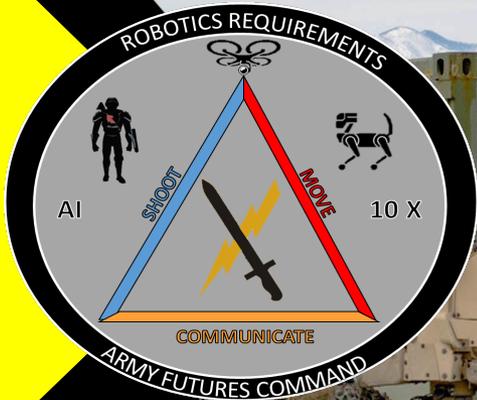




Army Robotics at the Tactical Edge



↑ ROBOTS
DONT
BLEED



Robotics Requirements Division
 Maneuver Capability Development Integration Directorate
 US Army Futures Command
 POC: RRD-MCDID-ASO@army.mil



AGENDA



- RRD Mission
- HMI-IBCT OV-1
- FY 23 Rollup
- Air Branch
- Ground Branch/ Software
- C-sUAS Branch
- AI/10X Branch
- FY24 Challenges

XVIII Airborne Corps @18airbornecorps

We're about to go live.
Quadcopters drop bombs.
The future is now.

@82ndABNDiv @usarmy_devcom @101stAASLTDIV

#modernization

11:38 AM · Feb 23, 2023 · 9,500 Views



RRD Mission and Purpose

Enabling Lethality and Improving Survivability Through Disciplined Innovation & Focused Integration

MISSION

RRD, in coordination with key stakeholders, will enable the Army to deliver robotics that enables our Army to Fight and Win and Dominate in a Multi-Domain environment by 2030.

VISION

We will **drive requirements** and **drive transitions** in order to deliver AI enabled robotics that is expeditionary, integrated, hardened, and intuitive that enables the lethality of our Warfighters to dominate in any environment, anytime and anywhere.



PRIORITIES

Meeting Army Senior Leader Priorities & Combatant Commander Requirements

- **People- Talent Management**
- **Process- Learning Organization; Improve Everyday**
- **Products- Professional, Timely, and accurate**
- **PPBE- Align Resources to Deliver Capability**

Drive Requirements

Continuous Evolution & Refinement of Operational Requirements

Threat Informed

Market Research

Science & Technology

Experimentation & Demonstration

Test & Evaluation

Drive Transitions

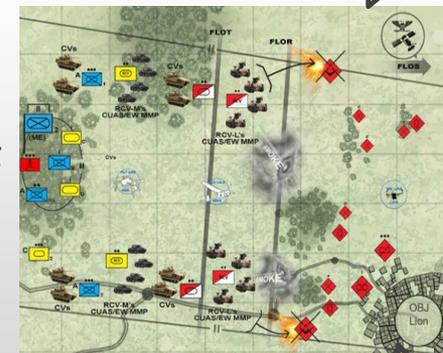
“As we move into the Future...a Soldier should never be the first to make contact with the Enemy...” – GEN Kurilla

RRD narrows assigned Army Capability gaps using DOTMLPF-P enhancements to enable overmatch, while continually informing Stakeholder enterprise across the Army, Joint services, Coalition Partners, Defense Laboratories, Industry, and Academia

RRD informs technology transitions, research and development, and user assessments, and then rapidly transitions operational requirements for procurement in support of our Nations Warfighters

RRD integrates and synchronizes robotic activities across the Army, tied to joint requirements, bolstered by Stakeholder enterprise information, with focused effort to improve speed, capability, cost effective, and state-of-the-art material solutions

RRD will engage in expert analysis, focused experiments, technology demonstrations and gather meaningful Soldier feedback to inform and drive innovation and transition well developed and refined capability documentation



“New equipment without integration is just fielding kit and not capability ...” – GEN James E. Rainey, AFC Commanding General

