

Army Robotic and Autonomous Systems (RAS) Portfolio

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This briefing is:

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Strategic Guidance

2018 National Defense Strategy - “the character of war is changing based on rapid technological advancements in the areas of advanced computing, “big data” analytics, **artificial intelligence, autonomy, robotics**, directed energy, hypersonics, and biotechnology...”

2018 Army Multi-Domain Operations – “**Integrated unmanned systems** play a pivotal role in our ability to penetrate and defeat multiple layers of stand-off in all domains--land, sea, air, space and cyberspace.

“The Army of 2028 will be ready to deploy, fight and win decisively against any adversary, anytime and anywhere, in a joint, multi-domain, high-intensity conflict, while simultaneously deterring others and maintaining its ability to conduct irregular warfare. Further, and this is very important...The Army will do this through the employment of modern **manned and unmanned** ground combat vehicles, aircraft, sustainment systems, and weapons, coupled with robust combined arms formations and tactics based on a modern warfighting doctrine, and centered on exceptional Leaders and Soldiers of unmatched lethality.”

Dr. Mark T. Esper,
Secretary of the Army
26 March 2018



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Army Modernization

Modernization Strategy: Regain
Overmatch Against Near & Mid-Term Threats

- Continue to make **incremental improvements** to existing combat systems to ensure the U.S. can fight and win in the near term
- **Focus our Science and Technology** investments, on a **limited number** of prioritized portfolios, to guarantee our Soldiers have formation based tactical overmatch and technological superiority in the near to mid-term
- **Begin prototyping** a select number of next generation combat system technologies and vehicles IAW **Army Modernization Priorities**; begin development as soon as the technologies are mature enough we can rapidly move from prototype to production.
- **Enable Cross Functional Teams** to develop Next Generation Systems that make our Soldiers and units more lethal
- **Sustain** current systems to extend useful life
- Continue to **divest** less important capabilities to free resources for higher priorities

4/23/2019

Modernization Priorities

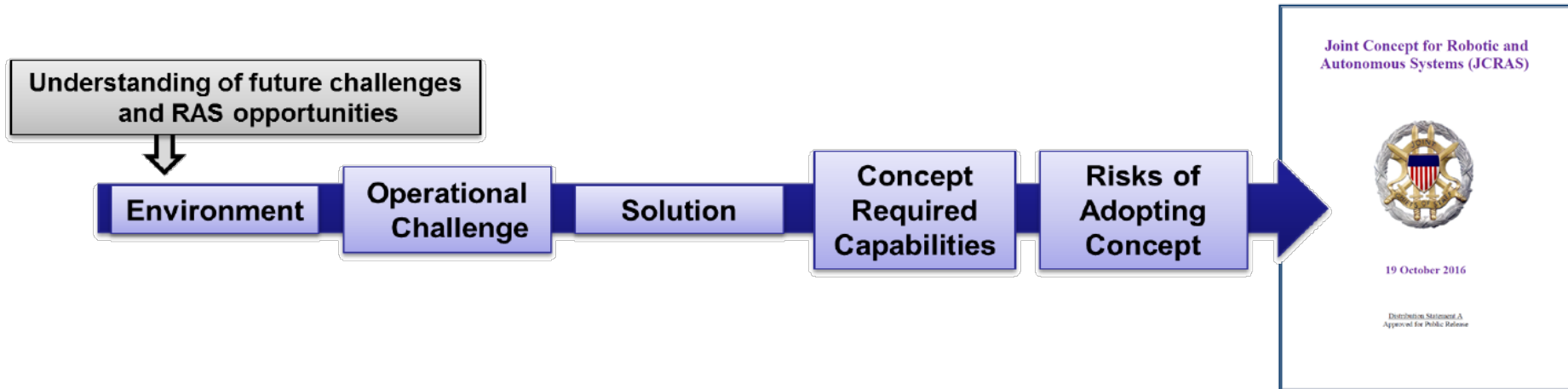
1. **Long-Range Precision Fires**
2. **Next Generation Combat Vehicle**
3. **Future Vertical Lift**
4. **Army Network**
5. **Air and Missile Defense**
6. **Soldier Lethality**

