Are Rapid Fielding and Good Systems Engineering Mutually Exclusive?

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What's the Problem

✴ **Conflicting data**

  • **Get it to the field now – request from field**

    – Items with long term positive benefit

    – Lots of stuff that never gets used – reports from field (better than in Desert Storm)

    – Other stuff that gets used and discarded/abandoned

Hon. Robert Gates
Secretary of Defense

Our Challenge
"What can I do to help people downrange today?"

Why Rapid Fielding?

* Address urgent warfighter needs

    - Save lives – protect our troops

    - Pull from COCOMs

    - Push from Industry & Government S&T

* Current technology to the field quickly

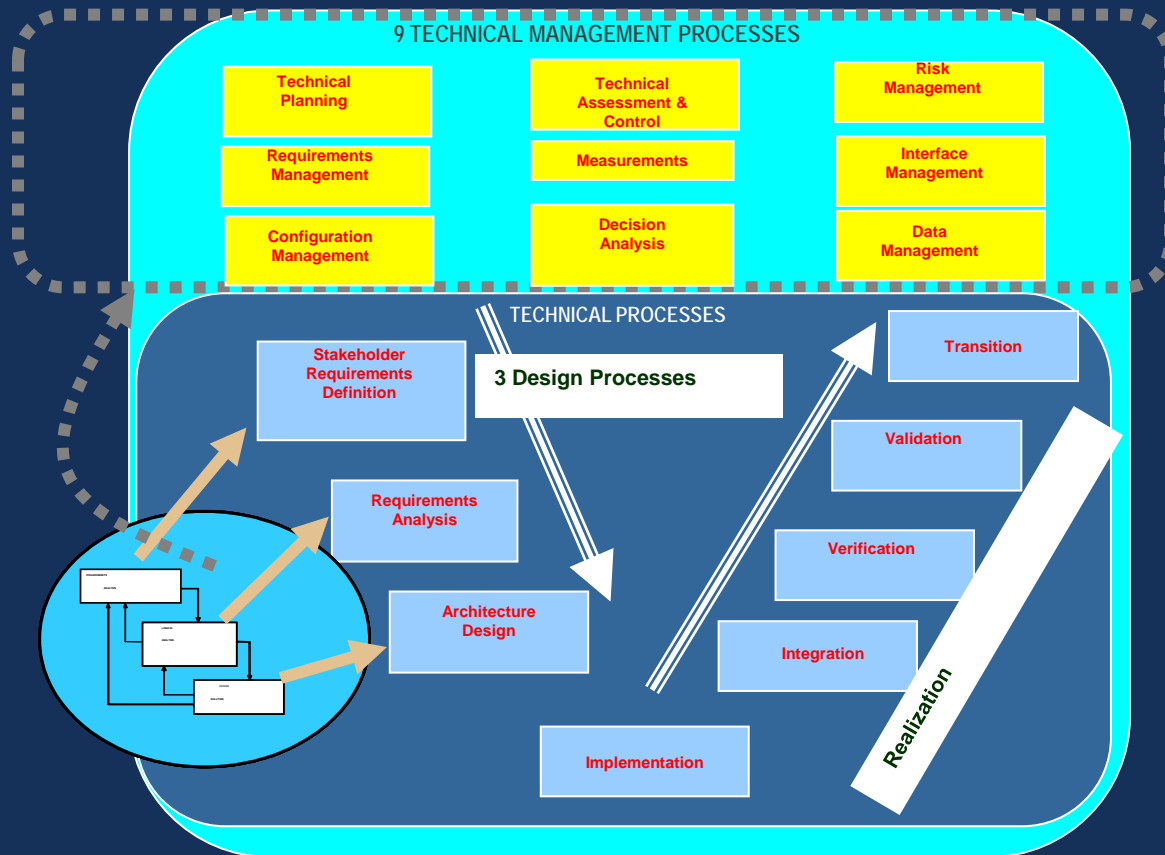* Direction from the top (President, SecDef)

Why Systems Engineering?

* Directed to by policy

* Best practice in government and industry

* Provides discipline to acquisition
  * Repeatable, predictable process
  * Reduces risk
  * Best balance of cost/performance

* Basis for efficient/effective development, production, deployment, operations & maintenance

DoD Policy and Guidance on Systems Engineering

* **Directive 5000.01 requires:**

  Systems Engineering. Acquisition programs shall be managed through the application of a systems engineering approach that optimizes total system performance and minimizes total ownership costs. A modular open-systems approach shall be employed, where feasible.

* **DoD Instruction 5000.02 emphasizes the use of systems engineering per the following extract:**

  Effective sustainment of systems begins with the design and development of reliable and maintainable systems through the continuous application of a robust systems engineering methodology.

