Army Robotics at the Tactical Edge

TM RRD
Robotics Requirements
Maneuver Capability Development Integration
Directorate US Army Futures Command

AGENDA

- Introduction Who are we – Engagement Space
- Operational Level Ecosystem
- Robotic & Autonomous Command and Control OV-1 (RAC²)
- Tactical Level Ecosystem: Hunter – Killer Pairing Robotics Autonomous Systems
- The Light Infantry Fight – System Approach

RRD Mission and Purpose

Enabling Lethality and Improving Survivability Through Disciplined Innovation & Focused

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

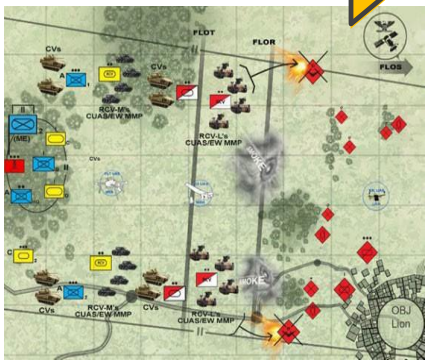
"As we move into the Future…a Soldier should never be the first to make contact with the Enemy…" – GEN Kurilla

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



"This is an iterative build to the end state. We never truly reach the end state; the end state is constant innovation…" – GEN Murray

RRD Team of Teams Approach

Coalition/Joint Partners

AUS	Joint Staff	SOCOM
UK	USMC	COCOMs
NL	USAF	DARPA
	USN	DIU
	USSF	

Force
G-8
G-3/5/7
G2
CIO/ G-6
HQDA
ASA FM&C /ABO
OSD/ CAPE
ERDC
ACC
CECOM
USACE
AMC
DARPA
PEO GCS
PEO Soldier
DASA RT
PEO AVN
ASA(ALT)
ARNG
OCLL/ SAFM-BUL
Policy & Resources
75th Innovation
DOT&E
Consortiums
OTAs
PEO IEW&S
PEO C3T
PEO EIS
RCO
Acquisition
Sustainment / Contracting
Legal
CCDC ARL
CCDC
CCDC C5ISR
CCDC SC
AI Task Force
DSI
Warrior Suit
Weponization
EXO
40mm Drop
ATEC
Test & Evaluation
AFC
FCC
Ground
Additive Manufact
Innovation & Market Research
Battle Labs
JMC
CDIDs
TCMs
Key Industry
AIR
AI
ROBOTICS REQUIREMENTS
AI
SHOOT
MOVE
10 X
COMMUNICATE
ARMY FUTURES COMMAND
C2 / S&T / Architecture
Requirements
JROC
JAIC
ICDT
JOINT PARTNERS
JRASE
Maneuver CCoE
TCMs
INSCOM
MEDCOM
USAEUR
USARPAC
SMDC/ ARSTRAT
Experiment, Demo, & Prototype
USASOC
TRADOC
Avn CoE
TCMs
DIU
JSOC
75th RR
5th SFG
1st SFG
MCCoE
CCoE
ICoE
REF
FVL
NETWORK
Key Programs (Integration)
NGCV
AMD
APNT
SFACs
FORSCOM
I Corps
NAMC Consortium
GVSC
AI2C
LRPF
Soldier Lethality
82ND ABN
XVIII Corps
III Corps
IV CORPS
NTC JRTC
C-UAS
50TH ESB-E
101ST ABN

