RDECOM

*Presented to:*

**Huntsville Aerospace Marketing Association**

# *Aviation S&T: Joint Multi-Role Technical Demonstrator*

AMRDEC

*Approved for public release; distribution unlimited. Review completed by the AMRDEC Public Affairs Office 3 May 2012; FN5207*

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

**12 April 2012**

*Presented by:*

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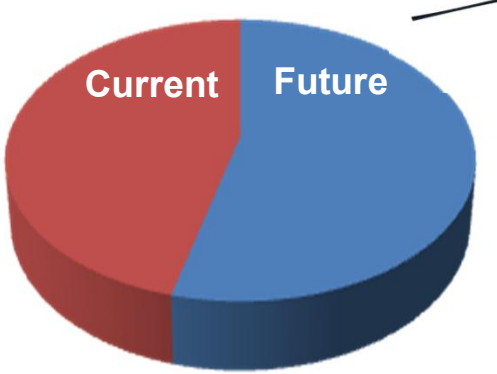
**Aviation and Missile Research, Development and Engineering Center**

# Bottom Line Up Front

- Aviation S&T supports both the current helicopter and future rotorcraft fleets in improving survivability, performance, and affordability
- Current efforts are focused on platforms, power, survivability, vehicle management, and operations support and sustainment
- Future efforts are focused on the Joint Multi-Role (JMR)
  - Technology Demonstrator (TD)
  - Focus on Transition to PEO-Aviation



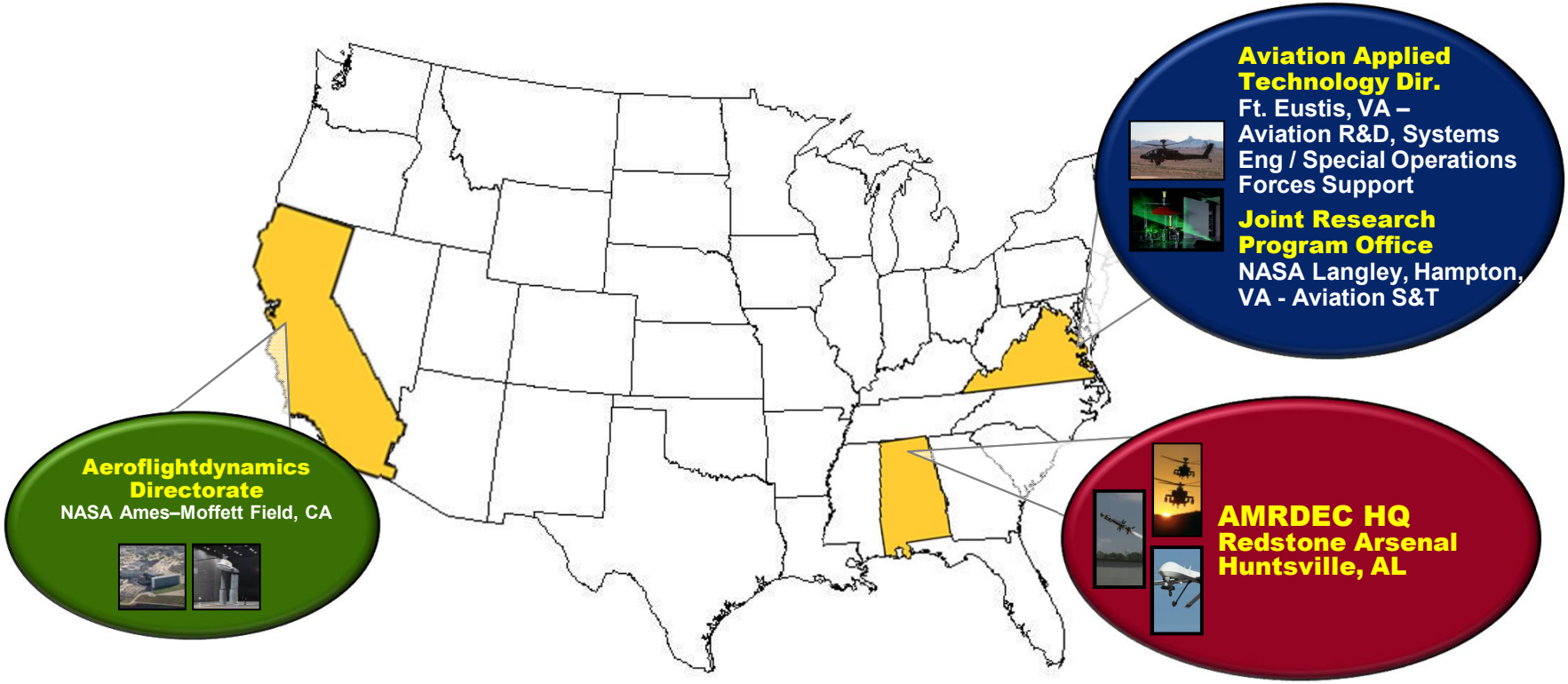

***Army Aviation S&T balances the needs of the current and future fleets***

# RDEC Aviation S&T Mission

AMRDEC

**Empower a preeminent, distributed, collaborative Aviation workforce that:**

- **Discovers new technologies and approaches**
- **Develops advanced concepts**
- **Demonstrates technical maturity**
- **Delivers the Warfighter capabilities to dominate the battlefield**




