DEFENSE ACQUISITION UNIVERSITY

ENG 301 – Leadership in Engineering Defense Systems

151007

Course Learning/Performance Objectives followed by its enabling learning objectives on separate lines if specified.

1	From an engineering leadership perspective, the student will describe elements of DoD systems engineering policy and process across the Defense acquisition life-cycle in accordance with DoD 5000 series directives and instructions, the Defense Acquisition Guidebook (DAG), DoD Systems Engineering Plan Outline, and recent DoD memoranda and directives as discussed in class.
	Recognize the interrelationships among the major DoD decision support systems (Defense Acquisition System, JCIDS, and PPBES) that support systems acquisition.
	Recognize the role of Systems Engineering (SE) in establishing a program structure and acquisition strategy.
	Recognize the relationships and interactions among elements of the systems engineering process model as described in the DAG and discussed in class.
	Recognize SE activities and technical maturity criteria needed to support each acquisition life-cycle decision point as described in DoD 5000 series and DAG Chapter 4.
	Recognize the mandates and best practices promulgated in recent USD (AT&L) memorandum and directives that relate to the application of systems engineering as discussed in class.
	Describe an example how a Systems Engineering Plan is used to manage program technical activities.
	From the perspective of an program engineering lead or chief engineer, summarize an approach to organizing for development or major update of a systems engineering plan (SEP) .
2	The student will relate engineering leadership principles discussed in class to technical organization and staffing considerations described in DoD Integrated Product and Process Development Guide and the OSD Systems Engineering Plan Outline.
	Recognize the considerations that affect the organizational structure and technical staffing decisions for an acquisition program office and its constituent Integrated Product Teams (IPTs).
	Relate elements of an IPT charter to effective systems engineering management and leadership.
	Describe examples of benefits derived from effective stakeholder management within the context of a defense acquisition program.
	From and engineering leadership perspective, discuss the characteristics and considerations for effective team and stakeholder communication.
3	The student will debate the characteristics and principles of effective systems engineering leadership.
	Relate behaviors associated with the 'art' and 'science' of systems engineering to effective engineering leadership.
	Relate the principles of critical thinking to systems engineering leadership.
	Relate the principles of systems thinking to systems engineering leadership.
	Describe the personal characteristics of an effective systems engineering leader.
	Compare the characteristics of the 'art' of systems engineering versus the characteristics of the 'science' of systems engineering as discussed in class.
4	The student will evaluate professional ethical conduct in a given systems engineering situation in accordance with professional standards of conduct discussed in class.
	Describe the characteristics of ethical conduct in the engineering profession
	Discuss recent experiences related to ethical decision making in an engineering context.
	Discuss the application of the concepts of 'decision making under risk' and 'decision making under uncertainty.'
	Debate potential outcomes of ethical responses to systems engineering situations.
	Develop ethical responses (decisions and/or actions) to entries in an engineer's notebook that have potential safety consequences.
5	Given a capability development scenario, the student will analyze a capability need and develop a systems engineering risk assessment to support early acquisition life-cycle development planning in accordance with policy established in DoDI 5000.02 and the Defense Acquisition Guidebook.
	Identify the systems engineering inputs to a Material Development Decision (MDD)
	Identify the major elements of an Analysis of Alternatives as described in the DAG.
	Identify sources for investigating technology opportunities and risks related to development of a needed capability.
	Derive a list interfacing systems and stakeholder organizations that will influence the requirements and constraints for a preferred materiel solution.
	Analyze an Initial Capabilities Document (ICD) to support development of system-level performance requirements.
	Assess a proposed materiel solution for technology insertion risks and opportunities.
	Assess user capability requirements and the related preferred materiel solution for risks related to systems engineering design considerations.