- Buy down Risk by leveraging **Rapid Prototyping** and **Rapid Fielding** of innovative system components or technologies
- Increase acquisition agility with the use of **ACAT IV** programs and delegation of MDA authority of select ACAT II/III/IV directly to PEOs
- Smart contracting to leverage commercial item procurement and **Other Transaction Authority** (OTA)
- Reduce **testing time and cost**
- Maintain visibility of cutting edge industry technology through a **Buy-Try-Decide-Acquire** methodology
- Rapidly deliver systems to operational units to gain early **Soldier Feedback** to inform concepts and requirements
- Don't let the **perfect** be the **enemy of the better**



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Joint Concept for Robotic and Autonomous Systems



Operational Challenge: How will the joint force employ RAS to gain and maintain operational advantage in a future operating environment featuring increased lethality and sophistication, accelerated pace of operations, eroding military advantages, and congested environments?

Central Idea: By 2035, the Joint Force will employ integrated teams of humans and RAS in a wide variety of combinations to expand the Joint Force commander's options.

Precept #1: Employ Human-RAS Teams

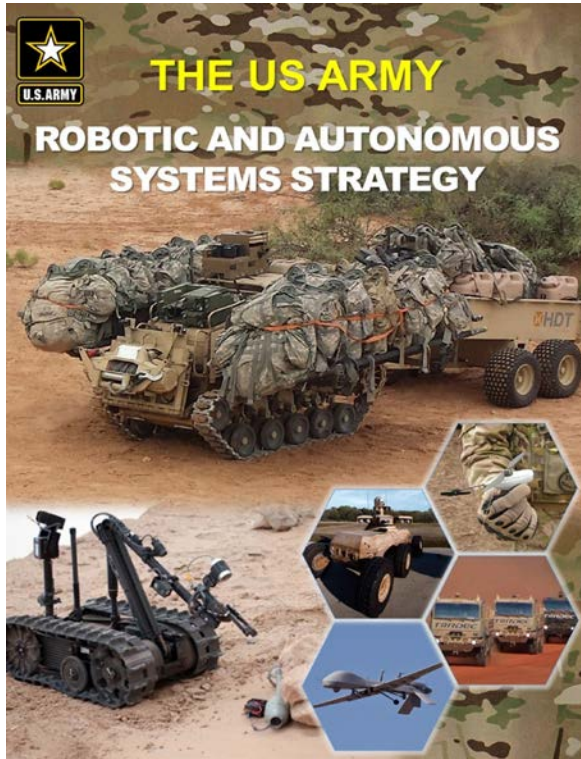
Precept #2: Leverage Autonomy as a Key Enabler

Precept #3: Integrate RAS to Develop Innovative CONOPs



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Army Robotic and Autonomous Systems Strategy



March 2017

Overview:

- The strategy synchronizes Army RAS activities and fosters **unity of effort** to identify and develop opportunities to accelerate and integrate RAS capabilities
- The Army will employ RAS to **protect** Soldiers, increase capabilities to **maintain overmatch**, and **extend the area and time** over which a force can be effective
- Technology development seeks to achieve the optimal level of autonomy by designing systems that will **maximize strengths of both humans and machine** through **Manned-Unmanned Teaming (MUM-T)**

Priorities:

- Improve **situational awareness** and persistently monitor the environment
- **Lighten** physical and cognitive **workloads**
- **Sustain** with increased distribution, throughput, and efficiency
- Facilitate **movement and maneuver**
- **Protect** the force

Endstate:

Robotics and Autonomous Systems (RAS), through Manned-Unmanned Teaming (MUM-T), enable Army formations to increase their **endurance, persistence, lethality, protection** and **depth**.

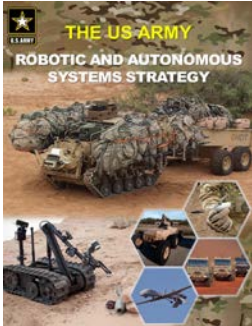
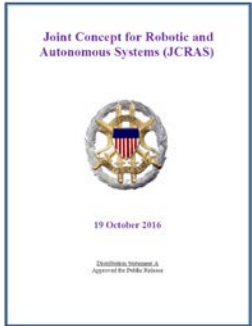


