



CURRICULUM

Answers to Question #3

Naval Postgraduate School
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Compilation of Theses Abstracts

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ESR

EDUCATIONAL SKILL REQUIREMENTS
SYSTEMS ENGINEERING AND INTEGRATION
CURRICULUM (308)
Subspecialty Code 6500P

1. **BASICS:** Introduction to the mathematics, physics, and computer skills needed to understand the technical aspects of combat, information, and decision systems.

2. **SYSTEMS ENGINEERING:** Understand the systems engineering process and how to perform systems engineering studies, to include a knowledge of system design, development, and deployment; technical and economic trade-offs; human-in-the-loop issues; project management; systems acquisition and the planning, programming and budgeting system (PPBS). Be able to integrate relevant technological disciplines that bear on weapons, sensor and information systems. Understand responsiveness to realistic military requirements, specifications and cost limitations. Study the linkage between strategic planning, requirements, project organization, and technology.

3. **INFORMATION SYSTEMS TECHNOLOGY:** Develop a knowledge of information systems technology, to include: computer systems; computer networks and communications systems; software engineering; data base management. Demonstrate awareness of the capabilities, limitations, design and operation, and vulnerabilities of information systems. Understand the concepts of defensive and offensive Information Warfare.

4. **SENSOR AND WEAPON SYSTEMS:** Gain a solid understanding of the scientific, mathematical and engineering principles behind existing and future military systems. Understand the elements that impact sensor system performance. Understand the principles behind existing and emerging sensor technologies, including radar, sonar, electro-optical sensors, and sensors based on novel physical principles. Understand the technologies underlying weapons systems, and the principles that guide successful integration of weapons and sensors with platforms. Understand the basics of weapons of mass destruction, and their utilization.

5. **OPERATIONS ANALYSIS:** Understand uncertainty and risk and their impact on military planning, decision making and operations. Become familiar with complexity and the modeling of competitive systems. Gain a working knowledge of modeling, simulation and gaming. Learn how OR techniques, including experimental design, are applied to operational test and evaluation; planning and analyzing fleet battle experiments; and to military decision making. Learn how to apply advanced management and operations research ideas to defense problems, to include cost benefit and cost effectiveness analysis.

6. **STRATEGY AND POLICY:** Officers develop a graduate-level ability to think strategically, critically analyze past military campaigns, and apply historical lessons to future joint and combined operations, in order to discern the relationship between a nation's policies and goals and the ways military power may be used to achieve them. Fulfilled by completing the first of the Naval War College course series leading to Service Intermediate-level Professional Military Education (PME) and Phase I Joint PME credit.

7. **JOINT PROFESSIONAL MILITARY EDUCATION:** Completion of Joint Professional Military Education (JPME) is required for all USN officers enrolled in the 308 curriculum. Graduates will develop understanding of warfighting within the context of operational art, to include: national military capabilities and command structure, joint and service doctrine, joint planning and execution, and joint and multinational forces and systems integration at the operational level of war. Fulfilled by completing the Naval War College three-course series leading to Service Intermediate-level Professional Military Education (PME) and Phase I Joint PME credit.

8. **INDEPENDENT STUDY:** Each student must demonstrate the ability to conduct independent and team oriented research and analysis on problems that link technical solutions to tactical problems, and to present the results in writing and oral briefings. A thesis or substantive project report will be required of all participants.

Date: March 1999

EDUCATIONAL SKILL REQUIREMENTS
INFORMATION SYSTEMS AND OPERATIONS
CURRICULUM (356)
Subspecialty Code 6100P

Rapid advances in Information Technology are swiftly changing Warfare in the 21st Century. A key enabler of 21st Century Warfare is the concept of Information Superiority. To accomplish the needed change in concepts for warfighting and the innovative application of Information Technology to implement them, the officer corps must have a new intellectual basis for decision making. A significant factor in creating the needed intellectual capital is graduate education provided by the Information Systems, and Operations Curriculum. The graduates of this curriculum shall satisfy the following:

1. SCIENCE AND TECHNOLOGY

The graduate shall understand the terminology, methods, application and effect of the following information sciences and technologies: Communications, Computer Systems, databases, information assurance, sensors, signal processing, space systems, networks, simulation and gaming.

2. STRATEGY, POLICY AND DOCTRINE

The graduate shall understand the terminology and processes; analyze and formulate; and synthesize strategy, policy and doctrine as it is effected by Information Operations utilizing the concepts found in the theories of Conflict in the Information Age, Network-Centric Warfare, and the requirements found in Policy and Doctrine Planning, National Directives, and Rules of Engagement

3. ORGANIZATION AND SYSTEMS

The graduate shall understand the terminology, processes and structures; analyze and develop organizational elements and agile organizations utilizing the best current practices found in Command and Control, complex systems, cybernetics, networks and grids, and operational architecture theories.

4. METHODS AND ELEMENTS

The graduate shall understand the terminology and processes associated with all aspects of Information Superiority and Warfare to include: deception, psychological operations, operational security, military intelligence, electronic warfare, C4ISR, special operations and military operations in space.

5. STRATEGY AND POLICY

Graduates will develop an ability to think strategically, analyze past operations, and apply historical lessons to future joint and combined operations, in order to discern the relationship between a nation's political interests and goals and the ways military power may be used to achieve them. Fulfilled by completing the first of three Naval War College courses leading to Service Intermediate-level Professional Military Education (PME) and Phase I Joint PME credit. (Required only for USN and USMC students.)

6. JOINT PROFESSIONAL MILITARY EDUCATION (JPME): Graduates will develop understanding of warfighting within the context of operational art, to include: national military capabilities and command structure, joint and service doctrine, joint planning and execution, and joint and multinational forces and systems integration at the operational level of war. Fulfilled by completing the Naval War College three-course series leading to Service Intermediate-level Professional Military Education (PME) and Phase I Joint PME credit.

7. PROBLEM SOLVING AND REAL WORLD APPLICABILITY

The officer shall possess skills that permit a realistic perspective on problem solving and provide an appreciation of the difficulty and power of applying theory to the real of Information Operations. This includes:

- a. Completing a significant project applying academic skills outside of the classroom
- b. Exercising skills in problem formulation, synthesis, criteria specification, analysis, and evaluation and presentation of results.
- c. Clearly communicating the project in writing and verbally.

Curriculum Sponsor and ESR Approval Authority

Director, Space, Information Warfare, Command and Control (N6)

March 2000

EDUCATIONAL SKILL REQUIREMENTS
OPERATIONS ANALYSIS
CURRICULUM (360)
Subspecialty Code 3211P

1. **BASICS:** The graduate will possess the mathematical skills required to support graduate study in operations research and have the ability to use stand alone and network computers as a tool to aid in analysis.
2. **MODELING UNCERTAINTY:** The graduate will be well-versed in applications of probability and statistics to the modeling, simulation, and analysis of military decision problems.
3. **OPTIMIZATION:** The graduate will be able to formulate and solve a wide variety of optimization problems and also be conversant with the major uses of such models in DOD and the private sector.
4. **STOCHASTIC MODELING:** The graduate will be able to formulate and solve problems involving stochastic processes (processes with uncertainty over time) and also be familiar with the major applications of such models.
5. **SIMULATION:** The graduate will be able to construct and utilize Monte Carlo simulations of combat and other processes that evolve in time, and will be able to deal with statistical issues associated with the need for replication.
6. **WARFARE ANALYSIS:** The graduate will be familiar with U.S./Allied and potential enemy capabilities, doctrine, tactical and logistical support concepts. The graduate will be able to model and analyze military operations using Operations Analysis techniques, and be able to develop new tactical concepts based on theory and exercise reconstruction and analysis.
7. **HUMAN FACTORS:** The graduate will be familiar with the man-machine interface and also will be able to quantify the limitations imposed on systems designed for use by human operators.
8. **SYSTEMS ANALYSIS:** The graduate will understand the basic principles of economics and systems analysis as well as their application to various defense problems.
9. **JOINT MARITIME STRATEGY:** The graduate will have a knowledge of development and execution of military strategy, the effects of technical developments on warfare, an understanding of the means of formulation of U.S. policy, the roles of military forces and joint planning, and current issues in defense organization.
10. **PRACTICE:** The graduate will have gained experience working on all aspects of an analytical study and will demonstrate the ability to conduct independent analytical studies and proficiency in presenting the results both orally and in writing.

Curriculum Sponsor and ESR Approval Authority Director, Assessment Division (N-81)
September 2004

EDUCATIONAL SKILL REQUIREMENTS
OPERATIONAL LOGISTICS
CURRICULUM (361)
Subspecialty Code 3212P

1. **MODELING UNCERTAINTY:** The graduate will be well versed in probability and statistics and their application to Operations Research (OR) problems.
2. **OPTIMIZATION:** The graduate will be able to formulate and solve a wide variety of optimization problems and also be conversant with the major uses of such models in DOD and the private sector.
3. **STOCHASTIC MODELING:** The graduate will be able to formulate and solve problems involving processes (processes with uncertainty over time) and also be familiar with the major applications of such models.
4. **TRANSPORTATION:** The graduate will have an understanding of transportation systems and the constraints they place on operations, especially strategic airlift and sealift.
5. **LOGISTICS:** The graduate will understand all aspects of the Naval logistics system and Joint planning systems, and the use of analysis in all aspects of planning for the logistics support of forces at sea.
6. **WARFARE ANALYSIS:** The graduate will be familiar with U.S./Allied and potential enemy capabilities, and will be able to model and analyze military operations using OR techniques. He/she will further be able to develop new tactical and logistics concepts based on theory and analysis.
7. **SYSTEMS ANALYSIS:** The graduate will understand the basic principles of economics and system analysis as well as their application to various defense problems.
8. **BASICS:** The graduate will possess the mathematics skills required to support graduate study in or have the ability to use a mainframe and microcomputer as tools to aid in analysis.
9. **PRACTICE:** The graduate will have gained experience working on all aspects of an analytical study in the field of operational logistics. Specifically, he/she will demonstrate the ability to conduct independent analytical studies and proficiency in presenting the results both orally and in writing.
10. **STRATEGY AND POLICY:** Graduates will develop an ability to think strategically, analyze past operations, and apply historical lessons to future joint and combined operations, in order to discern the relationship between a nation's political interests and goals and the ways military power may be used to achieve them. Fulfilled by completing the first of three Naval War College courses leading to Service Intermediate-level Professional Military Education (PME) and Phase I Joint PME credit. (Required only for USN and USMC students.)
11. **JOINT PROFESSIONAL MILITARY EDUCATION (JPME):** Graduates will develop understanding of warfighting within the context of operational art, to include: national military capabilities and command structure, joint and service doctrine, joint planning and execution, and joint and multinational forces and systems integration at the operational level of war. Fulfilled by

completing the Naval War College three-course series leading to Service Intermediate-level Professional Military Education (PME) and Phase I Joint PME credit. (For incoming USN students only.)

Curriculum Sponsor and ESR Approval Authority

Deputy CNO Logistics (N-4)
September 1999

EDUCATIONAL SKILL REQUIREMENTS
JOINT COMMAND, CONTROL, COMMUNICATIONS,
COMPUTERS & INTELLIGENCE (C4I) SYSTEMS
CURRICULUM (365)
Subspecialty Code 6204P

The graduate shall be able to:

1. **TECHNOLOGIES:** Analyze and synthesize communications, computer, and information systems, including digital and analog communications systems, computer architectures, networks, databases, decision support systems, sensors, information security techniques, user-network interface, and system tradeoff analyses.

2. **SYSTEMS ENGINEERING AND ANALYSIS:** Perform systems engineering studies, develop architectures, and integrate systems, including mission requirements determination: operational, technical and systems architectures; data analysis, modeling and simulation, and experimental design and analysis; evaluation of human-in-the-loop C4I systems; technical analysis of selected C4I systems and architectures; interoperability of hardware and software within and across systems of systems; and standard and alternative acquisition process.

3. **JOINT C4I:** Understand joint C4I systems, including national and DOD C2 and intelligence concepts, policies, doctrine, processes, and organizations; joint C4I systems and architectures; information warfare and C2 warfare environments; effects of combined operations; and future concepts and current issues.

4. **STRATEGY AND POLICY:** Officers develop a graduate-level ability to think strategically, critically analyze past military campaigns, and apply historical lessons to future joint and combined operations, in order to discern the relationship between a nation's policies and goals and the ways military power may be used to achieve them. Fulfilled by completing the first of the Naval War College course series leading to Service Intermediate-level Professional Military Education (PME) and Phase I Joint PME credit.

5. **PRACTICE:** The graduate will demonstrate the ability to conduct independent analysis of joint command, control, communications, computers, and intelligence systems and will demonstrate proficiency in presenting the results in writing and orally by means of a thesis and a command-oriented briefing.

Curriculum Sponsor and ESR Approval Authority

Director, C4 Systems (J-6)
Director, Space and Electronic Warfare (N-6)
June 1997

**EDUCATIONAL SKILL REQUIREMENTS
SPACE SYSTEMS OPERATIONS
CURRICULUM (366)**

Subspecialty Code 6206P – Space Systems Operations

All officers with graduate education in Space Systems Operations must be competent in the below core subjects. These competencies will enable graduates to serve in positions that design, acquire, operate, or secure military space and information systems and/or deny potential adversaries the effective use of their own. The skills and competencies are detailed below.

