



Acquisition Modeling & Simulation Update: NDIA M&S Committee

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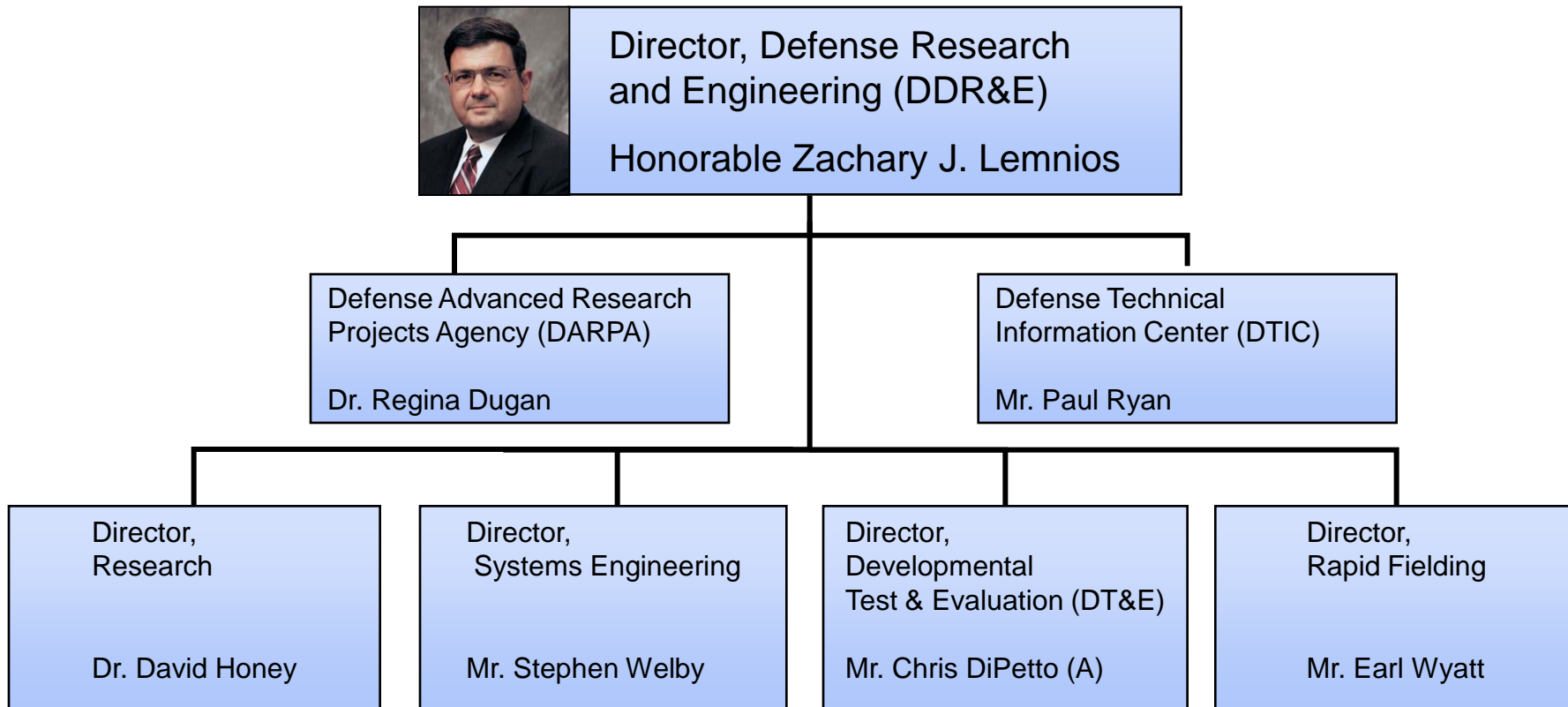
Discussion Topics



- **DDRE Organization and Imperatives**
- **Systems Engineering Organization and Objectives**
- **Centers of Gravity:**
 - WSARA and Development Planning
 - Military Operations Research Society (MORS) Analytic Agenda Workshop
 - Rapid Development Toolkit Study
 - Systems of Systems M&S support
 - Transition Acquisition M&S Working Group to Systems Analysis



