



Future Vertical Lift Overview

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FVL S&T IPT Lead

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Genesis Of Future Vertical Lift



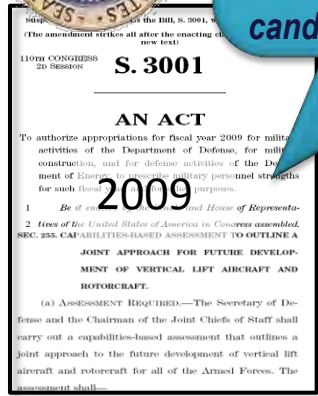
(1) Congressional Request:

"The Congressional Rotorcraft Caucus is concerned about the lack of a strategic plan for improving the state of vertical lift aircraft in the United States."



(3) 2009 NDAA:

*"Sec. 255. The SecDef... shall outline a joint approach of the future development of vertical lift aircraft for all the military services."
 Sec. 1043. The SecDef and Joint Staff ... rotorcraft survivability.... propose candidate technologies ..."*



(2) SecDef Direction:

"I have directed AT&L...to lead the development of a Capabilities Based Assessment....future development of vertical lift aircraft"



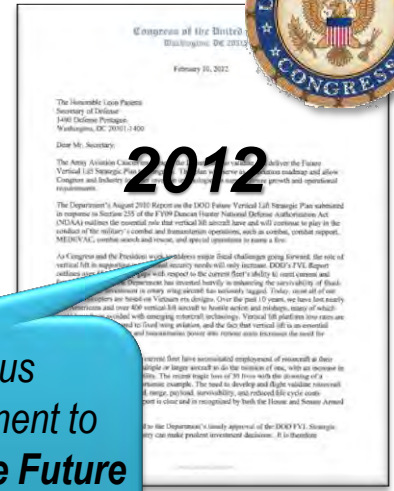
(4) AT&L Direction:

"This initiative will only be successful with the full support of and partnership with, the vertical lift industry."

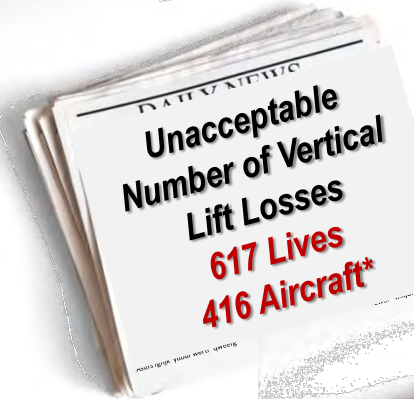
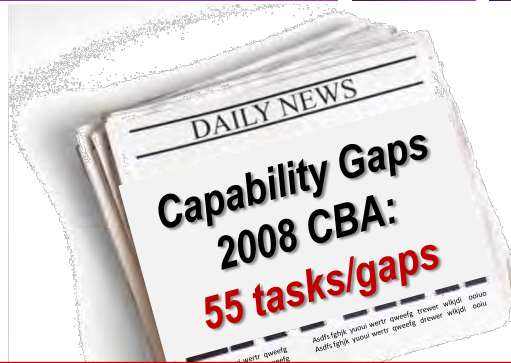


(5) Congressional Caucus

The Army Aviation Caucus encourages the Department to validate and deliver The Future Vertical Lift Strategic Plan to Congress



FVL Strategy



- ## 6 Elements of the FVL Strategy
1. Decision Point -Based Plan of Execution
 2. S&T Plan that Aligns Technology Development with Milestone Decision Options
 3. Early Joint Requirements Development
 4. Multi-Role Family of Aircraft
 5. Common Systems and Open Architecture
 6. Industry Partnership/Interaction (thru the VLC)





FVL Implementation



- **FVL describes a family of vertical lift aircraft**
 - Includes multiple sizes/classes of vehicles
 - Considers the vertical lift needs across the DoD
 - Achieves significant commonality between platforms
 - Addresses the capability gaps identified in the Army Aviation Operations CBA, and the OSD-sponsored Future Vertical Lift CBA
 - Current fleet mainly comprised of the 1960-80's development in rotorcraft; FVL is about the next revolutionary vertical lift period