1. JOINT STRATEGY AND POLICY

a. Officers develop a graduate-level ability to think strategically, critically analyze past military campaigns, and apply historical lessons to future joint and combined operations, in order to discern the relationship between a nation's policies and goals and the ways military power may be used to achieve them. This is fulfilled by completion of the first of the Naval War College course series leading to Service Intermediate-level Professional Military Education (PME) and Phase I Joint PME credit.

b. Understand current Navy and USMC doctrine (e.g., Sea Power 21, Expeditionary Maneuver Warfare).

2. ORBITAL MECHANICS, SPACE ENVIRONMENT AND REMOTE SENSING:

a. Understand the basic physics of orbital motion, the parameters used in the description of orbits and their ground tracks. Understand the design of orbits, how they are achieved, maintained, and controlled including the design of constellations and how spacecraft are maneuvered and repositioned. Understand spacecraft tracking and command/control from a ground station. Understand the various orbital perturbations, including those due to nonspherical earth and due to atmospheric drag. Understand the relationships of orbits to mission requirements, including the advantages and disadvantages of various orbits.

b. Understand the natural and induced environment of space including solar activity, geomagnetic and magnetospheric phenomena, physics of the ionosphere and upper atmosphere and their response to natural and artificial disturbances. Understand the impacts to spacecraft parts and materials due to this space environment.

c. Understand the principles of active and passive sensors used in current and future spacecraft for sensing through the atmosphere. Understand the effects of the space environment and countermeasures on sensor performance. Understand the tradeoffs among various sensor techniques, including area of coverage, resolution, processing, and power requirements.

3. MILITARY SPACE SYSTEMS

Understand the two major components of military space systems: (These systems include MILSATCOM, Commercial systems, GPS, Meteorological systems, space surveillance, National systems, space-based warning, and other nations' systems)

a. **Military Space Operations:** Understand the operational requirements and limitations of current and future space systems used by the DOD for Space Control and Force Application. Understand the roles of the Services in the development, operation, and use of these systems. Understand the roles, responsibilities and relationships of national and Joint DOD organizations in establishing policies, priorities, and requirements for these space systems; and in their design, acquisition and operation. Understand the nature of space warfare (theory, history, doctrine, and policy) including space control, assured access, global engagement, and full force integration. Be familiar with Joint Doctrine (e.g. JP 314).

b. **Warfighter Support Obtained from Space:** Understand the capabilities and use of space systems to enable and support Joint air, land, and sea military operations (i.e. Force Enhancement). Understand the intelligence collection and analysis process for space systems and how warfighters access information from these sources. Understand doctrine and operational concepts (e.g. USSTRATCOM's "Long Range Plan") and be able to contribute to the development of space tactics that enhance or support military operations.

4. PROJECT MANAGEMENT AND SYSTEM ACQUISITION:

a. Understand project management and DOD system acquisition methods and procedures to include contract management, financial management and control, and the Planning, Programming and Budgeting System (PPBS). Receive an introduction to the Defense Acquisition University and the acquisition courses and qualifications available.

b. Understand the system acquisition organizational responsibilities and relationships (e.g. Congress, DOD, Services; Resource Sponsor, Systems Commands, Operating Forces) as they pertain to the acquisition of systems for DOD, Naval, and civilian agency users.

5. COMMUNICATIONS:

a. Understand the basic principles of communications systems engineering including the space and ground segments. Understand digital and analog communications architecture design, including frequency reuse, multiple access, link design, repeater architecture, source encoding, waveforms, and propagation media. Understand current and future communications systems used or planned by Naval operating and Joint forces afloat and ashore. Understand how space systems are used to meet joint warfighters' communications requirements.

b. Be able to articulate from the joint warfighter's perspective the advantages and disadvantages of various frequencies used by DOD for communications across the frequency spectrum. Understand the national and international issues involving use of the frequency spectrum.

c. Understand current and future MILSATCOM bandwidth allocation processes.

d. Understand the nature of the rapid evolution in commercial satellite communications systems. Be able to articulate potential uses to satisfy Joint DOD Information Operations requirements.

6. ANALYSIS, SYNTHESIS AND EVALUATION:

a. Be able to derive, assess, and articulate cost-effective requirements for the operational use of space systems to meet C3I/O requirements, using modeling and simulation, field and laboratory experiments, and other quantitative and qualitative methods as they pertain to the Federal and DOD Acquisition System.

b. Be able to perform business case (economic) and trade-off analyses for commercial and DOD Systems.

c. Receive introduction to Naval Warfare Development Command and become familiar with real world exercises (e.g., Fleet Battle Experiments, Millennium Challenge)

7. ARCHITECTING JOINT MILITARY SPACE MISSIONS:

a. Understand the basic principles of architecting a complex joint military space mission, the life cycle process by which a space system is conceived, structured, designed, built, tested, certified and operated in a way that ensures its integrity and performance. Be able to formulate a consistent set of principles and techniques to be followed throughout all phases of the architecting process.

b. Understand the systems design of a spacecraft that includes its various subsystems: propulsion, structure, thermal, attitude determination and control; electrical power, and telemetry, tracking and command; and their integration. Gain an appreciation of the key interactions between the various subsystems and their effects on performance requirements. Understand the system design criteria from stated performance requirements, and the trade-offs between payloads and other spacecraft subsystems.

c. Understand the basic principles of launch vehicle performance; launch environment, launch windows, and their role in military operations. Understand the differences between the various classes of current and future launch systems including the upper stages. Gain an appreciation of the various business issues involved in the selection of the launch vehicle (e.g.: pricing, insurance, policy). Be familiar with the issues of integrating a spacecraft with a launch vehicle. Perform a trade-off analysis in the selection of the launch vehicle.

d. Understand the application of the principles of systems engineering to a Joint space project from the needs assessment phase to the final operations cycle. Be able to apply the tools of project management (e.g. scheduling, costing, budgeting, planning, resource negotiation, risk management) to a space project. Gain an appreciation of the review process from the systems requirements review to the critical design review. Gain a familiarity with typical spacecraft testing: electromagnetic compatibility tests, vibration and thermal tests, functional tests, deployments tests, alignment tests, inertia determination tests and comprehensive system tests. Understand the necessity to ensure the integrity, workmanship, and performance of the spacecraft.

- e. Understand the basic elements of joint mission operations: command the spacecraft, manage payloads, resolve anomalies, schedule ground station support, design failure workarounds, plan orbit maneuvers, and link users and operators.
- f. Be able to develop a concept of operations for a space system. Be able to develop and assess a course of action using the Joint Operational Planning and Evaluation System (JOPES) process for best utilization of space systems. Be able to develop the space systems component of OPLANS.

8. ADVANCED CONCEPTS AND TECHNOLOGIES IN SPACE SYSTEMS :

- a. Understand the future of military space requirements stemming from information superiority.
- b. Understand the future concepts of operations published by various DOD organizations based on an understanding of the emerging technologies and their impact on military space.
- c. Develop an understanding of the advanced concepts and technologies in military space systems.

INFORMATION SUPERIORITY:

- a. The graduate shall have a broad understand and ability to innovatively employ information superiority technologies, develop and implement top level systems and subsystems and influence applications of the following knowledge domains: Joint C4I, Information Warfare, Space System Operations, Information Technology Management, Computer Science, Modeling and Simulation.

ESR Approved by:
Deputy for Command, Control, Communications and Computers (C4), Integration and Policy (OPNAV N6F)
Nov 2004

EDUCATIONAL SKILL REQUIREMENTS
COMPUTER SCIENCE
CURRICULUM (368)
Subspecialty Code 6203P

All officers with graduate education in Computer Science must be competent in Computer Science Core subjects including advanced expertise in a specific computer science functional area. These competencies will enable graduates to serve in positions that design, acquire, operate, or secure military networks and systems and/or deny potential adversaries the effective use of their own. The skills and competencies are detailed below.

1. **MATHEMATICS:** The officer will have a thorough knowledge of mathematical tools and concepts that are intrinsic to Computer Science, including but not limited to logic, discrete math, combinatorics, and modeling & simulation.

2. **NETWORKING:** The officer will have a sound understanding of networking theory and practical application as it pertains to the design and operation of military Information Systems and Computer Network Operations (CNO) within Information Warfare. This includes structure, architecture, protocols, communications and security in modern networks, network engineering, and distributed networks. The officer will also be introduced to the fundamental hardware and software components of networks.

3. **PROGRAMMING AND SYSTEMS:** The officer will be proficient in programming and programming languages, and in analyzing large software-intensive systems. The officer will demonstrate advanced knowledge and understanding of programming practices and programming paradigms and be familiar with assembly languages. The officer will demonstrate advanced knowledge and understanding of system modules, interfaces, risk factors and project management.

4. **PRACTICES AND FOUNDATIONAL PRINCIPLES:** Officers will have competence in computer science practices and principles including design and mechanics of computing and their applications to military needs. Officers will be proficient in core technologies including algorithms, architectures, operating systems, data structures, compilers, databases, software engineering, intelligent systems, and human-computer interactions.

5. **COMPUTER SCIENCE SPECIALIZATION:** Each officer will complete a specialization track that integrates computer science in DOD systems, software, and operations. The major area specializations will include: (a) Network Operations; (b) Information Security and Assurance; (c) Software Engineering and Architecture. These specializations require further emphasis in minor areas of study through sequences of courses. The specialization will include a thesis project in a framework that exercises the practice of innovation, problem-solving, systems-thinking, and real-world applicability.

Major area sponsor

Director, Space, Information Warfare, Command and Control Directorate, OPNAV (N61)

Curriculum Sponsor and ESR Approval Authority

Commander, Naval Security Group

Last curriculum review: June 2004

EDUCATIONAL SKILL REQUIREMENTS
MODELING, VIRTUAL ENVIRONMENTS AND SIMULATION (MOVES)
CURRICULUM (399)
Subspecialty Code 6202P

All officers with advanced degree education in Modeling, Virtual Environments and Simulation (MOVES) must possess skills and competencies in the fundamentals of modeling and simulation (including visual simulation), human-computer interaction, statistics and data analysis. Topics in this curriculum include: object-oriented programming, artificial intelligence, computer communications and networks, computer graphics, human-computer interaction, virtual world and simulation systems, physically based modeling, virtual environment network and software architectures, probability, statistics, stochastic modeling, data analysis, human performance measurement and evaluation, and combat modeling. The skills and competencies are detailed below.

1. JOINT AND MARITIME STRATEGIC PLANNING

The officer must understand the application and evaluation of modeling and simulation tools in Joint and maritime strategic planning. This applies to development and execution of military strategy; 'what-if' analytical evaluation of proposed tactics and strategy; analysis of alternative courses of action; and the effects of technical developments on warfare, formulation of U.S. policy, roles of military forces, joint planning, and current issues in defense reorganization. In view of the increasing emphasis on joint training, joint planning, and joint analysis in support of system procurement decisions, the officer must understand and be able to employ Modeling & Simulation in distributed simulation networks joining a variety of M&S tools, developed and operated by other Service agencies.

2. SPACE, INFORMATION WARFARE AND COMMAND & CONTROL PROFESSIONAL PRACTICES

The naval officer shall possess skills in the SIWCC core subject areas of Science and Technology (Information Technology, Communications, Space and Sensors), Analysis and Evaluation (Statistics, Operations Analysis, and System Evaluation), Operations Information Management and Systems (C2, C4ISR, Info Operations and Acquisition Management).

3. SOFTWARE DEVELOPMENT

The officer must have a thorough knowledge of modern software development to include: an understanding of the software development process; the ability to plan and implement a major programming project and develop the appropriate documentation, and; the ability to utilize object-oriented techniques in system design, and to use modern software development tools in the construction of modeling, virtual environment and simulation systems.

4. SOFTWARE TECHNOLOGY

The officer must have a thorough knowledge of software technology to include: properties of object-oriented languages; programming techniques for parallel and distributed applications; the structure of storage media; methods useful in representing structured data in storage; techniques of operating upon data structures; computer systems organization from the operating systems level down to the computer architecture level; memory management; file system design and

management; object-oriented operating environments; artificial intelligence techniques including heuristic search, artificial intelligence languages, knowledge representation, expert systems, and means-end analysis; rapid prototyping for object-oriented design; and use of tools.

5. COMPUTER SYSTEMS DESIGN

The officer must have a thorough knowledge of computer system design to include: empirical and analytical methods for determining the efficiency and performance of computer systems; modeling of processes; an understanding of the design issues of hardware/software compatibility, operating systems compatibility, information systems requirements, and interoperability, especially via networks.

6. COMPUTER ARCHITECTURE

The officer must have a thorough knowledge of computer architecture to include: basic components of computer systems and their patterns of configuration and communication including large scale mainframes, microcomputers, supercomputers, parallel processors, and networks of workstations; the organization, logic design, and components of digital computing systems relating to multiprocessing, parallel processing, distributed processing, networking, communication, multimedia, and peripheral devices.

7. ANALYTICAL SKILLS

The graduate must possess the skills in higher mathematics required to support graduate study in modeling, virtual environments and simulation. The graduate must understand the use of M&S in design of experiments, including selection of the most appropriate models for specific requirements. The graduate must also gain proficiency in the development of software, and in employment of software of special importance for modeling, virtual environments and simulation.

8. DATA ANALYSIS AND STOCHASTIC MODELING

The graduate must have the ability to apply probability, statistics, and exploratory data analysis as appropriate, to formulate and execute analyses involving uncertainty, including analyses of military operations. The graduate will be proficient in the principles of probability and statistics and the use of one or more statistical graphics programs, and be able to apply interactively a variety of methods to actual data. The graduate will be able to analyze a variety of DOD data sets to answer specific operational questions utilizing modeling, virtual environment and simulation systems. The graduate will be able to formulate and solve problems involving processes with uncertainty over time, including the ability to apply the theory to warfare, and tactical decision analyses.

