



Engineered Resilient Systems

From Today's Tools and Practices to Tomorrow's Investments: New Directions in Systems Engineering

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Secretary of Defense Guidance on Science & Technology (S&T) Priorities FY13-17



SECRETARY OF DEFENSE
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MEMORANDUM FOR SECRETARIES OF THE MILITARY DEPARTMENTS
CHAIRMAN OF THE JOINT CHIEFS OF STAFF
UNDER SECRETARY OF DEFENSE FOR ACQUISITION,
TECHNOLOGY AND LOGISTICS
ASSISTANT SECRETARY OF DEFENSE FOR RESEARCH
AND ENGINEERING
DIRECTORS OF THE DEFENSE AGENCIES

SUBJECT: Science and Technology (S&T) Priorities for Fiscal Years 2013-17 Planning

The Department's S&T leadership, led by the Assistant Secretary of Defense for Research and Engineering, in close coordination with leadership from the Under Secretary of Defense for Policy, the Assistant Secretary of Defense for Nuclear, Chemical, and Biological Defense, the Deputy Assistant Secretary of Defense for Manufacturing and Industrial Base Policy, and the Joint Staff, has identified seven strategic investment priorities. These S&T priorities derive from a comprehensive analysis of recommendations resulting from the Quadrennial Defense Review mission architecture studies directed in the FY12-16 Defense Planning Programming Guidance.

The priority S&T investment areas in the FY13-17 Program Objective Memorandum are:

- (1) **Data to Decisions** – science and applications to reduce the cycle time and manpower requirements for analysis and use of large data sets.
- (2) **Engineered Resilient Systems** – engineering concepts, science, and design tools to protect against malicious compromise of weapon systems and to develop agile manufacturing for trusted and assured defense systems.
- (3) **Cyber Science and Technology** – science and technology for efficient, effective cyber capabilities across the spectrum of joint operations.
- (4) **Electronic Warfare / Electronic Protection** – new concepts and technology to protect systems and extend capabilities across the electro-magnetic spectrum.
- (5) **Counter Weapons of Mass Destruction (WMD)** – advances in DoD's ability to locate, secure, monitor, tag, track, interdict, eliminate and attribute WMD weapons and materials.
- (6) **Autonomy** – science and technology to achieve autonomous systems that reliably and safely accomplish complex tasks, in all environments.
- (7) **Human Systems** – science and technology to enhance human-machine interfaces to

The Assistant Secretary of Defense for Research and Engineering, with the Department's S&T Executive Committee and other stakeholders, will oversee the development of implementation roadmaps for each priority area. These roadmaps will coordinate Component investments in the priority areas to accelerate the development and delivery of capabilities consistent with these priorities.

