US Planning and Investing for Defense Aerospace R&D

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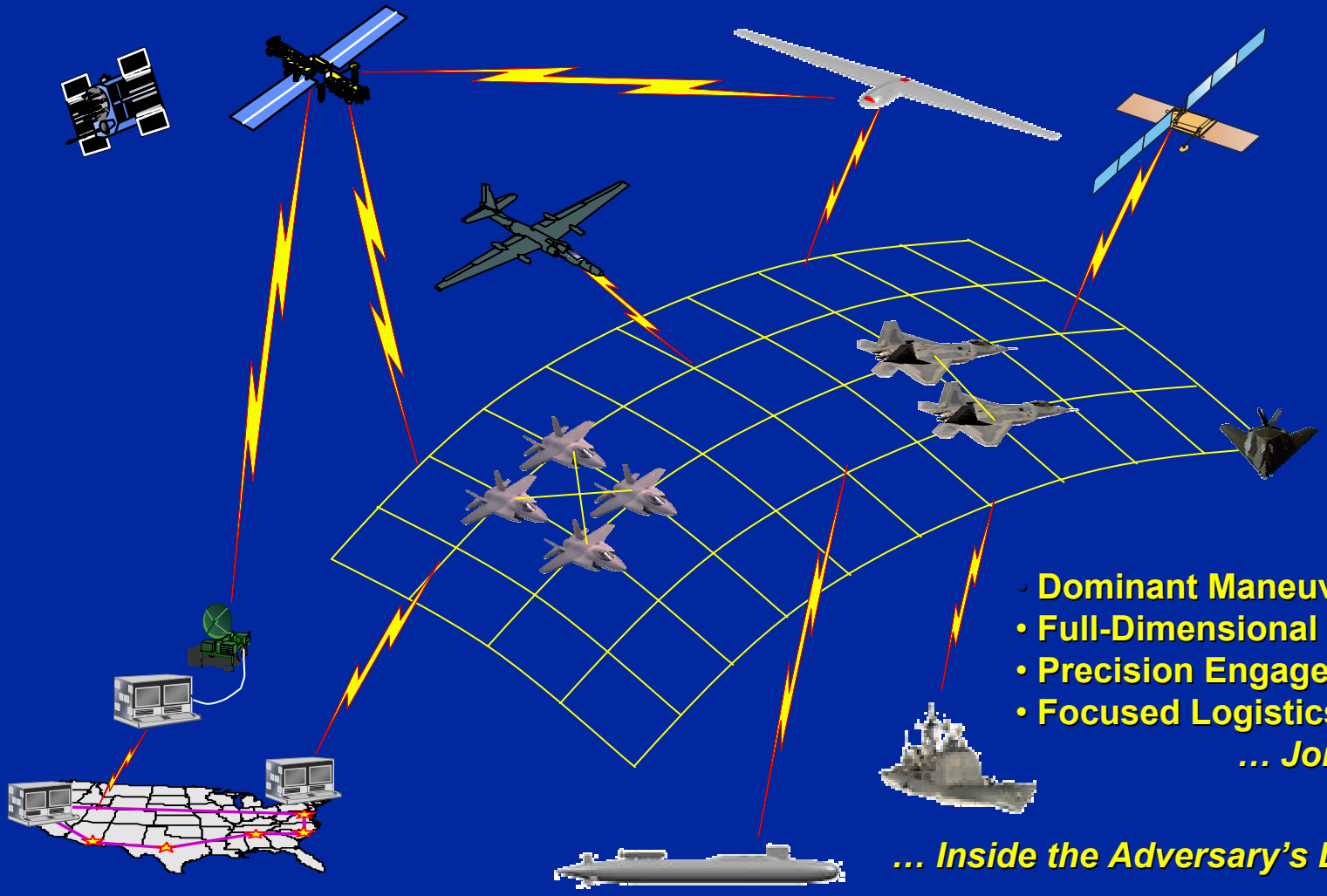
Topics

- Working with the Customer on Transformation
- Industry Best Practices
- Recent Lessons Learned
- Technology Acquisition Strategy
- Technical Personnel

War Fighting in the 21st Century

Future Warfighting Blueprint Based on an Architectural Perspective …
Coalitions…Operational … Systems … Technical