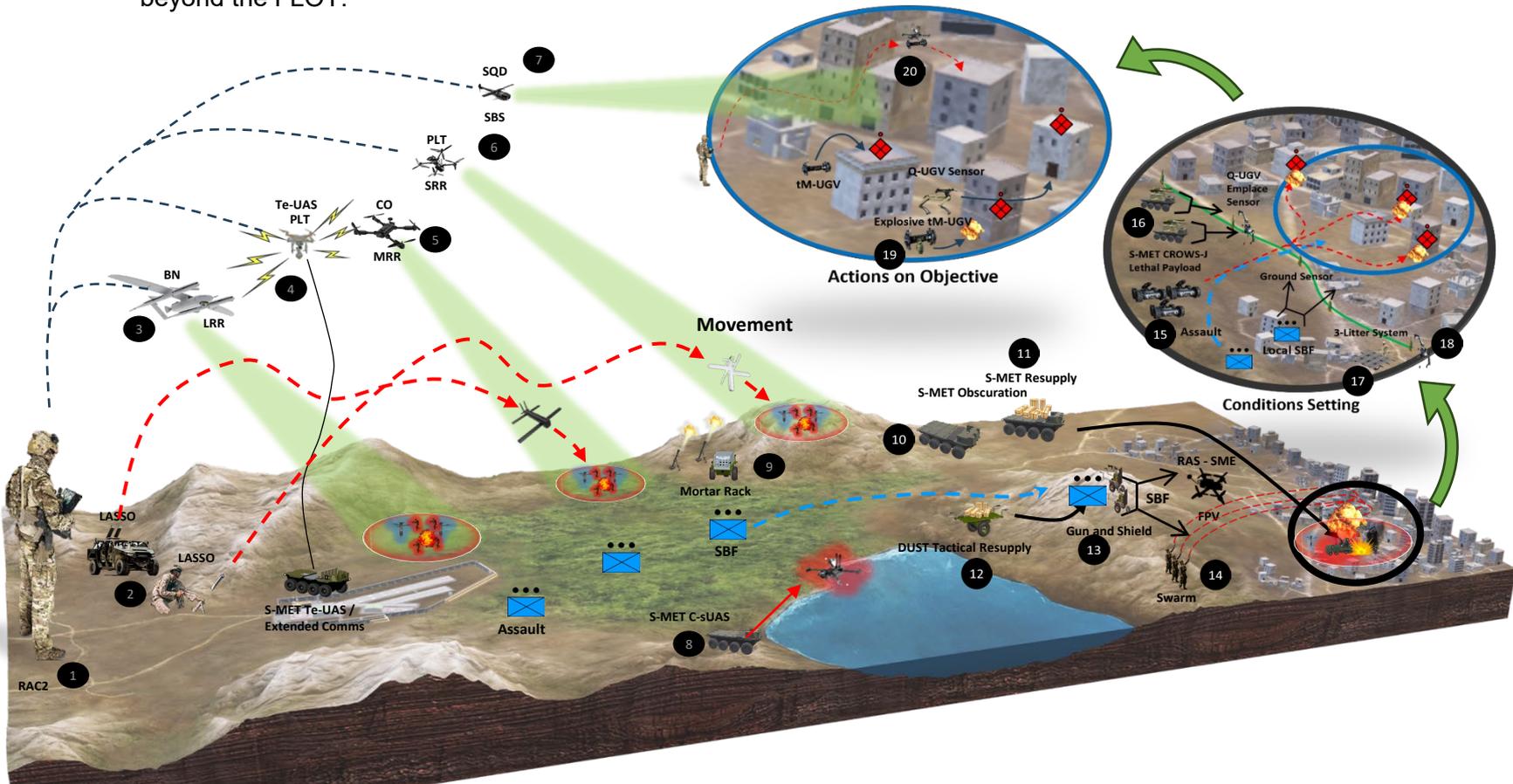
Unclassified



HMI-IBCT OV-1

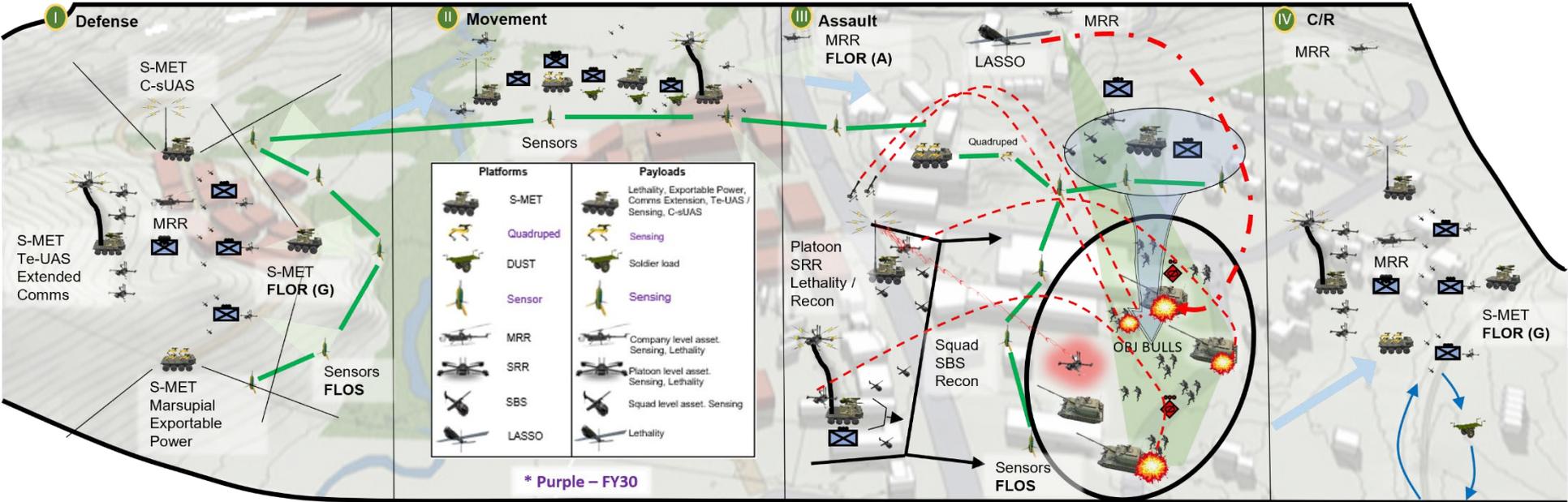


Robotic Enabled Maneuver at the Tactical Edge: Equipped with ground Robotic Autonomous Systems (RAS), which are integrated as part of a layered network of sensors and shooters, the Infantry Soldier provides leaders a sense, detect, and identification capability at extended range. This will enhance situational awareness and increase decision space to employ organic or higher headquarters effects (lethal and non-lethal) with precision to shape the battlefield. "Close with and Destroy" remains fundamental to the Light Infantry Formation. Robotic Enabled Maneuver provides the ability to gain and maintain contact beyond the FLOT.





“A Way” for HMI Light Employment





Key Tasks FY23 Rollup



Air Key tasks:

- Nano SBS: Expected staffing in 1QFY25
- SRR: Projected down select late FY24
- Swarm: FY23 Market research led to AEWE 2024 submission
- Te-UAS: Staffing projected NLT 3QFY24
- MRR: Supported through approved Co-Lv UAS Directed Requirement for Tranche 1
- LRR: Currently in Army Staffing

Ground Key Tasks:

- SMET INC 2/MMP Development: Approved Requirement in August 2023; RFP released to Industry
- Electric Lightweight Transport, AKA Dismounted Unit Soldier Transport (DUST) in development process
- RAC2: Merged technical approach with SCI for Uncrewed Vehicle Control (UVC) efforts; SRR Tranche 2 Will be the first platform with RAC2 software

AI Key Tasks:

- 10X 23/24 Trust: Campaign of Experiments to integrate AI and Robotic capabilities into a maneuver force and to inform Robotic Enabled Maneuver ICD
- Launched Effects: Family of systems under MTA Rapid Prototyping Effort, Medium Range A-CDD approved May 2020, Short-Range Moving to AROC with A-CDD next month.

