SOF Future Vertical Lift

COL Doug Rombough
PEO Rotary Wing
May 2011
Agenda

- Mission
- SOF Acquisition Team
- SOF Rotary Wing Programs
- Transformation of SOF VL
- Contact Info
- Way Ahead
Mission

Provide program oversight for Rotary Wing Systems in USSOCOM. Support all stakeholders in Rotary Wing Acquisition process to provide cutting edge capabilities to the SOF Community
• Equip the soldiers of the 160th SOAR(A) with the most capable rotary wing aircraft in the world.

• Equip the airmen of the 6th SOS with NSWRA.
Current SOF RW Capabilities

A/MH-6M MELB
Mission Equipped Little Bird (MELB)
Light Attack/Assault
* 6 Combat Equipped Troops (Assault)
* Cruise Speed: 90 knots
* Max Gross Weight: 4,700 lbs
Rapidly Deployable
Shipboard Operations
Surgical Point Insertion
Aerial Reconnaissance
Close Air Support
Reconfigurable Armament (Attack)

MH-60M Blackhawk
Medium Assault
* 9 Combat Equipped Troops
* Cruise Speed: 140 knots
* Max Gross Weight: 24,500 lbs
* Ext Loads 9,000 lbs
Aerial Refuel Capable
Suppressive Fire Capability
Resupply
Advanced Aircraft Survivability Equipment
Defensive Armed Penetrator (DAP)
Reconfigurable Armament
Armed Escort & Close Air Support

MH-47G Chinook
Heavy Assault
* 44 Combat Equipped Troops
* Cruise Speed: 120 knots
* Max Gross Weight: 54,000 lbs
* Ext Loads:
  25K lbs tandem & 26K lbs center hook
Aerial Refuel Capable
Suppressive Fire Capability
Resupply
Advanced Aircraft Survivability Equip

Mi-8/17
Medium Assault
* 32 Combat Equipped Troops
* Cruise Speed: 130 knots
* Max Gross Weight: 28,600 lbs
* Ext Loads: 10K lbs
Troop Movement
Resupply

YMQ-18A Hummingbird
Unmanned Aerial System
Multi-role Missions (ISR/Re-Supply)
* Gross Weight : 5500 lbs
* Payload: 2500 lbs
* Range: 2250 NM
* Endurance: 18.7 hrs w/300 lbs
  12.1 hrs w/532 lbs
  8.1 hrs w/1000 lbs
* Speed: 142 kts
* Ceiling : 20000 ft
SOF RW Transformation

MH-6C  →  AH-6J  →  MH-6J
MH-6oL  →  MH-6oL DAP  →  MH-6oL C2  →  MH-6oK
MH-47D  →  MH-47E  →  MH-6M (51)
MH-6oM (72)  →  MH-47G (69)
Rotary Wing Lift Transformation

- Lighter & Faster
- Increase Payloads
- Increase Lethality
- Increase Survivability
- Increase Situational Awareness
- Reduce Crewmember Workload
- Seamless & Quick Aircraft Integration
Incremental Improvement MH-47

MH-47D/E

MH-47G

CH-47 A/B/C

MH-47G New Build

BGAD 1 BGAD 1.1 BGAD 2.0

BGAD 2.1 BGAD 2.2 BGAD 2.3

1960’s 1980’s 2000 2010 2025
Incremental Improvement CV-22

- **Development**
  - MV-2: Block C
  - T&E: Integrated T&E, OT

- **CV-22**
  - Block 20
    - Incr 1: Design/development, Grd & flt tests
    - Incr 2: Design/development, Grd & flt tests
    - Incr 3: Design/development, Ground & flight tests
  - T&E: Integrated T&E

- **Procurement**
  - CV-22 Block 10: 28, 5, 5
  - Block 20: 6, 4, 3
  - CV-22 Deliveries: 18, 21, 21, 21, 21, 21, 21, 21

**Timeline:**
- FY10
- FY11
- FY12
- FY13
- FY14
- FY15
- FY16

**Incr 1:**
- Design/development
  - Ground & flight tests

**Incr 2:**
- Design/development
  - Ground & flight tests

**Incr 3:**
- Design/development
  - Ground & flight tests

**Procurement:**
- CV-22 Block 10: 28, 5, 5
  - FY11: 5, FY12: 5
- Block 20: 6, 4, 3
  - FY12: 6, FY13: 4, FY14: 3
- CV-22 Deliveries: 18, 21, 21, 21, 21, 21, 21, 21