- **Dominant Maneuver**
- **Full-Dimensional Protection**
- **Precision Engagement**
- **Focused Logistics**

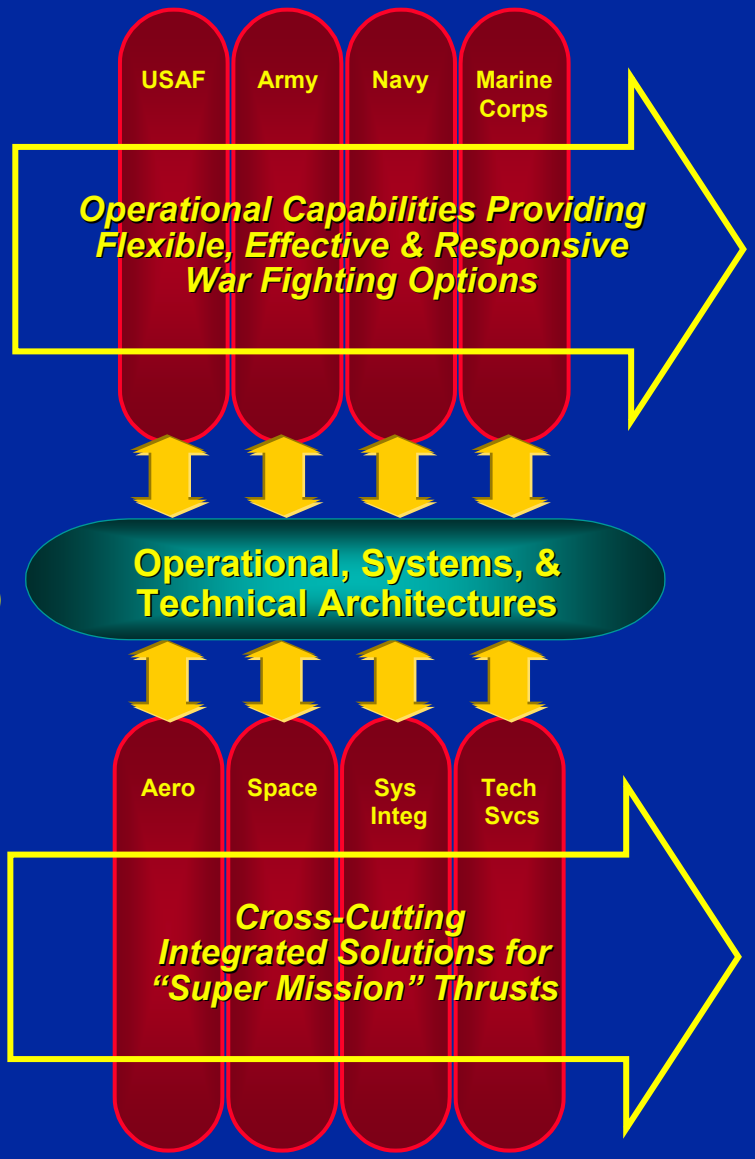
… Joint Vision 2020

… Inside the Adversary's Decision Loop

A New Level of Integration

Government - DoD

- Goldwater Nichols Act
- Coalition Operations
  (Desert Storm, Bosnia,…)
- Defense Strategy (JV2020)
- Joint Forces Command
- *September 11th* Response