***Partnerships enable sharing resources and efforts***

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# TEST FACILITIES AND WIND TUNNELS

**FT. EUSTIS, VA | HAMPTON, VA | MOFFETT FIELD, CA**

## Ballistics Test Range

*Ft. Eustis, VA*
**Fuel Tank Testing up to 30 mm Ammunition**

## National Full-Scale Aerodynamics Complex

*Moffett Field, CA*
**Advanced Testing of Full Scale Rotorcraft**

## Countermeasures Test Facility

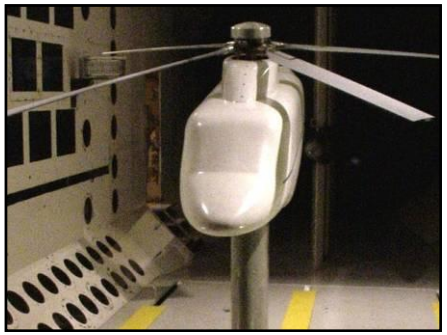
*Ft. Eustis, VA*
**Acoustic/Infrared Radiation Testing of Turbine Engines**

## Large Rotor Test Apparatus

*Moffett Field, CA*
***Full* Scale Rotorcraft Component Testing**

## Structural Test Facility

*Ft. Eustis, VA*
**Rotor- Blade Test Fixture for Loads and Fatigue Testing**



## Transonic Dynamics Tunnel

*Hampton, VA*
**Helicopter Performance, Loads, and Stability Testing**

# Aviation S&T Portfolio

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## Rotors & Vehicle Management

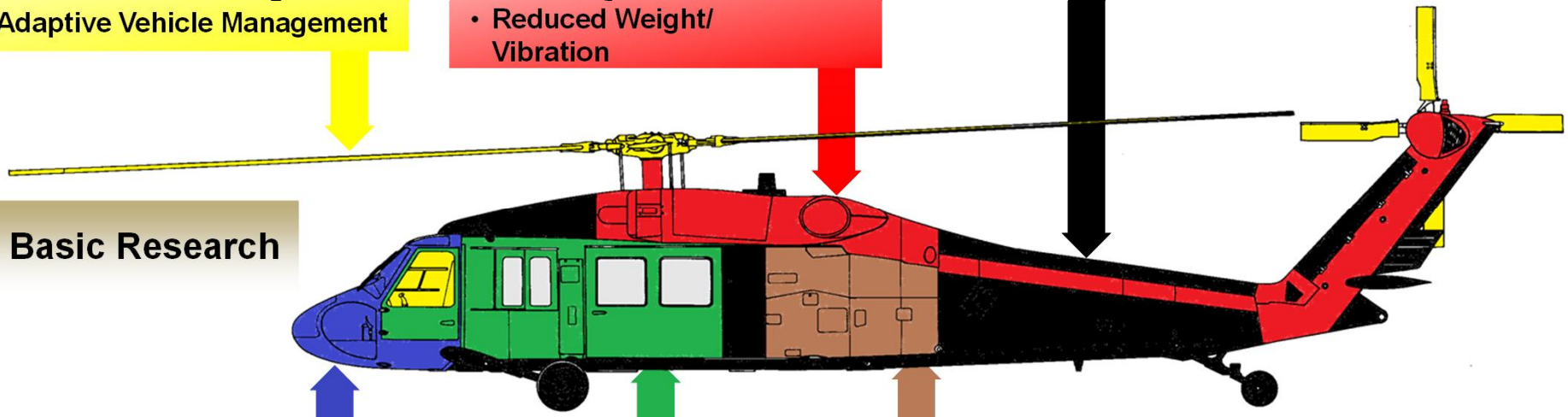
- Improved Vehicle Performance
- Reduced Vibrations
- Reduced Acoustic Signature
- Adaptive Vehicle Management

## Engines & Drive Trains

- Increased Fuel Efficiency Engines
- Lightweight Drive Trains
- Improved Reliability and Durability
- Reduced Weight/ Vibration

## Platform Design & Structures

- Advanced Air Vehicle System Concepts
- Joint Multi-Role Technology Demonstrator
- Rotorcraft Airframe Technology
- Platform Durability and Damage Tolerance
- National Rotorcraft Technology Center



+ Basic Research

## Unmanned & Optionally Manned Systems

- Common Human Machine Interface
- Increased Levels of Autonomy
- Manned-Unmanned Intelligent Teaming

## Aircraft & Occupant Survivability

- Reduced Vehicle Signatures
- Threat Warning Sensors
- Active Jammers & Decoys
- Opaque & Transparent Armor
  - Energy Absorbing Seats & Landing Gear
  - Weapons Integration

