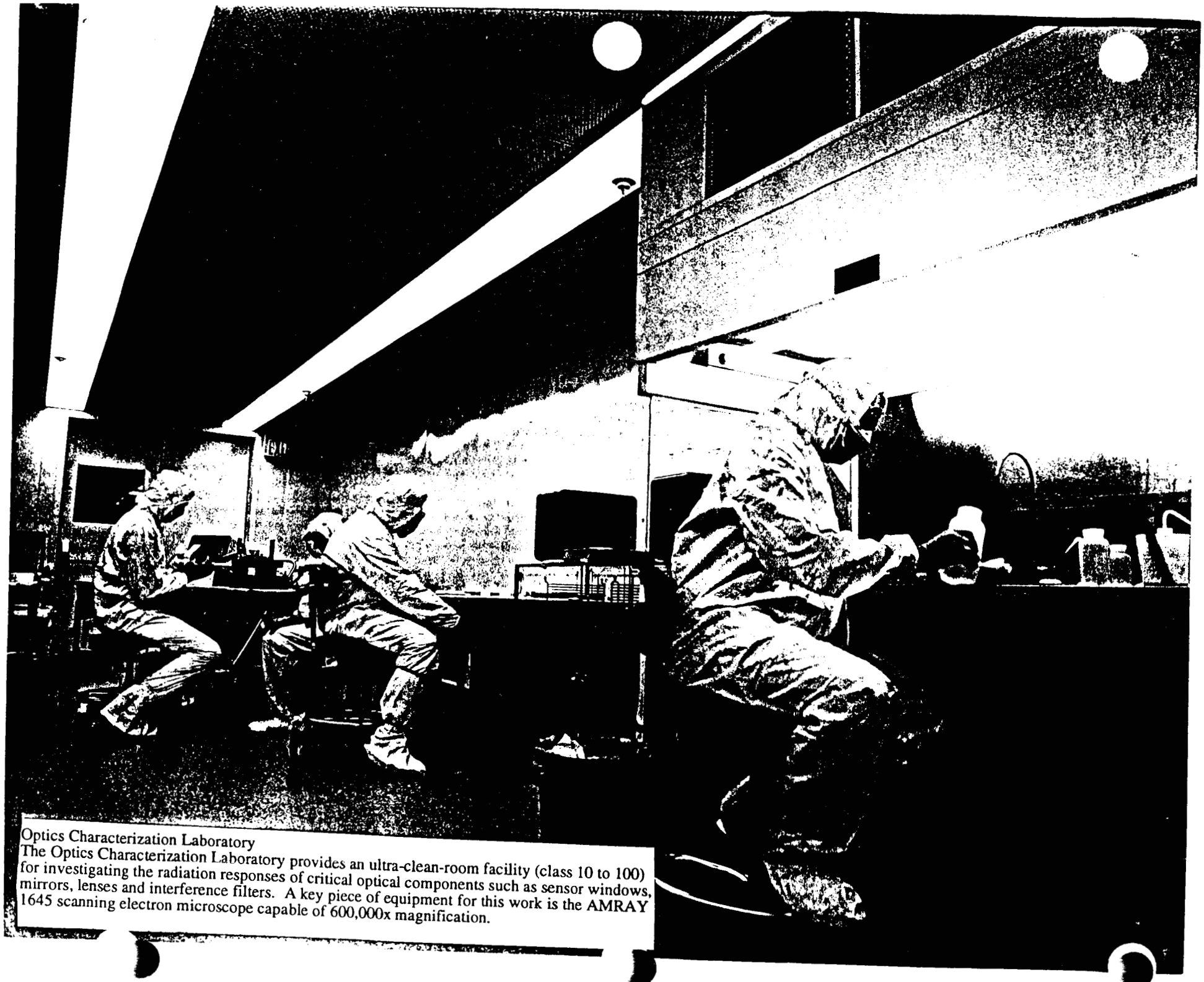
FLASH X-RAY GENERATOR



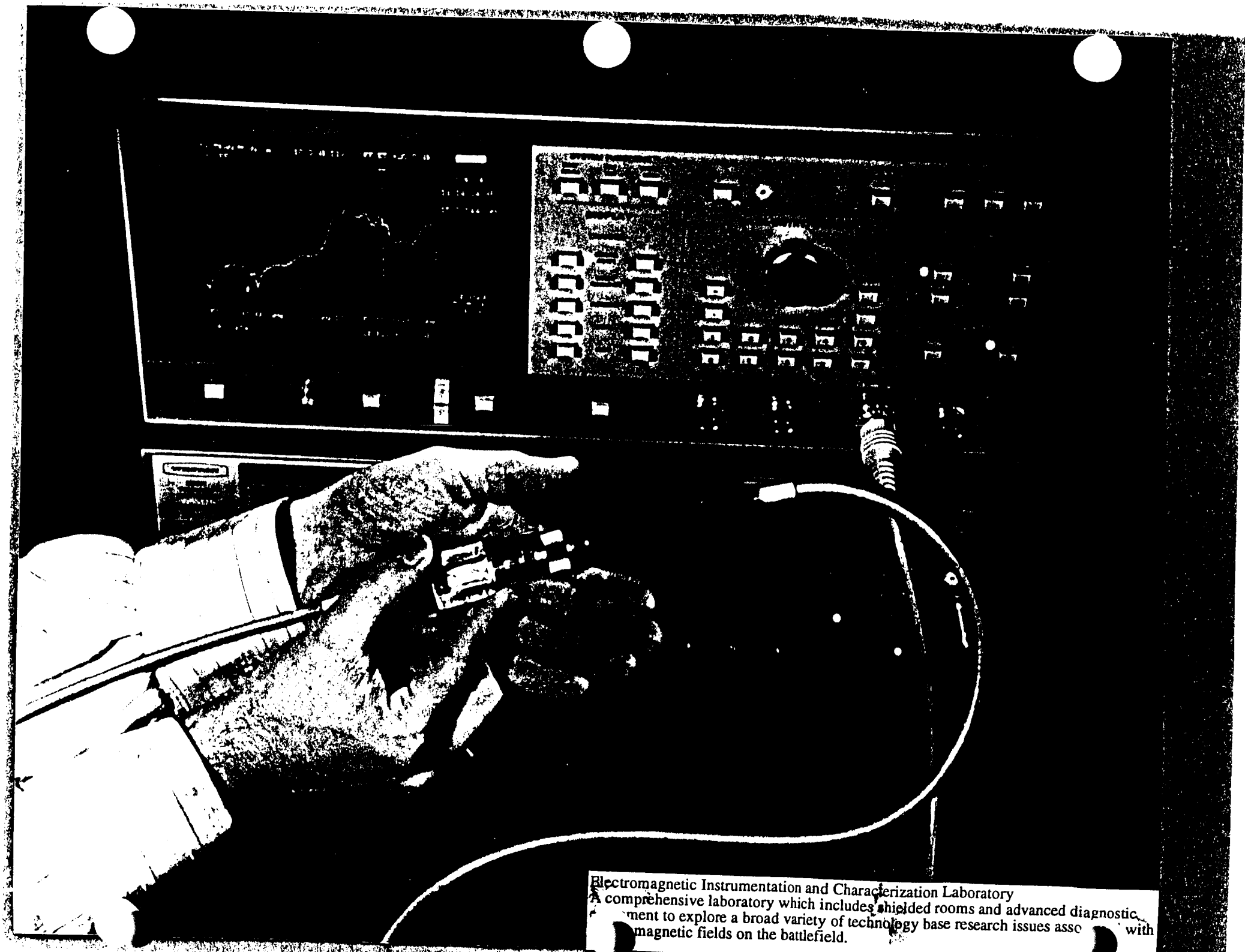
Cobalt 60 Facility
This facility is especially designed for maximum flexibility in the radiation exposure of materials, components or small systems. Total dose irradiations can be conducted at the bottom of a pool of water for high gamma flux and high dose or at lower gamma flux over a larger area in air. This facility is extensively used to support both Army mission programs and customers.

ARACOR Research Facility

Two semiconductor irradiation test sources manufactured by the Advanced Research and Applications Corporation are available for 10 keV x-ray evaluation of the ionizing dose response of semiconductor materials and devices. The sources are combined with IC pa r testers and computer controllers to evaluate the radiation survivability of advanced elect materials and devices such as ferroelectric random access memories, SiC devices and adva ced Si based devices.



Optics Characterization Laboratory
The Optics Characterization Laboratory provides an ultra-clean-room facility (class 10 to 100) for investigating the radiation responses of critical optical components such as sensor windows, mirrors, lenses and interference filters. A key piece of equipment for this work is the AMRAY 1645 scanning electron microscope capable of 600,000x magnification.



Electromagnetic Instrumentation and Characterization Laboratory
A comprehensive laboratory which includes shielded rooms and advanced diagnostic
ment to explore a broad variety of technology base research issues asso with
magnetic fields on the battlefield.

P

ACTIVITY: Army Research Laboratory, Aberdeen Proving Ground, MD

Section II: Capacity of DOD Component

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2.1 Workload

Information Required	Fiscal Years											
	86	87	88	89	90	91	92	93	94	95	96	97
Total Funds Programmed ($M)	-	-	-	-	-	-	-	110.4	110.5	109.0	99.2	100.7
Total Actual Funds ($M)	-	-	-	-	-	-	-	125.4	-	-	-	-
Programmed Workyears	-	-	-	-	-	-	-	1605	1587	1424	1295	1293
Actual Workyears	-	-	-	-	-	-	-	1556	-	-	-	-

2.2 Excess Lab Capacity: 1556 - 1293 = 263

Notes:
-ARL established FY93.
-Programmed funds are percentage estimates based on ARL total workyears for FY95-97.
-Funds data does not include reimbursable, SBIR, FAST, Explitation of Foreign Items, QRIP, Industrial Preparedness, or Armor/Anti-Armor funds. These funds are not "programmed," but received during the year of execution.
-Workyears include all government personnel (to incl reimbursable if applicable).
-The ARL at Aberdeen Proving Ground includes the Human Systems and Nuclear Weapons Effects common support functions within the totals.

ction III: Capability of Activities to Perform Common Support Functions

3.0 Mission: The ARL at APG has the ballistics research and exploratory development mission for the U.S. Army -- both the offensive (under CSF Weapons - Guns and Ammo) and the defensive (under CSF Ground Vehicles - Tracked) aspects. Both efforts are executed in the Weapons Technology Directorate and make up the major thrust of the directorate. The Weapons - Guns and Ammo functional efforts in 6.1 (basic research) and 6.2 (exploratory development) areas are well coordinated with the Armaments Research and Development and Engineering Center (ARDEC) and PMs located at Picatinny Arsenal, NJ; the Ground Vehicles - Tracked efforts are coordinated with the Tank and Automotive RDEC and PMs in Warren, MI. This coordination insures a smooth transition of maturing technology from basic and applied research, through exploratory and advanced development, and finally into engineering and manufacturing development. This relationship is further cemented using Technology Planning Annexes in which agreements between the tech directors of all the RDECs and the ARL Director are signed pledging that a full 50% of the mission efforts of ARL are dedicated to projects and studies considered of major import to the RDEC scientists and engineers. In addition ARDEC and ARL representatives actively participate in the RELIANCE panel on Conventional Air/Surface Weaponry with their Navy and Air Force counterparts. One of the agreements coming out of the RELIANCE efforts was that the Army would be the only DoD component that would pursue basic and exploratory development in ballistics and guns. Current efforts include research liquid propellants, electric guns and active/reactive armors.

- o Interior Ballistics
  - formulation of energetic materials for propellants from the molecular level
  - phenomenology of aggregate propellants - burning rates, impetus, heat transfer, fracture, etc.
  - thermomechanical/mechanical interactions - heat transfer, mechanical loading and momentum transfer among the breech, gun tube, sabot, cartridge case, etc.
- o Exterior Ballistics
  - aeromechanical - 3-D simulations of sabot separation, induced yaw, muzzle-induced instability, muzzle blast
  - aerodynamics - drag, drag-reducing opportunities, computational fluid dynamics, flight characteristics of long rod penetrators
  - accuracy - induced errors from mechanical effects during propulsion and launch, muzzle release and sabot separation; yaw in flight, meteorological effects
- o Terminal Ballistics
  - warhead performance - optimizing terminal effects of long rod kinetic energy penetrators, chemical energy shaped charge jets and explosively-formed fragments
  - enhanced performance produced by jacketed rods, segmented rods, tungsten vs. DU materials, precursored rods
- o Explosives
  - formulation of insensitive high explosives
  - safe storage of energetic materials in vehicles
- o Weapons Systems
  - autonomous/semi-autonomous weapon systems and weapons
    - smart/competent/brilliant munitions
    - smart/competent/brilliant weapons systems
  - interfacing promising emerging technologies with battlefield requirements of TRADOC and its schools

Interconnectivity with other common support functions:
- Advanced Materials on optimized penetrators
- Human Systems on human interface to semi-autonomous systems
- Environmental Quality on cleanup of energetic materials from firing ranges/war zones

- Ground Vehicles on armor vulnerability to ballistic damage
- Air Vehicles on vulnerability of structures to ballistic damage
- Conventional Missiles on vulnerability of structures to ballistic damage

3.1 Location.

3.1.1 Geographic/Climatological Features: Because of Spesutie Island and the Chesapeake Bay, the APG site has access to large tracts of empty land and open water/marshes. This allows munition testing of large caliber weapons and large outdoor experiments involving propellants, explosives and nuclear weapons effects. The year-round temperate climate makes for favorable conditions for ballistic/NWE testing.

3.1.2 Licenses & Permits. The following licenses and permits are currently held at the APG:

National Pollution Discharge Elimination System (NPDES) Permit: ARL/APG operates under the limitations of three NPDES permits issued by the State of Maryland. Two of the permits are for the waste water treatment plants and the limitations pertain to the entire post. The NPDES permits for the waste water plants restrict all day to day operations, in that very few things are allowed down the sanitary sewer system. The third NPDES permit is specific to various operations. Weapons Technology Directorate has three buildings as part of this permit.

Storm Water General Permit: The ARL/ APG site is required to comply with the National Pollution Discharge Elimination System (NPDES) Maryland General permit for Storm Water Discharges. ARL/APG has 18 permitted storm water facilities, 9 in WTD. Test firing projects, vehicle maintenance, and storage of scrap aterials at these facilities are permitted because of the implementation of "Best Management Practices" MP's) that rectify the discrepancies produced and by a inspection program that maintains the BMP program.

Resource, Conservation and Recovery Act (RCRA) Hazardous Waste Storage Permit: APG holds a RCRA permit to properly house and dispose of hazardous waste at the Treatment, Storage and Disposal Facility (TSDF) located in Edgewood, MD. Waste generated by ARL/APG operations is strictly monitored and stored & disposed of through this permitted facility.

Open Burning/Open Detonation (OB/OD) of ARL waste propellants, explosives and pyrotechnics (PEP) material is done at two sites, one at the Aberdeen area and one at the Edgewood area of APG. These operations are covered by a RCRA interim permit which has limits as to the amount of waste PEP that can be disposed of through this method.

Firing into the Chesapeake Bay.

Explosive Storage.

Health Physics.

3.1.3 Environmental Constraints:
1. Resource Conservation and Recovery Act - Hazardous Waste. The current interim permit limits all of APG to 29.9K lbs/year.
2. Clean Water Act - Storm Water. As long as Best Management Practices (BMPs) are followed, all mission tasks can be performed. The limitation is cost of BMPs.
Clean Water Act - Point Source Discharge Certain operations in Bldg 1171 have been hindered.
4. Clean Air Act - Open Burning Minimal adverse impact, no curtailment of mission.

Clean Air Act - General State/Federal Air Permits. Spray painting operations are prohibited.
6. Firing into the Chesapeake Bay. There are noise and blast environmental constraints to the current or enhanced mission scope.
7. Explosive Storage. Primary limitation is safety. The environmental concern is that much of APG is wetlands and unsuitable for construction of explosive storage facilities.
8. Health Physics. Hard impact testing of DU is limited to enclosed facilities.

3.1.4 Special Support Infrastructure:

Indoor/outdoor ranges
Ammo/explosives bunkers
Specialized laboratory structures/equipment

3.1.5 Proximity to Mission-Related Organizations:

Common Support Functions	Name	Type of Organization	Distance	Workyears Performed	Workyears Funded
Weapons Guns &Ammo	John Hopkins	Unvi	25 miles	2	2
	Univ of Delware	Unvi	30 miles	3	0
	AAI	Ind	25 miles	2	0
	White Labs	Ind	10 miles	2	0
	TECOM	OGA	0 miles	2	2

3.2 Personnel.
3.2.1 Total Personnel:

Types of Personnel	Number of Personnel			
	Government		On-Site FFRDC	On-Site SETA
	Civ	Mil		
Technical	228	5	0	0
Management (Supv)	16	0	0	0
Other	20	0	0	0

3.2.2 Education:

Types of Degree/Diploma	Number of Personnel by Type of Position		
	Technical	Management (Spv)	Other
High School or Less	45	0	16
Associates	11	0	2
Bachelor	74	1	2
Masters	40	2	0
Doctorate	63	13	0

2.3 Experience:

Type of Position	Years of Government and/or Military Service: Less than 3 years	3-10 years	11-15 years	16-20 years	More than 20 years
Technical	8	66	49	34	76
Management (Supv)	0	0	0	1	15
Other	0	3	7	4	6
Total	8	69	56	39	97

3.2.4 *Accomplishments During FY91-93.*

3.2.4.1 Patents Awarded/Patent Disclosures:

Common Support Function	Disclosures	Awarded	Patent Titles
Weapons-Guns & Ammo	11		Listed below

1. Hollow Aluminum Training Round
2. Baton with Integral Projectile Launcher
3. Fold-Out Fin Configuration
4. A Device for Determining the Time and Location of Impact in Real Time
5. Non-Obtrusive Missile Control Surface Monitor System
6. Multiple Pinhole Yawsonde Sun Sensor Module
   A Technique for Determining the Spin Rate of Kinetic Energy Projectiles
   . Technique for Inducing Subcaliber Projectile Yaw
9. Sensitive Detection of Nitro Compounds Employing Excimer Laser Radiation at 193 nm
10. Position Compensation System
11. Combustible Fin Protection Devices

		9	Listed Below

1. 5,191,167 Multi-Point Optic Ignitor
2. 5,165,041 Frangible Sabot
3. 5,189,245 Thermally and Mechanically Stable Muzzle Reference System Collimator Assembly
4. 5,245,905 Continuous Bore Evacuation System
5. 5,162,118 Apparatus for Compaction of Ceramic
6. 5,189,251 Sabot for High Dispersion Shot Shell
7. 5,191,168 Sabot for High Dispersion Shot Shell
8. 5,192,830 Sabot for High Dispersion Shot Shell
9. 5,175,391 Method for the Multimaterial Construction of Shaped-Charge Liners

.2.4.2 Papers in Peer Reviewed Journals:

Common Support Function	Number Published	Paper Titles
Weapons-Guns & Ammo	21	Listed below

1. Step-Function Current in a Metallic Foil As a Step-Function Heat-Flux Source, Journal of Applied Physics, Vol. 72, No. 9, pp. 3904-3907, Nov-92
2. Pyrolysis GC-FTIR Studies of a LOVA Propellant Formulation Series, Journal of Energetic Materials, Vol. 10, pp. 221-250, Nov/Dec 1992
3. US Army Activities in Multidimensional Modeling of Electrothermal Guns, IEEE Transactions on Magnetics, Vol 29, No 1, pp 631-636, Jan-93
4. Investigation of Plasma-Augmented Solid Propellant Interior Ballistic Processes, IEEE Transactions on Magnetics, Vol 29, No 1, Jan-93
5. Nonsteady Penetration of Long Rods into Semi-Infinite Targets, International Journal of Impact Engineering, Vol 14, pp. 303-314, Jan-93
6. Pyrolytic Decomposition of Solid Propellants, Pure and Applied Chemistry, Vol.65, No. 2, pp. 317-323, Feb-93
7. Triple Quadrupole Mass Spectrometry as Applied to Flame Diagnostics: Study of the C2H4/N2O/Ar Flame, Journal of Am. Soc. for Mass Spectrometry, Vol 4, pg 152, Feb-93
8. Using Powder Packs for Passive Fire Protection of Military Vehicles, Journal of Fire Sciences, Vol 39, May-93
9. A Thermal/Mechanical Model of Axially Loaded Thick-Walled Composite Cylinders, Journal of Composites ngineering, Jun-93
0. Observation and Analysis of Rotationally Reversed B-X Electronic Transitions of CD-Ar, Chemical Physics Letters, Vol 210, pp 350-354, Jul-93
11. Investigation of the Gas-Phase Electronic Spectra of CH-Ar by Laser-Induced Fluorescence, Journal of Chemical Physics, Vol 99, pp 91-98, Jul-93
12. A Uniaxial Nonlinear Viscoelastic Constitutive Model with Damage for M30 Gun Propellant, Mechanics of Materials, Vol 15, No 4, pp 323-335, Jul-93
13. Ab Initio Potential Energy Surface for the H + OCS Reaction, Journal of Chemical Physics Letters, Vol 211, pp 283-292, Aug-93
14. Unique One- and Two-Photon Absorption Processes Near 6000 A in Nascent CN in a Flame: Direct and Collision-Assisted Population of the B2SIGMA + Electronic State, Chemical Physics, Vol 175, pp 343-356, Aug-93
15. Flame Structure Studies of H2/N2O/Ar Low Pressure Flames Employing Molecular Beam/Mass Spectrometry and Modeling, Combustion and Flame, Vol 94, pp407-425, Sep-93
16. Time-Resolved Emission Studies of ArF Laser Produced Microplasmas, Applied Optics, Vol 32, pg 939, Sep-93
17. Trace Detection of Nitrocompounds by ArF Laser Photofragmentation/Ionization Spectrometry, Applied Spectroscopy, Vol 47, No 11, Sep-93
18. Technique for Measuring Thermal Diffusivity/Conductivity of Small Thermal-Insulator Specimens, Rev Science Instr, Vol 64, pp 2954-2960, Oct-93
19. Performance of an Expanding Telescope Used to Obtain a Low Divergence Hi-Beam, Nuclear Instruments and Methods in Physics Research, A312, pp 397-414, FY93
20. Methods of Adapting Ion Beam Analysis Techniques for Use on Curved Surfaces, Nuclear Instruments and Methods in Physics Research, B63, pg 434, FY93
1. A Review of Jet Breakup Time Models, Propellant, Explosives, and Pyrotechnics, Vol. 18, pp. 241-246, FY93

3.3 Workload.
3.3.1 FY93 Workload.
3.3.1.1 Work Year and Lifecycle:

"Lab"	Fiscal Year 1993 Actual			
	Civilian	Military	FFRDC	SETA
Science & Technology	264	5	0	0
Engineering Development	0	0	0	0
In-Service Engineering	0	0	0	0

3.3.1.2 Engineering Development by ACAT: None.

3.3.1.3 In-Service Engineering: None.

3.3.2 Projected Funding.

3.2.1 Direct Funding ($K): RDTE

Common Support Function	FY94	FY95	FY96	FY97
Weapons Guns & Ammo	16424	14145	14050	14128

3.3.2.2 Other Obligation Authority:

Common Support Function	FY94	FY95	FY96	FY97
Weapons Guns & Ammo				
Reimbursable	24562	31557	35478	33434
Direct Cite	0	0	0	0

3.4 Facilities and Equipment:

Common Support Function	Major Facility or Equipment Description	Unique To: DOD	Federal Govt	U.S.	Replacement Cost ($M)
Wpns-G&A	Large Caliber Range (Range 18)				$0.5
	Transonic Range				$4.6
	DU Range (Range 9)				$1.3
	Range 14				$0.4
	Range 7				$1.6
	Range 7A				$0.7

Explosive Mechanics Facility	$0.8
Small Caliber IB	$5.4
Small-Caliber High Velocity TB	$2.9
Aerodynamics Range	$0.3
Veh-Trac Hot Melt	$0.9

3.5 Expansion Potential.

3.5.1 Laboratory Facilities:

Common Support Function	Facility or Equipment Description	Type of Space	Space Capacity (KSF) Current	Used	Excess
Wpns-G&A	Bldg 328	Admin	2.4	2.4	0.0
		Tech	1.5	1.5	0.0
	Bldg 309/309A/B/C	Admin	27.1	27.1	0.0
		Tech	9.3	9.3	0.0
	Bldg 390/390A	Admin	48.4	48.4	0.0
		Tech	15.8	15.8	0.0
	Bldg 1121	Admin	.8	.8	0.0
	Bldg 1122	Tech	2.3	2.3	0.0
	Bldg 120	Admin	54.7	54.7	0.0
		Tech	19.3	19.3	0.0
	Bldg 391/391A	Admin	3.3	3.3	0.0
		Tech	1.8	1.8	0.0
	Bldg 394	Admin	3.7	3.7	0.0
	Bldg 740A (Transonic Range)	Tech	35.7	35.7	0.0
	Bldg 740B	Admin	3.9	3.9	0.0
		Tech	3.9	3.9	0.0
	Bldg 1135 (Range 18)	Tech	1.7	1.7	0.0
	Bldg 1138/1143 (Range 7A)	Admin	1.5	1.5	0.0
		Tech	6.1	6.1	0.0
	Bldg 1145A/B (Range 7)	Admin	1.0	1.0	0.0
		Tech	5.5	5.5	0.0
	Bldg 1150A/B (Range 14)	Admin	1.8	1.8	0.0
		Tech	5.0	5.0	0.0
	Bldg 1179 (Range 9)	Admin	1.7	1.7	0.0
		Tech	12.4	12.4	0.0
	Bldg 1185/1186 (Expl Mech)	Admin	0.9	0.9	0.0
		Tech	7.8	7.8	0.0
	Assorted Magazines	Tech	6.5	6.5	0.0
	Assorted Storage Bldgs	Tech	50.0	50.0	0.0
	Veh-Trac Bldg 393	Admin	9.3	9.3	0.0
		Tech	2.2	2.2	0.0
	Bldg 1171/1175 (Hot Melt)	Tech	4.1	4.1	0.0
	Bldg 1179	Tech	12.4	12.4	0.0

3.5.1.1 Capacity of activity to absorb similar workyears: There is ample physical space at the Aberdeen site to accommodate and effectively utilize additional workyears. Ongoing MCA construction and movements of other tenant activities at the host installation (APG) has and will continue to free up admin and technical space for expansion. There are many new SARDA-sponsored initiatives in need of additional technical support.

3.5.1.2 If capacity to absorb additional workyears, how many can be supported: If there are customers (PEO/PMs) and missions (SARDA) that need expertise in these Common Support Functions, this site has the capacity to absorb 100-150 additional.

3.5.1.3 Impact of military construction program or other alteration projects programmed in FY95 PBS: The ARL is currently planning to move the Materials Directorate mission and people to this site (APG). An MCA project has already begun to build a massive building to house the entire Materials operation as well as other ARL elements. This construction will make additional admin and technical space available for expansion.

3.5.2 Land use: APG has 1150 buildable acres. ARL is a tenant at APG and as such does not have any specific number of acres set aside for expansion. If ARL required additional land areas for expansion it will be requested from APG.

3.5.3 Utilities: As the former location of a hypersonic wind tunnel, this area has no problem with electrical requirements. A state-of-the-art telephone system has recently been installed. Water and sewer facilities still have excess capacity. All of the utility services are provided to the tenants by the host installation (APG).

ACTIVITY: ARL, ABERDEEN PROVING GROUND (APG), MD CSF: HUMAN SYSTEMS

Section III: Capability of Activities to Perform Common Support Functions

3.0 Mission:

The key mission is to determine land based soldier oriented research and technology needs, and to plan and execute research and technology programs to address those needs. Resulting empirical data serve as the basis for weapon system and equipment design standards, guidelines, handbooks, and, as part of the manpower and personnel integration (MANPRINT) program, soldier manpower, personnel and training and human engineering requirements determination to improve overall soldier-system equipment operation and maintenance. The program comprises:

- o Research on soldier-system performance
- o Human factors and human engineering research and development
- o Maximize effectiveness of the soldier in concert with existing and emerging materiel, in order to survive and prevail on the battlefield
- o Conduct specialized lab and field studies and evaluations to collect and analyze performance data on capabilities and limitations of soldiers; emphasis on soldier and equipment interaction, individually and as fighting units.
- o Key R&D areas:
  - Cognitive and Decision Processes
  - Ergonomics
  - Simulation Systems
  - Soldier-System Control
  - Visual and Auditory Processes
  - MANPRINT Information Systems, Maneuver and Mobility, Weapons, and Integration Methods

Application of these R&D advancements yields reduced workload, fewer soldier-system errors, enhanced soldier protection, and user acceptance -- all aiding the soldier to extract maximum performance from the equipment. The program is consistent with the Army Modernization Plan, the Army Science and Technology Master Plan, and the Defense Science and Technology Master Plan and AR 602-2, Manpower and Personnel Integration (MANPRINT) in the System Development and Acquisition Process. The program receives funds from the Advanced Research Program Agency in the areas of MANPRINT and more general simulation and modeling, Virtual Reality, and Robotics. The 6.2 aspects of this program are part of the Human-System Interfaces Tri-Service Reliance Panel.

In order to minimize program redundancy and maximize R&D leveraging opportunities ARL-HRED works in concert with the Natick RDEC (NRDEC), the Army Research Institute for (ARI) the Behavioral and Social Sciences and our sister Services on issues of operator performance and Manpower, Personnel, Training and Human Systems through formal agreement and joint participation on the DOD Human Factors Engineering Technical Advisory Group; and with NRDEC, ARI and the Medical R&D Command through the Soldier System Technology Base Executive Steering Committee. ARL-HRED efforts focus on trade-off analyses and integration across those areas while ARI efforts deal with individual requirements in each of those areas.

Internationally, ARL-HRED is represented on three NATO Research Study Groups (Ergonomics, Robotics, Test and Evaluation) and The Technical Cooperation Program. It has working agreements with France, Israel, Australia, Canada, and Germany. ARL-HRED is further represented by scientist exchange (France and Germany for FY94) and direct scientist support (Korea).

ARL-HRED also has extensive interactions with other ARL Directorates at APG, most notably the Advanced Computational and information Sciences (ACIS) Directorate, The Survivability/Lethality Analysis Directorate (SLAD)and the Weapons Technology Directorate (WTD).

HRED, SLAD and WTD have in place a memorandum of understanding (MOU) for the use of an approximately 100 acre joint test facility at a remote site on the Edgewood area at APG. SLAD and WTD will use the site for studying the effects of electromagnetic field generation on various devices and spectral analysis of electronic signatures of military equipment. HRED has set up a simulated ammunition resupply point complete with 450 short tons of (simulated and inert) ammunition and containers, a truck equipped for the Palletized Loading System, and forklifts for use in ammunition logistics and materials handling studies. In addition to in-house studies, HRED also uses this site and its associated equipment to support DA level studies involving ammunition resupply, such as a planned study on metabolic work rate determination for ammo resupply of the Future Armored Resupply Vehicle, where the joint leveraging of facilities and personnel will yield soldier performance data of interest to all concerned.

SLAD has an interest in the Edgewood site for soldier survivability testing, and HRED is also working with them on domain assessment methodology and other MANPRINT related research for analysis and modeling of survivability issues.

ARL-HRED and ACIS are cooperating on research command and control communications on the future battlefield. HRED is currently constructing MANPRINT models of the crew operations in a future mobile command and control center. The MANPRINT workload analysis will be in part based on data from existing systems and interaction with subject matter experts at ACIS and other sources related to the expected capabilities and use of future command and control systems and components. The interaction between HRED and ACIS has resulted in increased awareness of issues of mutual concern for command and control of the battlefield of the future.

ARL-HRED has established a solid and mutually beneficial working relationship with the TECOM Combat Systems Test Activity (CSTA) at APG. ARL-HRED in some cases has shared the design, implementation, debugging, use and modification of test facilities with CSTA, most notably in the area of robotics and remote operation of military vehicles and platforms. A high degree of synergism results from the mix of CSTA's vehicle and equipment evaluation expertise, experience and instrumented test facilities combined with ARL-HRED's emphasis on performance enhancement for the individual soldier. This mix allows for a more detailed analysis of the soldier and equipment as a system, with both agencies gaining better insight into what happens during a test and where soldier or system performance could be enhanced.

The synergism is further enhanced in some areas by complementary roles and responsibilities. For example, CSTA has been designated as the Army Center for Unmanned Ground Vehicle (UGV) testing and at the same time ARL-HRED has been working closely with PM/UGV on the development of portable operator control stations and techniques for computer-aided remote driving. Cooperative test and evaluation plans and studies can derive the maximum amount of useful data from a minimum use of equipment and test subjects. As noted in section 3.4, this joint approach eliminates duplication of facilities and testing as well as providing unique and common facilities that allow for safe operation and evaluation of large, remotely operated military systems. Additionally, the data collection and instrumentation infrastructure within CSTA would be difficult to duplicate in terms of experience and capabilities. Having those kinds of capabilities at hand at APG has allowed ARL-HRED to put the maximum amount of resources toward research as opposed to research equipment and support personnel.

The indoor robotic test facility (described in section 3.4) is a 35,000 square foot instrumented test track and analysis center which allows for highly sensitive performance measures for both driver and vehicle under test. Estimated use for the past year was about 70% ARL-HRED and 30% CSTA, but this could vary in the future.

The outdoor facility is a 14-acre site with a closed loop test course enclosed by over a mile of concrete "Jersey Barriers" of the kind used on major highways to stop errant vehicles (see section 3.4). A global positioning system is used for vehicle tracking. ARL-HRED used this facility about 85% of the time last fiscal year.

In summary, the interactions between ARL-HRED and CSTA are more than associations fostered by convenience or propinquity, they are associations of mutual research interest which permit the most efficient use of scarce resources in the evaluation of Army equipment and soldiers as a system. Each benefits not only in the efficient accomplishment of their goals but in the ability to generate and evaluate data from the interaction of soldier and equipment which may lead to better evaluation of overall performance and possible enhancements for soldier or equipment.

Interconnectivity with CFSs: ARL-HRED supports human engineering and MANPRINT needs of combat and materiel developers across all product functions and provides key research data through basic and applied research in the pervasive areas of Human Systems, Manpower and Personnel, and Chemical Biological Defense. Support includes:

duct Functions.

Air Vehicles - in crew station design and avionics for programs including the Advanced Attack Helicopter, the Longbow Apache, and the Comanche helicopters, and in support of operator interface and workload analysis for PM Unmanned Aerial Vehicles (PM-UAV).

Weapons

ICBMs - in the area of human-in-control issues for the National Missile Defense Engagement Planning Office.

Conventional Missiles/Rockets - in support to PM Theater High Altitude Air Defense, Close Combat Anti-Armor Weapon Systems, PEO Tactical Missiles, and PEO Missile Defense (PATRIOT). Focus is on workstation design, displays and controls, standardized symbology and operator workload issues. Guns and Ammunition - in studies related to the effect of weapon recoil on operator accuracy, as well as live fire weapons accuracy studies for Project Director, Close Combat Optic on our instrumented outdoor test range.

Space Systems

Ground Control Systems - In supporting SATCOM with operator interface and crew station design support for satellite control and communications systems and shelters.

C4I Systems

Fixed Ground-based C4I - in human factors and MANPRINT system design support for the Light and Special Division Individual Sensor program at MICOM, the Advanced Sensors Directorate, the All Source Analysis System (ASAS) , and the Combat Service Support Control System (CSSCS) . ARL-HRED

has developed the Knowledge-Based Logistics Planning System, now part of the Logistics Anchor Desk (LAD) concept. Also with the military intelligence community developing a prototype brigade staff Intelligence Decision Support System (IDSS).

Ground Mobile C4I - in crew station design and detailed MANPRINT analysis of crew tasks and workload for a future ground mobile C4I system, and in developing user interface guidelines and a soldier simulation model for Digitization of the Battlefield.

Ground Vehicles (Including Unmanned) - generally in operator interaction with emerging systems such as the inter vehicular information system (IVIS) and developing operator interface guidelines for combat ID systems. Conducting MANPRINT evaluations for crew size reduction in future fighting vehicles.

Wheeled and Tracked - Support includes MANPRINT evaluations for the M1A2 testing, human factors evaluations for the Armored Gun System (AGS) and Abrams Milestone III. Emphasis on human performance and crew station design issues. HRED is working with PM Unmanned Ground Vehicles (PM-UGV) on evaluation of alternate operator control station designs for UGVs (from small platforms to HMMWVs) as well as testing the effects of different fields of view and feedback of audio information on remote vehicle operator performance. Testing is conducted at the APG on-site indoor test facility and outdoor test sites.

Clothing, Textiles and Food - Evaluating clothing comfort and equipment portability, currently for Special Operations Command (SOCOM) at the APG outdoor portability test facility.

Chemical/Biological Defense - In the human performance evaluation and testing of CBW masks and clothing. HRED supports the Biological Integrated Detection System (BIDS) Team at Edgewood in the design of communications interfaces.

Pervasive Functions

Human Systems - ARL-HRED conducts research on soldier-system interaction and soldier performance, including the areas of visual, auditory, cognitive, and stress-related performance. Studies are done in the laboratory, in the field, using distributed interactive environments, and using the technologies of virtual reality simulation The objective is to identify, describe and manage underlying human-system interface design factors critical to Army weapon systems and programs such as the 21st Century Land Warrior. From operator interface design guidance on systems as sophisticated as theater missile control stations, to field evaluations of modular sleeping bags and prototype infantry shelters, HRED works to ensure that soldier and system performance as well as soldier survivability issues are considered together in the design, testing and fielding of a product. In addition to feeding back to immediate product design efforts, results of HRED work are incorporated into design guidelines, human figure performance models and standards for future researchers and program developers.

Manpower and Personnel - ARL-HRED is at the forefront of simulation and modeling of operator

performance and workload issues, as well as in evaluating the effects of system redesign or crew reduction on personnel workload or staffing requirements. The primary mechanism is the HARDMAN III MANPRINT tool set, which is being used and improved by HRED. ARL-HRED is working to translate research results and models (such as modeling of the MI officer's tasks and cognitive processes) into design guidance for decision support systems for the future digitized battlefield.

Civil Engineering - In the area of operator performance analysis for the Product Manager, Heavy Assault Bridge (HAB).

Chemical Biological Defense - in terms of evaluating soldier performance on specific systems while using protective gear.

3.1 Location.

3.1.1 Geographic/Climatological Features: None.

3.1.2 Licenses and Permits. The following licenses and permits are currently held at the APG:

National Pollution Discharge Elimination System (NPDES) Permit: ARL /APG operates under the limitations of three NPDES permits issued by the State of Maryland. Two of the permits are for the waste water treatment plants and the limitations pertain to the entire post. The NPDES permits for the waste water plants restrict day to day operations, in that very few things are allowed down the sanitary sewer system.

Storm Water General Permit: The ARL/ APG site is required to comply with the National Pollution Discharge Elimination System (NPDES) Maryland General permit for Storm Water Discharges. ARL/APG has 18 permitted storm water facilities, 2 in HRED. Test firing projects, vehicle maintenance, and storage of scrap materials at these facilities are permitted because of the implementation of "Best Management Practices" (BMP's) that rectify the discrepancies produced and by a inspection program that maintains the BMP program.

Resource, Conservation and Recovery Act (RCRA) Hazardous Waste Storage Permit: APG holds a RCRA permit to properly house and dispose of hazardous waste at the Treatment, Storage and Disposal Facility (TSDF) located in Edgewood, MD. Waste generated by ARL@ APG operations is strictly monitored and stored & disposed of through this permitted facility.

Open Burning/Open Detonation (OB/OD) of ARL waste propellants, explosives and pyrotechnics (PEP) material is done at two sites, one at the Aberdeen area and one at the Edgewood area of APG. These operations are covered by a RCRA interim permit which has limits as to the amount of waste PEP that can be disposed of through this method.

Explosive Storage: Explosive storage is controlled and licensed by APG (host activity). As an R&D tenant, ARL/APG is only authorized "Service Storage" (limited to 4 hours of operation quantities) of ammunition and explosives. ARL/APG has 34 facilities currently licensed for storage of ammunition and explosives.

3.1.3 Environmental Constraints: There are no known environmental constraints to the current or enhanced mission scope, other than those described above dealing with permits and licenses. Any new "radioactive materials" missions would most likely require new NRC licenses and any other new operations would have to operate so that the parameters required by the various environmental permits may be maintained.

3.1.4 Special Support Infrastructure: In cases where larger weapons must be fired for performing impulse noise hearing loss studies, the CSTA ranges located about a mile away are used. CSTA armored and tactical vehicles are constantly used for quantifying and assessing the effects of noise on personnel. Significant additional costs would be incurred if these weapons, vehicles, and facilities were not available nearby. The monetary value of supporting facilities such as ranges and the associated firing personnel, armored vehicles, military systems, courses on which to drive vehicles, ammunition and weapon storage facilities is very high (millions of dollars) and would be difficult to estimate; also these are not services that could be contracted.

Additional facilities include two APG military airfields (Phillips and Wiede) with support staff and structures (e.g., for flight-related operator and maintenance evaluation support); and the massive water facilities due to APG's location on the Chesapeake Bay (e.g., for firing-over-water noise reduction studies).

Also available and utilized are the animal maintenance and research facilities at nearby Edgewood Arsenal (20 minutes' drive), and climate chambers at APG and Edgewood.

3.1.5 Proximity to Mission-Related Organizations:

CSF	Name	Type of Organization	Distance	Workyears Performed	Workyears Funded
Human Systems					

L-HRED has 17 field elements at TRADOC centers and AMC RDECs and Major Subordinate Commands (MSC). With these 17 field elements, ARL-HRED supports human engineering and MANPRINT needs of combat and materiel developers across **all product functions**, as well as direct human performance analysis and modeling support to the Army Battle Labs. Recent requests have been to expand out to more locations.

As described in sections 3.1.4 and 3.4, ARL-HRED depends heavily on local mission-related organizations. These include facilities used jointly with CSTA for unmanned ground vehicle indoor and outdoor courses and test firings, as well as the ammunition logistics facility. Without ready access, approximately 20 percent of the HRED remote driving program would be negatively affected, impacting our ability to conduct R&D critical to "keeping the soldier out of harm's way." The auditory research, making up approximately another 10 percent of our program, and jeopardizing our pending CRDA with General Motors on impulse noise reduction research (for their air bag program). These facilities are within 3 minutes of our APG organization (20 minutes for the Edgewood Area). Day/night, clear/adverse weather, etc. conditions all play a critical part in the ARL-HRED R&D mission, requiring full-time access to these facilities which are required to emulate the mission of the ground combatant.

Our modeling and simulation work, the only one worldwide dealing directly with the individual ground combatant, is carried out in conjunction with ARL-ACIS (advanced computing). The easy exchange of information and ideas provided by this proximity was at the heart of ARL's organizational planning. Up to 20 percent of our program, involving our most future-oriented elements, would be impacted without this collocation. The other ARL agency we work with is the Survivability and Lethality Analysis Directorate, with which HRED shared joint control of the Army DCSPER's MANPRINT soldier-survivability R&D program; area facilities by both Directorates as well as available at APG and Edgewood are not available elsewhere. rently, this will increase as the program matures.

ie University of Pennsylvania is some 90 minutes commute; the ARL-HRED Human Figure Performance Model program is run jointly with UPenn. Our WYs are approximately 4; a $300K per year "grant" to UPenn provides support for 8 graduate students (full time) and one faculty member (part time). Our vision program enlists 2 WYs from HRED, and 2 WYs from Morgan State, an HBCU.

3.2 Personnel.

3.2.1 Total Personnel:

Types of Personnel	Government		Number of Personnel	
	Civ	Mil	On-Site FFRDC	On-Site SETA
Technical	129	5	0	2
Management (Supv)	10	1	0	0
Other	64	8	0	3

3.2.2 Education: Civilian Only

Types of Degree/Diploma	Number of Personnel by Type of Position		
	Technical	Management (SUpv)	Other
h School or Less	0	0	49
ociates	0	0	6
Bachelor	51	4	8
Masters	47	1	0
Doctorate	31	5	1

3.2.3 Experience: Civilian Only

Type of Position	Years of Government and/or Military Service				
	Less than 3 years	3-10 years	11-15 years	16-20 years	More than 20 years
Technical	4	35	18	21	51
Management (Supv)	0	1	0	4	5
Total	4	36	18	25	56

ACTIVITY: ARL, ABERDEEN PROVING GROUND (APG), MD CSF: HUMAN SYSTEMS

.2.4 Accomplishments During FY91-93.

3.2.4.1 Patents Awarded/Patent Disclosures:

CSF	Disclosures	Awarded	Patent Titles
Human Systems	PA 5165137 Amrein, Bruce E. Nickel, Jeffrey D.	24 Nov 92	Head Support and Adjustable by Compound Turnbuckle
	PA 5057815 Smoot, Wayne Amrein, Bruce McCoy, Curtis Brucksch, Robert	15 Oct 91	Combat Vehicle Light Signaling System
	PA 5039829 Brucksch, Robert	13 Aug 91	Push-Pull Switch and Lock Therefor
	PA 5113779 Amrein, Bruce Mehnik, George McCoy, Curtis Brucksch, Robert	19 May 92	Flotation Device for a Combat Vehicle
	PA 5009252 Faughn, Jim	23 Apr 91	Air Distribution Connector Valve
Total	5		

3.2.4.2 Papers in Peer Reviewed Journals:

Common Support Function	Number Published	Paper Titles
Human Systems	14	Listed below

1. "Role of Artificial Intelligence (AI) in the US Army Human Engineering Laboratory" The AI Exchange, Jan 91
2. "How Much Area of Coverage is Needed on a Counter-Air Situation Awareness Display for Army Aviation?" MANPRINT Bulletin, Jan 91
3. "A Comparison of Information Display Formats for Target Acquisition Using Pilot Performance and Subjective Workload Measures" Human Factors Bulletin, Feb 91
4. "An Intelligent Pilot Vehicle Interface for the Army Aviation Counter-Air Helicopter Cockpit" MANPRINT Bulletin, Mar 91
5. "Effects of Speech Intelligibility Level on Concurrent Visual Task Performance" Journal of the Human Factors Society, May 91
6. "Spatial Ability and Land navigation Under Degraded Visual Conditions" Journal of the Human Factors Society, Nov 91
7. "Intelligent Interfaces" The AI Exchange, Dec 91

ACTIVITY: ARL, ABERDEEN PROVING GROUND (APG), MD CSF: HUMAN SYSTEMS

8. "Navigation in Off-Road Environments" Environment and Behavior, Sep 91
9. "Interaction of Image Quality and Target Size on Visual Performance" Journal of the Human Factors Society, Feb 92
10. "Program Cluster - An Identification of Fixation Cluster Characteristics" Behavior Research Methods, Instruments and Computers, Apr 92
11. "An Expert System for Human Factors Engineers" The AI Exchange, Apr 92
12. "Knowledge-Based Logistics Planning" The AI Exchange, Apr 92
13. "Solving Problems Does Not Have to Cause Problems" Army RD&A Bulletin, Jul 92
14. "Detection of Target Signal in Localized Versus Non-localized Noise" Journal of the Acoustical Society of America, Jan 93

3.3 Workload.

3.3.1 FY93 Workload.

3.3.1.1 Work Year and Lifecycle:

"Lab"	Fiscal Year 1993 Actual			
	Civilian	Military	FFRDC	SETA
Science & Technology	203	14	0	5
Engineering Development	0	0	0	0
In-Service Engineering	0	0	0	0

3.3.1.2 Engineering Development by ACAT: None.
3.3.1.3 In-Service Engineering: None.

3.3.2 Projected Funding.
3.3.2.1 Direct Funding ($K): RDTE

Common Support Function	FY94	FY95	FY96	FY97
Human Systems	18,143	16,769	16,989	17,995

3.3.2.2 Other Obligation Authority

Common Support Function	FY94	FY95	FY96	FY97
Human Systems				
Reimbursable	4,638	4,174	3,757	3,001
Direct Cite	3,400	3,060	TBD	TBD

ACTIVITY: ARL, ABERDEEN PROVING GROUND (APG), MD CSF: HUMAN SYSTEMS

3.4 Facilities and Equipment: The Army Research Laboratory's (ARL) Human Research & Engineering Directorate (HRED) has several robotic technology base research programs which are focused on researching combat vehicle teleoperation, to support the Office of the Secretary of Defense (OSD) Unmanned Ground Vehicle (UGV) Program. OSD's UGV program is focused on demonstrating tele-assisted vehicles and systems to evaluate mission capabilities and technology enhancements required for tactical UGV operation. HRED's UGV program is aimed at defining and evaluating critical Man Machine Interface (MMI) issues related to teleoperation of unmanned platforms.

HRED has developed an in-house research effort which focuses on validating the operator interface requirements for UGV operation and low data-rate imagery requirements for remote operations. HRED's efforts are being coordinated within ARL and the Combat Systems Test Activity (CSTA), APG, to integrate four robotic combat vehicles.

In 1989 CSTA was designated as the Army Center for UGV testing. HRED and CSTA have undertaken an aggressive program to identify and fulfill the technical testing needs of UGV technical base researchers and developers. Efforts to date include the joint development of the Indoor Unmanned Ground Vehicle Test Facility and the Outdoor UGV Test Area.

This joint development eliminates duplication of facilities. It provides unique and common facilities that allow safe operation of unproved unmanned ground vehicles. The facilities also provide a robust data collection and instrumentation capability to evaluate UGV systems and components. This data collection capability is both critical and common to support both CSTA's technical testing capability and HRED's basic and applied human factors research of man-machine interfaces for unmanned vehicle control.

CSF: Human Systems

Major Facility or Equipment Description	Unique to: DOD	Federal Gov't	U.S.	Replacement Cost ($K)
Indoor Unmanned Ground Vehicle Test Facility				4,500
Outdoor UGV Test Area				
Ammunition Logistic Facility	X			7,150
Acoustic Facilities				
Vision Facilities				
Hostile Environment Simulator	X			1,205
Small Arms Pop-Up Target Facility (M Range)				10,000
Mobility-Portability Obstacle Course (KD Range)	X			

Detailed descriptions:

Indoor Unmanned Ground Vehicle Test Facility. 4,500
See attached photos.

A 35,000 sq ft UGV test area with a 2400 sq ft structure housing a laboratory, data acquisition office, vehicle control and conference areas. It is currently configured as an instrumented serpentine course to support HRED research studies. The 9' wide black macadam roadway is approximately 1/4 mile long. The area surrounding the road is painted a lighter shade to define path boundaries. Driving performance on the straight-aways, serpentine and obstacle-avoidance segments is scored automatically, and summary statistics are available after each run. Performance data include vehicle speed and accuracy, which is the amount of deviation from the centerline of the roadway. Data that pertain to deviations from the centerline are collected

within 1 to 2 inches of accuracy at a rate of 60 times a second. Future plans include improvements to video transmission capabilities, a ventilation and climatic control system. The replacement cost of the indoor UGV test facility approaches $4.5M, which includes the building, test tract, instrumentation, and support equipment.

Estimated use for the past year was about 70% ARL-HRED/Human Systems CSF and 30% CSTA/Ground Vehicle CSF, but this could vary in the future.

Outdoor UGV Test Area. See attached photos.
A 14-acre tract of relatively level terrain contains a 12' wide gravel roadway that tracts a 1-mile stretch of jersey barriers that surround the course. The interior grassland provides a versatile environment capable of being structured to assess the many diverse and complex issues associated with robotic system design and performance. Test emphasis is on initial safety evaluation and repeatable performance measurements. Improvements include a GPS position location system, a closed loop test track, an EOD court, a standardized obstacle course with sand, mud and fording options and advanced data acquisition and analysis systems.

ARL-HRED/Human Systems CSF used this facility about 85% of the time last fiscal year; CSTA utilized the facility approximately 15% for test and evaluation of ground vehicles.

Ammunition Logistic Facility, (See attached photo.)

X 7,150

LFAST Test Site, Edgewood Area, APG. The Ammunition Logistic Facility is representative of an ammunition age point (ASP) designed to provide HRED with the capability to conduct field trials, using soldiers. The facility provides a remote site, with sufficient area in which human performance data can be gathered on ammunition handling. This data is collected using current and future material handling military equipment (MHE), ammunition configurations, and user doctrine and procedures. The facility consists of a mobile trailer (ML-E22), garage (E1041), portable storage shelter, and inert ammunition @450 short tons. This facility is unique to DOD in that it provides HRED with the capability to conduct current or future ammunition handling equipment trials, using soldiers in an area that provides for safety and isolation, yet is close to all required major support facilities to include hospitals. The replacement costs for this facility currently would be inexpensive in that the most important feature is the 100 or so acres of ground that is located close to all required support activities.

The building that houses acoustics and vision facilities was completed in 1984. Replacement costs are estimated at:

Building	$2,500,000
Chambers & special facilities	2,000,000
Acoustical instrumentation	1,500,000
Visual instrumentation	800,000
Computer equipment	350,000

Human Systems CSF utilization at 100%.

Acoustic Facilities. Consists of specially treated sound attenuating and absorbing walls which enclose a t chamber, a reverberant chamber, and an anechoic chamber. This acoustic area was designed to have very low ambient noise levels by surrounding it with a specially treated

rridor, and completely surrounding this corridor by offices which all have treated walls, ceilings, and floors. This facility is used to conduct studies in acoustics such as: localization, speech intelligibility, hearing loss, detection, etc. It contains state of the art instrumentation to generate, measure, and analyze all types of steady state, transient, and impulse noise. Each of the three chambers has special wiring leading to an instrumentation console. This room houses about $1M of acoustical instrumentation. Isolation transformers protect the instrumentation and computers from power surges.

There is a smaller acoustical facility which encloses a quietchamber and a double walled audiometric chamber. This lab contains about $250K of instrumentation.

Two specially equipped ranges are used in support of the acoustics work. The first is the detection range located at Spesutie Island. This is an 800 meter long grass covered area which has been landscaped to be perfectly flat. It is located in an area of APG which is sufficiently quiet to meetthe requirements for conducting auditory and sensor detection studies of noise sources. The range is located adjacent to a complete meteorological facility which is required when conducting propagation studies.

The second is the HRED Bullet Trap Range. This range is about 100' long. It has a large berm to keep projectiles from going outside of the range and a steel lined trap to contain the projectile once it impacts. The design and safety implications required to establish this facility were considerable. This instrumented range is used to conductresearch dealing with the effects of impulse noise upon hearing. Typical research would study the effects of silencer and other muzzle devices, and would study the effects of impulse noise upon animal models. Associated with the cost of this range are the facilities for storing weapons and ammunition. These ilities meet all the safety and security requirements, and are located nearby. Another consideration of the et Trap Range is the cost of housing and the accreditation process associated with the animal subjects which are used for hearing experiments. Presently, we have an agreement with veterinary personnel at Edgewood who maintain the animal colony for HRED in accordance with the requirements of the American Association for the Accreditation of Laboratory Animal Care.

In those cases where larger weapons must be fired for performing impulse noise hearing loss studies, the CSTA ranges located about a mile away are used. CSTA armored and tactical vehicles are constantly used for quantifying and assessing the effects of noise on personnel. Significant additional costs would be incurred if these weapons, vehicles, and facilities were not available nearby. The monetary value of supporting facilities such as ranges and the associated firing personnel, armored vehicles, military systems, courses on which to drive vehicles, ammunition and weapon storage facilities is very high (millions of dollars) and would be difficult to estimate; also these are not services that could be contracted.

Human Systems CSF utilization at 100%.

Vision Facilities. These consists of specially treated sound attenuating and absorbing walls which enclose two quiet chambers. This vision lab area was designed to have very low ambient noise levels by having a specially treated corridor with treated walls, ceilings, and floors. Each of the two chambers has special wiring leading to patch panels that support a variety of instrumentation requirements. Each of the two chambers is electrically shielded for neurophysiological recordings. This room houses about $245K of visual instrumentation. Isolation transformers protect the instrumentation from power surges.

An image processing lab houses a large variety of instruments, including computers, video cameras and lenses, resolution monitors, time lapse recorders, and a large terrain board. The purpose of this facility is to develop appropriate visual stimuli (black and white, color, still or moving video) for various research

rograms.

A separate room contains two large experimental chambers which are sound attenuated and electrically shielded providing a special environment required for low level (micro volt) bioelectric recordings. Both chambers have dual glass windows to allow visual stimuli to be optically projected into the rooms. There is also a control room containing computers, electronics, and optical equipment and a subject room for applying electrodes and administering various visual, auditory, and psychological tests. All four rooms are supplied with"clean" power from two isolation transformers and an isolated ground system. In addition, each room has numerous electrical connectors to allow electrical inputs and outputs without disturbing the electricaland acoustical shielding in the walls.

Human Systems CSF utilization at 100%.

Hostile Environment Simulator. (HES) See attached photo. X 1,205

This facility is a high fidelity, multi-media audio and video reproduction facility which is capable of reproducing high intensity sounds (up to 150 dBA) typically found on the battlefield (specifically the sounds and feel of incoming artillery shells). This facility consists of a 2500 sq ft single wall acoustical chamber, with a 22' interior height. Adjacent to the chamber is a two level air conditioned control room containing 1500 sq ft of floor space. Housed in the control room are the audio amplification system, video projector room, experiment control station and supporting computer systems. The entire research ility is air conditioned. The HES audio system consists of three front channels, which each generate ,000watts (RMS) of power, and a 2400 watt (RMS) surround channel. Approximately 75% of the audio power is in the frequency range below 160 Hertz. The frequency range of the system is from 10 Hz to 15 kHz. Typical ambient battlefield sounds and blast signatures from various weapons systems are generated from digitized computer files either in pre-arranged "canned" scenarios or under subject control. The video system consists of a 300 inch diagonal screen and a high brightness General Electric Talaria video projection with resolution of up to 1024 x 1268 pixels. Capability exists to synchronize the audio and video source material (from many source formats) to provide a true multi-media environment. This HES is a unique facility within the Army. It is the only known facility with the capability to produce sound pressure levels of this magnitude within the confines of an acoustical chamber. This facility was completed in FY94. The replacement cost are:

Building	$ 375,000
Acoustical Chamber	300,000
Audio Equipment	150,000
Video Equipment	200,000
Computer Equipment	150,000
Utilities & Commo	30,000

Human Systems CSF utilization at 100%.

Small Arms Pop-Up Target Facility. (M Range). See attached photo. 10,000

This is a state-of-the-art small arms firing range capable of accommodating weapons firing projectiles from n to .50 caliber, including the Army's 9mm pistol, .45 cal pistol, M14 and M16 rifle, and the M60 ...achine-gun. This range contains a total of 160 man-sized targets at ranges of 10m, 25m, 75m, 100m,

50m, 200m, 250m, 300m, 400m, 500m, and 550m. The range is configured into 4 lanes, each 50m wide. Each lane contains 5 targets each at 10m and 25m, plus 3 targets each at each range from 50m to 550m, for a total of 40 targets per lane. The range may be operated as 4 independent lanes or as one consolidated range with one firing point. All pop-up targets are pneumatically operated by computer control from an elevated control point located behind the firing berm. Pneumatic pressure is obtained from a pair of 15HP rotary screw air compressors, air dryers, and a 250 gallon air received. All air supply pipes, electrical lines, and control cables are buried 36 inches below ground. There are over 15 miles of buried control cable and over 2 miles of buried air piping on the range. Computer control is provided by a Digital Equipment Company PDP-11 mini-computer that monitors the status of all targets, raises and lowers the targets on que, records all shots and hits and provides summary printouts of all activity on the range. Hits are recorded on a unique electrically powered target silhouette that generates a momentary short-circuit when a metallic projectile passes through the target. This method of detecting hits is a vast improvement over the standard impact type of hit detection which could be fooled by flying debris. The range occupies over 28 acres of actual space, but obviouslyrequires adequate space to safely accommodate the worst-case trajectory of any projectile fired down range. Support structures on the range include an enclosed subject holding area and storage sheds. This facility was completed in 1986, but has recently been upgraded. It is considered to be one of the Army's premier R&D firing ranges. The replacement cost, excluding land, is estimated to be $10,000,000. An environmental assessment is required to construct this facility. Environmental issues include ground cover disturbance during construction, lead contamination from spent ammunition, and noise abatement procedures. Adequate facilities for secure storage of weapons andammunition, plus range control services are required.

Human Systems CSF utilization at 100%.

bility-Portability Obstacle Course (KD Range). X
See attaced photo.

This obstacle course is a state-of-the-art Army standard for measuring the effects of soldier load on mobility and physiological functions. The course also provides distribution and method of attachment interaction among materiel the soldier carries, and durability studies for fielded and developmental items. The course consists of hard surfaced and wooded march areas and obstacles that require the soldier to run, jump, crawl, or climb on various instrumented obstacles that simulate tasks typically accomplished by combat soldiers. Objective course data, such as time and error rates; subjective data, such as soldier opinions and comments are augmented by real-time physiological data. Features of the course include: Two lanes, each with 16 instrumented obstacles; interactive system software for information identification, storage and retrieval; an integrated system status board for real-time trial status; data collection software to compile individual obstacle time, intra-obstacle time, and total elapsed time. The obstacle course contains a buried data collection system that transmits all event data to the elevated control trailer which contains the computerized control system and communications systems. Additionally, the elevated trailer contains the radio base station and data analysis hardware for a bio-physical telemetry system for monitoring soldier heart rate, skin and core temperature with projected growth to include sweat rate and "G" loading. The obstacle course occupies over 15 acres of land, with over 5 kilometers of trails in close proximity through adjacent woods. There are facilities on site to feed and house up to a platoon of soldiers. The facility was completed in the late 1970s, but was completely refurbished during the late 1980s. The replacement cost fo all obstacles, trailers and instrumentation would be in excess of $1,500,000. This does not include the cost of land. No permits should be required to operate this facility, however an environmental assessment would be required prior to any constructionor excavation as direct .

uman Systems CSF utilization at 100%.

ACTIVITY: ARL, ABERDEEN PROVING GROUND (APG), MD CSF: HUMAN SYSTEMS

3.5 Expansion Potential.

3.5.1 Laboratory Facilities:

Common Support Function	Facility or Equipment Description	Type of Space	Space Capacity (KSF) Current	Used	Excess
Human Systems	Facilities	Lab	31,914	31,914	0
		Admin	71,565	71,565	0
		Shop	13,875	13,875	0
		Storage	4,903	4,903	0
		ADP	2,286	2,286	0
		Range Fac	655	655	0
		Magazine	135	135	0

Equipment (Over $100K)	($K)	
Symbolics 3675 Computer	127	
Loader/Transporter, HAWK	275	
Manipulator, Odetics	250	
Robotics	100	
Computer, Human Performance	239	
Computer, Image Generation	150	
Video System for R&D	115	
Mobile Test Facility	131	
Transport Truck for R&D	122	
Virtual Reality Lab, FY94-95	1,500	(contracted)

3.5.1.1 Capacity of activity to absorb similar workyears categorized in the same common support function: ARL-HRED as a tenant at APG has no existing excess capacity. However, with minor modifications and host activity agreement, up to 15 percent additional similar workyears could be absorbed. This would require minor modifications, such as re-designing existing laboratory and administrative space and boosting telephone lines.

With major modification and host activity agreement, we could absorb up to another 50 percent of similar workyears. This would entail either building an addition to the main facility (Bldg 459, just over 60,000 sq ft over the existing rear parking lot, or addition of a fourth floor. The estimated cost of this 30,426 sq ft laboratory space addition would be approximately $2.6M, according to the Corps of Engineers Means Guide, 1994; equipment, etc., would round the cost upward.

With either of the above absorption options, proper scheduling would allow existing ranges (remote driving, NATO-standard "obstacle" course, firing range) and laboratory facilities (e.g., simulators) to suffice, and more use could be made of other locally available ranges and facilities around APG.

Coupled with both open range and hilly, wooded terrain features, the APG site in aggregate (with airfields and other facilties) would serve as an ideal Tri-Service (or broader) venue for military and other high-technology Human Systems research and development efforts.

3.5.1.2 If capacity to absorb additional workyears, how many can be supported: With slight modifications, 12-15 workyears could be absorbed. With major modifications, up to 55 workyears could be absorbed.

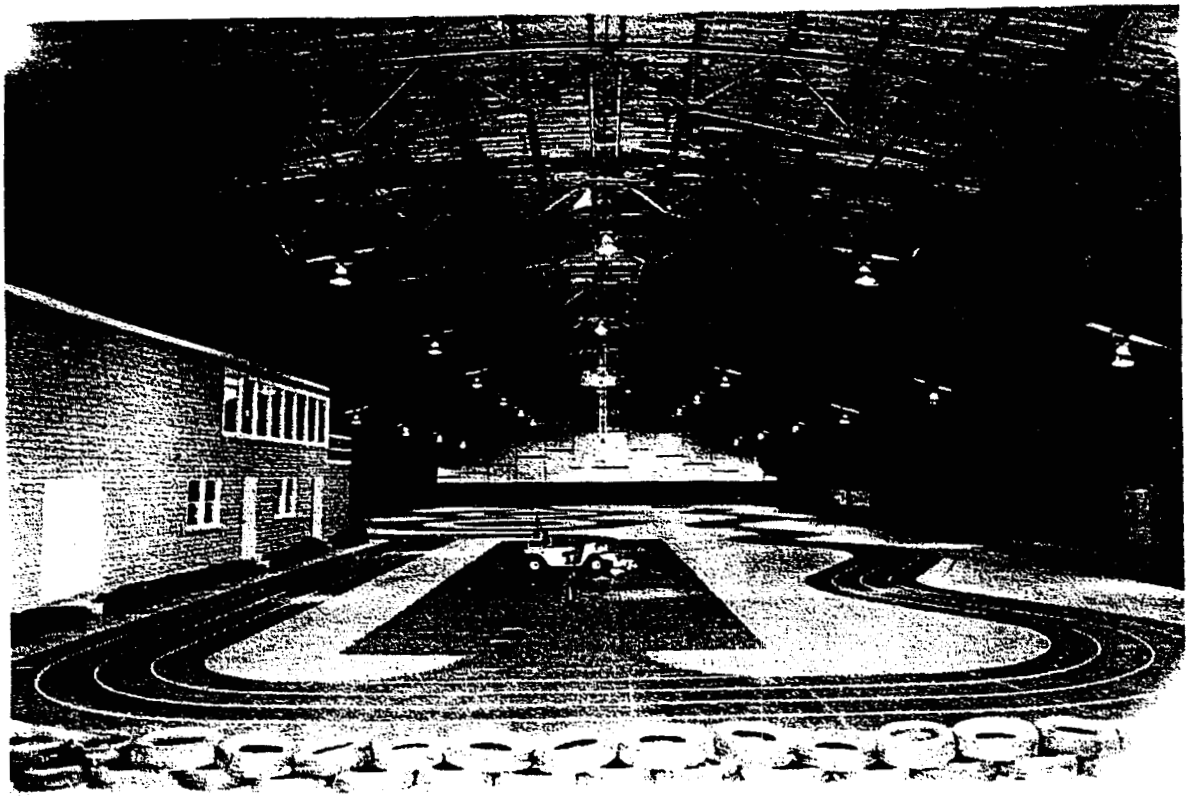
3.5.1.3 Impact of military construction program or other alteration projects programmed in FY95 PBS: None.

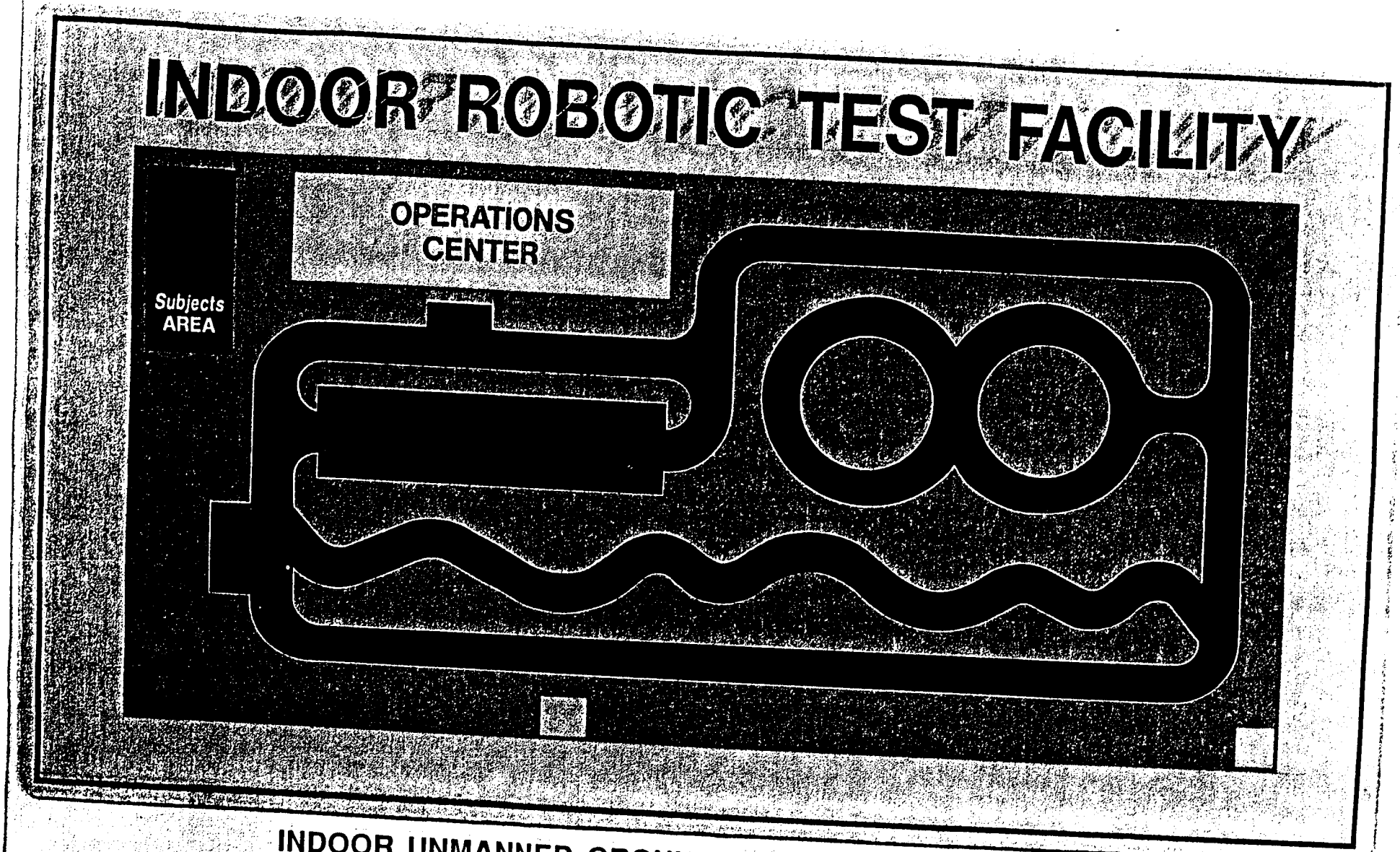
3.5.2 Land use: APG has 1150 buildable acres.

3.5.3 Utilities: Utilities for increased utilization at ARL-HRED should be addressed by the host installation in concert with other master planning.

1. **Indoor Unmanned Ground Vehicle Test Facility.** Building 456, APG. - A 35,000 square foot UGV test area with a 2400 square foot structure housing a laboratory, data acquisition office, vehicle control and conference areas. It is currently configured as an instrumented serpentine course to support HRED research studies. The 9 feet wide black macadam roadway is approximately 1/4 mile long. The area surrounding the road is painted a lighter shade to define path boundaries. Driving performance on the straight-aways, serpentine and obstacle-avoidance segments is scored automatically, and summary statistics are available after each run. Performance data include vehicle speed and accuracy, which is the amount of deviation from the centerline of the roadway. Data that pertain to deviations from the centerline are collected within 1 to 2 inches of accuracy at a rate of 60 times a second. Future plans include improvements to video transmission capabilities, a ventilation and climatic control system.

The replacement cost of the indoor UGV test facility approaches $4.5M, which include the building, test track, instrumentation, and support equipment. See Photo.





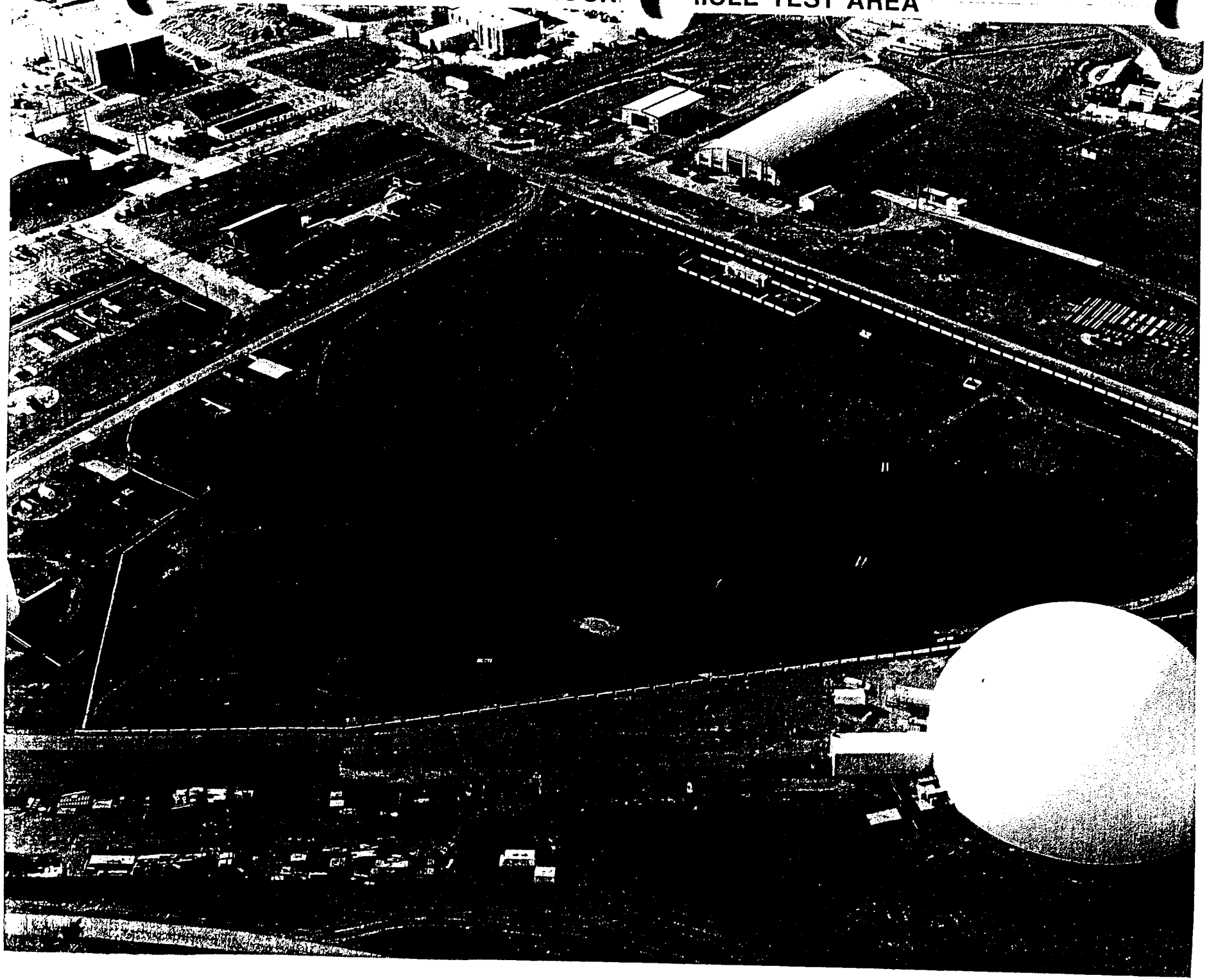
INDOOR UNMANNED GROUND VEHICLE TEST FACILITY

FOR OFFICIAL

OUTDOOR UNMANNED GROUND VEHICLE TEST AREA

FOR OFFICIAL USE ONLY -Close Hold

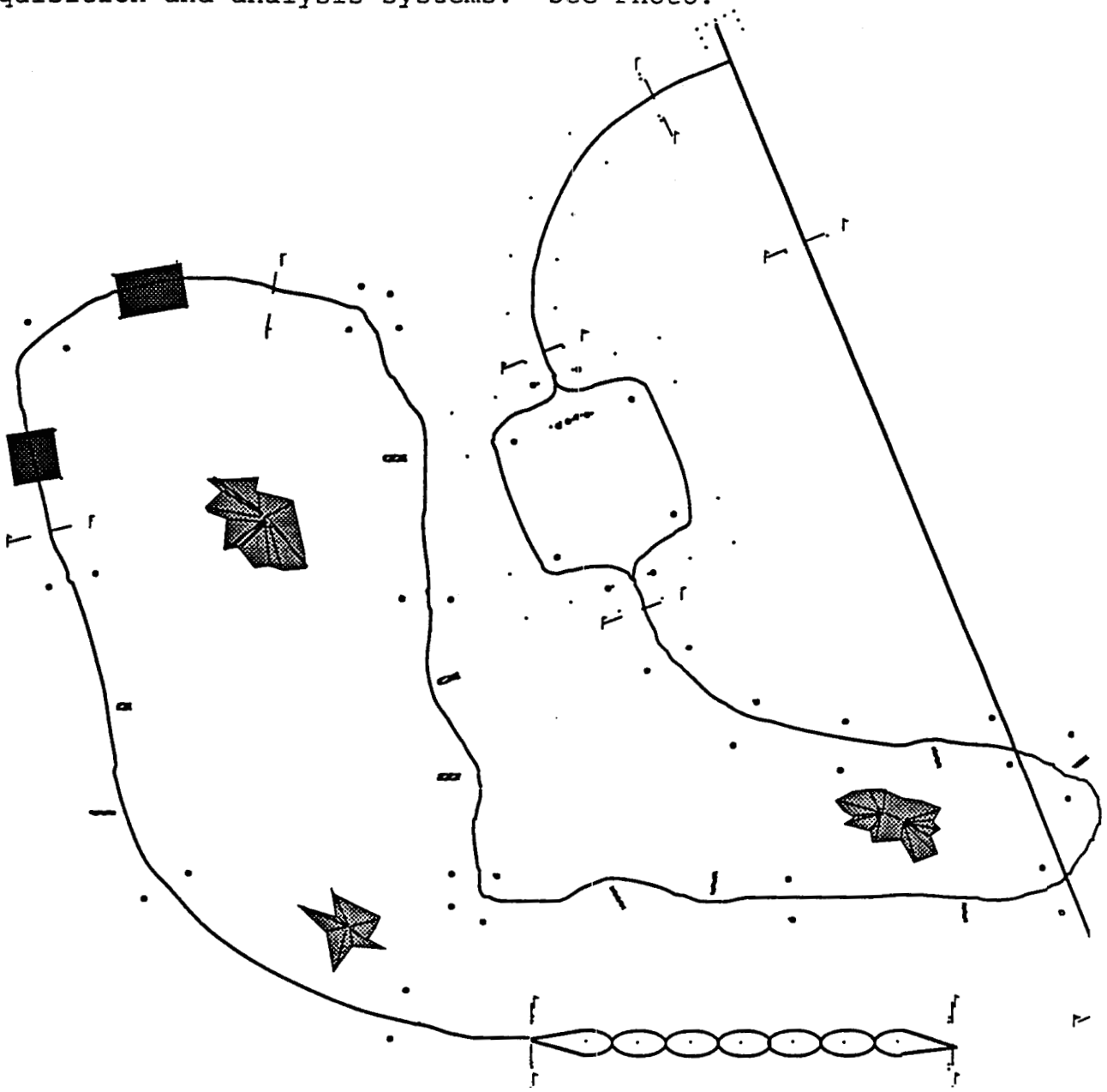
OUTDOOR UNMANNED GROUN HICLE TEST AREA



FOR OFFICIAL USE ONLY

-Close Hold

2. **Outdoor UGV Test Area** - A 14 acre tract of relatively level terrain contains a 12-foot-wide gravel roadway that tracts a 1-mile stretch of jersey barriers that surround the course. The interior grassland provides a versatile environment capable of being structured to assess the many diverse and complex issues associated with robotic system design and performance. Test emphasis is on initial safety evaluation and repeatable performance measurements. Improvements include a GPS position location system, a closed loop test track, an EOD court, a standardized obstacle course with sand, mud and fording options and advanced data acquisition and analysis systems. See Photo.



Outdoor Test Area, with test course routes shown.

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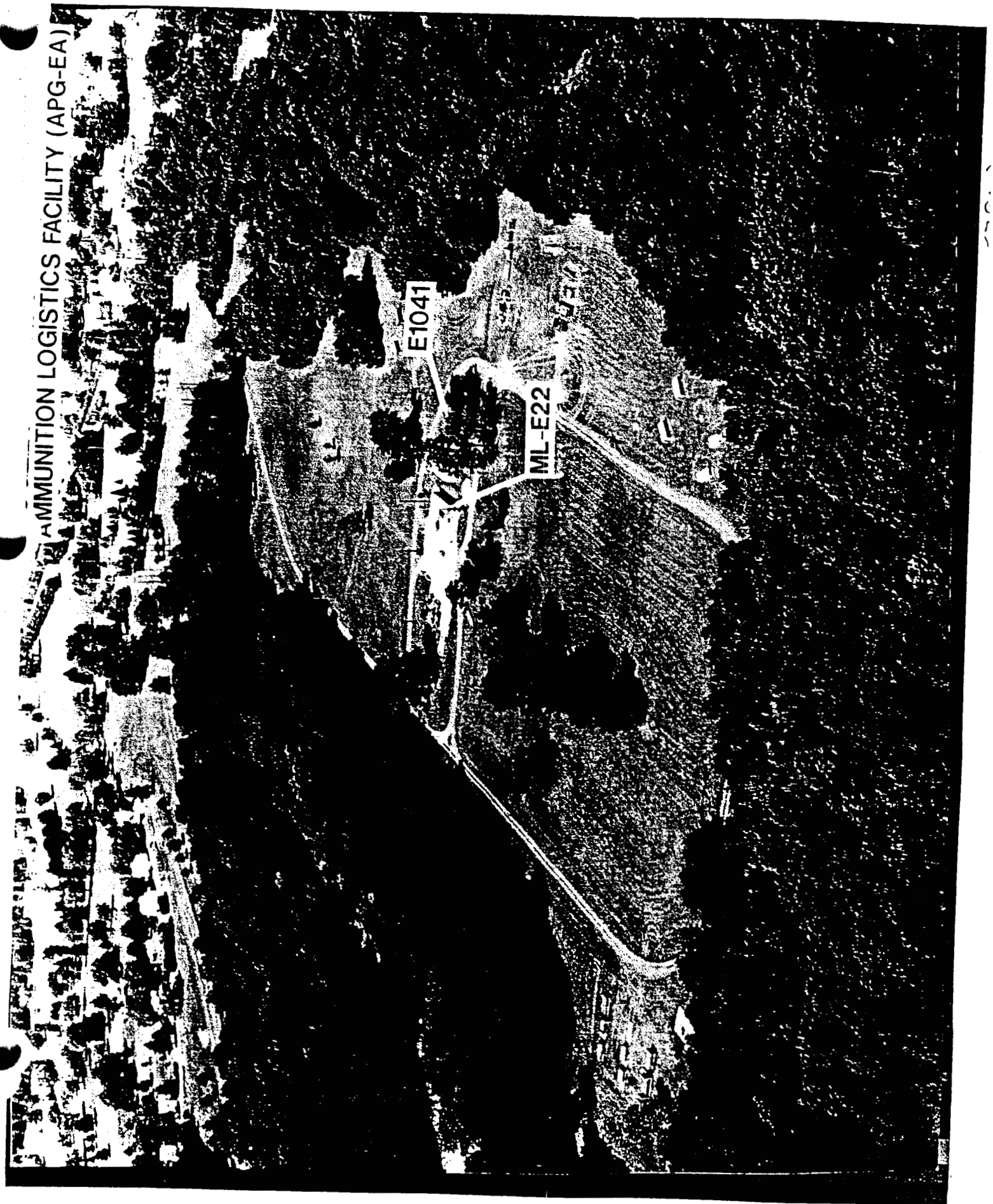
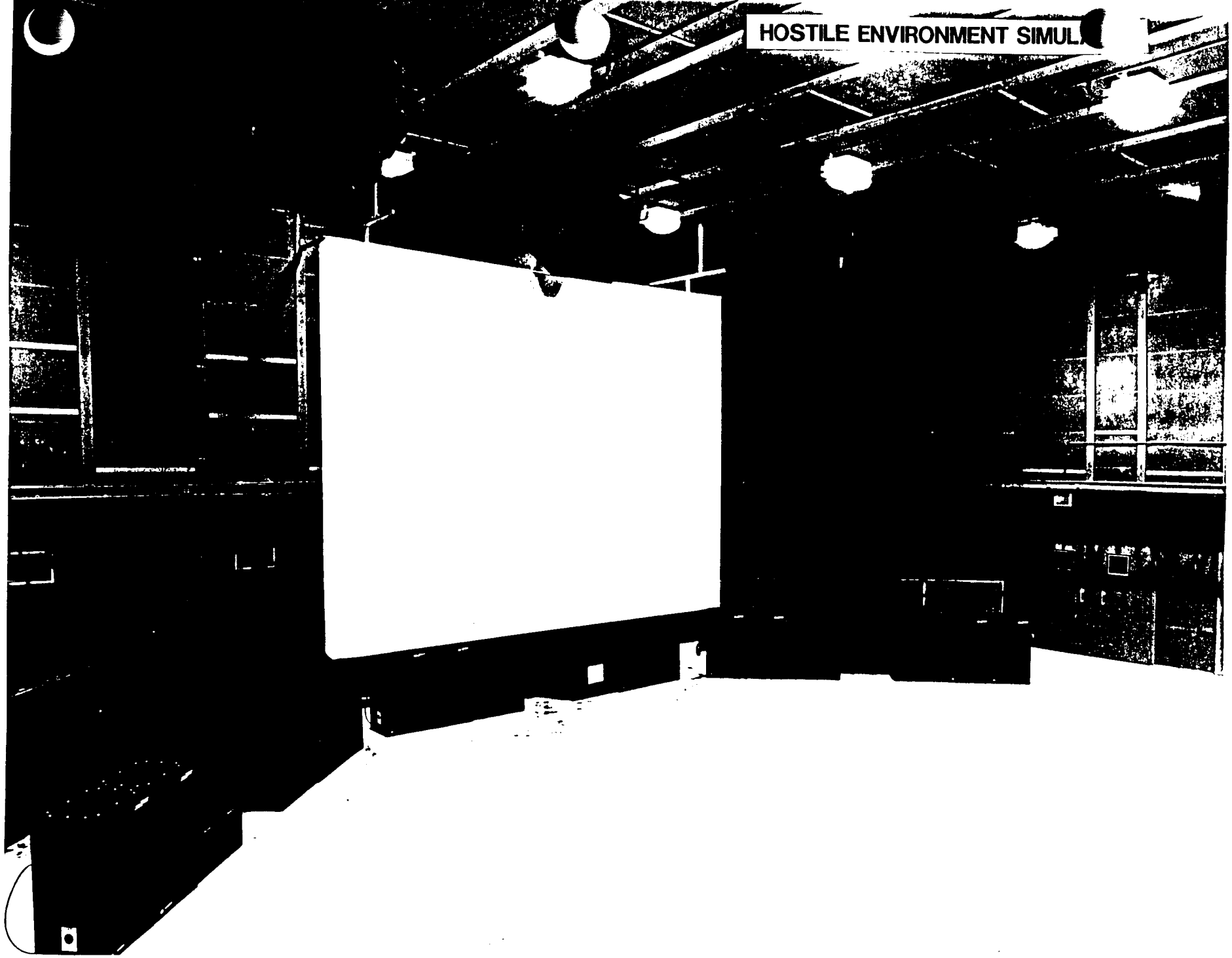
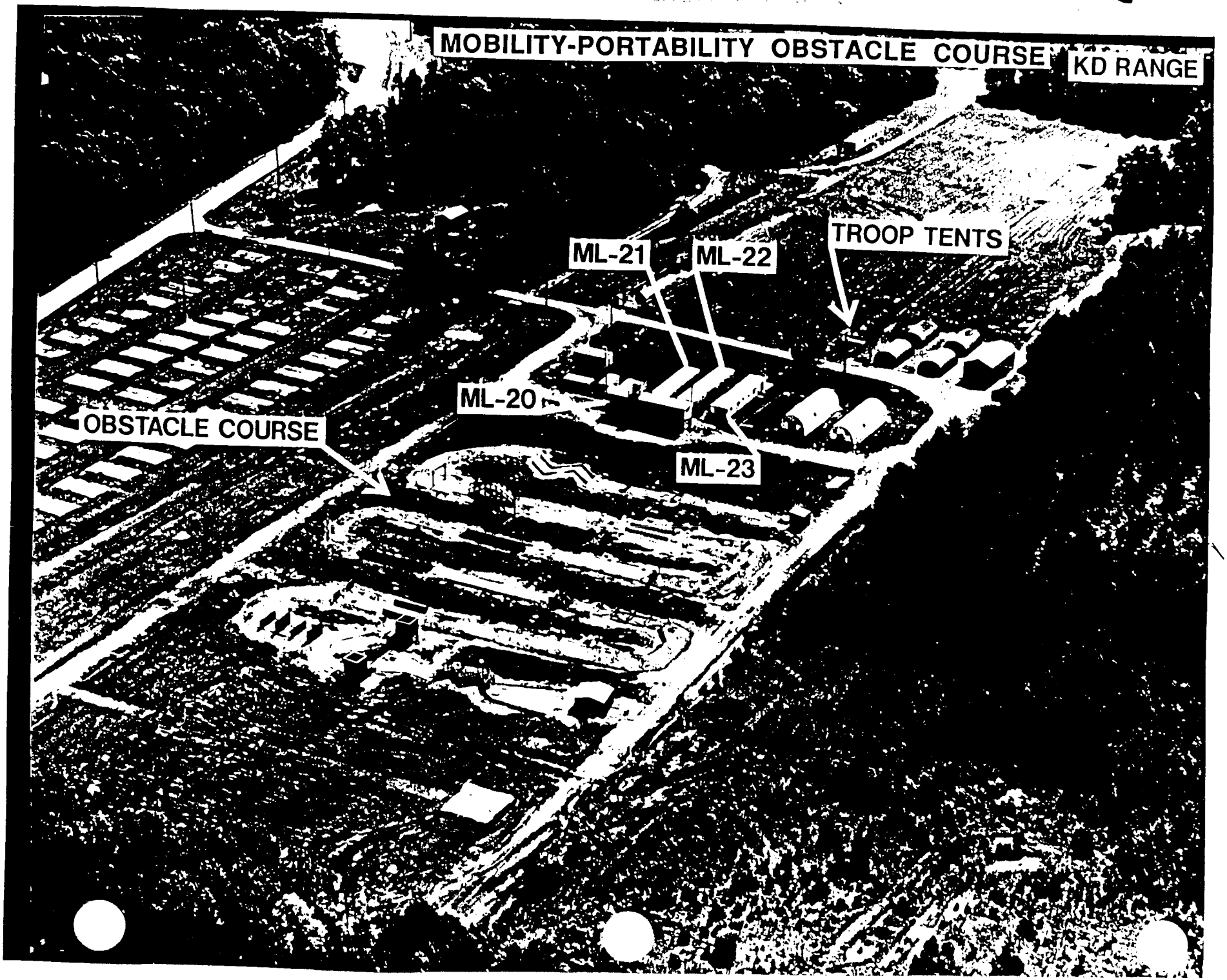
INDOOR UNMANNED GROUND VEHICLE TEST FACILITY

5314-1

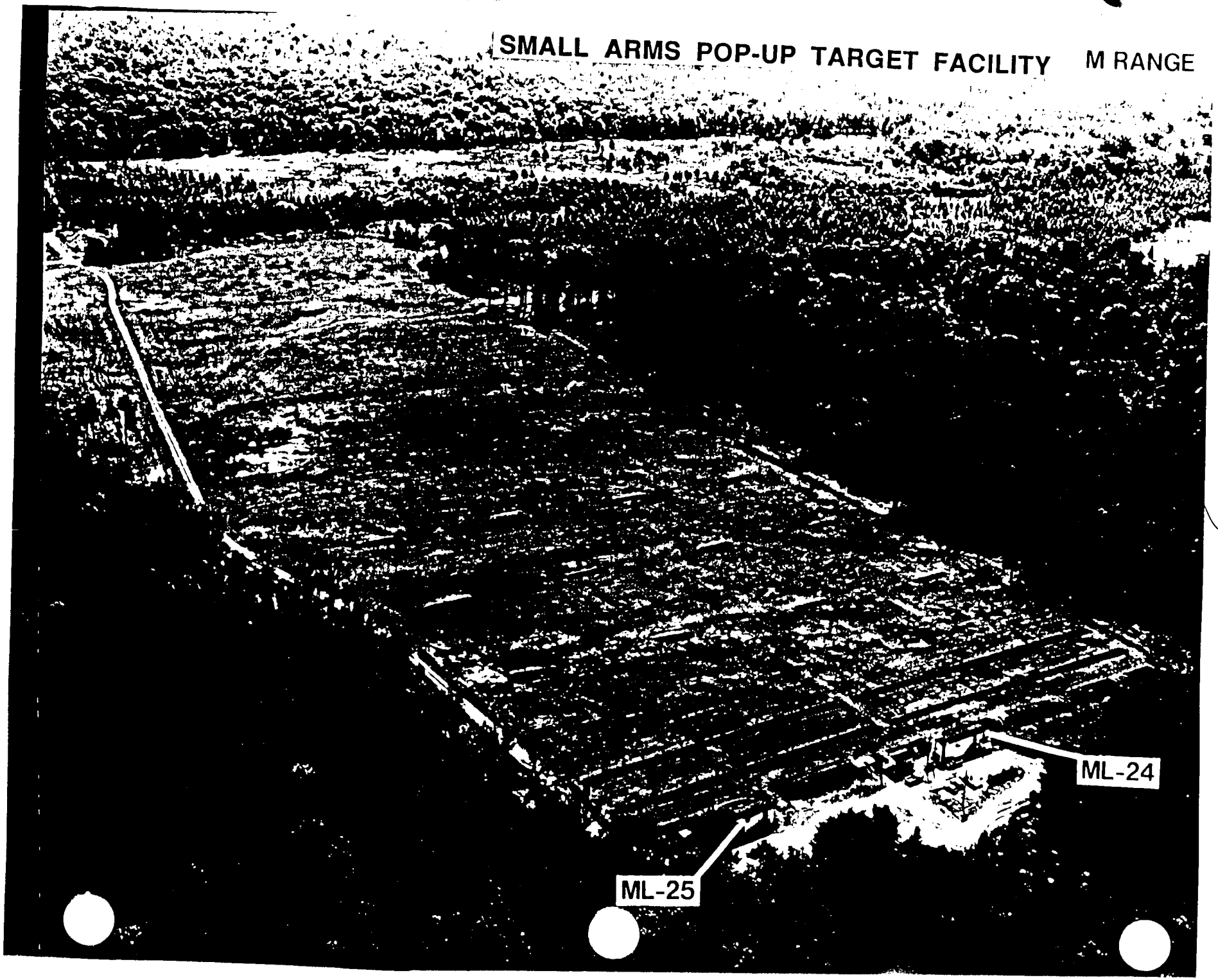
FOR OFFICIAL USE ONLY -CLOSE HOLD




HOSTILE ENVIRONMENT SIMUL


MOBILITY-PORTABILITY OBSTACLE COURSE
KD RANGE
TROOP TENTS
ML-21
ML-22
ML-20
OBSTACLE COURSE
ML-23

SMALL ARMS POP-UP TARGET FACILITY M RANGE



ction III: Capability of Activities to Perform Common Support Functions

3.0 Mission: The ARL at APG has the ballistics research and exploratory development mission for the U.S. Army -- both the offensive (under CSF Weapons - Guns and Ammo) and the defensive (under CSF Ground Vehicles - Tracked) aspects. Both efforts are executed in the Weapons Technology Directorate and make up the major thrust of the directorate. The Weapons - Guns and Ammo functional efforts in 6.1 (basic research) and 6.2 (exploratory development) areas are well coordinated with the Armaments Research and Development and Engineering Center (ARDEC) and PMs located at Picatinny Arsenal, NJ; the Ground Vehicles - Tracked efforts are coordinated with the Tank and Automotive RDEC and PMs in Warren, MI. This coordination insures a smooth transition of maturing technology from basic and applied research, through exploratory and advanced development, and finally into engineering and manufacturing development. This relationship is further cemented using Technology Planning Annexes in which agreements between the tech directors of all the RDECs and the ARL Director are signed pledging that a full 50% of the mission efforts of ARL are dedicated to projects and studies considered of major import to the RDEC scientists and engineers. In addition ARDEC and ARL representatives actively participate in the RELIANCE panel on Conventional Air/Surface Weaponry with their Navy and Air Force counterparts. One of the agreements coming out of the RELIANCE efforts was that the Army would be the only DoD component that would pursue basic and exploratory development in ballistics and guns. Current efforts include research liquid propellants, electric guns and active/reactive armors.

o Protection against Ballistic Threats
- Passive Armor - monolithic metallic defense against long rod penetrators and shaped charges; spaced armors; novel uses of composites and ceramics
- Reactive Armor - explosively or electromagnetically driven
- Synergistic Combinations of Passive and Reactive
- Active Armor - sensing threat, determining response, cueing a device, launching a deterrent, minimizing or defeating the threat

o Evaluation of Performance
- determining warfighting potential (lethality and survivability) of tracked vehicles in reality-based simulations of battlefield scenarios

Interconnectivity with other common support functions:
- Advanced Materials on new/novel materials for armor applications
- Weapons-Guns & Ammo on realistic threats to tracked vehicles
- Air Vehicles on lightweight armor and protection schemes

3.1 Location.

3.1.1 Geographic/Climatological Features: Because of Spesutie Island and the Chesapeake Bay, the APG site has access to large tracts of empty land and open water/marshes. This allows munition testing of large caliber weapons and large outdoor experiments involving propellants, explosives and nuclear weapons effects. The year-round temperate climate makes for favorable conditions for ballistic/NWE testing.

3.1.2 Licenses & Permits. The following licenses and permits are currently held at the APG:

National Pollution Discharge Elimination System (NPDES) Permit: ARL/APG operates under the limitations of three NPDES permits issued by the State of Maryland. Two of the permits are for the waste water treatment plants and the limitations pertain to the entire post. The NPDES permits for the waste water plants restrict all day to day operations, in that very few things are allowed down the sanitary sewer system. The third NPDES permit is specific to various operations. Weapons Technology Directorate has three buildings as part of this permit.

orm Water General Permit: The ARL/ APG site is required to comply with the National Pollution Discharge Elimination System (NPDES) Maryland General permit for Storm Water Discharges. ARL/APG has 18 permitted storm water facilities, 9 in WTD. Test firing projects, vehicle maintenance, and storage of scrap materials at these facilities are permitted because of the implementation of "Best Management Practices" (BMP's) that rectify the discrepancies produced and by a inspection program that maintains the BMP program.

Resource, Conservation and Recovery Act (RCRA) Hazardous Waste Storage Permit: APG holds a RCRA permit to properly house and dispose of hazardous waste at the Treatment, Storage and Disposal Facility (TSDF) located in Edgewood, MD. Waste generated by ARL/APG operations is strictly monitored and stored & disposed of through this permitted facility.

Open Burning/Open Detonation (OB/OD) of ARL waste propellants, explosives and pyrotechnics (PEP) material is done at two sites, one at the Aberdeen area and one at the Edgewood area of APG. These operations are covered by a RCRA interim permit which has limits as to the amount of waste PEP that can be disposed of through this method.

Firing into the Chesapeake Bay.

Explosive Storage.

Health Physics.

3.1.3 Environmental Constraints:

1. Resource Conservation and Recovery Act - Hazardous Waste. The current interim permit limits all of APG to 29.9K lbs/year.
2. Clean Water Act - Storm Water. As long as Best Management Practices (BMPs) are followed, all mission tasks can be performed. The limitation is cost of BMPs.
3. Clean Water Act - Point Source Discharge Certain operations in Bldg 1171 have been hindered.
4. Clean Air Act - Open Burning Minimal adverse impact, no curtailment of mission.
5. Clean Air Act - General State/Federal Air Permits. Spray painting operations are prohibited.
6. Firing into the Chesapeake Bay. There are noise and blast environmental constraints to the current or enhanced mission scope.
7. Explosive Storage. Primary limitation is safety. The environmental concern is that much of APG is wetlands and unsuitable for construction of explosive storage facilities.
8. Health Physics. Hard impact testing of DU is limited to enclosed facilities.

3.1.4 Special Support Infrastructure:
Indoor/outdoor ranges
Ammo/explosives bunkers
Specialized laboratory structures/equipment

3.1.5 Proximity to Mission-Related Organizations:

Common Support Functions	Name	Type of Organization	Distance	Workyears Performed	Workyears Funded
Vehicles- Tracked	TECOM	OGA	0 miles	3	3
	AMSAA	OGA	0 miles	3	0

3.2 Personnel.
3.2.1 Total Personnel:

Types of Personnel	Government Civ	Government Mil	Number of Personnel On-Site FFRDC	Number of Personnel On-Site SETA
Technical	73	3	0	0
Management (Supv)	7	0	0	0
Other	4	0	0	0

3.2.2 Education:

Types of Degree/Diploma	Number of Personnel by Type of Position: Technical	Management (Spv)	Other
High School or Less	19	0	2
Associates	2	0	2
Bachelor	21	0	0
Masters	16	2	0
Doctorate	18	5	0

3.2.3 Experience:

Type of Position	Years of Government and/or Military Service: Less than 3 years	3-10 years	11-15 years	16-20 years	More than 20 years
Technical	3	16	18	7	32
Management (Supv)	0	0	0	1	6
Other	0	1	1	1	1
Total	3	17	19	9	39

3.2.4 Accomplishments During FY91-93.
3.2.4.1 Patents Awarded/Patent Disclosures:

Common Support Function	Disclosures	Awarded	Patent Titles
Vehicles - Tracked		0	
	1		Enhanced Protective Arrangement Against Projectile Alternating Density

3.2.4.2 Papers in Peer Reviewed Journals:

Common Support Function	Number Published	Paper Titles
Vehicles - Tracked	2	Listed Below

SHS Materials Compaction Research at BRL, International Journal of SHS, Vol1, No 3, FY93
2. Armor Acceptance Procedure, Quality Engineering Journal, Vol 5 (2), p. 213-223, FY93

.3 Workload.

