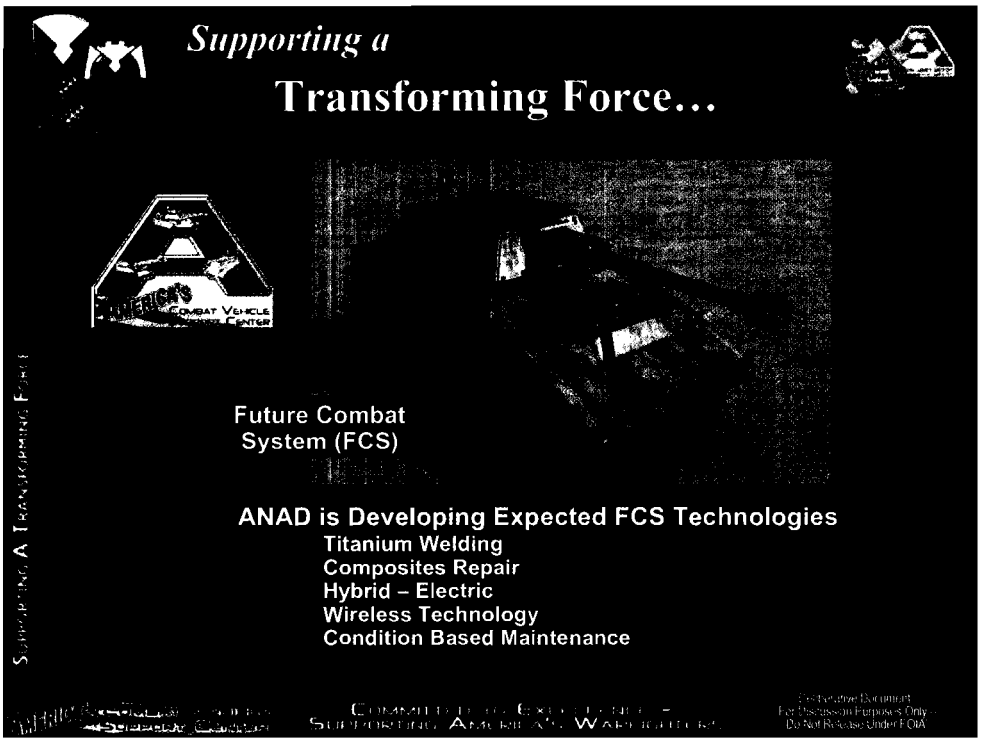
Supporting A Transforming Force

Table of Contents

Vehicle Engine Driven Electrical Power (VEDEP)

New Technology



We are also positioning ourselves to be a part of the future combat systems by developing technologies that we expect the systems to use …….such as robotic titanium welding, composite repair and hybrid-electric drives.

Anniston is also actively working with academia to develop concepts that are applicable to future production processes, business models, and vehicle technologies.

Agenda

- Purpose of Meeting
- Vehicle Engine Driven Electric Power (VEDEP) Mission
- VEDEP Description
- VEDEP Benefits
- Technologies Areas
- Proposed Engineering Center
- ANAD Capabilities
- Conclusion

Purpose

To Propose Establishing a Vehicle Engine Driven Electric Power (VEDEP) Engineering Center At the Anniston Army Depot

VEDEP Mission

To Develop On-Board Power Generation Systems to Meet the Growing Electrical Demands of Military Systems and to Facilitate Technology Transfer to Legacy and Future Combat Systems.

VEDEP will Extend the Useful Military Life of Legacy Vehicles

VEDEP Description

- VEDEP uses the Propulsion Power of a Vehicle Engine or Motor to Develop Electrical Power for On-board and Off-board applications. Power Output Scaled to On-Board Engine Size.
- Electrical Power can be Produced Using Upgraded Alternators, Generators, and Hybrid Electric Technology.
- VEDEP will Utilize a Closed Loop Electrical Feedback Circuitry to Best Match Power Demands to Power Production.
- VEDEP will Produce a Range of Power Outputs using Power Electronics to Develop Selectable Frequencies 50Hz, 60Hz, 400Hz, DC; and Output Voltages, 3Ø208V, 1Ø120VAC; 28 VDC, 270 VDC.
- VEDEP will also Permit the Networking of Vehicles to Form a Local Power Grid as well as the Ability to Interface with Commercial Power Grids World-Wide.

