National Aeronautics and Space Administration

Safety and Mission Assurance

Training Curriculum

December, 2010

Introduction

The SMART/Safety and Mission Assurance Rotation Training program is designed to provide Goddard's Flight Project managers and engineers with safety and mission assurance tools and skills that can be used to foster mission success. The program will instill safety, reliability, and quality concepts, values, and skills in flight program personnel over a 6-month to 2-year period. Founded on enabling technical skills training listed and described in this document, other important elements are: mentoring by senior level reliability, safety, or quality engineers; leadership coursework; case study review/analysis; and on-the-job training through rotational assignments. For additional details, refer to the SMART Handbook (select "Handbook" tab on the SMART web site http://sma.gsfc.nasa.gov/smart/overview.php).

The purpose of this document is to provide the Mentor and SMART Mentee/Applicant a means to review existing training from which to craft a tailored learning plan that can be documented and tracked in SATERN (System for Administration, Training and Educational Resources for NASA).

Built in large part on the NASA Safety Center/NSC's Safety and Mission Assurance Technical Excellence Program/STEP curriculum and further tailored by adding Goddard-specific courses and documents, this document lists each discipline's (1) Essential Training, (2) Elective Training and (3) Optional Training followed by Recommended Reading/Resources and, lastly, Course Titles, Course Codes, and Descriptions as they are documented in SATERN. The courses occur in the following formats: on-line (designated by this icon) and instructor-led (designated by this icon). To add Instructor-led training/ILT to your SATERN Learning Plan, locate the course, select "Request Schedule", and review the "Available Scheduled Offerings". If there are no available offerings in the time period needed, enter the desired date in the "Need By Date" field under "Request Schedule" along with any comments you might have. Lastly, select the "Request" button on the lower right.

The SMART Program would like to acknowledge assistance and encouragement from the NASA Safety Center's Technical Excellence group who formulated the STEP (http://nsc.nasa.gov/step).

Contents

- Introduction 1
- Reliability Engineering Curriculum 4
- Reliability Engineering Readings & Resources 5
- Reliability Engineering Course Descriptions 6
- Quality Engineering Curriculum 11

- Quality Engineering Readings & Resources 13
- Quality Engineering Course Descriptions 14
- System Safety Curriculum 24
- System Safety Readings & Resources 25
- System Safety Course Descriptions 26
- Software Assurance Curriculum 31
- Software Assurance Readings & Resources 32
- Software Assurance Course Descriptions 33
- SkillSoft Leadership Course Descriptions 40

SMART Reliability Engineering Curriculum

ENABLING TRAINING

Enabling Training is comprised of three topics that every SMART Mentee must know: Decision Analysis (DA), Risk Management (RM) and Fundamentals of Systems Engineering (FSE).

√	Hours	Course Title	STATUS: (as of 12/2010)
☐	16	Decision Analysis for STEP	Available
☐	8	Risk Management for STEP	Available Oct, 2010
☐	40	Fundamentals of Systems Engineering for STEP	Available; ILT

ELECTIVE TRAINING

Elective training builds on the Level 1 "Basics of Reliability and Maintainability "course. Note: Although Code 300 has few maintainability responsibilities, the STEP includes Availability and Maintainability within the Reliability discipline.

√	Hours	Course Title	STATUS:
☐	28	Design for Reliability	Available Mar, 2011
☐	8	System Safety I	Available; ILT
☐	24	R&M Principles And Planning	Available; ILT
☐	12	Reliability, Availability, and Maintainability (RAM) Planning for Programs and Projects	Available
☐	24	Probabilistic Risk Assessment Methods (PRAM) For Practitioners And Managers	Available; ILT

OPTIONAL TRAINING

Optional Training provides the Mentee targeted topics that may either be related to job-specific duties or of future interest.

√	Hours	Course Title	STATUS:
☐	8	Basic Fault Tree Analysis I	Available; ILT
☐	16	Data Collection And Analysis I	Not Available
☐	16	FMEA/CIL And FMECA	Not Available
☐	19	NASA Root Cause Analysis	Available; ILT
☐	16	Parts And Materials Assessment I (IEEE, Mechanical, Parts Stress/Derating)	Not Available
☐	16	R&M Testing And Demonstration I	Not Available
☐	16	Reliability, Availability And Maintainability Modeling I	Not Available
☐	8	Probability & Statistics	Available; ILT

(Reliability Engineering Course Descriptions start on page 6.)

READINGS AND RESOURCES

Reference Material includes readings and resources that relate to the above listed courses. Depending on the Mentee's assigned job tasks, the Mentor will prioritize the following resources in the order to be completed.

√	Reference #	Resource title
☐	NPD 8720.1	NASA Reliability and Maintainability (R&M) Program Policy
☐	NPD 8700.1	NASA Policy for Safety and Mission Success
☐	NASA-STD-8729.1	Planning, Developing, and Managing an Effective Reliability and Maintainability (R&M) Program
☐	EEE-INST-002	Instructions for EEE Parts Selection, Screening, Qualification, and Derating
☐	NPR 8725.1	Reliability and Maintainability (R&M) Requirements for NASA (draft)
☐	NPR 8705.5	Probabilistic Risk Assessment (PRA) Procedures for NASA Programs and Projects
☐	R&M MIL-STDs & Handbooks	To be defined by SMART Mentor
☐	NPR 8000.4	Agency Risk Management Procedural Requirements
☐	NPR 8705.6	Safety and Mission Assurance Audits, Reviews, and Assessments
☐	NPR 8705.2	Human-Rating Requirements for Space Systems
☐	NPR 7120.5	NASA Space Flight Program and Project Management Requirements
☐	NPR 1000.0	NASA Governance and Strategic Management Handbook
☐	NASA/SP-2007-6105	NASA Systems Engineering Handbook (pages to be identified by SMART Mentor)
☐	NASA Reference Publication 1358	System Engineering "Toolbox" for Design-Oriented Engineers (pages to be defined by SMART Mentor)
☐		Report of the Presidential Commission on the Space Shuttle Challenger Accident (Rogers Commission Report) - Chap. 5, 6 and 7
☐		Columbia Accident Investigation Board Report - Volume 1 (pgs 3-11, Chapter 6, Section 7.4 pgs 184-193, pgs 213-217)
☐	NASA STD 8709.2	NASA Safety and Mission Assurance Roles and Responsibilities for Expendable Launch Vehicle Services
☐	NASA/SP-2007-6105	NASA Systems Engineering Handbook (pages to be identified by SMART Mentor)
☐	NPR 8715.6	NASA Procedural Requirements for Limiting Orbital Debris
☐		Fault Tree Handbook with Aerospace Applications (http://www.hq.nasa.gov/office/codeq/doctree/fthb.pdf)
☐		A History of Aerospace Problems, Their Solutions, Their Lessons by Robert S. Ryan: NASA Technical Paper 3653

Reliability Engineering Course Descriptions

Icons Used in this Section:

Online course | Webinar course | Classroom course | Course hours

ENABLING TRAINING

Decision Analysis for STEP
SMA-CORE-WBT-DA

This 2 day class is designed to provide the tools necessary to improve the quality of a factually based decision-making process for resolving technical issues at NASA. You will learn how to work in team situations to analyze a problem and make a decision based on group-generated alternatives. Note: This computer based course is a video capture of the Instructor-Led Decision Analysis course.

Risk Management
APPEL-RM

This 8-hour course provides an overview of the new NASA Risk Management (RM) process required by NPR 8000.4A, Agency Risk Management Procedural Requirements, including step-by-step coverage of its two constituent processes: Risk-Informed Decision Making (RIDM) and Continuous Risk Management (CRM), how and why they must be fully integrated, and how they function together and interact with one another in the NASA organizational hierarchy. The course contains technical background and concepts; coverage of the NPR definitions, functional roles, and requirements; and "how to" content from applicable NASA handbooks (including extensive material from the new NASA Risk-Informed-Decision Making handbook, NASA/SP-2010-576). A simplified planetary science mission example is used throughout the course to illustrate the key learning points.

Fundamentals of System Engineering
APPEL-FSE

This course introduces the methods and techniques for a structured systems development process that proceeds from requirements to concept to production to operation and is based upon NASA policy guidelines, specifically NPR 7123.1A and 7120.5D. The NASA practice of systems engineering is the glue that works across all engineering and project management disciplines to tie customer needs to the right solution. Systems engineering focuses on the interfaces between the people, processes, and products that are often outside the responsibility of any one function or discipline. This course equips your teams with the knowledge necessary to realize successful solutions.

The course is structured as a five-day class with an option to provide additional hands-on systems engineering life cycle experience, to include a focused activity such as a project review, for example, SRR, PDR or CDR, or another life cycle activity tailored to meet a specific Center need

ELECTIVE TRAINING

Design for Reliability
SMA-RM-WBT-221

This course will provide a detailed overview and learning for design for reliability and ultimately mission success. The course will focus process, procedures, and tools to use in each phase of the lifecycle, as well as for each classification of mission, including man-rated systems. All areas of design will be covered, and tips and pointers will be provided. Hands on projects will be provided where students can work as part of a design team to apply the concepts taught. Concepts such as analysis tools and how they drive the design, when to apply which specific analyses, how to use redundancy, how parts and materials choices affect the design, and most importantly, understanding the expected operating environment. Also, the use of flight rules, workarounds, and focusing on availability of systems will be discussed.

System Safety I
SMA-RISK-OSMA-0011

This course will provide an overview of system safety practices that play a supporting role in implementation of NPR 8000.4A, Agency Risk Management Procedural Requirements. System safety practices, and their tie to systems engineering, from qualitative to quantitative assessments will be described. Included in the course discussion will be examples of scenario characteristics (e.g., hardware failures, human errors, or phenomenological events leading to a mishap). Elements of the system safety case, including hazards, modeling, performance measures, and uncertainty will be addressed. How decisions are supported through application of system safety tools and technical skills will be explored by describing decision objectives, the role of communication, and how information is managed.

R&M Principles and Planning
SMA-RM-ILT-211

The R&M principles and planning course will provide a high-level, general overview of the processes, tools, and value associated with implementing reliability, availability, and maintainability disciplines on a system, based on the systems engineering lifecycle. The course will focus on defining and providing some detail on application of the three disciplines as they relate to the product lifecycle.
Developing and implementing a R&M Plan on a new program or project is extremely important and adds tremendous value. The R&M plan will drive the project to design R&M into the system or solution, whatever the project is focusing on. This course will provide details on how to develop an excellent, value-added plan, how it relates to each phase of the lifecycle, what value it brings, and will provide opportunities for hands-on learning in the process.