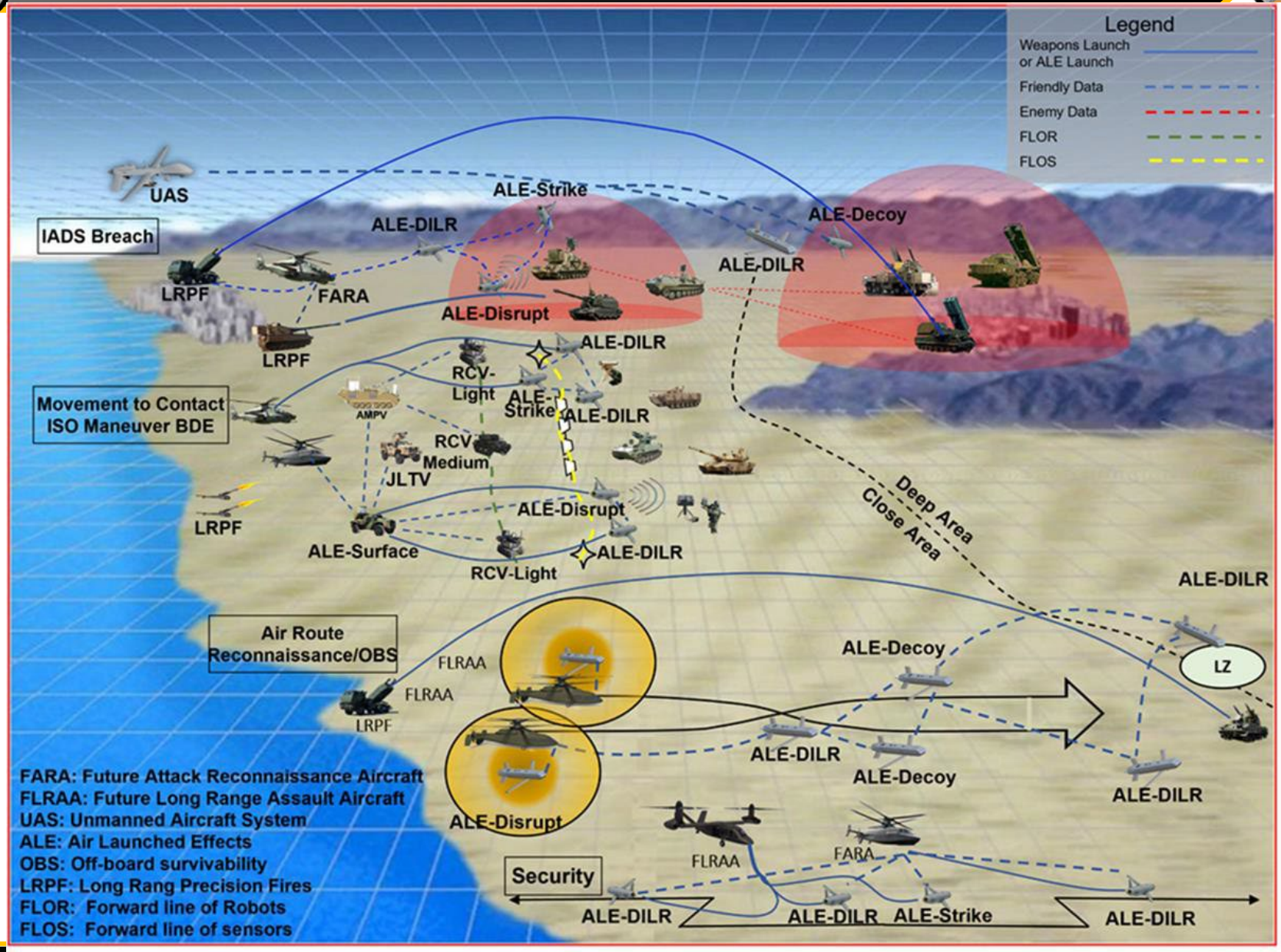
Academia
Auburn
Lincoln Labs/MIT
Tuskegee
Columbia
GTRI

FFRDCs
IDA
MITRE
Lincoln Labs/MIT
Johns Hopkins/APL
Carnegie Mellon
Batel Labs

Legend
- AFC Headquarters
- Supporting Members
- Enabling Members
- CFTs
- Army Stakeholders
- Joint/Coalition Stakeholders
- FFRDCs
- Initiatives

Data Points
Soldier Touch Points
Industry/DEVCOMs
SOF Demonstrations/X-Talk
Army Warfighter Experiment
Project Convergence

Operational Level Ecosystem



sUAS at Echelon - Near Term Efforts

Battalion/Cavalry Squadron/Troop

Organic airborne reconnaissance and surveillance system providing day/night situational awareness to maneuver commanders

- Recon and security
- Counter rocket and mortar
- Long endurance surveillance
- Lethal & Modular Mission Payloads (MMPs)

Company/Scout Platoon

Organic airborne reconnaissance and surveillance system providing day/night situational awareness to maneuver elements.

- Recon and security
- Counter rocket and mortar
- Lethal & MMPs

Platoon/Scout Section

Organic small form factor senor providing real time surveillance and situational awareness support to maneuver squads.

- Recon and security
- Persistent surveillance (Hover/Perch and Stare)
- IED interrogation
- Bridge/culvert inspection
- Lethal & MMPs

