NDIA Development Planning Working Group Workshop:

"Improving the Integration of Government and Industry S&T/IR&D to Support Development Planning"

NDIA 15th Annual Systems Engineering Conference

24 October 2012

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Agenda

- Overview
- Workshop Findings
- NDIA DPWG Workshop Artifacts
- Summary

Overview

NDIA DPWG Workshop

NDIA Systems Engineering Division
In conjunction with the Military Operations Research Society
Development Planning Working Group
Collaborative Engagement Workshop
on
Development Planning, S&T, Pre-milestone A SE, and IR&D Interactions

Lockheed Martin Global Vision Center
2121 Crystal Drive, Arlington (Crystal City), VA

June 21 – 22

- 43 Senior Level Attendees
  - Approximate 2:1 Government to Industry
  - The Services were well represented

Workshop Objectives

- Identify the critical linkages among Government Development Planning (DP), Government S&T, Industry Pre-milestone A Systems Engineering (SE), and Industry Independent Research & Development (IR&D)
- Understand how to better align Service and Industry technology investments;
  - Provide recommendations to improve the transition rate of technology from development to fielded capability;
- Identify available and potential mechanisms where Industry Pre-milestone A SE and IR&D can provide information needs to better inform Government Decision Makers;
  - Define the "context" that is needed for contractors to better respond to DP and S&T RFIs;
  - Include both Intellectual Property (IP) and non-IP environments
- Understand the differences in Development Planning and S&T focus relative to near term threat response and long term mission needs
  - Supports ASD R&E Rapid Fielding Initiative
- Define effective analytical techniques and methodologies used in the Development Planning timeframe
  - Identify supporting tools as appropriate

Improving the Integration of Government and Industry S&T/IR&D to support Development Planning Decisions

Workshop Agenda (1 of 2)

- Welcome & Introductions
  - Mr. Steve Henry, Northrop Grumman, NDIA SE Division Chair
  - Mr. Sam Yakulis, Director, Engineering Excellence, Lockheed Martin
- Opening Comments
  - Ms. Kristen Baldwin, Principal Deputy, DASD, Systems Engineering
- NDIA DPWG Overview
  - Mr. John Lohse, Raytheon, NDIA DPWG Chair
- Government DPWG Overview
  - Ms. Aileen Sedmak, ODASD (SE)
- MORS Acquisition Workshop DPWG Overview
  - Mr. Kirk Michealson, Lockheed Martin, MORS DPWG Co-Chair
- DoD Overview
  - Mr. Ron Kurjanowicz, OASD R&E

Workshop presentations located at:
http://www.ndia.org/Divisions/Divisions/SystemsEngineering/Pages/Past_Projects.aspx

Workshop Agenda (2 of 2)

- Improving Integration of Government and Industry S&T/IR&D to support Development Planning Decisions
  - US Air Force Perspective – Col. Ralph Sandfry, SAF/AQR
  - US Navy Perspective – Mr. Adam Nave, Director, R&D, Office of Deputy Assistant Secretary of Navy for Research, Development, Test & Evaluation
  - US Army Perspective – Mr. Leo Smith, Director, Program of Record (PoR) Engineering Support, ASA (ALT), Office of the Chief Systems Engineer
  - Industry Speaker – Dr. John C Zolper, Raytheon, Vice President, Research and Development, Corporate Technology and Research
  - Industry Speaker – Mr. Wesley Covell, Harris, Vice President of Strategy and Chief Growth Officer
- Industry DPWG Findings on RFI Language and Pre-milestone A Analytics
  - Mr. Gene Rosenbluth, Northrop Grumman
  - Mr. Kirk Michealson, Lockheed Martin

Facilitated Discussion on Improving the Integration of Government and Industry S&T/IR&D to support Development Planning Decisions

