Next Gen Armored Reconnaissance: ARV Introduction and Requirements

- Brief to Industry-

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Fires & Maneuver Integration Division
Agenda

• LAV Investment Background
• Gaps and Shortfalls
• ARV Storyboard – Core and Enabling Capabilities
• ARV Concept of Employment
• Boundary Conditions
• ARV Functional Hierarchy
**LAV Investment Background**

**1980s**  
AAO

**1990s**  
770

**2000s**  
925

**2010s**  
1,005

**2020s**  
808

**2030s**  
~600-700

**2035 Exit Date**

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**Service Life Extension Program**

**LAV to LAVA1**

- Automatic Fire Suppression System (AFSS), Ballistic Protection Upgrade Package (BPUP) applique armor, Generation II Suspension, Power Pack Enhancements (Fuel Injectors, Fuel Cooler, and Improved Radiator), and Electronic Turret Drive
- Extended Exit Date 2015-2025

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**IROAN Program at the Depots**

**LAV SLEP (1997-2010) 770 AAO**
- Fix maintenance issues, upgrade tire/wheel assemblies, thermal signature reduction, Improved Thermal Sight System (ITSS).
- Extended Exit Date 2005-15

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**Survivability Upgrade (2008-13) Cancelled:** Self-sealing fuel tanks, energy attenuating seats, structural reinforcement, light weight underbody protection

**LAV-C2 Upgrade (2005-12) AAO 50:** Integrated modern C4I suite

**LAV-R Upgrade (2008-14):** AAO 45, New winch, generator, storage racks

**Lethality Upgrade (2006-Present) AAO 402**
- Mod 25mm cannon to fire Depleted Uranium rounds, firing tables, soft recoil mod, heavy breech, and muzzle brake

**LAV Anti-tank Modernization (2010 – Present) AAO 106:** Developed modern turret system (TOW/SABRE system compatible)

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**LAV-A2 Upgrade**

**C2 Upgrade**

**Survivability Upgrade**

**LAV-R Modernization**

**LAV MOB**

**LAV OB**

**LAVA2 Upgrade (2005-2012) 925 AAO**
- Automatic Fire Suppression System (AFSS), Ballistic Protection Upgrade Package (BPUP) applique armor, Generation II Suspension, Power Pack Enhancements (Fuel Injectors, Fuel Cooler, and Improved Radiator), and Electronic Turret Drive
- Extended Exit Date 2015-2025

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Despite this history of investment, LAVs today face increasing depot maintenance costs and decreasing equipment readiness combined with capability shortfalls in **protection, lethality, and mobility**

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LAV – Capability

(U) LAR battalions require greater capacity to conduct combined arms reconnaissance and surveillance, raids and offensive actions, security and defensive operations in support of maneuver, and counter-reconnaissance with the level of independence and autonomy necessary to operate across extended lines of communication with minimal external support.

- Greater capacity to sense, orient, track, classify, and defeat incoming threats; organic ground and unmanned sensing capability to extend surveillance reach and expand the security area IOT provide a basis for responsive and accurate direct and indirect fires.
- Improved networked C4I and fire control capability/capacity to keep pace with the increasing tempo of the operating environment. Need to preserve rapidity and timeliness within the armored recon commanders decision cycle.
- Greater shore-to-shore water mobility to expand the maneuver space in the littorals without bridging and land mobility to conduct security operations across the ROMO while keeping pace with the future MAGTF.
- LAR battalions require effective, organic, all-weather direct and indirect fire systems to fight and win the counter-reconnaissance battle while conducting reconnaissance and security operations. Insufficient lethality to deliver effective direct fire effects at range to defeat threats; defeat close-in enemy heavy armor threats with organic heavy anti-armor weapons; effectively execute the LAR commander’s EFSTs with organic precision indirect fires and with full spectrum tactical EW capability.
- Improved force protection and system survivability for the emerging & forecasted threat operating environment.
- Capability to conduct counter-UAS operations with kinetic and non-kinetic means.
Next Generation Armored Reconnaissance Concept

To perform its primary role for the MAGTF in the future operating environment – *fight for information and shape the battle* – Light Armored Reconnaissance (LAR) Battalion will operate in increasingly complex and highly contested environments, countering threats that have more capable reach and lethality.

