Enhancing Systems Engineering Planning and Practices

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RSESC/Army –
Cost Sharing Cooperative Agreement Initial Goals

- In August 2002 UAH was competitively awarded cooperative agreement – AMRDEC/PEO Aviation and UAHuntsville
  - Establish a technical center to elevate rotorcraft knowledge and skill levels in Northern Alabama headquartered at UAHuntsville.
  - Establish degreed SE academic programs
  - Provide System Engineering Support to Redstone agencies
  - Support the sustaining engineering needs of the Army Aviation
  - Life Cycle Management
    - Systems Engineering
    - Reliability Centered Maintenance
    - Helicopter Aerodynamics

$1.1 Million Investment by UAH

RSESC

- Multifaceted Organization Focused on Applied Systems Engineering
- Independent Assessments
- Systems Engineering Support
- Hardware Design, Analysis, Fabrication and Testing
- Non Destructive Testing and Evaluation
- Reverse Engineering
- Health Monitoring
- Damage Tolerance

- Projects funded through NASA, PEO Aviation, PEO Missiles and Space, OSD, and Industry

Education and Training

- Developed two new Master of Science Programs
  - Rotorcraft Systems Engineering
  - Missile Systems Engineering
- 56 Master of Science Degrees Conferred – Redstone Engineers
- 2 Current PhD students
- Developing two new AMRDEC / PEO related curricula
  - Reliability Engineering
  - Acquisition Engineering

RSESC Curriculum
MSE–Rotorcraft & Missile Systems Eng.

1st Semester
- Selected Topics in Mathematics
- Statistical Methods for Engineers
- Aircraft Stability and Control

2nd Semester
- Helicopter Theory
- Aerospace Systems Engineering
- Rotorcraft Design I

3rd Semester
- Rotorcraft Design II
- Performance Flight Testing
- Modeling and Simulation

4th Semester
- Engineering Reliability
- System Safety
- Aviation Systems Simulation

1st Semester
- Missile Aerodynamics
- Rocket Propulsion
- Aero Systems Engineering

2nd Semester
- Missile Design
- Graduate Engineering Analysis
- Statistical Methods

3rd Semester
- Stability and Control
- Performance Flight Testing
- Reliability Engineering

4th Semester
- System Simulation
- System Modeling & Analysis
- Integrated Product & Process Design

RSESC Labs

- Two System Engineering Labs w/ full SE software resources
- Aero Simulation Lab
- Electrical and Mechanical Design and Manufacture Lab with a Machine Shop
- Modal Testing
- Environmental Testing
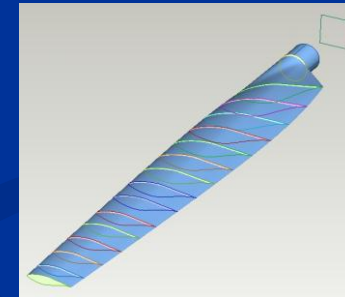- Systems Design and Testing Lab
- NDE/NDT

SE Planning, Design, Simulate, Develop, Fabricate and Test
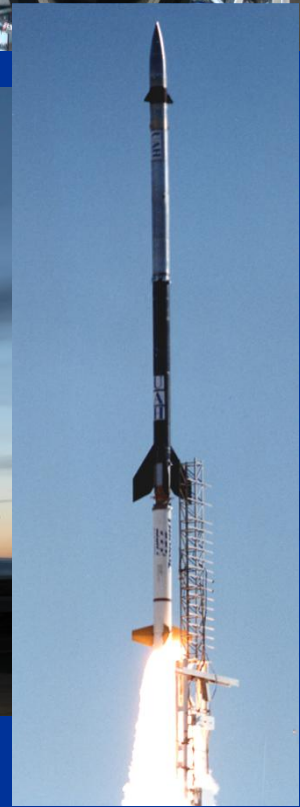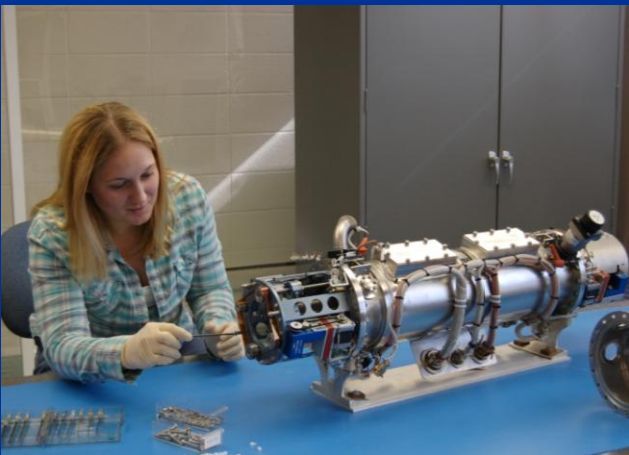
Design and Analysis
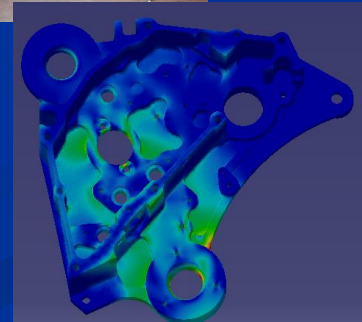
- Prototype Designs
- Independent Analysis
- Specialty Analysis