Reliability, Availability, And Maintainability (RAM) Planning for Programs and Projects
SMA-RM-WBT-241

The RAM business concerns course will provide a general overview of the value associated with implementing reliability, availability, and maintainability disciplines on a system, based on the systems engineering lifecycle. This course will focus on the business aspects and monetary value associated with designing failure modes out of a system, the merits of alternative maintainability approaches, improving the operational availability of a system, as well as the costs associated with accepting certain types of risk. The student will learn why it is cost effective to invest early in the lifecycle to ensure long term cost savings and mission success and will perform.
Implementing RAM early in the program's lifecycle can save as much as ten times or more when compared to failures in the later phases. When a failure mode is designed out while the system is still on

paper, as opposed to physically manufactured, it costs much less to complete. Not to mention the savings in maintenance, spares, logistics, and the cost of mission success. There are many cost implications when it comes to loss of mission, mission degradation, or even tolerating minor issues, and each of these will be addressed in this course. NOTE: This is a video-recorded version of the course.

Probabilistic Risk Assessment Methods (PRAM) M)/Derating) Mechanical Derating) For Practitioners And Managers
SMA-RISK-OSMA-0001

This three-day workshop will cover the applicability of Probabilistic Risk Assessment (PRA) to NASA programs/projects and activities, the current state-of-the-art of PRA methodology for aerospace applications, and its use in risk-informed decision-making (RIDM). The workshop will be valuable to both program/project managers and PRA practitioners. It will begin with an introduction to PRA for managers, including the PRA role in the RIDM process based on the draft of the RIDM handbook developed by OSMA. Following this introduction, there will be a discussion of the major concepts used in PRA. Several recently completed studies that have used PRA techniques to support decision-making will be presented.

OPTIONAL TRAINING

Basic Fault Tree Analysis I
SMA-RISK-OSMA-0009

This course will provide a basic understanding of the use and development of Boolean logic-based models such as fault trees. The course covers the topics of the history of fault tree analysis; basic events and associated probability concepts; basic reliability modeling; common logic gate types; strengths and limitations of logic-based models; and construction methods for fault tree analysis.

Data Collection And Analysis I
SMA-RM-WBT-321

This course focuses on importance of data collection, methods of collecting data, analyzing data, sources of data, and issues associated with data collection. It discusses data pedigree and underlying assumptions that need to be considered when collecting and using data for analysis and decision making. It covers various data types and sources such as discrete, continuous, attribute, vendors, field, commercial, surrogate systems, and so on. Data analysis includes parametric and non-parametric methods, classical and sophisticated analysis methods such as Bayesian, Weibull, Markov, and Uncertainty Analysis (UA). It also talks about data sources historical data, GIDEP, data libraries (e.g. MIL-HDBK 217, PRACA, RiAC) and data mining. http://guidebook.dcma.mil/226/226-4/index.cfm#competencies

FMEA/CIL And FMECA
SMA-RM-WBT-361

The primary purpose of this course is to understand the benefits of Failure Mode and Effects Analysis (FMEA/CIL) in early identification of potential failure modes at subsystem and system level so they can be eliminated or minimized during early design phases. A Functional FMEA is the first level of analysis, developed during the early design phases which consist of the identification of potential functional failures and the effects on systems performance and identifying the potential criticality/severity of the effect on the system. The second level of analysis is the Hardware FMEA consisting of a more detailed analysis on subsystems and components as the design matures. A Failure Mode, Effects and Criticality Analysis (FMECA) is similar to the FMEA but subjectively calculates the risk of each failure mode cause

through measurements of the severity and probability of a failure effect. Both of these methods are intended to provide information for making risk management decisions. The FMEA/FMECA is a living document during the development and operation of the hardware design. It is important that the FMEA/ FMECA are continually updated to keep pace with the evolving design as well as during the operational life so it can be used effectively throughout design development and sustainment of the system. The course will focus on understanding concepts, the best methods for performing the analyses and documenting, and providing hands-on practice with relevant NASA systems.

NASA Root Cause Analysis
SMA-SAFE-OSMA-4003

This course will provide training on Root Cause Analysis methodology that can be used in both general problem solving and mishap and close call investigation. This course will provide students with an understanding of the Root Cause Analysis methodology and terminology adopted by NASA in August 2003. It will allow students to gain hands-on experience differentiating between events and conditions, identifying cause and effect relationships, discriminating between barriers and controls, constructing a time line, and constructing Event and Causal Factor Trees. Examples and exercises will be provided from NASA and other government agencies.
Prerequisite: all attendees shall complete the NASA SATERN Introduction to Mishap Investigation Course SMA-002-06 (4 modules) prior to attending this training.

Parts And Materials Assessment I (IEEE, Mechanical, /Derating) Mechanical Derating) Parts Stress Derating
SMA-RM-WBT-311

This course defines Electrical, Electronic, and Electro-mechanical (EEE) part terminology, describes the effects of space environments of EEE parts, and explains general parts quality and reliability evaluation techniques. The main focus is NASA's approach for managing a parts program: identifying requirements, key personnel, and essential roles/responsibilities. Key Topics includes NASA EEE Parts Program; Approved Parts List; Parts Types; Classification of Parts such as Space Class Parts, Military Parts, COTS; Commercial Off-The-Shelf (COTS) Parts; Parts Traceability; As-Built/As-Designed Parts Lists; Mechanical Parts; GIDEP/NASA/SAFE ALERTS; Counterfeit part issues; Parts control plan; Parts grades; Flight parts screening; Storage control.

R&M Testing And Demonstration I
SMA-RM-WBT-341

Testing for Reliability, Availability, and Maintainability performance is critical to ensuring a design will meet requirements. Testing can be conducted using a variety of methods and to demonstrate specific outcomes, and this course will focus on design of specific tests, development of test plans, and application of classical as well as accelerated methods. The curriculum will provide real-life NASA examples of effective test regimens that have ensured success of NASA programs.

Reliability, Availability And Maintainability Modeling I
SMA-RM-WBT-331

This course focuses on methodologies for design performance and its improvement through sensitivity and gap analysis. RAM modeling can simulate the configuration, operation, failure, repair, and maintenance of system(s) for various phases such as pre-launch, launch, ascent, orbit, cruise, landing on Lunar/Mars, descent. The objective is to teach various modeling techniques and demonstrate how they are used.
In deterministic models, a good decision is judged by the outcome alone. However, in probabilistic

models, the decision-maker is concerned not only with the outcome value but also with the amount of risk each decision carries. Probabilistic Modeling is largely based on application of statistics for probability assessment of uncontrollable events, as well as risk assessment of your decision. The probabilistic models are used for protection against adverse uncertainty in decision making.

Probability & Statistics I
SMA-RISK-OSMA-0005

This course provides an overview of quantitative concepts from the fields of probabilistic modeling, statistics, and reliability theory that arise frequently in probabilistic risk assessment (PRA). Through lecture and example problems, participants are presented with mathematical techniques from probability and statistics that have applications in current PRA. This course is intended for the familiarization of NASA program, project, mission support, institutional, systems engineering, and safety and mission assurance personnel who wish to become more effective participants in their organizational units' applications of probabilistic techniques.

SMART Quality Engineering Curriculum

ENABLING TRAINING

Enabling Training is comprised of three topics that every SMART Mentee must know: Decision Analysis (DA), Risk Management (RM) and Fundamentals of Systems Engineering (FSE).

√	Hours	Course Title	STATUS: (as of 12/2010)
☐	16	Decision Analysis For STEP	Available
☐	8	Risk Management For STEP	Avail Oct, 2010
☐	40	Fundamentals Of Systems Engineering For STEP	Available; ILT
☐	0.5	Audits	Avail 2011
☐	3	Quality Assurance Plans	Avail 2011
☐	0.5	Quality Assurance Surveillance Plan	Avail 2011

ELECTIVE TRAINING

Elective training provides more Quality engineering-specific training that builds on the Level 1 "Basics of Quality Engineering " course

√	Hours	Course Title	STATUS:
Corrective Actions and Problem Reporting Overview			
☐	1	Corrective Action and Problem Reporting Systems Overview	Avail 2011
☐	1	NASA Safety Reporting System	Available
Design and Development Overview			
☐	1	Parts Control Overview	Avail 2011
☐	1	Workmanship Standards Overview	Avail Dec, 2010
Procurement Quality Overview			
☐	8	Procurement Quality Overview	Avail 2011
Production, Material & Process Control Overview			
☐	0.5	Packaging, Handling, & Shipping Overview	Avail 2011
Quality Management and Planning Overview			
☐	4	Quality Management Overview	Avail 2011
☐	1.5	Technical Assessment Overview	Avail 2011
Corrective Actions and Problem Reporting			
☐	3	GIDEP Overview	Avail 2011

OPTIONAL TRAINING

Optional Training provides the Mentee targeted topics that may either be related to job-specific duties or of future interest.

√	Hours	Course Title	STATUS:
Corrective Actions and Problem Reporting Overview			
☐	5	Introduction to Mishap Investigation	Available
☐	1	Material Review Board	Avail; 2011
Design and Development Overview			
☐	3.5	Configuration Management	Avail 2011
☐	2	Data Management	Avail 2011
☐	4	Design Inputs and Reviews Overview	Avail 2011

☐	1	Drawings, Dimensions, & Tolerances Overview	Avail Nov, 2010
☐	1	FMEA/CIL	Available
☐	0.5	Functional Configuration Audit / Physical Configuration Audit	Avail 2011
☐	4	Mistake Proofing Overview	Available; Cost
Inspection, Testing & Acceptance Overview			
☐	0.5	Certification of Flight Readiness Overview	Avail 2011
☐	0.5	Hardware / Software / Service Acceptance	Avail 2011
☐	5	Inspection	Avail 2011
☐	0.5	Inspection Control and Personal Warranty	Avail Dec, 2010
☐	1	Non-Destructive Inspection (NDI) / Evaluation (NDE)	Avail 2011
☐	0.5	Qualification	Avail 2011
☐	1	Testing	Avail 2011
Procurement Quality Overview			
☐	2	NASA Letter of Delegation	Avail 2011
Production, Material & Process Control Overview			
☐	2	Cleanliness and Contamination Control Overview	Avail Dec, 2010
☐	1	Control of Foreign Object Debris (FOD)	Avail Nov, 2011
☐	4	Electrostatic Discharge (ESD) Control	Available; ILT
☐	4.5	Manufacturing Processes Overview	Avail 2011
☐	4.5	Material Control	Avail 2011
☐	4	Measurement Systems Analysis Overview	Avail 2011
☐	0.5	Metrology and Calibration	Avail 2011
Quality Management and Planning Overview			
☐	1	Program Quality Integration Overview	Avail 2011
☐	24	Space System Verification And Validation For STEP	Available; ILT
Corrective Actions and Problem Reporting			
☐	8	Corrective Action and Problem Reporting Systems	Avail 2011
Design and Development			
☐	8	Design Inputs and Reviews	Avail 2011
☐	16	Mistake Proofing	Available; Cost
☐	8	System Safety I	Available; ILT
☐	40	Drawings, Dimensions, & Tolerances	Available; ILT
Production, Material & Process Control			
☐	4	Manufacturing Process	Avail 2011
Quality Management and Planning			
☐	1	Lessons Learned	Avail 2011
☐	3	Program Quality Integration	Avail 2011
☐	8	Quality Management Systems	Avail 2011;ILT

(Quality Engineering Course Descriptions begin on page 14.)