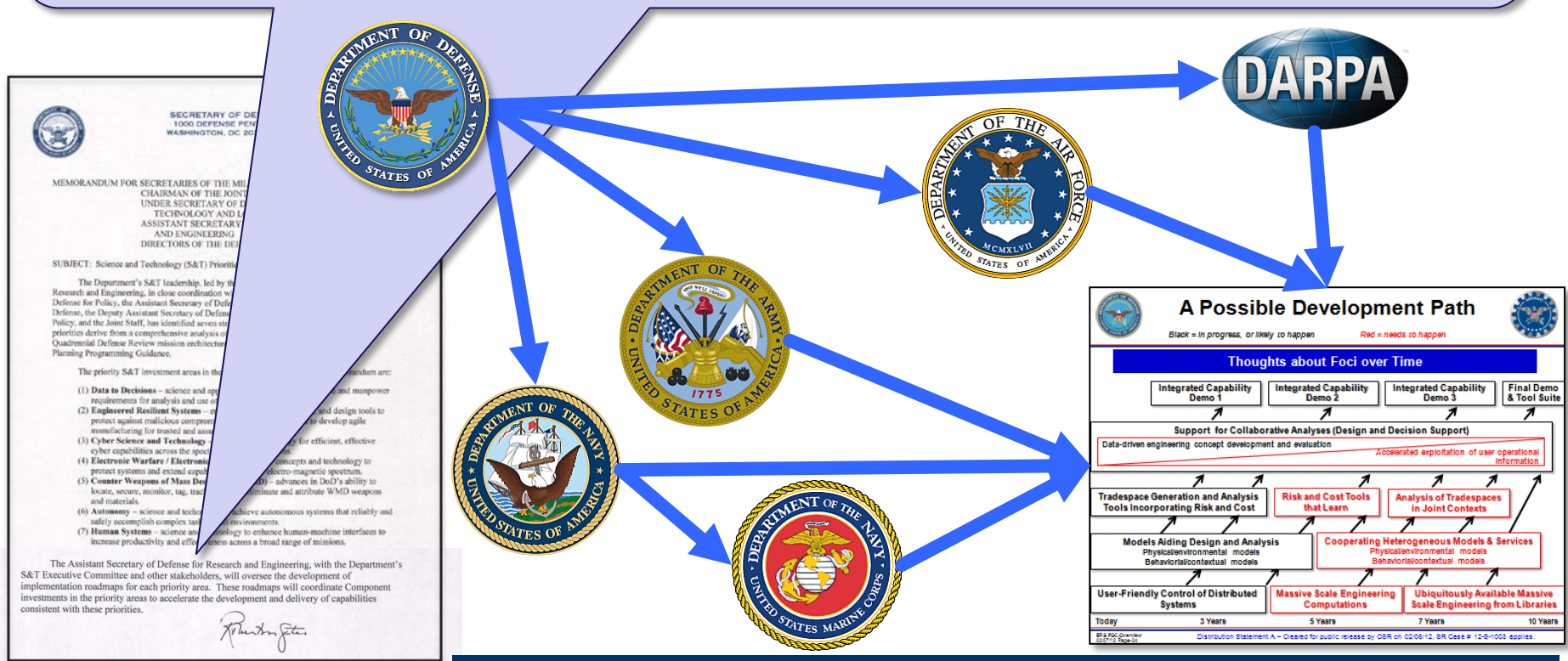
Priority S&T Investment Areas:

1. Data to Decisions
2. Engineered Resilient Systems
3. Cyber Science and Technology
4. Electronic Warfare / Electronic Protection
5. Counter Weapons of Mass Destruction
6. Autonomy
7. Human Systems



Engineered Resilient Systems: A DoD-wide Activity

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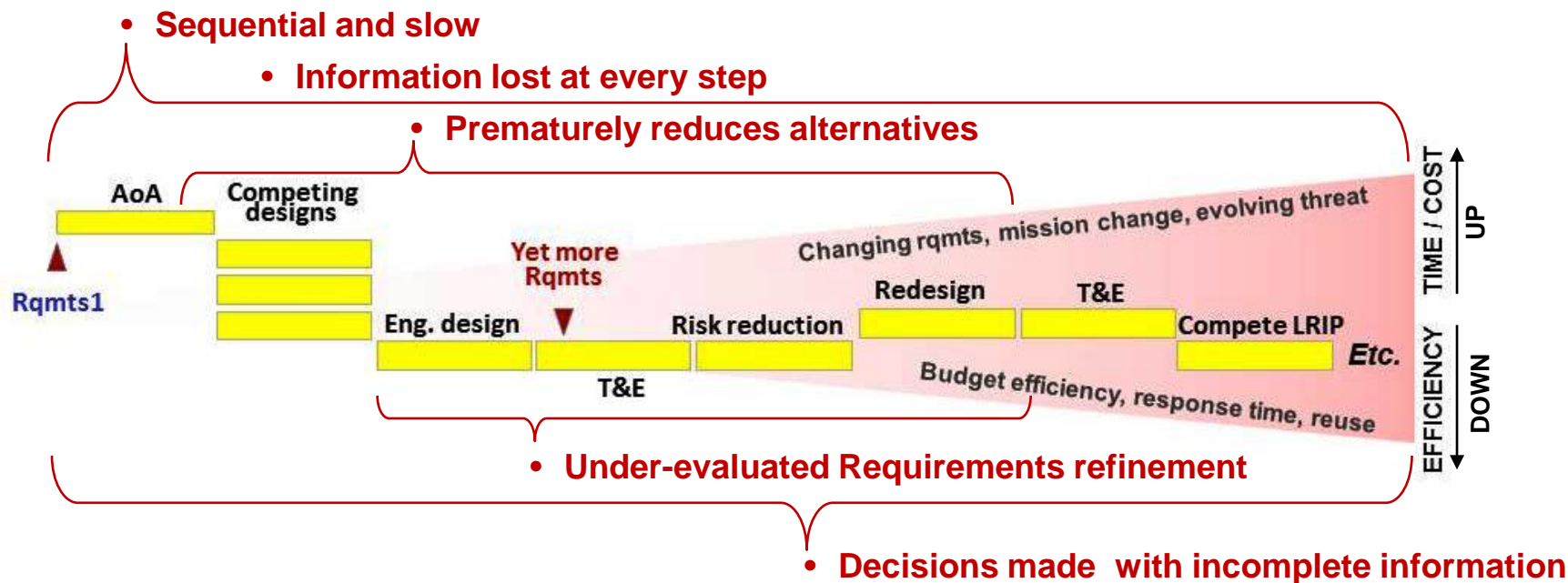