9. VIRTUAL ENVIRONMENTS & COMPUTER-HUMAN INTERACTION

The graduate will be knowledgeable with the development of networked virtual environment and simulation systems, and will be able to implement such systems or manage a team capable of developing such systems. Topics included in study: computer-human interfaces, and networking; real-time, 3D computer graphics and human-computer interaction, virtual worlds, distributed interactive simulation, virtual environment network and software architectures; intelligent displays, and computer-mediated autonomous systems; use of video, audio, haptic, and other sensory I/O to coordinate human-machine activities via remote access; and physically based modeling.

10. PROBLEM SOLVING AND REAL WORLD APPLICABILITY

The officer shall possess skills that permit a realistic perspective on problem solving and provide an appreciation of the difficulty and power of applying theory to the real world in a Navy organization. This includes: completing a significant project applying academic skills outside of the classroom; exercising skills in problem formulation, criteria specification, analysis, and evaluation and presentation of results; and clearly communicating the project in writing and verbally.

11. STRATEGY AND POLICY

Graduates will develop an ability to think strategically, analyze past operations, and apply historical lessons to future joint and combined operations, in order to discern the relationship between a nation's political interests and goals and the ways military power may be used to achieve them. Fulfilled by completing the first of three Naval War College courses leading to Service Intermediate-level Professional Military Education (PME) and Phase I Joint PME credit. (Required only for USN and USMC students.)

Curriculum Sponsor and ESR Approval Authority

Director, Space, Information Warfare, Command and Control Directorate, OPNAV (N6)
March 2000

EDUCATIONAL SKILL REQUIREMENTS
SOFTWARE ENGINEERING
CURRICULUM (369)

All officers with advanced degree education in Software Engineering must possess skills and competencies in software design, development processes, and related software technology applicable to large-scale military systems. The skills and competencies are detailed below.

1. SOFTWARE DESIGN

The officer must have a thorough knowledge of software system design to include:

- a. System analysis and design theory encompassing the basics of requirements engineering and specification, system modeling and software architecture and its application to automation of military processes;
- b. An understanding of the design issues related to digital data processing, interfacing to hardware systems, real-time command and control, distributed computation, and end-to-end systems integration. An understanding of the design issues related to software system interoperability, system reengineering, design rationales, system architecture, and software reuse;
- c. The ability to design systems that are readily adaptable to changing military needs;
- d. An understanding of system reliability issues and quality assurance methods for achieving high software reliability; and
- e. The ability to understand, diagnose and recover from software failures.

2. DEVELOPMENT PROCESSES

The officer must have a thorough knowledge of software development processes to include:

- a. An understanding of the software development process, including requirements determination, feasibility assessment, design, configuration management, implementation, quality assurance, and system evolution;
 - b. The ability to perform feasibility assessments of complex computer-based systems via prototyping, simulation, and static analysis;
 - c. The ability to plan, evaluate, and manage major software projects, choose appropriate design automation tools and develop appropriate documentation; and
 - d. The ability to assess software development risks and improve software development processes to reduce costs and produce more reliable systems.
 - e. An understanding of the development process issues related to improving maintainability and upgradeability of software in integrated systems.
-

3. SOFTWARE TECHNOLOGY

The officer must have a thorough knowledge of software technology that includes:

- a. Methods for efficiently representing data and techniques for efficiently operating upon data structures;
- b. The structure, control, and design of software systems involving multiprocessing, distributed processing and network-centric computing;
- c. Representations and automatable methods for design and analysis of software systems;
- d. Tools and techniques for simulation and modeling of systems; and
- e. Engineering automation capabilities for design and assessment of software systems, program generation, and computer aided software design tools.

4. PROBLEM SOLVING AND MILITARY APPLICABILITY

The officer shall possess skills that enable a realistic perspective on problem solving and provide an appreciation of the difficulty and power of applying theory to military concerns such as information warfare and command and control. This includes:

- a. Completing a significant project applying software engineering skills to Navy and/or DOD relevant problems;
- b. Exercising skills in problem formulation, criteria specification, analysis, design, and evaluation of results as they relate to military requirements; and
- c. Clearly communicating the results of a project orally and in writing.

5. STRATEGY AND POLICY

Graduates will develop an ability to think strategically, analyze past operations, and apply historical lessons to future joint and combined operations, in order to discern the relationship between a nation's political interests and goals and the ways military power may be used to achieve them. Fulfilled by completing the first of three Naval War College courses leading to Service Intermediate-level Professional Military Education (PME) and Phase I Joint PME credit. (Required only for USN and USMC students.)

**EDUCATIONAL SKILL REQUIREMENTS
INFORMATION SYSTEMS TECHNOLOGY
CURRICULUM (370)
Subspecialty Code 6201P**

The Information Systems Technology graduate shall have the knowledge skills and competencies to Engineer Information Systems afloat and ashore; Manage Information Systems, centers and commands afloat and ashore; and Solve Information Systems engineering and management problems individually and in teams. These general education skill requirements are supported by the following topical educational skill requirements.

1. STRATEGY AND POLICY

Graduates will develop an ability to think strategically, analyze past operations, and apply historical lessons to future joint and combined operations, in order to discern the relationship between a nation's political interests and goals and the ways military power may be used to achieve them. Fulfilled by completing the first of three Naval War College courses leading to Service Intermediate-level Professional Military Education (PME) and Phase I Joint PME credit. (Required only for USN and USMC students.)

2. SPACE, INFORMATION WARFARE AND COMMAND & CONTROL PROFESSIONAL PRACTICES

The naval officer shall possess skills in the ISSO core subject areas of Science and Technology (Information Technology, Communications, Space and Sensors), Analysis and Evaluation (Statistics, Operations Analysis, and System Evaluation), Operations Information Management and Systems (C2, C4ISR, Info Operations and Acquisition Management).

3. SOFTWARE DEVELOPMENT

The officer must have a thorough knowledge of modern software development to include: an understanding of the software development process; the ability to plan and implement a major programming project and develop the appropriate documentation, and; the ability to utilize object-oriented techniques in system design, and to use modern software development tools in the construction of modeling, virtual environment and simulation systems.

4. INFORMATION SYSTEMS TECHNOLOGY

The officer must have a thorough knowledge of information systems technology to include: Computer System Components, Computer Networks, Communication Systems and Networks, Software Engineering, Database Management Systems, Decision Support and Expert Systems.

5. INFORMATION SYSTEMS ANALYSIS AND MANAGEMENT

The officer must master the following concepts to effectively manage information system assets: Managerial Concepts, Evaluation of Information Systems, Systems Analysis and Design, Management of Information Systems, Adapting to Technological, Organizational, and Economic Changes, Military Use of Commercial Telecommunications Systems

6. MILITARY APPLICATIONS

The officer must be able to combine analytical methods and technical expertise with operational

experience for effective military applications to include: DOD Decision Making Process on Information Systems, Information Technology Acquisition Management, DOD Computer and Telecommunications, C4ISR and C2W.

7. INDEPENDENT RESEARCH

The graduate will demonstrate the ability to conduct independent research analysis, and proficiency in communicating the results in writing and orally by means of a thesis and a command oriented briefing. The research in information technology and its management will include problem formulation, decision criteria specification, decision modeling, data collection and experimentation, analysis and evaluation.

Curriculum Sponsor and ESR Approval Authority

Director, Space, Information Warfare, Command and Control Directorate, OPNAV (N6)
March 2000

EDUCATIONAL SKILL REQUIREMENTS
METOC
CURRICULUM (373)
Subspecialty Code 6401P

1. The officer must have a thorough understanding of the principles governing the physical and dynamic properties of the oceans and atmosphere and a general understanding of numerical model and numerical model process.
2. The officer must have the ability to observe, assimilate, analyze, interpret and predict oceanic and atmospheric parameters and conditions using field experimentation, direct and remote sensing observational techniques, statistical analysis and numerical models.
3. The officer must have a thorough understanding of the effects of oceanic, and atmospheric properties and conditions on weapon, sensor and platform performance while conducting and supporting Naval warfare as described in "Forward...from the Sea" with particular emphasis on oceanic acoustics and electromagnetic and optical propagation.
4. Graduates will develop an ability to think strategically, analyze past operations, and apply historical lessons to future joint and combined operations, in order to discern the relationship between a nation's political interests and goals and the ways military power may be used to achieve them. Fulfilled by completing the first of three Naval War College courses leading to Service Intermediate-level Professional Military Education (PME) and Phase I Joint PME credit. (Required only for USN and USMC students.)
5. The officer must have a thorough understanding of the fundamentals of Global Geospatial Information and Services (GGI&S), precise time and time interval (PTTI), and astrometry.
6. The officer must successfully complete all NPS requirements for the Joint Masters Degree in Meteorology and Physical Oceanography.

Curriculum Sponsor and ESR Approval Authority

Oceanography of the Navy (N-096)
November 1996

EDUCATIONAL SKILL REQUIREMENTS
OPERATIONAL OCEANOGRAPHY
CURRICULUM (374)
Subspecialty Code 6402P

1. The officer must have a thorough understanding of the principles governing the physical and dynamic properties of the oceans and atmosphere and a general understanding of numerical model and numerical model process.
2. The officer must have the ability to observe, assimilate, analyze, interpret and predict oceanic and littoral water conditions using field experimentation, direct and remote sensing observational techniques, statistical analysis and numerical models.
3. The officer must have an understanding of the effects of oceanic, littoral and atmospheric properties and condition on weapons, sensor and platform performance while conducting and supporting Naval warfare as described in "Forward...from the Sea" with particular emphasis on ocean acoustics.
4. Graduates will develop an ability to think strategically, analyze past operations, and apply historical lessons to future joint and combined operations, in order to discern the relationship between a nation's political interests and goals and the ways military power may be used to achieve them. Fulfilled by completing the first of three Naval War College courses leading to Service Intermediate-level Professional Military Education (PME) and Phase I Joint PME credit. (Required only for USN and USMC students.)
5. The officer must successfully complete all NPS requirements for the Masters Degree in Physical Oceanography.

Curriculum Sponsor and ESR Approval Authority

Oceanography of the Navy (N-096)
November 1996

EDUCATIONAL SKILL REQUIREMENTS
COMBAT SYSTEMS SCIENCES AND TECHNOLOGY
CURRICULUM (533)
Subspecialty Code 570XP

1. **MATHEMATICS, SCIENCE, AND ENGINEERING FUNDAMENTALS:** A solid foundation in mathematics, physics, and engineering underpinning combat-systems technology to support the theoretical and experimental aspects of the technical courses in the curriculum.
2. **ACOUSTIC AND ELECTROMAGNETIC SYSTEM:** A graduate level understanding of acoustic and electromagnetic propagation; physics of solid state, and electro-optic devices; including the principles of radar and sonar systems; and signal analysis and decision theory.
3. **COMMUNICATION SYSTEMS:** A graduate level understanding of various communication systems including fiber optics, automatic control systems, and open architecture designs and their implications on integration of computing resources and in advanced combat systems.
4. **WEAPONS SYSTEMS AND APPLIED FLUID MECHANICS:** A graduate level understanding of the fluid dynamics of subsonic and supersonic weapons, warheads and their effects, counter measures and deception techniques.
5. **COMBAT SYSTEMS ANALYSIS, SIMULATION AND TESTING:** Sufficient foundation in Systems Analysis and Simulation to understand the limits of each, and their effect on required combat systems testing.
6. **COMBAT SYSTEMS ENGINEERING:** An understanding of the principles of design, development, upgrades and maintenance; and the importance of performance and economic trade-offs in combat systems.
7. **MATERIALS SCIENCE:** A familiarity of the concepts of materials science sufficient for an understanding of the mechanical, electrical, and thermal properties of materials important in present and future combat systems.
8. **JOINT AND MARITIME STRATEGIC PLANNING:** American and world military history and joint and maritime planning including the origins and evolution of national and allied military strategies which address the entire spectrum of conflict; the U.S. maritime component of national military strategy; the organizational structure of the U.S. defense establishment; the role of the commanders of unified and specified commands in strategic planning, the process of strategic planning; joint and service doctrine, and the roles and missions of each in meeting national strategy.
9. **TECHNICAL SPECIALIZATION:** Each officer will also acquire technical competence in one or more of the following areas as it pertains to Combat Systems: **ELECTROMAGNETIC SYSTEMS, WEAPONS & EFFECTS, UNDERWATER ACOUSTIC SYSTEMS, MISSILE SYSTEMS OR A SPECIFIC ENGINEERING DISCIPLINE.** The knowledge required for an approved concentration is

A. ELECTROMAGNETIC SYSTEMS

- 1) Propagation and scattering of optical, IR, and microwave radiation in the turbulent atmosphere as they influence target detection.
- 2) Advanced sensor and detection techniques for military applications.
- 3) Advanced concepts of target surveillance, acquisition, and engagement.

B. WEAPONS & EFFECTS

- 1) Nuclear weapons and their effects.
- 2) Effects of radiation & EMP on electronic systems.
- 3) Principles of directed energy weapons systems and their effects.
- 4) Survivability & lethality considerations.

C. UNDERWATER ACOUSTIC SYSTEMS

- 1) Wave propagation in the ocean; scattering, fluctuations and boundary interactions as they effect detection, localization, and prosecution of underwater targets; underwater transducer design and array theory.
- 2) Active and passive acoustic signal processing for detection of submarines, mines, and other underwater weapons; adaptive techniques.
- 3) Acoustic influences of oceanographic phenomena, which effect target detection including boundary characteristics, ambient noise, sound speed profiles, fronts, and eddies.