3.3.1 FY93 Workload.

3.3.1.1 Work Year and Lifecycle:

"Lab"	Fiscal Year 1993 Actual			
	Civilian	Military	FFRDC	SETA
Science & Technology	84	3	0	0
Engineering Development	0	0	0	0
In-Service Engineering	0	0	0	0

3.3.1.2 Engineering Development by ACAT: None.

3.3.1.3 In-Service Engineering: None.

3.2 Projected Funding.

3.3.2.1 Direct Funding ($K): RDTE

Common Support Function	FY94	FY95	FY96	FY97
Vehicle Tracked	5248	6004	6105	6555

3.3.2.2 Other Obligation Authority:

Common Support Function	FY94	FY95	FY96	FY97
Vehicle Tracked				
Reimbursable	5000	5000	5000	5000
Direct Cite	0	0	0	0

3.4 Facilities and Equipment:

Common Support Function	Major Facility or Equipment Description	Unique To: DOD	Federal Govt	U.S.	Replacement Cost ($M)
Vehicle Tracked	Hot Melt				$0.9

5 Expansion Potential.

3.5.1 Laboratory Facilities:

Common Support Function	Facility or Equipment Description	Type of Space	Space Capacity (KSF) Current	Used	Excess
Vehicle Tracked	Bldg 393	Admin	9.3	9.3	0
		Tech	2.2	2.2	0
	Bldg 1171/1175 (Hot Melt)	Tech	4.1	4.1	0
	Bldg 1179	Tech	12.4	12.4	0

3.5.1.1 Capacity of activity to absorb similar workyears: There is ample physical space at the Aberdeen site to accommodate and effectively utilize additional workyears. Ongoing MCA construction and movements of other tenant activities at the host installation (APG) has and will continue to free up admin and technical space for expansion. There are many new SARDA-sponsored initiatives in need of additional technical support.

3.5.1.2 If capacity to absorb additional workyears, how many can be supported: If there are customers (PEO/PMs) and missions (SARDA) that need expertise in these Common Support Functions, this site has the capacity to absorb 100-150 additional.

3.5.1.3 Impact of military construction program or other alteration projects programmed in FY95 PBS: The ARL is currently planning to move the Materials Directorate mission and people to this site (APG). An MCA project has already begun to build a massive building to house the entire Materials operation as well as other ARL elements. This construction will make additional admin and technical space available for expansion.

3.5.2 Land use: APG has 1150 buildable acres. ARL is a tenant at APG and as such does not have any specific number of acres set aside for expansion. If ARL required additional land areas for expansion it will be requested from APG.

3.5.3 Utilities: As the former location of a hypersonic wind tunnel, this area has no problem with electrical requirements. A state-of-the-art telephone system has recently been installed. Water and sewer facilities still have excess capacity. All of the utility services are provided to the tenants by the host installation (APG).

›ction III: Capability of Activities to Perform Common Support Functions

3.0 Mission: Research into blast and thermal effects of nuclear weapons.

- o Calculational simulation of nuclear blast environments and their interaction with Army materiel.
- o Experimental simulation of nuclear airblast and thermal radiation.
- o Define and develop simulation capability for the non-ideal nuclear airblast environment.
- o Development of cost-effective nuclear hardening technologies.

This mission is unique in the military services and provides technology support for all three services. As a result of Reliance consolidations, the Air Force terminated efforts in this technology area and closed the shock tube facility at Kirtland Air Force Base. The Navy had withdrawn from this technology area prior to Reliance. Primary interconnectivity of the Army nuclear weapons effects (NWE) is with the Defense Nuclear Agency (DNA) as lead agency in the Reliance process. A significant portion of the funding for the Army program is provided by DNA.

The NWE program conducted in Weapons Technology Directorate (WTD) at ARL has vital links with programs in the Materials Directorate (MD) and Survivability/Lethality Analysis Directorate (SLAD). We depend heavily on computer support provided by ACIS. Facilities within the Nuclear and Directed Energy Division also support other activities within WTD.

Links with MD are in the area of composite materials which are being studied for their nuclear survivability characteristics.

`'.AD is a primary user of many technology tools developed in WTD.

Interconnectivity with other common support functions consists of providing nuclear survivability technology for incorporation into these products.

Ground Vehicles/tracked and wheeled: Non-ideal nuclear airblast environments which vehicles must survive.

Clothing, Textiles and Food: Flammability studies of uniform systems with thermal radiation source (TRS).

Chemical/Biological Defense: Thermal radiation effects on protective garments and equipment.

3.1 Location.

3.1.1 Geographic/Climatological Features: None.

3.1.2 Licenses & Permits. The following licenses and permits are currently held at the APG:

National Pollution Discharge Elimination System (NPDES) Permit: ARL/APG operates under the limitations of three NPDES permits issued by the State of Maryland. Two of the permits are for the waste water treatment plants and the limitations pertain to the entire post. The NPDES permits for the waste water plants restrict all day to day operations, in that very few things are allowed down the sanitary sewer system. The third NPDES permit is specific to various operations. Weapons Technology Directorate has three buildings as part of this permit.

Storm Water General Permit: The ARL/ APG site is required to comply with the National Pollution Discharge Elimination System (NPDES) Maryland General permit for Storm Water Discharges. ARL/APG has 18 permitted storm water facilities, 9 in WTD. Test firing projects, vehicle maintenance, and storage of scrap materials at these facilities are permitted because of the implementation of "Best Management Practices" (BMP's) that rectify the discrepancies produced and by a inspection program that maintains the BMP program.

Resource, Conservation and Recovery Act (RCRA) Hazardous Waste Storage Permit: APG holds a RCRA permit to properly house and dispose of hazardous waste at the Treatment, Storage and Disposal Facility (TSDF) located in Edgewood, MD. Waste generated by ARL/APG operations is strictly monitored and stored & disposed of through this permitted facility.
Open Burning/Open Detonation (OB/OD) of ARL waste propellants, explosives and pyrotechnics (PEP) material is done at two sites, one at the Aberdeen area and one at the Edgewood area of APG. These operations are covered by a RCRA interim permit which has limits as to the amount of waste PEP that can be disposed of through this method.

3.1.3 Environmental Constraints:

There are no known environmental constraints to the current or enhanced mission scope, other than those described above dealing with permits and licenses. Any new "radioactive materials" missions would most likely require new NRC licenses and any other new operations would have to operate so that the parameters required by the various environmental permits may be maintained.

3.1.4 Special Support Infrastructure:

Small Shock Tubes, 5.5 ft. Shock Tube, Large Blast/Thermal Simulator Probative Tube, and Thermal Radiation Source (Research and Development)

3.1.5 Proximity to Mission-Related Organizations:

Common Support Functions	Name	Type of Organization	Distance	Workyears Performed	Workyears Funded
NWE	Defense Nuclear Agency	OGA	100 mi.	3	0
NWE	USANCA	OGA	100 mi.	0	0

The proximity of the Defense Nuclear Agency and USANCA (U.S. Army Nuclear and Chemical Agency) have been essential for the proper coordination of an integrated nuclear weapons effects program which avoids duplication of effort both within the Army and within the DoD. A significant portion of ARL's nuclear weapons effects funding has come through the Defense Nuclear Agency. If these agencies were not nearby, significant increases in travel would be incurred to continue these coordinating functions. Furthermore, separation from USANCA which determines nuclear survivability criteria is likely to reduce our responsiveness to the needs of the field Army.

? Personnel.

.2.1 Total Personnel:

Types of Personnel	Number of Personnel			
	Government		On-Site FFRDC	On-Site SETA
	Civ	Mil		
Technical	13	0	0	0
Management (Supv)	1	0	0	0
Other	1	0	0	0

3.2.2 Education:

Types of Degree/Diploma	Number of Personnel by Type of Position		
	Technical	Management (Spv)	Other
High School or Less	3	0	1
Associates	1	0	0
Bachelor	5	0	0
Masters	3	1	0
Doctorate	1	0	0

3.2.3 Experience:

Service Type of Position	Years of Government and/or Military				
	Less than 3 years	3-10 years	11-15 years	16-20 years	More than 20 years
Technical	1	4	3	1	4
Management (Supv)	0	0	0	0	1
Total	1	4	3	1	5

3.2.4 Accomplishments During FY91-93.

3.2.4.1 Patents Awarded/Patent Disclosures: None

3.2.4.2 Papers in Peer Reviewed Journals: None

3 Workload.

3.3.1 FY93 Workload.

3.3.1.1 Work Year and Lifecycle:

"Lab"	Fiscal Year 1993 Actual			
	Civilian	Military	FFRDC	SETA
Science & Technology	15	0	0	0
Engineering Development	0	0	0	0
In-Service Engineering	0	0	0	0

3.3.1.2 Engineering Development by ACAT: None.

3.3.1.3 In-Service Engineering: None.

3.2 Projected Funding.

3.3.2.1 Direct Funding ($K): RDTE

Common Support Function	FY94	FY95	FY96	FY97
Nuclear Weapons Effects	1,242	1,260	1,275	1,500

3.3.2.2 Other Obligation Authority:

Common Support Function	FY94	FY95	FY96	FY97
Nuclear Weapons Effects				
Reimbursable	681	500	500	500
Direct Cite	0	0	0	0

) Facilities and Equipment: Equipment/facilities listed are wholly owned by WTD and utilized for the NWE CSF at 100%.

Common Support Function	Major Facility or Equipment Description	Unique To: DOD	Federal Govt	U.S.	Replacement Cost ($M)
Nuclear Weapons Effects					
	Small Shock Tubes (4 in. and 2 ft.)				$1.5
	5.5 ft. Shock Tube being used as Non-Ideal Airblast test bed	X	X		$2.5
	Large Blast/Thermal SimulatorProbative Tube	X	X	X	$5.0
	Thermal Radiation Source (Research and Development)	X	X		$2.5

The Large Blast/Thermal Simulator Probative Tube is used to support Army programs and research for DNA's arge Blast/Thermal Simulator.

3.5 Expansion Potential.

3.5.1 Laboratory Facilities:

Common Support Function	Facility or Equipment Description	Type of Space	Space Capacity (KSF) Current	Used	Excess
Nuclear Weapons Effects					
	Bldg 1101A (Small Shock Tubes)	Administrative	0.5	0.5	0
		Technical	4.8	4.8	0
	Bldg 1101B	Administrative	2.8	2.8	0
	Bldg 1102B	Administrative	1.6	1.6	0
	Range 11 (Lg Shock Tubes and TRS)	Technical	3.0	3.0	0
		Storage	0.1	0.1	0

3.5.1.1 Capacity of activity to absorb similar workyears: None.

3.5.1.2 If capacity to absorb additional workyears, how many can be supported: None.

3.5.1.3 Impact of military construction program or other alteration projects programmed in FY95 PBS: None.

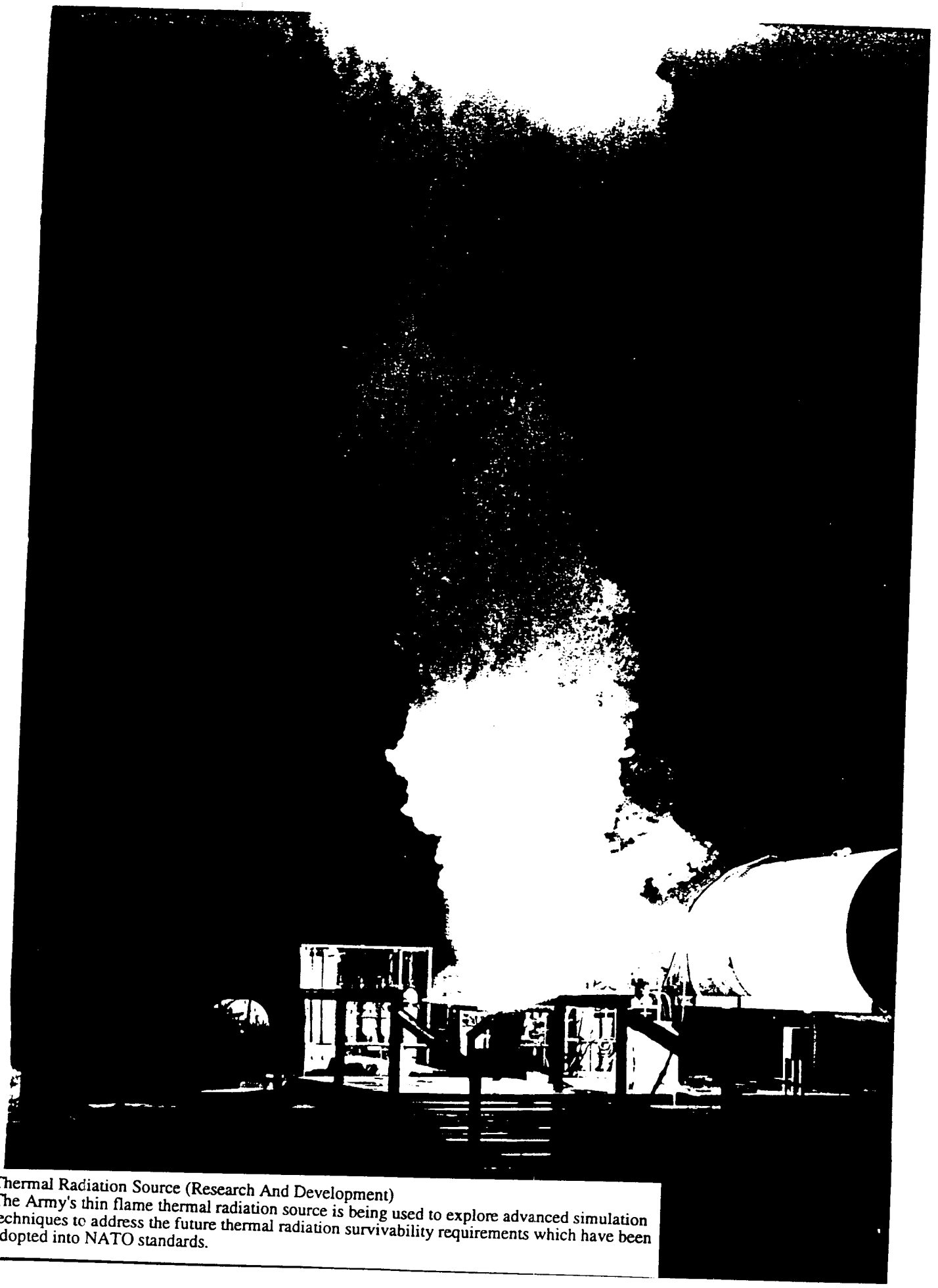
3.5.2 Land use: APG has 1150 buildable acres. ARL is a tenant at APG and as such does not have any specific number of acres set aside for expansion. If ARL required additional land areas for expansion it will be requested from APG.

3.5.3 Utilities: Information must be provided by APG.

Small Shock Tubes (4 inch and 2 foot)
The small shock tube facilities at APG are used as a cost effective way to explore potential uses for the larger shock tubes. These tubes can also be used to test experimental hardening concepts for small pieces of Army equipment.

5.5 ft. e (Non-Ideal Airblast test bed) and Large Blast/Thermal Simulator
Tube

This dual shock tube facility which was originally built to support the NIKE missile program has been a flexible research facility over a number of years. The jet from the 5.5 ft. shock tube is being used as a test bed for non-ideal airblast and hurricane blast simulation. The 8 ft. shock tube has been modified over the years to be a scale model of the Large Blast/Thermal Simulator (LB/TS) recently built at White Sands Missile Range by the Defense Nuclear Agency. This facility will be used to explore product improvements to the LB/TS as they are required as well as providing an excellent test bed to explore experimental hardening concepts for Army materiel.



Thermal Radiation Source (Research And Development)
The Army's thin flame thermal radiation source is being used to explore advanced simulation techniques to address the future thermal radiation survivability requirements which have been adopted into NATO standards.

94-09-23 17:31 RCVD

ACTIVITY: Army Research Laboratory, White Sands Missile Range, NM

Section II: Capacity of DOD Component

2.1 Workload

Information Required	Fiscal Years											
	86	87	88	89	90	91	92	93	94	95	96	97
Total Funds Programmed ($M)	-	-	-	-	-	-	-	42.2	38.4	25.4	20.8	20.6
Total Actual Funds ($M)	-	-	-	-	-	-	-	43.1	-	-	-	-
Programmed Workyears	-	-	-	-	-	-	-	428	371	355	297	285
Actual Workyears	-	-	-	-	-	-	-	415	-	-	-	-

2.2 Excess Lab Capacity: 415 - 285 = 130

Notes:
-ARL established FY93.
-Programmed funds are percentage estimates based on ARL total workyears for FY95-97.
-Funds data does not include reimbursable, SBIR, FAST, Explitation of Foreign Items, QRIP, Industrial Preparedness, or Armor/Anti-Armor funds. These funds are not "programmed," but received during the year of execution.
-Workyears include all government personnel (to incl reimbursable if applicable).

ACTIVITY: ARL, WSMR, NM CSF: ENVIRONMENTAL SCIENCE

ction III: Capability of Activities to Perform Common Support Functions

3.0 Mission:

This submission assumes implementation of BRAC 91 whereby elements of the Battlefield Environment Directorate of the Army Research Laboratory will be located at the Adelphi Laboratory Center (ALC).

The mission of the ARL Battlefield Environment Directorate (BED) at White Sands Missile Range (WSMR) and the Adelphi Laboratory Center (ALC) is to: Own the weather by advancing our understanding of the atmosphere and its critical relationship to performance of Army systems and operations. Develop, acquire and integrate new technologies that enable Land Force Dominance.

o Advance the understanding of Land Warfare Atmospheric Effects, including the propagation of acoustic and electro-magnetic energy through the lower atmosphere and the impact of natural and man-made atmospheres on target and background signatures.

o Develop Land Warfare Atmospheric Measurements capabilities, including remote, passive/low signature, and in-situ atmospheric data.

o Incorporate realistic Land Warfare Atmospheric Simulation/Visualation effects into wargaming and training, to assess and analyze the impact of the atmosphere on combat materiel, tactics, and doctrine.

o Develop and exploit atmospheric data collection, digitization, processing and distribution systems, ading to horzontal integration of weather information to be used in Land Warfare Weather Decision Aids and Target Area Meteorology.

o Determine atmospheric susceptiblity due to boundary layer processes affecting transport and diffusion of nuclear/biological/chemical agents and pollutants.

Interconnectivity with other CSFs:

C4I -- Leverage the power of digitized weather information and technologies to enhance the performance of soldiers, weapons, and sensor systems and provide automated environmental predictions as a force multiplier.

Chemical/Biological Warfare -- Develop, adapt and interface models and simulations that realistically portray the influence of the atmosphere and terrain on weapons performance and hazards from biological/chemical attacks.

Weapons -- Design, develop, and demonstrate the suite of mobile meteorological sensors and data processing systems to support Deep Battle Targeting for artillery fires and precision strike munitions.

Training -- Simulation and visualization research to create realism in training simulators and exercises via weather technology insertion in wargame models and training devices.

3.1 Location.

3.1.1 Geographic/Climatological Features: WSMR provides the isolation of test sites from inhabited areas, ch is required for operation of acoustic sytems and dispersion of smokes and other chemicals critical to vironmental research and development to include monitoring, characterization, and modeling. Provides the

' desert enviromental generally free of clouds and other natural obscurants, and requred for tests of electro-tical, acoustical, and other electronic detection-identification equipment and frequently involving controlled dispersion of man-made obscurants and chemicals.

3.1.2 Licenses and Permits: None.

3.1.3 Environmental Constraints: None.

3.1.4 Special Support Infrastructure: The Acoustic Meterological Test Bed is loated at the Dusy Infrared Test (DIRT) site, in the extreme southeast portion of White Sands Missile Range. It is designed to investigate atmospheric effects on acoustic propagation to determine the performance and utility of acoustic and meteorological models being used to predict the environmental impact on passive acoustic detection/tracking systems. The test bed is well instrumented with both acoustic and meteorological sensors and a variety of acoustic sources. The meteorological sensors vary from instructed towers to tethered and free flying instrumented balloons to state-of-the-art remote profiling systems. The test bed is also well instrucmented with acoustic microphones that can be mounted on the ground tripods, 30 meter towers, or tethered balloons. There are four electronic loud speakers driven by tape recorders capable of producing 115dB which provide the acoustic source.

The Atmospheric Profiler Research Facility (APRF) is a unique specialized remote sensing measurement and analysis facility. High resolution profiles of the refractive index structure parameter (Cn2), wind and temperature are mearsured by 4 radar systems; and FM-CW radar, a large (150m diameter) aperture 50 MHz profiler, a 404 MHz NOAA Demonstration Network profiler, and a 924 MHz boundary layer profiler. In addition, the APRF operates an acousitc sounder, an array of surface and tower instrumentation, a complete ospheric radiation station, and balloon borne instrumentation.

3.1.5 Proximity to Mission-Related Organizations

Common Support Functions	Name	Type of Organization	Distance	Workyears Performed	Workyears Funded
Envi Science	Los Alamos National Lab	CGA	300 miles	3	2
	Phillps Lab	CGA	240 miles	1	1
	Sandia National Lab	CGA	240 miles	1	1
	New Mexico State	Unvi	25 miles	30	20
	Unvi of Texas	Unvi	40 miles	5	2
	Ft. Bliss	CGA	40 miles	0	0
	New Mexico Tech Institute	Unvi	60 miles	0	0

ACTIVITY: ARL, WSMR, NM CSF: ENVIRONMENTAL SCIENCE

? Personnel.

.2.1 Total Personnel:

Types of Personnel	Government Civ	Government Mil	Number of Personnel On-Site FFRDC	On-Site SETA
Technical	64	3	3	0
Management (Supv)	6	0	0	0
Other	6	0	0	0
Total	76	3	3	0

3.2.2 Education

Types of Degree/Diploma	Number of Personnel by Type of Position: Technical	Management (Spv)	Other
High School or Less	0	0	4
Associates	4	0	2
Bachelor	35	0	0
Masters	15	6	0
Doctorate	10	0	0

2.3 Experience

Type of Position	Years of Government and/or Military Service: Less than 3 years	3-10 years	11-15 years	16-20 years	More than 20 years
Technical	3	6	12	22	21
Management (Supv)	0	0	1	3	2
Other	0	2	2	1	1
Total	3	8	15	26	24

3.2.4 Accomplishments During FY91-93

3.2.4.1 Patents Awarded/Patent Disclosures

Common Support Function	Disclosures	Awarded	Patent Titles
Environmental Science		1	#5319-213 "Thermal Target Test Board"
	3		Docket # ARL 93-32 "CIRRUS - Clouds, IR, Real for Use in Simulations
			Docket # ARL 94-2 "Real-time Optical Simulator for Atmospheric Turbulence Effects in Imaging Systems Performance"
			Docket # ARL 94-11 "Electronic Filtered Stethoscope"

3.2.4.2 Papers in Peer Reviewed Journals

Common Support Function	Number Published	Paper Titles
Environmental Science	15	Listed below

"Summer Monsoon Over White Sands Missile Range, New Mexico as Seen by VHF Radar", Nastrom, G.D. and Eaton, F.D., Journal of Geophysical Research, Vol 98, No. D12, pp 23,235-23,243, Dec 20, 1993.

"Suppression of Stimulated Raman Scattering from Microdroplets by Seeding with Nanometer-Sized Latex Particles", J. G. Xie, T. Ruekgauer, R. Armstrong, and R.G. Pinnick, Optics Letters, Vol 18, no. 5pp 340-342; March 1993.

"Millimeter Wavelength Attenuation Efficiencies of Fibrous Aerosols", C.W. Bruce, A. Jelinek, R. Haloren, M. Stehling, J. Pederson, P. Waterman, Journal of Applied Physics, Vol 74, p. 3688, 1993.

"Absorption and Scattering of Microwaves by Falling Snow" P. Chylek, J. Zhan, and R. Pinnick, International Journal of Infrared and Millimeter Waves, Vol 14, p. 2295, 1993.

"Carbon and the Optical Properties of Atmospheric Dust", J.D. Lindberg, R. Douglass, and D.M. Garvey, Applied Optics, Vol 20, pp 6077-6081, 20 Oct 93.

"Microanalysis of the Aerosol Collected Over South-central New Mexico During the ALIVE Field Experiment", J. Sheridan, R.C. Schnell, J.D. Kahl; J.F. Boatman, and D.M. Garvey, Atmospheric Environment, Vol 27A, pp 1169-1183; June 1993.

"Airborne Measurements of Aerosol Optical Properties Over South-central New Mexico", R.L. Gunter, A.D.A. Hansen, J.F. Boatman, B.A. Bodhaine, R.C. Schnell, and D,M. Garvey, Atmospheric Environment, Vol 27A, pp 1329-1332; June 1993.

"Effects of Submicrometer-sized Particles on Microdroplet Lasing", R. Armstrong, J.G. Xie, T. Ruekgauer, J. Gu, and R.G. Pinnick, Optics Letters, Vol18, pp 119-121; January 1993.

"Aerosol in the Arid Southwestern United States: Measurements of Mass Loading, Volatility, Size Distribution, Absorption Characteristics, Black Carbon Content, and Vertical Structure to 7km Above Sea Level", R. G. Pinnick, G. Fernandez, E. Andazola, B. Hinds, A. Hansen, and K. Fuller, Journal of Geophysical Research, Vol 98, pp 2651-2666; February 1993.

"The Coupling of Gravity Waves and Turbulence at White Sands, New Mexico, From VHF Radar Observations", G.D. Nastrom, F.D. Eaton, Journal of Meteorology, Vol 32, No. 1, Jan 93.

"Imaginary Refractive Index of Buckyballs", J.D. Lindberg, R.E. Douglass, D.M. Garvey, Applied Optics, Vol 32, 20 Jul 93.

"Polynomial Approximation of the Optical Properties of Water Clouds in the 8-12 Micron Spectral Region", P. Chylek, R. Damiano, D. Ngo, R,G. Pinnick, Journal opf Applied Meteorology, Vol 31, pp 1210-1218; October 92.

bservations of Stimulated Raman Scattering and Laser-Induced Breakdown in Millimeter-Sized Droplets", A. swas, R.G. Pinnick, J. Xie, T. Ruekgauer, R. Armstrong, Optics Letters, Vol 17, pp 1569-1571; November 1992.

"Two-Photon-Pumped Lasing in Microdroplets", A.S. Kwok, A. Serpenguzel, W.F. Hsieh, R.K. Chang, J.B. Gillespie, Optics Letters, Vol 17, no 20, pp 1435-1437, 15 Oct 92.

"An Assessment of the One-Dimensional Icing Forecast Model Applied to Stratiform Clouds", A. Tunick, H. Rachele, Journal of Aircraft, Vol 29, No 4, pp 703-706, Jul-Aug 92.

3.3 Workload.

3.3.1 FY93 Workload.

3.3.1.1 Work Year and Lifecycle:

"Lab"	Fiscal Year 1993 Actual			
	Civilian	Military	FFRDC	SETA
Science & Technology	76	3	3	
Engineering Development				
In-Service Engineering				

3.3.1.2 Engineering Development by ACAT: None.

3.3.1.3 In-Service Engineering: None.

.3.2 Projected Funding.

3.3.2.1 Direct Funding ($M):

Common Support Function Environmental Science	FY94	FY95	FY96	FY97
61102.53A	5.5	5.5	6.2	6.8
62784.H71	4.2	5.9	5.4	5.8
65702.127	9.5	4.5	0	0
65502.M40	.2	TBD	TBD	TBD

3.3.2.2 Other Obligation Authority ($):

Common Support Function Environmental Science	FY94	FY95	FY96	FY97
Reimbursable	1.8	2.3	2.4	2.2
Direct Cite	1.0	2.2	1.4	1.3

3.4 Facilities and Equipment

mmon Support Function	Major Facility or Equipment Description	Unique To: DOD	Federal Govt	U.S.	Replacement Cost ($K)
Environmental Science	Lidar Remote Sensing System	X			$ 600
	FM-CW Radar	X			$1,800
	Dusty Infrared Test (DIRT) Site	X			Unkown: 5 sq mi of instrumented range
	Wind & Turbulance Radar Profiler	X			$ 500
	Meteorological Rocket Launch Complex	X			$1,500
	Target Contrast Characterizer			X	$ 400
	Multispectral Imagery Data Analysis (MIDAS) Atmospheric Transmittance Large Area System (ATLAS)		X		$1,200
	Transportable Atmospheric Characterization System	X			$2,200
	Research Visible and Infrared Transmissometer (REVIRT)	X			$1,500
	Visiocellometer (Eyesafe)	X			$ 300
	Sound Detection and Ranging (SODAR)	X			$ 800
	Multiple Path Transmissometer/ Radiometer (MPTR)	X			$ 700
	Mobile Atmospheric Spectrometer System (MASS)	X			$1,000

Nephelometers	X	$ 400
Noise Assessment and Predicion Systems (NAPS)	X	$ 700
Atmospheric Turbulance Measurement and Observation System (ATMOS)	X	$1,100
Artificial Fog Generators	X	$ 400
Technology Exploitation Weather Test Bed (TEWTB)	X	$1,500

3.5 Expansion Potential.

3.5.1 Laboratory Facilities:

Common Support Function	Facility or Equipment Description	Type of Space	Space Capacity (KSF) Current	Used	Excess
Environmental Science		Administrative	37,562	37,562	0
		Technical	15,997	15,997	0
		Storage	3,464	3,464	0
		Utility	6,807	6,807	0

3.1.1 Capacity of activity to absorb similar workyears categorized in the same common support function. a BED is a tenant at WSMR. There have been significant reductions in personnel strength from FY90's 270 manyears to FY93's 132 manyears. This reduction has not directly coincided with the loss of facility space. As a result the current BED facilities being occupied at the WSMR site has a capacity to absorb an additional 100 manyears of effort without any major renovations or refurbishments of existing facilities.

3.5.1.2 If capacity to absorb additional workyears, how many can be supported. 100 -- see above.

3.5.1.3 Impact of military construction program or other alteration projects programmed in FY95 PBS. None.

3.5.2 Land use: APG has 260,480 buildable acres. ARL is a tenant at White Sands Missile Range (WSMR) and as such does not have any specific number of acres set aside for expansion. If ARL requires additional land areas for expansion at WSMR, it will be requested from the host installation.

3.5.3 Utilities: Must be provided by WSMR.

94-09-23 17:31 RCVD

ACTIVITY: Army Research Laboratory, NASA Langley, VA

Section II: Capacity of DOD Component

2.1 Workload

Information Required	Fiscal Years											
	86	87	88	89	90	91	92	93	94	95	96	97
Total Funds Programmed ($M)	-	-	-	-	-	-	-	4.2	4.2	3.6	3.8	3.8
Total Actual Funds ($M)	-	-	-	-	-	-	-	4.8	-	-	-	-
Programmed Workyears	-	-	-	-	-	-	-	53	62	61	61	64
Actual Workyears	-	-	-	-	-	-	-	53	-	-	-	-

2.2 Excess Lab Capacity: N/A

Notes:
-ARL established FY93.
-Funds data does not include reimbursable, SBIR, FAST, Explitation of Foreign Items, QRIP, Industrial Preparedness, or Armor/Anti-Armor funds. These funds are not "programmed," but received during the year of execution.
-Workyears include all government personnel (to incl reimbursable if applicable).
-The ARL at NASA Langley consists of the Air and Ground Vehicle common support functions.

ACTIVITY: ARL, NASA LANGLEY, VA

CSFs: AIR VEHICLES, ROTARY, STRUCTURE
GROUND VEHICLES (WHEELED & TRACKED)

Section III: Capability of Activities to Perform Common Support Functions

3.0 Mission: Plan, manage and execute research, exploratory, and advanced development programs through independent in-house research and contracts. These programs are primarily related to Army vehicle structures (air vehicles-rotary wing and ground vehicles both wheeled and tracked) for which unique facilities exist at the NASA Langley Research Center.

- o Structural Analysis & Dynamics
- o Ground Vehicle Structures
- o Static/Dynamic Loading
- o Vehicle Structural Integrity
- o Advanced Concepts
- o Design Methodology
- o Robotic Structures
- o Non-Destructive Evaluation
- o Vehicle Crashworthiness

VSD has two common support functions, air vehicles (rotary and structure) and ground vehicles (wheeled and tracked). Basic and applied research is oriented towards improvement in the Army's aviation and ground vehicle technology. VSD is collocated with elements of ATCOM and CECOM at the NASA Langley Research Center. Research in areas of mutual interest is performed in joint cooperation with NASA to increase knowledge in aeroelasticity, structural acoustics, vibration reduction for rotrocraft, structural integrity, structural analysis, crashworthiness, and nondestructive evaluation of composite and metallic rotorcraft structures. Research results are shared with other Army agencies, private industry, and academia.
The VSD has two CSFs-- air vehicles and ground vehicles. Basic and applied research is oriented towards improvements in the Army's aviation and ground vehicle technology.

Interconnectivity.

The VSD is collocated at the NASA Langley Research Center with elements of the Aviation and Troop Command (ATCOM) Joint Research Projects Office (JRPO) and the Communications Electronics Command (CECOM) JRPO.

VSD provides technical advice and consultation on all aspects of composite structures, suspension dynamics, dynamics of kinematic structures, structural integrity, aeroelasticity, structural analysis, crashworthiness and nondestructive evaluation of composites and metallic rotorcraft structures to its customers, private industry, contractors, and other services. During FY94 VSD developed 4 Cooperative Research and Development Agreements with private industry. In FY93 VSD had one customer Technology Program Annex with ATCOM, in FY94 VSD obtained two additional customers and its multi-customer factor is in excess of 2. VSD prepared a Science and Technology Objective (STO) and marketed it within the Training and Doctrine Command (TRADOC) community. A VSD researcher in nondestructive evaluation represents the Army on the Reliance Panel. VSD developed an ARL interdirectorate team on composites research. The Weapons Technology Directorate, the Materials Directorate, and VSD all work together on all aspects of the Composite Armored Vehicle (CAV) Program. VSD is working with NASA, the Air Force and the Federal Aviation Administration to sign a memorandum of agreement for structures research at Langley. All team leaders attend briefings at ATCOM, the Missile Command (MICOM) and the Tank and Automotive Command (TACOM) to exchange technology needs and identify technology programs.

ACTIVITY: ARL, NASA LANGLEY, VA

CSFs: AIR VEHICLES, ROTARY, STRUCTURE
GROUND VEHICLES (WHEELED & TRACKED)

Research and development from VSD's common support functions can be applied to other CSFs in a variety of ways; an advanced composite material may be used to make a weapons system lighter more durable or corrosion resistant; noise and vibration research may be used to control noise around airports or residential areas.

Product Functions

Air Vehicles--rotary and structures research

Weapons-- composite materials-corrosion resistant

Space Systems--structural integrity, crashworthiness, aeroelasticity

C4I Systems--none

Ground Vehicles--wheeled and tracked research

Clothing, Textiles and Foods--material weaves, multiple ply failure analysis

Chemical/Biological Defense--none

ervasive Functions

Electronics Devices--advanced composite materials for improved conductivity

Environmental Sciences--improved fuselage design, crashworthiness

Infectious Diseases--none

Human Systems--acoustics and vibration abatement

Manpower and Personnel--none

Training Systems--none

Environmental Quality--noise and vibration control

Advanced Materials--composites and metallic materials investigations

Civil Engineering--lightweight bridge structures

Combat Casualty Care--none

Combat Dentistry--none

Nuclear Weapons Effects--none

Chemical Biological Defense--none

ACTIVITY: ARL, NASA LANGLEY, VA

CSFs: AIR VEHICLES, ROTARY, STRUCTURE
GROUND VEHICLES (WHEELED & TRACKED)

3.1 Location.
3.1.1 Geographic/Climatological Features: None.
3.1.2 Licenses and Permits: None.
3.1.3 Environmental Constraints: None.
3.1.4 Special Support Infrastructure: See 3.4 Facilities & Equipment

3.1.5 Proximity to Mission-Related Organizations

CSF	Name	Type of Organization	Distance	Workyears Performed	Workyears Funded
Air Vehicles, Rotary, Structure	NASA	OGA	Collocated	37	37
Ground Vehicles (Wheeled & Tracked)	NASA	OGA	Collocated	13	13

The Army Research Laboratory's Vehicle Structures Directorate (VSD) is collocated at NASA Langley, VA. The Army and NASA have common R&D interests represented in the facilities and programs at the Langley Research Center. The joint use and support of which achieve large scale tangible economies and promote efficiency with respect to continuing R&D of aeronautical and ground vehicles. Without this support, the Army would not be ›le to accomplish its aeronautical research and development mission with respect to structural integrity for .r vehicles and ground vehicles.

3.2 Personnel.
3.2.1 Total Personnel:

Air Vehicles, Rotary, Structure--ARL NASA Langley

	Number of Personnel			
	Government			
Types of Personnel	Civ	Mil	On-Site FFRDC	On-Site SETA
Technical	33	1		
Management (Supv)	3			
Other				

Ground Vehicles (Wheeled & Tracked)--ARL NASA Langley

	Number of Personnel			
	Government			
Types of Personnel	Civ	Mil	On-Site FFRDC	On-Site SETA
Technical	12			
Management (Supv)	1			
Other				

ACTIVITY: ARL, NASA LANGLEY, VA

CSFs: AIR VEHICLES, ROTARY, STRUCTURE
GROUND VEHICLES (WHEELED & TRACKED)

3.2.2 Education:

Air Vehicles, Rotary, Structure--ARL NASA Langley

Types of Degree/Diploma	Number of Personnel by Type of Position: Technical	Management (Supv)	Other
High School or Less	5	1	
Associates	4		
Bachelor	11		
Masters	9		
Doctorate	4	2	

Ground Vehicles (Wheeled & Tracked)--ARL NASA Langley

Types of Degree/Diploma	Number of Personnel by Type of Position: Technical	Management (Supv)	Other
High School or Less	2		
Associates			
Bachelor	2		
Masters	5	1	
Doctorate	3		

3.2.3 Experience:

Air Vehicles, Rotary, Structure--ARL NASA Langley

Type of Position	Years of Government and/or Military Service: Less than 3 years	3-10 years	11-15 years	16-20 years	More than 20 years
Technical	0	7	11	7	8
Management (Supv)				1	2
Total	0	7	11	8	10

Ground Vehicles (Wheeled & Tracked)--ARL NASA Langley

Type of Position	Years of Government and/or Military Service: Less than 3 years	3-10 years	11-15 years	16-20 years	More than 20 years
Technical	0	5	4	0	3
Management (Supv)					1
Total	0	5	4	0	4

ACTIVITY: ARL, NASA LANGLEY, VA

CSFs: AIR VEHICLES, ROTARY, STRUCTURE
GROUND VEHICLES (WHEELED & TRACKED)

3.2.4 Accomplishments During FY91-93: The Vehicles Structures Directorate became part of the newly established Army Research Laboratory in October 1992 (FY93).

3.2.4.1 Patents Awarded/Patent Disclosures:

Common Support Function	Disclosures	Awarded	Patent Titles
Air Vehicles, Rotary, Structure	4	2	Method & Apparatus for Weaving a Woven Angle Ply Fabric, Gary Farley No. 5,224,519, Jul 93 Integral Fill Yarn Insertion & Beatup Method, Gary Farley, No. 5,188,153, Feb 93
Total	4	2	

Ground Vehicles (Wheeled & Tracked)--ARL NASA Langley: None

3.2.4.2 Papers in Peer Reviewed Journals:

r Vehicles, Rotary, Structure--ARL NASA Langley

CSF	Number Published	Paper Titles
AV	10	JACKSON, KAREN E.; Kellas, S.; and Morton, J.: ""Scale Effects"in the Response and Failure of Fiber Reinforced Composite Laminates Loaded in Tension and in Flexure," Journal of Composite Materials, Vol. 26, No. 18, pp. 2674-2705, 1992. JACKSON, KAREN E.; Morton, J.; Lavoie, A.; and BOITNOTT, R.L.: "Scaling of Energy Absorbing Composite Plates." Journal of the AHS, January, 1993. Ho, H.: Tsai, M. Y.; Morton, J.; and FARLEY, G. L.: "An Experimental Procedure for the Iosipescu Composite Specimen Tested in the Modified Wyoming Fixture," Journal of Composite Technology and Research, Vol. 15, No. 1, pp. 52-58, Spring 1993 JOHNSON, ARTHUR R.; Quigley, C. J.; Young, D. G.; and Danik, J. A.: "Viscohyperelastic Modeling of Rubber Vulcanizates," Tire Science and Technology, TSTCA, Vol. 21, No. 3, July-September, 1993, pp. 179-199. YEAGER, WILLIAM T.; MIRICK, PAUL H.; HAMOUDA, M-NABIL H.; WILLBUR, MATTHEW L.; SINGLETON, JEFFREY D.; and WILKIE, W. KEATS: "Rotorcraft Aeroelastic Testing in the Langley Transonics Dynamics Tunnel," Journal of the American Helicopter Society, pp. , Volume 38-Number 3, July 1993.

ACTIVITY: ARL, NASA LANGLEY, VA

CSFs: AIR VEHICLES, ROTARY, STRUCTURE
GROUND VEHICLES (WHEELED & TRACKED)

Huey, Cecil O.; and FARLEY, GARY L: "Development of Generalized 3-D Braiding Machines for Composite Preforms," Composite Engineering, Vol.3, No. 3, pp.209-218, 1993.

Ho, H.: Tsai, M. Y.; Morton, J.; and FARLEY, G. L.: "Numerical Analysis of the Iosipescu Specimen for Composite Materials," Composite Science and Technology 46, pp. 115-128, 1993.

Martin, R. and JACKSON, WADE C.: ""Damage Prediction in Cross-Piled Curved Composite Laminates," Fourth Volume, ASTS STP 1156, pp. 105-126, 1993.

JACKSON, WADE C.; Smith, B. T.; and Hinkley, J. A.: "Characterization of Damage Modes in Impacted Thermoset and Thermoplastic Composites," Journal of Reinforced Plastic and Composites, Vol. 11, No. 10, pp. 1111-1126, October 1992.

Kellas, S.; Morton, J.; and JACKSON, K.: "Damage and Failure Mechanisms in Scaled Angle-Ply Laminates," Composite Materials: Fatigue and Fracture, Fourth Volume, ASTM STP-1156, W.W Stinchcomb and N. E. Ashbaugh, Eds., American Society for Testing and Materials, Philadelphia, 1993.

ound Vehicles (Wheeled & Tracked)--ARL NASA Langley: None

ACTIVITY: ARL, NASA LANGLEY, VA

CSFs: AIR VEHICLES, ROTARY, STRUCTURE
GROUND VEHICLES (WHEELED & TRACKED)

3.3 Workload.
3.3.1 FY93 Workload.
3.3.1.1 Work Year and Lifecycle:

Air Vehicles, Rotary, Structure--ARL NASA Langley:

"Lab"	Fiscal Year 1993 Actual			
	Civilian	Military	FFRDC	SETA
Science & Technology	36	1		
Engineering Development				
In-Service Engineering				

Ground Vehicles (Wheeled & Tracked)--ARL NASA Langley:

"Lab"	Fiscal Year 1993 Actual			
	Civilian	Military	FFRDC	SETA
Science & Technology	13			
Engineering Development				
In-Service Engineering				

3.3.1.2 Engineering Development by ACAT: None.
3.3.1.3 In-Service Engineering: None.

3.3.2 Projected Funding.
3.3.2.1 Direct Funding ($K): RDTE

Common Support Function	FY94	FY95	FY96	FY97
Air Vehicles, Rotary, Structure	3,392	2,669	2,826	2,760
Ground Vehicles (Wheeled & Tracked)	847	968	970	1,006

3.3.2.2 Other Obligation Authority ($K)

Common Support Function	FY94	FY95	FY96	FY97
Air Vehicles, Rotary, Structure	200	280	Unknown	Unknown
Ground Vehicles	375	550	650	700

ACTIVITY: ARL, NASA LANGLEY, VA

CSFs: AIR VEHICLES, ROTARY, STRUCTURE
GROUND VEHICLES (WHEELED & TRACKED)

3.4 Facilities and Equipment.
3.4.1 Major Equipment & Facilities: Facilities and equipment may be used interchangeably to support both CSF (Air Vehicle/Rotary/Structure and Ground Vehicles, Wheeled and Tracked).

Common Support Function*	Major Facility or Equipment Description**	Unique To: DOD	Federal Govt	U.S.	Replacement Cost ($K)
Air Vehicles (Rotary Wing)	Impact Dynamics Research Facility	X	X		125M
	Mechanics of Materials Laboratory	X	X		69M
Ground Vehicles (Wheeled & Tracked)	14x22' Subsonic	X	X		57M
	LTPT	X	X		24M
	TDT	X	X		166M

All facilities and equipment listed in section 3.4 Facilities and Equipment of BRAC 95 Data Call #5 for VSD are wholly owned by NASA. The Army/NASA Master Agreement allows the VSD, the ATCOM Joint Research Project Office (JRPO) and the CECOM JRPO Scientists and Engineers (S&Es) to work along side NASA S&Es with access to "world class" facilities. The use of the numerous NASA research facilities gives the Army aviation and ground vehicles community access to superior research facilities and capabilities.

Descriptions:
The Army's Vehicle Structures Directorate/ATCOM Joint Research Projects Office/CECOM Joint Research Project Office, collocated at NASA Langley Research Center, Hampton, VA, specialize in basic and applied research in rotorcraft aeromechanics and vehicle structures. Individual Army researchers and scientists are experts in such disciplines as: rotorcraft aeroelasticity, aerodynamics, dynamics, vibrations, metal and composite structures, fatigue and fracture, rotorcraft crashworthiness, and acoustics.

The Army/NASA cooperative agreement allows Army researchers to work alongside NASA researchers at NASA Langley Research Center with access to "world class" research facilities. The ability to utilize the numerous NASA research facilities; such as, 14'-by 22' foot subsonic wind tunnel and 3 component laser velocimeter system, transonic dynamics tunnel, impact dynamics branch crashtower, free-flight test facility, anechoic noise facilities, materials research laboratories, and a wide variety of test equipment and computers, gives the Army aviation and structures/materials community superior research facilities and capabilities at a nominal investment and operating cost.

IMPACT DYNAMICS RESEARCH FACILITY. This facility simulates crashes fixed wing, and rotorcraft, under controlled conditions. Simulation is accomplished by swinging the aircraft by cables, pendulum-style, into the ground from as A-frame structure approximately 400 ft. long by 250 ft high. The aircraft is suspended by cables from 2 pivot points off the ground. It is then pulled back along an arc to a pre-determined height by pullback cable from a movable bridge on top of the A-frame, released from the pullable, the aircraft then strikes the ground in a pre-determined position and speed.

APPLICATIONS AND CAPABILITY: The ""Crashtower"" originally built for the lunar lander testing, now the full scale testing of aircraft and subcomponents.

ACTIVITY: ARL, NASA LANGLEY, VA CSFs: AIR VEHICLES, ROTARY, STRUCTURE
GROUND VEHICLES (WHEELED & TRACKED)

VALUE: The facility allows full scale testing of aircraft for crashworthiness to ensure that the aircraft and its subcompnents meet all required DOD and FAA crashworthiness criteria.

ESTIMATED OPERATING/REPLACEMENT COSTS: $2.4/$125.0M.

Army use at approximately 70%; NASA use at approximately 30%. Approximateley 66 2/3% of the Army's effort at NASA Langley is devoted to the common support function of air vehicle research and the remaining 33 1/3% is devoted to ground vehicle research.

MECHANICS OF MATERIALS LABORATORY. The MML houses experimental facilities for conducting a wide range of research to characterize the behavior of advanced structural materials under the application of mechanical and thermal loads. This research encompasses the study of deformation characteristics and damage mechanisms leading to the development of nonlinear constitutive models, strength criteria, and durability and damage tolerance criteria.

APPLICATIONS AND CAPABILITY: A high bay area surrounded by 8 enclosed laboratories house 51 servohydraulic testing systems (1-kip to 400 kips, a scanning electron microscope, 3 X-ray radiography systems, 13 high temperature creep frames and 3 multiparameter test facilities.) The multiparameter facility permits the simultaneous testing of up to six coupons under combined temperature (up to 3000 F), cyclic mechanical loads, and partial pressures.

VALUE: This laboratory provides integrated research facilities to conduct alloy synthesis and development, innovative processing and joining, coatings technology, and complex characterization using electron optics and surface analysis techniques. Equipment and instrumentation are available to conduct surface analysis, thermal analysis, metallurgy, microscopy, X-ray, and dimensional stability studies.

ESTIMATED OPERATING/REPLACEMENT COSTS: $1.3M/$69.0M

Army use at approximately 20%; NASA use at approximately 80%. Approximateley 66 2/3% of the Army's effort at NASA Langley is devoted to the common support function of air vehicle research and the remaining 33 1/3% is devoted to ground vehicle research.

14' X 22' FOOT SUBSONIC WIND TUNNEL. This Subsonic Wind Tunnel is used for low-speed (under 200 knots) testing of powered and unpowered aircraft configurations, including rotorcraft. The tunnel is a closed return, variable air flow tunnel, powered by a 6650 hp AC motor in tandem with a 1350 hp DC motor driving a 9 bladed 40 foot diameter propeller fan. The tunnel is equipped with adjustable air intake flaps, movable re-entry lips, fixed turning vanes, flow control valve, diffusion screen, and fixed screen. The test section is a slotted throat with movable walls. Removable floor sections permit installation of a model support turntable with mast and rotary sting, and 200 knot ground plane belt systems. 5000 psi air and low pressure steam are available for model use. Precise speed control to 318 ft./sec. is provided.

APPLICATIONS AND CAPABILITY: The tunnel has excellent flow characteristics and flow visualization capabilities. The tunnel is used for studies involving rotorcraft flight mechanics such as performance, drag and handling qualities. Wind tunnel flow anemometry is achieved via a two-component laser velocimeter system. Several significant modifications to this tunnel have been made by NASA to enhance rotorcraft testing. These include flow and acoustic environment improvements, a rotor hover test cell and a laser laboratory.

ACTIVITY: ARL, NASA LANGLEY, VA

CSFs: AIR VEHICLES, ROTARY, STRUCTURE
GROUND VEHICLES (WHEELED & TRACKED)

VALUE: Rotorcraft research over two decades has included basic research in fluid mechanics such as rotor inflow studies. A complete stable of Army model fuselages, stores, mission equipment packages and rotors have also been tested in this facility.

ESTIMATED OPERATING/REPLACEMENT COSTS: $2.0M/$57.5M.

Army use at approximately 10%; NASA use at approximately 90%. Approximateley 66 2/3% of the Army's effort at NASA Langley is devoted to the common support function of air vehicle research and the remaining 33 1/3% is devoted to ground vehicle research.

LOW TURBULENCE PRESSURE TUNNEL (LTPT) The LTPT is a single-return, closed circuit wind tunnel that can be operated at pressures from near vacuum to 10 atmospheres. The LPTP is capable of testing at Mach numbers from 0.05 to 0.50 and unit Reynolds numbers from 0.1 million/ft to 15 million/ft. The test section size is 3.0-feet by 7.5-feet.

APPLICATIONS AND CAPABILITY: The measured turbulence level in the LPTP is very low due to its large contraction ratio and anti-turbulence screen. The excellent flow quality makes it particularly suitable for testing low drag airfoils. Two-dimensional airfoil models usually span the 3-foot wide test section and have a chord of about 2 feet. Three-dimensional models can be tested with spans of about 2 feet.

VALUE: Advanced rotorcraft airfoils of Army design have been evaluated in the LPTP, resulting in several patent awards and the incorporation of these airfoil designs in advanced rotorcraft.
ESTIMATED OPERATING/REPLACEMENT COSTS: $0.9M/$24.0M.

Army use at approximately 15%; NASA use at approximately 85%. Approximateley 66 2/3% of the Army's effort at NASA Langley is devoted to the common support function of air vehicle research and the remaining 33 1/3% is devoted to ground vehicle research.

TRANSONIC DYNAMICS TUNNEL. The Transonic Dynamics Tunnel is a closed-circuit tunnel powered by a 30,000 hp electric motor. The facility has a 16- by 16-foot test section which can accommodate pressures from vacuum to atmospheric and provide Mach numbers up to 1.2; both are continuously controllable. The facility unique uses either air or a heavy gas (R12) as the test medium. The use of heavy gas provides significant advantages over air as the test medium for dynamically-scaled rotor models. The facility is equipped with many features uniquely suited to dynamic testing. These include a dynamic data system, safety features for flow control during stability testing, and a gust generating system for rotor gust response testing.

APPLICATIONS AND CAPABILITY: The TDT satisfies the need for a large transonic wind tunnel dedicated specifically to work on the dynamics and aeroelastic problems associated with advanced aircraft, including rotorcraft. Rotor models tested in the TDT enjoy the testing advantages of simultaneous Mach and Froude scale, less power absorption, and strength, safety and cost benefits.

VALUE: Rotor systems tested in the TDT and separate hover test facility over the past two decades included the UH-1, AH-1, UH-60, and Growth Utility rotors. Advanced concepts, such as higher harmonic control and conformable rotors have been explored and proven in the TDT. In addition, advanced hub

configurations and tiltrotor stability for the V-22 were assessed in this world-unique wind tunnel.

ESTIMATED OPERATING/REPLACEMENT COSTS: $2.4M/$166.0M.

Army use at approximately 30%; NASA use at approximately 70%. Approximateley 66 2/3% of the Army's effort at NASA Langley is devoted to the common support function of air vehicle research and the remaining 33 1/3% is devoted to ground vehicle research.

3.5 Expansion Potential: None. VSD is a tenant on the NASA installation.
3.5.1 Laboratory Facilities.

Common Support Function	Facility or Equipment Description	Type of Space	Space Capacity (KSF) Current	Used	Excess
Space specifically allocated to VSD is administrative; technical space is utilized cooperatively with NASA scientists.					
Air Vehicles	Office	Administrative	2405	2405	0
Ground Vehicles	Office	Administrative	1105	1105	0

3.5.1.1 Capacity of activity to absorb similar workyears categorized in the same common support function: VSD is a tenant on the NASA installation. Negotiations would have to be made with NASA to absorb additional similar workyears. Capacity would be dependent on NASA's mission, available space, test schedules, etc. Vacant office space or temporary buildings would suffice until permanent space is located.

3.5.1.2 If capacity to absorb additional workyears, how many can be supported: In light of the hiring freeze and budget constraints 75 to 100 additional researchers could be absorbed without major modifications.

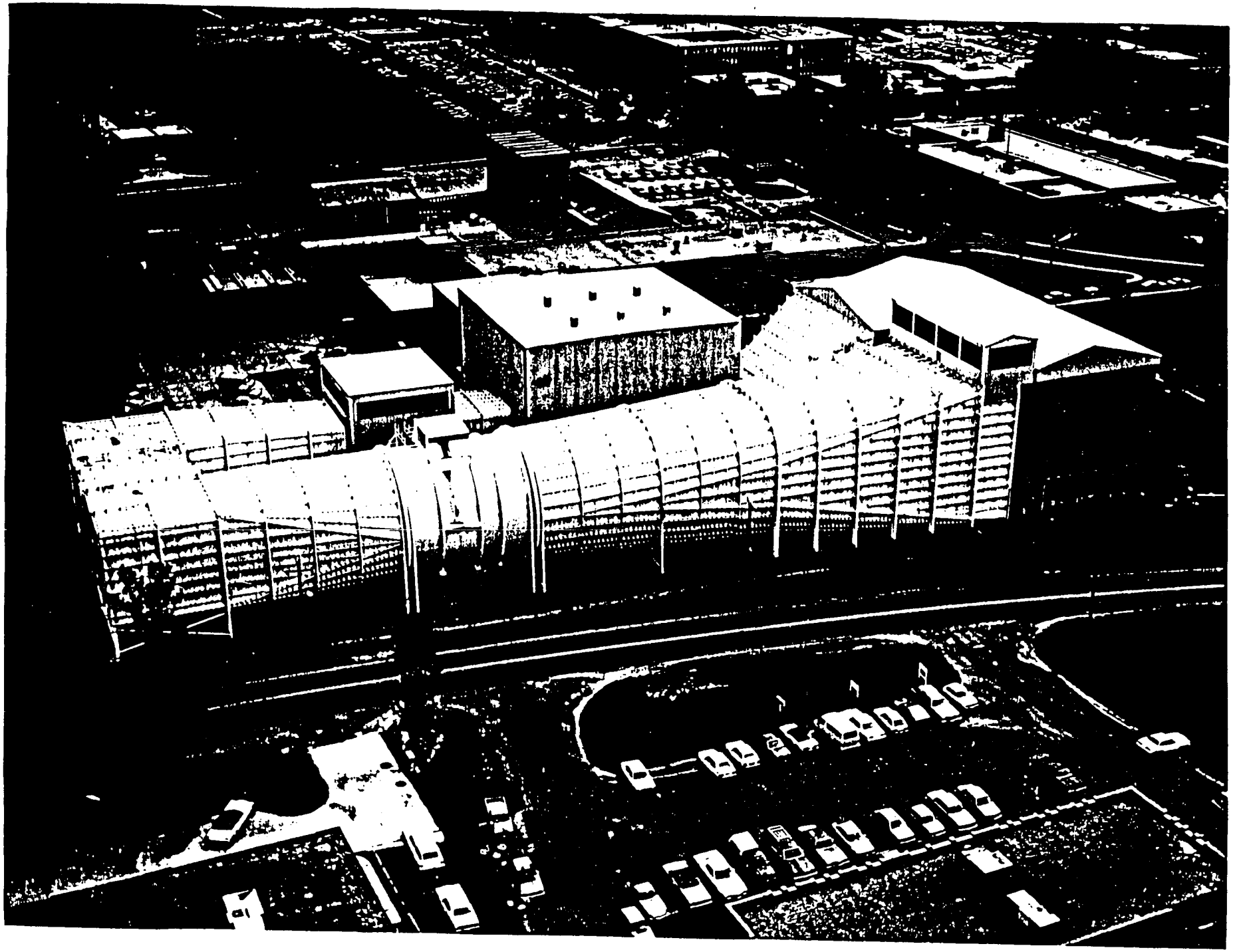
3.5.1.3 Impact of military construction program or other alteration projects programmed in FY95 PBS: None.

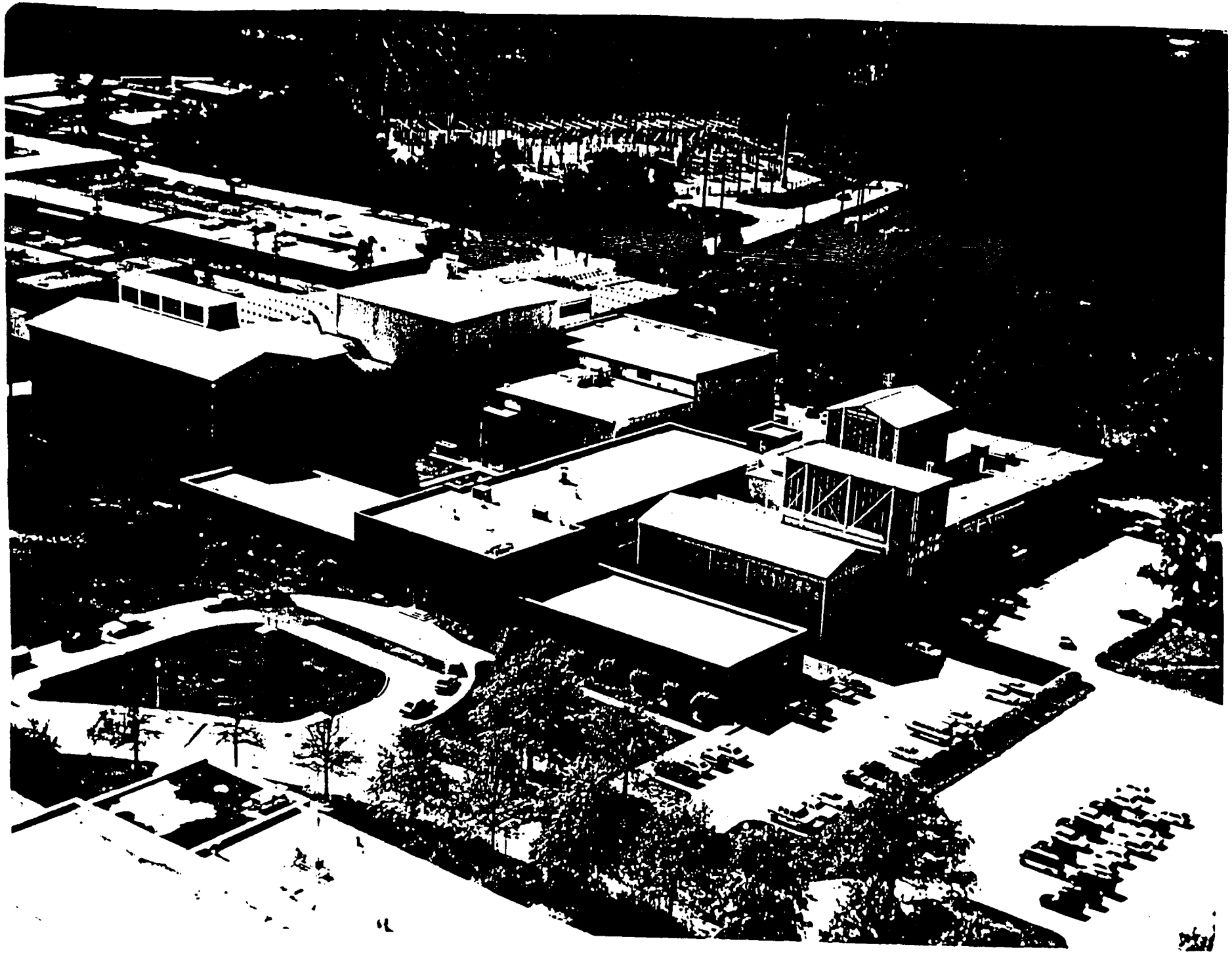
3.5.2 Land use. Per NASA, there are approimately 100 acres available for real estate development.

3.5.3 Utilities: The Army at NASA (ARL-VSD, ATCOM and CECOM) does not pay for utilities. Base operations support is provided at no cost under the terms of the Army/NASA Master agreement.

NASA
81-5962

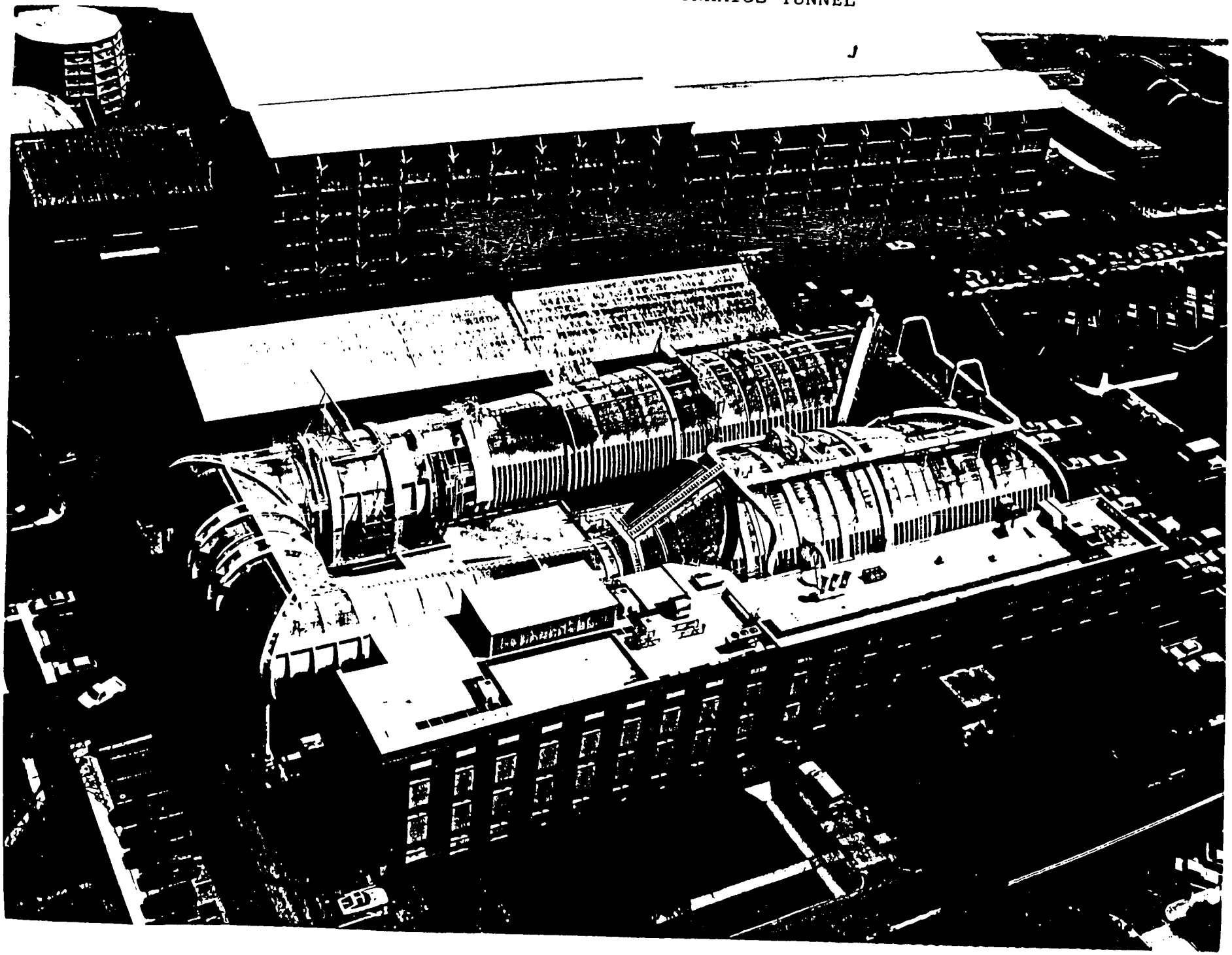
4'X22' SUBSONIC WIND TUNNEL





TRANSONIC DYNAMICS TUNNEL

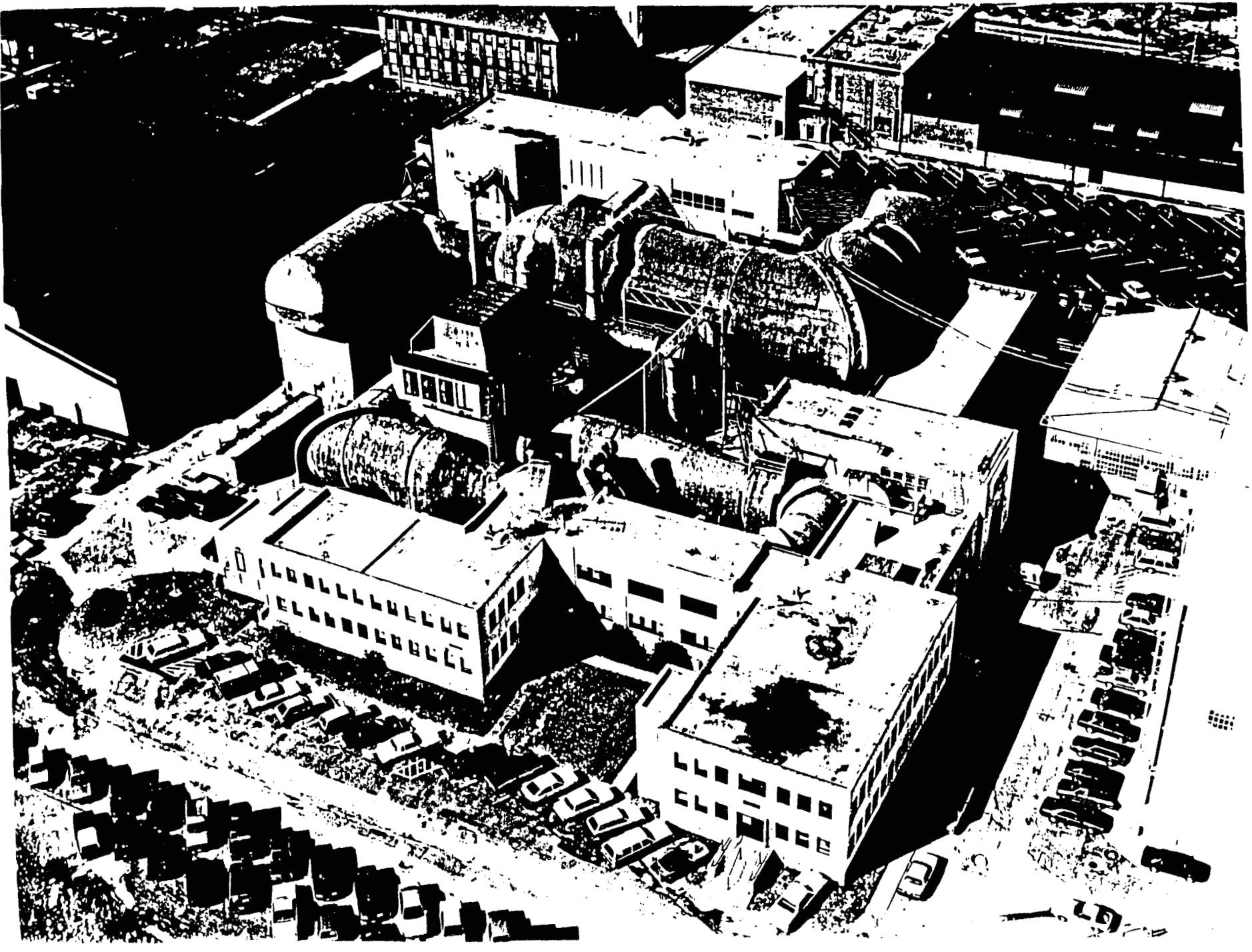
Langley Research Center
Hampton, Virginia 23665-5225



NASA

8 FOOT TRANSONIC PRESSURE WIND TUNNEL

Langley Research Center
Hampton, Virginia 23665-5225



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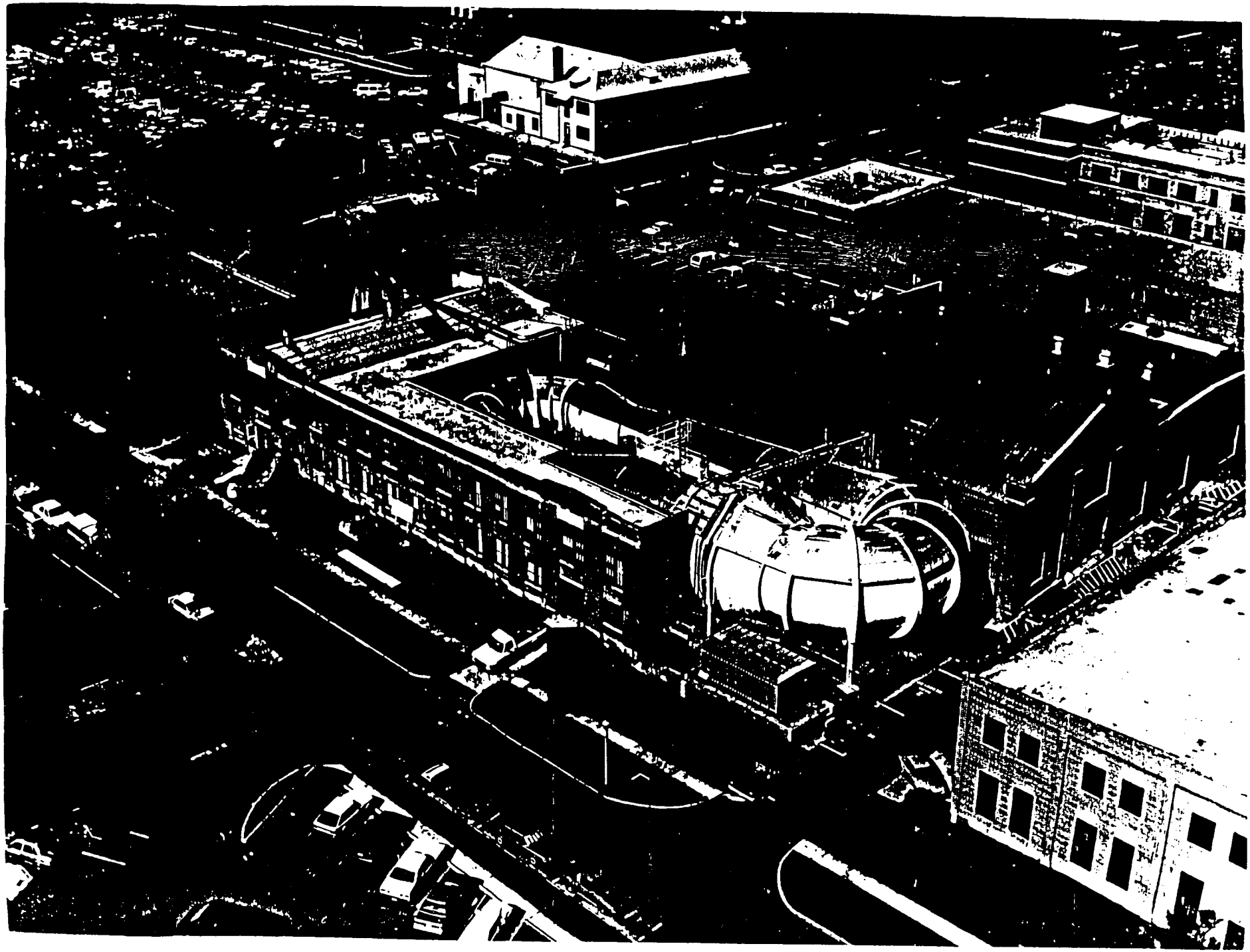
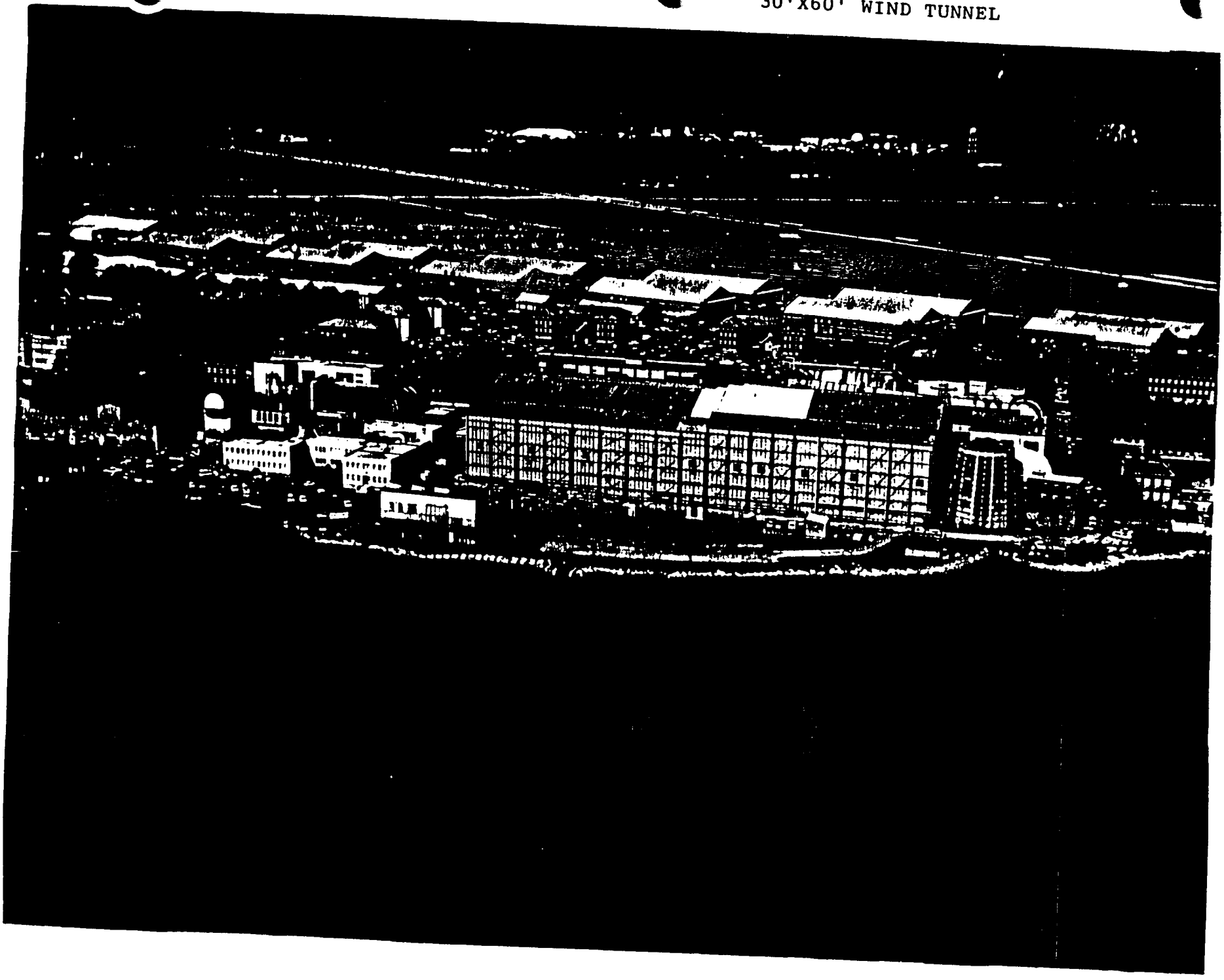
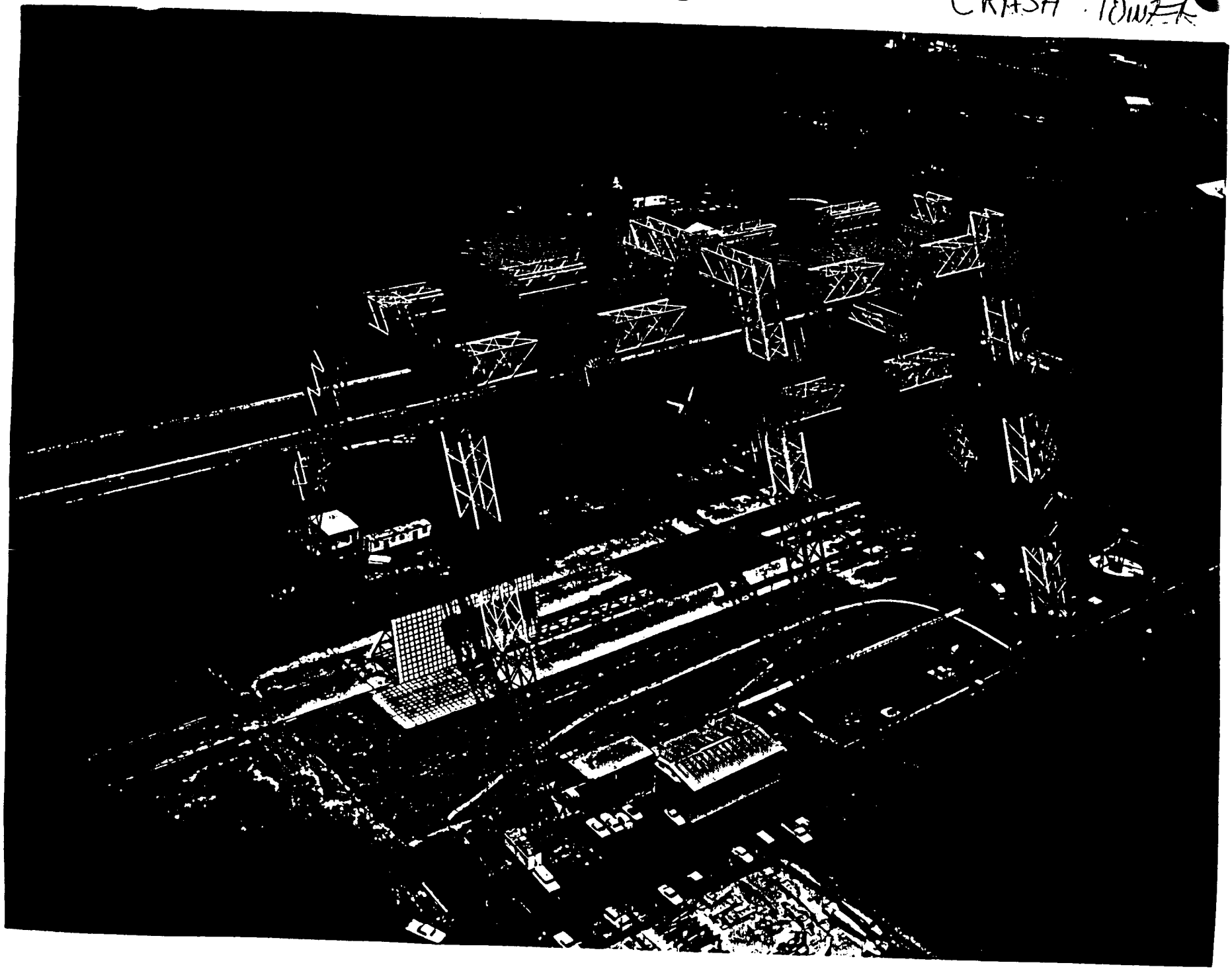
LOW TURBULENCE PRESSURE TUNNEL



30'X60' WIND TUNNEL



CRASH TOWER

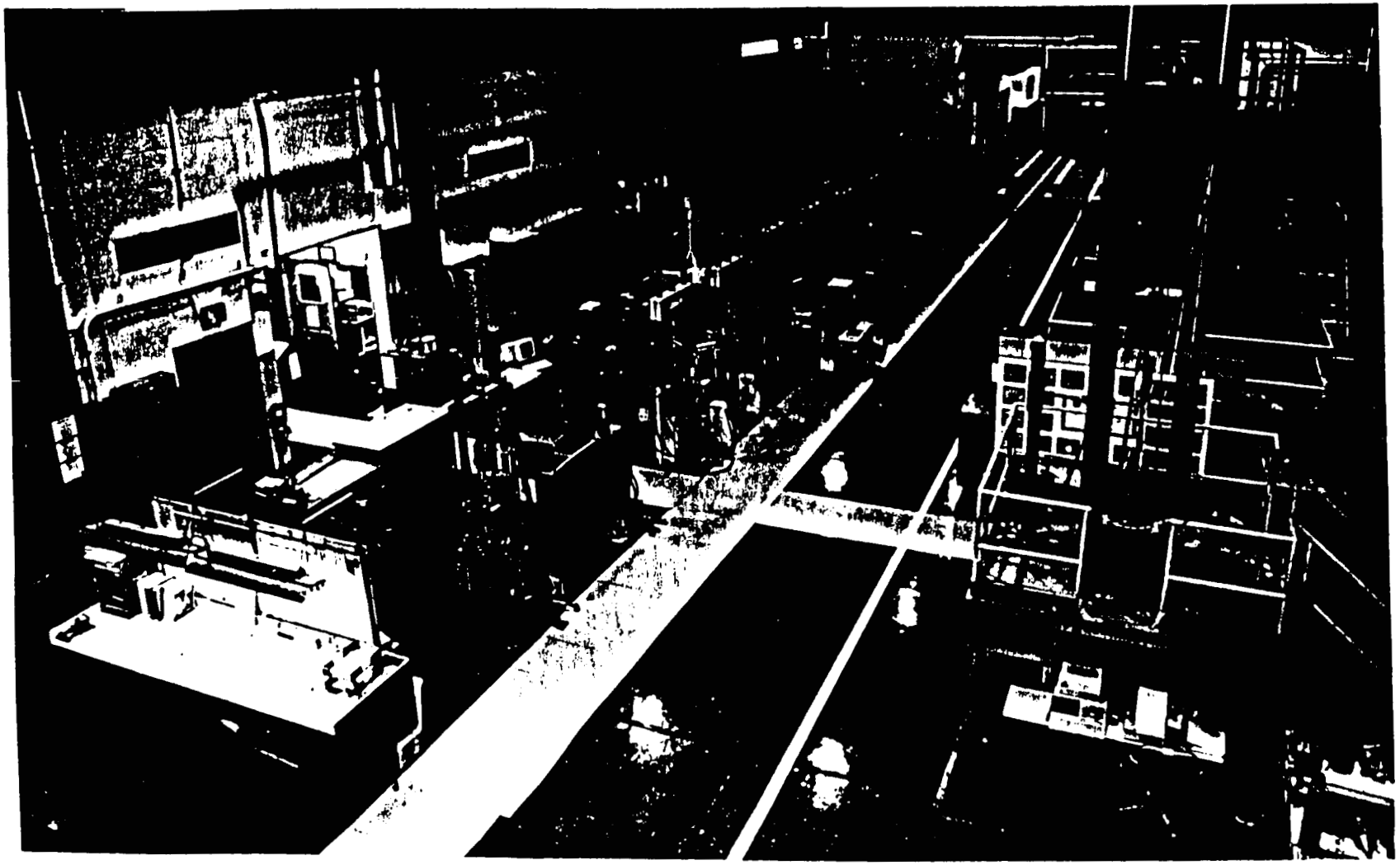


1594

Mechanics of Materials Laboratory

51 Test stands
Combined loads
Elevated temperatures

Environmental fatigue
Long-term durability
Instrumented impact



94-09-23 17:31 RCVD

ACTIVITY: Army Research Laboratory, NASA Lewis, OH

Section II: Capacity of DOD Component

2.1 Workload

Information Required	Fiscal Years											
	86	87	88	89	90	91	92	93	94	95	96	97
Total Funds Programmed ($M)	-	-	-	-	-	-	-	5.6	5.1	4.4	4.4	4.3
Total Actual Funds ($M)	-	-	-	-	-	-	-	5.7	-	-	-	-
Programmed Workyears	-	-	-	-	-	-	-	55	61	63	73	80
Actual Workyears	-	-	-	-	-	-	-	51	-	-	-	-

2.2 Excess Lab Capacity: N/A

Notes:
-ARL established FY93.
-Funds data does not include reimbursable, SBIR, FAST, Explitation of Foreign Items, QRIP, Industrial Preparedness, or Armor/Anti-Armor funds. These funds are not "programmed," but received during the year of execution.
-Workyears include all government personnel (to incl reimbursable if applicable).
-The ARL at NASA Lewis consists of the Air and Ground Vehicle common support functions.

ACTIVITY: ARL, NASA LEWIS, OH

CSFs: AIR VEHICLES, ROTARY, PROPULSION
GROUND VEHICLES (WHEELED & TRACKED)

Section III: Capability of Activities to Perform Common Support Functions

3.0 Mission: Develop technology necessary to provide the Army with light weight, efficient, reliable propulsion systems for air vehicles and ground vehicles; and drive train systems for rotorcraft; transition technology to customers.

Air Vehicles - aero component experimental research and development, CFD analysis, mechanical component research and development, tribological research, propulsion materials research and development, structural analysis, advanced propulsion concepts and analysis, rotorcraft drivetrain/transmission research and development.

Ground Vehicles - high temperature tribology, low heat rejection coatings, advanced bearing analytical tools.

Previous Project Reliance deliberations recommended that the Army Research Laboratory (ARL) Vehicle Propulsion Directorate (VPD) be assigned the responsibility for turboshaft engines under 5000 horsepower, and thad VPD have sole responsibility for rotocraft drivetrains and transmissions.

Interconnectivities: The Army Research Laboratory (ARL) Vehicle Propulsion Directorate (VPD) conducts many of its programs cooperatively with NASA, other military services, other government agencies, and turbine engine manufacturers. VPD has cooperative programs in the following areas:
Air Force - Splittered compressor rotor, powder lubrication, magnetic bearings, and engine stability hancement.
Navy - advanced lubricants for helicopter transmissions.
FAA - diagnostics for helicopter transmissions.
NASA and/or engine manufacturers - advanced turboshaft engine compressors, ceramic matrix composite applications in turbines.

Interconnectivities with CSFs:

Pervasive functions.

Environmental Sciences - reduced fuel usage.

Human Systems - acoustics and vibration abatement.

Environmental Quality - clean burning combusters, noise and vibration control.

Advanced Materials - metallics, ceramic matrix composites, polymers.

3.1 Location.
3.1.1 Geographic/Climatological Features: None.
3.1.2 Licenses and Permits: None.

3.1.3 Environmental Constraints: Special containment and disposal of some fuels and lubricants employed. This is all addressed through facilities and infrastructure provided by the NASA host agency--no Army burden.

ACTIVITY: ARL, NASA LEWIS, OH

CSFs: AIR VEHICLES, ROTARY, PROPULSION
GROUND VEHICLES (WHEELED & TRACKED)

3.1.4 Special Support Infrastructure: The Army Research Laboratory's Vehicle Propulsion Directorate (VPD) is collocated with NASA at the Lewis Research Center. NASA owns and maintains the bulk of the highly specialized component and subsystem test facilities, computational facilities and technical support based used by the Army in conducting its propulsion R&D. In addition, Lewis Research Center houses world class research facilities in all of the critical scientific disciplines essential to propulsion R&D including CFD, tribology, high temperature materials, structures, sensors and controls. Many of the facilities at Lewis are unique within the government and specifically applicable to Army's special propulsion interests. Among these are the rotorcraft transmission component and subsystem test facilities, the Small Turboshaft Engine Research facilities, compressor test facilities specifically dedicated to non-axial turbomachinery (an Army unique interest within DoD) and the icing research facilities (again, an area of especially strong Army interest because of its typical flight modes). Taken as a whole, the Army collocation with NASA at Lewis Research Center provides direct access, without construction and maintenance costs to approximately $1B worth of unique, Army interest focussed R&D facilities.

3.1.5 Proximity to Mission-Related Organizations:

CSF	Name	Type of Organization	Distance	Workyear Performed	Workyears Funded
Air Veh. Rotary Propulsion	NASA	OGA	Collocation	45	46
	U of Akron	UNIV	30 Miles		1
	Cleveland State U	UNIV	10 Miles		1
	Case Western Reserve U.	UNIV	10 Miles		1
Ground Veh Propulsion	NASA	OGA	Collocation	6	8
	U of Akron	UNIV	30 Miles		1

Direct collocation with NASA at Lewis Research Center gives VPD access to propulsion component and system test facilities applicable to both rotary wing air vehicle propulsion and to ground vehicle propulsion (both tracked and wheeled). In addition, research facilities and infrastructure are available to VPD to perform all of the necessary discipline area research (fluid mechanics, structural mechanics, materials, special computational methods, and analytical resources) needed to support component and propulsion subsystem development. Furthermore, because of proximity to Lewis Research Center, unique research capabilities have grown at nearby universities in areas crucial to mechanical power transfer (transmissions), micro-sensors and control elements, tribology and seal technology. Specifically, at Cleveland State University, unique capabilities in transmission system dynamic analysis are available and are an integral part of VPD;s rotorcraft power transmission tech base program; already this specific capability forms the basis for an important cooperative program with Sikorsky in support of Comanche. A center of excellence in the area of microsensors and micromachines at Case Western Reserve University is the basis for some advanced concept icing sensors and aerodynamic load sensors, the latter being essential to our advanced aero component development program. Also at Case Western Reserve University is an extensive world class capability in various engineering mechanics disciplines whereby VPD's S&E's enjoy ready access to relevant high quality graduate training. Research facilities and expertise in brush seal fluid mechanics at the University of Akron has helped VPD maintain a leading edge R&D program in the area of advanced sealing technology for engines, critical to achieving engine efficiency objectives. The Army Research Office (ARO) maintains a University Research Initiative (URI) center in gearing at Ohio State University (OSU), the relatively close proximity to

which enables VPD very effective interchange of people, especially OSU students who desire to do some of their experimental work on the extensive facilities at Lewis Research Center. Finally, easy access (3 hour drive) of both Wright Patterson Air Force Base (WPAFB) and the Tank Automotive Research Development and Engineering Center (TARDEC) make it possible for VPD to coordinate programs with peers at these government lab locations. This has been fruitful in developing cooperative R&D programs involving people and resources at Lewis and these other two centers. The frequent interchange possible has promoted numerous close working relationships. Absence of the collocation of VPD with NASA at Lewis Research Center would obviously nullify all of the above in-place benefits. Reproducing the capabilities enjoyed by VPD at Lewis, both facility and technical expertise, would be prohibitively expensive on one hand (over $1B worth of facilities are employed in VPD's tech base program), and impossible to realize on the other (critical mass of expertise available on call in all technical areas comprising VPD's mission). In effect, VPD can perform a mission with roughly 50 people and $5M/year budget that would require at least 400 people and more than $100M/year if the Army were "going it alone."

3.2 Personnel.

3.2.1 Total Personnel:

Air Vehicles, Rotary, Propulsion--ARL NASA Lewis

Types of Personnel	Number of Personnel			
	Government		On-Site FFRDC	On-Site SETA
	Civ	Mil		
Technical	39	1	2	
Management (Supv)	2			
Other	2			1

Ground Vehicles Propulsion--ARL NASA Lewis

Types of Personnel	Number of Personnel			
	Government		On-Site FFRDC	On-Site SETA
	Civ	Mil		
Technical	6	0	1	
Management (Supv)	1			
Other	1			1

ACTIVITY: ARL, NASA LEWIS, OH

CSFs: AIR VEHICLES, ROTARY, PROPULSION
GROUND VEHICLES (WHEELED & TRACKED)

3.2.2 Education: Civilian Only

Air Vehicles, Rotary, Propulsion--ARL NASA Lewis

Types of Degree/Diploma	Number of Personnel by Type of Position		
	Technical	Management (Supv)	Other
High School or Less	4		
Associates	4		1
Bachelor	14	1	1
Masters	7		
Doctorate	10	1	

Ground Vehicles Propulsion--ARL NASA Lewis

Types of Degree/Diploma	Number of Personnel by Type of Position		
	Technical	Management (Supv)	Other
High School or Less	1		
Associates			1
Bachelor	3		
Masters	2	1	
ctorate			

3.2.3 Experience: Civilian Only

Air Vehicles, Rotary, Propulsion--ARL NASA Lewis

Type of Position	Years of Government and/or Military Service				
	Less than 3 years	3-10 years	11-15 years	16-20 years	More than 20 years
Technical	2	12	6	3	16
Management (Supv)					2
Total	2	12	6	3	18

Ground Vehicles Propulsion--ARL NASA Lewis

Type of Position	Years of Government and/or Military Service				
	Less than 3 years	3-10 years	11-15 years	16-20 years	More than 20 years
Technical		1	3		2
Management (Supv)					1
Total		1	3		3

ACTIVITY: ARL, NASA LEWIS, OH

CSFs: AIR VEHICLES, ROTARY, PROPULSION
GROUND VEHICLES (WHEELED & TRACKED)

3.2.4 Accomplishments During FY91-93
3.2.4.1 Patents Awarded/Patent Disclosures

Common Support Function	Disclosures	Awarded	Patent Titles
Air Vehicles, Rotary, Propulsion	2	1	Substituted 1, 1, 1 - Triaryl - 2, 2, 2 Trifluoroethanes and Processes for their systhesis.

Ground Vehicles Propulsion: None

3.2.4.2 Papers in Peer Reviewed Journals

Common Support Function	No. Published	Paper Titles
Air Veh. Rotary, Propulsion	16	Listed below

Microstructural and Strength Stability of CVD SiC Fibers in Argon Environment; Bhatt, Hull; Ceramic Engineering Science Proceedings, Vol. 12, pp 1832-1942; 1991; Prepared for the 15th Annual Conference Composites and Advanced Ceramics sponsored by the American Ceramic Society, 13-16 January 1991.

NASA Low-Speed Centrifugal Compressor for 3-D Viscous Code Assessment and Fundamental Flow Physics Research; Hathaway, Wood, Wasserbauer; ASME Journal of Turbomachinery; April 1992; Vol 114.

Surface Fatigue Life of M50NiL and AISI 9310 Spur Gears and RC Bars; Townsend, Bamberger; Journal of Propulsion and Power, Vol 7, No. 4; July/August 1991.

Cyclopent Adiene Evolution During Pyrolysis-Gas Chromatography of PMR Polyimides; Alston, Gluyas, Snyder; Referred paper that is now part of book "Advances in Polymide Science and Technology," 1993.

Structure-to-Property Relationship in Addition Cured Polymers IV-Correlations Between Thermo-Oxidative Weight Losses of Norbornenyl Cured Polyimide Resins and Their Composites; Alston; American Chemical Society Polymer Reprints; April 1992; Vol 33 No. 1.

Maximum Life Spiral Bevel Reduction Design; Savage, Prasanna, Coe; Gear Technology; Journal of Gear Mfg. vol. 10, no. 5; September-October 1993.

Model Simulation of Gearbox Vibration With Experimental Correlation; Choy, Ruan, Zakrajsek, Townsend, Oswald, Decker; Journal of Propulsion and Power, vol. 9, no. 2; March-April 1993.

Maximum Life Spur Gear Design; Savage, Mackulin, Coe, Coy; Journal of Propulsion and Power, vol. 8, no. 6; November-December 1992.

In Situ X-Ray Monitoring of Damage Accumulation in SiC/RBSN Tensile Specimens; Baaklini, Bhatt; Ceramic Engineering and Science Proceedings, vol 12.; 1991.

ACTIVITY: ARL, NASA LEWIS, OH

CSFs: AIR VEHICLES, ROTARY, PROPULSION
GROUND VEHICLES (WHEELED & TRACKED)

Ultrasonic Velocity Technique for Monitoring Property; Kautz, Bhatt; Ceramic Engineering and Science Proceedings, no 7 & 8.; 1991.

Experimental and Computational Investigation of the NASA Low Speed Centrifugal compressor Flow Field; Hathaway, Chriss, Wood, Strazisar; AASME of Turbomachinery, vol. 115; July 1993.

Tooth Contact Shift in Loaded Spiral Bevel Gears, Gear Technology; Savage, Altidis, Lewicki, Coy, Litvin; The Journal Of Gear Manufacturing; November-December 1993.

Calculation of Hot Gas Ingestion for a Stovl Aircraft Model; Fricker, Holdeman, Vanka; AIAA Journal of Aircraft; September-October 1993.

Simultaneous Pressure Measurement and High-Speed Photography Study of Cavitation in a Dynamically Loaded Journal Bearing; Sun, Brewe, Abel; Trans. ASME vol. 115, Journal of Triboloby, no. 1; January 1993.

Applications of an Exponential Finite-Difference Technique; Handschuh, Keith; Numerical Heat Transfer, Part A, vol. 22; November 1992.

Dibenzanthracene Dianhydride-Based Polyimides; Alston; Fifth Annual High Temperature Review; October 1992.

Ground Veh Propulsion 5 Listed below

Extension of Transonic Flow Computational Concepts in the Analysis of Cavitated Bearings; Vijayaraghavan, Brewe; ASME Trans., vol. 113, Journal of Tribology, no. 3; July 1991.

A System-Approach to the Elastohydrodynamic Lubrication Point-Contact Problem; Lim, Brewe; STLE Tribology Transactions, vol. 35, no. 2; April 1992.

A Frequency Effects on the Stability of a Journal Bearing for Periodic Loading; Vijayaraghavan, Brewe; Trans. ASME, vol 114, Journal of Tribology, no. 1; January 1991.

Effect of Out-of-Roundness on the Performance on a Diesel Engine Connecting-Rod Bearing; Vijayaraghavan, Brewe, Keith; Trans. ASME, vol 115, Journal of Tribology, vol. 115; July 1993.

Two Reference Time Scales for Studying the Dynamic Cavitation of Liquid Films; Sun, Brewe; Trans. ASME, vol 114, Journal of Tribology, no. 3; July 1992.

ACTIVITY: ARL, NASA LEWIS, OH

CSFs: AIR VEHICLES, ROTARY, PROPULSION
GROUND VEHICLES (WHEELED & TRACKED)

3.3 Workload.

3.3.1 FY93 Workload.

3.3.1.1 Work Year and Lifecycle:

Air Vehicles, Rotary, Propulsion--ARL NASA Lewis

"Lab"	Fiscal Year 1993 Actual			
	Civilian	Military	FFRDC	SETA
Science & Technology	43*	1	2	1
Engineering Development	0			
In-Service Engineering	0			

* Plus 3 workyears of college student effort.

Ground Vehicles Propulsion--ARL NASA Lewis

"Lab"	Fiscal Year 1993 Actual			
	Civilian	Military	FFRDC	SETA
Science & Technology	8		1	1
Engineering Development	0			
In-Service Engineering	0			

3.3.1.2 Engineering Development by ACAT: None.
3.3.1.3 In-Service Engineering: None.

3.3.2 Projected Funding.

3.3.2.1 Direct Funding ($K): RDTE

Common Support Function	FY94	FY95	FY96	FY97
Air Vehicles, Rotary, Propulsion	4,539	3,820	3,680	3,618
Ground Vehicles Propulsion	610	588	703	673

ACTIVITY: ARL, NASA LEWIS, OH

CSFs: AIR VEHICLES, ROTARY, PROPULSION
GROUND VEHICLES (WHEELED & TRACKED)

3.3.2.2 Other Obligation Authority ($K):

Common Support Function	FY94	FY95	FY96	FY97
Air Vehicles, Rotary, Propulsion	300	300	300	300
Ground Vehicles Propulsion		100	200	300
*Dual Application Ground Vehicle Propulsion and Air Vehicles, Rotary, Propulsion	1,000	1,000	1,000	

*Dual application addresses funding provided to support development/demonstration of the Regenerative Feedback Turbine Engine (RFTE) concept. This concept is equally applicable to future armored combat vehicles and rotorcraft. Source of the funding is NASA through their Advanced Concepts Program Office at NASA Headquarters. The RFTE Project was initiated at LeRc by VPD; proposal submission was orchestrated by VPD; selection of RFTE for funding by NASA was on a competitive basis, and RFTE was one of three programs selected for funding at Lewis, out of more than 100 submissions. VPD is proud of this success, and will proceed with NASA in implementing the program.