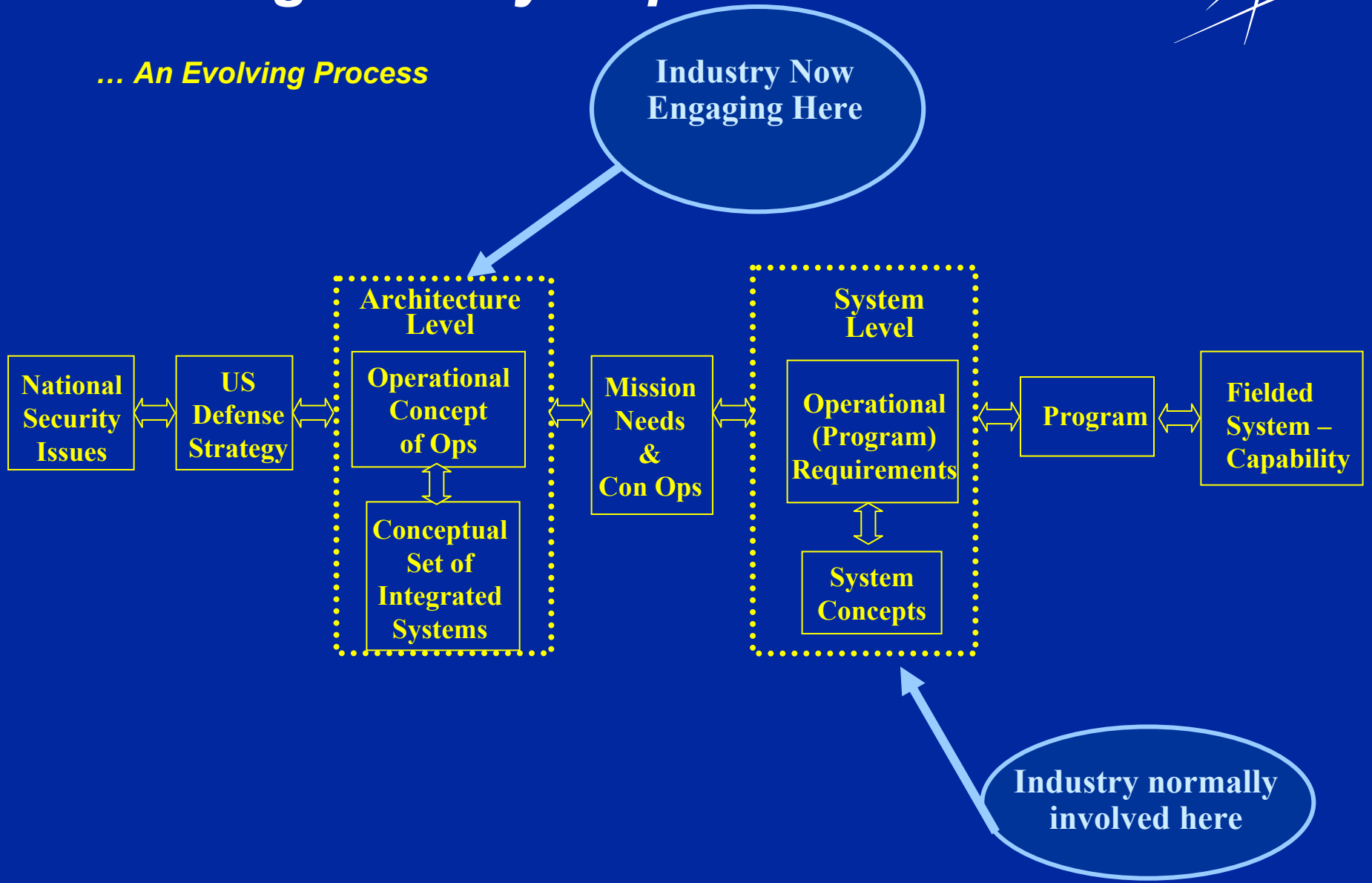
Joint CONOPS
Synchronized Execution
Flexible Combat Solutions
Coalition Force Integration

Industry

Interoperable Systems
Increased Use of Automation
Global Industry Teams
Network Centric Solutions