Defense Research & Engineering





DDR&E Imperatives




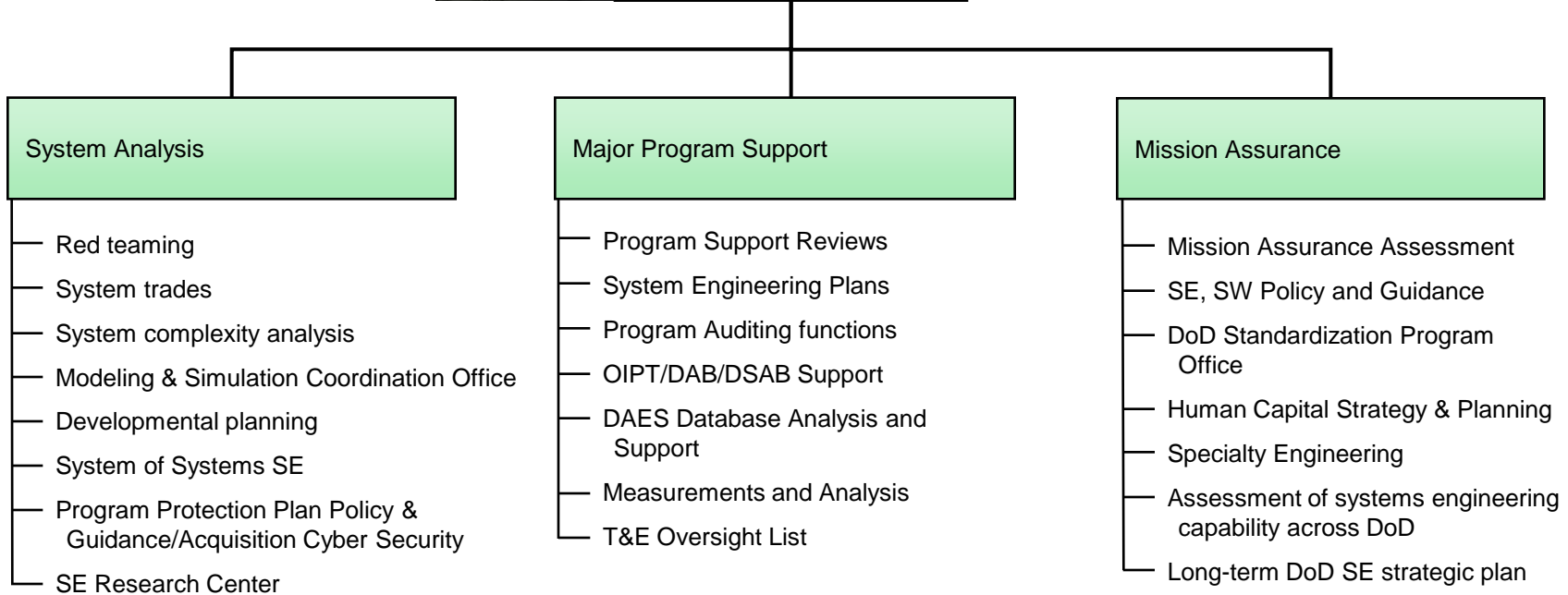
- **Accelerate delivery of technical capabilities to win the current fight**
- **Prepare for an uncertain future**
- **Reduce the cost, acquisition time and risk of our major defense acquisition programs**
- **Develop world class science, technology, engineering, and mathematics capabilities for the DoD and the Nation**



Director, Systems Engineering



	Director, Systems Engineering Steve Welby
	Principal Deputy Terry J. Jagers



Responsible to provide technical support, systems engineering (SE) oversight, program development and mission assurance certification to USD(AT&L) in support of planned and ongoing acquisition programs