Facilities and Equipment

Common Support Function	Major Facility or Equipment Description (%Army/%NASA)	Unique To: DOD	Federal Govt	U.S.	Replacement Cost ($K)
Air Vehicles, Rotary,Propulsion	3000 HP Transmission Stand (100/0)		X	X	15,000
	500 HP Transmission Stand (75/25)	X	X		2,000
	Small Turbine Engine Research Facility (100/0)	X	X	X	15,000
	Small Compressor Facility (50/50)	X	X		10,000
	Small Warm Turbine Facility (50/50)	X	X	X	10,000
	Combustor Liner Test Facility (25/75)	X	X	X	5,000
	Large Low Speed Compressor Facility (50/50)	X	X	X	10,000
	Gear Noise Research Facility (50/50)	X	X	X	2,000
	Spiral Bevel and Spur Gear Rings (75/25)	X	X	X	2,000
	Split Torque Test Rig (90/10)	X	X	X	1,000
	Waverotor Research Facility (40/60)	X	X	X	2,000
	Advanced Seal Test Facility (50/50)	X	X		1,000
Ground Vehicles Propulsion	Low Heat Rejection Coating Research Facility (75/25)	X	X	X	1,000
	In-Cylinder Tribology Research Facility (75/25)	X	X		1,000

ACTIVITY: ARL, NASA LEWIS, OH

CSFs: AIR VEHICLES, ROTARY, PROPULSION
GROUND VEHICLES (WHEELED & TRACKED)

All facilities listed are wholly owned by NASA. These facilities are considered to be "world class," with most having been built specifically to obtain "benchmark" experimental data. In addition to having access to these facilities, the ARL VPD has scientists, engineers, and technicians working side-by-side with their NASA counterparts in them. The VPD presence and active participation in these facilities, as well as the associated test equipment and computers, provides the Army aviation and ground vehicle community access to superior "world class" research facilities at nominal cost.

3.5 Expansion Potential: NASA owns the space occupied by VPD. Though space capacity data can be provided, the issue of excess (though such does not exist) must be negotiated with NASA.

3.5.1 Laboratory Facilities: Major component and subsystem test facilities are presently saturated with projects (mostly cooperative programs with industry) through FY96.

Common Support Function	Facility or Equipment Description	Type of Space	Space Capacity (KSF) Current	Used	Excess
Space specifically allocated to VPD is administrative; technical space is utilized cooperatively with NASA scientists. Facilities/equipment may be used interchangeably to support bothAir Vehicle and Ground Vehicles.					
Air/Ground Vehicles (Could not be broken out)	Office	Administrative	6210	6210	0

3.5.1.1 Capacity of activity to absorb similar workyears categorized in the same common support function: In basic research arena there is laboratory facility and office space capacity available to absorb up to 20 additional manyears. Specific research areas that could potentially absorb these manyears include Materials and Structures, instrumentation sensors and controls, tribology, combustion, and advanced propulsion and power concept analysis. Preliminary discussions between VPD and the NASA Lewis Research Center management have been broached. NASA appears to welcome the opportunity to accommodate this level of staff increase at Lewis Research Center.

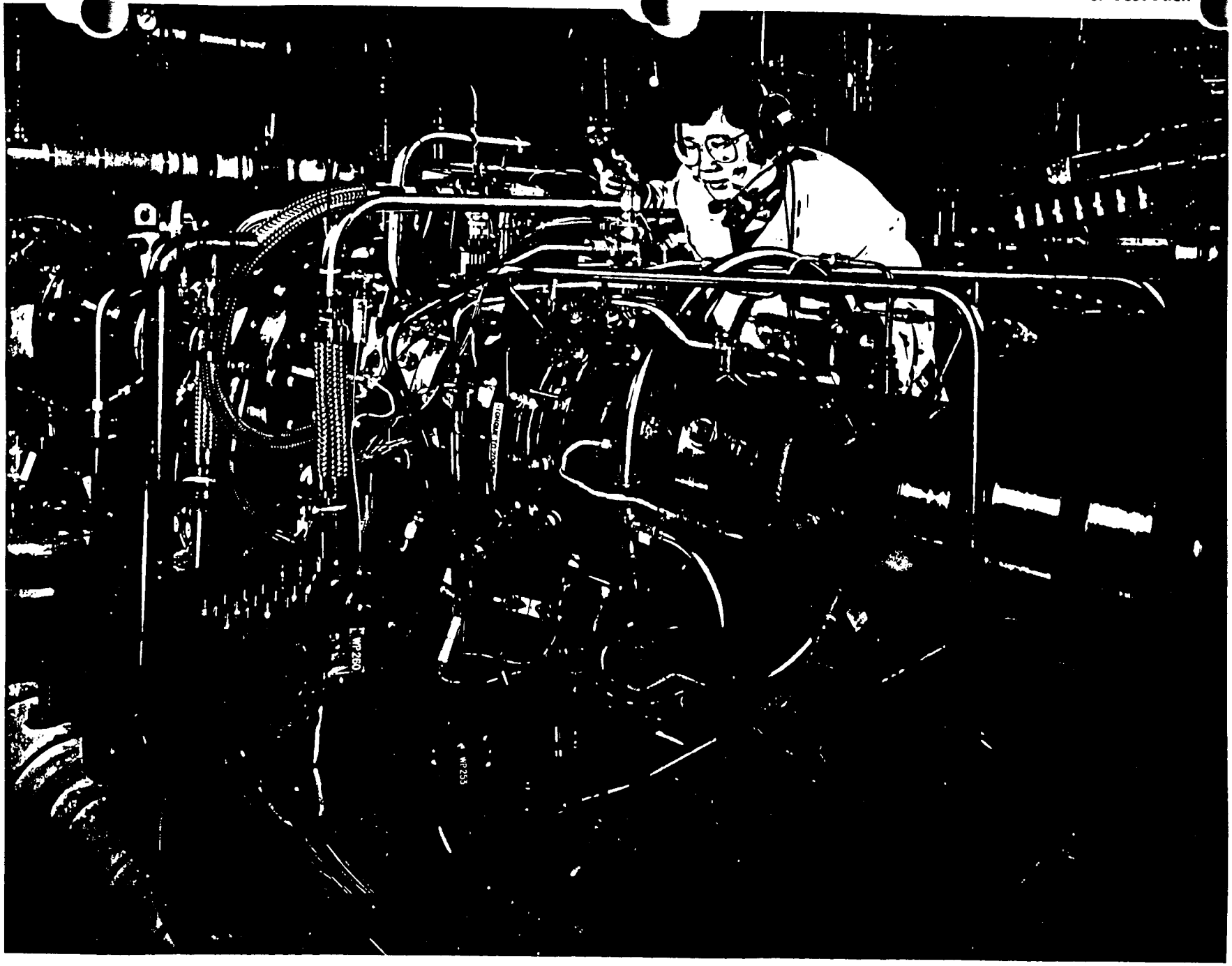
3.5.1.2 If capacity to absorb additional workyears, how many can be supported: 20

3.5.1.3 Impact of military construction program or other alteration projects programmed in FY95 PBS: None.

3.5.2 Land use. Per NASA Lewis, there are no buildable acres at the site.

3.5.3 Utilities. Unknown. VPD is a tenant at the NASA facility.

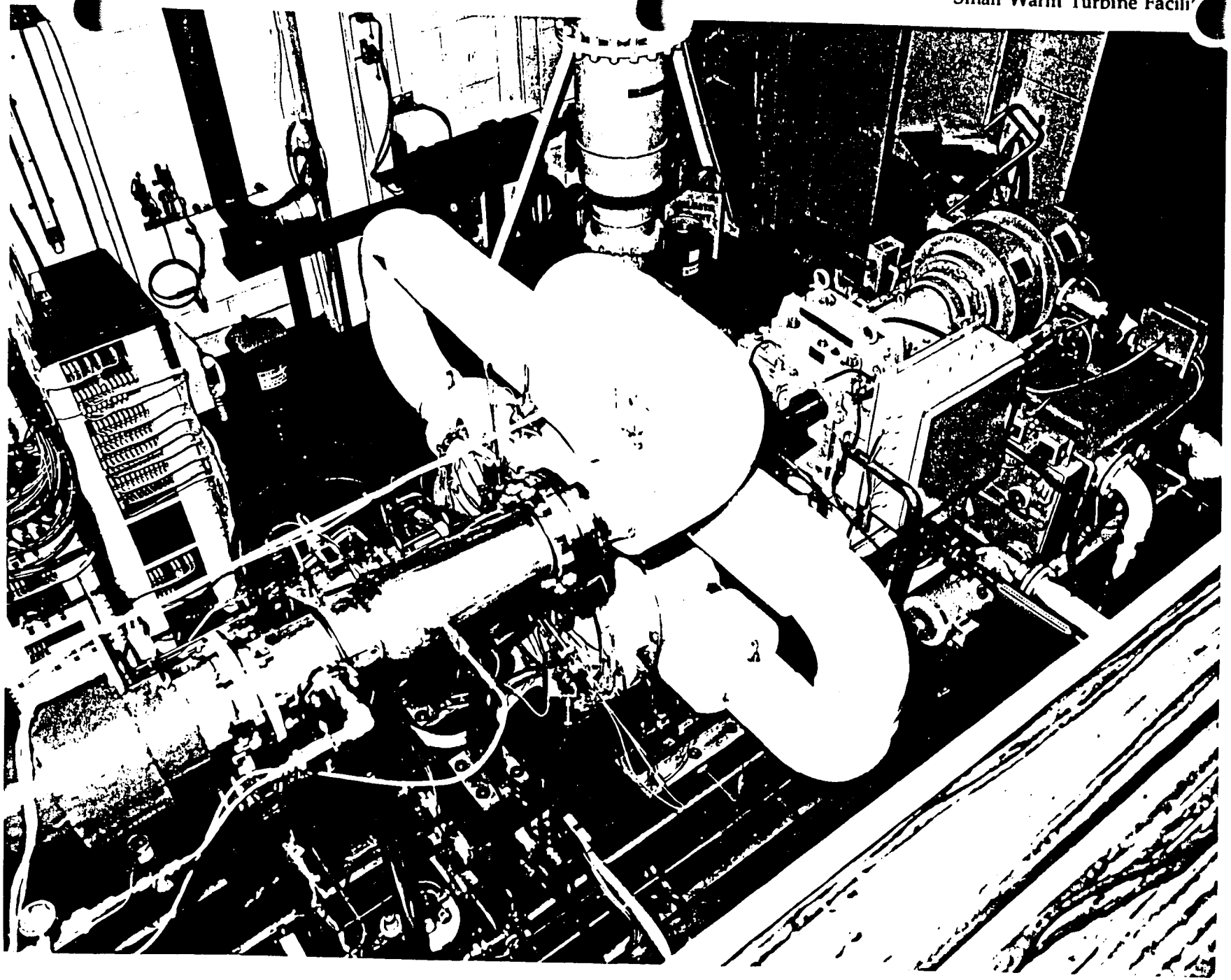
Combustor Liner Test Facil

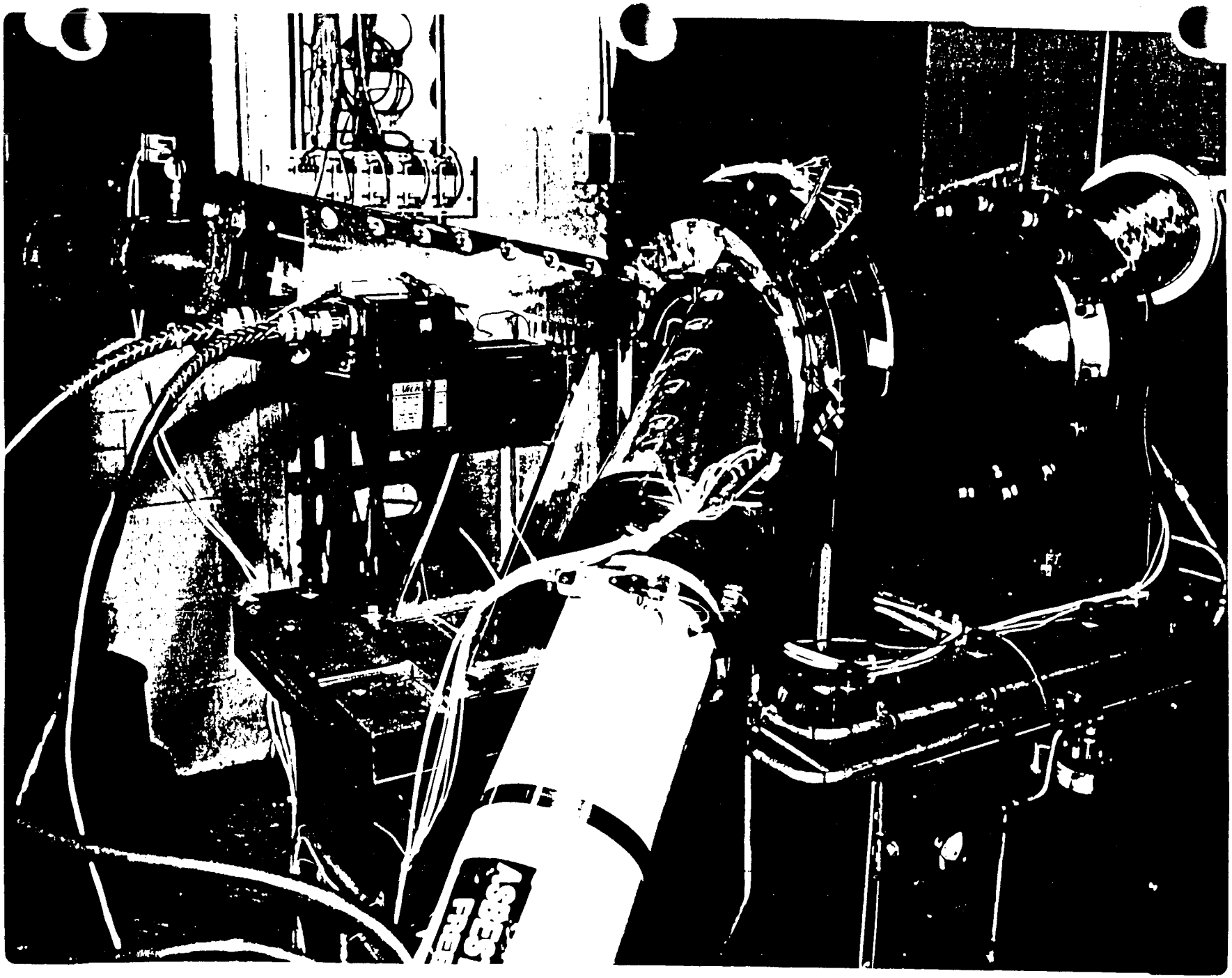


NASA
C-93-03214

Advanced Seal Test Facility

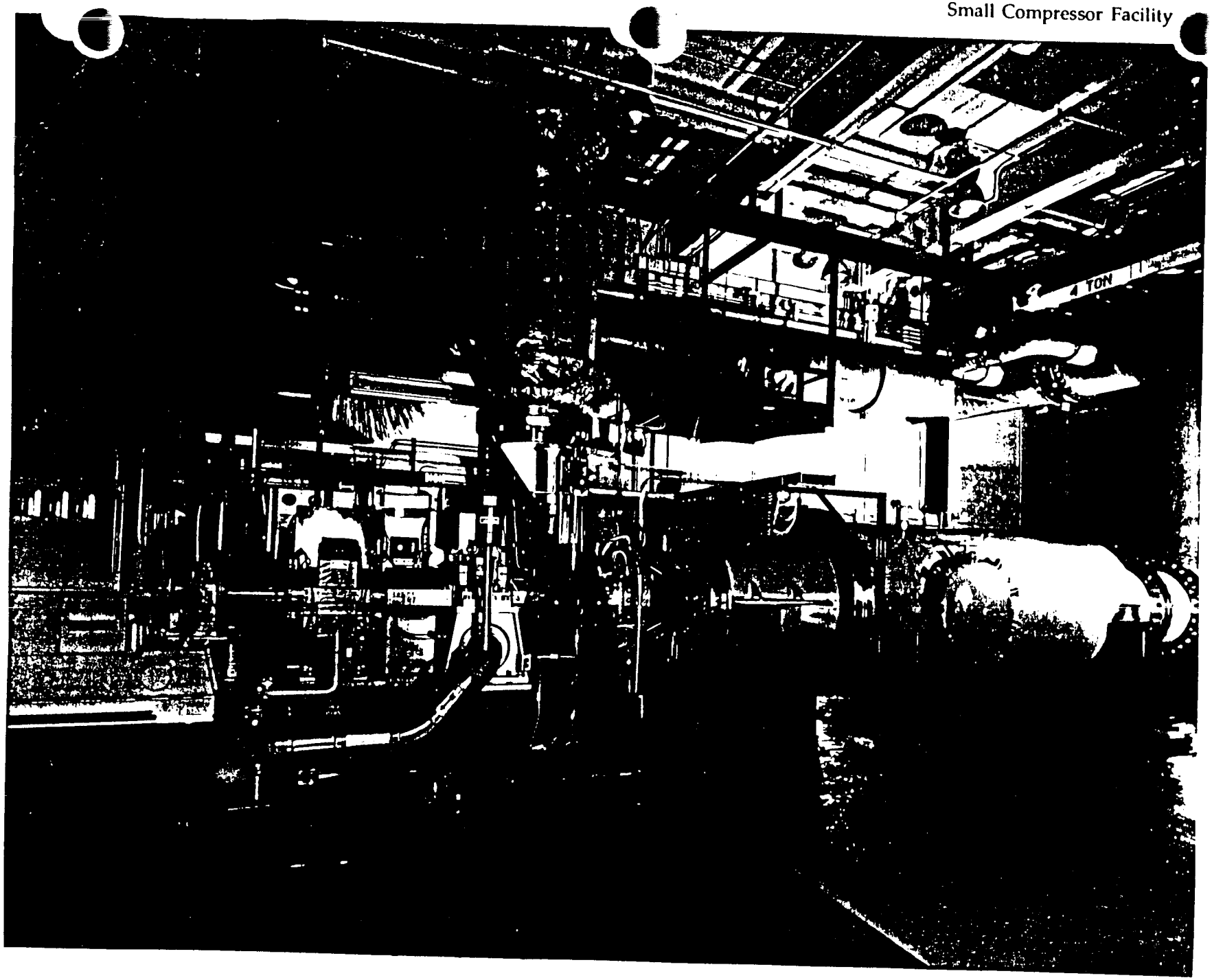
Small Warm Turbine Facili

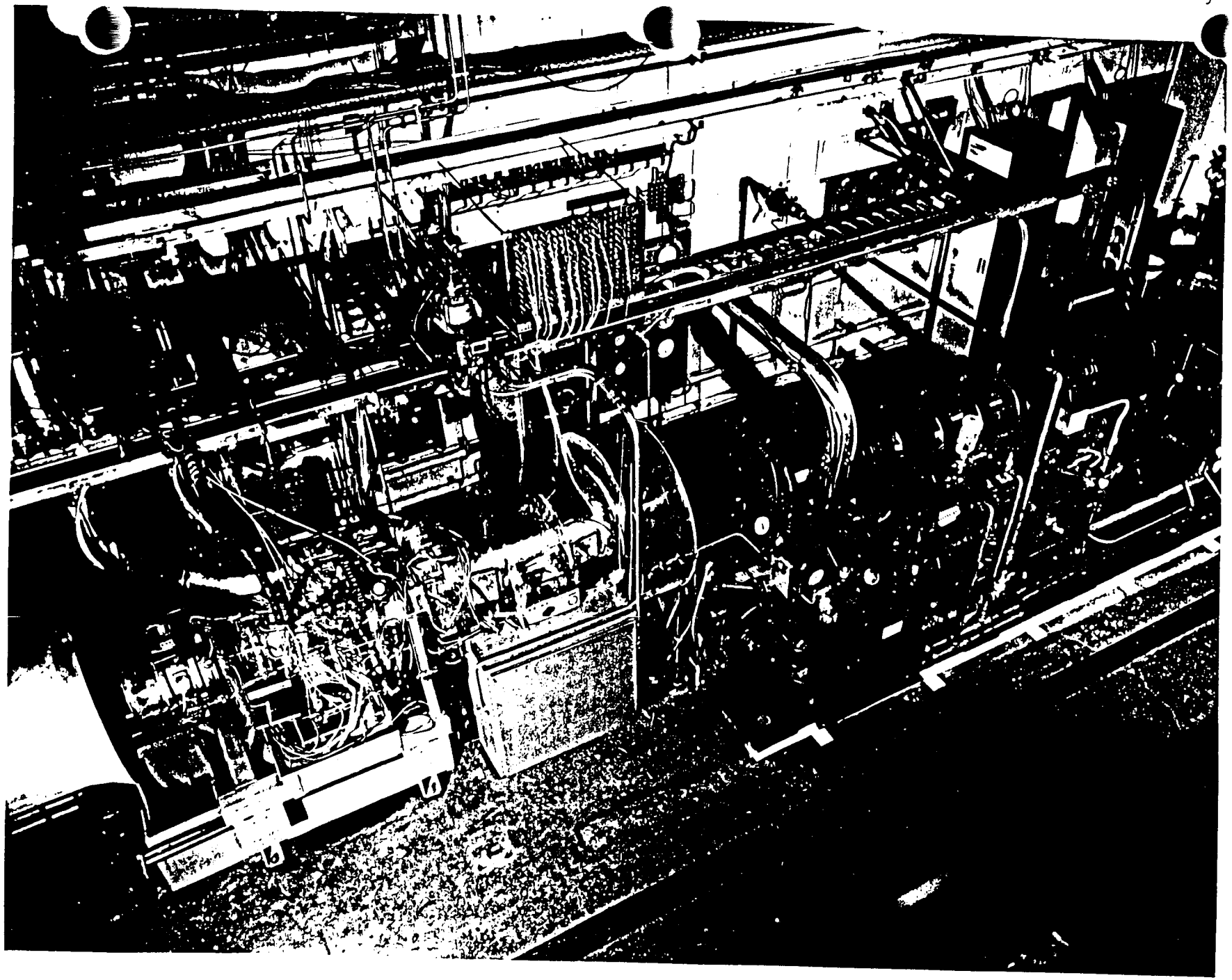




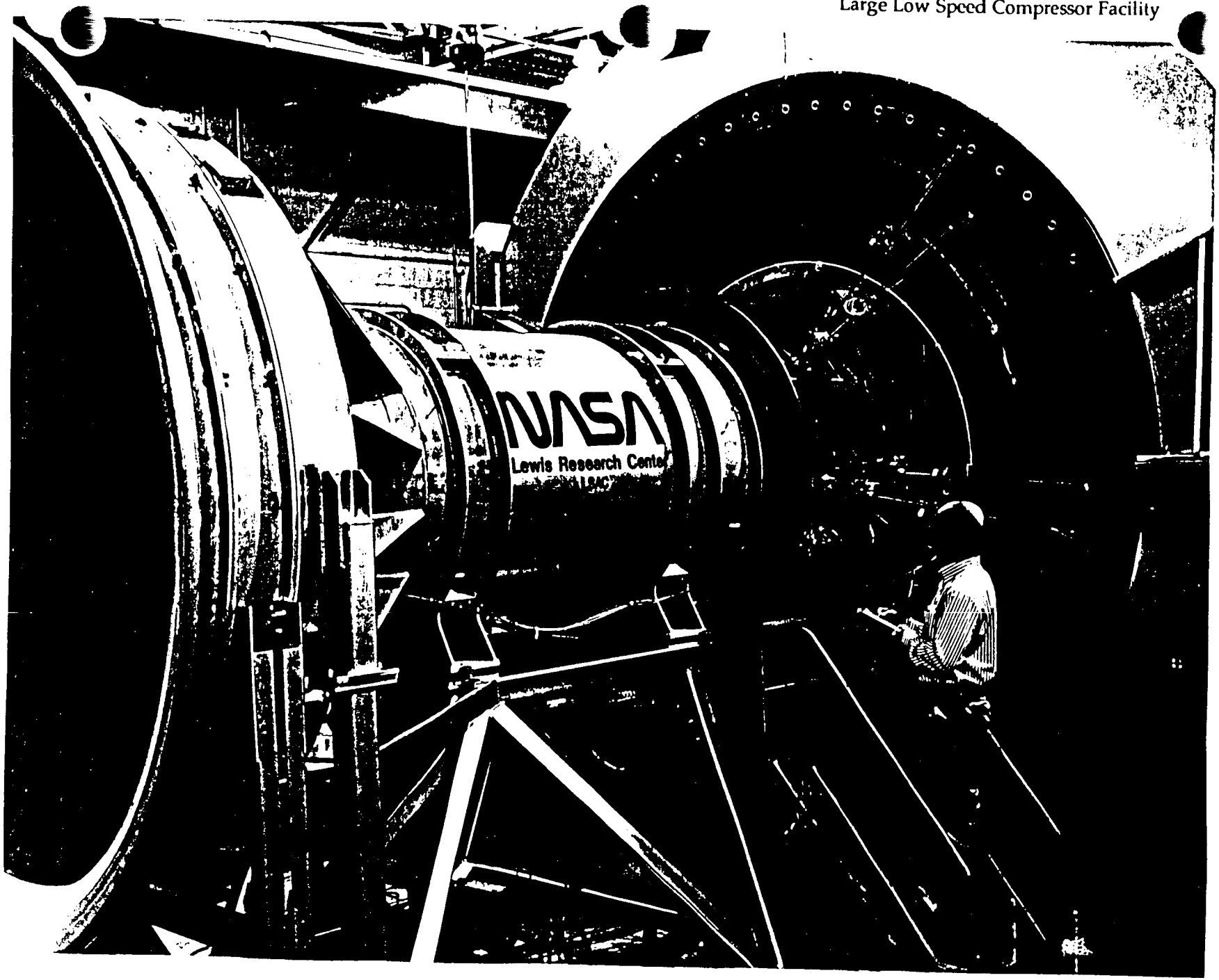
NASA LeRC C# 92-7605

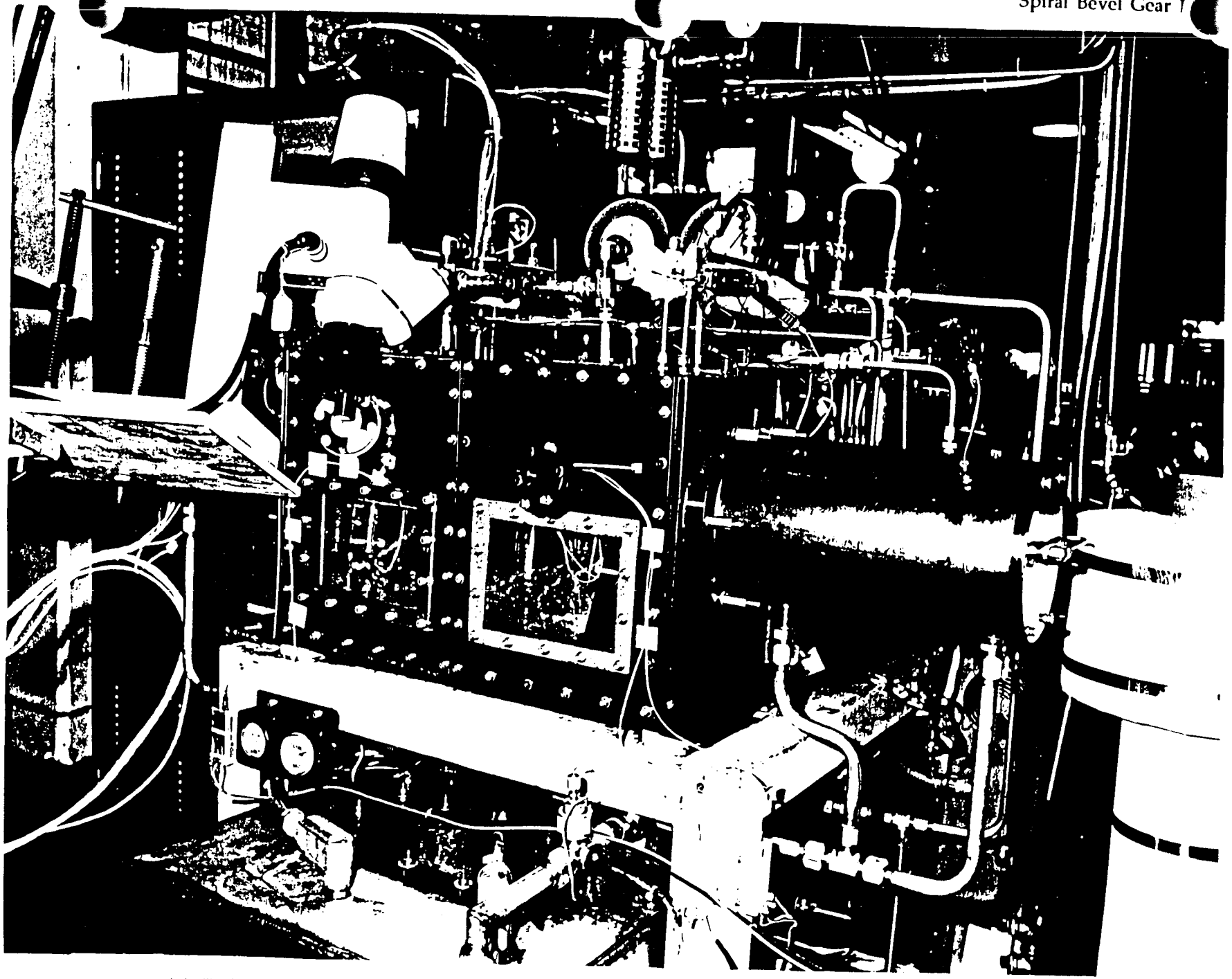
Small Compressor Facility



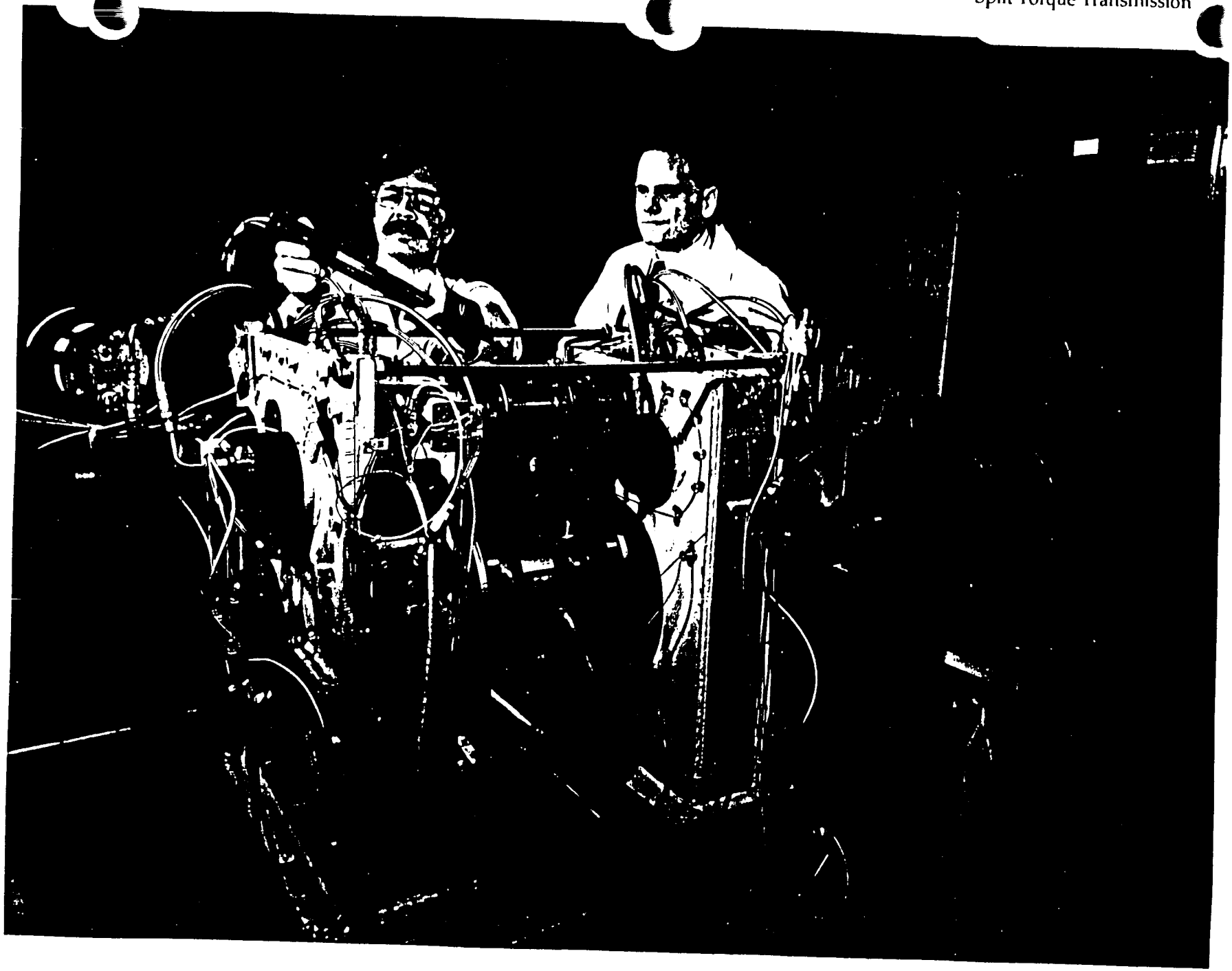


Large Low Speed Compressor Facility

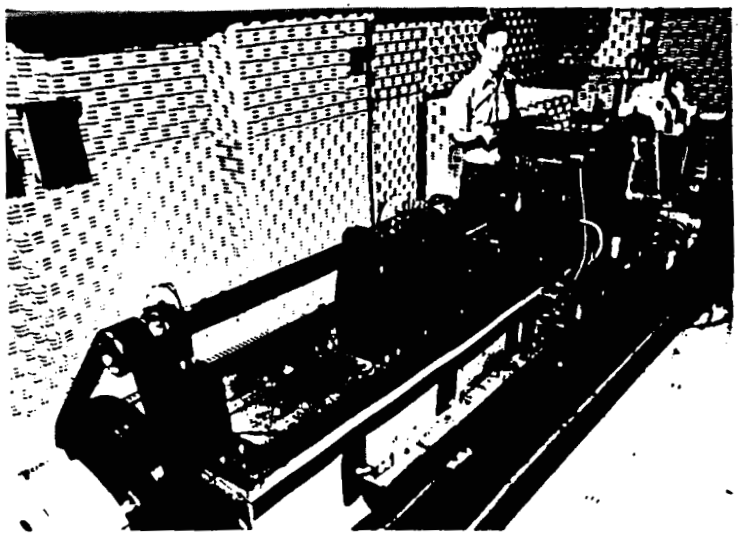


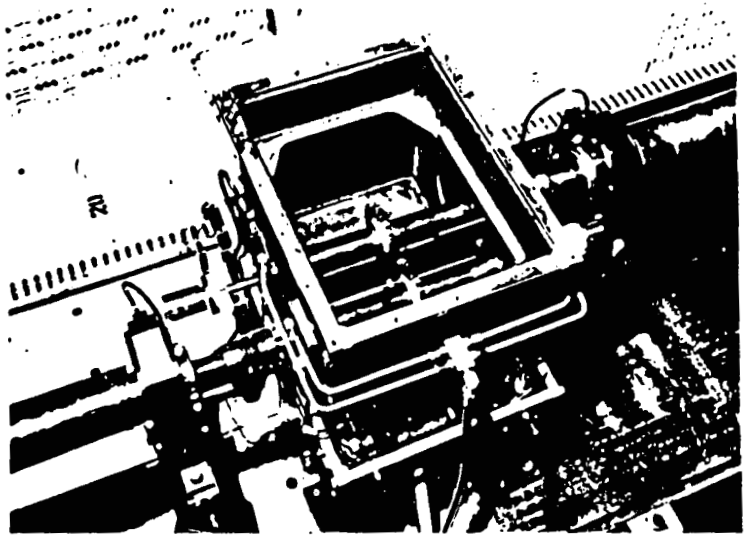


NASA LeRC C# 92-3697



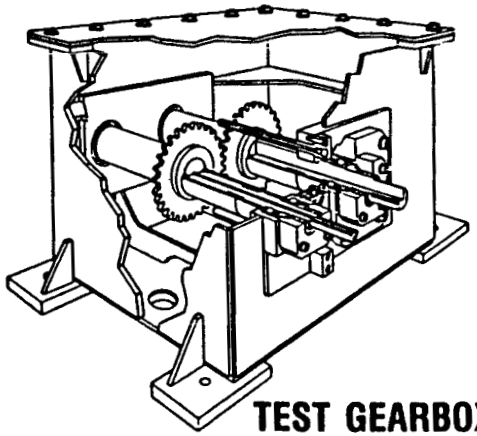
GEAR NOISE RIG



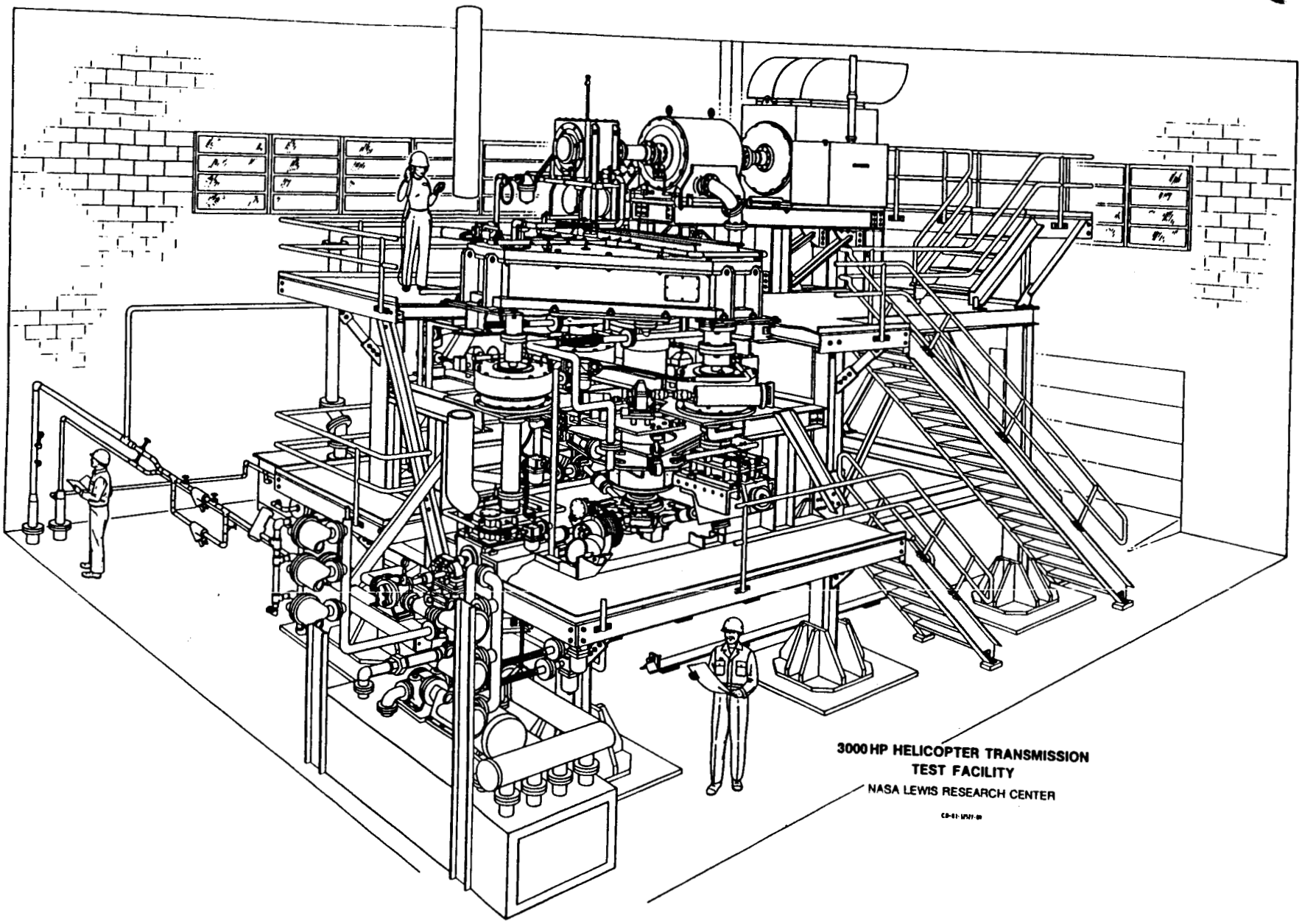


- GEAR NOISE & DYNAMICS MEASUREMENTS
- PARAMETRIC STUDIES OF GEAR DESIGN VARIABLES
- MAXIMUM POWER—175 hp
  MAXIMUM INPUT SPEED—10,000 rpm
  MAXIMUM OUTPUT SPEED—6,000 rpm

CD-88-36087



TEST GEARBOX



3000 HP HELICOPTER TRANSMISSION
TEST FACILITY
NASA LEWIS RESEARCH CENTER

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DEPARTMENT OF THE ARMY
U.S. ARMY AVIATION AND TROOP COMMAND
NATICK RESEARCH, DEVELOPMENT AND ENGINEERING CENTER
NATICK, MA
01760-5019

REPLY TO ATTENTION OF

SATNC-I

MEMORANDUM FOR Commander, U.S. Army Materiel Command
(ATTN: AMCRD-IT), 5001 Eisenhower Avenue
Alexandria, VA 22333-0001

SUBJECT: Requests for Clarification to the Laboratories Joint Cross-Service Group BRAC-95 Data Call

1. Reference memorandum, DACS-TABS, 9 Sep 94, subject as above.

2. In accordance with paragraphs 1a and 1b of the referenced memorandum, enclosed is the clarification for sections 3.2.4.2 (encl 1) and 3.3.1.2 (encl 2) of the U.S. Army Natick Research, Development and Engineering Center (NRDEC) BRAC-95 Data Call.

3. In developing the data for section 3.3.1.2, the direction to use the 1993 Army ACAT list caused us major concern. The list contains only five entries pertinent to NRDEC versus 72 actual ACAT programs in the FY95 PBG. To avoid presenting a very incomplete picture of the workload at NRDEC, a comprehensive program list is contained in three footnotes that relate the actual ACAT programs to the "categories" of activities that appear on the 1993 Army ACAT list. The footnotes also include ACAT programs in the areas of airdrop, shelters, and organizational equipment which were essentially ignored on the ACAT listing. Airdrop, shelters, and organizational equipment were clarified early on in the BRAC process as being part of the CSF of Clothing, Textiles and Food.

3. Per your request, we are also forwarding four complete copies of the revised Data Call (including all changes made to date) and two data disks under separate cover. The information contained herein is accurate and complete to the best of my knowledge and belief.

David E. Faulkner LTC, QM
for MORRIS E. PRICE, JR.
Colonel, IN
Commanding

2 Encls

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DEPARTMENT OF THE ARMY

U.S. ARMY TROOP SUPPORT COMMAND
NATICK RESEARCH, DEVELOPMENT AND ENGINEERING CENTER
NATICK, MA

REPLY TO
ATTENTION OF

1 AUG 1994

SATNC-CM

MEMORANDUM FOR Commander, U.S. Army Materiel Command
(ATTN: AMCRD-IT), 5001 Eisenhower Avenue
Alexandria, VA 22333-0001

SUBJECT: BRAC 95 Data Call #5 - Supplemental Request for Information and Clarification

1. Reference:

a. Memorandum, AMCRD-IT, 27 July 1994, subject as above.

b. Memorandum, DACS-TABS, 26 July 1994, subject: BRAC Data Call #5 - Laboratories.

2. In accordance with paragraphs 2.b. and 2.c. of reference 1.b. above, enclosed is supplemental information on the U.S. Army Natick Research, Development and Engineering Center (NRDEC). The enclosed information should be applied to the original data submission as follows:

a. Section 3.0 Mission - Substitute original data with enclosure 1.

b. Section 3.4.1 Major Equipment and Facilities - Supplement original data with enclosure 2.

c. Section 3.5.2 Land Use - Substitute original data with enclosure 3.

3. The information contained herein is accurate and complete to the best of my knowledge and belief.

3 Encls

MORRIS E. PRICE, JR.
Colonel, IN
Commanding

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3.0 Mission:

Capabilities: Major capabilities for NRDEC Business Areas (Food, Clothing and Individual Equipment, Airdrop, Shelters, Organizational Equipment) are:

- Science and Technology
- System Design, Development, Engineering and Integration
- Simulation and Modeling
- Production Engineering in Support of Procurement and Fielded Items
- Standardization Management

Relationship: As DoD's world-class team providing customers with the essentials of life, NRDEC's unique mission and technical programs are focused on the readiness of the primary weapon system, the warfighter. The superior products and equipment resulting from NRDEC's RD&E efforts are critical to the survivability, sustainability, supportability, combat effectiveness and quality of life of the warfighter operating under world wide environmental extremes and hazardous conditions. No other DoD RD&E organization has this essential mission, and the nature of the effort is that NRDEC's systems and equipment are required in every mission and are in every weapon system. NRDEC performs research, development and engineering in the areas of combat clothing systems and individual protection, airdrop, rations, organizational equipment, and tactical shelters and tentage -- for use in wartime, peacetime, force projection, peacekeeping, and humanitarian efforts. NRDEC is the DOD Project Reliance Center of Excellence for Clothing, Textile and Food Science and Technology and is a center of excellence for airdrop and anthropometry.

Interconnectivity: NRDEC's CSF of Clothing, Textiles and Food is interconnected with other common support functions as it relates primarily to the operability, survivability, sustainability, and mobility of the individual soldier and crewman. These common support functions include:

Air Vehicles - As it relates to the sizing of the cockpit and the survival and sustainment of the aircrews through the development of protective clothing and food.

Weapons - as part of the interface of the operator (aircrew, combat vehicle crew, infantry) with the weapon system through integration of electronic interfaces in helmet systems.

C4I - as part of the interface with the individual aircrewman, combat vehicle crewman, or infantryman through soldier system integration.

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Ground Vehicles - As it relates to the sizing of the crew compartment and the survival and sustainment of the aircrews through the development of protective clothing and food.

Nuclear Weapons Effects - As it relates to the protection of the individual soldier from the high thermal heat flux of thermonuclear devices.

Human Systems - As it relates to sizing and the effects of protective clothing systems on range of motion and performance degradation of the individual soldier when encapsulated in protective systems.

Nuclear, Biological and Chemical (NBC) Defense - As it relates to the percutaneous protection of the individual combatant against exposure to chemical warfare agents and agents of biological origin.

Infectious Diseases - As it relates to the percutaneous protection of the individual combatant against insect vectors contaminated with agents of biological origin.

Training Systems - As it relates to acclimatization, operability, and mission performance of the individual combatant when encapsulated in protective clothing systems.

Advanced Materials - As it relates to bioengineered materials for individual protection

Environmental Quality - As it relates to environmentally safe processes for textile based polymers, fibers, and fabrics and the associated fabric treatments that provide protection.

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SECTION II: CAPACITY OF DOD COMPONENTS

2.1 Workload.

Information Required	Fiscal Years					
	86	87	88	89	90	91
Total Funds * Programmed($M)	91.3	88.4	76.8	99.2	107.3	142.2
Total Actual Funds ($M)	91.3	88.4	76.8	99.2	107.3	142.2
Programmed Workyears	801	792	812	801	807	808
Actual Workyear	801	792	812	801	807	808

Information Required	Fiscal Years					
	92	93	94	95	96	97
Total Funds * Programmed($M)	120.5	136.1	108.6	120.4	123.4	120.0
Total Actual Funds ($M)	120.5	136.1				
Programmed Workyears	787	738	690	669	659	653
Actual Workyear	787	738				

* Funds and workyears include actual reimbursable and direct cites through FY93, and estimates of reimbursable and direct cites in FY94-FY97. Base Ops, RPMA, MCA, AFH, and Environmental funding and workyears are excluded from above figures

2.2 Excess "Lab" Capacity - Measured at the DOD Component Level

-Excess "Lab" Capacity = Sum of the Peak Workyears - Sum of the Projected WorkYears

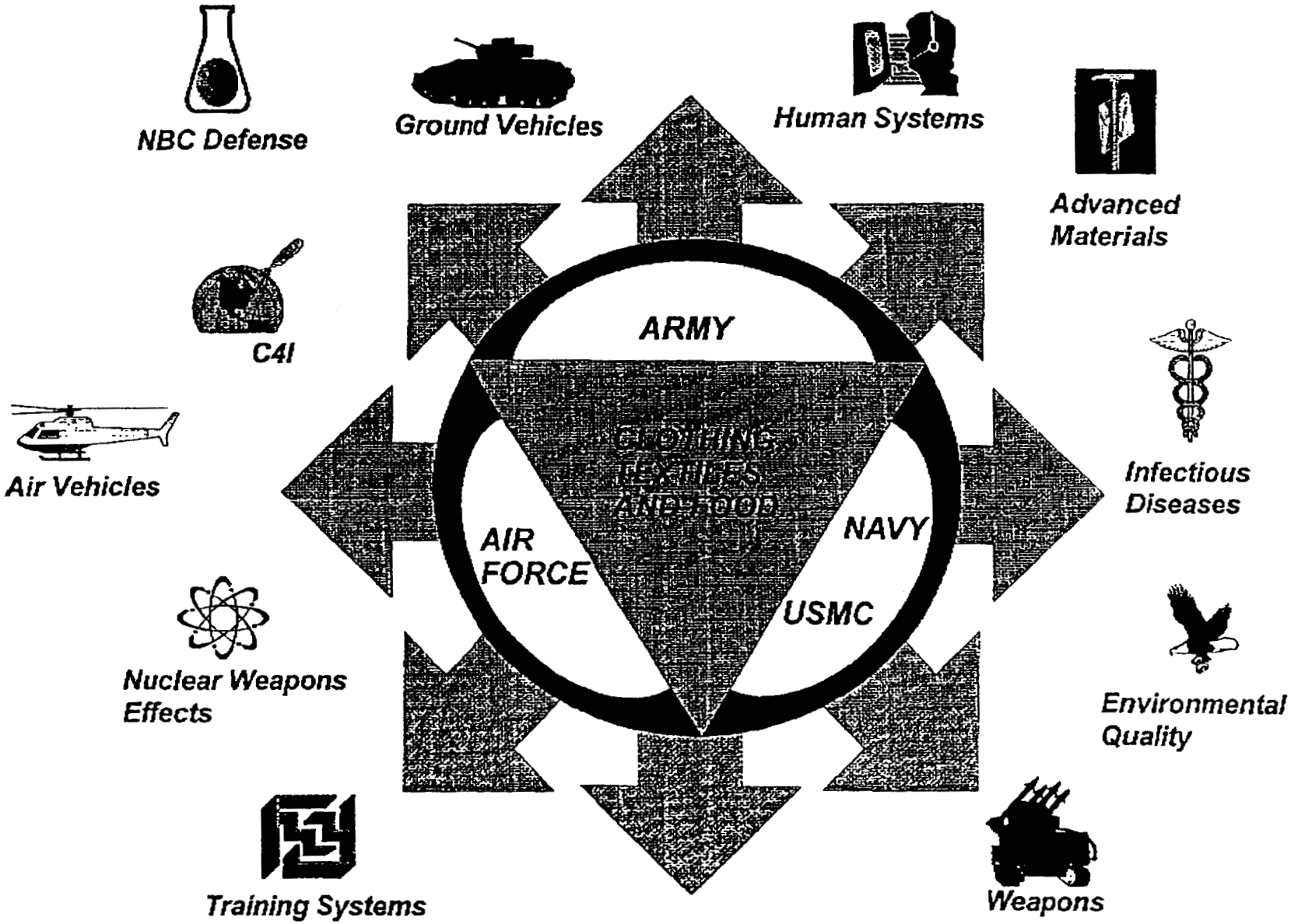
-Peak at each activity = Highest value between FY86 and FY93

-Projected at each activity = Estimated at FY97

PEAK WORKYEAR = FY88 PROJECTED WORKYEAR = FY97

812 - 653 = 159 (Excess Lab Capacity)

CLOTHING, TEXTILES AND FOOD CSF CONNECTIVITY



3.1 Location

3.1.1 Geographic/Climatological Features:

Our geographic location provides a variety of weather and terrain conditions suitable for evaluation of our soldier system equipment. Our proximity to the Cold Regions Research and Engineering Laboratory and the Mountain Warfare Center affords a unique opportunity to share information in the areas of training, doctrine, materials solutions, logistics and maintenance and participate in exercises with users of our food, clothing and equipment.

Natick's unique location offers specialized expertise, a professional environment and a source of well-qualified personnel for recruitment and leveraging. Our proximity provides (1) state-of-the-art expertise directly related to textiles and clothing, rations, airdrop and shelters, e.g., MIT, Harvard, UMass, Tufts, Brandeis, (2) exploitation of local privately owned companies in medical, textile and materials research that have been spun-off from the universities, (3) excellent recruiting source for highly talented personnel in specialized areas, such as biotechnology, food science, nutrition, aerodynamics, advanced materials and textile science, (4) cooperative education agreements, including student contracts, with local universities, and (5) interaction with world renowned medical institutions. Natick is located in the midst of one of the greatest concentrations of high tech companies and the largest concentration of firms in biotechnology.

Additionally, tenants on the Natick complex include the U.S. Army Research Institute of Environmental Medicine (USARIEM), and the Navy Clothing and Textile Research Facility (NCTRF). USARIEM is a unique medical research facility whose mission requires co-location to coordinate complementary programs and share use of such facilities as the environmental chambers. The NCTRF, which carries out a comparable mission for the Navy, has consolidated all of its work force in the area to a newly constructed (1990) building on the Natick site to take advantage of the expertise and facilities of our RD&E Center.

3.1.2 Licenses & Permits

LICENSES:

U.S. NUCLEAR REGULATORY COMMISSION (NRC) LICENSE # 20-00315-02

This license allows Natick and our tenant the U.S. Army Research Institute of Environmental Medicine to conduct research and development as a means of theoretical analysis, exploration or experimentation, or the extension of investigative findings and theories of a scientific or technical nature into practical application for experimental production or testing of models, materials and processes. Conditions of use of specific byproducts, source, and/or special nuclear materials are designated by chemical and/or physical form with designated maximum amounts allowed.

Currently, research and development efforts are being conducted on-site in recombinant DNA techniques, microbiological degradation of contaminated (high explosives) soil, and radionuclides for analysis.

PERMITS:

WATER QUALITY PERMITS

-DISCHARGE WATER RESTRICTION

a. Lake Water:
National Pollution Discharge Elimination System (NPDES) Permit #MA0001724: Natick RD&E and USARIEM missions require climatic controlled environments. This permit allows Natick to withdraw and discharge non-contact cooling water into the lake.

b. Sanitary Sewer:
Massachusetts Water Resources Authority (MWRA) Sewer Use Discharge Permit #22001808: Waste water discharged to the MWRA system shall not exceed MWRA pollutant discharge limits and Special Prohibitions contained in the MWRA Sewer Use Rules and Regulations, 360 C.M.R. 10.023. The U.S. Army Natick CSF mission requires this permit to discharge process waste water into the MWRA system.

-WATER SUPPLY WELLS

Water Withdrawal Permit #9P-3-14-19.01. Authorized volumes are based upon needs at the facility. The authorized volume, 0.21 mgd (million gallons per day), may be exceeded by up to 0.1 mgd on an annual average basis. Natick withdraws water from two wells. Town water supply is also available for emergency use only.

3.1.2 Licenses & Permits (Cont'd)

AIR QUALITY PERMIT

-PATHOLOGICAL INCINERATOR, USARIEM

Modified Conditional Permit, Application #MBR-87-INC-002. This unique permit sets disposal limits of 200 pounds per day waste (30% pathological and 70% plastics and paper). The USARIEM mission requires disposal of pathological wastes, in order to perform its medical research mission. The incinerator permit was grandfathered to Natick Labs as the result of a previous incinerator permit. Obtaining a new permit for this mission would be highly unlikely, due to the new Clean Air restrictions.

3.1.3 Environmental Constraints:

Buffer zone, shoreline:

The Natick Installation is located on a lake peninsula. Construction is restricted in the 100 foot buffer zone around the lake perimeter.

Wellhead Protection Area:

The new zone II drinking water restriction area protects 2.75 acres on a peninsula at the very southern tip of the Natick Labs facility. No open storage or vehicle parking will be permitted in this area after July 1, 1995. No structures or sanitary facilities are located within 250 feet of this zone.

3.1.4 Special Support Infrastructure:

- Lake water cooling system. We pump 1.5 million gallons of water out of Lake Cochituate per day to cool our air conditioning and multitude of environmental test chambers. This water is also used in our fire lines for the fire hydrants and sprinkler systems.

- Natick currently has a dual potable water system. We have the capability to get our total water needs from our own wells plus we are connected into the City of Natick's system and if our system fails or is down for maintenance the system automatically switches over to the City lines.

- Dual heating capability that allows Natick to turn off its main boiler plant which saves the government substantial money in utility costs with four (4) small boilers strategically placed throughout the installation for use during non-duty hours.

- Main Boiler Plant is also self sufficient so that if Massachusetts has a total power failure Natick can maintain power independently.

- Natick also has dual main electrical feeders coming into the installation on separate grids so if one fails the other automatically switches over.

- We have major expansion capabilities in our current supply of utilities. We can triple our current demand uses, see para 3.5.3.

- Natick has central deionized water systems, vacuum system, and gas to all the lab buildings.

- Special Lab Hood exhaust systems to remove chemical fumes.

- We have a metering system that meters all Natick server discharges into the main state system.

- Basic to the Information Systems infrastructure, the geotechnical architecture consists of a fiber optic backbone, Ethernet subnets, about 30 servers and 1200 client work stations.

- Natick has a Video Teleconference Center with interconnectivity to 72 major installations. It has voice-activated cameras which simulates face-to-face meetings and is able to transmit all types of support data. It is also used for teleconferences by other DoD agencies.

3.1.4 Special Support Infrastructure:

- Natick's Conference Center is a secure facility which allows for briefings, demonstrations and seminars. State-of-the-Art equipment allows the briefer to use remote controls to play audio/visual tapes, show 35 mm slides, and other overhead projections.

- State approved hazardous waste storage facility.

- All of our underground tanks have been replaced with dual wall units with leak detection systems.

- All of the buildings have been equipped with emergency lighting to include lighted fire exits backed by trickle charge battery back up.

- All Polychlorinated Biphenyl (PCB) transformers have been replaced on the installation.

- Fuel Cell has been acquired and will be installed by September 1994. The fuel cell will produce energy 25 percent to 40 percent more efficiently than conventional sources. It is a Cogeneration unit. The fuel cell power plant is an electrochemical device which converts hydrocarbon fuel (in this case natural gas) directly to electric power without combustion. Produces electricity at 200 kw/hr plus 540,000 BTU/hr of useful hot water at full load. Natick is the second military site to be chosen to demonstrate the $18 million program, was selected after an extensive energy analysis of the site.

- As the lead RDEC for the Dismounted Warfighting Battle Laboratory, Natick has acquired and is installing a Defense Simulation Internet Node. This is in support of our effort in the joint Dismounted Warfighting Battle Laboratory/AMC Advanced Warfighting experiments and simulations.

3.1.5. Proximity to Mission Related Organizations:

Common Support Functions	Name	Type of Organiza-tion	Distance	Workyears Performed By Your Activity	Workyears Funded By Your Activity
Clothing Textiles & Food	U.S. Army Institute of Environ mental Med icine	Government	Co-located	See Footnote 1	See Footnote 2
"	U.S. Navy Clothing& Textile Research Facility	Government	Co-located	See Footnote 3	See Footnote 4
"	University of Mass	University	25 Miles		36.7
"	Foster Miller	Commercial	12 Miles		34.2
"	GEO-Centers	Commercial	5 Miles		34.0

Footnote 1 - 122.3 NRDEC workyears devoted to complementary programs with ARIEM whereby funding is allocated directly to managing organization (NRDEC).

Footnote 2 - 25.6 ARIEM workyears devoted to complementary programs with NRDEC whereby funding is allocated directly to managing organization (ARIEM).

Footnote 3 - 83.3 NRDEC workyears devoted to complementary programs with NCTRF whereby funding is allocated directly to managing organization (NRDEC).

Footnote 4 - 43.0 NCTRF workyears devoted to complementary programs with NRDEC whereby funding is allocated directly to managing organization (NCTRF).

Importance and Impact:

Natick Research, Development and Engineering Center is a joint R&D facility. The U.S. Army Research Institute of Environmental Medicine (ARIEM) and the Navy Clothing and Textile Research Facility (NCTRF) are co-located with NRDEC. ARIEM performs medical and physiological evaluations of NRDEC's clothing and food products. Areas of synergy include nutrient composition, food metabolic testing, biomedical designs, physiological

testing, materials' evaluations, biomechanics and modeling. Collaborative studies between NRDEC and ARIEM are performed particularly in the area of performance enhancing rations. The separation of NRDEC and ARIEM and it's subsequent loss of synergy would have a severe impact on the performance of the NRDEC mission.

NCTRF carries out a clothing and textile mission for the Navy and was deliberately located at Natick to take advantage of NRDEC's expertise and facilities. For example, NCTRF works closely with NRDEC, the PM-Soldier and other services on the Joint Service Lightweight Integrated Suit Technology (JSLIST) program. Other areas of synergy include clothing and textile science and technology, chemical protection, environmental protection, flame resistance, and anthropometry. The impact resulting from the separation of NRDEC and NCTRF would not only result in loss of synergy, but would be in non-compliance with Project Reliance, i.e. a single site co-location of clothing and textile science and technology at NRDEC.

University of Massachusetts provides NRDEC with technical expertise required in the areas of biochemistry, polymer science, and biology. UMass technical expertise also supports the NRDEC food business area. UMass expertise supports NRDEC efforts to develop packaging from renewable resources as well as NRDEC's advanced materials development efforts. In addition, UMass contributes specific knowledge and expertise in the subjects of bioengineered proteins and chemical kinetics in foods, among others. UMass also affords NRDEC membership in the Center for University of Massachusetts Industry Research on Polymers (CUMIRP). The CUMIRP program provides NRDEC extensive interface with both academic and industrial expertise in the polymer arena.

Foster Miller provides NRDEC with scientific, engineering and technical expertise in support of exploratory, advanced development and engineering efforts encompassing all NRDEC business areas. In particular, Foster Miller provides support to NRDEC's food business area and development efforts on Microclimate Cooling Systems. The absence of Foster Miller's expertise would result in possible serious delays to NRDEC programs.

GEO-Centers provides NRDEC with scientific, engineering and technical expertise in support of exploratory, advanced development and engineering efforts encompassing all NRDEC business areas. With a large contingent of on-site personnel, GEO-Centers is uniquely able to provide the necessary technical expertise and interaction required to support NRDEC programs. The absence of this would result in possible serious program delays to NRDEC programs.

3.2 Personnel:

3.2.1 Total personnel:

Types of Personnel	Number of Personnel			
	Government		Onsite FFRDC	On-Site SETA
	Civilian	Military		
Technical	426	18	0	34
Management (Supv)	63	2	0	0
Other	95	32	0	0

3.2.2 Education:

Type of Degree/Diploma	Number of Government Personnel by Type of Position		
	Technical	Management (Supv)	Other
High School or less	51	4	113
Associates	9	2	7
Bachelor	237	24	6
Masters	95	26	1
Doctorate	52	9	0

3.2.3 Experience:

	Years of Government and/or Military Service				
Type of Position	<3 Years	3-10 Years	11-15 Years	16-20 Years	>20 Years
Technical	28	200	80	49	87
Management (Supv)	0	6	11	17	31
Total	28	206	91	66	118

3.2.4 Accomplishments During FY91-93:

3.2.4.1 How many patents were awarded and patent disclosures (only count disclosures with issued disclosure numbers) were made?

CSF	Disclosures	Awarded	Patent Titles
Clothing, Textiles & Food	FY91: 3	FY91: 4	Dual Valve Liquid Transfer Tube 11/20/90 (4,971,048) Heat Pipe Convection Oven 1/22/91 (4,986,253) Method of Forming a Crosslinked Chitosan Polymer and Product Thereof 5/14/91 (5,015,293) Accordion Bread Pan 9/17/91 (5,048,707)
	FY92: 6	FY92: 4	Leavened Breads with Extended Shelf Life 10/22/91 (5,059,432) Synergistic Effect of Amylopectin-Permetherin in Combination on Textile Fabrics 2/18/92 (5,089,298) Combustion Chamber for Multi-Fuel Fired Ovens and Griddles 3/17/92 (5,096,412) Method of Synthesizing an Enzyme-Catalyzed Polymerized Monolayer 9/1/92 (5,143,828)
	FY93: 9	FY93: 6	Enzyme Detergent Formulation and Methods of Detoxifying Toxic Organophosphorous Acid Compound 12/8/92 (5,169,554) Quick Release Buckle Assembly 4/27/93 (5,205,021) Radial Reefing Means For Use in Packing and Opening a Parachute Canopy in a Controlled Manner 5/11/93 (5,209,436) Self-Heating Individual Meal Module 6/22/93 (5,220,909) Dry Soup Mix 8/3/93 (5,220,909) Method to Achieve Solubilization of Spider Silk Proteins 9/14/93 (5,245,012)

3.2.4.2 Papers Published in Peer Reviewed Journals

CSF	NUMBER PUBLISHED (FY91)	PAPER TITLES
Clothing, Textiles, & Food	6	Nutrient, Waste Management, and Hygiene Systems for Chemical Protective Suits. Published in MILITARY MEDICINE, Volume 156, No. 5, May 1991.
		The Effects of Heating on Food Acceptability and Consumption. Published in the JOURNAL OF FOOD SERVICE SYSTEMS, Volume 6, August 1991.
		Thin Sectioning of Carbonaceous Adsorbent Spheres For Visualization by Light Microscopy and Scanning Electron Microscopy. Published in SCANNING MICROSCOPY, Volume 5, No. 2, June 1991.
		Correlation of Extrudate Infusibility with Bulk Properties Using Image Analysis. Published in JOURNAL OF FOOD SCIENCE, Volume 55, No. 5, October 1990.
		Continuous Culture System for Production of Bio-Polymer Levan Using Erwinia Herbicola. Published in BIOTECHNOLOGY AND BIOENGINEERING, Volume 38, No. 5, August 1991.
		Bacteria and Volatile Compounds Associated with Ground Beef Spoilage. Published in the JOURNAL OF FOOD SCIENCE, Volume 56, No. 5, September 1991.

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3.2.4.2 Papers Published in Peer Reviewed Journals (Cont'd)

CSF	NUMBER PUBLISHED (FY92)	PAPER TITLES
Clothing, Textiles & Food	14	Convenient Agarose Medium for Simultaneous Determination of the Low-Calcium Response and Congo Red Binding by Virulent Strains of Yersinia Enterocolitica. Published in the JOURNAL OF CLINICAL MICROBIOLOGY, Volume 29, No. 10, October 1991.
		Synthesis and Characterization of Polymers Produced by Horseradish Peroxidase in Dioxane. Published in the JOURNAL OF POLYMER SCIENCE: PART A: POLYMER CHEMISTRY, Volume 29, No. 11, October 1991.
		Molecular Weight Distribution of Chitosan Isolated from Mucor Rouxii Under Different Culture and Processing Conditions. Published in BIOTECHNOLOGY AND BIOENGINEERING, Volume 39, No. 3, February 1992.
		Effect of Particle Size Distribution in Determining a Powder's Fractal Dimension by a Single Gas BET: A Mathematical Model. Published in the JOURNAL OF COLLOID AND INTERFACE SCIENCE, Volume 149, No. 1, March 1992.
		Secular Trends of 22 Body Dimensions in Four Racial/Cultural Groups of American Males. Published in the AMERICAN JOURNAL OF HUMAN BIOLOGY, Volume 4, August 1992.
		Interobserver Error in a Large Scale Anthropometric Survey. Published in the AMERICAN JOURNAL OF HUMAN BIOLOGY, Volume 4, August 1992.
		Temperature Influence on Acetyllysine Interaction with Glucose in Model Systems Due to Maillard Reaction. Published in the JOURNAL OF FOOD SCIENCE, Volume 57, No. 1, January 1992.
		Controlled Opening Method for Clustered Parachutes. Published in the JOURNAL OF AIRCRAFT, Volume 29, No. 2, March 1992.
		Linear Models for the Prediction of Stature from Foot and Boot Dimensions. Published in the JOURNAL OF FORENSIC SCIENCES, Volume 37, No. 3, May 1992.

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3.2.4.2 Papers Published in Peer Reviewed Journals (FY92 Cont'd)

CSF	NUMBER PUBLISHED (FY92)	PAPER TITLES
Clothing, Textiles & Food		Physiological and Perceptual Responses to Load-Carrying in Female Subjects Using Internal and External Frame Backpacks. Published in ERGONOMICS, Volume 35, No. 4, April 1992.
		Nocturnality as a Defensive Behavior in the Rat: An Analysis in Terms of Selective Association Between Light and Aversive Stimulation. Published in the PSYCHOLOGICAL RECORD, Volume 42, 1992 (annual).
		An Analysis of the System Effects in Woven Fabrics Under Ballistic Impact. Published in the TEXTILE RESEARCH JOURNAL, Volume 62, September 1992.
		Effect of Substitution at C-6 on the Susceptibility of Pullulan to Pullulanases. Enzymatic Degradation of Modified Pullulans. Published in the CANADIAN JOURNAL OF MICROBIOLOGY, Volume 4, April 1992.
		Biological Degradation of Explosives and Chemical Agents. Published in CURRENT OPINION IN BIOTECHNOLOGY, Volume 3, June 1992.

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3.2.4.2 Papers Published in Peer Reviewed Journals (Cont'd)

CSF	NUMBER PUBLISHED (FY93)	PAPER TITLES
Clothing, Textiles & Food	19	Effects of Disconfirmed Consumer Expectations on Food Acceptability. Published in the JOURNAL OF SENSORY STUDIES, Volume 7, No. 4, December 1992.
		Paradoxical Behavior of Antioxidants in Food and Biological Systems. Published in TOXICOLOGY AND INDUSTRIAL HEALTH, Volume 9, No. 1/2, January/February 1993.
		Study of Surface Modified Poly(Ethylene) Yarns. Published in SCANNING MICROSCOPY, Volume 6, No. 4, December 1992.
		Control of Molecular Weight Distribution of the Biopolymer Pullulan Produced by Aureobasidium Pullulans. Published in the JOURNAL OF ENVIRONMENTAL POLYMER DEGRADATION, Volume 1, No. 1, 1993 (annual).
		Biological Degradation of Explosives and Chemical Agents. Published in BIODEGRADATION, Volume 3, No. 2/3, May 1993.
		Pneumatic Bursting Characteristics of Plastic Films. Published in POLYMER ENGINEERING AND SCIENCE, Volume 33, No. 8, April 1993.
		Characterization of Chitosans Via Coupled Size-exclusion Chromatography and Multiple-Angle Laser Light-scattering Technique. Published in CARBOHYDRATE RESEARCH, Volume 238, 1, January 1993.
		Intrinsic Chemical Markers for Aseptic Processing of Particulate Foods. Published in FOOD TECHNOLOGY, Volume 47, No. 1, Janauary 1993.
		Comparative Analysis of Macromolecules in Mollusc Shells. Published in COMPARATIVE BIOCHEMISTRY AND PHYSIOLOGY, PART B, Volume 105b, Nos. 3/4, July/August 1993.
		The Effects of Various Thicknesses of Chemical Protective Gloves on Manual Dexterity. Published in ERGONOMICS, Volume 36, No. 6, June 1993.

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3.2.4.2 Papers Published in Peer Reviewed Journals (Cont'd)

CSF	NUMBER PUBLISHED (FY93)	PAPER TITLES
Clothing, Textiles & Food		Recovery of Heat-stressed Spores of Bacillus Stearothermophilus on Solid Media Containing Calcium- and Magnesium-deficient Agar. Published in the JOURNAL OF FOOD PROTECTION, Volume 56, No. 8, August 1993.
		Biopolymer Metal Catalysis for the Hydrolysis of Nerve Gases. Published in CHEMICO-BIOLOGICAL INTERACTIONS, Volume 87, 1993 (annual).
		Stereoselectivity of Soman Detoxication by Organophosphorus Acid Anhydrases from Escherichia Coli. Published in CHEMICO-BIOLOGICAL INTERACTIONS, Volume 87, 1993 (annual).
		Critical Evaluation of Sensory Techniques. Published in FOOD QUALITY AND PREFERENCE, Volume 4, No. 1/2, August 1993.
		The Effects of Name and Recipe on the Perceived Ethnicity and Acceptability of Selected Italian Foods by British Subjects. Published in FOOD QUALITY AND PREFERENCE, Volume 3, No. 4, February 1993.
		Formulation and Characterization of Langmuir Silk Films. Published in LANGMUIR, Volume 9, No. 7, July 1993.
		Sensory Quality. Published in CEREAL FOODS WORLD, Volume 38, No. 6, June 1993.
		What do Consumers Expect from Low-Cal, Low-Fat, Lite Foods? Published in CEREAL FOODS WORLD, Volume 38, No. 2, February 1993.
		Cross-Cultural Sensory Testing: A Changing Tide? Published in CEREAL FOODS WORLD, Volume 38, No. 9, September 1993.

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3.3 Workload

3.3.1 FY 93 Workload:

3.3.1.1 Work Year and Lifecycle:

"LAB"	Fiscal Year 1993 Actual			
	Civilian	Military	FFRDC	SETA
Science & Technology	400	50	0	12
Engineering Development	137	5	0	19
In-Service Engineering	201	4	0	3

3.3.1.2 Engineering Development By ACAT for the Common Support Function of Clothing, Textiles and Food

As requested, the following table was developed using the 1993 Army ACAT list. The ACAT list is significantly incomplete in terms of including the specific Natick ACAT programs that were in existence in FY93. (All but one of Natick's Engineering Development efforts are categorized as ACAT IV.) Two of the five entries that were included in the Army ACAT list appear to be groupings of programs rather than individual program entries. A complete list of programs that fall within each grouping is footnoted following the table.

Engineering Development	Number	Wkyrs (FY93 Actual	FY93 Funds Received (Obl. Auth $K	Narrative (list)
ACAT III	1	9.7	2,699	Standard Integrated Command Post System
ACAT IV	1	2.4	469	Containerized Kitchen
ACAT IV	1	29.5	4,774	Combat Feeding Clothing & Equipment (see footnote 1)
ACAT IV	1	13.0	6,886	Force Provider
ACAT IV	1	4.7	628	Soldier Enhancement (see footnote 2)

Additionally, a very serious omission from the 1993 Army ACAT list is the work that Natick performs in the areas of Airdrop, Shelters (other than SICPS), and Organizational Equipment. These ACAT programs (see footnote 3) are also listed in order to provide a complete picture of Natick's mission and workload. A total of 69 ACAT IV programs are listed in the footnotes. Because there is no way to reconcile most of the actual ACAT Programs against the official ACAT listing, efforts that were completed in FY93, and those that are expected to be completed in FY94 are not included because they do not appear in the FY95 PBS.

FY95 new starts are listed and are designated by a "0" in the "FY93 Funds Received" column. Additional new starts may be added throughout the balance of FY94 and FY95.

Encl 2

Footnote 1 to section 3.3.1.2

The following ACAT IV programs are included under the general category of Combat Feeding Clothing & Equipment:

	Wkyrs (FY93 Actual)	FY93 Funds Received (Obl. Auth) $K	Narrative (list)
Food			
	.9	391.	Initial Deployment Kitchen, Air Force/Army
	2.0	230.	Powered Multi-Fuel Burner
	.7	92.	Army Field Feeding System Future/Unitized Group Ration
	.9	77.	Food Packet, Long Range Patrol, Improved
		0	Advanced Food Equipment & Automation Technology for AFRS
		0	Advanced Design Refrigeration
		0	P-3 Galley Design
		0	Fielded Group Ration Improvement Program
		0	Nutritional Labeling of Operational Rations
		0	Fielded Individual Ration Program
		0	Cold Weather Feeding
Clothing & Individual Equipment			
	1.2	153.	Individual Soldier Micro-climate Cooling Vest
	3.4	363.	Individual Soldier Microclimate Cooling System
	1.8	44.	Multiple Threat Body Armor
	2.9	434.	Self-Contained, Toxic Environmental Protective Outfit
	.7	252.	Land Warrior
		0.	Advanced CVC Helmet
	1.7	120.	Aircrew Cold Weather Clothing System
	.4	61.	Enhanced Aircrew Uniform, Integrated Battlefield

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Footnote 1 to section 3.3.1.2 (continued)

.6	55.	Auxiliary Aviation Lighting Devices
1.8	377.	Body Armor System, Individual Countermine P3I
.1	16.	CP Underwear Program
.5	40.	CVC Coveralls
.2	10.	Firefighter's Chemical/ Protective Suit
1.2	150.	Intermediate Cold/Wet Glove
.2	191.	JSLIST Program
1.1	300.	Lightweight CB Protective Garment
1.1	450.	Multipurpose Overboot
.8	81.	Personal Ice Cooling System
1.9	281.	Special Protective Eyewear Cylindrical System P3I
.2	32.	Improved TAP Suit
.8	105.	Vapor Protective/Flame Resistant Undergarment

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Footnote 2 to section 3.3.1.2

The following ACAT IV programs are included under the general category of Soldier Enhancement:

Engineering Development	Number	Wkyrs (FY93 Actual)	FY93 Funds Received (Obl. Auth) $K	Narrative (list)
ACAT IV	D668,	6.4	Soldier Enhancement Program	
		1.0	104.	Mounted Crewman Cold Weather Boot
		0	6.	Combat Medic Vest System
		.9	60.	Second Generation ECWCS
		0	5.	Improved Chemical/Bio Glove
		0	11.	Improved Butt Pack
		.1	8.	Inconspicuous Body Armor
		*	25.	Individual Air Activated Catalytic Heater
		*	18.	Individual Soldier Enhanced Ration
		*	9.	Lightweight Underwear
		.9	135.	Load Bearing Equipment Clasps
			0.	Enhanced Tactical Load Bearing Vest
			0.	Insect Repellent Face Paint
			0.	Improved Flotation Device
		*	5.	Lightweight Chemical Overgarment
		1.8	226.	Mounted Crewman Cold Weather Glove
		*	16.	Small Unit Shower

* Negligible Hours Charged

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Footnote 3 to section 3.3.1.2

The following programs were not included in the ACAT listing for FY93:

	Wkyrs (FY93 Actual)	FY93 Funds Received (Obl. Auth) $K	Narrative (list)
Airdrop Equipment			
	3.8	3,833	Low Altitude Retrorocket System
		0	Ballistic Resupply Airdrop System
		0	Enhanced Container Delivery System
	12.5	1,819	60,000 lb Capacity Low Velocity Airdrop System
	6.0	2,247	Airdrop Engineering for USAF C17
	0	120	60K Capacity Low Altitude Parachute Extraction System
		0	Advanced Reserve Parachute System
Shelters			
	1.0	571	Cargo Bed Covers
		0	Modular Building Concept
		0	Rigid/Soft Hybrid Shelter
	.8	238	Modular Expandable Rigid-Wall Shelter
	.2	14	EMI Hardened Expandable Wall Shelter
		0	EMI-ISO Component P3I
Unit/Organizational Equipment			
	.4	330.	Laundry and Dry Cleaning System
	1.0	441	Family of Space Heaters
		0.	Containerized Laundry & Shower System
		0.	Ballistic Protective System
		0.	Modular Ammo Solar Shade
		0.	Lightweight Maintenance Tent

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Footnote 3 to section 3.3.1.2 (continued)

1.4	273.	New Family of Tents for 1990's
.7	300.	Transportable Helicopter Enclosure

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3.3.1.3 In-Service Engineering:

Common Support Function	In-Service Engineering Efforts	FY93 Actual		Weapon System(s) Supported
		Funds ($K) Received (Obl. Auth.)	Work-years	
Clothing, Textiles, & Food	Eng. Spt - Food	4,240.	81	The Soldier System
"	Eng. Spt - CIE	4,674.	73	"
"	Eng. Spt-Airdrop	1,415.	14	"
"	Eng. Spt-Shelters	1,265.	17	"
"	Eng. Spt-Org Eqp	4,526.	16	"
"	OMA/DBOF (Total*)	16,120.	201	"

*Includes Direct & Reimbursable OMA; Direct & Reimbursable DBOF

3.3.2 Projected Funding

3.3.2.1 Direct Funding: Identify direct mission funding by appropriation from FY94 to FY97 ($M). Use FY95 PBS for FY95-97.

APPROP	CSF	FY94	FY95	FY96	FY97
RDTE OMA DBOF ARPA	Clothing, Textiles & Food	62.3 7.8 1.7 2.6	64.7 7.3 2.4 1.1	64.1 6.1 2.5 1.1	62.9 5.8 2.5 1.1
	Total	74.4	75.5	73.8	72.3

3.3.2.2 Other Obligation Authority: Identify reimbursable and direct-cite funding (other obligation authority expected) from FY94-FY97. Funding allocation must be traceable to FY95 PBS. ($M)

	CSF	FY94	FY95	FY96	FY97
	Clothing, Textiles & Food	34.2	44.9	49.6	47.7

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3.4.1 Major Equipment and Facilities

PERCENT USAGE OF NRDEC MAJOR EQUIPMENT & FACILITIES

EQUIPMENT/ FACILITY	NRDEC*	USARIEM**	NCTRF***
Climatic Chambers	35%	50%	15%
Food Pilot Plant	100%		
Hypobaric Chamber Facility		100%	
Hydro-Environmental Simulator Lab			100%
Rain Room	100%		
Fiber Plant	100%		
Dye/Print/Finish Plant	100%		
Core Molecular Bio Lab	100%		
Roller Test Facility	100%		
Computerized Pattern Maker	100%		
Ultrathin Film Facility	100%		
Laser Lab	100%		
Thermal Test Facility	100%		
Terrain Analysis System	100%		
Shade Room	100%		
Biomechanics Lab	50%	50%	

* U.S. Army Natick Research, Development and Engineering Center
** U.S. Army Research Institute of Environmental Medicine
*** U.S. Navy Clothing and Textile Research Facility

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3.4 Facilities and Equipment

3.4.1 Major Equipment and Facilities

Common Support Function	Major Facility or Equipment Description	Unique To			Replace-ment Cost $K)*
		DOD	Fed Gov't	US	
Clothing Textiles& Food	Climatic Chambers	X	X	X	$50,074
"	Food Pilot Plant	X			$22,238
"	Hypobaric Chamber Facility	X	X	X	$ 7,000
"	Hydro-Environmental Simulator Laboratory	X			$ 4,652
"	Rain Room (Raincourt)	X	X	X	$ 3,800
"	Fiber Plant	X	X	X	$ 2,000
"	Dye/Print/Finish Plant	X			$ 1,250
"	Core Molecular Bio Lab	X			$ 1,000

*Replacement Cost is based on MEANS, the National Construction Estimator cost/SF. Replacement Cost calculated in accordance with the algorithm provided was not possible in many cases due to incomplete information for each facility. MEANS provides a realistic assessment of the true cost of replacement.

3.4.1 Major Equipment and Facilities (Cont'd)

Common Support Function	Major Facility or Equipment Description	Unique To			Replacement Cost $K)*
		DOD	Fed Gov't	US	
Clothing Textiles & Food	Roller Test Facility	X			$ 750
"	Computerized Pattern Maker	X			$ 638
"	Ultrathin Film Facility	X			$ 600
"	Laser Lab	X	X		$ 250
"	Thermal Test Facility	X	X		$ 175
"	Terrain Analysis System	X	X	X	$ 72
"	Shade Room	X	X	X	$ 65

*Replacement Cost is based on MEANS, the National Construction Estimator cost/SF. Replacement Cost calculated in accordance with the algorithm provided was not possible in many cases due to incomplete information for each facility. MEANS provides a realistic assessment of the true cost of replacement.

3.4 Facilities and Equipment

3.4.1 Major Equipment and Facilities

Common Support Function	Major Facility or Equipment Description	Unique To:	Replacement Cost ($K)
Clothing, Textiles & Food	Climatic Chambers	U.S.	$50,074.

The Climatic Chambers is a unique facility that has been described as a "National Treasure" by the US Congress. These are the largest human research rated climatic chambers in the world, which can duplicate environmental conditions found anywhere on earth. There are no other chambers in the world that have all the same capabilities. There are two chambers in the building, the Arctic Chamber and the Tropic Chamber. These chambers can test both human subjects and equipment on a long term basis. The Arctic Chamber can reproduce temperatures from -70 degrees to +70 degrees Fahrenheit, while the Tropic Chamber can reproduce temperatures from 0 degrees to +165 degrees Fahrenheit. Both chambers can create winds from 0 to 40 miles per hour, rain from 0 to 4 inches per hour, and relative humidity from 10 to 90 percent plus solar loading. Each chamber can be observed from an external observation and test monitoring area. The building has live-in quarters and an exercise area where scientists can conduct research on such areas as nutritional intake and sleep patterns. In addition to the main chambers, there are Arctic and Tropic Conditioning Rooms that can produce the same temperature and humidity ranges as the main chambers. A 19 million dollar renovation of these facilities is now being completed.

3.4 Facilities and Equipment

3.4.1 Major Equipment and Facilities

Common Support Function	Major Facility or Equipment Description	Unique To:	Replacement Cost ($K)
Clothing, Textiles & Food	Food Pilot Plant	DoD	$22,238.

The Food Processing and Packaging Development Laboratories of the Pilot Plant are advanced integrated R&D facilities staffed by an interdisciplinary team of scientists and equipped with specialized pilot plant scale production sized equipment for the development of new or novel ration components and packaging systems and for the improvement of existing items.

The Food Processing facility consists of built-in state-of-the-art, fully equipped, temperature controlled meat processing room and humidity/temperature controlled production area, Advanced Starch Research and Baking Laboratory with commercial scale ovens and proofers, a full specially plumbed and floor loaded pilot plant scale food preparation and production area, and two laboratories for Chemical and physical testing of developmental items.

Specialized drying equipment:

- Large built-in production model freeze dryer.
- Two specialized state-of-the-art freeze dryers.
- Microwave assisted dryer systems.
- Centrifugal Fluidized Bed Dryer.
- Precision Ball Dryer.
- Air Dryer.

Thermal Processing capabilities include five steam retort systems with two capable of rotary retorting for optimizing food quality attributes and one specially configured to simulate a broad range of processing techniques and parameters including high temperature-short time processing and aseptic packaging.

A state-of-the-art computer controlled twin screw extruder has recently been installed for development of a new family of shelf stable cereal/meat combination products for nutritional enhancement and quality improvements for operational rations.

A continuous processor/sealer system for the production of pureed foods in collapsible tubes for use in high altitude Air Force covert surveillance flights has been designed and installed. Food is produced annually at Natick for cost/security reasons.

Natick Packaging Laboratories contain specially fitted and configured equipment to produce and evaluate packaging systems against the full range of physical and environmental conditions:

- Biotesters for pouches, cylindrical cans and traycans.
- MIOCON Leak Detector.
- Gas transmission rate (GTR) tester.
- Water vapor transmission rate (WVTR) tester.
- Simulated Shipping Tester (Repetitive Shock).
- Drop tester.
- Incline-impact tester.
- Revolving Hexagonal Drum tester.
- Compression tester.
- Environmental Chambers maintained at:
    - Standard Conditions (72oF, 50%RH)
    - Tropical Conditions (100oF, 90%RH)
    - Desert Conditions (140oF, 10%RH)
    - Arctic Conditions (-60oF, 10%RH)
    - Cycling Conditions (35oF to 160oF, 10% to 90%RH)
- Complete package and shipping container prototype fabrication equipment.
- Insectary for growth of insects for stored products testing.
- These unique facilities test ration packaging systems for:
    - Compatibility with food chemical components.
    - Resistance to post process bacterial contamination.
    - GTR.
    - WVTR.
    - Resistance to damage from physical abuse, including air drops.
    - Resistance to stored products insect infestation.
    - Deterioration during long term storage in environmental extremes.

Extensive chemical and microbiological test laboratories are also located in close proximity to the pilot plant to support food safety studies and for nutritional quality analysis on developed items.

This pilot plant has been used for limited production of rations for Special Operational Forces and other special missions.

3.4 Facilities and Equipment

3.4.1 Major Equipment and Facilities

Common Support Function	Major Facility or Equipment Description	Unique To:	Replacement Cost ($K)
Clothing, Textiles & Food	Hypobaric Chamber Facility	U.S.	$7,000.

The U.S. Army Research Institute of Environmental Medicine hypobaric chamber facility is the only human-rated facility in the U.S., capable of controlling both altitude and thermal conditions. This allows the study of cross stressors such as cold and altitude as they naturally occur. In addition, this hypobaric facility is the only one in the world that can simulate conditions of barometric pressure and ambient temperature and dewpoint for elevations as high as Mt Everest (8,848 meters, 29,000 ft). The hypobaric chamber facility is a unique complex of two environmentally-controlled study chambers separated by a common airlock. This facility simulates global atmospheric conditions by reduction of ambient barometric pressure using vacuum pumps in combination with precise manipulation and control of temperature and relative humidity. Accurate control is obtained using dedicated system microcomputer interfaced with control microprocessors. Since the hypobaric chamber is employed primarily for studying adaptive and maladaptive life processes of humans and animal models to high terrestrial elevations, the chamber's control systems and support equipment are designed for sustained periods of operation.

3.4 Facilities and Equipment

3.4.1 Major Equipment and Facilities

Common Support Function	Major Facility or Equipment Description	Unique To:	Replacement Cost ($K)
Clothing, Textiles & Food	Hydro-Environmental Simulator Laboratory	DOD	$4,652.

The Navy Clothing and Textile Research Facility's Hydro-Environmental Simulator Laboratory can reproduce air-sea interface temperature conditions existing anywhere on earth. The air chamber and marine tank combination permits simulation of temperature variations from the Arctic Ocean (air, -40F; sea, 28F) to the Red Sea (air, 120F; sea 110F). With the use of turbo fans, we can create various wind speeds at the air-sea interface. A paddle wave maker was developed and installed above the marine tank to create continuous wave action. The wave maker can develop continuous 1 to 1.5 foot waves that are 6 feet crest to crest. Both biophysical and physiological tests in this laboratory have been conducted on various types of anti-exposure suits. Utilization of the wavemaker test methodology can reduce the need to conduct more costly field testing.

3.4 Facilities and Equipment

3.4.1 Major Equipment and Facilities

Common Support Function	Major Facility or Equipment Description	Unique To:	Replacement Cost ($K)
Clothing, Textiles & Food	Rain Room (Raincourt)	U.S.	$3,800.

The Raincourt is a unique facility located in the Technology and Engineering Building. It is a concrete structure 40' X 40' X 40' designed to deliver rain at a predetermined density on test samples for a given amount of time. In this one of a kind facility, field environments can be simulated under controlled conditions, thus minimizing the need for field testing and at the same time accumulating data on the effects of specific rainfall. The effect of fabric weaves, seams, and other variables of textile construction can be fully evaluated before an item ever gets into the field.

The system is capable of delivering three different rates which simulate naturally occurring rainfall. The three rates of rainfall are 0.2, 1.0, and 3.0 inches per hour. The rate most often used in testing is 1.0 inch per hour. At this rate the drops are produced from the ceiling level by calibrated nozzles located at a height of 37 feet. From this height the water droplets travel at a top speed of 20 feet/second. Under these conditions the water droplets average about 2 millimeters in diameter, the same as in naturally occurring rain delivered at 1 inch/hour.

Uses for this facility are many and varied. The Raincourt is used to determine how well laboratory testing can predict actual performance. End items such as tentage, clothing or equipment which must withstand and perform well in rainfall are tested in this facility. A large number of fabric candidates for the new standard U.S. Army tents were exposed in the Raincourt as a screening procedure. Tents and shelter prototypes are tested in the Raincourt for water tightness, especially in the seamed areas. Testing of all types of rain wear, commercial and military, is carried out in the Raincourt, often using live subjects. Textiles treated with new water repellent finishes develop ed by industry are tested for resistance to penetration by rainfall, with suitable candidates receiving approval for military use. In addition to developmental work, items from all services that fail in field use are normally subjected to Raincourt testing to evaluate how and why the failures occurred. The DoD clothing and textile procurement agency, the Defense Personnel Support Center, often requests Raincourt evaluations in order to make decisions regarding the expected field performance of water resistant items that perform marginally or poorly in

laboratory quality control testing. Recently at the request of the U.S. Marine Corps, Raincourt testing was used to evaluate the effects of petroleum, oil, and lubricants on the water resistant characteristics of candidate materials for the Extended Cold Weather Clothing System. Because the Raincourt is a one of a kind facility, it is in constant demand for testing. The Raincourt plays an important role in developing end items to keep our soldiers dry and comfortable during field operations in a wet environment.

3.4 Facilities and Equipment

3.4.1 Major Equipment and Facilities

Common Support Function	Major Facility or Equipment Description	Unique To:	Replacement Cost ($K)
Clothing, Textiles & Food	Fiber Plant	U.S.	$2,000.

This area contains Fiber Spinning, Recycling, and Film Preparation capabilities for both production and research and development. The area supports efforts in the camouflage program allowing for the experimentation on incorporation of unique signature modifying materials or identification capability directly into fibers. In addition to the primary responsibility to the U.S. Treasury the area is also used extensively to support U.S. Department of Agriculture and U.S. Navy sponsored efforts on bio-degradable packaging materials as well as new high performance fiber development for ballistic protection.

In 1977 the Fiber Project was established and wholly funded by the U.S. Treasury Department, Bureau of Engraving and Printing. The primary responsibilities include: production (as the only source) of distinctive fibers for all U.S. currency paper amounting to approximately 30,000 pounds/year; and providing Research and development on synthetic fibers and films for use in currency as counterfeit deterrence features.

The Fiber Spinning and Recycling Facility consists of processing equipment for Melt Spun Fiber, Multilayer Extruded and Blown Films, and Recycling Fiber and Film Waste as follows:

. Experimental Melt Spinning Fiber Unit: which is capable of producing textile grade filament yarns for evaluation.

. The Production Scale Melt Spinning Fiber Unit: is specifically designed to handle current distinctive fiber requirements with capabilities for expansion to more complex systems. The system consists of a four hopper blender feed system with a mixing chamber, a single screw extruder, and dual metering pumps. The yarn bundle consists of over 700 filaments, which requires using paired heated godets due to the size of the bundle. The base material of the fiber is nylon 6,6, which requires a three step drawing process. The initial draw or jet stretch reduces the fiber diameter by 50% and is followed by a hot draw at 2:1, followed by a relaxation and heat set.

. Experimental Scale Film System using either a single or twin screw extruder for preparation (A patent on processing of biodegradable films using the twin screw process has recently been granted.)

. Multilayer Film System: capable of producing materials containing three different polymers as seven layers extruded or three layer blown films for packaging applications using biodegradable materials. This system consists of three extruders feeding a single head assembly through a splitter block with associated takeoffs for the type of film being prepared.

. Recycling System: consisting of a Granulator and Takeoff to convert fiber waste into powder prior to repelletizing. The reprocessed material is then used the production process.

3.4 Facilities and Equipment

3.4.1 Major Equipment and Facilities

Common Support Function	Major Facility or Equipment Description	Unique To:	Replacement Cost ($K)
Clothing, Textile & Food	Dye, Printing, and Finishing Fabrics Pilot Plant	DoD	$1,250.

This facility provides the ability to perform textile testing and development work in support of combat clothing, textile based equipment, e.g. backpacks & tentage. Included is the capability to perform textile dyeing, printing, applying functional finishes, and small scale simulated rainfall testing as well as multiple laundering/dry cleaning testing of textile items. We are able to produce small quantities of prototype textile materials for fabrication and evaluation, to identify any deficiencies and correct before scaling-up to production quantities. The following equipment is available in this area:

- Textile Dyeing Equipment
- Textile Printing Equipment
- Textile Functional Finish Application Equipment
- Textile Fixation Equipment
- Textile Coating Equipment
- Small Scale Rainfall Simulator
- Laundering/Drying/Dry Cleaning Equipment

This equipment represents a unique capability in DoD to dye and finish small amounts of textiles to meet special or quick reaction needs. The facilities are used by the U.S. Navy and support U.S. Marine Corps, U.S. Air Force, and Special Forces needs.

The following are some practical ways in which this equipment is being used:

- Dye standard as well as new camouflage colors on textile fabrics for prototype development.

- Produce printed standard camouflage designs as well as new experimental camouflage designs (based on field data), and apply these designs to new and standard textile materials for prototype development.

- Apply standard and experimental functional finishes to textile fabrics. These finishes impart properties to the textile fabric such as antistatic, antifungicide, water repellency, flame resistance, etc.

- Perform experimental coatings work on textile substrates using low emissivity materials and binders to produce fabrics for uniforms which will lower soldiers' thermal signature.

- Perform small scale rainfall simulation testing, a screening test for water repellent finishes on textile fabrics.

- Perform laundering or drying testing on textile fabrics and garments to test for colorfastness to laundering, dimensional stability.

3.4 Facilities and Equipment

3.4.1 Major Equipment and Facilities

Common Support Function	Major Facility or Equipment Description	Unique To:	Replacement Cost ($K)
Clothing, Textiles & Food	Core Molecular Biology Laboratory	DoD	$1,000.

The Core Molecular Biology Laboratory is a state-of-the-art facility featuring a unique combination of equipment that provides the capability for synthesis, purification, and physical characterization of a wide range of biological materials.

This laboratory exploits highly automated techniques such as capillary and micro-preparative gel electrophoresis, column chromatographic purification and separation, and DNA and peptide synthesis to support research programs in genetic engineering, smart materials, and pollution prevention and remediation.

Army applications of these advanced biomaterials include improved ballistic protection, parachute suspension lines for reduced opening shock, underwater adhesives for special operations, chemical protection, and environmental clean-up of contaminants in soil/water. Many of these biomaterials will have dual use applications due to their superior performance and environmental compatibility.

Programs utilizing this facility leverage the capabilities and resources of academia, (University of Massachusetts, Boston University, and University of Connecticut), private industry (Monsanto) and other government agencies (Army Research Laboratory and Army Research Office).

3.4 Facilities and Equipment

3.4.1 Major Equipment and Facilities

Common Support Function	Major Facility or Equipment Description	Unique To:	Replacement Cost ($K)
Clothing, Textiles & Food	Roller Test Facility	DOD	$750.

The Roller Test Facility simulates a C-141 aircraft rollerbed. It has 136 instrumented rollers that are able to measure point loading of cargo within an airdrop aircraft. The primary use of the Roller Test Facility is to demonstrate that Army airdrop loads will not overload the Air Force C-141 aircraft cargo floor.

The Roller Test Facility is also equipped to simulate up to 100,000 lbs. of parachute extraction force.

Associated and adjacent to the Roller Test Facility is a 45 foot high Drop Tower capable of lifting and releasing instrumented airdrop loads up to 100,000 lbs.

The Drop Tower is used to simulate the impact shocks that are exerted on parachute loads when they impact the ground.

The Roller Test Facility's primary function is to certify airworthiness of air cargo for air transport and airdrop, as well as External Air Transport (EAT) with helicopters.

Secondary uses include dynamic snatch load tests of parachute lines, webbing, harnesses, and simulated impact tests of equipment on the parachutist's lowering line.

3.4 Facilities and Equipment

3.4.1 Major Equipment and Facilities

Common Support Function	Major Facility or Equipment Description	Unique To:	Replacement Cost ($K)
Clothing, Textiles & Food	Computerized Pattern Design System	DoD	$638.

The Computerized Pattern Design System represents our internal capability to design and develop dress and combat clothing, fabricate representative prototypes, and furnish computer graded patterns to procuring agencies and contractors. This automatic apparel design system provides a nearly endless variety of menu driven software choices for grading, marking, plotting, cutting and drawing. The system can be tailored to preferred grading and marking procedures. For pattern output the system provides patterns via plotter or paper cutting table. Additionally, the system enables the users to furnish data via telecommunications, magnetic tapes or diskettes.

The function of the system is to generate a complete tariff of sizes from one master size digitized for those categories already compiled utilizing Computer Aided Design (CAD).

The menu driven software consists of a Pattern Design System (PDS) capable of making pattern modification(s) by computer. The Grading and Marking Software (GMS) is flexible enough to provide either customer preference styled grade or a constraint grading due to anthropometric body differences.

The CAD hardware consists of a digitizing board, Local Area Network (LAN) communications, a WORM (write once - read many) drive; network manager (file server), printer, four work stations, ink jet plotter, magnetic tape unit, cutter/plotter flatbed table and modem (electronic linking). This facility enables quick efficient service in support of clothing developments as well as providing a quick response link to the DoD clothing and textile procurement agency, the Defense Personnel Support Center (DPSC), industry and academia.

3.4 Facilities and Equipment

3.4.1 Major Equipment and Facilities

Common Support Function	Major Facility or Equipment Description	Unique To:	Replacement Cost ($K)
Clothing, Textiles & Food	Ultrathin Film Molecular Assembly Facility	DoD	$600.

The Ultrathin Film/Molecular Assembly Facility utilizes a unique combination of state-of-the-art laboratory equipment for the fabrication and manipulation of various biological systems into highly organized films, one molecule thick, using the Langmuir-Blodgett technique.

The Langmuir-Blodgett technique allows preparation of ultrathin films while maintaining complete control over the organization, assembly and orientation of the individual molecules. This control of molecular order allows for unique optimized material properties.

The research being conducted has the potential to significantly enhance Army warfighting capability by providing dynamic visible camouflage, selectively permeable barrier films, laser eye protection, and bioengineered ceramic and composite ballistic protective materials. Dual use applications of this technology can potentially improve domestic economic competitiveness.

This program utilizes technical collaborations with foreign scientists and leverages the capabilities of academia (University of Massachusetts, Dartmouth College), DoE Laboratories (Lawrence Berkele Laboratory), and other institutions (Worcester Foundation for Experimental Biology).

3.4 Facilities and Equipment

3.4.1 Major Equipment and Facilities

Common Support Function	Major Facility or Equipment Description	Unique To:	Replacement Cost ($K)
Clothing, Textiles & Food	Laser Lab	Fed. Govt.	$250.

The Laser Lab is designed for evaluation of laser/eye protective systems against an array of battlefield laser devices including the Ruby Laser (694 nm), the Neodymium Laser (1064 nm) and the doubled Neodymium Laser (532 nm). The Laser Lab has allowed us to evaluate various fielded items and prototypes that incorporate specific laser protective technologies, including:

. Dye Absorbers. This technology has been incorporated into sun, wind and dust (SWD) goggle ballistic insert, M17A2 gas mask outsert, BLPS, SPECS and SPH4 visor. The current devices attenuate the laser radiation by a factor of at least 10,000 (optical density (OD) of 4) and have visual transmittances between 25 - 50%.

