PROJECT MANAGER FORCE PROJECTION

Army Ground Robotics Portfolio: NDIA Ground Robotics Capability Conference

Bryan J. McVeigh
PM Force Projection

Agenda

- Portfolio Overview
- Active Robotics Programs
- Emerging Robotics Requirements
- Strategic Efforts

Framing the Army's Robotics and Autonomous Systems (RAS) Strategy

As the Army articulates RAS integration across multiple Warfighting Functions, this vision must also show ***realistic objectives*** in the **near-term**, ***feasible objectives*** in the **mid-term,** and ***visionary objectives*** for the **far-term.** Beginning with near-term objectives, each successive phase links its objectives to and builds from the achievements of the previous phase.

Near-Term Vision- *Adapt*

Near-Term Objectives:

- *Leader-Follower Convoy Technology Employment*
- *Lighten the Soldier load*
- *Enhance stand-off from threats and improve situational awareness*

Mid-Term Objectives:

- *Technologies improve the **autonomy** of unmanned systems*
- *Technologies will enable unmanned cargo delivery*
- *Robots act as "teammates" rather than tools*
- *Micro autonomous air and ground systems will also enhance Platoon, Squad, and Soldier situational awareness*

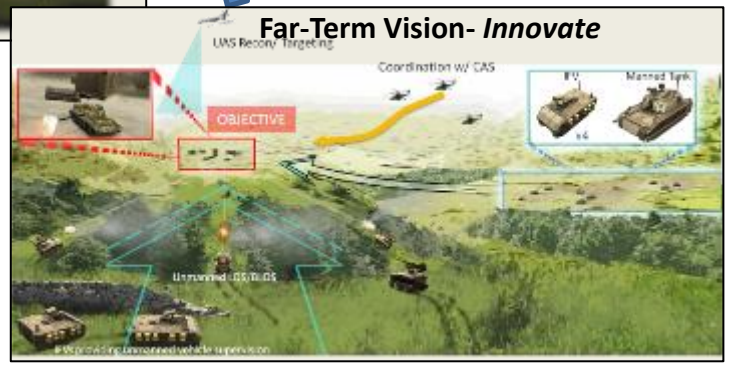
Mid-Term Vision (F2025)- *Evolve*

Source for All Listed Objectives: **TRADOC Pam 525-3-1, *Army Operating Concept*, Appendix C-2.**

Far-Term Objectives:

*Technologies will **enable manned and unmanned teaming in both air and ground maneuver** though investments in scalable sensors, scalable teaming, **Soldier-robot communication**, and shared understanding through advancements in machine learning.*

Far-Term Vision- *Innovate*



PEO CS&CSS Robotics Portfolio

Man-Transportable Robotics System Mark I & II (EOD)

M160 Light Flail

Semi-Autonomous Control

Route Clearance & Interrogation System

Leader/Follower

Robotic Enhancement Program

Man-Transportable Robotics System Increment II

Common Robotic System Individual

Squad Multipurpose Equipment Transport

Automated Convoy Operations

Talon IV	Packbot 510 FASTAC	SUGV 310 Mini-EOD	Dragon Runner	First Look
				

Non-Standard Equipment

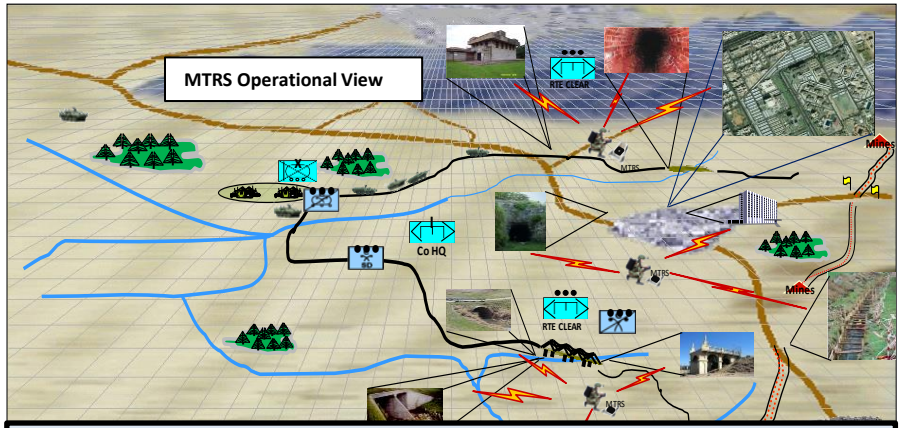
Common Robotic System Heavy *

EOD Robotics Payload *

Husky Mounted Detections System

*** Images are conceptual representations, not endorsements.**

MTRS Inc II Program Overview / Update



- The Man Transportable Robotic System (MTRS) Inc II is a remotely operated, man-transportable, robotic system
- Provides a standoff capability to interrogate, detect, confirm and neutralize presence across War-fighting functions
- Capability to identify and disposition explosive hazards
- Army's medium sized common platform allowing use of various platform payloads in support of current and future missions

* AAO includes EOD requirement of 587

- ✓ **CPD: Approved, 15 MAY 2013**
- ✓ **RFP Released: 09 NOV 2016**
- **Contract Award: 4QFY17**
- **AAO: 1,210**
- **Users: Engineer, CBRN and EOD**