Systems Engineering Mission



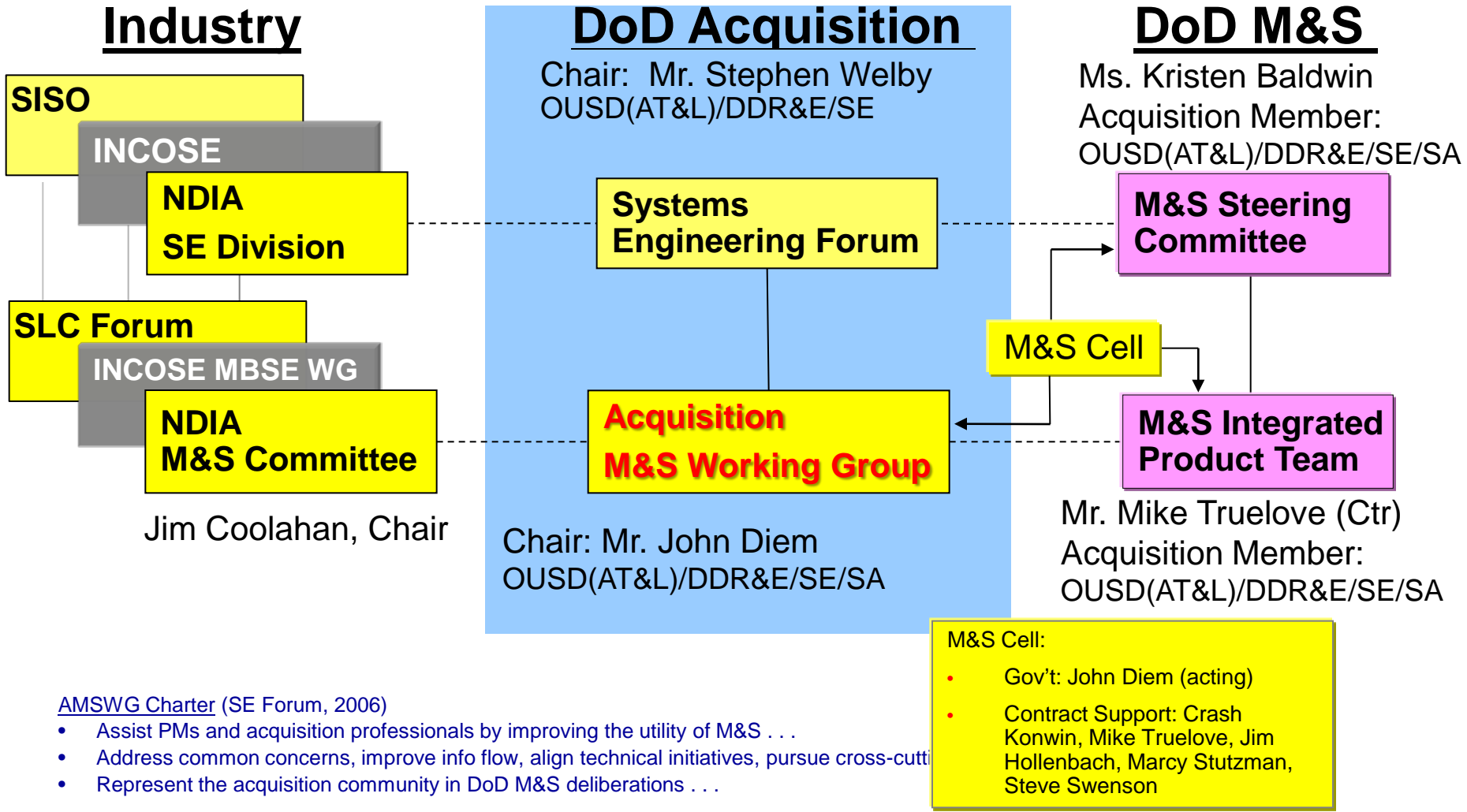
Execute substantive technical engagement throughout the acquisition life cycle with major and selected acquisition efforts across DoD to apply best Systems Engineering practices to:

- Help program managers identify and mitigate risks
- Shape technical planning and management
- Provide insight to OSD stakeholders
- Identify systemic issues for resolution above the program level





Acquisition M&S Working Group Relationships



AMSWG Charter (SE Forum, 2006)

- Assist PMs and acquisition professionals by improving the utility of M&S . . .
- Address common concerns, improve info flow, align technical initiatives, pursue cross-cutting
- Represent the acquisition community in DoD M&S deliberations . . .



Anticipation

Rapid Fieldings

Technology Tools for Rapid Capability Fielding: *Final Outbrief*



Superior Capabilities

Cleared for Open Publication by DoD Office of Security Review
Case 10-S-0787, Jan 25, 2010





Terms of Reference

- **Objective:** Provide specific recommendations to DDR&E regarding technological opportunities to significantly decrease the development time and increase the operational effectiveness of rapidly fielded capabilities.
- **Study Questions:** What are the current technical tools used in both the defense and commercial industries to rapidly design, fabricate, test and validate new systems?
 - Pay particular attention to **modeling and simulation** tools to support rapid design, fabrication, and testing; **system engineering** tools to rapidly design and re-design complex systems; and **manufacturing** processes and tools to speed development.
 - Are there tools that would allow for end to end rapid development, to include such functions as CONOPS development, interoperability, and testing?
- **For each of these tools, assess their current capabilities and limitations for DoD rapid fielding needs.**
- **What are the emerging technology opportunities? Identify the technical leaders in these areas and propose approaches to validate the impact of these tools.**
- **How might these technology opportunities best be developed? Program scope, scale, and schedule? Suggestions as to how this might best be done, and by whom are invited.**
- **Is there any way to tailor current tools, techniques, models, methodologies, best practices, etc, to achieve better rapid fielding capability immediately?**