Squad

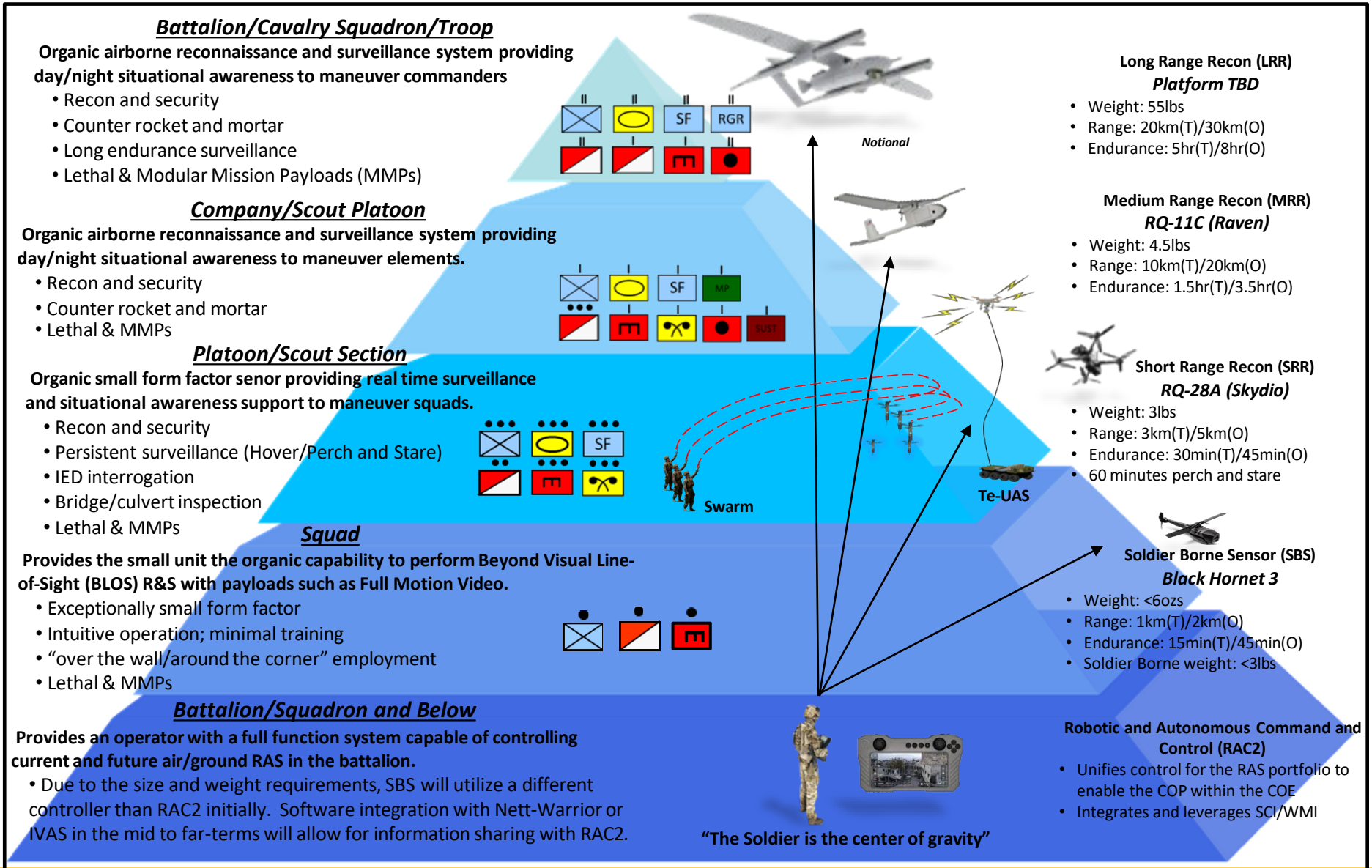
Provides the small unit the organic capability to perform Beyond Visual Line-of-Sight (BLOS) R&S with payloads such as Full Motion Video.

- Exceptionally small form factor
- Intuitive operation; minimal training
- "over the wall/around the corner" employment
- Lethal & MMPs

Battalion/Squadron and Below

Provides an operator with a full function system capable of controlling current and future air/ground RAS in the battalion.

- Due to the size and weight requirements, SBS will utilize a different controller than RAC2 initially. Software integration with Nett-Warrior or IVAS in the mid to far-terms will allow for information sharing with RAC2.



Long Range Recon (LRR)
Platform TBD

- Weight: 55lbs
- Range: 20km(T)/30km(O)
- Endurance: 5hr(T)/8hr(O)

Medium Range Recon (MRR)
RQ-11C (Raven)

- Weight: 4.5lbs
- Range: 10km(T)/20km(O)
- Endurance: 1.5hr(T)/3.5hr(O)

Short Range Recon (SRR)
RQ-28A (Skydio)

- Weight: 3lbs
- Range: 3km(T)/5km(O)
- Endurance: 30min(T)/45min(O)
- 60 minutes perch and stare

Soldier Borne Sensor (SBS)
Black Hornet 3

- Weight: <6ozs
- Range: 1km(T)/2km(O)
- Endurance: 15min(T)/45min(O)
- Soldier Borne weight: <3lbs