READINGS AND RESOURCES

Reference Material includes readings and resources that relate to the above listed courses. Depending on the Mentee's assigned job tasks, the Mentor will prioritize the following resources in the order to be completed.

√	Reference #	Resource title
☐	ANSI/ESD S20.20	ESD
☐	ANSI/ISO/ASQ Q9001	American National Standard, Quality management systems – Requirements
☐	NPD 1280.1	NASA Management System Policy
☐	SAE AS-9100	Quality Management Systems – Aerospace – Requirements
☐	NPD 8700.3	Safety and Mission Assurance (SMA) Policy for NASA Spacecraft, Instruments, and Launch Services
☐	NPD 8730.1	Metrology and Calibration
☐	NPD 8730.2	NASA Parts Policy
☐	NPD-8700.1	NASA Policy for Safety and Mission Success
☐	NPD-8730.5	NASA Quality Assurance Program Policy
☐	NPR 7120.6	Lessons Learned Process
☐	NPR 8000.4	Risk Management Procedures and Guidelines
☐	NPR 8735.1	Procedures for Exchanging Parts, Materials, and Safety Problem Data Utilizing the Government-Industry Data Exchange Program and NASA Advisories
☐	NPR-8735.2	Management of Government Quality Assurance Functions for NASA Contracts
☐	NPD 7120.4	Program/Project Management
☐	NPR 7120.5D	NASA Space Flight Program and Project Management Requirements
☐	NPR 7120.8	NASA Research and Technology Program and Project Management Requirements
☐	NPR 7123.1	NASA Systems Engineering Processes and Requirements
☐	NPR 8705.4	Risk Classification for NASA Payloads
☐	NPR 8705.6	Safety and Mission Assurance Audits, Reviews, and Assessments
☐	SP-6105	NASA Systems Engineering Handbook (pages to be identified by SMART Mentor)
☐	NASA Reference Publication 1358	Systems Engineering Toolbox for Design-Oriented Engineers (pages to be defined by SMART Mentor)
☐		Workmanship standards

SMART Quality Engineering Course Descriptions

Icons Used in this Section:

Online course

Webinar course

Classroom course

Course hours

ENABLING TRAINING

Decision Analysis For STEP
SMA-CORE-WBT-DA

This 2 day class is designed to provide the tools necessary to improve the quality of a factually based decision-making process for resolving technical issues at NASA. You will learn how to work in team situations to analyze a problem and make a decision based on group-generated alternatives. Note: This computer based course is a video capture of the Instructor-Led Decision Analysis course.

Risk Management For STEP
SMA-CORE-WBT-RM

This 8-hour course provides an overview of the new NASA Risk Management (RM) process required by NPR 8000.4A, Agency Risk Management Procedural Requirements, including step-by-step coverage of its two constituent processes: Risk-Informed Decision Making (RIDM) and Continuous Risk Management (CRM), how and why they must be fully integrated, and how they function together and interact with one another in the NASA organizational hierarchy. The course contains technical background and concepts; coverage of the NPR definitions, functional roles, and requirements; and “how to” content from applicable NASA handbooks (including extensive material from the new NASA Risk-Informed-Decision Making handbook, NASA/SP-2010-576). A simplified planetary science mission example is used throughout the course to illustrate the key learning points.

Fundamentals Of Systems Engineering For STEP
SMA-CORE-ILT-FSE

This course introduces the methods and techniques for a structured systems development process that proceeds from requirements to concept to production to operation and is based upon NASA policy guidelines, specifically NPR 7123.1A and 7120.5D. The NASA practice of systems engineering is the glue that works across all engineering and project management disciplines to tie customer needs to the right solution. Systems engineering focuses on the interfaces between the people, processes, and products that are often outside the responsibility of any one function or discipline. This course equips your teams with the knowledge necessary to realize successful solutions.

The course is structured as a five-day class with an option to provide additional hands-on systems engineering life cycle experience, to include a focused activity such as a project review, for example, SRR, PDR or CDR, or another life cycle activity tailored to meet a specific Center need.

Audits
SMA-QE-WBT-217

In this course, learners will understand and recognize the major aspects of audits, including the various types of audits (quality audits, internal audits, external audits, and third party audits), roles and responsibilities, audit planning, reporting, and implementation.

Quality Assurance Plans

SMA-QE-WBT-214

This course discusses where quality assurance plans fit in with the rest of the Quality Engineering Competencies, and further explores the importance of quality assurance plans, quality assurance activities, and how to document quality assurance plans.

Quality Assurance Surveillance Plan

SMA-QE-WBT-218

This course identifies various surveillance activities and how to evaluate and identify personnel resource requirements. It also identifies how to assess organization and supplier/partner surveillance activities and document the results.

ELECTIVE TRAINING

Corrective Actions and Problem Reporting Overview

SMA-STEP-LEVEL2-QE-CAPRO

These courses provide the learner with a broad recognition of the Corrective Actions and Problem Reporting Competency and its related sub-competencies.

Corrective Action And Problem Reporting Systems Overview

SMA-QE-WBT-261

This course discusses the topics of corrective actions, problem reporting and reporting systems including an introduction to root cause analysis.

NASA Safety Reporting System

SMA-038-01

NASA Safety and Mission Assurance is more critical to success than ever before. To ensure Safety and Mission Assurance, the NASA Safety Program allows NASA employees and contractors to report hazardous conditions to line management and local safety organizations. NASA instituted the NSRS—NASA Safety Reporting System as a result of the Challenger accident in 1986. The NSRS was designed to give NASA employees at any level and contractors an alternate avenue or channel through which to communicate safety concerns and issues to upper management. This training module is designed to provide the student a general overview of the goals and uses of the NASA Safety Reporting System.

Design and Development Overview

SMA-STEP-LEVEL2-QE-DDO

These courses provide the learner with a broad recognition of the Design and Development Competency and its related sub-competencies.

Parts Control Overview

SMA-QE-WBT-229

This course covers parts control principles including Counterfeit Parts, Pyrotechnics, EEE Parts, and Mechanical Parts.

Workmanship Standards Overview

SMA-QE-WBT-223

This course provides an introduction to the NASA Workmanship Standards and their applications.

Procurement Quality Overview
SMA-STEP-LEVEL2-QE-PQO
This course provides the learner with an in-depth recognition of the Procurement Quality Engineering Competency and its related sub-competencies.

Procurement Quality Overview
SMA-QE-WBT-231

This course covers procurement quality principles including Risk based acquisition management, Purchase order review, Pre and post award surveys, Development of statements of work, Flow down requirements, Data deliverables, Government mandatory inspection points, and Key characteristics in procurements.

Production, Material & Process Control Overview (Sub- curriculum)
SMA-STEP-LEVEL2-QE-PMPCO
This course provides the learner with a broad recognition of the Production, Material & Process Control Competency and its related sub-competencies.

Packaging, Handling, & Shipping Overview
SMA-QE-WBT-245

This course presents the basic concepts of product packaging, handling & shipping.

Quality Management and Planning Overview SMA-STEP-LEVEL2-QE- QMPO
This group of courses provides the learner with a broad recognition of the Quality Management and Technical Assessment competencies

Quality Management Overview
SMA-QE-WBT-211

This course begins with an overview of the Quality Engineering Competencies and an examination of where the Quality Management and Planning Competency fits into that spectrum. The course continues with overview discussions of Quality Management Systems, Strategic Planning, Communication Mechanisms, Work Environment, and Human Factors.

Technical Assessment Overview
SMA-QE-WBT-216

In this course, learners will understand and recognize the process involved to determine capability (Design, Production, and Servicing), NASA policies on audits and identify related training, and the importance of surveillance.

Corrective Actions and Problem Reporting
GIDEP Overview
SMA-QE-WBT-265

This training will provide general information and guidance concerning the NASA processes for the documentation and exchange of significant non-conformance, problem, and concern data. The scope of this module will be at the overview level and will cover the following topics:

- Introduction to NASA's Participation in GIDEP and the NASA Advisory System
- Type of GIDEP Failure Experience Document or NASA Advisory to Be Used
- How to Generate GIDEP Failure Experience Documents and NASA Advisories
- Review and Evaluation of GIDEP Failure Experience Documents and NASA Advisories

- How to Search for Related Problems and Conditions

OPTIONAL TRAINING

Corrective Actions and Problem Reporting SMA-STEP-LEVEL2-QE-CAPRO

These courses provide the learner with a broad recognition of the Corrective Actions and Problem Reporting Competency and its related sub-competencies.

Introduction to Mishap Investigation
SMA-002-06

5

This course fulfills requirements for introductory training on NASA mishap investigations in accordance with NPR 8621.1. It covers NASA mishap investigation policies and procedures and root cause analysis. This course is divided into 4 modules: -Mishap Investigation Process Overview; -Mishap Investigation Roles and Responsibilities
-Conducting an Investigation
-Root Cause Analysis

Material Review Board
SMA-QE-WBT-263

1

This course covers the process and requirements of establishing a review board to disposition nonconforming products, the types of dispositions the board can make and the relationship to identifying corrective actions.

Design and Development Overview SMA-STEP-LEVEL2-QE-DDO

This group of courses provides the learner with a broad recognition of the Design and Development Competency and its related sub-competencies.

Configuration Management
SMA-QE-WBT-226

3.5

This module presents an overview of the configuration management (CM) function and also provides a perspective of the configuration management process. The module will address the basic requirements of configuration management and general NASA Agency policies related to program/project configuration management. Content will primarily consist of an overview of the configuration management elements for identifying, controlling, accounting, and verifying program/project requirement baselines throughout the item's life cycle. The engineering change process will be discussed to include a description of the types of engineering changes and the typical, configuration change control board process. Waivers and deviations will be addressed as well.

Data Management
SMA-QE-WBT-228

2

This course covers data management principles including Acceptance Data Packages and Quality Assurance Records.

Design Inputs And Reviews Overview
SMA-QE-WBT-221

4

This course introduces design input and review principles including Technical document review, Quality requirements, Customer and special requirements, Human Factors in design, Work authorization review, Key characteristics, Critical safety items, and Preventive action.

Drawings, Dimensions, & Tolerances Overview
SMA-QE-WBT-224

This course provides an introduction to drawings, dimensions and tolerances including understanding drawing types and applications. It also addresses how to recognize areas, lines, control boxes, symbology, projections, and tolerances on engineering drawings and blueprints.