C-sUAS Key Tasks:

- Dismounted capability: in development with partnership with AMD-CFT
- Mounted Capability : in development with partnership with AMD-CFT
- Munitions Ballistic PROX/DE, EW: Working with joint community on existing technologies for kinetic capability
- UAV vs. UAV: Working with industry partners on several variations of this capability (EW, kinetic and pneumatic)
- Passive vs. Active Detect: System limitations and lessons learned are being analyzed for consideration for future
- C2 data Transport: Supporting PM efforts to move to an application-based capability



J-sUAS Modular Mission Payloads: Future



Old Req. Documents:

1. 2013 Rucksack Portable CPD. Covers RQ-11B/C Raven (Current Co level Medium-Range Reconnaissance capability) & RQ-28A Short-Range Reconnaissance Tranche 1 – 2 (Platoon).
2. 2017 Soldier Borne Sensor (SBS) CPD (Squad).

New Req. Documents:

1. 2023 Joint-small UAS CDD (Officially Signed 13 June 2023). RRD Air Branch writing annexes for: SRR / SBS / MRR / LRR / Te-UAS / Swarm / and FPV.
2. 2023 Company-Level sUAS Army Futures Command Commanding General Directed Requirement (MRR) – Will provide initial capability / inform MRR J-sUAS Annex development.
3. 2022 Robotic Autonomous Command & Control (RAC2) Capability Needs Statement. (Software Acquisition Pathway for Common Robotic Control [Air & Ground Robotics]).
4. 2023 Operational Needs Statement for 6-8 CAV Enhanced Ground Reconnaissance Initiative (Te-UAS).
5. 2022 Lethal Unmanned Systems (LUS) AFC CG Directed Requirement (J-sUAS = Hunter / LUS = Killer) *Note: Lethal Modular Mission Payloads enable Family of J-sUAS to carry organic "precision strike / attack" capabilities.