Workshop Findings

Finding Summary

1. The issue of Organizational Conflict of Interest (OCI) is seen as a barrier to collaboration
2. The issue of Intellectual Property (IP) is seen as a barrier to collaboration
3. Systems Engineering discipline is needed in the DP/S&T/IR&D Timeframe
4. Tactical and Strategic S&T/IR&D can be better leveraged to support Development Planning
5. Improved Methods of Collaboration and Communication Mechanisms are needed
6. 6.1/6.2 Investment Strategies need to align across Government and Industry

Finding: The issue of OCI is seen as a barrier to collaboration

- Needed to enable Industry participation in pre-MDD and Material Solution Analysis activities
  - Current approach tends to be for the Government to use the lowest-risk interpretation, which typically causes exclusion of Industry participation
- Review DoD Source documentation
  - Identify key language and “genuine” OCI requirements
  - Critique DoD requirement vs Service language
  - Identify OSD/Service leads for reference
  - Review the “Myth Busting” Memorandum from the Office of Federal Procurement Policy, dated February 2, 2011
- Provide recommendations that are practical and feasible, and communicate the results
  - Clear guidance on what type of Industry involvement IS and IS NOT allowed would help mitigate the current reluctance

NOTE: This finding suggests clarifying the OCI provisions, not loosening them.

Finding: The issue of IP is seen as a barrier to collaboration

- Identify the boundaries of Industry (IP).
  - Define what IP is, and what it is not.
  - Define the boundary lines where Industry can and cannot be collaborative
  - Identify when Industry should/should not share data
- Address both sides of the issue
  - E.g. Industry sees IP as “our inventions that are important to our business”
  - E.g. Potential Gov’t disclosure of IP
  - E.g. Inventions created under Gov’t contract vs IR&D
  - Look at recently released FAR clause on IR&D

The NDIA DPWG will stand up an Industry team to address this effort.

Finding: Systems Engineering discipline is needed in the DP/S&T/IR&D Timeframe

- Need to inject effective SE into Mission/Operations Analysis "pre-Materiel Development Decision (MDD)"
  - Clearly define critical definitions to agree on common terminology
    - Distinguish the difference in the roles between Operations Analysis and SE
    - Distinguish between Engineering and S&T
  - Understand how the new JCIDS 3170 documentation informs decision makers at MDD and shows traceability between the pre-MDD mission analysis and the acquisition decision
  - Correlate Key Performance Parameters (KPPs) to the Measures of Effectiveness (MOEs)
  - Perform conceptual analysis to identify Critical Technology Elements (CTEs), Measures of Performance (MoPs), Key Performance Characteristics (KPCs), etc
  - Identify methods to involve Technology Generalists/SMEs

Finding: Systems Engineering discipline is needed in the DP/S&T/IR&D Timeframe

- Provide a framework (including information flows) for Early Systems of Systems Engineering (i.e. Mission/Ops Analysis pre-MDD and "program" Systems Engineering post-MDD)
  - Determine critical information exchanges for DP activities between Government DP/S&T and Industry Pre-Milestone A SE/IR&D
  - Improve the development of analyses, methodologies, and tools
  - Apply Mission/Operations Analysis tools in the S&T/IR&D environment
    - Identify and publish specific tool sets for S&T/IR&D, DP, etc.
- Identify methods for Systems Engineering to be applied "across" technology domains to improve technology integration
- Correlate S&T/IR&D investments to the UJTLs, i.e. define why we do the S&T that we do
  - Need to understand the phasing of the information flow
- Increase the education of SE within the S&T environment
  - Accomplished SEs have multiple technology domain experience

Finding: Tactical and Strategic S&T/IR&D can be better leveraged to support Development Planning

- Need to better leverage our tactical and strategic investment to support Development Planning
  - Identify the differences between short term and long term technology development.
  - Tie tactical and strategic S&T/IR&D to 6.1, 6.2, and 6.3 funding lines
  - Suggest a timeline for the ROI on S&T/IR&D investments
  - Better coordinate 6.1 efforts across the Government, Industry, and Universities to express the future problem space
  - Look at Tech Based IR&D and Strategic IR&D