. Reflective technologies. Dielectric coatings and holograms have been applied to the SWD goggle. Using dielectric coatings we have been able to block all laser lines in the near infrared (650 - 1200nm) with an OD of 4, and visual transmittance of 70%. These are currently undergoing user acceptability testing/ evaluation.

. Tunable Systems. Nonlinear optical (NLO) materials and device design are being developed that will attenuate the laser radiation of tunable lasers to safe levels for the eyes.

- A lenslet concept and design has been developed to exploit the properties of NLO materials. It allows focusing of the laser beam to increase its intensity by a factor of 1 million to evoke useful responses in current NLO materials. The design has intermediate focal regions where nonlinear materials are inserted. The laser beam\NLO material interaction causes the laser light to be absorbed, defocused, scattered, or otherwise disrupted, yet allows low-intensity light (ambient) to pass. This concept is currently being assembled for laboratory testing.

- Nonlinear materials, benzoporphyrins, developed at Natick have been tested in the lenslet configuration and limiting properties (attenuation) measured. Newer materials from this class and materials from bioengineering technology are continually being tested as materials suitable for tunable laser eye protection.

3.4 Facilities and Equipment

3.4.1 Major Equipment and Facilities

Common Support Function	Major Facility or Equipment Description	Unique To:	Replacement Cost ($K)
Clothing, Textiles & Food	Thermal Test Facility	Fed. Govt.	$175.

The Thermal Test Facility provides the capability to evaluate material samples against CO2 laser radiation for thermal transfer properties and time to ignition as a function of laser fluence (joules/cm2).

Full uniform ensembles can also be tested against a high power CO2 laser for protection characteristics, in terms of skin burns, and for ignition times. The laser beam irradiates a large area of the uniform covering an instrumented manikin. The manikin has 124 skin sensors and records the temperature as a function of time for conversion into skin burn assessment.

The instrumented manikin is dressed with full uniform ensembles and subsequently irradiated by a pulse from a thermal radiation simulator (TRS) that mimics a nuclear thermal pulse. Time-temperature values are recorded and the data analyzed in terms of skin burns and protection limits.

Such laboratory data minimizes overall cost by allowing us to evaluate only the most promising materials in the field. Both laboratory and field test data are used to determine the thermal protective properties of materials and uniform systems and to guide the future development of new materials and uniform design for maximum thermal protection.

3.4 Facilities and Equipment

3.4.1 Major Equipment and Facilities

Common Support Function	Major Facility or Equipment Description	Unique To:	Replacement Cost ($K)
Clothing, Textiles & Food	Terrain Analysis System	U.S.	$72.

This facility provides the capability to evaluate camouflage year-round. Deciduous trees are in bloom for only about five months of the year, and for the remainder of the year, the leaves are either multicolored or the trees are bare. Additionally, it is impractical to travel to desert areas on a regular basis.

The scenes serve as a controlled background against which camouflage patterns can be evaluated. The facility saves time and money in enabling us to evaluate camouflage and eliminate the least effective patterns prior to committing to expensive field testing. This facility provides the capability to quickly evaluate the effectiveness of foreign camouflage materials and items. It is also used to support the DoD clothing and textile procurement agency, the Defense Personnel Support Center (DPSC) during supply procurement of textile based items to evaluate the effect of minor deviations from specification requirements on overall camouflage effectiveness.

The background on the left is a desert background. The sand in this background is actual desert sand from Yuma, Arizona which is also a good representation of the sand in the Middle East. The mannequin on the right is wearing the 6-color desert camouflage pattern which saw use in Desert Storm, while the mannequin on the left is wearing the new 3-color desert camouflage pattern. The main difference between these two uniforms is in the visual range of the electromagnetic spectrum. The 6-color pattern contains too much brown to be a good match to this type of desert sand, while the 3-color pattern is a much better match. Both uniforms contain the proper dyestuffs to match the sand in the near-infrared region of the spectrum in which image intensifiers are sensitive, and therefore will look about the same through night vision goggles.

The background on the right is a woodland background. This background contains live plants, which have a very high reflectance in the near-infrared region of the spectrum. The mannequin on the left is wearing an old olive green uniform, while the mannequin on the right is wearing the current 4-color woodland camouflage pattern. The main difference between these two uniforms is in the near-infrared region of the electromagnetic spectrum. When looking through night vision

goggles, the old olive green uniform appears very dark against the background since it was not designed to defeat this type of sensor, while the 4-color woodland pattern is a good match. The 4-color woodland pattern maintains a disruptive pattern even through the night vision goggles. A image intensifier or night vision device basically amplifies the amount of light from the night sky. For situations where there is no ambient light, the device also contains a near-infrared source which can be activated as needed. Currently, we have six incandescent lamps for illuminating the scene. Each lamp can be adjusted independently of one another for simulating different levels of moonlight, as well as moonless skies.

One of the other capabilities is the Terrain Analysis System (TAS) which enables us to collect data for any background on video tape. The data is then brought back and read into a computer, which reduces the scene down to the most predominant colors. The scene can be broken down into a user-specified number, from 2 to 5, of the most predominant colors and shapes used to design a camouflage pattern.

Alternatively, the scene can be broken down as a background scene into 200-250 colors on which an experimental pattern can be overlaid to visually evaluate its camouflage effectiveness. The pattern can then be modified as necessary in an interactive manner on the display to optimize it before conducting a trial printing run. Some of the patterns designed by the terrain analysis system include two of the snow camouflage patterns and the two color patterns of the four urban uniforms on display.

One of the other areas we are working on is reversible camouflage. The sample uniform is pigment printed with the 4-color woodland pattern on one side and printed with the 3-color desert pattern on the reverse with vat dyes. We are currently attempting to achieve reversible patterns on lighter weight fabrics, which is difficult due to strike-thru of the darker colors, and are experimenting with various uniform designs. We are also investigating adaptive camouflage for the future, including electrochromic, photochromic and thermochromic technologies. Photochromic materials which responds to ultraviolet light are available, however further research is required in order to obtain the appropriate change in the areas of the electromagmetic spectrum in which threat sensors operate for various backgrounds.

Due to the technological advances in thermal imagery, such as uncooled detectors, and smaller, more portable imagers, we are investigating various methods to defeat thermal imagers. One method is to vary the emissivity of the garment. Research is being conducted to obtain thermal camouflage without sacrificing visual and near-infrared camouflage.

3.4 Facilities and Equipment

3.4.1 Major Equipment and Facilities

Common Support Function	Major Facility or Equipment Description	Unique To:	Replacement Cost ($K)
Clothing, Textiles & Food	Shade Room	U.S.	$65.

As the name indicates, this is a room where shade or color of textiles is evaluated. The standard lighting conditions for viewing shade are artificial daylight, that has a correlated temperature of 7,500 ± 200 degrees K (Kelvin), 100 ± 20 foot candles, and incandescent lamplight at 2,300 ± 200 degrees K.

The DoD clothing and textile procurement agency, the Defense Personnel Support Center (DPSC) and industry have the same standard lighting for passing or failing production contract samples for shade. These standard lighting conditions are cited in all military specifications as a requirement for matching shades. The importance of using standard lighting is that color perceived by an evaluator can vary depending on the light source. If the samples match the standard sample under the two light sources mentioned above, the samples pass, if not they may fail, depending on established shade tolerances. The reason two light sources are used is to avoid a shade condition called metamerism. Metamerism is when two shades match using one light source, but mismatch under another light source.

The shade room and color measurement lab also contain spectrophotometers to measure color in the visible and near infrared spectrum in cases where there is some question whether a sample is within the established acceptable shade tolerance range. Research has been conducted with universities to establish numerical acceptance parameters which are more objective than visual pass/fail evaluations, especially on borderline samples. Any samples that fail numerically are evaluated visually to determine if they would pass when viewed in combination with the other acceptable shades.

Based on our work in the numerical color measurement area with Germany under the exchange scientist program, that country is now establishing an instrumental color measurement program with the assistance of one of our scientists in Germany.

Development work in dyeing and finishing is done first on a laboratory scale. If the lab samples meet the desired criteria, then a larger pilot plant run is conducted. If results are positive, arrangements are made to contract out to industry for a production run. The standard sample is established from

the production run and is furnished to DPSC for use in large scale procurements. Shade tolerance samples are established from contract samples from various suppliers over a period of time. They represent allowable shade variation parameters which reflect state-of-the-art by industry for the particular fabric in dyeing, printing, and finishing.

Over the years, hundreds of textile shade standards have been sent to DPSC for procurement. The standards are replenished or replaced with improved standards as appropriate. A complete master file of all textile standards sent to DPSC is kept in the Shade Room for project reference and for shade evaluations.

The standard samples and shade tolerances are an integral part of shade acceptance by DPSC, and shade control by industry. They are used daily in the production and acceptance of multi-million dollar textile contracts for shade, appearance and colorfastness.

Many standards and tolerances are common to all services. They are also used by other government agencies such as General Services Administration for procurements.

3.5.1 Laboratory Facilities: Use-facilities records as of fourth-quarter FY93 in answering the following (in square feet (SF)) for each CSF: (BRAC Criteria II)

Common Support Function	Facility or Equip Description	Type of Space	Space Capacity (SF)		
			Current	Used	Excess*
Clothing, Textiles and Food	Climatic Chambers Bldg 2	Admin Technical **	1,195 36,800 55	550 36,800	645
"	Research Bldg 3	Admin Technical Storage Utility **	44,540 19,950 18,780 1,440 36,470	20,488 19,950 18,780 1,440	24,052
"	Development Bldg 4	Admin Technical Storage Utility **	32,540 40,693 1,715 4,300 29,779	14,968 40,693 1,715 4,300	17,572
"	Technology Engineering Bldg 5	Admin Technical Storage Utility **	9,831 35,980 2,190 320 9,038	4,522 35,980 2,190 320	5,309
"	Food Service Equipment Lab Bldg 16	Admin Technical Storage Utility **	5,060 6,445 265 410 8,916	2,328 6,445 265 410	2,732
"	Engineering Bldg 36	Admin Technical Storage Utility **	16,320 28,040 1,840 2,235 15,090	7,507 28,040 1,840 2,235	8,813
"	Instrumentation Bldg 44	Admin Technical Utility **	400 1,525 180 549	184 1,525 180	216

* Underutilized Space
** Difference between Net and Total Building Footage (e.g. hallways, stairwells, restrooms, etc.)

3.5.1 Laboratory Facilities (continued):

Common Support Function	Facility or Equip Description	Type of Space	Space Capacity (SF)		
			Current	Used	Excess*
Clothing, Textiles and Food	Roller Test Bldg 66	Technical	1,500	1,500	
"	Combustion Test Bldg 77	Technical	1,500	1,500	
Clothing, Textiles and Food	ARIEM Bldg 42	Admin Technical Storage Utility **	15,040 27,081 275 4,400 30,156	15,040 27,081 275 4,400	0
"	Navy Bldg 7	Admin Technical Utility **	475 11,038 400 1,377	475 11,038 400	0

* Underutilized Space
** Difference between Net and Total Building Footage (e.g. hallways, stairwells, restrooms

3.5.1.1 Describe the capacity of your activity to absorb additional similar workyears categorized in the same common support function with minor facility modification. If major modification is required, describe to what extent the facilities would have to be modified. (USE FY97 workyears as your requirement)

Natick has the capacity to absorb additional similar workyears under the CSF Clothing, Textiles & Food by reconfiguring total administrative space more efficiently. This would only require minor facility modification. From section 3.5.1 above 59,339 SF* have been identified as excess based on current underutilization. An additional 71,160 SF are available from other administrative type facilities (Bldgs 1, 20,and 45). With reconfiguration and proper utilization, the total available space is 130,499 SF.

* This figure does not take into account dry lab space which is also used for limited administrative work.

3.5.1.2 If there is capacity to absorb additional workyears, how many additional workyears can be supported?

Based on the 130,499 SF identified as underutilized, and by using 130 SF/person (net), Natick has the capacity to absorb an additional 1004 people into its current available administrative space.

3.5.1.3 FY95 MCA

Family Housing Revitalization: Natick has a project to revitalize 35 family housing units in Hudson. The housing units are for junior and senior enlisted personnel. The project cost is $4.05 million. The project is approved and programmed in the Army's Family Housing Revitalization Program for Fiscal Year 1995. A design/build contract award is scheduled for April 1995.

The housing units will be designed to current revitalization standards and will include wood frame construction with brick veneer, stucco or prefinished siding, central air conditioning, hard wired smoke detectors, kitchen appliances, landscaping, streets, carports with exterior storage, street lighting, utilities, recreational facilities, and paving.

Repair Heating, Ventilation and Air Conditioning (HVAC) System in Food Engineering Lab has design completion scheduled for July 1994 and construction contract award for phase 1 scheduled for September 1994. The estimated construction cost for Phase 1 is $850,000 and will provide additional A/C for the office wing. Phase 2 is scheduled for construction award for $500,000 and includes replacement of existing heating, ventilating and air conditioning systems including equipment, ductwork, piping and controls, throughout the Laboratory building.

Both these projects will have a significant impact on morale, quality of life and productivity for the Natick employee, the enlisted soldiers and their families and ultimately the DOD.

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3.5.2 Land Use:

Enclosed are locations of buildable acres under NRDEC's control.

NRDEC proper and our Hudson area. This information will become part of our Master Plan.

Natick	12 buildable acres
Hudson	27 buildable acres
Total*	39 buildable acres

* Data call does not take into account potential to expand vertically upon existing structures. Addition of one floor to existing NRDEC structures will create an additional 4 acres (174,000 sf) of office/laboratory space.

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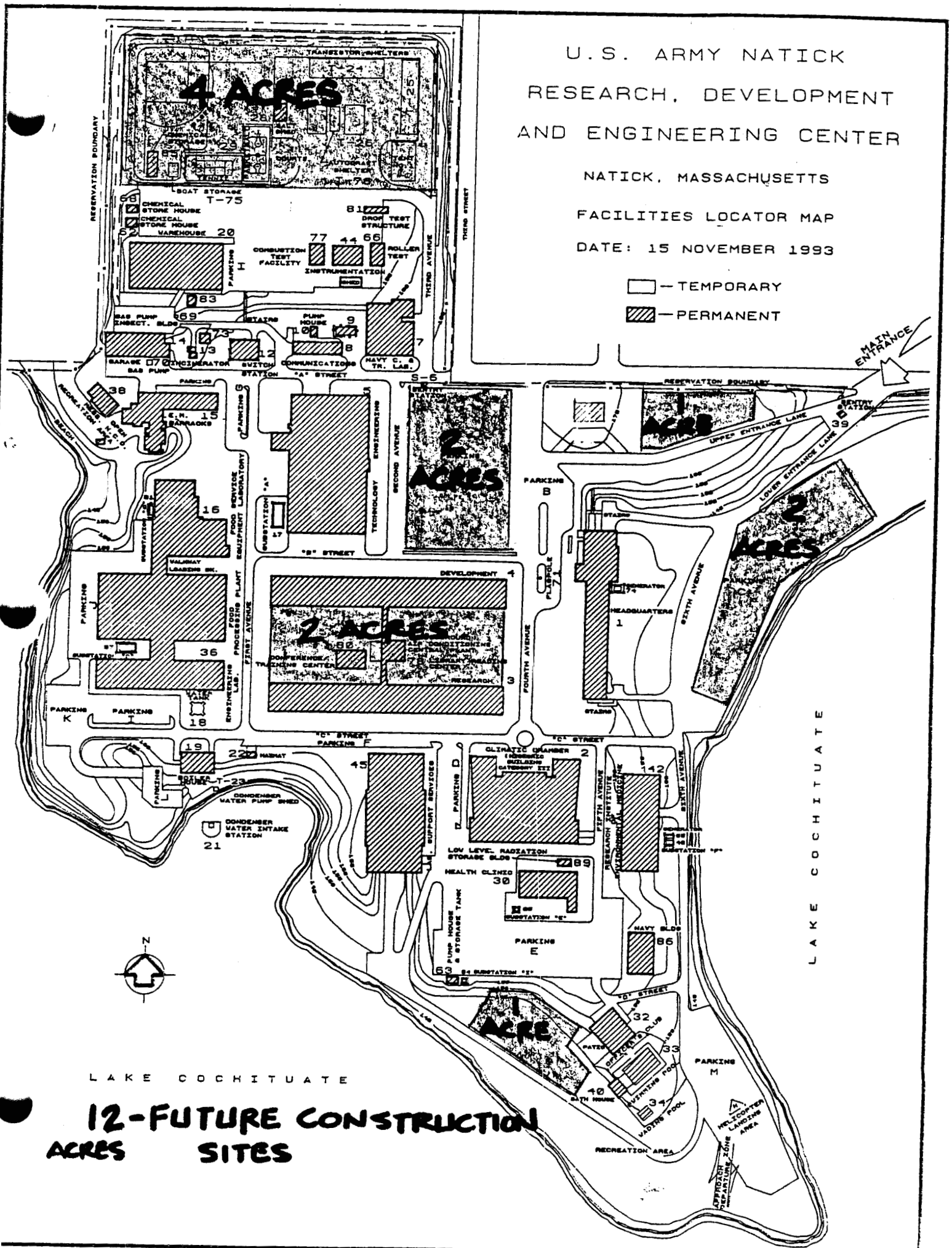
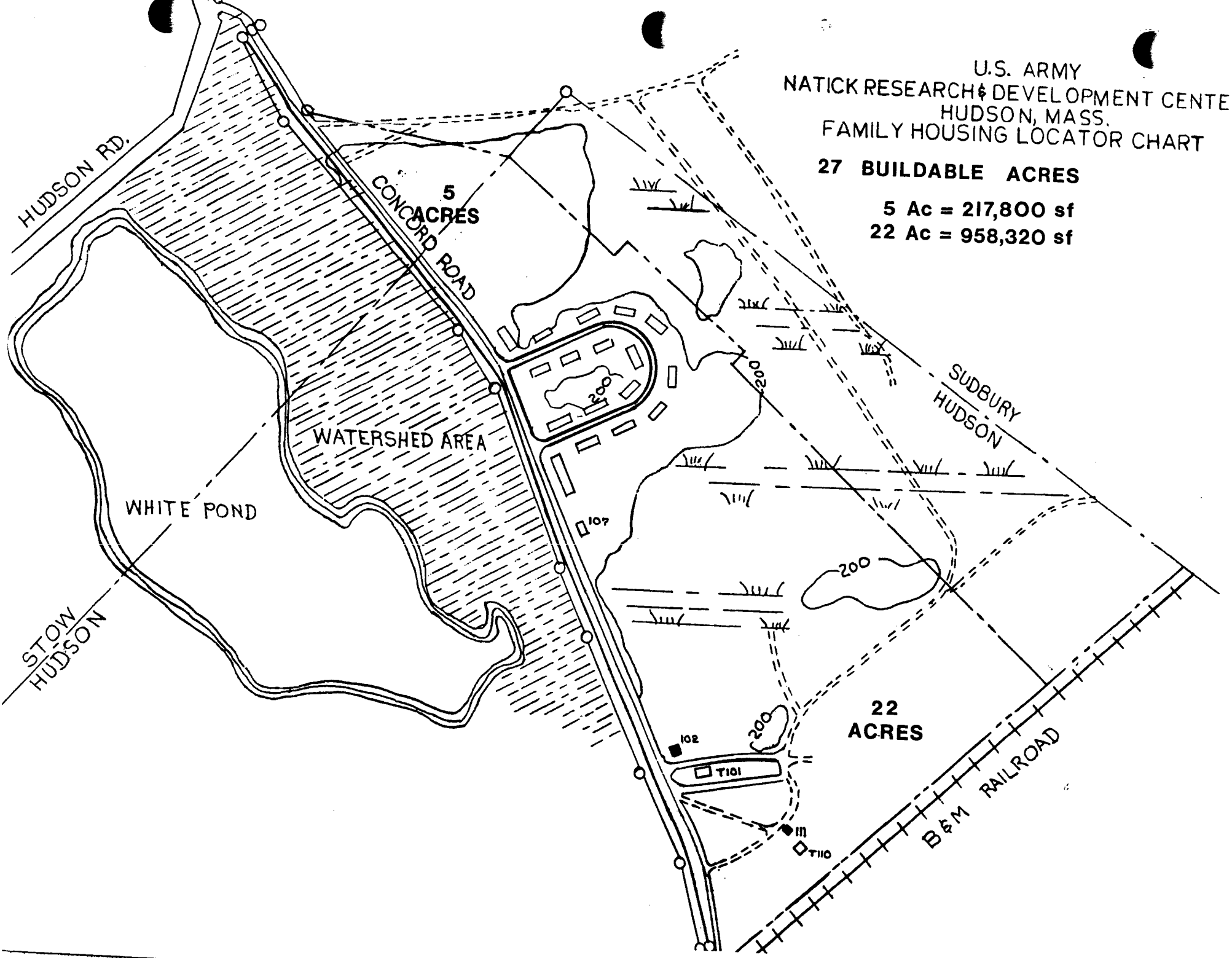

U.S. ARMY NATICK
RESEARCH, DEVELOPMENT
AND ENGINEERING CENTER
NATICK, MASSACHUSETTS
FACILITIES LOCATOR MAP
DATE: 15 NOVEMBER 1993
— TEMPORARY
— PERMANENT
4 ACRES
2 ACRES
2 ACRES
2 ACRES
1 ACRE
MAIN ENTRANCE
LAKE COCHITUATE
LAKE COCHITUATE
12-FUTURE CONSTRUCTION SITES
ACRES

U.S. ARMY
NATICK RESEARCH & DEVELOPMENT CENTER
HUDSON, MASS.
FAMILY HOUSING LOCATOR CHART

27 BUILDABLE ACRES

5 Ac = 217,800 sf
22 Ac = 958,320 sf



3.5.3 Utilities:

Electric: Present consumption 6.4 million kwh/year
System capacity* is 28.4 million kwh/year
Capacity to expand is 22 million kwh/year

Gas: Present consumption is 13,000 cubic feet/hr
System capacity* is 52,000 cubic feet/hr
Capacity to expand is 39,000 cubic feet/hr

Water: Present consumption is 125 gal per min
System capacity* is 600 gal per min
Capacity to expand is 475 gal per min

* System capacity is what the local utilities can provide without modification to existing systems.

DEPARTMENT OF THE ARMY
HEADQUARTERS, US ARMY AVIATION AND TROOP COMMAND
4300 GOODFELLOW BOULEVARD, ST. LOUIS, MO 63120-1798

REPLY TO
ATTENTION OF

AMSAT-R-S

DRAFT

MEMORANDUM FOR COMMANDER, U.S. ARMY MATERIEL COMMAND, ATTN: AMCRD-JL (JAN BENSKIN), 5001 EISENHOWER AVENUE, ALEXANDRIA, VA 22333-0001

SUBJECT: BRAC 95 Data Call #5 - Laboratories

1. Reference memorandum, DACS-TABS, 9 Sep 94, subject: Requests for Clarification to the LJCSG BRAC-95 Data Call.

2. The Aviation and Troop Command (ATCOM), Aviation, Research, Development, and Engineering Center, St. Louis, MO; the Aviation Applied Technology Directorate, Ft. Eustis, VA; and the Aeroflightdynamics Directorate, Moffett Field, CA, prior Data Call #5 submissions were reviewed to assure consonance with referenced memorandum. In reference to Tables 3.3.1.2, specified Acquisition Categories (ACATs) were limited to the Military Department ACAT listing for Fiscal Year 1993. A further breakdown of general programs has been footnoted.

3. I certify that the information provided is accurate and complete to the best of my knowledge.

4. Point of contact for this action is Mr. Don MacVittie, AMSAT-R-S, DSN 693-1412 or commercial (314) 263-1412.

Encl

THOMAS L. HOUSE
Executive Director, Aviation Research,
Development,and Engineering Center

AVIATION RESEARCH, DEVELOPMENT, AND ENGINEERING CENTER - ST. LOUIS

BRAC 95 DATA CALL #5 REQUIREMENTS

JUNE 1994

SECTION II CAPACITY OF DoD COMPONENTS

2.1 Workload AVRDEC - St. Louis

Information Required	Fiscal Year 86	87	88	89	90	91	92	93	94	95	96	97
Total Funds Programmed ($M)	78.0	81.7	91.0	104.6	51.0	55.1	73.4	64.9	64.3	64.0	70.3	64.6
Total Actual Funds ($M)	78.0	81.7	91.0	104.6	51.1	55.6	74.2	60.2				
Programmed Workyears	415	446	429	430	438	504	493	466	495	424	456	437
Actual Wkyrs	430	449	462	412	414	455	439	424				

The Aviation Research, Development, and Engineering Center (AVRDEC) - St. Louis consists of seven organizations, namely, the Advanced Systems Directorate, which includes the Aviation Systems Research and Analysis Office located at Moffett Field, California (established in FY91), the Engineering Directorate, the Life Cycle Software Engineering Directorate, the Test and Evaluation Management Office, the Safety Office, The AVRDEC Business Management Office, and the AVRDEC Headquarters.

Note: Fiscal year workload data does not include funding and workyears of those activities that transfer to the Army Research Laboratory in FY93, namely the Propulsion Directorate at NASA-Lewis, Cleveland, Ohio and the Aerostructures Directorate at Langley AFB, Virginia.

2.2 Excess "Lab" Capacity -- Measured at the DoD Component Level

Peak workyears between FY86 and FY93	462
Projected workyears for FY97	437
Excess "Lab" Capacity	25

SECTION III: CAPABILITY OF ACTIVITIES TO PERFORM COMMON SUPPORT FUNCTIONS (CSFs)

3.0 Mission:

The mission of the U.S. Army Aviation Research, Development, and Engineering Center (AVRDEC) - St. Louis addresses the following Common Support Functions (CSF):

Air Vehicle - Rotary/Fixed - Structures
Air Vehicle - Rotary/Fixed - Propulsion
Air Vehicle - Rotary - Avionics
Air Vehicle - Rotary/Fixed - Flight Subsystems
Human Systems

Under each of the above functions, the mission addresses specifics in the areas of:

Science & Technology: Planning and executing the Army Aviation Science and Technology Base Program

System Development: Supporting ATCOM and PEO-Aviation in:
- System requirements, specifications and design standards
- Concurrent engineering
- Production engineering
- Airworthiness releases
- Software engineering
- Test and evaluation

Fleet Support: Keeping fielded systems airworthy and operational
- Concurrent engineering/quick fixes
- Safety of flight
- Spare part alternate source approval and TDP development
- Value engineering
- Engine component improvement programs
- Airworthiness releases

Process Management: Providing life cycle management and total system life support
- Aviation strategy and financial program planning
- Configuration management
- Standardization
- Software
- Producibility

Work Force Quality: Developing and maintaining a capable technical workforce

Note: Efforts that do not fall clearly under one of the directed CSFs, particularly work in the areas of aeromechanics and certain engineering support, were included under Flight Subsystems.

Interconnectivity with Other Common Support Functions: For each of our CSFs within Air Vehcile - Rotary and for the CSF Human Systems, there is a potential for interconnectivity with the following CSFs:

Weapons: As part of integration of various air-to-air and air-to-ground weapons both precision and area.

C4I: As part of ability to communicate with both airborne and ground vehicles and provide command and control.

Space Systems: As a platform to provide sensor for intelligence to rotary wing systems.

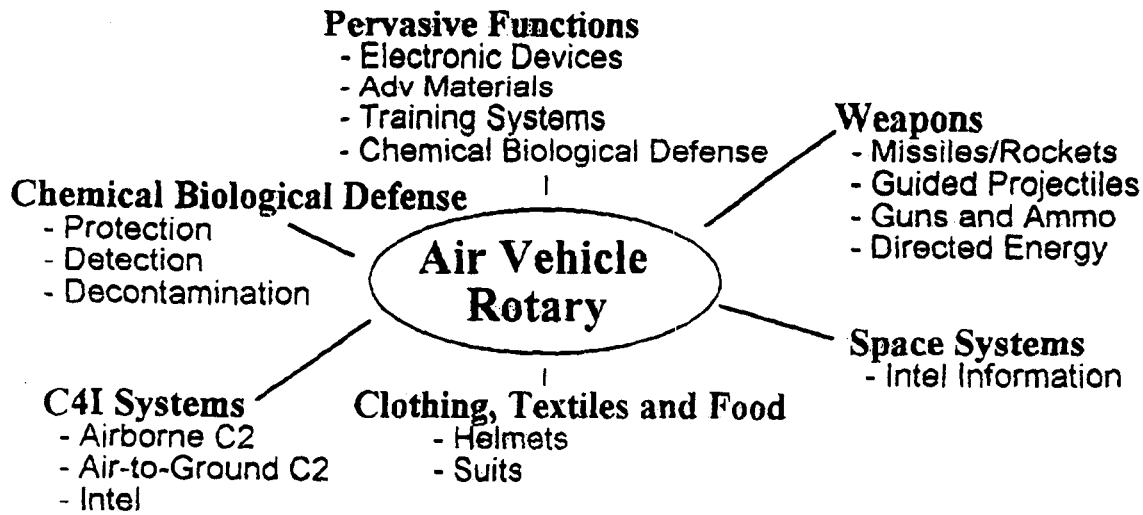
Clothing, Textiles and Food: As part of the crew equipment helmets and flight suits.

Chemical/Biological Defense: As part of survivability by detection, protection and decontamination of both vehicle and personnel.

Electronic Devices: As it relates to the hardware for flight/engine controls, MEP and other avionics.

Training Systems: As it pertains to simulation and devices for crew proficiency for rotary wing flight ground simulation and maintenance.

Advanced Materials: As it relates to rotors, airframes, transmissions, engines, landing gears, and canopies.



3.1 Location

3.1.1 Geographic/Climatological Features:

Air Vehicle - Rotary/Fixed - Strucutres: None
Air Vehicle - Rotary/Fixed - Propulsion: None
Air Vehicle - Rotary - Avionics: None
Air Vehicle - Rotary/Fixed - Flight Subsystems: None
Human Systems: None

3.1.2 Licences & Permits:

Air Vehicle - Rotary/Fixed - Strucutres: None
Air Vehicle - Rotary/Fixed - Propulsion: None
Air Vehicle - Rotary - Avionics: None
Air Vehicle - Rotary/Fixed - Flight Subsystems: None
Human Systems: None

3.1.3 Environmental Constraints:

Air Vehicle - Rotary/Fixed - Strucutres: None
Air Vehicle - Rotary/Fixed - Propulsion: None
Air Vehicle - Rotary - Avionics: None
Air Vehicle - Rotary/Fixed - Flight Subsystems: None
Human Systems: None

3.1.4 Special Support Infrastructure:

Air Vehicle - Rotary/Fixed - Strucutres: None
Air Vehicle - Rotary/Fixed - Propulsion: None
Air Vehicle - Rotary - Avionics: None
Air Vehicle - Rotary/Fixed Flight Subsystems: None
Human Systems: None

3.1.5 Proximity to Mission-Related Organizations AVRDEC - St. Louis

Common Spt Functions	Name	Type of Orgt'n	Distance	Workyears Performed by Your Activity	Workyears Funded by Your Activity
Air Vehicle Rotary Avionics	Science Applications International Corp	Commercial	10	11	16
Air Vehicle Rotary Avionics	FGS, Inc.	Commercial	10	1	7
Air Vehicle Rotary Avionics	Modern Technologies Corp	Commercial	8	2	3
Air Vehicle Rotary Flight Subsystems	PEO - Aviation	Government	0	18	0

1. - 3. Both the Government personnel and support contractors require frequent access to the Test Program Set (TPS) and Software Engineering technical repositories and access to the ATCOM Library; DSREDs; FEDLOG and other data resources only available at ATCOM. There is a definite need for the government personnel to interface with the contractors on a routine basis. If the contractor is not collocated there will be an impact on response time and support. Removing the contractor from the area would cause delays in the processing of tasks. Many of the taskings received require a minimal response time, i.e., less than one day turn around.

a. Not being able to respond in a timely manner to taskers by higher headquarters relating to Software Engineering.

b. Not being able to provide personnel for participation on study groups, teams, panels, or other efforts hosted or sponsored by higher headquarters.

c. Technical data from the TPS repository is required on a daily basis. The contractor's ability to support the TPS Center effort would be greatly impacted.

d. Database development efforts require network interface and availability of documentation for research purposes.

e. Contractor personnel need to interface with the Life Cycle Software Engineering (LCSE) Center's and TPS Center's customers, i.e., PEO/PMs, in order to support the mission and functions of the LCSE Center and TPS Center.

f. The requirement to maintain the technical repository would be hampered. It would be difficult to update and file data from a different location.

4. The Aviation RDEC provides reimbursable matrix engineering support to the Aviation PEO. In some cases, individuals are collocated with the PMs or in the PEO headquarters. The PEO requirements for daily activity including some immediate actions require the engineering functions to be geographically located close to the PM. As such, one requirement for the Aviation RDEC is to have its engineering population located at the St. Louis location of the PEO. This customer/supplier arrangement is further being amplified now and in the future with the "one-stop" support concept for the PMs. Under this arrangement, the Aviation RDEC is providing and coordinating the total technical support for their programs. The nucleus of engineering core capabilities allows the PM to receive total concurrent engineering support thus improving the effectiveness of the support as well as reducing their overall support costs.

3.2 Personnel AVRDEC - St. Louis

3.2.1 Total Personnel

5

CSF: Air Vehicles - Rotary - Structures

AVRDEC - St. Louis Types of Personnel	Number of Personnel Government		On-Site FFRDC	On-Site SETA
	Civilian	Military		
Technical	21	2		1
Management (SUPV)	5			
Other	3			

3.2.2. Education

Type of Degree/Diploma	Number of Government Personnel Technical	Management	Other
High School or Less			2
Associates			
Bachelor	10	1	
Masters	11	1	
Doctorates	2	2	

3.2.3. Experience

Type of Position	Years of Government and/or Military Services Less Than 3 Years	3-10 Years	11-15 Years	16-20 Years	More Than 20 Years
Technical	1	4	9	1	8
Management				3	2
Total	1	4	9	4	10

CSF: Air Vehicles - Rotary - Propulsion 6

Number of Personnel

Types of Personnel	Government		On-Site FFRDC	On-Site SETA
	Civilian	Military		
Technical	30			3
Management (SUPV)	3			
Other	4			

3.2.2. Education

Type of Degree/Diploma	Number of Government Personnel		
	Technical	Management	Other
High School or Less			3
Associates			
Bachelor	27	1	
Masters	4	2	
Doctorates	1		

3.2.3. Experience

Type of Position	Years of Government and/or Military Services				
	Less Than 3 Years	3-10 Years	11-15 Years	16-20 Years	More Than 20 Years
Technical		18	6	1	7
Management					3
Total		18	6	1	10

CSF: Air Vehicle - Rotary - Avionics

AVRDEC - St. Louis Types of Personnel	Number of Personnel Government		On-Site FFRDC	On-Site SETA
	Civilian	Military		
Technical	18			13
Management (SUPV)	3			
Other	4			

3.2.2. Education

Type of Degree/Diploma	Number of Government Personnel Technical	Management	Other
High School or Less			2
Associates			
Bachelor	13		1
Masters	6	2	
Doctorates		1	

3.2.3. Experience

Type of Position	Years of Government and/or Military Services Less Than 3 Years	3-10 Years	11-15 Years	16-20 Years	More Than 20 Years
Technical		8	3	1	7
Management					1
Total		8	3	1	8

CSF: Air Vehicles - Rotary - Flight Subsystems 8

AVRDEC - St. Louis Types of Personnel	Number of Personnel Government		On-Site FFRDC	On-Site SETA
	Civilian	Military		
Technical	168			13
Management (SUPV)	39	1		
Other	72			

3.2.2. Education

Type of Degree/Diploma	Number of Government Personnel Technical	Management	Other
High School or Less	1		63
Associates			5
Bachelor	131	18	2
Masters	32	21	2
Doctorates	4	1	

3.2.3. Experience

Type of Position	Years of Government and/or Military Services Less Than 3 Years	3-10 Years	11-15 Years	16-20 Years	More Than 20 Years
Technical	1	78	24	27	38
Management		1	3	9	27
Total	1	79	27	36	65

CSF: Human Systems 26

AVRDEC - St. Louis Types of Personnel	Number of Personnel Government		On-Site FFRDC	On-Site SETA
	Civilian	Military		
Technical	1	2		
Management (SUPV)	1			
Other	1			

3.2.2. Education

Type of Degree/Diploma	Number of Government Personnel Technical	Management	Other
High School or Less			
Associates			
Bachelor	5		
Masters			
Doctorates			

3.2.3. Experience

Type of Position	Years of Government and/or Military Services Less Than 3 Years	3-10 Years	11-15 Years	16-20 Years	More Than 20 Years
Technical		1	1	1	2
Management					
Total		1	1	1	2

CSF: Air Vehicles - Fixed - Structures

AVRDEC - St. Louis

Types of Personnel	Number of Personnel			
	Government		On-Site FFRDC	On-Site SETA
	Civilian	Military		
Technical	2			
Management (SUPV)				
Other				

3.2.2. Education

Type of Degree/Diploma	Number of Government Personnel		
	Technical	Management	Other
High School or Less			
Associates			
Bachelor	2		
Masters			
Doctorates			

3.2.3. Experience

Type of Position	Years of Government and/or Military Services				
	Less Than 3 Years	3-10 Years	11-15 Years	16-20 Years	More Than 20 Years
Technical		2			
Management					
Total		2			

CSF: Air Vehicles - Fixed - Propulsion

AVRDEC - St. Louis Types of Personnel	Number of Personnel Government Civilian	Government Military	On-Site FFRDC	On-Site SETA
Technical	1			
Management (SUPV)				
Other				

3.2.2. Education

Type of Degree/Diploma	Number of Government Personnel Technical	Management	Other
High School or Less			
Associates			
Bachelor	1		
Masters			
Doctorates			

3.2.3. Experience

Type of Position	Years of Government and/or Military Services Less Than 3 Years	3-10 Years	11-15 Years	16-20 Years	More Than 20 Years
Technical		1			
Management					
Total		1			

CSF: Air Vehicles - Fixed - Flight Subsystems

AVRDEC - St. Louis Types of Personnel	Number of Personnel Government		On-Site FFRDC	On-Site SETA
	Civilian	Military		
Technical	9			
Management (SUPV)	1			
Other	5			

3.2.2. Education

Type of Degree/Diploma	Number of Government Personnel Technical	Management	Other
High School or Less			5
Associates			
Bachelor	6	1	
Masters	3		
Doctorates			

3.2.3. Experience

Type of Position	Years of Government and/or Military Services Less Than 3 Years	3-10 Years	11-15 Years	16-20 Years	More Than 20 Years
Technical		5	3		1
Management			1		
Total		5	4		1

3.2.4 Accomplishments During FY 91-93 AVRDEC - St. Louis

3.2.4.1 Patents:

Air Vehicle - Rotary/Fixed - Strucutres: None
Air Vehicle - Rotary/Fixed - Propulsion: None
Air Vehicle - Rotary - Avionics: None
Air Vehicle - Rotary/Fixed - Flight Subsystems: None
Human Systems: None

3.2.4.2 Papers:

Air Vehicle - Rotary/Fixed - Strucutres: None
Air Vehicle - Rotary/Fixed - Propulsion: None
Air Vehicle - Rotary - Avionics: None
Air Vehicle - Rotary/Fixed - Flight Subsystems: None
Human Systems: None

3.3 Workload

3.3.1 FY93 Workload AVRDEC - St. Louis

CSF: Air Vehicles - Rotary - Structures

3.3.1.1. Work Year and Lifecycle

"LAB"	Fiscal Year 1993 Actual			
AVRDEC - St. Louis	Civilian	Military	FFRDC	SETA
Science & Technology	15	1		
Engineering Dev	11	1		1
In-Service Engineering	4			

3.3.1.2. Engineering Development by ACAT

Engineering Development	Name or Number	Workyears (FY 93 Actual)	FY 93 Funds Received (Obligation Authority $M)	Narrative
ACAT IC				
ACAT ID	Comanche	3	0.49	Systems Engr;
	Longbow Apache	7	1.13	Airworthiness Qual; T&E Support
ACAT II	Special Operations Acft	1	0.163	Systems Engr; Airworthiness Qual
ACAT III/IV	Avn Survivability Equipment;	1	0.163	Systems Engr for System Integration; Engr/Airworthiness
	Classified	1	0.163	Qualification
Other				

CSF: Air Vehicles - Rotary - Propulsion

3.3.1.1. Work Year and Lifecycle

"LAB"	Fiscal Year 1993 Actual			
AVRDEC - St. Louis	Civilian	Military	FFRDC	SETA
Science & Technology	2			
Engineering Dev	8			3
In-Service Engineering	25			

3.3.1.2. Engineering Development by ACAT

Engineering Development	Name or Number	Workyears (FY 93 Actual)	FY 93 Funds Received (Obligation Authority $M)	Narrative
ACAT IC				
ACAT ID	Comanche	5	0.867	Systems Engr/
	Longbow Apache	3	0.49	Airworthiness Qual; T&E Spt
ACAT II	Special Operations Acft	2.5	0.408	Systems Engr/ Airworthiness Qual
ACAT III/IV	Classified	0.5	0.082	Systems Engr/ Airworthiness Qual
Other				

CSF: Air Vehicles - Rotary - Avionics

3.3.1.1. Work Year and Lifecycle

"LAB"	Fiscal Year 1993 Actual			
AVRDEC - St. Louis	Civilian	Military	FFRDC	SETA
Science & Technology	2			
Engineering Development	8			1
In-Service Engineering	15			12

3.3.1.2. Engineering Development by ACAT

Engineering Development	Name or Number	Workyears (FY 93 Actual)	FY 93 Funds Received (Obligation Authority $M)	Narrative
ACAT IC				
ACAT ID				
ACAT II				
ACAT III/IV	Avn Survivability Equipment	9	1.471	T&E Support; Systems Engr for System Integration
Other				

CSF: Air Vehicles - Rotary - Flight Subsystems

3.3.1.1. Work Year and Lifecycle

"LAB"	Fiscal Year 1993 Actual			
AVRDEC - St. Louis	Civilian	Military	FFRDC	SETA
Science & Technology	56			
Engineering Development	87			10
In-Service Engineering	140.5	1		3

3.3.1.2. Engineering Development by ACAT

Engineering Development	Name or Number	Workyears (FY 93 Actual)	FY 93 Funds Received (Obligation Authority $M)	Narrative
ACAT IC	Blackhawk; Apache Upgrade; Kiowa Warrior	8	0.725	Safety Engineering
ACAT ID	Comanche; Longbow Apache	45	7	Safety Engineering Systems Engr/ Airworthiness Qual
ACAT II	Special Operations Acft	22.5	3.545	Safety Engineering Systems Engr/ Airworthiness Qual
ACAT III/IV	Avn Survivabilty Equipment	5.98	1.133	T&E Support
Other	Avn Life Support Equip; Classified; Common Support Equipment*	15.52	2.462	Systems Engr for System Integration

* Support to the Weapon System Manager for Avn Ground Support Equipment

CSF: Human Systems

3.3.1.1. Work Year and Lifecycle

"LAB"	Fiscal Year 1993 Actual			
AVRDEC - St. Louis	Civilian	Military	FFRDC	SETA
Science & Technology	3	2		
Engineering Development				
In-Service Engineering				

CSF: Air Vehicles - Fixed - Structures

3.3.1.1. Work Year and Lifecycle

"LAB"	Fiscal Year 1993 Actual			
AVRDEC - St. Louis	Civilian	Military	FFRDC	SETA
Science & Technology				
Engineering Development				
In-Service Engineering	2			

CSF: Air Vehicles - Fixed - Propulsion

3.3.1.1. Work Year and Lifecycle

"LAB"	Fiscal Year 1993 Actual			
AVRDEC - St. Louis	Civilian	Military	FFRDC	SETA
Science & Technology				
Engineering Dev				
In-Service Engineering	1			

CSF: Air Vehicles - Fixed - Flight Subsystems

3.3.1.1. Work Year and Lifecycle

"LAB"	Fiscal Year 1993 Actual			
AVRDEC - St. Louis	Civilian	Military	FFRDC	SETA
Science & Technology				
Engineering Dev				
In-Service Engineering	15			

3.3.1.3 In-Service Engineering AVRDEC - St. Louis

Common Spt Functions	In-Service Engineering Efforts (List)	FY 93 Actual		Weapons System (s) Supported
		Funds Received (Obligation Authority)	Workyears	
Air Vehicle - Rotary - Structures	Note 1	0.654	4	All ATCOM/ AvnPEO Sys
Air Vehicle - Rotary - Propulsion	Note 2	3.917	24	All ATCOM/ AvnPEO Sys
Air Vehicle - Rotary - Propulsion	T&E Support	0.326	1	All ATCOM/ AvnPEO Sys
Air Vehicle - Rotary - Avionics	PDSS	2.4	26	AH-64A/D OH-58D/MH-47E MH-60K
Air Vehicle - Rotary - Avionics	T&E Support	0.326	1	All ATCOM/ AvnPEO Sys
Air Vehicle - Rotary - Flight Subsystems	Materiel Chg	0.3	5	All ATCOM/ AvnPEO Sys
Air Vehicle - Rotary - Flight Subsystems	Quick React Test Capability	0.465	4.5	All ATCOM/ AvnPEO Systems
Air Vehicle - Rotary - Flight Subsystems	Safety Engr	0.814	10	UH-1/AH-1/ OH-58
Air Vehicle - Rotary - Flight Subsystems	T&E Support	0.654	2	All ATCOM/ AvnPEO Sys
Air Vehicle - Rotary - Flight Subsystems	Note 3	20.083	123	All ATCOM/ AvnPEO Sys
Air Vehicle - Fixed - Structures	Note 1	0.326	2	Sema/Fixed Wing
Air Vehicle - Fixed - Propulsion	Note 2	0.163	1	Sema/Fixed Wing
Air Vehicle - Fixed - Flight Subsystems	Note 3	2.286	14	Sema/Fixed Wing
Air Vehicle - Fixed - Flight Subsystems	Safety Eng	0.083	1	C-12/C-23

Note 1: Efforts include Systems Engineering Support to include support to field and Avn Program/Project/Product Managers in the areas of Structural Integrity and Material Components.

Note 2: Efforts include Systems Engineering Support to include support to field and Avn Program/Project/Product Managers in theareas of the Engine Component Improvement Program.

Note 3: Efforts include Systems Engineering Support to include support to field and Avn Program/Project/Product Managers in the areas of aeromechanics, standardization, weapons and aircrew integration, value engineering, and production and facilities engineering.

3.3.2 Projected Funding AVRDEC - St. Louis

3.3.2.1 Direct Funding

CSF	FY 94	FY 95	FY 96	FY 97
Air Vehicle - Rotary - Structures	**3.883**	**3.848**	**4.26**	**3.855**
Research and Development	3.324	3.434	3.866	3.431
OMA	0.201	0.057	0.045	0.042
DBOF	0.358	0.357	0.349	0.382
Air Vehicle - Rotary - Propulsion	**5.898**	**5.846**	**6.471**	**5.856**
Research and Development	2.353	3.153	3.779	3.100
OMA	1.310	0.371	0.291	0.273
DBOF	2.235	2.322	2.401	2.483
Air Vehicle - Rotary - Avionics	**4.115**	**4.078**	**4.515**	**4.086**
Research and Development	1.878	2.421	2.863	2.390
OMA	0.806	0.228	0.179	0.168
DBOF	1.431	1.429	1.473	1.528
Air Vehicle - Rotary - Flight Subsystems	**39.767**	**39.627**	**43.631**	**39.486**
Research and Development	8.395	17.814	21.258	16.813
Procurement	12.273	7.726	7.989	8.260
OMA	6.851	1.939	1.526	1.426
DBOF	12.248	12.148	12.858	12.987
Human Systems	**0.255**	**0.252**	**0.279**	**0.253**
Research and Development	0.255	0.252	0.279	0.253
Air Vehicle - Fixed - Structures	**0.306**	**0.303**	**0.335**	**0.303**
OMA	0.151	0.042	0.033	0.031
DBOF	0.155	0.261	0.302	0.272
Air Vehicle - Fixed - Propulsion	**0.153**	**0.151**	**0.168**	**0.152**
OMA	0.051	0.014	0.011	0.011
DBOF	0.102	0.137	0.157	0.141
Air Vehicle - Fixed - Flight Subsystems	**2.224**	**2.205**	**2.441**	**2.209**
Research and Development	0.267	0.755	0.991	0.725
OMA	0.705	0.200	0.157	0.147
DBOF	1.252	1.250	1.293	1.337

3.3.2.2 Other Obligation Authority

CSF	FY 94	FY 95	FY 96	FY 97
Air Vehicle - Rotary - Structures	0.528	0.542	0.562	0.576
Air Vehicle - Rotary - Propulsion	0.802	0.823	0.854	0.875
Air Vehicle - Rotary - Avionics	0.56	0.574	0.596	0.61
Air Vehicle - Rotary - Flight Subsystems	5.41	5.551	5.761	5.902
Air Vehicle - Fixed - Structures	0.042	0.043	0.044	0.045
Air Vehicle - Fixed - Flight Subsystems	0.358	0.367	0.383	0.392

3.4 Facilities and Equipment

3.4.1 Major Equipment and Facilities:

Air Vehicle - Rotary/Fixed - Strucutres: None
Air Vehicle - Rotary/Fixed - Propulsion: None
Air Vehicle - Rotary - Avionics: None
Air Vehicle - Rotary/Fixed - Flight Subsystems: None
Human Systems: None

3.5 Expansion Potential

3.5.1 Laboratory Facilities AVRDEC-St. Louis

Common Support Function	Facility or Equipment	Type of Space	Space Capacity (KSF) Current	Used	Excess
Air Vehicle - Rotary - Structures	Office	Admin	0.888	0.888	0
Air Vehicle - Rotary - Structures	Office	Technical	10.619	10.619	0
Air Vehicle - Rotary - Propulsion	Office	Admin	1.349	1.349	0
Air Vehicle - Rotary - Propulsion	Office	Technical	5.439	5.439	0
Air Vehicle - Rotary - Avionics	Office	Admin	0.941	0.941	0
Air Vehicle - Rotary - Avionics	Office	Technical	3.795	3.795	0
Air Vehicle - Rotary - Flight Subsystems	Office	Admin	9.099	9.099	0
Air Vehicle - Rotary - Flight Subsystems	Office	Technical	36.674	36.674	0
Human Systems	Office	Admin	0.058	0.058	0
Human Systems	Office	Technical	0.235	0.235	0
Air Vehicle - Fixed - Structures	Office	Admin	0.07	0.07	0
Air Vehicle - Fixed - Structures	Office	Technical	0.282	0.282	0
Air Vehicle - Fixed - Propulsion	Office	Admin	0.035	0.035	0
Air Vehicle - Fixed - Propulsion	Office	Technical	0.141	0.141	0
Air Vehicle - Fixed - Flight Subsystems	Office	Admin	0.511	0.511	0
Air Vehicle - Fixed - Flight Subsystems	Office	Technical	2.051	2.051	0

3.5.1.1 The U.S. Army Aviation Research, Development and Engineering Center (AVRDEC)- St. Louis is a tentant on a GSA owned industrial complex located within the City of St. Louis, Missouri. Within the currently allotted square footage for the AVRDEC, no additional workyears could be absorbed under an one shift operation. The U.S. Army Aviation and Troop Command (ATCOM), of which the AVRDEC is only one of three (3) Centers, currently leases 1,018,162 sq. ft. of office space on the complex with an average cost of $8.59/sq. ft.. HQ AMC pays an annual rent of approximately $10.2M for space, maintenance, and utilities. This is based only on a 40 hour operating week. Expenditures accumulated above this basis are paid by the ATCOM. In FY93, ATCOM paid an additional $1.7M in base operations. The AVRDEC currently does not bear any share of this cost differential. Additional expansion of th AVRDEC on the Federal Center complex, would have to be addressed by the ATCOM and the GSA.

3.5.1.2 Not applicable

3.5.1.3 The AVRDEC - St. Louis has no projects programmed in the FY95 PBS.

3.5.2 On the Federal Center complex, there is an additional 60 buildable acres and there is further expansion potential within existing buildings. Specifics would have to be addressed by the ATCOM and the GSA.

3.5.3 Utilities must be directly negotiated with the ATCOM and GSA.

3.5.1.1 - 3.5.3

The U.S. Army Aviation Research, Development and Engineering Center (AVRDEC)- St. Louis is a tentant on a GSA owned industrial complex located within the City of St. Louis, Missouri. The U.S. Army Aviation and Troop Command (ATCOM), of which the AVRDEC is only one of three (3) Centers, currently leases 1,018,162 sq. ft. of office space on the complex with an average cost of $8.59/sq. ft.. HQ AMC pays an annual rent of approximately $10.2M for space, maintenance, and utilities. This is based only on a 40 hour operating week. Expenditures accumulated above this basis are paid by the ATCOM. In FY93, ATCOM paid an additional $1.7M in base operations. The AVRDEC currently does not bear any share of this cost differential. On the Federal Center complex, there is an additional 60 buildable acres and there is further expansion potential within existing buildings. Specifics would have to be addressed by the ATCOM and the GSA.

To summarize additional buildable acres at the outlying AVRDEC laboratories (provided in separate reports):

Aeroflightdynamics Directorate, NASA/Ames, Moffett Field, CA		10 acres
Aviation Applied Technology Directorate, Fort Eustis, VA		
	Installation	480 acres
	Adjacent to AATD existing facilities	14.2 acres

H

AEROFLIGHTDYNAMICS DIRECTORATE
MOFFETT FIELD, CALIFORNIA

BRAC 95 DATA CALL #5 REQUIREMENTS

JUNE 1994

SECTION II CAPABILITY OF DoD COMPONENTS

2.1 Workload

	Fiscal Year											
	86	87	88	89	90	91	92	93	94	95	96	97
Total Funds Programmed												
AFDD-Ames	21	25.7	18.3	17.7	16.6	16.3	19.5	17.6	13.1	11.4	11.4	11.4
AFDD-Langley								*2.2	1.5	1.1	1.1	1.1
AFDD Total	21	25.7	18.3	17.7	16.6	16.3	19.5	19.8	14.6	12.5	12.5	12.5
Total Actual Funds												
AFDD-Ames	21	25.7	18.3	17.7	16.6	16.3	19.5	17.6				
AFDD-Langley								*2.2				
AFDD Total	21	25.7	18.3	17.7	16.6	16.3	19.5	19.8				
Programmed Workyears												
AFDD-Ames	141	141	141	143	144	147	153	154	147	145	145	145
AFDD-Langley								*25	24	24	24	24
AFDD Total	141	141	141	143	144	147	153	179	171	169	169	169
Actual Workyears												
AFDD-Ames	141	141	141	143	144	147	153	154				
AFDD-Langley								*25				
AFDD Total	141	141	141	143	144	147	153	179				

* Inception of Activity

2.2 Excess "Lab"Capacity -- Measured at the DoD Component Level

Peak workyears between FY86 and FY93	179
Projected workyears for FY97	169
Excess "Lab" Capacity	10

SECTION III: CAPABILITY OF ACTIVITIES TO PERFORM COMMON SUPPORT FUNCTIONS (CSFs)

3.0 Mission

1. **Air Vehicles - Rotary - Flight Subsystems:** Conduct research, exploratory development, technology demonstration, and provide engineering support (to developmental and fielded aviation systems) in the areas of rotary wing:

Aerodynamics
Dynamics
Comprehensive Modeling and Analysis
Acoustics
Flight Control
Handling Qualities/Simulation
Performance/Optimization
Computational Fluid Dynamics (CFD)
Systems Integration

Capabilities Include:

Experimental Research and Development
Computational Fluid Dynamics Modeling and Analysis
Computational Concurrent Engineering Design and Analysis
Ground-Based and In-Flight Simulation

2. **Human Systems:** Conduct exploratory development, technology demonstration, and provide engineering support (to developmental and fielded aviation systems) in the areas of rotary wing:

Human Factors
Human-Machine Integration
Crew Station Design
Simulation

Capabilities Include:

Experimental Research and Development
Computational Design and Analysis
Ground-Based and In-Flight Simulation

3. **Interconnectivity of Common Support Functions:** Both Air Vehicles-Rotary-Flight Subsystems and Human Systems are integral parts of the overall aviation mission area and are critically related through classical systems (to include air vehicle and crew) integration considerations throughout the weapons system life cycle.

Interconnectivity with Other Common Support Functions: For both Air Vehcile - Rotary - Flight Subsystems and Human Systems, there is a potential for interconnectivity with the following CSFs:

Weapons: As part of integration of various air-to-air and air-to-ground weapons both precision and area.

C4I: As part of ability to communicate with both airborne and ground vehicles and provide command and control.

Space Systems: As a platform to provide sensor for intelligence to rotary wing systems.

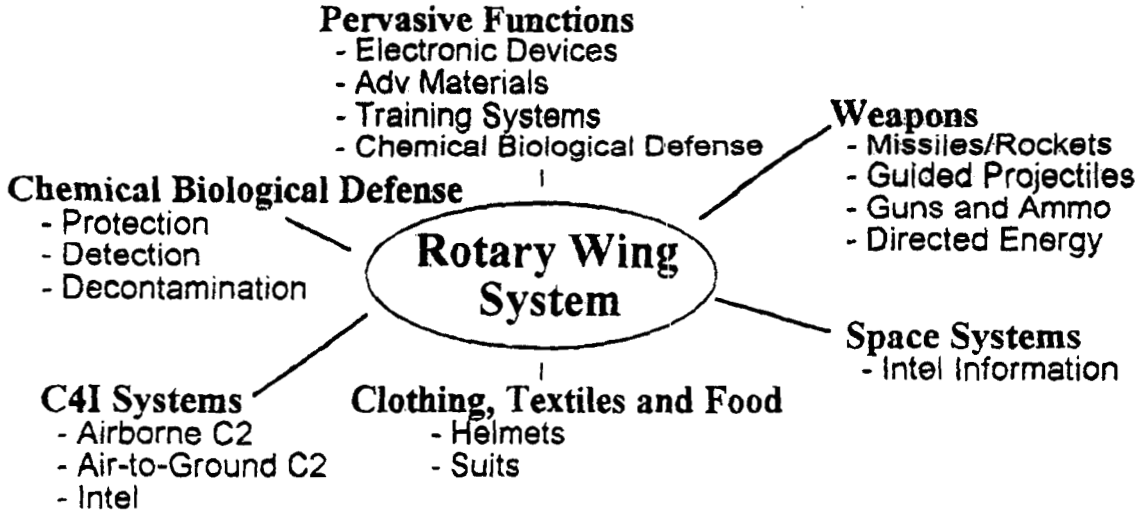
Clothing, Textiles and Food: As part of the crew equipment helmets and flight suits.

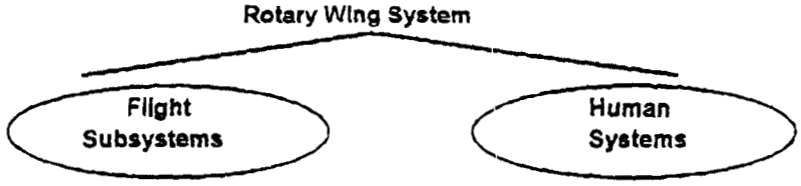
Chemical/Biological Defense: As part of survivability by detection, protection and decontamination of both vehicle and personnel.

Electronic Devices: As it relates to the hardware for flight/engine controls, MEP and other avionics.

Training Systems: As it pertains to simulation and devices for crew proficiency for rotary wing flight ground simulation and maintenance.

Advanced Materials: As it relates to rotors, airframes, transmissions, engines, landing gears, and canopies.





#3a

3.1 Location

3.1.1 Geographic/Climatological Features:

Air Vehicle - Rotary - Flight Systems: None
Human Systems: None

3.1.2 Licenses and Permits:

Air Vehicle - Rotary - Flight Systems: None
Human Systems: None

3.1.3 Environmental Constraints:

Air Vehicle - Rotary - Flight Subsystems and Human Systems: Special containment and disposal of some fuels, lubricants, and other hazardous materials in small quantities is required. Containment and disposal is handled through facilities and infrastructure provided by NASA host.

3.1.4 Special Support Infrastructure: (applies to both Air Vehicle - Rotary - Flight Subsystems and Human Systems)

Under the Army/NASA Joint Agreement, the Aeroflightdynamics Directorate (AFDD) is collocated with the National Aeronautics and Space Administration (NASA) Ames and Langley Research Centers. NASA Ames/Langley own, maintain, and operate the bulk of the highly specialized research and development facilities and technical support facilities used by the Army in conduct of aeromechanics and human-systems integration. Many of these facilities are unique in the world and include:

Ames:
- 7x10 Foot Wind Tunnel
- 40x80x120 Foot Wind Tunnel
- Fluid Mechanics Laboratory
- Numerical Aerodynamic Simulator
- Vertical Motion Simulator
- Crew Station Research and Development Facility
- Automation Sciences Research Facility
- In-Flight Simulators and Research Aircraft

Langley:
- 14x22 Foot Wind Tunnel

AFDD collocation with NASA Ames and NASA Langley provides the Army direct access, without construction and maintenance costs, to world class, unique facilities with a capital value of approximately $1.5B.

In addition, the predominance of the administrative (financial, personnel, maintenance, technical support) infrastructure is provided by NASA.

3.1.5. Proximity to Mission-Related Organizations

AFDD Ames

COMMON SUPPORT FUNCTION	NAME	TYPE OF ORG.	DISTANCE	WORKYEARS PERFORMED BY YOUR ACTIVITY	WORKYEARS PERFORMED BY YOUR ACTIVITY
Air Vehicles Rotary Flt Subsystems	NASA Ames	Govt R&D	Collocated	124	124
Human Systems	NASA Ames	Govt R&D	Collocated	30	30
Air Vehicles Rotary Flt Subsystems	Naval Post Grad School	Govt University	45 miles		
Air Vehicles Rotary Flt Subsystems	Stanford University	University	10 miles		

AFDD Langley

COMMON SUPPORT FUNCTION	NAME	TYPE OF ORG.	DISTANCE	WORKYEARS PERFORMED BY YOUR ACTIVITY	WORKYEARS PERFORMED BY YOUR ACTIVITY
Air Vehicles Rotary Flt Subsystems	NASA Langley	Govt R&D	Collocated	25	25

AFDD collocation with NASA Ames and Langley includes far more than simply the use of NASA facilities as discussed in section 3.1.4. (even though that is a substantial benefit alone). Perhaps the most significant benefit is the leverage that the Army obtains in NASA personnel and financial resources focused on R&D in direct support of AFDD's mission.

Through complete integration of the AFDD work force into the NASA Ames/Langley organizations, AFDD has been able to focus NASA efforts in the following rotary wing and human systems technology areas:

CFD
Unsteady Aerodynamics
Configuration Aerodynamics
Acoustics
Aeroelastic Stability
Vibratory Loads

Handling Qualities
Comprehensive Modeling
Optimization
Simulation
Human-Machine Integration
Human Factors
Crew Station Design

In addition to leveraging NASA's science and technology program, AFDD has been able to involve NASA world class technical experts as team members in support of Comanche and Apache Longbow development.

Absence of collocation of AFDD with NASA Ames and Langley would obviously nullify all of the above "in-place" benefits. Reproducing the capabilities enjoyed at NASA Ames and Langley, in both facilities and technical expertise, would be prohibitively expensive on one hand (over $1.5B worth of NASA facilities are employed on the AFDD S&T program), and impossible to realize on the other (critical mass of NASA expertise on-call and leveraged NASA resources in all technical areas comprising AFDD's mission). In net effect, AFDD can perform its mission with roughly 140 Army personnel and $16M budget that would require 450 people and more than $155M/year if the AFDD were not collocated with NASA Ames/Langley.

3.2 Personnel

3.2.1 Total Personnel

AFDD-Ames

		NUMBER OF PERSONNEL			
		Government		On-Site	On-Site
	Types of Personnel	Civ	Mil	FFRDC	SETA
Air Vehicle Rotary Flight Subsystems	Technical	51	1		..1
	Management (Supv)	12			
	Other	37			
Human Systems					
	Technical	..7			32
	Management (Supv)	..2			
	Other	11			

AFDD-Langley

	Types of Personnel	NUMBER OF PERSONNEL Government Civ	Mil	On-Site FFRDC	On-Site SETA
Air Vehicle Rotary Flight Subsystems	Technical	18	1		4
	Management (Supv)	1			
	Other	1			

3.2.2 Education

AFDD-Ames

	Type of Degree/ Diploma	NUMBER OF GOV. PERSONNEL BY POSITION Technical	Management Supervisory	Other
Air Vehicle Rotary Flight Subsystems	High School or Less	0	1	25
	Associate	2	0	5
	Bachelor	20	5	5
	Masters	18	4	1
	Doctorate	12	2	0
Human Systems	High School or Less	0	0	5
	Associate	0	0	2
	Bachelor	0	0	3
	Masters	5	1	1
	Doctorate	2	1	0

AFDD-Langley

	Type of Degree/ Diploma	NUMBER OF GOV. PERSONNEL BY POSITION Technical	Management Supervisory	Other
Air Vehicle Rotary Flight Subsystems	High School or Less	4	0	1
	Associate	2	0	0
	Bachelor	3	0	0
	Masters	7	1	0
	Doctorate	2	0	0

3.2.3 Experience

AFDD-Ames

	Type of Position	YEARS OF GOVERNMENT AND/OR MILITARY SERVICE Less than 3 yrs	3-10 yrs	11-15 yrs	16-20 yrs	More than 20 yrs
Air Vehicle Rotary Flight Subsystems	Technical		24	6	4	18
	Management (Supv)		2	1	2	7
	Total		26	7	6	25
Human Systems	Technical		2	3	2	
	Management (Supv)				1	1
	Total		2	3	3	1

AFDD-Langley

	Type of Position	YEARS OF GOVERNMENT AND/OR MILITARY SERVICE Less than 3 yrs	3-10 yrs	11-15 yrs	16-20 yrs	More than 20 yrs
Air Vehicle Rotary Flight Subsystems	Technical		1	0	6	12
	Management (Supv)		0	0	0	1
	Total		1	0	6	13

3.2.4 Accomplishments During FY91-93

3.2.4.1 Patents

Human Systems: None

	Disclosures	Awarded	Patent Title
AirVehicle Rotary Subsystems			
AFDD-Ames		1	Output Optics for Laser Velocimeters
AFDD-Langley	1		Slotted Airfoil

3.2.4.2 Papers

FLIGHT SUBSYTEMS - AFDD - AMES (14)

TISCHLER, M. B.; FLETCHER, J. W.; Morris, P. M.; and Tucker, G. E., "Flying Quality Analysis and Flight Evaluation of a Highly Augmented Combat Rotorcraft", Journal of Guidance, Control and Dynamics, Volume 14, Number 5, Pages 954-963, September-October 1991.

GALLMAN, J. M.; Myers, M. K.; and Farassat, F., "Boundary Integral Approach to the Scattering of Nonplanar Acoustic Waves by Rigid Bodies", AIAA Journal, Volume 29, Number 12, Pages 2038-2046, December 1991.

Hess, R. A.,; Malsbury, T.; and ATENCIO, A.; "A Model-Based Assessment of Rotorcraft Flight Simulator Fidelity in a Lateral Translation Maneuver", published in the AIAA Jounral of Guidance, Control and Dynamics, December 1991.

SCHROEDER, J. A.; TISCHLER, M. B.; Watson, D. C.; and ESHOW, M. M., "System Identification of a Combat Helicopter in Hover", published in the Journal of the American Helicopter Society, January 1992.

ESHOW, Michelle M.' "Flight Investigation of Variations in Rotorcraft Control and Display Dynamics for Hover", published in the AIAA Journal of Guidance, Control and Dynamics, Volume 15, Numer 2, Paper Number AIAA-90-3482, Pages 482-490, March-April 1992.

TAKAHASHI, Marc D., "Synthesis and Simulation Evaluation of H_2 Multivariable Flight-Control Law for a Helicopter in Hover", published in the AIAA Journal of Guidance, Control and Dynamics, June 1992.

CARR, Lawrence W.; and YU, Yung H., "The Use of Interferometry in the Study of Rotorcraft Aerodynamics", Journal of Optics and Lasers in Engineering, November 1992, pp. 121-146.

STRAWN, R. C.; and Barth, T. J., "A Finite-Volume Euler Solver for Computing Rotary-Wing Aerodynamics on Unstructured Meshes", Journal of the American Helicopter Society, Vol. 38, No. 2, April 1993.

Srivivasan, G. R.; and BAEDER, J. D., "TURNS: A Free-Wake Euler/Navier-Stokes Numerical Method for Helicopter Rotors", AIAA Journal, Vol. 31, No. 5, May 1993.

Srinivasan, R. G.; Raghavan, V.; and DUQUE, E. P. N., "Flowfield Analysis of Modern Helicopter Rotors in Hover by Navier-Stokes Method", Journal of the American Helicopter Society, Vol. 38, No. 4, July 1993.

Srinivasan, G. R.; and McCROSKEY, W. J., "Euler Calculations of Unsteady Interaction of Advancing Rotor with a Line Vortex", AIAA Journal, Vol. 31, No. 8, August 1993.

TAKAHASHI, Marc D., "Rotor-State Feedback in the Design of Flight-Control Laws for a Hovering Helicopter", published in the Journal of the American Helicopter Society, July 1993.

SCHROEDER, J. A.; TISCHLER, M. B.; Watson, D. C.; and ESHOW, M. M., "Identification and Simulation Evaluation of a Combat Helicopter in Hover", published in the Journal of the American Helicopter Society, August 1993.

Pausder, Heinz-Jurgen; and BLANKEN, Chris L., "Investigation of the Effects of Bandwidth and Time Delay on Helicopter Roll-Axis Handling Qualities", published in the Journal of the American Helicopter Society, December 1992.

FLIGHT SUBSYTEMS - AFDD - LANGLEY (1)

WILSON, J. C.; and KELLEY, H. L., "The Strake: A Simple Means for Directional Control Improvement", VERTIFLIGHT, Volume 39, No. 2, March/April 1993, pp. 29-31.

HUMAN SYTEMS: None

3.3 Workload

3.3.1 FY93 Workload

Science and Technology	Civilians	Military	On-Site FFRDC	On-Site SETA
Air Vehicle - Rotary - Flight Subsystems				
AFDD-Ames	107	1		16
AFDD-Langley	20	1		4
AFDD Total	127	2		20
Human Systems				
AFDD-Ames	13			17
AFDD-Langley	0			0
AFDD Total	13			17

3.3.2 Projected Funding

3.3.2.1 Direct Funding (RDTE)

	FY94	FY95	FY96	FY97
Air Vehicle - Rotary - Flight Subsystems				
AFDD-Ames	8.0	6.9	6.9	6.9
AFDD-Langley	1.5	1.1	1.1	1.1
AFDD Total	9.5	8.0	8.0	8.0
Human Systems				
AFDD-Ames	5.1	4.5	4.5	4.5
AFDD-Langley	0.0	0.0	0.0	0.0
AFDD Total	5.1	4.5	4.5	4.5

3.3.2.2 Other Obligation Authority

	FY94	FY95	FY96	FY97
Air Vehicle - Rotary - Flight Subsystems				
AFDD-Ames	1.3	1.3	1.3	1.3
AFDD-Langley	0.9	0.9	0.9	0.9
AFDD Total	..2.2	2.2	2.2	2.2
Human Systems				
AFDD-Ames	2.8	2.8	2.8	2.8
AFDD-Langley	0.0	0.0	0.0	0.0
AFDD Total	2.8	2.8	2.8	2.8

3.4 Facilities and Equipment

3.4.1 Major Equipment and Facilities: (reference paragraph 3.1.4, Special Support Infrastructure)

AFDD Ames

COMMON SPT FUNCTION	MAJOR FACILITY	UNIQUE TO DOD	UNIQUE TO FED	UNIQUE TO U.S.	REPLACEMENT COST ($K)
Air Vehicles Rotary Wing Flt Subsystems	Hover Anechoic Chamber	X	X		6,000
	7x10 Foot Wind Tunnel				19,000
	40x80x120 Ft Wind Tunnel	X	X	X	339,000
	Fluid Mechanics Laboratory	X	X		6,000
	Numerical Aerody Simulator	X	X	X	48,000
	Vertical Motion Simulator	X	X	X	128,000

COMMON SPT FUNCTION	MAJOR FACILITY	UNIQUE TO DOD	FED	U.S.	REPLACEMENT COST ($K)
Human Systems					
	Crew Station R&D Facility	X	X	X	34,000
	Helicopter Human Factors Research Facility	X	X	X	11,000
	Automation Sciences Research Facility				12,000
					57
AFDD Langley					
Air Vehicles Rotary Wing Flt Subsystems	14x22 Foot Wind Tunnel	X	X		57,000
	Free Flight Research Facility	X	X	X	1,000

3.5 Expansion Capability

3.5.1 Laboratory Facilities

AFDD-Ames

COMMON SPT FUNCTION	FACILITY	TYPE OF SPACE	SPACE CAPACITY (KSF) CURRENT	USED	EXCESS
Air Vehicles Rotary Flt Subsystems	Building N215 (90%)	Admin/Technical	8	8	0
	Building N219	Admin/Technical	8	8	0
	Building N210	Technical	1	1	0
	Bldg. N211 (office)	Technical	1	1	0
	Bldg. N211 (hanger)	Utility	56	56	0
	Hover Anechoic Chamber	Technical	6	6	0
	7x10 Foot Wind Tunnel	Tech/Utility	25	25	0
Human Systems	Bldg. N215 (10%)	Admin/Technical	8	8	0
	Bldg. N243	Tech/Admin/Utility	40	40	0
AFDD-Langley					
Air Vehicles Rotary Flt Subsystems	Multiple Locations	Admin/Tech/Utility	40	40	0

3.5.1.1. and 3.5.1.2. Capacity to absorb additional workyears. AFDD at both Ames and Langley has the capacity to absorb additional workyears of up to twice our on-board with no additional technical/experimental facilities requirements. Additional office space, however, is required for any additional personnel.

NASA Ames is collocated with Naval Air Station (NAS), Moffett Field. As part of a previous BRAC action, NAS Moffett Field functions relocate and NASA Ames assumes control of all NAS Moffett Field facilities. Approximately 300,000 square feet of office space is available. Minor construction would be required to rehabilitate and modify this space. Access to this space, however, would require direct negotiation with NASA.

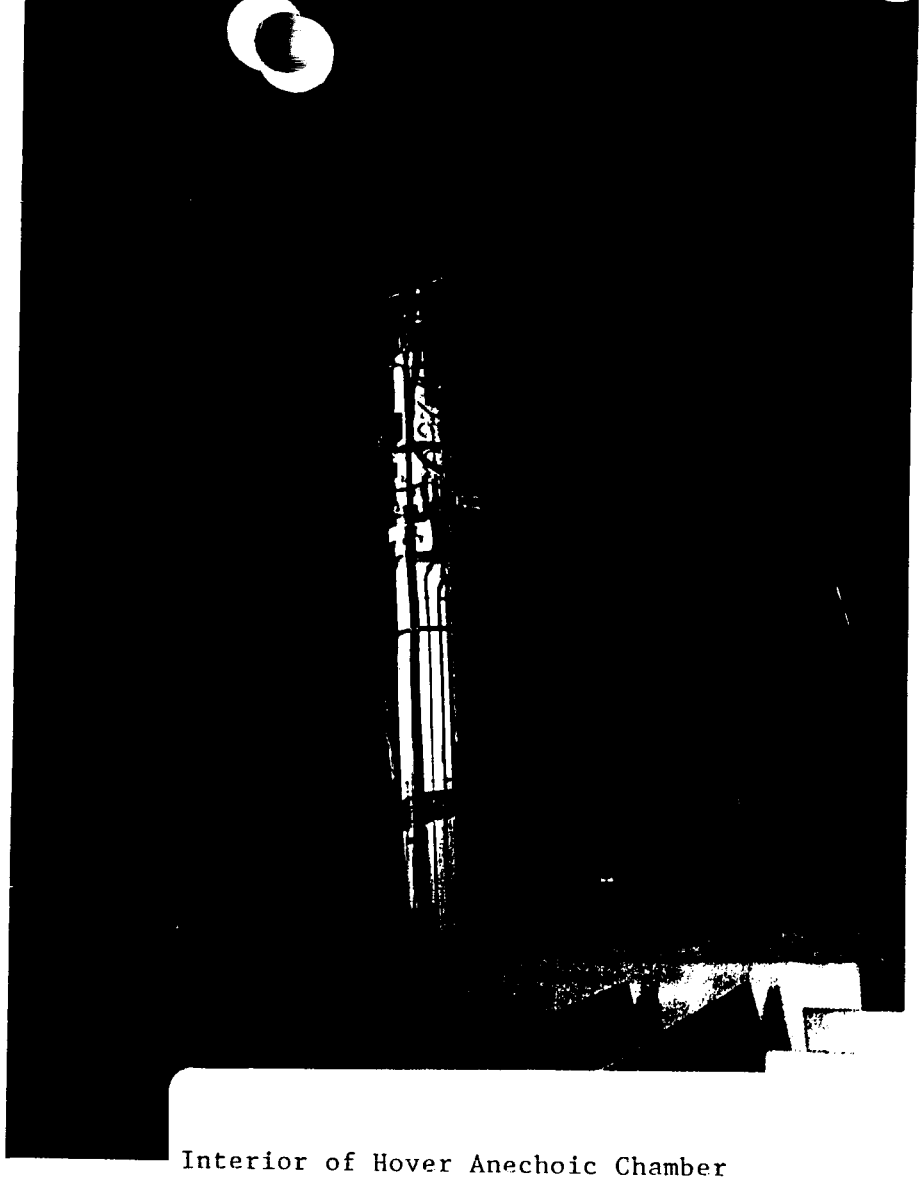
Access to excess space at Langley would require direct negotiation with NASA.

3.5.1.3

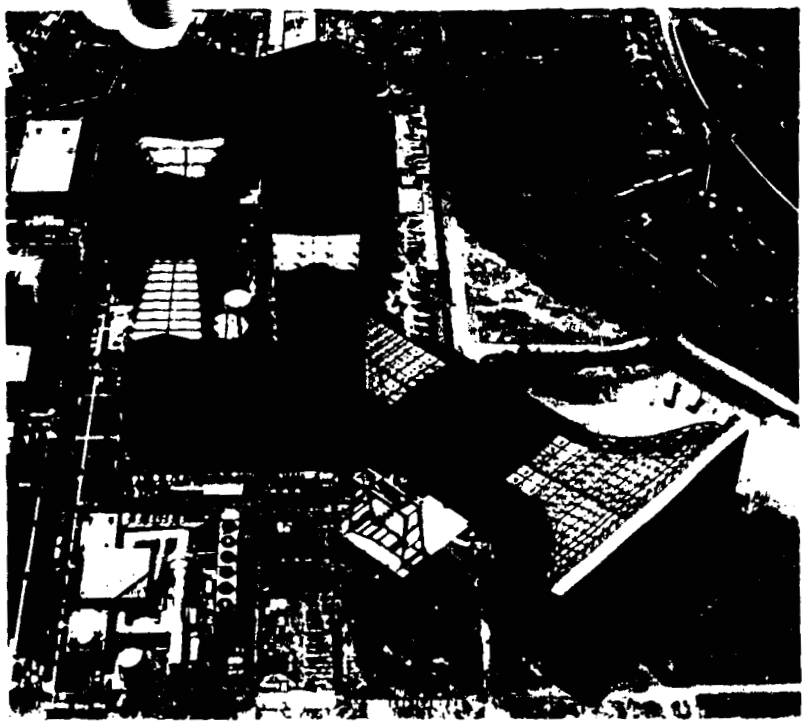
Air Vehicle - Rotary - Flight Subsystems: None
Human Systems: None

3.5.2 10 buildable acres are available at NASA Ames/Moffett Field for additional laboratory/administrative support construction. Land use, however, must be negotiated directly with NASA.

3.5.3 Utilities must be negotiated directly with NASA.



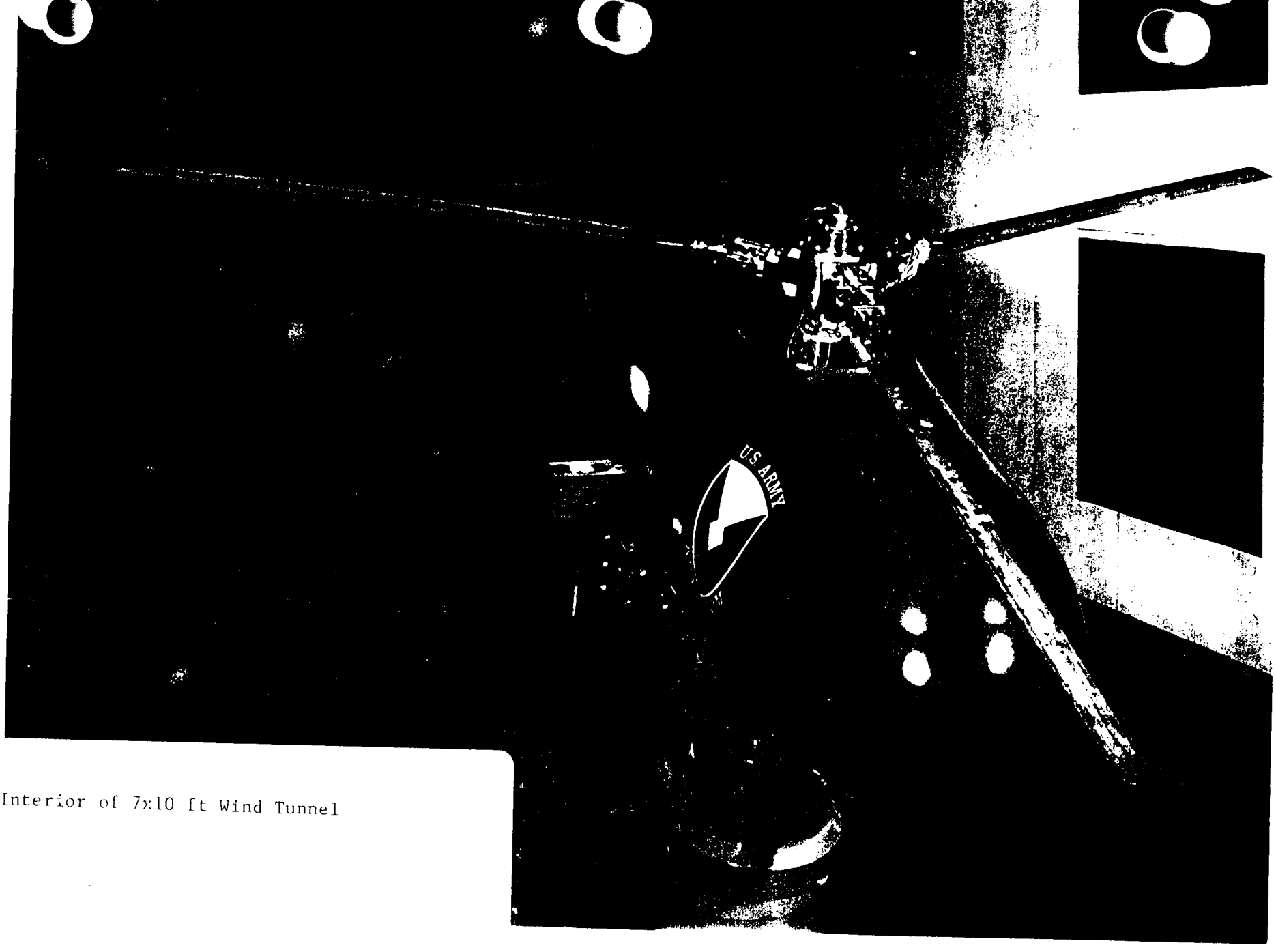
Interior of Hover Anechoic Chamber



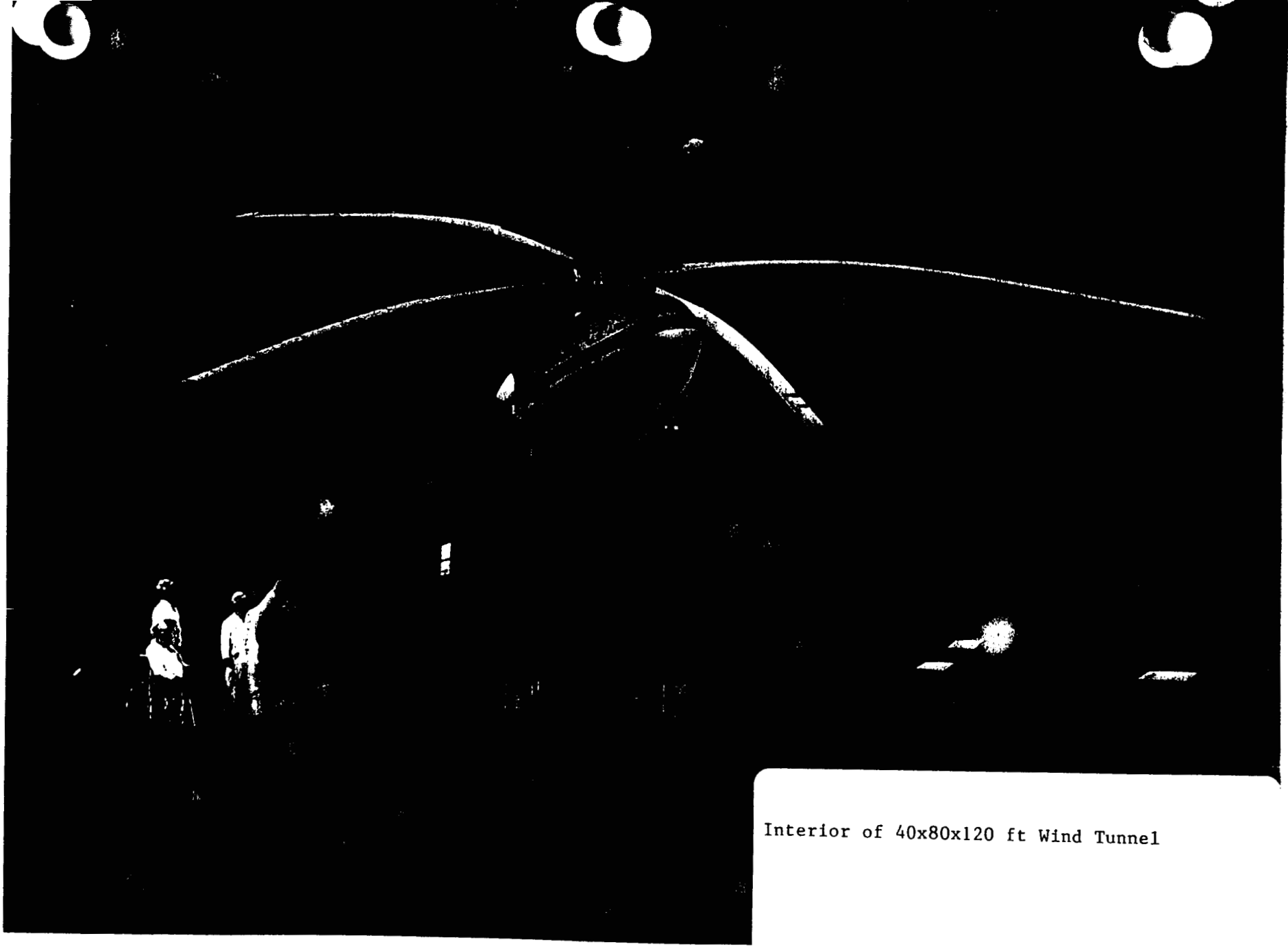
40- BY 80/80- BY 120-FOOT WIND TUNNEL
NATIONAL FULL-SCALE AERODYNAMICS
COMPLEX (NFAC)

OUTDOOR AERODYNAMIC
RESEARCH FACILITY (OARF)

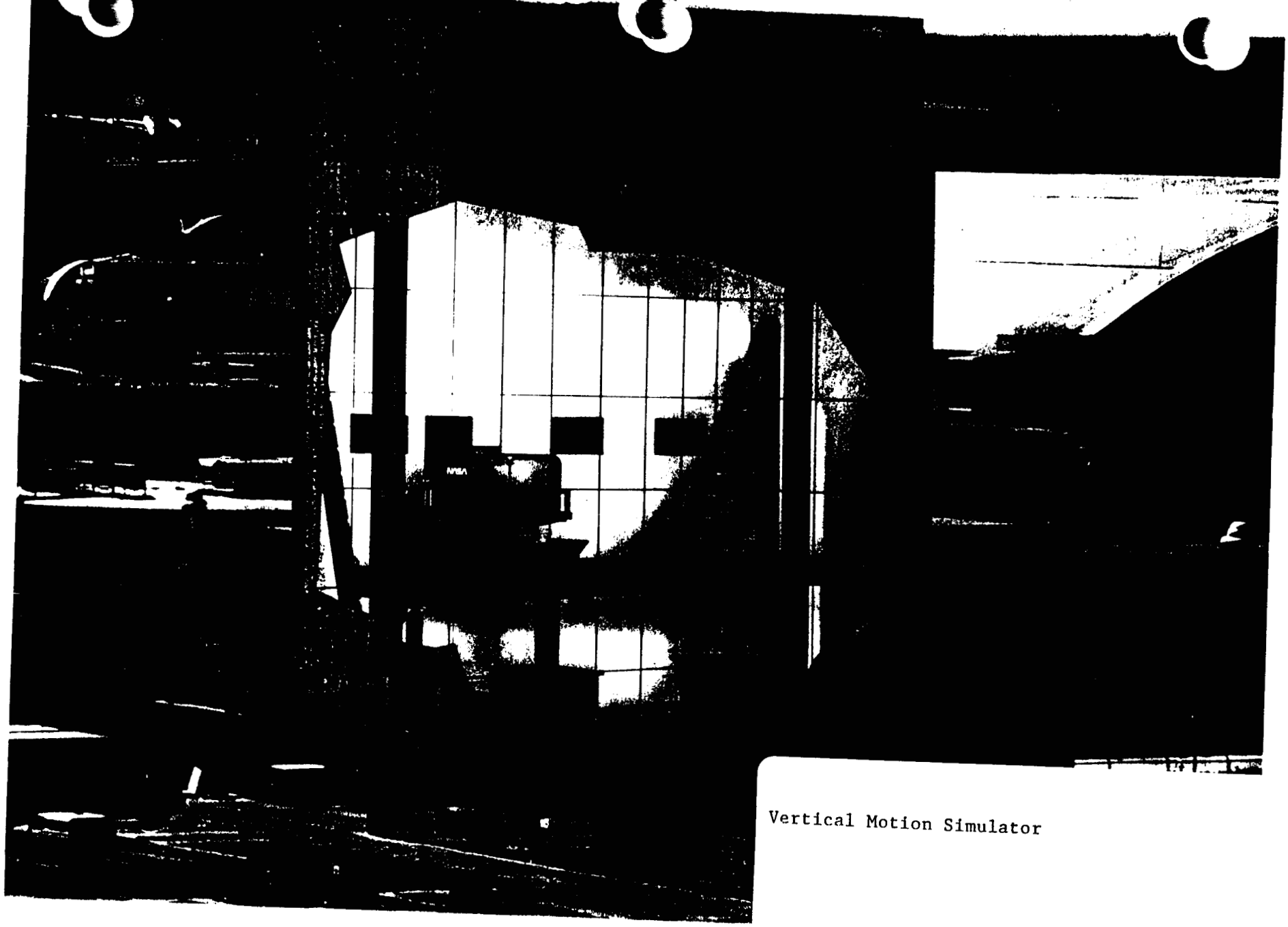
7- BY 10-FOOT WIND TUNNEL



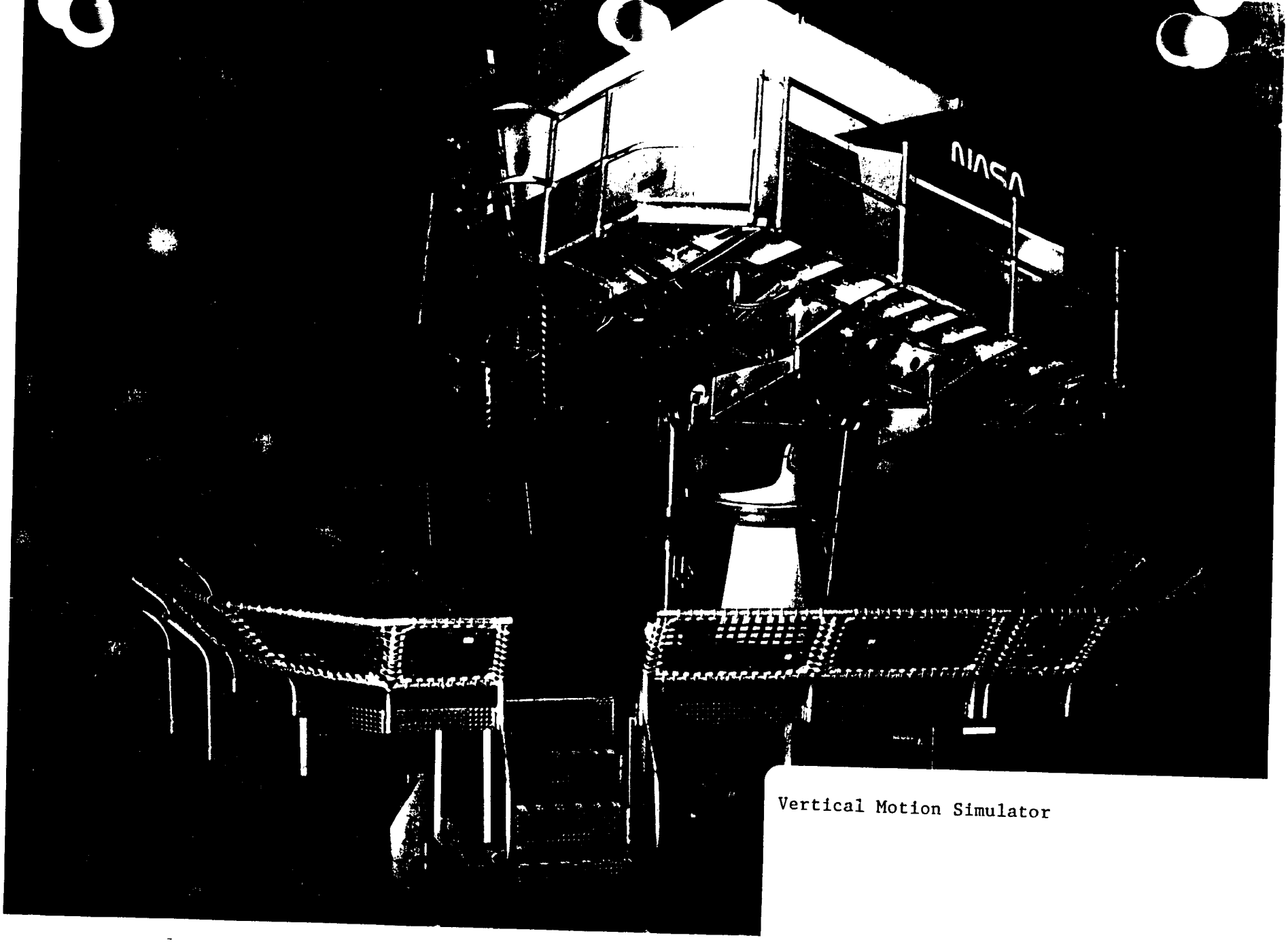
Interior of 7x10 ft Wind Tunnel



Interior of 40x80x120 ft Wind Tunnel



Vertical Motion Simulator

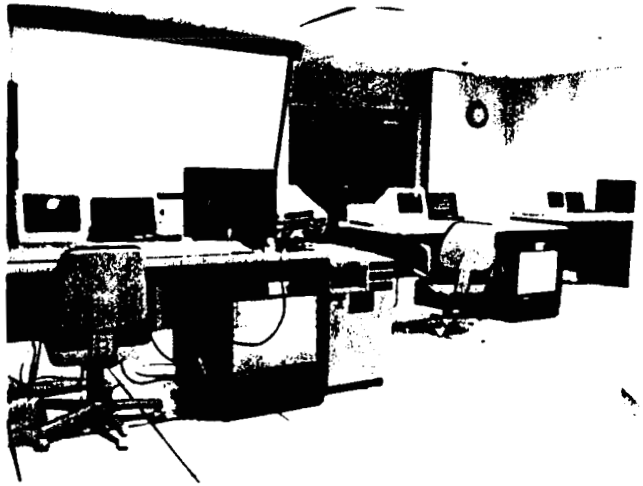


Vertical Motion Simulator

CREW STATION RESEARCH DEVELOPMENT COMPLEX

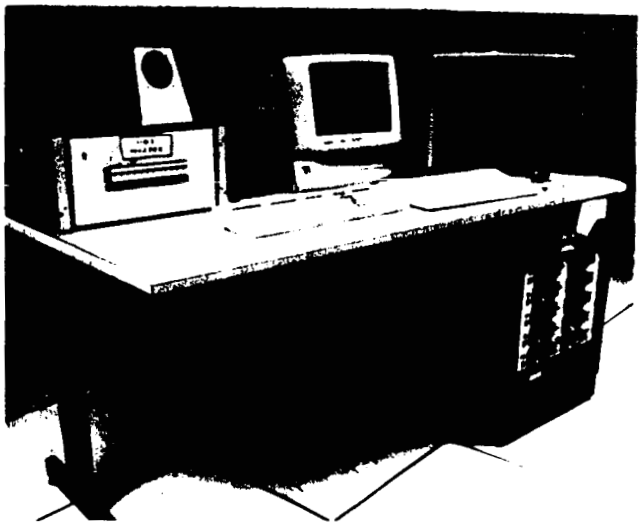
Experimenter/operator console

One/two seat cab

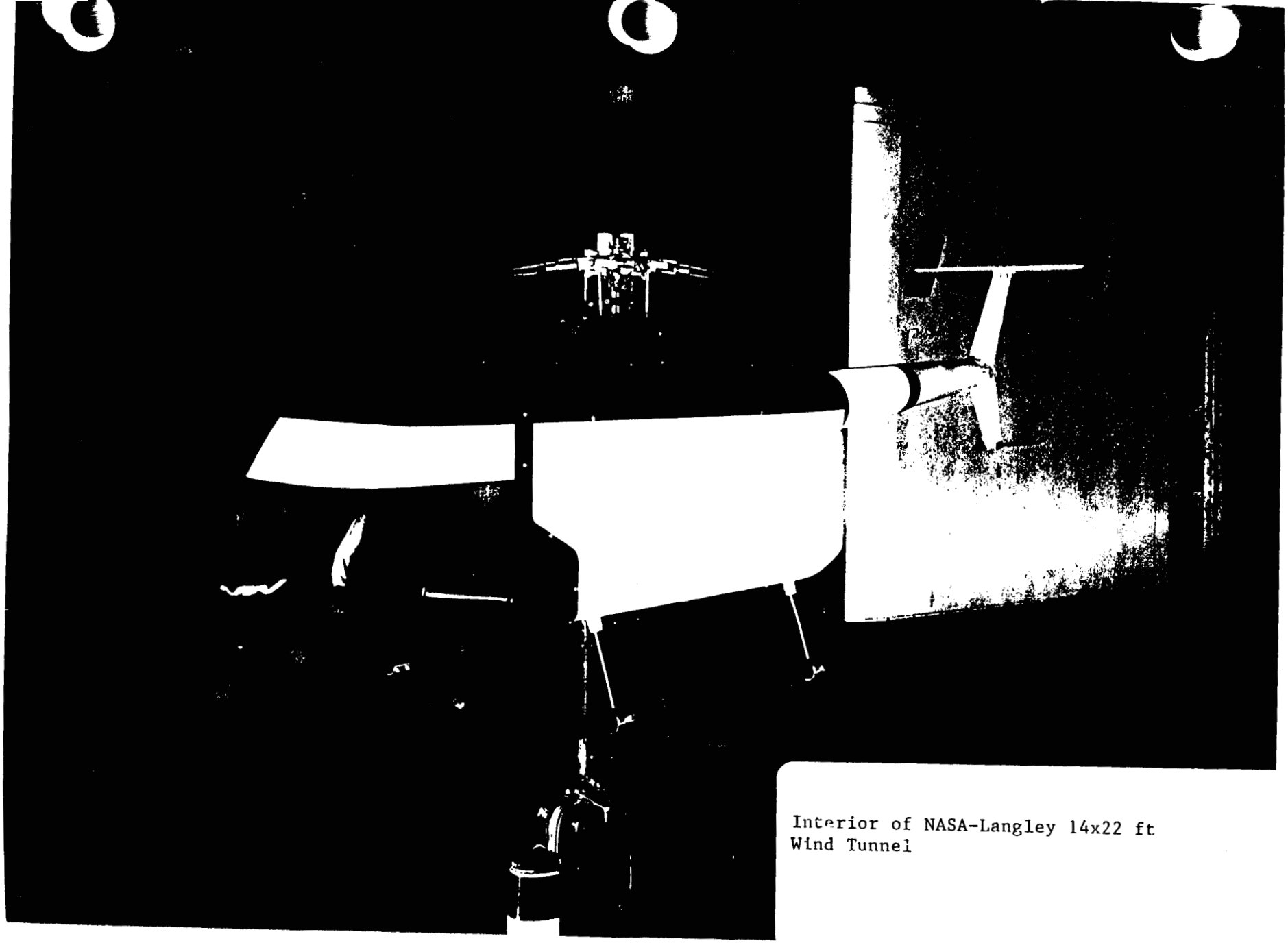


Red/blue team stations

Fiber optic helmet mounted display



White team station



Interior of NASA-Langley 14x22 ft
Wind Tunnel

AVIATION APPLIED TECHNOLOGY DIRECTORATE (AATD)
FORT EUSTIS, VIRGINIA

BRAC 95 DATA CALL #5 REQUIREMENTS
JUNE 1994

SECTION II: CAPACITY OF DoD COMPONENTS

2.1 Workload

Information Required	Fiscal Years											
	86	87	88	89	90	91	92	93	94	95	96	97
Total Funds Programmed ($K)	130,479	82,735	62,656	50,248	36,131	48,692	49,744	54,598	51,044	58,174	72,184	53,172
Total Actual Funds ($K)	205,138	123,090	103,712	67,177	55,240	60,848	70,519	75,072				
Programmed Workyears	329	322	323	321	321	329	309	304	260	257	257	257
Actual Workyears	336	330	327	328	337	325	313	292				

2.2 Excess "Lab" Capacity - Measured at the DOD Component Level

Sum of the peak workyears (highest value between FY86 and FY93)	337
Sum of projected workyears (estimated at FY97)	257
Excess Lab Capacity	80

SECTION III. CAPABILITY OF ACTIVITIES TO PERFORM COMMON SUPPORT FUNCTIONS

3.0 Missions:

Structures: - Maintain technical expertise in order to formulate and execute safety and survivability R&D programs to provide advanced technology applications in the area of structural crashworthiness and ballistic damage hardening.
- Maintain technical expertise in order to formulate and execute advanced structures R&D programs aimed at improved structural efficiency, lower production and O&S cost with improved survivability, reliability and maintainability.
- Maintain expertise in rotorcraft airframe, landing gear, and rotor structural components and related material applications.
- Provide quality, responsive engineering technical support to developmental and fielded aviation systems in the areas of structures, safety, survivability, reliability, and maintainability.
- Coordinate and provide support to other discipline elements within the Government and industry to assure timely and effective execution of the Science and Technology Programs and engineering support.
- Maintain and operate a ballistic test range facility for supporting ballistic test evaluation for Government and industry.
- Conduct in-house studies, analyses and experimental test programs in support of research and development of advanced structural concepts developed through contracted R&D, Cooperative Research and Development Agreements, work agreements with other agencies.
- Conduct in-house studies, analyses and experimental test programs in support PEO/PM's and Special Mission customers.