Working Toward A DoD-Wide Roadmap



Conventional Engineering Practice

50 years of process reforms haven't controlled time, cost and performance



Engineering practice must meet *new challenges*:

- Pace of technology development
- Uncertain sociopolitical futures
- Global availability of technology to potential competitors

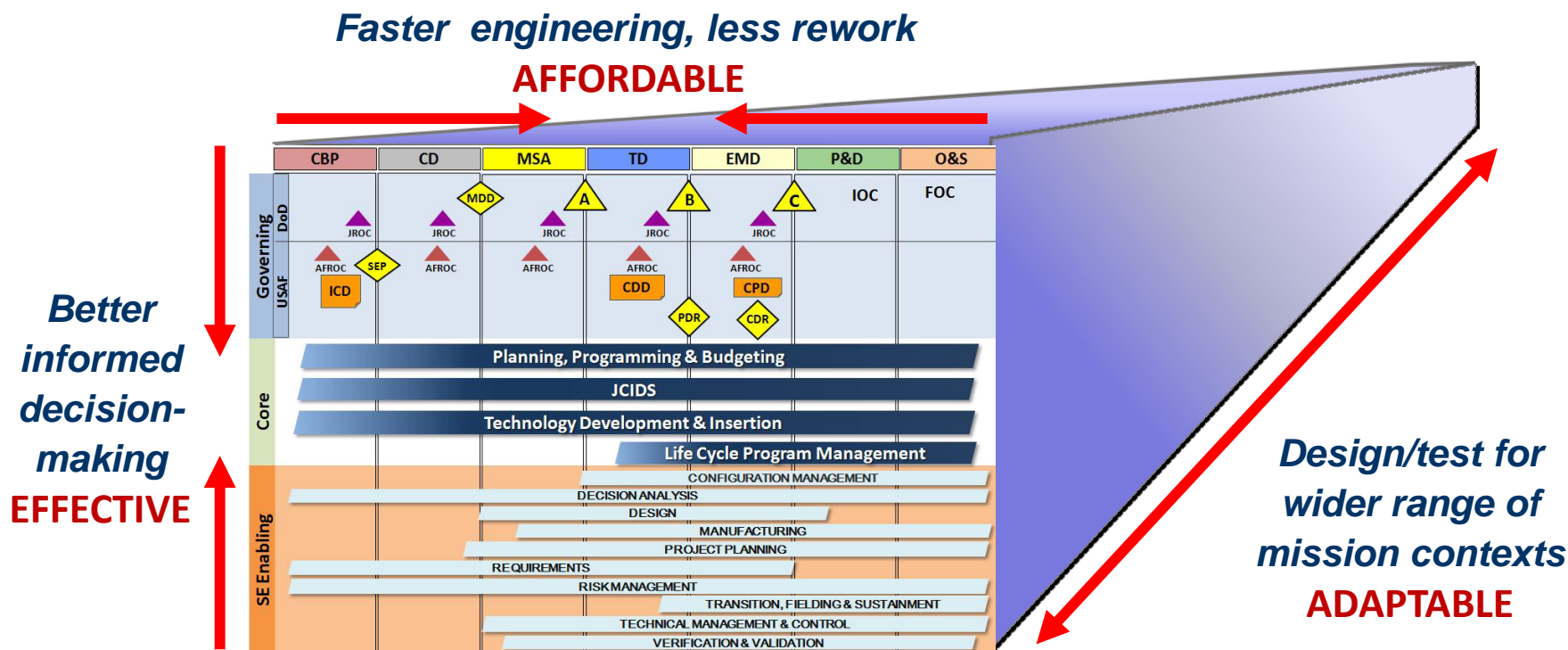


Transforming Engineering of Complex Systems