No Longer a Need for a Separate Diesel Engine Dedicated to Electric Power - A Single Engine can provide Both Vehicle Propulsion and Electric Power

VEDEP Benefits

VEDEP can Significantly Reduce the Logistics Requirements of Military Systems

- Reduction in Number of Battlefield Motor Generators
- Reduction in Trailers Required for Generators
- Reduced Spare Parts Required
- Reduced Fuel Requirements (Trailered Loads Require 17% More Fuel)
- Reduced Deployment Transport Requirements
- Reduce 'Wet Stacking' Problems with Diesel Electric Generators

VEDEP can Significantly Improve Military Systems Operational Capability

- Reduction in Systems' Hardware Reduces Deployment Assets, Time & Costs
- Reduction in Operational Set Up and Tear Down Times
- Improve Roadworthiness & Speed of Systems Movement during Battlefield Operations
- Reduced Fuel Requirements

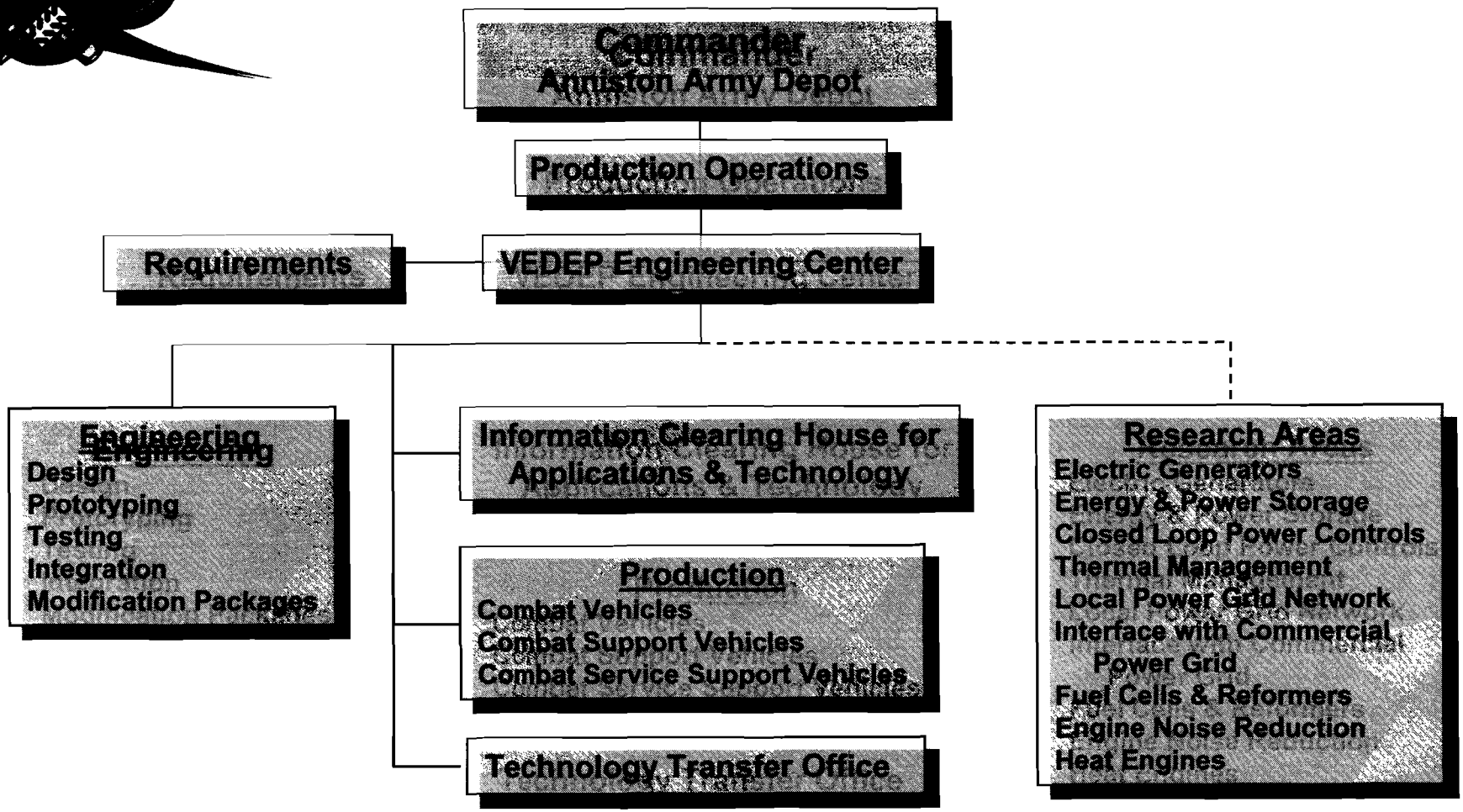
VEDEP Technology Areas

- Heat Engines and Fuel Reformers/Cells
- Electric Generators
- Engine Noise Reduction
- Closed Loop Power Control
- Thermal Management
- Energy and Power Storage
- Local Power Grid Network
- Interface with Commercial Power Grid
- Militarization and Packaging
- Payload Integration

Information Clearing House for On-Board Power Generation Applications and Technology in the Army