FMEA/CIL
SMA-017-01

This training provides a familiarization with the Failure Modes and Effects Analysis (FMEA) and the Critical Items List (CIL). It is a short presentation on how the study of a system and the working relationships of its elements can determine ways in which failure can occur. It also addresses the subsequent effect of each potential failure on the system element in which it occurs, on other system elements, and on the success of the system's mission. It also discusses how the analysis can be used to ensure controls are in place to prevent system failures.

Functional Configuration Audit / Physical Configuration Audit
SMA-QE-WBT-227

This course addresses the functional and physical baselines identified during a project/program lifecycle. It also covers the verification and validation of those baselines during functional configuration audits and physical configuration audits.

Mistake Proofing Overview
SMA-QE-EXTW-222

This course introduces the fundamental concepts of the mistake-proofing process. Mistake-proofing is a powerful problem-solving technique that provides fast, accurate and effective solutions for most manufacturing-related problems. Its analysis methods can be used for all processes, whether they are technical or transactional. By following mistake-proofing practices, organizations can eliminate the possibility of producing defects.

Inspection, Testing & Acceptance Overview (Sub- curriculum) SMA-STEP-LEVEL2-QE-ITAO

This group of courses provides the learner with a broad recognition of the Inspection, Testing & Acceptance Competency and its related sub-competencies.

Certification Of Flight Readiness (COFR) Overview
SMA-QE-WBT-257

This course will provide an overview of the various activities associated with the process of certification of hardware for flight.

Hardware / Software / Service Acceptance
SMA-QE-WBT-256

This course will cover the various activities associated with the process of accepting hardware, software and services for NASA.

Inspection
SMA-QE-WBT-251

This course covers inspection principles including Government mandatory inspection points, Receiving, In process, Final and First Article Inspections

Inspection Control and Personal Warranties
SMA-QE-WBT-252

NASA prescribes that accomplishment of product assurance actions shall be attested to by signature, legible printed name, and date or by an inspection control system such as inspection stamps or electronic medium. This course covers how stamps or electronic mediums are controlled and used. It also covers Stamp Warranty, which means that the person saw or performed the work as stated in the record and was qualified to do so.

Non-Destructive Inspection (NDI)/ Evaluation (NDE) Overview
SMA-QE-WBT-254

This course will provide an overview of various NDI /NDE techniques including: Liquid Penetrant; Magnetic particle; Ultrasonic; Radiographic & Eddy Current Testing.

Qualification
SMA-QE-WBT-255

This course will cover the various activities associated with the process of qualifying hardware to meet the specified requirements.

Testing
SMA-QE-WBT-253

This course will provide an awareness and general knowledge of testing in flight hardware and software development, acceptance, and maintenance environments.

Procurement Quality Overview SMA-STEP-LEVEL2-QE-PQO

This course provides the learner with an in-depth recognition of the Procurement Quality Engineering Competency and its related sub-competencies.

NASA Letter of Delegation
SMA-QE-WBT-232

This course describes NASA Letters of Delegations and identifies the related QE functions. It also details how to develop a Letter of Delegation.

Production, Material & Process Control Overview (Sub-curriculum) SMA-STEP-LEVEL2-QE-PMPCO

This group of courses provides the learner with a broad recognition of the Production, Material & Process Control Competency and its related sub-competencies

Cleanliness & Contamination Control Overview
SMA-QE-WBT-243

This course will identify basic contamination control practices and clean room protocols. It will also define various cleanliness levels.

Control of Foreign Object Debris (FOD)
SMA-QE-WBT-244

FOD prevention is a course which presents information on: the importance of a foreign object debris program, what FOD is, and how to prevent it. The training also explains how a FOD prevention program works, including FOD monitors, FOD walk downs, and individual responsibility in eliminating foreign object debris/damage.

Electrostatic Discharge (ESD) Control: Tailoring an ESD Control Program
SMA-SAFE-NSTC-0076

The purpose of this course is to provide guidance in tailoring an ESD control program or project plan to the requirements of an external ESD control standard. It is based largely on the JPL ESD control program, an implementation of JPL standard D-1348F "Electrostatic Discharge Control" tailored to comply with MIL-STD1686, and the current ESD Association S20.20. Topics covered include: The motivation for ESD Control, Electrostatic charge generation, Effects of electrostatic charge and discharge, ESD control for people, Packaging for ESD control, Managing the ESD control program.

Manufacturing Processes Overview
SMA-QE-WBT-241

This course provides an overview of the many aspects of NASA's manufacturing process, including Manufacturing Plan Evaluations, Process Controls including variation management, Special Processes including Workmanship Standards, and Process FMEA.

Material Control
SMA-QE-WBT-246

This course covers material control related topics including Identification & Traceability, Control of Nonconforming Material, Limited Life Items and Parts Control.

Measurement Systems Analysis Overview
SMA-QE-EXTW-247

Measurement Systems Analysis examines the nature of measurement systems and the fundamental analyses used to examine them. Participants will learn about the various studies that can gage the extent of variation within measurement results, and what the sources of the variation are. Sources of variation can be found by analyzing a measuring device's bias, linearity, stability, repeatability and reproducibility.

Metrology and Calibration
SMA-QE-WBT-248

This training provides NASA personnel with an awareness and general knowledge of metrology and calibration processes and procedures used by NASA.

Quality Management and Planning Overview SMA-STEP-LEVEL2-QE- QMPO

This course provides the learner with a broad recognition of the Quality Management and Planning Competency and its related sub-competencies

Program Quality Integration Overview
SMA-QE-WBT-213

This course contains overview discussions of Classification of NASA missions and projects, Quality Engineering in the project life cycle, NASA work breakdown structure, and Operational/on orbit quality.

Space System Verification And Validation For STEP
SMA-QE-ILT-SSVV

This course deals with an overview the Verification and Validation sub-competency. This course will: Explain the end-to-end System Engineering process and how it applies to system (and lower level) requirements definition, allocation, validation and verification; Describe the purpose and scope of key

documents required in the validation and verification processes, and describe typical errors committed; Describe various methods of verification, determine when they are appropriate, and how they are used as part of a verification plan; Determine appropriate circumstances and applicability of verification methods to prototype and proto-flight systems; Describe capabilities of various automated requirements tracking tools (e.g. CORE and DOORS) and their applicability to the validation and verification process; Develop, evaluate and implement a master verification plan for a space system including hardware, software, and associated ground support equipment (GSE); Apply processes and techniques in a hands-on workshop associated with a system of interest; Highlight applicable NASA, Dept. of Defense, and Industry Standards and lessons learned to support system verification decisions and activities.

Corrective Actions and Problem Reporting
SMA-STEP-LEVEL3-QE-CAPR

This course provides the learner with in-depth recognition of the Corrective Action and Problem Reporting Competency and its related sub competencies. This sub-curriculum will cover the following topics in more detail than in Level 2.

Corrective Action and Problem Reporting Systems
SMA-QE-WBT-361

8

This course provides a detailed discussion on the topics of corrective actions, problem reporting and reporting systems including root cause analysis.

Design and Development
SMA-STEP-LEVEL3-QE-DD

This group of four (4) courses provides the learner with in-depth recognition of the Design and Development Competency and its related sub competencies. This sub curriculum will cover the following topics in more detail than in Level 2.

Design Inputs and Reviews
SMA-QE-WBT-321

8

This course covers design input and review topics including Technical document review, Quality requirements, Customer and special requirements, Human Factors in design, Work authorization review, Key characteristics, Critical safety items, and Preventive action.

Mistake Proofing
SMA-QE-EXTW-322

16

Mistake-proofing is a powerful problem-solving technique that provides fast, accurate and effective solutions for most manufacturing-related problems. Its analysis methods can be used for all processes, whether they are technical or transactional.

System Safety I
SMA-RISK-OSMA-0011

8

This course will provide an overview of system safety practices that play a supporting role in implementation of NPR 8000.4A, Agency Risk Management Procedural Requirements. System safety practices, and their tie to systems engineering, from qualitative to quantitative assessments will be described. Included in the course discussion will be examples of scenario characteristics (e.g., hardware failures, human errors, or phenomenological events leading to a mishap). Elements of the system

safety case, including hazards, modeling, performance measures, and uncertainty will be addressed. How decisions are supported through application of system safety tools and technical skills will be explored by describing decision objectives, the role of communication, and how information is managed. NOTE: A video-recorded version of this course is in development and will be available TBD.

Drawings, Dimensions, & Tolerances
SMA-QE-EXTI-325

This course deals with the Drawings, Dimensions & Tolerances sub competency. This course will cover the following topics in more detail than in Level 2: Performing QE drawing review functions including Read and interpret areas, lines, control boxes, symbology, projections, and tolerances on engineering drawings and blueprints, Understand basic requirements for surface texture, screw threads and gears, Identify essential components/elements required in fabrication drawings (i.e. NASA requirements, symbology), Recognize the standard practices used for geometric dimensioning and tolerancing, Define ANSI symbology and terminology, Recognize criteria for selecting datum's, Apply ANSI principles to dimensional, assembly, and functional problem solving, and Analyze compliance to ANSI standards.

Production, Material & Process Control
SMA-STEP-LEVEL3-PMPC

This group of three (3) courses provides the learner with in-depth recognition of the Production, Material & Process Control Competency and its related sub competencies. This sub curriculum will cover the following topics in more detail than in Level 2.

Manufacturing Process
SMA-QE-WBT-341

This course provides a detailed review of the many aspects of the Quality Engineering functions associated with NASA's manufacturing processes.

Quality Management and Planning
SMA-STEP-LEVEL3-QE-QMP

This group of three (3) courses provides the learner with in-depth recognition of the Quality Management and Planning Competency and its related sub competencies. This sub curriculum will cover the following topics in more detail than in Level 2.

Lessons Learned
SMA-QE-WBT-215

In this course, learners will explore how to review lessons learned libraries and determine applicability of the library to new work based on program/project requirements, evaluate current program/project work against existing lessons learned libraries and determine which lessons learned should be applied to the new program or project, and ensure identified lessons learned are documented so that they can be integrated into the program/project plan. Learners will also discover how to Implement lessons learned into the program/project planning and/or document initial risk management practices for risk associated with not implementing lessons learned, review the processes applied and work performed on a program/project and identify lessons learned for future use, document identified lessons learned so that they can be understood, assessed for applicability, and applied in future programs/projects and Integrate documented lessons learned into organizational lessons learned libraries.

Program Quality Integration
SMA-QE-WBT-312

This course provides information on program quality integration, including classification of NASA missions and projects, Quality Engineering in the project life cycle, and the NASA work breakdown structure.

Quality Management Systems
SMA-QE-EXTI-311

This course will address in detail, Quality management systems. You will learn how to make it a part of your organization and review advanced quality management principles, best practice techniques, tools and skills.

SMART System Safety Curriculum

ENABLING TRAINING

Enabling Training is comprised of three topics that every SMART Mentee must know: Decision Analysis (DA), Risk Management (RM) and Fundamentals of Systems Engineering (FSE).