J-sUAS CDD Annex LOEs:

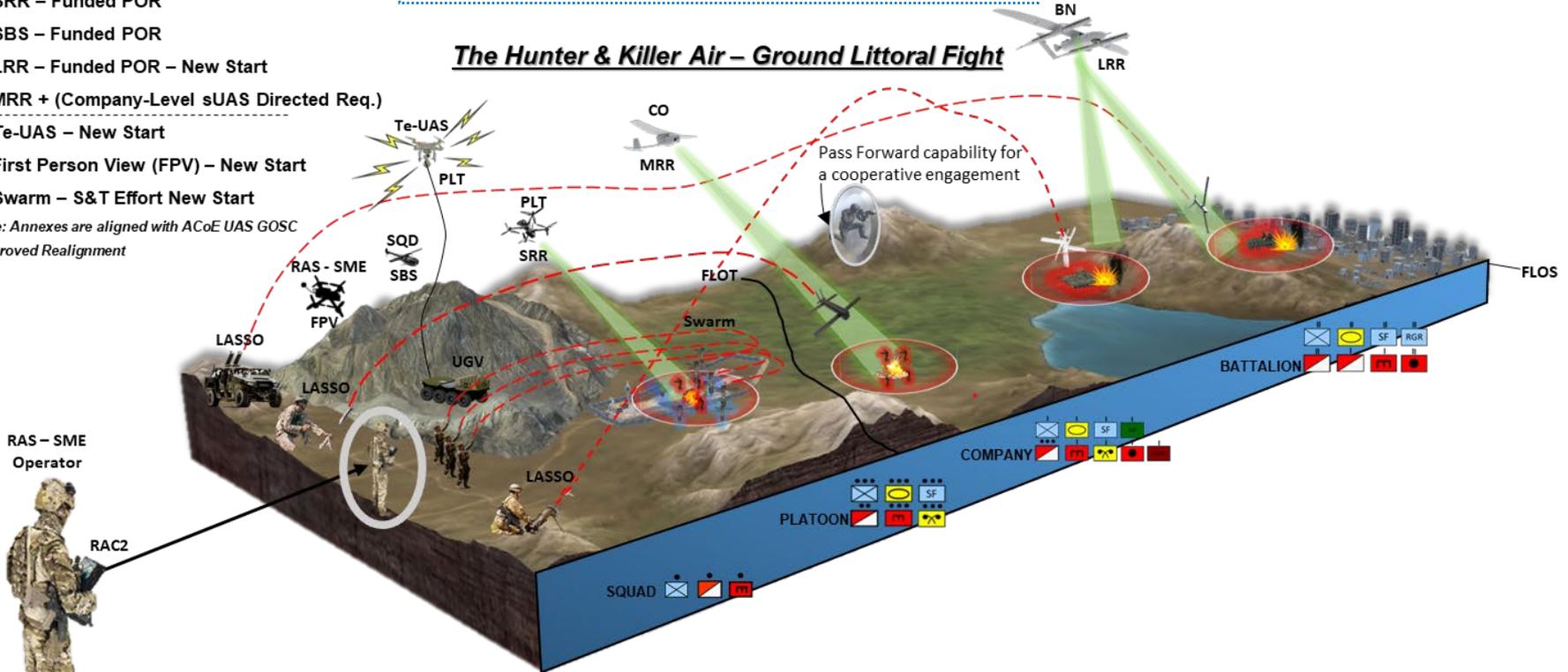
1. SRR – Funded POR
2. SBS – Funded POR
3. LRR – Funded POR – New Start
4. MRR + (Company-Level sUAS Directed Req.)
5. Te-UAS – New Start
6. First Person View (FPV) – New Start
7. Swarm – S&T Effort New Start

Note: Annexes are aligned with ACoE UAS GOSC Approved Realignment

Expanded LOE:

- Modular Mission Payloads (EO/IR, Comms Relay & Network Extension, EW – Sensing (+), Lethality):

The Hunter & Killer Air – Ground Littoral Fight



The Soldier is the "Center of Gravity" on the battlefield for Robotic Enabled Maneuver



Echeloning of sUAS / U.S. Army Strategy / UAS Realignment 2030+



Current Programs of Record 2013 RPUAS CPD / SBS CPD

Brigade: RQ-7 Shadow
 Range: 60 km / 4 hours
 Payloads: EO/IR
 System Cost: \$23m
 System Configuration: 4 x Aircraft, 2 x Controller, Ancillary Equipment.