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Establishing Common Terms

Key Terms

- **Autonomy** is the level of independence that humans grant a system to execute a given task. It is the condition or quality of being self-governing to achieve an assigned task based on the system’s own situational awareness (integrated sensing, perceiving, analyzing), planning and decision-making. Autonomy refers to a spectrum of automation in which independent decision-making can be tailored for a specific mission, level of risk, and degree of human-machine teaming.
- A **Robot** is a powered machine capable of executing a set of actions by direct human control, computer control, or a combination of both. It is comprised minimally of a platform, software, and a power source.
- **Robotic and Autonomous Systems (RAS)** is an accepted term in academia and the science and technology (S&T) community; it highlights the physical (robotic) and cognitive (autonomous) aspects of these systems. For purposes of this concept, RAS is a framework to describe systems with a robotic element, an autonomous element, or more commonly, both. As technology advances, there will be more robotic systems with autonomous capabilities as well as non-robotic autonomous systems.



US Army

RAS
ICD

14 Dec 18

Pursuing Greater Autonomy, while maintaining Flexible Autonomy based on system capabilities and limitations, complexity of the mission, and characteristics of the environment

4/23/2019



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RAS Assured Control

Assured Control: The operator has reasonable confidence that the Robotic and Autonomous System (RAS) will perform as designed and directed. Loss of control may be caused by, but is not limited to: loss of link with operator's controller, cyber-attacks, or anomalies in the programming. RAS should render itself inert, automatically return to base, or conduct safe manual recovery.

- RAS Initial Capabilities Document
14 December 2018

Assured control is critical for the establishing the trust and confidence required for the integration of increasingly autonomous systems into the force, especially armed systems.



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Robotics Portfolio Overview

Family of SUAS

Small Unmanned Aircraft Systems



Long Range Recon (LRR)



Medium Range Recon (MRR)

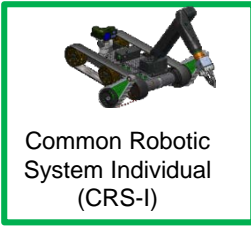


Short-Range Recon (SRR)

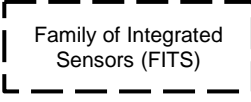


Soldier Borne Sensor (SBS)

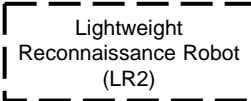
Individual Transportable



Common Robotic System Individual (CRS-I)



Family of Integrated Sensors (FITS)



Lightweight Reconnaissance Robot (LR2)

Vehicle Transportable



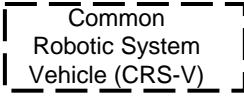
MTRS INC 2



M160 Light Flail



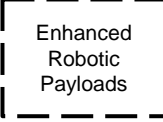
CRS-Heavy



Common Robotic System Vehicle (CRS-V)

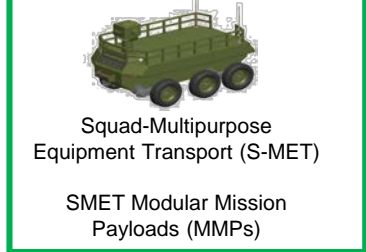


NSE-Robots
MTRS - I
MTRS-RC



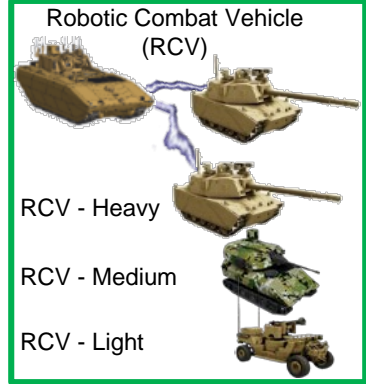
Enhanced Robotic Payloads

Self Transportable



Squad-Multipurpose Equipment Transport (S-MET)

SMET Modular Mission Payloads (MMPs)



Robotic Combat Vehicle (RCV)

RCV - Heavy

RCV - Medium

RCV - Light

Robotic Applique



Leader Follower

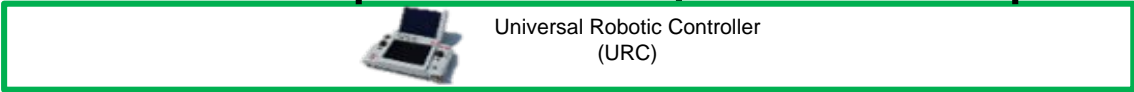


Exoskeleton



Warrior Exosuit

Photos are notional



Universal Robotic Controller (URC)