Creating Military Capabilities

… An Evolving Process



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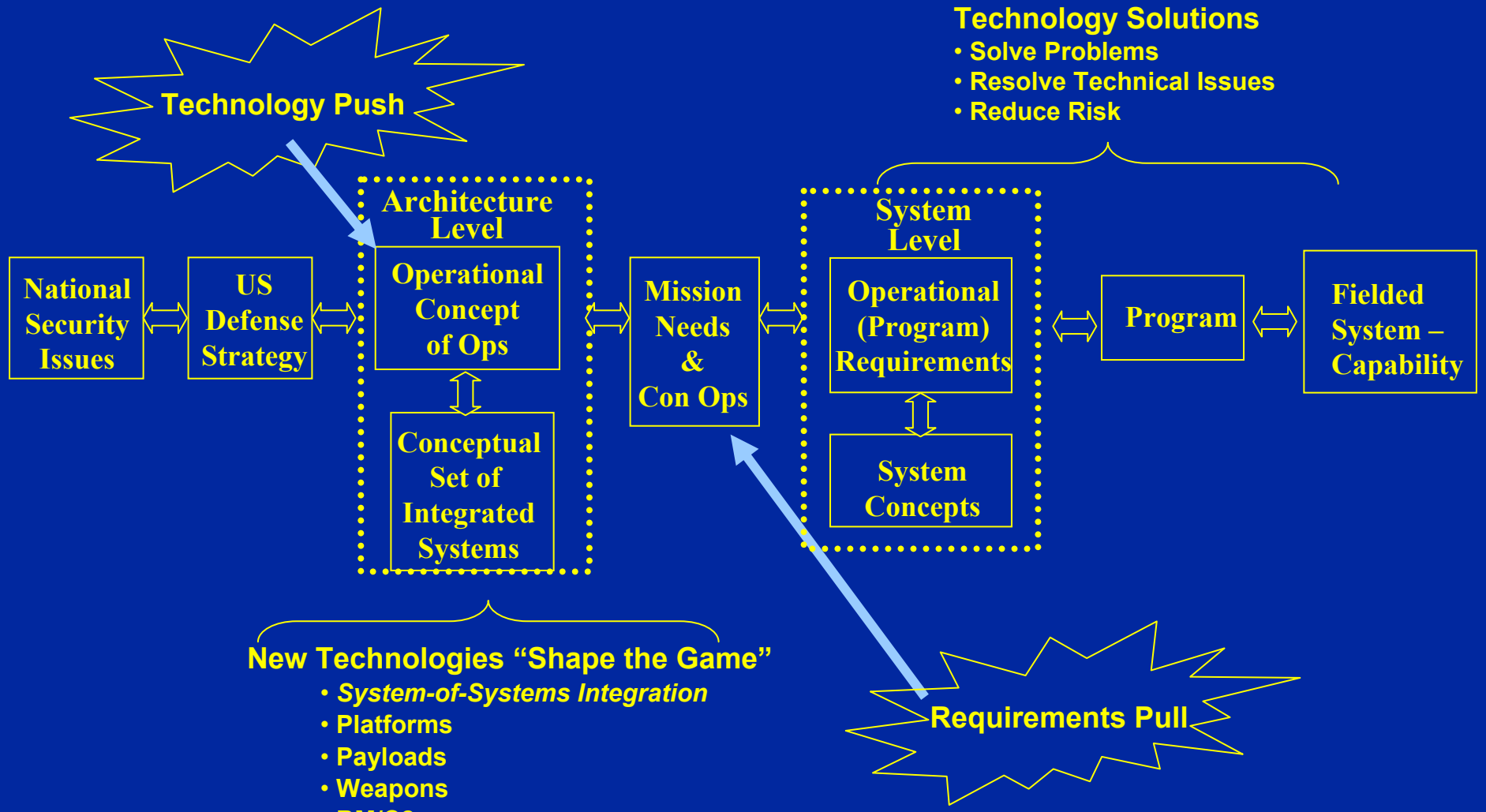
Creating Military Capabilities