Improve S&T/IR&D Transition to Fielded Capability

Finding: Improved Methods of Collaboration and Communication Mechanisms are needed

- Identify methods of collaboration
  - Identify and document existing methods
  - Investigate and report on the concept of mission focused consortiums (collaborative mission analysis)
  - Understand and report on the USAF Model for Industry engagement
- Identify better methods to communicate collaboration opportunities
  - Identify communication opportunities and work with the Government to implement them
  - Determine methods to “push” the communication to the right audience
  - Use Industry Associations to help get the word out
    - Identify appropriate Industry associations and develop an implementation plan.

Finding: 6.1/6.2 Investment Strategies need to align across Government and Industry

- Show the relationship of 6.1/6.2 investments to S&T needs
- Increase Industry involvement in the MURI (Multidisciplinary University Research Initiative) process
  - Enable Industry to be a submitter of 6.1 topics as an input to the Gov't S&T planning effort
  - Provide methods of facilitation (e.g. NDIA SE Division forums, Industry days, etc.)
  - Understand the 6.1/6.2 funding model
- Increase Industry awareness and use of Defense Innovation Marketplace
  - Website: http://www.defenseinnovationmarketplace.mil
- Identify methods/framework for increased Industry involvement with universities in the 6.1 to 6.2 environment to expedite the technology maturation timeline
  - *Include connections to UARCs and the SERC*