√	Hours	Course Title	Status: (as of 12/2010)
☐	16	Decision Analysis for STEP	Available
☐	8	Risk Management for STEP	Avail Oct, 2010
☐	40	Fundamentals of Systems Engineering for STEP	Available; ILT

ELECTIVE TRAINING

Elective Training provides more System Safety-specific training that builds on the Level 1 "Basics of System Safety "course.

	Hours	Course Title	Status:
☐	8	Basic Fault Tree Analysis I	Available; ILT
☐	8	Risk Informed Decision Making (RIDM)	Available; ILT
☐	36	System Safety Fundamentals	Available; ILT
☐	8	System Safety I	Available; ILT
☐	28	Probabilistic Risk Assessment Methods (PRAM) for Practitioners and Managers	Available; ILT

OPTIONAL TRAINING

Optional Training provides the Mentee more specific topics of concentration that may either be related to job-specific duties or of future interest.

√	Hours	Course Title	Status:
☐	16	Basic Fault Tree Analysis II	Available; ILT
☐	8	Probability and Statistics I	Available; ILT & WBT
☐	16	Probability and Statistics II	Available; ILT
☐	8	Accident Precursor Analysis I	Available; ILT
☐	16	Accident Precursor Analysis II	Available; ILT
☐	8	Application of Simulation Techniques to Safety Analysis	Available; ILT
☐	24	Management of Space Technology for STEP	Available; ILT
☐	40	Project Planning Analysis And Control For STEP	Available; ILT
☐	21	System Safety II	Available; ILT

(System Safety Course Descriptions begin on page 26.)

READINGS AND RESOURCES

Reference Material Reference Material includes readings and resources that relate to the above listed courses. Depending on the Mentee's assigned job tasks, the Mentor will prioritize the following resources in the order to be completed.

√	Reference #	Resource Title
☐	NPR 8715.3	NASA General Safety Program Requirements (Especially Chapters 1, 2, and 9)
☐	NPD 8700.1	NASA Policy for Safety and Mission Success
☐	NPR 8000.4	Risk Management
☐	NPR 8705.2	Human Rating Procedural Requirements
☐	NPR 8705.5	Probabilistic Risk Assessment (PRA) Guidelines for NASA Programs and Projects
☐	NPR 8705.6	NASA Procedural Requirements for Safety and Mission Assurance Reviews and Assessments
☐	NPR 7120.5	NASA Program/Project Management Processes and Requirements
☐	NPR 1000.0	NASA Strategic Management and Governance Handbook (Technical Authority)
☐		Rogers Commission Report (Chap. 5, 6 and 7)
☐		Columbia Accident Investigation Board Report. Volume 1 (pgs 3-11, Chapter 6, Section 7.4 pgs 184-193, pg 213-217
☐	NPD 8700.2	Policy for Safety and Mission Assurance for Experimental Aerospace Vehicles
☐	NPD 8700.2	Policy for Safety and Mission Assurance for Expendable Aerospace Vehicles
☐	NPR 8705.3	Safety and Mission Assurance Requirements for Experimental Aerospace Vehicles
☐	NPR 8705.3	Safety and Mission Assurance Requirements for Expendable Aerospace Vehicles
☐	NASA STD 8709.2	NASA Safety and Mission Assurance Roles and Responsibilities for Expendable Launch Vehicles
☐	NPR 8715.7	Expendable Launch Vehicle Payload Safety Program
☐	NPR 8621.1	NASA Procedural Requirements for Mishap Reporting, Investigating, and Recordkeeping
☐	NASA-GB-8719.13	NASA Software Safety Guidebook
☐	NPD 8710.3B	NASA Policy for Limiting Orbital Debris Generation
☐		NASA Reference Publication 1358: Systems Engineering "Toolbox" for Design-Oriented
☐	NASA/SP-2007-6105	NASA Systems Engineering Handbook (entire document)
☐		Fault Tree Handbook with Aerospace Applications: http://www.hq.nasa.gov/office/codeq/doctree/fthb.pdf
☐		History of Aerospace Problems, Their Solutions, Their Lessons" by Robert S. Ryan: NASA Technical Paper 3653
☐	NSS 1740.14	Guidelines and Assessment Procedures for Limiting Orbital Debris
☐	NASA-STD-8719.7	Facility System Safety
☐	NPR 8715.5	Range Safety
☐	NPR 8705.2A	Human-Rating Requirements and Guidelines for Space Flight Systems
☐	NASA/SP-2007-6105	NASA Systems Engineering Handbook (entire document)
☐	NASA Reference Publication 1358	Systems Engineering "Toolbox" for Design-Oriented Engineers (entire document)

SMART System Safety Course Descriptions

Icons Used in this Section:

Online course

Webinar course

Classroom course

Course hours

ENABLING TRAINING

Decision Analysis For STEP
SMA-CORE-WBT-DA

This 2 day class is designed to provide the tools necessary to improve the quality of a factually based decision-making process for resolving technical issues at NASA. You will learn how to work in team situations to analyze a problem and make a decision based on group-generated alternatives. Note: This computer based course is a video capture of the Instructor-Led Decision Analysis course.

Risk Management For STEP
SMA-CORE-WBT-RM

This 8-hour course provides an overview of the new NASA Risk Management (RM) process required by NPR 8000.4A, Agency Risk Management Procedural Requirements, including step-by-step coverage of its two constituent processes: Risk-Informed Decision Making (RIDM) and Continuous Risk Management (CRM), how and why they must be fully integrated, and how they function together and interact with one another in the NASA organizational hierarchy. The course contains technical background and concepts; coverage of the NPR definitions, functional roles, and requirements; and "how to" content from applicable NASA handbooks (including extensive material from the new NASA Risk-Informed-Decision Making handbook, NASA/SP-2010-576). A simplified planetary science mission example is used throughout the course to illustrate the key learning points.

Fundamentals Of Systems Engineering For STEP
SMA-CORE-ILT-FSE

This course introduces the methods and techniques for a structured systems development process that proceeds from requirements to concept to production to operation and is based upon NASA policy guidelines, specifically NPR 7123.1A and 7120.5D. The NASA practice of systems engineering is the glue that works across all engineering and project management disciplines to tie customer needs to the right solution. Systems engineering focuses on the interfaces between the people, processes, and products that are often outside the responsibility of any one function or discipline. This course equips your teams with the knowledge necessary to realize successful solutions.

The course is structured as a five-day class with an option to provide additional hands-on systems engineering life cycle experience, to include a focused activity such as a project review, for example, SRR, PDR or CDR, or another life cycle activity tailored to meet a specific Center need.

ELECTIVE TRAINING

Basic Fault Tree Analysis I
SMA-Risk-OSMA-0009

This one-day course will provide a basic understanding of the use and development of Boolean logic-based models such as fault trees. The course covers the topics of the history of fault tree analysis; basic events and associated probability concepts; basic reliability modeling; common logic gate types; strengths and limitations of logic-based models; and construction methods for fault tree analysis. NOTE: A video-recorded version of this course is in development and should be available August, 2010.

Risk-Informed Decision Making (RIDM)
SMA-RISK-OSMA-0013

This 8-hour course provides detailed coverage of Risk-Informed Decision Making, one of the two processes that comprise NASA Risk Management (RM) as required by NPR 8000.4A, Agency Risk Management Procedural Requirements. It is intended as a follow-on to the 8-hour Risk Management course, of which RIDM is a part. Its content is based on the NASA RIDM Handbook (NASA/SP-2010-576), and it provides detailed guidance for implementing RIDM, with a specific focus on programs and projects in the Formulation Phase.

The course provides in-depth coverage of the six steps of the RIDM process, illustrating the key learning points of each with a notional planetary science mission example that serves as the basis for in-class student exercises. Topics to be addressed include developing performance objectives and performance measures from stakeholder expectations; structuring and pruning trade trees; conducting interdisciplinary risk analyses that span organizational boundaries; translating risk tolerances into performance commitments; and structuring deliberations to assure appropriate consideration of risk.

The course also includes presentation and discussion of selected examples from within NASA that show how elements of RIDM have been applied at the agency prior to the issuance of the NPR and Handbook, how the RIDM process has built upon best practices, and where it has striven to advance best practice. Additionally, the course addresses RIDM process interfaces across organizational boundaries and with the Continuous Risk Management (CRM) process.

This course is intended for NASA program, project, mission support, institutional, systems engineering, safety and mission assurance personnel, and others who wish to play a role in bringing about improved decision making anywhere in the Agency. NOTE: A video-recorded version of this course is in development and should be available September, 2010.

System Safety Fundamentals
SMA-SAFE-NSTC-0002

This course instructs the student in the fundamentals of system safety management and hazard analysis of hardware, software, and operations. Basic concepts and principles of the analytical process are stressed. The student is introduced to NASA publications that require and guide safety analysis, as well as to general reference texts on subject areas covered. Types and techniques of hazard analysis are addressed in enough detail to give the student a working knowledge of their uses and how they are accomplished. Skill in analytical techniques is developed through the use of practical exercises worked by the students in class. This course establishes a foundation for the student to pursue more advanced studies of system safety and hazard analysis techniques while allowing students to effectively apply their skills to straightforward analytical assignments. NOTE 1: This course is a combination of SMA-SAFE-NSTC-0008 (System Safety Workshop) and SMA-SAFE-NSTC-0015 (System Safety Special Subjects). Students who have taken either of these classes should discuss taking this class with the NSTC management staff. NOTE 2: A video-recorded

version of this course is in development and should be available October, 2010.

System Safety I
SMA-RISK-OSMA-0011

This one-day course will provide an overview of system safety practices that are consistent with the Agency's safety and risk management policies. The course will address safety-relevant attributes and uncertainty of system design as well as attributes of the analysis of safety performance, with a view to assuring that the analysis – through a documented safety case – validly supports safety decision-making. It is aimed at engineers and provides an integrated structure for scoping safety analysis principles and goals; identifying and controlling hazards; and supporting mission implementation. Regarding design attributes, the course will address formulation of practical, system-specific safety requirements and hazard controls to guide design at early stages of system development. With regard to analysis attributes, in order to support safety decision-making at later stages of system lifecycle (e.g., analysis to confirm expected safety performance of a given design), the course will address safety-case protocols for safety analysis. These protocols correspond to the nature of the safety demonstration required for decision-making. For example, addressing a high-level safety goal requires certain elements in the system safety approach, including analysis protocols supporting an integrated assessment of risk, explicit performance commitments that are consistent with satisfaction of the goal, and the means to verify performance in the actual implementation of the system. NOTE: A video-recorded version of this course is in development; its availability is TBD.