Robotic and Autonomous Command and Control (RAC2)

- Unifies control for the RAS portfolio to enable the COP within the COE
- Integrates and leverages SCI/WMI

Ground Robotics Branch

Current	Emerging	Army 2030 - 2040

Universal Robot Control

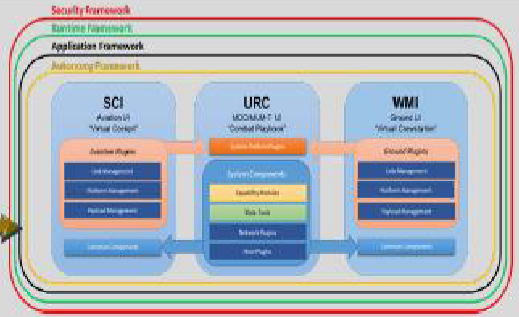
Common Robotic System – Individual (CRS-I)	Small Multipurpose Equipment Transport (S-MET)	Small Multipurpose Equipment Transport Inc. I (S-MET Inc. I)	Modular Mission Payloads (MMPS)	Robotic Combat Vehicle – Light (RCV- L) *NGCV-CFT	Exoskeleton / Warrior Suit	Family of Integrated Tactical Sensors (FITS)	Legged Robots
			• Low Cost • Modular • Rapid Development • Increased SA/Lethality • C-sUAS		 *Notional	 *Notional	 *Notional
• 25lbs man-packable • 4 DoF Arm/6.5lbs of lift • Color/Thermal Camera – 600m Recognition • Modular Mesh radios – 2000m + Range • Sub-T Operations	• 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	• AROC ~4QFY22 • Will be re-competed • Modular autonomy kit • Includes MMP Annexes - C- sUAS - JP-8 Fuel Cell - Distributed Comms - Lethality - CASEVAC		• Help shape 1st human contact, does not prevent • Assured communication • AI-Assisted Target Recognition and Detection • Leverage robust sensor packages • Supports Modular Mission Payloads	• Reduced Soldier Load • Increased task performance • Reduce musculoskeletal injuries • Powered / Passive	• Provides enhanced SA/SU • Lightweight/low cost • Multiple modalities - Seismic - Acoustic - Magnetic • Multiple Emplacement methods	• Active Sensors • Lethality Packages • Recon/Surveillance • Sub-T Operations

Payload Development

Robotic and Autonomous Command and Control

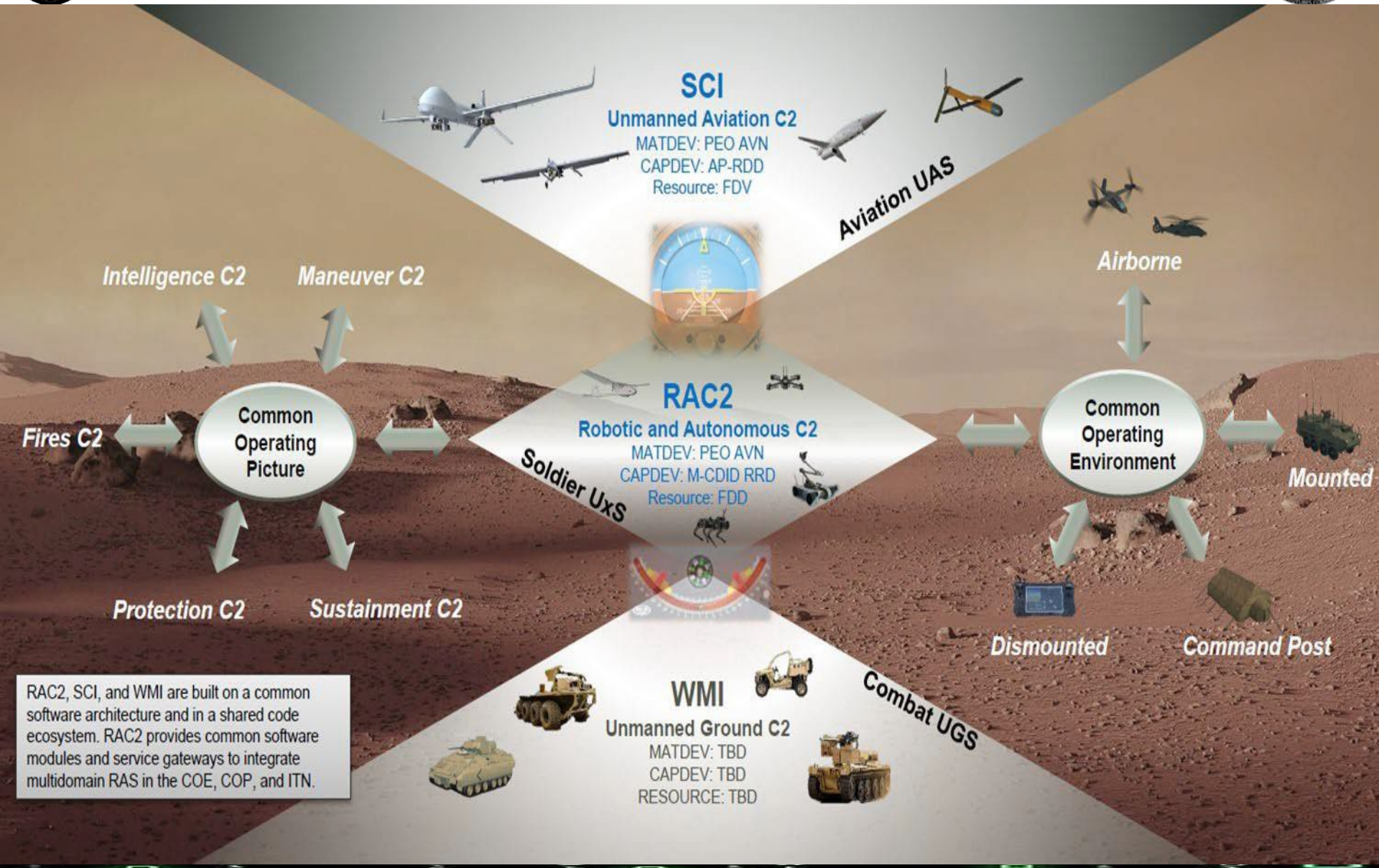
Ground Systems → Air Systems → AI/ML → Payload Control