DPWG Workshop Action Items

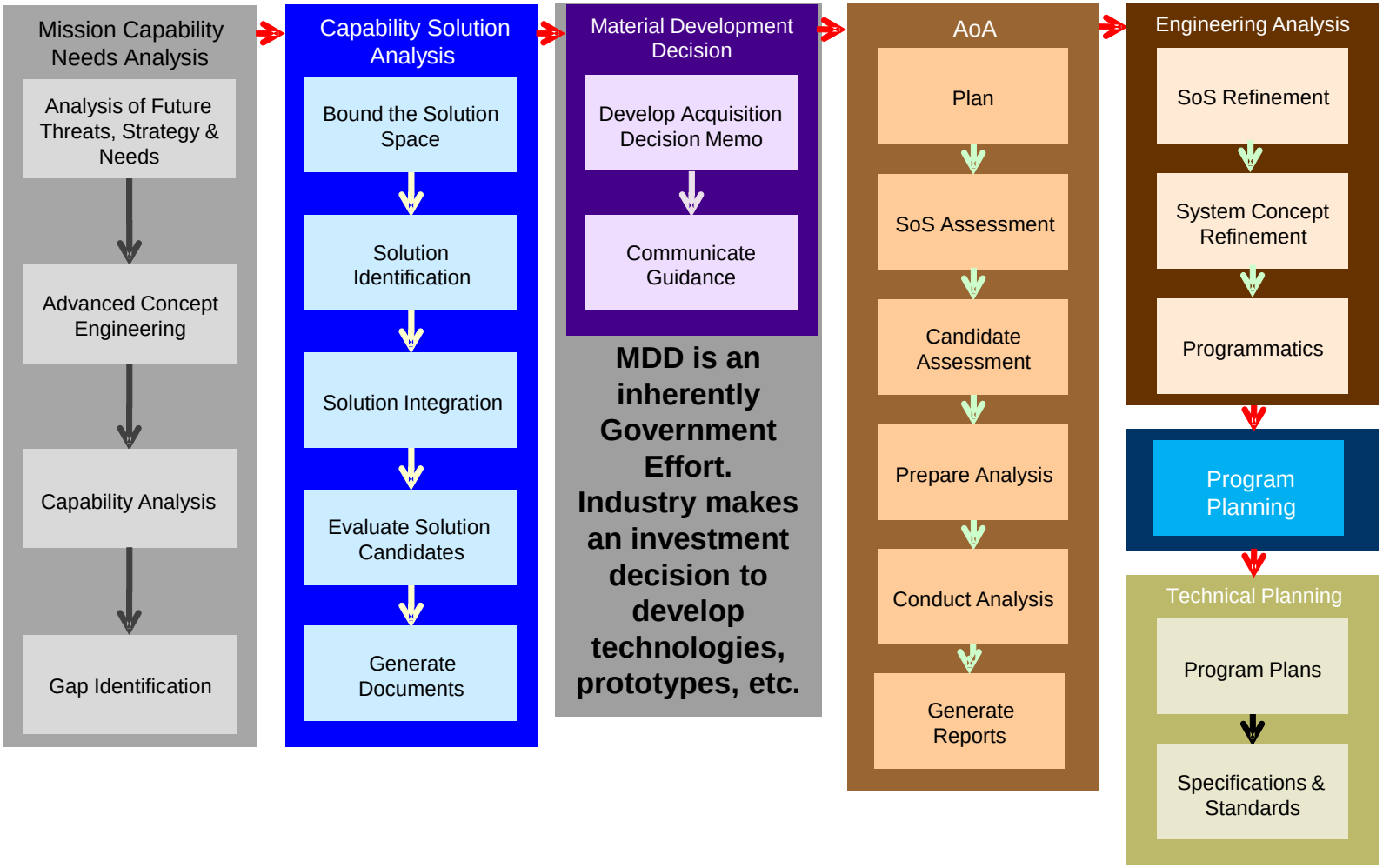
Action	Action Team	Action Lead	Due Date	Status
1. Generate the DPWG Workshop Formal Report	NDIA	Lohse	Final – November 30 Submittal – December 21	Draft report in work
2. Address the Issue of OCI (as a barrier to collaboration)	NDIA	Rosenbluth Roedler	Initial Findings – November 21 2013 – Continued Efforts	Identifying "genuine" OCI requirements and key language
3. Address the Issue of IP (as a barrier to collaboration)	NDIA	Rosenbluth Roedler	Initial Findings – November 21 2013 – Continued Efforts	DPWG Industry team collecting Industry input
4. Improve and Communicate the Systems Engineering Process in the Development Planning Timeframe (including SE as a part of S&T/IR&D)	NDIA	Lohse Michealson	Initial Findings – November 21 2013 – Continued Efforts	Applying NDIA DPWG Development Planning Analytics Table
5. Identify Methods to Better Leverage Tactical and Strategic S&T/IR&D in Development Planning	NDIA	Lohse Guise	Initial Findings – November 21 2013 – Continued Efforts	Initial efforts in work
6. Identify Methods of Collaboration and Communication Mechanisms	NDIA/Gov't	Lohse Guise AFRL	Initial Findings – November 21 2013 – Continued Efforts	Partnering with AFRL for 2013 continued efforts
7. Provide Suggestions for Improving the 6.1/6.2 Investment Strategy	NDIA/Gov't	Lohse OASD R&E	Initial Findings – November 21 2013 – Continued Efforts	Partnering with OASD R&E for 2013 continued efforts
8. Collaborate Across Government and NDIA DPWGs	NDIA/Gov't	Lohse Michealson Sedmak	Initial Findings – November 21 2013 – Continued Efforts	Partnering with the Gov't DPWG for 2013 continued efforts

All Efforts To Be Coordinated Across Government and Industry

NDIA DPWG Workshop Artifacts

- Development Planning Analytics Table
- The Role of Architecture
- Early Mission Analysis in the S&T/IR&D Process
- Operational Context for DP/S&T RFIs

Industry's Pre-Milestone A Systems Engineering Process



The answer to "What problem are we trying to solve?" enables the tailoring of this process!