Modeling and Simulation Findings



- **Community is vast, with a good deal of excellent work occurring in pockets**
- **Training community leveraging emerging technologies (e.g. gaming, virtual, mixed, augmented reality)**
 - Appears to be little exploitation in acquisition communities
- **Ability to easily and rapidly develop gaming scenarios is impressive**
 - Work still needed in enhancing realism and physics-based effects
- **Physics-based simulation applied to engineering design holds the promise of having a substantive impact on rapid capability fielding**
 - Reducing design-build-test cycles (e.g. Goodyear, P-3 sensor integration)
 - Development efforts are expensive and lengthy
- **Platform EMI and battlefield communications modeling efforts exist, however a rapid battlefield electromagnetic modeling effort should be explored**
- **Ability to model human/cultural behavior limited**
 - Agent-based modeling coupled to Monte Carlo with real world calibration may hold promise
- **There is limited visibility into existing DoD-wide M&S capabilities that might be applied to rapid capability fielding efforts**
 - Interoperability also an issue

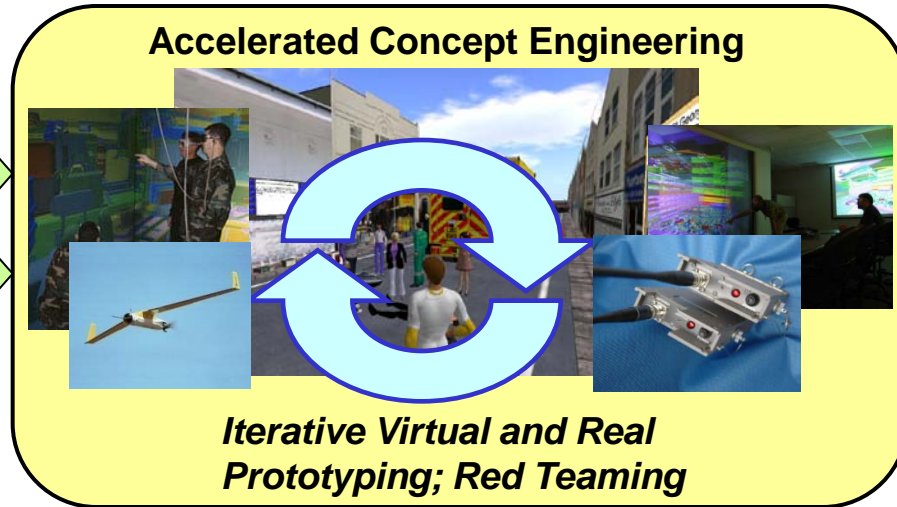


Concept Engineering

Warfighter Needs



Anticipatory Opportunities



- Conceptual Designs
- CONOPs
- TTPs
- Input to Detailed Design
- Prototype(s)

- Need/mission focused (the right tool(s) to answer the question)
- Warfighter-centric (CONOPS integral, real prototypes where possible, user-centered design and development)
- A persistent environment that favors speed over fidelity
 - Responsive to needs, but also anticipatory
 - Work collaboratively with higher fidelity simulations (e.g. SIMEX), physical exercises, and field experiments

Immerse Users/Developers in a Rapidly-Configured Environment with Real and Virtual Prototypes: Accelerated Concept Engineering



Concept Engineering Tools

Virtual Environments

User-centered

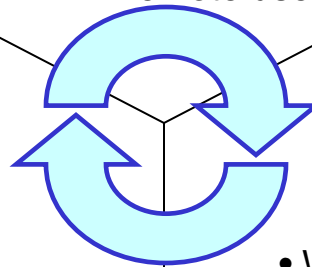


- Persistent, virtual environment
- Gaming, virtual/mixed/augmented reality, 3-D visualization
- Rapidly create relevant environment to explore concepts and CONOPS
- Couple to physical prototyping where user interaction important
- Real-time user feedback
- Bootstrap training
- Remote users