RAC2 Software unifies Tactical C2 and extends Operational C2 for the RAS portfolio to enable the Common Operating Picture within the Common Operating Environment.



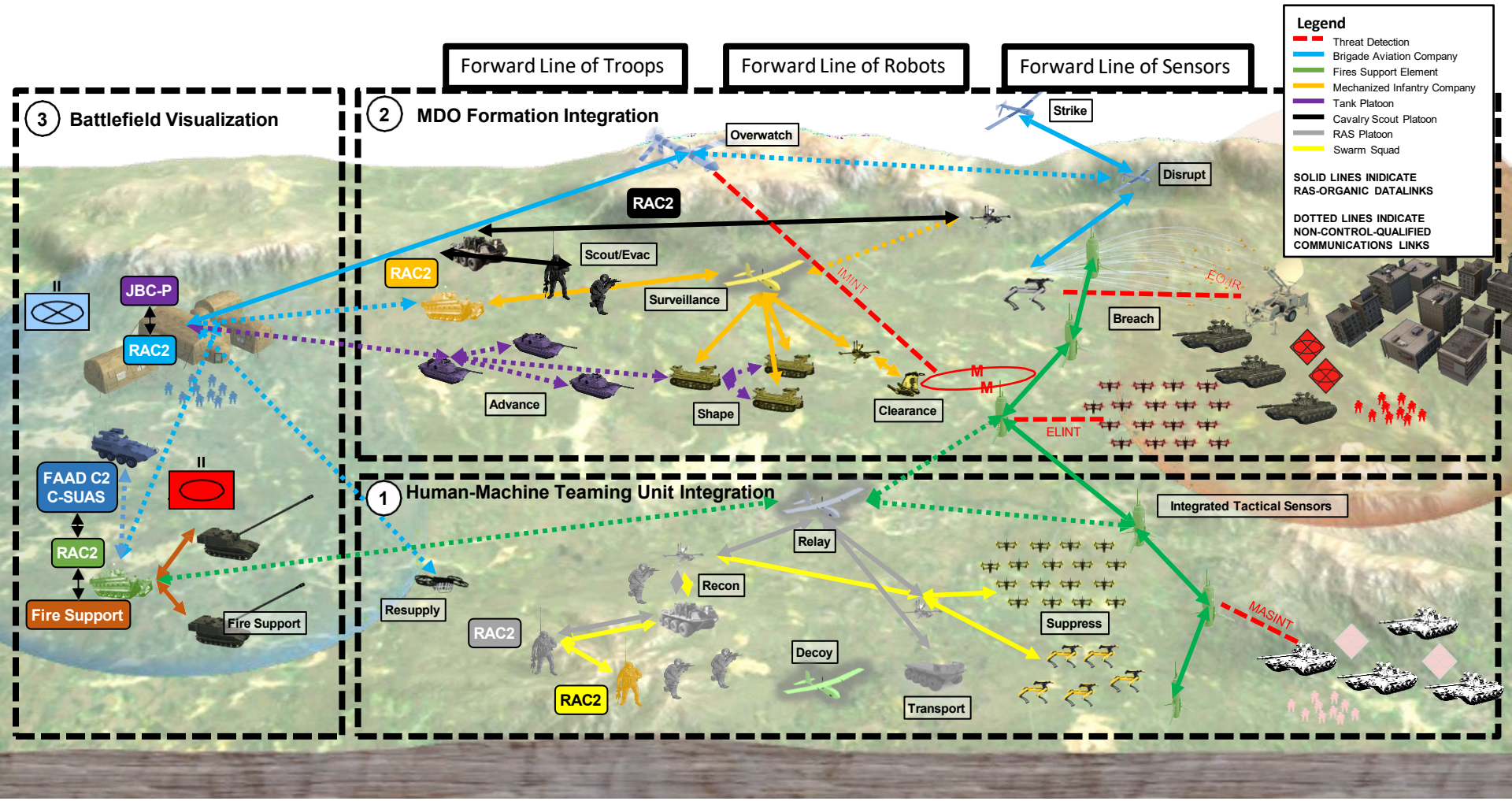
RAC2 integrates and leverages common RAS C^2 software with Peer Programs: Scalable Control Interface (SCI) and Warfighter-Machine Interface (WMI)