Pre-MDD
- Enablers and Analytics

Phase		Enablers	Analytics
Pre-MDD	**Mission Capability Needs Analysis**	Threat Intelligence Scenario Databases and Development (e.g. Integrated Security Constructs) Mission Task Breakdown Service Task Lists Joint Capability Areas Mission Architecture Concept of Employment (existing) Wargaming Activities Government Documentation (e.g. QDR, NSS, NDS, NMS, Joint and Service UONs, Risk Assessments, etc) Military Exercises and Experimentation Warfighting Lessons Learned	**Identify the Problem** Threat Set Definition Political Impact (e.g. DIME - Diplomatic, Information, Military, Economic) Mission Capability Needs Measures of Effectiveness Performance Standards and Conditions Current State and Programmed State of Capability Mission Capability Gaps Red Team Assessments Stakeholder Analysis
	Capability Solution Analysis	Mission Capability Needs Mission Capability Gaps Measures of Effectiveness Current State of Technology Technology Roadmaps SoS Architecture Rules of Engagement Concept of Operations Planning and Budgeting	**Identify/Reduce Potential Candidate Solutions** DOTMLPF Assessment Concept Feasibility Assessment Solution Space Constraints Technology Needs Assessment Technology Gaps Assessment Technology Realism Assessment Solution Boundaries Key/Critical Measures (i.e. MoPs, COIs, KPPs, KSAs) Concept of Employment (per candidate) Affordability Analysis Service Budget Portfolio Analysis Cost, Schedule, Risk Assessment Tradespace Analysis Solution Capability Assessment (per candidate) Red Team Assessments Stakeholder Analysis

Pre-MDD
- Activities

Phase		Activities	Techniques, Methodologies, and Tools
		Analysis of Future Threats, Strategy, & Needs	
Pre-MDD	Mission Capability Needs Analysis	Identify threats	
		Identify range of missions/mission areas/use cases	
		Identify strategic/political interests	BOGSAT
		Identify mission areas of interest	Back of the Envelope
		Advanced Concept Engineering	Spreadsheet analysis
		Define representative scenarios (including operating environments and conditions)	Math Models
		Understand current Mission Architecture	First Principal Analysis
		Identify Mission Measures of Efectiveness (MOEs)	Monte Carlo Analysis
		Solicit advanced concepts from S&T Base	Analytic Hierarch Process (AHP)
		Solicit advanced concepts from Industry	Discrete Event Simulation
		Capability Analysis & Gap Identifiction	Architecture (DoDAF, Zachman, etc.)
		Identify current capabilities (of mission area(s) of interest)	Concept of Employment (ConEmp)
		Identify current Concepts of Employment (ConEMPs)	
		Evaluate current capabilties based on MOEs	M&S: EADSIM, ESAMS, STORM, SUPPRESSOR,
		Identify capability gaps	
		Rank gaps relative to the importance to the mission and the severity of the gap	
		Bound the Solution Space	
	Capability Solution Analysis	Perform or incorporate JCIDS DOTMLPF Study (Verify need for a materiel solution)	
		Understand current SoS Architecture	
		Identify conceptual solution space constraints (physical, doctrinal, technology, schedule, and budget)	
		Provide a timeline projection for the availability of critical needs	
		Define/bound the conceptual solution space	BOGSAT
		Identify Mission Measures of Peformance (MOPs) and Critical Operating Issues (COIs)	Spreadsheet analysis
		Solution Identification	Math Models
		Explore potential technologies from S&T and Industry Base (e.g. JCTDs, CRADAs, CRAD, IRAD, etc.)	First Principal Analysis
		Identify "potential" conceptual solution candidates (including disruptive and late blooming technologies)	Monte Carlo Analysis
		Provide technology assessment of conceptual solution space (current vs future, practical vs plausible, TRL, MRL, etc.)	Analytic Hierarch Process (AHP)
		Understand technology, cost, and schedule realism	Discrete Event Simulation
		Downselect conceptual solution candidates	Architecture (DoDAF, Zachman, etc.)
		Generate ConEmps for each candidate	Concept of Employment (ConEmp)
		Integrate ConEmps into SoS Architecture for each candidate (i.e. system integration assessment)	Constrained Opitimization Framework
		Evaluate conceptual solution candidates against "programmatics" (e.g. cost, schedule, risk, etc.)	3DoF to 6DoF Simulations
		Evaluate conceptual solution candidates against the MOPs (i.e. how well does the solution meet performance requirements?)	
		Evaluate conceptual solution candidates against capability gaps using MOEs (i.e. how well does the solution concept fill the gap?)	M&S: EADSIM, ESAMS, STORM, SUPPRESSOR,
		Evaluate conceptual solution candidates for compliance to the "ilities"	
		Rank the conceptual solution candidates	
		Write a "draft" Initial Capabilties Document	
		Influence the writing of the AoA Study Guidance	