**Rotary Wing**

**UNCLASSIFIED**
The current fleet of DOD rotorcraft cannot continue to be incrementally improved to meet future operational requirements. Significant increases in range, speed, payload, survivability, reliability, and reduced logistical footprint are all required and can only be met through the application of new technologies, which are best developed through a Joint Multi-role/commonality approach.
DOD Initiative (2009 FVL Begins)

- The genesis of this initiative was a letter from the Congressional Rotorcraft Caucus, signed by co-chairs Congressman Sestak and Congresswoman Granger, to the Secretary of Defense and Chairman of the Joint Chiefs of Staff requesting they conduct and provide the results of an Assessment of future DOD Vertical Lift aircraft capabilities. Secretary of Defense Gates directed the Office of the Secretary of Defense (OSD) Acquisition, Technology and Logistics (AT&L) to:

  "Lead the development of an Assessment that will outline a Joint approach to the future development of vertical lift aircraft for all the Military Services."
DOD Initiative (Cont)

• Subsequent to Secretary Gates’ response, the 2009 Duncan Hunter National Defense Authorization Act was signed into law and included Section 255, which had similar language directing:

  “The Secretary of Defense and the Chairman of the Joint Chiefs of Staff shall carry out a capabilities-based assessment that outlines a joint approach to the future development of vertical lift aircraft and rotorcraft for all of the Armed Forces.”

• The OSD (AT&L) Director, Land Warfare and Munitions (LW&M) and the Deputy Director, Resources and Acquisition, J-8, Joint Staff, co-chaired the Future Vertical Lift (FVL) Executive Steering Group (ESG) to provide guidance and oversight to the capabilities based assessment team.
## Platform Assessment

### FY07 - FY34

<table>
<thead>
<tr>
<th>Year</th>
<th>RECON/ATTACK</th>
<th>Utility</th>
<th>Cargo/Heavy Lift</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY07</td>
<td>Block II Upgrade</td>
<td>New Airframe</td>
<td>New Airframe*</td>
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<tr>
<td>FY10</td>
<td>Block III</td>
<td>New Airframe</td>
<td>New Airframe</td>
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<tr>
<td>FY13</td>
<td>OH-58D KW</td>
<td>New Airframe</td>
<td>New Airframe</td>
</tr>
<tr>
<td>FY16</td>
<td>PIP Airframe</td>
<td>New Airframe</td>
<td>New Airframe</td>
</tr>
<tr>
<td>FY19</td>
<td>PIP Airframe</td>
<td>Class I</td>
<td>New Airframe</td>
</tr>
<tr>
<td>FY22</td>
<td>PIP Airframe</td>
<td>Firescout</td>
<td>New Airframe</td>
</tr>
<tr>
<td>FY25</td>
<td>PIP Airframe</td>
<td>MQ-1C</td>
<td>New Airframe</td>
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<tr>
<td>FY28</td>
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<td>New Airframe</td>
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<td>FY31</td>
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<tr>
<td>FY34</td>
<td>PIP Airframe</td>
<td>New Airframe</td>
<td>New Airframe</td>
</tr>
</tbody>
</table>

**Estimated Half-life (IOC A/C)**
- Initial Operational Capability
- Estimated Half-life (IOC A/C)
- Estimated End of Useful Life (IOC A/C)
- Estimated End of Production Run

**Development Phases**
- DP 1: New Start Technology Development
- DP 2: New Start System Development & Demonstration

*Airframe structure is new. Some components overhauled/remanufactured.*
### Baseline Aircraft by Class

<table>
<thead>
<tr>
<th>MISSION</th>
<th>SVC</th>
<th>2010</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
<th>2035...2050</th>
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</thead>
<tbody>
<tr>
<td>Trainer</td>
<td>USA, USN</td>
<td>TH-57B/C</td>
<td>TH-67</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Light Attack, Recon, ISR, C²</td>
<td>USMC</td>
<td>OH-58D</td>
<td>(KW)</td>
<td>Firescout</td>
<td>MH/AH-6J</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MEDEVAC, SOF, SAR, Assault</td>
<td>USA</td>
<td>HH-60G</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Attack, Recon, ISR, C²</td>
<td>USMC</td>
<td>MH-60S</td>
<td>MV-22B</td>
<td>MH-60R</td>
<td>CV-22</td>
<td></td>
<td></td>
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<tr>
<td>Utility, ASW, SUW, VERTREP, MCM, CSAR</td>
<td>USA</td>
<td>AH-1Y</td>
<td>MH-60T</td>
<td>AH-64D</td>
<td>UH-60M</td>
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<tr>
<td>VOD, Cargo, Heavy Lift, MCM, SOF, CSAR, Assault</td>
<td>USA</td>
<td>AH-1W</td>
<td>AH-1Z</td>
<td>CVLSP</td>
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<tr>
<td>MEDEVAC, MVM, Cargo, Ultra Lift, Transport</td>
<td>USMC</td>
<td>CH/MH-47</td>
<td>D/F/G</td>
<td>CH-53D</td>
<td>CH-53K</td>
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<tr>
<td></td>
<td>USA</td>
<td>CH-53E</td>
<td>CH-53K</td>
<td>CH-53E</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SAF</td>
<td>ICD</td>
<td></td>
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</tr>
</tbody>
</table>