DRAFT

Proposed Engineering Center

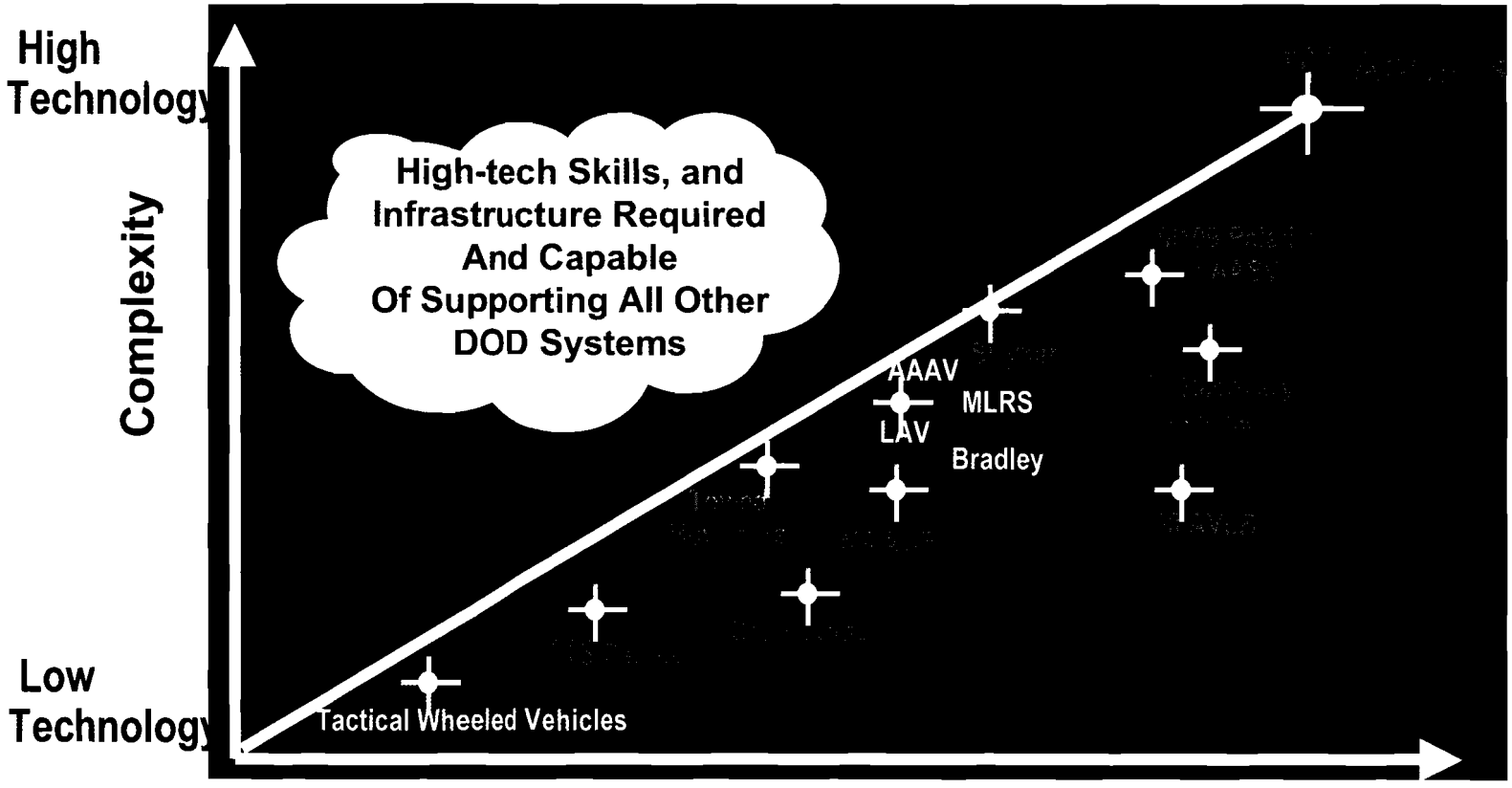


Depot

University Support

DRAFT

ANAD Capabilities



AAAV – Advanced Amphibious Assault Vehicle
MLRS – Multiple Launch Rocket System
AVLB – Armored Vehicle Launched Bridge
LAV – Light Armored Vehicle
FAASV – Field Artillery Ammunition Supply Vehicle

DRAFT

ANAD Capabilities

DRAFT

Conclusion

Technology Transfer

Transforming Our:

- Technologies
- Capabilities
- Processes
- Skills
- Infrastructure

M1A2

Stryker

FCS

To Support… The Future Force

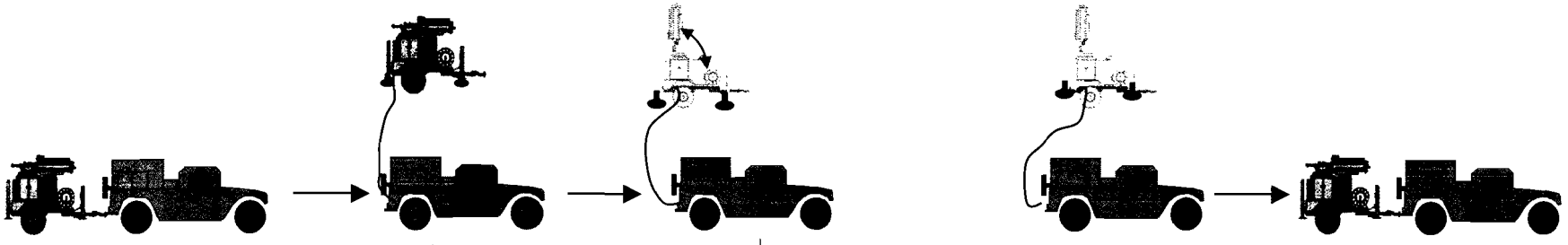
VEDEP Supports ANAD's and the Army's Transformation Mission

Backup Charts

DRAFT

Sentinel Radar Reduced Timelines

Current



Deploy Trailer, Outriggers, & Cables

Erect & Level Antenna Startup Radar

Teardown

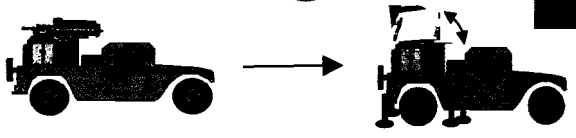
Emplacement Time – 15 min

March Order ~ 10 min

Key Technologies

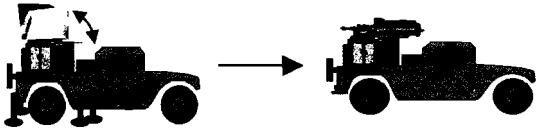
- **Hybrid Electric Power / Advanced Generator**
- **Lightweight Power Conditioning**
- **Active Stabilization and Leveling System**

Future



Erect & Level Antenna; Startup Radar

Emplacement Time ~ 7 min



Teardown

March Order ~ 3 min

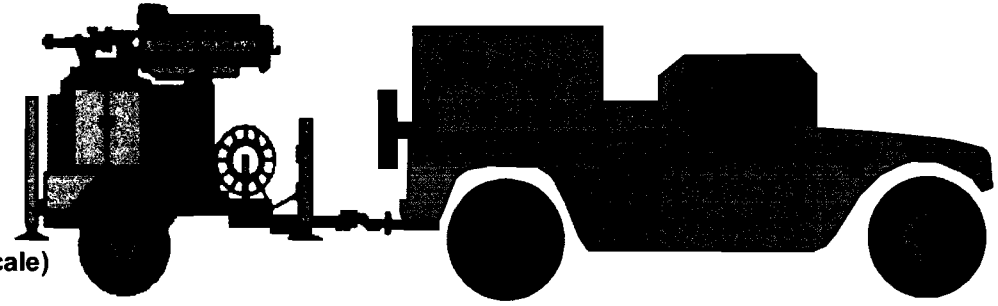
Over 50% Reduction in Emplacement and March Order Timelines

DRAFT

Sentinel Radar System Stowed Configurations

Current Stowed Configuration

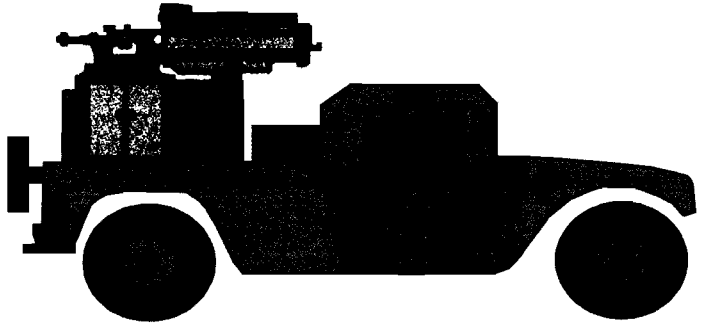
System
- 13,040 lbs
- 1,546 cu ft



(Not to Scale)

High Mobility Stowed Configuration

System
- 9,570 lbs
- 944 cu ft



(Not to Scale)