D. MISSILE SYSTEMS

- 1) Missile aerodynamics
- 2) Missile Propulsion
- 3) Guidance and control systems for missiles.
- 4) Missile and warhead lethality.
- 5) Missile design.

E. ENGINEERING DISCIPLINE: A series of at least five graduate-level courses in an area related to combat systems in the disciplines of Engineering (Mechanical, Electrical, Aeronautical, or Space Systems), Computer Science, or Software Engineering. This series must be approved by the Curricular Officer.

10. THESIS: The graduate will demonstrate the ability to conduct independent research in combat systems sciences and technology and proficiency in presenting the results in writing and orally by means of a thesis and command-oriented briefing.

Curriculum Sponsor and ESR Approval Authority

Commander, Naval Sea Systems Command
May 2000

EDUCATIONAL SKILL REQUIREMENTS
UNDERSEA WARFARE
CURRICULUM (525)
Subspecialty Code 6301P

1. **PHYSICS:** The officer will understand physical principles applicable to acoustic, non-acoustic USW systems and underwater weapons systems.

2. **ACOUSTICS:** The officer will understand acoustical phenomena affecting the design, performance, and operation of acoustic USW systems.

3. **OCEANOGRAPHY AND METEOROLOGY:** The officer will understand atmospheric and oceanographic processes influencing the performance and tactical use of USW systems.

4. **SIGNAL PROCESSING:** The officer will understand principles of signal processing as they apply to USW systems.

5. **OPERATIONS RESEARCH:** The officer will understand the principles of USW search, detection, and localization; and be able to perform computer modeling and simulation. The officer will understand principles of tactical decision aids and data analysis in the evaluation of USW systems.

6. **UNMANNED SYSTEMS:** Understand the fundamental technologies and capabilities of unmanned underwater systems and tactical robotics.

The officer will understand tactical decision aids for USW systems.

6. **JOINT PROFESSIONAL MILITARY EDUCATION:** Graduates will develop an ability to think strategically, analyze past operations, and apply historical lessons to future joint and combined operations, in order to discern the relationship between a nation's political interests and goals and the ways military power may be used to achieve them. Graduates will also develop understanding of warfighting within the context of operational art, to include: national military capabilities and command structure, joint and service doctrine, joint planning and execution, and joint and multinational forces and systems integration at the operational level of war. (Fulfilled by completing the Naval War College three-part series leading to Service Intermediate-level Professional Military Education (PME) and Phase I Joint PME credit. Required for USN and USMC students.)

8. **PROBLEM SOLVING AND PRACTICAL APPLICABILITY**

The officer will demonstrate the ability to conduct independent analysis in Undersea Warfare and proficiency in presenting the results in writing and orally.

Curriculum Sponsor and ESR Approval Authority

Director, Submarine Warfare Division (N-77)

Director, Expeditionary Warfare Division (N75)

May 2005

EDUCATIONAL SKILL REQUIREMENTS
NAVAL/MECHANICAL ENGINEERING
CURRICULUM (570)
Subspecialty Code 5600P

Officers entering into the Naval/Mechanical Engineering curriculum will be offered the necessary preparatory level courses to enable them to satisfy the equivalent of a baccalaureate degree in Mechanical Engineering. They shall meet, as a minimum, the requirements set forth by the Accreditation Board for Engineering and Technology (ABET).

At the graduate level, the officer will acquire the competence to participate in technical aspects of naval systems research, design, development, maintenance and acquisition. The background to deal with future advances is gained through the emphasis on design and a combination of the core program requirements, specialization and thesis research.

In pursuit of the above, the goal is for each officer to acquire a senior/upper division level physical and analytical understanding of the following topics. It is recognized that all students may not meet all ESR's depending on individual circumstances determined by the curricular officer and the academic associate. However, each student will be exposed to fundamentals in all ESR areas.

1. **THERMODYNAMICS AND HEAT TRANSFER:** Fundamentals of thermodynamics and heat transfer with applications to all marine engineering power cycles as well as propulsion and auxiliary system cycle analysis and design.
2. **FLUID MECHANICS:** Compressible and incompressible flow, both viscous and inviscid, with emphasis on propellers, cavitation, and design of shipboard fluid systems (e.g., fluid machinery, pumps, turbomachinery).
3. **DYNAMICS AND CONTROL:** Kinematic and dynamic analysis of particle, rigid-body and multi-body mechanical systems. Modeling of engineering systems, including examples from mechanical, electrical and hydraulic applications. Feedback control concepts, both classical and modern and their application to the design of ship stabilization systems, weapon direction systems and power plant control. Instrumentation for propulsion system monitoring and control.
4. **STRUCTURAL MECHANICS AND VIBRATION:** Statically determinant and indeterminant structural analysis, stress/strain analysis, buckling and fatigue. Shock and vibration response of marine structures, including surface ships and submarines.
5. **MATERIALS AND FABRICATION:** Metallurgical processes and transformations; analytical approach to failure of materials in Naval Engineering use and a basic understanding of the materials technology associated with welding and marine corrosion; an introduction to the developing fields of composites and superconducting materials.
6. **COMPUTERS:** A basic understanding of computer system architecture, operating systems (such as UNIX), networking and introduction to engineering software design. Practical experience of structured programming languages (such as FORTRAN, C), and the use of

integrated design tools for computational and symbolic manipulation (such as MATLAB and Maple). Use and application of mainframe, workstation and personal computers for the solution of Naval engineering design and analysis tasks. Exposure to finite element and finite difference tools and techniques, with application to the thermo-fluid and structural mechanics/dynamics areas, including experience of representative software packages.

7. **MATHEMATICS:** Sufficient mathematics, including integral transforms and numerical analysis, to achieve the desired graduate education.

8. **DESIGN/SYNTHESIS:** Design synthesis and introduction to optimization techniques, with emphasis on the design of mechanical subsystems and their integration into the ship system.

9. **ELECTRICAL ENGINEERING:** Electromagnetic and circuit theories, dc circuits, steady-state ac circuits, methods of circuit analysis, including Laplace transforms. Exposure to the construction and operating characteristics of rotating machinery, static converters, and power distribution systems and multiphased circuits.

10. **NAVAL ARCHITECTURE:** Fundamentals of naval architecture including the geometry, hydrostatics and hydrodynamics of monohull floating and submerged structures. Wave and skin friction analysis, power requirements of particular designs. Longitudinal and transverse stability of floating and submerged bodies, hull girder strength requirements. Introduction to seakeeping and survivability principles.

11. **SPECIALIZATION:** Each officer will also acquire technical competence in one or more of the following areas: **THERMAL/FLUID SCIENCES, SOLID AND STRUCTURAL MECHANICS, DYNAMICS AND CONTROLS, MATERIAL SCIENCE, OR TOTAL SHIP SYSTEMS ENGINEERING** through additional graduate level courses and their associated prerequisites.

12. **JOINT AND MARITIME STRATEGIC PLANNING:** American and world military history and joint and maritime planning including the origins and evolution of national and allied strategy; current American and allied military strategies which address the entire spectrum of conflict; the U.S. maritime component of national military strategy; the organizational structure of the U.S. defense establishment; the role of the commanders of unified and specified commands in strategic planning, the process of strategic planning; joint and service doctrine, and the roles and missions of each in meeting national strategy.

13. **THESIS:** The graduate will demonstrate the ability to conduct independent analysis, in the area of Naval/Mechanical Engineering and proficiency in presenting the results in writing and orally by means of a thesis and command-oriented briefing appropriate to this curriculum.

Curriculum Sponsor and ESR Approval Authority

Deputy Commander, Engineering Directorate
NAVSEA (SEA-03)
June 1997

EDUCATIONAL SKILL REQUIREMENTS
ELECTRONIC SYSTEMS ENGINEERING
CURRICULUM (590)
Subspecialty Code 5300P

1. **MATHEMATICS:** The officer will have a thorough knowledge of mathematical tools which are intrinsic to electrical and computer engineering, including, but not limited to differential equations, vector analysis, linear algebra, probability, numerical analysis, and Fourier and Laplace methods.

2. **ENGINEERING SCIENCE AND DESIGN:** To acquire the requisite background needed to meet the other military education requirements, the officer will acquire proficiency in modern physics, electromagnetics, electronic devices and circuits, system theory, modern electronic system design, and integrated electrical power systems and their controls. In addition, proficiency will be gained in other appropriate fields such as underwater acoustics, dynamics, fluid mechanics and thermo-dynamics that provide the requisite breadth to a military engineering education.

3. **COMPUTERS:** The officer will have a sound understanding of computer hardware, software, and their integration into military systems including programming in higher order languages, digital logic circuits, and microprocessor applications.

4. **ELECTRONIC AND ELECTRICAL ENGINEERING:** In order to provide officers skilled in the application of electronic systems to military needs, the officer will have competence in the broad area of electrical engineering including circuits, electronics, fiber optics, computer communications networks, systems analysis signal processing, and optimal control theory. The officer will select elective courses to obtain breadth in his/her understanding of military electronic systems. In addition to achieving depth of understanding, the officer shall specialize in one of the following areas: (a) communication systems including electronic counter-counter measures, low probability of intercept systems, low probability of detection systems, and other military issues; (b) guidance, navigation, and control systems; (c) radar, electro-optic, and electronic warfare systems; (d) high performance computer systems including advanced integrated circuits, networking and data communications, parallel and distributed systems, and reliable real time military platforms; (e) signal processing systems as applied to surveillance, underwater acoustic data acquisition and processing, imaging and target location, and other military issues; (f) total ship systems power engineering; (g) joint services electronic warfare techniques and systems; (h) signals intelligence systems.

5. **SYSTEM DESIGN AND SYNTHESIS:** The officer will have a sound understanding of engineering principles utilized in engineering system design, particularly as they relate to military systems, including establishment of system related operational requirements and criteria.

6. **CONDUCTING AND REPORTING INDEPENDENT INVESTIGATION:** The officer will demonstrate the ability to conduct independent investigation of a Navy and/or DOD relevant electronic systems problem, to resolve the problem, and to present the results of the analysis in both written and oral form.

7. **JOINT AND MARITIME STRATEGIC PLANNING:** The officer will demonstrate knowledge of American and world military history and joint and maritime planning including the origins and evolution of national and allied strategy; current American and allied military strategies which address the entire spectrum of conflict; the U.S. maritime component of national military strategy; the organizational structure of the U.S. defense establishment; the role of the commanders of unified and specified commands in strategic planning; the process of strategic planning; joint and service doctrine, and the roles and missions of each in meeting national strategy.

Curriculum Sponsor and ESR Approval Authority

Commander, Space and Naval Warfare Systems Command
July 1998

**EDUCATIONAL SKILL REQUIREMENTS
SPACE SYSTEMS ENGINEERING
CURRICULUM (591)**

Subspecialty Code 5500P – Space Systems Engineering

All officers with graduate education in Space Systems Engineering must be competent in the below core subjects. These competencies will enable graduates to serve in positions that design, acquire, operate, or secure military space systems and/or deny potential adversaries the effective use of their own. The skills and competencies are detailed below.

JOINT STRATEGY AND POLICY:

- a. Officers develop a graduate-level ability to think strategically, critically analyze past military campaigns, and apply historical lessons to future joint and combined operations, in order to discern the relationship between a nation's policies and goals and the ways military power may be used to achieve them. This is fulfilled by completion of the first of the Naval War College course series leading to Service Intermediate-level Professional Military Education (PME) and Phase I Joint PME credit.
- b. Understand current Navy and USMC doctrine (e.g., Sea Power 21, Expeditionary Maneuver Warfare).

ORBITAL MECHANICS, SPACE ENVIRONMENT AND REMOTE SENSING:

- a. Understand the basic physics of orbital motion, the parameters used in the description of orbits and their ground tracks. Understand the design of orbits, how they are achieved, maintained, and controlled including the design of constellations and how spacecraft are maneuvered and repositioned. Understand spacecraft tracking and command/control from a ground station. Understand the various orbital perturbations, including those due to nonspherical earth and due to atmospheric drag. Understand the relationships of orbits to mission requirements, including the advantages and disadvantages of various orbits.
- b. Understand the natural and induced environment of space including solar activity, geomagnetic and magnetospheric phenomena, physics of the ionosphere and upper atmosphere and their response to natural and artificial disturbances. Understand the impacts to spacecraft parts and materials due to this space environment.
- c. Understand the principles of active and passive sensors used in current and future spacecraft for sensing through the atmosphere. Understand the effects of the space environment and countermeasures on sensor performance. Understand the tradeoffs among various sensor techniques, including area of coverage, resolution, processing, and power requirements.

MILITARY SPACE SYSTEMS:

Understand the two major components of military space systems: (These systems include MILSATCOM, Commercial systems, GPS, Meteorological systems, space surveillance, National systems, space-based warning, and other nations' systems)

a. **Military Space Operations:** Understand the operational requirements and limitations of current and future space systems used by the DOD for Space Control and Force Application. Understand the roles of the Services in the development, operation, and use of these systems. Understand the roles, responsibilities and relationships of national and Joint DOD organizations in establishing policies, priorities, and requirements for these space systems; and in their design, acquisition and operation. Understand the nature of space warfare (theory, history, doctrine, and policy) including space control, assured access, global engagement, and full force integration. Be familiar with Joint Doctrine (e.g. JP 3-14).

b. **Warfighter Support Obtained from Space:** Understand the capabilities and use of space systems to enable and support Joint air, land, and sea military operations (i.e. Force Enhancement). Understand the intelligence collection and analysis process for space systems and how warfighters access information from these sources. Understand doctrine and operational concepts (e.g. USSTRATCOM's "Long Range Plan") and be able to contribute to the development of space tactics that enhance or support military operations.