Worldwide operations

Performance

Affordability

Affordability
Size
Scale
Risk

Range
Payload
Fuel Efficiency
Station Time
Speed

Environmental

6K/95
All Weather Ops
in Degraded
Visual
Environment

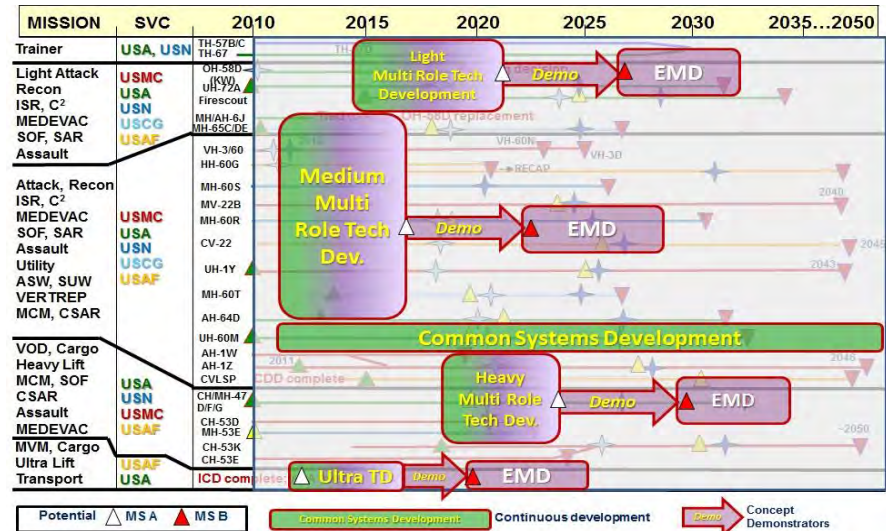
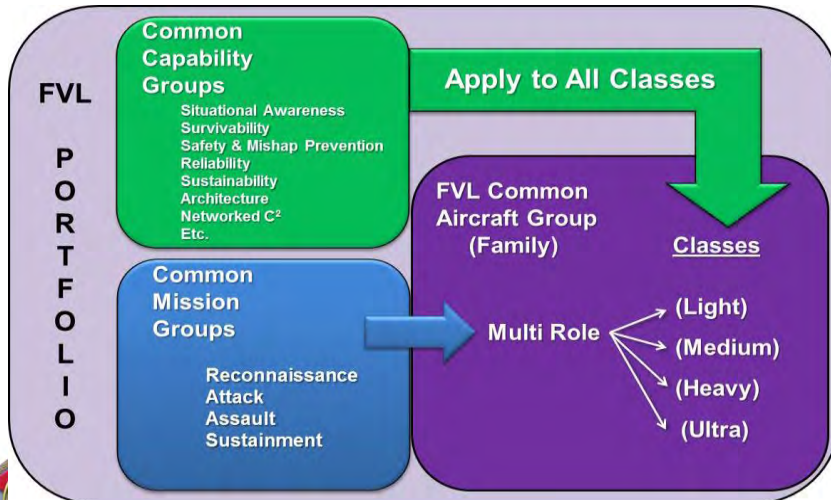
Future
Aviation
Capabilities