Systems Engineering Labs

Fully Integrated SE Lab

Analysis and System Engineering Software

Integrated with CAD Lab, Computer Cluster, Rapid Prototyping Machines

	KEY PERFORMANCE PARAMETERS		COMPANY 1		
	[GO / NO GO CRITERIA]		9780-0095/0129		9780-0073 / -0074	
K.P.P. 1	AC: 400Hz, 3 Phase, 115/200V, 47kVA Cont., 69kVA Peak		-	-	-	-
	DC: 28V, 210A Cont., 500A Peak		-	-	-	-
	HYD.: 12gpm @ 3350psig (start), 15gpm @ 3000psig (service)		GO	-	GO	-
	PNEU.: 30lb/min @ 30-50 psig		-	-	-	-

			Multi-Function Aerospace GSE #ACT95	
		KEY SYSTEM ATTRIBUTES	Yes/No	COMMENTS
	K.S.A. 1	Simultaneous Operations	YES	A/C, DC, Hydraulic and Pneumatic
	K.S.A. 2	Mobility	?	Trailer
	K.S.A. 3	Transportability	YES	L X W X H = 13' X 6.9' X 6.9' Weight = 7,700 lbs (wet)
	K.S.A. 4	Reliability	?	

Systems Engineering Toolkit
&
System Engineering Projects

Revitalization of SE in DoD

- In February 2004, the Department of Defense mandated the re-vitalization of systems engineering throughout all the services

- All acquisition category level programs were required to create system engineering plans (SEP)

- From this mandate the Office of the Deputy Under the Secretary of Defense (OSD) created a SEP Preparation Guide for all programs to follow.

Systems Engineering Plan

Preparation Guide

"Technical Planning for Mission Success"

Version 2.01
April 2008

Department of Defense

Office of the Deputy Under Secretary of Defense for Acquisition and Technology

Systems and Software Engineering Enterprise Development
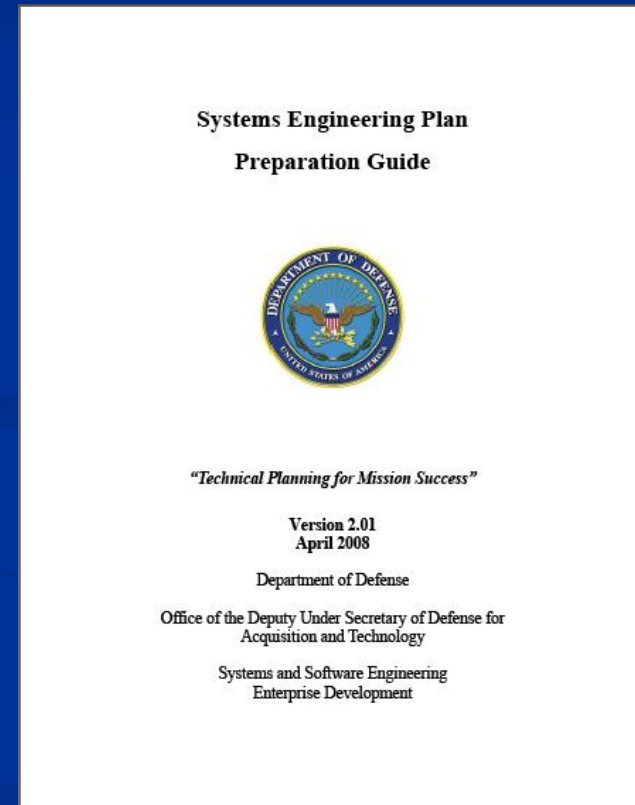
Problem Statement

- Systems Engineering is highly complex subject
- Data is required in many engineering fields
- Metrics need to be determined to ensure systems engineering is performed effectively and efficiently
- One method to collect data and to create metrics was through a web based SE tool

Solution

- The Rotorcraft Center's initial response to support PEO-Aviation and PEO-Missiles and Space in enhancing systems engineering planning was to create a checklist to ensure the requirements for systems planning were met in the SEP.

- This checklist evolved into the Systems Engineering Toolkit to ease the burden of creating a SEP and to create a means for metrics, sharing of information and application based learning to enhance systems engineering planning.