PROJECT MANAGEMENT AND SYSTEM ACQUISITION:

a. Understand project management and DOD system acquisition methods and procedures to include contract management, financial management and control, and the Planning, Programming and Budgeting System (PPBS). Receive an introduction to the Defense Acquisition University and the acquisition courses and qualifications available.

b. Understand the system acquisition organizational responsibilities and relationships (e.g. Congress, DOD, Services; Resource Sponsor, Systems Commands, Operating Forces) as they pertain to the acquisition of systems for DOD, Naval, and civilian agency users.

SPACECRAFT COMMUNICATIONS AND SIGNAL PROCESSING:

a. Understand the basic principles of communications systems engineering including the space and ground segments. Understand digital and analog communications architecture design, including frequency reuse, multiple access, link design, repeater architecture, source encoding, waveforms, and propagation media. Understand current and future communications systems used or planned by Naval operating and Joint forces afloat and ashore. Understand how space systems are used to meet Joint warfighters' communications requirements.

b. Understand link budget calculations/analysis, waveforms, and modern SATCOM hardware design. Understand signal processing techniques, both digital and analog, as applied to spacecraft communications, surveillance, signals intelligence, and electronic warfare. Understand spacecraft vulnerabilities in an electronic warfare context.

COMPUTERS: HARDWARE AND SOFTWARE:

a. Understand the fundamentals of digital logic and digital system design. Design simple digital computer subsystems.

b. Gain knowledge of current computer architecture, such as one of the common 16-bit or 32-bit micro-processor systems. Understand the ways in which computers are used in complex systems such as guidance, signal processing, communications and control systems.

c. Understand the fundamentals of electronic component design, fabrication, reliability, and testing (to include radiation hardening), with emphasis on parts, materials and processes.

SPACECRAFT DYNAMICS, GUIDANCE AND CONTROL:

A fundamental understanding of the field of spacecraft guidance and control which includes, linear control, rotational kinematics, rigid body dynamics, single-spin stabilization, stability of dual-spin stabilized spacecraft, active nutation control, gravity-gradient stabilization, disturbance torques: solar, magnetic, gravity gradient, and aerodynamic, attitude sensors, actuators, attitude determination, quaternion feedback control, three-axis-stabilized spacecraft attitude control design, biased momentum, thrusters, magnetic, three reaction wheel system, and control moment gyro system, rapid spacecraft reorientation maneuvers and tracking, and military spacecraft guidance and control.

SPACECRAFT STRUCTURES AND MATERIALS:

a. Understand the engineering of space structures including simplified sizing calculations and analytical modeling of advanced materials, which can be incorporated in system design and integration. Understand the advanced dynamics and control of these structures.

b. Apply reliability and maintainability to testing, evaluation, and manufacturing, which can be used to predict the functional dependability of spacecraft structures

PROPULSION SYSTEMS:

Understand the operating principles of current and proposed propulsion devices for space applications; including launch, orbit changing and maneuvering engines. Understand the interaction between mission requirements and propulsion requirements.

SPACECRAFT THERMAL CONTROL AND POWER:

a. Understand the principles of heat transfer on spacecraft, including radiation and conduction. Understand the variations in the radiative properties of surfaces with respect to wavelength and temperature. Understand the design and applications of current active and passive thermal control devices (including heat pipes, louvers, and materials).

b. Understand the sources of heat in space (solar, terrestrial, reflected solar, internal vehicle generation) and their variation as a function of vehicle orbit.

c. Gain knowledge of the major power generating systems for spacecraft and their operating characteristics, including the performance of photovoltaic sources in the natural and artificial radiation environment. Understand the role of energy storage devices in power systems design.

SPACECRAFT DESIGN AND INTEGRATION:

- a. Understand the principles of space systems design, integration, and systems engineering, and their application to an overall spacecraft/mission. Consideration will be given to life cycle costs, performance, maintainability, reliability, configuration control and systems integration.
- b. Gain an appreciation of system design criteria from stated performance requirements, of trade-offs between payload and other spacecraft subsystems, and of test and evaluation procedures.
- c. Gain proficiency in CAD, MATLAB, Satellite Tool Kit (STK), or similar programming simulators and analysis tools.

CONDUCT AND REPORT INDEPENDENT RESEARCH:

Conduct independent research on a space systems problem, including resolution of the problem and presentation of the results and analysis in both written and oral form.

**ESRs approved by
Commander SPAWAR Space Field Activity
Nov 2004**

EDUCATIONAL SKILL REQUIREMENTS
INFORMATION WARFARE
CURRICULUM (595)
Subspecialty Code 6205P

1. **INFORMATION WARFARE:** The officer will have an in-depth understanding of IW/C2W and the disciplines needed to support them.
2. **COMMUNICATIONS/COMPUTER/INFORMATION NETWORKS:** The officer will have an in-depth understanding of the capabilities, limitations, design and operation of communications, computers and information networks.
3. **INFORMATION SYSTEMS:** The officer will have a systems level understanding of information systems and their vulnerabilities as well as capabilities.
4. **ORGANIZATIONAL PROCESSES AND STRUCTURE:** The officer will understand the organizational decision process, as well as the structure and other processes of organizations with emphasis on their vulnerabilities and capabilities.
5. **INTELLIGENCE:** The officer will understand the concepts, principles, methods and capabilities of joint operational intelligence, with emphasis on the operational requirements levied upon the intelligence community to support IW/C2W.
6. **IW INTEGRATION :** The officer will understand the integration of IW as a weapon and its role in modern warfare; understand the integral roles of EW, psychological operations, military deception, OPSEC, and physical destruction; understand INFOSEC and nodal attack in this warfare area; employ real time intelligence, tactics and EW systems; understand the physical principles of generation, transmission, propagation, reception, processing and suppression of detection and surveillance information.
7. **PROBLEM SOLVING AND PRACTICAL APPLICABILITY:** The officer will demonstrate the ability to conduct independent analysis in IW/C2W and proficiency in presenting the results in writing and orally by means of a thesis and command oriented briefings.
8. **STRATEGY AND POLICY:** Officers develop a graduate-level ability to think strategically, critically analyze past military campaigns, and apply historical lessons to future joint and combined operations, in order to discern the relationship between a nation's policies and goals and the ways military power may be used to achieve them. Fulfilled by completing the first of the Naval War College course series leading to Service Intermediate-level Professional Military Education (PME) and Phase I Joint PME credit.

Curriculum Sponsor and ESR Approval Authority

Commander, Naval Security Group
October 1995

EDUCATIONAL SKILL REQUIREMENTS
REGIONAL SECURITY STUDIES
CURRICULA (681, 682, 683, and 684)
Subspecialty Codes 2101P, 2102P, 2103P, 2104P

The goal of these curricula is to educate military officers and civilian officials of the United States and other nations in regional studies and the unique challenges involved in effective security cooperation with states in other world regions. The curricula include a core of military and diplomatic history, comparative politics and international relations, policy analysis, and the U.S. decision-making process. Each curriculum includes a specific series of courses focused on region specific history and culture, politics and government, security structures and processes, security issues, and relationships with the United States and other countries and international organizations. These curricula draw upon other NPS curricula including Regional Intelligence, Strategic Studies, and Civil-Military Relations.

Students conduct research (including classified research) on questions of interest to the program sponsors, the U.S. Armed Services, the unified commands, and other federal agencies. Special emphasis is placed on the writing of a thesis, which gives the student the opportunity to develop the skills required for critical thought and coherent expression while producing a study of value to the Department of Defense. Graduates will understand regional challenges to U.S. national security and the role of U.S. national security policy in addressing such challenges. They will thoroughly understand the security situation of the particular region in which they specialize, as well as U.S. foreign and defense policies applicable to that region.

The Regional Security Studies curricula also incorporates NPS and Naval War College courses to earn Professional Joint Education (JPME) Phase I credit.

Navy Officers completing these curricula, in addition to receiving the applicable sub-specialty code for their region of study, will also receive the Additional Qualification Designator (AQD) designating them as Navy Foreign Area Officers (FAO) in accordance with applicable instructions.

1. Analytical Skills. Graduates will be able to logically combine data and theory to analyze and explain international political, economic, and military events. They will develop their skills to formulate innovative solutions to strategic problems. Students will demonstrate writing, briefing, and computer skills in preparing and presenting their findings.

2. International and Comparative Politics. Graduates will understand the conditions, events, and ideas that shape the interactions of nation-states and other actors in the international system. Students will study the history and major theories explaining international relations (including realism, cognitive, and cultural paradigms) and will be able to use their knowledge to analyze and explain international and domestic issues.

3. The International Economy. Graduates will gain a basic understanding of the economic factors that shape the international security environment, including the economic dimensions of national security policy and the ways in which economic policies and interests affect military strategy and force structure.

4. Regional Security Issues. Graduates will be aware of the economic, political, social, and military characteristics of regions of strategic concern to the United States.

5. Overseas Presence. Graduates will understand the overseas presence and engagement missions of U.S. military forces as defined in the National Military Strategy of the United States. Students will examine the role of overseas presence as a means for cultivating and sustaining political relationships with foreign governments; as a basis for activities that maintain technical and doctrinal interoperability with allies and coalition partners; as an instrument for maintaining and protecting air and sea lines of communication; and as a source of support for operations other than war.

6. Naval Power and Policy. Graduates will understand the role and influence of maritime power in the international system. Students will learn about regional differences in naval capabilities, roles and missions; concepts of seapower including land-based sea and area denial forces; and systemic trends including weapons technology, ocean law regimes, and international and regional political developments.

7. Strategy and Policy: Graduates will develop an ability to think strategically, analyze past operations, and apply historical lessons to future joint and combined operations, in order to discern the relationship between a nation's political interests and goals and the ways military power may be used to achieve them. Fulfilled by completing the first of three Naval War College courses leading to Service Intermediate-level Professional Military Education (PME) and Phase I Joint PME credit. (Required only for USN and USMC students.)

8. Joint Professional Military Education (JPME): Graduates will develop understanding of warfighting within the context of operational art, to include: national military capabilities and command structure, joint and service doctrine, joint planning and execution, and joint and multinational forces and systems integration at the operational level of war. Fulfilled by completing the Naval War College three-course series leading to Service Intermediate-level Professional Military Education (PME) and Phase I Joint PME credit. (Only required for USN students.)

9. Regional Politics, History and Culture. Graduates will understand major political systems, historical background, political culture, and prevalent political ideologies and their impact on regional security, as well as the influence of ethnic, cultural, and religious values on security situations.

10. Military Forces and Strategic Posture. Graduates will gain an understanding of the main factors determining the strategic postures of countries in their specific region, including strategic culture and goals, threat perceptions, and military force structures.

11. U.S. Regional Security Policy. Graduates will understand the U.S. foreign policy objectives and political, economic, and military strategy, including U.S. engagement policy, for their selected region. They will study the formulation of U.S. policy regarding the region including the role of Congress and the interagency process. Students will become knowledgeable on security assistance programs and their relevance to a region.

12. Emerging Security Challenges. Graduates will understand the major global and regional security issues, including political and military relationships between states, especially the

potential for military conflict, insurgencies and terrorism, social and economic problems, and other issues affecting the security of nations and regions. Graduates will know regional sources of political and social instability and violence, including ethnic conflict, and their influence on regional security planning and U.S. national security policy.

13. Regional Conflict: Graduates will understand the characteristic patterns of violent conflict in their specialty region, the likely sources and character of regional wars in the present and future, and the historical and prospective impact of such wars on the international system as a whole.

Curriculum Sponsor and ESR Approval Authority

Deputy Chief of Naval Operations
(Plans, Policy and Operations) (N3/N5)
March 1999

EDUCATIONAL SKILL REQUIREMENTS
SPECIAL OPERATIONS AND LOW INTENSITY CONFLICT (SO)
CURRICULUM (699)
Subspecialty Code 2500P

1. STRATEGY AND POLICY

Graduates will develop an ability to think strategically, analyze past operations, and apply historical lessons to future joint and combined operations, in order to discern the relationship between a nation's political interests and goals and the ways military power may be used to achieve them. Fulfilled by completing the first of three Naval War College courses leading to Service Intermediate-level Professional Military Education (PME) and Phase I Joint PME credit. (Required only for USN and USMC students.)

2. THE DYNAMICS OF INTER-STATE AND INTRA-STATE CONFLICT : An understanding of the political, ethnic, and cultural dynamics that explain the outbreak of war between and within modern states. Particular attention should be given to the issues of intra-state conflict, unconventional forms of inter-state military rivalry, the integrated role of force and diplomacy in crisis management operations short of war, problems of escalation in a crisis environment, military alliance behavior, the dynamic differences between zero sum and nonzero sum conflicts, the special problems associated with suppressing and resolving zero sum engagements, military and nonmilitary approaches to conflict resolution. Students must have a close understanding of the prevailing analytical literature on these and related subjects and be able to apply this literature to a broad range of contemporary and historical cases.

3. TERRORISM, SOCIAL REVOLUTION, AND UNCONVENTIONAL WARFARE: A detailed understanding of the problems of domestic and international terrorism, social revolution, and other forms of irregular conflict. Close attention must be given to problems of both threat and response. The student must have a close knowledge of the prominent contending theoretical perspectives on the problems of terrorism and social revolution, a detailed knowledge of the operational and organizational dynamics underlying each of these forms of conflict, and a strong working understanding of the ways in which these and similar forms of irregular conflict have been countered historically. Where appropriate, the courses designed to satisfy this requirement should survey the U.S. experience in irregular warfare as well as that of other states that have been prominently engaged in such actions in the past, such as Great Britain, France, Israel, and the former Soviet Union.