## Maintainability & Sustainability

- Reduced Maintenance Actions
- Improved Reliability
- Improved Mission Readiness
- Reduced Spares Logistics

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# Operational Challenge

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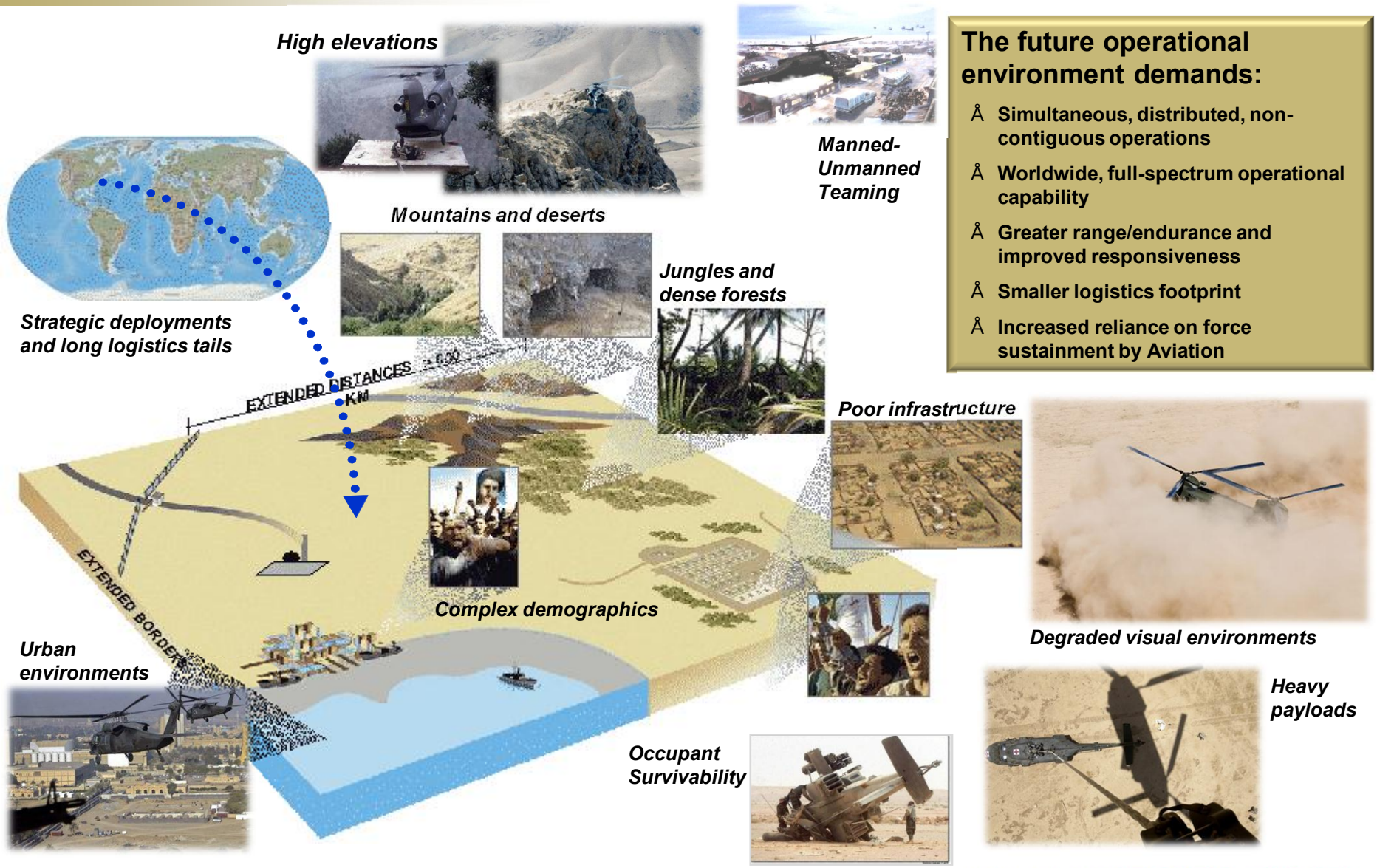


## The future operational environment demands:

- Simultaneous, distributed, non-contiguous operations
- Worldwide, full-spectrum operational capability
- Greater range/endurance and improved responsiveness
- Smaller logistics footprint
- Increased reliance on force sustainment by Aviation