Survivability

Survivability
IR/RF/Laser
Kinetic Threat
Small Arms

Operational
Availability
Operations
& Support
Costs

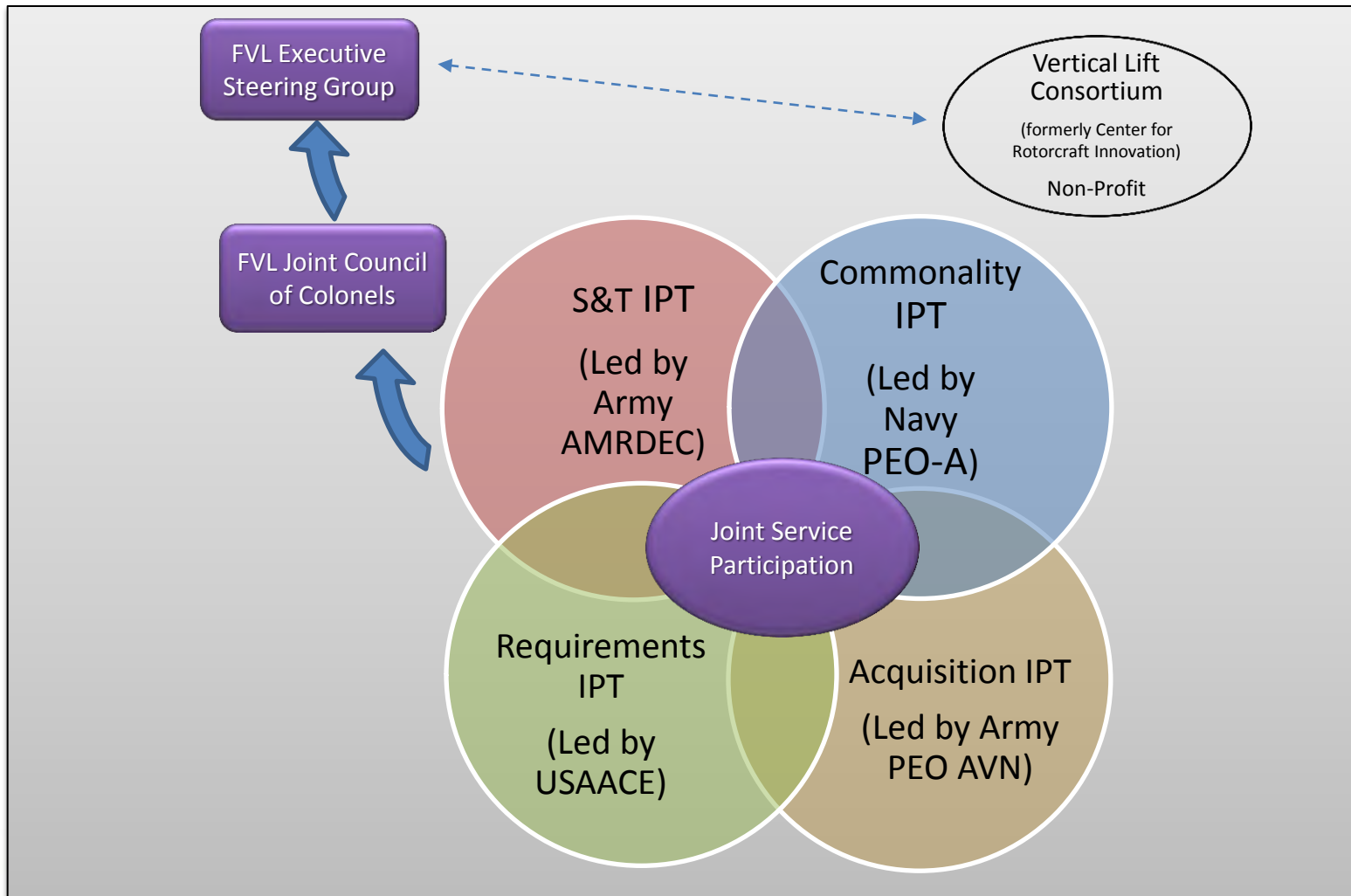
Sustainability



Notional FVL JMR Family Aircraft Sequencing



FVL DOD Organization



S&T Link to FVL



"The Congressional Rotorcraft Caucus is concerned about the lack of a strategic plan for improving the state of vertical lift aircraft in the United States."