4. HISTORICAL AND COMPARATIVE PERSPECTIVES ON SPECIAL OPERATIONS: A close understanding of the historical use of special operations forces, to include how these and similar forces have been organized, trained, equipped, directed, and employed. Attention should be given not only to the U.S. experience but to other national experiences as well, such as those of Great Britain, Germany, Italy, and the former Soviet Union. Similarly, this examination should not be restricted to contemporary history alone, but should extend back into the historical record to examine the ways in which special operations and related forces have been employed creatively to support state objectives in the more distant past. Throughout this inquiry attention should be given to the contemporary lessons that can be drawn from historic experience.

5. SPECIAL OPERATIONS DOCTRINE, CONCEPTS, AND INSTITUTIONS: A detailed and conception understanding of the development of doctrine for special operations. Work in this area should focus, first, on the defining events and experiences that have stimulated doctrinal and institutional innovations in SO and, second, on the forms these innovations have taken. This examination should cover the period from the end of World War II through the post-Cold War era. These and related issues should be explored creatively in an effort to uncover the appropriate roles and missions and strengths and limitations of military power in the emerging multipolar environment.

6. CRISIS MANAGEMENT AND THE CONTINGENT USE OF MILITARY POWER: An understanding of the political role played by military power in operations short of war, the problem of military crisis management, and the contingent use of force in support of local U.S. policy objectives. Attention should be given to the "signaling" role that can be played by military force, the special problems of deterrence and coercion in a crisis environment, and the military consequences of deterrence failure. The student should have a close knowledge of the historical record of "armed diplomacy" throughout the post-war period. This should include a knowledge of the individual cases of U.S. military intervention in the Third World, from Lebanon (1958) to Somalia (1993). Attention should be given to both the theoretical and empirical literature on these subjects to provide the student with an understanding of the special political and operational issues associated with operating in a crisis environment.

7. COMPARATIVE CASES OF AND RESPONSES TO REGIONAL CONFLICT: A close knowledge of historical and contemporary "small wars" and other forms of low intensity conflict in Latin America, Asia, and the Middle East. The courses that satisfy this requirement should examine the pertinent theoretical literature on political violence in the region in question, review the recent history of regionally-based terrorism, insurgency, and communal conflict, the regional and international implications of these conflicts, and any functional issues that are of particular interest or concern in the particular area under investigation, such as, the religious or communal sources of political violence or the relationship between narcotics and insurgency.

8. SPECIAL OPERATIONS AND THE REVOLUTION IN MILITARY AFFAIRS : An understanding of the ways in which the proliferation of new and emerging technologies is changing the shape of modern warfare. An important aspect of this requirement is to examine the likely impact of these developments on the dynamics and characteristics of 21st century warfare within both the inter-state and intra-state arena. The student must have a working knowledge of the major technological developments and trends in this area (both lethal and non lethal) and their conflict implications.

9. SPECIAL OPERATIONS AND INFORMATION WARFARE: An understanding of the likely and potential implications of information warfare on future special operations. An important aspect of this requirement is to examine the principles of information warfare and examine the ways in which SOF can contribute to U.S. information dominance on the 21st century battlefield. This examination should address the problem of information dominance at the inter-state and intra-state level of war.

10. WEAPONS OF MASS DESTRUCTION (WMD) PROLIFERATION AND COUNTERPROLIFERATION: Students will have an understanding of the developing problem of WMD proliferation and counterproliferation. Students may have a technical or operational perspective on WMD. The student must have an understanding of the political dynamics of

WMD proliferation and an understanding of recent and possible future trends in this areas. Close attention should also be given to the problem of counterproliferation and the ways in which SOF might approach this task. Students having a technical focus should have a working knowledge of nuclear and non-nuclear WMD Technologies..

11. ANALYTICAL METHODS AND APPLICATIONS: Each student will receive a grounding in analytical methods and their application to military modeling, simulations, and gaming. Close attention will be given to the ways in which such analytical techniques can be used as heuristic and decision making tools for strategic and operational planning. Attention will be given to both historical and contemporary military applications with particular focus on the ways in which such techniques can be used to address issues of interest to the special operations community.

12. STRATEGIC AND OPERATIONAL COMPLEXITY: Special Operations (SO) is a style of warfare. No traditional single academic discipline can adequately address the educational requirements of the special operations community, so an interdisciplinary approach is required. Each student will develop a course of study that permits them to pursue a disciplinary orientation that best suits their particular academic background and interests within the substantive limits of the other ESRs.

Curriculum Sponsor and ESR Approval Authority

Commander in Chief, U.S. Special Operations Command
May 1995

**EDUCATIONAL SKILL REQUIREMENTS
ACQUISITION AND CONTRACT MANAGEMENT
CURRICULUM (815 (MBA))**

1. **MANAGEMENT FUNDAMENTALS:** The graduate will understand the theory of and have an ability to apply accounting, economic, mathematical, statistical, and managerial and other state-of-the-art management techniques and concepts to problem solving and decision-making responsibilities as military managers.

2. **ADVANCED MANAGEMENT CONCEPTS:** The graduate will have the ability to apply advanced management and operations research techniques to defense problems. This includes policy formulation and execution, strategic planning, Defense resource allocation, cost benefit and cost effectiveness analysis, Federal fiscal policy, computer-based information and decision support systems, and complex managerial situations requiring comprehensive integrated decision-making.

3. **ACQUISITION AND CONTRACTING PRINCIPLES:** The graduate will have an understanding of and will be able to apply the principles and fundamentals of acquisition and contracting within the Federal government including knowledge of the acquisition laws and regulations, particularly the Federal Acquisition Regulation (FAR) and the DOD FAR Supplement (DFARS); the unique legal principles applied in Government contract law and the Uniform Commercial Code; and the application of sound business principles and practices to Defense contracting problems. Further, the graduate will be able to apply innovative and creative approaches not only to resolve difficult acquisition and contracting issues but to significantly influence the legal and regulatory structure within which acquisition decision-making occurs. Finally, the graduate will have the ability to conceptualize, develop and execute strategic business alliances and relationships necessary to the successful acquisition of goods and services.

4. **ACQUISITION AND CONTRACTING POLICY:** The graduate will have an ability to formulate and execute acquisition policies, strategies, plans and procedures; a knowledge of the legislative process and an ability to research and analyze acquisition legislation; and a knowledge of the Government organization for acquisition, including Congress, the General Accounting Office, the Office of Federal Procurement Policy, the Federal and military contracting offices, the Boards of Contract Appeals, and the court system.

5. **CONTRACTING PROCESS:** The graduate will understand the theory of and have the ability to manage the field contracting, system acquisition and contract administration processes. This involves a knowledge of the defense system life cycle processes, including requirements determination, funding, contracting, ownership, and disposal; an ability to evaluate military requirements, specifications, and bids and proposals; an ability to utilize the sealed bid, competitive proposal and simplified acquisition methodologies; a comprehensive knowledge of all contract types and their application in Defense acquisition; an ability to conduct cost and price analyses; and an ability to negotiate various contracting actions including new procurement, contract changes and modifications claims, equitable adjustment settlements, and noncompliance issues.

6. **BUSINESS THEORY AND PRACTISES:** The graduate will have an understanding of the business philosophy, concepts, practices and methodologies of the global commercial industrial base and the ability to apply these to the Federal Government acquisition environment.

7. **FEDERAL AND DEFENSE BUDGETING:** The graduate will have an ability to apply economic and accounting principles, including monetary and fiscal theories, to defense acquisition and contracting issues.

8. **PROGRAM MANAGEMENT:** The graduate will have an understanding of the basic principles and fundamentals of Program Management, with particular emphasis on the Procuring Contractor Officer's and Administrative Contracting Officer's roles and relationships with the Program Manager.

9. **ACQUISITION WORKFORCE:** The graduate will satisfy all requirements of the Defense Acquisition Workforce Improvement Act (DAWIA) and mandatory contracting courses required by the Defense Acquisition University (DAU) at Levels I, II and III.

10. **ETHICS AND STANDARDS OF CONDUCT:** The graduate will have an ability to manage and provide leadership in the ethical considerations of military acquisition, including the provisions of procurement integrity, and to appropriately apply Defense acquisition standards of conduct.

11. **STRATEGY AND POLICY:** Officers develop a graduate-level ability to think strategically, critically analyze past military campaigns, and apply historical lessons to future joint and combined operations, in order to discern the relationship between a nation's policies and goals and the ways military power may be used to achieve them. Fulfilled by completing the first of the Naval War College series leading to Service Intermediate-level Professional Military Education (PME) and Phase I Joint PME credit.

12. **ANALYSIS, PROBLEM SOLVING AND CRITICAL THINKING:** The graduate will demonstrate the ability to conduct independent research and analysis, and proficiency in presenting the results in writing and orally by means of a thesis and a command-oriented briefing appropriate to this curriculum.

Curriculum Sponsor and ESR Approval Authority

Director, Acquisition Career Management (ASN (RD&A))
October 04

837 – Financial Management

Curriculum Sponsor and ESR Approval Authority:	N8/N82
Point of Contact:	RADM Bruce Engelhardt
Phone:	(703) 697-7105

EDUCATIONAL SKILL REQUIREMENTS
MASTER OF SCIENCE IN CONTRACT MANAGEMENT
CURRICULUM (835) Distributed Learning

1. **ADVANCED MANAGEMENT CONCEPTS:** The graduate will have the ability to apply advanced management theory and techniques to problems in both the public and private sectors. This includes policy formulation and execution, strategic planning, resource allocation, Federal fiscal policy, computer-based information and decision support systems, and complex managerial situations requiring comprehensive integrated approaches. The graduate will have the ability to apply state-of-the-art management concepts and practices to problem solving and decision-making responsibilities as middle and senior managers.

2. **ACQUISITION AND CONTRACTING PRINCIPLES:** The graduate will have an understanding of and will be able to apply the principles and fundamentals of acquisition and contracting within the Federal Government including knowledge of the acquisition laws and regulations, particularly the Federal Acquisition Regulation (FAR) and the Defense FAR Supplement (DFARS); the unique legal principles applied in Government contract law and the Uniform Commercial Code; and the application of sound business principles and practices to Defense contracting problems. Further, the graduate will be able to apply innovative and creative approaches not only to resolve difficult acquisition and contracting issues but to significantly influence the legal and regulatory structure within which acquisition decision-making occurs. Finally, the graduate will have the ability to conceptualize, develop and execute strategic business alliances and relationships necessary to the successful acquisition of goods and services.

3. **CONTRACTING PROCESS:** The graduate will understand the theory of and have the ability to manage the field contracting, system acquisition and contract administration processes. This involves a knowledge of the defense system life cycle processes, including requirements determination, funding, contracting, ownership, and disposal; an ability to evaluate military requirements, specifications, and bids and proposals; an ability to utilize the sealed bid, competitive proposals and simplified acquisition methodologies; a comprehensive knowledge of all contract types and their application in Defense acquisition; an ability to conduct cost and price analyses; and an ability to negotiate various contracting actions including new procurement, contract changes and modifications, claims, equitable adjustment settlements, and noncompliance issues.

4. **ACQUISITION AND CONTRACTING POLICY:** The graduate will have an ability to formulate and execute acquisition policies, strategies, plans and procedures; a knowledge of the legislative process and an ability to research and analyze acquisition legislation; and a knowledge of the Government organization for acquisition, including Congress, the General Accounting Office, the Office of Federal Procurement Policy, the Federal and military contracting offices, the Boards of Contract Appeals, and the court system.

5. **BUSINESS THEORY AND PRACTICES:** The graduate will have an understanding of the business philosophy, concepts, practices and methodologies of the commercial industrial base (both domestic and global) and the ability to apply these to the Federal Government acquisition environment.

6. **DEFENSE FINANCIAL MANAGEMENT AND BUDGETING:** The graduate will have an ability to apply sound financial management theories, principles and practices to defense acquisition and contracting issues, including fiscal and monetary policy.

7. **PRODUCTION AND QUALITY MANAGEMENT:** The graduate will have an understanding of the basic principles and fundamentals of Production and Quality Management, with particular emphasis on the Procuring Contracting Officer's and Administrative Contracting Officer's roles and relationships with industry and the Government Program Manager.

8. **ANALYSIS AND APPLICATION:** The graduate will demonstrate an ability to apply acquisition, contracting and management principles in dealing with the significant issues encountered in managing the contracting process in one of the following areas: (1) major weapon systems acquisition, (2) research and development, (3) field procurement, and (4) facilities contracting.

9. **ETHICS AND STANDARDS OF CONDUCT:** The graduate will have an ability to manage and provide leadership in the ethical considerations of military acquisition, including the provisions of procurement integrity, and to appropriately apply Defense acquisition standards of conduct.

10. **ACQUISITION WORKFORCE:** The graduate will satisfy all requirements of the Defense Acquisition Workforce Improvement Act (DAWIA) and mandatory contracting courses required by the Defense Acquisition University (DAU) at Level III.

11. **ANALYSIS, PROBLEM SOLVING AND CRITICAL THINKING:** The graduate will demonstrate the ability to conduct independent research and analysis, and proficiency in presenting the results in writing and orally by means of a thesis and a command-oriented briefing appropriate to this curriculum.