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# FVL Strategic Drivers

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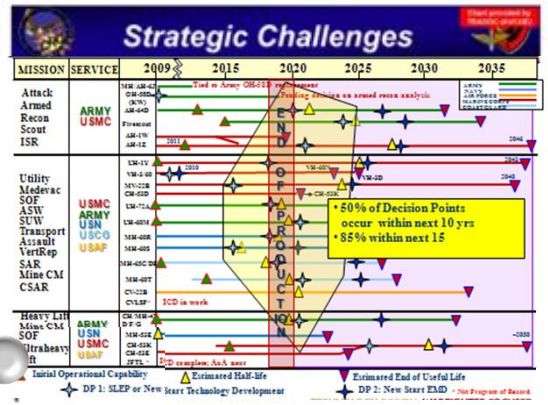
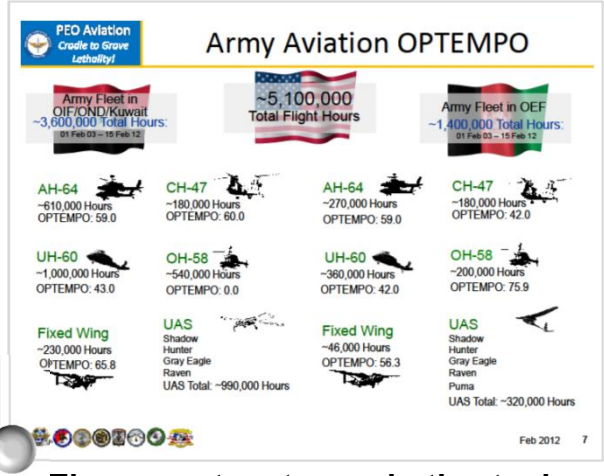
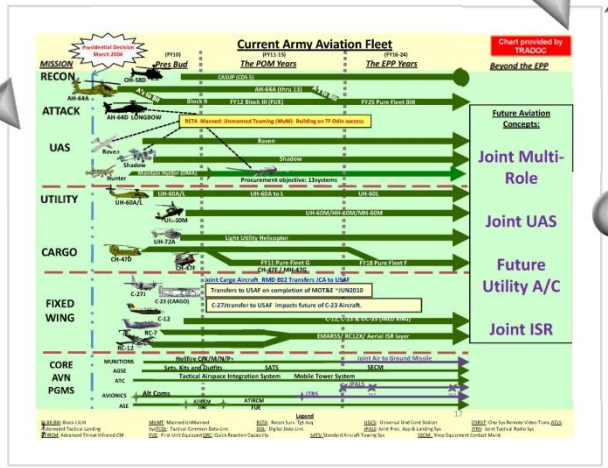



The DoD rotary wing aviation fleet is aging and upgrades do not provide the capabilities required by the future fleet

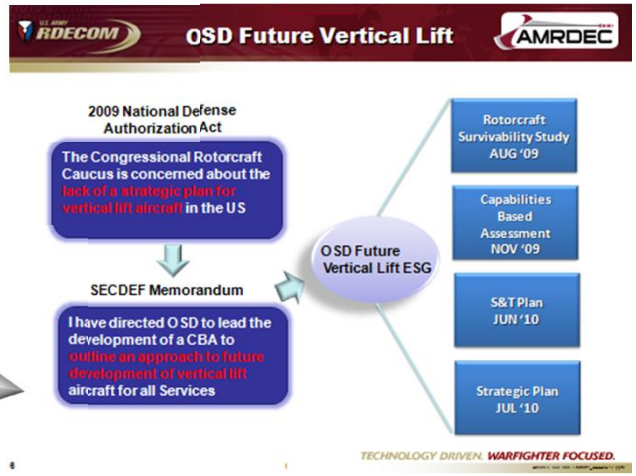




The current op tempo in-theater is 5X the peacetime rate, further taxing an already aging fleet

*Congress places emphasis on future vertical lift*




The User recognizes the need and is planning for FVL




OSD, USAACE and Joint community are defining the attributes to provide required capabilities

# ‹tical Lift (FVL) Emerging Attributes

| FVL Emerging Attributes | Light | Medium | Heavy | Ultra |
|---|---|---|---|---|
| Speed | >170-300+ kts | >170-300+ kts | >170-300+ kts | 300+ kts |
| Combat Radius | ~424 km | ~424 km | ~424 km | ~462 km |
| Payload (Int) | ~2.5k+ lbs | ~5k - 20k lbs | ~20-30k lbs | ~40-72k lbs |
| Payload (Ext) | ~2.5k+ lbs | ~13k - 23k lbs | ~30k lbs | ~40-72k lbs |
| Passengers | ~4-6 | ~13-24 | ~33-52 | ~100-120 |
| High/Hot Performance | 6k/95 HOGE w/500fpm VROC | 6k/95 HOGE w/500fpm VROC | 6k/95 HOGE w/500fpm VROC | (Ultra being worked under different effort) |
| Survivability<br>- Crash energy<br>- Ballistic protect<br>- IR sig reduction<br>-ASE | <br>Crew/passengers<br>12.7mm<br>-50%<br>Fully Integrated | <br>Crew/passengers<br>30mm<br>-50%<br>Fully Integrated | <br>Crew/passengers<br>30mm<br>-50%<br>Fully Integrated | |
| Reliability/Maintain<br>- FMC Rate | 90% | 90% | 90% | |
| Manned/Unmanned Teaming | LOI 5<br>Optionally manned<br>Multiple UAS control | LOI 5<br>Optionally manned<br>Multiple UAS control | LOI 5<br>Optionally manned<br>Multiple UAS control | |
| Shipboard Compatible | Extended operations (above/below deck) | Extended operations (above/below deck) | Extended operations (above/below deck) | |
| Transportability/ Deployability | Rapid load/unload operational w/i15min | Self deploy 2100nm Aerial refueling | Self deploy 2100nm Aerial refueling | |
| Network Enabled C2 | Integrated network | Integrated network | Integrated network | |
| Sensors/DVE | Multi-Spectral<br>Multi-Function<br>High resolution | Multi-Spectral<br>Multi-Function<br>High resolution | Multi-Spectral<br>Multi-Function<br>High resolution | |