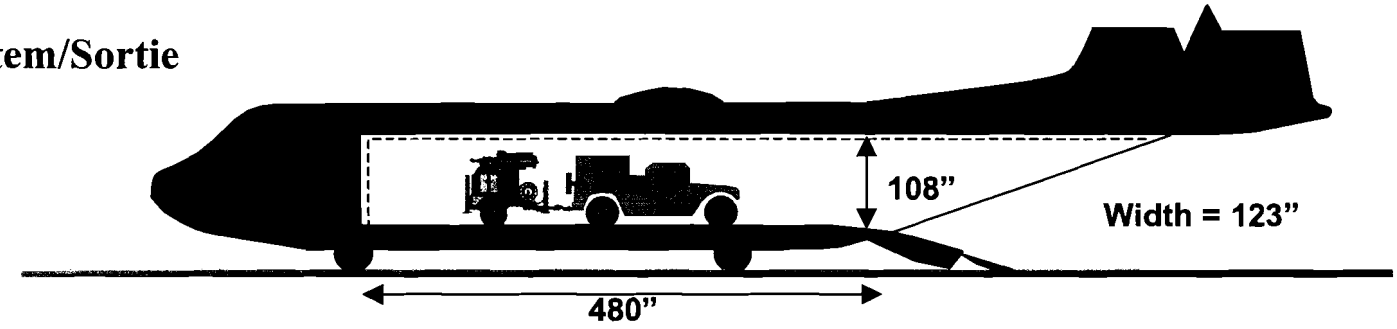
Systems Savings: 25% Reduced Mass, 40% Reduced Volume

DRAFT

Sentinel Radar System Transportability

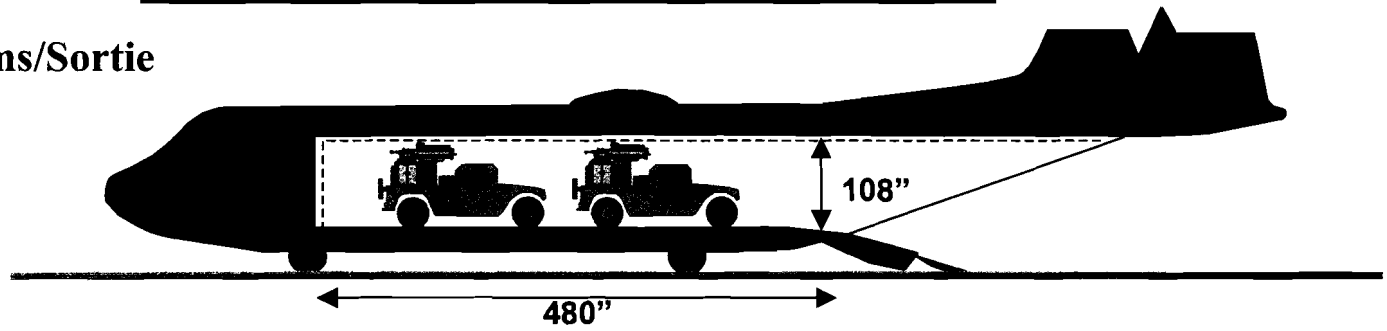
C-130 Transport of Current System

One System/Sortie



C-130 Transport of High Mobility System

Two Systems/Sortie



VEDEP System Doubles C-130 Transport Capability

VEDEP Mission

To re-power legacy vehicles/systems to meet growing electrical demands and to assist in technology development for the Future Combat Systems.

- Develop, test, and produce electrical power kits to maintain currency and to extend the useful military life of legacy vehicles
- Modify current vehicles to meet growing power needs versus developing or postponing introduction of a new generation of vehicles.
- Provides platforms and expertise to conduct the engineering design, testing and integration of power systems required prior to fielding and to provide a technical facility to support research and development.
- Support ARDEC power generation research efforts through technology insertion of VEDEP products.

VEHICLE ENGINE DRIVEN ELECTRICAL POWER: ANNISTON'S CONTINUOUS COMMITMENT TO EXCELLENCE

For soldiers on the battlefield, having reliable, on-demand electrical power is critical to mission success. The Army is evolving into a more technologically based force that will require increased electrical power to support the myriad of power electronics being introduced into vehicles. The focus of future Army vehicles will be smaller, lighter, and more mobile which will require a paradigm shift from the use of conventional battlefield generators. Many of the military's generators require their own trailers which restrict mobility, require additional logistics support in terms of mechanics, repair arts and fuel, and have a history of availability problems. Conventional military systems require two diesel engines; one engine is to propel the vehicle with a second to generate electrical power to operate the system. It is essential to develop alternative power generation capabilities to transform legacy vehicles to keep pace and ahead of the changing technology required of today's military vehicles.

Vehicle Engine Driven Electrical Power (VEDEP) is an initiative to develop on-board electrical power using the vehicle's propulsion system. VEDEP can be in the form of an upgraded alternator, an additional generator or a hybrid electric system. VEDEP will eliminate the need for an additional trailer to transport the additional generator by transforming the vehicle into a mobile power source. It is envisioned that VEDEP will provide the capability to provide a wide range of power options using the latest power electronics. Current mobile power generators are designed to support a single function while VEDEP will be designed to support multiple missions (e.g. 110/220 vdc and 50, 60, 400 Hz). The VEDEP system will also be able to be girded together to form a power network and to utilize plug or wall power (to make use of commercial power when available). This technology will allow systems to be placed in and taken out of operation much faster that conventional generator based systems. VEDEP technology will permit legacy vehicles to evolve with the ever increasing power demands placed on military vehicles and will extend their useful life.