Materiel Solutions Analysis Phase - Enablers and Analytics

Phase		Enablers	Analytics
MDD to Milestone A	AoA	Initial Capabilities Document Measures of Effects Critical Operating Issues Measures of Performance Current State of Technology Technology Roadmaps SoS Architecture Planning and Budgeting	**Refine and Select Solution** Candidate Trade Analyses Capability vs Cost Capability vs Risk Life Cycle Assessment Technology Realism Assessment Concept of Employment (per candidate) Affordability Analysis Cost, Schedule, Risk Assessment Solution Capability Assessment (per candidate) Red Team Assessments Stakeholder Analysis
	Engineering Analysis	Measures of Performance System Architecture SoS Interface Definition Technology Readiness Levels Manufacturing Readiness Levels	**Refine Selected Solution** Critical Technology Element Definition Affordability Analysis Cost, Schedule, Risk Assessment Performance Requirements Decomposition Design Requirements Definition System Concept Red Team Assessments Stakeholder Analysis

Materiel Solutions Analysis Phase - Activities

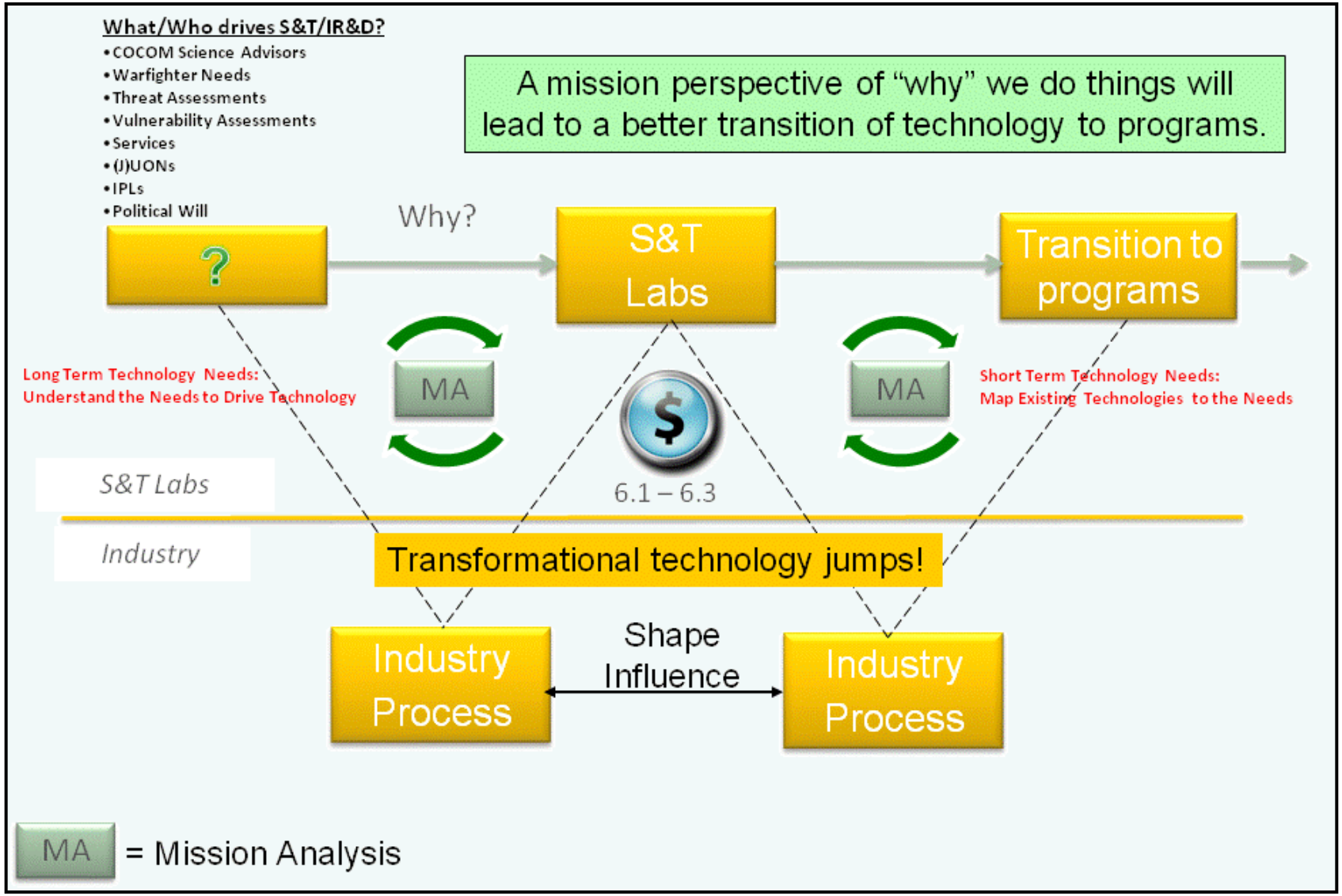
Phase		Activities	Techniques, Methodologies, and Tools
		AoA Planning	
MDD to Milestone A	**AoA**	Identify the conceptual solution candidates to be evaluated (from the AoA Study Guidance)	
		Identify technical, schedule, and budget constraints	
		Identify relevant trade studies	
		Identify the AoA evaluation criteria/critical success factors	
		Refine representative scenarios (including operating environments and conditions)	
		Write the AoA Plan	
		Refine the SoS Architecture around each candidate	
		Identify SoS interfaces and enabling systems/technologies	
		Understand legacy system knowledge for SoS interfaces or system upgrades	Monte Carlo Analysis
		Define life cycle parameters, attributes, suitability, etc.	Analytic Hierarch Process (AHP)
		Provide technology assessment of candidates (current vs future, practical vs plausible, TRL, MRL, etc.)	Discrete Event Simulation
		Provide advanced technology prototype assessment	Architecture (DoDAF, Zachman, etc.)
		Provide T&E and "ilities" assessments of candidates (sustainability, reliability, maintainability, survivability, training, etc.)	Concept of Employment (ConEmp)
		Provide integration readiness assessment of candidates for SoS interfaces	Constrained Opitimization Framework
