



# Objectives Sheet

## ENG 302 - Advanced Systems Engineering

*Course Learning/Performance Objectives followed by enabling learning objectives*

<b>ENG 302.U01.01</b>	<b>From an engineering leadership perspective, the student will describe elements of DoD systems engineering policy and process across the Defense acquisition life-cycle</b>
ENG 302.U01.01.01	Recognize the interrelationships among the major DoD decision support systems ( Defense Acquisition System, JCIDS, and PPBES) that support systems acquisition.
ENG 302.U01.01.02	Recognize the role of Systems Engineering (SE) in establishing a program structure and acquisition strategy.
ENG 302.U01.01.03	Recognize the relationships and interactions among elements of the systems engineering process model as described in the DAG and discussed in class.
ENG 302.U01.01.04	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 3.
ENG 302.U01.01.05	Recognize the mandates and best practices promulgated in recent USD memorandum and directives that relate to the application of systems engineering as discussed in class.
ENG 302.U01.01.06	Describe how a Systems Engineering Plan is used to manage program technical activities.
<b>ENG 302.U02.01</b>	<b>The student will discuss the characteristics and principles of effective systems engineering leadership.</b>
ENG 302.U02.01.01	Relate the principles of critical thinking to systems engineering leadership.
ENG 302.U02.01.02	Relate the principles of systems thinking to systems engineering leadership.
ENG 302.U02.01.03	Relate behaviors associated with the 'art' and 'science' of systems engineering to effective engineering leadership.
ENG 302.U02.01.04	Describe examples of benefits derived from effective stakeholder management within the context of a defense acquisition program.
ENG 302.U02.01.05	From an engineering leadership perspective, discuss the characteristics and considerations for effective team and stakeholder communication.
<b>ENG 302.U03.01</b>	<b>The student will evaluate professional ethical conduct in a given systems engineering situation in accordance with professional standards of conduct discussed in class.</b>
ENG 302.U03.01.01	Describe the characteristics of ethical conduct in the engineering profession
ENG 302.U03.01.02	Discuss recent experiences related to ethical decision making in an engineering context.
ENG 302.U03.01.03	Discuss the application of the concepts of 'decision making under risk' and 'decision making under uncertainty.'
ENG 302.U03.01.04	Debate potential outcomes of ethical responses to systems engineering situations.
ENG 302.U03.01.05	Develop ethical responses (decisions and/or actions) to entries in an engineer's notebook that have potential safety consequences.
<b>ENG 302.U04.01</b>	<b>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.</b>
ENG 302.U04.01.01	Recognize the role of architecture within the systems engineering process.
ENG 302.U04.01.02	Recognize the purpose of architecture frameworks, such as DoDAF, in supporting the systems engineering process.
ENG 302.U04.01.03	Recognize the relationship among architectural descriptions, architectural viewpoints, architectural views, and DoDAF described models.
ENG 302.U04.01.04	Identify examples of constraints imposed by an enterprise architecture on a typical solution architecture.
ENG 302.U04.01.05	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.).
ENG 302.U04.01.06	Describe the use of specific architectural views in addressing stakeholder questions or concerns.
ENG 302.U04.01.07	From engineering leadership perspective, describe the relationship of a system's architecture to the planning and management of technical projects.
ENG 302.U04.01.08	Describe the application of system architecture and DoDAF to the definition and development of a system's information technology interoperability requirements and design.
<b>ENG 302.U05.01</b>	<b>The student will describe strategies for applying Digital Engineering in support of systems engineering across the Defense Acquisition Life-cycle as described in the DoD 5000.02, the DAG and as discussed in class.</b>
ENG 302.U05.01.01	Recognize key sources of DoD Digital Engineering policy and guidance.
ENG 302.U05.01.02	Recognize the potential benefits achievable through use of Digital Engineering methods.
ENG 302.U05.01.03	Recognize the programmatic considerations with regard to the development of a Digital Engineering strategy.
ENG 302.U05.01.04	Recognize the focus and purpose of the levels of the Digital Engineering hierarchy.
ENG 302.U05.01.05	Recognize the purpose of Digital Engineering interoperability standards.
ENG 302.U05.01.06	Describe the application of Live, Virtual, and Constructive simulations to the systems engineering process.
ENG 302.U05.01.07	Recognize issues related to Digital Engineering reuse.
ENG 302.U05.01.08	Recognize the purposes of Digital Engineering Verification, Validation, & Accreditation
ENG 302.U05.01.09	Describe the Model-Test-Model process.