	Based on early systems engineering assessment of technical risk, develop a system verification approach for the next acquisition phase.
6	The student will describe the role of architecture in the engineering of defense systems in accordance with the Defense Acquisition Guidebook, Department of Defense Architecture Framework (DoDAF), and the principles and practices discussed in class.
	Recognize the role of architecture within the systems engineering process.
	Recognize the purpose of architecture frameworks, such as DoDAF, in supporting the systems engineering process.
	Recognize the relationship among architectural descriptions, architectural viewpoints, architectural views, and DoDAF described models.
	Identify examples of constraints imposed by an enterprise architecture on a typical solution architecture.
	Describe the application of model-based systems engineering methods to the development of system architectural data and an integrated digital system model.
	Given views into a system architecture, describe the influence of the architecture on the system's behavior and other system attributes (-ilities, e.g., reliability, security, testability, etc.).
	Describe the use of specific architectural views in addressing stakeholder questions or concerns.
	From engineering leadership perspective, describe the relationship of a system's architecture to the planning and management of technical projects.
	Describe the application of system architecture and DoDAF to the definition and development of a system's information technology interoperability requirements and design (Net-Ready Key Performance Parameter).
7	The student will describe strategies for applying modeling and simulation in support of systems engineering across the Defense Acquisition Life-cycle as described in the DoD 5000.02, the DAG chapter 4, and as discussed in class.
	Recognize key sources of DoD M&S policy and guidance.
	Recognize the potential benefits achievable through use of Model-based Systems Engineering methods.
	Recognize the programmatic considerations with regard to the development of a M&S strategy.
	Recognize the focus and purpose of the levels of the M&S hierarchy.
	Recognize the purpose of M&S interoperability standards.
	Describe the application of Live, Virtual, and Constructive simulations to the systems engineering process.
	Recognize issues related to M&S reuse.
	Recognize the purposes of M&S Verification, Validation, & Accreditation
	Describe the Model-Test-Model process.
	Outline a strategy for the application of M&S to systems engineering activities conducted in the various DoD acquisition life-cycle phases.
	From an engineering leadership perspective, debate the challenges associated with the development and use of models and simulations on an acquisition program.
8	The student will describe major elements of system security engineering as it applies to the design, development, procurement, and sustainment of DoD systems in accordance with the directives and guidance discussed in class.
	Define system security engineering related terms of critical program information (CPI), mission critical functions, mission critical components, trusted systems and networks (TSN), and supply chain.
	Describe the major elements of program protection plan (PPP).
	Describe the methods for determining system security engineering requirements and design features.
	Describe CPI risk assessment concept.
	Describe horizontal protection process.
	Describe TSN risk assessment concept.
	Recognize the appropriate application of specific countermeasures to the protection of technology, mission-critical functions, mission-critical components, and information.
	Describe countermeasure considerations of foreign involvement to include Anti-Tamper.
	Describe software assurance (SwA).
	Describe supply chain risk management (SCRM).
	Describe cybersecurity as a countermeasure.
	Describe the integrated risk management concept.

