5800P Educational Skills Requirements 2015-2017
(includes 5801-5804)

ESR-1: [UNDERGRADUATE MATHEMATICS AND BASIC SCIENCES] Understand and apply engineering-baccalaureate-equivalent mathematics and physics. For mathematics, this includes single and multi-variable differential and integral calculus, ordinary differential equations, probability, and statistics. Basic sciences include physics, chemistry, and terrestrial sciences. This can be met by the appropriate undergraduate work.

ESR-2: [CAPABILITY ENGINEERING] Model and analyze military operations in the context of achieving needed capability. Apply model-based systems engineering approaches, based on UML or SysML, and modeling and simulation techniques, and be able to assess legacy systems, emerging technological concepts, and as-yet-to-be-developed concepts into the joint war fighting environment considering technology readiness levels, effectiveness, cost, and risk. Understand the process of war fighting gaps to synthesis of as-yet-realized system concepts to meet emerging capability needs. Understand and apply modeling and simulation to include deterministic and stochastic modeling of systems, economic models, cost models, and life-cycle suitability analyses. This includes the ability to develop original discrete-event and continuous run-time simulations, as well some familiarity with large-scale government and commercial war fighting simulations.

ESR-3: [SYSTEM ARCHITECTING] Perform system architecting, applying and integrating methods for both software and hardware aspects. Construct feasible system functional and physical architectures that represent a balanced approach to meeting stakeholder needs and expectations, stated, implied, and derived system requirements, and suitability objectives such as being open, modular, extensible, maintainable, and reusable. Understand system architecture frameworks and their role in architecture development. Use model-based systems engineering techniques, based on UML or SySML to create, define, and develop system architectures. Develop, analyze, and compare alternative architectures against appropriate, system-level evaluation criteria and select the best based on quantitative and qualitative analysis, as appropriate.

ESR-4: [SYSTEM DESIGN] Understand and apply the system design process in a holistic context, applying and integrating methods for both software and hardware aspects including identifying capability need, defining requirements, conducting functional analysis and allocation to hardware, software, and human elements, creating a system functional design, designing a system, deriving and defining requirement specifications, allocating requirement specifications to sub-systems (for hardware, software, and human elements), design for suitability, including reliability, availability, maintainability, operability, and logistical supportability, perform system

assessment by conducting trade-off studies, evaluating system design alternatives against system capability need expressed as military effectiveness, estimating and analyzing the system cost and risk, including risk mitigation strategies, integrating human elements into the system design, and analyzing and planning for system testing and evaluation.

ESR-5: [ENGINEERING DESIGN ANALYSIS] Understand and apply core qualitative and quantitative methods of engineering design analysis, to include problem formulation, alternatives development, alternatives modeling and evaluation, alternatives comparison, optimization, decision analysis, failure analysis, risk analysis, and futures analysis. Mathematical techniques may include multiple criteria optimization, design of experiments, response surface methods, set-based design, real options, systems dynamics, and probabilistic analyses.

ESR-6: [SYSTEM INTEGRATION AND DEVELOPMENT] Apply the core skills of system integration and development to include integrating relevant technological disciplines that bear on the system effectiveness and cost, including weapons, sensor and information systems, while being responsive to realistic military capability need and war fighting effectiveness, requirements, functions, specifications, cost, and risk. Integrate systems and analyze aspects during the entire life-cycle. Understand system realization methods and processes, including prototyping and production. Apply production quality methods for continuous process improvement, such as statistical process control, lean, and six sigma.

ESR-7: [SYSTEM TEST & EVALUATION] Apply the core skills of system test and evaluation to include system effectiveness while being responsive to realistic military capability need and war fighting effectiveness, requirements, functions, and specifications. Evaluate systems and analyze test and evaluation aspects during the entire life-cycle using inferential statistics methods, including design of experiments (DOE) and analysis of variance (ANOVA). Apply fundamental verification and validation principles to systems development methods.

ESR-8: [HUMAN SYSTEMS INTEGRATION] Address human factors during requirements definition, as well as workload, safety, training, operability and ergonomics during design. Conduct functional analysis and allocation to human elements, performing cost-risk-effectiveness trade-offs among hardware, software, and human elements. Evaluate proposed designs for man-machine integration, human performance testing, and usability during development test and evaluation. Understand basic human biology as applied to human systems.

ESR-9: [PROJECT MANAGEMENT] Work as a team member or leader on a

military systems engineering project. Demonstrate an understanding of project management principles. Demonstrate competence in the planning and management of complex projects. Understand the principles of and apply current industry approaches and technology to manage systems design, integration, test, and evaluation for large engineering projects.

ESR-10: [SPECIALIZATION] Demonstrate in-depth understanding of the principles, technologies, and systems used in at least one major specialty area. These areas can be specific warfare areas, such as combat systems, total ship systems, EW, IW, avionics, undersea warfare, or net-centric systems, a single traditional engineering specialty, such as mechanical, electrical, software, aerospace engineering, or naval architecture, or specialized disciplines such as human factors, availability, or safety. Demonstrate in-depth understanding of the scientific and engineering principles of the respective specialty, such as sensors, weapons, C4I systems, information systems, ship structures, hydrodynamics, power systems, and reliability. Demonstrate broad understanding of systems context of the specialization. Apply that understanding to the design of system components, sub-systems, and interfaces in the holistic context of the engineering of systems.

There will be four tracks of specialization resulting in differing P – Codes:

1. 5801 – Total Ship Systems Design Specialization
2. 5802 – Combat Systems specialization
3. 5803 – System of Systems Engineering and Integration
4. 5804 – Naval Air Systems Specialization

ESR-11: [THESIS] Conduct independent analysis and research in the area of Systems Engineering, and show proficiency in presenting the results in writing and orally by means of a thesis and command-oriented briefing appropriate to this curriculum.

Approved:

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VADM Terry J. Benedict,   Date
Director, Strategic Systems Program

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VADM Ronald Route (Ret.), President,   Date
Naval Postgraduate School

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Director, TFMTER, (OPNAV N12)   Date