- ***Requires unique expertise***
- ***Takes years to develop workforce***
- ***Must be smart buyer***
  - ***In-house S&T***
  - ***Retain expertise***
  - ***Maintain working relationship w/ PM***
  - ***Tech. collaboration***

# Future Vertical Lift (FVL) – JMR TD

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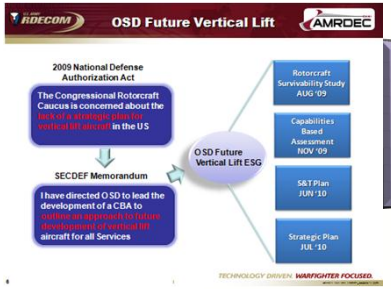
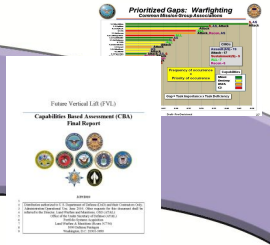


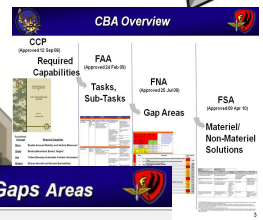

Congressional Interest




OSD FVL CBA

FVL FOS ICD

Analytical Underpinnings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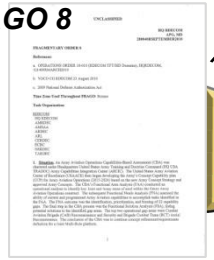


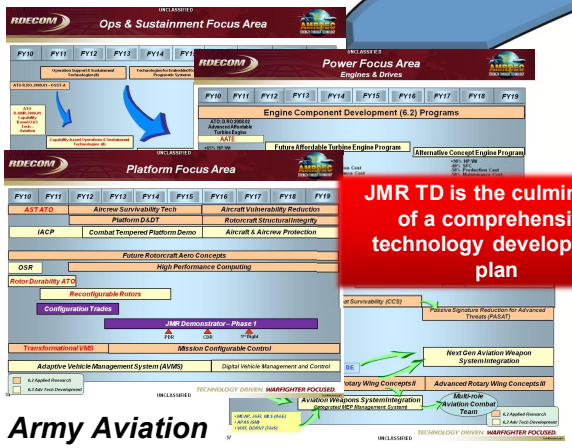
Protection
Sensors
P&E
Network
M&L
Lethality
HD&T
Soldier
Ground
Effects
CBRNE
C4ISR
Air

JMR TD

Avn Ops CBA Gaps Areas

| |
|---|
| CAB Reconnaissance and Security |
| BCT Aerial Reconnaissance |
| Conduct Tactical Transport of Light Maneuver Forces and Provide Routine Sustainment of Forces/Equipment |
| Conduct Relief and Stability operations |
| Suppression / Destruction of Enemy Air Defense (SEAD / DEAD) |
| Combat Identification |
| Organization of MEDEVAC companies |
| Lethality Options |
| Counter Reconnaissance Against Aerial Threats |
| Control of Joint effects |
| Protect Aircraft from Threat Weapon Systems |
| Safe Operations in Degraded Visual Environments (DVE) and Urban Terrain |
| Protect Individuals and Systems |
| Maintain CAB Equipment Readiness During High OPTEMPO Combat Operations |
| Range Extension of Blue Force's Communications |
| Prepare for Tactical Operations |
| Airborne Battle Command on the Move (BCOTM) |
| Aircraft Platform Battle Management System |
| Air Traffic Services (ATS) in the Terminal Environment |
| ATS in the Enroute Environment |
| Airfield Management/operations |
| Conduct Tactical Airlift and Routine Sustainment of Mounted Medium Weight (30T Combat Vehicle) Forces |