Propulsion: - Maintain technical expertise in order to formulate and execute helicopter propulsion exploratory and advanced development programs of turbine engines, rotorcraft drive systems, and associated components.
- Maintain technical expertise in component areas of inlets, compressors, combustors, turbines, mechanical systems, controls, gears, bearings, clutches, and related material applications.
- Provide supporting technical and engineering discipline expertise to developmental and fielded aviation systems and engine/drive train development programs.

Flight Subsystems: - Maintain technical expertise in order to formulate and execute safety and survivability R&D programs to provide advanced technology applications in the area of signature reduction, and air vehicle hardening against nuclear, biological, and chemical and directed energy weapons.
- Provide engineering support in the areas of signature reduction, and air vehicle hardening against nuclear, biological, and chemical and directed energy weapons.
- Establish, maintain and employ a repository of aircraft observable signatures for evaluating aircraft susceptibility and vulnerability to sensors and weapon systems.
- Conduct system-level survivability analyses to assess deficiencies in current, developmental, and future aviation systems and to identify concepts for resolution.
- Maintain and operate a countermeasures test facility for test and evaluation of advanced infra-red suppression concepts.

- Maintain technical expertise in order to formulate and execute R&D programs for the integration of flight controls, weapons & targeting, navigation, and communications, into proof-of-concept technology rotary wing air vehicles systems applications.
- Coordinate and guide the interface requirements with the user and subsystem R&D organizations, such as MICOM, AMCCOM, and CECOM to insure effective and efficient integration of those subsystems into Rotary Wing Air Vehicle platforms to enhance warfighting capabilities of current and future systems.
- Maintain technical expertise in order to formulate and execute exploratory and advanced development of prognostics/diagnostics and advanced maintenance concepts for application to future rotary wing aircraft for O&S cost reduction.
- Maintain technical expertise in order to formulate and execute development and initial fielding of advanced technology aviation ground support equipment. - Maintain technical expertise in order to formulate and execute Dem/Val of innovative, productivity enhancing concepts for internal and external cargo handling operations.

Interconnectivity with Other Common Support Functions: Related to all three CSFs, Air Vehicle - Rotary - Structures, Propulsion, and Flight Subsystems, there is a potential for interconnectivity with the following CSFs:

Weapons: As a weapon platform for conventional missiles and rockets, guided projectiles, guns and ammuntions. As a technology application of signature reduction and air vehicle hardening to protect against directed energy weapons and chemical/biological weapons.

Space Stations: As a method of gaining situational awareness by using satellites.

C4I Systems: As it relates to on-board air-to-ground communication, command and control activities.

Chemical/Biological Defense: By employing air vehicle technologies which provide defense against chemical and biological weapons.

Electronic Devices: As it applies to enemy detection, identification and targeting. As it applies to communication and location capabilities.

Advanced Materials: As it relates to improved durability, increased ballistic protection, and cost savings.

3.1 Locations

3.1.1 Geographic and Climatalogical Features:

Air Vehicle - Rotary - Structures and Flight Subsystems: Sufficient acreage to permit the safe conduct of ballistic testing.

Air Vehicle - Rotary - Propulsion: None

3.1.2 Licenses and Permits:

Air Vehicle - Rotary - Structures and Flight Subsystems: Permit to store and use high explosive ballistic projectiles up to 30mm.

Air Vehicle - Rotary - Propulsion: None

3.1.3 Environmental Constraints:

Air Vehicle - Rotary - Structures: None
Air Vehicle - Rotary - Propulsion: None
Air Vehicle - Rotary - Flight Subsystems: None

3.1.4 Special Support Infrastructure:

Air Vehicle - Rotary - Structures: None
Air Vehicle - Rotary - Propulsion: None
Air Vehicle - Rotary - Flight Subsystems: None

3.1.5 Proximity to Mission Related Organizations

Common Support Function	Name	Type of Organization	Distance	Wkyrs Performed by your Act'ty	Wkyrs Funded by your Act'ty
Structures	Aviation Logistics School	Govt Training	1 Mile	2	0
Air Vehicle Rotary Flight Subsystems	ARL Vehicle Structures Dir	Govt R&D	15 Miles	1	1
Structures	Nasa Langley Reseach Ctr	Govt R&D	15 Miles	0	5
Air Vehicle Rotary Flight Subsystems	TRADOC Headquarters	Govt	20 Miles	0	0
Air Vehicle Rotary Flight Subsystems	Air Force Air Combat Cmd	Operational Unit	17 miles	0	0

1. The close proximity of the U.S. Army Logistics School facilitates the ability of AATD engineers and managers to coordinate ongoing programs and requirements with the school. AATD is involved with the development of numerous ground support and maintenance items which support the soldier in the field and close coordination is needed to ensure maximum benefits to the soldier and maintainer. Close coordination on such programs as Integrated Fault Isolator, New Aircraft Tool System, and Unit Maintenance Aerial Recovery Kits has been invaluable in developing equipment that meets the maintainers needs.

2. The Vehicle Structures Directorate (VSD) of the Army Research Laboratory (ARL) is the primary ARL Lab that provides 6.1 and 6.2 Structures Research and Development. The deliverables from the ARL VSD provide a Science and technology base for transition into aviation specific structures technology applications. The close proximity of the two organizations enables close coordination and the opportunity for cooperative R&D.

3. The NASA Langley Research Center in Hampton, Virginia has the unique capability to conduct crashworthiness testing of entire aircraft vehicles. The close proximity of the two organizations enable AATD to effectively coordinate the conduct crashworthiness testing and wirestrike protection testing of rotorcraft structures with the NASA LARC.

4. The U.S. Army Training and Doctrine Command located in Hampton, Virginia serves as the representative of the user. The close proximity of TRADOC enables quick and easy coordination on aviation user requirements and issues. Of particular significance is the coordination of AATD's efforts in the area of Advanced Maintenance Concepts and Equipment and Cargo Handling Systems.

5. The Air Force Air Combat Command is located in Hampton, Virginia and serves as a focal point for coordination on the development of Tri-service efforts such as the Advanced Boresight Equipment.

3.2 Personnel

3.2.1 Total Personnel

Number of Personnel

Air Vehicle Rotary - Structures 5

Types of Personnel	Government		On-Site FFRDC	On-Site SETA
	Civilian	Military		
Technical	..18			
Management (Supv)	1			
Other	2			

Air Vehicle Rotary - Propulsion 6

Types of Personnel	Government		On-Site FFRDC	On-Site SETA
	Civilian	Military		
Technical	13			
Management (Supv)	1			
Other	2			

Air Vehicle Rotary - Flight Subsystems 8

Types of Personnel	Government		On-Site FFRDC	On-Site SETA
	Civilian	Military		
Technical	115	4		
Management (Supv)	21	3		
Other	80			

Notes:

1. Personnel shown as "Other" under Flight Subsystems also work in the areas of Structures and Propulsion; predominant work is in the area of Flight Subsystems, however.

2. Technical support personnel (i.e., engineering technicians and skilled trades personnel) shown as "Technical" under Flight Subsystems also work in the areas of Structures and Propulsion; predominant work is in the area of Flight Subsystems, however.

3.2.2 Education

Number of Government Personnel by Type of Position

Air Vehicle Rotary - Structures

Type of Degree/Diploma	Technical	Management (Supv)	Other
High School or Less	2	0	1
Associates	1	0	1
Bachelor	9	1	0
Masters	6	0	0
Doctorate (Include Med/Vet/etc.)	0	0	0

Air Vehicle Rotary - Propulsion

Type of Degree/Diploma	Technical	Management (Supv)	Other
High School or Less	0	0	2
Associates	0	0	0
Bachelor	10	1	0
Masters	3	0	0
Doctorate (Include Med/Vet/etc.)	0	0	0

Air Vehicle Rotary - Flight Subsystems

Type of Degree/Diploma	Technical	Management (Supv)	Other
High School or Less	31	5	64
Associates	5	1	3
Bachelor	60	7	8
Masters	22	10	5
Doctorate (Include Med/Vet/etc.)	1	1	0

3.2.3 Experience

Years of Government and/or Military Service

Air Vehicle Rotary - Structures

Type of Position	Less than 3 years	3-10 years	11-15 years	16-20 years	More than 20 years
Technical	0	4	4	2	8
Management (Supv)	0	0	0	0	1
Total	1	4	4	2	9

Air Vehicle Rotary - Propulsion

Type of Position	Less than 3 years	3-10 years	11-15 years	16-20 years	More than 20 years
Technical	0	6	3	0	4
Management (Supv)	0	0	0	0	1
Total	0	6	3	0	5

Air Vehicle Rotary - Flight Subsystems

Type of Position	Less than 3 years	3-10 years	11-15 years	16-20 years	More than 20 years
Technical	1	36	35	23	24
Management (Supv)	0	2	1	7	14
Total	1	38	36	30	38

3.2.4 Accomplishments During FY91-FY93:

3.2.4.1 Patents: (2)

CSF	Disclosure	Awarded	Patent Titles (List)
Air Vehicles - Rotary (Propulsion)	1	1	Self-Actuated Rotor System
Air Vehicles - Rotary (Flt Subsys)	1	1	Protective Hardside Covers for Vehicle Surfaces

3.2.4.2 Papers Published: (3)

CSF	Paper Titles (List)
Air Vehicles - Rotary (Flt Subsys)	1. "Army Helicopter Detection Program", Aircraft Survivability, Fall 1993 2. "Arming the OH-58D", U.S. Army Aviation Digest, Number 5, September-October 1993 3. "The Future of Army Cockpit Crash Protection", Aircraft Survivability, Spring 1994

3.3.1 FY93 Workload

3.3.1.1 Work Year and Lifecycle:

Air Vehicle-Rotary-Structures	Fiscal Year 1993 Actual Civilian	Military	FFRDC	SETA
Science & Technology	29			
Engineering Development				
In-Service Engineering				

Air Vehicle-Rotary-Propulsion	Fiscal Year 1993 Actual Civilian	Military	FFRDC	SETA
Science & Technology	33			
Engineering Development				
In-Service Engineering	2			

Air Vehicle-Rotary-Flight Subsystems	Fiscal Year 1993 Actual Civilian	Military	FFRDC	SETA
Science & Technology	113	1		
Engineering Development	76	4		
In-Service Engineering	32	2		

3.3.1.2 Engineering Development By ACAT:

Air Vehicle - Rotary - Flight Subsystem Engineering Development	Name or Number	Wkyears (FY93 Actual)	FY93 Funds Received (Obligation Authority $K)	Narrative
ACAT IC				
ACAT ID	Comanche	4	$264	Airworthiness Qualification
ACAT III/IV	Common Grd Equip	53	$23,324	See Footnote
Other	Materiel Chg	19	$6,873	Advanced Material External Cargo
	Materiel Chg			Advanced Aerial Cargo
	Draft ORD			Intelligent Fault Locator
	Draft ORD			Enhanced Aircraft Maintenance
	AMC Task 7462			Improved Airframe Mfg Technology

Footnote:		
	CARDS 165	Internal/External Pallet System
	CARDS 0599	Helicopter Battle Damage Repair
	CARDS 0517P	Advanced Boresight Equipment
	CARDS 0590	New Aircraft Tool System
	CARDS 1654P	Unit Maintenance Aerial Recovery
	Classified	Classified

3.3.1.3 In-Service Engineering:

Common Support Functions	In-Service Engr Efforts (List)	FY93 Funds Rec'd (Oblg Auth) ($K)	Wkyrs	Weapon System(s) Supported
Air Vehicles Rotary Flight Subsystems	Upgrades for performance enhancement	$3,819	26	MH-60L MH-47D A/MH-6
Air Vehicles Rotary Propulsion	Upgrades for performance enhancement	$157	2	Fielded Systems
Air Vehicles Rotary Flight Subsystems	Upgrades for performance enhancement	$640	6	Fielded systems Grd spt equip

3.3.2 Projected Funding

3.3.2.1 Direct Funding: (RDTE; $K)

CSF	FY94	FY95	FY96	FY97
Air Vehicle - Rotary - Structures	$1,709	$2,000	$2,000	$2,000
Air Vehicles - Rotary - Propulsion	$5,463	$6,928	$8,107	$8,965
Air Vehicles - Rotary - Flight Subsystems	$22,226	$30,722	$47,318	$32,883

3.3.2.2 Other Obligation Authority: ($K)

CSF	FY94	FY95	FY96	FY97
Air Vehicles - Rotary - Flight Subsystems	$21,646	$18,524	$14,759	$9,324

3.4.1 Major Facilities and Equipment

Common Support Functions	Major Facility or Equipment Description	-----Unique To------ DoD	Federal Govt	U.S.	Replacement Cost($K)
Air Vehicle - Rotary:					
Propulsion	Infra-Red Suppressor Facility				$2,917
	Sub-scale IRS Cold Flow Test (Bldg 3513)	X			($21)
	Exp IR Suppressor Test (Bldg 3517)	X	X	X	($142)
Structures	Ballistic Test Facility				$1,166
	Ballistic Test Indoor Firing Range (Bldg 3940)	X	X	X	($140)
	Ballistic Test Range 1&2	X			($85)
Structures	Structures Lab (Bldg 409)				$6369
	Structural Test Fixtures	X	X		($2991)
Structures (8%) Propulsion (7%); Flight Subsystem (86%)	Offices (Bldg 401)				$4,914
Structures (8%) Propulsion (7%); Flight Subsystem (86%)	Computer Center Equipment				$807
Structures (8%) Propulsion (7%); Flight Subsystem (86%)	Technical Library Equipment				$118
Structures (8%) Propulsion (7%); Flight Subsystem (86%)	Secure Computing Facility				$209
Structures (8%) Propulsion (7%); Flight Subsystem (86%)	Design and Graphics (bldg 403)				$189
Structures (8%) Propulsion (7%); Flight Subsystem (86%)	Design and Graphics Equipment				$38
Structures (8%) Propulsion (7%); Flight Subsystem (86%)	Offices, Secure (Bldg 404)				$733
Structures (8%) Propulsion (7%); Flight Subsystem (86%)	Fabrication Equipment				$13
Structures (8%) Propulsion (7%); Flight Subsystem (86%)	Elec & Mech Test Instrumentation				$1027
Structures (8%) Propulsion (7%); Flight Subsystem (86%)	Photo Instrumentation Equipment				$153
Structures (8%) Propulsion (7%); Flight Subsystem (86%)	Lab Annex (Bldg 423)				$49
Structures	Lab Annex (Bldg 449)				$19
Structures	Chemical Storage (Bldg 400E)				$17

3.4.1 Major Facilities and Equipment (cont'd)

Common Support Functions	Major Facility or Equipment Description	-----Unique To------ DoD	Federal Govt	U.S.	Replacement Cost($K)
Air Vehicle - Rotary:					
Structures (8%)	Aviation Support (Bldg 2402)				$997
Propulsion (7%); Flight Subsystem (86%)					
Structures (8%)	Exp Fab Shop (Bldg 3507)				$57
Propulsion (7%); Flight Subsystem (86%)					
Structures (8%)	Machine Shop (Bldg 3508)				$46
Propulsion (7%); Flight Subsystem (86%)					
Structures (8%)	Lathes, Mills, Saws, Grinders, etc.				$461
Propulsion (7%); Flight Subsystem (86%)					
Structures (8%)	Model/Wood Shop (Bldg 3509)				$300
Propulsion (7%); Flight Subsystem (86%)					
Structures (8%)	Drill Presses, Saws, Lathes, Oven, etc.				$3,600
Propulsion (7%); Flight Subsystem (86%)					
Structures (8%)	Msn Prop Warehouse (Bldg 3519A)				$97
Propulsion (7%); Flight Subsystem (86%)					
Flight Subsystems	AVIM Facility (Bldg 3159B)				$112
Structures (8%)	Secure Storage (Bldg 3521)				$20
Propulsion (7%); Flight Subsystem (86%)					
Propulsion	RPV Test Facility (Bldg 3522)				$42
Structures (8%)	RDTE Spt Warehouse (Bldg 3523)				$106
Propulsion (7%); Flight Subsystem (86%)					
Structures (8%)	Gen Warehouse Facility (Bldg 3524)				$45
Propulsion (7%); Flight Subsystem (86%)					
TOTAL AATD FACILTY/EQUIPMENT REPLACEMENT COST					$24,621

3.4.1 Major Facilities and Equipment (Justification of Uniqueness)

1. Structural Test Fixtures: The AATD Structural Test laboratory contains numerous test fixtures for conducting structural tests of coupons, elements and major aircraft components. In addition, the Structural Test Laboratory contains a Multi-purpose Structural Load Frame (Backstop) capable of static and dynamic testing of complete helicopter airframes up to and including airframes of the size of the UH-60 BLACKHAWK. The Rotor Blade Test Fixture which is capable of testing 25 foot sections of a rotor blade under alternating bending, torsion and Centrifugal loads is unique in that it is the only fixture within the Government capable of conducting such tests.

2. Sub-Scale Infra-red Suppression (IRS) Cold Flow Test Facility: This facility is unique in its capability to conduct rapid design and development of new Infra-red Suppression concepts for Army rotary wing aircraft prior to more costly full-scale hot flow engine testing.

3. The experimental IRS test facility is unique in its ability to conduct performance; design verification and flight certification endurance tests on full scale experimental and developmental designs for rotary wing aircraft. Unique features include:

- engine stand compatible with the T-55, T-53, T-700 and Allison 250-C30 engines
- secure, all weather, around the clock tests within a secure indoor facility.
- built-in high speed temperature and pressure data acquisition
- rapid engine turn around
- dedicated IRS fabrication, modification, assembly and instrumentation shop
- portable and self contained IR/EO measurement system for spectral data and imagery.

4. The ballistic indoor firing range has the following unique features:

- Indoor test capability
- Secure test facility
- Advanced data acquisition for ultra-high speed frequency response.
- Real-time data monitoring for rotorcraft induced gunfire loading, vibration and acoustics.
- Rapid turn-around prototype testing

5. The Outdoor firing ranges are unique in that they reside in a secure area.

3.5.1 Expansion Potential

Common Support Function	Facility or Equipment Description	Type of Space	Space Capacity (KSF) Current	Used	Excess
Structure	Offices (Bldg 401)	Technical	9.00	7.20	1.80
	Offices (Bldg 401)	Admin	5.10	4.08	1.02
Propulsion	Offices (Bldg 401)	Technical	7.30	5.84	1.46
	Offices (Bldg 401)	Admin	4.10	3.28	0.82
Subsystems	Offices (Bldg 401)	Technical	18.30	14.6	43.66
	Offices (Bldg 401)	Admin	10.40	8.32	6.66
Structures	Design & Graphics (Bldg 403)	Technical	0.52	0.42	0.10
	Design & Graphics (Bldg 403)	Admin	0.52	0.52	0.00
Propulsion	Design & Graphics (Bldg 403)	Technical	0.42	0.34	0.08
	Design & Graphics (Bldg 403)	Admin	0.42	0.42	0.00
Subsystems	Design & Graphics (Bldg 403)	Technical	1.06	0.85	0.21
	Design & Graphics (Bldg 403)	Admin	1.06	1.06	0.00

Common Support Function	Facility or Equipment Description	Type of Space	Space Capacity (KSF) Current	Used	Excess
Structures	Offices, Secure (Bldg404)	Technical	1.39	1.25	0.14
	Offices, Secure (Bldg404)	Admin	0.48	0.43	0.05
Propulsion	Offices, Secure (Bldg404)	Technical	0.90	0.81	0.09
	Offices, Secure (Bldg404)	Admin	0.31	0.28	0.03
Subsystems	Offices, Secure (Bldg404)	Technical	1.80	1.62	0.18
	Offices, Secure (Bldg404)	Admin	0.62	0.56	0.06
Structures	Structures Laboratory (Bldg 409)	Technical	12.68	10.14	2.54
	Structures Laboratory (Bldg 409)	Admin	3.17	2.54	0.63
Structures	Instrumentation Laboratory	Technical	1.19	0.71	0.48
	Instrumentation Laboratory	Admin	0.30	0.30	0.00
Propulsion	Instrumentation Laboratory	Technical	0.96	0.58	0.38
	Instrumentation Laboratory	Admin	0.24	0.24	0.00
Subsystems	Instrumentation Laboratory	Technical	2.42	1.45	0.97
	Instrumentation Laboratory	Admin	0.60	0.60	0.00
Structures	Photo Instrument'tn Lab (Bldg 409)	Technical	0.16	0.16	0.00
	Photo Instrument'tn Lab (Bldg 409)	Admin	0.15	0.15	0.00
Propulsion	Photo Instrument'tn Lab (Bldg 409)	Technical	0.13	0.13	0.00
	Photo Instrument'tn Lab (Bldg 409)	Admin	0.59	0.59	0.00
Subsystems	Photo Instrument'tn Lab (Bldg 409)	Technical	0.32	0.32	0.00
	Photo Instrument'tn Lab (Bldg 409)	Admin	0.32	0.32	0.00
Structures	Instrument'tn Lab Annex (Bldg 409)	Technical	0.26	0.26	0.00
Propulsion	Instrument'tn Lab Annex (Bldg 409)	Technical	0.21	0.21	0.00
Subsystems	Instrument'tn Lab Annex (Bldg 409)	Technical	0.54	0.54	0.00
Structures	Structures Lab Annex (Bldg 423)	Technical	0.60	0.48	0.12
		Storage	0.40	0.32	0.08
Structures	Chemical Storage (Bldg 400E)	Storage	0.13	0.10	0.03
Structures	Aviation Support (Bldg 2402)	Technical	3.96	3.17	0.79
	Aviation Support (Bldg 2402)	Admin	0.63	0.50	0.13
Propulsion	Aviation Support (Bldg 2402)	Technical	3.20	2.56	0.64
	Aviation Support (Bldg 2402)	Admin	0.51	0.41	0.10
Subsystems	Aviation Support (Bldg 2402)	Technical	8.08	6.46	1.62
	Aviation Support (Bldg 2402)	Admin	1.29	1.03	0.26
Structures	Exp Fab Shop (Bldg 3507)	Technical	0.45	0.45	0.00
	Exp Fab Shop (Bldg 3507)	Admin	0.09	0.09	0.00
Propulsion	Exp Fab Shop (Bldg 3507)	Technical	0.37	0.37	0.00
	Exp Fab Shop (Bldg 3507)	Admin	0.07	0.07	0.00
Subsystems	Exp Fab Shop (Bldg 3507)	Technical	0.94	0.94	0.00

Common Support Function	Facility or Equipment Description	Type of Space	Space Capacity (KSF) Current	Used	Excess
	Exp Fab Shop (Bldg 3507)	Admin	0.19	0.19	0.00
Structures	Machine Shop (Bldg3508)	Technical	1.30	1.30	0.00
Propulsion	Machine Shop (Bldg3508)	Technical	1.05	1.05	0.00
Subsystems	Machine Shop (Bldg3508)	Technical	2.70	2.70	0.00
Structures	Model/Wood Shop (Bldg 3509)	Technical	1.30	1.30	0.00
Propulsion	Model/Wood Shop (Bldg 3509)	Technical	1.05	1.05	0.00
Subsystems	Model/Wood Shop (Bldg 3509)	Technical	2.70	2.70	0.00
Structures	CM Test Facility (Bldg 3513)	Technical	0.07	0.07	0.00
Propulsion	CM Test Facility (Bldg 3513)	Technical	0.06	0.06	0.00
Subsystems	CM Test Facility (Bldg 3513)	Technical	0.15	0.15	0.00
Structures	CM Shop/Storage (Bldg 3514)	Technical	0.96	0.96	0.00
	CM Shop/Storage (Bldg 3514)	Utility	0.96	0.96	0.00
Subsystems	CM Shop/Storage (Bldg 3514)	Technical	1.44	1.44	0.00
	CM Shop/Storage (Bldg 3514)	Utility	1.44	1.44	0.00
Structures	CM Test Facility (Bldg 3517)	Technical	0.52	0.52	0.00
Propulsion	CM Test Facility (Bldg 3517)	Technical	0.42	0.42	0.00
Subsystems	CM Test Facility (Bldg 3517)	Technical	1.08	1.08	0.00
Structures	Bldg 3519A Msn Prop Warehouse	Storage	1.30	1.04	0.26
Propulsion	Bldg 3519A Msn Prop Warehouse	Storage	1.05	0.84	0.21
Subsystems	Bldg 3519A Msn Prop Warehouse	Storage	2.70	2.16	0.54
Subsystems	Bldg 3519B AVIM Facility	Technical	0.56	0.56	0.00
Subsystems	Bldg 3519B AVIM Facility	Administrativ	1.12	1.12	0.00
Subsystems	Bldg 3519B AVIM Facility	Storage	1.12	1.12	0.00
Subsystems	Bldg 3521 Secure Storage	Storage	0.28	0.22	0.06
Propulsion	Bldg 3522 RPV Test Facility	Technical	0.80	0.64	0.16
Structures	Bldg 3523 RDTE Spt Warehouse	Storage	1.30	1.04	0.26
Propulsion	Bldg 3523 RDTE Spt Warehouse	Storage	1.05	0.84	0.21
Subsystems	Bldg 3523 RDTE Spt Warehouse	Storage	2.70	2.16	0.54
Structures	Bldg 3524 General Facility	Storage	0.33	0.26	0.07
Propulsion	Bldg 3524 General Facility	Storage	0.27	0.22	0.05
Subsystems	Bldg 3524 General Facility	Storage	0.69	0.55	0.14

Common Support Function	Facility or Equipment Description	Type of Space	Space Capacity (KSF) Current	Used	Excess
Structures	Bldg 3939 Ballistic Test Range	Technical	0.96	0.77	0.19
Subsystems	Bldg 3939 Ballistic Test Range	Technical	1.44	1.15	0.29
Structures	Bldg 3940 Ballistic Test Range	Technical	0.47	0.38	0.09
	Bldg 3940 Ballistic Test Range	Admin	0.29	0.23	0.06
	Bldg 3940 Ballistic Test Range	Storage	0.15	0.12	0.03
Subsystems	Bldg 3940 Ballistic Test Range	Technical	0.70	0.56	0.14
	Bldg 3940 Ballistic Test Range	Admin	0.44	0.35	0.09
	Bldg 3940 Ballistic Test Range	Storage	0.22	0.18	0.04
Structures	Bldg 3942 Ballistic Test Range	Technical	0.96	0.96	0.00
Subsystems	Bldg 3942 Ballistic Test Range	Technical	1.44	1.44	0.00

3.5.1.1 Capacity to Absorb Additional Work Years

The Aviation Applied Technology Directorate manpower levels have been as high as 350 personnel as compared with the current level of 258. The existing physical facility can certainly support a larger workforce without any significant modification to facilities. This increased manpower could support the three Common Support Functions of Structures, Propulsion and Flight Subsystems under air vehicle-rotary.

3.5.1.2 As stated in 3.5.1.1 above the Aviation Applied Technology Directorate could absorb approximately 80 personnel workyears without significant facilities modifications.

3.5.1.3 None

3.5.2 Land use:

Number of buildable acres

Installation	480
Adjacent to AATD existing facilities	14.2

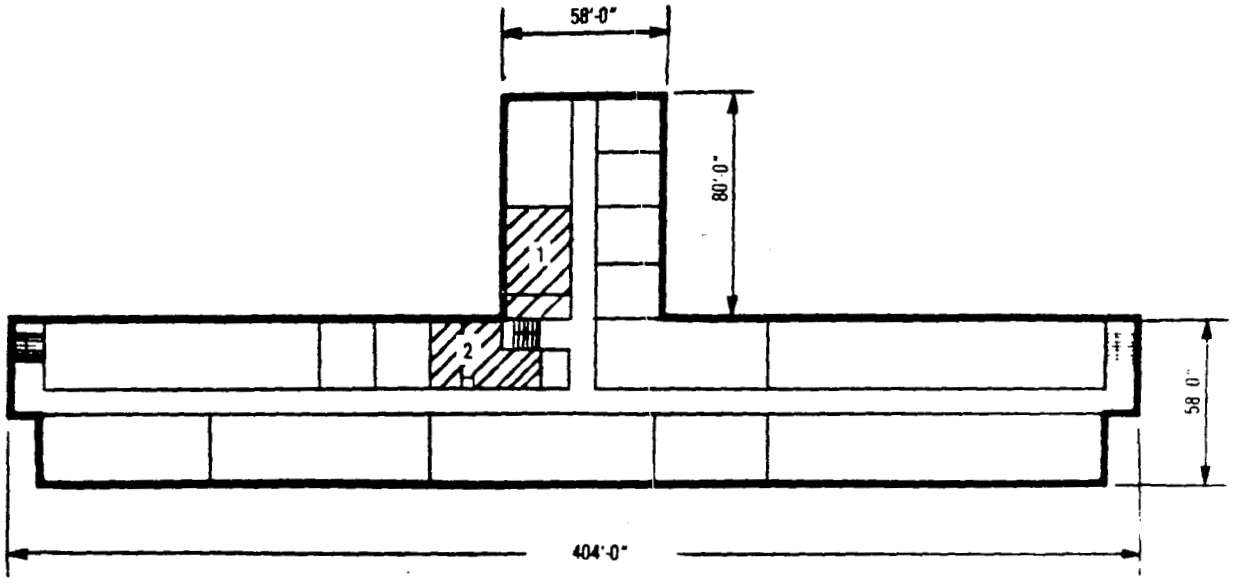
3.5.3 Utilities:

	Current Use	Capability
Electric	19,000 KVA	44,800 KVA
Water	2 MGD	4 MGD
Sewer	1.6 MGD	3 MGD
Gas	Unlimited	

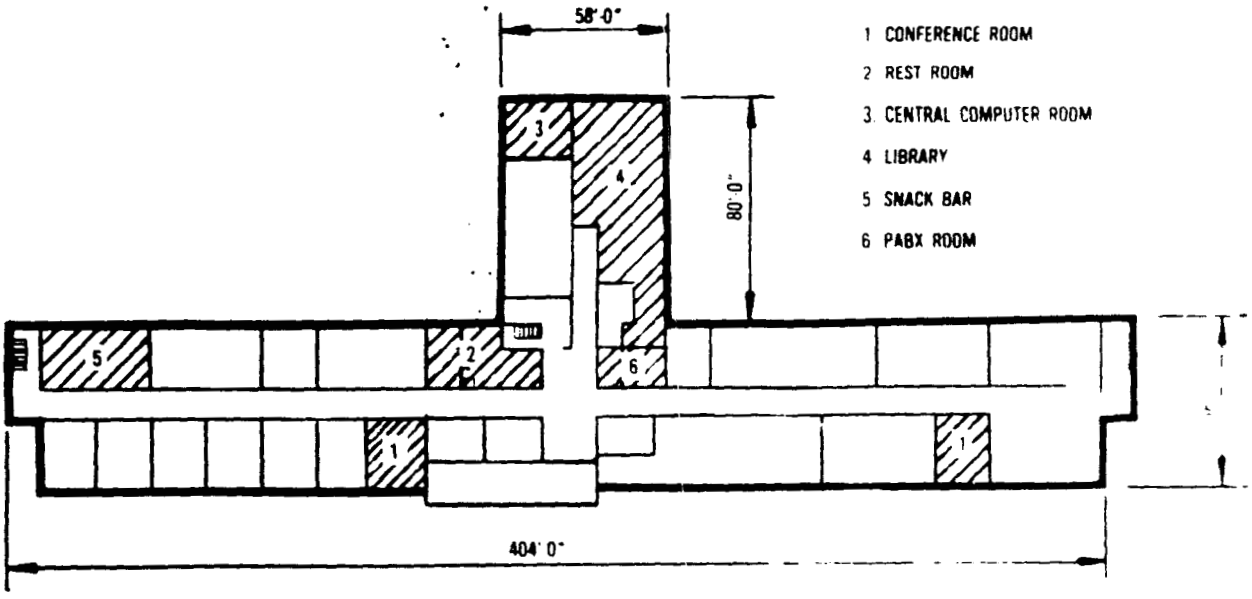
Narrative: Based on the land use and utilities data above, the potential exists to double the size of this organization's buildings and facilities. Land adjacent to existing facilities does not require excavation and is readily accessible to existing utility connections. As such, minimal site preparation would be necessary to

construct additional facilities and buildings for expansion. Expansion could support a significant increase in workyears in air vehicle rotary research and development.

AATD HEADQUARTERS
BLDG 401 AREA: 55,000 SQ FT

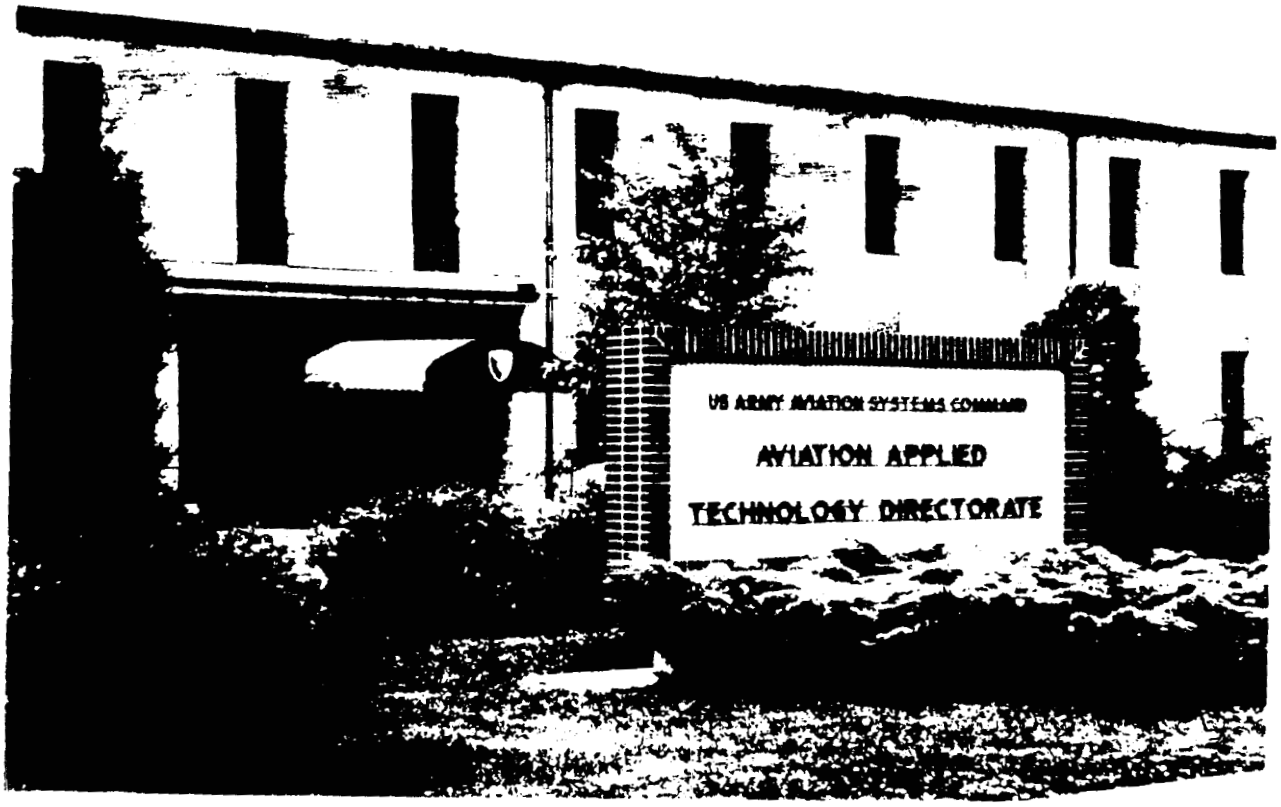


SECOND FLOOR PLAN
AREA: 27,200 SQ FT

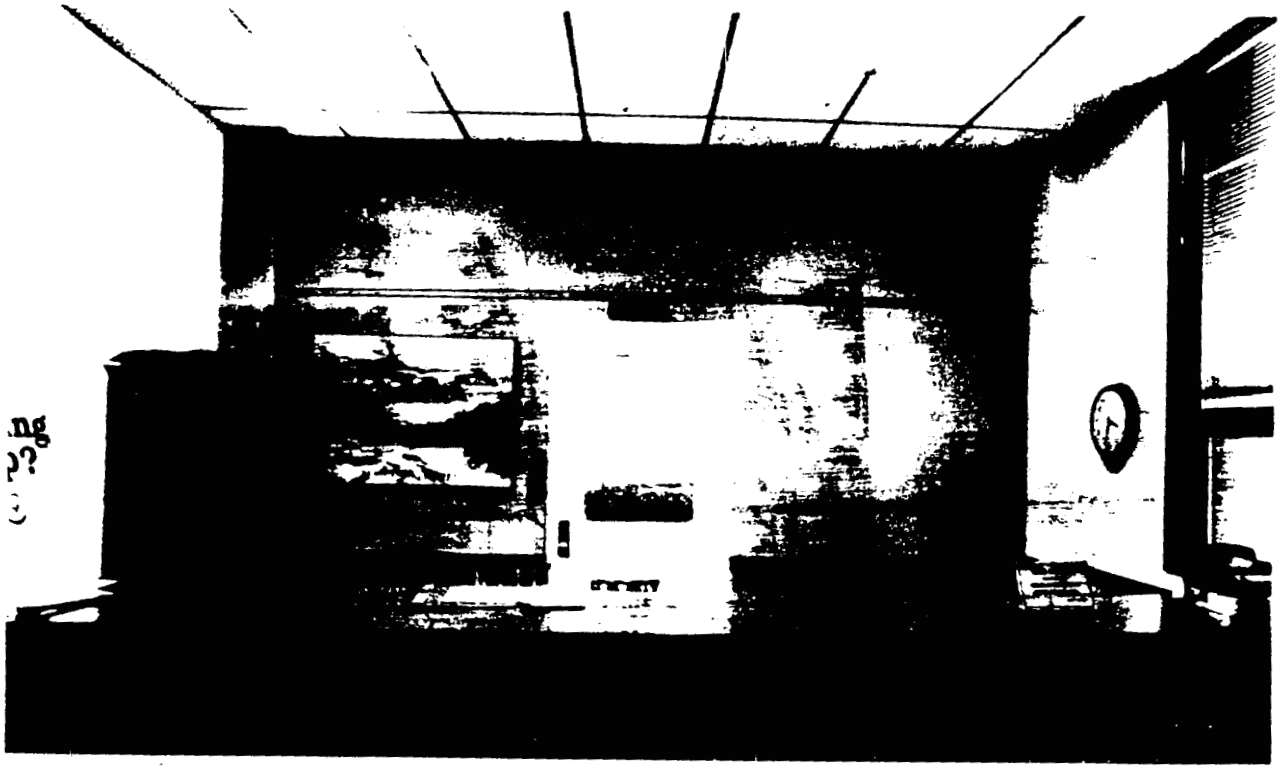


FIRST FLOOR PLAN
AREA: 27,800 SQ FT

FOR OFFICIAL USE ONLY

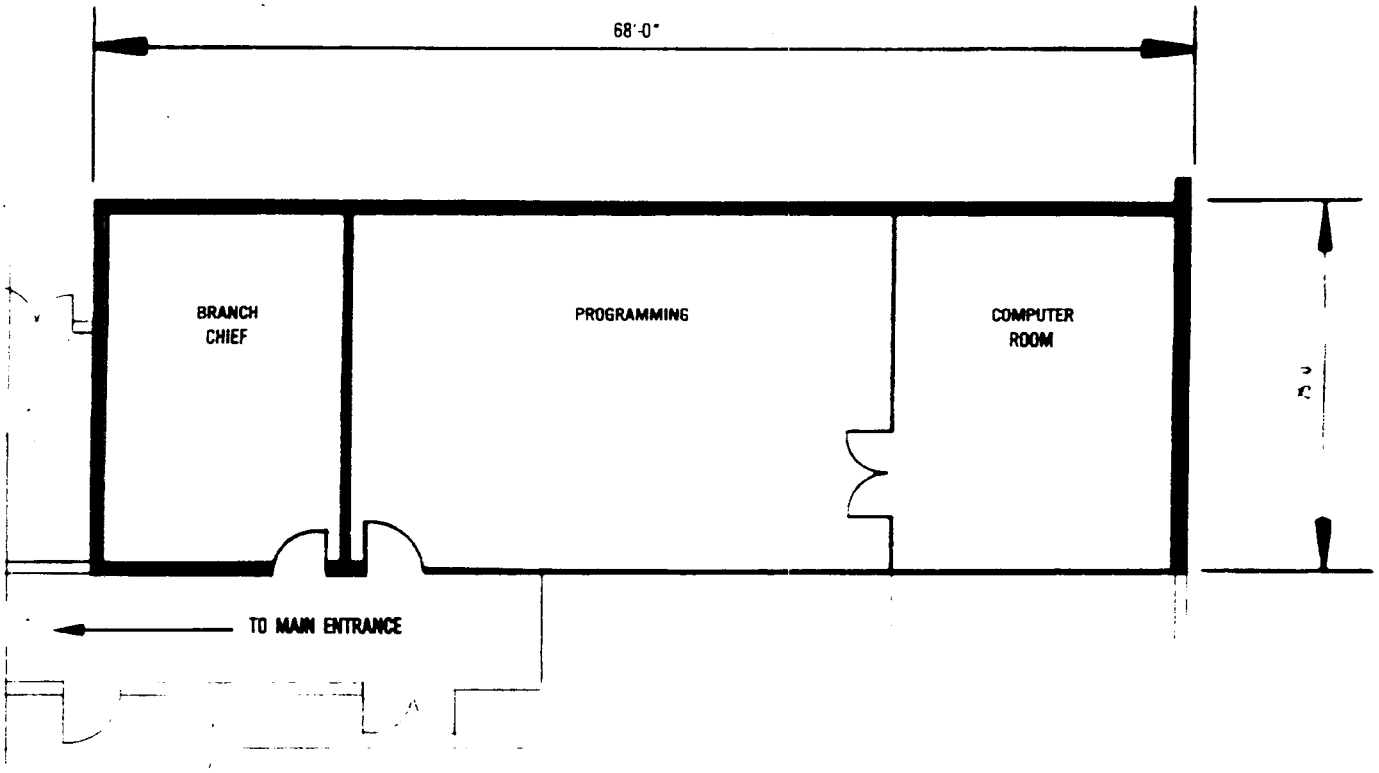


MAIN ENTRANCE, BLDG 401



VISITOR RECEPTION AREA, BLDG 401

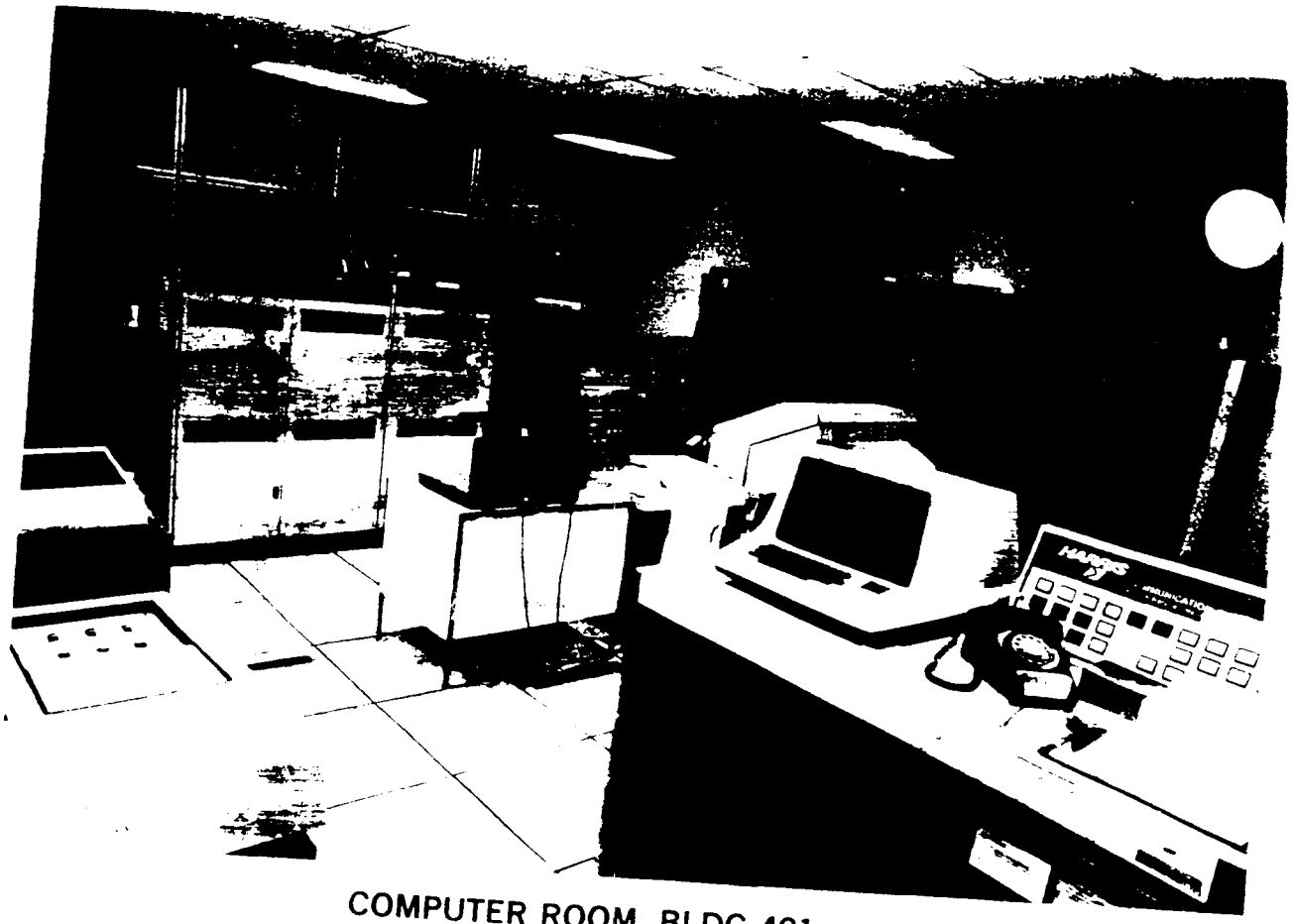
COMPUTER FACILITY VIA MAIN ENTRANCE, BLDG 401



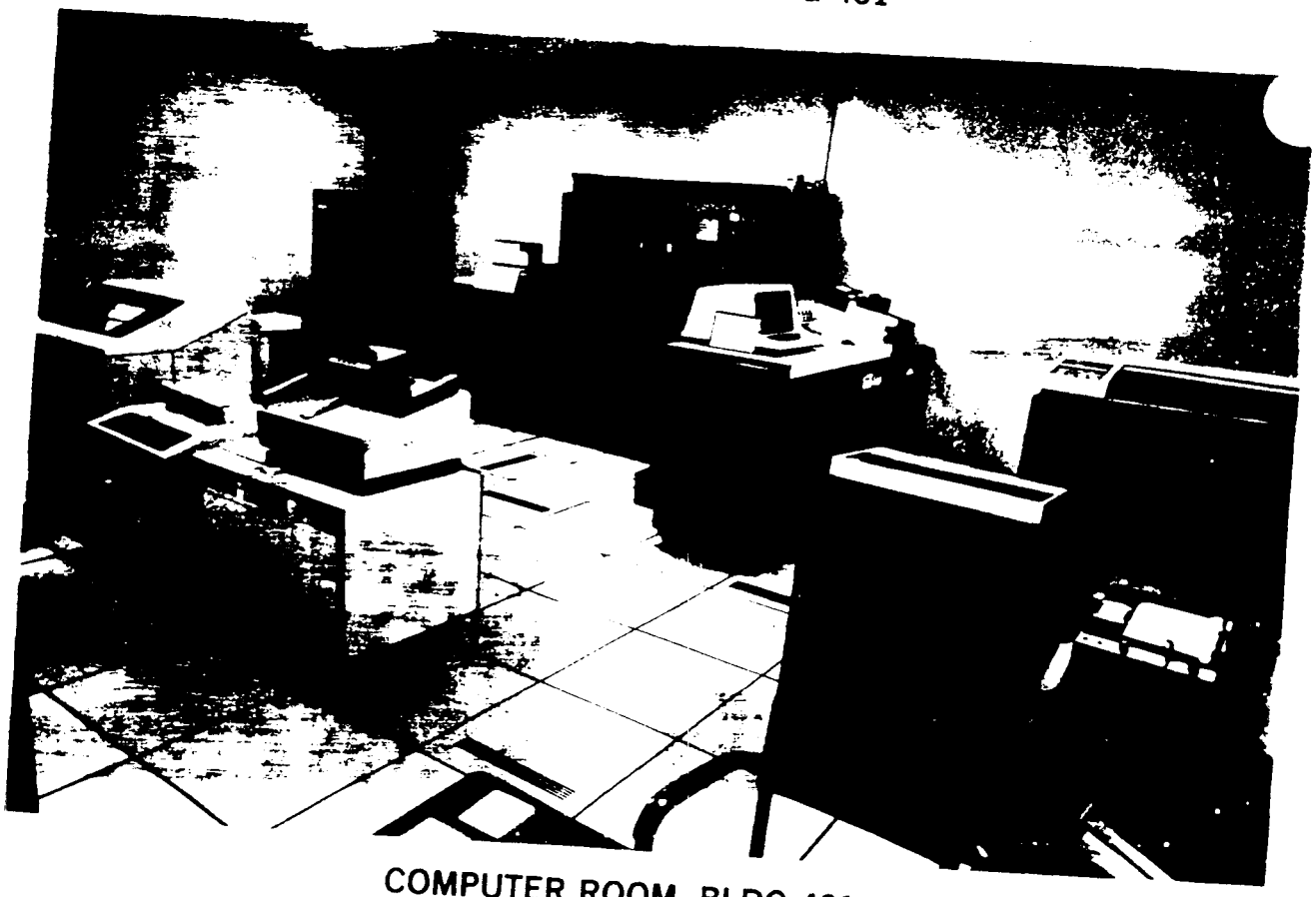
COMPUTER SERVICES FACILITY
BLDG 401 AREA: 1728 SQ FT

FOR OFFICIAL USE ONLY

AATD

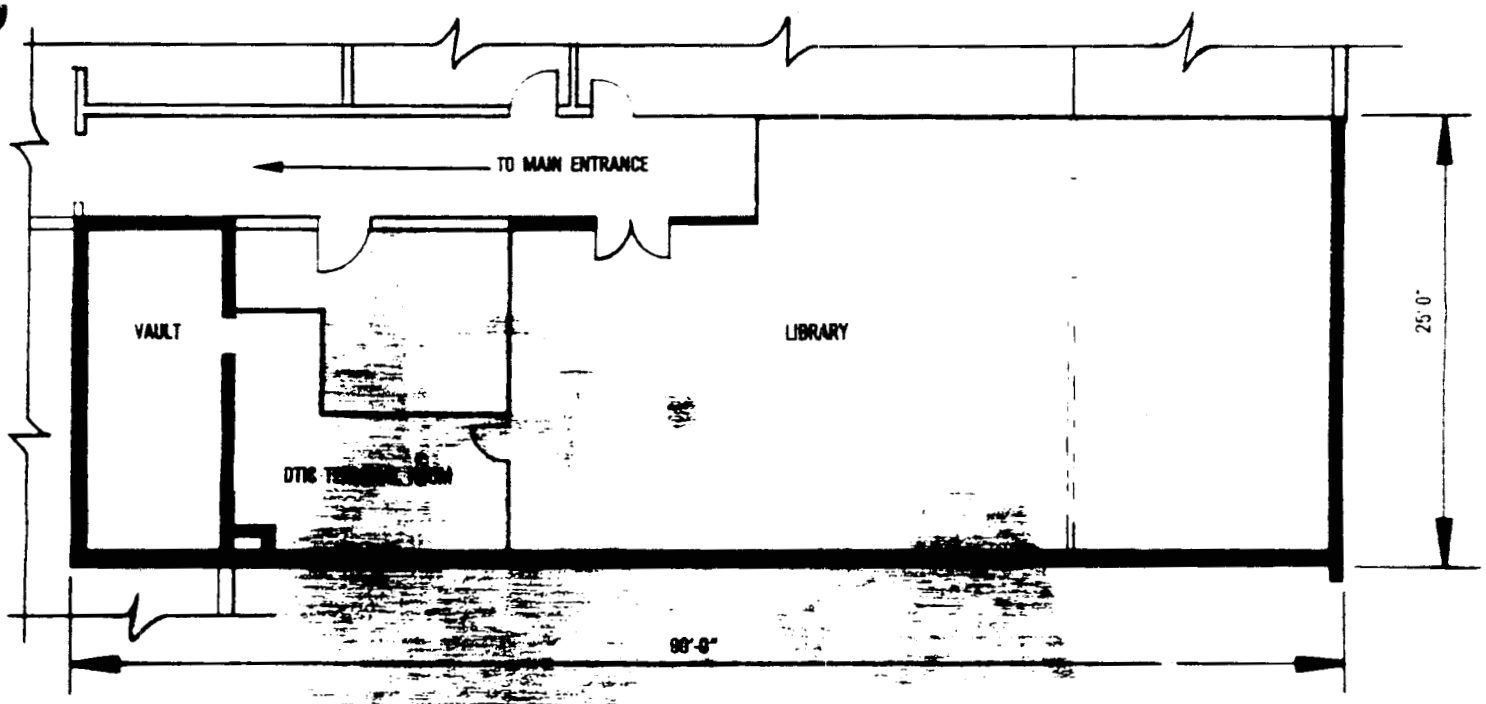


COMPUTER ROOM, BLDG 401



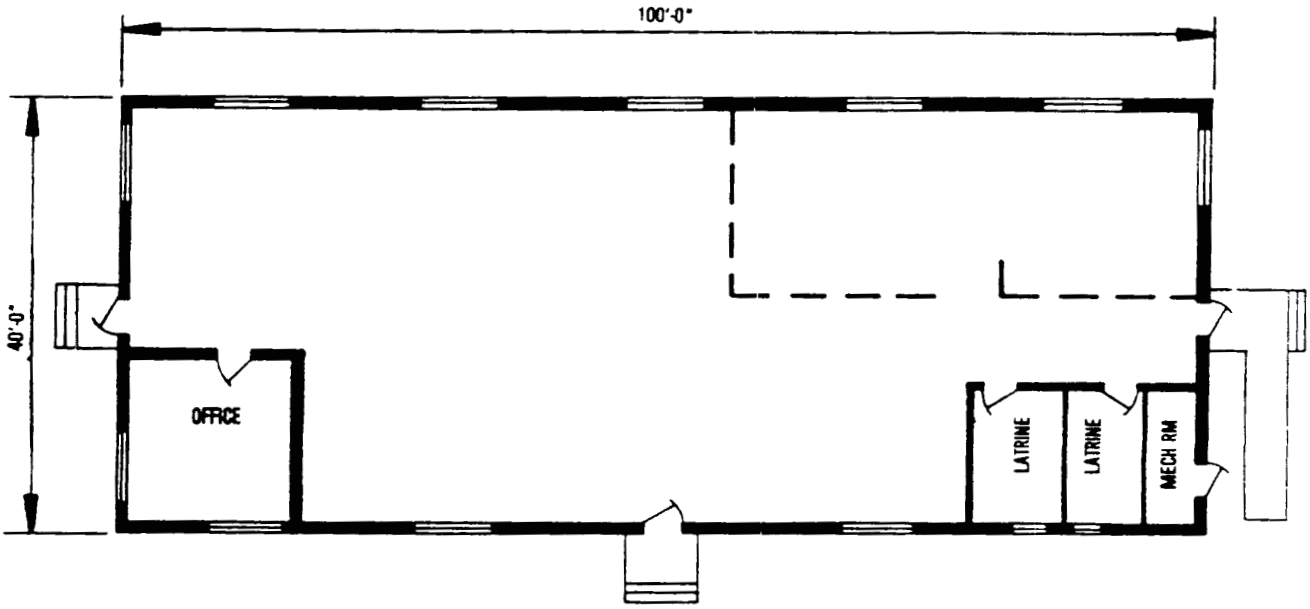
COMPUTER ROOM, BLDG 401

LIBRARY ENTRANCE RIGHT VIA MAIN LOBBY, BLDG 401



TECHNICAL LIBRARY FACILITY
BLDG 401 AREA: 2622 SQ FT

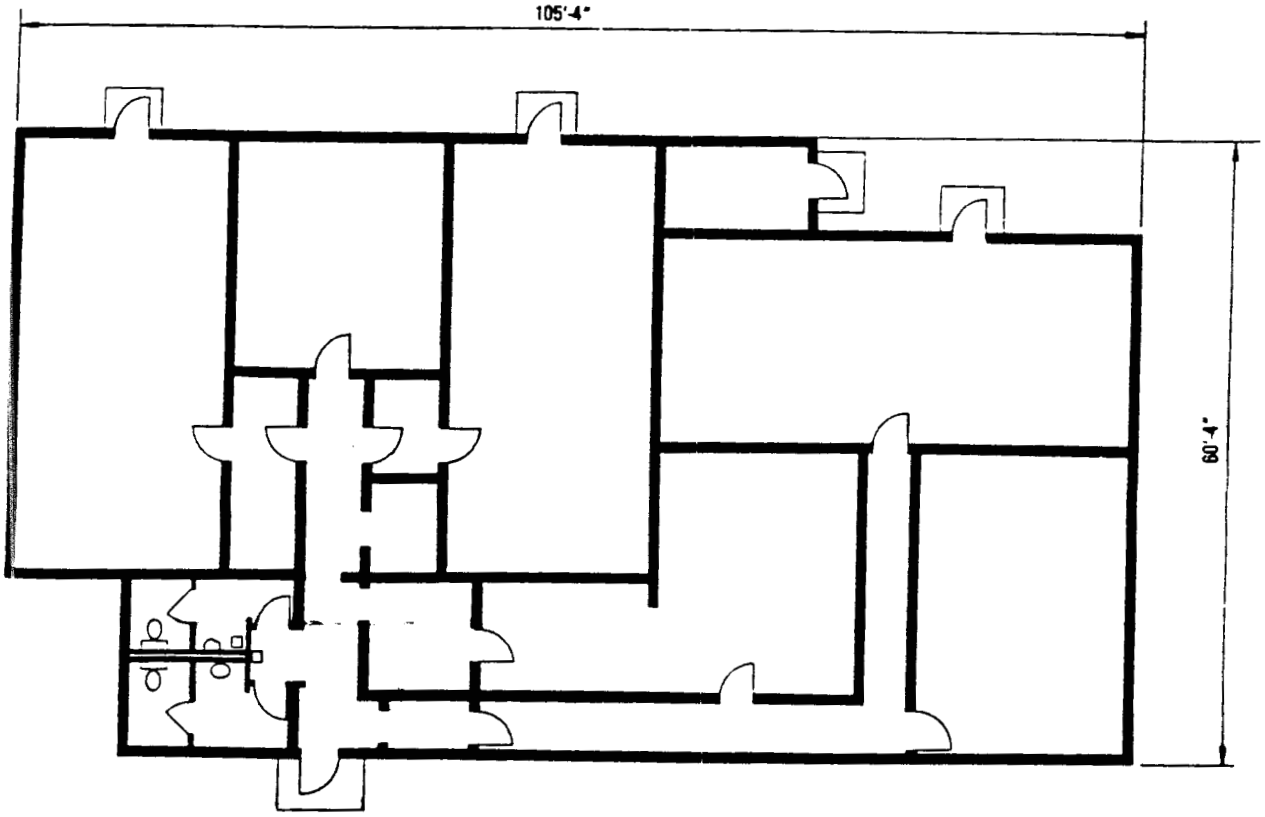
TECHNICAL LIBRARY, BLDG 401



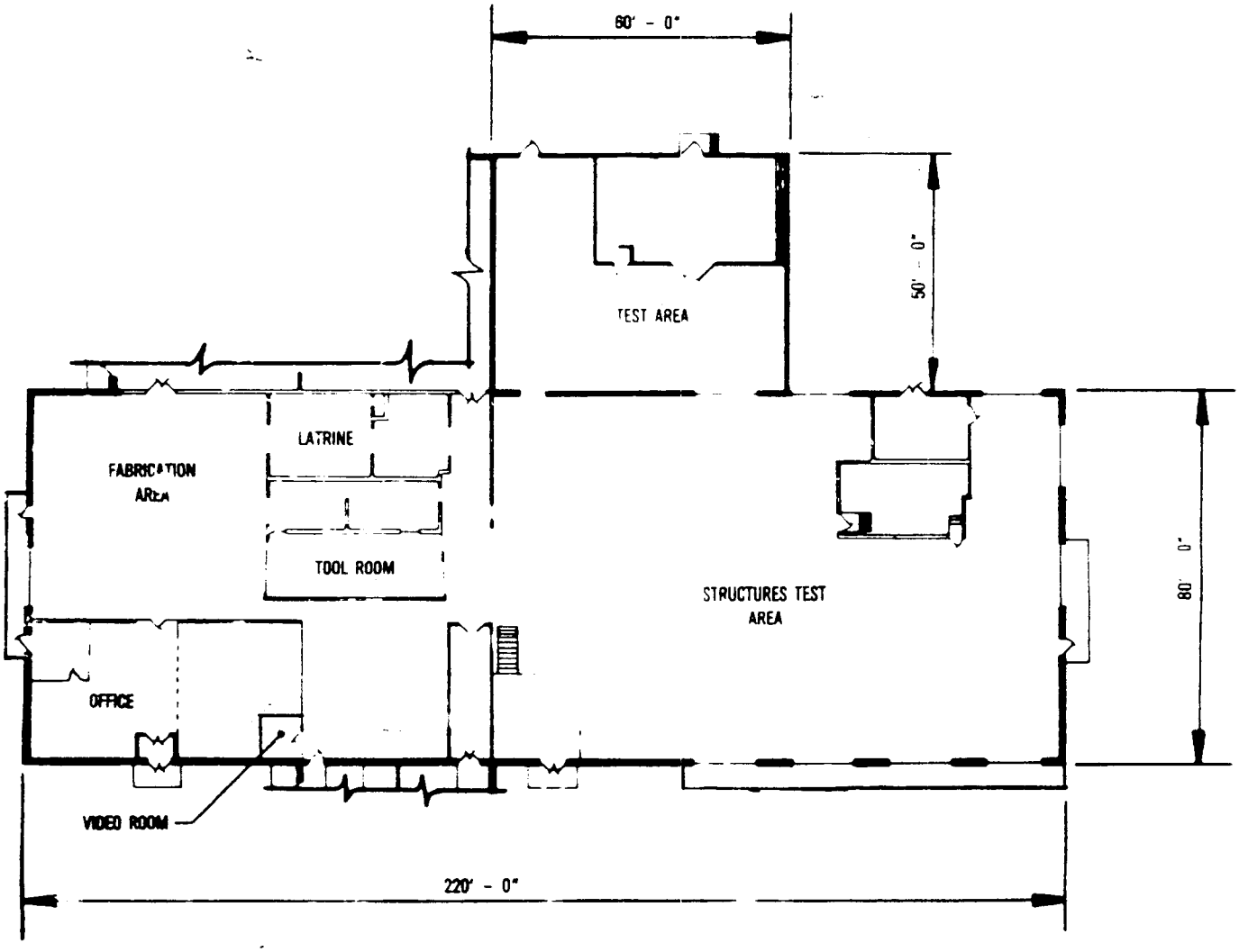
DESIGN, DRAFTING AND TECHNICAL ILLUSTRATION FACILITY
BLDG 403 **AREA: 4000 SQ FT**

DESIGN-DRAFTING ROOM, BLDG 403

ILLUSTRATION-GRAPHICS ROOM, BLDG 403



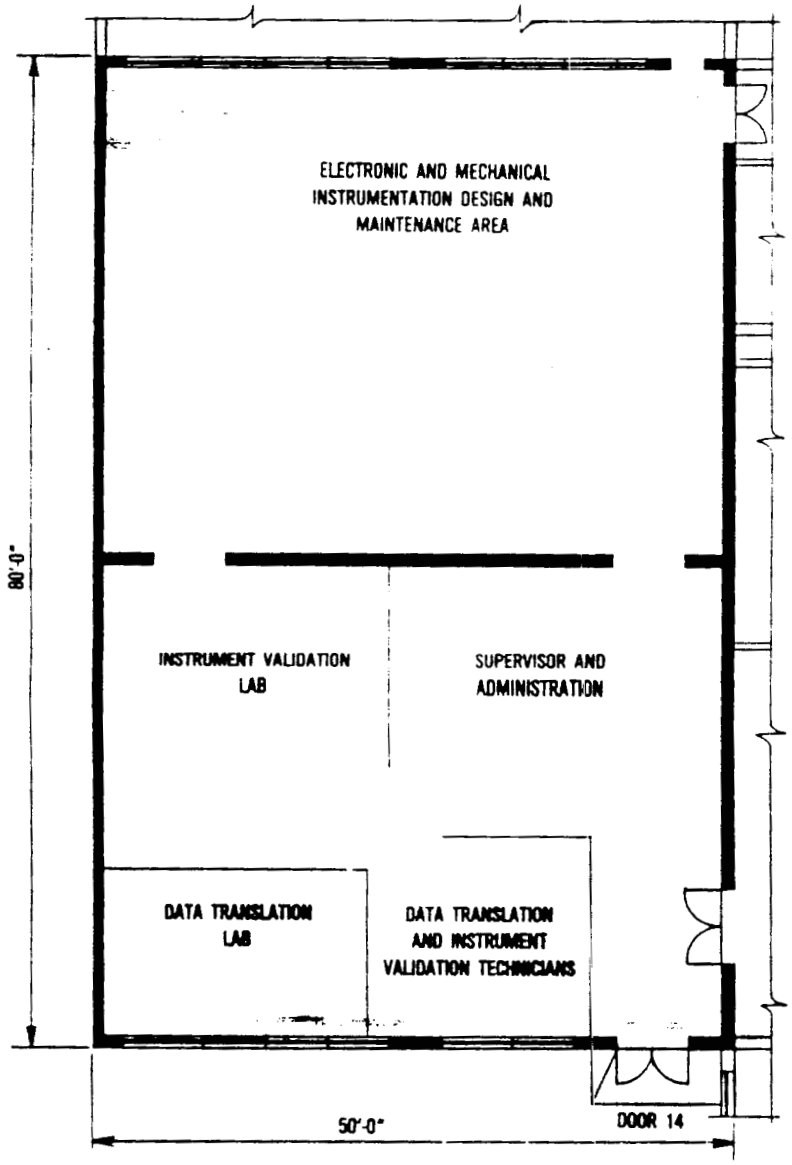
SECURE R&D FACILITY
BLDG 404 AREA: 5500 SQ FT



STRUCTURES TECHNICAL AREA LABORATORY
BLDG 409 AREA: 15,854 SQ FT

MULTI-PURPOSE STRUCTURAL LOAD FRAME (BACKSTOP), BLDG 409

ROTOR BLADE TEST MACHINE, BLDG 409



INSTRUMENTATION FACILITY
BLDG 409 (Door 14) AREA: 5700 SQ FT

FOR OFFICIAL USE ONLY

AATD

CAD WORK STATION, BLDG 409

TYPICAL ELECTRONIC INSTRUMENTATION WORK STATIONS, BLDG 409

CALIBRATION LAB, BLDG 409

DATA TRANSLATION LAB, BLDG 409

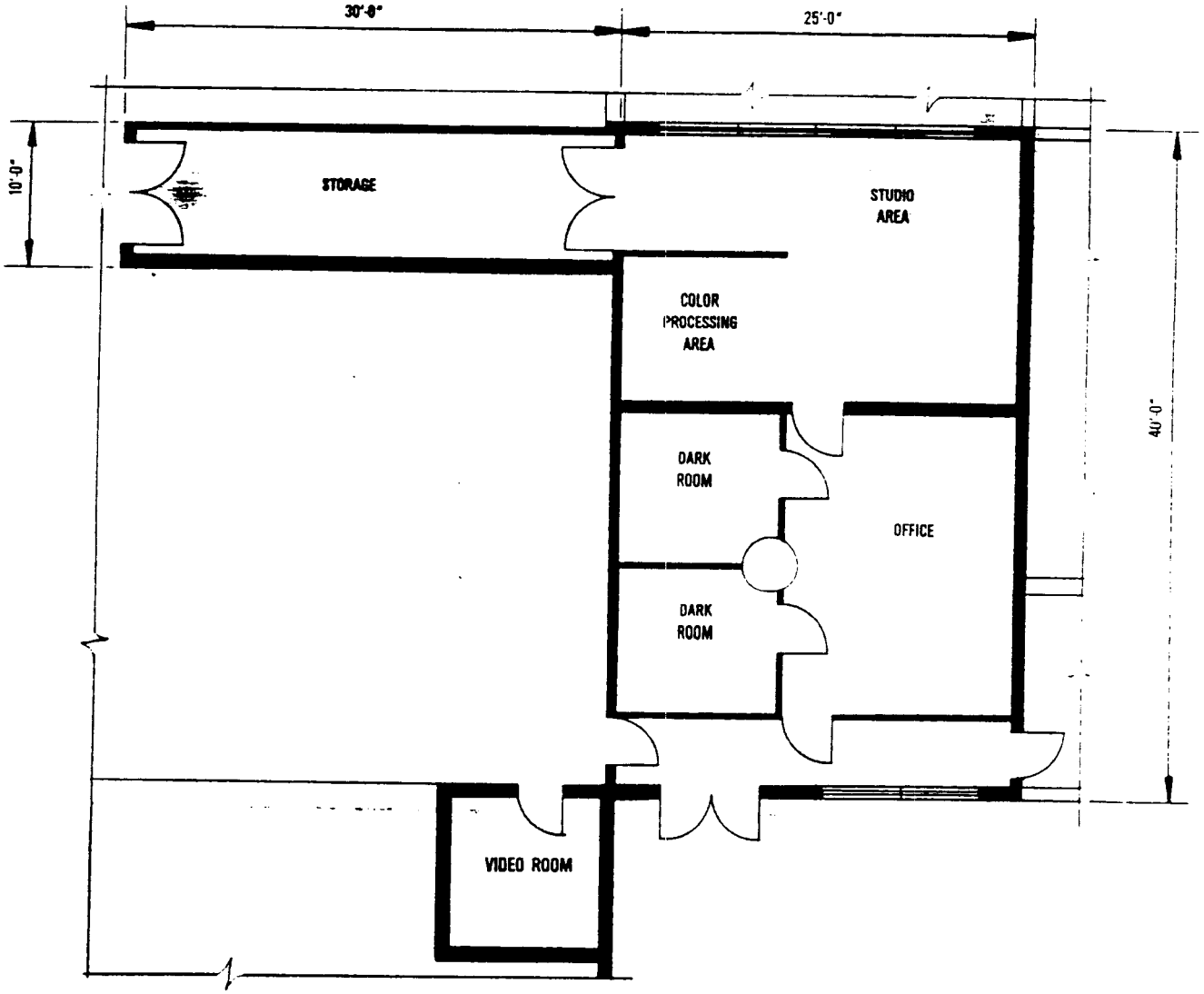


PHOTO-INSTRUMENTATION FACILITY
BLDG 409 AREA: 1390 SQ FT

FOR OFFICIAL USE ONLY

AATD

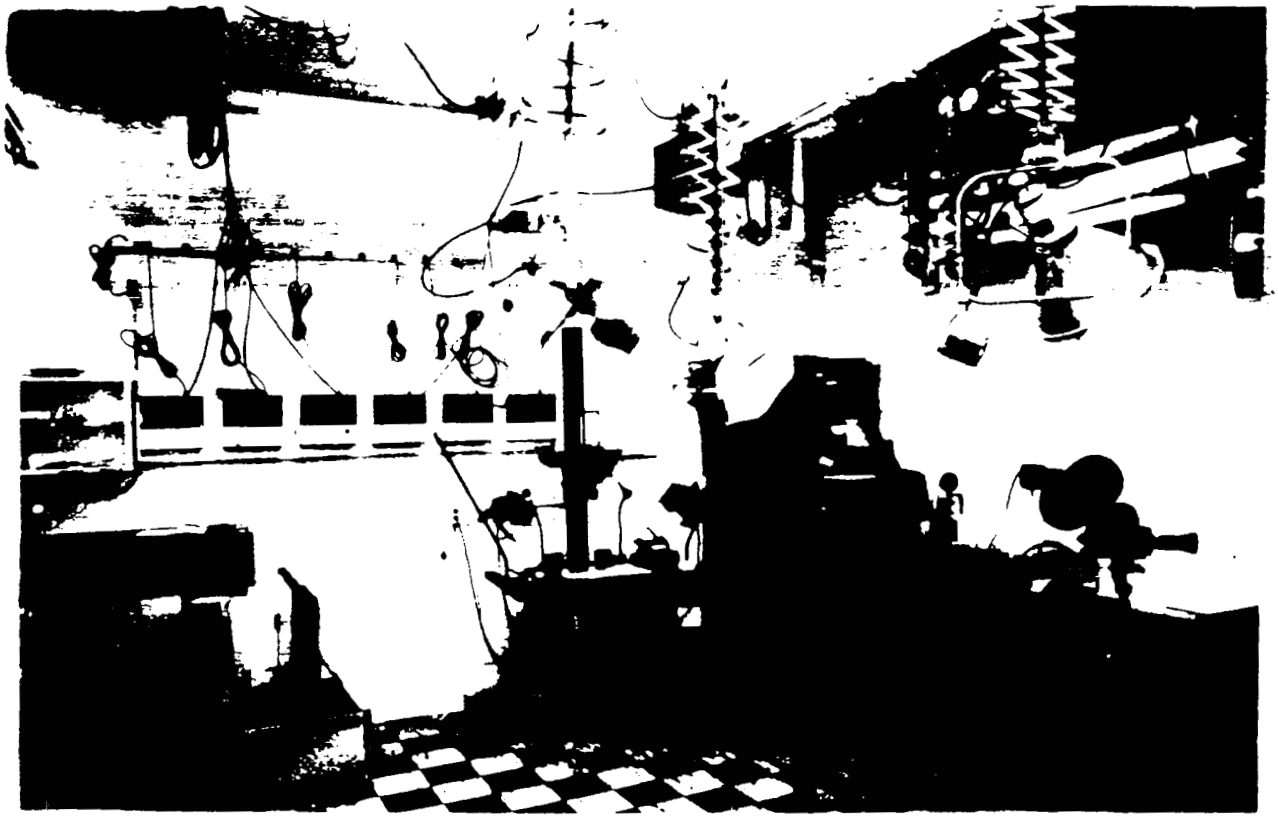
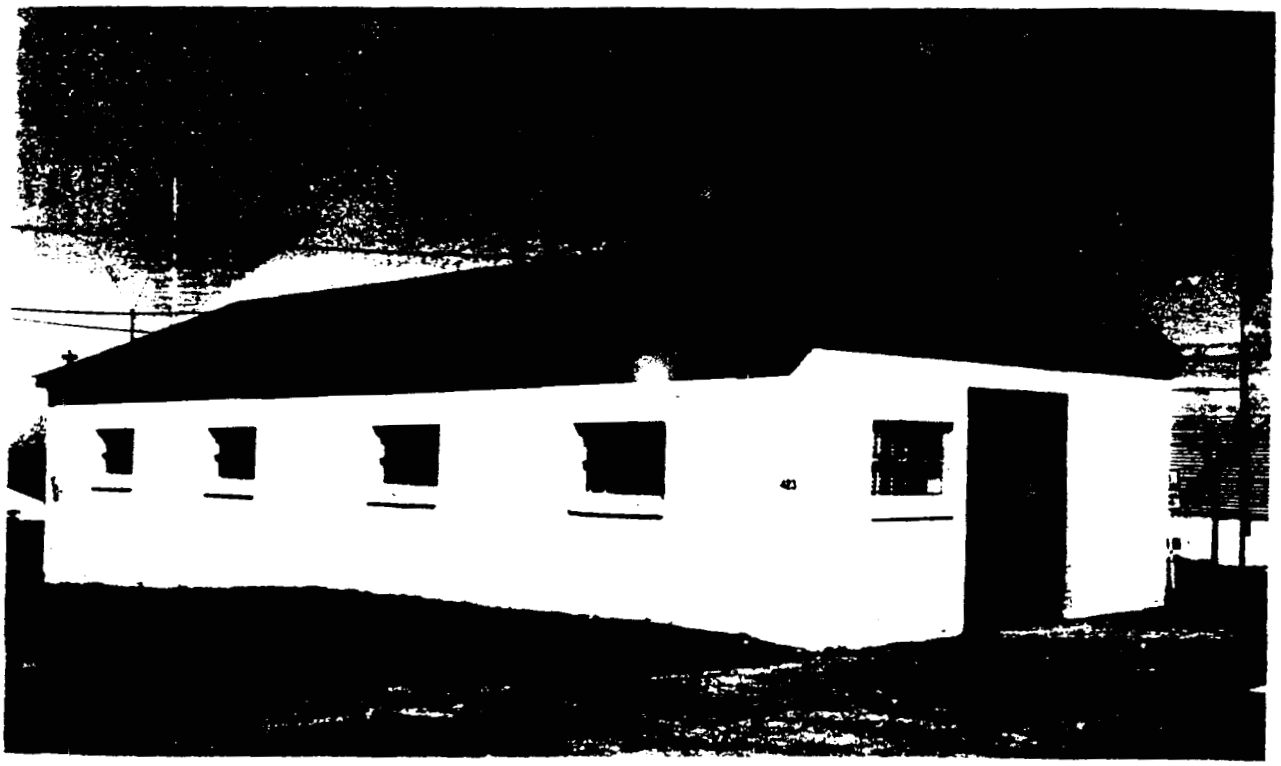
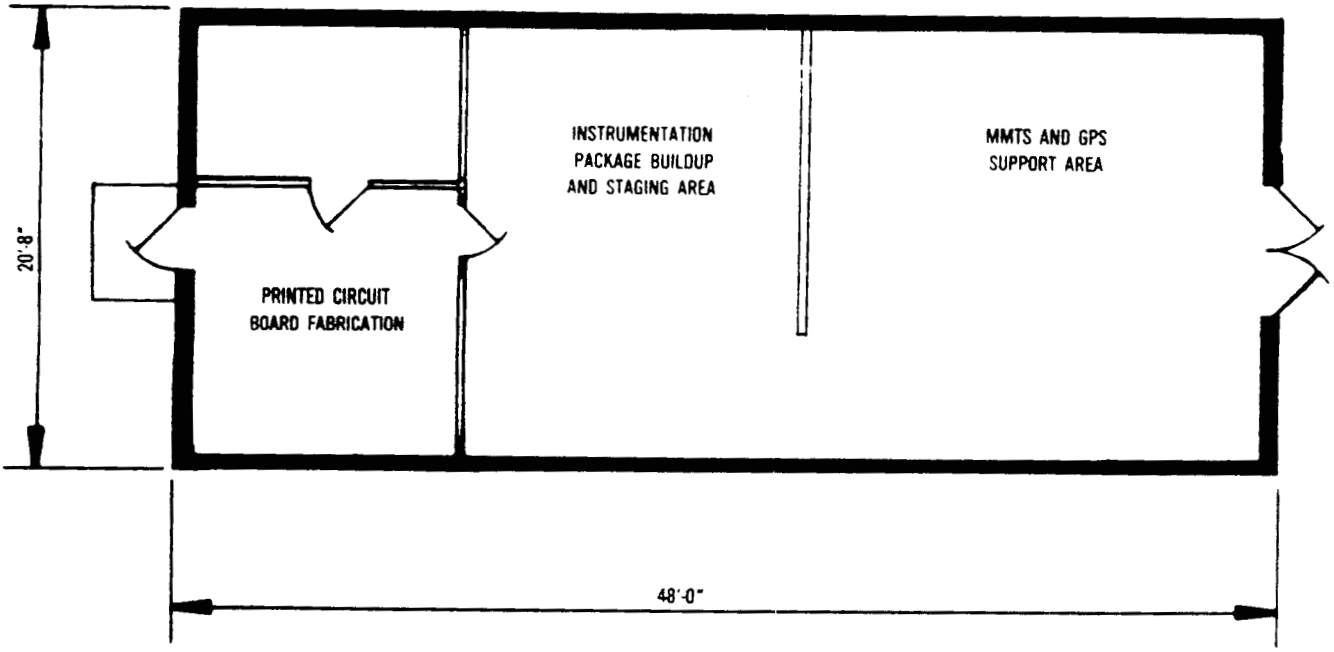


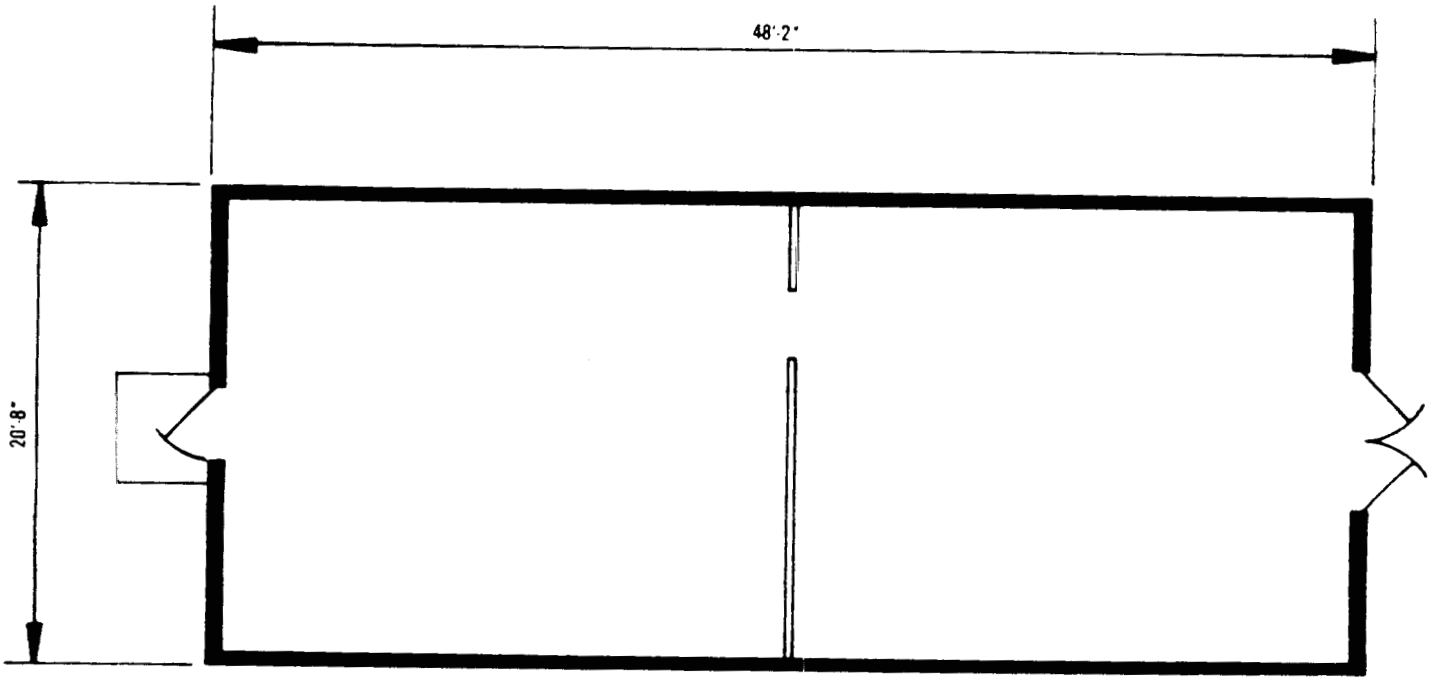
PHOTO LAB STUDIO AREA, BLDG 409

PHOTO LAB COLOR PROCESSING AREA, BLDG 409

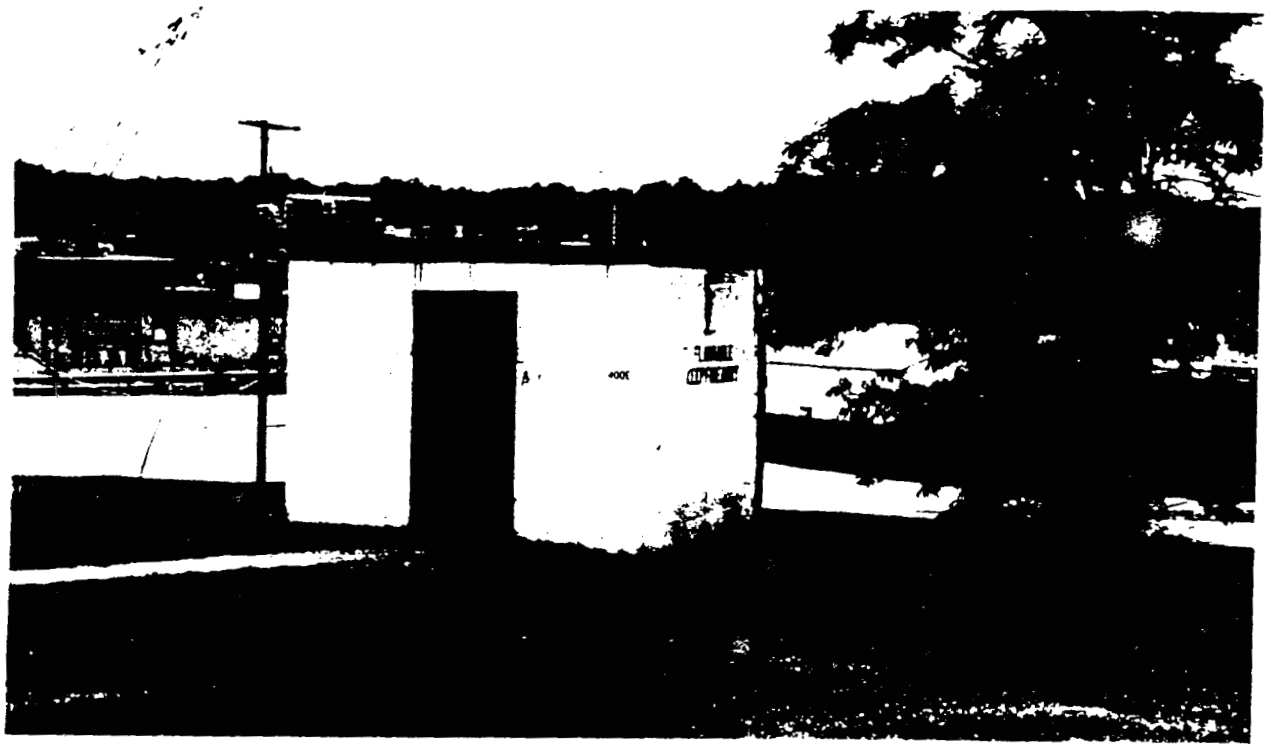


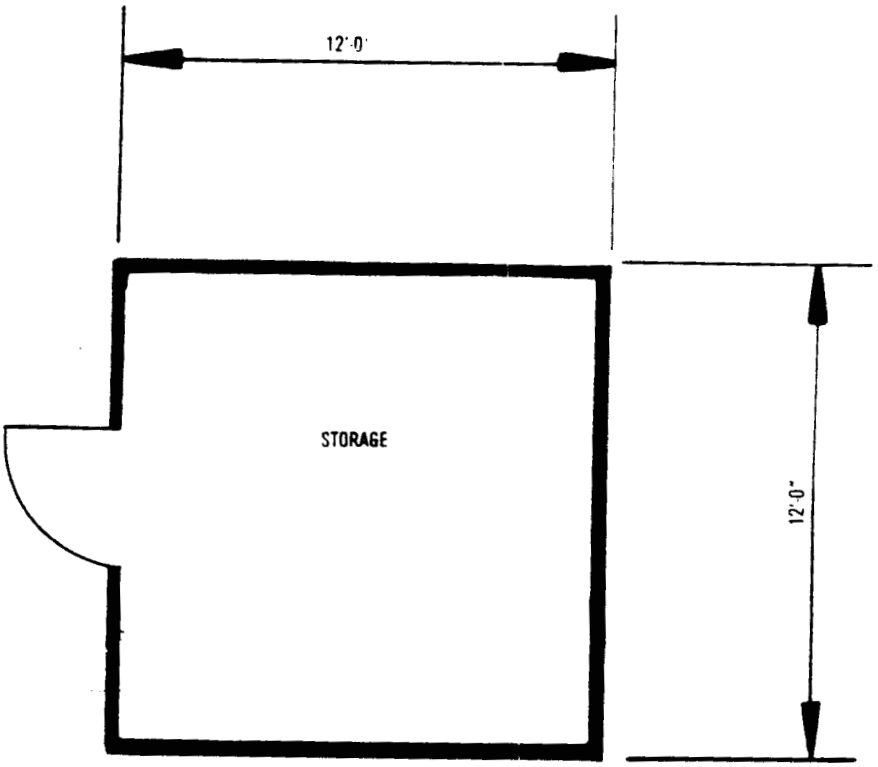


INSTRUMENTATION FACILITY ANNEX
BLDG 423 AREA: 1000 SQ FT



STRUCTURES TECHNICAL AREA LABORATORY ANNEX
BLDG 449 AREA: 1000 SQ FT

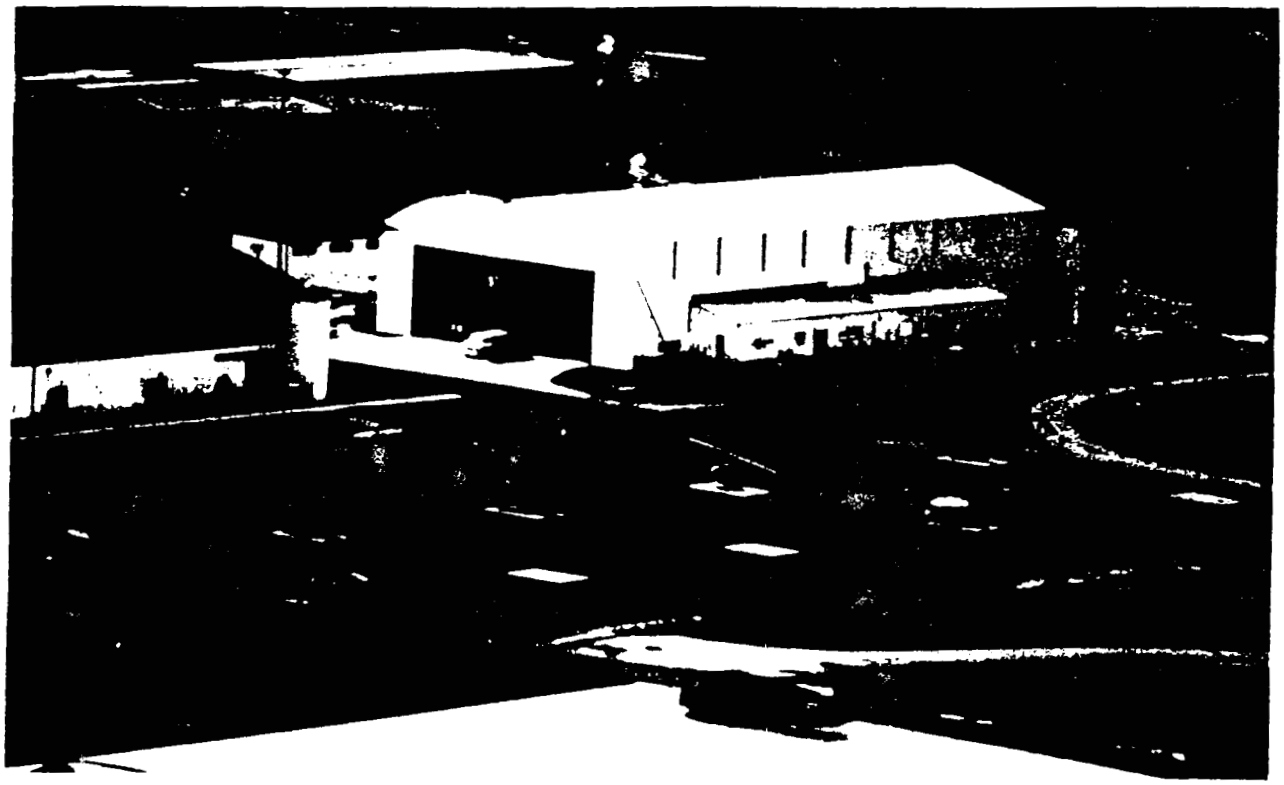


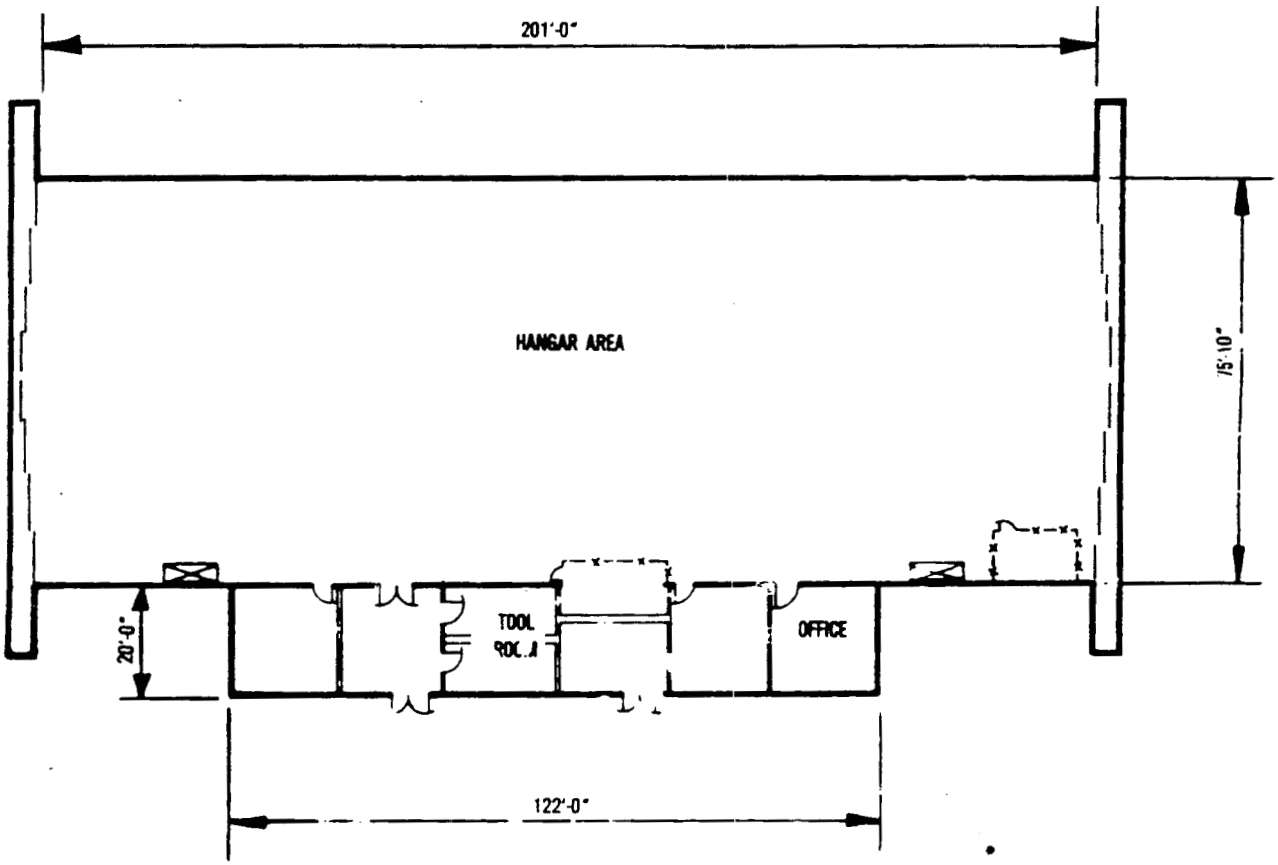


CHEMICAL STORAGE FACILITY
BLDG 400E AREA: 128 SQ FT

FOR OFFICIAL USE ONLY

AATD

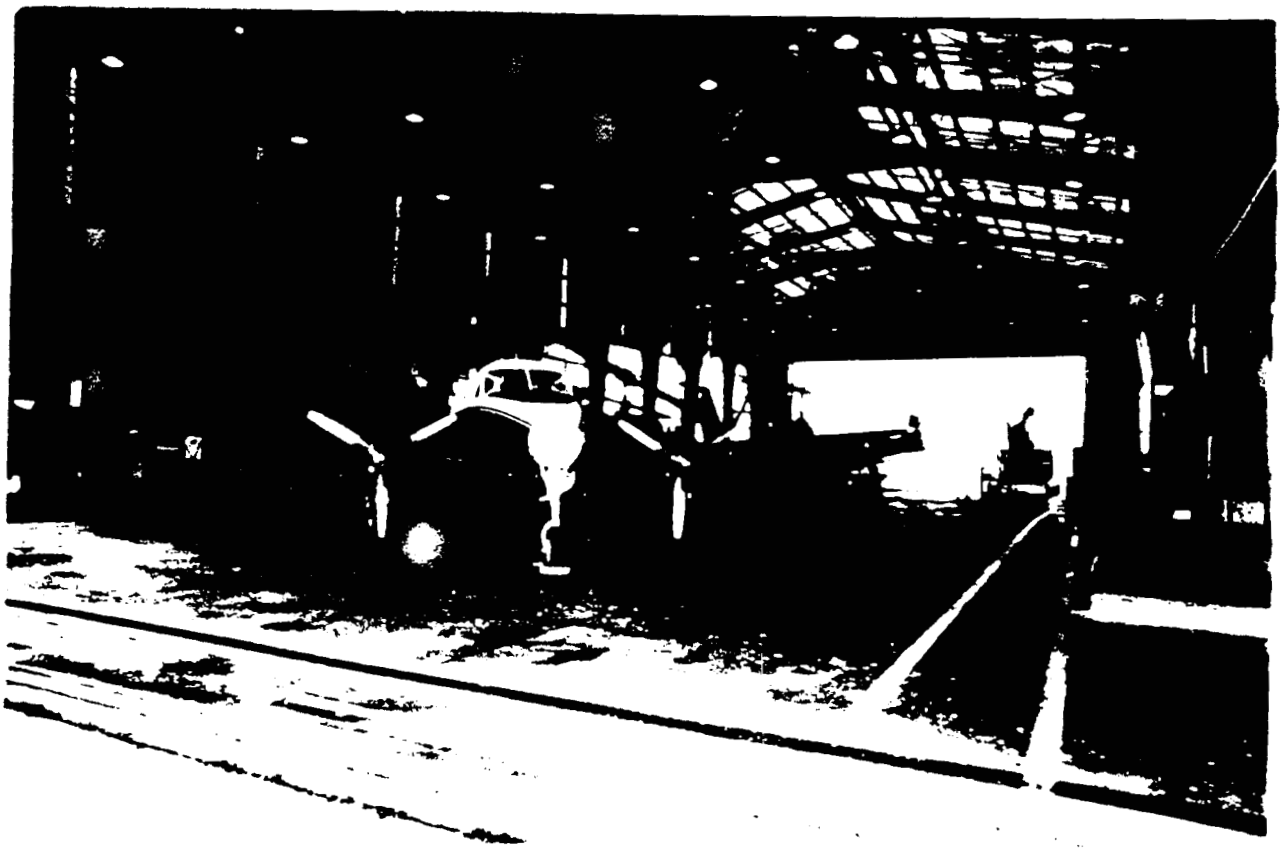


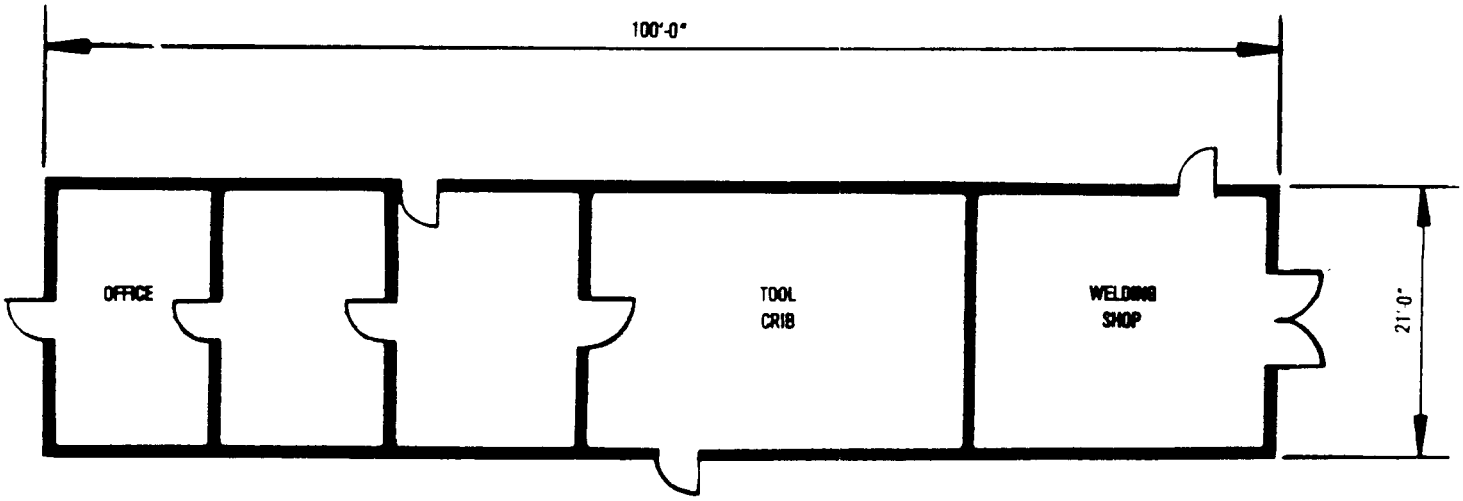


AATD AVIATION TEST SUPPORT FACILITY
HANGAR 2402 AREA: 17,685 SQ FT

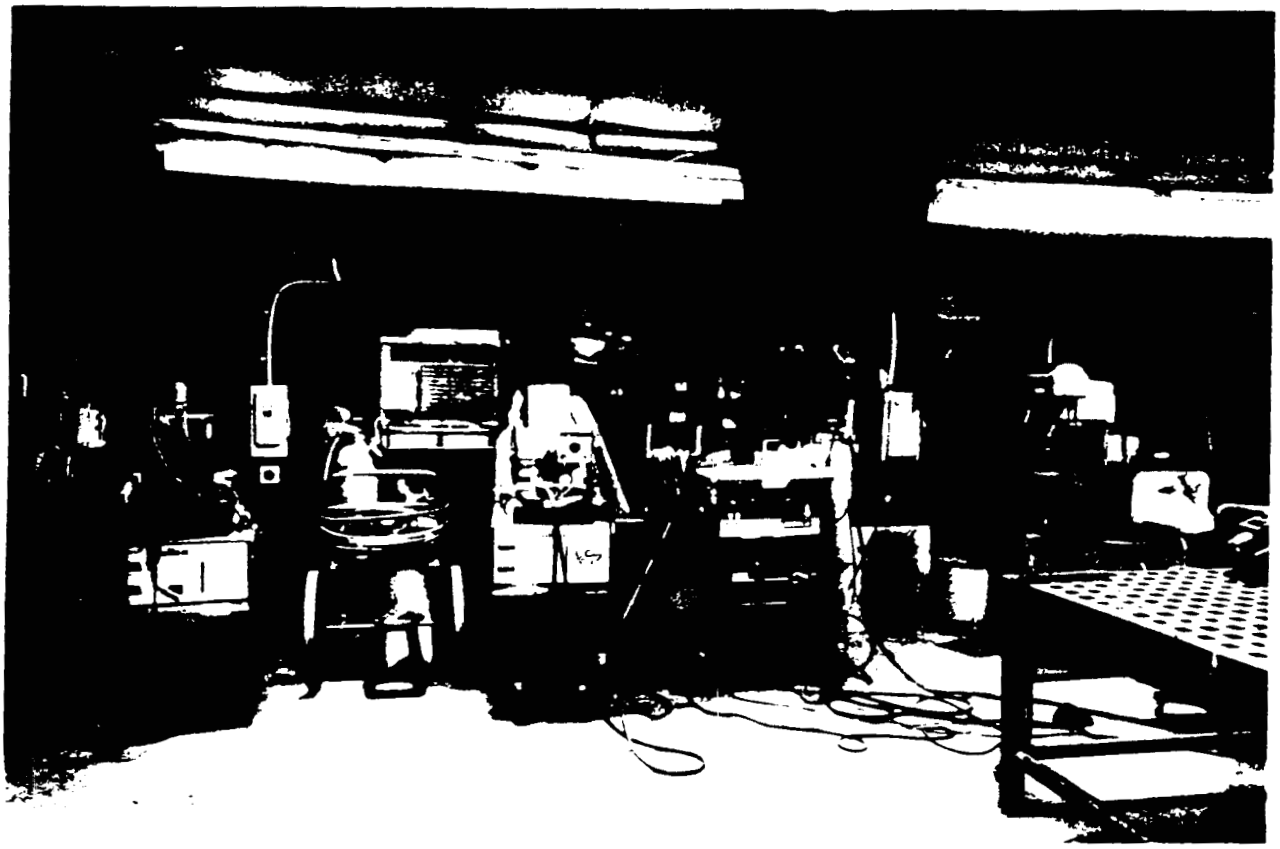
FOR OFFICIAL USE ONLY

HANGAR INTERIOR, BLDG 2402



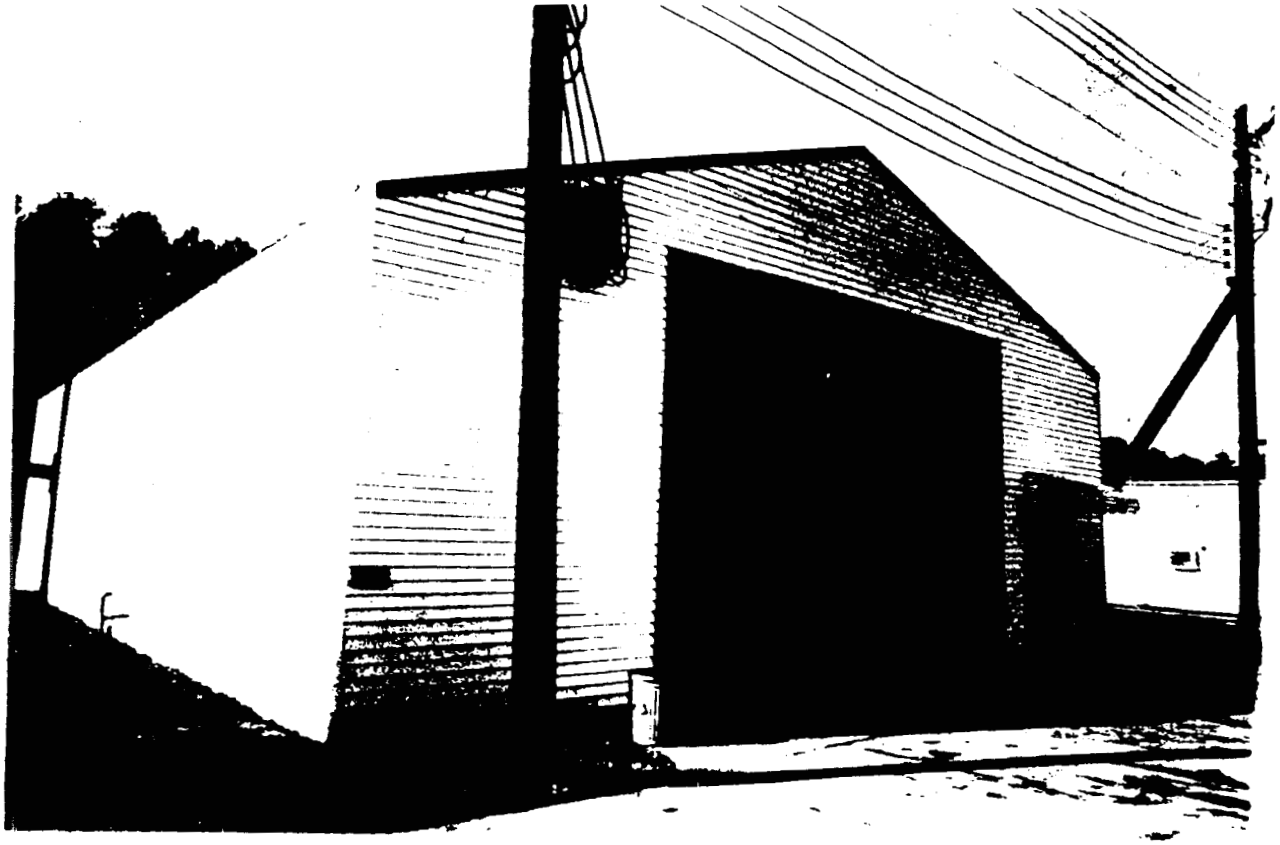


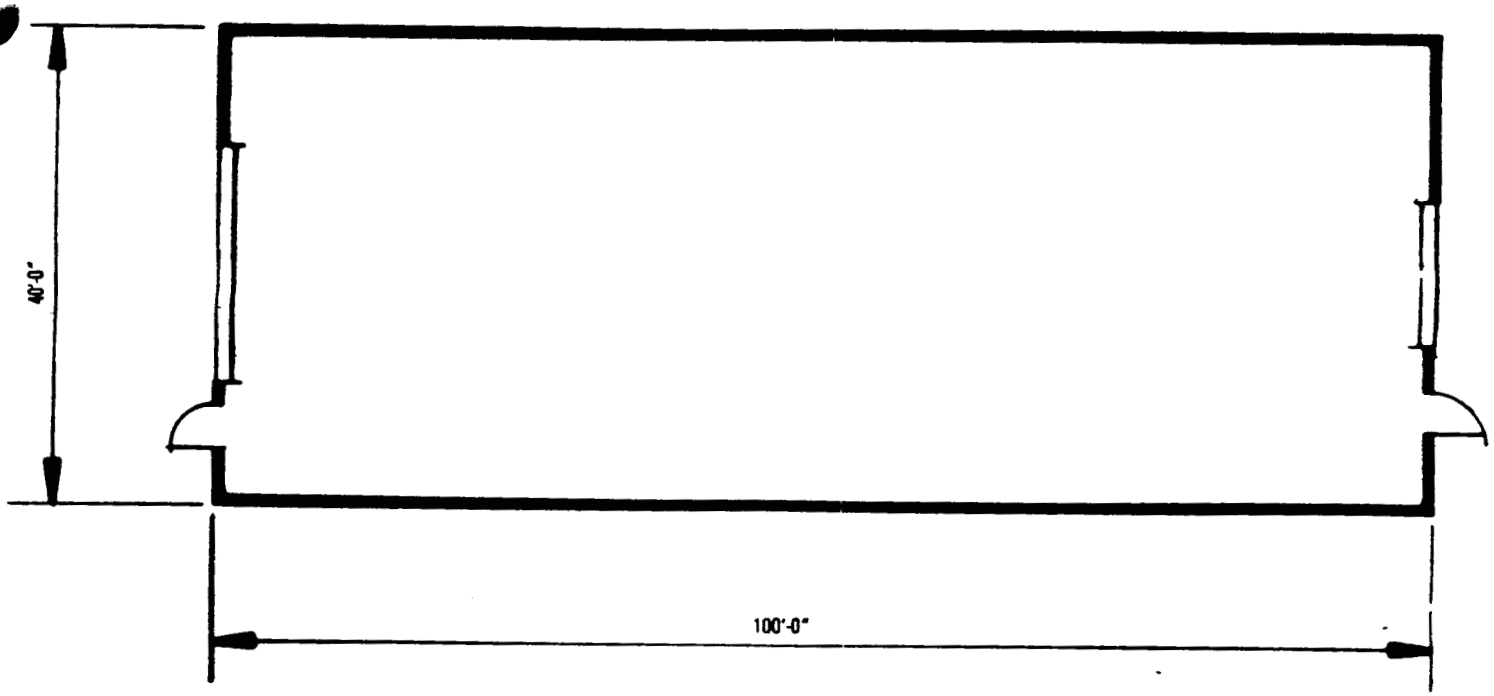
EXPERIMENTAL FABRICATION FACILITY
BLDG 3507 AREA: 2100 SQ FT