While the ARDEC is pursuing similar technologies focused on power generation for future Army systems, ANAD will focus on developing this technology to upgrade current legacy systems. With the utilization of VEDEP on current systems, soldiers would experience reduced emplacement and march-order times, improved roadworthiness and speed of systems movement during battlefield operations, reduction in fuel requirements, increased operational availability and reduced spare parts required. In addition to better support to the soldier on the battlefield, VEDEP would also reduce the strategic deployment requirements; lower procurement costs (e.g. generators and trailers) and would allow for the better utilization of logistics personnel.

Anniston Army Depot's overall mission, infrastructure, technology, and workforce all validate the site as the ideal site for the VEDEP Center for Excellence. In fulfilling our mission to overhaul and repair heavy and light combat systems, we continue to look for innovative ways to improve the mobility and operability of current weapon systems. VEDEP would allow us to remain abreast of the latest technology while simultaneously extending the life of current weapon systems. Not only are Anniston's highly skilled technicians experts when it comes to the overhaul and repair of current weapon systems, they are consistently trained to use the most up-to-date [in some cases, one-of-a-kind] technology and equipment available. Additionally, Anniston is centrally located to research universities in the southeast that would support this mission.

VEDEP supports the Department of Defense's mission to continuous transform the force to a lighter, more sustainable force and Anniston boasts the resources to most successfully perform the task.

Anniston requests approval to proceed pursuing this initiative.

POINT PAPER

AMSTA-AN-PEIT UNCLASSIFIED 17 March 2004

SUBJECT: CTMA/NCMS (Commercial Technologies for Maintenance Activities / National Center for Manufacturing Sciences)

CTMA
Commercial Technologies for Maintenance Activities

ncms
An NCMS/DoD Partnership

ISSUE: Advancements in manufacturing technology and methodology are being introduced at an accelerated rate. In order for ANAD to keep its repair and overhaul missions as efficient and cost effective as possible the need to investigate these technologies is essential. CTMA/NCMS is one avenue available to facilitate this endeavor.

BACKGROUND: Participation in symposiums and conferences showcasing manufacturing and repair technologies are good starting points for the investigation of what repair and manufacturing technologies are available. Participation in programs like CTMA/NCMS provide communications between the repair depots, private industry, and academia to work together to solve problems encountered with depot level work.

CURRENT STATUS: ANAD is currently participating several active and proposed CTMA/NCMS projects:

- LENS – Laser Engineered Net Shaping
- Managing Product Characteristics In the Supply Chain
- LAV (Light Armored Vehicle) Life Cycle Logistics Support Tool
- Rapid Manufacturing for Forward Deployment and Maintenance

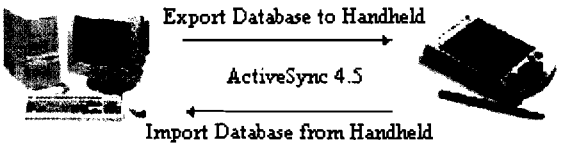
RECOMMENDED ACTION: Continue to actively participate in projects, conferences and meetings with CTMA/NCMS to continue researching technology and methodology for manufacturing and repair.

POINT PAPER

AMSTA-AN-PE UNCLASSIFIED 14 MARCH 2004

SUBJECT: Wireless Technology Application

ISSUE: Support DGRC rail systems inspection process. Replace paper driven process with a wireless electronic system.



BACKGROUND:

o DGRC performs periodic on-site inspections of various railcars and engines throughout the United States. The results of these inspections were recorded on paper check sheets and later tabulated at the main office.

o Two problems existed with the system. First, inspection scheduling was difficult given the number of cars and engines in the fleet. Second, the inspection results did not lend themselves to storage and analysis.

CURRENT STATUS:

o Purchased the LISS software system to handle inspection scheduling. Designed an electronic checklist that collects and transfers inspection results from a wireless handheld computer to LISS central database.

o New system is currently being evaluated. New laptops and handheld computers have been purchased to support operation.

RECOMMENDED ACTION:

o Finalize implementation.

o Design a dynamic web page that can display the overall status of the various rail systems based upon the inspection results.

