

FY17-19 EDUCATIONAL SKILLS REQUIREMENTS (ESRs)

**Combat Systems
Subspecialty Code 57XX
Curriculum 533**

1. Curriculum Number: 533
2. Curriculum taught at NPS.
3. Curriculum Length in months: 24 months
4. APC Required: 323
5. Community Managers have agreed to allow billets to be coded for Combat Systems Science and Engineering (533) and officers to be educated for this curriculum.

<u>Designator</u>	<u>Officer Community Manager</u>
a. 1110	Surface
b. 1120	Submarine
c. 1140	EOD
d. 1300	Aviation
e. 1440	Engineering Duty

6. The officer must understand the fundamental concepts and be familiar with the basic functional areas of Combat Systems within the Department of the Navy (DON) and the DoD including:

ESR-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.

ESR-2: ACOUSTIC AND ELECTROMAGNETIC SYSTEMS: 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, processing, and decision theory.

ESR-3: COMMUNICATION SYSTEMS: A graduate level understanding of various communication systems including fiber optics and automatic control systems.

ESR-4: WEAPONS SYSTEMS AND APPLIED FLUID MECHANICS: A graduate-level understanding of the fluid dynamics of subsonic and supersonic weapons, warheads and their effects.

ESR-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.

ESR-6: COMBAT SYSTEMS ENGINEERING: An understanding of the principles of design, development, testing and evaluation; and the importance of performance and economic trade-offs in combat systems. The fundamentals, and requirements for Verification, Validation, and Assessment (VV&A) Processes including open architecture designs and their implications on integration of computing resources in advanced combat systems.

ESR-7: MATERIALS SCIENCE: A familiarity with 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.

ESR-8: CYBER: Understand and apply the fundamentals of the underlying principles of cyber infrastructure and systems; inherent vulnerabilities and threats, including industrial control systems; and defensive security procedures. (* ESR Required for 14XX designators only)

ESR-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, PHYSICS, UNDERWATER ACOUSTIC SYSTEMS, OR A SPECIFIC ENGINEERING DISCIPLINE. The knowledge required for an approved concentration is:

a. ELECTROMAGNETIC SYSTEMS (5701)

- (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 (5702)

- (1) Molecular energetics and detonation physics.
- (2) Impact phenomena. Kinetic, fragmentation, and rod-like projectile penetration.
- (3) Warhead design and lethality considerations; target vulnerability and survivability consideration; kill probability.
- (4) Principles of directed energy weapons systems and their effects.
- (5) Electric ship weapon systems.

c. PHYSICS (5703)

- (1) Statistical physics.

- (2) Advanced E&M radiation.
- (3) Advanced Quantum Mechanics.


d. UNDERWATER ACOUSTIC SYSTEMS (5704)


- (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.


e. TOTAL SHIP SYSTEMS ENGINEERING (5705)

- (1) Power systems.
- (2) Naval architecture and ship design.
- (3) Shipboard combat systems.
- (4) Integration issues.

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

APPROVED:  14 July 17
Curriculum Sponsor, PEO IWS [DATE]

APPROVED:  7-14-2017
President, NPS [DATE]

APPROVED:  8/15/2017
Director, TFMTER (OPNAV N12) [DATE]