* **A recent USD(AT&L) memorandum establishes systems engineering policy and mandates a Systems Engineering Plan for all programs. An extract from the memorandum follows:**

  Systems Engineering (SE). All programs responding to a capabilities or requirements document, regardless of acquisition category, shall apply a robust SE approach that balances total system performance and total ownership costs within the family-of-systems, systems-of-systems context. Programs shall develop a Systems Engineering Plan (SEP) for milestone Decision Authority (Milestone Decision Authority) approval in conjunction with each Milestone review, and integrated with the Acquisition Strategy. This plan shall describe the program's overall technical approach, including processes, resources, metrics, and applicable performance incentives. It shall also detail the timing, conduct, and success criteria of technical reviews.
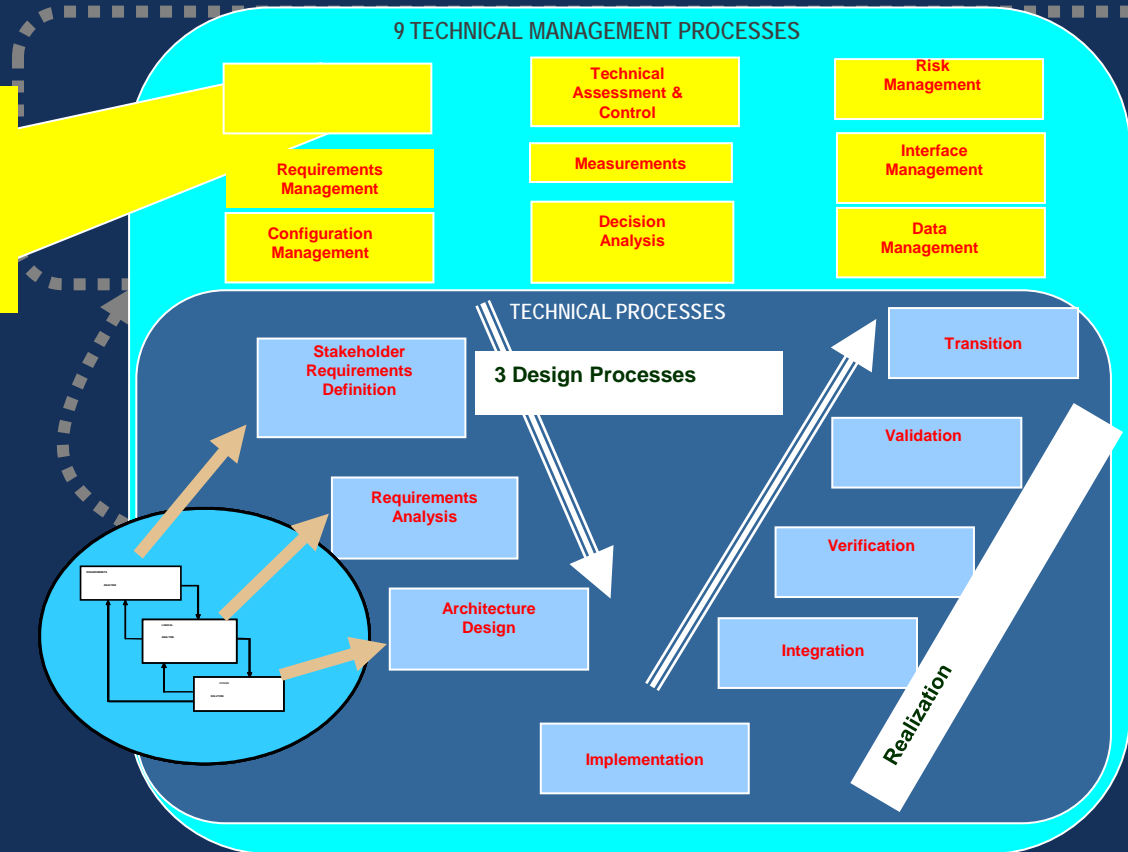
SE Management Process that may be applicable to RF

* Technical Planning

* Requirements management

* Configuration management

* Interface management

* Data management

* Risk management

9 TECHNICAL MANAGEMENT PROCESSES

Technical Planning	Technical Assessment & Control	Risk Management
Requirements Management	Measurements	Interface Management
Configuration Management	Decision Analysis	Data Management

TECHNICAL PROCESSES

Stakeholder Requirements Definition

3 Design Processes

Transition

Validation

Verification

Requirements Analysis

Architecture Design

Integration

Realization

Implementation

Technical Planning

Technical Planning

* Test planning
* FMEA
* Supportability
* Certifications
  * Safety
  * IA
  * Environmental