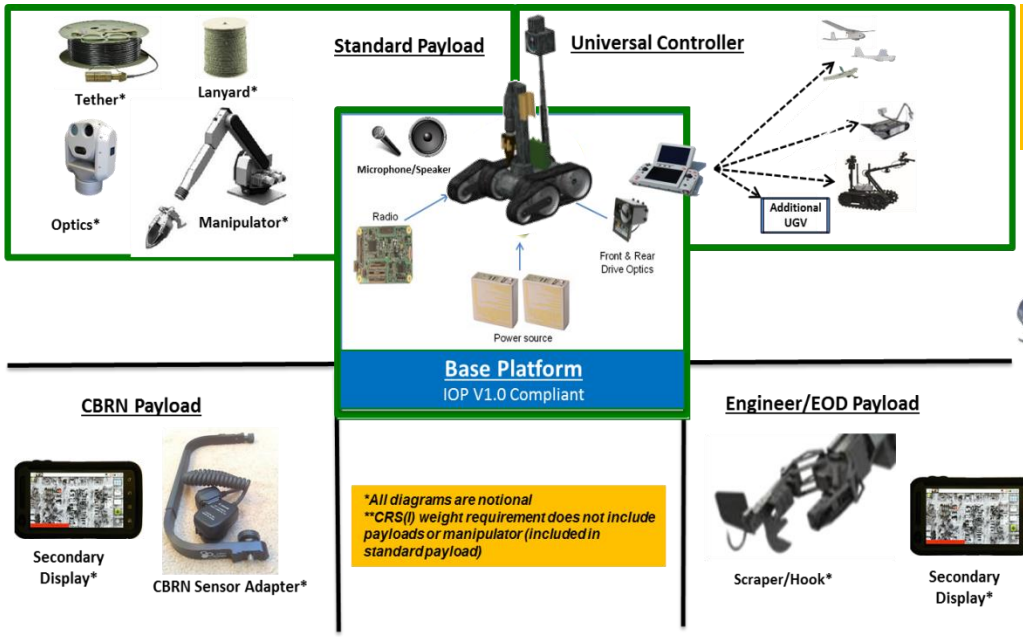
Common Robotic System (Individual) {CRS(I)}

System Description: A man-packable (< 25lbs), miniature, highly mobile, unmanned robotic system with advanced sensors and mission modules for dismounted forces. Designed so that operators can quickly reconfigure for various missions by adding/removing modules and/or payloads.

Common Robotic Platform Enabling Payloads to Address the Operational Capabilities Gaps:

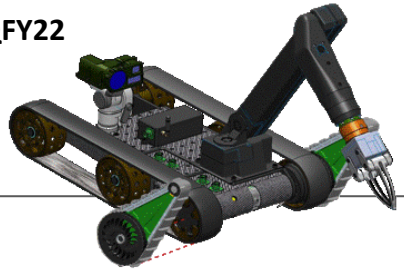
- Standoff short range Intelligence, Surveillance, & Reconnaissance (ISR)
- Remote Chemical, Biological, Radiological, and Nuclear (CBRN) detection
- Remote Explosive Obstacle Counter Measure (EOCM)
- Remote Explosive Ordnance Disposal (EOD) operations
- Remote clearance of danger areas

Users: INF, CBRN, ENG and EOD (EOD equals ENG payload; no unique requirement)



Entire CRS(I) System required to fit into single Large MOLLE

- **AAO: 3,258 (Does not include Marines)**
- **RFP Target Release: APR 2017**
- **Milestone B: 4QFY17**
- **EMD Contract Award: 1QFY18**
- **Milestone C: 4QFY20**
- **IOC: 4QFY22**



CRS(I) Proposed Materiel Solution

Standard Payload

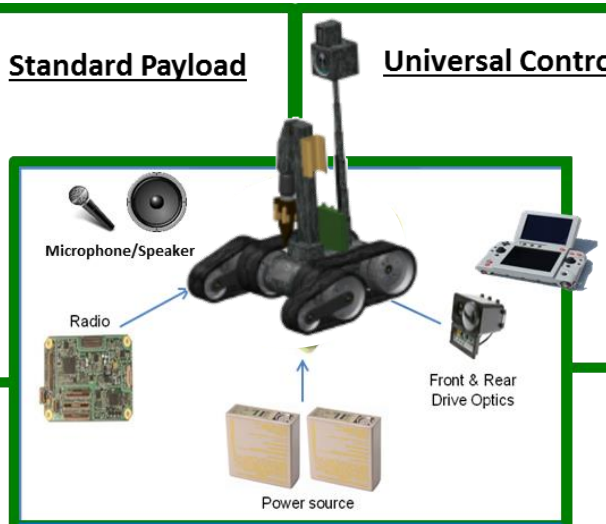
Tether*

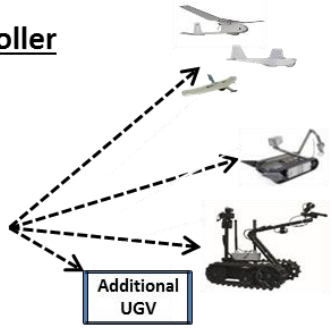
Lanyard*

Optics*

Manipulator*

Universal Controller





Base Platform
IOP V1.0 Compliant

CBRN Payload

Secondary Display*

CBRN Sensor Adapter*

**All diagrams are notional*
***CRS(I) weight requirement does not include payloads or manipulator (included in standard payload)*