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9	Given a system development scenario, the student will evaluate a system's interoperability requirements and design in accordance with the Net Ready Key Performance Parameter (NR-KPP) development method described in CJCSI 6212.01 (NR-KPP Instruction).
	Discuss the challenges in developing appropriate Threshold/Objective values for NR-KPP attributes.
	Analyze a provided set of NR-KPP attributes to ensure they best match a given system's CONOPS.
	Analyze a system's CONOPS and architecture description to identify potential interoperability issues from a System of Systems perspective.
10	Given a system development scenario and system architectural description, the student will develop appropriate system security risk mitigations (system security features), in accordance with the Defense Acquisition Guidebook and concepts discussed in class.
	Analyze a system's CONOPS and architecture description for critical system functions and related critical program information.
	Analyze a system's CONOPS and architecture description to identify potential System Security risks.
	Evaluate a system CONOPS for tradeoffs between interoperability related requirements and system security requirements.
	Given a set of system security risks, develop a mitigation strategy to reduce the risks.
11	Given a system development scenario, the student will evaluate strategies to manage program uncertainty through integration of program metrics and technical measurement with program risk management in accordance with Earned Value Management standards, the DoD Risk Management Guide, and the Defense Acquisition Guidebook.
	Recognize the role of systems engineering in establishing a cost, schedule, and performance baselines for a given project.
	Describe a process for developing a set of program metrics and measures (EVM and TPMs) to support integrated technical assessment and program management.
	Identify sources of program technical risks.
	Given a specific risk, analyze the risk in accordance with the DoD Risk Management guide.
	Derive a set of technical performance measures to support management of program risk.
	Discuss strategies to integrate use of technical performance measurement and Earned Value Management to manage program risk and uncertainty.
12	Given a system development scenario, the student will evaluate strategies for integrating engineering risk reduction activities with requirements development and systems engineering affordability trade-off activities in Technology Maturation and Risk Reduction Phase in accordance with DoD 5000.02 and the Defense Acquisition Guidebook.
	Recognize the application and limitations of cost estimation methods at various stages of the acquisition life-cycle.
	Recognize the relationship between affordability goals and cost estimates.
	Recognize the purpose of system affordability constraints established at key life-cycle decisions points.
	Identify elements of the portfolio level affordability analysis process as described in DoD 5000.02 and the DAG.
	Identify the technical maturity criteria associated with the technical reviews and decision points that are part of TMRR phase.
	Recognize situations that require the application of sensitivity analysis to trade-off analyses.
	Analyze a program's approach to addressing TMRR phase objectives.
	Evaluate strategies for facilitating effective trade-off decisions during TMRR Phase.
	Evaluate strategies for integrating engineering activities to address key technical risks during TMRR phase.
	Evaluate a design trade-space to support a systems engineering affordability trade-off analysis.
13	Given a system scenario, evaluate the impacts of Human Systems Integration (HSI) considerations on the system's requirements, design, development, and sustainment in accordance with DoD 5000.02, MIL-STD-882, and the Defense Acquisition Guidebook.
	Recognize the impact of HSI domain variables on a system's design and performance.
	Recognize the required acquisition program and planning documentation associated with HSI domain areas.
	Describe the impact of HSI driven requirements on verification and validation planning and execution.
	Describe the application of anthropometrics to human factors engineering.
	Discuss impacts to system requirements, performance, and cost driven by HSI domain areas including: Human Factors Engineering, Manpower, Personnel, Training, Habitability, Personnel Survivability, and ESOH.
14	The student will summarize the purpose, timing, and resource requirements for major elements of a Reliability & Maintainability (R&M) program plan in accordance with the DoD 5000.02; the Defense Acquisition Guidebook; DoD SEP Outline; Reliability, Availability, & Maintainability Cost Rationale Report Manual (RAM-C), and applicable standards, handbooks, and guides discussed in class.
	Given an acquisition life-cycle phase, recognize the R&M engineering activities that would typically be required for that phase in accordance with the DAG chapter 4.

