



Project Management Influences on Systems Engineering Presented to the NASA Masters Forum February 11, 2003

L. Dale Thomas, Ph.D., P.E.

Director of Systems Management Marshall Space Flight Center





- Project management can positively influence systems engineering by:
 - 1. Aligning the WBS, the PBS, & the Organization Chart
 - 2. Creating realistic customer & stakeholder expectations early in the development cycle
 - 3. Managing systems engineering as a project



Organizational & PBS/WBS Relationships









- For a given project, a poorly aligned WBS, PBS, & project organization will manifest itself as:
 - Project management
 - Increased quantity of control accounts
 - Increased management complexity
 - Systems Engineering
 - Increased quantity of interfaces
 - Increased complexity of interfaces





Both systems

- Have performed in an outstanding manner
- Included international participation
- Involved significant technical challenges
- However, consider
 - Cost & schedule performance during system development

NASA

Chandra X-Ray Telescope Architecture





February 11, 2003

Hubble Space Telescope Architecture





ASA



Customer & Stakeholder Expectations





Resources (How Much)

Work exhaustively & continuously with customers & stakeholders to create clear, cogent, mutual & hopefully stable understanding of project content, schedule, & resources.

February 11, 2003

Systems Engineering Hierarchy





February 11, 2003







- When the customers &/or stakeholders change, expectations will change
- Likelihood of Customer &/or stakeholder change grows as a function of project scope & duration
- Hence, large &/or long-duration projects are stability challenged
 - 2nd Generation Reusable Launch Vehicle vs. Mars Rover





- Systems engineering needs to plan just as any other project
 - A Systems Engineering Management Plan should include:
 - Milestones
 - Deliverables
 - Process(es)
 - Risks
 - Budget



2GRLV SEMP Extract



| Table 3.2.1.1-1. SYSTEMS DEFINITION OFFICE FUNCTIONS AND PRODUCTS TABLE | | | | | |
|---|--|--|---|---|---|
| | INPUT(S) | PROVIDER(S) | OFFICE FUNCTION | PRODUCT(S) | CUSTOMER(S) |
| | | | PROCESS | | |
| Sta Ree Leş Do (ST L1) Co | keholder Level 1 quirements Input gacy cumentation FAS, NRA 8-27, R 8/99) ntractor Input | HQ Space Transportation Council NASA Centers DoD Agencies HQ Architecture Contractors | Operations Concept Definition Level 1 Requirements Generation and Revision Control Design Reference Mission (DRM) Generation and Revision Control Mission Figures of Merit (FOM) Generation and Revision Control | Operations Concept Document Level I Requirements Document DRM Document FOM Document | Architecture Contractors 2nd Gen RLV Offices Project Manager Technology Project Managers SE&IO Manager TIRM |
| | | | Systems Engineering Process Definition and Planning Document/Plan Generation and Revision Control Process | Systems Engineering Management Plan 2nd Gen RLV Architecture Operations Concept (OCD) Document Integrated Trade Study Plan and Process V&V Plan and Process | |
| L11 FO DR Teo Co: Stu | R PMs RMs chnology Updates ntractor Trade idies | SDO Technology Projects SAO - LSEs | Architectural Evaluation | Integrated Trade Tree | Program Manager Contractors HQ TIRM |

International Space Station





Not Shown: Italian Mini Pressurized Logistics Module (attaches to Node 2)

OA 3001-02 ColorCodedSS



ISS Incremental Design Review (IDR) Approach to SE Planning



The IDR content is tailored to the product/integration maturity required to achieve the launch schedule -- a "lead-time away" based review.

Program Integration Activities:







- Systems engineering can positively influence project management by:
 - 1. Aligning the WBS, the PBS, & the Organization Chart
 - 2. Creating realistic customer & stakeholder expectations early in the development cycle
 - 3. Managing systems engineering as a project