Other

- Robotics Development
- Robotics Architecture
- Robotics Enhancement Program (REP)

Robotics

- 6 Sub Portfolios
- 22 Programs
- 13 Roots

Emerging Programs	6
Actively Managed	15
Programs in Sustainment	1
Total Programs	22

Emerging Programs

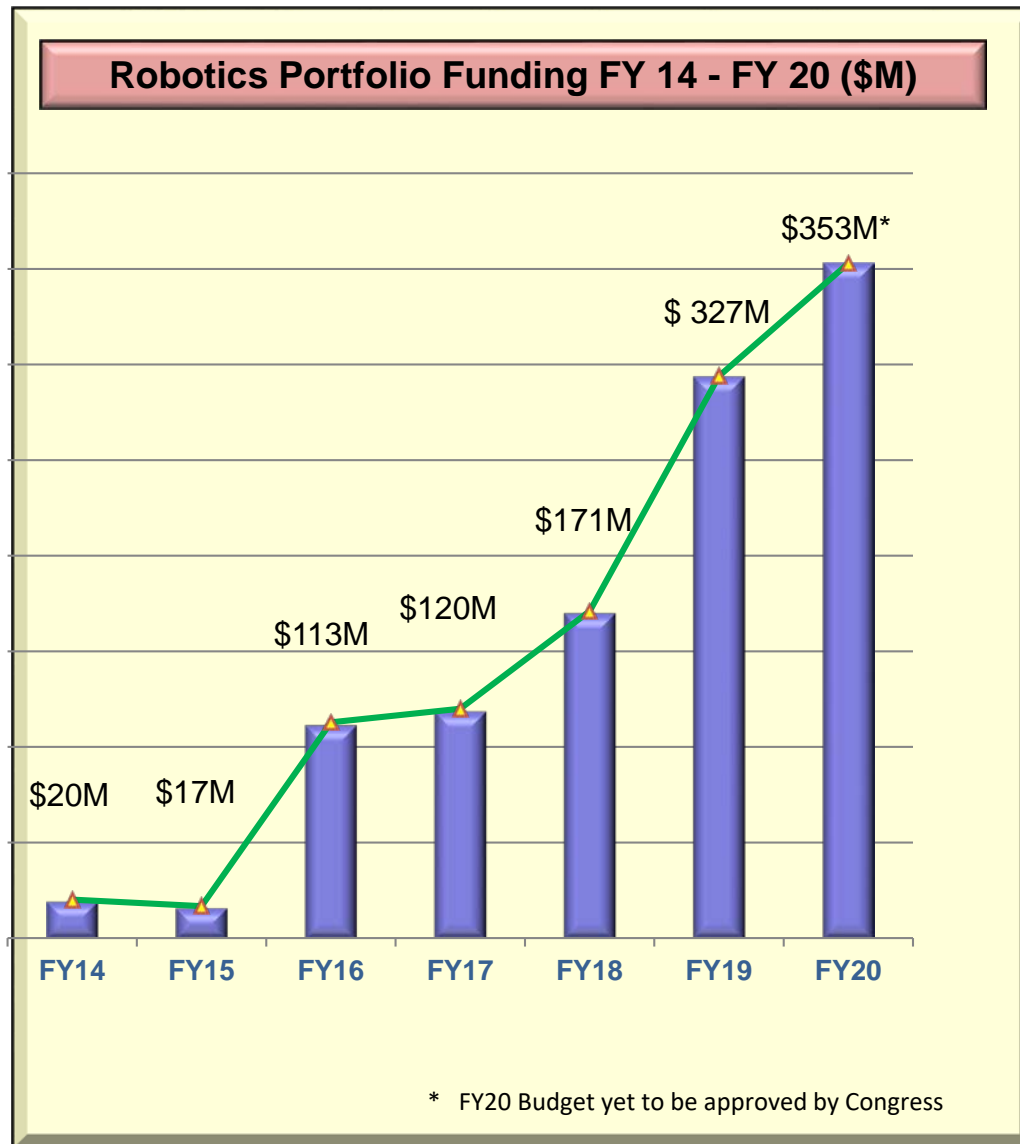
Actively Managed

Sustainment



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Robotics Portfolio Resources