POINT PAPER

AMSTA-AN-PEIT UNCLASSIFIED 17 March 2004

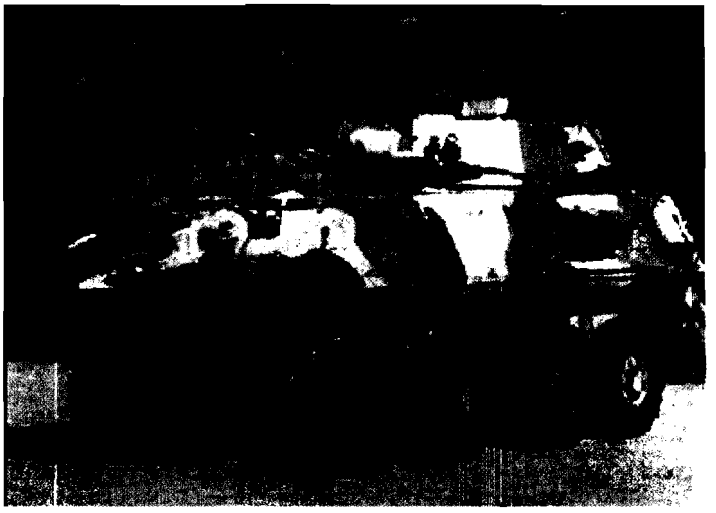
SUBJECT: LAV (Light Armored Vehicle) Life Cycle Logistics Support Tool

ISSUE: The Department of Defense spends $40 billion annually on weapons systems maintenance with continuing cost growth due to inflation and new acquisitions. These expanding costs create the need for new practices that increase the overall speed and quality of maintenance actions while integrating maintenance configuration management, and other logistic practices.

BACKGROUND: A number of new and emerging technologies including diagnostic sensors, knowledge management data accessibility, energy management systems, remote support-based telematics, secure communication, condition-based software algorithms, case based reasoning, browser based interfaces and web portal data delivery

CURRENT STATUS: ANAD is currently participating in a CTMA/NCMS (Commercial Technologies for Maintenance Activities / National Center for Manufacturing Sciences) Project funded by the DoD. The USMC LAV was chosen as the project vehicle. The LAV will have the following sensors installed:

- Oil Quality Sensor
- Fuel Level Sensor
- Battery Health Sensor
- GPS Location of vehicle
- Additional Sensors to be developed during project
    - Occupancy level
    - Cabin temperature
    - Roll over detection



These sensors will be linked, via secure satellite communications, back to a Depot Data Center. Monitoring of the sensors and the vehicle location will be displayed in theater, real-time, on mapping software with indications (Red, Yellow, Green) of its health. This data can also be sent via in range wireless LAN and Bluetooth communications devices.

RECOMMENDED ACTION: Continue to participate in the CTMA/NCMS LAV project. Predictive maintenance and life cycle cost reduction are some additional benefits. Project goals include future applications of the technology to Army vehicles.

POINT PAPER

AMSTA-AN-PEIT UNCLASSIFIED 17 March 2004

SUBJECT: LENS – Laser Engineered Net Shaping, Phase 1 & 2

ISSUE: AGT1500 turbine engine components replacement parts are difficult to obtain, are no longer available, have extremely long procurement lead times and are expensive. Need to investigate new and emerging repair technologies and methodologies for possible application in repair of turbine engine components. Areas outside of the turbine engine repair realm could also benefit from these technologies.

BACKGROUND: The overhaul and repair of the AGT1500 turbine engine will remain a part of ANAD's mission as long as the M1 Abrams main battle tank is in service. Additionally, the reciprocating engine, transmission and final drive overhaul and repair have similar problems in obtaining replacement parts. A new powder metal deposition system originally developed by the Sandia National Laboratory trademarked as LENS can be applied to ANAD repair requirements. The LENS system uses a high-energy laser beam focused on the base metal to create a melt pool to which powdered metal is introduced. The powder metal fuses with the melt pool and adds material to the base metal. The process can be used to build up worn area on components.

CURRENT STATUS: ANAD is currently participating in a CTMA/NCMS (Commercial Technologies for Maintenance Activities / National Center for Manufacturing Sciences) Project funded by the DoD. The completed LENS Phase one project identified turbine engine components that could be repaired using this technology with an estimated savings of over $6 million. LENS Phase two has identified and additional $1.5 million in possible savings.