WELDING SHOP, BLDG 3507

TOOL CRIB, BLDG 3507

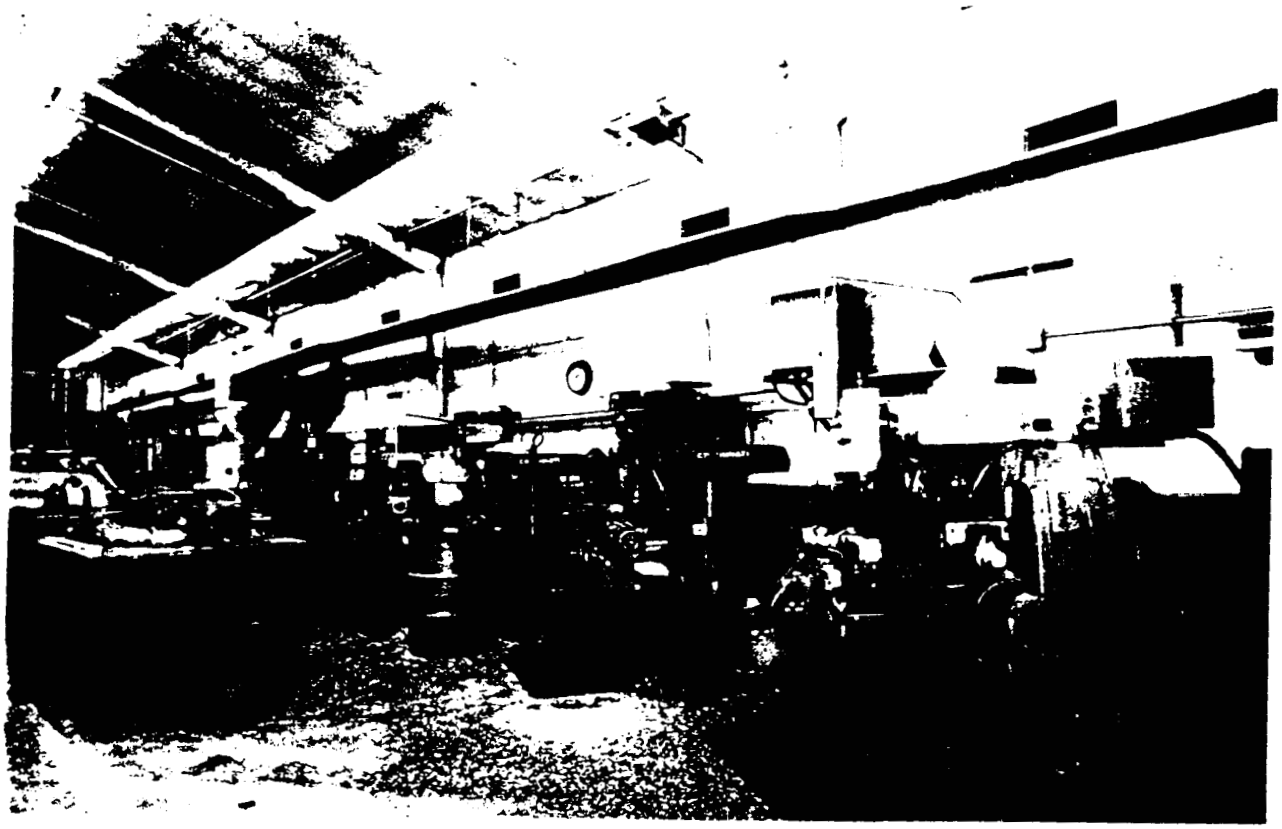




SHEET METAL & MACHINE SHOP FACILITY
BLDG 3508 AREA: 4000 SQ FT

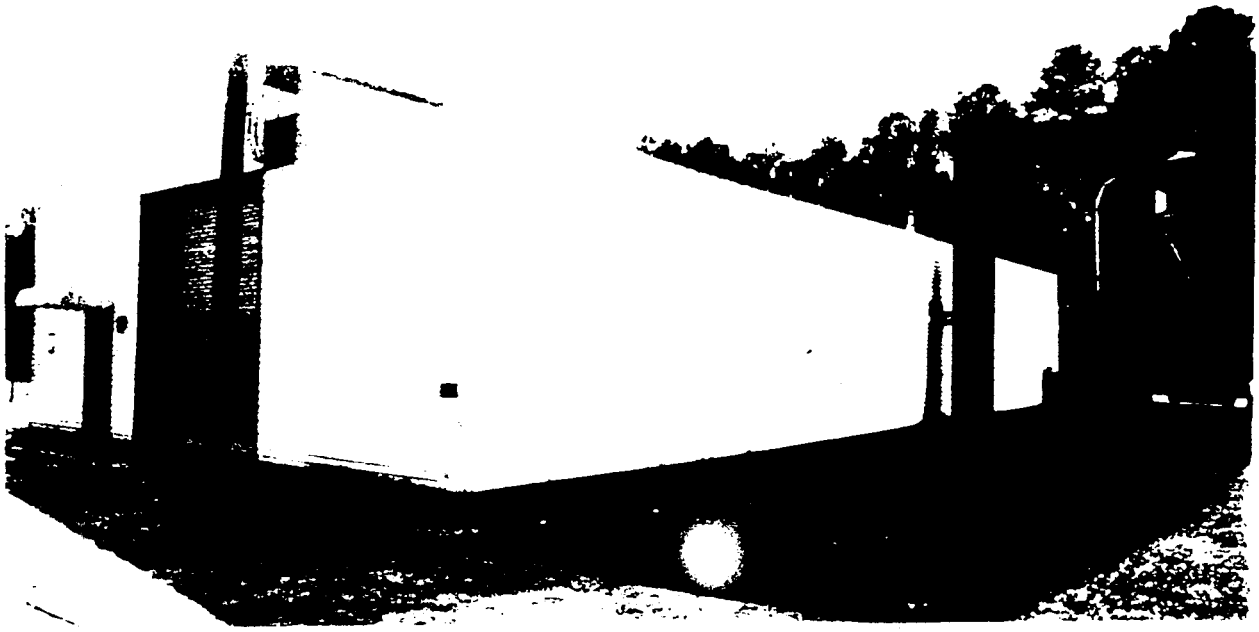
FOR OFFICIAL USE ONLY

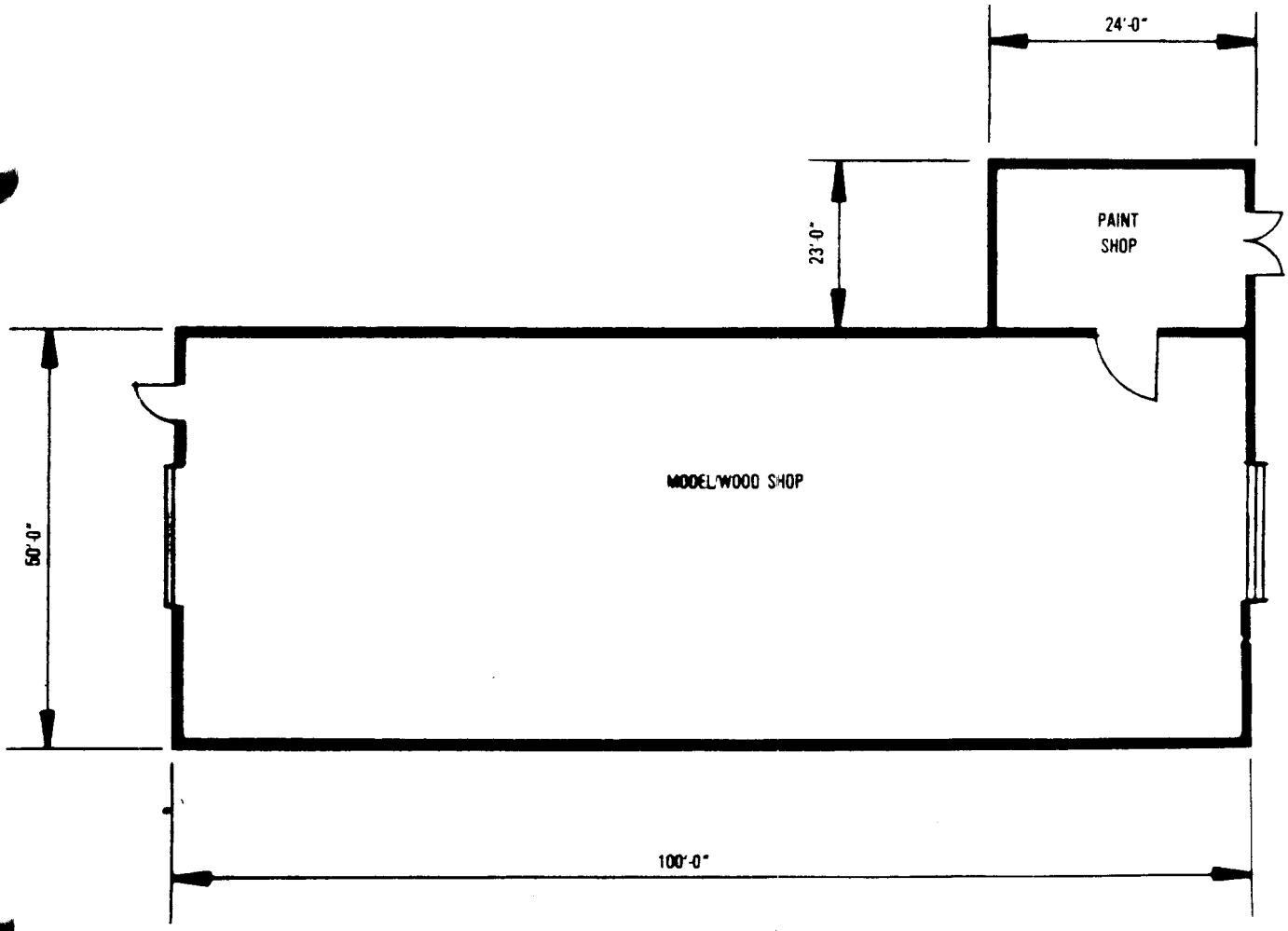
AATD



MACHINE SHOP, BLDG 3508

MACHINE SHOP, BLDG 3508



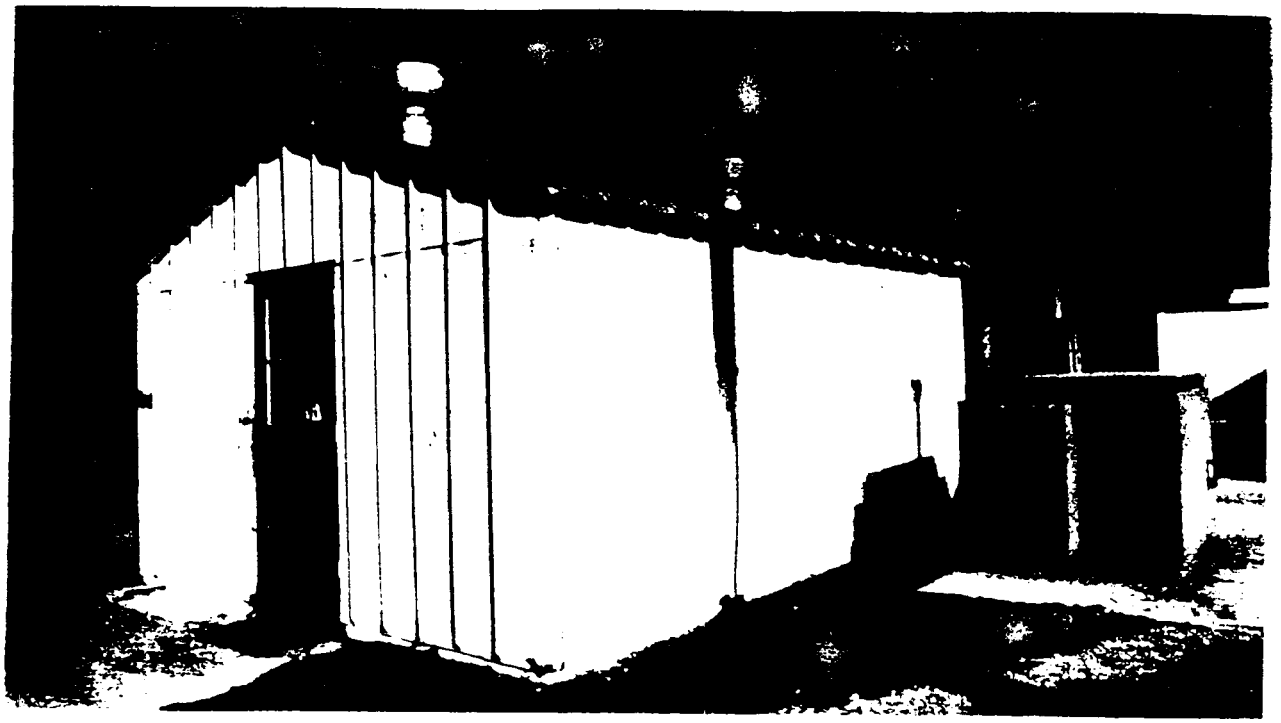


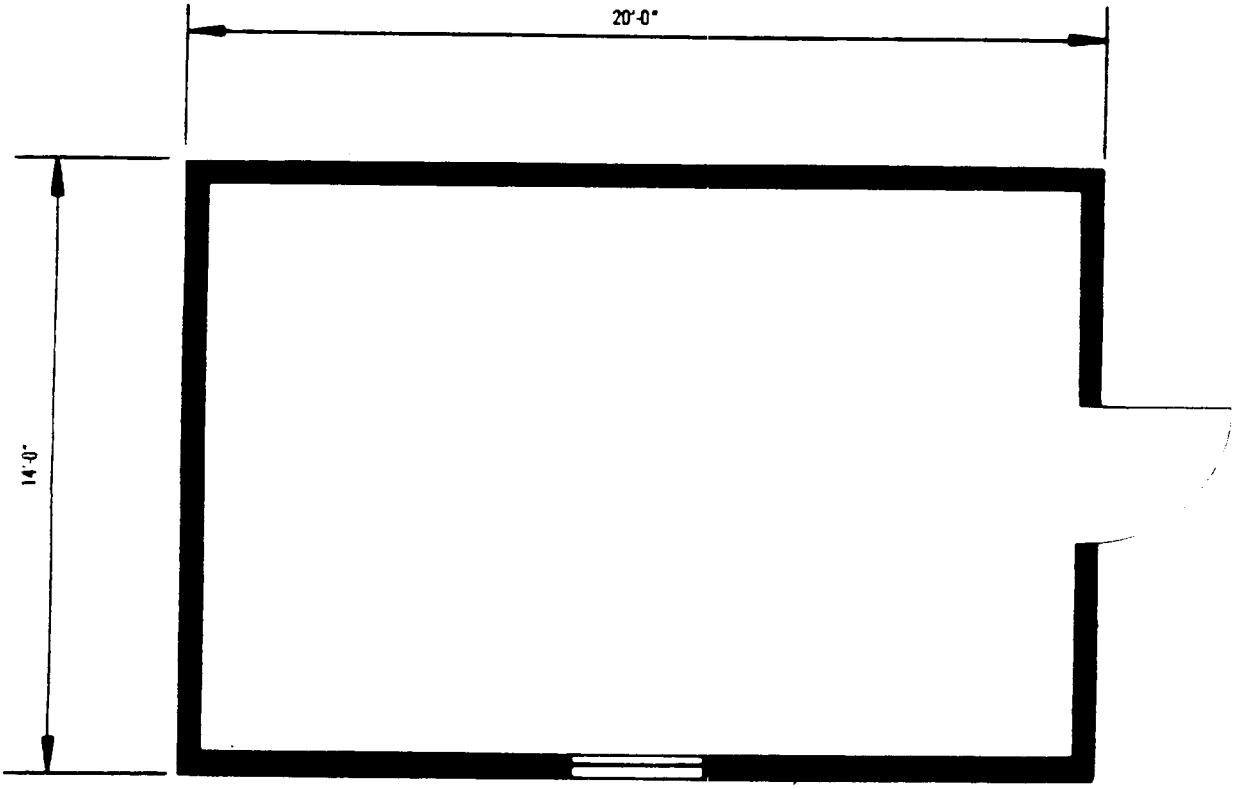
MODEL AND WOOD SHOP FACILITY
BLDG 3509 AREA: 5000 SQ FT

FOR OFFICIAL USE ONLY

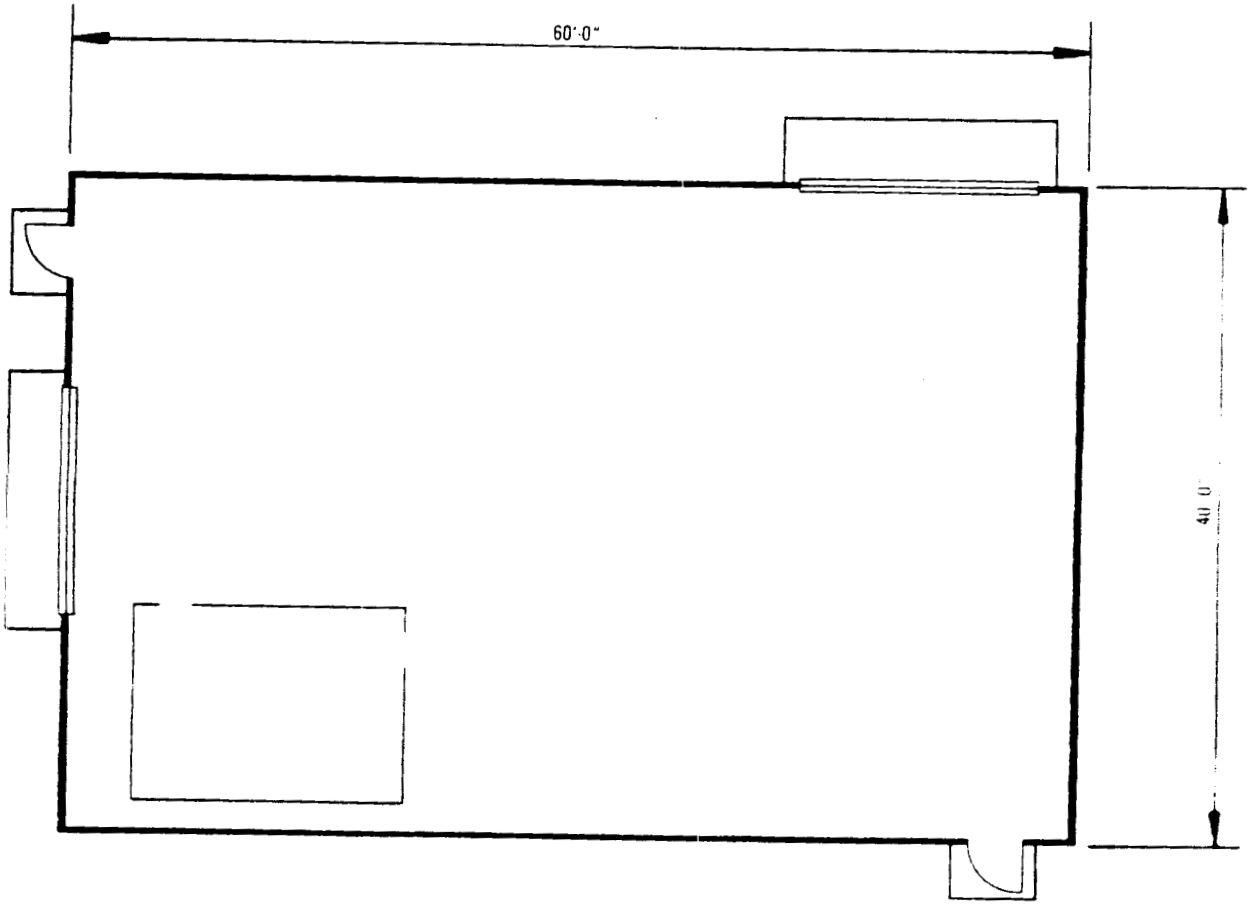
MODEL SHOP, BLDG 3509

MODEL SHOP, BLDG 3509





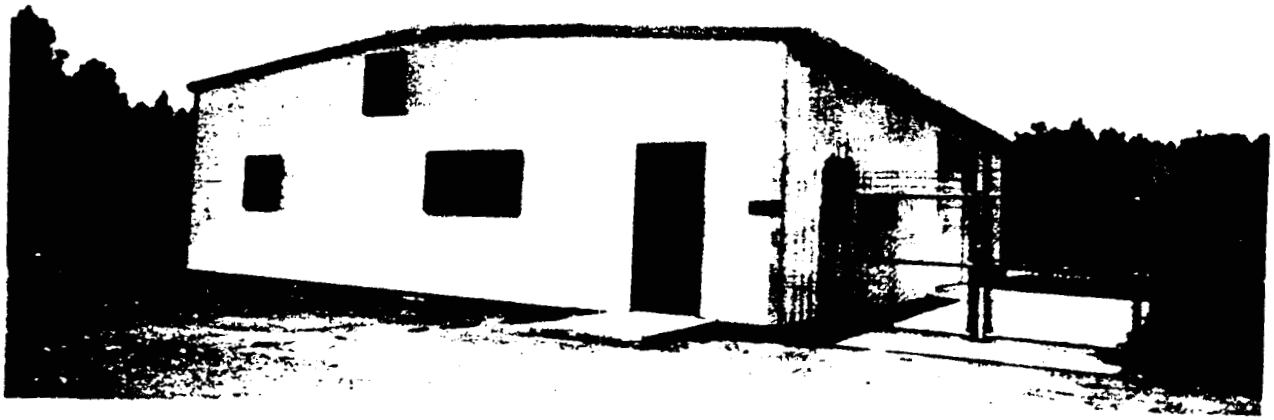
COUNTERMEASURES TEST FACILITY
BLDG 3513 AREA: 280 SQ FT

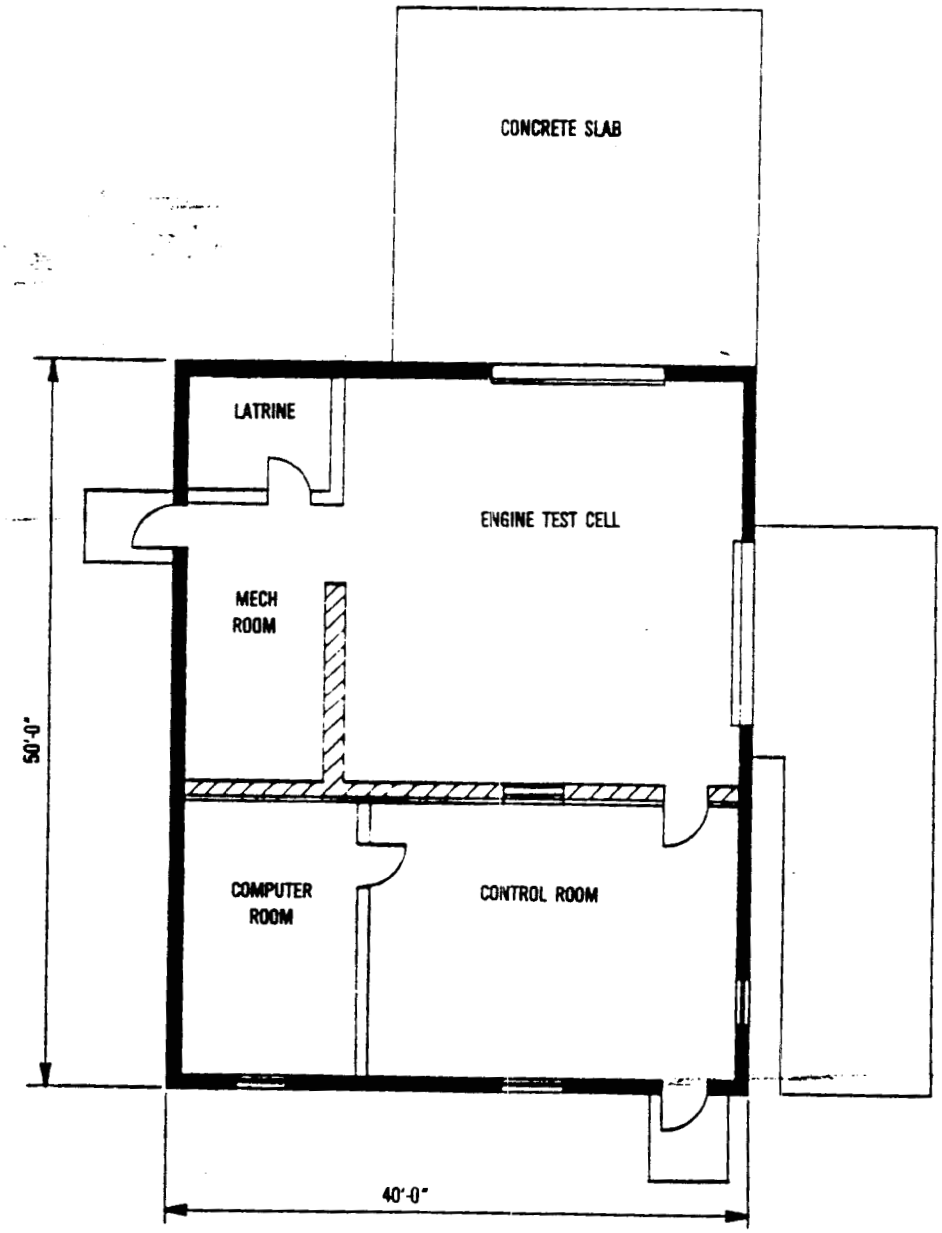


COUNTERMEASURES TEST FACILITY
BLDG 3514 AREA: 2400 SQ FT

FABRICATION, ASSEMBLY & STORAGE AREA, BLDG 3514

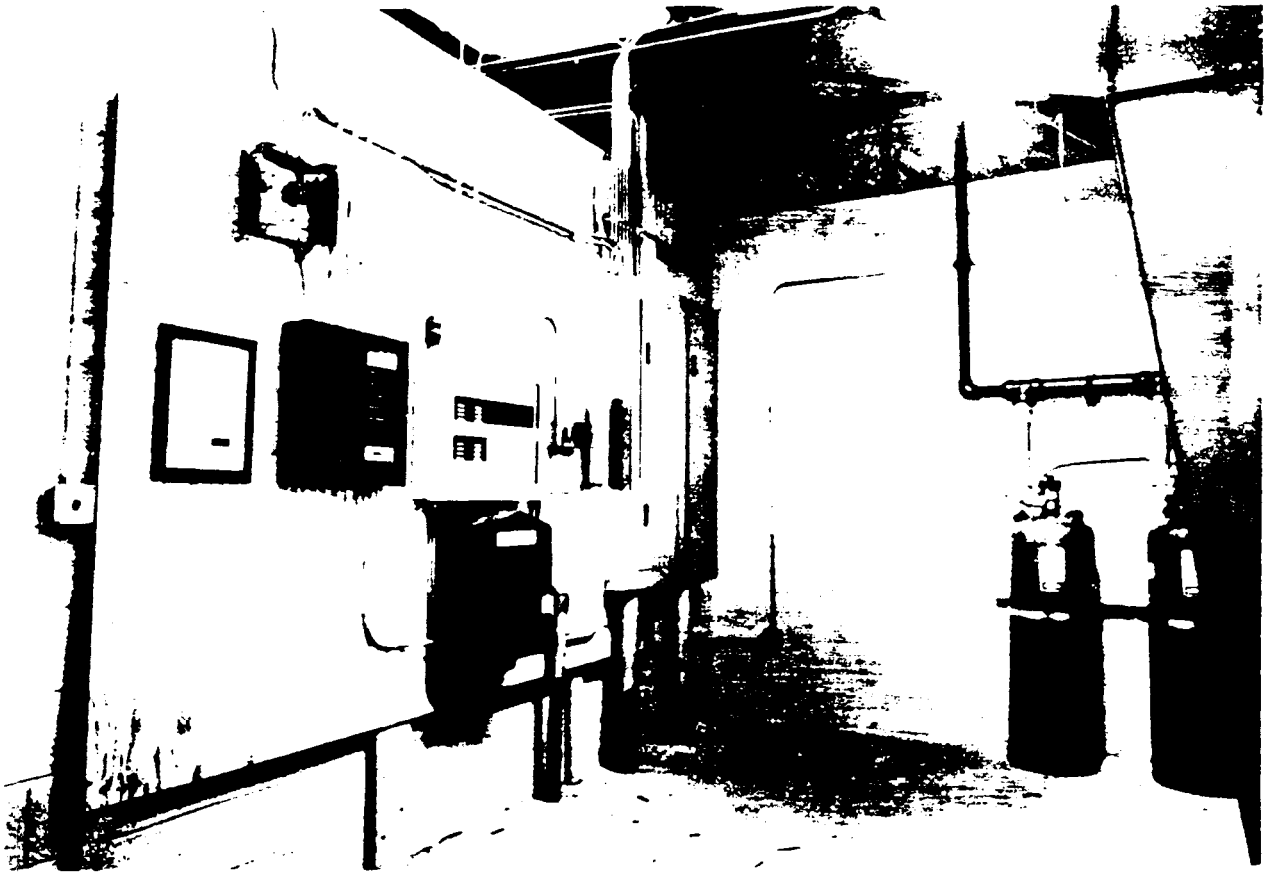
FABRICATION, ASSEMBLY & STORAGE AREA, BLDG 3514





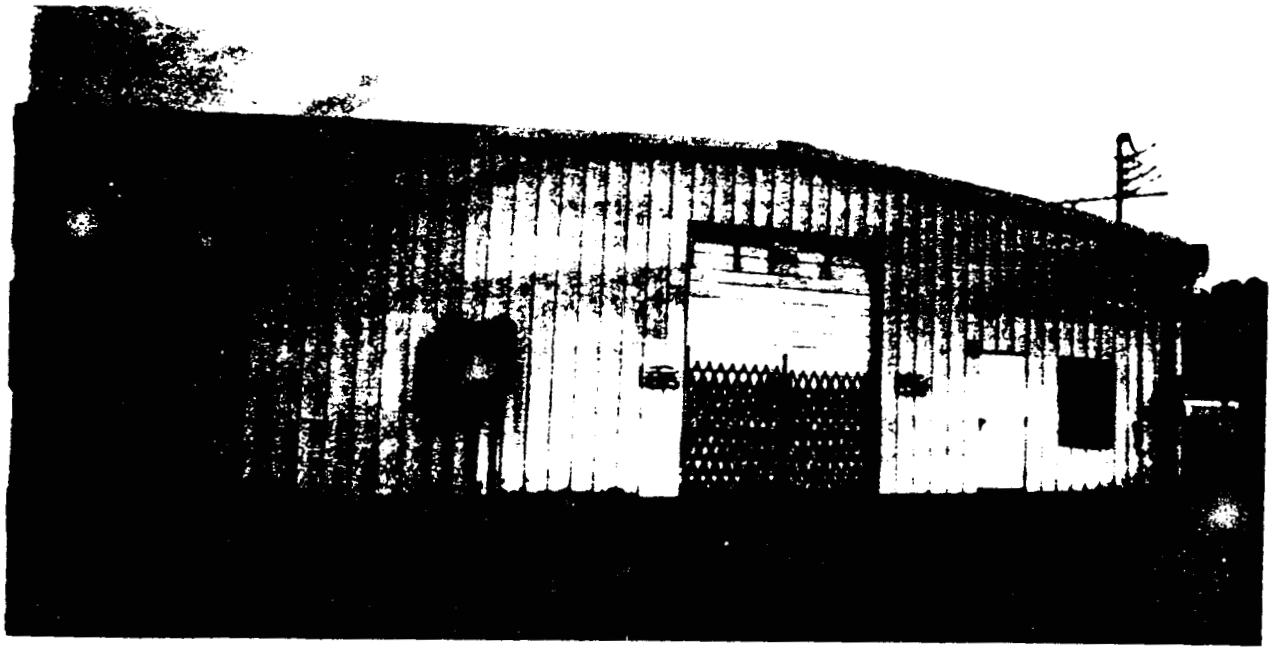
COUNTERMEASURES TEST & CONTROL FACILITY
BLDG 3517. **AREA: 2000 SQ FT**

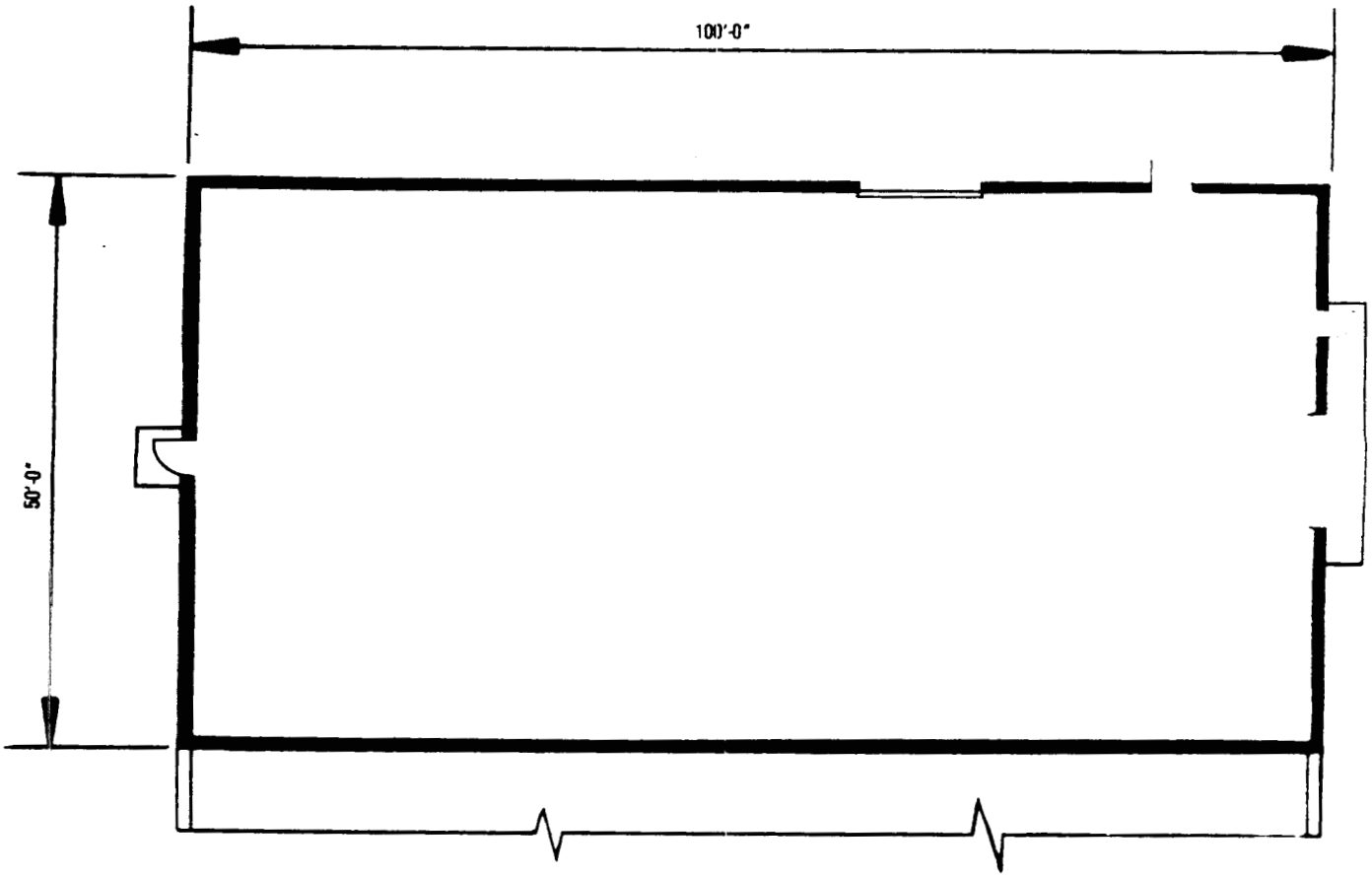
FOR OFFICIAL USE ONLY



MECHANICAL EQUIPMENT ROOM, BLDG 3517

COMPUTER ROOM, BLDG 3517





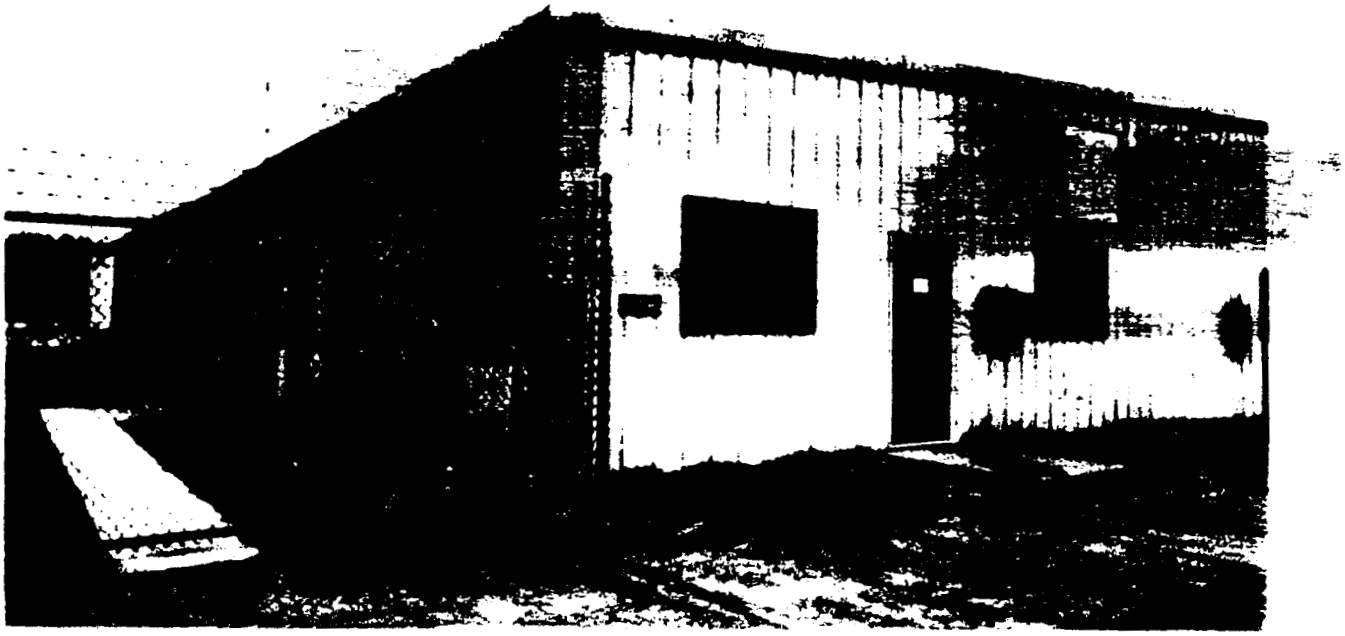
MISSION PROPERTY WAREHOUSE
BLDG 3519A AREA: 5000 SQ FT

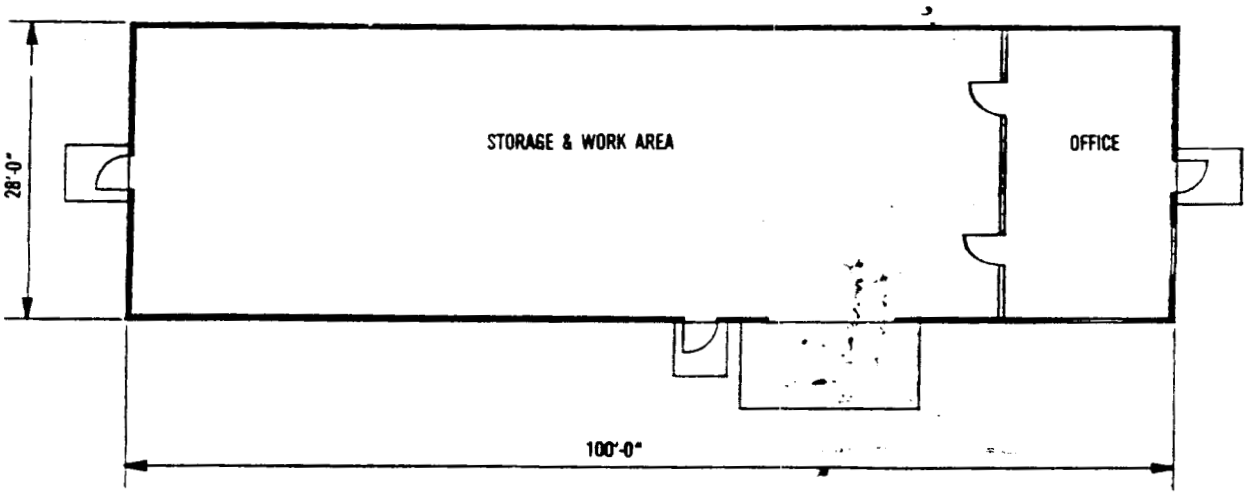
FOR OFFICIAL USE ONLY

AATD

LOGISTICS WAREHOUSE, BLDG 3519

LOGISTICS WAREHOUSE, BLDG 3519

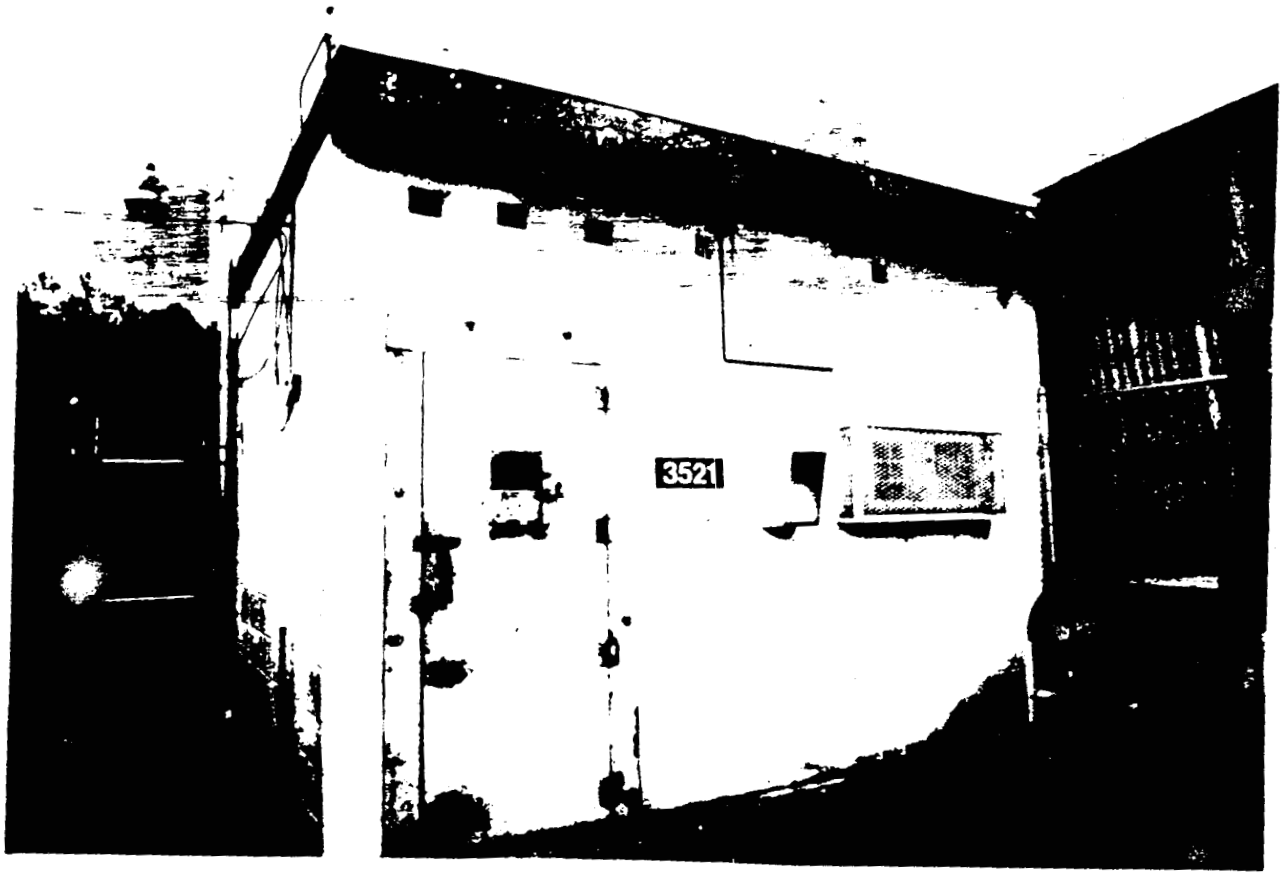


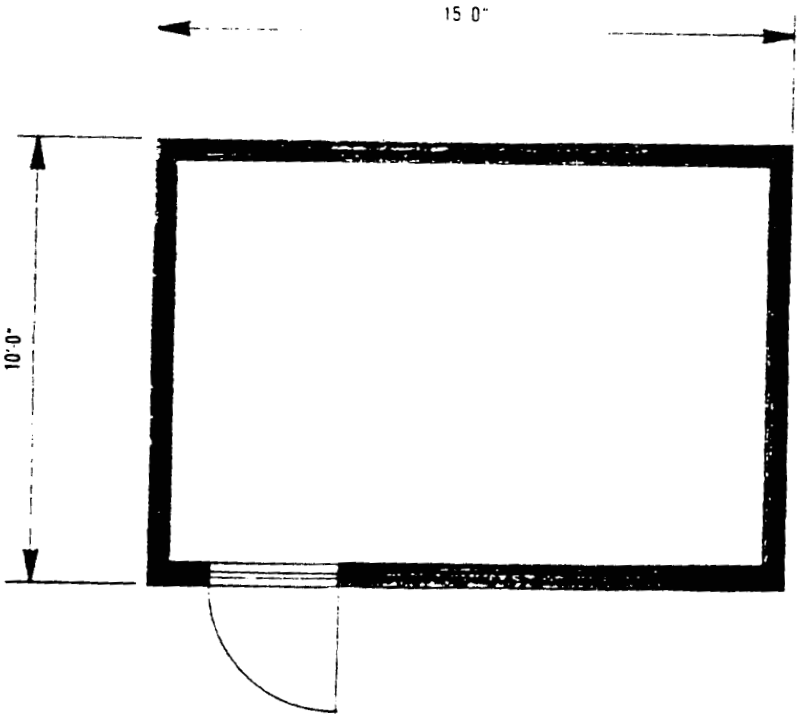


AVIMS WORKSHOP & OFFICE FACILITY
BLDG 3519B AREA: 2800 SQ FT

AVIMS WORK AREA BLDG 3519B

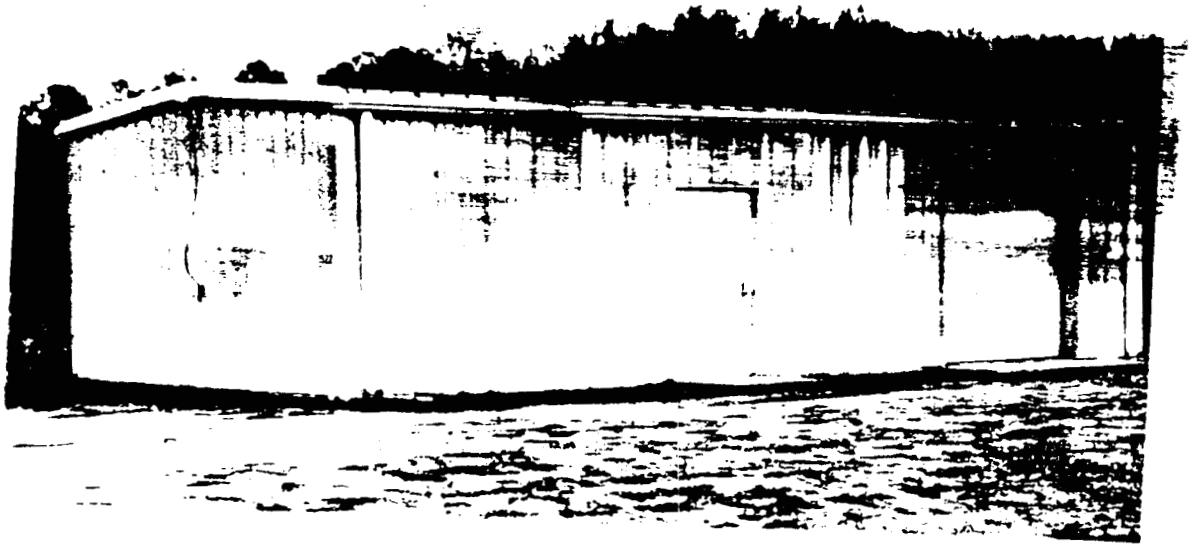
AVIMS EQUIPMENT STORAGE AREA BLDG 3519B

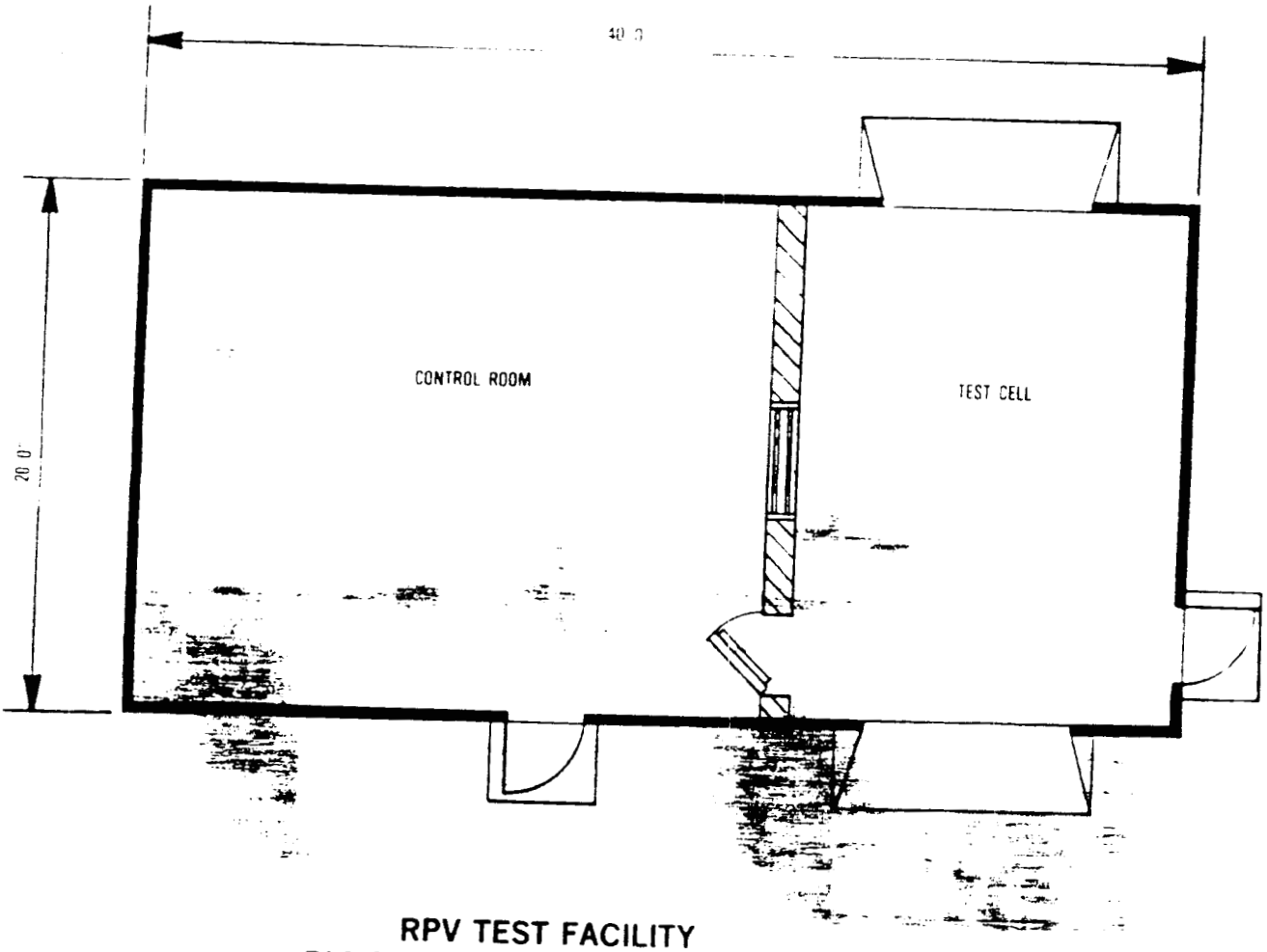




SECURE STORAGE FACILITY
BLDG 3521 AREA: 150 SQ FT

FOR OFFICIAL USE ONLY

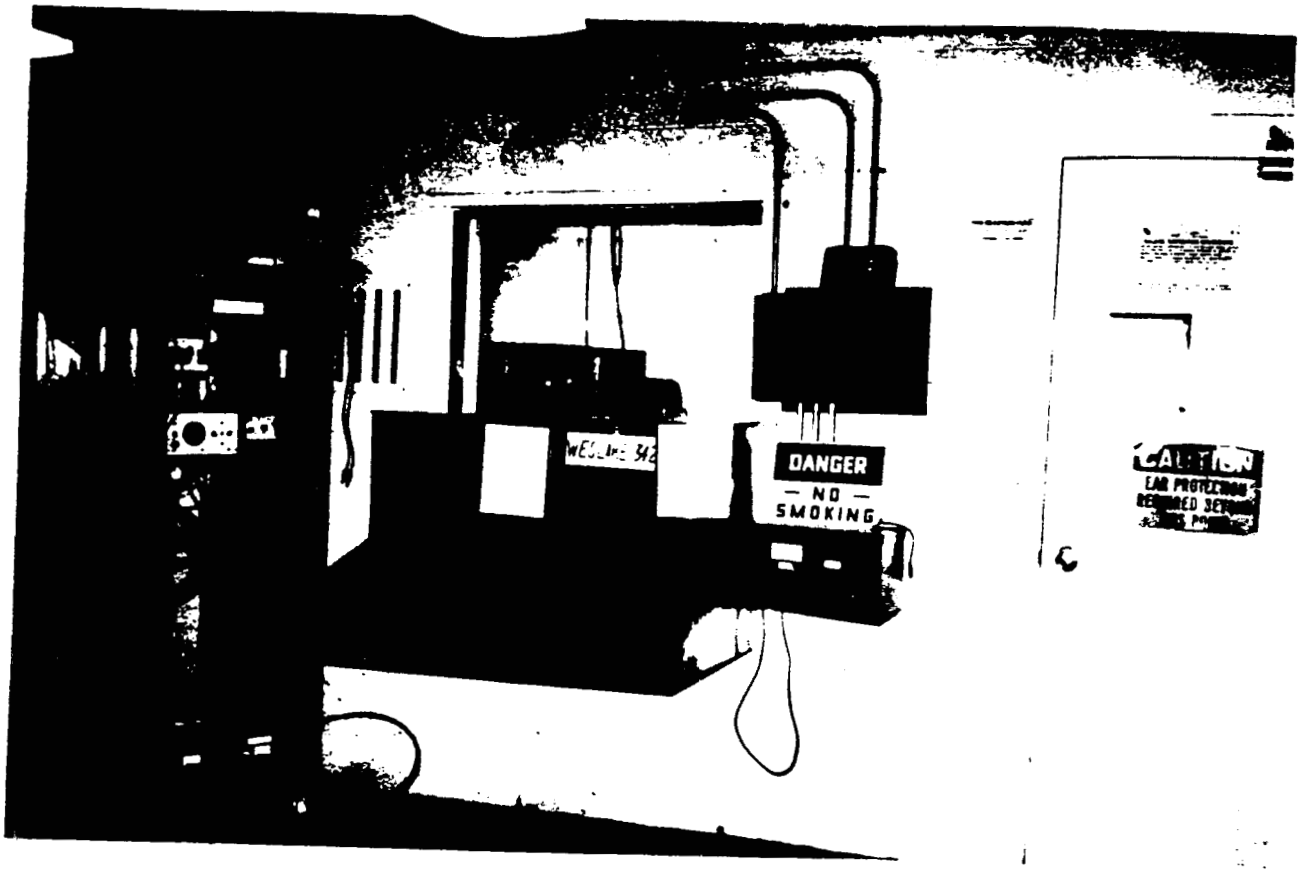




RPV TEST FACILITY
BLDG 3522 AREA: 800 SQ FT

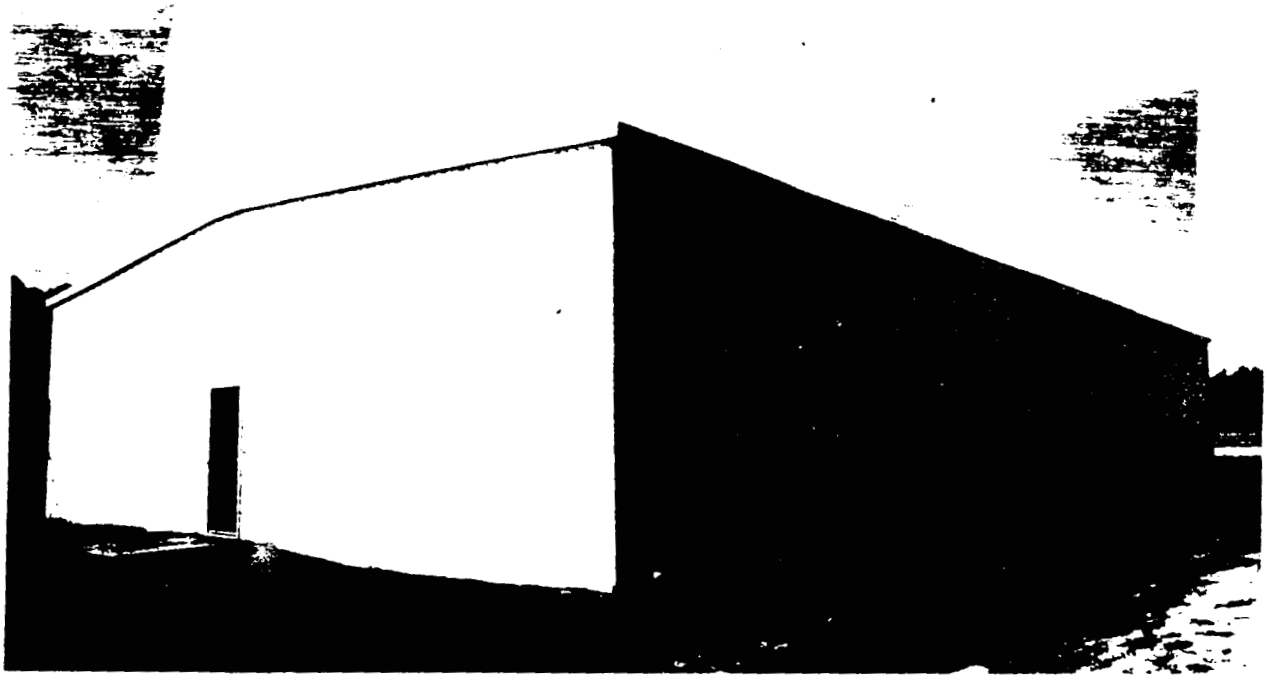
FOR OFFICIAL USE ONLY

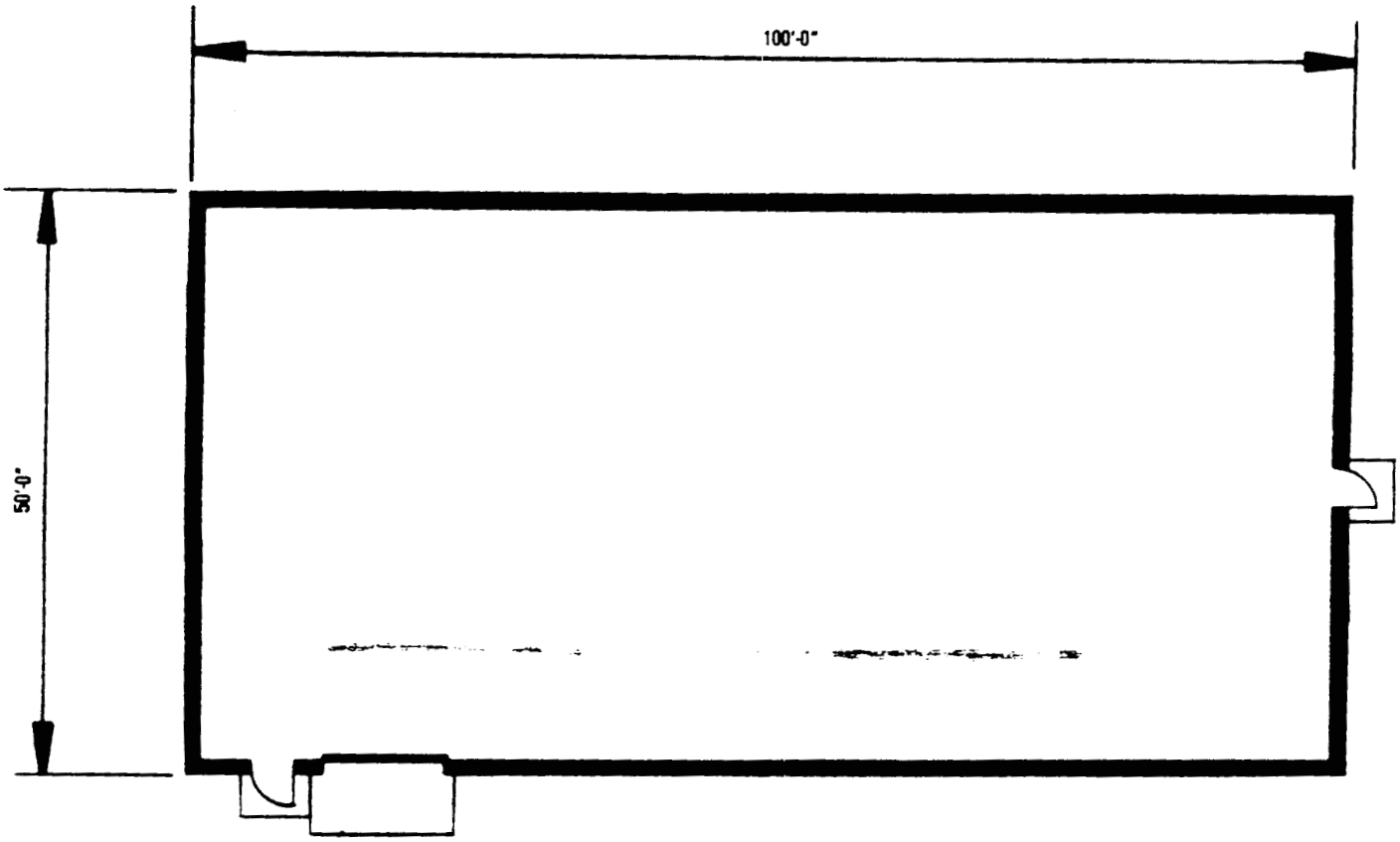
AATD



CONTROL ROOM, BLDG 3522

ENGINE TEST STAND, BLDG 3522



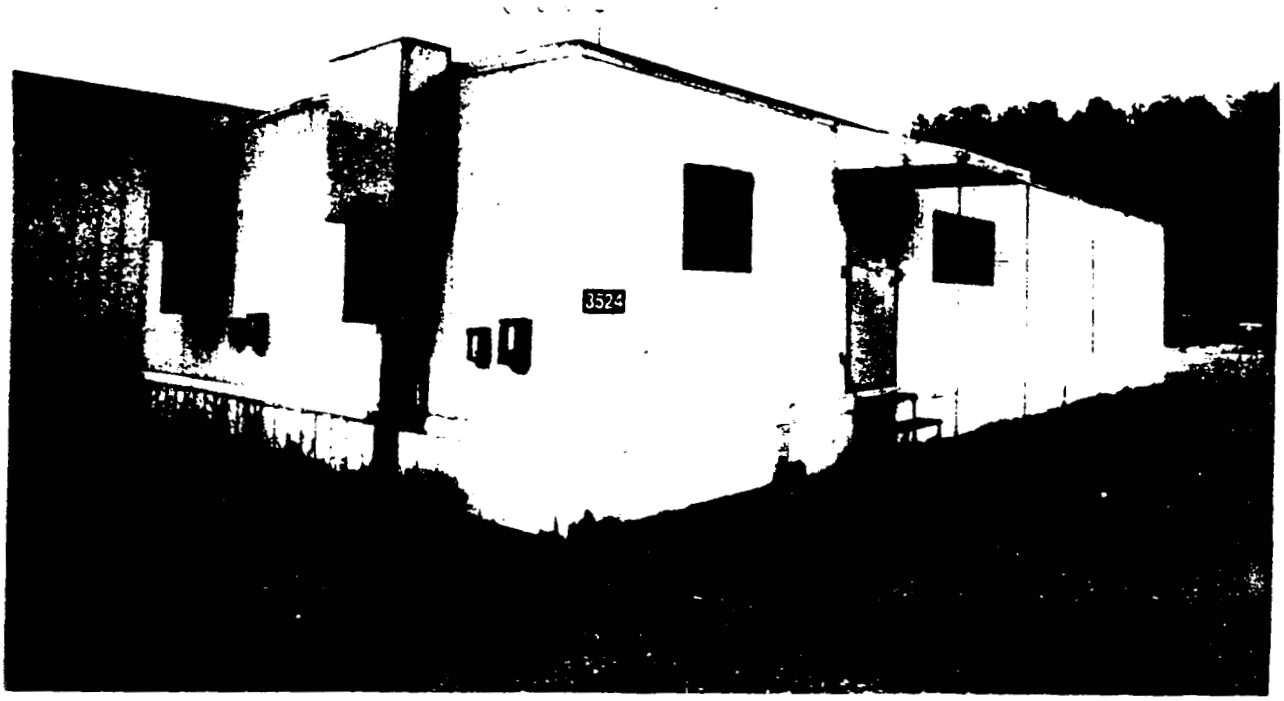


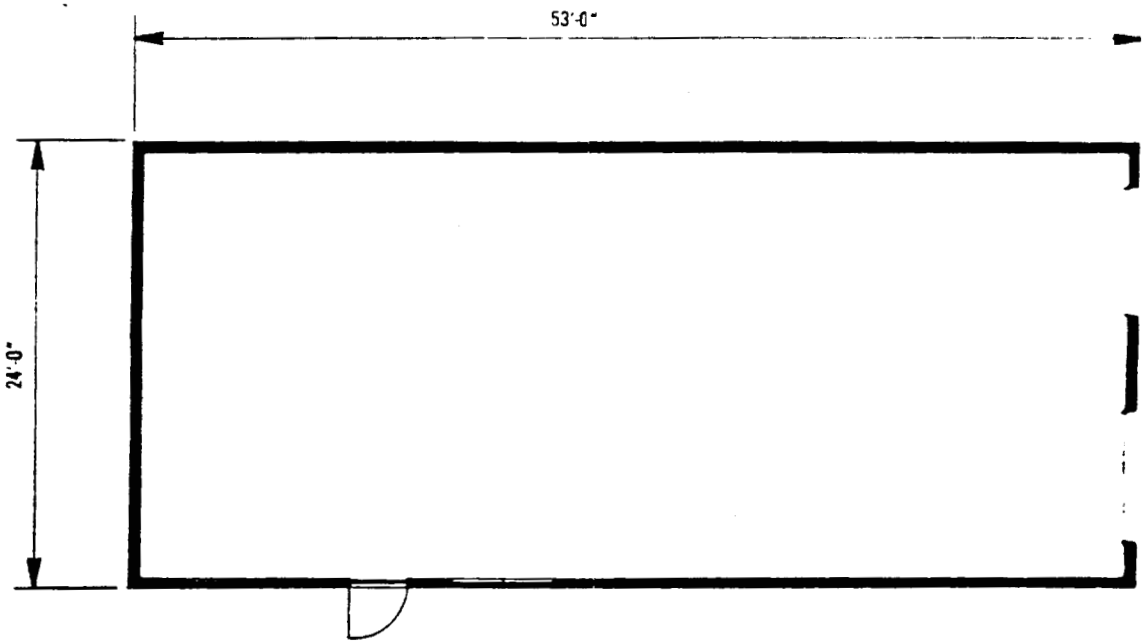
WAREHOUSE (R&D EQUIPMENT)
BLDG 3523 AREA: 5000 SQ FT

FOR OFFICIAL USE ONLY

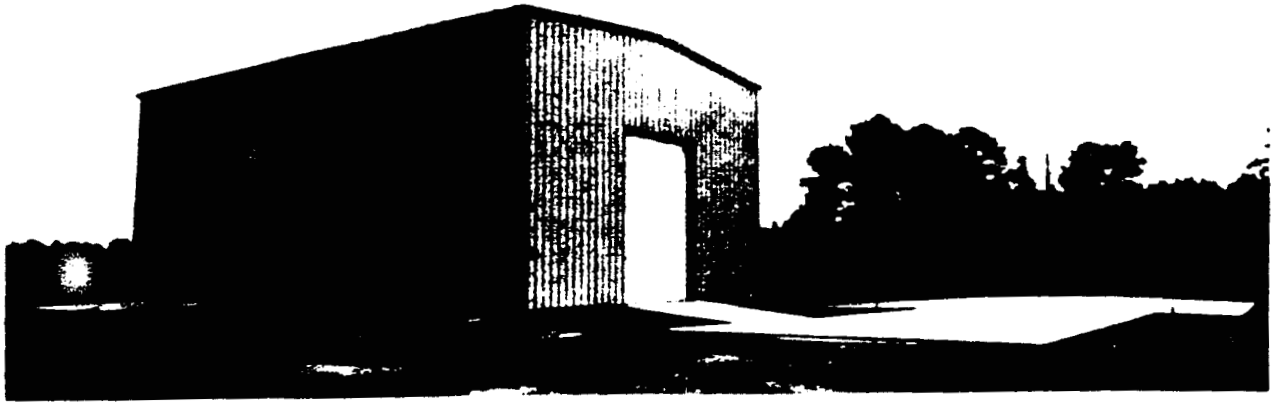
USER WAREHOUSE, BLDG 3523

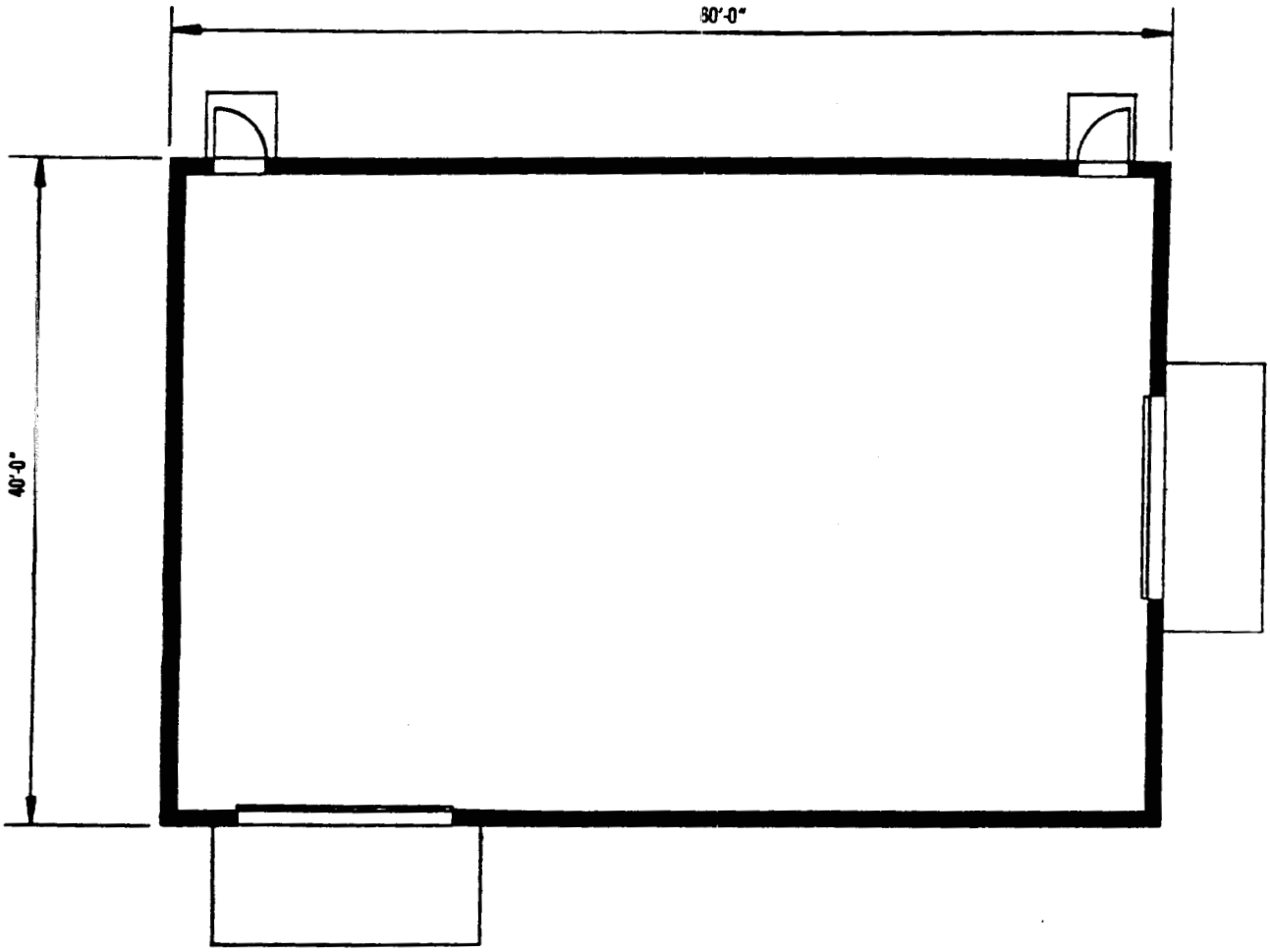
USER WAREHOUSE, BLDG 3523





GENERAL SUPPORT FACILITY
BLDG 3524 AREA: 1272 SQ FT



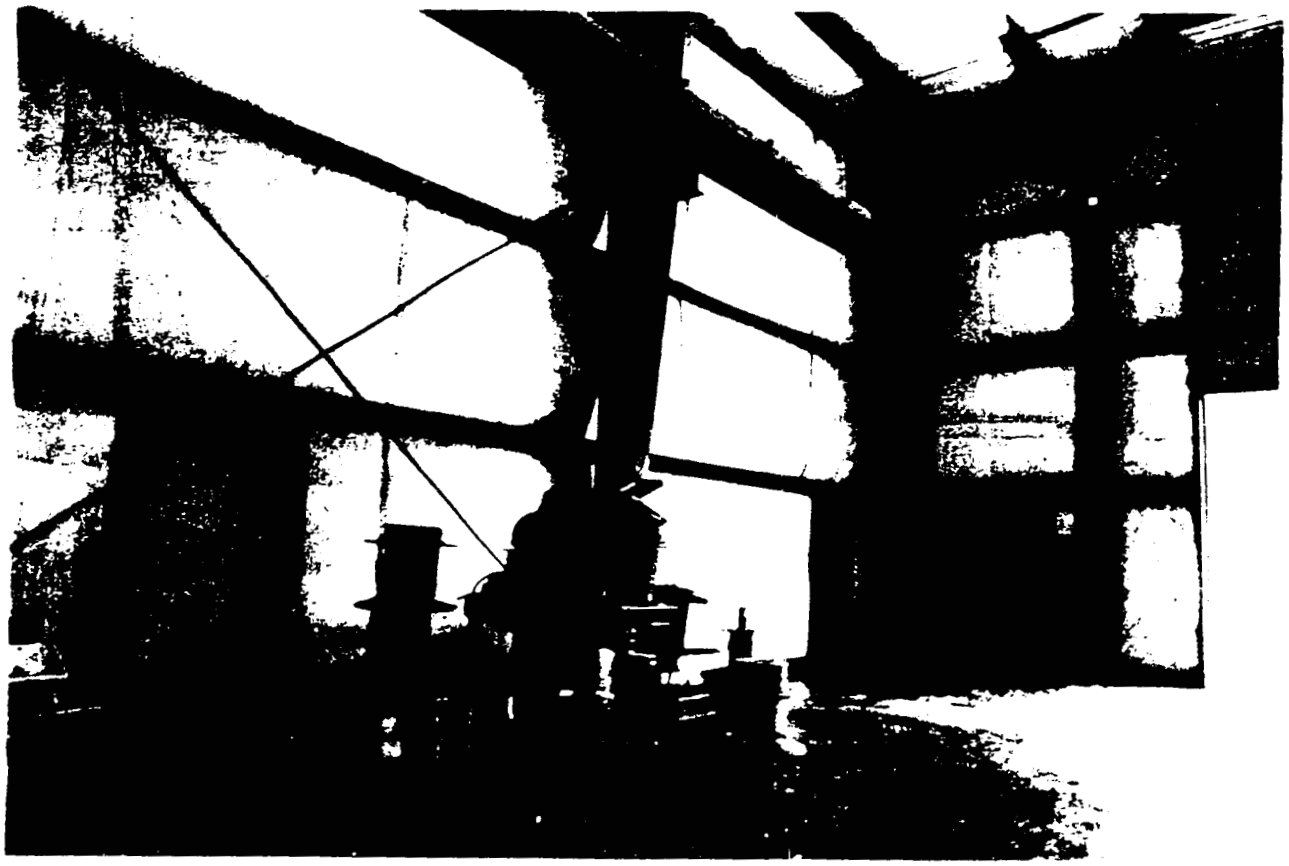


FABRICATION, ASSEMBLY & STORAGE FACILITY #2

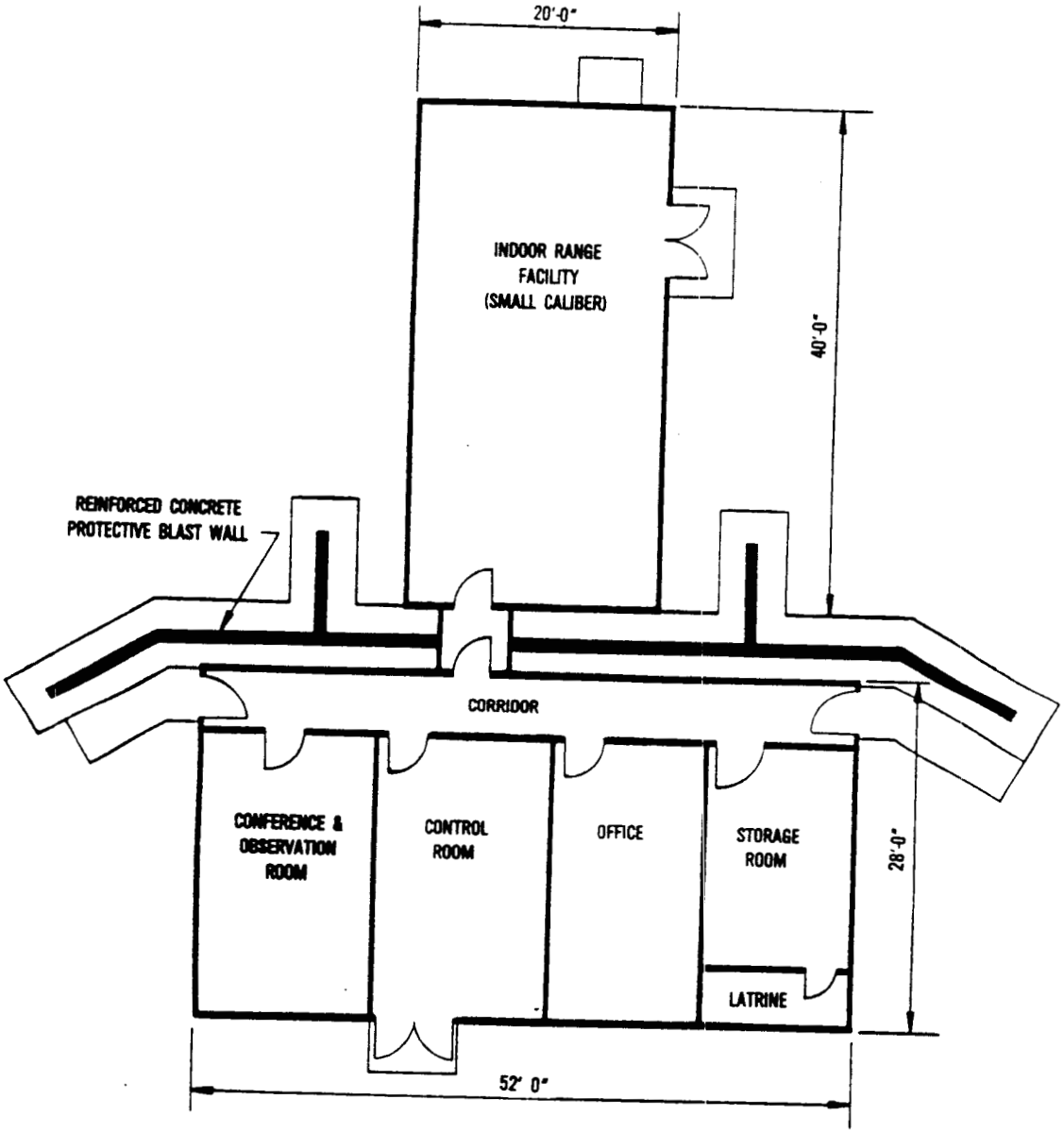
BLDG 3939 **AREA: 2400 SQ FT**

FOR OFFICIAL USE ONLY

FABRICATION & ASSEMBLY AREA, BLDG 3939



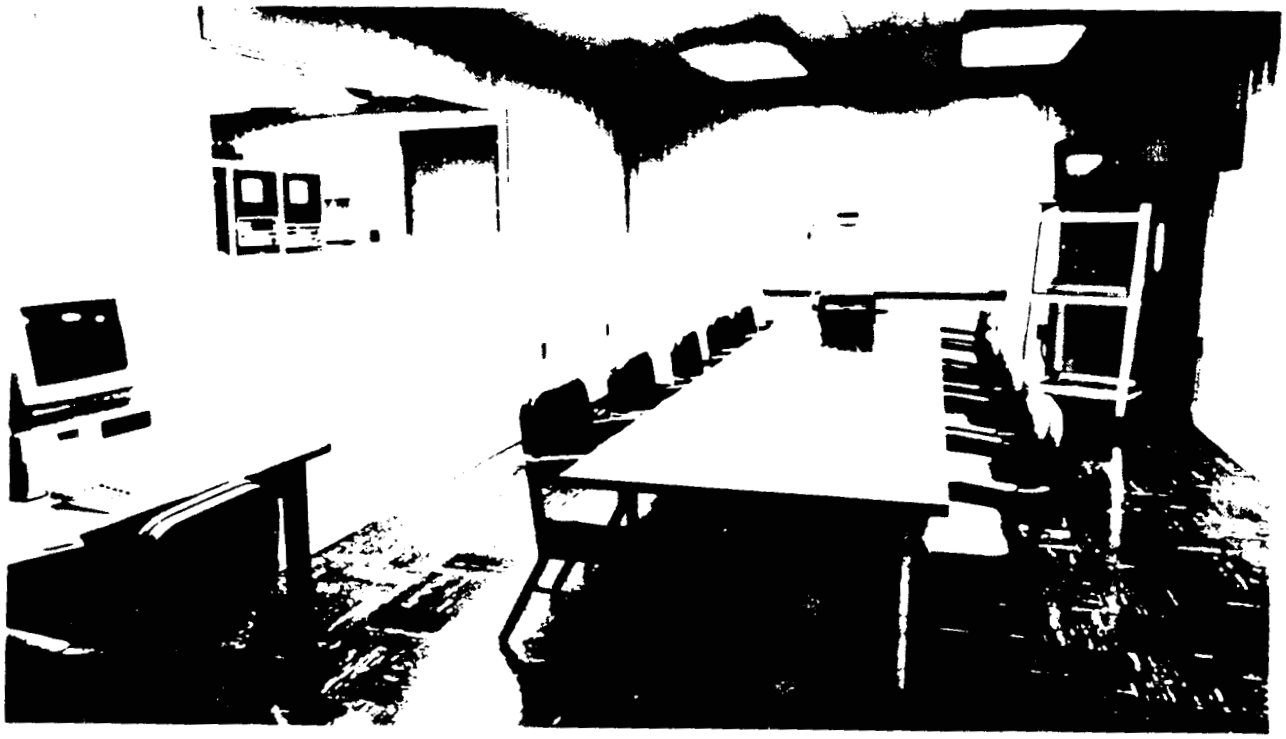
FABRICATION & ASSEMBLY AREA, BLDG 3939



CONTROL CENTER BALLISTIC TEST RANGE FACILITY (BTRACS)
BLDG 3940
AREA: 2280 SQ FT

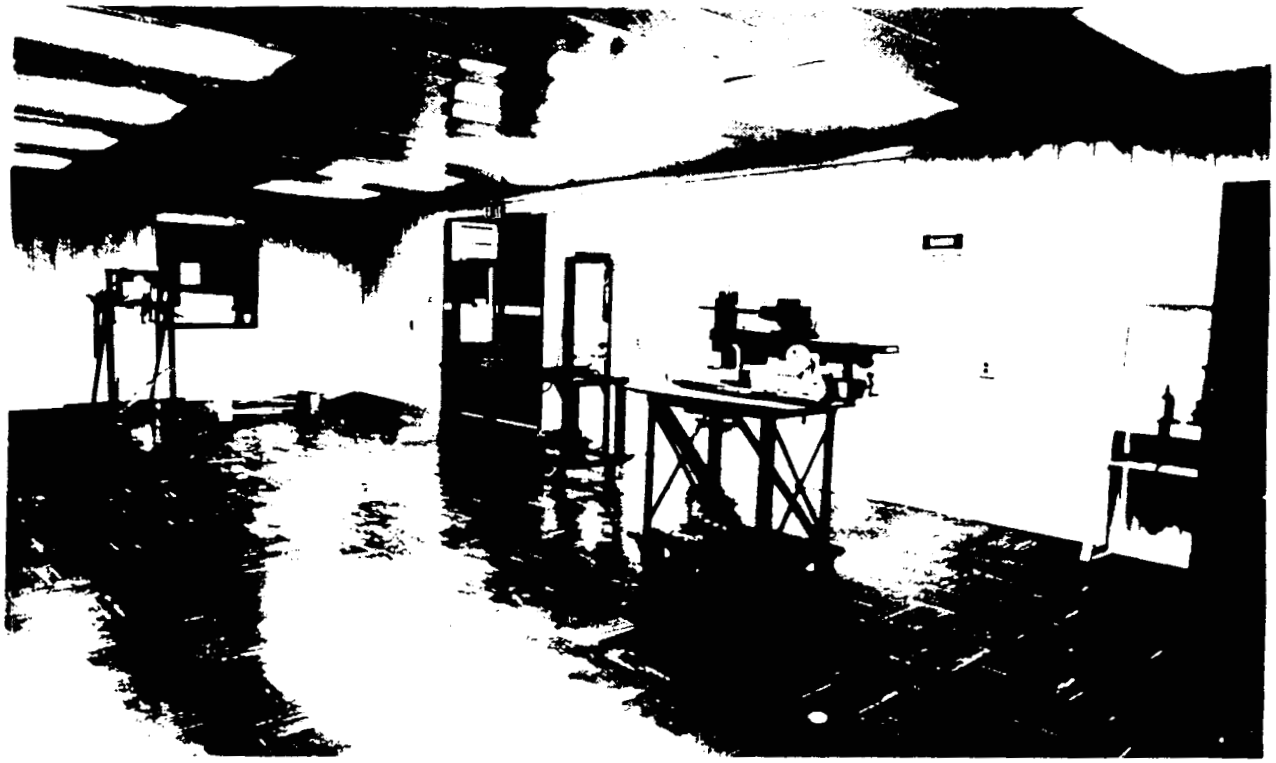
FOR OFFICIAL USE ONLY

OFFICE, BTRACS FACILITY, BLDG 3940

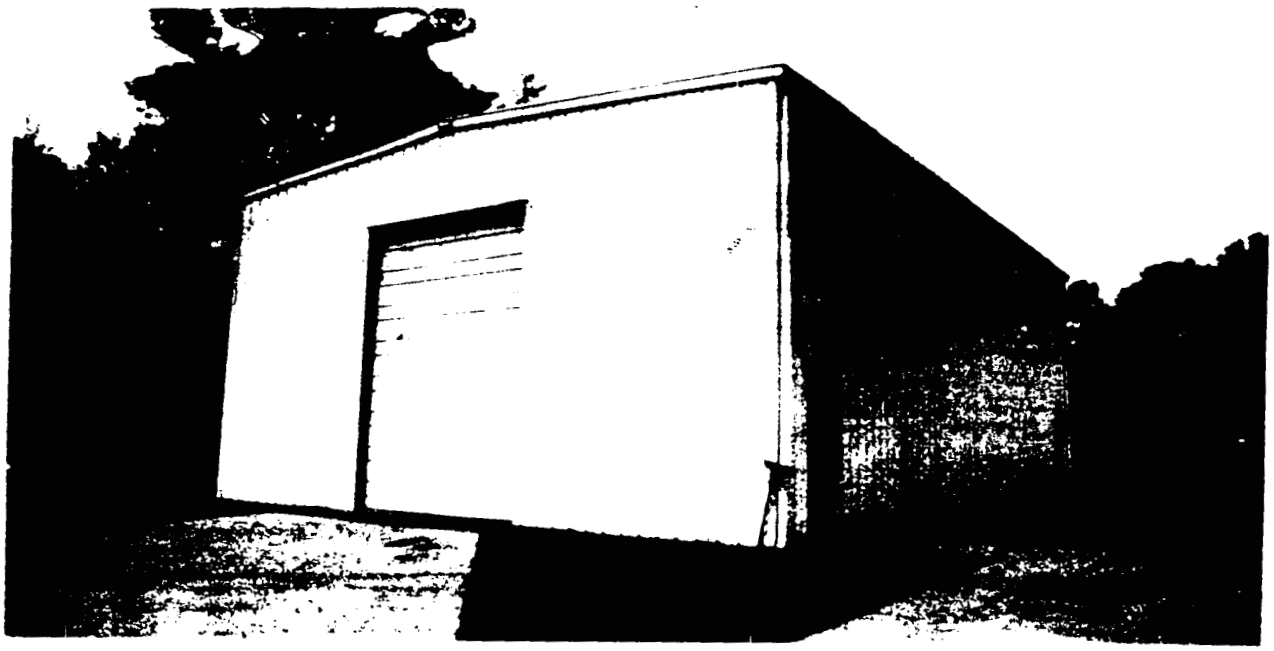


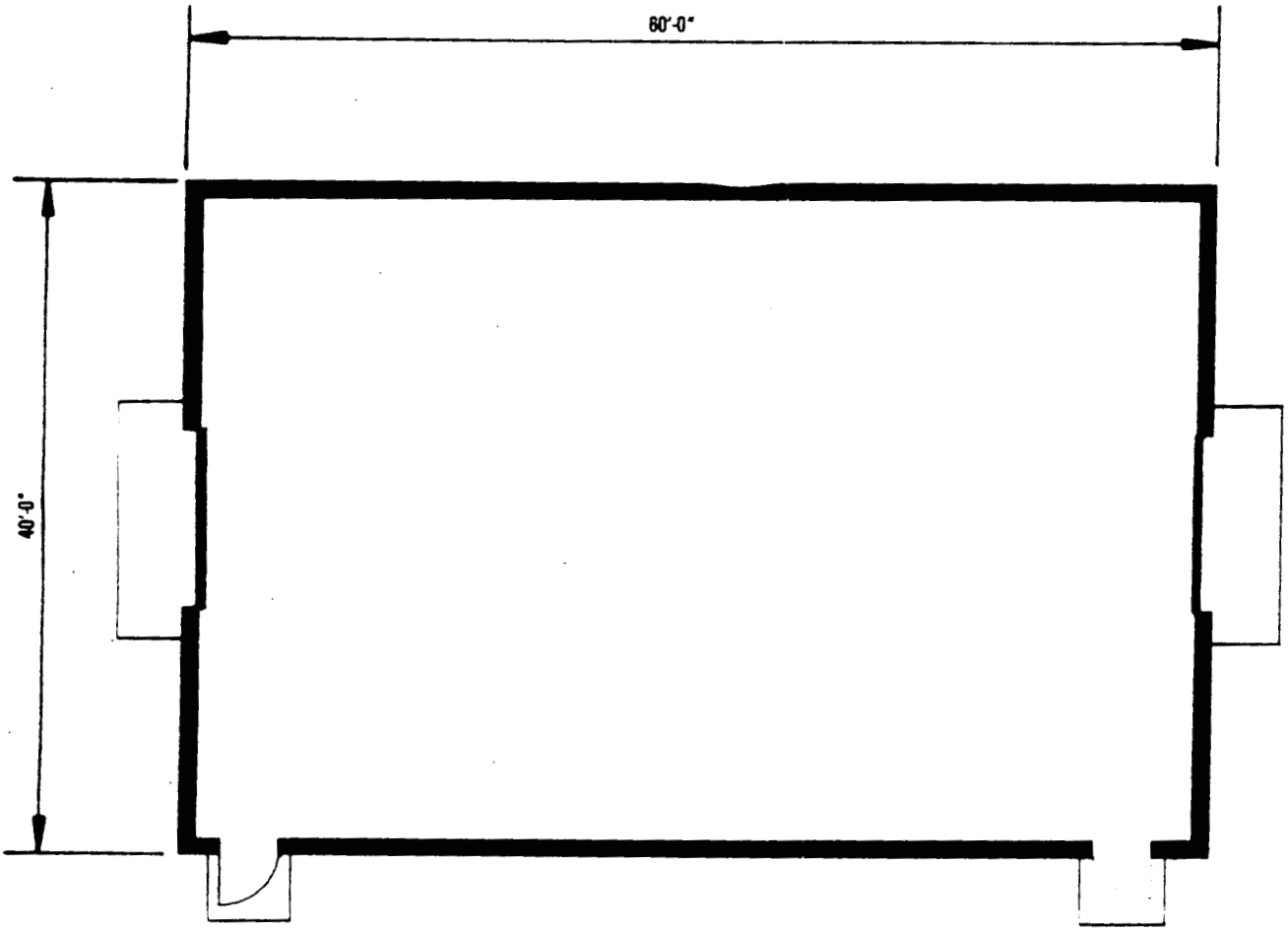
CONFERENCE AND OBSERVATION ROOM, BLDG 3940

CONTROL ROOM, BLDG 3940



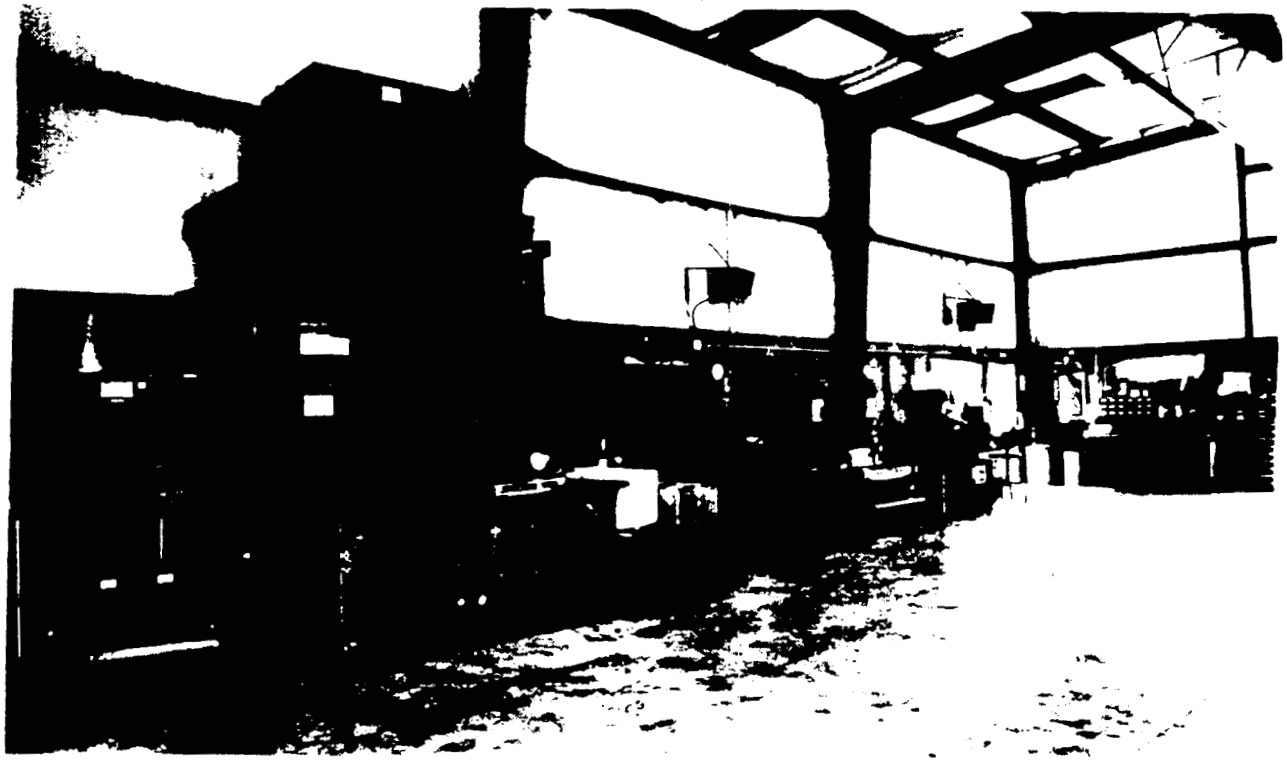
INDOOR RANGE FACILITY (SMALL CALIBER), BLDG 3940





FABRICATION & ASSEMBLY FACILITY #1
BLDG 3942 AREA: 2400 SQ FT

ASSEMBLY/STORAGE AREA, BLDG 3942



ASSEMBLY/STORAGE AREA, BLDG 3942

3.5.1.1 - 3.5.3

The U.S. Army Aviation Research, Development and Engineering Center (AVRDEC)- St. Louis is a tenant on a GSA owned industrial complex located within the City of St. Louis, Missouri. The U.S. Army Aviation and Troop Command (ATCOM), of which the AVRDEC is only one of three (3) Centers, currently leases 1,018,162 sq. ft. of office space on the complex with an average cost of $8.59/sq. ft.. HQ AMC pays an annual rent of approximately $10.2M for space, maintenance, and utilities. This is based only on a 40 hour operating week. Expenditures accumulated above this basis are paid by the ATCOM. In FY93, ATCOM paid an additional $1.7M in base operations. The AVRDEC currently does not bear any share of this cost differential. On the Federal Center complex, there is an additional 60 buildable acres and there is further expansion potential within existing buildings. Specifics would have to be addressed by the ATCOM and the GSA.