… An Evolving Process



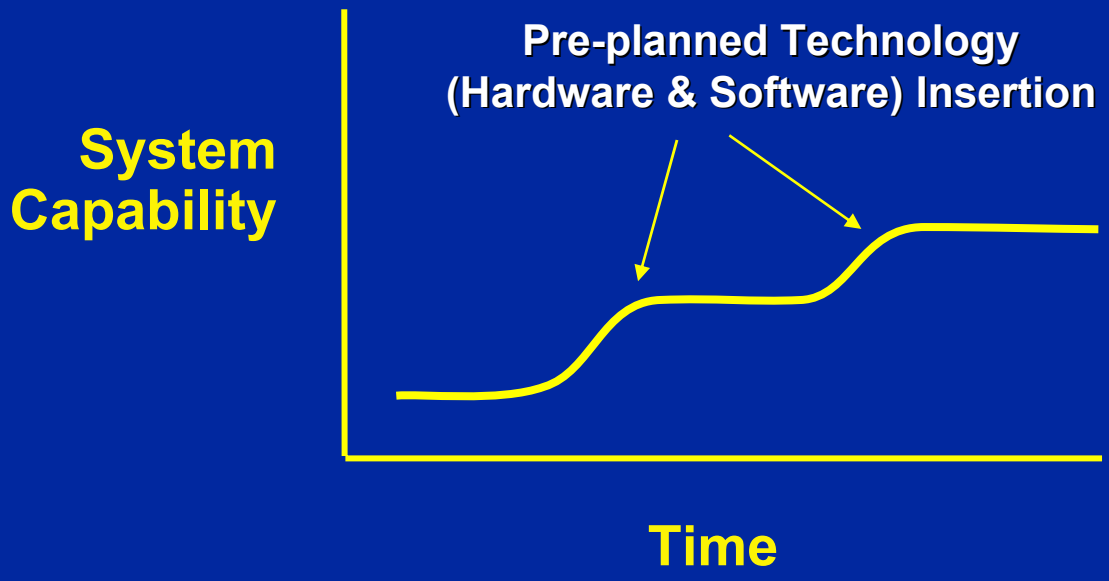
R&D Acquisition Best Practices

- Technology Readiness Level Assignment, Tracking and Planning
- Spiral Development and Planned System Improvements
- Rapid Prototyping, and Residual Operational Capability
- Make/Buy and Partnering
- Portfolio Balancing
  - Evolutionary/Revolutionary
  - Tech Base/IRAD/CRAD
  - Manufacturing/Logistics Technology

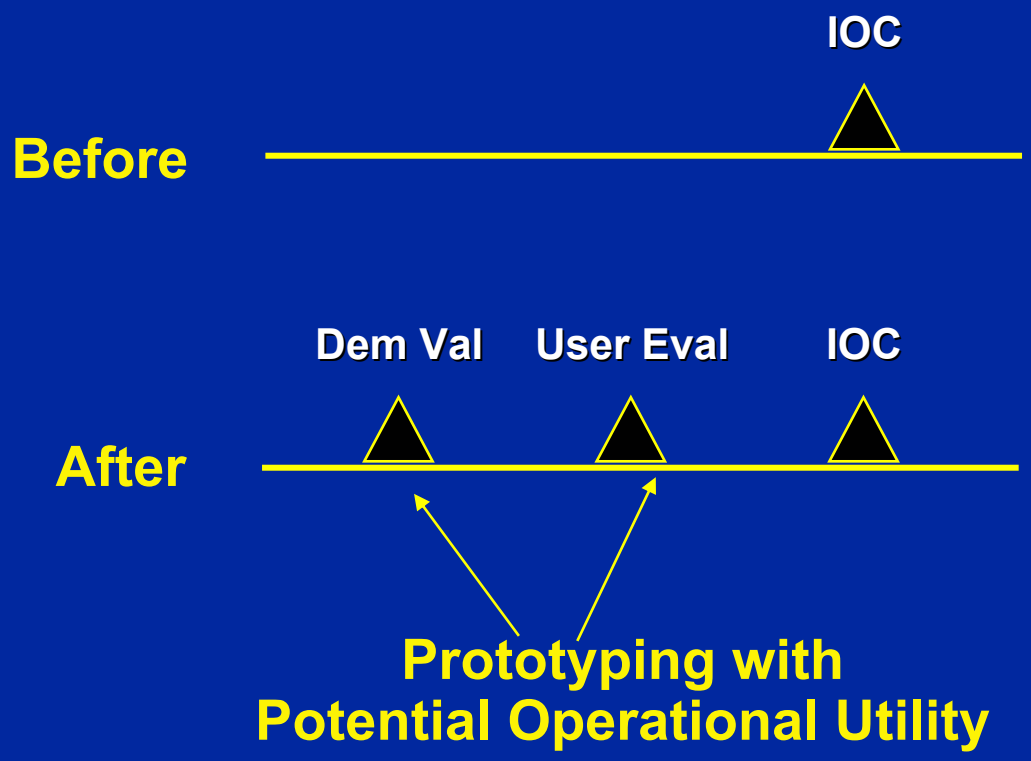
Technology Readiness Level Assignment, Tracking & Planning (from NASA Experience)