RAC2 Concept



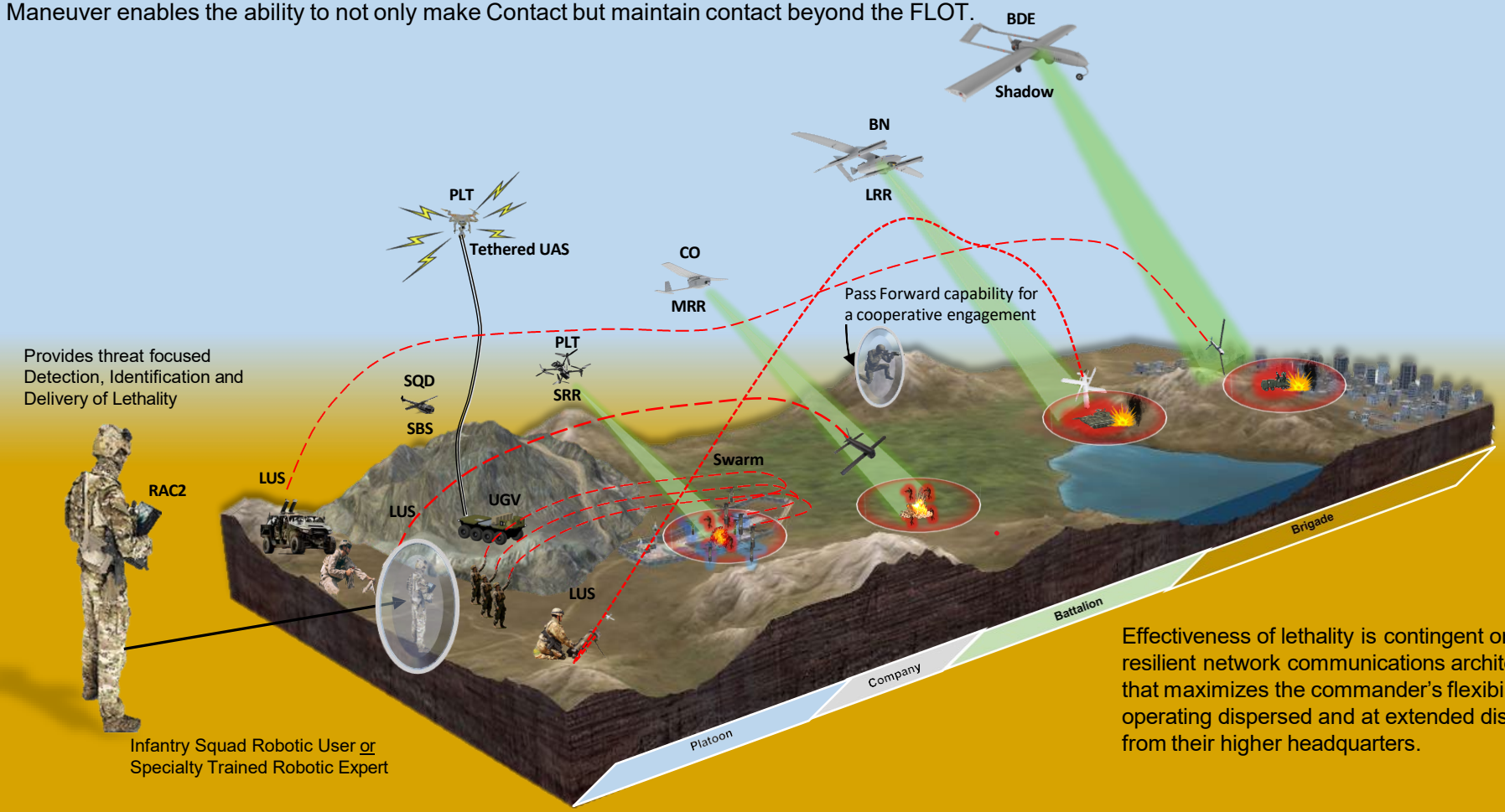
RAC2, SCI, and WMI are built on a common software architecture and in a shared code ecosystem. RAC2 provides common software modules and service gateways to integrate multidomain RAS in the COE, COP, and ITN.