To summarize additional buildable acres at the outlying AVRDEC laboratories (provided in separate reports):

Aeroflightdynamics Directorate, NASA/Ames, Moffett Field, CA		10 acres
Aviation Applied Technology Directorate, Fort Eustis, VA		
	Installation	480 acres
	Adjacent to AATD existing facilities	14.2 acres

DEPARTMENT OF THE ARMY
U.S. ARMY EDGEWOOD RESEARCH, DEVELOPMENT AND ENGINEERING CENTER
ABERDEEN PROVING GROUND, MARYLAND 21010-5423

REPLY TO
ATTENTION OF

SCBRD-TD (70-1p) 14 SEP 1994

MEMORANDUM FOR Commander, U.S. Army Materiel Command, ATTN: AMCRD-IT (Jan Benskin), 5001 Eisenhower Avenue, Alexandria, VA 22333-0001

SUBJECT: Requests for Clairficationto the LICSG BRAC-95 Data Call

1. Reference memorandum, HQ, AMC, AMCRD-IT, 09 Sep 94, SAB.

2. Enclosed are four hardcopies and two disks of the revised ERDEC BRAC 95 data call. Only the information related to (Paras 3.2.4.2 and 3.3.1.2) was revised. I certify that the information is accurate and complete.

Encl
as

JOSEPH J. VERVIER
Acting Technical Director

USA EDGEWOOD RESEARCH, DEVELOPMENT
AND ENGINEERING CENTER

BASE REALIGNMENT AND CLOSURE COMMISSION
(BRAC) 95 DATA CALL #5
LABORATORIES

"OF ALL THE WEAPONS OF MASS DESTRUCTION, BIOLOGICAL WEAPONS WORRY ME THE MOST"

GENERAL COLIN POWELL
CHAIRMAN JOINT CHIEFS, FEBRUARY 1993

"THE ENEMY WILL CLOSE US DOWN ON EARLY ENTRY IF WE DON'T HAVE A MEANS TO PROTECT THE FORCE AGAINST WEAPONS OF MASS DESTRUCTION"

MG JAY M. GARNER
ASSISTANT DCS FOR FORCE DEVELOPMENT
MARCH 1994

"THE CRDEC (ERDEC) IS THE ONLY SOURCE OF TECHNOLOGY IN THE UNITED STATES TO DEAL WITH DETECTION-PROTECTION FOR THE WARRIOR IN CHEMICAL/BIOLOGICAL (C/B) WARFARE ENVIRONMENTS, WHICH IS AN ISSUE OF UTMOST IMPORTANCE."

ARMY SCIENCE BOARD
FINAL REPORT ON AMC RDEC'S MARCH 1993

2.1 Workload: Use the following table to describe historic and projected workload at each activity in terms of funding and workyears. Assume previous BRAC closures and realignments are implemented on schedule. Projected funding will be derived from FY95 President's Budget Submission (Then year dollars). Past fiscal year data shall begin with FY96 or at the inception of the activity as it exists on 1 Oct 93. (BRAC Criteria I & IV)

2.1 WORKLOAD

Information Required	Fiscal Years											
	86	87	88	89	90	91	92	93	94	95	96	97
Total Funds Programmed* ($M)								288	279	220	249	243
Total Actual Funds * ($M)								308	X	X	X	X
Programmed rkyears								1161	1020	980	990	1000
Actual Workyears								1161	X	X	X	X

* Excludes OMA which currently funds CBDCOM headquarters personnel. Includes customer funds and OPA funds executed by ERDEC teams.

Data is submitted starting with FY93 when ERDEC was formed concurrently with and subordinate to USACBDCOM. Comparison of data between ERDEC and the former CRDEC would be invalid. Data throughout is for ERDEC only.

2.2 Excess "Lab" Capacity - Measured at the DOD Component Level

- Excess "Lab" Capacity = Sum of the Peak Workyears - Sum of the Projected Workyears
- Peak at each activity = Highest value between FY86 (or since inception of organization) and FY93
- Projected at each activity = Estimated at FY97

Excess "Lab" Capacity = 1161 - 1000 = 161 workyears

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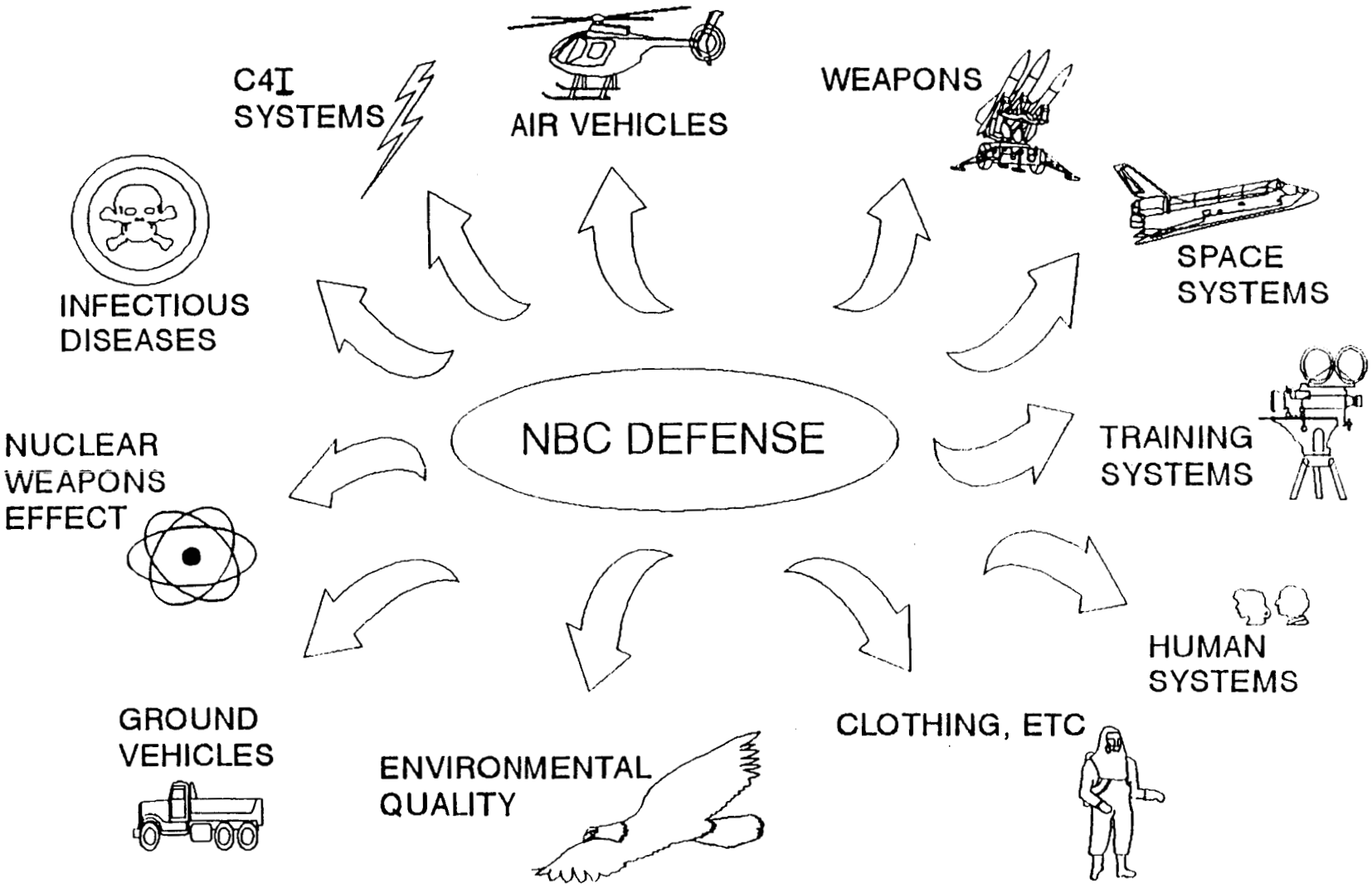
CONNECTIVITY OF COMMON SUPPORT FUNCTIONS



FOR OFFICIAL USE ONLY

NUCLEAR, BIOLOGICAL AND CHEMICAL (NBC) DEFENSE

o Mission: Describe the major capabilities at your activity contributing to the common support function in bulletized format. Describe any relationship and interconnectivity with other functions (common or otherwise) in support of the overall activity mission.

The ERDEC has two common support functions, product and pervasive NBC defense. Both are defined identically but are distinguished only as to the stages of research and development and application to a specific product. The basic and applied research done under pervasive NBC defense is increasingly affording opportunities to provide alternative technologies that also benfit other common support functions such as environmental quality. Because these two common support functions are highly integrated in the process of NBC defense some of the data provided here has not been artificially segregated (e.g., personnel, education, experience, location and facilities).

o Science and engineering facilities and personnel to execute the nuclear, biological and chemical defense research, development, engineering and acquisition program for the Army and joint services. (This includes smoke/obscurants, flame and less-than-lethal effects).

o Provides NBC survivability technology and engineering to joint services and their contractors

o Provides chemical agent standards and reference materials for government and industry

o Provides technical and engineering support to PMs and PEOs in the area of NBC defense.

o Interconnected with other common support functions as it relates primarily to NBC defense and survivability of air, ground and weapon systems. These common support functions include:

Air vehicles - as a part of the survivability of the air system and their crews

Weapons - as a part of the survivability of the weapon system
- smoke, flame and less-than-lethal technology for munitions and warheads

C4I - as a part of the detection and warning of CB materials

Space - as a platform for NBC sensors

NUCLEAR, BIOLOGICAL AND CHEMICAL (NBC) DEFENSE

5.0 Mission (cont'd)

Ground vehicles - as a part of the survivability of the ground vehicles and their crews and the NBC Reconnaissance System
- smoke systems for self-defense

Clothing etc. - as part of the survivability of soldiers in an NBC environment

Nuclear Weapons Effect - as it relates to detection nuclear radiation in a battlefield scenario

Human systems - as it relates to protecting personnel from NBC contamination and the effect of potential degradation in a contaminated environment

Infectious Diseases - as a biological detector may provide the first indication that infectious diseases may have been introduced on the battlefield
- Collaborative work with USAMRIID and exchange of antibodies

Training Systems - as NBC defense factors into the use of any military system in a potentially contaminated environment.

Environmental Quality - as it provides analytical capabilities to determine the nature and extent of chemical contamination and remediation technology for chemical decontamination and demilitarization

.1 Geographic/Climatological Features: Describe any ographic/climatological features in and around your activity hat are relevant to each CSF. Indicate and justify those that are required versus those that just serve to enhance accomplishing the mission of the activity.

The Edgewood RDE Center is located on the Edgewood peninsula of Aberdeen Proving Ground, Maryland. It has no special geographic/climatological features that are relevant to NBC defense.

2 Licenses and Permits: Describe and list licenses or permits (e.g., environmental, safety, etc.) that your activity currently holds and justify why they are required to allow tests, experiments, or other special capabilities at your location for each CSF. For example, permit to store and use high explosives. (BRAC Criteria I)

EXPLOSIVE LICENSING

Both AR 385-64, U.S. Army Explosive Safety Program, and DA PAM 385-64, Ammunition and Explosive Safety Standards, require the establishment of a explosive license for all explosive storage facilities. The U.S. Army Test & Evaluation Command (TECOM) has expanded the requirement to include all explosive facilities (excluding laboratories). The Q-D standards contained in DA PAM 385-64 form the basis of explosive licensing. The licenses are locally developed and approved. The licenses describe which explosive hazard classes and the quantity may be placed into the facility. Licenses are good until they are updated or rescinded. Installation and unit commanders are responsible for ensuring that ammunition and explosives are stored only in licensed location. Quantities will not exceed the amounts authorized on the license.

ERDEC EXPLOSIVE BUILDINGS

OPERATING BUILDINGS

MANUFACTURING/ASSEMBLY BUILDINGS

E-3580
E-5265
E-5050
E-1407
E-1410
E-2556
E-5830
DROP TOWER

EXPLOSIVE DISSEMINATION CHAMBERS

E-3370
E-3728
E-3566
E-3726
E-3724
E-3266

'LOSIVE ENVIRONMENTAL CONDITIONING CHAMBERS

E-3540
E-3542
E-3544
E-3546
E-3552
E-3570

EXPLOSIVE LAB

E-3300

STORAGE MAGAZINES

EARTH COVERED STORAGE

E-2630
E-2634
E-2638
E-2642
E-2646
E-2652
E-2654
E-2656
-5753

BOVE GROUND STORAGE

E-2310
E-2312
E-2314
E-2320
E-2322
E-2328
E-2330
E-2380
E-2390
E-2620

SERVICE MAGAZINES

E-3582
E-5269
E-3571
E-5265
CONEX BOXES AT E-3580 (1,2,3,4)

.2 Licenses and Permits (cont'd)

NUCLEAR REGULATORY COMMISSION (NRC) LICENSES
AT ERDEC

License: 19-10306-01, Broad Scope

Description: This license authorizes ERDEC to posses and use a wide variety of radionuclides for research, development and testing. The license is designed to allow unique RDT&E operations with prototype equipment, state-of-the-art hardware and advanced scientific applications.

Justification: Broad scope licenses are difficult to obtain from the NRC because they allow a great deal of freedom in selection of experiments and tests with radioactive material. In addition, this license has the unusual feature of permitting ERDEC personnel to perform (or directly supervise) RDT&E operations with radioactive material anywhere in the U.S.. The ERDEC mission requires the flexibility to use a wide variety of radioactive materials in chemical detection, microbiological detection, toxicology, non-destructive testing, and other scientific applications.

.ense: 19-00294-21

Description: This license authorizes ERDEC to possess and use a 10,000 Curie Cobalt-60 source. Cobalt-60 is the radionuclide of choice for irradiating materials because it has a very strong gamma photon and a relatively long half life (5.3 years). Gamma irradiation is used at ERDEC to kill microorganisms and to determine the effects of high energy radiation fields on various military unique chemicals. Future uses of gamma irradiation may include development of Army radiation detection and dosimetry devices at ERDEC (RADIAC Program).

Justification: ERDEC has a unique biological and chemical mission which requires the ability to render microorganisms non-viable before samples are removed from protective packaging.
Gamma irradiation is also needed to support the Center's chemical RDT&E mission in diverse battlefield conditions. In addition, gamma irradiation is an integral part of the research and development effort for the Army's RADIAC Program.

License: SUB 1142

Description: This license authorizes ERDEC to possess and use 950 kg of depleted uranium (primarily Uranium-238). ERDEC has a

2 Licenses and Permits (cont'd)

utron generator which is used to bombard military unique and super-toxic chemicals with high energy neutrons. This neutron bombardment simulates various nuclear battlefield conditions. Depleted uranium is needed to shield high energy neutron activation products.

Justification: This license is needed to support the Center's chemical RDT&E mission in a wide variety of battlefield conditions.

HAZARDOUS WASTE PERMIT

The installation holds a hazardous waste permit which includes one facility operated by ERDEC. Two additional facilities will be added in a permit modification currently underway. The Thermal Treatment Unit is currently licensed for treatment of corrosive and reactive hazardous waste. It is used to treat 3X solids and spent decontamination solutions to render them 5X. The application for modification of the permit includes storage of waste chemical surety materiel (CSM) at the Chemical Transfer Facility (CTF) and the N-Field storage facility as well as chemical treatment of Chemical Surety Material waste at the CTF.

ERDEC operates several 90 day hazardous waste storage cilities. Although a permit is not required for these facilities, the installation is required to report the locations of such facilities to the State of Maryland under the terms of a 1989 Consent Judgement. These facilities are located in buildings E2380, E5844, E5100, E3580, and E2188.

The following facilities are registered with the State of Maryland as air emission sources:

Building	Registered Source
E3160	Engine (static) and dispenser
E1434	Decontamination Test Facility
E3580	Pyrotechnic Processing Mixer
M-Field	Aircraft Engine
M-Field	Test Range
E3516	Plating Baths
E3525	Spray Paint Booth

3 Environmental Constraints: Describe and list the ironmental or land use constraints present at your activity ich limit or restrict your current scope for each CSF, i.e. would not allow increased "volume" or"spectrum" for the CSF. Example -- Volume; frequency of a type of detonation or storage of increased quantity of explosives without legal waiver (state law) or relocation of surrounding (non-govt) buildings. (BRAC Criteria II)

Wetlands. Some testing facilities owned by APG and operated by ERDEC are located near wetlands. Proper evaluation of the impacts of operations on the wetlands are performed and such evaluation would be required in order to expand operations. NEPA documentation routinely addresses potential impacts of proposed actions on wetlands.

Air Constraints. Maryland has had toxic air pollutant regulations since 1988. These regulations require that emissions of listed toxic air pollutants be quantified and that sources not meeting specified limits employ best available control technology. Initiating or expanding work using a listed toxic air pollutant may invoke the requirement to install best available control technology. Although Maryland was among the first to have an air toxics program, the reauthorized federal Clean Air Act is instituting a similar requirement which will ly to all states.

zardous Waste Management. ERDEC currently operates a licensed thermal treatment facility for treatment of 3X solids and spent decontamination solutions. The permit limits the use of the facility to corrosive and reactive hazardous wastes. Non-hazardous solid waste can also be treated there. Although the permit does not allow for treatment of other hazardous wastes, the installation's chemical waste disposal contractor has been able to arrange for disposal of a wide range of chemical waste including solutions with less than drinking water concentrations of agent and contaminated 3X material.

Water and Wastewater. Laboratory buildings at the Edgewood Area are serviced by a Federally Owned Treatment Works owned and operated by APG. It operates under a state issued National Pollution Discharge Elimination System (NPDES) permit. Because the plant has only primary and secondary treatment, many industrial wastestreams cannot be discharged without pretreatment, however, industrial wastewater which cannot be discharged to this plant has been shipped off post for disposal in a contractor owned industrial wastewater treatment plant.

.4 Special Support Infrastructure: List and describe the ortance of any mission related special support infrastructure .g. utilities) present at your location for your activity.

Infrastructure was considered to be utilities (water electricity, steam power, communication/data lines, sanitary sewer service) and roadways that would be necessary for human occupation of a military installation, regardless of the mission. While ERDEC has a significant number of unique facilities and equipment, their descriptions are included under paragraph 3.4.1. ERDEC has no special support infrastructure that is specifically mission related.

3.1.5 Proximity to Mission-Related Organizations: List and describe the importance and impact of not having nearby organizations which facilitate accomplishing or performing your mission -- e.g., operational units, FFRDCs, universities/colleges, other government organizations, and commercial activities. Restrict your response to the top five. Complete the following: (BRAC Criteria I)

3.1.5. PROXIMITY TO MISSION-RELATED ORGANIZATIONS

Common Support Functions	Name	Type of Organi-zation	Distance (miles)	Workyears Performed by Your Activity	Workyears Funded by Your Activity
#7,13 NBC	CBDCOM (HQ & TEU)	Gov't	0	6	104
#13 NBC	USACMDA	Gov't	0	7	0
#7,13 NBC	ARL-SLD	Gov't	0	14	12
#7,13 NBC	USAMRICD	Gov't	0	8	0
#7,13 NBC	APG CSTA	Gov't	0	7	0

1. USACBDCOM was created in FY93 to provide a central focal point for all non-medical aspects of the chemical and biological defense program. As such it is the major subordinate command (MSC) to which ERDEC reports. During FY93 and FY94 "institutional funding" for CBDCOM was not available and much of the cost was born by the ERDEC RDT&E program. There are major areas of infrastructure overlap and interdependency since CBDCOM and ERDEC were created out of the former CRDEC with no additional personnel. ERDEC receives its R&D procurement, business management, program analysis, legal, and management information support from CBDCOM. ERDEC and TEU need to be collocated since TEU is responsible for transporting agents/materials in and out of ERDEC and provide delivery to ERDEC contractors. Proximity to an airfield is essential. The Edgewood RDEC uses TEU to encase and move suspect munitions found on the APG Ranges that are used or have been used by ERDEC. TEU is part of the Emergency Response Team that is use in case of agent release or an accident in any of the center's labs.

2. During FY93 and FY94 ERDEC provided scientific and technical support to the USACMDA in a number of areas including investigation of alternatives to incineration for destruction of the chemical stockpile and in the development of methods to destroy non-stockpile materials. This support was a direct off-shoot of long-standing ERDEC expertise in chemical agent chemistry. The CBDCOM, CMDA and ERDEC create a synergy of operations which is not adequately expressed in the amounts of money which changed hands between the various organizations. It is

3.1.5 Proximity to Mission-Related Organizations (cont'd)

anticipated that the support to the USACMDA by ERDEC in FY95 and beyond will increase very substantially as USACMDA joins USACBDCOM in FY95.

3. The Survivability/Lethality Assessment Division of ARL has been assigned the mission of providing assessment of NBC survivability. This mission is accomplished with a group of analysts who, prior to FY93, were part of ERDEC modeling and simulation group. Those analysts are currently, and for the foreseeable future, collocated in the same building as the remainder of the ERDEC modeling and simulation group. They share common models, work on interlocking aspects of the same problems and coordinate their activities on a day-to-day, if not hour-to-hour basis. None of this is adequately reflected in the funding of one organization by the other since both are performing their own portion of the task using their own resources.

4. The US Army Medical Research Institute of Chemical Defense (MRICD) performs R&D on the prophylaxis and therapy portions of the chemical defense mission. As such it is very closely linked to the ERDEC program especially in the areas of life sciences, toxicology and agent chemistry; scientific papers are frequently published jointly by investigators in both organizations. ERDEC provides MRICD infrastructure support having to do with the conduct of chemical surety operations, to include the provision of certified reference materials. The prophylaxis and therapy portions of the Biological defense program are pursued by the US Army Medical Research and Development Command (MRDC) at Ft. Detrick, MD, only 70 miles away from ERDEC. MRDC is also the MSC to which MRICD reports.

5. APG Combat Systems Test Activity - The Edgewood Center is located on APG and we use the Combat System Test Activity test ranges on a daily basis. We have been assigned several ranges for which we only need notify the CSTA of what and when we are testing. These ranges are environmentally permitted for smoke and obscurant tests of both pyrotechnic grenades as well as large generators using IR and millimeter wave, and visual smoke. Chemical agent simulants are used to test point and standoff detectors and decontamination studies are carried out on these ranges. The Center maintains the Chemical Agent Stockpile of Mustard Agent for APG located in the Edgewood Area of the proving ground. The Center maintains the monitoring system at the site, performs the only inspection of the stockpile and any maintenance of agent containers.

3.2 Personnel: ERDEC Personnel Only

3.2.1 Total Personnel: What is the total number of government (military and civilian), on-site federally funded research and development center (FFRDC), and on-site system engineering technical assistance (SETA) personnel engaged in science and technology (S&T), engineering development and in-service engineering activities as of end FY93? For individuals that predominately work in CSFs, involved in more than one CSF, account for those individuals in the CSF that represents the preponderance of their effort. (BRAC Criteria I)

3.2.1. TOTAL PERSONNEL

Common Support Function "Product #7" NBC Defense

Types of Personnel	Number of Personnel			
	Government		On-Site FFRDC	On-Site SETA
	Civilian	Military		
Technical	758	22	0	50
Management (Supv)	38	1	0	1
Other	188	1	0	19

Common Support Function "Pervasive #13" NBC Defense

Types of Personnel	Number of Personnel			
	Government		On-Site FFRDC	On-Site SETA
	Civilian	Military		
Technical	112	9	0	5
Management (Supv)	5	0	0	0
Other	19	1	0	0

3.2.2 Education: What is the number of government personnel actively engaged in S&T, engineering development and in-service engineering activities by highest degree and type of position? Provide the data in the following table: (Brac Criteria I)

3.2.2 EDUCATION

Common Support Function "Product #7" NBC Defense

Type of Degree/Diploma	Number of Government Personnel by Type of Position		
	Technical	Management (Supv)	Other
High School or Less	194 (14)	3	165
Associates	47	0	16
Bachelor	410 (5)	20	7 (1)
Masters	100 (2)	12 (1)	1
Doctorate (include Med/Vet/etc.)	29	4	0

( ) = Number of military included.

Common Support Function "Pervasive #13" NBC Defense

Type of Degree/Diploma	Number of Government Personnel by Type of Position		
	Technical	Management (Supv)	Other
High School or Less	11 (2)	0	20 (1)
Associates	0	0	0
Bachelor	46 (5)	0	0
Masters	23 (3)	1	0
Doctorate (include Med/Vet/etc.)	41	4	0

( ) = Number of military included.

3.2.3 Experience: What is the experience level of government personnel? Fill in the number of government personnel in the appropriate boxes of the following table. (BRAC Criteria I)

3.2.3 EXPERIENCE

Common Support Function "Product #7" NBC Defense

	Years of Government and/or Military Service				
	Less than 3 years	3-10 years	11-15 years	16-20 years	More than 20 years
Technical	32	255 (11)	208 (5)	81 (4)	204 (1)
Management (Supv)	0	2	8	5	24 (1)
Total	32	257 (11)	216 (5)	86 (4)	228 (2)

( ) = Number of military included.

Common Support Function "Pervasive #13" NBC Defense

	Years of Government and/or Military Service				
	Less than 3 years	3-10 years	11-15 years	16-20 years	More than 20 years
Technical	14 (9)	23 (1)	35	10	39
Management (Supv)	0	1	0	1	3
Total	14 (9)	24 (1)	35	11	42

( ) = Number of military included.

.4 Accomplishments During FY91-93: For government personnel wer the following questions.

.2.4.1 How many patents were awarded and patent disclosures (only count disclosures with issued disclosure numbers) were made? (BRAC Criteria I)

CSF	DISCLOSURES	PATENTS AWARDED	PATENT TITLES
NBC-Product 7	31	21	Aerosol-Forming Pyrotechnic Composition
			Projected Grenade Simulator
			Method of Measuring the Efficiency of Gas Mask Filters Using Monodispersed Aerosols
			Method of Testing the Efficiency of Gas Mask Filters Using Monodispersed Aerosols (Patent I)
			Method for Testing the Efficiency of Gas Mask Filters Using Monodispersed Aerosols (Patent II)
			Method of Testing the Efficiency of Gas Mask Filters Using Poly-Alpha Olefin Aerosol Mixtures
			Short Scan Passive Infrared Remote Sensor
			Method of Measuring the Efficiency of Gas Mask Filters Respirators and other Personnel Protective Equipment
			Small Arms Ammunition
			Method for Measuring and Testing the Efficiency of Gas Mask Filters Using Monodispersed Aerosols

CSF	DISCLOSURES	AWARDED	PATENT TITLES
-Product 7			Composition (Pyrotechnic composition which produces a white a white smoke for use in military screening opn.)
			Method of Chemical Decontamination
			Compact High-Energy Auxiliary Power Method and Means
			Dispersible Smoke/Obscurant Forming Compositions
			Powered Scrub Brush
			Millimeter Wave Screening Cloud and Method
			Multilayer Protective Gas Mask
			Tank Alerting System
			Thermoluminescence Sensor for the Remote Detection of Chemical Agents and their Simulants
			Method of Measuring the efficiency of Gas Mask Filters Using Non-Toxic Mono Dispersed Aerosols
			Method for Mesuring the Efficiency of Gas Mask Filters

CSF	DISCLOSURES	AWARDED	PATENT TITLES
C-Pervasive 13	42	17	Biodegradation of 1,4-Dibenz-Oxazepine and Related Compounds
			Emulsifier Mixing Cell
			Detection of Sulfur Mustards Using Spectrofluorometry
			Crop Frost Protection by Jet-Dispersed Microencapsulated Aerosols
			Process for Replacement of Dioctyl Phthalate with Liquid Isostearic Acid in a Cold Smoke Automated Filter Tester
			Method for the Generation of Monodispersed Aerosols for Filter Testing
			Supersonic, Low-Drag, Solid Fuel Ramjet Tubular Projectile
			VX Adsorption From a Chlorofluorocarbon Solvent Using a Macroreticular Strong Acid Resin
			Composition For Use in Flares
			Anti-Fouling Connector For Electronically Detonated Munitions
			Method of Generating Mono Dispersed Aerosols for Non Destructive Gas Mask Filter Testing

CSF	DISCLOSURES	AWARDED	PATENT TITLES
C-Pervasive 13			Cell for Measuring Electrical Conductivity and Ion Content of Vapor
			Process of Making Carfentanil and Related Analgesics
			Method of Chemical Decontamination
			4-[1-(1-Naphthalenyl)-ethyl]-1H-imidazole
			Composition of Biologically Pure Cultures of Alcaligenes Denitrificans Denitrificans and a Porous Carrier Useful for Biodegradation
			Azimuth Determination Method

3.2.4.2 How many papers were published in peer reviewed journals? (BRAC Criteria I)

JOURNAL ARTICLES
FY91-93

CSF	JOURNAL	PAPER TITLES
NBC-Product 7	Journal of Microbiological Methods (Jan 1991)	Enzyme-Substrate Assay for the Qualitative Detection of Microorganisms by Ion Mobility Spectrometry
	Carbon (Oct 1991)	Spectroscopic Analysis and Performance of an Experimental Copper-Zinc Impregnated, Activated Carbon
	Journal of the IES (April 1991)	Design Consideration of Expander Heads for Vibration Testing .3. The Inverted Truncated Pyramid Expanding Head
	Analytical Letters (June 1991)	4,4'-Bis(Dimethylamino) Thiobenzophenone as a 2-Chloroethylethylsulfide Vapor-Sensing Coating for Optical Based Microsensors
	Analytical Letters (Jun 1991)	2-(Diphenylacetyl)-1,3-Indanedione-1-Hydrazone (Dipain) Derivatives for Detection of Trichothecene Mycotoxins
	Journal of the IES (March 1991)	Design Consideration of Expander Heads for Vibration Testing .2. Damping Equations for Square, Constant Thickness Expander Heads

CSF	JOURNAL	PAPER TITLES
NBC-Product 7	Journal of the IES (Feb 1991)	Design Consideration of Expander Heads for Vibration Systems .1. Natural Frequency Equations for Square, Constant Thickness Expander Heads
	Atmospheric Environment Part A-Gen Topics (May-Jun 1991)	Partitioning of Partially Soluble Volatiles Between the Vapor and Liquid Aerosol Phase
	Analytical Chemistry (Mar 1991)	Detection of Bacteria by Ion Mobility Spectrometry
	Aerosol Science & Technology (Feb 1991)	Some Candidate Replacement Materials for Dioctyl Phthalate in Hot Smoke Aerosol Penetrometer Machines
	Carbon (Jan 1991)	Effects of Environmental Weathering on the Properties of ASC-Whetlerite
	Applied Optics (Nov 1990)	Infrared Detection of Liquids on Terrestrial Surfaces
	Biosensors and Bioelectronics (1991)	Pharmacological Specificity of a Nicotinic Acetylcholine Receptor Optical Sensor
	Applied Optics (Oct 1990)	Chemical Ionization Fourier-Transform Mass-Spectrometry of Chemical Warfare Agent Simulants Using Laser-Produced Metal-Ions

CSF	JOURNAL	PAPER TITLES
NBC-Pervasive 13	Thermochemica Acta (Dec 1993)	Subambient Applications of Differential Thermal-Analysis for the Determination of Vapor-Pressure
	Journal of Soil Contamination (1993)	Controlled Environment Soil-Core Microcosm Unit for Investigating Fate, Migration, and Transformation of Chemicals in Soils
	Applied and Environmental Microbiology (1993)	Purification and Properties of a Highly-Active Organophosphorus Acid Anhydrolase from Alteromonas-Undina
	Chemical Physics Letters (Oct 1992)	Polarization of the Nucleic-Acid Bases in Aqueous-Solution
	Chemico-Biological Interactions (1993)	Screening of Halophilic Bacteria and Alteromonas Species for Organosphophorus Hydrolyzing Enzyme-Activity
	Journal of the Chemical Society - Perkin Transaction II (1993)	A Conformational Analysis of Sulfur Mustard from Molecular Mechanics, Semiempirical and Ab Initio Methods
	Journal of the Chemical Society - Perkin Transaction II (1993)	Using Theoretical Descriptors in Quantitative Structure-Activity-Relationships - Gas-Phase Acidity
	Organic Mass Spectrometry (1993)	Determination of Collision-Induced Dissociation Mechanisms and Cross-Sections in Organophosphorus Compounds by Atmospheric-Pressure Ionization Tandem Mass-Spectrometry

CSF	JOURNAL	PAPER TITLES
NBC-Product 7	Analytical Chemistry (Oct 1990)	Characterization of Underivatized Lipid Biomarkers from Microorganisms with Pyrolysis Short-Column Gas Chromatography/ Ion Trap Mass Spectrometry
	Aquatic Toxicology and Environmental Fate (Oct 1990)	Biodegradation and Reduction in Aquatic Toxicity of the Persistent Riot Control Material 1,4-Dibenz-Oxazepine
	Chemical Reviews (Dec 1992)	Decontamination of Chemical Warfare Agents
	Journal of the IES (Jul-Aug 1992)	Methodology for Developing a Combined Environmental-Stress Schedule for Reliability Growth Testing .3. Designing a Reliability Test Schedule with Combined Environmental Schedules
	Analytical Instrumentation (Dec 1992)	Measurement of a Michelson Interferometer Mirror Velocity
	AIAA Journal (Nov 1992)	Correlation of Mean Velocity-Measurements Downstream of a Swept Backward-Facing Step
	Catalysis Today (Jan 1992)	Deactivation of a PT/AL203 Catalyst During the Oxidation of Hexafluoropropylene
	International Journal of Environmental Analytical Chemistry (April 1992)	Method for Screening and Analysis of Residues Common to Munition Open Burning/ Open Detonation (OB/OD) Sites
	Journal of the IES (Jul-Aug 1992)	Methodology of Developing a Combined Environmental-Stress Schedule for Reliability Growth Testing .2. The Tracked Vehicle Vibration Environment

CSF	JOURNAL	PAPER TITLES
NBC-Product 7	Journal of the IES (Jul-Aug 1992)	Methodology of Developing a Combined Environmental-Stress Schedule for Reliability Growth Testing .1. Determining the Environmental Stresses from an Operational Mode Summary Mission Profile (OMS/MP)
	Chemical Reviews (Dec 1993)	Decontamination of Chemical Warfare Agents
	Journal of Molecular Catalysis (Apr 1992)	Solid-State P-31 MAS NMR-Study of the Distribution and Reaction of Organo-Phosphorus Esters Adsorbed on Synthetic Resin Catalysts
	American Industrial Hygiene Association Journal (March 1992)	Respirator Performance Rating Table for Mask Design
	Journal of Fundamental and Applied Toxicology (1992)	Recommendation for the Conduct of Acute Inhalation Limit Tests
	Respiration Physiology (Nov 1992)	Effects of Exercise Modality on Patterns of Ventilation and Respiratory Timing
	Biosensors and Bio-electronics (1993)	Detection of Sub-Nanogram Quantities of Mojave Toxin via Enzyme-Immunoassay with Ligand Addressable Potentiometric Detector
	Journal of Cellular Biochemistry (1993)	Biochemical Demilitarization of Chemical Warfare Agents
	Carbon (1993)	Influence of Acetoacetamide on the Chemisorption of Cyano-Containing Vapors of Whetlerites

CSF	JOURNAL	PAPER TITLES
NBC-Product 7	American Biotechnology Laboratory News (1993)	Spectroscopic Identification of the Atypical Metabolites Obtained from Hydrogen Peroxide Oxidation 2-Chloroethyl Sulfides, Use of Peroxides for Decontamination of Blister-Causing Sulfides
	Journal of Agriculture & Food Chemistry (Jan 1993)	Rapid Detection of Anti-cholinesterase Insecticides by a Reusable Light Addressable Potentiometric Sensor
	Analytical Chemistry (1993)	Portable Hand-Held Gas-Chromatography Ion Mobility Spectrometry Device
	American Laboratory (Oct 1992)	Portable Hand-Held Gas-Chromatography Ion Mobility Spectrometry Device
	Journal of Cellular Biochemistry (March 1993)	Biosensors for Monitoring Chemical-Pollutants in the Environment
	Recent Advances in Toxicology (Oct 1992)	Detection of Botulinum Toxin Using an Evanescent Wave Immunosensor
	Biosensor Design and Application (Nov 1992)	Fiber Optic Biosensors Based on Total Internal Reflection Fluorescent
	Biosensors and Bio-electronics (Feb 1993)	Detection of Sub-Nanogram Quantities of Mojave Toxin Via Enzyme Immunoassay with Light Addressable Potentiometric Detector

JOURNAL ARTICLES
FY91-93

CSF	JOURNAL	PAPER TITLES
NBC-Pervasive 13	Journal of Fluorine Chemistry (Dec 1991)	Some New Chemistry of Perfluoro-Tert-Butylsilver
	Quantitative Structure-Activity Relationships (Dec 1991)	Using Theoretical Descriptors in Quantitative Structure-Activity-Relationships - Comparison with the Molecular Transform
	Organic Mass Spectrometry (Dec 1991)	Characterization of Cyclotetramethylene-tranitramine (HMX) Thermal-Degradation by Isotope Analyses with Analytical Pyrolysis Atmospheric-Pressure Ionization Tandem Mass-Spectrometry
	Carbon (Oct-Dec 1991)	Influence of Moisture-Content on the Breakthrough Behavior of Perfluoroisobutene
	Theochem-Journal of Molecular Structure (Oct 1991)	Calculation of the Electronic-Structures and Spectra of Several Organic and Inorganic Radicals Containing Aluminum
	Chemometrics and Intelligent Laboratory Systems (Oct 1991)	Interactive Self-Modeling Multivariate-Analysis of Thermolysis Mass-Spectra
	Journal of Molecular Spectroscopy (Nov 1991)	Theoretical Prediction of Geometries and Vibrational Infrared-Spectra of Ruthenium Oxide Molecules
	Journal of the American Chemical Society (Nov 1991)	Molecular-Orbital Theory Calculations of Aqueous Solvation Effects on Chemical-Equilibria

CSF	JOURNAL	PAPER TITLES
NBC-Pervasive 13	Journal of the American Chemical Society (Oct 1991)	General Parameterized SCF Model for Free-Energies of Solvation In Aqueous-Solution
	Journal of Colloid and Interface Science (Nov 1991)	Determination of the Activity of 2-Propanol In Dibutylphthalate From Single Droplet Absorption Studies
	Solid State Ionics (Jan 1991)	Variable Temperature I-127 MAS NMR of Beta-AGI - Sensitivity of the I-127 MAS Linewidth to AG+ Diffusion
	Journal of RAMAN Spectroscopy (Aug 1991)	Vibrational-Spectra and Assignments of Diethyl Sulfide, 2-Chlorodiethyl Sulfide and 2,2'-Dichlorodiethyl Sulfide
	Journal of Organic Chemistry (Aug 1991)	Dependence of Isotropic Hyperfine Coupling in the Fluoromethyl Radical Series on Inversion Angle
	Colloids and Surfaces (May 1991)	Electrochemistry of Solutes in Microemulsions - Electrostatically Bound Aqueous Ions, Surfactant-Like Ions and Oil Soluble Molecules
	Journal of Molecular Catalysis (June 1991)	Soman Hydrolysis Catalyzed By Hepes Buffer
	Journal of the American Chemical Society (March 1991)	The Fluorophosphoranyl Series - Theoretical Insights into Relative Stabilities and Localization of Spin
	Journal of Bacteriology (March 1991)	Purification and Properties of an Organophosphorus Acid Anhydrase From a Halophilic Bacterial Isolate

CSF	JOURNAL	PAPER TITLES
NBC-Pervasive 13	Journal of Fluorine Chemistry (Feb 1991)	Decomposition of Phosphonofluoridates on Glass
	Theochem-Journal of Molecular Structure (Mar-Apr 1991)	Theoretical Prediction of Structures and Infrared Frequencies .2. Alcohols and Ethers
	AICHE Journal - American Institute of Chemical Engineers (Feb 1991)	Critical Transport Velocity in 2-Phase, Horizontal Pipe-Flow
	International Journal of Quantum Chemistry (Jan 1991)	Calculations Using a Set of Evenly Spaced S-Type Gaussian Functions
	Journal of Chemical Physics (Jan 1991)	Abinitio Study of the Electronic Magnetic Circular-Dichroism Spectrum in Acetylene - The B)-X and 1 1B2)-X Transitions
	Molecular Reproduction and Development (Jan 1991)	The Binding Characteristics of Cholinergic Sites in Rabbit Spermatozoa
	Journal of Applied Physics (Oct 1990)	Steady State Temperature of an Evaporating Water Droplet with a Monolayer Coating
	Journal of Chemical Physics Research (Dec 1990)	Accelerated Drying of Moistened Porous Substrates in Electric Fields
	Experimental Eye Research (1990)	Partial Characterization of High Affinity [Ca2+Mg2+]-Dependent Adenosinetriphosphatase from Bovine Retina

CSF	JOURNAL	PAPER TITLES
NBC-Pervasive 13	Journal of Soil Science Society (May 1991)	Anion Effects on Potassium in Variable Charge Atlantic Coastal Plain Soils
	International Journal of Quantum Chemistry (Nov 1991)	The Integrated Molecular Transform as a Correlation Parameter
	Journal of the American Chemical Society (Nov 1990)	Theoretical Rotation, Pseudorotation, and Pseudoinversion Barriers for the Hydroxyphosphoranyl Radical
	Atmospheric Environment (1991)	Wind Tunnel Measurements of Line Integrated Concentrations
	Agron Abstracts (Oct 1990)	Fate of Munition Residues in Sandy Loam Soil
	Global Environmental Issues: Challenge for the 90's (Oct 1990)	Migration of Munition Residues in Sandy Loam Soil
	Global Environmental Issues: Challenge for the 90's (Oct 1990)	Toxicology of Selected Chemical Mixtures on Cucumber Plants and Earthworms
	Tetrahedron Letters (Oct 1990)	Intramolecular [4+2] - Cycloadditions of Nitroalkenes with Olefins, 2
	Synthesis Communications (Oct 1990)	Dehydrogenation of Imidazolines to Imidazoles with Pd-C
	Thermochimica Acta (Dec 1992)	High-Temperature Thermal-Analysis of a Pyronol Composition
	Thermochimica Acta (Dec 1992)	Subambient Applications of Differential Thermal-Analysis for the Determination of Vapor-Pressure

CSF	JOURNAL	PAPER TITLES
NBC-Pervasive 13	Journal of Computer-Aided Molecular Design (Dec 1992)	AM1-SM2 and PM3-SM3 Parameterized SCF Solvation Models for Free-Energies in Aqueous-Solution
	Journal of Pharmaceutical Sciences (Dec 1992)	Synthesis and Anticholinesterase Activity of New Bispyridinium Compounds
	International Journal of Quantum Chemistry (1992)	Molecular Transform Quantization of Enzyme Surface Probes
	Carbon (1992)	Water Isotherm Measurements for Microparticles of Carbon
	Journal of Fluorine Chemistry (Oct 1992)	Simultaneous Scission of C-S and S-S Bonds of Bis(Trifluoromethyl) Trisulfide by Grignard-Reagents
	Journal of the American Chemical Society (Nov 1992)	What Causes Aqueous Acceleration of the Claisen Rearrangement
	Molecular Reproduction and Development (Nov 1992)	Automated-Analysis of Rabbit Sperm Motility and the Effect of Chemicals on Sperm Motion Parameters
	Journal of American Chemical Society (Oct 1992)	A Computational Study of Solvent Effects on the Conformation of Dopamine
	Journal of the American Chemical Society (Sep 1992)	Comparison of MNDO, AM1 and PM3 Rotational Barriers in Branched Alkanes
	Journal of Physical Organic Chemistry (Jul 1992)	Evaporation Kinetics of Ventilated Waterdrops Coated with Octadecanol Monolayers

CSF	JOURNAL	PAPER TITLES
NBC-Pervasive 13	Journal of Physical Organic Chemistry (Jul 1992)	Using Theoretical Descriptors in Quantitative Structure-Activity-Relationships - Some Physicochemical Properties
	Quantitative Structure-Activity Relationships (June 1992)	Descriptors in Quantitative Structure-Activity-Relationships - Opiate Receptor Activity by Fentanyl-like Compounds
	Journal of Plant Nutrition (Jun-Jul 1992)	A Recirculating Resin-buffered Hydroponic System for Controlling Nutrient Ion Activities
	Journal of Clean Technology and Environmental Sciences (Apr-Jun 1992)	Review of Pesticides - Chemistry, Uses and Toxicology
	Phosphorus, Sulfur and Silicon and the Related Elements (May 1992)	Formation of Sulfoxide Dimers from Hydrogen-Peroxide Oxidation of 2-Chloroethyl Methyl Sulfide and 2-Chloroethyl Ethyl Sulfide
	Tetrahedron Letters (March 1992)	Arylnitrenium and Alkylnitrenium Ions - Singlet-Triplet Gaps Via Abinitio and Semiempirical Methods
	Applied Optics (March 1991)	Determination of Alcohol Partial Molar Volumes from Single-Droplet Gravimetric and Optical Resonance Data
	Cytometry (Feb 1992)	Invivo Measure of Average Bacterial-Cell Size from a Polarized-Light Scattering Function

CSF	JOURNAL	PAPER TITLES
NBC-Pervasive 13	Journal of Atmospheric and Terrestrial Physics (Feb 1992)	Enhanced Drying Rates of Wetted Materials in Electric Field
	Environmental Pollution (1993)	A Novel Method for the Measurement of the Evaporation of Contaminant Liquids from Sand
	Science (Apr 1992)	An SCF Solvation Model for the Hydrophobic Effect and Absolute Free-Energies of Aqueous Solvation
	Journal of Molecular Catalysis (1993)	Characterization of the Molecular-Exchange Process Observed for Dimethyl Methylphosphonate Absorbed on a Sorptive Reactive Resin Mixture by P-31 Magnetization - Transfer and 2-D Exchange MAS NMR
	Computers and Chemistry (1993)	Estimating Physical-Properties of Chemical Compounds - Problem Revisited
	Applied Spectroscopy (1993)	Variability of Steady-State Bacterial Fluorescence with Respect to Growth Conditions
	Optic Letters (1993)	Photon-Correlation Spectroscopy for Small Spherical Inclusions in a Micrometer-Sized Electrodynamically Levitated Droplet

CSF	JOURNAL	PAPER TITLES
NBC-Pervasive 13	Thermochemica Acta (Dec 1993)	Subambient Applications of Differential Thermal-Analysis for the Determination of Vapor-Pressure
	Journal of Soil Contamination (1993)	Controlled Environment Soil-Core Microcosm Unit for Investigating Fate, Migration, and Transformation of Chemicals in Soils
	Applied and Environmental Microbiology (1993)	Purification and Properties of a Highly-Active Organophosphorus Acid Anhydrolase from Alteromonas-Undina
	Chemical Physics Letters (Oct 1992)	Polarization of the Nucleic-Acid Bases in Aqueous-Solution
	Chemico-Biological Interactions (1993)	Screening of Halophilic Bacteria and Alteromonas Species for Organosphophorus Hydrolyzing Enzyme-Activity
	Journal of the Chemical Society - Perkin Transaction II (1993)	A Conformational Analysis of Sulfur Mustard from Molecular Mechanics, Semiempirical and Ab Initio Methods
	Journal of the Chemical Society - Perkin Transaction II (1993)	Using Theoretical Descriptors in Quantitative Structure-Activity-Relationships - Gas-Phase Acidity
	Organic Mass Spectrometry (1993)	Determination of Collision-Induced Dissociation Mechanisms and Cross-Sections in Organophosphorus Compounds by Atmospheric-Pressure Ionization Tandem Mass-Spectrometry

CSF	JOURNAL	PAPER TITLES
NBC-Pervasive 13	International Journal of Quantum Chemistry (1993)	The Inverse Molecular Transform Index: A Descriptor for Molecular Similarity Analysis
	Journal of Fluorine Chemistry (1993)	Exchange-Reactions of Organotin and Organosilicon Compounds with Vinylic Fluorine
	Environmental Pollution (1993)	A Novel Method for Measuring the Evaporation of Contaminant Liquids from Sands
	Biosensors and Bioelectronics	Determination of Free Calcium
	Journal of Computational Chemistry (1993)	Conformational Dependence of the Electrostatic Potential-Derived Charges of Dopamine - Ramifications in Molecular Mechanics Force-Field Calculations in the Gas-Phase and in Aqueous-Solution
	Microchemical Journal (June 1993)	DNA-DNA Hybridization in Real Time Using BIAcore
	Molecular Reproduction & Development (Nov 1992)	Automated-Analysis of Rabbit Sperm Motility and the Effect of Chemicals on Sperm Motion Parameters
	Phosphorus, Sulfur and Silicon and the Related Elements (July 1993)	Theoretical Predictions of the Structure and Vibrational Infrared Frequencies of 2,2'-Dichlorodiethyl Sulfide and Hydrolysis Products
	Journal of Computational Chemistry (May 1993)	Evaluation of One-Electron Integrals for Arbitrary Operators V(r) Over Cartesian Gaussians: Application to Inverse-Square Distance and Yukawa Operators

3.3.1 FY93 Workload

3.3.1.1 Work Year and Lifecycle: Identify the number of actual workyears executed for each applicable CSF in FY93 for each of the following: government civilian, military on-site FFRDCs and on-site SETAs. (BRAC Criteria I)

3.3.1.1 WORK YEAR AND LIFECYCLE

Common Support Function "Product #7" NBC Defense

ERDEC	Fiscal Year 1993 Actual			
	Civilian	Military	FFRDC	SETA
Science and Technology	277	0	0	51
Engineering Development	441	23	0	0
In-Service Engineering	279	0	0	0

Common Support Function "Pervasive #13" NBC Defense

ERDEC	Fiscal Year 1993 Actual			
	Civilian	Military	FFRDC	SETA
Science and Technology	164	9	0	5
Engineering Development	0	0	0	0
In-Service Engineering	0	0	0	0

3.3.1.2 Engineering Development By ACAT: For each Common Support Function (e.g. Airborne C41) at each activity engaged in ineering development provide:

For each ACAT IC, ID, and II program (as defined in DODI 5000.2):
- The name of the program
- A brief program description
- For each ACAT III and IV programs:
- The number of such programs
- A list of program names
- For each program not an ACAT I, II, III, IV.
- The number of such programs
- A list of program names

- For the purpose of this question, any program between Milestone I and IV and containing demonstration and validation (Dem/Val 6.4)/Engineering and Manufacturing Development (EMD 6.5) funds in the FY95 PBS is considered to be engaged in engineering development (BRAC Criteria I).

Engineering Development	Name or Number	Workyears (FY93 Actual)	FY93 Funds Received (Oblig Auth)	Narrative
ACAT IC	0			
ACAT ID	0			
ACAT II	0			
ACAT III/IV	9	25	13.4M	Recon System, FOX
		27	5.1	Mask, CB Aircrew
		53	11.3	BIDS (formerly BC*
		0	0.0	XM58 Carrier Mech Smk*
		14	6.4	Adv Integrated Coll Prot Sys*
		25	3.1	Modular Decon*
		4	2.1	XM81 CVDOS*
		0	0	LVOSS*
		0	0.0	CB Mass Spectrometer*
		17	9.4	Multipurpose Integrated Chem Agent Detector (MICAD) FY94/96 Funds*

*Addition to list (dated April 1993) are those contained in FY95 PBS.

?.3.1.3 In-Service Engineering: For each Common Support nction at each activity engaged in in-service engineering, ist the in-service engineering efforts, the FY93 funds (from ll sources) obligated for these efforts, the FY93 workyears of these efforts, and the weapon system(s) supported by these efforts. In-service engineering consists of all engineering support of fielded and/or out of production systems and include efforts to improve cost, throughout, and schedule to support customer requirements as well as mods and upgrades for reliability, maintainability, and performance enhancements. (BRAC Criteria I) Dollars shown in Thousands.

Common Support Functions	In-Service Engineering Efforts (list)	FY93 Actual		Weapon System(s) Supported
		Funds Rcvd (Oblig. Auth)	Workyears	
PROD #7 NBCDEF	MMT	588	5	Manufacture Methods & Tech
	Engr Spt in/out Prod.			
	M12A1 Decon	57	1	M12A1 Decon
	NBC Recon, XM93	2264	13	XM93 NBC Recon
	XM21 RSCAAL	1979	15	M21 Remote Sensing Cml Agt Alarm
	M40/M42 Mask	3042	25	M40/M42 NBC Prot Mask
	ARMS Control	225	2	Treaty Verification/Compliance
	PMFVS	339	3	Protective Mask Fit Validation System
	CAM/ICAM	2266	16	Contamination Monitor/Impr
	M20	401	3	M20 Simplified CP
	Grenades	941	5	Various
	Smk Pots	600	3	Various
	M43A1 Mask	596	5	M43A1 Aircraft Mask
	M17A3 Decon	1016	9	M17A3 Lightweight Decon
	M825 Smk Proj	138	1	M825 Smoke Projectile
	Army Stock Fund	13247	124	Various
	Other	600	49	Various
	TOTAL	28002	279	RDTE/OPA/OMA

3.3.2 Projected Funding

3.3.2.1 Direct Funding: For each applicable CSF, identify direct mission funding by appropriation from FY94 to FY97. Use FY95 PBS for FY95-FY97. (BRAC Criteria 1).

3.3.2.1 DIRECT FUNDING ($M)

CSF	FY94	FY95	FY96	FY97
NBC (#7) R&D	128	57	60	69
NBC(#7) OMA	7	89	4	4
NBC(#7) OPA	74	8	124	105
NBC(#13) R&D	23	17	13	14
Total	232	171	201	192

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3.3.2.2 Other Obligation Authority: For each applicable CSF, identify reimbursable and direct-cite funding (other obligation authority expected) from FY94 to FY97. Funding allocation must be traceable to FY95 PBS. (BRAC Criteria I)

DOLLARS SHOWN IN MILLIONS

CSF	FY94	FY95	FY96	FY97
NBC-Product 7	47	49	48	51
NBC-Pervasive 13	54	87	85	90

NOTE: No Direct Cite Funding Identifiable.

3.4 Facilities and Equipment

3.4.1 Major Facilities and Equipment: Describe major facilities and equipment necessary to support each Common Support Function (include SCIFs). If the facilities and equipment are shared with other functions, identify those functions and the percentage of total time used by each of the functions. Provide labeled photographs that picture the breadth and scope of the equipment and facilities described. If it is unique to DOD, to the Federal Government, or to the US, describe why it is unique. Insert the replacement cost. For this exercise, Replacement cost = (Initial cost + capital investment) multiplied by the inflation factor for the original year of construction. (BRAC Criteria II)

* Photo included.

Common Support Function	Major Facility or Equipment Description	Unique To: DOD	FED GOVT	US	Replacement Cost ($K)	
NBC Defense	Super Toxic Facility E3300*	X	X	X	17,297	Y
NBC Defense	Nuclear Magnetic Resonance, E3300*	X	X	X	1,500	Q
NBC Defense	Design Evaluation Lab E3510*	X	X	X	8,810	Y
NBC Defense	Chemical Evaluation Lab E5100*	X	X	X	11,661	Y
NBC Defense	Chemical Transfer Facility, E3832*	X	X	X	3,411	U
NBC Defense	Process Engineering Facility, E3835*	X	X		20,000	E
NBC Defense	Biopolymer/Tandem Mass Spectrometer E3835*	X	X		3,500	Q
NBC Defense	Chemical Biological Defense Berger Lab, E3549*	X			38,870	E
NBC Defense	Decontamination/Detoxification Facility, E3946*	X	X	X	2,705	U

Common Support Function	Major Facility or Equipment Description	Unique To: DOD	FED GOVT	US	Replacement Cost ($K)	
NBC Defense	Explosive Test Chamber, E3566*	X	X	X	15,000	Z
NBC Defense	Toxic Dissemination Test Chamber, E3726	X	X	X	8,500	Z
NBC Defense	Inhalation Toxicology Laboratories*	X	X	X	22,820	Z
NBC Defense	Pyrotechnics Buildg, E3580*	X			3,083	
NBC Defense	Advanced Protective System Integration Lab, E5604	X	X	X	3,910	
NBC Defense	Laser Spectroscopy Laboratory*	X			3,016	Q
NBC Defense	Rapid Prototyping Processing/Lithography Equipment, E3514*	X			1,500	Q
NBC Defense	Rubber Lab, E3500*	X	X		607	Q
NBC Defense	Molecular Modeling Facility*	X			1,500	Q
NBC Defense	Microland*	X			2,863	Q
NBC Defense	Experimental Fabrication Fac., E3516*	X			14,605	E
NBC Defense	Vertical and Transonic Wind Tunnels	X			2,350	
NBC Defense	Aquatic Tox Lab*	X			900	Q
NBC Defense	Life Sciences Research Facility*	X	X		33,000	A

Common Support Function	Major Facility or Equipment Description	Unique To: DOD	FED GOVT	US	Replacement Cost ($K)	
NBC Defense	Catalyst/Adsorbent Evaluation Lab	X			3,248	Y,E
NBC Defense	Nephelometry Lab/ Single Particle Laboratory	X			2,500	Q
NBC Defense	DMMP Simulation Charcoal/Filter Testing Equipment, E5165	X	X	X	500	Q
NBC Defense	Smoke/Breeze Tunnel	X			500	
NBC Defense	Controlled Env. Soil Core Microcosm Unit (CESUM) Chambers	X			440	Q
NBC Defense	Decontamination Test Facility E1649	X			333	
NBC Defense	Open Air Environmental Effects Facility	X			275	Q
NBC Defense	Climate Controlled Facility	X			150	Q
NBC Defense	SCIF				100	

Notes:

Y - Specialized laboratories for surety operations are currently estimated at $390 per square foot. We used that as the most useful replacement cost. For E3510 and E5100 (facilities for which we found the method given in the data call. For E3300, we did not find an original construction cost. Since it is a surety lab, we feel confident that the replacement cost of $390/ft2 is a good estimate.

Z - General laboratory space is now estimated at $360/ft2. It was used as indicated where original construction costs were found.

U - Includes upgrades since original construction

- Includes specialized laboratory equipment in subject building.

- New construction (MCA)

Q - Equipment cost only

.1 Major Equipment and Facilities (Continued)

Unique Characteristics

Super Toxic Facility (E3300) - DoD, Govt, US

This facility supports DoD CB defense R&D and intelligence sampling and analysis. This facility can handle any of the toxic chemical agents. This building houses the only Nuclear Magnetic Resonance lab in the U.S. certified to work with chemical surety material.

Design Evaluation Chemical Surety Lab (E3510) - DoD, Govt, US

This is a research and development facility for the chemical evaluation (surety and non-surety) of candidate detection items and protective materials. A unique environmental chamber, certified for chemical surety material use, is available to evaluate multiple detectors at hot or cold temperatures. One vapor challenge/vapor permeation apparatus is available (12 swatches total at one) for chemical surety material evaluation.

mical Evaluation Laboratory (E5100) - DoD, Govt, US

his facility is unique within the United States as it was designed and is a full surety laboratory containing 60 surety fume hoods, specially designed ventilation and toxic filtering systems to all exhausts from the building so as to meet the latest occupational safety and health standards.

Chemical Transfer Facility (E3832) - DoD, Govt, US

This facility is a unique structure designed for storage, operation and ultimate destruction of RDTE Chemical Agents. It is also the nexus of the "Chemical Agent Standard Analytical Reference Materials (CASARM) Program which provides the DoD Chemical Community with ultra-high purity replicable standards for experimental and proof acceptance use.

:ess Engineering Facility (E3835) - DoD, Govt

e Process Engineering Facility houses both the Bioprocess Engineering Facility and the Biopolymer Facility. The Biopolymer Facility houses the only high-field, high-resolution, four-sector, tandem mass spectrometer along with equally atypical mass spectrometers and allied instrumentation available anywhere with the US Government laboratories. It is a unique capability within Army to support projects for both process development of antibodies and thermostable enzymes used in biological detection, and processes used to support chemical agent demilitarization and production processes for materials for environmental bioremediation.

Berger Chemical/Biological Defense Laboratory (E3549) - DoD

The Berger Lab Complex is a multi-purpose building with professional offices, a 100-seat auditorium, general purpose labs, and high-bay test areas for handling combat vehicles. Specifically, the focus of the mission is to develop defensive equipment used by troops under nuclear, biological and chemical attack and to conduct biological research.

'ontamination/Detoxification Facility (E3946) - DoD, Govt, US

e Decon/Detox Facility is currently the only RCRA permitted incinerator within DoD with the express purpose and design necessary to process previously chemical agent contaminated material for release to the private sector. The incinerator serves Medical Research Institute for Chemical Defense (MRICD) and Army Environmental Hygiene Agency (AEHA) as well as CBDCOM.

Explosive Test Chamber (E3566) - DoD, Govt, US

The explosive test chamber allows research and development testing of a wide range of chemical agent and simulants, prototypes of related end items and technology such as protective and decontamination equipment, and alarm systems. The chamber has a volume of 16,000 cu ft which may be automatically controlled and maintained at -50F to 165 F. Detonation of munitions with up to 1 lb TNT equivalency is possible. It is one of only two chambers in the US (both at ERDEC) which provides a state-of-the-art filtered toxic agent containment capability.

ic Dissemination Test Chamber (E3726) - DoD, Govt, US

This chamber is 32 feet in diameter and 20 feet high. It is capable of withstanding the forces generated by the detonation of one pound of TNT. It possesses the capability to develop chemical systems and determine their effectiveness, including munitions, protective or decontamination equipment, CB alarm systems and disseminating devices. The chamber supports all services in development of chemical defensive equipment through the DoD T&E Reliance program.

Inhalation Toxicology Laboratories - DoD, Govt, US

The Inhalation Toxicology Laboratories consist of a modularized series of specialized chambers, wind tunnels, generators and supporting analytical and clinical equipment permitting the exposure of a wide variety of species via head only or whole body exposure for acute, subchronic and chronic toxic effects. it also has the unique capability to test materials via pyrotechnic or explosive dissemination and the analytical capability to characterize the resultant cloud for vapor and aerosol components.

Pyrotechnics building (E3580) - DoD

The facility equipment and accessories provide remote control capabilities for mixing and pressing explosives and pyrotechnics. The facility is also equipped to perform tests of sensitivity and physical properties for the following pyrotechnic materials; Screening Smoke, Incapacitating Smoke, Colored Smoke, Pyrotechnic Delays, riot Control Smoke and Pyrotechnic Fuzes.

Advanced Protective System Integration Lab (APSIL,E5604) - DoD, Govt, US

The mask fit test facility is designed for use in evaluating the performance of new respirators and chemical protective clothing ensembles. The fit of protective equipment is assessed while undergoing challenge by a polydispersed aerosol. This facility is unique within the United States. The Joint Service standardization agreement for fit factor testing of military masks designates this facility as the standard for all the services.

Human Performance Test Facility focuses on vision testing; measurement of various parameters including ventilation volumes, breathing frequencies, and cardiovascular parameters; executing of computer generated cognitive performance tasks to quantify the psychological stress factors; and communications testing (i.e. speech intelligibility).

er Spectroscopy Lab - DoD

e facility is applied primarily to research and development of new concepts for detection and identification of biological and chemical materials using optical and mass spectrometric approaches. Current development/acquisition efforts supported by this facility include standoff biological agent detector and next-generation biological mass spectrometer. Laser-based approaches constitute the only viable means of standoff biodetection and represent one of only two viable options for the next-generation biological mass spectrometer.

Rapid Prototyping Laboratory (E3514) - DoD

The lithography facility is a R&D facility which allows the rapid production of prototypes through the use of a computer-aided design (CAD) system. A state-of-the-art SLA 250 stereolithography system converts CAD models to solid prototypes using a laser and a UV curable liquid resin. The facility has been used extensively on future protective mask development programs.

Rubber Laboratory - DoD, Govt

Rubber Laboratory possesses all of the equipment necessary to ke an idea for a respirator from crude concept to a minimum level production run (1000 to 2000 items). Projects have been taken from concept through production and fielding within this facility. The test laboratory includes a unique device for visually tracking the air flow in a respiratory device and digital leak test equipment for both air flow and particulate leakage.

Molecular Modeling Facility - DoD

The facility consists of a network of computer-assisted software, computers and sophisticated computer devices integrated to understand and characterize chemical and biological interactions and reactions for the development of predictive models to efficiently and effectively enhance the development of CB defense detection devices, decontamination and protection materials. The facility incorporates state-of-the-art computational/theoretical chemistry and molecular modeling algorithms and sophisticated computer graphics devices with a unique chemical/biological warfare material data base.

:oland - DoD

is laboratory supports all ERDEC needs in the areas of electron microscopy and surface spectroscopy. The range of complementary capabilities under on roof is unusual and the combination of these techniques with specialized knowledge in aerosols, fine particle studies, and CB issues is unique to DoD.

Experimental Fabrication Facility - DoD

The experimental fabrication facility is configured for quick responses to the design and manufacturing requirements of research and development hardware. Computer aided design/computer aided manufacturing, is used to interact with the hardware designers to provide a true concurrent engineering/manufacturing capability.

Vertical and Transonic Wind tunnels - DoD

Vertical Wind tunnel: The only vertical wind tunnel within the Army R&D organizations. It has been used to design and study special purpose decelerators/stabilizer systems. This has provided research for ARL, Army Environmental Center, Patuxant Naval Research Center and Naval Surface Weapons Center.

nsonic Wind tunnel: This is the largest transonic wind tunnel the Army R&D system with 0.4 to 1.2 mach numbers and a 0.51 meter square test section. This has provided research for others such a ARDEC, ARL, Lawrence Livermore Lab, Naval Surface Weapons Center, University of Delaware, Motorola, and Aerojet.

Aquatic Toxicology Facility - DoD

The Aquatic Toxicology Facility consists of a series of laboratories which house 13 animal/organism species, the media and environments to culture organisms, and the supplies and materials with which to conduct appropriate aquatic tests for investigation of the acute and chronic toxicity and fate of military-unique materiels. The availability of an on-site well and water treatment system has enabled the facility to maintain the necessary water quality for aquatic species survival and good health.

Life Sciences Research Facility - Govt

Will provide the DoD lead laboratory a state-of-the-art facility to conduct development of a toxicological data base in animal models to define health hazards of military chemicals to soldier in the field, training personnel, depot handlers, development and ufacturing personnel and to effectively evaluate impact of these emicals on the environment. Construction is to start in fourth quarter FY94.

lyst/Adsorbent Evaluation Laboratory - DoD

e focus of the laboratory evaluation systems is toxic vapor separation from air streams and design of air purification systems for chemical warfare respiratory protection applications. Fundamental adsorption (isotherms, mass transfer rates) and catalytic oxidation (reaction rates) data are measured and utilized to develop performance-prediction capability for each technology.

Nephelometry Laboratory/Single Particle Laboratory - DoD

Aerosol research at ERDEC has pioneered techniques for characterizing individual micron-sized particles both in rapid flow-through instruments (1,000 particles per second) and levitated in electrodynamic balance where they can be studied for extended periods of time. The laboratory includes specialized instruments for controlled generation of single particles, managing the concentrations of various vapors and gases surrounding the particles, a variety of balances including some of novel design, nephelometry (light scattering measurements including full treatment of polarization effects), and many types of spectroscopy such as fluorescence spectroscopy and photon correlation spectroscopy.

? Agent Simulation Charcoal/Filter Testing Facility (E5165) - D, Govt, US

The filter test area is a production acceptance facility housing a variety of testers capable of determining gas life of charcoal and charcoal filters sized 12 cfm to 1200 cfm. Production lot filters are statistically sampled and submitted to this test facility and are challenged with dimethylmethyl-phosphonate (DMMP).

Smoke Breeze Tunnel

The Smoke Breeze Tunnel is a smoke/obscurant test facility. It is joined to a particulate filtration unit with a retention capability of 99.9% particulates and 99.5% droplets. The facility has the capability to: 1) test full-scale smoke generators; 2) evaluate screening materials; 3) determine impact of screening materials on military hardware, and 4) perform as a wind tunnel with limited capabilities.

This facility is considered unique in that it eliminates or minimizes the need for open air testing and is not affected by weather conditions that otherwise limit natural environment testing. The facility supports all services through the DoD T&E liance Program.

:rolled Environment Soil-Core Microcosm Unit (CESMU) Chambers -

The CESMU chambers support the investigation of the environmental fate, migration, and transformation of chemicals/materials in site-specific soils, and the investigation of the efficacy of bioremediation treatments on contaminated site-specific soils. CESMU chambers are housed in a greenhouse to take advantage of natural sunlight, and "high-end" temperature control. These chambers/methodologies are improvements upon existing US Environmental Protection Agency and ASTM soil microcosm methods and were conceived of and built by ERDEC scientists.

Decontamination Test Facility (1649) - DoD

The facility has been designed to meet latest safety and environmental requirements. The facility is designed to accommodate military systems comparable in physical size, weight and ground pressure to the M1 tank. It is intended to support all military services and provide the capability to conduct unscaled research, development and engineering studies of decontaminants and decontamination equipment. The facility is considered unique in that it facilitates on-site testing with the added benefit of rapidly accommodating retests prompted by equipment and erimental design changes.

Open-Air Environmental Effects Facility - DoD

The Open-Air Environmental Effects Facility consists of a prepared, fenced, field-site containing 14 open-top chambers (and companion comparison plots) for Advanced Ecological Assessments of military-unique materiel. The use of open-top chambers as exposure chambers for advanced ecological assessments, and the filling of field assessment data gaps in this manner, was conceived of by ERDEC scientists, and remains a state-of-the-art method for obtaining terrestial field data on the ecotoxicological effects of chemicals and materials.

Climate Controlled Facility - DoD

The facility was deigned to provide an environmentally controlled area in which to conduct the Standard Aquatic Microcosm (SAM). SAM is a 63 day assay that uses ten species of algae, invertebrates, protozoa and rotifers to estimate the ecological impact on community structure, and yields information that cannot be determined by single species exposure. The facility now also provides the space needed to conduct the 10 day sediment toxicity st. ERDEC personnel were involved in the development and round pin validation testing of the SAM assay. The Climate Controlled acility is one of only a handful of laboratories that conduct this assay.

:itive Compartmented Information Facility (SCIF)

e SCIF located in Bldg E-3331 is an approximate 1300 square foot space, that is divided into five separate areas. The facility was rennovated in 1985-6 with the addition of specialized panelling for sound absorbancy, and electrical/signal emanations, specialized wiring and telephone signal filtration components. It is the only DIA accredited SCIF on the Edgewood Area of APG, and serves CBDCOM elements and the MRICD. The only other accredited SCIF on APG is 15 miles away, on the Aberdeen Area of APG.

3.5 Expansion Potential

3.5.1 Laboratory Facilities: Use facilities records as of fourth-quarter FY93 in answering the following (in sq ft) for each CSF: (BRAC Criteria II)

Common Support Function	Facility or Equipment Description	Type of Space	Space Capacity (KSF) Current	Used	Excess
NBC Defense	Safe Shelter	Storage	0.85	0.85	
NBC Defense	Metal & Wood-working Shop	Technical	5.40	5.40	
NBC Defense	AC Plant Bldg	Utility*	0.30	0.30	
NBC Defense	Greenhouse	Technical	0.94	0.94	
NBC Defense	Gas Compressor	Technical	1.30		1.30
NBC Defense	Compressed Air Plant Bldg	Utility	1.36		1.36
Defense	General Training Equipment Facility	Technical	9.21	9.21	
NBC Defense	Dispatch Bldg	Admin	0.02	0.02	
NBC Defense	Transportation Corps Admin Bldg	Admin	3.13	3.13	
NBC Defense	Change Hours	Technical	7.92	3.10	4.82
NBC Defense	Lumber and Plumbing Shed	Utility*	0.39	0.39	
NBC Defense	Calibration Facility	Technical	1.15	1.15	
NBC Defense	Nonmetallic Material Fac	Technical	43.95	39.79	4.16
NBC Defense	Electron Equipment Fac	Technical	6.36	5.37	1.00
NBC Defense	Waiting Shelter	Admin	0.04	0.04	

Common Support Function	Facility or Equipment Description	Type of Space	Space Capacity (KSF) Current	Used	Excess
NBC Defense	Storage Shed General Purpose	Storage	3.02	3.02	
NBC Defense	Standby General	Admin	0.32	0.32	
NBC Defense	Chemical Equip Material Fac	Technical	54.30	52.40	1.90
NBC Defense	Inflammable Material Storehouse	Storage	16.18	15.87	0.31
NBC Defense	Filter Lab	Technical	18.44	17.22	1.22
NBC Defense	Physics Lab	Technical	26.97	26.97	
NBC Defense	Components Cleaning Fac	Technical	1.69	0.88	0.81
NBC Defense	Scale House	Technical	0.14	0.14	
[illegible] Defense	Care & Press Facility	Technical	4.00	4.00	
NBC Defense	Transition Shed	Technical	7.81	7.81	
NBC Defense	Chemical Field Maintenance Shop	Technical	34.29	34.29	
NBC Defense	General Purpose Magazine	Storage	0.50	0.50	
NBC Defense	Sentry Station	Admin	8.28	8.28	
NBC Defense	General Purpose Warehouse	Storage	82.88	82.88	
NBC Defense	General Store-house	Storage	30.10	29.48	0.62
NBC Defense	Storehouse	Storage	27.77	27.30.	0.47
NBC Defense	Igloo Storage	Storage	16.59	16.59	

mmon pport nction	Facility or Equipment Description	Type of Space	Space Capacity (KSF) Current	Used	Excess
NBC Defense	Chemical Admin Building	Admin	165.88	165.88	
NBC Defense	High Explosive Magazine	Storage	69.76	69.76	
NBC Defense	Administration General Purpose	Admin	62.55	62.55	
NBC Defense	Decontamination Facility	Technical	20.99	20.99	
NBC Defense	Lab General Purpose	Technical	452.40	390.39	62.01
NBC Defense	Chemistry Lab	Technical	289.23	273.95	15.28
TOTALS			1,476.42	1,381.16	95.26

The paper work has been completed for responsibility transfer the building(s) to the U.S. Aberdeen Provings Grounds Support Activity (USAAPGSA), but official transfer has not yet occurred.

The facilities records are kept category codes as directed by AR 415-28 for ERDEC's 1.5 million square footage in 257 buildings. The square footage is a total of all the buildings under that category code. Excess square footage consists of buildings that are proposed for "turn-in" to USAAPGSA, because

the buildings no longer serve a purpose for ERDEC's current or future mission.

Square footage numbers were rounded to the nearest 1/100th (10 square feet).

3.5.1.1 Describe the capacity of your activity to absorb additional workyears categorized in the same common support function with minor facility modification. If major modification required, describe to what extent the facilities would have to modified. (Use FY97 workyears as your requirement) (BRAC Criteria III)

The excess capacity identified in 2.2 (161 workyears) could be absorbed without minor facility modification or major modification.

3.5.1.2 If there is capacity to absorb additional workyears, how many additional workyears can be supported? (BRAC Criteria III)

161 workyears

3.5.1.3 For 3.5.1.2 and 3.5.1.2 (above) describe the impact of military construction programs or other alteration projects programmed in the FY95 PBS. (BRAC Criteria II)

No military construction programs or other alteration projects are programmed in the FY95 PBS for Edgewood RDE Center.

3.5.2 Land Use: Provide number of buildable acres for additional laboratory/administrative support construction at your installation. (BRAC Criteria II)

ERDEC is a tenant on Aberdeen Proving Ground which is an installation owned by USA Test and Evaluation Command. APG installation reports 1,150 buildable acres for contingency, mobilization, and future requirements for possible use by any of the 54 current tenants at APG (including ERDEC) and/or sites for future tenants. At this time, none of the buildable acres at APG have been specifically committed to ERDEC for additional laboratory/administrative support construction.

3.5.3 Utilities: Provide an estimate of your installation's capability to expand or procure additional utility services (electric, gas, water). Estimates should be provided in appropriate units - e.g., KWH of electricity. (BRAC Criteria II)

Data is part of APG installation data call. ERDEC does not have decision authority for this issue.

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TABLE OF CONTENTS (PHOTO AND DESCRIPTION)

EDGEWOOD AREA PENINSULA

ER TOXIC FACILITY

Nuclear Magnetic Resonance

DESIGN EVALUATION CHEMICAL SURETY LAB

CHEMICAL EVALUATION LAB

CHEMICAL TRANSFER FACILITY

PROCESS ENGINEERING FACILITY

1500 Liter Fermentor
Biopolymer/Tandem Mass Spectrometer

BERGER CHEMICAL/BIOLOGICAL DEFENSE LAB

High Bay
CAD Facilities

DECONTAMINATION/DETOXIFICATION FACILITY

EXPLOSIVE TEST CHAMBER

TOXIC DISSEMINATION TEST CHAMBER

ALATION TOXICOLOGY LAB

PYROTECHNICS BUILDING

ADVANCED PROTECTIVE SYSTEM INTEGRATION LAB

LASER SPECTROSCOPY LABORATORY

RAPID PROTOTYPING LAB

RUBBER LAB

MOLECULAR MODELING FACILITY

MICROLAND

EXPERIMENTAL FABRICATION FACILITY

VERTICAL AND TRANSONIC WIND TUNNELS

AQUATIC TOXICOLOGY FACILITY

LIFE SCIENCES RESEARCH FACILITY

TABLE OF CONTENTS (DESCRIPTION ONLY)

ATALYST/ADSORBENT EVALUATION LAB

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NEPHELOMETRY LAB/SINGLE PARTICLE LABORATORY

.P SIMULATION CHARCOAL/FILTER TESTING FACILITY

SMOKE BREEZE TUNNEL

CONTROLLED ENV SOIL-CORE MICROCOSM UNIT (CESUM) CHAMBERS

DECONTAMINATION TEST FACILITY

OPEN AIR ENVIRONMENTAL EFFECTS FACILITY

CLIMATE CONTROLLED FACILITY

SENSITIVE COMPARTMENTED INFORMATION FACILITY (SCIF)

AMSEL-RD-ADO-B DRAFT

MEMORANDUM FOR COMMANDING GENERAL, U.S. ARMY MATERIEL COMMAND
ATTN: AMCRD-IT

SUBJECT: BRAC 95 Data Call #5- Laboratories

1. Reference:

a. Subject input to The Army Basing Study (TABS) Office, 17 June 94.

b. Memorandum, DACS-TABS, 9 Sep 94.

2. Regarding Question 3.2.4.2. Papers published in peer review journals: Revised submission incorporates revised list of papers to include journals and dates.

3. Regarding Question 3.3.1.2. ACAT Systems: Revised submission separates ACAT systems listed on MILDEP ACAT listing. However, also included are those systems (footnoted) with major efforts, even those not appearing on MILDEP listing. Note that most of latter are ACAT III systems.

4. Regarding question 3.4.1. Reason for no breakout for Common Support Functions for Space: the following explanation is incorporated into Section III, paragraph 3.0., of revised submission:

Efforts at CECOM are actually efforts in support of Project Managers in development, acquisition, test and evaluation of ground terminal satellite communications equipments and systems. *There is no space unique or space specific work; only command, control, communications, and electronic warfare for ground control systems utilizing space systems for transfer of data.* Efforts include ensuring that ground terminal equipment meets technical requirements of the Defense Satellite Communication System (DSCS) and provides proper communications capacity and connectivity; for PM MILSTAR, CECOM supports development and testing of the MILSTAR satellite utilizing the Army developed ground terminal equipment, which currently includes the MILSTAR EHF Terminal and the Advanced SCAMP, a manportable EHF system. CECOM's involvement in conducting the MST-8000 test of the first MILSTAR satellite consists of demonstration of communication capabilities of Army to Army satellite terminal performance as well as Army interoperability with Air Force and Navy ground terminals. The DSCS program is a joint Army, Navy, and Air Force program with Army having responsibility for ground terminal development, acquisition and fielding; Air Force has responsibility for satellite hardware.

5. Regarding Table 2.1. Separate table for Ft. Belvoir: Revised submission includes two tables, separating information by Ft. Monmouth and Ft. Belvoir.

6. A complete resubmission package is attached, as requested, to include above revisions.

7. I certify that the information contained in this report is accurate and complete to the best of my knowledge and belief.

8. POC for this action is Roger Wiest, AMSEL-RD-ADO-B, DSN 995-4542.

AMSEL-RD-ADO-B
SUBJECT: BRAC 95 Data Call #5- Laboratories

9. CECOM Bottom Line: THE SOLDIER.

encl

OTTO J. GUENTHER
Major General, USA
Commanding

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DEPARTMENT OF THE ARMY
HEADQUARTERS, US ARMY COMMUNICATIONS-ELECTRONICS COMMAND
AND FORT MONMOUTH
FORT MONMOUTH, NEW JERSEY 07703-5000

REPLY TO
ATTENTION OF
AMSEL-RD-ADO-B

24 AUG 1994

MEMORANDUM FOR COMMANDING GENERAL, U.S. ARMY MATERIEL COMMAND
ATTN: AMCRD-IT

SUBJECT: BRAC 95 Data Call #5- Laboratories

1. Reference:

a. Subject input to The Army Basing Study (TABS) Office, 17 June 94.

b. Army Audit Agency (AAA) audit of subject input.

c. Memorandum, DACS-TABS, 12 Aug 94.

2. As a result of reference b, amendments are submitted to reference a as attached (encl 1). These amendments and revisions are incorporated into the revised BRAC data call submission.

3. In response to reference c., answers are provided to the seven questions (encl 2).

4. I certify that the information contained in this report is accurate and complete to the best of my knowledge and belief.

5. POC for this action is Roger West, AMSEL-RD-ADO-B, DSN 995-4542.

6. CECOM Bottom Line: THE SOLDIER.

Encl
as

for OTTO J. GUENTHER
Major General, USA
Commanding

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AMENDMENTS RESULTING FROM AAA AUDIT

Element 2.1 Workload: It should be annotated that the numbers reported as programmed workyears for FY89-97 actually represent the center's authorized strength at the beginning of each fiscal year. It should also be annotated that the numbers reported as actual workyears for FY89-93 represent the center's actual strength at the end of each fiscal year. Corporate information databases do not have auditable data for actual "workyears" as defined in the DOD reporting guidance, so the aforementioned represents the best available data relevant to DOD guidance.

Excess Laboratory Capacity (Element 2.2): As noted in above paragraph, excess workyears calculation is based on staffing levels, not workyears. However, CECOM considers this estimate to be accurate.

Licenses and Permits (Element 3.1.2): One additional Nuclear Regulatory Commission and three additional DA permits are to be added to original submission as follows:

NRC License # 29-01022-14:

Purpose: Calibration and operational checking of radiation detection instrumentation for R&D (Cobalt 60, Krypton 85, Strontium 90, Cesium 137, Plutonium 239, Americium 241, Thorium 230, 232).

DA Permits #A29-10-06, A29-10-10, A29-10-12

Purpose: authorization for possession and use of radioactive materials.

Added in a subsequent submission (see regulation sections in the data)

FY93 Workyear and Life Cycle (Element 3.3.1.1): The total workyears in the original submission were based on actual staffing level at the end of FY93. Also, the sum of military reported in categories at Ft. Monmouth totalled 151. The correct total should have been 141, consisting of the following changes: 24 Airborne S&T, 20 Airborne Engineering Development, and 13 Airborne In Service Engineering. Other figures in this element will remain unchanged.

Major Equipment and Facilities (Element 3.4.1): In the original submission, the Communications Systems Design Center laboratory was inadvertently omitted from the list for replacement costs. The replacement cost is $20,000,000; net square footage is 9300sf.

Laboratory Facility Expansion Potential (Element 3.5.1): The original submission only listed those laboratories which were identified with excess space; i.e., the Army Research Lab in the Myer Center. Total square footage for all laboratories should have been provided as below (in thousands of square feet):

CSF	FACILITY DESCRIPTION	TYPE OF SPACE	SPACE CAPACITY (KSF) CUR	USED	EXCESS
Ft. Monmouth					
C4I	Ft. Monmouth Laboratories	Technical	189.1	189.1	0
C4I	Ft. Monmouth Laboratories	Admin	315.9	315.9	0
C4I	Ft. Monmouth Laboratories	Storage	16.9	16.9	0
C4I	Myer Center ARL	Technical	57.5	0	57.5
C4I	Myer Center ARL	Admin	45.3	0	45.3
C4I	Myer Center ARL	Misc	7.1	0	7.1
C4I	Battery Test Facl	Technical	5.4	0	5.4

Ft. Belvoir

CSF	FACILITY DESCRIPTION	TYPE OF SPACE	SPACE CAPACITY		
			CUR	USED	EXCESS
C4I	Ft. Belvoir Laboratories	Technical	232.3	232.3	0
C4I	Ft. Belvoir Laboratories	Admin	46.0	46.0	0

All facilities listed support CSF C4I 100%. An artificial attempt to separate these into subcategories of CSF's (ground mobile, ground fixed, airborne) is meaningless. Projected technology base efforts at Ft. Monmouth are estimated to be 51% Ground Mobile, 39% Airborne, and 10% Ground Fixed. The ratios at Ft. Belvoir for science and technology efforts project to 58% Airborne, 32% Ground Mobile, and 10% Ground Fixed.

Utilities (Element 3.5.3). The original submission reported a current electrical capacity of 65,000 kilovolt amperes. The correct number is 78,000. As far as capability to expand or procure additional utility services, the Ft. Monmouth Garrison has determined that the capability to accomodate additional utility requirements is virtually unlimited.

Supporting Documentation: AAA reported six data elements were unsubstantiated. Each of these data elements and corrective actions being taken are detailed below:

Proximity to Mission-Related Organizations (Element 3.1.5); workyears performed/funded. AAA could not verify that source records gave an accurate counting of workyears. CERDEC is gathering documentation on workyear costs for contractual and internal efforts (dollars per workyear) to substantiate the average workyear cost used.

FY93 Workyear and Life Cycle (Element 3.3.1.1). AAA was unable to substantiate the breakout of workyears by S&T, Engineering Development, and In Service Engineering, in four of five directorates reporting. The directorates have been instructed in writing and in meetings that documentation clearly providing audit trail from FY93 obligations records must be ready for inspection by a follow up audit. The directorates are in process of gathering and consolidating this audit trail.

Engineering Development and In Service Engineering (Elements 3.3.1.2 and 3.3.1.3). AAA was unable to verify FY93 funding reported by system, or average cost per workyear. The directorates have been instructed in writing and in meetings that documentation clearly providing audit trail from FY93 obligations records must be ready for inspection by a follow up audit. The directorates are in process of gathering and consolidating this audit trail. CERDEC is gathering documentation on workyear costs for contractual and internal efforts (dollars per workyear) to substantiate the average workyear cost used.

Major Equipment and Facilities (Element 3.4.1). CERDEC was unable to produce facility records documenting costs as per guidance. CERDEC is in the process of collecting facilities hand receipts, contracts, and all property book and other documentation to provide accountability for all facilities and equipment. An in process review is scheduled for late August to determine problems and schedules. Expected date to have all property accountability records documented is on or about December 1994.

Workyear Expansion Potential (Element 3.5.1.2). AAA did not receive documentation for an estimated 50 additional workyears estimated by one Directorate, above the substantiated estimate of 350 people in ARL's laboratory. Documentation is being gathered to provide an audit trail for this.

The information shown on this page was incorporated into a subsequent transmission.

RESPONSES TO TABS OFFICE QUESTIONS

(1) 3.0 Mission.

The CECOM RDEC's mission is to be a full spectrum center of technical excellence for airborne, fixed ground based and mobile ground based C4I systems. 100% of the CECOM RDEC's efforts support the Common Support Function C4I. Efforts are interconnected with other common support functions as it relates to platforms for command, control, communications, electronic warfare, and sensors. These common support functions include:

Air vehicles- as part of the air platforms integrated avionics system, to include electronic warfare, navigation, communications, radar, electro-optic sensors, and associated software system and support.

Weapons- as part of electronic guidance and control, and sensors, for guided projectiles, missiles and rockets, and anti-air defense systems.

Space- as part of C4I for satellites and associated ground control systems.

Ground Vehicles- as a platform for C4IEW equipment.

Electronic Devices- as collaborative work with Army Research Lab who performs basic and early applied research for semiconductor and superconductor materials for optoelectronic, acoustic and microwave devices.

(2) 3.1.1. Geographical/Climatological Features

No Change

3.1.1 Geographic/Climatological Features- Ft. Monmouth NJ.

Ft. Monmouth, NJ is centrally located in proximity to several major metropolitan areas, such as New York, Philadelphia, Washington, Baltimore, Hartford, Boston and New Haven. CECOM is also close to many of the finest academic, industrial and commercial electronic activities. As per Scientific America, NJ has the highest per capita concentration of engineers and scientists in the nation (approximately 145,000).

The above is relevant to all subcategories of CSF C4I.

3.1.1 Geographic/Climatological Features- Ft. Belvoir VA.

No Change

NVESD has two testing facilities, the Observation Range and Laser Range operated and maintained by NVESD with several unique features, including their proximity to Ft. Belvoir, VA and Washington DC. The Observation Range is used for placement of military targets to evaluate military and prototype sensor systems, as a staging area for field tests, air to ground and ground to air operations, and testing of IR devices. The range has varying topographical backgrounds useful for testing purposes under different terrains. The Laser Range is a unique, highly instrumented facility allowing users to test non-eye safe lasers. The facility has four bays, an elevated platform, and target ranges with high voltage, high current commercial power capabilities. This facility is one of only a couple of approved laser ranges on the east coast of the U.S.

The above is relevant to all subcategories of CSF C4I.

The above was provided in original submission.

3.1.2. Licenses and permits.

In the original submission, NRC License # 45-00953-01, and DA Permit #A45-95-03, are for Ft. Belvoir. The other licenses and permits are Ft. Monmouth.

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3.1.3. Environmental Constraints:

This information was incorporated into a subsequent submission.

There are no environmental constraints pertinent at either Ft. Monmouth or Ft. Belvoir.

3.1.4. Special Support Infrastructure:

There are no special support infrastructure requirements at Ft. Belvoir. The original submission stated the Pulse Power Center requirement for Ft. Monmouth.

(3) 3.1.5. Proximity to Mission Related Organizations.

NAME	TYPE ORG	DIST	WY PERF C4I GM	A	GF	WY FND C4I GM	A	GF
Ft. Monmouth								
PEO'sCOMM/CCS/IEW	Gov't	Coll	497	253	65	0	0	0
CRDA CONTRACTORS	Commercial	10-100mi	0	0	0	7	6	1
UNIVERSITIES	Universities	5-50 mi	0	0	0	15	12	3
C3I ACQ CTR	Gov't	Coll	91	46	12	0	0	0
HI TECH CONTRACTORS	Commercial	1-20 mi	0	0	0	102	78	20
Ft. Belvoir								
A.P. HILL	Gov't	90 mi	1	1	0	.5	1	0
DAVIDSON	Airfield	4 mi	5	8	1	3	6	
1								
ARL	Gov't	50mi	Tech Plan Annexes					
GEORGE MASON	University	20 mi						
UNIV OF VA	University	120mi						

(4) 3.2.4.1; 3.2.4.2.: Patents/Papers Published in Peer Review Journals:

Patents and papers relate to communications and electronics technologies such image intensification, situation awareness, lasers, automatic target recognition, fiber optics, etc. C4I equipment and technologies subcategories of C4I are related to platforms of these equipments and technologies; however, except where noted in the original submission, attempting to artificially breakout patents and publications on technologies by these subcategories is meaningless.

Projected technology base efforts at Ft. Monmouth are estimated to be 51% Ground Mobile, 39% Airborne, and 10% Ground Fixed. The ratios at Ft. Belvoir for science and technology efforts project to 58% Airborne, 32% Ground Mobile, and 10% Ground Fixed.

(5) 3.3.1.3. In Service Engineering:

TROJAN program was listed as "all" because it interacts with airborne and ground fixed elements; however, the TROJAN program itself is appropriately categorized as Ground Mobile. Therefore, all workyears and funds would accurately be attributed to C4I Ground Mobile.

C2SI integration consists of approximately the following:

C4I-A		C4I-GM		C4I-GF	
Funds	WY	Funds	WY	Funds	WY
266	3.6	337	3.8	52	.6

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(6) 3.4.1. Facilities/Equipment:

All facilities listed support CSF C4I 100%. An artificial attempt to separate these into subcategories of CSF's (ground mobile, ground fixed, airborne) is meaningless. Projected technology base efforts at Ft. Monmouth are estimated to be 51% Ground Mobile, 39% Airborne, and 10% Ground Fixed. The ratios at Ft. Belvoir for science and technology efforts project to 58% Airborne, 32% Ground Mobile, and 10% Ground Fixed.

The following facilities have interconnectivity with other CSF's:

COMMAND AND CONTROL AUDIO SIGNAL PROCESSING LABORATORY
TACTICAL COMMAND AND CONTROL LABORATORY
Interconnects with Avionics function with respect to development, testing and demonstration of systems such as AMPS (Aviation Mission Planning System), and contains the hardware (cockpit simulator, control loaders, instrumentation, etc.) and software (six degree of freedom, non-linear aero model) required to perform real time, man in the loop, aircraft simulations.

PROTOTYPE FABRICATION FACILITY
Interconnects with common support functions for air and ground vehicles with respect to projects for installation kits for air and ground vehicle platforms.

STRATEGIC SPACE SYSTEMS RESEARCH FACILITY (SSRF)
Provides interconnectivity with Space CSF with respect to test integration for strategic satellite systems.

TACTICAL SPACE SYSTEMS RESEARCH FACILITY (TSSRF)
Provides interconnectivity with Space CSF with respect to development, testing and field engineering for satellite communications terminals and tactical satellite platforms.

NUH-60 SYSTEM TESTBED FOR AVIONICS RESEARCH (STAR)
Provides interconnectivity with Avionics CSF with respect to avionics platforms for C4I equipment.

PULSE POWER CENTER
Provides interconnectivity with respect to electronic devices and ground vehicle platforms.

NAVIGATION VAN
PRECISION NAVIGATION TESTBED
Provides interconnectivity with avionics CSF with respect to providing a navigation test facility for flight testing of avionics platform and airborne systems.

The above facilities support C4I equipment for avionics or space platforms, as indicated. An artificial attempt to give percentages separating the CSF's is meaningless.

The CSE Battlefield Software Facility is actually 77,742 square feet of laboratory/system space, with 79 host and 132 target computer systems, unique wide area network linking remote sites to Ft. Monmouth computers, local area network links to contractor sites, electronic warfare environmental simulator, unique computer firmware replication facility, external pad facility, and a common/customized office automation and automated configuration management environment, housed in a secure, fenced in, television monitored area. The capital investment in host, target, and facilities is $500 Million.