	Describe the relationship among a system's reliability, maintainability, availability, and life-cycle costs.
	Recognize the purpose and application of an Operational Mode Summary/Mission Profile with regard to R&M engineering activities.
	For a given system, identify the components of the Sustainment Key Performance Parameter (KPP) and Key System Attributes (KSAs) as defined by the JCIDS.
	Recognize the key outputs of the Reliability, Availability, and Maintainability Cost Rationale (RAM-C) analysis/report.
	Explain the application of probability distributions to modeling the reliability of systems and system components as discussed in class.
	Recognize the purpose and application of R&M engineering activities listed in the DoD SEP annotated outline (Failure Mode, Effects, and Criticality Analysis (FMECA), maintainability and Built-In Test (BIT)demonstrations, reliability growth testing at the subsystem and system level, R&M allocation, block diagrams, R&M prediction, Failure Definitions and Scoring Criteria, Failure Reporting, Analysis and Corrective Action (FRACAS)).
	Recognize the relationship that R&M engineering activities have to supportability analysis and the development of logistics product data for a given system as discussed in class.
	Recognize the purpose of different types of equipment, subsystem, and system-level verification that support reliability & maintainability engineering (Reliability Growth Testing, Reliability Demonstration Testing, Accelerated Life Testing, Highly Accelerated Life Testing, Environmental Testing, BIT Demonstrations, Maintainability Demonstrations, Highly Accelerated Stress Screening, Environmental Stress Screening, and Production Reliability Acceptance Testing) as discussed in class.
	Describe how R&M requirements are included in request for proposals and contracts.
15	Given a proposed Reliability & Maintainability (R&M) engineering plan, the student will evaluate the plan for adequate scope and technical merit in accordance with the DAG, OSD System Engineering Plan Outline, and R&M engineering concepts discussed in class.
	For a given system, recognize the engineering and management parameters that are required for reliability growth planning.
	For a given system, recognize the engineering and management parameters that are required for a maintainability evaluation.
	Explain the purpose of Operating Characteristic Curve analysis with regard to reliability growth planning and reliability demonstration.
	Evaluate a reliability program plan in accordance with the DAG and planning aids provided in class.
	Evaluate a maintainability program plan in accordance with the DAG and planning aids provided in class.
	Given a set of reliability and maintainability planning assumptions and trade-off decisions, assess a the risk of meeting system Availability requirements.
	Evaluate a reliability growth plan using a reliability growth planning tool provided in class.
16	The student will discuss current areas of interest related to engineering leadership and systems engineering.
	Recognize current topics of interest related to engineering leadership and systems engineering management in DoD, the Defense Industry, and the engineering profession.
	Discuss the application and impact of emerging systems engineering and engineering leadership practices on defense acquisition programs.
17	Given a system development scenario, the student will develop a plan to manage the system technical baselines and product technical data while accommodating Intellectual Property and Open Systems Architecture considerations in accordance with DoD technical data management and configuration management policies and practices as described in the DAG and class discussions.
	Recognize the types of technical data that constitute a typical technical data package (TDP) as described in MIL-STD-31000.
	List examples of typical TDP life cycle management risks and issues from a government program perspective.
	Recognize the Open System Architecture and intellectual property considerations associated with the use of COTS and Non-Developmental Items (NDI)
	Explain the Government's need for rights in technical data and software.
	Given a WBS and acquisition strategy, determine what technical data and computer software is needed to be delivered to the government.
	Given a life cycle competition strategy for a program, determine what type of rights are appropriate for the technical data or computer software.
	Given the life cycle acquisition, engineering and logistics requirements for a product, develop an open systems architecture appropriate to support the product through its planned life.
18	The student will analyze the role of systems engineering processes in software acquisition in accordance with concepts and practices described in the Defense Acquisition Guidebook and discussed in class.
	Describe relationship between systems engineering processes and software development models.

	Recognize the relationship between software architecture and software behavior, performance, and quality attributes.
	Recognize the life-cycle considerations associated with use of commercial off the shelf / government off the shelf (COTS/GOTS) software items.
	Describe risks and benefits associated with use of COTS software.
	Recognize the activities that encompass software quality assurance.
	Discuss the use of software process maturity models.
	Map software metrics to software product, process, and project performance and quality assessment.
	Recognize the applicability and relative effectiveness of software verification methods and techniques.
	Summarize common sources of risk associated with development of software intensive systems.
	Discuss the application of Agile methods and principles to reduce the duration and cost of the software development lifecycle.
	Differentiate the strengths and weaknesses of the various software development models that are in use within the Defense Industry (waterfall, spiral, incremental, agile, etc.).
	Given a set of software metrics, assess their usefulness to managing a software development project.
19	Given a program scenario and cost reduction opportunities, the student will develop engineering inputs for a should-cost management plan in accordance with in accordance with DoDI 5000 and the Defense Acquisition Guidebook (DAG).
	Recognize the relationship between Affordability, Will-Cost, and Should-Cost baselines.
	Compare Value Engineering to should cost management.
	Describe an approach to implementing should cost management on an acquisition program.
	Given a set of executable cost reduction initiatives, analyze the initiatives from an engineering perspective.
	Given a set of executable cost reduction initiatives and set of constraints, develop an associated program should cost baseline.
	Given a program scenario, develop a list cost reduction initiatives to support should cost management in the operations and sustainment phase.
20	The student will recognize key characteristics of the DoD manufacturing environment and process improvement practices and their impact on system.
	Recognize the correct application of process improvement tools (lean, six sigma, Theory of Constraints, etc.) to the production and manufacturing environment.
	Compare and contrast design for manufacturing and assembly (DFMA) principles with those of designing reliable and sustainable systems.
	Using personal examples, illustrate the role of an engineer in applying the three aspects of lean implementation: strategic, cultural and tactical.
	Research the purpose, engineering application, and personal benefit of the Production Readiness Review and present the results.
	Research the purpose, engineering application, and personal benefit of the Manufacturing Readiness Assessment and present the results.
21	Given a system production & manufacturing scenario, the student will develop recommendations for improving manufacturing processes and overall production readiness based manufacturing concepts discussed in class.
	After reviewing the Harvard Business Review article, “Read a plant fast,” discuss the application of the assessment process described in article to the DoD manufacturing environment.
	After reviewing the Harvard Business Review article, “Read a plant fast,” and viewing manufacturing videos, evaluate the manufacturing processes using the article’s process as a guide.
	After reviewing the Harvard Business Review article, “Read a plant fast,” and viewing manufacturing videos, develop recommendations for improving manufacturing processes depicted in the video.
22	Given and urgent need, the student will develop a systems engineering approach to support the rapid acquisition of the needed capability in accordance with the DoDI 5000.02, the Defense Acquisition Guidebook (DAG), and principles and practices discussed in class.
	Recognize the DoD policy that pertains to the rapid acquisition of urgent needs.
	Recognize the conditions under which a rapid acquisition approach is appropriate.
	Describe examples of systems engineering leadership considerations for a rapid acquisition program.
	Evaluate the availability of mature technologies that can be used meet an urgent need.
	Develop a course of action to support the rapid acquisition of an urgent need.
	Evaluate a rapid acquisition course of action for sources of technical risk.
	From an engineering leadership perspective, develop a list of factors to be considered when assigning or selecting personnel to support a rapid acquisition program.