Robotic & Autonomous Command and Control OV-1 (RAC²)



Hunter – Killer Pairing - Robotics Autonomous Systems

Robotic Enabled Maneuver at the Tactical Edge: Equipped with ground and air Robotic Autonomous Systems (RAS), which are integrated as part of a layered network of sensors and shooters, the Infantry Soldier provides CO/BN/BCT Commanders a sense, detect, and identification capability at extended range. This will enhance situational awareness and increases decision space to employ organic or higher headquarters Lethal Unmanned Systems (LUS) with precision to shape the battlefield. "Close with and Destroy" remains fundamental to the Light Infantry Formation. Robotic Enabled Maneuver enables the ability to not only make Contact but maintain contact beyond the FLOT.



Effectiveness of lethality is contingent on a resilient network communications architecture that maximizes the commander's flexibility when operating dispersed and at extended distances from their higher headquarters.

The Soldier is the "Center of Gravity" on the battlefield

Key Tasks FY23-24

Air Key tasks MMP (Lethality, Range Extension, ISR, EW) J-CDD Annex development

- Nano SBS
- SRR
- Swarm
- Te-UAS
- MRR
- LRR

Ground Key Tasks

- SMET INC 2/MMP Development
- Electric Lightweight Transport (Requirements Development)
- FITs SEP proposal for air/ground deployment
- RAC2

AI

- 10X 23/24 Trust
- Launched Effects SESU (Swarm, Sharing, Paring)
- AMASS (ALE, SESU, COMBAT, ASTARTE, FIRESTORM, OFFSET)
- RAQ2 (LOE3-COP and LOE HMT/Trust/AISUM

C-sUAS

- Dismounted capability
- Mounted Capability
- Munitions Ballistic PROX/DE, EW
- UAV vs. UAV
- Passive vs. Active Detect
- C2 Data Transport