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ENG 302.U05.01.10	Outline a strategy for the application of Digital Engineering to systems engineering activities conducted in the various DoD acquisition life-cycle phases.
ENG 302.U05.01.11	From an engineering leadership perspective, debate the challenges associated with the development and use of models and simulations on an acquisition program.
<b>ENG 302.U06.01</b>	<b>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 DAG.</b>
ENG 302.U06.01.01	List interfacing systems and stakeholder organizations that will influence the requirements and constraints for a preferred materiel solution.
ENG 302.U06.01.02	Analyze an Initial Capabilities Document (ICD) and Analysis of Alternatives (AoA) to support the development of system-level performance requirements.
ENG 302.U06.01.03	Assess a proposed materiel solution for technology insertion risks and opportunities.
ENG 302.U06.01.04	Assess user capability requirements and the related preferred materiel solution for risks related to systems engineering design considerations.
ENG 302.U06.01.05	Based on early systems engineering assessment of technical risk, develop a system verification approach for the next acquisition phase.
<b>ENG 302.U07.01</b>	<b>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 DAG.</b>
ENG 302.U07.01.01	Recognize the role of systems engineering in establishing a cost, schedule, and performance baselines for a given project.
ENG 302.U07.01.02	Demonstrate a process for developing a set of program metrics and measures (EVM and TPMs) to support integrated technical assessment and program management.
ENG 302.U07.01.03	Identify sources of program technical risks and analyze the risks in accordance with the DoD Risk, Issue and Opportunity Management Guide.
ENG 302.U07.01.04	Derive a set of technical performance measures to support management of program risk.
ENG 302.U07.01.05	Discuss strategies to integrate use of technical performance measurement and Earned Value Management to manage program risk and uncertainty.
<b>ENG 302.U08.01</b>	<b>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.</b>
ENG 302.U08.01.01	Define key system security engineering related terms: critical program information (CPI), supply chain risk management, criticality analysis, mission critical functions, software assurance and cyber security.
ENG 302.U08.01.02	Describe major elements of program protection planning.
ENG 302.U08.01.03	Describe information analysis risk assessment.
<b>ENG 302.U09.01</b>	<b>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.</b>
ENG 302.U09.01.01	Analyze the impact of HSI domain variables on a system's design and performance.
ENG 302.U09.01.02	Recognize the required acquisition program and planning documentation associated with HSI domain areas.
ENG 302.U09.01.03	Describe the impact of HSI driven requirements on verification and validation planning and execution.
ENG 302.U09.01.04	Describe the application of anthropometrics to human factors engineering.
ENG 302.U09.01.05	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.
<b>ENG 302.U10.01</b>	<b>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.</b>
ENG 302.U10.01.01	Describe relationship between systems engineering processes and software development models.
ENG 302.U10.01.02	Discuss the relationship between software architecture and software behavior, performance, and quality attributes.
ENG 302.U10.01.03	Recognize the life-cycle considerations associated with use of commercial off the shelf / government off the shelf (COTS/GOTS) software items.
ENG 302.U10.01.04	Analyze common sources of risk associated with development of software intensive systems.
ENG 302.U10.01.05	Discuss the application of Agile methods and principles to reduce the duration and cost of the software development lifecycle.
ENG 302.U10.01.06	Given a set of software metrics, assess their usefulness to managing a software development project.
<b>ENG 302.U11.01</b>	<b>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.</b>
ENG 302.U11.01.01	Recognize the application and limitations of cost estimation methods at various stages of the acquisition life-cycle.
ENG 302.U11.01.02	Recognize the relationship between affordability goals and cost estimates.