Next Generation Armored Reconnaissance Family of Vehicles

The ARV will be a modern combat vehicle system, capable of fighting for information, that balances competing capability demands to sense, shoot, move, communicate, and remain transportable as part of the naval expeditionary force. The ARV will provide a balanced set of performance, payload, and protection attributes with sufficient design reserve to be readily adaptable over its service life. This combination of the ARV base variant with incremental upgrades and key enablers will yield a *family of vehicles* with exceptional mobility on land and in the water, redundant and resilient MAGTF communications, and protection against direct and indirect fires, mines and IEDs, and guided munitions.
ARV Concept – Core & Enabling Capabilities

Core Capabilities

- **Land/Water Mobility:** Robust cross-country/on-road mobility performance with shore-to-shore water mobility
- **Transportability:** Size and weight within legacy LAV configuration (4 on LCAC/SSC)
- **Protection:** Full spectrum active & passive force protection and system survivability
- **Growth:** 25 percent growth margin with no performance degradation

Enabling Capabilities

- **Lethality:** Kinetic and non-kinetic means to deliver direct and indirect fires
- **Communication:** Modern C4I suite with tactical battle management system
- **MUM-T:** Manned Unmanned-Teaming capability extends LAR reach and offsets risk to ARV crews
- **Sense:** Broad spectrum capability to enhance and extend reconnaissance reach and provide persistent surveillance

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ARV Concept – Integrating Key Capabilities

**Electronic Warfare**
- Advanced, networked, multi-function EW capabilities support Assured C2, Situational Awareness, and Electronic Fires to enable the counter-recon fight
- Multi-band comm systems to outpace RF threats
- Collaborative RF sensing to orient, classify, and track threat systems
- Jamming to deny, disrupt, and degrade adversary use of RF spectrum; directed energy for physical effects against targets

**Electronic Warfare**
- Enhanced lethality to orient, classify, track, engage and neutralize threats at range to shape the battlespace
- Automatic medium caliber cannon capable of delivering anti-personnel, anti-materiel, and anti-armor munitions on the move [Army XM813 30mm weapon system]
- Anti-armor capability to defeat close-in heavy armor threats
- PGMs to defeat threats beyond the range of threat systems [Spike]
- Unmanned systems swarm capability to provide persistent, multi-function munitions

**Command and Control**
- Modern C4I suite with resilient digital architecture
- Expandable for range of electronic requirements with growth capacity
- Networked and Joint-interoperable Battle Management System enables secure voice, video, and data exchanges from extended ranges and in GPS-denied environments to expand the battlespace

**Sensors**
- Full spectrum capability to enhance and extend reconnaissance reach and surveillance persistence as UAS/UGS payloads
- Networked among crew, scouts, and commanders
- Networked with other MAGTF and Joint sensing assets
- Interoperable with MAGTF and Joint targeting systems

**Active and Passive Vehicle Protection**
- Achieve standoff to sense, orient, classify, track, and defeat incoming RPG, ATGM, and PGM threats with hard- and soft-kill capability
  - [Army Modular APS – Vehicle Active Protection System]
  - [Army HAEDS S&T – collective multiple counter-threat capability]

**Unmanned Aerial and Ground Systems (UAS/UGS)**
- Mission role variant payload to extend reconnaissance reach and surveillance persistence
- Group 3 for long-range RSTA and precision strike
- Group 3 delivery of UGS payload for I&W sensing at areas of interest
- Group 1 for local security, RSTA, and point target attack [Switchblade]
- Unmanned system payload to find, fix, finish IEDs
ARV – Draft Concept of Employment

- CoE Exists in Draft Form
- Describes the capability as an evolution of the current LAR Bn capability with technology enhancements to:
  - Fight for Information
  - Shape the Battle