		Provide initial list of Critical Technology Elements (CTEs)	3DoF to 6DoF Simulations
		Provide initial cost estimate of candidates	Leverage Existing Simulations
		Provide initial schedule estimate of candidates	Man-in-the-Loop Simualtions
		Create initial risk assessment of candidates based on technology, cost, and schedule	Software/Hardware-in-the-Loop Simulations
		AoA Conduct	Leverage Tech Demos
		Identify common models, data, and tools	
		Gather relevant models, data, and tools	M&S: EADSIM, ESAMS, STORM, SUPPRESSOR,
		Validate models, data, and tools	
		Determine procedure for model/data/tool configuration management and knowledge repository	
		Identify analysis techniques	
		Perform capability vs cost trades (i.e. affordability analysis)	
		Perform capability vs risk trades (i.e. performance, schedule, cost)	
		Perform AoA	
		Identify the Preferred System Concept	
		Write a CONOPs for the Preferred System Concept	
		Write AoA report	
	Engineering Analysis	Identify Preferred System Concept technical, schedule, and budget constraints	
		Refine SoS Architecture	Monte Carlo Analysis
		Identify level of expectations for Preferred System Concept	Analytic Hierarch Process (AHP)
		Identify Preferred System Concept SoS interfaces and enabling systems/technologies	Discrete Event Simulation
		Understand legacy system knowledge for SoS interfaces or system upgrades	Architecture (DoDAF, Zachman, etc.)
		Create evolutionary life cycle planning	Concept of Employment (ConEmp)
		Refine Preferred System Concept life cycle parameters, attributes, suitability, etc.	Constrained Opitimization Framework
		Refine Preferred System Concept MOPs	3DoF to 6DoF Simulations
		Refine technology assessment of the Preferred System Concept (TRL, MRL, etc.)	Leverage Existing Simulations
		Refine integration readiness assessment of the Preferred System Concept for SoS interfaces	Man-in-the-Loop Simualtions
		Refine Preferred System Concept CTEs	Software/Hardware-in-the-Loop Simulations
		Provide cost estimate of the Preferred System Concept	Leverage Tech Demos
		Provide schedule estimate of the Preferred System Concept	
		Identify risk assessment of the Preferred System Concept based on technology, cost, and schedule	M&S: EADSIM, ESAMS, STORM, SUPPRESSOR,