Army RAS Operational Technology Demonstrations

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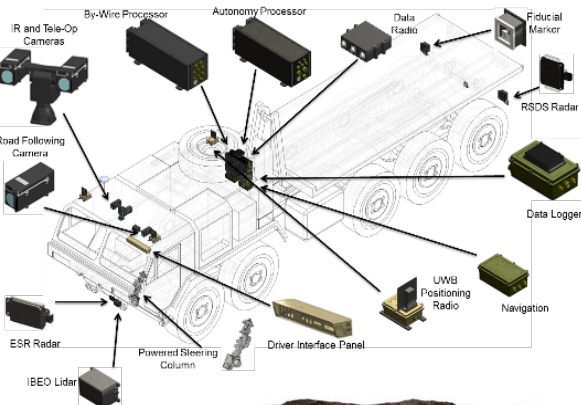


- **Squad Multipurpose Equipment Transport (SMET)**
 - Nov 2018 – Jun 2019
 - 80 systems to two IBCTs

- **Leader – Follower Technology for Tactical Wheeled Vehicles**
 - Sep 2019 – Nov 2020
 - 60 systems to two PLS Truck Companies

- **Next Generation Combat Vehicles (NGCV) Robotic Combat Vehicle (RCV)**
 - Four RCV-Heavy Surrogates in FY20
 - Platoon of each RCV-Light/Medium/Heavy in FY21
 - Two platoons of RCV-Heavy in FY23

Photos are notional



Innovation and Better Buying Power 3.0

Rapid prototyping, Operational Evaluation, and Transition to Procurement



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Soldier Borne Sensor (SBS)



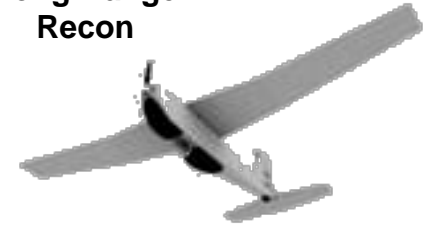
Short-Range Recon



Medium Range Recon



Long Range Recon



Tethered UAS



Photos are Notional

Universal Robotic Controller



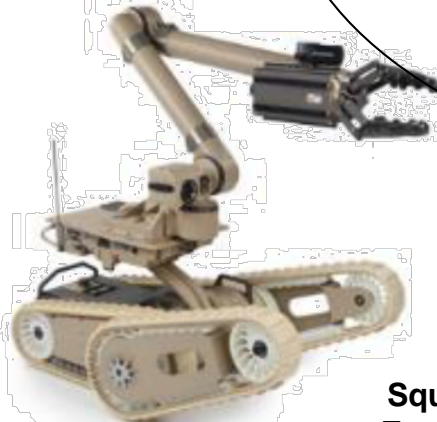
Common Robotic System-Individual (CRS-I)



MTRS INC 2



CRS-Heavy



Squad-Multipurpose Equipment Transport (S-MET)



~ 5 lbs

~50 lbs

**Payload:
~300 lbs**

~1000 lbs

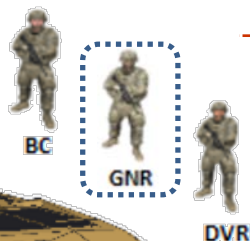
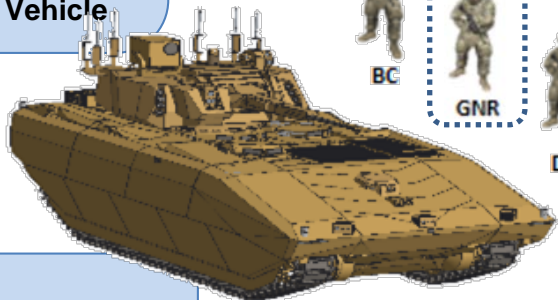


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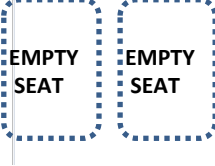
NGCV Optionally Manned Fighting Vehicle (MFV) and NGCV Robotic Combat Vehicle (RCV) Concept