Cross Cutting Capability Enablers

OPS:
Synch Strategy
SL-CFT
GVSC
NGCFT

FVL
AMD
LRPF
FCC
AI2C
DEVCOM

Backup Slides

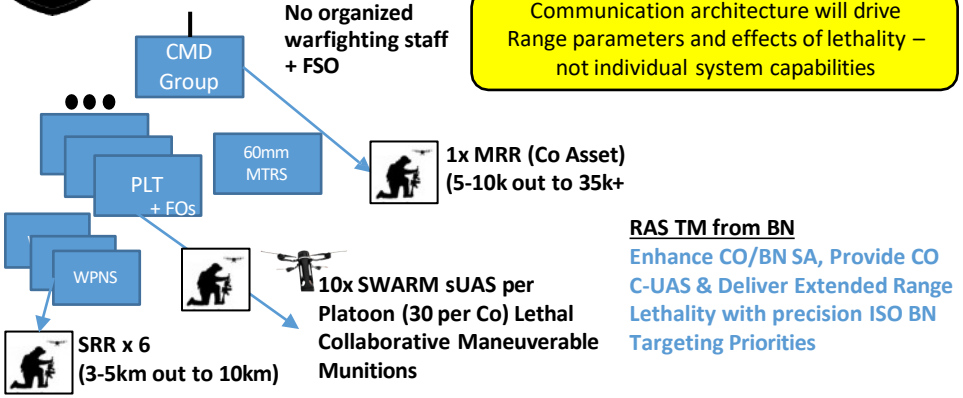
Talking Points

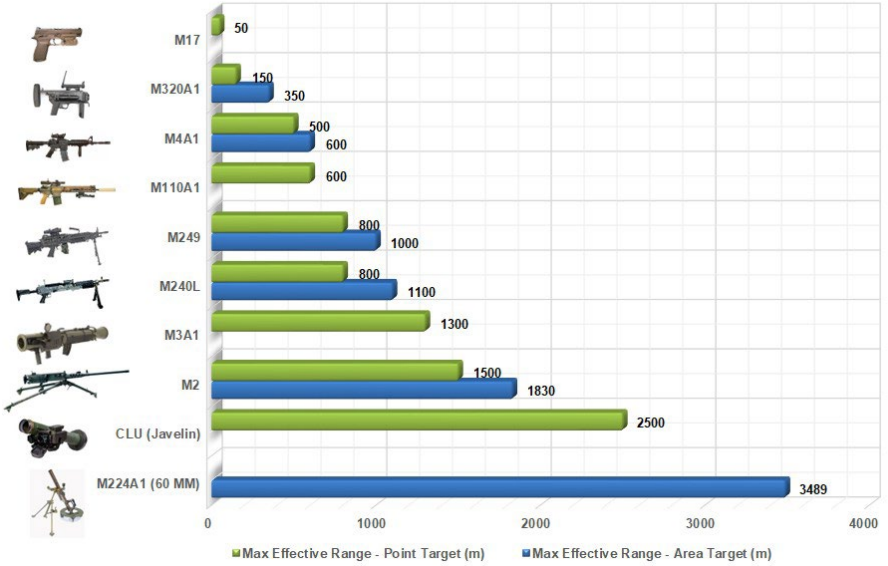
- **Software Priorities for Robotic-Enabled Maneuver:**
  1. **Robotic Platform and Payload Control (AISUM)**
  2. **Common Operating Environment – linkage to TAK/Net Warrior through ITN**
  3. **Autonomous systems support the human ability to sense, make sense, decide, and act in combat situations faster than the adversary. The RAS system-of-systems shortens and thickens the kill chain by increasing speed and redundancy in engagements**

- **Joint Small UAS Capabilities Development Document (J-sUAS CDD)**
  1. **Annexes: Soldier Borne Sensor, Short-Range Reconnaissance, Swarm, Medium-Range Reconnaissance, Tethered UAS, Long-Range Reconnaissance.**
  2. **Contingent upon RAC²**
  3. **System Standardization**

- **Communications (ML/AI)**
  1. **Data optimized at the tactical edge with specific message formats, datalink protocols, and multipath data routers.**
  2. **Develop, evaluate, and optimize echeloned AI enabled networks (multiband, multi-path, multi-form) with limited network processing in the close combat environment.**
  3. **Optimize system information formats/packets to enable rapid, narrow AI at the edge (small scale HSC), focused on critical mission data –not open access to complete network.**
  4. **"Ping" based system that recognizes access points sequentially, by protection level Soldier-to Platform, Platform-to-node-, Node-to integrated network enterprise.**
  5. **End user device enabled with accelerometer and weapon based digital compass. When weapon system fired, updated line of bearing sent as short message form as fire control protocols and ATR architecture developed and utilized in the SBU environment .**

Light Infantry Fight (Time & Space)





All Domain Sensing / Detecting Situational Awareness

Killing – Organic

Killing / Shaping - BN Supported

Shaping/Understanding: 5-35KM

Enemy Capabilities, Environment / Weather, and Duration considerations

Understanding enables decision space for the Company with the ability to begin the shaping process with lethal systems delivered from BN, BDE or another source

Te-UAS- extend comms 0-43K MMP-C-UAS/ Tgt PID- 8K

Air Augmentation- Direct Delivery w/Precision (Man-Portable, Ground, UAS or Tube launched from existing systems)

SBS 0-2k 15 mins

SWARM 1-10k with Lethal Payload

SRR 3-5k with Lethal Payload 30 mins

MRR [10+k] 120 mins w/Lethality

5-10k LUS

LUS 5-20k 4500m

LRR [20k + 5 hours+ w/Lethality

	0m	500m	1300m	2500m	
Direct Fire	Individual WPNs + M3A1, IAM		CLU (Javelin)	TOW IIB Extended Range	
Ind Fire	60mm Mortar (3489m)				BN -120mm or E81 (7000-8000m)
CsUAS Sense	Single Robot or Vehicle (SRV) Passive Detect, ID, Track (4k)				(SRV) Passive Detect 8K
CsUAS Defeat	SRV Kinetic (30/40mm, 50 Cal) 1500m			Interceptor Drone or Missile (1-25km)	

Ground-Based Augmentation w/Multi-Purpose Munitions and Ext. Range Communications (SMET / ISV)

Transporting Lethality

Extends logistical / power & energy resources from 72 to 96 hours (Co).

Key enabler for aerial platform recharging and ground launched effects, i.e. SWARM & Lethal Unmanned System (LUS).

Terrain, Weather, and duration considerations