Engineer/EOD Payload

Scraper/Hook*

Secondary Display*

Entire CRS(I) System required to fit into single Large MOLLE

Projected CRS(I) Allocated Breakdown

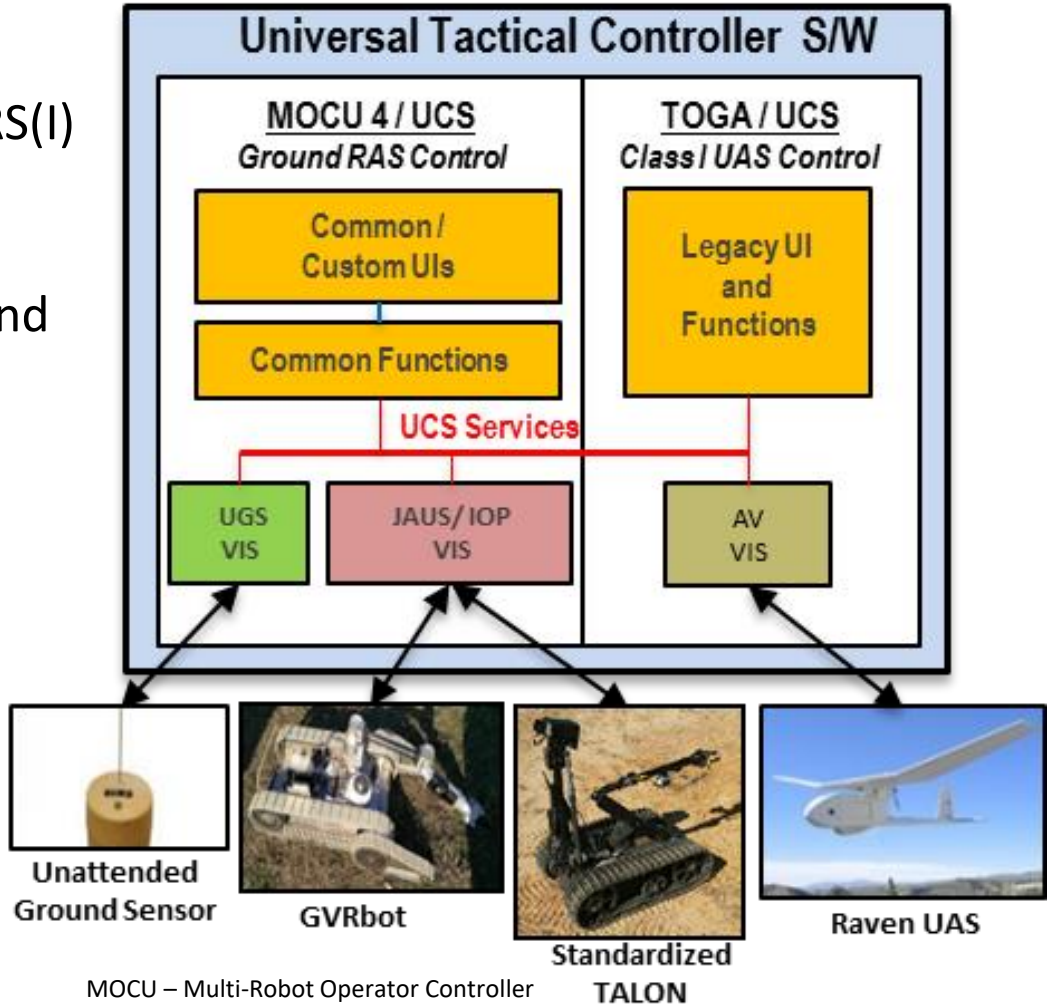
CRS(UC) Demonstration at Ft Benning

Purpose:

Reduce overall program risk to meet CRS(I) Universal Controller(UC) KPPs while providing an cost-effective and viable government solution to meet current and future requirements

Objectives:

- Confirm UAS H-GCS (aka TOGA) can operate both a UAS and UGV
- Confirm MOCU4 Software can incorporate both UAS and UGV applications and enable hand-off between platforms within an operationally relevant environment