Battalion: None / Capability Gaps

Company: RQ-11 Raven (RPCPD)
 Range: 10 km / 1.5 hours
 Payloads: EO/IR
 System Cost: \$200k
 System Configuration: 2 x Aircraft, 1 x Controller, Ancillary Equipment.



Platoon: RQ-28A SRR (RPCPD)
 Range: 3 km / 30 min
 Payloads: EO/IR
 System Cost: \$45k
 System Configuration: 2 x Aircraft, 1 x Controller, Ancillary Equipment.



Squad: Black Hornet 3 (SBSCPD)
 Range: 1 km / 30 min
 Payloads: EO/IR
 System Cost: \$15k
 System Configuration: 2 x Aircraft, 1 x Controller, Ancillary Equipment.



Future PORs & J-sUAS CDD Lines of Effort 2023 J-sUAS CDD Approval and UAS Realignment with AVCoE

Brigade: Future Tactical UAS (FTUAS)

Range: 125 km / 8 hours
 Payloads: EO/IR, Communications Ext.
 System Cost: \$10m
 System Configuration: 6 x Aircraft, 2 x Controller, Ancillary Equipment.



BN: Long Range Reconnaissance (LRR)

Range: 40 km / 5 hours
 Payloads: EO/IR, Comms Ext, EW-S, Lethality
 System Cost: \$1.1m
 Sys. Configuration: 2 x Aircraft, 2 x Controller, Ancillary Equipment.



CO: Medium-Range(MRR)

Range: 10 km / 8 hours per 24-hour period
 Payloads: EO/IR, Comms Ext, EW-S, Lethality
 System Cost: \$350k
 Sys. Configuration: 2 x Aircraft, 2 x Controller, Ancillary Equipment.



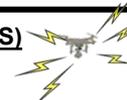
PLT: Short Range (SRR)

Range: 3-5km / 30+ min
 Payloads: EO/IR, Comms Ext, Lethality
 System Cost: \$40k
 Sys. Configuration: 2 x Aircraft, 1 x Controller, Ancillary Equipment.



PLT: Tethered UAS (Te-UAS)

New Start
 Range: NA / Persistent Stare
 Payloads: EO/IR, Comms Ext, EW-Sensing
 System Cost: \$200k
 Sys. Configuration: 1 x Aircraft, 1 x Controller, Ancillary Equipment.



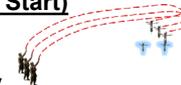
SQD - PLT: First Person View (FPV)

New Start
 Range: 2km / 30 min
 Payloads: EO/IR,
 System Cost: \$3k
 Sys. Configuration: 3 x Aircraft, 1 x Controller, Ancillary Equipment.



Co: Swarm (S&T New Start)

New Start
 Range: 5km+ / 30 min
 Payloads: EO/IR, Lethality
 System Cost: Unknown
 Sys. Configuration: Undetermined



SQD: BH4 Soldier Borne Sensor (SBS)

Range: 2km / 30+ min
 Payloads: EO/IR, Comms Ext
 System Cost: \$16k
 Sys. Configuration: 1 x Aircraft, 1 x Controller, Ancillary Equipment.



Influencing LOEs to J-sUAS 2024 - 2025

Company-Level sUAS DR

Informs J-sUAS CDD MRR Annex
 Range: 10 km / 8 hours per 24-hour period
 Payloads: EO/IR, Comms Ext, EW-S, Lethality
 System Cost: \$350k
 Sys. Configuration: 2 x Aircraft, 2 x Controller, Ancillary Equipment.



CSA COTS Initiative

Non-Deployable Trainer
 Range: 3 km / 30 min
 Payloads: EO/IR
 System Cost: \$25 m
 Sys. Configuration: 1 x Aircraft, 1 x Controller, Ancillary Equipment.



Endstate

JROC
Acceptance
Memo



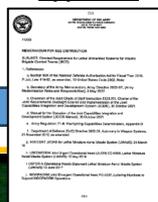
J-sUAS
CDD
Approved



Co-Level
sUAS DR
Approved



LASSO DR
Approved



LRR ANNEX
100%



MRR ANNEX
0%



Te-UAS ANNEX
100%



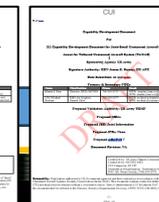
Next Gen
SRR ANNEX
85%



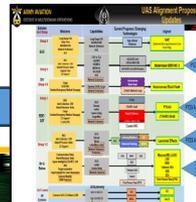
Next Gen
SBS ANNEX
90%



Swarm ANNEX
0%



UAS
Realignment 2030+





Ground Robotics Branch Path Forward



Robotic and Autonomous Command and Control (RAC2)