S. 3001
AN ACT
 To authorize appropriations for fiscal year 2009 for military activities of the Department of Defense; for military construction; and for defense activities of the Department of Energy; to provide military personnel benefits for such fiscal year, and for other purposes.

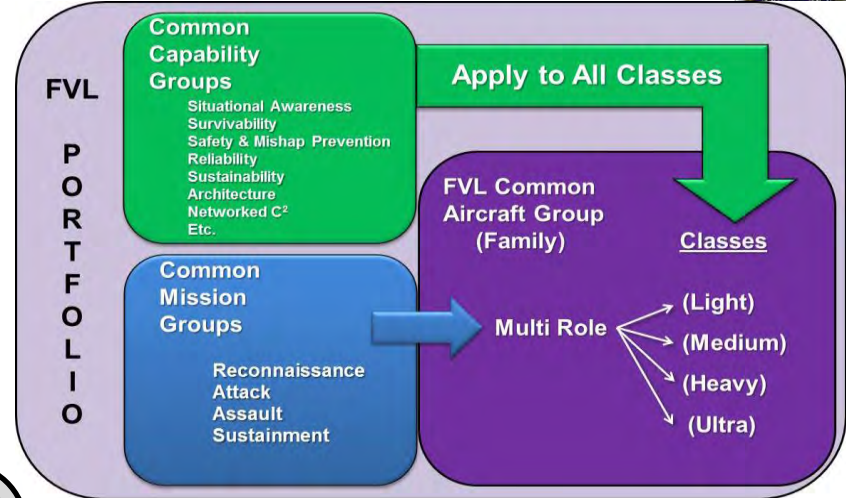


Defining the future of vertical lift

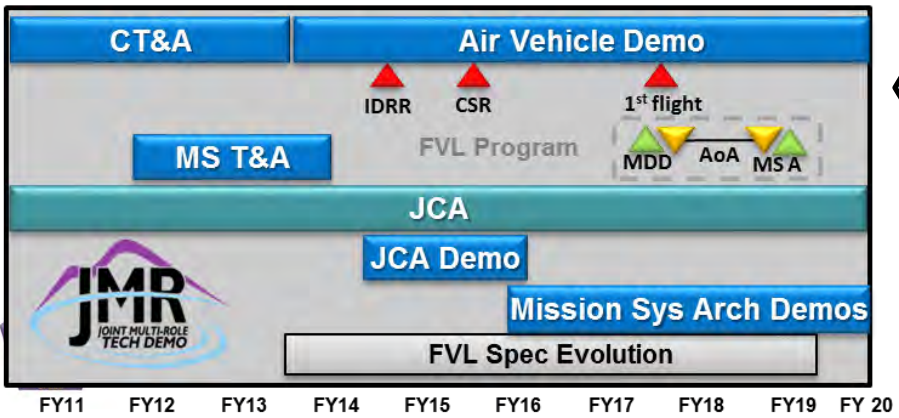
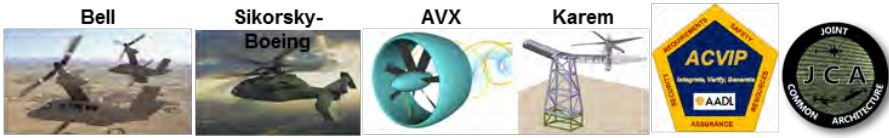
21 May 08 Secretary Gates: "I have directed the Joint Advanced Concepts Directorate... to lead the development of a CBA that will outline a joint approach to the future development of vertical lift aircraft for all the Military Services."