Rapid Prototyping



analyze methods and tools	types	benefits
user analysis	<ul style="list-style-type: none"> • User-centered design • Participatory design • Contextual inquiry • Wizard of Oz • Scenario-based design • Task-based design • Scenario-based design • Task-based design 	<ul style="list-style-type: none"> • User requirements • User expectations • User needs • User preferences • User constraints • User capabilities • User limitations • User attitudes • User beliefs • User values • User goals • User motivations • User interests • User concerns • User fears • User hopes • User dreams • User wishes • User desires • User wants • User needs • User requirements • User expectations • User preferences • User constraints • User capabilities • User limitations • User attitudes • User beliefs • User values • User goals • User motivations • User interests • User concerns • User fears • User hopes • User dreams • User wishes • User desires • User wants
generics	<ul style="list-style-type: none"> • Scenario-based design • Task-based design • Scenario-based design • Task-based design 	<ul style="list-style-type: none"> • User requirements • User expectations • User needs • User preferences • User constraints • User capabilities • User limitations • User attitudes • User beliefs • User values • User goals • User motivations • User interests • User concerns • User fears • User hopes • User dreams • User wishes • User desires • User wants
business analysis	<ul style="list-style-type: none"> • Business process analysis • Business model analysis • Business case analysis • Business plan analysis • Business strategy analysis • Business structure analysis • Business culture analysis • Business environment analysis • Business risk analysis • Business opportunity analysis • Business threat analysis • Business competitive analysis • Business financial analysis • Business legal analysis • Business ethical analysis • Business social analysis • Business environmental analysis • Business technological analysis • Business human resources analysis • Business marketing analysis • Business operations analysis • Business production analysis • Business distribution analysis • Business sales analysis • Business customer analysis • Business partner analysis • Business supplier analysis • Business competitor analysis • Business industry analysis • Business government analysis • Business community analysis • Business culture analysis • Business environment analysis • Business risk analysis • Business opportunity analysis • Business threat analysis • Business competitive analysis • Business financial analysis • Business legal analysis • Business ethical analysis • Business social analysis • Business environmental analysis • Business technological analysis • Business human resources analysis • Business marketing analysis • Business operations analysis • Business production analysis • Business distribution analysis • Business sales analysis • Business customer analysis • Business partner analysis • Business supplier analysis • Business competitor analysis • Business industry analysis • Business government analysis • Business community analysis 	<ul style="list-style-type: none"> • User requirements • User expectations • User needs • User preferences • User constraints • User capabilities • User limitations • User attitudes • User beliefs • User values • User goals • User motivations • User interests • User concerns • User fears • User hopes • User dreams • User wishes • User desires • User wants
product analysis	<ul style="list-style-type: none"> • Product design • Product development • Product testing • Product evaluation • Product improvement • Product innovation • Product differentiation • Product positioning • Product branding • Product packaging • Product distribution • Product sales • Product support • Product lifecycle • Product strategy • Product structure • Product culture • Product environment • Product risk • Product opportunity • Product threat • Product competitive • Product financial • Product legal • Product ethical • Product social • Product environmental • Product technological • Product human resources • Product marketing • Product operations • Product production • Product distribution • Product sales • Product customer • Product partner • Product supplier • Product competitor • Product industry • Product government • Product community 	<ul style="list-style-type: none"> • User requirements • User expectations • User needs • User preferences • User constraints • User capabilities • User limitations • User attitudes • User beliefs • User values • User goals • User motivations • User interests • User concerns • User fears • User hopes • User dreams • User wishes • User desires • User wants



- Create routine user-centered feedback
- Employ selected tools and techniques from “design” community (i.e. IIT, Stanford, Ideo Inc)
- Build upon DARPA TIGR and network of forward-deployed S&T personnel
- Systematically anticipate needs and user-centered design factors
- Iterate with CONOPS

- Where possible, rapidly develop physical prototypes of candidate concepts
 - Physical mockups and functional prototypes as technology permits
- Inform CONOPS development, user interfaces, logistics and maintenance driven changes
- Leverage vast array of capabilities across DoD
- Over time, seamlessly integrate with virtual environment