Curriculum Sponsor and ESR Approval Authority

Director, Acquisition Career Management (ASN (RD&A))
October 2004

837 – Financial Management

Curriculum Sponsor and ESR Approval Authority:	N8/N82
Point of Contact:	RADM Bruce Engelhardt
Phone:	(703) 697-7105

Naval Postgraduate School
Educational Skill Requirements for XX31P
Financial Management Curriculum 817 and 837

7/00 revisions

1. Management Fundamentals: The graduate will have the ability to apply quantitative, accounting, economics, information technology, and other state-of-the-art management techniques and concepts to military management problems. Also, the graduate will know basic management theory and practices, embracing leadership, communication, organization design, staffing, quality, and planning within large public and private sector organizations, as well as military sub-units and activities. Additionally, the graduate will have the ability to understand and use computer systems and information technology in problem solving, and will have a basic understanding of management information systems, including database management, financial systems and e-business systems.

2. Federal and Defense Budgeting: The graduate will understand the roles of the executive and legislative branches in setting federal fiscal policy, allocating resources to national defense, budget formulation, negotiation, and execution strategies. In addition, the graduate will have knowledge of all aspects of the federal, Defense, and Navy budget cycles including the Planning, Programming, and Budgeting System with emphasis on budget formulation and execution.

3. Funds Management. In support of approved programs, the graduate will be able to manage appropriated, revolving, and non-appropriated funds in compliance with regulations of the Comptroller of the Navy and the federal government. Also, the graduate will be able to develop and review financial reports, analyze budget execution against operating and financial plans, develop alternate plans based on analyses of an activity's financial performance, and prepare recommendations or make decisions regarding the reallocation or reprogramming of funds. The guidelines of the Defense Finance and Accounting System and the Federal Accounting Standards Advisory Board are relevant.

4. Internal Control and Auditing: In accordance with the auditing standards of the U.S. General Accounting Office, the Defense and Navy audit organizations, and the professional standards of the American Institute of Certified Public Accountants, the graduate will learn to apply audit procedures and techniques that enforce sound internal accounting and administrative controls, safeguard defense assets, and assure the completeness and integrity of financial reports.

5. Acquisition Management: The graduate will understand the purpose and concepts of the Defense systems acquisition process and the application of project management methods within this process.

6. Economy, Efficiency, and Effectiveness: The graduate will have the skills for solving complex and unstructured management problems in which alternatives must be identified, evaluated, and selected in accordance with economical procurement of resources, efficient utilization of resources, and effective accomplishment of overall Defense and Navy goals and objectives. This includes cost/benefit analysis, systems analysis, cost estimation, and application of relevant Defense regulations.

7. Cost Management and Analysis: The graduate will be able to design, implement, and evaluate different costing systems encountered within Defense and Navy organizations and activities as well as those found in private sector organizations conducting business with the federal government. In addition to private sector cost management policies and practices, the graduate will understand the application of Defense unit costing guidelines to functional business areas, and the Office of Management and Budget's Cost Accounting Standards for major suppliers of goods and services to the federal government.

8. Strategic Planning and Control: The graduate will have knowledge of strategic planning and management control concepts for setting goals and objectives; designing programs to achieve objectives; assigning individual responsibility for resource management, actions, and decision making; measuring performance; reporting results; and evaluating and rewarding performance. The graduate will be able to assess existing management systems and determine appropriate policies, procedures, organization structure, and information systems to ensure optimal use of available human, physical, and financial resources to satisfy the mission.

9. Strategy and Policy: Officers develop a graduate-level ability to think strategically, critically analyze past military campaigns, and apply historical lessons to future joint and combined operations, in order to discern the relationship between a nation's policies and goals and the ways military power may be used to achieve them. Fulfilled by completing the first of the Naval War College series leading to Service Intermediate-level Professional Military Education (PME) and Phase I Joint PME credit.

10. Innovation and Creativity: The graduate will demonstrate initiative and creativity in performing independent research. This includes specifying research questions, formulating a research program, performing the research, and presenting the results in writing and orally by means of a thesis and a command oriented briefing appropriate to the financial management curriculum.

Curriculum Sponsor and ESR Approval Authority:

Financial Management (837): N8/N82 Defense Systems Analysis (817): USMC: MC HQ

814 – Transportation Management

Curriculum Sponsor and ESR Approval Authority:

Point of Contact:

Phone:

JPME:

Military Sealift Command

Mr. Steve Lucido

(202) 685-5114

Partially Embedded

EDUCATIONAL SKILL REQUIREMENTS
Master of Business Administration in Logistics
Curriculum 813, 814, 819, 827
Subspecialty Codes 1302, 1304, 3122 combined into 3121

1. Management Fundamentals - Quantitative Analysis: The graduate will have the skills to apply mathematical, statistical, accounting, economic and other state-of-the-art quantitative techniques and concepts to the solving of day-to-day military management problems as well as the capability to use these skills as a participant in the long range strategic planning efforts of the Navy and DOD.

2. Management Fundamentals - Organization and Management: The graduate will have a thorough knowledge of basic management theory and practices, embracing leadership, communication, organizational design, staffing, directing, planning and controlling of military organizations.

3. Integrated Logistics Support Management: The graduate will have a detailed understanding of the processes associated with designing an integrated logistics support system for a new weapon system. The graduate will also have detailed knowledge about the DOD processes for contracting for and acquiring a new weapon system. The graduate will be able to serve as an assistant program manager for logistics (APML) for a major weapon system.

4. Budgeting and Financial Controls: The graduate will have an understanding of the financial management practices of DOD, will be able to conduct cost/benefit analyses, and participate in the budgetary planning by a hardware systems command for the support of both old and new weapon systems.

5. Production/Operations Management: The graduate will be able to apply the techniques of production/operations management at Naval Aviation Intermediate Activities and Depots, Navy Fleet Industrial and Support Activities, and other DOD maintenance and maintenance support activities.

6. Materials and Physical Distribution Management: The graduate will be able to apply the techniques of materials management and physical distribution management in designing and operating of fleet and troop support systems both during peacetime and during rapidly developing wartime contingencies. This will include acquiring materiel and transportation assets to insure that the distribution of materiel is both cost-effective and efficient.

7. Strategy & Policy: The graduate will have knowledge of the development and execution of military strategy and the effects of technical effects on warfare, an understanding of the means of formulation of US policy, the roles of military forces and joint planning, and current issues in the defense organization.

8. Thesis or Project: The graduate will demonstrate the ability to conduct independent research and analysis, and proficiency in presenting the results in writing by means of a thesis or project appropriate to this curriculum.

Curriculum Sponsor and ESR Approval Authority:

Transportation Logistics Mgmt (813): NAVSUP

Transportation Management (814): COMMSC

Systems Inventory Mgmt (819): NAVSUP

Material Logistics Support (827): NAVAIR

847 – Manpower Systems Analysis

Curriculum Sponsor and ESR Approval Authority: N-13

Point of Contact: RADM Talbot/CAPT Mullarky

EDUCATIONAL SKILL REQUIREMENTS
MANPOWER SYSTEMS ANALYSIS
Subspecialty Code 3130P

Curriculum 847
September 2002

1. Management Fundamentals Organization and Management - The graduate will have the ability to apply contemporary management principles, organizational theory, and social science methodology to the development, implementation, and management of effective MPT polices and programs throughout DoN/DOD. The graduate will have the ability to use and understand computer systems in problem solving and will have a basic understanding of management information systems and E-Business.
2. Budgeting and Financial Controls - The graduate will have an understanding of basic financial management practices of DoN/DOD and will be able to conduct cost benefit analyses and participate in the budgetary planning of commands and/or DoN programs. The graduate will have an understanding of the Planning, Programming, and Budgeting System (PPBS) and the ability to analyze the impact of budgetary changes on DoN/DOD manpower and personnel programs and polices.
3. Automated Data Analysis - The graduate will possess the skills in data manipulation, statistics, and exploratory data analysis to be able to formulate and execute analyses of a wide variety of manpower, personnel and training issues. The graduate will have proficiency in computing with mainframe and microcomputer systems to interactively apply a variety of methods to large-scale DoN and DOD databases. The graduate will have a thorough understanding of the manpower information systems.
4. Management Fundamentals - Analytical Techniques. The graduate will be able to apply mathematical, statistical, accounting, economic and other analytical techniques and concepts to day-to-day military management issues. The graduate will be able to gather and analyze qualitative data. The graduate will also be able to use these techniques and concepts as a participant in the long-range strategic planning efforts of the Navy and DOD.
5. Advanced Quantitative and Qualitative Analysis - The graduate will have the ability to apply a wide range of advanced organizational, economics, statistical, and mathematical techniques and concepts to manpower and personnel polices and issues. These include the use of econometric techniques in the quantitative analysis of large-scale DoN/DOD manpower and personnel databases, of qualitative techniques in the analysis of survey and personnel data, of manpower decision support systems, and of Markov models in the analysis of force structure and manpower planning, forecasting and flow models.
6. Manpower Systems Analysis Fundamental Concepts. The graduate will have an understanding of the fundamental concepts and basic functional areas of manpower, personnel and training (MPT) within DoN/DOD as listed below as well as an understanding of the MPT systems and their interrelationships.

Manpower: Requirements determination; billet authorizations; billet costs; end strength planning; and total force planning and programming.

Personnel: Recruiting; accession plans and policies; officer and enlisted community management; attrition; retention; compensation; and readiness.

Training: Applications of theories of learning; instructional technologies; the systems approach to training; evaluation of training effectiveness and cost; and the relationship between training and fleet readiness. .

7. Manpower Systems Analysis Policy Analysis - The graduate will have the ability to analyze critically the strengths and weaknesses of proposed manpower, personnel, and training policies and to suggest alternatives that recognize the potential impact on DoN/DOD program planning, resources and objectives.

8. Joint Military Strategic Planning - The graduate will have an understanding of the development and execution of military strategy, the effects of technical developments on warfare, and the processes for formulating U.S. policy, the roles of military forces, joint planning, and current issues in the defense organization. This understanding will include expertise on the combined use of active and reserve forces in joint warfare.

9. Evaluation, Innovation and Creativity - The graduate will demonstrate individual initiative and creativity in the application of the skills and knowledge gained from the Manpower Systems Analysis program. The graduate will select a manpower, personnel, or training policy or management issue of importance to DoN/DOD, develop a plan to investigate the issue, analyze all of its aspects, suggest a solution as appropriate, and report the significant findings and recommendations in writing by means of a thesis.

Curriculum Sponsor and ESR Approval Authority: Chief of Naval Personnel (N13)

EDUCATIONAL SKILL REQUIREMENTS
INFORMATION SYSTEMS MANAGEMENT
CURRICULUM (000)
Subspecialty Code XXXXP

The Information Age has generated a revolution in the means in which we conduct business and warfare. New technologies have changed the traditional views of the marketplace, supply chain management, and logistics. As the range and complexity of computer applications have grown, the need to manage and exploit those resources has increased. This curriculum provides both the technical skills and business acumen to deal with a constantly evolving digital world.

The Information Systems Management graduate shall have the knowledge skills and competencies to:

- (1) Manage the acquisition of Information Systems.
- (2) Manage Information Systems and infrastructure support afloat and ashore.
- (3) Solve Information Systems engineering and management problems individually and in teams.
- (4) Effectively manage and lead in today's constantly changing digital world.
- (5) Develop and implement effective strategies and policies to take advantage of technological opportunities and mitigate risk.
- (6) Assimilate new technologies and transform organizations, processes, and strategies to compete in the marketplace or on the battlefield.

These general education skill requirements are supported by the following topical educational skill requirements:

1. **INFORMATION SYSTEMS TECHNOLOGY.** The officer must have a thorough knowledge of information systems technology to include:
 - a. Computer System Components: Central processing units, input/output devices, storage devices, operating systems, programming languages, distributed computer systems, and computer security.
 - b. Computer Networks: Fiber optics, wide and local-area network hardware software, components and systems, physical layer interfaces and protocols, and network management protocols.
 - c. Software Engineering: Methodologies for the analysis, design, development, prototyping, testing, implementation and maintenance of software; software metrics and reliability; productivity analysis and software cost estimation and planning; CASE and ICASE tools.
 - d. Database Management Systems: Database technologies (including object-oriented databases and XML), technical and administrative issues involved in the design, implementation and maintenance of database management systems.

- e. **Decision Support and Expert Systems:** Problem identification, formulation, and design of systems to support decision making: application of artificial intelligence technology to preserve perishable expertise and enhance distributed expertise; understanding the design of executive information systems, office automation, group decision support systems and crisis management systems, and their potential impacts on organizations and missions.
- f. **Knowledge Management Systems:** Knowledge collection technologies designed to capture, categorize, store, retrieve and present both tacit and explicit knowledge. Identify the challenges, current limitations and benefits of knowledge management.
- g. **Computer Security:** Methods for ensuring integrity, confidentiality, authentication, and availability of computer resources, distributed databases and networks.
- h. **Web Technology:** Understanding Web protocols, architecture of Web systems, data interchange, access and cryptographic security, electronic payments, brokering software, access to databases, multimedia, search engines, and intelligent agents.