#### Development Phases
- **Light Multi Role Tech Development**
  - Tech Demos
  - EMD
- **Medium Multi Role Tech Dev.**
  - Tech Demos
  - EMD
- **Common Systems Development**
  - Tech Demos
  - EMD
- **Heavy Multi Role Tech Dev.**
  - Tech Demos
  - EMD
- **Ultra TD**
  - Tech Demos
  - EMD

**Timeframes**
- **S&T Dev**: 6.2-6.3
- **Tech Demos**: 6.3-6.4
- **EMD**: 6.5+
### JMR Emerging Attributes

#### JMR Study Performance Ranges

<table>
<thead>
<tr>
<th></th>
<th>Light</th>
<th>Medium</th>
<th>Heavy</th>
<th>Ultra</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed</td>
<td>&gt;170-300+ kts</td>
<td>&gt;170-300+ kts</td>
<td>&gt;170-300+ kts</td>
<td>300+ kts</td>
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<tr>
<td>Combat Radius</td>
<td>~424 km</td>
<td>~424 km</td>
<td>~424 km</td>
<td>~462 km</td>
</tr>
<tr>
<td>Payload (Int)</td>
<td>~2k - 4.5k lbs</td>
<td>~6k - 20k lbs</td>
<td>~20-30k lbs</td>
<td>~40-72k lbs</td>
</tr>
<tr>
<td>Payload (Ext)</td>
<td>~2k - 4.5k lbs</td>
<td>~10k - 20k lbs</td>
<td>~16-30k lbs</td>
<td>~40-72k lbs</td>
</tr>
<tr>
<td>Passengers*</td>
<td>~4-6</td>
<td>~11-24</td>
<td>~33-44</td>
<td>~100-120</td>
</tr>
</tbody>
</table>

- **Light**: Recon ISR, MEDEVAC, SOF, SAR, Amphib Assault, Attack, ASW, ASUW, C2, Transport, Security
- **Medium**: Recon ISR, MEDEVAC, SOF, SAR, Amphib Assault, Attack, ASW, ASUW, VERTREP, MCM, C2, VOD, Cargo/Lift, Transport
- **Heavy**: Recon ISR, SOF, Amphib Assault, CSAR, VERTREP, MCM, VOD, Cargo/Lift, Transport
- **Ultra**: VOD, Cargo/Lift, Transport, MVM

*Combat troop weight 365 lbs

identified range of Joint missions

The Ultra category is being examined through the United States Air Force Aeronautical Systems Center (ASC) Capabilities Integration Directorate (ASC/XR) and is not included in this RFF.
FVL JMR Study Timeline

Major Milestones

AMBL Survivability Study Phase I (Apr-Sep)

20-21 Jul
FVL JMR WG #1
Confirm Missions and Evaluate ICD Attribute Areas

30 Jun Strategic Plan S&T Plan to Congress

21 Oct Brief RFI to Industry VLC NASA AMES NAVAIR

7-9 Dec Industry VLC Sessions

30 Nov-1 Dec
FVL JMR WG #3
Determine Key Attribute Values for each JMR Class

15-16 Mar
FVL JMR WG #5
Risk Assessment Attribute Description

10-11 Aug
Army Aviation S&T

25 Aug
JMR Demo Tm and Navy Meeting

26 Aug
USAACE Workshop Preparation for FVL JMR WG #2

19-20 Jan
FVL JMR WG #4 (S&T)

28-29 Sep
FVL JMR WG #2
Determine Key Attribute Values for each JMR Class

15-16 Mar
FVL JMR WG #5
Risk Assessment Attribute Description

25-26 May
FVL JMR WG #6 Risk Assess cont

FVL JMR Study Continues
** No current intent to establish an ICD developmental plan beyond the framework depicted in the FVL Strategic Plan.
SOCOM Involvement (Proposed)