RECOMMENDED ACTION: Continue to participate in the CTMA/NCMS LENS project. Investigate additional applications for repair by LENS in other areas at ANAD

POINT PAPER

AMSTA-AN-PEIT UNCLASSIFIED 17 March 2004

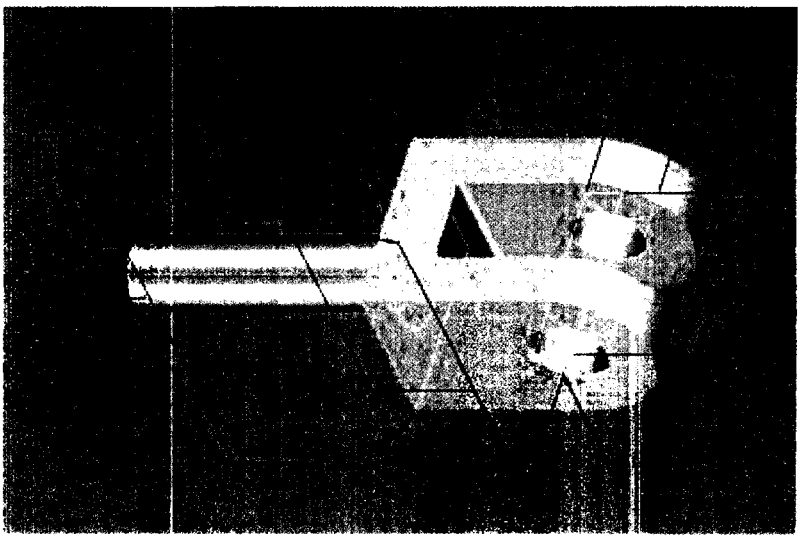
SUBJECT: N-STEP Project, National Automotive Center - Standardized Exchange of Product Data

ISSUE: The use and exchange of technical data today mainly involves the use of two dimensional paper drawings and documents to manufacture parts to support ANAD's repair mission. Some advances have been made to convert this data into electronic form. Drawings can be scanned to produce an electronic version that can be viewed and transferred. An example of this is JEDMICS (Joint Engineering Data Management Information Control System) currently used at ANAD. This electronic version is just as limited as the drawing because it is only a picture of the original drawing. The CAD/CAM systems in existence throughout industry are capable of producing a 3-dimensional (3-D) representation, or model, of a given part. The 3-D model can be manipulated for viewing from any vantage point. The model can also be modified and used for manufacturing purposes. One shortfall of the 3-D model is that it is not easily transferable between different brands of CAD/CAM systems. This ends up creating additional work to generate the 3-D model on another CAD/CAM system.

BACKGROUND: The use of 3-D data in manufacturing is becoming more common. The need for a neutral 3-D model format is needed to be able to freely exchange data between the many different CAD/CAM systems is becoming more essential. This is true for data exchange between ANAD entities as well as other Army and DoD entities. The need for this data exchange also extends to private industry as well.

CURRENT STATUS: ANAD is currently participating a National Automotive Center sponsored project titled N-STEP. The project is using the ISO (International Standards Organization) Standard 10303 for STEP (Standardized Exchange of Product Data) to develop a neutral technical data package containing not just the 3-D model data but all of the data need to produce the part. The package also contains a 2-D drawing that is associated to the 3-D model. The N-STEP project is in its second year and continues to demonstrate benefits for data exchange and manufacturing.

RECOMMENDED ACTION: Continue to participate in the N-STEP project to further the use of the internationally accepted STEP standard. Continue to develop methods for using this STEP model.

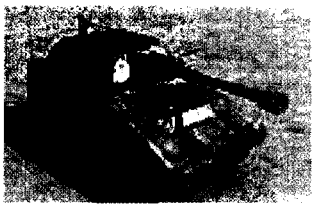


POINT PAPER

AMSTA-AN-PEIT UNCLASSIFIED 17 March 2004

SUBJECT: Titanium Fabrication/Welding and Composites Manufacture and Repair

ISSUE: FCS (Future Combat Systems) will need to be lighter and faster to keep pace with modern warfare. The new systems must be capable of being rapidly and effectively transported by air to the theater of operations. FCS will need to be just as lethal and provide similar protection for the warfighter as today's systems. The two major technologies available today to facilitate this are titanium and composite manufacturing.



BACKGROUND: Historically the technologies used to produce and field new weapon systems are introduced to the depots at the time they are fielded. This places the depot in catch-up mode for new technology applications. Having the depots involved during the development of new weapon systems keeps the depots maintenance abilities current. This allows the depots to respond rapidly to new maintenance and repair issues rather than spending valuable time learning new technologies. ANAD assisted ARDEC in construction of the Interim Hybrid Vehicle which combines titanium welding and composites for a lightweight combat vehicle hull. ANAD machined the weld joint for the welding of 1" thick titanium plates to support the construction of the I.H.S.

CURRENT STATUS: ANAD is actively pursuing cooperative associations with ARDEC and TARDEC for participation in titanium and composites manufacturing and repair as well as any other new technologies with possible application in the repair of weapon systems. A robotic welding cell is being developed at ANAD to prepare procedures for welding titanium.

We are also involved with the University of Delaware's Center for Composite Materials.

RECOMMENDED ACTION: Continue to actively pursue relationships with internal (Army) research, development and engineering centers and laboratories as well as other approved resources.