2. INFORMATION SYSTEMS ANALYSIS AND MANAGEMENT. The officer must master the following concepts to effectively manage information system assets:

- a. **Managerial Concepts:** Decision-making theory, microeconomics, marketing, operations analysis, statistics, financial management, organizational development, and research methodologies.
- b. **Evaluation of Information Systems:** Cost-performance (effectiveness) analysis; selection, evaluation, acquisition, installation and effective utilization of information systems hardware and software, risk assessment, and information system architectures involving alternative system concepts.
- c. **Systems Analysis and Design:** Information systems feasibility studies and life cycle management, techniques for determining system requirements and specifications, system performance evaluation, conversion and maintenance of legacy systems, post-implementation evaluation, man-machine interfaces, system ergonomics, re-hosting applications and security analysis of information systems.
- d. **Management of Information Systems:** Metrics evaluation, monitoring, capacity planning, human resource management, budgeting and financial control of computer centers, design of effective organization structure, understanding architectural constraints, control and security (INFOSEC) policies, and training requirements for both the user and support staff.
- e. **Adapting to Technological, Organizational, and Economic Changes:** Evaluation of potential impacts of new technology on information systems and organizational strategy. Decision making under uncertainty.
- f. **Military Use of Commercial Telecommunications Systems:** Architectural integration, cost-performance (effectiveness), and geopolitical-legal aspects.

- g. Database Management: Performing backups, synchronizing data, cleaning data, database security, legacy database management, normalizing data and object oriented databases vs. relational databases.
3. **MILITARY APPLICATIONS.** The officer must be able to combine analytical methods and technical expertise with operational experience for effective military applications to include:
- a. DOD Decision-Making Process on Information Systems: DOD, DoN, OMB, and congressional decision making on information systems matters.
 - b. Information Technology Acquisition Management: Acquisition policies and procedures of the DOD, including the planning, programming and budgeting system; project management.
 - c. DOD Computer and Telecommunications: Architectures and specifications of Navy and DOD systems, computers, telecommunications networks and services, including the DISN; Navy fleet communications systems including satellite communications, JMCIS, GCCS, and the Navy Telecommunications System (NTS); Decision Support Systems.
 - d. Logistical Support: Management of information systems that provide financial, inventory, transportation, medical, and administrative services to the fleet.
4. **ELECTRONIC COMMERCE.** The officer must master the following concepts to effectively manage or utilize electronic commerce systems:
- a. E-commerce Technology: Evaluate e-commerce tools and hardware such as HTTP servers, secure transaction software, firewalls, heterogeneous networks, financial institution networking tools, and intelligent agents.
 - b. Design and development of e-commerce system: Evaluate potential architectures, design software and languages, server platforms, front end user interfaces, and back end databases.
 - c. Supply Chain Management: Inventory management policies, including procurement, storage, stock control, and contracting. Also includes strategies, processes and organizational changes necessary to deal with technology and a dynamic marketplace.
 - d. Financial Accounting: Provide the financial and security infrastructure necessary to support E-commerce.
 - e. Legal Considerations: Laws and regulations pertaining to local, interstate, and international E-commerce, as well as intellectual property
 - f. Marketing: Supplier and customer relationship management, partnering, outsourcing, pricing and packaging digital content, auctions, and mass personalization.

- 5. INDEPENDENT RESEARCH.** The graduate will demonstrate the ability to conduct independent research analysis and proficiency in communicating the results in writing and orally by means of a field application study. The research in information technology and its management will include problem formulation, decision criteria specification, decision modeling, data collection and experimentation, analysis and evaluation.

Curriculum Sponsor and ESR Approval Authority

Commander, Naval Supply Systems Command
June, 2001

EDUCATIONAL SKILL REQUIREMENTS
LEADERSHIP EDUCATION AND DEVELOPMENT
CURRICULUM (856)
Subspecialty Code 4500P

1. MANAGEMENT FUNDAMENTALS - LEADERSHIP, MANAGEMENT, AND ORGANIZATION: Officers will have the ability to apply basic management and leadership practices to organizational operations.

Officers will understand the fundamental principles of leadership and management in military organizations. They will be able to implement appropriate structures for organizations and jobs; they will understand state-of-the-art information technologies and planning and budgeting tools; they will become skilled in spoken and written communications; and they will understand the higher-level leadership skills and the systems perspective of organizations in which day-to-day organizational operations and strategy formulation occur.

2. EVALUATING AND IMPROVING GROUP PERFORMANCE: Officers will become skilled at analyzing and improving group morale, cohesion, and performance.

Graduates of the program will have the ability to analyze and improve group effectiveness through leadership practices that also develop the leadership abilities of subordinates. This ability will be based on knowledge of managing people from diverse backgrounds, teambuilding, conflict management, group dynamics and management of change. Officers will be exposed to varied approaches for building strong shared values within the military.

3. MOTIVATING SUBORDINATES: Officers will effectively motivate subordinates to achieve high standards in all military endeavors.

Program graduates will have the ability to motivate subordinates in order to provide focus and encouragement as they face the rigorous requirements and goals of the military. This ability requires an understanding of how effective leaders use goal setting, equitable discipline, reward systems, analysis of individual needs, empowerment, coaching, and high expectations to achieve peak performance from individuals.

4. EVALUATING AND IMPROVING INDIVIDUAL PERFORMANCE: Officers will become skilled in analyzing and improving the performance of individuals.

The officers will have the ability to evaluate the performance of subordinates and provide appropriate feedback and counseling. This includes activities that range from formal performance appraisal to informal assessment on an ongoing basis. These skills require knowledge of basic performance measurement and giving feedback, as well as knowledge of how to deal with performance outside of the norms that may lead to violations of military rules and regulations.

5. BEING A ROLE MODEL FOR SUBORDINATES: Officers will model and otherwise communicate the information about the military that subordinates will need to know to successfully transition to Naval and Marine Corps Leaders.

Officers will utilize the operational experience they bring to the job, in addition to a broader base of knowledge created through the program, to visibly embody the high standards and values of Naval and Marine Corps officers. The Officer will communicate knowledge of the military culture, current policy and operations, and future plans for the Navy and joint operations in the Department of Defense. These abilities are based on a knowledge of the military in a democratic society, managing organizational cultures, DOD policy, and the behaviors of good role models and mentors.

6. MANAGING EDUCATIONAL PROCESSES: Officers will have a foundation of knowledge about educational processes that will enable them to effectively teach and develop their subordinates.

The program graduate will have the ability to formulate and answer research questions about educational experiences within the Navy and Marine Corps. Through the thesis process, the officer will explore important issues while concurrently broadening his/her knowledge of training and education in the military.

Curriculum Sponsor and ESR Approval Authority

United States Naval Academy
August 1997

**EDUCATIONAL SKILL REQUIREMENTS
HOMELAND DEFENSE AND SECURITY (HLD/S)
CURRICULUM (251)
Subspecialty Code 2600P**

The goal of this curriculum is to educate military officers and civilian officials of the United States in policy-making, strategic planning, and budgeting for HLD/S. The curriculum includes studies of civil-military relations, critical infrastructure vulnerability and analysis, asymmetric conflict, law enforcement and legal issues, planning and budgeting, information technology, comparative government, and intelligence for homeland security.

The delivery method is novel – students attend resident courses at NPS for two weeks each quarter and interact with “scenarios” over the Internet for eight weeks of each quarter. Two courses are taken simultaneously in this fashion, for six quarters (18 months). The Master of Arts degree program includes a thesis requirement involving research on questions of interest to the program sponsors. The thesis gives the student the opportunity to develop the skills required for critical thought and coherent expression while potentially producing a study of value to the DHS, Office for Domestic Preparedness, USNORTHCOM and DON.

ESRS COMMON TO HOMELAND SECURITY AND SECURITY BUILDING:

Analytical Skills. Graduates will be able to logically combine data and theory to analyze and explain political, economic, and military events in the context of the new DHS. Students will demonstrate writing, briefing, and computer skills in preparing and presenting their findings. Each course requires individual students to present a significant project to the entire class during the final week of each quarter (part of the residency requirement). (NS 2011, NS 4080)

ESRS SPECIFIC TO HOMELAND SECURITY LEADERSHIP DEVELOPMENT:

National Security Issues. Graduates will be aware of the economic, political, social, and military characteristics of homeland security, homeland defense, and national security issues such as intelligence gathering and information sharing, Posse Comitatus, and the interaction of law enforcement with military command (NS 3180).

Critical Infrastructure Vulnerability. Graduates will gain an understanding of how the eight major critical infrastructure sectors within the United States work, what their vulnerabilities are, and how to “harder” the critical nodes in each sector. Particular emphasis will be on the Internet and “networks of all kinds” that contain critical nodes. (CS 3660)

Threat Analysis. Graduates will learn about domestic threats and asymmetric conflict and how they pertain to homeland security, NORCOMM, and state, local, and federal responses. What is the nature of the threat, and who are the terrorists? (SO 3210)

Civil-Military Relations. Graduates will understand the field of civil-military relations as it applies to homeland security and security building within the confines of the U.S. Constitution and civil-military history. Students will be able to identify key players in homeland security at the various levels of government and understand the dynamics of political institutions in homeland security (Office of Homeland Security, USNORTHCOM, FBI, CIA, etc.). (NS 3027)

Law Enforcement and the Judicial System. Graduates will understand the interface between domestic law enforcement, state and local police, emergency response teams, investigation by various agencies such as the U.S. Postal Service, etc. and military support of civilians. They will know the roles and responsibilities of each of the various law enforcement agencies. They will understand how the judicial system interfaces with the military at the state and local levels. (NS 4881)

Planning and Budgeting. Graduates will understand the state, local and federal levels and how they cooperate (compete) and what is required to successfully launch programs to combat and prepare to respond to terrorist attacks. Budgeting and planning and the required interactions at all levels will be emphasized. (NS 4755)

Intelligence in Homeland Security. Graduates will understand the role of intelligence in defense of the homeland, how it is different from military intelligence, and what can be learned from military intelligence and applied to homeland security. Graduates will understand the complexities of information sharing, gathering, and analysis in the context of homeland security. (NS 4156)

Comparative Politics. Graduates of the program will use the knowledge gained in the Civil-Military Relations, Comparative Governments, and Introduction to Homeland Security courses to make policy for local, state, and federal level programs. (NS 3023)

Information Technology for Homeland Security. Computers, the Internet, and software for law enforcement, data collection, information sharing, and analysis will be key technologies for successful homeland security building. Graduates will become familiar with the tools and techniques of information technology in various sectors (from critical infrastructure protection to intelligence gathering and analysis). (IS 4010)

Curriculum Sponsor and ESR Approval Authority:

Deputy Chief of Naval Operations (Plans, Policy and Operations) (N3/N5)
April 2003

EDUCATIONAL SKILL REQUIREMENTS
HUMAN SYSTEMS INTEGRATION
CURRICULUM (362)
Subspecialty Code 4600P

The goal of this curriculum is to educate military officers and civilian officials of the United States in Human Systems Integration. The delivery method is an in-resident course at the Naval Postgraduate School. Officers enrolled in the master's program are expected to complete a six-week experience tour to adopt a thesis topic of interest to commands with follow-on tours and with real-world application.

- 1. BASICS:** The graduate will recognize the human as the most valuable component in technology and weapon systems. The graduate will possess the skills necessary to function as a specialist in HSI. Graduates will possess a thorough background in all HSI components: Human Factors Engineering; Manpower, Personnel & Training; System Safety; Human Survivability; Habitability; and Health Hazards.
- 2. DATA ANALYSIS:** Graduates will understand and be able to apply the statistical methods and tools necessary to perform analyses of data from human systems integration studies. They will have the requisite knowledge that enables successful application of these analytical methods and tools within the context and constraints of military operations or system development.
- 3. RESEARCH DESIGN:** Graduates will be able to investigate a problem in HSI, formulate a research question, review pertinent literature, develop appropriate data collection protocols, analyze the data appropriately and interpret the results. Graduates will be able to apply these research principles in both field and laboratory settings. Graduates will demonstrate the ability to present research finding in written and oral format to both technical and non-technical audiences.
- 4. HUMAN PERFORMANCE:** Graduates will understand the basis of human performance including human information processing, perception, cognition, decision-making, and motor control. Graduates will understand current theory and practice in assessing cognitive factors that affect human performance such as attention, memory, situation awareness, stress, fatigue, and motivation. Graduates will understand current scientific knowledge of factors affecting human performance and human error.
- 5. MODELING:** Graduates will be able to apply HSI principles to human modeling capabilities and human-in-the-loop simulations. They will demonstrate the capability to apply human modeling techniques to analyses of military systems development and effectiveness.
- 6. ORGANIZATIONAL BEHAVIOR:** Graduates will understand the political, organizational, social, and economic issues associated with integrating human-machine systems into organizational cultures and environments.
- 7. SYSTEM ACQUISITION:** Graduates will understand and be able to apply the basic principles of defense acquisition.

8. MANPOWER, PERSONNEL AND TRAINING: Graduates will understand the importance of properly assessing, screening, selecting, training, and integrating the human into military systems. This process includes understanding the empirical basis for recruitment, selection and classification, training, and retention of personnel. Graduates will understand current and emerging technologies that contribute to personnel success and performance such as automation, training systems technologies, and job aids.

9. ENVIRONMENT AND SAFETY: Graduates will acquire a thorough understanding of the environmental factors that influence human performance, effectiveness, and safety in the high stress and hazardous environments commonly encountered in military operations. Graduates will acquire the knowledge and skills necessary to analyze environmental and safety issues for their impact on systems effectiveness and personnel safety.

10. JOINT PROFESSIONAL MILITARY EDUCATION (JPME): Students will be encouraged to complete the Joint Professional Military Education (JPME) program. This sequence develops an understanding of warfighting within the context of operational art. Topics include: national military capabilities and command structure, joint and service doctrine, joint planning and execution, and joint and multinational forces and systems integration at the operational level of war. Fulfilled by completing the Naval War College three-course series leading to Service Intermediate-level Professional Military Education (PME) and Phase I Joint PME credit. (For incoming USN students only.)

Curriculum Sponsor and ESR Approval Authority:

N00T (MAS)
N1 (RS/SME)