Conclusion

Findings

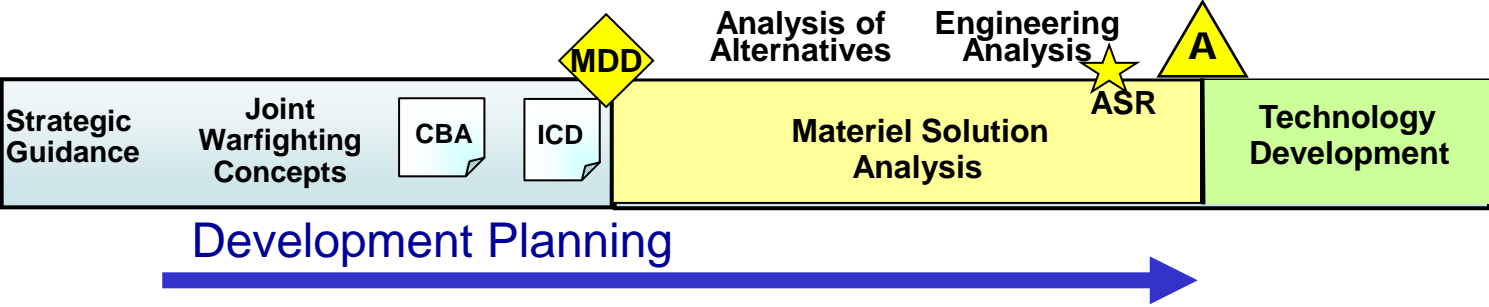
- Significant opportunities exist to develop and deploy technologies to strengthen the Department's ability to conduct rapid capability fielding
 - However, non-technical challenges (e.g. cultural, budgetary, contracting, etc) must be simultaneously addressed
- Greatest leverage in the "front end" of the life cycle
 - Concept Engineering: Rapidly elucidating the need, exploring solutions, developing CONOPs, and deriving requirements for materiel solutions
 - Virtual environments and rapid physical prototyping are linchpin technologies
- Opportunities exist to increase design, test, and production efficiencies
 - Examples include physics-based M&S to reduce testing and model-based engineering and manufacturing approaches

Recommendations

- A concept engineering center should be implemented immediately that leverages the substantial existing capabilities across the Department
- A strategic R&D roadmap should be developed and implemented to mature and transition emerging tools and promising innovative ideas
- A set of potential pilots is recommended to demonstrate the application of today's toolset to relevant rapid capability challenges



WSARA and Development Planning





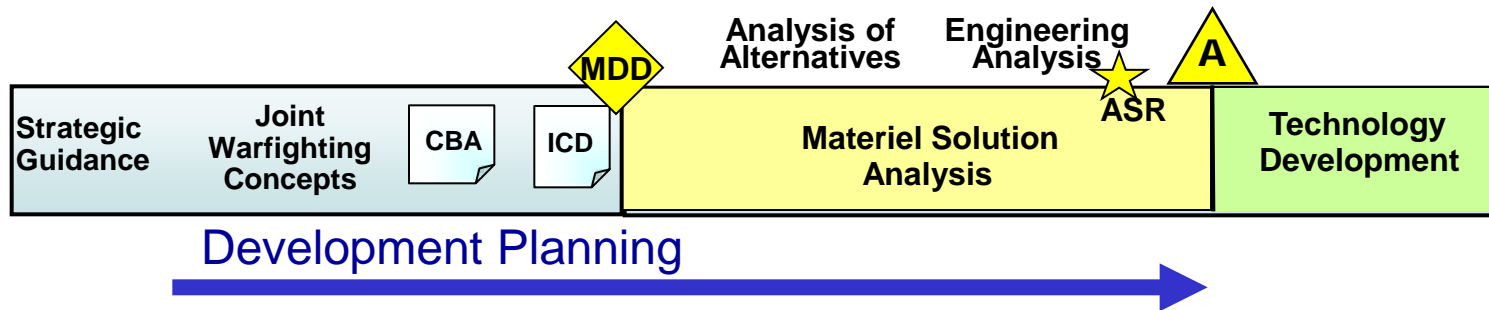
WSARA Development Planning Requirements



- **Development Planning** is a new function identified in the 2009 legislation
- **Specifically, SE is required to:**
 - Monitor and Review systems engineering and *development planning* activities of the major defense acquisition programs
 - Provide advocacy, oversight, and guidance to elements of the acquisition workforce responsible for systems engineering and *development planning*
 - Provide input on the inclusion of systems engineering requirements in the process for consideration of joint military requirements by the Joint Requirements Oversight Council
 - Periodically review the organizations and capabilities of the military departments with respect to systems engineering and *development planning* capabilities
- **Immediate Action Taken**
 - Promulgated initial development planning Guidance for Service Assessments directed by WSARA
 - OSD analysis of Service inputs will be included in March 2010 Joint Report
- **FY10 Plans**
 - Define and promulgate development planning guidance and expectations, assessment procedures, staffing and resource planning