- ***Basic Technology Research:***
  - **Level 1: Basic principles observed and reported**
- ***Research to Prove Feasibility:***
  - **Level 2: Technology concept and/or application formulated**
  - **Level 3: Analytical and experimental critical function and/or characteristic proof of concept**
- ***Technology Development:***
  - **Level 4: Component and/or breadboard validation in laboratory environment**
- ***Technology Demonstration:***
  - **Level 5: Component and/or breadboard validation in relevant environment**
  - **Level 6: System/subsystem model or prototype demonstration in a relevant environment**
- ***System/Subsystem Development:***
  - **Level 7: System prototype demonstration in an operational environment**
- ***System/Test Launch & Operations:***
  - **Level 8: Actual system completed and "fight qualified" through test and realistic demonstration**
  - **Level 9: Actual system "flight proven" through successful mission operations**

Spiral Development and Planned System Improvements



Rapid Prototyping and Residual Operational Capability



Make/Buy and Partnering

- **US aerospace firms not vertically integrated - buy key elements from suppliers worldwide**
- **Customer wants best solution with representative industry "team"**
- **Must know own technical limits and judge when/how to buy outside/overseas**
- **Need to develop long term agreements with key suppliers and collaborators**

Portfolio Balancing

- **Aerospace sector will never have enough IRAD (<3%), so CRAD is vital to progress.**
- **Major customer is Gov't Military, so IRAD heavily focused on DOD (proportional)**
- **Large part of internal investment should sustain and grow competitive position – be sensitive to partners' growth also**
- **Mortgaged IRAD is bad business – DOD policy prohibits, but customers still push for risk reduction investment**
- **Must allocate executable resources to disruptive technologies – beat "innovators dilemma"**
- **Manufacturing and Logistics R&D requires investment**

Recent Lessons Learned

- **Return On-Investment Metrics**
- **COTS Technology**
- **Commercialization/Technology Mining**
- **Corporate R&D Labs/Centers**
- **IRAD Mortgaging**

Technology Strategy & Leverage (1)

- ***Acquisition Vision* – Field and Sustain World's Best High Tech Defense Systems w/ Strong Linkages Across Allies**
  - **Cost Effectiveness Emphasis in All R&D Planning & Execution**

- ***Oversight to Optimize Investments (~$20B/yr)***
  - ***Insight* & Critique by Coordinated Staffs Planning & Execution Review**
  - **Crosscutting Tech Focus, e.g., Advanced Sensors, GNC, BMD, Nanotechnology, Unmanned Systems**
  - **Identification and Feedback of Synergies, Overlaps, e.g., Software, Processors, Power, Net Enabled Systems**
  - **IPT's at Customer and User (Program, Technology, Mission)**

Optimize Near /Far Term ROI w/ Coordinated Efforts

R&D - Corporate Strategy & Leverage (2)

- **OSD/Corporate Level Technology ($10B) – DDRE/CTO Direction, w/ Agency/Business Area Coordination**
  - Support to Fielded Force (~ 1/2)
  - Transformation (~1/4)
  - Advanced Technology (~1/5)
  - University/Basic Research (~1/20)

- **Other Tools**
  - Tech Assistance, e.g., FFRDC, DOE Labs, SETA Cos, Independent Consultants (Advice/Assessments)
  - Customer Feedback, Annual Warfighter Conferences
  - Global IT Network (Virtual Collocation, Collaboration)
  - DoD & Other Advisory Groups, Customer (S&T) Interaction, e.g., NRC, SAB's, NNI, NAI, DEPS

US Technical Personnel

- Execute total technology acquisition effort
- Make connection to external/international R&D
- Link with business, finance and program management initiatives,

But,…

- Industry and government anticipate major shortfall in technical manpower
- Revolution in technology demands new skills
- Government personnel harder to hire and retain
- US demographics don't support technical needs
- Number of US trained foreign S&E's returning to native countries leveling international competition
- Council on Competitiveness Report highlights problem – DOD studying other ways to stimulate sustainment of manpower pool

Conclusions

- **Transformation requires earlier participation of industry and balanced tech push/user pull**
- **Achieving acquisition vision requires investment focus and customer oversight**
- **Observing best practices and lessons learned will optimize R&D investments**
- **Large, diverse organizations must horizontally integrate R&D and leverage external R&D**
- **The US must ensure availability of manpower for successful technology acquisition**