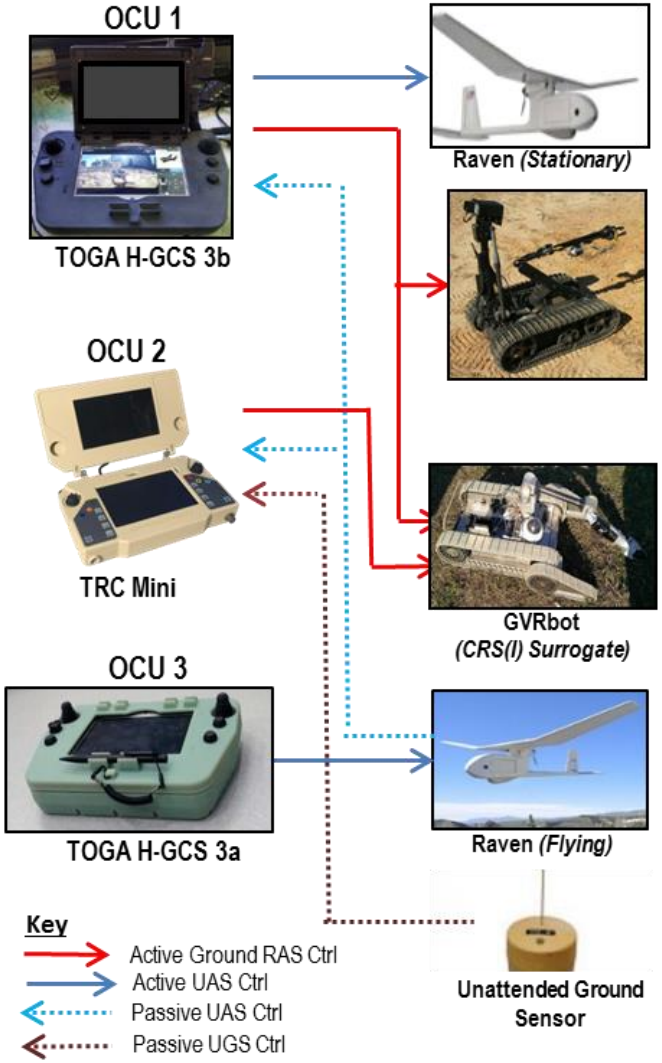
MOCU – Multi-Robot Operator Controller
TOGA – Tactical Open Government-Owned Architecture
VIS – Vehicle Interface Specification
UCS – Unmanned Control Segment
JAUS – Joint Architecture for Unmanned Systems

CRS(UC) Demonstration at Ft Benning (Cont)

Outcome:

- Controlled a UAS, Unattended Sensor, MTRS Inc II and CRS(I) surrogates
- Performed hand-off between multiple unmanned systems
- Demonstrated MOCU3&4 software interoperability on multiple controllers
- Confirmed MOCU software as a viable starting point (TRL6) for prospective CRS(I) offerors

Demo Configuration



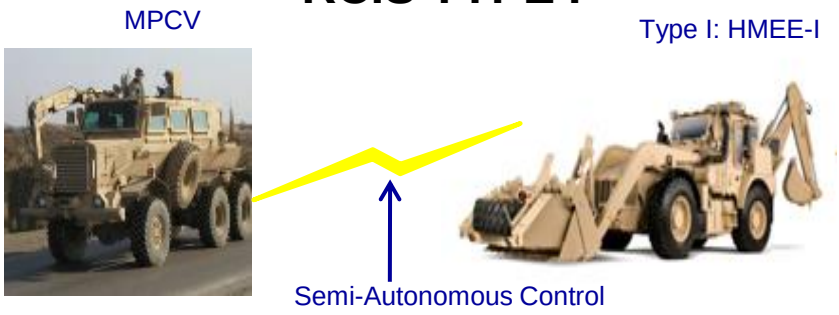
Route Clearance & Interrogation System (RCIS)

Route Clearance & Interrogation System (RCIS) CPD consists of two capabilities that are unmanned, semi-autonomously controlled, highly mobile platforms to support Route Clearance Platoons and the BCTs.

- RCIS Type I:
  - Optionally manned or unmanned
  - High Mobility Engineering Excavator (HMEE) capable of enabling Soldiers to semi- autonomously interrogate, excavate, and classify deep buried explosive hazards, IEDs, and caches.

    ✓ **CPD: Approved, Dec 2012**
    ✓ **Industry Day: 1-2 Aug 2016**
    - **RFP Release: MAR 17**
    - **Milestone B: 1QFY18**
    - **Contract Award: 1QFY18**
    - **AAO: 260**
- RCIS Type II to follow, leveraging technology and architecture from the RCIS Type 1 program

RCIS TYPE I



RCIS TYPE II

Robotic Enhancement Program (REP)

- "Buy, try and inform" - evaluate state-of-the-art robotic systems and/or payloads that are Government-Off-The-Shelf (GOTS), Commercial-Off-The-Shelf (COTS) and Non-Developmental Items (NDI) to inform the requirement and acquisition process
- Status:
  - Experiment 16.1 – 17.1
    - Proposals submitted 109
    - Proposals Selected: 25
  - Experiment 17.2

    Proposals submitted 146 (62 New/ 84 Previous)

    Council of Colonels convened: 2 MAR 17

- REP Submission Site: http://www.peocscss.army.mil/rep.html

SMET FORSCOM Excursion

Description: Select ~4 Surrogates, totaling 60-80 systems issued to Soldiers in 2-3 Brigades for a 1 Year Excursion to develop TTPs and CONOPs

Two Configurations: Unmanned and Optionally Manned

Required Capabilities:

• Carry 1000 pounds	• Operate over 60 miles in 72 hrs	• Generate 3KW stationary and 1KW moving

Stretch Goals:

• Follow Me • Battery Charging • Reliability	• Silent Watch • Universal controller compatibility • Anti-Rollover	• Transportability at convoy speed • Imbedded Video TMs and Manuals • Interoperability/Expandability

Questions for Industry:

- What is your production lead time and rate?
  - Robotic Rodeo (1-2 each)
  - Test (1-2 each)
  - Excursion Production (~5 unit sets)
- What is the earliest date you can have a system to Ft Benning for Rodeo assessment?
- How would you support Test, and Excursion?
- Is 5-10K sufficient to offset Rodeo costs?
- Would Rodeo assets be available to immediately support safety testing?