Probabilistic Risk Assessment Methods (PRAM) for Practitioners and Managers
SMA-RISK-OSMA-0001

This three-day course covers the applicability of Probabilistic Risk Assessment (PRA) to NASA programs and activities, the state-of-the-art PRA methodology for aerospace applications. The course begins with a management introduction to PRA and its role in risk-informed decision making. Following this introduction, major concepts used in PRA are discussed. Case studies of PRA application to design concepts are also presented in this workshop. NOTE: A video-recorded version of this course is in development and should be available November, 2010.

OPTIONAL TRAINING

Basic Fault Tree Analysis II
SMA-Risk-OSMA-0010

This two-day course will help develop practitioner user level skills in performing fault tree analysis, including the topic of fault tree to event tree linking approaches. The course, through the use of discussion and examples, provides hands-on modeling experience. At the completion of this course, the student will be able to:

- Use aleatory failure models for basic events
- Model super-components in fault trees
- Evaluate dependent failure analysis
- Describe the treatment of logic loops
- Discuss Boolean logic model quantification
- Discuss time-dependent issues

NOTE: A video-recorded version of this course should be available August, 2010.

Probability and Statistics I
SMA-RISK-OSMA-0005

This one-day course provides an overview of quantitative concepts from the fields of probabilistic modeling, statistics, and reliability theory that arise frequently in probabilistic risk assessment (PRA). Through lecture and example problems, participants are presented with mathematical techniques from probability and statistics that have applications in current PRA. This course is intended for the familiarization of NASA program, project, mission support, institutional, systems engineering, and safety and mission assurance personnel who wish to become more effective participants in their organizational units' applications of probabilistic techniques. NOTE: A video-recorded version of this course (SMA-SS-WBT-0005) is also currently available.

Probability and Statistics II
SMA-RISK-OSMA-0006

This two-day course explores advanced applications of Bayesian statistical inference in risk assessment through lectures and hands-on case studies using numerical tools. The emphasis is on practical calculations using modern tools rather than on theory. At the completion of this course, the student will be able to:

- Describe of Bayesian probability concepts
- Apply Probabilistic Modeling Techniques
- Describe Common Inference Methods
- Perform Uncertainty Propagation for typical risk assessment models
- Discuss Model Validation

NOTE: A video-recorded version of this course is in development and should be available September, 2010.

Accident Precursor Analysis I
SMA-RISK-OSMA-0007

This one-day course will provide a basic understanding of the use and application of the NASA accident precursor analysis (APA) process. Its content is based on the NASA Accident Precursor Analysis (APA) Process Guide Ver 1.0. Content includes an overview of the NASA APA process, the technical details and purpose of the various steps in the APA process, interspersed with opportunities for student participation throughout the course to illustrate the key learning points. This course is intended for NASA program, project, mission support, institutional, systems engineering, and safety and mission assurance personnel who wish to get a top-level understanding of NASA's accident precursor analysis process.

Accident Precursor Analysis II
SMA-RISK-OSMA-0014

This two-day course will provide a basic understanding of the use and application of the NASA accident precursor analysis (APA) process. The course covers the general APA methodology; APA process roles and responsibilities; building a caseload for APA; generalizing an anomaly failure mechanism to other potential occurrences; grading a an anomalous condition for risk modeling, observation and trending, or no further action; and the insight into system risk that the APA process is designed to produce.

Application of Simulation Techniques to Safety Analysis
SMA-RISK-OSMA-0015

This course will provide a basic understanding of the use and application of the NASA accident precursor analysis (APA) process. The course covers the general APA methodology; APA process roles and responsibilities; building a caseload for APA; generalizing an anomaly failure mechanism to other potential occurrences; grading a an anomalous condition for risk modeling, observation and trending, or no further action; and the insight into system risk that the APA process is designed to produce. At the completion of this course, the student will be able to:

- Describe the distinguishing features of an accident precursor
- Identify the APA process roles and responsibilities
- Identify potential sources of anomaly data to which the APA process may be applied
- Discuss the identification of an anomaly's failure mechanism
- Discuss anomaly failure mechanism generalization
- Describe the process for assessing and grading a GPF
- Discuss the roles that risk modeling and observation and trending play in the APA process
- Discuss the insight into system risk that the APA process is designed to produce

Management of Space Technology for STEP
SMA-SS-ILT-MSTP

24

This three-day course examines the dynamics of organizational management at NASA. Participants will examine these dynamics at the technical, organizational and political level-of-analysis. The interrelationships among these levels influence program/project management processes and outcomes that determine whether implementation of complex space projects is met with success or failure. Participants will learn how NASA project practitioners and systems engineers dealing with systems integration work navigate between the development of complex space technology to achieve technical excellence and specific operational methods, namely systems management practices, project management, and systems engineering are explored.

Project Planning Analysis And Control For Step
SMA-SS-ILT-PPAC

40

This five-day course offers a foundation in program planning, analysis, and control and provides intensive instruction in project management fundamentals across the entire project life cycle. Course content covers the areas of technical integration of project elements, design and discipline functions, and their associated interactions to balance performance, cost, schedule, reliability, and operability. Proven strategies and practical tools for planning, executing, and controlling a variety of projects are presented.

System Safety II
SMA-RISK-OSMA-0012

21

This two-day course is aimed at exploring in greater depth the concepts outline in System Safety I. One key topical area of this course is aimed at improving awareness of the factors that contribute to uncertainty in system safety models (both probabilistic and deterministic), and the need to identify, characterize and communicate the uncertainties, assumptions, and biases. The course will describe why it is the responsibility of the system safety analyst is to explicitly understand and communicate those assumptions, the limits of model applicability, and the uncertainty in the output.

SMART Software Assurance Curriculum

ENABLING TRAINING

Enabling Training is comprised of three topics that every SMART Mentee must know: Decision Analysis (DA), Risk Management (RM) and Fundamentals of Systems Engineering (FSE).

√	Hours	Course Title		STATUS: (as of 12/2010)
☐	16	Decision Analysis for STEP		Available
☐	8	Risk Management for STEP		Avail Nov, 2010
☐	40	Fundamentals of Systems Engineering for STEP		Available; ILT

ELECTIVE TRAINING

Elective training provides more Software Assurance-specific training that builds on the Level 1 "Basics of Software Assurance" course.

Note: The "Q", "R" and "S" designations at the end of the course titles indicate three specialty areas of: (1) Software Quality and V&V, (2) Software Reliability, and (3) Software Safety. The SMART Mentor and Mentee will decide which specialty is more appropriate for the job tasks assigned.

√	Hours	Course Title		STATUS:
☐	2	Basics of Software Assurance for Practitioners		Available
☐	24	Intermediate Software Quality Assurance		Avail Dec, 2010
☐	8	Introduction to Software Reliability Engineering - R		Available
☐	40	Software System Safety - S		Avail Nov2010

OPTIONAL TRAINING

Optional Training Optional Training provides the Mentee targeted topics that may either be related to job-specific duties or of future interest.

√	Hours	Course Title	STATUS
☐	8	Introduction to Software Testing	Avail Dec, 2010
☐	24	Intermediate Software Testing	Available; ILT
☐	1	Corrective Actions and Problem Reporting System Overview	Avail May, 2011
☐	10	Formal Inspections: A Perspective-Based Approach	Available; ILT
☐	16	Software Auditor Skills	Available; ILT
☐	16	Software Configuration Management and Data Management	Avail Jan, 2011
☐	1	Overview Of NASA Software Independent Verification & Validation - Q	Avail Jan, 2011
☐	16	Software Verification And Validation - Q	Avail Jan, 2011
☐	1	Overview Of Formal Methods – Q, R	In Development
☐	2	Overview Of Software Safety - S	Available
☐	16	Introduction And Assurance Of Complex Electronics	Avail Feb, 2011
☐	24	Introduction to CMMI	Available; ILT
☐	2	Safety Of Complex Electronics	Avail Jan, 2011
☐	8	Software Failure Modes, Effects, And Criticality Analysis, And Fault Tree Analysis	Avail Jan, 2011
☐	24	Software Requirements Definition, Development, And Management	Available; ILT
☐	2	System And Software Certification	In Development

☐	24	Software Assurance Planning And Management - Q	Available; ILT
☐	4	Introduction To Formal Methods – Q, R	In Development
☐	40	Intermediate Software Reliability – R	Available; ILT
☐	30	Software Safety For Practitioners - S	Available; ILT

(Software Assurance Course Descriptions begin on page 33.)

READINGS AND RESOURCES

Reference Material includes readings and resources that relate to the above listed courses. Depending on the Mentee's assigned job tasks, the Mentor will prioritize the following resources in the order to be completed.

√	Reference #	Resource title
☐	NASA -STD-8739.8	SW Assurance Standard
☐	NASA-GB-8719.13	SW Safety Guidebook
☐	NASA-GB-8739.8	SW Assurance Guidebook
☐	NASA-STD-8719.13	SW Safety Standard
☐	NPD 8700.1	NASA Policy for Safety and Mission Success
☐	NPR 7150.2	SW Engineering Requirements
☐	NPR 8000.4	Risk Management
☐	NPR 8715.3	NASA General Safety Program Requirements
☐	NPR 8705.6	Safety and Mission Assurance Audits, Reviews, and Assessments
☐	NPD 8720.1	NASA Reliability and Maintainability Program Policy
☐	NPR 7120.5	NASA Program and Project Management Processes and Requirements
☐	NPR 7123.1	NASA Systems Engineering Processes and Requirements
☐		Simulations and Models
☐		SEI-CMMI Software Engineering Institute Capability Maturity Model Integrated
☐	NASA-STD-2202-93	Software Formal Inspections Standard
☐	NASA Handbook 8719.X	Complex Electronics
☐	NASA-GB-A301	Software Quality Assurance Audits Guidebook
☐	NASA-GB-A302	Software Formal Inspections Guidebook
☐		Center Specific documents to be determined by each Center

SMART Software Assurance Course Descriptions

Icons Used in this Section:

Online course | **Webinar course** | **Classroom course** | **Course hours**

ENABLING TRAINING

Decision Analysis For STEP
SMA-CORE-WBT-DA

This 2-day class is designed to provide the tools necessary to improve the quality of a factually based decision-making process for resolving technical issues at NASA. You will learn how to work in team situations to analyze a problem and make a decision based on group-generated alternatives. Note: This computer based course is a video capture of the Instructor-Led Decision Analysis course.

Risk Management For STEP
SMA-CORE-WBT-RM

This 8-hour course provides an overview of the new NASA Risk Management (RM) process required by NPR 8000.4A, Agency Risk Management Procedural Requirements, including step-by-step coverage of its two constituent processes: Risk-Informed Decision Making (RIDM) and Continuous Risk Management (CRM), how and why they must be fully integrated, and how they function together and interact with one another in the NASA organizational hierarchy. The course contains technical background and concepts; coverage of the NPR definitions, functional roles, and requirements; and "how to" content from applicable NASA handbooks (including extensive material from the new NASA Risk-Informed-Decision Making handbook, NASA/SP-2010-576). A simplified planetary science mission example is used throughout the course to illustrate the key learning points.