Development Planning

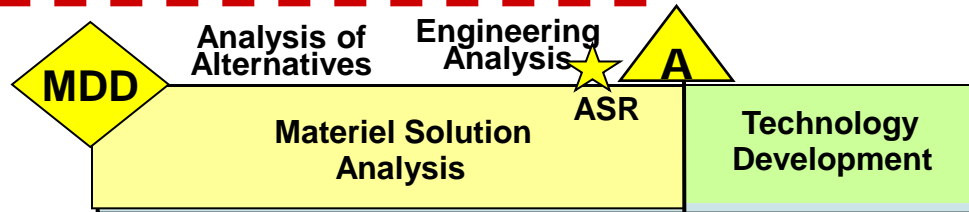


Development Planning is the upfront technical preparation to ensure successful selection and development of a materiel solution



Significant Technical Issues Pre-MS A

ISSUE	POTENTIAL IMPACTS
<ul style="list-style-type: none"> Lack of consistent technical engagement with the operational user to ensure: <ul style="list-style-type: none"> Awareness of potential solutions Understanding of user performance needs Opportunities for incremental capability delivery 	<ul style="list-style-type: none"> Narrow AoA scope, missed solution opportunities Acquisition cost/schedule growth due to lack of understanding of the CONOPS
<ul style="list-style-type: none"> Program-focused analysis, when solutions will impact broad sets of systems and SoS 	<ul style="list-style-type: none"> Delivery of capability that will not integrate, or that has reduced benefit because of external system issues
<ul style="list-style-type: none"> Lack of consistent technical engagement prior to and following the AoA 	<ul style="list-style-type: none"> Immature alternatives enter the AoA Lack of engineering on preferred solutions to prepare for MS A and TD Phase





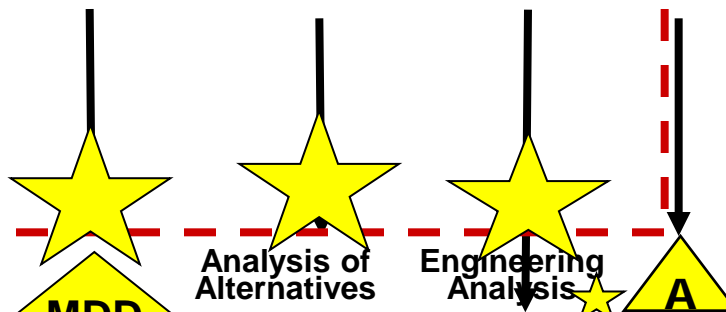
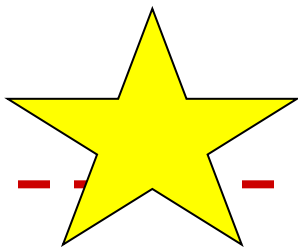
Development Planning Opportunities

Concept Development and Engineering

Focused SoS analysis and development of advanced systems concepts to support needs when they arise

Concept Evaluation and Refinement

Ensure optimal material solutions are identified with sound understanding of risks and opportunities



Strategic Guidance

Joint Warfighting Concepts

CBA

ICD

Analysis of Alternatives

Engineering Analysis

ASR

Technology Development

Material Solution Analysis



Development Planning Opportunities

DoD 5000



Development Planning - Summary

- WSARA establishes the technical leadership and engagement needed pre-MS A in the new requirement for Development Planning
 - The D, SE shall oversee Development Planning activities of major defense acquisition programs, and periodically assess Component Development Planning capabilities*
- Development planning activities span the lifecycle, including:

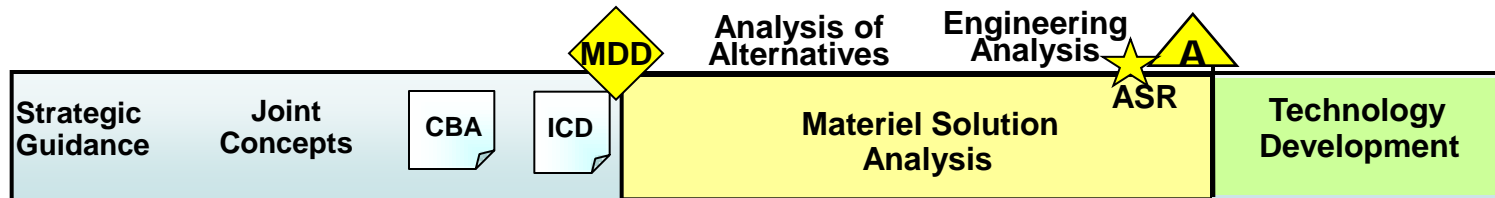
Analysis of future user needs and engineering of new system concepts in a System of Systems (SoS) operational environment

