

Systems Engineering A Management Perspective

Goddard Space Flight Center
Systems Engineering Colloquium
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Points

- Systems engineering denotes different things to different people
- Systems engineering is critical to mission and programmatic success
- Non-technical factors inhibit the growth of a robust systems engineering capability
- Continuously Improving the Center's systems engineering capability is a challenging and important task for the Goddard Team

Systems Engineering

Source: Encarta Encyclopedia

1. Systems Engineering

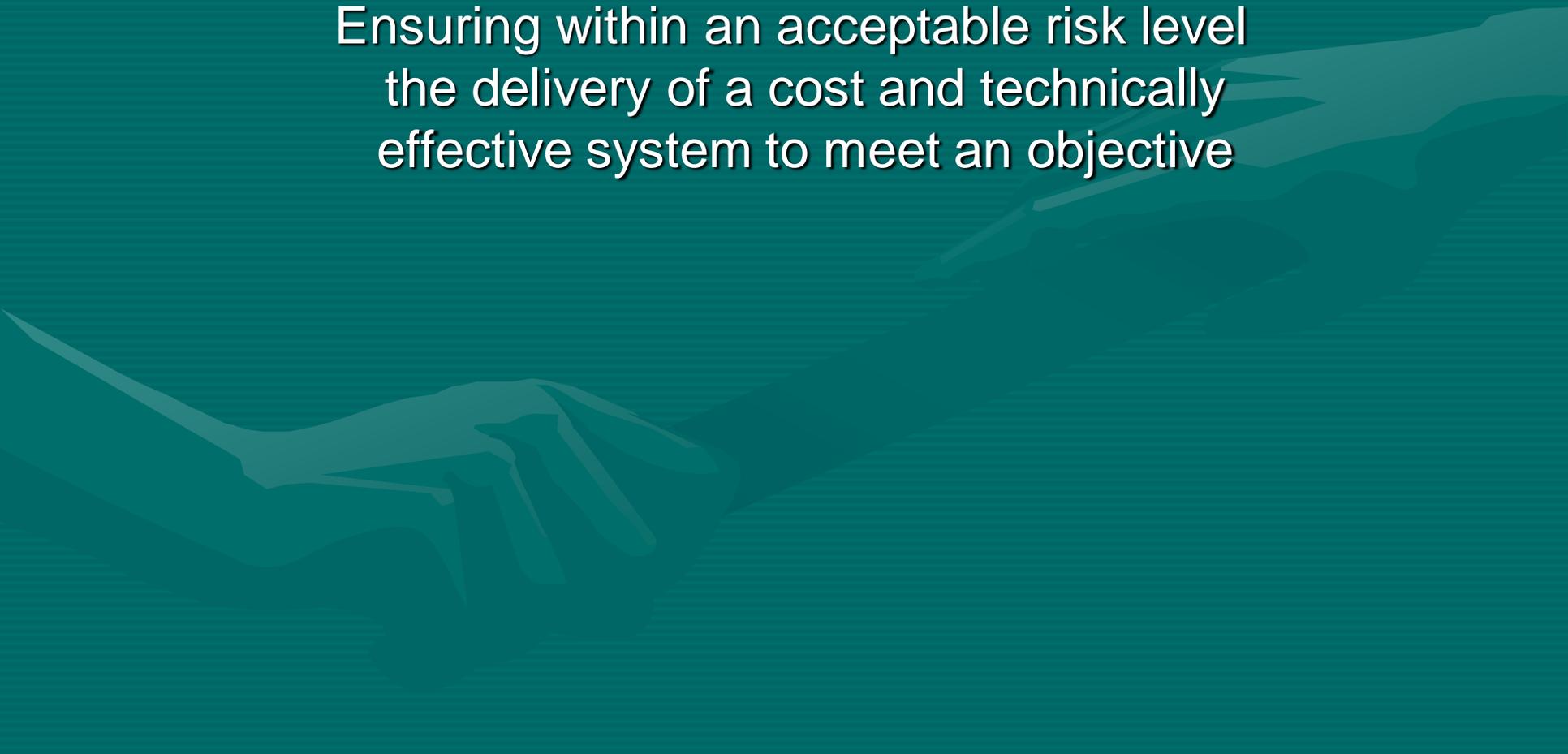
“Systems Engineering, an approach to engineering that emphasizes the scientific method and examination of all aspects of the engineering project”

Systems Engineering Scope

- Mission Design and System Requirements trades
- System Design and Analysis
- System and Operations Development Technical Management

System Engineering Product

Ensuring within an acceptable risk level
the delivery of a cost and technically
effective system to meet an objective



Systems Engineering is Critical to Mission and Programmatic Success

Mission Design Choices

System Design Evaluation

System & Operations Development
Technical Management and integration

Mission Design

Requirements Analysis and Architecture Development

- Understanding of mission & architecture design alternatives
 - mission success metrics
 - relative mission & programmatic risks versus cost
- Enabling technology
 - options, maturity & risks
- Understanding of residual risks at launch
 - stakeholder buy-in at inception
- Stability of requirements
 - thorough conceptual studies lead to more robust PDR

Design and Analysis

- Evaluate and ensure design choices meet mission and programmatic requirements
 - System
 - ConOps
- Analyze performance requirements versus design margins
- Identify risk retirement profile
- Identify residual mission and system risks and develop mitigation plan

Technical Management

- Requirements and interface management
- Risk management and retirement tracking
 - technology maturity
 - impact of environment changes acceptability of risk
- Test and verification plan and requirements verification and validation tracking
 - interface integration and validation
 - illities oversight

Non-technical factors inhibit growth of a robust systems engineering capability

- Project staffed versus engineering discipline base
- Prime and/or institutional contracts
- Systems engineer as the technical leader versus processor
- Flight and ground versus system organization & contract structures
- Center capability or Project unique investment
- Funded via overhead or Program/Project Tax
- Investment in Civil Servants versus Contractor
- Without a good systems engineering process the system architecture and design tends to reflect the organization

Challenges

- Attracting and developing systems engineers
- Establishing Institutional systems engineering capability funding mechanisms
- Managing the right balance of investments in institutional and project developed systems engineering capabilities
- Leveraging major Goddard Prime Contractor systems engineering processes and tools

Improving systems engineering capability is important

Provides Skill Base, Processes and Tools to:

- Maintain and improve systems development process and continue to deliver on the Center's mission success and programmatic commitments
- Ensure systems engineering discipline in new mission formulation
- Develop new innovative and cost effective missions and technology
- Improve both Civil Service and support Contractor capabilities and residual knowledge base
- Improve the mission design process, requirements management and resulting Prime contract performance

Closing

- Systems engineering is critical to mission and programmatic success and needs to lead the technical development process
- Pro active managing of non technical institutional and project system engineering obstacles is essential to developing a robust systems engineering capability
- Continuously Improving the Center's systems engineering capability is a challenging and important task for the Goddard Team