Technology for the Future of Vertical Lift

Presented by:
Layne B. Merritt
Chief Engineer, Aviation Development
Aviation and Missile Research, Development and Engineering Center

22 November 2012
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, mission systems, and sustainment.

Future efforts are focused on the Joint Multi-Role (JMR):
- Future Vertical Lift Technologies
- Unmanned and Autonomous Systems
Aviation S&T Supports the Current Fleet and Future Vertical Lift

**CH-47F Chinook**

**RC-12**

**UH-60M Black Hawk**

**Aircrafts Designed for Future 2025**

**UH-72A Lakota**

**Future Vertical Lift**

**OH-58D Kiowa Warrior**

**Tiltrotor**

**MQ-5B Hunter**

**Advanced Rotorcraft**

**MQ-1C Gray Eagle**

**Compound Rotorcraft**

**Puma**

**RQ-11B Raven**

**RQ-7B Shadow**

**AH-64D Apache**

**UH-72A Lakota**

**Advanced Rotorcraft**

**TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.**
Why Future Vertical Lift?

CH-47 Basic Design Is 70+ Years Old

UH-60 Basic Design Is Nearly 50 Years Old

AH-64 Basic Design Is Nearly 50 Years Old

OH-58 Basic Design Is Nearly 50 Years Old

However...

They Will Not Last Forever
Future Vertical Lift (FVL) Rotorcraft Vision

- 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

- Objective vehicle attributes
  - Scalable common core architecture
  - Integrated aircraft survivability
  - Speed 170+ kts
  - Range 424 km (combat radius)
  - Performance at 6,000 feet and 95°F (“6k/95”)
Purpose:
- Demonstrate transformational vertical lift capabilities to prepare the DoD for decisions regarding the replacement of the current vertical lift fleet

Products:
- Demonstrated and refined set of technologically feasible and affordable capabilities
- Technology maturation plans
- Cost analysis for future capabilities
- Two demonstrator test bed aircraft

Payoff:
- Reduced risk for critical technologies
- Acquisition workforce with improved skill sets to develop specifications and analyze technical data
- Data readily available to support future DoD acquisitions
Over the last ten years, DVE conditions are the leading contributor of aviation deaths and loss of aircraft.

- Complex, Multi-disciplinary Problem
- Multiple Operating Environments
- Potentially Very Expensive
Incremental Build on Capabilities

**FOUNDATION LAYER**
- Improved Flight Controls, Navigation, SVB
- Existing Sensors
- TTPs, Training

**Display**
- MFD, HUD, HMD

**Symbology**
- BOSS, BFT, Threats

**Digital Databases**
- Terrain, Obstacles, Wires

**Crew Warning**
- Visual, Aural, Tactile

**Video Enhancement**
- Brownout, wire/obstacle detection

**Passive Sensors**
- Multi-function, all-aspect capability

**Active Sensor(s)**
- Multi-function - MMW, 3D LADAR

**Overlay Symbology**
- Fuse active sensor data
- "Remove" brownout, detect obstacles
- Fuse WFOV sensor video
- Terrain/Obstacle/Threats

**Synthetic Vision (All-weather)**
- Network with other a/c

**Multi-Ship Collaboration**
- Networking, Digital Interoperability

**Display NFOV sensor video**
Army Unmanned Aircraft Systems, across all tactical echelons supporting Army and Joint operations, provide the Warfighter a disproportionate advantage through:

- Near real-time situational awareness,
- Multi-role capabilities on demand (including communications, reconnaissance, and armed response), and
- System employment from dynamic retasking through autonomous operations.

Focus Areas

- **Near Term (Now -- 2015)**
  - Improved Endurance/Range
  - Precision Engagements
  - Multi-mission capability
  - Optionally Piloted Vehicle Concepts
  - Improved Propulsion Systems

- **Mid Term (2016 – 2025)**
  - Increased commonality
  - Cognitive Aiding Software
  - Improved Survivability (onboard and swarm ASE)
  - Lethal/Non-Lethal Payloads
  - All Weather Capability
  - Fully Compliant Sense and Avoid

- **Far Term (2026 – 2035)**
  - Autonomous Behavior
  - Swarming and other Teaming Capabilities
  - Self Healing Network
**Army Aviation S&T Focus Areas**

**Platforms (54%)**
- Advanced Air Vehicle System Concepts
- Joint Multi-Role Technology Demonstrator
- Rotorcraft Airframe Technology
- Platform Durability and Damage Tolerance
- National Rotorcraft Technology Center
- Reduced Vibrations
- Reduced Acoustic Signature
- Adaptive Vehicle Management
- Improved Vehicle Performance

**Power (15%)**
- Increased Fuel Efficiency Engines
- Lightweight Drive Trains
- Improved Reliability and Durability
- Reduced Weight/Vibration
- Alternative Concept Engines

**Operations Support & Sustainment (7%)**
- Reduced Maintenance Actions
- Improved Reliability
- Improved Mission Readiness
- Reduced Spares Logistics
- High Rel Prognostics/Diagnostics

**Mission Systems (21%)**
- DVE Mitigation
- Common Human Machine Interface
- Increased Levels of Autonomy
- Manned-Unmanned Intelligent Teaming
- Reduced Vehicle Signatures
- Threat Warning Sensors
- Active Jammers & Decoys
- Weapons Integration

**Concept Design & Evaluation (3%)**
- Advanced Concept Studies
- Configuration Trades & Analysis
AMRDEC maintains several levels of international engagement with various international partners in mutual areas of interest.

**Interest Areas**
- Engines and Drive Trains
- Platform Design and Structures
- Rotors and Vehicle Management
- Aircraft and Occupant Survivability
- Unmanned and Autonomous Systems
- Maintainability and Sustainability
- Basic Research in Rotorcraft Technologies
Layne B. Merritt
Chief Engineer
Aviation Development
US Army

layne.merritt@us.army.mil