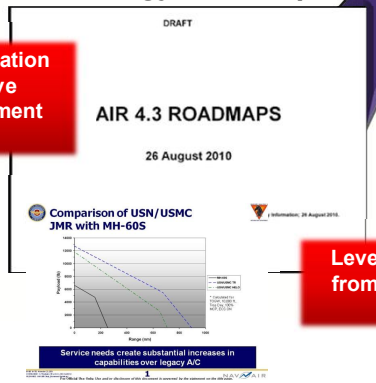
Army Aviation CBA




Army Aviation Technology Roadmaps

JMR TD is the culmination of a comprehensive technology development plan

Naval Aviation Technology Roadmaps




Leverages resources from across the DoD community

Responsive to the needs of, and the capabilities expected from, the Joint Rotary Wing fleet

Advances the technology readiness level of the ultimate FVL family-of-vehicles

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# e Vertical Lift (FVL) Rotorcraft Vision

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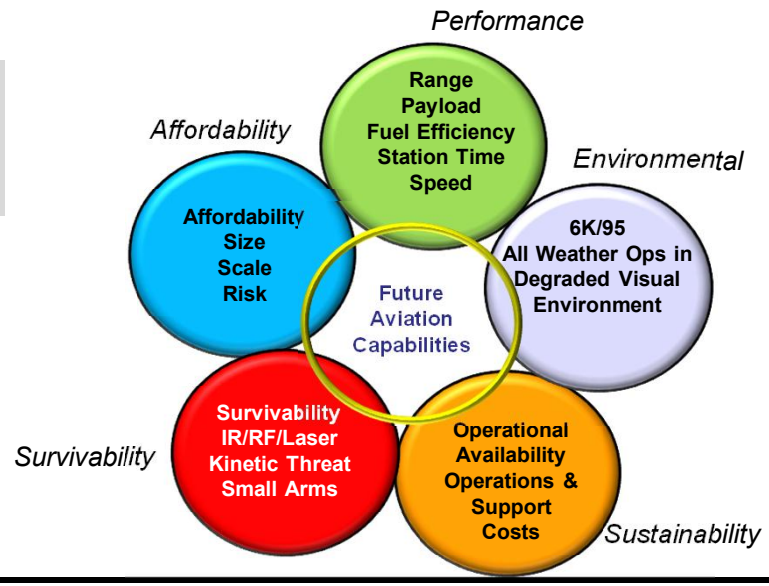
- **FVL describes a family of vertical lift aircraft**
  - Includes **multiple sizes/classes** of vehicles
  - Considers the vertical lift needs **across the DoD**
  - Achieves **significant commonality** between platforms
  - Addresses the **capability gaps** identified in the Army Aviation Operations CBA, and the OSD-sponsored Future Vertical Lift CBA

**Light**
**Medium**
**Heavy**
**Ultra**




- **Objective vehicle attributes**
  - Scalable common core architecture
  - Integrated aircraft survivability
  - Speed 170+ kts
  - Range 424 km (combat radius)
  - Performance at 6,000 feet and 95ºF (ñ6k/95ò)
  - Shipboard Compatible
  - Fuel Efficient
  - Supportable
  - Affordability
  - Optionally Manned
  - Commonality


Worldwide operations

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# R TD Schedule Overview

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| FY09 | FY10 | FY11 | FY12 | FY13 | FY14 | FY15 | FY16 | FY17 | FY18 | FY19 | FY20 |
|---|---|---|---|---|---|---|---|---|---|---|---|

AoA start

AoA finish

Rucker/FVL Study

Ph I | Ph II

Vehicle Trades

Phase 1 Spec

**Scope**
- Å Trade space description
- Å Prioritize critical attributes/capabilities
- Å Establish success metrics
- Å Assess value and affordability

MS Trades

**Scope**: Design, fabricate, & test 2 vehicles
- ÅPerformance demonstration and verification
- ÅTechnology characterization
- ÅTest predictions and correlation
- ÅValue and readiness assessments

Phase 1 – Air Vehicle Development

PSR

CSR

1st flight

Joint Common Architecture

**Scope**
- ÅEstablish architecture design criteria
- ÅEvaluate architecture function and performance via Systems Integration Lab (SIL)

JCA Demo

Phase 2 Spec

**Scope**:
- ÅManagement and presentation of controls, displays, and man/machine interface
- ÅIntegrated mission system processing, network structure, integration of hardware and software components

Phase 2 – Mission Systems Development

1st flight

JMR Spec Dev

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# Design Industry Efforts

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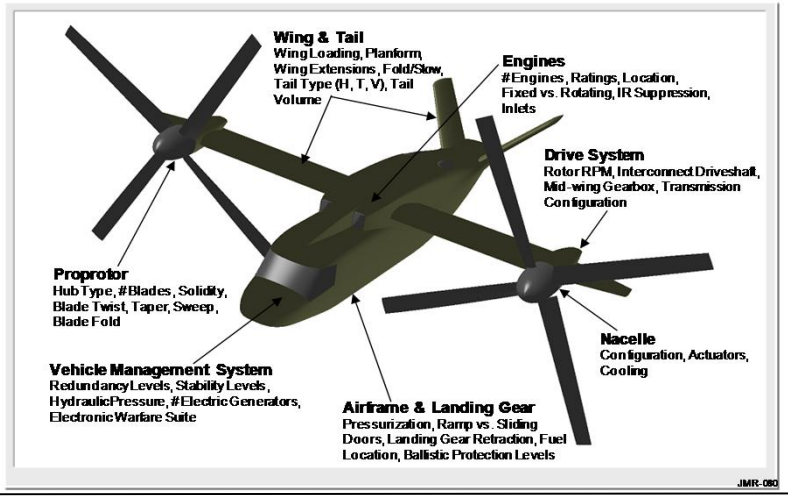
## Bell-Boeing