NIE16.1 OCT15 SMET Surrogates

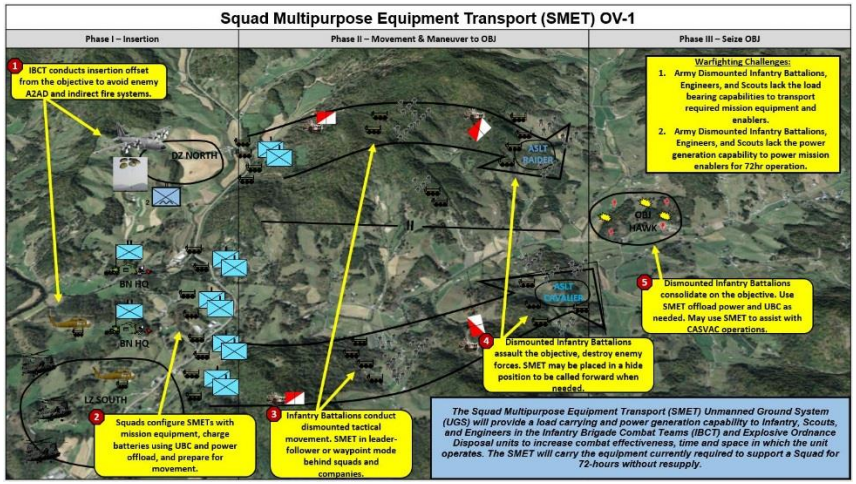
RFI (+) coming soon

Army SMET Goals

Army leadership desires automation & robotics sooner vs later.

Near Term (April to October 2017)

- OTA Request for Information/Proposal
- FY17 SMET Trials (late summer)
- Contract for Systems(~15-20 total)
  - 1-5 Test Assets
  - 10-15 Excursion Assets
- $100K per system target cost



Long Term (FY18-FY19)

- Excursion with 60-80 systems in 2-3 Brigades and at Test Sites
  - Demonstrate and insert increased capabilities
  - FSR Support for 15-20 systems at 4+ Government Sites/Installations
- CPD developed/informed by developing TTPs and CONOPs
- OTA continued leverage
- Informed Program Decisions Determine Future

Leader Follower Excursion

Description: Capitalize on Automated Ground Resupply S&T efforts to equip 3 Transportation Companies with Leader Follower capability for up to 2 year Excursion for TTP and CONOP development

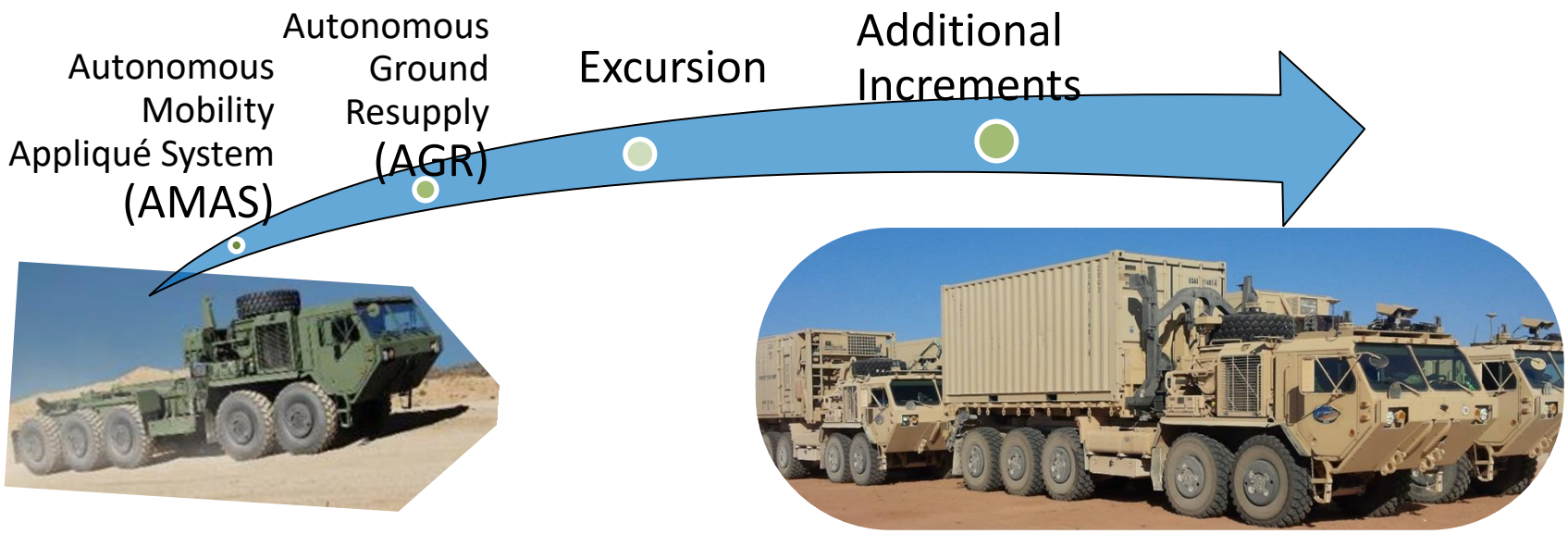
Required Capabilities:

• Lane Following • Day/Night Ops	• Obstacle Detection • Line of Site Operation	• Primary/Secondary Roads • Optionally Manned

Stretch Goals:

• Automated Reverse • Sensor Range Improvement	• GPS Denied Ops • Obstacle Avoidance	• Heavy Rain/Snow/Fog • Unimproved Roads/Trails

System Evaluation/ Measurement : September 2017



Army LF Goals

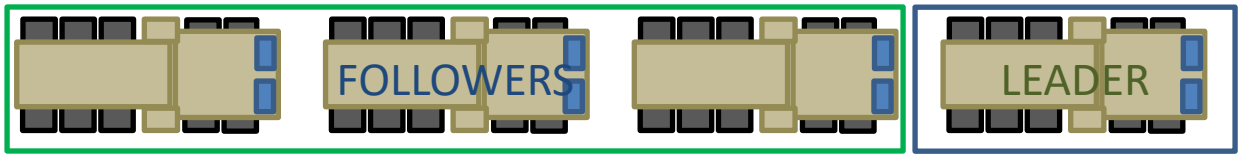
Army leadership desires automation & robotics sooner vs later.

Near Term (Demonstrate in September 2017)

▪ Modes (Leader Follower, Teleop) ▪ Assembly (Manual Line Up Vehicles) ▪ Formations (Column) ▪ Reverse (Teleoperation and Manned)	▪ GPS Denied (LOS to Leader) ▪ Turnaround (Vehicle K Turn) ▪ Obstacles (Static & Large Dynamic) ▪ Dynamic Rerouting (None)	▪ AO (Primary & Secondary Roads) ▪ Operations (Day and Night Driving) ▪ Weather (Light Rain/Snow/Fog) ▪ Safe Harbor (Stop)

Long Term (FY18-20)

▪ Capitalize on S&T Investments ▪ Incremental approach and build ▪ 2+ Year Excursion ▪ OTA Leveraged Activities	▪ 10 Test Systems ▪ 140 additional Excursion Systems ▪ Hardware Purchases	▪ CPD developed/informed ▪ OTA continued leverage ▪ Informed Program Decisions Determine Future



Autonomous Trucks Testing: "Long Tail" of Use-Cases

Use case variables include:

Operations:
Wartime - High Intensity (7-day Surge)
Wartime - Low Intensity (30-day Period)
Peacetime - Low Intensity (240-day Period)

Hauling:
Local Haul
Line Haul

Terrain:
Primary Roads
- High Quality Paved
- Secondary Pavement
- Rough Pavement Degraded
- Rough Pavement Highly Degraded

Secondary Roads
- Loose Surface
- Washboard & Potholes
- Belgian Block

Off-Road
- Trails
- Rough Trails

Speeds:
45 - 55 mph Primary Roads
30 - 45 mph Secondary Roads
10 - 30 mph Trails
5 - 15 mph Rough Trails