9 TECHNICAL MANAGEMENT PROCESSES

- Technical Assessment & Control
- Risk Management
- Requirements Management
- Measurements
- Interface Management
- Configuration Management
- Decision Analysis
- Data Management

TECHNICAL PROCESSES

- Stakeholder Requirements Definition
- 3 Design Processes
- Transition
- Requirements Analysis
- Validation
- Verification
- Architecture Design
- Integration
- Implementation
- Realization

Requirements Management

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TECHNICAL PROCESSES

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- Validation
- Verification
- Architecture Design
- Integration
- Implementation
- Realization

Requirements Management

✶ Validated by user(s)

✶ Stable – change control

✶ Basis for JROC staffing

✶ Clear, testable

Configuration Management

Configuration Management

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TECHNICAL PROCESSES

- Stakeholder Requirements Definition
- 3 Design Processes
- Transition
- Requirements Analysis
- Validation
- Architecture Design
- Verification
- Integration
- Implementation
- Realization
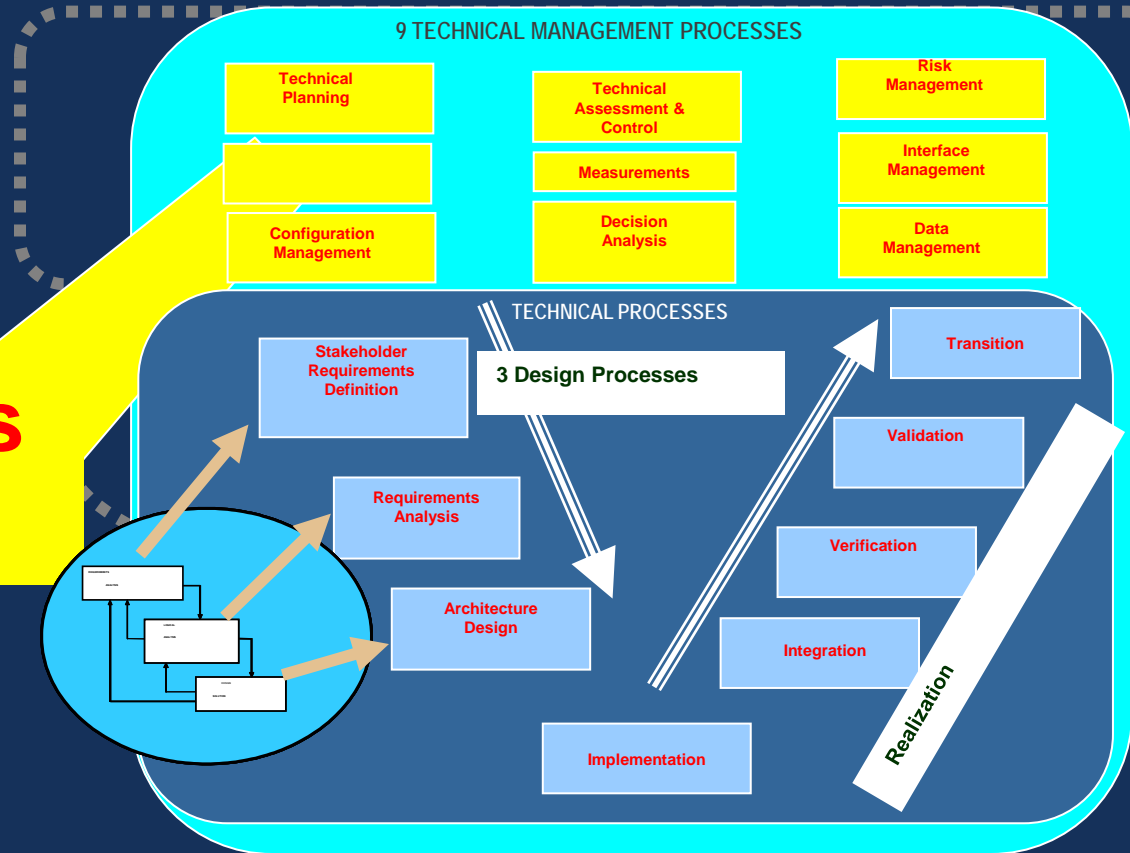
✴ Stable configuration
- Enables integration/support