	Develop a tailored approach to technical reviews to support a rapid acquisition program.
	Develop a tailored system verification approach to support a rapid acquisition program.
23	Given a set of technical issues for a system in the operations & support phase, the student will evaluate strategies for corrective actions and systems modification in accordance with DoD policy.
	Identify the elements of product support for DoD systems.
	Given a set of technical issues, differentiate between appropriate and inappropriate funding sources that could be used to address the issues.
	Given a set of technical issues, evaluate a corrective action strategy for its consideration of life cycle cost, manpower and support needs, and Diminishing Manufacturing Sources/Material Shortages (DMSMS) for the system.
	Given a set of technical issues and associated options for corrective action, evaluate the configuration management impacts of each option.
	Given a set of corrective actions, select appropriate technical assessment metrics for analyzing and comparing the effectiveness of the corrective actions.
	Develop a framework for estimating life-cycle cost impacts of proposed system modifications.
	Develop a framework for a business case analysis to support selection of specific system upgrade options.
24	Given contractor business information, e.g., Annual Reports and Form 10-K's, students will (1) discuss the contractor's development and implementation of mission, goals, and business strategies, and (2) evaluate the impact of various government acquisition strategies on the contractors' ability to achieve its business goals.
	Discuss the way government contractors develop their corporate business strategies, goals, and objectives.
	Describe how government contractors implement their business strategies.
	Explain differences between General and Administrative (G&A), Bid & Proposal (B&P), independent Research & Development (IR&D), and company internal R&D funds used for business development.
	Analyze a defense contractor's annual report to determine the contractor's mission, goals, and business strategies.
	Evaluate the impact of various government acquisition strategies on the ability of the contractor to achieve strategic goals.
25	From an engineering leadership perspective and in a team setting, students will develop alternative solutions to a systems engineering challenge.
	Given a complex engineering problem, develop a clear and concise problem statement in accordance with the method provided in pre-course materials.
	Apply the systems engineering process as problem solving methodology to develop alternative courses of action to address an engineering problem.
	Apply decision analysis methods to selection of a preferred alternative.
	Identify sources of technical risk associated with the preferred alternative.
	Develop a technical assessment approach for the preferred alternative.
26	In a classroom environment, the student will lead a multi-disciplinary team in addressing an engineering challenge by providing proactive technical direction and motivation to ensure the effective application of systems engineering leadership in accordance with principles, policies, and practices discussed in class.
	Apply key attributes of an effective technical briefing (see rubric).
	Organize an engineering team for technical problem solving.
	Create an environment conducive to effective team performance.
	Develop effective two-way communication, both verbally and in writing, among team members and with external organizations and leadership.
	Develop evidence based decisional or informational briefings that demonstrate application of engineering leadership concepts and systems engineering knowledge areas presented in class.