<table>
<thead>
<tr>
<th>Combat Function</th>
<th>Capability Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sense</td>
<td>Persistent UAS organic to LAR formation to extend surveillance reach of unit and expand security area portion of the battlespace. Provide basis for responsive and accurate fires. Expand reconnaissance reach of unit along multiple routes, areas or across a broader zone.</td>
</tr>
<tr>
<td>Communicate</td>
<td>Provide greater networked C4I capability and capacity to facilitate operations within expanded battlespace (Data, BLOS radio, UAS, SATCOM) and rapid transfer of information to the main body.</td>
</tr>
<tr>
<td>Engage (EW)</td>
<td>Full spectrum vehicle mounted EW (EA/ES/EP), cyber and counter-UAS as a means of defending the unit and enabling an effective counter-reconnaissance fight.</td>
</tr>
<tr>
<td>Maneuver (Land)</td>
<td>Highly mobile (on and off road) protected systems that leverage man-unmanned teams to provide broader coverage within an area of operations, increase unit lethality, enable more rapid and accurate engagements, and reduce blue force casualties.</td>
</tr>
<tr>
<td>Maneuver (Water)</td>
<td>Shore-to-shore water mobility to facilitate operations in the littorals and expand maneuver options without bridging.</td>
</tr>
<tr>
<td>Protect</td>
<td>Active and passive protection systems enabling vehicle and formation capabilities to sense, orient, track, classify, and defeat incoming threats. Collective battle management capability to share information and coordinate action in order to counter inbound munitions and defeat the threat.</td>
</tr>
<tr>
<td>Shoot (Indirect)</td>
<td>Indirect fire organic to the unit. Future LAV-Mortar mission role variant contain a box of precision munitions (such as switch-blade-like and Spike-like PGMs capable of loitering.</td>
</tr>
<tr>
<td>Shoot (Direct)</td>
<td>Medium caliber cannon capable in order to deliver accurate programmable air-burst munitions at range to defeat infantry, materiel, and other light armored threats. Organic heavy armor capability to defeat close-in enemy armor threats and dominate battle space.</td>
</tr>
</tbody>
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NEXT GENERATION ARMORED RECONNAISSANCE VEHICLE CONCEPT OF EMPLOYMENT

1. Introduction
a. Purpose
The combat developer produces a concept of employment (CoE) to describe narratively a specific system, its attributes, and its employment within the constructs of existing concepts of operations. This CoE describes an armored reconnaissance vehicle as the foundation for a next generation Marine Corps armored reconnaissance capability required within Marine Corps Operating Concept (MOC) of 2016.

b. Background
LAR capabilities directly support the Capstone Concept for Joint Operations (CGJO) by enabling the MAGTF to assist the joint commander in the following six fundamental joint actions:

- Establish, expand, and secure reach
- Acquire, refine, and share knowledge
- Build knowledge on information from integrated strategic, operational, and tactical sources
- Understand the adversary and the environment
- Employ essential capabilities inside the operational area to shape an environment, deter or defeat an adversary, resolve crises, or support other strategic objectives
- Identify, create, exploit effects

LAR Battalion conducts armored reconnaissance, security, and economy of force missions in the deep battle or in the shaping phase of an operation at extended ranges from the MAGTF main body to inform the MAGTF commander's operational decision-making, within its capabilities, LAR Battalion also conducts offensive and defensive actions that exploit its mobility and firepower for a supported commander. LAR missions can be task organized to focus on the physical or security aspects of the operating environment, even when weather, the environment, or the adversary present significant challenges. LAR Battalion ensures continuous reconnaissance, retains freedom of maneuver, gains and maintains threat contact without becoming decisively engaged, and rapidly develops emerging and dynamic situations to provide

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**ARV – Boundary Conditions**

- **Boundary Conditions** – hard/fast requirements with a significant design or capability restriction

  **Lethality** – Medium Caliber Weapon System (integrated space and weight claims, center of buoyancy)

  **Move Combat Power** – Crew and embarked scouts drive under armor volume... weight

  **Move Water** – riverine implies a positive balance between vehicle volume and vehicle weight (density) and a marine drive system

  **Move Land and Growth Capacity** – significant propulsion capacity with capable off-road suspension both with growth margin

  **Deploy** – 4x SSC (weight and geometry implications) and L-Class embarkation

  **Protect** – Vehicle underbody and ballistic armor.... weight

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ARV – Functional Hierarchy

• The functional hierarchy is a comprehensive decomposition of the ARV operational requirements
  – Ensures comprehensive consideration
  – Each function describes in nouns and verbs what we want ACV to be able to do
  – Later steps assign metrics and parameters leading to a full capability statement
  – Enables future development of relative priority among capabilities
• This process effectively applied on other ACAT1 programs like JLTV and ACV.
Combat Functions
ARV Functional Hierarchy – Move Across Terrain