FVL Phased Management Construct adapted from Draft FVL SP

<table>
<thead>
<tr>
<th>Year</th>
<th>Phase 0</th>
<th>Phase I</th>
<th>Phase II</th>
<th>Phase III</th>
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</thead>
<tbody>
<tr>
<td>2011</td>
<td>Strategy Plan Signed</td>
<td>Coordination/Integration Cell Manage Near Term FVL Activities &amp; Oversight by Council of Colonels (3-4 Gov't &amp; 1-2 CTR)</td>
<td>Technology and Concept Demonstrators</td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>POM 13</td>
<td>Coordination/Integration Cell Manage Near Term FVL Activities &amp; Oversight by O-6 Director (Full Time Core: 5-6 Gov’t &amp; 3-4 CTR)</td>
<td>Joint Management Office(s) Establish &amp; Manage FVL Programs</td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td></td>
<td>Coordination/Integration Cell Manage Near Term FVL Activities &amp; Oversight by O-6 Director (Full Time Core: 5-6 Gov’t &amp; 3-4 CTR)</td>
<td>Joint or Lead Service Leadership</td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td></td>
<td>Coordination/Integration Cell Manage Near Term FVL Activities &amp; Oversight by O-6 Director (Full Time Core: 5-6 Gov’t &amp; 3-4 CTR)</td>
<td>Full time program management activities</td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td></td>
<td>Coordination/Integration Cell Manage Near Term FVL Activities &amp; Oversight by O-6 Director (Full Time Core: 5-6 Gov’t &amp; 3-4 CTR)</td>
<td>Potential for multiple programs</td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td></td>
<td>Coordination/Integration Cell Manage Near Term FVL Activities &amp; Oversight by O-6 Director (Full Time Core: 5-6 Gov’t &amp; 3-4 CTR)</td>
<td>1° MOD (notional)</td>
<td></td>
</tr>
<tr>
<td>2017</td>
<td></td>
<td>Coordination/Integration Cell Manage Near Term FVL Activities &amp; Oversight by O-6 Director (Full Time Core: 5-6 Gov’t &amp; 3-4 CTR)</td>
<td>1° CDG</td>
<td></td>
</tr>
<tr>
<td>2018</td>
<td></td>
<td>Coordination/Integration Cell Manage Near Term FVL Activities &amp; Oversight by O-6 Director (Full Time Core: 5-6 Gov’t &amp; 3-4 CTR)</td>
<td>1° MOD (notional)</td>
<td></td>
</tr>
<tr>
<td>2020+</td>
<td></td>
<td>Coordination/Integration Cell Manage Near Term FVL Activities &amp; Oversight by O-6 Director (Full Time Core: 5-6 Gov’t &amp; 3-4 CTR)</td>
<td>1° CDG</td>
<td></td>
</tr>
</tbody>
</table>

Executive Steering Group: Focus on Strategic Plan execution, review and decision points.

SOCOM Engagement:
- Pro-rata Share of Support and RTD&E Funding
  - Funding for full time support of Coordination/Integration Cell
- Phase 0, 4(-) Pax
  - Habitually aligned, part time AO Executive Working Group monitoring, bi-monthly (1 J8-RA)
  - Habitually aligned, part time AO Council of Colonels membership, bi-monthly (1 J8-RA)
  - Habitually aligned, part time AOs Working Group(s) membership, bi-monthly (1-3 S&T, DSOA, AFSOC)
- Phase I, 6(-) Pax
  - Phase 0 support plus,
  - Habitually aligned, part time AOs Coordination/Integration Cell membership (2, S&T, SORDAC)
- Phase II, 9-11(-) Pax
  - Phase I support plus,
  - Additional habitually aligned, part time AOs Coordination/Integration Office membership (3, 160th SOAR(A), AFSOC, TAPO)
  - Dedicated full time AO Coordination/Integration Office (1 Contractor)
- Phase III
  - Phase II support / Joint Office support

= Key Event
X-49/X3/ X2 Demonstrators
Examples of today's VL technology

Low Vibration
Active Vibration Control
Low Noise

250 Kts Speed
Low Pilot Workload

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### Exceeding Current Capability

<table>
<thead>
<tr>
<th>Feature</th>
<th>Percentage Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hover altitude</td>
<td>150% Increase</td>
</tr>
<tr>
<td>Mission Speed</td>
<td>100% Increase</td>
</tr>
<tr>
<td>Endurance</td>
<td>100% Increase</td>
</tr>
<tr>
<td>Payload</td>
<td>40% Increase</td>
</tr>
<tr>
<td>Acoustic Detection</td>
<td>50% Reduction</td>
</tr>
<tr>
<td>Size</td>
<td>15% Reduction</td>
</tr>
<tr>
<td>Turn Radius</td>
<td>50% Reduction</td>
</tr>
</tbody>
</table>