A joint collaborative environment for future capability discussions

- Escalating Ops and Sustainment Cost
- Unacceptable Number of Vertical Lift Losses
- Vertical Lift Fleet Accelerated Aging Due to OPTEMPO
- Capability Gaps (2008 CBA – 55 gaps)
- Decaying US Vertical Lift Industrial Base



JMR TD Program



- ## 6 Elements of the FVL Strategy
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FVL S&T IPT



S&T IPT Purview



- Broadly represent the S&T interests of FVL stakeholders
- Solicit the support of the National S&T Enterprise to develop technology products that provide capability for the next generation vertical lift aviation fleet
- Survey the Enterprise to identify and leverage candidate technologies that address desired FVL attributes
 - Farther
 - Faster
 - Cheaper
 - All weather
 - Networked
 - Survivable

A focused and comprehensive Enterprise investment strategy is fundamental to FVL success



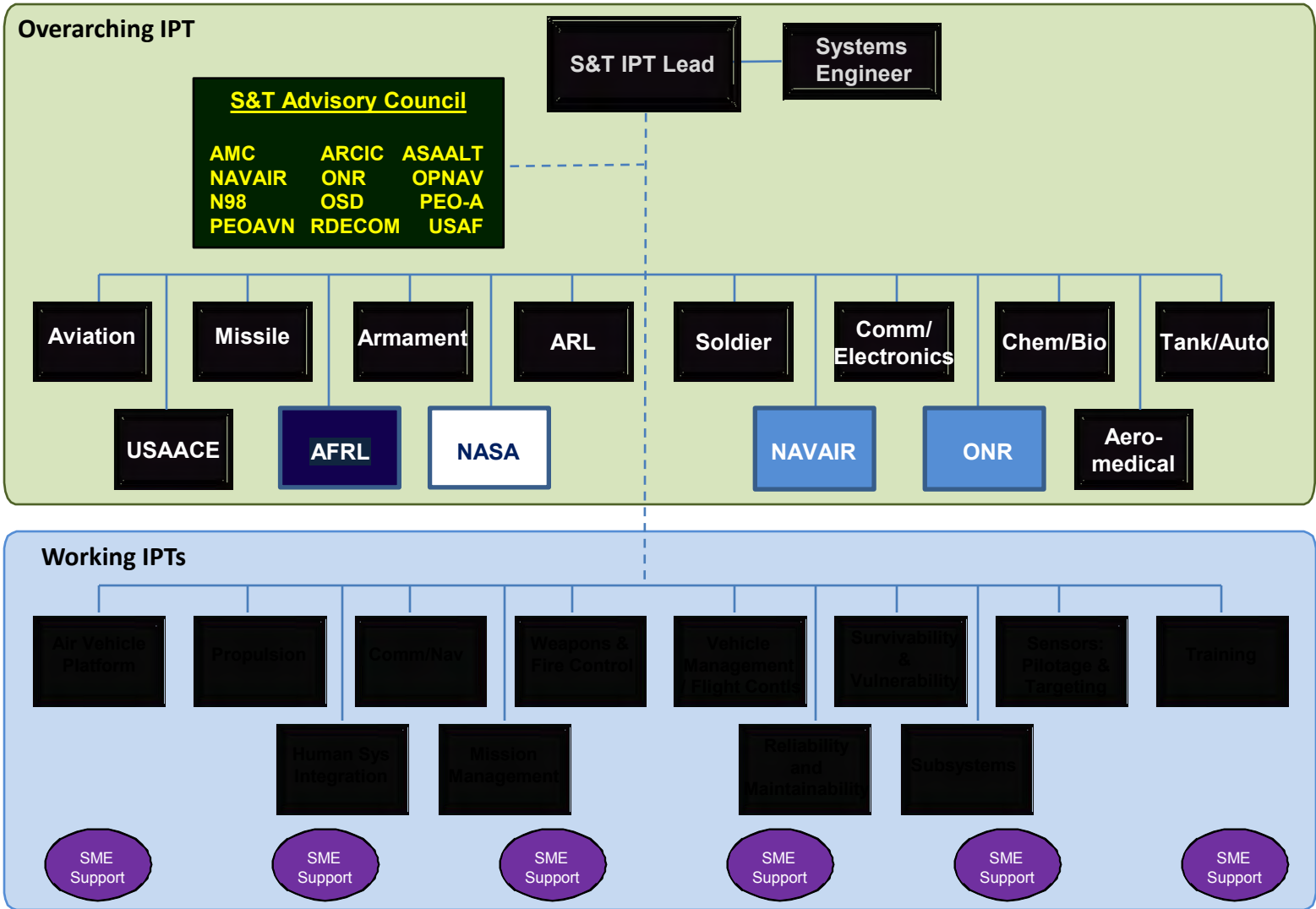
FVL S&T IPT Charter



- Critical features of the S&T IPT
 - Coordinates technology development efforts focused on FVL
 - Provides technical expertise required to define and accommodate the Aviation environment
 - Identify technology priorities and gaps
 - Serve as an advocate for the prioritization, funding, and execution of FVL related technology development efforts
 - Aggregate and assess component, configuration, and system design/ performance data
 - Reflects the coordination of the S&T enterprise to meet a DoD priority
- S&T IPT does not:
 - Execute programs
 - Design systems, subsystems, components
 - Conduct in-depth technical modeling and analyses



FVL S&T IPT Organization



FVL S&T IPT



Objective

Develop and maintain an enterprise-wide Science and Technology Strategy supportive of FVL

- Identify critical enabling technologies
- Present a roadmap of system level technology development that leverage the resources and investments of the OSD Communities of Interest (CoI)
- Advocate FVL system development as a priority
- Enable risk reduction measures that minimize technology risks for transition to an FVL PoR