The Role of Architecture

Understand The Problem	Develop An Operational Concept	Develop A System Concept
Mission Architecting	**SOS Architecting**	**System Architecting**
• Understand Customer's Desired Capabilities • Analyze Requirements & Needs • Analyze Operations • Analyze Quality Attributes • Identify Reuse Assets • Identify Key Performance Goals And Measures • Initiate Technical Standards List • Understand Customer's Architecture	• Define Mission Nodes & Their Relationships • Define Information Exchanges • Define Operational Activities • Develop Operational States • Develop Operational Event Sequence Diagrams • Initiate Simulation Activities	• Define System Functions From Operational Activities • Define System Data Exchange • Define Systems, Sub-systems, & Functions • Develop State Event Sequence Diagrams • Perform Capacity Planning • Perform Performance Predictions

Mission Architecting
Is The First Step In The Architecting Process

Early Mission Analysis in the S&T/IR&D Process



Operational Context for DP RFIs

- **Clearly state the problem to be solved**
- Identify the mission area being addressed
- Identify the threat/threat type
- Define representative scenarios
- Define operating conditions/environments
- Provide expectant MOEs/COIs
- Highlight any known constraints
  - Physical, Doctrinal, Technology, Budget, Schedule, Certification and Accreditation (C&A), etc.
- Define key criteria and weighting factors (trades)
- List specific information/criteria needed for decisions
- Etc.

Operational Context for S&T RFIs

- **Clearly state the problem to be solved**
- Identify as either a long term or short term need
- Provide the timeframe for technology maturation
- State the desire for either “narrow scope” or “out of the box” responses
- Identify the mission need for the technology being pursued
  - Explain why the Government is pursuing this technology
  - Identify potential mission areas
  - Provide expectant operating conditions/environments
- Provide expectant MOEs/COIs/MOPs
- Highlight any known constraints
  - Physical, Doctrinal, Cost, Timeframe, C&A, etc.
- Define key criteria and weighting factors (trades)
- Etc.

Summary

- Multiple perspectives were shared
  - ASD R&E, Service, Industry
- Facilitated discussion held to address all of the objectives
- Findings were documented and actions undertaken
- This effort will continue into 2013 in support of our Warfighters

Improving the Integration of Government and Industry S&T/IR&D to support Development Planning Decisions