(7) **3.5: Laboratory Facilities:**

3.5.1.1. Ft. Belvoir:
In FY93 NVESD had responsibility for 5 buildings within the 300 compound located at Ft. Belvoir, VA. Due to BRAC 93 the Belvoir Research and Development Center was dissestablished, this resulted in transferring 5 new business areas to NVESD with 180 plus personnel.

When the BRAC 93 exodus has been completed in October 1997 (assuming that there are no delays or changes), the 300 compound will have lost approximately 300 personnel as a result of that action. Conversely, new tenants identified and approved for occupancy within the compound will total more than 250 personnel. Additionally, there are other activities currently seeking space within the 300 compound that could include from 250-300 personnel.

Of the 45 habitable buildings within the compound, only 42 are currently inhabited. Bldg. 372 has been identified as an historical site and there are no plans for future occupancy. Buildings 327 and 358 will require extensive renovation to make them habitable; funds to accomplish said renovation have not been identified or requested. Buildings 354 and 366, although currently occupied, have been identified for possible destruction. As a result of a detailed study and analyses nine buildings within the compound have been identified for potential return to Fort Belvoir Garrison's control by October 1997. These buildings could accomodate approximately 550 personnel and other limited special requirements space. Return of any/all of these facilities is contingent upon the scheduled, timely departure of TACOM and ARL elements. It also presupposes that no additional tenants will impose space requirements on the compound. The buildings identified for potential return to Ft. Belvoir Garrison are all located adjacent to the existing fence line, allowing for a reconfiguration of said fence to exclude those facilities from the compound when, and if, they are no longer required for tenant use.

3.5.1.2. Ft. Belvoir: If NVESD does not return the nine buildings scheduled to be returned to the Garrison then they would be able to increase our workyears by approximately 200.

3.5.1.3. Ft. Belvoir. No military construction projects are currently programmed in FY95 PBS.

3.5.2. Land Use Ft. Belvoir: CECOM Nightvision and Electronic Sensors Directorate is a tenant of Ft. Belvoir; its area includes [redacted] 913.7 developable acres for Research & Development and Administrative/Education acreage. The total developable acreage for Ft. Belvoir is 3,286.6, but this figure includes family housing medical, recreation, community facilities, etc.

12 AUG REC'D

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DEPARTMENT OF THE ARMY
U.S. ARMY AUDIT AGENCY
NORTHEASTERN REGION
1027 ARCH STREET
PHILADELPHIA, PENNSYLVANIA 19107-2317

SAAG-NER (36-5e) 8 August 1994

MEMORANDUM FOR Commander, U.S. Army Communications-Electronics Command, ATTN: AMSEL-IR, Fort Monmouth, New Jersey 07703-5029

SUBJECT: Review of Data Furnished DOD Cross-Service Work Groups; U.S. Army Communications-Electronics Command Research, Development and Engineering Center; Fort Monmouth, New Jersey--INFORMATION MEMORANDUM NR 94-715

1. **Introduction.** This is the report on our review of the data your command provided for the laboratory data call for the DOD Cross-Service Work Group. The Director of Management requested the review. We will include data in this report in a summary report to higher levels of management.

2. **Objectives and Scope.** The overall objective of our review was to evaluate the accuracy of data the Army furnished DOD cross-Service work groups. Our specific objective was to determine whether data furnished was:

- Accurate.

- Supported by reasonable documentation.

- In accordance with cross-Service work group, DA and major command guidance.

We made the review during June and July 1994. In most material respects, we made the review in accordance with generally accepted government auditing standards. And, accordingly, we tested internal controls to the extent we considered necessary under the circumstances. We didn't follow certain aspects of the fieldwork and reporting standards. In our opinion, however, not following those standards had no material effect on the results of our review. To evaluate the accuracy of data furnished the laboratory cross-Service group, we:

- Reviewed cross-Service work group, DA and major command guidance and compared it with procedures center personnel followed to respond to the cross-Service group data call.

- Interviewed personnel from the U.S. Army Communications-Electronics Command Research, Development and Engineering Center; Resource Management Office; Safety Office; and Program Analysis and Evaluation Directorate; and from Fort Monmouth's Directorate of Public Works. The personnel we contacted helped prepare, review and validate command's response to the data call.

- Tested the accuracy of selected source documentation.

- Verified calculations of data values.

3. **Background**

a. **Cross-Service Work Groups.** The Defense Base Closure and Realignment Act of 1990, as amended, provides DOD a means to make needed adjustments to the installation structure. On 7 January 1994, the Deputy Secretary of Defense established six DOD-led work groups to evaluate opportunities for cross-Service base closure and realignment actions. The work groups focused on:

- Military Treatment Facilities and Graduate Medical Education Centers.

- Test and Evaluation Facilities.

- Laboratories.

- Undergraduate Pilot Training.

- Depot Maintenance.

- Economic Impact.

Each of the work groups prepared a data call requiring activities to provide information needed to assess and identify cross-Service opportunities.

b. **Army Process.** Army guidance required responses from each activity identified in the cross-Service data calls. Activities were to furnish the responses to their major commands. The major commands provided certified data to the Army Basing Study Office. The office will then provide the data to the cross-Service work groups. This memorandum addresses your command's response to the laboratory data call.

c. **Laboratory Data Call.** The laboratory data call consisted of 25 data elements. The elements included a mix of objective and subjective questions about a laboratory's mission, workload and facilities. These questions were developed by the DOD work group to identify cross-Service opportunities. The Research, Development and Engineering Center is a laboratory of the Communications-Electronics Command, which is a subordinate activity of the U.S. Army Materiel Command. We evaluated the accuracy and support for 21 of the 25 data elements the

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Engineering Center reported on for its Fort Monmouth facility. The center also reported on its laboratory facility at Fort Belvoir, Virginia. We didn't review the information submitted for Fort Belvoir.

4. **Results of Review.** The center reported accurate, verifiable data for 9 of the 21 elements we reviewed. The data for six elements was inaccurate, and we couldn't tell if the data reported for the remaining six elements was accurate because of inadequate documentation. Four of the six inaccuracies may be significant; the other two were minor errors. Details on the data elements reviewed and differences noted are in the annex. Our conclusions on specific objectives follow.

a. **Accuracy of Reported Data.** The center reported accurate data for nine elements. It reported inaccurate data for six elements.

(1) **Accurate Data.** The center reported accurate data for these nine elements:

Title	Data Elements
Mission	3.0
Geographical/Climate Features	3.1.1
Environmental Constraints	3.1.3
Special Support Infrastructure	3.1.4
Total Personnel	3.2.1
Projected Direct Funding	3.3.2.1
Projected Other Obligations	3.3.2.2
Planned Construction	3.5.1.3
Buildable Acres	3.5.2

(2) **Inaccurate Data.** The center reported inaccurate data for six elements.

(a) **Workload (Element 2.1).** The center reported funding and workyears between FYs 89 and 97. The funding information was accurate, but the numbers reported as workyears didn't represent workyears as defined in the DOD reporting guidance:

- The "programmed" workyears reported were actually the center's authorized strength at the *beginning* of each fiscal year.

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- The "actual" workyears reported were the center's actual strength at the *end* of each fiscal year.

Responsible personnel told us the center's corporate information systems didn't provide the workyear data DOD requested, so they reported the authorized and actual staffing information. The center's submission didn't indicate that the information reported wasn't workyears.

(b) **Excess Laboratory Capacity (Element 2.2).** This element is based on the data reported in element 2.1. It shows excess laboratory capacity by subtracting the workyears programmed for FY 97 from the peak workyears between FYs 89 and 93. The center reported 363 workyears. But its calculation was based on staffing levels, not workyear data.

(c) **Licenses and Permits (Element 3.1.2).** The center reported four licenses from the U.S. Nuclear Regulatory Commission and one permit from DA. Generally, the documents authorize the handling of radioactive materiel. We identified one additional Nuclear Regulatory Commission license and three additional DA permits the center should have reported. We consider this a minor error.

(d) **FY 93 Workyear and Life Cycle (Element 3.3.1.1).** The center reported its actual staffing level at the end of FY 93, not the number of workyears for FY 93. Also, the center reported 151 military personnel on board at that time. The correct strength was 141.

(e) **Laboratory Facility Expansion Potential (Element 3.5.1).** The center reported that it had about 115,000 square feet of laboratory facility space and that all of it would be excess when all BRAC 91 relocations are completed. The center actually has much more space than that--one major laboratory facility alone has about 400,000 square feet of space. Center personnel believed they had to report only excess space. The DOD reporting guidance asked for total space, used space and excess space--not just excess space.

(f) **Utilities (Element 3.5.3).** The center reported a current electrical capacity of 65,000 kilovolt-amperes. The correct number is 78,000 kilovolt-amperes. We consider this a minor error. Also, the center reported the current capacity of its utility systems (electricity, water and sewage). The DOD reporting guidance asked for the center's capability to expand or procure "additional" utility services.

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b. **Supporting Documentation.** The center didn't have adequate supporting documentation for six data elements.

(1) **Proximity to Mission-Related Organizations (Element 3.1.5).** The center couldn't fully document its estimate of workyears performed for or by mission-related organizations. (The reported proximity to the organizations was reasonable.) It used various noncorporate databases (for example, records of support provided to program executive officers and records of cooperative research and development agreements with academic institutions and corporations). We verified that the center used these records to estimate the workyears, but we couldn't verify that the records used gave an accurate counting of workyears.

(2) **FY 93 Workyear and Life Cycle (Element 3.3.1.1).** In addition to reporting its staffing level at the end of FY 93 rather than workyears incurred during the year (an inaccuracy discussed earlier), the center couldn't support its breakdown of the data into science and technology, engineering development and in-service engineering categories. We reviewed the support for the breakdown at five of the center's directorates (the activities that developed the information). Only one directorate could reconstruct the numbers it reported to the center level.

(3) **Engineering Development and In-Service Engineering (Elements 3.3.1.2 and 3.3.1.3).** The center couldn't fully document the funding and workyears reported for engineering development and in-service engineering. We verified the accuracy of the funding reported for some of the systems we reviewed, but weren't able to do so for most. The center also couldn't reconstruct the "average cost a workyear" factor it used to convert funding to workyears.

(4) **Major Equipment and Facilities (Element 3.4.1).** The center couldn't document the $844 million estimated replacement cost reported for 23 major facilities. Generally, directorate personnel making the estimates told us they lacked the facility records needed to estimate the costs using the procedure called for in the DOD reporting guidance (inflating original cost). Instead, they roughly estimated what they believed it would cost to build such a facility today.

(5) **Workyear Expansion Potential (Element 3.5.1.2).** The center couldn't fully document that it could support 350 to 400 additional workyears without major modification to its laboratory facilities. The lower number is supported: as part of BRAC 91, the Army Research Laboratory will move from Fort Monmouth and about 350 people work for the laboratory. But the

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center had no documentation for the estimate that another 50 people beyond that could work in its laboratory facilities. Currently, about 2,000 personnel work in the facilities.

c. **Compliance with Cross-Service, DA and Major Command Guidance.** The center didn't comply with the DOD data call guidance for six elements. For Workload (Element 2.1), Excess Laboratory Capacity (Element 2.2) and FY 93 Workyears (Element 3.3.1.1), the center should have reported workyears rather than staffing levels. For Major Equipment and Facilities (Element 3.4.1), it should have estimated replacement cost by inflating original cost. For Laboratory Facility Expansion Potential (Element 3.5.1), it should have reported total space, used space and excess space instead of just excess space. For Utilities (Element 3.5.3), it should have reported the capability to expand or procure additional utility service instead of its current capacity.

5. **Discussion of Results.** We discussed the results of our review with Mr. Roger Weist and Ms. Connie Carnevale of the center and Ms. Patricia Devine of the Program Analysis and Evaluation Directorate on 1 August 1994. They agreed with our conclusions and said that the center would:

- Notify the Materiel Command that the data reported as workyears was actually staffing levels at various times.

- Better document and explain the workyear estimates it did report.

- Better document its facility replacement cost estimates.

- Correct the minor errors in the data reported for the licenses/permits and utilities elements.

This report isn't subject to the official command-reply process.

6. Thank you for the courtesies and cooperation extended to us during the review.

Encl

HENRY P. CULLERTON
Regional Auditor General

CF: w encl
DOD Inspector General

SAAG-NER
SUBJECT: Review of Data Furnished DOD Cross-Service Work Groups; U.S. Army Communications-Electronics Command Research, Development and Engineering Center; Fort Monmouth, New Jersey--INFORMATION MEMORANDUM NR 94-715

CF: (CONT)

Army Basing Study Office
Commander, Army Materiel Command

Updated Info Memo.

AMSEL-RD-ADO-B

MEMORANDUM FOR COMMANDING GENERAL, U.S. ARMY MATERIEL COMMAND
ATTN: AMCRD-IT

SUBJECT: BRAC 95 Data Call #5- Laboratories

1. Reference:
   a. Memorandum, DACS-TABS, undated, SAB.
   b. Memorandum, AMCRD-IT, 27 July 94, SAB.

2. Additional information is provided as requested below:

a. **Section III: Para 3.0 Mission:** The CECOM RDEC provides the highest quality support to American Armed Forces by delivering superior technologies, products and service for:

Additional information w/ 24 Aug 94 Memo; Response to TABS(1)

Digitizing the Battlefield
Owning the Night
Owning the Spectrum
Knowing the Enemy
Software Development & Sustainment
System of Systems Architecture
Global Seamless Communications

Support crosses many technical disciplines, covers all Army platforms, promotes for interoperability, and provides the system engineering needed to integrate the battlefield.

Interconnected with other common support functions as it relates to platforms for command, control, communications, electronic warfare, and sensors. These common support functions include:

Air vehicles- as part of the air platforms integrated avionics system, to include electronic warfare, navigation, communications, radar, electro-optic sensors, and associated software system and support.
Weapons- as part of electronic guidance and control, and sensors, for guided projectiles, missiles and rockets, and anti-air defense systems.
Space- as part of C4I for satellites and associated ground control systems.
Ground Vehicles- as a platform for C4IEW equipment.
Electronic Devices- as collaborative work with Army Research Lab who performs basic and early applied research for semiconductor and superconductor materiels for optoelectronic, acoustic and microwave devices.

b. **Section III: Para 3.4.1 Major Equipment and Facilities:** Superceded by 24 Aug 94 Memo; Response to TABS (6)

All laboratories support CSF C4I 100%, as indicated in the original submission. The following laboratories have interconnectivity with other CSF's.

COMMAND AND CONTROL AUDIO SIGNAL PROCESSING LABORATORY
TACTICAL COMMAND AND CONTROL LABORATORY
Interconnects with Avionics function with respect to development, testing and demonstration of systems such as AMPS (Aviation Mission Planning System), and contains the hardware (cockpit simulator, control loaders, instrumentation, etc.) and software (six degree of freedom, non-linear aero model) required to perform real time, man in the loop, aircraft simulations.

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Superceded by 24 Aug 94 Memo, Response to TABS (6)

PROTOTYPE FABRICATION FACILITY
Interconnects with common support functions for air and ground vehicles with respect to projects for installation kits for air and ground vehicle platforms.

STRATEGIC SPACE SYSTEMS RESEARCH FACILITY (SSRF)
Provides interconnectivity with Space CSF with respect to test integration for strategic satellite systems.

TACTICAL SPACE SYSTEMS RESEARCH FACILITY (TSSRF)
Provides interconnectivity with Space CSF with respect to development, testing and field engineering for satellite communications terminals and tactical satellite platforms.

NUH-60 SYSTEM TESTBED FOR AVIONICS RESEARCH (STAR)
Provides interconnectivity with Avionics CSF with respect to avionics platforms for C4I equipment.

PULSE POWER CENTER
Provides interconnectivity with respect to electronic devices and ground vehicle platforms.

NAVIGATION VAN
PRECISION NAVIGATION TESTBED
Provides interconnectivity with avionics CSF with respect to providing a navigation test facility for flight testing of avionic and airborne systems.

All other facilities have indirect connectivity with other CSF's to the degree that electronics, sensors, and C4I supported relate to platforms as described in mission statement.

c. **Section III: Para 3.5.2 Land Use:** The original submission addressed Ft. Monmouth in its entirety in terms of buildable acreage. There are 281 buildable acres for additional laboratory/ administrative support construction at Ft. Monmouth. With regard to vertical expansion, the Ft. Monmouth Department of Public Works has determined that it is not economically and structurally feasible to expand existing facilities vertically (i.e., add additional stories).

3. **Section III: Para 3.3.1.2.Engineering Development by ACAT:** The original submission data remains unchanged. Each system is identified by association with Ft. Monmouth/Ft. Belvoir on attached (encl).

4. The information contained in this report is accurate and complete to the best of my knowledge and belief.

5. POC for this action is Roger Wiest, AMSEL-RD-ADO-B, DSN 995-4542.

6. CECOM Bottom Line: THE SOLDIER.

OTTO J. GUENTHER
Major General, USA
Commanding

Encl

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DEPARTMENT OF THE ARMY
HEADQUARTERS, US ARMY COMMUNICATIONS-ELECTRONICS COMMAND
AND FORT MONMOUTH
FORT MONMOUTH, NEW JERSEY 07703-5000

REPLY TO
ATTENTION OF

AMSEL-CG

MEMORANDUM FOR Commander, U.S. Army Materiel Command, Joint Laboratory Group Task Force, ATTN: AMCRD-JL 5001 Eisenhower Avenue, Alexandria VA 22333-0001

SUBJECT: BRAC 95 Data Call #5, Laboratories

1. Reference Memorandum, AMCRD-JL, Subject: BRAC Data Calls #5, 20 April 1994.

2. Subject data is enclosed as requested in reference memorandum.

3. To assure accuracy, all data was extensively reviewed by functional proponents and by our Program, Analysis and Evaluation Directorate. There were no data limitations. All data is supported by documentation maintained in the CECOM Research, Development and Engineering Center and Directorate for Resource Management.

4. The information contained in this report is accurate and complete to the best of my knowledge and belief.

5. The POC is Mr. Roger Wiest, AMSEL-RD-ST-OP, DSN 992-0203 or Ms. Connie Carnevale/Ms. Diane Manfready, AMSEL-RD-ADO-B, DSN 992-0829.

6. CECOM Bottom Line: THE SOLDIER.

Encl

OTTO J. GUENTHER
Major General, USA
Commanding

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BRAC 95 DATA CALL #5 - LABORATORIES

SECTION 2.1 CAPACITY OF DOD COMPONENTS

CAPACITY OF DOD COMPONENTS- Ft. Monmouth

INFORMATION REQUIRED	FISCAL YEARS								
	89	90	91	92	93	94	95	96	97
TOTAL FUNDS PROGRAMMED $M	674	628	670	796	627	559	531	507	496
TOTAL ACTUAL FUNDS ($M)	677	613	680	766	614				
PROGRAMMED WORKYEARS	1422	1427	1802	2063	1748	1728	1638	1600	1571
ACTUAL WORKYEARS	1438	1492	1651	1754	1673				

CAPACITY OF DOD COMPONENTS- Ft. Belvoir

INFORMATION REQUIRED	FISCAL YEARS								
	89	90	91	92	93	94	95	96	97
TOTAL FUNDS PROGRAMMED $M	179	178	179	142	353	279	268	259	253
TOTAL ACTUAL FUNDS ($M)	179	178	179	142	353				
PROGRAMMED WORKYEARS	496	519	507	476	508	690	673	639	605
ACTUAL WORKYEARS	496	519	507	476	508				

It should be annotated that the numbers reported as programmed workyears for FY89-97 actually represent the center's authorized strength at the beginning of each fiscal year. It should also be annotated that the numbers reported as actual workyears for FY89-93 represent the center's actual strength at the end of each fiscal year. Corporate information databases do not have auditable data for actual "workyears" as defined in the DOD reporting guidance, so the aforementioned represents the best available data relevant to DOD guidance.

The programmed workyears and dollars for Ft. Belvoir for FY94-97 represent totals for Nightvision & Electronic Sensors Directorate (NVESD). Planning information to dissect these between NVESD Ft. Monmouth and NVESD Ft. Belvoir is unavailable.

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SECTION III: CAPABILITY OF ACTIVITIES TO PERFORM COMMON SUPPORT FUNCTIONS

3.0 Mission:
The CECOM RDEC's mission is to be a full spectrum center of technical excellence for airborne, fixed ground based and mobile ground based C4I systems. 100% of the CECOM RDEC's efforts support the Common Support Function C4I. The CECOM RDEC provides the highest quality support to American Armed Forces by delivering superior technologies, products and service for:

Digitizing the Battlefield
Owning the Night
Owning the Spectrum
Knowing the Enemy
Software Development & Sustainment
System of Systems Architecture
Global Seamless Communications

This mission is relevant to all subcategories of CSF C4I.

Support crosses many technical disciplines, covers all Army platforms, promotes for interoperability, and provides the system engineering needed to integrate the battlefield.

Efforts are interconnected with other common support functions as it relates to platforms for command, control, communications, electronic warfare, and sensors. These common support functions include:

Air vehicles- as part of the air platforms integrated avionics system, to include electronic warfare, navigation, communications, radar, electro-optic sensors, and associated software system and support.

Weapons- as part of electronic guidance and control, and sensors, for guided projectiles, missiles and rockets, and anti-air defense systems.

Space- as part of C4I for satellites and associated ground control systems. Efforts at CECOM are actually efforts in support of Project Managers in development, acquisition, test and evaluation of ground terminal satellite communications equipments and systems. *There is no space unique or space specific work; only command, control, communications, and electronic warfare for ground control systems utilizing space systems for transfer of data.* Efforts include ensuring that ground terminal equipment meets technical requirements of the Defense Satellite Communication System (DSCS) and provides proper communications capacity and connectivity; for PM MILSTAR, CECOM supports development and testing of the MILSTAR satellite utilizing the Army developed ground terminal equipment, which currently includes the MILSTAR EHF Terminal and the Advanced SCAMP, a manportable EHF system. CECOM's involvement in conducting the MST-8000 test of the first MILSTAR satellite consists of demonstration of communication capabilities of Army to Army satellite terminal performance as well as Army interoperability with Air Force and Navy ground terminals. The DSCS program is a joint Army, Navy, and Air Force program with Army having responsibility for ground terminal development, acquisition and fielding; Air Force has responsibility for satellite hardware.

Ground Vehicles- as a platform for C4IEW equipment.

Electronic Devices- as collaborative work with Army Research Lab who performs basic and early applied research for semiconductor and superconductor materiels for optoelectronic, acoustic and microwave devices.

3.1 Location -

3.1.1 Geographic/Climatological Features- Ft. Monmouth NJ.
Ft. Monmouth, NJ is centrally located in proximity to several major metropolitan areas, such as New York, Philadelphia, Washington, Baltimore, Hartford, Boston and New Haven.

CECOM is also close to many of the finest academic, industrial and commercial electronic activities. As per Scientific America, NJ has the highest per capita concentration of engineers and scientists in the nation (approximately 145,000).
The above is relevant to all subcategories of CSF C4I.

3.1.1 Geographic/Climatological Features- Ft. Belvoir VA.

NVESD has two testing facilities, the Observation Range and Laser Range operated and maintained by NVESD with several unique features, including their proximity to Ft. Belvoir, VA and Washington DC. The Observation Range is used for placement of military targets to evaluate military and prototype sensor systems, as a staging area for field tests, air to ground and ground to air operations, and testing of IR devices. The range has varying topographical backgrounds useful for testing purposes under different terrains. The Laser Range is a unique, highly instrumented facility allowing users to test non-eye safe lasers. The facility has four bays, an elevated platform, and target ranges with high voltage, high current commercial power capabilities. This facility is one of only a couple of approved laser ranges on the east coast of the U.S.

The above is relevant to all subcategories of CSF C4I.

3.1.2 Licenses and permits:

Ft. Belvoir:

NRC License # 45-00953-01
DA Permit # A45-95-03

Provide authority to conduct surveys on radioactive materiels (transitioned from BRDEC per BRAC 93).

Ft. Monmouth:

NRC License # 29-01022-06
Purpose: cover R&D for training and instruments calibration.

NRC License # 29-01022-07
Purpose: Irradiation of materiels for purpose of R&D (Cesium 137, Cobalt 60)

NRC License # 29-01022-10
Purpose: Irradiation of materiels for purposes of R&D (Cobalt 60)

DA Authorization A29-10-01
Purpose: authorization of materiels in radiation detection instrumentation R&D; basic and applied R&D technologies; instrument calibration.

NRC License # 29-01022-14:
Purpose: Calibration and operational checking of radiation detection instrumentation for R&D (Cobalt 60, Krypton 85, Strontium 90, Cesium 137, Plutonium 239, Americium 241, Thorium 230, 232).

DA Permits #A29-10-06, A29-10-10, A29-10-12
Purpose: authorization for possession and use of radioactive materials.

3.1.3 Environmental constraints:

Ft. Monmouth: None
Ft. Belvoir: None

Above is relevent to CECOM RDEC for all CSF subcategories.

he above is relevant to all subcategories of CSF C4I.

3.1.1 Geographic/Climatological Features- Ft. Belvoir VA.

NVESD has two testing facilities, the Observation Range and Laser Range operated and maintained by NVESD with several unique features, including their proximity to Fr. Belvoir, VA and Washington DC. The Observation Range is used for placement of military targets to evaluate military and prototype sensor systems, as a staging area for field tests, air to ground and ground to air operations, and testing of IR devices. The range has varying topographical backgrounds useful for testing purposes under different terrains. The Laser Range is a unique, highly instrumented facility allowing users to test non-eye safe lasers. The facility has four bays, an elevated platform, and target ranges with high voltage, high current commercial power capabilities. This facility is one of only a couple of approved laser ranges on the east coast of the U.S.

The above is relevant to all subcategories of CSF C4I.

3.1.2 Licenses and permits: Additional Permits added w/ 24 Aug 94 Memo; AAA Amendments

NRC License # 45-00953-01 } @ Ft Belvoir per 24 Aug 94 Memo; Response to TABS (2)
DA Permit # A45-95-03

Provide authority to conduct surveys on radioactive materiels (transitioned from BRDEC per BRAC 93).

NRC License # 29-01022-06
Purpose: cover R&D for training and instruments calibration.

NRC License # 29-01022-07
Purpose: Irradiation of materiels for purpose of R&D (Cesium 137, Cobalt 60)

NRC License # 29-01022-10
Purpose: Irradiation of materiels for purposes of R&D (Cobalt 60)

DA Authorization A29-10-01
Purpose: authorization of materiels in radiation detection instrumentation R&D; basic and applied R&D technologies; instrument calibration.

3.1.3 Environmental constraints: Per 24 Aug 94 Memo; Response to TABS (2):

Not applicable to CECOM RDEC for all CSF subcategories. No environmental constraints at either location.

3.1.4 Special Support Infrastructure- Ft. Monmouth NJ.

The Pulse Power Center located in the Charles Wood Area, currently belonging to ARL but transitioning to CECOM in FY95, has a requirement for a 10 Megawatt cooling system installed at a cost of $8 Million. It also contains two 60 foot tempest classified high bays to perform experiments with high impulses of electrical power. This requirement is applicable to all CSF C4I sub-categories.

Per 24 Aug 94 Memo; Response to TABS (2):
Above paragraph applies to Ft. Monmouth.
There are not any special support infrastructure requirements at Ft. Belvoir.

3.1.5 Proximity to Mission-Related organizations: Fort Monmouth NJ.

PROXIMITY TO MISSION-RELATED ORGANIZATIONS

COMMON SUPPORT FUNCTIONS	NAME	TYPE OF ORGANIZATION	DISTANCE	WY PERF CECOM	WY FND CECOM
C4I	PEO COMM/CCS/IEW	GOVT	COLL	815	0
C4I	CRDA CONTRACTORS	COMMERCIAL	10-100 MI	0	14
C4I	UNIVERSITIES	UNIVERSITIES	5-50 MI	0	30
C4I	C3I ACQ CTR	GOVT	COLL	149	0
C4I	HI-TECH CONTR	COMMERCIAL	1-20 MI	0	200

The above figures are applicable across all CSF C4I sub-categories.

These colums are broken out into Ground-Mobile, Air, + Ground-Fixed C4I in the 24 Aug 94 Memo; Response to TABS (3).

0 X 30 foot concrete pads and a 25 foot elevated helicopter platform with commercial power is located within the compound. A transponder radar for use in airborne evaluation and ground ranging system with 15 target tracking capability is available. The range has full meteorological support to include atmospheric transmission and calibrated infrared target signature measurements. Wheeled and tracked vehicles with operators are available to include 1/4 to 2 1/2 ton trucks, M113, M114, M551, and M60's. Additional vehicles include: M-1, Main Battle Tank: M2, Armored Personnel Carrier; M110A1, Self Propelled Howitzer; M88 and M578 Armored Recovery Vehicles; and the Vulcan Air Defense System. A classified vault for equipment storage, assigned frequency communications equipment and contracted security guards are available.

PROXIMITY TO MISSION-RELATED ORGANIZATIONS - FT. BELVOIR

COMMON SUPPORT FUNCTIONS	NAME	TYPE OF ORGANIZATION	DISTANCE	WY PERF	WY FND
C4I	A.P.HILL	TEST/TRAIN	90 MILES	2	1.5
C4I	DAVIDSON	AIRFIELD	4 MILES	14	10
C4I	ARL	6.1-6.2	50 MIL3S	TECH PLAN	ANNEXES
C4I	GEORGE MASON	UNIVERSITY	20 MILES		
C4I	UNIV OF VA	UNIVERSITY	120 MILES		

The above figures are applicable to all CSF C4I sub-categories.

3.2 Personnel

3.2.1 Total Personnel- Ft. Monmouth NJ

CSF- C4I Airborne: 70

TOTAL PERSONNEL

TYPES OF PERSONNEL	NUMBER OF PERSONNEL			
	GOVERNMENT		ON-SITE FFRDC	ON-SITE SETA
	CIVILIAN	MILITARY		
TECHNICAL	450	24	0	50
MANAGEMENT (SUPV)	70	12	0	0
OTHER	158	21	0	7

Ft. Monmouth NJ
CSF- C4I Ground Fixed 91

TOTAL PERSONNEL

TYPES OF PERSONNEL	NUMBER OF PERSONNEL			
	GOVERNMENT		ON-SITE FFRDC	ON-SITE SETA
	CIVILIAN	MILITARY		
TECHNICAL	112	6	0	12
MANAGEMENT (SUPV)	18	3	0	0
OTHER	39	5	0	2

Ft. Monmouth NJ
CSF: C4I Ground Mobile 92

TOTAL PERSONNEL

TYPES OF PERSONNEL	NUMBER OF PERSONNEL			
	GOVERNMENT		ON-SITE FFRDC	ON-SITE SETA
	CIVILIAN	MILITARY		
TECHNICAL	541	29	0	63
MANAGEMENT (SUPV)	88	14	0	1
OTHER	198	27	0	9

Total Personnel- Ft. Belvoir VA
CSF: C4I Airborne

TOTAL PERSONNEL

TYPES OF PERSONNEL	NUMBER OF PERSONNEL			
	GOVERNMENT		ON-SITE FFRDC	ON-SITE SETA
	CIVILIAN	MILITARY		
TECHNICAL	196	16	0	47
MANAGEMENT (SUPV)	37	1	0	0
OTHER	58	0	0	31

Ft. Belvoir VA
CSF: C4I Ground Fixed

TOTAL PERSONNEL

TYPES OF PERSONNEL	NUMBER OF PERSONNEL			
	GOVERNMENT		ON-SITE FFRDC	ON-SITE SETA
	CIVILIAN	MILITARY		
TECHNICAL	34	2	0	8
MANAGEMENT (SUPV)	5	0	0	0
OTHER	10	0	0	4

Ft. Belvoir VA
CSF: C4I Ground Mobile

TOTAL PERSONNEL

TYPES OF PERSONNEL	NUMBER OF PERSONNEL			
	GOVERNMENT		ON-SITE FFRDC	ON-SITE SETA
	CIVILIAN	MILITARY		
TECHNICAL	116	7	0	25
MANAGEMENT (SUPV)	21	0	0	0
OTHER	30	1	0	13

3.2.~~3~~2 Education: Ft. Monmouth NJ
CSF: C4I Airborne

EDUCATION

TYPE OF DEGREE/DIPLOMA	NUMBER OF GOVERNMENT PERSONNEL BY TYPE OF POSITION		
	TECHNICAL	MANAGEMENT (SUPV)	OTHER
HIGH SCHOOL OR LESS	54	2	128
ASSOCIATES	15	1	10
BACHELOR	222	19	17
MASTERS	154	42	3
DOCTORATE	5	6	0
(INCLUDE :D/VET/ETC...)			

Ft. Monmouth NJ
CSF: C4I Ground Fixed

EDUCATION

TYPE OF DEGREE/DIPLOMA	NUMBER OF GOVERNMENT PERSONNEL BY TYPE OF POSITION		
	TECHNICAL	MANAGEMENT (SUPV)	OTHER
HIGH SCHOOL OR LESS	14	1	32
ASSOCIATES	4	0	2
BACHELOR	54	5	4
MASTERS	39	10	1
DOCTORATE (INCLUDE MED/VET/ETC...)	1	2	0

Ft. Monmouth NJ
CSF: C4I Ground Mobile

EDUCATION

TYPE OF DEGREE/DIPLOMA	NUMBER OF GOVERNMENT PERSONNEL BY TYPE OF POSITION		
	TECHNICAL	MANAGEMENT (SUPV)	OTHER
HIGH SCHOOL OR LESS	69	4	159
ASSOCIATES	19	2	12
BACHELOR	252	25	21
MASTERS	194	52	5
DOCTORATE (INCLUDE MED/VET/ETC...)	7	5	1

Education- Ft. Belvoir VA.

Ft. Belvoir VA
CSF: C4I Airborne

EDUCATION

TYPE OF DEGREE/DIPLOMA	NUMBER OF GOVERNMENT PERSONNEL BY TYPE OF POSITION		
	TECHNICAL	MANAGEMENT (SUPV)	OTHER
HIGH SCHOOL OR LESS	32	1	49
ASSOCIATES	6	1	2
BACHELOR	95	11	6
MASTERS	53	18	1
DOCTORATE (INCLUDE MED/VET/ETC...)	10	6	0

Ft. Belvoir VA
CSF: C4I Ground Fixed

EDUCATION

TYPE OF DEGREE/DIPLOMA	NUMBER OF GOVERNMENT PERSONNEL BY TYPE OF POSITION		
	TECHNICAL	MANAGEMENT (SUPV)	OTHER
HIGH SCHOOL OR LESS	5	0	9
ASSOCIATES	1	0	0
BACHELOR	17	2	1
MASTERS	9	3	0
DOCTORATE (INCLUDE MED/VET/ETC...)	2	0	0

Ft. Belvoir VA
CSF: C4I Ground Mobile

EDUCATION

TYPE OF DEGREE/DIPLOMA	NUMBER OF GOVERNMENT PERSONNEL BY TYPE OF POSITION		
	TECHNICAL	MANAGEMENT (SUPV)	OTHER
HIGH SCHOOL OR LESS	15	1	27
ASSOCIATES	3	1	1
BACHELOR	66	6	2
MASTERS	27	9	0
DOCTORATE (INCLUDE MED/VET/ETC...)	5	4	0

3.2.3 Experience: Ft. Monmouth NJ

	A	I	Q	Y	AG	AO
1		EXPERIENCE				
2		YEARS OF GOVERNMENT AND/OR MILITARY SERVICE				
3	TYPE OF	LESS THAN	3-10	11-15	16-20	MORE THAN
4	POSITION	3 YEARS	YEARS	YEARS	YEARS	20 YEARS
5	0	47	370	238	145	303
6	MANAGEMEN	0	5	23	34	114
7	(SUPV)	0	0	0	0	0
8	TOTAL	47	375	261	179	417

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Ft. Monmouth NJ
CSF: C4I Airborne

	A	I	Q	Y	AG	AO
1		EXPERIENCE				
2		YEARS OF GOVERNMENT AND/OR MILITARY SERVICE				
3	TYPE OF	LESS THAN	3-10	11-15	16-20	MORE THAN
4	POSITION	3 YEARS	YEARS	YEARS	YEARS	20 YEARS
5	TECHNICAL	18	148	95	58	131
6	MANAGEMEN	0	2	9	14	45
7	(SUPV)	0	0	0	0	0
8	TOTAL	18	150	104	72	176

Ft. Monmouth NJ
CSF: C4I Ground Fixed

	A	I	Q	Y	AG	AO
1		EXPERIENCE				
2		YEARS OF GOVERNMENT AND/OR MILITARY SERVICE				
3	TYPE OF	LESS THAN	3-10	11-15	16-20	MORE THAN
4	POSITION	3 YEARS	YEARS	YEARS	YEARS	20 YEARS
5	TECHNICAL	5	37	24	15	31
6	MANAGEMEN	0	0	2	3	13
7	(SUPV)	0	0	0	0	0
8	TOTAL	5	37	26	18	44

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Ft. Monmouth NJ
CSF: C4I Ground Mobile

	A	I	Q	Y	AG	AO
1		EXPERIENCE				
2		YEARS OF GOVERNMENT AND/OR MILITARY SERVICE				
3	TYPE OF	LESS THAN	3-10	11-15	16-20	MORE THAN
4	POSITION	3 YEARS	YEARS	YEARS	YEARS	20 YEARS
5	TECHNICAL	24	185	119	72	141
6	MANAGEMEN	0	3	12	17	56
7	(SUPV)	0	0	0	0	0
8	TOTAL	24	188	131	89	197

Experience: Ft. Belvoir VA

	A	I	Q	Y	AG	AO
1		EXPERIENCE				
2		YEARS OF GOVERNMENT AND/OR MILITARY SERVICE				
3	TYPE OF	LESS THAN	3-10	11-15	16-20	MORE THAN
4	POSITION	3 YEARS	YEARS	YEARS	YEARS	20 YEARS
5	TECHNICAL	4	164	63	29	86
6	MANAGEMEN	0	3	6	3	51
7	(SUPV)	0	0	0	0	0
8	TOTAL	4	167	69	32	137

Ft. Belvoir VA
CSF: C4I Airborne

	A	I	Q	Y	AG	AO
1		EXPERIENCE				
2		YEARS OF GOVERNMENT AND/OR MILITARY SERVICE				
3	TYPE OF	LESS THAN	3-10	11-15	16-20	MORE THAN
4	POSITION	3 YEARS	YEARS	YEARS	YEARS	20 YEARS
5	TECHNICAL	3	92	36	17	48
6	MANAGEMEN	0	2	4	2	29
7	(SUPV)	0	0	0	0	0
8	TOTAL	3	96	40	19	77

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Ft. Belvoir VA
CSF: C4I Ground Fixed

	A	I	Q	Y	AG	AO
1		EXPERIENCE				
2		YEARS OF GOVERNMENT AND/OR MILITARY SERVICE				
3	TYPE OF	LESS THAN	3-10	11-15	16-20	MORE THAN
4	POSITION	3 YEARS	YEARS	YEARS	YEARS	20 YEARS
5	TECHNICAL	0	16	6	3	9
6	MANAGEMEN	0	0	0	0	5
7	(SUPV)	0	0	0	0	0
8	TOTAL	0	16	6	3	14

Ft. Belvoir VA
CSF: C4I Ground Mobile

	A	I	Q	Y	AG	AO
1		EXPERIENCE				
2		YEARS OF GOVERNMENT AND/OR MILITARY SERVICE				
3	TYPE OF	LESS THAN	3-10	11-15	16-20	MORE THAN
4	POSITION	3 YEARS	YEARS	YEARS	YEARS	20 YEARS
5	TECHNICAL	1	56	21	9	29
6	MANAGEMEN	0	1	2	1	17
7	(SUPV)	0	0	0	0	0
8	TOTAL	1	57	23	10	46

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3.2.4. Accomplishments During FY93

3.2.4.1 Patents *Not included in 24 Aug 94 Memo; Response To TABS (-1)*

PATENTS NVL = Ft.Belvoir CECOM = Ft. Monmouth

CSF	DISCLOSURES	AWARDED	PATENT TITLES (LIST)
C4I	Ft. Belvoir	5164733	Phase Shift Detection for Use in Radar Enhanc-
			ing Systems
	Ft. Belvoir	5164948	Stabilized Local Oscillator Frequency for
			Heterodyn Laser Sensors
	Ft. Belvoir	5242537	Ion Beam Etching of Metal Oxide Ceramics
	Ft Belvoir	5245183	Vibration Resistant Coaxial Infrared Diode
			and Integrated Circuit Board
	Ft. Belvoir	5248172	Adjustable Fluid Transfer Apparatus
	Ft. Belvoir	5214532	Afocal Objective Lens
	NVL3047		Illuminated Sign Device
	NVL3048		Image Intensified System for Eye Resolution
	CECOM4880		Abrasion Resistant Diamond Like Coatings
			for Optical Fiber and Method Forming the
			Coating
	CECOM4655		D-Shaped Optic Fiber Transmitts and Reciever
GF	CECOM4796		Method of Establishing Line of Sight Propaga-
			tion
	CECOM4937		Magnetic Metal-Clad Optical Fibra Skin
			Bundling Payout Scheme
	CECOM4837		Situation Awareness Display
	AT&T 19-4CECO		Single Optical Fiber Hermaphroditic Connector
	NVL3035		Curtain Interlock
	NVL3036		High Performance Thermoelectric Elements
			Nanostructured
A/GM	NVL3037		Optical Echo for Atmospheric Turbulence and
			Pointing Jitter Compensation - An Energy
			Delivery ATD
	NVL3038		Image Dithering Device
	NVL3039		Night Time Weapons Training System
	NVL3024		New Concepts for Laser Rangefinder
	NVL3025		Binocular with a Sacrificial Mirror for Eye
			Protection
	NVL3026		A Fail -Safe Knob
	NVL3027		The Friedman-Blecha Fail-Safe Knob
	NVL3028		A Surface with a Real-Time Controllable
			Emissivity

	NVL3029		Knob Design
	NVL3030		Optical Design and Packaging Concept for
			a Folded Night Vision Goggle Objective
			and Eyepiece
	NVL3031		Ion Beam Etching of Metal Oxide Ceramics
	NVL3032		Thin Film Detector and Method of Manufacture
	NVL3033		IR Borescopte-Thermal
	NVL3034		Self-Timed Automatic Windshield
TOTAL	24	6	

All of the above are applicable to all C4I sub categories except as otherwise noted.

3.2.4.2 Papers Published in Peer Reviewed Journals

Notes included in 24 Aug 94 Memo; Response to TABS (4)

PAPERS

CSF	NUMBER PUBLISHED	PAPER TITLES (LIST) Ft. Monmouth
	Ft. Monmouth	CMI/ARL Video Tape
A/GM		Army Successfully Demonstrates New Cap-
		ability for Command & Control on the Move
		Direction Finding Via Extended Phase
		Interferometry
		Inter-Actor Conflict Mediation Within a Multi-
		Sensor Tactical Threat Assessment System
		Performance Analysis of a Stepped/Scanned
		Jammer
		RC-12 A/C Gramosis
GM		Test of an Integrated GPS/INS Sys for
		Precision Velocity
A		The Evolution of Army Airborne Data Transfer
		Devices
GM		Individual Soldier Computer Capabilities
		Omnibus Contracting for Command/Control
		and Systems Integration Directorate
		Computatinal Grammars for Hierarchial C2
		Automata
		Integrated Combat Analysis and Resource
		Allocation Program and Tool
		Ft. Belvoir
		Growth & Optical Properties of Ferroelectric
		Tungsten Bronze
		Artificial Neural Networks for Automatic Target

			and Eyepiece
	NVL3031		Ion Beam Etching of Metal Oxide Ceramics
	NVL3032		Thin Film Detector and Method of Manufacture
	NVL3033		IR Borescopte-Thermal
	NVL3034		Self-Timed Automatic Windshield
TOTAL	24	6	

All of the above are applicable to all C4I sub categories except as otherwise noted.

3.2.4.2 Papers Published in Peer Reviewed Journals (A = Airborne GF = Ground Fixed GM = Ground Mobile)

Title of Paper	Publication	Date Cleared
Ft. Monmouth		
Transportable Applications Environment Plus	*NSA Spinoff Journal*	5 Feb 92
Method of Fabricating Sub-micrometer Gold Wires on Optical Fiber	*Journal #208, 1992*	Oct 92
Tactical Line of sight Radio Propagation Reliability	*Rpt #TR-91-3, CECOM Tech Lib*	Oct 92
Tactical Line-Of-Sight Path Reliability/Improved MSF Systems Procedures	*Rpt#TR-92-1, CECOM Tech Lib*	Oct 92
A framework for Automated Tactical Data Fusion	*Phalanx*	08 Nov 91
A Hybrid Spatial/Object-Oriented DBMS to Support Automated Spatial, Hierarchical and Temporal Resoning	*Ablex Press, NJ*	21 Jan 92
Dual Band Microstrip Antenna with an Airgap	*Antenna & Propagations Symp Digest*	09 Jul 92
Army Successfully Demonstrates New Capability for C2 On the Move	*Signal Magazine*	05 Mar 93
The Evolution of Army Airborne Data Transfer Devices	*Signal Magazine*	19 Apr 93
A Proposed Data Fusion Process Model	*Monogram*	1992
An Improved Lisp Style Library for C.	*Dr. Dobbs Journal*	Sep 1992
Blackboard Concepts for Data Fusion Applications	*Int'l Journal of Pattern Recognition & Artificial Intelligence*	Apr 1993
Ft. Belvoir		
Contactless Tunnel Current of Infrared Focal Plane Detctr Array	*Journal of Vacuum Sci&Tn*	13 May 92

Location: Ft. Belvoir
CSF: Airborne

WORKYEAR AND LIFECYCLE

"LAB"	FISCAL YEAR 1993 ACTUAL			
	CIVILIAN	MILITARY	FFRDC	SETA
SCIENCE & TECHNOLOGY	214	12	0	57
ENGINEERING DEVELOPMENT	77	5	0	21
	0	0		
IN-SERVICE ENGINEERING	0	0	0	0

Location: Ft. Belvoir
CSF: C4I Ground Mobile

WORKYEAR AND LIFECYCLE

"LAB"	FISCAL YEAR 1993 ACTUAL			
	CIVILIAN	MILITARY	FFRDC	SETA
SCIENCE & TECHNOLOGY	118	6	0	28
ENGINEERING DEVELOPMENT	49	2	0	10
	0	0		
IN-SERVICE ENGINEERING	0	0	0	0

Location: Ft. Belvoir
CSF: C4I Ground Fixed

WORKYEAR AND LIFECYCLE

"LAB"	FISCAL YEAR 1993 ACTUAL			
	CIVILIAN	MILITARY	FFRDC	SETA
SCIENCE & TECHNOLOGY	37	2	0	9
ENGINEERING DEVELOPMENT	12	0	0	3
	0	0		
IN-SERVICE ENGINEERING	0	0	0	0

Growth & Optical Properties of Ferroelectric Tungsten Bronze	*Ferroelectric*	24 Sep 92
Artificial Neural Networks for ATR	*Optical Engineering*	13 Oct 92
Night Vision & Electo Optic Imaging Systems	*Jrnl of Imaging S&T*	20 Oct 92
Thermomigration of TE Precipitates & Optimization of CD,ZN	*Jrnl of Electrical Matter*	09 Nov 92
Tunnelling Current Probe for Contactless Electrical Perf	*IEEE Jrnl of Electric*	27 Oct 92
Vapor Phase Equilibrium in CD1-XZNXTE Alloy System	*Jrnl of Electric Matter*	09 Nov 92
High Efficiency Pyromethene Laser Doped Solid State Dye	*Applied Physics Letter*	9 Feb 93
ER:CA5(PO4)3F Satorable Absorber Q-Switch for ER:Glass	*Applied Physics Letter*	08 Apr 93
Liquid-Crystal Tetrazine-Containing Conjugated Polymer	*Chemistry & Materials*	07 June 93
Evaluation of a REgion-Growing Algorithm for Target Detection	*Journal of Imaging*	23 Aug 93
1993 IRIS Detector Specialty Group for Newsletter	*Spectral Reflections*	22 Sep 93

All of the above applicable to all CSF C4I sub-categories except as otherwise noted.

Patents and papers relate to communications and electronics technologies such image intensification, situation awareness, lasers, automatic target recognition, fiber optics, etc. C4I equipment and technologies subcategories of C4I are related to platforms of these equipments and technologies; however, except where noted in the original submission,

		Application of Shift Variant Convolutions to
		Image Generation
		Characterization of Spectroscopic Properties
		of ND3+: CA(MG)ZN

		Characterization of Spectroscopic Properties
		of ND3+: CAZN2Y2GE
		Adaptive Nonuniformity Correction Processing
		for Staring IRFPA
		Spectroscopic Properties and Effects of Color
		Centers
		IRIS Detector Specialy Group for Newsletter
		Night Vision and Electro Optical Imaging Sys
		An Evaluation of a Region-Growing Algorithm
		For Target Detection
TOTAL	72	

All of the above applicable to all CSF C4I sub-categories except as otherwise noted.

`.3 Workload

3.3.1 FY93 Workload

3.3.1.1 Work Year and Lifecycle:
Location Ft. Monmouth
CSF: C4I Airborne:

WORKYEAR AND
LIFECYCLE

"LAB"	FISCAL YEAR 1993 ACTUAL			
	CIVILIAN	MILITARY	FFRDC	SETA
SCIENCE & TECHNOLOGY	229	24 ~~28~~	0	29
ENGINEERING	263	20 ~~24~~	0	19
DEVELOPMENT	0	0		
IN-SERVICE	186	13 ~~15~~	0	9
ENGINEERING				

184
25
211

Changes per 24 Aug 94 Memo, AAA Admendments

Location Ft. Monmouth
CSF: C4I Ground Mobile

WORKYEAR AND
LIFECYCLE

"LAB"	FISCAL YEAR 1993 ACTUAL			
	CIVILIAN	MILITARY	FFRDC	SETA
SCIENCE & TECHNOLOGY	268	29	0	37
ENGINEERING	326	25	0	24
DEVELOPMENT	0	0		
IN-SERVICE	233	16	0	12
GINEERING				

Location Ft. Monmouth
CSF: C4I Ground Fixed

WORKYEAR AND
LIFECYCLE

"LAB"	FISCAL YEAR 1993 ACTUAL			
	CIVILIAN	MILITARY	FFRDC	SETA
SCIENCE & TECHNOLOGY	59	6	0	7
ENGINEERING	63	6	0	5
DEVELOPMENT	0	0		
IN-SERVICE	47	2	0	2
ENGINEERING				

3.3.1.2 Engineering Development By ACAT:

The following systems are CSF C4I Ground Mobile:

AFATDS: Army Field Artillery Tactical Data System-
Description: Broadens and modernizes Army Fire Support Command, Control, and Coordination system

ASAS: All-Source Analysis System-
Description: All-source intelligence fusion network. Block II includes conversion to ATCCS CHS open architecture

CHS: Common Hardware Software for the Army Tactical Command and Control Systems, consisting of Handhel Terminal Unit, Portable Computer Unit, Transportable Computer Unit, and compatible peripheral devices, along with software and a programming support environ ment.

CSSCS: Combat Service Support Control System is a computer software systemto rapidly collect, store, analyze and disseminate CSS informtion to support command, control and resource management.

FSAC: Fire Support ADA Conversion is a program to replace battery computer units with modern ATCCS lightweight computer units.

'S: Global Positioning System User Equipment-
Description: Consists of a family of ten different models meeting needs that range from foot soldier to military aircraft

PATRIOT: Anti missile launching system.

SCAMP: Single-Channel Antijam Manportable Block I
Description: Manportable, secure, antijam single channel worldwide voice and data satellite communications terminal

SMART-T Secure Mobile Antijam Reliable Tactical Terminal:
Description: Provides tactical users with secure, survivable, antijam communications on a mobile platform

EPLRS: Enhanced Position Location Reporting System-
Description: Provides position-locating and reporting information to both the user and his equipped higher headquaters

JTIDS: Joint Tactical Information Distribution System-
Description: Provides jam-resistant, secure data communications to high-volume users (sepcifically, FAADC@ and HIMAD)

MCS: Maneuver Control System Version 12
Description: Evolutionary development of v12 to accelerate fielding of MCS to all units utilizing CHS II

'SE: Mobile Subscriber Equipment consists of a network of switches, radio trunk, system ıtrol center, subscriber terminals, nodes and a radio access unit, which will replace ıe existing command and area communications system. It will provide users with means to communicate throughout the battlefield.

SINCGARS: Single Channel Ground and Airborne Radio System is a new family of VHF-FM combat net radios providing means of command and control for infantry, armor and artillery units.

BCIS: Battlefield Combat Identification System-
Description: Provides identification beyond maximum range of weapons systems to reduce incidents of fratricide

FIREFINDER: AN/TPQ-36 and AN/TPQ-37 mortar and artillery locating radar system.

NCTR: Non Cooperative Target Recognition devices provide passive identification of aircraft allowing air defense weapon systems to detect and engage targets at longer ranges than currently possible.

Joint STARS Radar Ground Station Module (Block I):
Description: Block I improvements entail open systems architecture, increased operational capabilities, and enhanced modularity

FIREFINDER Electronics Upgrade:
Description: Upgrades AN/TPQ-36 through the use of state-of-the-art electronics and CHS components

Fire Support Ada Conversion:
Description: Program established to provide focal points to manage major programs (e.g., BCS, MLRS, IFSAS)

ACMES: Automated COMSEC Management and Engineering System:
Description: Frequency management system designed to meet critical requirements for generating frequency-hopping information

ISYSCON: Integrated System Control-
Description: Provides automated assistance in managing and integrating various communications systems in tactical areas of operation

HT: Heavy Terminal Modernization Program-
Description: Provides upgrade of aging electronics in the HTs

HORIZONTAL INTEGRATION (HTI): Horozontal Integration of Second Generation Forward Looking Infrared will provide a balanced, synchronized warfighting capability across the combined Armed Forces.

STINGRAY:
Description: Electro-optical countermeasures system for area protection of groung combat vechicles

The following programs are CSF C4I Airborne:

Commanche: Fully integrated attack aircraft weapon system providing real time situation areness and capability to fly 1250 nautical miles, integrating targeting, fire control .d radar systems, and includes HELLFIRE, ATAS, Hydra-70 rockets and a 20mm turreted gun.

Longbow: Mast mounted millimeter wave fire control radar and fire and forget RF Hellfire missile system integrated to the APACHE attack helicopter system.

GR/CS: Guardrail Common Sensor is a Corps level Airborne Signal Intelligence collection/location system.

AN/ALQ-136(V)1/5: Designed to provide warning and Electronic Countermeasures (ECM) against Surface-to-Air and Anti-Aircraft Artillery directed against Scout and Attack Helicopters

AN/ALQ-136(V)2: Provides Special Electronic Mission Aircraft (SEMA) and Special Operations Aircraft (SOA) with effective electronic countermeasures against the radar mode of both Airborne and Ground Based Pulse Radar directed Weapon Systems

AN/ALQ-144A(V): The AN/ALQ-144A(V) Infrared Countermeasures Set provides protection for Army helicopters against surface-to-air and air-to-air homing type IR missiles.

AN/ALQ-162(V): Provides warning and Electronic Countermeasures (ECM) against Surface-to-Air and Airborne Interceptor Missiles that utilize a Continuous Wave (CW) Illumination Radar for guidance.

ATRJ-Advanced Threat Radar Jammer: Fully Integrated Radio Frequency System for simultaneous electronic protection against current and future radar directed air suppression weapons.

AN/APR-39A(V)1: Radar Warning Receiver designed to produce and field improved radar warning receiver to ID Specific Hostile Radar Directed Weapons Systems. Provide improved isual/audio warning in a multiple threat environment.

AN/APR-39A(XE-2): System provides RF threat warning to aircraft.

AN/APR-2: Laser Detecting Set that provides Army aircraft with increased survivability through early warning of attack by laser aided weapons.

AN/AVR-2A: (Same as above, but with more improved coverage around the aircraft)

ATIRCM (Advanced Threat Infrared Countermeasures): Provide and develop for the Army Aviation Fleet and advanced system that can detect both Infrared and RF Missile and protect an aircraft from Infrared Missile threats.

IASE (Integrated Aircraft Survivability Equipment): To increase the mission effectiveness and enhance the survivability of US Army aircraft. Improves situational awareness through integration of sensors.

AN/APR-39A(V)2: Produce and field improved Radar Warning Receiver to ID Specific Hostile Radar Directed Weapons Systems. Provide improved visual/audio warning in a multiple threat environment.

AVIATION NIGHT VISION IMAGING SYSTEM (ANVIS): The ANVIS is a lightweight, high performance passive third generation image intensifier system designed specifically for use by helicopter pilots during night flights including Nap-of-the-Earth (NOE) missions.

The following programs relate to CSF C4I Ground Fixed:

LSTAR Ground Command Post-
Description: Multiservice satellite communications system enabling the National Command Authority (NCA) to command and control strategic/tactical forces (note; this is a subsystem to the MILSTAR integrated satellite system).

JCALS: Joint Computer Aided Logistics System.

The following programs relate to all subelements of CSF C4I:

IMAGE INTENSIFIERS CONSIST OF:

AN/AVS-6
AN/PVS-6
AN/PAS-13
AN/AVS-7
AN/PLQ-5
AN/VAS-5
The above are all:

NIGHT VISION GOGGLES: The night vision goggles are lightweight, high performance passive third generation image intensifier systems.

MELIOS: Mine Eyesafe Laser Infrared Observation Set (MELIOS) will provide the individual soldier with accurate range and vertical angel determination to provide target acquisition data for direct and indirect weapons systems in eyesafe mode.

THERMAL WEAPON SIGHT (TWS): TWS is a class of low cost, light-weight, manportable infrared imaging devices of medium to high resolution to be used for surveillance fire control of individual and crew served weapons during both daylight and darkness.

RIVERS THERMAL VIEWER:

AVIATION NIGHT VISION IMAGING SYSTEMS / HEADS UP DISPLAY (ANVIS/HUD): A modification to the Aviators Night Vision Imaging System. It will collect and display critical flight information from aircraft sensors and convert this information into visual imagery.

LASER COUNTERMEASURE SYSTEM (LCMS): Meets the requirement to acquire a system which can be employed by the individual soldier to find and disrupt threat optical and electro-optical surveillance devices.

DRIVER'S VISION ENHANCER(DVE): A passive thermal imaging system designed to provide drivers of tactical wheeled vehicle with the capability to continue normal driving operations in all ambient light levels and in the presence of natural and man-made obscurants.

In the following charts, all items are CSF C4I. Subcategories are indicated as : A- airborne; GM- Ground Mobile; GF- Ground Fixed: If ALL is annotated, it indicates a system including components of all subelements, or a technology that crosses all subcategories:

The above are all:

NIGHT VISION GOGGLES: The night vision goggles are lightweight, high performance passive third generation image intensifier systems.

MELIOS: Mine Eyesafe Laser Infrared Observation Set (MELIOS) will provide the individual soldier with accurate range and vertical angle determination to provide target acquisition data for direct and indirect weapons systems in eyesafe mode.

THERMAL WEAPON SIGHT (TWS): TWS is a class of low cost, light-weight, manportable infrared imaging devices of medium to high resolution to be used for surveillance fire control of individual and crew served weapons during both daylight and darkness.

DRIVERS THERMAL VIEWER:

AVIATION NIGHT VISION IMAGING SYSTEMS / HEADS UP DISPLAY (ANVIS/HUD): A modification to the Aviators Night Vision Imaging System. It will collect and display critical flight information from aircraft sensors and convert this information into visual imagery.

LASER COUNTERMEASURE SYSTEM (LCMS): Meets the requirement to acquire a system which can be employed by the individual soldier to find and disrupt threat optical and electro-optical surveillance devices.

DRIVER'S VISION ENHANCER(DVE): A passive thermal imaging system designed to provide drivers of tactical wheeled vehicle with the capability to continue normal driving operations in all ambient light levels and in the presence of natural and man-made obscurants.

In the following charts, all items are CSF C4I. Subcategories are indicated as : A-airborne; GM- Ground Mobile; GF- Ground Fixed: If ALL is annotated, it indicates a system including components of all subelements, or a technology that crosses all subcategories:

Element 3.3.1.2: Engineering Development by ACAT.
The following systems are associated with Ft. Monmouth:

ACAT	CSF	SYSTEM	WY	FUNDS OBL	LOCATION
IC	GM	AFATDS	32	2814	FM
IC	GM	ASAS	5	477	FM
IC	GM	CHS+	18	1366	FM
IC	A	COMANCHE	4	350	FM
IC	GM	CSSCS	1	86	FM
IC	GM	FSAC	11	0	FM
IC	GM	GPS NAVSTAR	9	1075	FM
IC	A	LONGBOW	10	851	FM
IC	GM	MILSTAR	7	636	FM
IC	GM	SCAMP	13	1181	FM
IC	GM	SMART-T	16	1464	FM
ID	GM	EPLRS	21	1870	FM
ID	GM	JSTARS	9	644	FM
ID	GM	JTIDS	5	517	FM
ID	GM	MCS	24	2275	FM
ID	GM	MSE	54	4514	FM
ID	GM/A	SINCGARS	29	2495	FM
II	GM	COMBAT ID	13	1057	FM
II	GM	FIREFINDER	5	509	FM

ACAT	CSF	SYSTEM	WY	FUNDS OBL	LOCATION

II	A	GR/CS	33	3090	FM
II	A	NCTR	3	219	FM
III	GF	DSCS	10	26200	FM
III	GM	GMF CONTROL*	19	1745	FM
III	GF	DOCS*	0	0	FM
III	GM	TAC UHF ANTENNA*	1	110	FM
III	GF	AN/USC-28*	19	1700	FM
III	GF	SCTRS*	2	195	FM
III	ALL	ACMES*	2	183	FM
III	ALL	ISYSCON*	8	651	FM
III	GF	HTMP *	41	404	FM
III	GM	STINGRAY*	1	20	FM
III	GF	IEW SYSTEMS*	60	7620	FM
III	GM	IEW SYSTEMS *	110	13807	FM
III	A	IEW SYSTEMS*	18	2379	FM
III	A	AVIONICS SYSTEMS	32	2448	FM
III	GF	VARIOUS SYS*	5	436	FM
III	GM	VARIOUS SYS*	26	2267	FM
III	A	VARIOUS SYS*	20	1744	FM
III	A	ARC-220*	8	656	FM
III	GM	MINTERM*	8	627	FM
III	GM	AN/TSC-122*	0.2	15	FM
III	GM	C2V	4	333	FM
III	GM	JASORS*	1	125	FM
III	GF	FIBER OPTICS*	2	173	FM
III	GM	GPLAS	3	213	FM
III	GM	UGV JPO*	3	225	FM
III	GM	CVC2*	2	181	FM
III	GM	CDS*	3	249	FM
III	GM	EMUT*	1	85	FM
III	GM	KY-99*	1	106	FM
III	GM	SOCRATES*	1	120	FM
III	GM	SOFAR*	1	81	FM
III	GM	UNIV MODEM*	1	124	FM
III	GM	VIS*	8	648	FM
III	GM	CAC2*	4	325	FM

* Not included on MILDEP ACAT Listing

The following systems are associated with Ft. Belvoir:

ACAT	CSF	SYSTEM	WY	FUNDS OBL	LOCATION
II	A	AN/AVR-2	1.25	7336.9	FB
II	A	AN/AVR-2A	1.25	35026.8	FB
II	A	AN/ALQ-144A	2	2261.6	FB
II	A	ATRIM	3	10835	FB
II	A	IASE	3.8	1018.5	FB
II	A	AN/ALQ-136(V)QC	0.5	44.5	FB
II	A	AN/ALQ-136(V)2	1.5	138.8	FB
II	A	AN/APR-39A(V)1	2.5	8654.5	FB
II	A	AN/APR-39A(V)2	1.5	1704	FB
II	A	AN/APR-39A(XE-2)	1	4414	FB
II	A	AN/ALQ-162(V)2	0.5	50.3	FB
II	A	ATRJ	3	5860	FB
II	A	COMANCHE	6	555	FB
II	GM	HTI	20.3	2280	FB
III	A	AN/AVS-6	17.15	1648	FB
III	GM	AN/PVS-6	2.75	306	FB
III	GM	AN/PAS-13	4.65	498	FB
III	GM	THERMAL VIEWER	2.2	195	FB
III	A	AN/AVS-7	5.55	4.28	FB
III	GM	AN/PLQ-5	2.65	291	FB
III	GM	AN/VAS-5	4.1	409	FB
III	GM	LRAS	0.5	70	FB

None of the above ACAT II systems appears on the MILDEP ACAT Listing. However, they are listed since they represent substantial level of support.

3.3.1.3 Service Engineering

CSF	IN-SERVICE ENGINEERING EFFORTS (LIST)	FY93 ACTUAL		WEAPONS SYSTEMS(S) SUPPORTED
		FUNDS RECEIVED (OBLIGATION AUTHORITY)	WORKYEARS	
C4I A	C2 & System Integration	1231	14.3	Guardrail
C4I A	C2 & System Integration	1204	13.7	AEC
C4I A	C2 & System Integration	200	2.3	UH-60
C4I A	C2 & System Integration	543	6.2	Apache
C4I A	C2 & System Integration	170	1.9	Kiowa
I A	C2 & System Integration	47	0.7	UH-1
4I A	C2 & System Integration	9	0.1	ASE
C4I A	C2 & System Integration	6	0.1	ATC
C4I A	C2 & System Integration	1046	12.1	Blackhawk
C4I A	C2 & System Integration	34	0.4	EH-60A
C4I A	C2 & System Integration	92	1	CH-47
C4I GM	C2 & System Integration	970	11.3	SINCGARS
C4I GM	C2 & System Integration	450	5.4	MSCS
C4I GM	C2 & System Integration	203	2.4	FIREFINDER
C4I GM	C2 & System Integration	1916	22	FATDS
C4I GM	C2 & System Integration	290	3.5	MILSTAR
C4I GM	C2 & System Integration	28	0.3	RN
C4I GM	C2 & System Integration	160	1.9	JAGUAR
C4I GM	C2 & System Integration	218	2.6	MSE
C4I GM	C2 & System Integration	409	4.9	ADDS
C4I GM	C2 & System Integration	47	0.6	OPTADS
C4I GM	C2 & System Integration	263	3.2	PATRIOT
C4I GM	C2 & System Integration	60	0.7	MLRS
C4I GM	C2 & System Integration	52	0.6	FMTV
C4I GM	C2 & System Integration	49	0.6	REMBASS
4I A	C2 & System Integration	9	0.1	APACHE
4I GM	C2 & System Integration	25	0.3	ABR TANK

4I GM	C2 & System Integration	439	5.4	KY-58
C4I A	C2 & System Integration	29	0.4	OH-58
ALL	C2 & System Integration	655	8	OTHER X
ALL	Fielding /System Enhance	16516	16	TROJAN X
GM	MODS/UPGRADES	1527	11	Remote Relay
GM	MODS/UPGRADES	3157	2	CN/CMS
GM	MODS/UPGRADES	274	2.7	Met Measure System
A	System Enhancements	2285	28	Guardrail
GM	RAM	143	0	Meager
ALL	MODS/UPGRADES	77	0	CTT
GM	MODS/UPGRADES	87	0.5	MIS
A	Mods/Upgrades	160	2	IGRV
GM	RAM	289	0	Lightchain
GM	Upgrades	65	0	MDS
GM	RAM	120	1	Tracechain
GM	Fielding	266	2.8	IREMBASS
GM	RAM	94	0	OUTS/TRR-27A/Betafite
	RAM			
	PDSS	86730	1441	see below

The following weapons systems are prominent examples of the scores of systems that receive Post Deployment Software Support (PDSS): AEB Repeater, AJCM, AN/ALQ-136, AN/ALQ-156, AN/APR-39, AN/GSC-40, AN/GSC-52, AN/MSC-64, AN/TLQ-17A, AN/TSC-99, AN/TTC-39, AN/TYC-39, AN/UGC-144, AN/UPD-7, AN/USC-28, AN/USM-410, ARTBASS, ASAS, ASN-128, ASN-132, ASN-137, ATHS, BBS, BCS, BMMT, CBS, CDOSS, COMCAT, CSCCE, CSCE, DECS, DFCS, DOSS/DASA, EARTBASS, FIREFINDER-TD, FIREFINDER-US GUARDRAIL V, IGRV, JANUS, JSTARS, LTACFIRE, MCS V10, B\MDS, MMT, NABS/SCCC, NCT-IS, OQ-329-U, QUICKFIX, QUICKLOOK II, REGENCY NET, REMBASS, SAMS-J, SCCE, SCTR, SEOS, SSP-S, TACFIRE, TCAC, TEAMMATE, TRAILBLAZER.

The above WY and dollar figures represent both internal and contractual support for these items. CECOM supports some 93,000 items in total. The above listed systems represent those which receive the most prominent support. Approximately 290 workyears for PDSS supported Ground fixed, 1000 wy supported ground mobile, and 150 workyears supported airborne C4I, in FY93.

X Notes added in 24 Aug 94 Memo; Response to TABS(5).

3.3.2 Projected Funding

All figures are $M

3.3.2.1 Direct Funding

Ft. Monmouth
CSF-C4I Airborne
DIRECT
FUNDING

CSF	FY94	FY95	FY96	FY97
C4I RDTE	42.0	42.4	42.5	42.6
C4I PA	8.1	10.5	8.9	5.0
C4I OMA	19.7	17.1	16.7	17.3

Ft. Monmouth
CSF: C4I Ground Mobile
DIRECT
FUNDING

CSF	FY94	FY95	FY96	FY97
4I RDTE	54.9	55.4	55.5	55.7
.4I PA	28.2	36.6	31.3	17.6
C4I OMA	68.9	59.9	58.4	60.6

DIRECT
FUNDING
Ft. Monmouth
CSF-C4I GF

CSF	FY94	FY95	FY96	FY97
C4I RDTE	10.8	10.9	10.9	10.9
C4I PA	4.0	5.2	4.5	2.5
C4I OMA	9.8	8.6	8.3	8.7

DIRECT
FUNDING

Ft. Belvoir
CSF:C4I
Airborne

CSF	FY94	FY95	FY96	FY97
4I RDTE	58.5	65.5	60.7	60.7
:4I PA	10.6	2.1	2.1	1.6

C4I OMA	2.1	1.7	1.7	1.7

DIRECT
FUNDING

Ft. Belvoir
CSF C4I GM

CSF	FY94	FY95	FY96	FY97
C4I RDTE	32.3	36.1	35.6	30.0
C4I PA	5.8	1.2	1.2	0.9
C4I OMA	1.2	1.0	0.9	0.9

DIRECT
FUNDING
Ft. Belvoir
CSF-C4I GF

CSF	FY94	FY95	FY96	FY97
C4I RDTE	10.1	11.3	10.5	10.5
C4I PA	1.8	0.4	0.4	0.3
C4I OMA	0.4	0.3	0.3	0.3

3.3.2.2 Other Obligations:

OTHER
OBLIGATIONS

Ft. Monmouth
CSF: C4I Airborne

CSF	FY94	FY95	FY96	FY97
RDTE REIMB	21.5	21.6	20.2	20.2
OMA REIMB	10.7	9.3	8.5	8.5
DIR CITE	51.2	51.0	49.6	49.6

OTHER
OBLIGATIONS

Ft. Monmoutn
CSF: C4I GM

CSF	FY94	FY95	FY96	FY97
RDTE REIMB	42.3	42.6	39.7	39.7
OMA REIMB	21.1	18.3	16.7	16.7
DIR CITE	100.8	100.3	97.6	97.6

OTHER
OBLIGATIONS

Ft. Monmouth
CSF C4I GF

CSF	FY94	FY95	FY96	FY97
RDTE REIMB	5.5	5.6	5.2	5.2
OMA REIMB	2.8	2.4	2.2	2.2
IR CITE	13.2	13.2	12.8	12.8

OTHER
OBLIGATIONS

Ft. Belvoir
CSF C4I Airborne

CSF	FY94	FY95	FY96	FY97
RDTE REIMB	25.1	21.9	20.3	20.3
OMA REIMB	0.5	0.5	0.3	0.3
DIR CITE	64.4	63.8	63.8	63.8

OTHER
OBLIGATIONS

Ft Belvoir
CSF C4I GM

CSF	FY94	FY95	FY96	FY97
RDTE REIMB	13.9	12.1	11.2	11.2
A REIMB	0.3	0.3	0.2	0.2
DIR CITE	35.5	35.2	35.2	35.2

OTHER
OBLIGATIONS

Ft. Belvoir
CSF C4I GF

CSF	FY94	FY95	FY96	FY97
RDTE REIMB	4.3	3.8	3.5	3.5
OMA REIMB	.1	.1	.1	.1
DIR CITE	11.1	11.0	11.0	11.0

See Cover Memo (Aug 1, 94) for additional info. (@ 2.b)

3.4 Facilities and Equipment - Fort Monmouth

3.4.1 Major Equipment and Facilities:
Explanation of uniqueness and facility descriptions attached.
Additional Notes included in 24 Aug 94 Memo; Response to TABS (6).

MAJOR EQUIPMENT AND FACILITIES

CSF	MAJOR FACILITY OR EQUIPMENT DESCRIPTION	UNIQUE TO			
		DOD	FEDERAL GOV'T	U.S.	REPLACEMENT COSTS ($k)
C4I	Navigation Systems Test Lab				2026
C4I	C2 Audio Signal Process Lab				250
C4I	Tactical C2 Lab				5786
C4I	Battle Command C2 SW Lab				290
C4I	CAC2 Info Dist Tech Lab				26
C4I	AI/Decision Supt C2				2000
C4I	C2 Environ Test Lab				12000
I	Prototype Fabrication				15000
4I	SCIF R&D Facility				10682
C4I	Limited Access R&D Fac				6758
C4I	Limited Access R&D Whse				1792
C4I	CSE Battlefield SW Facility	X	X	X	500,000
C4I	Army Interoperability Network	X			16500
C4I	Strategic Space Systems Fac	X	X		80,000
C4I	Tactical Space Systems Fac	X	X		80,000
C4I	Photonics Lab				1200
C4I	Fiber Optics Pro Lab				2000
C4I	Local Area Networks Lb	X	X	X	1500
C4I	NUH-60 STAR Facility	X			46500
C4I	Pulse Power Center	X	X	X	55000
C4I	Mobile Comm Lab				4250
C4I	Audio Lab				350
C4I	Information Security Lab	X			260

Communications Systems Design Center

20,000 - per 24 Aug 94 Memo; AAA Amendments

Descriptions of laboratories and explanations of uniqueness are below.

These facilities all support all subcategories of CSF C4I across the board. Replacement costs above represent a true picture of cost to replace existing facilities.

Research, development and testing of self-contained and radio navigation systems is performed in the Navigation Laboratory. The Laboratory is a restricted area allowing storage and use of communication security equipment. The Laboratory hosts the Global Positioning System Test Environment System (GPST), Precision Navigation System (PNS), Doppler Navigation Test Set and the Global Positioning System AN/ASN-149 (V) 1 Bench Test Facility.

The GPST is used to characterize the performance of GPS receivers and GPS based navigation integrations. It simulates ten GPS satellite signals, host vechicle motion and navigation sensor aiding. Radio frequency signal generators and a spectrum analyzer are used with the GPST to test GPS jamming performance.

COMMAND AND CONTROL AUDIO SIGNAL PROCESSING LABORATORY

The ASP laboratory has been designed to facilitate the evaluation of automated speech recognition equipment and to this end is unique within the Army. Utilizing its vast libary of vechicle sound environments, automated evalutions of any form of speech recognition equipment can be preformed in an environment representative of that in which it would encounter in the field. The Audio Signal Processing (ASP) laboratory comprises an anechoic chamber, a sound absorption chamber and a suite of audio analysis equipment. The audio analysis equipment is under the control of a computer attached to the independent laboratory network.

TACTICAL COMMAND AND CONTROL LABORATORY

The Tactical Command and Control Laboratory, formerly known as the TASS (Tactical Avionics Systems Simulator), contains facilities for the development, testing and demonstration of systems such as the AMPS (Aviation Mission Planning System), and the ATOC (Advanced Tactical Operations Center). It also contains the hardware (cockpit simulator, control loaders, instrumentation, etc.) and software (six degree of freedom, non-linear aero model) required to perform real time, man in the loop, aircraft simulations.

THE BATTLE COMMAND C2 SOFTWARE INTEGRATION LABORATORY (BCC2 SIL)

Contains facilities for the development of integrated C2 software for Brigade and below. The BCC2 SIL focuses on the integration of in-house developed application software with PEO-CCS (PM OPTADS) contractor developed software. The BCC@ SIL resides as a node on the Myer Center's "digital battlefield" network providing command/soldier connection for man-in-the-loop simulation exercises with the user battlelabs. The BCC2 SIL work integration issues are associated with linking the Soldier System to other nodes on the digital battlefield.

CAC2 INFORMATION DISTRIBUTION TECHNOLOGY LABORATORY

The Information Distribution Laboratory contains facilities for developing, integrating, demonstrating and testing methods for horizontal integration of the battlefield and reducing the data being offered to tactical communications systems for the purpose of improving responsiveness and accuracy of command and control information. This facility is used primarily, as the testbed for the data base and data distribution functions being performed under the Combined Arms Command and Control (CAC2) Advanced Technology

emonstration (ATD). The laboratory has the capability of hosting data bases and applications at five tactical echelons and testing data base update techniques over real tactical communications systems interconnecting these hosts.

ARTIFICIAL INTELLIGENCE/DECISION SUPPORT COMMAND AND CONTROL LABORATORY

The AI/DS C2 Lab is an environmentally controlled lab providing engineers with lab Work Stations, computer and space necessary to conduct R&D Modeling, demonstrations, and prototyping of C2/Decision-Aid Technology to serve the needs of Army developmental C2 Systems.

COMMAND AND CONTROL ENVIRONMENTAL TEST LABORATORY

The C2 Environmental Test Laboratory possesses the capability of performing all MIL-STD-810 tests on Army C-E equipment and systems except road tests and fungus test, such as drive in, high temp/low temp/humidity, chamber, explosion, and Combined Environmental Reliability Test (CERT).

COMMAND AND CONTROL MACHINE, SHEETMETAL, WOODWORKING, ELECTRIC AND PAINT SHOPS

Provide quick reaction, creative, precision and standard shop services for prototype fabrication, pre-production evaluation and production base support. Typical projects include installation kits for any type of C-E equipment in any kind of vehicle (ground or air).

SENSITIVE COMPARTMENTALIZED INFORMATION FACILITY (SCIF)

The SCIF is comprised of the following:

Special Access Program (SAP) office and laboratory space have similar physical security requirements. The SAP laboratories are equiped with the latest state-of-the-art equipment which provides critical signal processing of high level priority threat signals of National intelligence interest. It embraces current statistical measurements and clustering processors that can examine numerous signals from a variety of recording mediums. This ability to provide signal processing expertise is due to the employment of substantial computer and graphical analysis equipment and techniques.

Signal Intelligence (SIGINT)/Data Fusion Lab - This space contains three separate laboratories as follows:

a. The Central Analysis Facility (CAF) is an Army owned analysis center to support research and development. The CAF allows IEWD personnel direct interface with users to maintain an awareness of present and future SIGINT problems. By bringing in real world signals for real time signals analysis, it provides the capability for quick response to tactical units on signals analysis/recognition problems. This is the first step in the development of methodology to support fielded units with signal recognition algorithms and software upgrades.

b. The Intelligence Data Fusion Test Bed integrates and incorporates diverse advanced fusion technology into the Army's diverse IEW systems. This effort involves interactive processes of specific applications for artificial intelligence technology,algorithms, rules, and software for manipulating fusion data bases in support of specific IEW fusion functions. The test bed is the U.S. Army nucleus for this major undertaking. This test bed develops and demonstrates the critical technology required to automate the manpower intensive nature of the tactical intelligence data fusion process and simultaes a realistic tactical fusion environment required to accurately test and evaluate fusion research. It relies on substantial computer and graphical analysis equipment and techniques to accomplish these efforts.

.. The Strategic Engineering Laboratory - Software and hardware are designed, developed and tested for strategic SIGINT systems applications in this facility.

Simulation and Modeling Lab: The IEW Simulation and Modeling Laboratory provides the capability to evaluate intercept and Electronics Countermeasures (ECM) systems effectiveness against both communications and radar targets when operating in or near an enemy location. Development of system evaluation techniques can be used to predict the performance of candidate systems by utilizing existing Government models, and provides support to IEWD engineers for development of systems, approaches and designs for countering hostile C3 threats systems, with emphasis on ground based threats.

Systems Integration Laboratory (SIL): SIL supports a multitude of projects and is a quick-reaction, in-house laboratory which can rapidly translate concepts into prototypes, integrate emerging technology into new or existing systems and bring ideas/concepts to the field for evaluation. With a high bay area, machine shop and laboratory space, the SIL offers the means and ability to support the integration of shelters and the building of prototypes.

Various Programs Lab: This laboratory supports two separate programs and contains both high bay space and office space.

STRATEGIC SPACE SYSTEMS FACILITY: Consists of two buildings comprising 17500 Sq ft (two structures) which house the Defense Satellite Communication System (DSCS)and equipment as well as a DSCS III satellite simulator. Also housed in the facility are the AN/GSC-52 satellite comm terminal and AN/GSC-39 prototype satellite comm terminal.

TACTICAL SPACE SYSTEMS FACILITY: 7500 square foot structure containing UHF, SHF, and EHF satellite communications equipment. The UHF are the military manpack systems, SHF include Ground Mobile Forces (GMF) systems, the AN/TSC-85 and AN/TSC-93. The EHF systems are the MILSTAR engineering development models terminals.

These two facilities provide a readily available system/equipment diagnostic interface and evaluation capability for assisting industry as well as government in satellite comm RDT&E.

Collocated at Ft. Monmouth, SATCOM evaluation facility and MILSATCOM equipment certification facility are the only facilities in DOD fir MILSATCOM that provide this level of total system evaluation and integration. A complete suite of the ground environment for the DSCS strategic terminals, SHF tactical terminals, DSCS and tactical SATCOM network control, UHF manpack terminals, and EHF Milstar terminals is installed here, including DSCS II and III satellite simulators. Also included are terminals for the Advanced Comm Technology Satellite (ACTS) and commercial INMARSAT satellite that are being used to leverage and evaluate advanced and commercial technology for military application. When coupled with existing terrestrial communications facilities, integrated seamless communications across the battlefield can be evaluated and demonstrated.

Communications Systems Design Center (CSDC) : This support facility has been used to obtain system performance data and to emulate reported field problems for several organizations. Emulation of field problems is improtant because it enables the rapid deployment of solutions to problems for the development of temporary workarounds. The facility also has been used for performing interoperability testing; providing other organizations with hands-on instruction; testing associated developmental and prototype equipment; evaluating new concepts; and defining specification requirements. Coupled with these capabilities, the CSDC also includes an integrated modeling and simulation facility. This integration of systems hardware and modeling and simulation provides a unique capability within the Army. The M&S facility provides several areas of expertise to meet the requirements of the soldier and PM's. The M&S effort has and continues to provide new system simulation models which then transition to fieldable systems. The models allow a conceptual network to be established and tested without actually using resources of the system analyzed, providing a cost effective means to plan for and conduct large communications network tests. The results of simulations can be of use to other models

nd simulations that exist throughout the Army. The M&S facility is using the Distributed Interactive Simulation (DIS) network terminals connectied via the Army Interoperability Network (AIN) circuits. The basic DIS network configuration is a collection of distributed, interactive, warfighter in the loop simulators with semi automated forces simulation providing battalion level operations linked via DIS protocols. There will also be the integration of realistic effects of C3IEW models to provide realism to the simulators.

INTEGRATED SYSTEM OF SYSTEMS LABORATORY FACILITY: This integrated testbed offers a unique networking capability linking not only the Communications labs (over 20 including mobile testbeds)but also their RDEC labs as well as other Army organizations, joint services, commercial, industry (AT&T, Bellcore, GTE), academia and allied services. This network infrastructure leverages off current lab investments and allows for greater sharing of resources, thereby reducing cost of purchasing duplicate equipment or travel and shipping costs of equipment associated with working off-site. Since CECOM is collocated with PEO COMM and PEO CCS, the integrated testbed further increases the efficiencies of seamlessly integrating emerging and legacy communications systems with Command and control (C2) systems in support of Digitization of Brigade 96 and Division 97. Hardware and software subject matter experts PEO COMM systems, internet compliance, and modeling and simulation all reside locally. An example of unique capability of the integrated testbed is the support provided on B2C2 of the NTC94-97 rotation. CECOM used the integrated lab to load, verify, and stress test software prior to NTC rotation. This was the first time that B2C2 was literally exercised over SINCGARS and EPLRS networks.

LOCAL AREA NETWORKS LAB FACILITY: Facility is uniquely capable of running simulations of several army specific combat net radio protocols and storing of simulation data, capability to manage networks via the Army Automated Network Manager, interconnection of etworks via the Tactical Multinet Gateway.

INFORMATION SECURITY LAB: Unique within the Army to include design, test, and production of installation kits, secure system integration, COMSEC chip embeddment, Computer security product evaluation and integration into Army platforms, network multilevel security for integration into tactical Army communciations system sna dtheir interconnect to DOD strategic and commercial comm systems, secure applications such as data base management, audit, key management, access control onto Army platforms. Video equipment, functions and applications are unique to DOD given very narrow comm bandwidths for compressed video to be transmitted, and displayed on tactical Army platforms.

AUDIO LABS: Equipped with semi-reverberant and anechoic chambers, the facility is used to survey, record,and analyze the acoustical noise environment on board vehicles, and then simulate the noise in the laboratory for evaluation of communication systems.

MOBILE COMMUNICATIONS LAB: The facility consists of a work area, work benches, screen room, VAX-11/730 computer and terminals, and channel simulator facility. The lab is devoted to the RDTE of HF and VHF radios, modems, and ancillary devices.

CECOM CSE BATTLEFIELD SOFTWARE SUPPORT FACILITY: These facilities provide life cycle support of software for battlefield automated systems, including Communications, intelligence/electronic warfare and avionics systems, fire support systems, training and manuever systems, and tactical fusion systems. It includes a unique wide area network using dedicated leased lines, fiber optics, and thickwire ethernet links remote sites to Ft. Monmouth computers.

ARMY INTEROPERABILITY NETWORK: This network of distributed communications and services supports software and interoperability for Army systems throughout the life-cycle. It is unique within Army and DOD.

H-60 SYSTEM TEST BED FOR AVIONICS RESEARCH (STAR): The STAR, NUH-60 helicopter, and associated hot bench, is designed to be used as a tool to develop and test advanced avionics concepts. It consists of core system which integrates all basic aircraft functions except flight controls. These functions include flight instructions, engine instruments, caution/warning systems, secondary system control, communications, and navigation systems. Extensive use of commercial hardware and software standards allow rapid and economical upgrade of systems as new technology evolves. The availability of existing sensor data in high power flexible processor, a wide variety of pilot interfaces, and the ease of interfacing new sensors makes this facility ideal for exploring new concepts which depend upon the integration processing and display of multiple sensor data. This facility permits the Army Aviation Research & Development community to develop and flight test *functional prototypes* of the future aviation systems.

PULSE POWER CENTER: The Pulse Power Center is a unique facility for research power electronics. It is a unique national research asset, used DOD wide and without equal in any other installation. DOD applications include electric guns, impulse radar, ECM & electric drives for combat vehicles. R&D efforts concentrate on high power components for a broad variety of missions, including high power switches and energy storage components for electric gun systems for DOD and the Defense Nuclear Agency.

3.4.1 Major Equipment and Facilities - Ft. Belvoir

MAJOR EQUIPMENT AND FACILITIES - FT. BELVOIR

CSF	MAJOR FACILITY OR EQUIPMENT DESCRIPTION	UNIQUE TO			
		DOD	FEDERAL GOV'T	U.S.	REPLACEMENT COSTS ($M)
C4I	SENSOR EVAL/TEST SITE				15M
[illegible]	LASER TEST RANGE				10M
[illegible]	SMALL ARMS FIRING RANGE				5M
C4I	SENSOR PROCESS.TEST/EVAL				35M
C4I	ADVANCED OPTICS TEST/EVAL				15M
C4I	LASER MATERIAL. CHARC. EVAL				5M
C4I	OPTICAL COUNTER-COUNTER MEAS. TEST/EVAL				3M

The above facilities are applicable to all subcategories of CSF C4I.

SENSOR EVALUATION TEST SITE: A 6000 meter test zone located at Ft. A.P. Hill specifically designated and constructed for testing and performance evaluation of electro-optic equipment (stand alone and integrated). This test range is the only available test and evaluation site that has sufficient length and size for ranging to targets and incorporates specialized electronic equipment required to effectively test and evaluate all aspects of E-O equipment.

LASER TEST RANGE: A 5000 meter range that is fully secured for the T&E of tactical laser systems. This is the only fully secure long range laser range on the east coast. It has been specially designed and constructed to allow testing of non-eyesafe laser systems in a tactical environment.

SMALL ARMS FIRING RANGE: A 125 foot in-house range constructed in building 305 of NVESD for evaluation of small arms sights on weapons systems (i.e. M16A2). This range is tunneled concrete structure with full sound proofing and vaulted access for maintaining, testing and wvaluating weapons sights utilizing live fire rounds. The range is constructed on a stabilized concrete base.

SENSOR PROCESSOR TEST AND EVALUATION FACILITY: in-house sensor/processor test and evaluation facility in building 309 of NVESD. This facility is utilized to evaluate, test score, analyze and data base ATR's, sensors, and sensor suites in a completely controlled laboratory environment. This is the only DOD facility available for the test and evaluation of ATR/sensor suites in a controlled lab environment. This facility includes a complete to scale model simulation chamber where specific battlefield environment are laid out.

ADVANCED OPTICS TEST AND EVALUATION: In-house Laboratory to test an evaluate advanced optical structures for electro-optic sensors/sensor suites. The facility is established on fully isolated (vibration free) concrete platforms in building 305 of NVESD which is an essential aspect when testing advanced optical components to eliminate jitter, vibrations, etc.

LASER MATERIAL CHARACTERIZATION EVALUATION LAB: An in-house test and evaluation facility in building 357 to characterize and evaluate new laser materials for lasing capability, quality, tunability and efficiency. This is the only DOD in-house capability for the evaluation, characterization and testing of new laser materials.

OPTICAL COUNTER-COUNTER MEASURE TEST/EVALUATION: Provides the baseline state-of-the-art technology insertion for Army Target Acquisition Sensor/Multi-Sensor System Suite Application. The ATR technology will significantly target acquisition timeline, increase weapon system survivability and lethality. This technological advancement will provide the baseline for Tri-Service ATR applications. The first ever 2nd generation focal plane array architecture will provide the baseline technology for the development of all future sensor systems. Based upon this standardized architecture DOD has implemented a major producibility effort to establish production capabilities for future target acquisition high performance sensor systems.

3.5 Expansion Potential Additional Notes included in 24 Aug 94 Notes; Response To TABS (7).

COMMON SUPPORT FUNCTION	FACILITY DESCRIPTION	TYPE OF SPACE	SPACE CAPACITY (KSF) CURRENT	USED	EXCESS
C4I- ALL	MYER CENTER	TECHNICAL	57.5		57.5
SUBELEMENTS	(ARL OCCUPIED)	ADMIN	45.3		45.3
		MISC	7.1		7.1
	BATTERY TEST FACL	TECHNICAL	5.4		5.4

Additional Facilities provided w/ 24 Aug 94 Memo; AAA Amendments.

3.5.1 Laboratory Facilities:

3.5.1.1
The CECOM RDEC has the capacity to absorb additional workyears without major modification. Previous BRAC implementation will free up several areas of the Myers Center. Minor modification will include some refurbishing of current laboratory equipment and workstations.

Based on the BRAC 93 implementation plan new facilities are planned for construction on the main post of Ft. Monmouth to house IEW personnel relocated from Vint Hill Farms.

3.5.1.2

An estimated 350-400 workyears could be absorbed without major modification.

3.5.1.3.
The only military construction programs programmed in the FY95 PBS are for a new SATCOM building and new IEW building (see above) on post. The IEW building will include special laboratory space and limited access areas for top secret programs. This building will house facilities as a result of implementation of BRAC 93 to close Vint Hill Farms Station and move mission to Ft. Monmouth. The building of the new SATCOM building is to accomodate existing workload and does not impact availability of excess space indicated above as associated with these CSF's.

3.5.2 Land Use: See Cover Memo for updated Info. (Aug 1, 94, fax, # 2.c)

~~There are currently 125.25 buildable acres on the Main Post at Ft. Monmouth, plus an additional 155.7 acres in the Charles Wood area. Camp Evans has 130 buildable acres, however, BRAC 93 implementation requires the closure of this area.~~

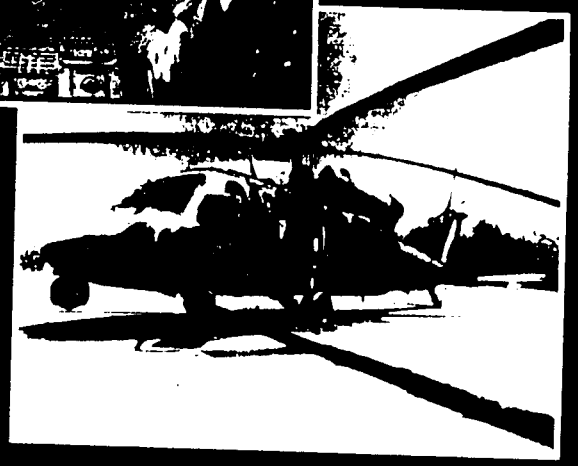
3.5.3 Utilities:
Ft. Monmouth: total electrical substation capacity, including the Main Post and Charles Wood area, is ~~65,000~~ 78,000 per 24 Aug 94 Memo AAA Amendments KVA. Water System capacity for the two areas totals 4.17 MGPD. Sanitary sewer capacity is 5.4 MGD. These figures do not include the Evans Area, which is to be closed per BRAC 93.

t. Belvoir: Bldg 305 has 3612 Kwh total electrical usage (FY93), 500K gallons water/sewer usage, 86,425 gallons oil usage, 300 therms gas; Bldg 307 had 775Kwh electrical, 200K gallons water/sewer usage, 3700 Klbs steam; Bldg 309 1560 Kwh electric, 300K gallons water/sewer, 7450 Klbs steam; Bldg 357 665,000 Kwh electric, 400K gallons water/sewer, 9700 Klbs steam.

MAJOR COMMAND & CONTROL FACILITIES

DIGITAL INTEGRATION LAB

SYSTEM TEST BED FOR AVIONICS RESEARCH (STAR)



STAR

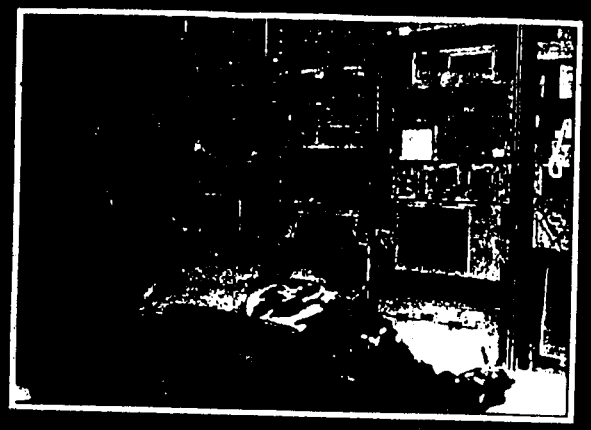
AVIATION MISSION PLANNING SYSTEM (AMPS)

ARTIFICIAL INTELLIGENCE FOR THE BATTLEFIELD

SOFTWARE PROTOTYPE LAB

1334-64

MAJOR ELECTRONIC COMBAT FACILITIES



CENTRAL ANALYSIS FACILTIY

STRATEGIC ENGINEERING LAB

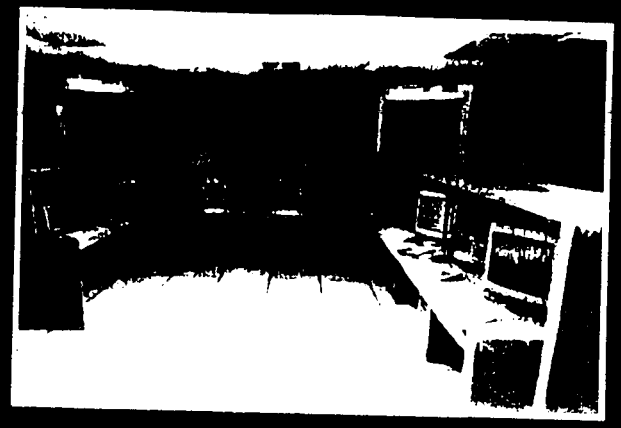
ELECTRONIC COUNTERMEASURES LAB

SYSTEMS INTEGRATION LAB

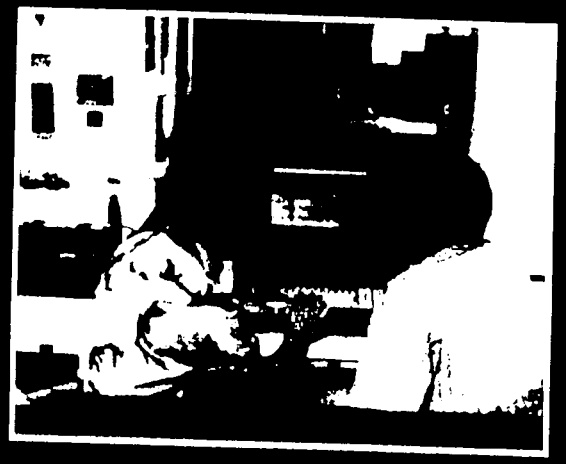
TROJAN INTEGRATION FACILITY

MAJOR COMMUNICATIONS FACILITIES

AUDIO LAB

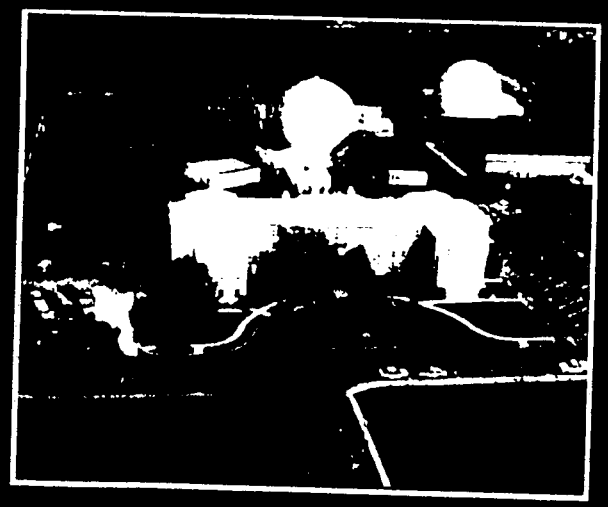


AIN CENTRAL CONTROL LAB

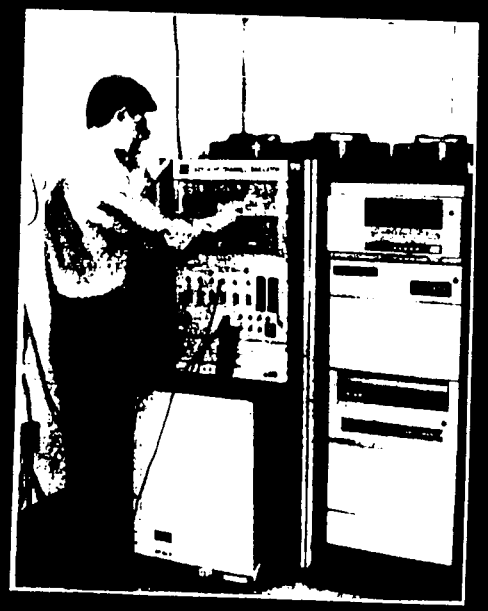


COMMUNICATIONS SOFTWARE LAB

INFOSEC LAB



SPACE SYSTEMS INTEGRATED RESEARCH FACILITY

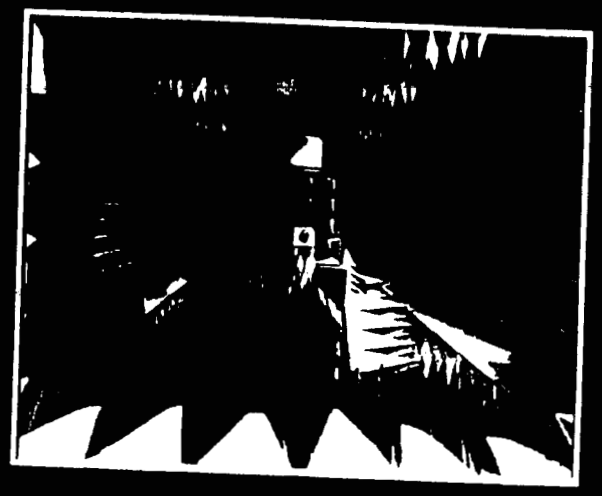


HF CHANNEL SIMLUATOR FACILITY

1178 - 2

MAJOR ELECTRONIC SENSOR FACILITIES

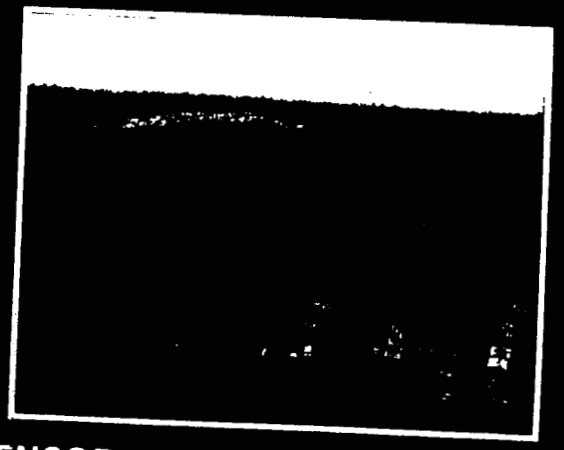
ENVIRONMENTAL TEST FACILITY
HEAVY EQUIP. TEST CHAMBER



MULTISPECTRAL
ENVIRONMENTAL CHAMBER

FOCAL PLANE ARRAY
MICROFACTORY

ADVANCED SENSOR
EVALUATION FACILITY



SENSOR EVALUATION TEST RANGE
FT. A.P. HILL