**FOR DISCUSSION
DRAFT
PURPOSES ONLY**

**NGCV
Optionally Manned
Fighting Vehicle**



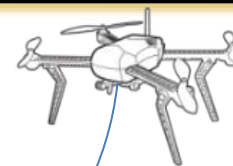
**Crew: 2-3
Payload: 5-7 Dismounts
Total: 7-10**



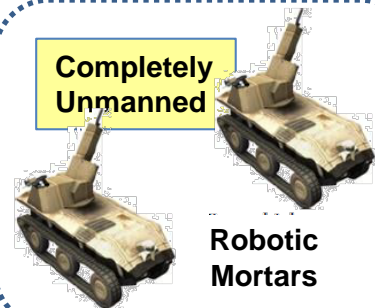
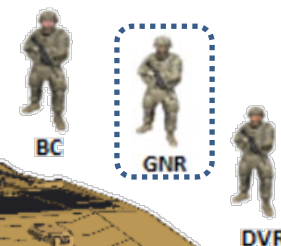
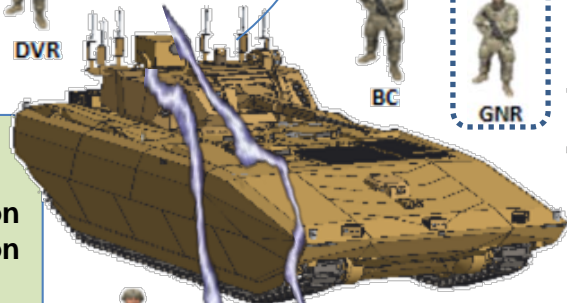
**NGCV Manned
C2 vehicle
for RCV**



**Crew: 2-3
Payload:
- RCV #1 C2 Station
- RCV #2 C2 Station
- Tethered UAS
Total: 7-8**



**Tethered
UAS**



**Completely
Unmanned**

**Robotic
Mortars**

**Completely
Unmanned**



**RCV-
Light
#2**

**Completely
Unmanned**



**RCV-
Light
#1**

**RCV-
Medium
#2**

**RCV-
Medium
#1**



**RCV-
Heavy
#2**

**RCV-
Heavy
#1**

**Completely
Unmanned**



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RCV FAMILY OF VEHICLES

- Limited on-board lethality (self defense, ATGM, recoilless weapons); Intelligent network cues appropriate MDO (off-board) strike to provide decisive lethality
- Robust Sensor package to establish enemy COP (UAV integration).
- Attritable system.

- Increased onboard lethality to defeat some Tier I threats (medium cannon / multiple ATGM / recoilless large cannon)
- Sensor package to establish enemy COP for MDO strike for remaining targets
- Durable system.

- On-board direct fire weapon systems defeat all Tier I threats
- Off-board sensor systems develop COP.
- Non-expendable system.

Intelligent Network leverages sensor-data to optimize multi-domain strikes

Increasing on Platform Lethality

Increasing Platform Survivability and Cost

Notional RCV Vehicle max size/weight constraints (Based on limits for different air transportability envelopes)

RCV Light (L)

< 7 Ton GVW
 224 x 88 x 94 in*
 Transport one RCV(L) by
 Rotary Wing

*L x W x H



RCV Medium (M)

~10 Ton GVW
 230 x 107 x 94 in*
 Transport one RCV (M) by
 C-130

*L x W x H



RCV Heavy (H)

~20 Ton GVW
 350 x 144 x 142 in*
 Transport two RCV (H) by C-17

*L x W x H



Notional pictures for representative vehicle characteristics only, not to be considered an endorsement or preference to any specific system or subsystem

Robotic Combat Vehicle enables a continuum of Decisive Lethality options



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Emerging Science & Technology Development



Don't be this guy

Send in the Robot



- **Interoperability Profiles (IOP) and Common Standards**
- **Modular Mission Payload** integration to expand common chassis functions
- **Robotic Operating System – Military (ROS-M)**
- **Next Generation Combat Vehicle (NGCV) Robotic Combat Vehicles (RCV)**
- **Manned – Unmanned Teaming (MUM-T)**
- **Autonomous Subterranean Mapping and Exploitation**
- **Autonomous Ground and Aerial Resupply**



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Questions?