Metric/Effectiveness

- Real time training
- Improved means to determine of areas of difficulty
- Clear Indication of the amount of time to create the document
- Ability to collect statistics on users and level of experience
- Time spent planning rather than formatting and issues with writing a complex document

Systems Engineering Toolkit (SET)

- The Systems Engineering Toolkit presently assists in creating SEPs.

- It is anticipated that future versions will be composed of several systems engineering tools.

- The tool is

  - Configuration Controlled with Global Access

  - Web based for generating Plans and Technical Documents

  - Tailorable to the Projects Needs, Phase and ACAT Level

  - Modular/adaptable system to many different documents, applications, and phases

- Available to DoD agencies

SEP Preparation

- **SEP portion of the tool is created from:**
  - OSD Preparation Guide
  - DAG Guide
  - Briefings from OSD on SEP content
- **Beta Version of SET released June 2007**
- **SET Version 1.0 released March, 2008 based on SEP Guidance V. 2.01**

Title and Coordination Pages
Table of Contents
1. Introduction
   1.1 Pr
   1.2 Pr
   1.3 A
2. Systems
   2.1 Sy
   2.2 Sl
   2.3 Sy
   2.4 Te
   2.5 In

ODUSD (A&T) Systems and Software Engineering/Enterprise Development
ATL-ED@osd.mil

SEP Preparation Tool

Welcome to the System Engineering Toolkit (SET)

Please log in

User Name [   ]

Password [   ]

[Login]

New User?

Register for SET
Eligibility: DoD, All Service
Branches, Government
Contractors

Help

Support
Users' Guide

FAQs

How do I register for SET?
How do I reset my password?
What is SET?

- Integrated review process
- Eight types of users
- Currently creates SEP into PDF documents, unchangeable only from within the SET preparation tool
- Secure and controlled access to programs
- Allows multiple users working on the same document at any time

SEP Planning Tool

Navigation tree based on SEP Preparation Guide TOC

Colored Status Indicators

Multiple SEPs and Permission Levels Available to Users

Message Area

Change Log

SEP Planning Tool

Document Generation

- Configuration controlled with automatic change logs
- Creates two types of PDF documents

Systems Engineering Toolkit

- Benefits
    - Most up-to-date information
    - Ability to leverage strengths of other projects/programs
    - Uniformity of Process
    - Decrease Approval Timeline
    - Team-Based SEP Generation = Consistent Execution
    - Minimize "Shelf-Ware"
    - Means to collect metrics and best applied practices
- Ten Organizations interested in or using the tool
    - PEO Aviation
    - PEO Missiles and Space
    - Joint PEO Chemical & Biological Defense
    - NAVAIR in support of JPEO CBD
    - AMRDEC
    - TARDEC
    - PEO IEW&S
    - PEO C3T
    - PEO CS&CSS
    - Marines in support of JPEO CBD

UAHuntsville

21

UAHuntsville's Involvement in SE

- Partnership created with AMRDEC in Huntsville to support Project offices in SEP development
- Training, educating and mentoring on tools, metrics and teaming in relation to systems engineering
- Active member of the Army Systems Engineering Forum since its inception
- Reviewing and creating workshops in Systems Engineering Planning for PEO-Aviation, PEO-Missiles and Space and NASA/MSFC
- Developing processes to assist in SE activities for NASA/MSFC
- Determining the effectiveness of SE
- Teaming
- Tailoring for the SEMP and SE Processes
- Modeling and Simulation of SE Processes

CMSA
Center for Modeling, Simulation and Analysis

Industrial and Systems Engineering and Engineering Management
UAH College of Engineering
Industrial and Systems Engineering and Engineering Management

UAH College of Business Administration

Rotorcraft Systems Engineering and Simulation Center
UAH RSESC

SER-UARC

- January 23, 2008 OSD sent a notice regarding creating a Systems Engineering Research (SER) University Affiliated Research Center (UARC).

- UAHuntsville partnered with Stevens Institute of Technology, Univ. of Southern CA and 14 other universities

- Two initial tasks have been identified that RSESC will be involved in
  - SE Effectiveness
  - Evaluating Methods, Processes and Tools (MPTs)

U.S. Department of Defense
Office of the Deputy Under Secretary of Defense (Acquisition and Technology) Systems and Software Engineering

Summary

- Vast experience in applied systems engineering processes, hardware and software development to add value to overall project success
- Experience in Systems Engineering and the practices of OSD and NASA
- Utilizing graduate and undergraduates on research projects to combine theory with practical applications and to help mentor engineers and scientists entering in the workforce
- Willing to partner with other universities and organizations bringing together the best assets to the community
- Systems Engineering Toolkit (SET) is available to the DoD PM offices and NASA

UAHuntsville and the Rotorcraft Systems Engineering and Simulation Center is committed to becoming one of the top research centers for Systems Engineering