## Boeing

## Sikorsky

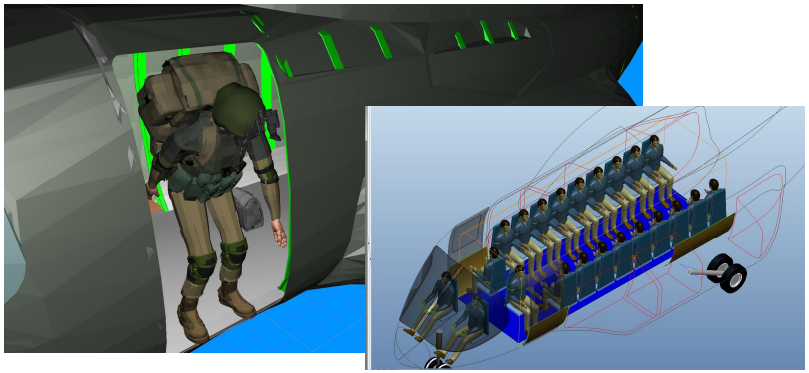
## AVX

***Process is underway***

# Design Government Efforts

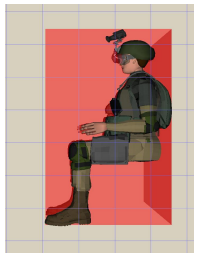
AMRDEC

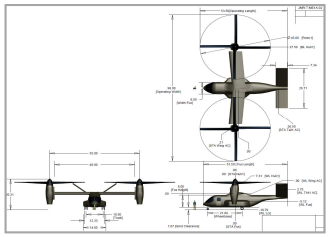
*Dismounted Soldier Egress*

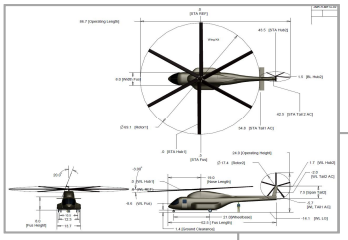


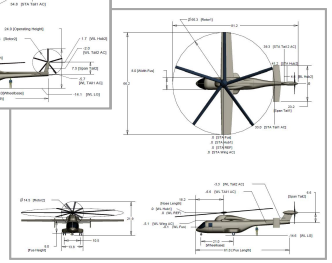
*Armor layout*

*Dismounted Soldier Seated Space Volume*

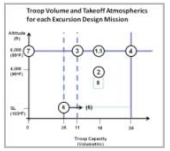






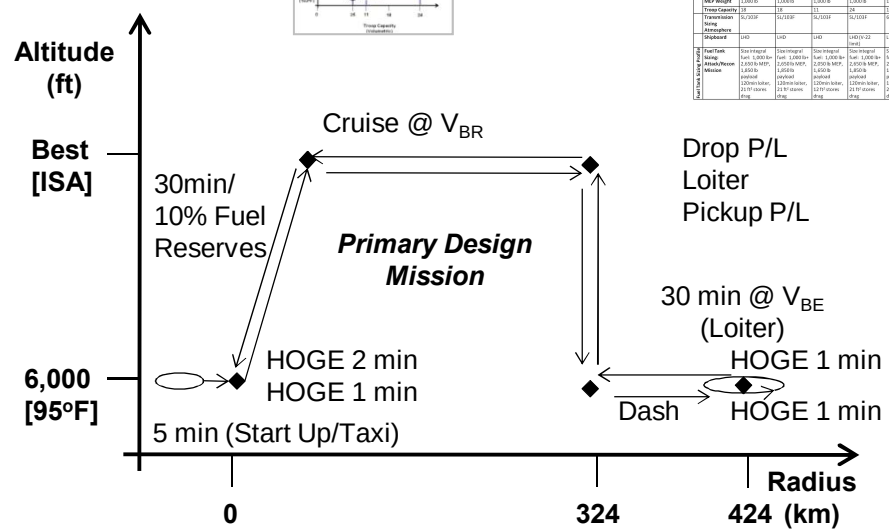


- *Advanced Helicopter*
- *Big-Wing Compound*
- *Advanced Tilt Rotor*

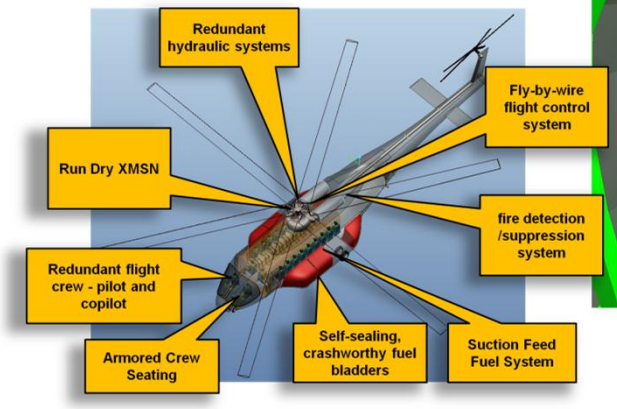


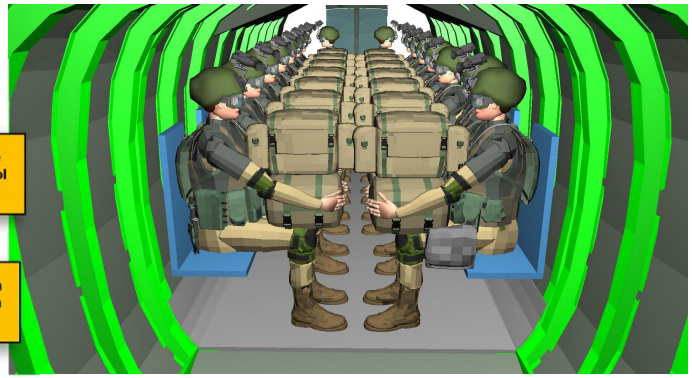

*Excursion Matrix and trade space*

| | Attribute | 1a) Mid-Capability | 2a) 44/95 | 3a) Small | 4a) Large | 5a) Flat-Rated | 6a) Small Deck Ship | 7) Dedicated Attack/ Recon | 8) Defined by Contractor |
|---|---|---|---|---|---|---|---|---|---|
| Primary Design Profile | Takeoff Condition | 44/95F 95% MURP VROC failout | 40/95F 95% MURP VROC failout | 66/95 95% MURP VROC failout | 66/95F 95% MURP VROC failout | 66/95F 95% MURP VROC failout | 51/103F 95% MURP VROC failout | 66/95F 95% MURP VROC failout | Atmospheric CFI VROC CFI |
| | Mission Radius | 424 km | 424 km | 424 km | 424 km | 424 km | 424 km | 424 km | 424 km |
| | Midpoint Condition | 44/95F VROC failout | 40/95F VROC failout | 66/95F VROC failout | 66/95F VROC failout | 66/95F VROC failout | 66/95F VROC failout | 66/95F VROC failout | 66/95F VROC CFI |
| | Midpoint Loiter | 30 min | 30 min | 30 min | 30 min | 30 min | 30 min | 120 min | 30 min |