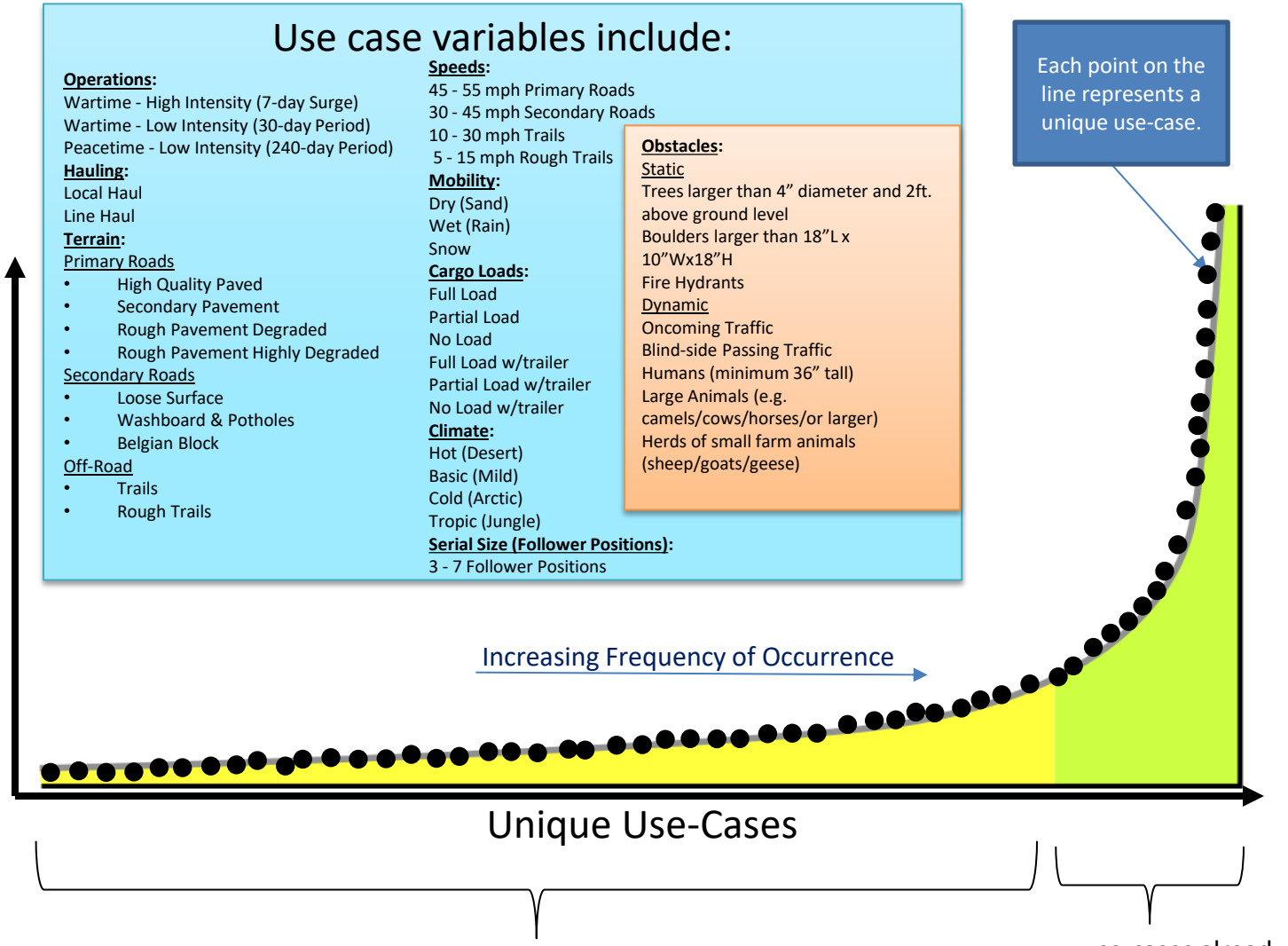
Mobility:
Dry (Sand)
Wet (Rain)
Snow

Cargo Loads:
Full Load
Partial Load
No Load
Full Load w/trailer
Partial Load w/trailer
No Load w/trailer

Climate:
Hot (Desert)
Basic (Mild)
Cold (Arctic)
Tropic (Jungle)

Serial Size (Follower Positions):
3 - 7 Follower Positions

Obstacles:
Static
Trees larger than 4" diameter and 2ft. above ground level
Boulders larger than 18"L x 10"Wx18"H
Fire Hydrants
Dynamic
Oncoming Traffic
Blind-side Passing Traffic
Humans (minimum 36" tall)
Large Animals (e.g. camels/cows/horses/or larger)
Herds of small farm animals (sheep/goats/geese)