✴ Support transition to program of record
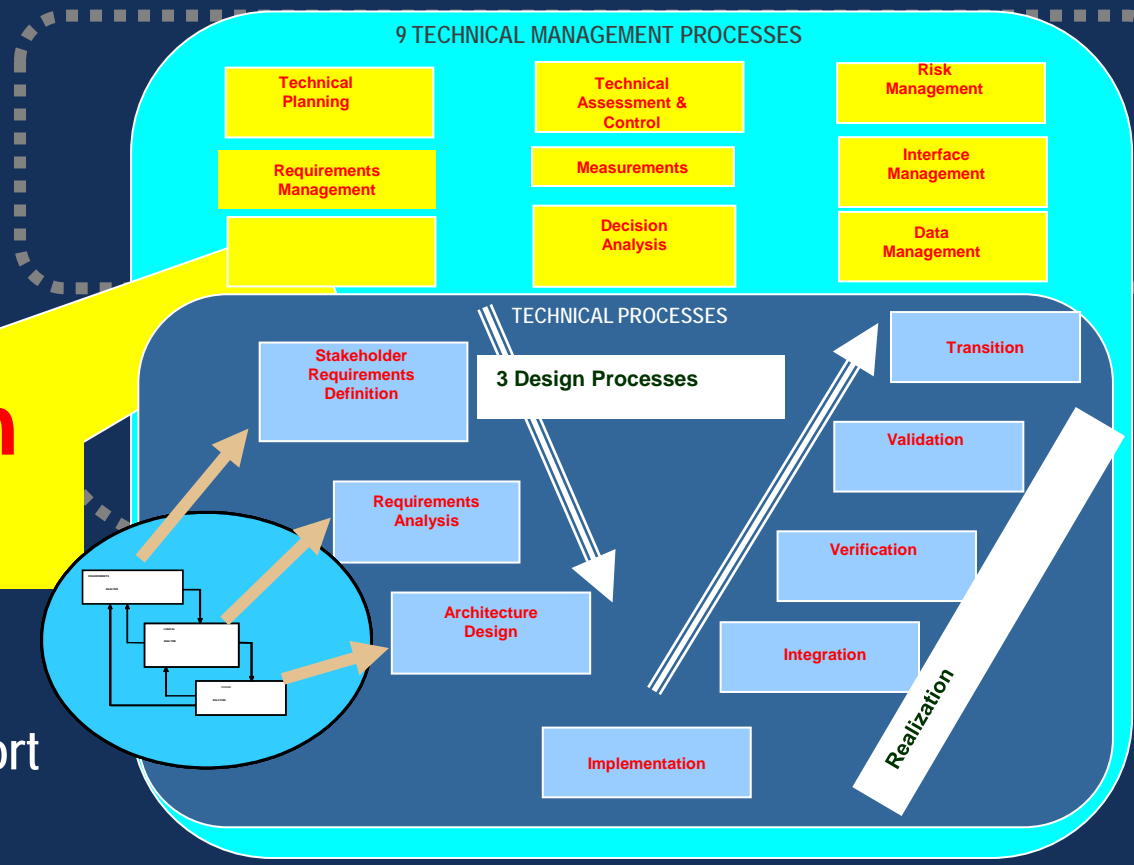
Data Management

9 TECHNICAL MANAGEMENT PROCESSES

- Technical Planning
- Technical Assessment
- Risk Management
- Requirements Management
- Measurements
- Interface Management
- Configuration Management
- Decision Analysis

Data Management

TECHNICAL PROCESSES

- Stakeholder Requirements Definition
- 3 Design Processes
- Transition
- Requirements Analysis
- Validation
- Architecture Design
- Verification
- Integration
- Implementation
- Realization

✴ Need all relevant data
- Design drawings
- Test results
- Training
- Interface
- Software code

✴ Intellectual property
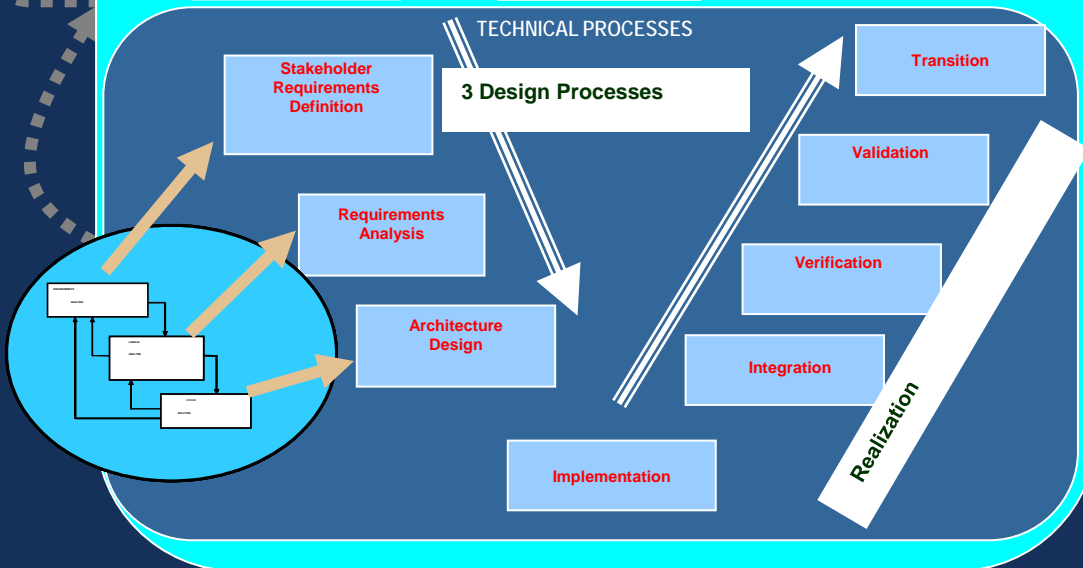- Get all data (even if less than unlimited rights!!)