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ENG 302.U11.01.03	Recognize the purpose of system affordability constraints established at key life-cycle decisions points.
ENG 302.U11.01.04	Identify the technical maturity criteria associated with the technical reviews and decision points that are part of TMRR phase.
ENG 302.U11.01.05	Recognize situations that require the application of sensitivity analysis to trade-off analyses.
ENG 302.U11.01.06	Analyze a program's approach to addressing TMRR phase objectives.
ENG 302.U11.01.07	Evaluate strategies for integrating engineering activities to address key technical risks during TMRR phase.
ENG 302.U11.01.08	Conduct a design trade-space to support a systems engineering affordability trade-off analysis.
<b>ENG 302.U12.01</b>	<b>The student will summarize the purpose, timing, and resource requirements for major elements of a Reliability &amp; Maintainability (R&amp;M) program plan in accordance with the DoD 5000.02; the Defense Acquisition Guidebook; DoD SEP Outline; Reliability, Availability, &amp; Maintainability Cost Rationale Report Manual (RAM-C), and applicable standards, handbooks, and guides discussed in class.</b>
ENG 302.U12.01.01	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.
ENG 302.U12.01.02	Describe the relationship among a system's reliability, maintainability, availability, and life-cycle costs.
ENG 302.U12.01.03	Recognize the purpose and application of an Operational Mode Summary/Mission Profile with regard to R&M engineering activities.
ENG 302.U12.01.04	For a given system, identify the components of the Sustainment Key Performance Parameter (KPP) and Key System Attributes (KSAs) as defined by the JCIDS.
ENG 302.U12.01.05	Recognize the key outputs of the Reliability, Availability, and Maintainability Cost Rationale (RAM-C) analysis/report.
ENG 302.U12.01.06	Explain the application of probability distributions to modeling the reliability of systems and system components as discussed in class.
ENG 302.U12.01.07	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)).
ENG 302.U12.01.08	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.
ENG 302.U12.01.09	Recognize the purpose of different types of equipment, subsystem, and system-level verification that support reliability & maintainability engineering.
ENG 302.U12.01.10	Describe how R&M requirements are included in request for proposals and contracts.
<b>ENG 302.U13.01</b>	<b>Given a contractor's inputs for performing Reliability &amp; Maintainability (R&amp;M) engineering, the student will evaluate these inputs for adequate scope and technical merit in accordance with the DAG, OSD System Engineering Plan Outline, and R&amp;M engineering concepts discussed in class.</b>
ENG 302.U13.01.01	For a given system, recognize the engineering and management parameters that are required for reliability growth planning.
ENG 302.U13.01.02	For a given system, recognize the engineering and management parameters that are required for a maintainability evaluation.
ENG 302.U13.01.03	Explain the purpose of Operating Characteristic Curve analysis with regard to reliability growth planning and reliability demonstration.
ENG 302.U13.01.04	Evaluate a reliability program plan in accordance with the DAG and planning aids provided in class.
ENG 302.U13.01.05	Evaluate a maintainability program plan in accordance with the DAG and planning aids provided in class.
ENG 302.U13.01.06	Given a set of reliability and maintainability planning assumptions and trade-off decisions, assess a the risk of meeting system Availability requirements.
ENG 302.U13.01.07	Evaluate a reliability growth plan using a reliability growth planning tool provided in class.
<b>ENG 302.U14.01</b>	<b>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 DAG.</b>
ENG 302.U14.01.01	Recognize the types of technical data that constitute a typical technical data package (TDP) as described in MIL-STD-31000.
ENG 302.U14.01.02	List examples of typical TDP life cycle management risks and issues from a government program perspective.
ENG 302.U14.01.03	Recognize the Modular Open System Architecture and intellectual property considerations associated with the use of COTS and Non-Developmental Items (NDI)
ENG 302.U14.01.04	Explain the Government's need for rights in technical data and software.
ENG 302.U14.01.05	Given a WBS and acquisition strategy, determine what technical data and computer software is needed to be delivered to the government.
ENG 302.U14.01.06	Given a life cycle competition strategy for a program, determine what type of rights are appropriate for the technical data or computer software.
ENG 302.U14.01.07	Given the product requirements for a life cycle acquisition, engineering and logistics, develop an open systems architecture appropriate to support the product through its planned life.