Move across Terrain 1.0

Conduct Point to Point Movement 1.1

Negotiate Slopes 1.1.1
- Ascend / Descend Steep Terrain 1.1.1.1
- Laterally Traverse Steep Terrain 1.1.1.2
- Maintain Speed on Steep Terrain 1.1.1.3

Control Displacement 1.1.2
- Control Direction 1.1.2.1
- Control Speed (Braking & Acceleration) 1.1.2.2
- Move to Operational Distances 1.1.2.3

Move through Unimproved Terrain 1.1.3
- Move over Soft Ground 1.1.3.1
- Move Rapidly over Hard Ground 1.1.3.2

Move through Built-up Terrain 1.1.4
- Travel on Primary Roads 1.1.4.1
- Move thru Narrow Terrain 1.1.4.2

Negotiate Obstacles on Land 1.2
- Negotiate Vertical Steps 1.2.1
- Cross over Trench Fighting Positions 1.2.2
- Negotiate Urban Rubble Piles 1.2.3
- Negotiate V-Ditches 1.2.4

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ARV Functional Hierarchy – Move Across Water

Move across Water 2.0

Conduct Riverine Operations 2.1
- Enter and Exit Water with a Current, Riverbank Transition 2.1.1
- Negotiate Submerged Obstacles while Waterborne 2.1.3
- Detect Underwater Obstacles 2.1.5
- Map Bathometric Data 2.1.7
- Move in Cross Current Water 2.1.2
- Negotiate Floating Obstacles while Waterborne 2.1.4
- Maintain Movement to a Distance 2.1.6

Conduct Littoral Operations 2.2
- Transition to/from Water in Beach Zone 2.2.1
- Move through Surf Zone 2.2.2
- Negotiate Submerged Obstacles while Waterborne 2.2.3
- Maintain Movement 2.2.4

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ARV Functional Hierarchy – Move Combat Power

- Move Combat Power
  - Move Crew and Scouts
    - Provide Habitable Space
      - Control Climate
        - Provide ESOH Compatible Environment
      - Provide Human Factors Capacity
    - Support Crew and Scout Embarkation
      - Enable Embark in Water Environment
      - Enable Embark in Land Environment
  - Provide On-Board Power to Carried-Aboard & Worn-Aboard Systems
    - Support Crew and Embarked Infantry Egress
      - Enable Egress in Water Environment
      - Enable Egress in Land Environment
  - Move Organic RAS
  - Provide Local Vehicle Security/Support
ARV Functional Hierarchy – Collect Information

Collect Battlefield Information 9.0

- Sense Battlefield Environment 9.1
  - Sense the Security Environment 9.1.1
    - Sense Visual Signatures 9.1.1.1
    - Thermal Signatures 9.1.1.2
    - Sense Electromagnetic (Communication) Signatures 9.1.1.3
    - Geo-Locate Sensed Signatures 9.1.1.4
  - Sense the Physical Environment 9.1.2
    - Sense Acoustic Signatures 9.1.1.5
    - Sense Chemical Signatures 9.1.1.6
    - Sense Radar Signatures 9.1.1.7
    - Detect Motion 9.1.1.8
- Investigate Signatures of Interest 9.2
  - Employ Vehicle-borne Sensors 9.2.1
    - Geolocate physical objects 9.1.2.1
  - Employ Organic Robotic and Autonomous Systems (RAS) 9.2.2
    - Prepare RAS 9.2.2.1
    - Launch RAS 9.2.2.2
    - Control RAS Movement 9.2.2.3
    - Process RAS-Collected Information 9.2.2.4
    - Recover RAS 9.2.2.6
    - Sustain RAS 9.2.2.7
  - Employ Scouts 9.2.3
  - Employ Non-Organic RAS 9.2.4
    - Provide Level I Control of Non-Organic RAS 9.2.4.1
    - Provide Level II Control of Non-Organic RAS 9.2.4.2
    - Provide Level III Control of Non-Organic RAS 9.2.4.3