RAC2 Software unified Tactical C2 & extends Operational C2 for the RAS portfolio

Air Branch

A/I Branch

AISUM

Current

Common Robotic System - Individual (CRS-I)



- 25lbs man-packable
- 4 DoF Arm/6.5lbs of lift
- Color/Thermal Camera – 600m Recognition
- Modular Mesh radios – 2000m + Range
- Sub-T Operations

Small Multipurpose Equipment Transport (S-MET)



- 2500lb Payload capacity
- 3kW Off loadable Power
 - 5 x Universal Battery Chargers
- Available payloads include:
 - An/PRC-162 (2)
 - AN/PRC-160 (1)
- Various CoTS C-sUAS systems

Payload Development

The RAS portfolio is a family of systems with mutually supporting characteristics across echelons to ensure resilience of the maneuver force



Ground Robotics Branch Path Forward – 2030-2040



Robotic and Autonomous Command and Control (RAC2)

RAC2 Software unified Tactical C2 & extends Operational C2 for the RAS portfolio

Air Branch

A/I Branch

AISUM

2030

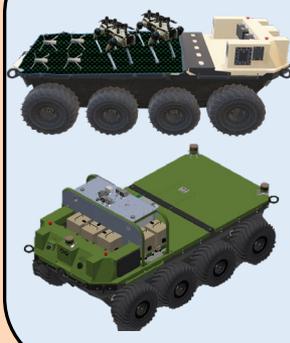
2040

Dismounted Unit Soldier Transport (DUST)



- Reduced Soldier Load
- Increased task performance
- Reduce musculoskeletal injuries
- Powered / Passive

Small Multipurpose Transport Inc. II (S-MET Inc. II)



- CDD Approved - 4QFY23
- Will be re-competed
- Modular autonomy kit
- Includes MMP Annexes
 - Autonomy
 - C-sUAS
 - Distributed Comms
 - Lethality
 - CASEVACG

Consumable Combat Robots (CCR)



**Notional*

- 120Km battery range
- 60Km/h – Top Speed
- Up to 50Kg explosives in body
- 10Km NLOS control range
- >750m enemy tank visual ID

Legged Robots (Q-UGV)



**Notional*

- Active Sensors
- Lethality Packages
- Recon/Surveillance
- Sub-T Operations

Payload Development



Platform Autonomy for Complex Environments (PACE)



Purpose: PACE adds autonomous behaviors to the Small Multipurpose Equipment Transport (S-MET) robotic platform to augment dispersed dismounted operations.

Approach: PACE Annex to the approved S-MET CDD for hardware development and experimentation under the MTA pathway and CNS Appendix for embedded software.

Development: PACE establishes detailed user operational requirements to guide S&T development and transition technologies into operationally relevant solutions.

Implementation: Modular Open System Approach (MOSA) strategy includes Army standards (RAS-G IOP v6+) for implementation on other ground robotic platforms.

BLUF – S-MET is the pathfinder that leads to follow-on Autonomous Capability across the ground robotic portfolio