Interface Management

9 TECHNICAL MANAGEMENT PROCESSES

- Technical Planning
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- Measurements
- Configuration Management
- Decision Analysis
- Data Management

Interface Management

TECHNICAL PROCESSES

- Stakeholder Requirements Definition
- **3 Design Processes**
- Transition
- Validation
- Requirements Analysis
- Verification
- Architecture Design
- Integration
- Implementation

Realization
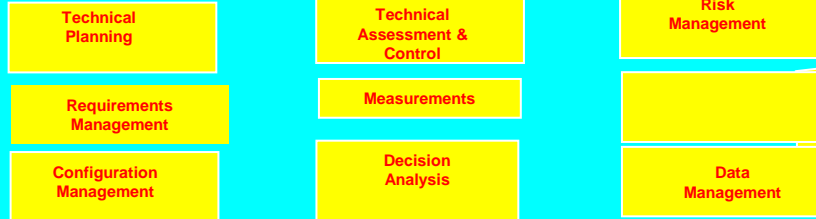
✵ Interface definition
- Hardware
- Software
- Data
- Thermal
- Aerodynamic
- Electrical (power)

✵ Interface control documents
- Architecture products (StdV-1, etc.)

Risk Management

8 TECHNICAL MANAGEMENT PROCESSES

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Risk Management

TECHNICAL PROCESSES

- Stakeholder Requirements Definition
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- Validation
- Transition

Realization

- ✳ Identify risks
  - Tools to identify
- ✳ Analyze (probability/consequence)
- ✳ Mitigate
  - Accept
  - Avoid
  - Transfer
  - Control (risk reduction efforts)

Tools for Risk Identification

* TRL checklists – USAF and NASA

* Quicklook checklists – Based upon Technology Program Management Model (TPMM) by Army SMDC and DTRA

* Where to find:
    * DAU Science and Technology Community of Practice – Best Practices

Project:				TRL:	6			
				DRAFT				

TRL 6 Quicklook Worksheet

TPMM Mnemonic	Description	Yes	No	N/A	Comments	Response
	TRL 6 Exit Criteria					
	Program Management					
66211	Technology has been assessed at TRL 6.	☐	■	☐		
56017	The technology program development strategy has been Finalized	☐	■	☐		
66047	Provide an estimate of the costs for Transition and Technology Integration into Acquisition Program	☐	■	☐		
66048	A realistic estimate total life-cycle costs have been documented	☐	■	☐		
66035	A Risk Mitigation plan has been documented and reviewed by the Programmatic	☐	■	☐		
13040	The Technology Advancement Degree Of Difficulty has been revised based on the validation process.	☐	■	☐		
	The Delivery Baseline is established and under formal Configuration control	☐	■	☐		
	All Corrective Actions are closed or resolved for closure	☐	■	☐		
	Software Development Cost projections for the Transition phase are updated in the TDS	☐	■	☐		
	Technical Management					
35009	Refined Operational And Mission Requirements/Objectives were finalized	☐	■	☐		
35015	System Functional Requirements were finalized	☐	■	☐		
66030	Specific performance goals and exit criteria that must be met before exceeding number of prototypes were met	☐	■	☐		
66110	The Physical Requirements to be used during this spiral or increment of development are complete	☐	■	☐		

https://acc.dau.mil/CommunityBrowser.aspx?id=178119&lang=en-US or William.decker@dau.mil

Bottom Line

* Pay me now or pay me later
* Do we want to slow down rapid fielding?
  - "Eyes wide open" approach
  - Use SE best practices to look for future problem areas
  - Risk assessment
    - Identify the risks
    - Balance between risk and benefit
    - Mitigation as appropriate