- Process Tactical Information 9.3
  - Receive Tactical Intelligence 9.3.1
  - Analyze/ Merge Tactical Intelligence 9.3.2
  - Disseminate Tactical Intelligence into MAGTF Networks 9.3.3
  - Fuze Geolocated objects to operational picture 9.3.4
  - Auto-Recognize Sensed Signatures 9.3.5
  - Participate in Intelligence Broadcast Services 9.3.6

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ARV Functional Hierarchy – Provide Command and Control

- Provide Intra-vehicle Communications (6.1)
  - Provide Intercom (6.1.1)
    - Communicate with Supported Commanders (6.2.1)
    - Securely Transmit/Receive Voice, Video, and Data (6.2.3)
    - Transmit and Receive on the Move (6.2.5)
    - Offboard / Obscure Emitted Signatures (6.2.7)
  - Transmit and Receive (6.2)
    - Provide Access to Unclassified and Classified Networks (6.2.2)
    - Retransmit/Relay Voice and Data Communications (6.2.4)
- Maintain Operational Picture (6.3)
  - Enable Local Situational Awareness, Open Hatch (6.3.1)
  - Enable Situational Awareness, Crew-Level (JBCP) (6.3.3)
  - Enable Situational Awareness, Individual Scout-Level (Vision System) (6.3.2)
- Provide Navigation Aid (6.4)
  - Navigate Across Terrain w/ GPS (6.4.1)
  - Navigate Across Terrain w/ Intermittent or Denied GPS (6.4.2)
- Provide C2 Growth Capacity (6.5)
  - Provide SWAP-C for C2 Growth (6.5.1)
  - Provide Open System Architecture (6.5.2)
ARV Functional Hierarchy – Neutralize Threats

Neutralize Threats

- Employ Organic Weapons
  - Detect, Recognize, & Identify Targets
    - Conduct Hunter-Killer Engagements
  - Engage Targets
  - Conduct BDA
  - Push Target Info to BMS
- Employ Non-Organic Weapons
  - Launch, Control, and Recover Weaponized RAS
  - Control Semi-Autonomous Wingman
- Support External Control
  - Transition between Manned/Unmanned Employment
  - Enable In-the-Loop/On-the-Loop Control
  - Submit to Full Control

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ARV Functional Hierarchy – Provide Protection

- Provide Protection 7.0
  - Avoid Detection 7.3
    - Minimize Thermal/IR Signature 7.3.1
    - Minimize Acoustic Signature 7.3.2
    - Minimize Visual Signature 7.3.3
    - Minimize Radar Signature 7.3.5
    - Offboard EM Signals 7.3.6
  - Avoid Being Hit 7.4
    - Avoid Hits by Anti-Armor Threats 7.4.1
    - Avoid Hits by RCIED Threats 7.4.3
    - Avoid Attacks by UAS 7.4.2
  - Protect the Occupants 7.2
    - Protect Occupants from Direct Fire 7.2.1
    - Protect Occupants from Indirect Fire 7.2.2
    - Protect Occupants from Side IED Attack 7.2.3
    - Protect Occupants from Under-Vehicle Mine/IED Attack 7.2.4
    - Protect Occupants from CBR Attack 7.2.5
    - Protect Occupants from DEW/Lasers 7.2.6
    - Protect Occupants from Air Threats 7.2.7
  - Protect the System, Mitigate Overmatch 7.1
    - Operate through / Recover from EMP Attack 7.1.2
    - Resist EW Attack 7.1.3
    - Egress Kill Zone/Protected Fuel 7.1.5
    - Decontaminate after CBR Attack 7.1.6
    - Extinguish Onboard Fires 7.1.1
ARV Functional Hierarchy – Enable Sustainment

Enable Sustainment

Enable Recovery
- Enable Like Vehicle Recovery on Water
- Enable Like Vehicle Recovery on Land
- Enable Self Recovery on Land

Enable Training

Facilitate Availability

Manage Energy

Resist Corrosion

Enable Maintainability (Low Maint Ratio)
- Enable Quick Repair (MTTR)
- Facilitate Vehicle Health Monitoring & Diagnostics
- Provide Simple PMCS
- Support Ease of Repair (ETM)
- Minimize Total Repair Time (MaxTRT)

Provide High Reliability