Fundamentals Of Systems Engineering For STEP
SMA-CORE-ILT-FSE

This course introduces the methods and techniques for a structured systems development process that proceeds from requirements to concept to production to operation and is based

upon NASA policy guidelines, specifically NPR 7123.1A and 7120.5D. The NASA practice of systems engineering is the glue that works across all engineering and project management disciplines to tie customer needs to the right solution. Systems engineering focuses on the interfaces between the people, processes, and products that are often outside the responsibility of any one function or discipline. This course equips your teams with the knowledge necessary to realize successful solutions.

The course is structured as a five-day class with an option to provide additional hands-on systems engineering life cycle experience, to include a focused activity such as a project review, for example, SRR, PDR or CDR, or another life cycle activity tailored to meet a specific Center need.

ELECTIVE TRAINING

Basics Of Software Assurance For Practitioners
SMA-SA-WBT-100

Basics of Software Assurance For Practitioners is designed for new practitioners in software assurance or those in the discipline who need a refresher.

The course provides a basis for understanding the importance of software assurance in making NASA missions and programs safer. You will be introduced to the software assurance components of software quality, software safety, software reliability, software verification and validation, and software independent verification and validation. You will gain a good understanding of how software assurance activities complement those of software engineering throughout the development life cycle. You will also learn what the software assurance responsibilities are for software providers and software acquirers.

Intermediate Software Quality Assurance
SMA-SA-WBT-201

Intermediate Software Quality Assurance is an in-depth course that teaches the purpose, concepts, roles and responsibilities, tools, techniques and products of software quality assurance, software quality engineering and software quality control of products and processes throughout the software development lifecycle. Software quality assurance roles and responsibilities from the perspective of a software acquirer and provider will be explained. Software assurance activities in support of other activities such as verification & validation, configuration management, problem reporting and corrective action, risk management, software project planning and management and software acquisition will also be described. The course will also provide a high level overview of developing a software assurance plan

Introduction to Software Reliability Engineering - R
SMA-SA-WBT-240

Introduction to Software Reliability Engineering is a beginning level course that introduces the basic concepts and activities of software reliability engineering. The course content will cover how software reliability is a part of system reliability, differences between software and hardware reliability, and basic concepts in designing for, analyzing, and predicting reliability. Examples of unreliable computing are also presented. The course focus is on practical suggestions and not theory.

Software System Safety - S
SMA-SA-WBT-231

This course discusses applications of systems safety concepts, principles, and techniques to the development of software, based primarily on NASA-STD-8719.13. Course topics include an overview of system safety and of software development, NASA requirements for software system safety, setting up a software system safety program, implementing a software system safety program, software hazard analysis including the application of Fault Tree and Failure Modes and Effects Analysis (FMEA) to software, software system safety design techniques, and software system safety assurance techniques.

OPTIONAL TRAINING

Introduction to Software Testing
SMA-SA-WBT-202

This is a beginning level course for software engineers, software assurance, and other professionals that are involved in the development, testing, assurance, and verification and validation of software. The course will provide participants with an overview of software testing levels, testing approaches, activities, and documents. Types of testing such as white box, black box, model based, functional, stress, and regression are taught. Participants are also introduced to test documentation (e.g., plans, procedures, cases, reports).

Intermediate Software Testing
SMA-SA-ILT-301

This is an intermediate level course for software engineers, software assurance and other professionals that are involved in the development, testing, assurance, and verification and validation of software. The course will provide participants with a thorough understanding of software testing approaches, activities, and documents. Participants learn how to define, implement, analyze and assess testing activities that occur during system development, acceptance, and maintenance. Types of testing such as white box, black box, model based, functional, stress, and regression are taught as well as considerations in testing such as coverage, traceability, and system safety. Test planning and management are also covered. Participants are also taught how to develop test documentation (e.g., plans, procedures, cases, reports).

Corrective Action and Problem Reporting Systems Overview
SMA-QE-WBT-261

This course discusses the topics of corrective actions, problem reporting and reporting systems including an introduction to root cause analysis.

Formal Inspections: A Perspective-Based Approach
SMA-SOFT-NSC-1004

Software inspection is a well-defined review process for finding and fixing defects in work products from all phases of software development.

Inspections have proven time and again to be one of the most effective practices available for ensuring quality software and on-time deliveries. Many studies have demonstrated their benefits, both within NASA and across many industrial organizations, including:

- Reduced cost and improved quality by reducing rework. Studies have shown that the rework effort saved not only pays for the effort spent on inspections, but also provides additional cost savings on the project. By removing defects at their origin, inspections prevent them from propagating through multiple phases and work products, and reduce the overall amount of rework necessary on projects.
- Improved software team efficiency: Side-effects of inspection meetings include improving team communication, more quickly bringing new members up to speed, and educating project members about effective development practices.

This training course provides all the information needed for conducting software inspections on a project.

Software Auditor Skills
SMA-SOFT-NSC-1006

Software Auditing is a detailed course that provides knowledge and skills in conducting software audits. The course content covers auditing terms; audit roles and responsibilities; types of audits; specific software assurance audits including FCA& PCA; conducting audits; planning audits; documenting audits; determining findings and nonconformances; taking corrective action, audit follow-up and closure; good auditor qualities, ethics, legal, professional concerns. NOTE: A Web-based version of this course is in development and should be available December, 2010.

Software Configuration Management And Data Management
SMA-SA-WBT-204

Software Configuration Management (SCM) is an introductory level course that explains the importance of SCM and data management; defines terms; introduces standards, describes the activities and products of the core processes (identification, control, status accounting, and verification); identifies elements of SCM and DM plans; describes the SCM infrastructure; describes software builds and releases, and describes SCM audits.

Overview of NASA Software Independent Verification And Validation - Q
SMA-SA-WBT-220

Overview of NASA Software Independent Verification and Validation (IV&V) is a high-level course that describes NASA's approach to IV&V and the work that is performed by its IV&V Facility. While it doesn't present in detail the processes of the NASA IV&V Facility, it does provide a participant with insight into what types of activities are performed and why.

Software Verification and Validation - Q

SMA-SA-WBT-221

Software verification and validation is an in-depth course that teaches the purpose, concepts, roles and responsibilities, tools, techniques and products of software V&V. The course identifies the role of V&V, describes the performance of V&V activities, and identifies V&V issues throughout the development life cycle. The course also discusses independent verification and validation (IV&V) and explains the industry best practices and approaches and requirements for IV&V. Planning V&V efforts is also described.

Overview Of Formal Methods – Q, R
SMA-SA-WBT-222

TBD

Overview of Software Safety - S
SMA-SA-WBT-230

Overview of Software Safety provides an introduction to the software safety discipline at NASA. The course introduces the NASA Software Safety Standard and Guidebook and explains how software safety integrates with a project's system safety program. The participant will be introduced to how safety-critical software is determined and to the software safety activities and products that are performed and produced throughout the software development and systems engineering life cycle.

Prerequisites Basic understanding of software engineering concept

Introduction and Assurance of Complex Electronics
SMA-SA-WBT-302

Complex electronics (CE) encompasses programmable and designable complex integrated circuits. These devices are becoming more prevalent in many of NASA's experiments, satellites, and spacecraft.

Introduction: The first part of this course will provide a general overview of complex electronics devices and where they fall within the hardware-to-software spectrum. It will also provide a history of integrated circuits and how they developed into complex electronics devices.

Design Overview: The second part of the course will show how complex electronics are designed, tested and verified, and how the design is "burned" into the hardware. In addition, the course will provide examples in Hardware Description Languages (HDLs) and future trends in the verification and assurance processes.

Assurance: The final part of the course begins with a brief review of the types of complex electronic devices and their characteristics. It provides an overview of the assurance process for these devices, including what to look for when evaluating them. Then it focuses on the specific assurance activities to be completed during each phase of the design cycle.

Introduction to CMMI
SMA-SA-ILT-303

This course introduces systems and software engineering managers and practitioners, appraisal team members, and engineering process group (e.g., SEPG, EPG) members to CMMI® fundamental concepts. CMMI models are tools that help organizations improve their ability to develop and maintain quality products and services. CMMI models are an integration of best

practices from proven, discipline-specific, process improvement models.

Safety of Complex Electronics
SMA-SA-WBT-304

This course will focus on the Safety aspects of complex electronics (CE). Safety deals with use, expected failures, human interfaces and reaction to its environment to name just a few areas. CE encompasses programmable and designable complex integrated circuits. “Programmable” logic devices can be programmed by the user and range from simple chips to complex devices capable of being programmed on-the-fly. These devices are commonly used within NASA systems, sometimes in safety-critical systems. Both software and quality assurance engineers need to understand what these devices are, where they are used, and how they are designed.

Software Failure Modes, Effects, and Criticality Analysis, and Fault Tree Analysis
SMA-SA-WBT-305

This is a detailed course on both Software Failure Modes, Effects, and Criticality Analysis (FMECA), and Software Fault Tree Analysis (FTA). The participants will learn how to develop a Failure Modes and Effects Analysis (FMEA) and critical items list (CIL) for software and how to use them to mitigate system risks. The participants will also learn how to perform a fault tree analysis on software and how to use the software fault trees to mitigate system risks.

Software Requirements Definition, Development, and Management
SMA-SA-ILT-306

This course is for software engineers, software assurance and other professionals who are involved in eliciting, documenting, evaluating and managing software requirements. Participants will learn techniques to gather, write, analyze and control software requirements.
Prerequisites: Completion of an introductory software engineering course

System and Software Certification
SMA-SA-WBT-307

This course explains the roles and responsibilities and the activities involved in certifying software in NASA safety-critical systems.

Software Assurance Planning and Management - Q
SMA-SA-WBT-320

Software Assurance Planning and Management is a course for personnel who plan and manage software assurance efforts. The course covers in detail how to develop a software assurance plan for small to large projects and of varying levels of complexity. Estimating resource needs and costs, planning and scheduling tasks, determining and assessing metrics for software assurance processes and products, managing software assurance records and assets, and procuring software assurance will also be covered. Management tools which aid in the above will also be introduced.
Prerequisites: Completion of Intermediate Software Quality Assurance, Software Safety for Practitioners, Intermediate Software Reliability, Software Engineering Management 301,

Software Acquisition, Intermediate CMMI, intermediate risk management

Introduction to Formal Methods- Q, R
SMA-SA-WBT-321

TBD

Intermediate Software Reliability - R
SMA-SA-WBT-340

Intermediate Software Reliability is a mid-level course. The course content will cover how a software reliability engineer will be able to comprehend and apply requirements and recommendations from the NASA Software Safety Standard, and Guidebook to projects. The participant will also be able to comprehend and apply technical ideas, principles, methods, and theories of the software reliability discipline and all of the software reliability activities throughout the lifecycle.

NOTE: A Web-based version of this course is in development and should be available January, 2011.