Multiple sufficiently robust, material options to address gap

Defined costs and benefits of the options including technical risk

Preferred solution with clear evidence & understanding of risk

Sufficiently robust, material solution and a risk-based TD Plan



On a path to collaboratively develop and implement Development Planning policy, guidance, and responsibilities for pre-MDD, MDD, pre-A and MS A



MORS Analytic Agenda Workshop 1- 4 March 2010

**WG 7: Development Planning
Chair: Ms. Kristen Baldwin**



MORS Analytic Agenda Conference Overview



- **Title: Analytic Agenda Way Ahead**
- **Date: March 1-4, 2010**
- **Location: Northrop Grumman Heritage Conference Center, 4803 Stonecroft Boulevard, Chantilly, VA 20151, on-site phone (703) 633-2200**
- **Problem Statement: How can we make the Analytic Agenda agile enough to respond effectively to the analytical needs of leadership within the Department of Defense and other organizations?**
- **This workshop will describe a way ahead for the Analytic Agenda by:**
 - Developing recommendations for improving Analytic Agenda processes and products,
 - Expanding the understanding of Analytic Agenda products and processes for workshop participants and the community of Analytic Agenda participants and customers
- **Classification: SECRET REL ACGU (all sessions); an unclassified summary will be produced for publication in the PHALANX**



MORS Analytic Agenda Conference Agenda



Monday	Tuesday		Wednesday		Thursday	
PM	AM	PM	AM	PM	AM	PM
Tutorials <ul style="list-style-type: none"> • Analytic Agenda Overviews <ul style="list-style-type: none"> – Policy – Joint Staff – CAPE – Intel Community – JDS • Development Planning 	Plenary <ul style="list-style-type: none"> • Policy/JS/PA&E panel • Service panel • COCOM/OSD panel(s) 	Working Groups 1. Warfight 2. Foundation Activities/Integrated Security Campaigns 3. Homeland Defense 4. Irregular Warfare		Working Groups 5. Data/Tools mgmt/VV&A 6. C4ISR/IO/EW analysis 7. Development planning 8. Interagency & International collaboration		Outbriefs <ul style="list-style-type: none"> • Working groups • Synthesis group



WG 7: Development Planning Framing Questions



- What type of analysis/engineering should be done at each stage?
- From what perspective?
- To what level of detail?
- Under what circumstances?
- What are the pros and cons of different mixes?
- Who should perform?
- What are the data requirements?
- What are the products?

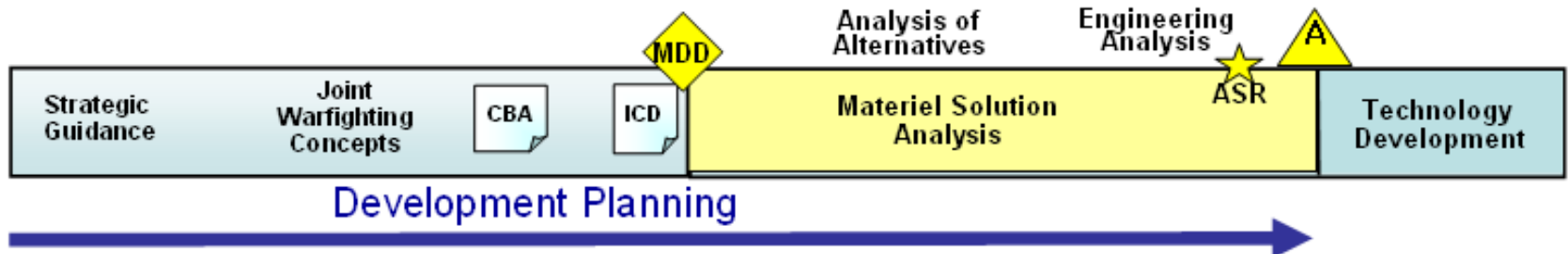
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Sufficiently robust materiel solution and a risk-based TD Plan





Wrap-Up



- **Other M&S efforts**
 - Systems of systems use of M&S, SoS T&E
 - Tools leverage: JIEDDO JTCOIC, AF-ICE, MATREX
 - Acquisition Community High Level Tasks under M&S Coordination Office and Senior Steering Group
- **Way-ahead**
 - Obtain clear understanding of M&S capabilities in the Acquisition community
 - Identify ways to leverage these capabilities toward new goals
 - Identify gaps in capability that need attention
- **Discussion**