**Coverage in Afghanistan**
- OH-58D: 40% Coverage
- ???: 97% Coverage

**UNCLASSIFIED**
FVL Mission Equipment
For Example ADAS

- Operating safely and swiftly in extremely dark conditions is crucial
- ADAS provides a multispectral, multifunction mission solution
- ADAS delivers expanded high resolution infrared and NIR imagery to entire crew simultaneously
- ADAS provides the only real solution concerning DVE-Brownout situations
- ADAS provides simultaneous imaging, navigation, and warning/ indication

**Infrared Search and Track (IRST)**
- Aircraft Acquisition
- Detection/Tracking of Enemy / Friendly Aircraft

**Passive Aircraft Detection**

**Multi-spectral Pilotage and Navigation**

**Missile Warning**

**Brownout Symbology**

**Passive Aircraft Detection**

**Missile Launch Detection (MLD)**
- Track (SAM & AAM)
- Ownership Alert
- Prediction of Time to Impact
- Missile / HFI Warning

**HFI Declare and Characterize**
- Small arms (7.62 to 30-mm)
- AAA guns (.30 caliber to 40-mm)
- RPGs
- Anti-Tank Guided Missiles

**Laser Warning**

**Hostile Fire Indicator**
With currently projected funding, the JMR Tech Demo program will produce two technology demonstration platforms.

DoD 5000 currently requires a minimum of two competitive prototypes for a MS B decision.

Under currently projected funding, the JMR Tech Demo program will produce MS B documentation. PEO/PM 6.4 funding will further enhance the fidelity and completeness of the JMR specification and other MS B documentation.
**X-Plane Development Timeline**

**X-Plane vs “Normal” DoD Flight Program**

Allows Multiple Projects for Same Dollars

<table>
<thead>
<tr>
<th>X-Plane Demo Program:</th>
<th>Estimate</th>
<th>Actual</th>
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</thead>
<tbody>
<tr>
<td>Contractor with 30-50 personnel full time</td>
<td>$200M</td>
<td>$40M</td>
</tr>
<tr>
<td>Government PM, DPM, and 5 Engineers full time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Schedule 3-5 years, depending on scale and complexity of demo</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost $30M to $200M</td>
<td></td>
<td></td>
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</tbody>
</table>

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<thead>
<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Contractor 120 -200 personnel</td>
<td>NAVAIR Decision to Transition to FAA Process Avoided 80% of Estimated X-49 Demo Cost</td>
<td></td>
</tr>
<tr>
<td>Government 48 – 80 FTE</td>
<td></td>
<td></td>
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<tr>
<td>Schedule 6-8 years, depending on Phased breakdown</td>
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<td></td>
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<tr>
<td>Cost $300M to $1.5B</td>
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</table>

Contractor X Plane Methods Support Faster, Multiple Demonstrations

**X Planes**
Today’s tools cannot predict multidisciplinary optimization: aerodynamics, dynamics, loads, vibes, handling qualities.

Iterative process of envelope expansion and tool development / calibration needed.

Flight Test Data Critical for Validating High Fidelity Models

Building X Planes Refines Tools and Validates Them
Future Rotary Wing Concepts
Where We Want to Be

- OPV – Optional Piloted Vehicles with BLOS data links
- Perfect Compound Helicopter/Higher Speeds
- More Composites / Lighter Weight/Stiffer Construction/Higher Resonant Frequencies
- Low Observable/Low Acoustic “silent mode”
  - Low Acoustic Signature Gears and Transmissions
  - Active Acoustic Suppression “Bose Headphones”
- ADAS
Future Rotary Wing Concepts (Cont)

- Small Arms/RPG Shields
- Manned/Unmanned Teaming: Control UAV Helos From Manned Helo Teammate
- Dynamically Shapeable Rotor Blades- Change for Different Fight Conditions
- Color Changing Paint
Way Ahead

Planning for the next five years:
• MH-60M Modernization
• MH-47G Plus 8 New Build
• MH-47G 2.3 Block Upgrade
• A/MH-6M 3.0 Block Upgrade
• Hostile Fire Indicating System (HFIS)
• Aircraft Occupant Ballistic Protection System (AOBPS)
• Reduce Optical Signature Emission Solution (ROSES)
• Secure Real-Time Video (SRTV)
• Degraded Visual Environment (DVE) - brown out/white out conditions
• Lightweight Fire and Forget Weapon
• Upgrade Legacy Simulators