| | Payload | 6,600 lb internal | 6,600 lb internal | 4,815 lb internal (Limited to AATE class stores) | 10,000 lb internal | 6,600 lb internal | Fallout lb internal | 1,850lb payload, 21 ft² stores drag | External: CFI lb Internal: CFI lb |
| | MEP Weight | 1,000 lb | 1,000 lb | 1,000 lb | 1,000 lb | 1,000 lb | 1,000 lb | 1,850 lb | CFI |
| | Troop Capacity | 18 | 18 | 11 | 28 | 18 | 35 | n/a | CFI |
| | Transmission Sizing | 51/103F | 51/103F | 51/103F | 51/103F | 66/95F | 51/103F | 51/103F | CFI |
| | Atmosphere Shipboard | LHD | LHD | LHD | LHD (V-22 Tested) | LHD | DDG | LHD | DDG – LHD |
| Fuel Tank Sizing Profile | Fuel Tank Sizing: Attack/Recon Mission | Size Integral fuel: 1,900 lb+ 2,650 lb MEP, 1,850 lb payload 120nm loiter, 21 ft² stores drag | Size Integral fuel: 1,900 lb+ 1,050 lb MEP, 1,850 lb payload 120nm loiter, 21 ft² stores drag | Size Integral fuel: 1,900 lb+ 2,850 lb MEP, 1,650 lb payload 120nm loiter, 12 ft² stores drag | Size Integral fuel: 1,900 lb+ 2,650 lb MEP, 1,850 lb payload 120nm loiter, 21 ft² stores drag | Size Integral fuel: 1,900 lb+ 2,850 lb MEP, 1,850 lb payload 120nm loiter, 21 ft² stores drag | Fallout radius, 51/103F TO, TOS ≥ 30min: 1,800 lb + 800lb MEP 400 lb payload 9 ft² stores drag | Design Mission | MEP: CFI Payload: CFI lb 120nm loiter Stores drag: CFI |




*Survivability Assumptions*



*Concept Design for Dismounted Troop Accommodation*

# What Will FVL Look Like?

AMRDEC

# Questions

- AMRDEC Role is twofold:
  - Provide best S&T available to support the current fleet
  - Lead the technology development effort for a new family of aircraft