Guide S&T and IRAD investment • Field capability • Transition to other programs



Dispersed Sensors and Low Flying Threats



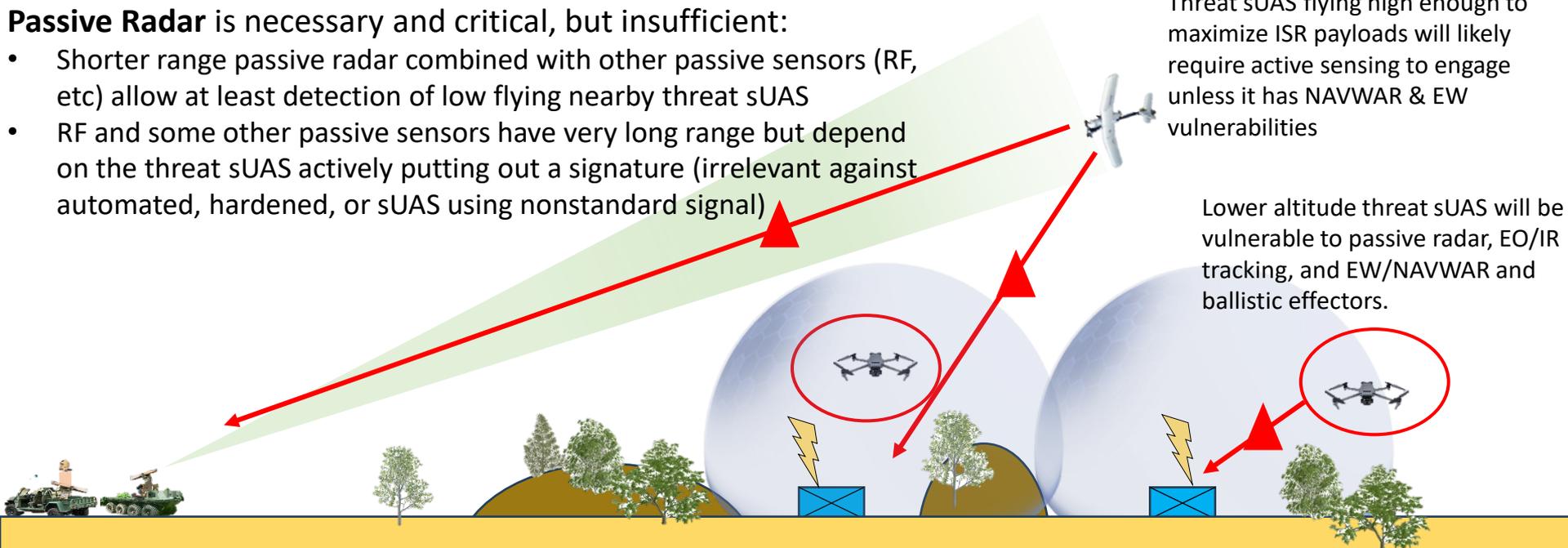
Detecting, tracking, and identifying threat sUAS requires dispersed capability combined with the range of active sensing.

Passive Radar is necessary and critical, but insufficient:

- Shorter range passive radar combined with other passive sensors (RF, etc) allow at least detection of low flying nearby threat sUAS
- RF and some other passive sensors have very long range but depend on the threat sUAS actively putting out a signature (irrelevant against automated, hardened, or sUAS using nonstandard signal)

Threat sUAS flying high enough to maximize ISR payloads will likely require active sensing to engage unless it has NAVWAR & EW vulnerabilities

Lower altitude threat sUAS will be vulnerable to passive radar, EO/IR tracking, and EW/NAVWAR and ballistic effectors.



Dispersed Sensing Capability:

- Contest airspace below long-range detection horizon
- Dispersed sensors and effectors throughout formations and echelons allow both self-defense and contribution to larger airspace defense plans
- Can be used in tandem to compliment active sensing



C-sUAS – 2030-2040



2030

Integrated Sensors



- Radar (active vs passive)
- RF detection
- EO/IR (SWIR/LWIR)
- Acoustic
- Laser designation
- Hyper spectral
- C2 for sensors/ effectors and sharing to force



***No one sensor addresses the problem**

Platform Agnostic



- ISV/S-MET (IBCT)
- Stryker (SBCT)
- AMPV (ABCT)
- On-the-Move vs static

***DOTmLPF-P implications**

The BCT C-sUAS must combine security, protection and counter reconnaissance principles.

Effectors



- Ballistics
- Interceptors (kinetic/non-kinetic)
- Rockets/Missiles
- Directed Energy
 - EW capabilities (Jam/ NAVWAR)
 - Microwave

***Space Claim and Integration**

System and Unit C2

Integrated Platforms Leading the Development



- FoCUS (DR signed 21 Jul 23); OA Inc 2 completed 28-30 Aug 23

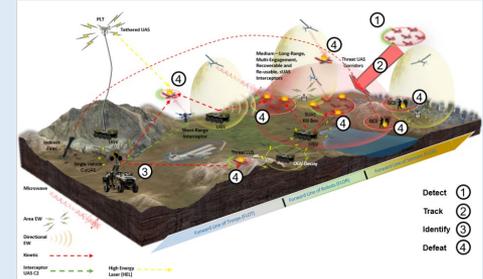
*** Multiple vendors with integration vs stand-alone**



2040

C-sUAS Future

- RAS Enabled Initiative to Contest and Overmatch maneuver BCT sUAS airspace to enable freedom of maneuver



- Echeloned and integrated capability that dis-integrates the adversary in depth

- MOS agnostic ASI trained leaders and operators
- Network enabled not network dependent
- Stand off ranges
- Homestation training enabled
- Fiscally affordable to required numbers
- JCIDS backed requirements derived from MTA experimentation
- LRU modeled modernization