Prerequisites: Introduction to Software Reliability Engineering

Software Safety for Practitioners - S
SMA-SOFT-NSC-1005

Software Safety for Practitioners is a detailed course for professionals in systems engineering, systems safety, software safety, software engineering, and software assurance. Participants are introduced to planning, scoping, and tailoring software safety efforts for various types of software. The course teaches participants how to perform hazard analyses for software systems and identifies software safety analyses and activities that are performed throughout the development life cycle. Safety panels, boards and reviews are also explained.

Prerequisites: Completion of Overview of Software Safety, Fundamentals of System Safety, Introduction to Software Engineering, and Fault Tree Analysis courses. Completion of a Software FMEA course is also recommended.

SkillSoft Leadership Advantage –

Taking Leadership Development to the Next Level

SkillSoft Leadership Advantage (SLA) is a targeted executive leadership development program designed for mid- to upper-level executives and aspiring executives and leaders. The SkillSoft Leadership Advantage solution offers a selection of learning tracks each comprised of a collection of assets thoughtfully selected and organized by leadership experts.

SkillSoft Leadership Advantage is a targeted leadership development solution leveraging multiple modes of instruction, including text, video and interactive practice activities to keep the learning quick, easy and engaging. Through a series of targeted learning tracks, the SkillSoft Leadership Advantage provides current leaders and high potentials with a collection of focused resources targeting essential leadership and management skills. Recognizing that today's leaders are busier than ever, each learning track is designed to take no more than **one hour** from start to finish.

SkillSoft courses are available on-line (via SATERN) 24x7.

Login to SATERN https://satern.nasa.gov//customcontent/splash_page/SATERN_Splash.html

Select "Browse Catalog:

Scroll down to "SkillSoft Courseware" and click on the "twist" icon to open.

Scroll down to "SkillSoft Leadership Advantage" and click on the "twist" icon to open.

Most of the Curricula Titles you see are listed below in this document. Courses can be added by selecting "Add to Learning Plan".

An alternative way to locate and add individual courses is to use "Simple Catalog Search", uncheck everything except "on-line", type in course title, select "Search, locate the course and "Add to Learning Plan". To delete the course, select the "remove" icon on your Learning Plan.

CURRICULA TITLE	COURSE TITLE & DESCRIPTION	DURATION	SELECT √
ACCOUNTABILITY	**Confrontation: What's the Best Approach.** Managers often find confronting employees difficult and unpleasant. This Business Impact explores strategies for turning these confrontations into positive, win-win experiences.	.12	
	Demonstrating Accountability in a Crisis Situation. In business, accountability can apply to the individual, the team, and the organization, and assigning responsibility under normal circumstances is a straightforward proposition. But deciding issues of ownership in a crisis situation poses a unique challenge.	.25	
BUILDING AND LEADING TEAMS	**Building and Leading Teams.** Leading a team requires facilitating effective interaction between team members. This Challenge examines the importance of maintaining team participation and commitment in order to overcome obstacles collectively.	0.53	

COACHING	**Coaching.** Successful organizations employ coaching to develop individuals and teams. This Challenge Series product explores different approaches for coaching.	0.57	
COMPETITIVE AWARENESS AND STRATEGY	**Competitive Awareness and Strategy.** Maintaining a competitive edge is an on-going process. This Challenge product focuses on Competitive Awareness and Strategy.	0.60	
CUSTOMER FOCUS	**Creating a Customer-focused Organization.** This Challenge Series exercise considers the many ways that business organizations can serve their customers - internal and external.	0.25	
DELEGATION	**Delegating Appropriate Tasks.** Delegating tasks requires careful consideration. This Business Impact explores strategies for delegating tasks to employees.	0.12	
	Developing Adaptable Managers. To meet the challenge of the new economy, businesses must reassess how they train and groom their emerging leaders in order to produce highly flexible and adaptable managers. This Business Impact suggests a five-step strategy for developing tomorrow's managers today.	0.07	
	Developing Employees through Delegation. Skillful delegation creates a true win-win situation: It allows managers to leverage their strengths and focus on strategy while giving team members opportunity to learn and grow. This Challenge Series exercise focuses on how to best develop employees through the practice of delegation.	0.25	
DEVELOPING A BUSINESS EXECUTION CULTURE	**Fostering a Business Execution Culture.** Even the best-conceived business strategies can flounder when the philosophies of senior management fail to translate in daily practice. This Business Impact explores the benefits of establishing and encouraging an execution-driven culture within your company.	0.08	
	Inspiring Your Team. This Business Impact explores the challenges leaders face when trying to find unique, appropriate, and effective methods to motivate team members to attain and surpass goals.	0.08	
	Developing a Business Execution Culture. A corporate initiative requires more than just a managerial mandate. Employee buy-in is absolutely essential to ensure success. This challenge focuses on methods for developing a business execution culture.	0.25	
DEVELOPING PEOPLE	**Preventing High Turnover Rates: How to Keep the Best.** While some turnover is unavoidable, companies must take proactive	.12	

	steps minimize its effect. This Business Impact explores retention strategies for holding on to top performers.		
	Developing People .All companies need to develop their employees. This Challenge examines how organizational restructuring can provide development opportunities.	.25	
ETHICS, INTEGRITY AND TRUST	**Building Trust Incrementally.** Trust in a manager is not a given. This Business Impact focuses on a new manager's challenge of winning the trust of her team.	.12	
	Ethics, Integrity, and Trust. Managers often face complex ethical dilemmas. This Challenge examines a situation that requires taking obligations, duties, and responsibilities into consideration.	.25	
GIVING AND RECEIVING FEEDBACK	**Criticism in Context.** Receiving criticism is rarely a pleasant experience. Yet, it can provide considerable opportunity for personal growth. This Business Impact explores some possible strategies for processing feedback in a useful manner.	.08	
	Giving Appropriate Feedback. Effective feedback requires consideration and forethought. This challenge focuses on methods for giving appropriate feedback.	.25	
INFLUENCE AND PERSUASION	**Influencing Key Decision Makers.** Even the best business proposals need the support of stakeholders. This Business Impact takes a look at three proven ways to gaining the support of key decision makers.	.08	
	Influence and Persuasion. Influencing and persuading others requires careful planning. This challenge explores focused methods of verbal influence and persuasion.	.25	
LEADER AS A MOTIVATOR	**Employee Exhaustion: Managing a Well-balanced Workload.** The possibility of employee burnout can threaten productivity. This impact examines strategies for balancing workloads.	.12	
	Leader as Motivator. Motivating employees isn't easy. This Challenge examines what leaders can do to create workplace environments where people feel motivated.	.25	
LEADING CHANGE	**Involving Employees in Corporate Change.** Given the potentially disruptive impact of change to business organizations, it's imperative that companies strive to find strategies to involve their employees in the transition process. This Business Impact highlights a number of effective approaches.	.07	
	Leading Change. Although often a force of progress, change can be disruptive to employees. This challenge focuses on methods for successfully managing change.	.25	

LEADING INNOVATION	**Executing Innovation.** Each innovation lifecycle is unique, but there are certain elements that successful innovations have in common. This Business Impact explores four critical components of executing innovation.	0.8	
	Wanted-Innovation Leaders. Innovation is important to growth. This impact explores how to nurture innovation leaders	0.8	
	Leading Innovation. Ideas don't come from thin air. This Challenge focuses on the on-going process for brainstorming and developing innovative advances.	0.25	
MANAGING CONFLICT	**Confrontation: What's the Best Approach.** Managers often find confronting employees difficult and unpleasant. This Business Impact explores strategies for turning these confrontations into positive, win-win experiences.	0.12	
	Facilitating Work-related Conflict Discussions. Project team conflict isn't always interpersonal in nature. Sometimes, it's work-related. This impact explores work-related conflict.	0.07	
	Using Conflict to an Organizations' Advantage. Using Conflict to an Organizations' Advantage explores how to manage conflict proactively, and turn it to a team's advantage.	0.12	
	Managing Conflict. While often considered destructive, conflict can prove beneficial if properly managed. This challenge focuses on methods for managing conflict.	0.25	
		0.12	
MANAGING DIVERSITY	**Understanding Workplace Diversity.** Differences and similarities of ethnic, cultural, and family background are only part of a comprehensive approach to workplace diversity. Here we consider additional elements that are crucial aspects of the diversity mixture in today's business world.		
	Managing Diversity. Leveraging diversity is a key for all organizations. This Challenge examines how diversity elements relate to business strategy.	0.25	
MANAGING PERFORMANCE	**Communicating a Shared Vision.** Communicating a Shared Vision shows how providing a project team with a vision, can help improve team motivation and ensure project success.	0.12	
	Underperforming Employee - Now What? Most managers have dealt with underperforming employees at one time or another. This Business Impact examines how to use turnaround agreements effectively.	0.08	
	Managing Performance. In order to best address performance of individuals and groups, managers must apply a comprehensive approach. This challenge focuses on methods for managing performance.	0.25	
PERSEVERANCE	**Perseverance and Flexibility in Times of Crisis.** Strong leaders	.57	

AND FLEXIBILITY	need to demonstrate a careful balance of perseverance and flexibility. They must know when to press on despite obstacles and opposition. And they must also know when to alter course. This Challenge Series exercise explores the various aspects of perseverance and flexibility that leaders need to consider when faced with an apparent setback.		
PROBLEM SOLVING AND DECISION	**Playing the Devil's Advocate in Decision Making.** Good decision making lies at the heart of success. This impact explores a strategy for ensuring that business decisions are sound.	0.12	
	Uncovering the Root Problem. This Challenge exercise focuses on an individual's ability to assess facts and work through the first step in problem solving and decision making: defining the problem.	0.25	
PROJECT MANAGEMENT ESSENTIALS	**Project Management Essentials.** Managing projects is a key function of leadership. This challenge examines methods for overseeing project teams and managing stakeholder expectations.	0.60	
SETTING AND MANAGING PRIORITIES	**Setting and Managing Priorities.** Prioritizing is an essential skill for any manager. This challenge considers methods for selecting and setting goals.	0.25	
STRATEGIC THINKING	**Wanted-Innovation Leaders.** Innovation is important to growth. This impact explores how to nurture innovation leaders.	0.08	
	Hiring Strategic Thinkers. Business strategy requires long-range planning. And to think strategically, effective business leaders must possess both logical and creative insight to be able to plot the future course of their company. This Challenge Series exercise focuses on how to identify and select truly strategic thinkers.	0.25	
THE EMOTIONALLY INTELLIGENT LEADER	**Managing the Stress of Organizational Change.** Organizational change has become commonplace in today's business world. This Business Impact examines the challenges an employee faces when his company restructures into a decentralized organization.	0.12	
	The Emotionally Intelligent Leader. Effective emotional competence requires focused self-development. This challenge examines the skills and attitudes necessary for mastering emotions in the workplace.	0.25	