Engineering for resilience: **robust** systems with **broad utility**

- *In a wide range of joint operations*
- *Across many potential alternative futures*



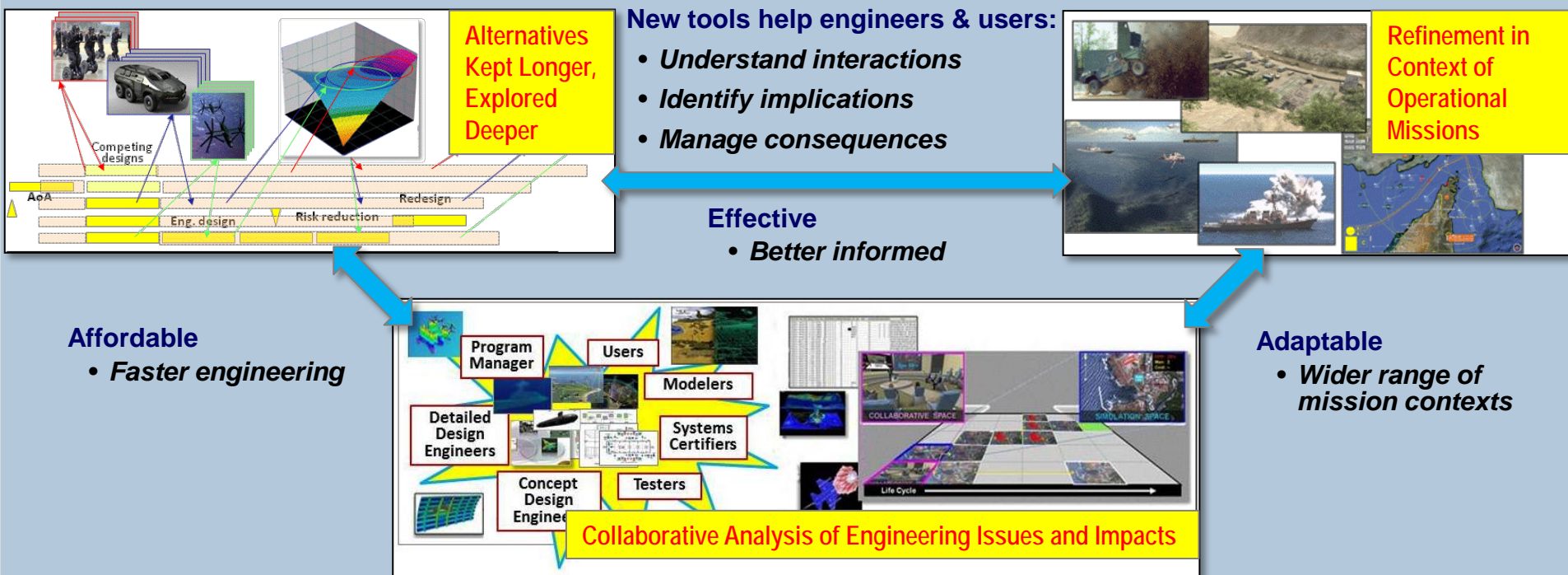


Engineered Resilient Systems

Transformational Engineering Practices



Increased computational power and availability allow more flexibility in data exploitation and application of services