***Adaptive to an ever changing threat**

Maneuver C-sUAS Capability Development



Launched Effects



Now

Current Programs

- Air Launched Effects (Aviation)
- Other Joint Programs

Characteristics

- **Single payload engagement**
- **Generally Known Enemy Disposition**
- Requires Communications
- Vendor Specific Control
- Launching Mechanisms Vendor Specific

Payloads

- EO/IR
- Lethal

Focus Area

2030

Launched Effects

2040

Launched Effects A-CDD

- Launched Effects (AVN + Maneuver Divisions)
- Other Joint Programs

Characteristics

- **Team Payload Engagements**
- Target Various Enemy Types
- Limited Autonomous Missions
- Common Army Software
- Mesh Network
- Modular Effects Launcher

Payloads

- Detect, Identify, locate, report
- Extend Communications
- BDA Assessment
- Lethal
- EW

Launched Effects CDD

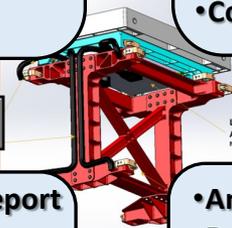
- Launched Effects (Joint)
- Across all Maneuver Formations and Echelons

Characteristics

- **Heterogenous Platforms with Teamed Payloads**
- Target Various Enemy Types
- Enhanced Autonomous Missions
- Common Joint Software
- Low-Cost Air Vehicles
- Common Joint Launcher S&H

Payloads

- Anything Interface Control Document Compliant





10x Overview



AIR



UAS Small



UAS Medium

Ground



Non- Lethal
Quadruped



Lethal
Quadruped



S-MET

CO Level
Assets



Tactical Resupply Vehicle (TRV-150)



UGV with Tethered UAS

Lethality



UAS Lethality



UGV
Lethality



QUGV
Lethality

* Lethality

10X TTX 10 Lines of Effort

Command
&
Control



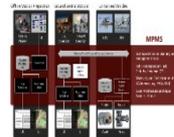
RAC2/WMI



ATR-MCAS



MPUS



MPMS



REAL-SA



Cloud
Relay
Network



Imaging

* Platforms

10X TTX 10 Lines of Effort



Data



Sensing



Automate



Human

Act

Observe

Robotic Enabled
Maneuver for
Infantry Platoon

Decide

Objective F(n)



Orient

Classify

Predict

* Power

10X TTX 10 Lines of Effort

Modular
Mission
Payloads



Q-UGV
Autonomy



C-UAS



Smoke
Obscuration



ATR



hydrogen fuel
cell power
system

* User Interface

AISUM

* Control

* Multi-Sensor Fusion

* Network

* Mission Planning

* Cloud (Nodes)

* Battlefield Visualization



FY 24 Challenges



Air Branch

- Swarm Capabilities and Technologies

Ground Branch

- Ground Autonomy
- Payload development

C-sUAS Branch

- Need integrated solutions of sensors and effectors on singular platforms to detect, track, ID, and defeat
- Must be fiscally affordable as proliferation of capability is more important than exquisite
- Operation is MOS agnostic
- Capability hosted on formation appropriate platforms, while core capabilities match across formations
- Capable of integrating with current and future Army C2
- Need for dispersed sensing

AI / 10 X Branch

- Network architecture to support fusion of data centric robotic systems at echelon
- Edge computing
- Affordable approach to maintain AI models and update algorithms with meaningful data to ensure AI enabled systems stay relevant on an evolving battlefield.

HMI

- Software and Common Control



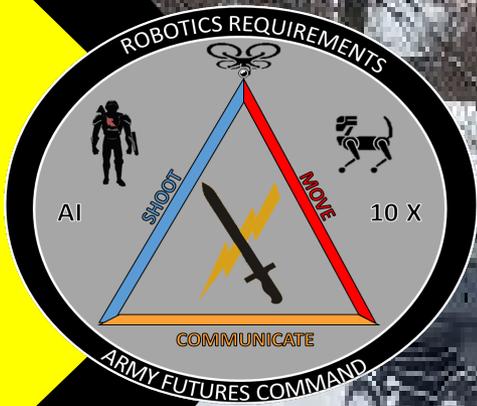
Meeting with RRD



If you were unable to signup for a one-on-one meeting with RRD for 29 FEB 24, RRD has from 1500-1600 (split into 30 min sessions) every Thursday blocked off to meet with Industry Partners. These can occur in person, on MS Teams, over the phone, or SVTC. If you wish to schedule a meeting, email RRD-MCDID-ASO@army.mil and we will place it on the calendar and confirm the meeting details with you.



Questions?



Robotics Requirements Division
Maneuver Capability Development Integration Directorate
US Army Futures Command
POC: RRD-MCDID-ASO@army.mil