- Highlight POM plans that support FVL from across the S&T enterprise and provide the status of that plan upon request

Products

- Common requirements baseline
- Synchronized technology development roadmaps
- Comprehensive FVL S&T investment strategy
- Technology performance metrics
- Risk identification and mitigation plans
- Technical data and analytical support for the FVL milestone and decision process
 - Cost/value assessments of enabling technologies and resulting system capabilities
 - Analysis methods and tool maturation

Milestone Schedule

Critical WIPT Tasks	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Roadmap Review	▲						
Technology Vision & Roadmap Refinement		▲					
Portfolio Assessment & Tech Effort Refinement			▲				
Tech Metric Development				▲			
Cost and Risk Assessment					▲		
Coordinated WIPT Investment Strategy						▲	
S&T IPT Investment Strategy							▲

Significant Progress

- S&T Enterprise is engaged and anticipating FVL
- Engineering requirements baseline continues to evolve
- The enterprise has been surveyed for technologies relevant to FVL development
- Assimilated survey inputs into a coherent description of ongoing and planned development efforts
- Initiated an assessment of the S&T investment strategy to ensure that it is comprehensive, thoroughly leverages the OSD COIs, and reflects the intent of stated FVL requirements





Purpose:

Demonstrate transformational vertical lift capabilities to prepare the DoD for decisions regarding the replacement of the current vertical lift fleet

Products:

- Technology maturation plans
- Foundation for cost analysis for future capabilities
- Two demonstrator test bed aircraft

Payoff:

- A refined set of technologically feasible and affordable capabilities that enable higher speed, better lift efficiency, lower drag (L/De), and improved Hover Out of Ground Effect (HOGE) at high/hot

conditions (6K/95)

- Standards, architectures and tools that increase SW reuse and reduce SW costs
- Reduced risk for critical technologies
- Data readily available to support future DoD acquisitions