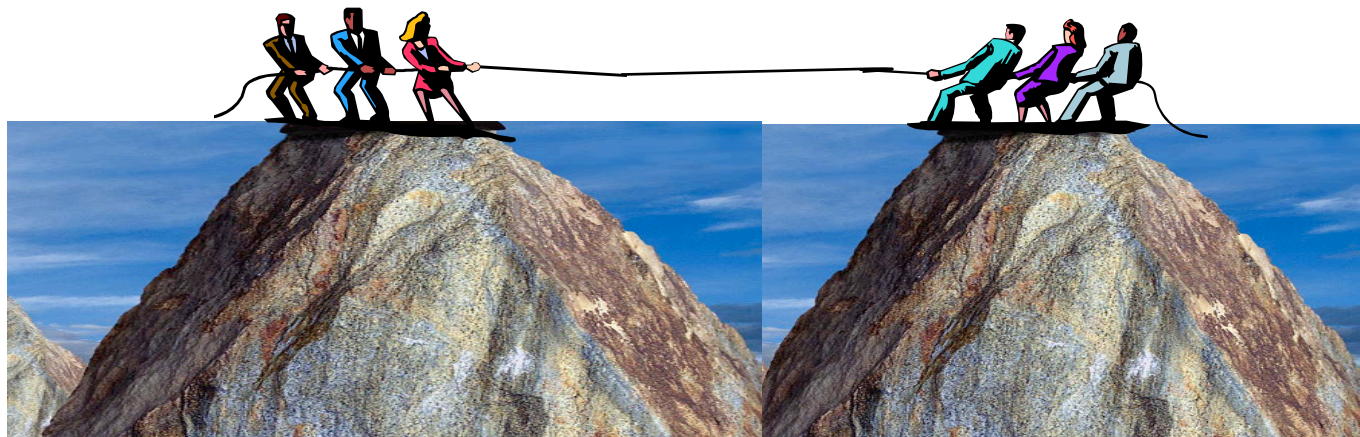


ERS envisions an ecosystem in which a wide range of stakeholders continually cross-feed multiple types of data that inform each other's activities



Who Owns the Tools?

***No
Single
Winning
Answer***



Pull too hard and everyone loses

Looking for a Win-Win

- **Tools for Government**
 - Better understanding and specifier of needs
 - Better evaluator of offerings
- **Tools for Systems Providers**
 - Risk mitigation through better understanding of customer
 - Ability to pre-qualify offerings, present meaningful opportunities
- **Tool Vendors: New Products to Sell Both**

Key Connectors are Data Exchange Protocols and Architectures



Envisioned End State

Improved Engineering and Design Capabilities

- More environmental and mission context
- More alternatives developed, evaluated and maintained
- Better trades: managing interactions, choices, consequences

Improved Systems

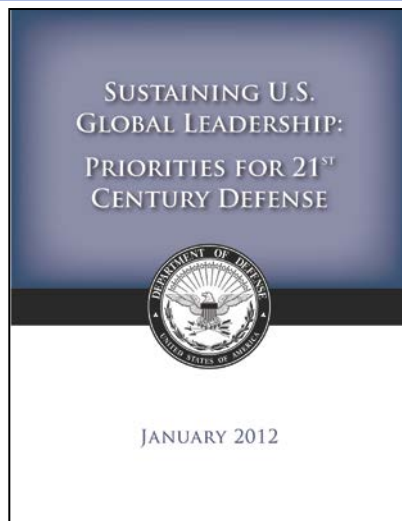
- Highly effective: better performance, greater mission effectiveness
- Easier to adapt, reconfigure or replace
- Confidence in graceful degradation of function

Improved Engineering Processes

- Fewer rework cycles
- Faster cycle completion
- Better managed requirements shifts



ERS: Foundational for Defense Systems across All Mission Areas



Ten DoD Strategic Missions

Overwhelming majority require affordable, adaptable & effective systems and Concepts of Operation:

Target Outcomes

50% reduction in cost and effort to adapt to new mission

12X Speed up in time to initial operating capability

95% of system informed by models and operational trades

Seven Strategic Principles to Ensure Success, including:

- Offer versatility
- Enable course changes
- Reduce costs
- Develop new capabilities leveraging network warfare