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<b>ENG 302.U15.01</b>	<b>The student will discuss current areas of interest related to engineering leadership and systems engineering.</b>
ENG 302.U15.01.01	Recognize current topics of interest related to engineering leadership and systems engineering management in DoD, the Defense Industry, and the engineering profession.
ENG 302.U15.01.02	Discuss the application and impact of emerging systems engineering and engineering leadership practices on defense acquisition programs.
<b>ENG 302.U16.01</b>	<b>The student will research key elements of the DoD production, quality, and manufacturing environment and discuss their impact on the system life-cycle in accordance with DoD production, quality, and manufacturing guidance.</b>
ENG 302.U16.01.01	Recognize the correct application of process improvement tools (lean, six sigma, Theory of Constraints, etc.) to the production and manufacturing environment.
ENG 302.U16.01.02	Compare and contrast design for manufacturing and assembly (DFMA) principles with those of designing reliable and sustainable systems.
ENG 302.U16.01.03	Using personal examples, illustrate the role of an engineer in applying the three aspects of lean implementation: strategic, cultural and tactical.
ENG 302.U16.01.04	Research the purpose, engineering application, and personal benefit of the Production Readiness Review and present the results.
ENG 302.U16.01.05	Research the purpose, engineering application, and personal benefit of the Manufacturing Readiness Assessment and present the results.
<b>ENG 302.U16.02</b>	<b>Given a system production &amp; manufacturing scenario, the student will evaluate manufacturing processes and develop recommendations for process improvements using concepts and methods discussed in class.</b>
ENG 302.U16.02.01	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.
ENG 302.U16.02.02	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.
ENG 302.U16.02.03	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.
<b>ENG 302.U17.01</b>	<b>Given contractor business information, students will analyze the contractor's development and implementation of mission, goals, and business strategies.</b>
ENG 302.U17.01.01	Understand the decision making environment of defense contractor management
ENG 302.U17.01.02	Describe how defense contractors implement their business planning.
ENG 302.U17.01.03	Become familiar with the vocabulary of the defense contractor
ENG 302.U17.01.04	Compare commercial and defense industry profit models
ENG 302.U17.01.05	Become familiar with the annual report as a valuable source of information on publically traded defense contractors
<b>ENG 302.U18.01</b>	<b>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).</b>
ENG 302.U18.01.01	Recognize the relationship between Affordability, Will-Cost, and Should-Cost baselines.
ENG 302.U18.01.02	Compare Value Engineering to should cost management.
ENG 302.U18.01.03	Describe an approach to implementing should cost management on an acquisition program.
ENG 302.U18.01.04	Given a set of executable cost reduction initiatives, analyze the initiatives from an engineering perspective.
ENG 302.U18.01.05	Given a set of executable cost reduction initiatives and set of constraints, develop an associated program should cost baseline.
ENG 302.U18.01.06	Given a program scenario, develop a list of cost reduction initiatives to support should cost management in the operations and sustainment phase.
<b>ENG 302.U19.01</b>	<b>Given an urgent capability need, the student will develop a systems engineering approach to support the urgent capability acquisition in accordance with the DoDI policies and principles and practices discussed in class.</b>
ENG 302.U19.01.01	Recognize the DoD policy that pertains to the urgent capability acquisition of a validated urgent need.
ENG 302.U19.01.02	Recognize the conditions under which a urgent capability acquisition approach is appropriate.
ENG 302.U19.01.03	Describe examples of systems engineering leadership considerations for a urgent capability acquisition program.
ENG 302.U19.01.04	Evaluate the availability of mature technologies that can be used meet an urgent capability need.
ENG 302.U19.01.05	Develop a course of action to support the urgent capability acquisition of an urgent need.
ENG 302.U19.01.06	Evaluate a urgent capability acquisition course of action for sources of technical risk.
ENG 302.U19.01.07	From an engineering leadership perspective, develop a list of factors to be considered when assigning or selecting personnel to support a urgent capability acquisition program.
ENG 302.U19.01.08	Develop a tailored approach to technical reviews to support a urgent capability acquisition program.
ENG 302.U19.01.09	Develop a tailored system verification approach to support a urgent capability acquisition program.



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<b>ENG 302.U20.01</b>	<b>Given a set of technical issues for a system in the operations &amp; support phase, the student will evaluate strategies for corrective actions and systems modification in accordance with DoD policy.</b>
ENG 302.U20.01.01	Identify the elements of product support for DoD systems.
ENG 302.U20.01.02	Given a set of technical issues, differentiate between appropriate and inappropriate funding sources that could be used to address the issues.
ENG 302.U20.01.03	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.
ENG 302.U20.01.04	Given a set of technical issues and associated options for corrective action, evaluate the configuration management impacts of each option.
ENG 302.U20.01.05	Given a set of corrective actions, select appropriate technical assessment metrics for analyzing and comparing the effectiveness of the corrective actions.
ENG 302.U20.01.06	Develop a framework for estimating life-cycle cost impacts of proposed system modifications.
ENG 302.U20.01.07	Develop a framework for a business case analysis to support selection of specific system upgrade options.