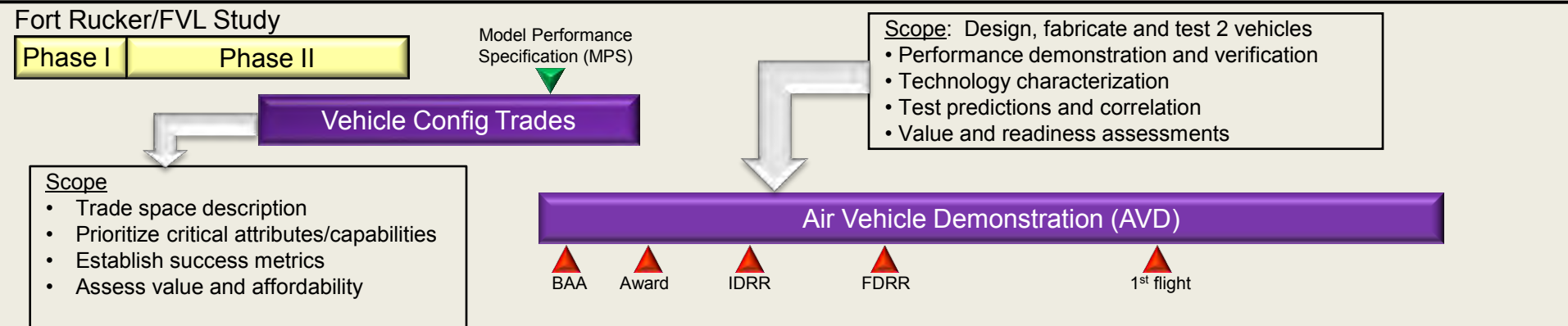
Schedule

MILESTONES	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	
Gov. Configurations	█										
Operational Analysis	█										
Industry Configurations		█									
Air Vehicle Demo				◆	◆		◆		◆	◆	
Joint Common Architecture	█										
Mission Systems Arch Demo									◆		
FVL Spec Evolution			█								



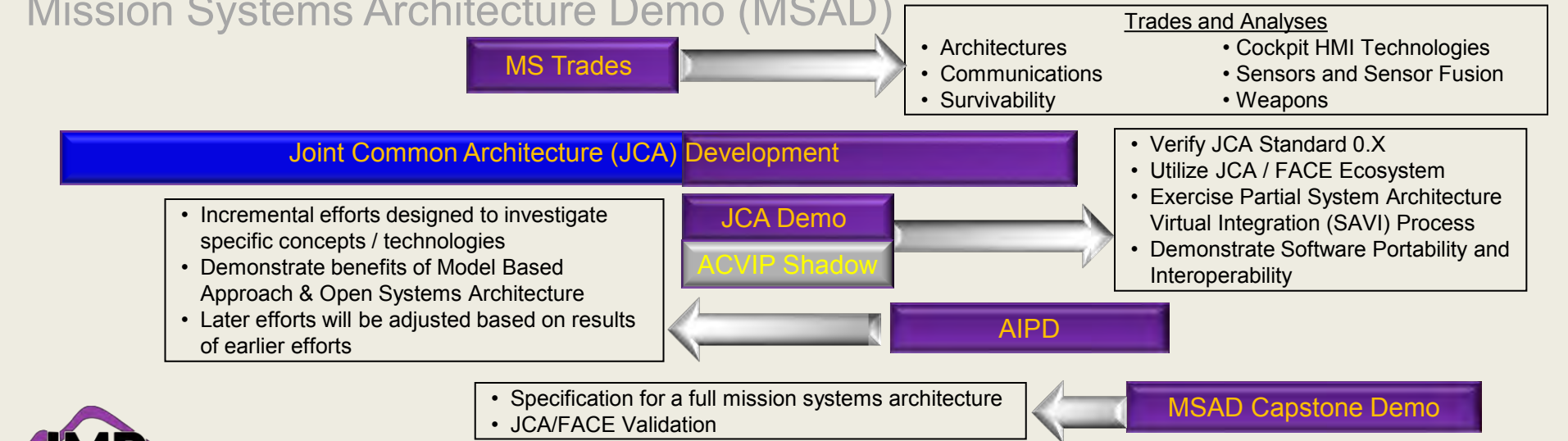


FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20
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Air Vehicle Demonstration (AVD)

Mission Systems Architecture Demo (MSAD)





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JMR TD



Fundamental Objectives

- **Demonstrate technologies** for the next generation fleet
- Design and build to a **representative requirement**
- Size to accommodate:
 - Demonstration of technologies applicable to multiple aircraft classes
 - Demonstration utility
- **Fly two new build demonstrator aircraft**
- May be the same or different configurations
- Evaluate the overall **value** of what is demonstrated
 - Technologies
 - Configurations
 - Capabilities
- **Mature the skillsets and tools required to design, analyze, predict, and evaluate the next generation rotorcraft**
- The JMR TD is not
 - An FVL prototyping effort
 - Indicative of an end state FVL performance requirement





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Key Features of the AVD



- BAA / MPS results in large aircraft
 - MPS represents a snapshot of a desired FVL-M capability
 - 230+ kt (significant impact on coaxial compound designs)
 - 6K / 95 F vertical take-off
 - 424 km combat radius
 - 4 crew + 12 troops (335 lb/troop)
 - Self-deploy
- Flight test efforts will implement commercial airworthiness processes
- Enables significant learning with regards to
 - Advanced technology implementation on high speed air vehicle configurations
 - The refinement of analytical methods for coaxial and tilt rotor configurations
 - The efficiencies a commercial airworthiness approach
 - The extent to which the MPS describes an affordable FVL solution
 - The collaboration of the rotary wing enterprise to provide an advanced, efficient, affordable Aviation weapon system





- JMR TD execution is driven by negotiated features of our business arrangement with Industry partners
 - Commercial Safety of Flight processes
 - Industry to Government cost share ratio of 3:1
- The negotiated business arrangements have a significant impact on the JMR TD
 - Data rights
 - Deliverables
 - Expectations of a usual “customer” relationship
 - Execution schedule
 - Milestone/design reviews
 - Interpretation of risk and liability

These Agreements do not represent business as usual!



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JMR Mission Systems Architecture Demonstration (MSAD)



Software reuse requires:

- Portability - FACE
- Modularity - JCA
- Functional Interchangeability
- Acquisition Strategy



Portability
Functional Allocation
Architectural Standardization
Architectural Analyses
Interface Standardization
Interoperability
Modularity

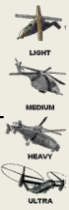
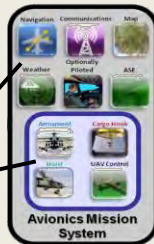
Open
Architecture



Acquisition Strategy

- Model-based Procurement & Reviews
 - Virtual Analysis
 - Strategic Reuse
 - IP/Data Rights

Core Assets



Task	FY	12	13	14	15	16	17	18	19
Mission Systems Trades			█	█					
Joint Common Architecture (JCA) Dev		█	█	█	█	█	█	█	█
MEP Definition				█	█	▲	▲	▲	▲
Safety / Security Study				█	█				
JCA Demo / ACVIP Shadow				█	█				
Architecture Implementation Process Demo (AIPD)						█	█		
Capstone Demo								█	█

Objective:

- Ensure that the *processes, tools and standards* are ready for FVL to specify, design, and implement a Mission Systems Architecture that meets the business goals of the Army aviation enterprise

Focus Areas:

- Open Systems Architecture (OSA)
- Model Based Engineering (MBE)
- Architecture Centric Virtual Integration Process (ACVIP)

Approach:

- Explore benefits / limitations of OSA, MBE & ACVIP
- Develop products when necessary:
 - Joint Common Architecture (JCA)
 - Objective MEP Definition
 - ACVIP Handbooks
- Leverage external initiatives / standards:
 - Future Airborne Capability Environment (FACE™) std
 - Hardware Open Systems Technologies (HOST) std
 - Architecture Analysis & Design Language (AADL) std
- Perform a series of increasing complex demonstrations directly relevant to FVL
- “Learn by doing”

Benefits/Payoffs:

- Inform Army aviation acquisition community
- Mature processes, tools and standards
- Identify gaps for OSA, MBE & ACVIP implementation
- Reduce risk for FVL

Customers:

- Future Vertical Lift Family of Systems
- Other DoD Rotorcraft