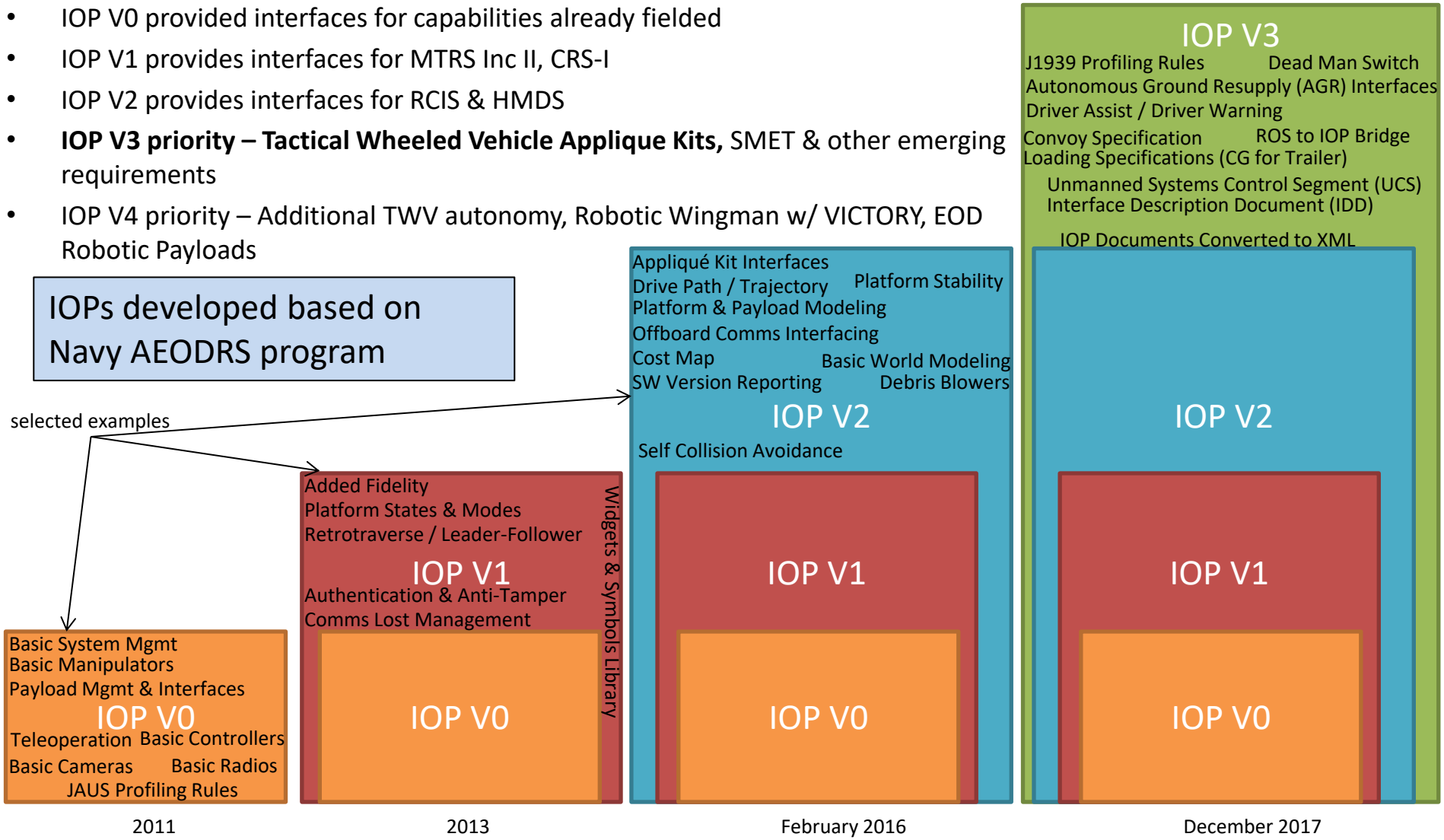
Interoperability Profiles (IOPs) Status

RAS-G IOPs enable modular open software & hardware interfaces

- IOP V0 provided interfaces for capabilities already fielded
- IOP V1 provides interfaces for MTRS Inc II, CRS-I
- IOP V2 provides interfaces for RCIS & HMDS
- **IOP V3 priority – Tactical Wheeled Vehicle Applique Kits,** SMET & other emerging requirements
- IOP V4 priority – Additional TWV autonomy, Robotic Wingman w/ VICTORY, EOD Robotic Payloads

IOPs developed based on Navy AEODRS program

selected examples



Video TM Concept

Supplement existing commercial manuals with video instructions to mirror private sector sustainability for COTS and NDI equipment.

Current Robotic Commercial TM

Commercial Manual + RPSTL Data + Warnings and Cautions + Video Supplements = Video TM Concept

Path Forward (Pilot Program – MTRS Inc II & CRS-I)

Decide on Pilot Program → Obtain COTS Manual → Video Production Cost Estimate → Storyboard and Record Videos → Video Storage Solutions → Live Demo with Videos and Soldiers

Video Production Cost Estimate → **$10,000**

Storyboard and Record Videos → **Current Status**


PROJECT MANAGER
FORCE PROJECTION
PM SKOT
PD TMDE
SUPPORT CENTER
GROUND VEHICLES
EQUIPMENT
MEASUREMENT
DIAGNOSTIC

Discussion

PROJECT MANAGER FORCE PROJECTION

Back Up

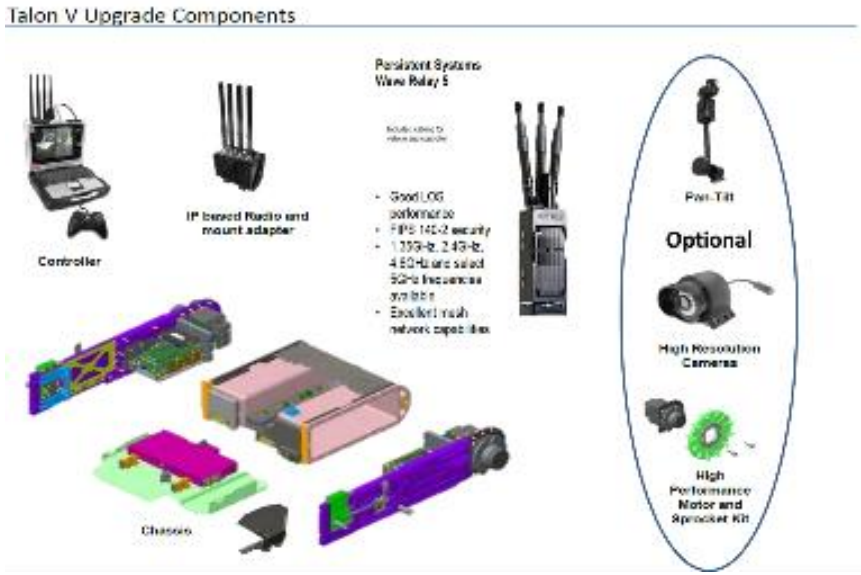
Bryan J. McVeigh
PM Force Projection

MTRS MKII (EOD) Recap

Program Description

- Recapitalize 478 MTRS MKII to the Talon 5A configuration utilizing a return/retrofit/field strategy
  - Fielding starts APR 2017 for 5 years
- Qinetiq conversion kit includes:
  - Talon V Chassis Upgrade
  - Q-Tray- longer battery life per vehicle mission
  - Wave Relay 5 Radio, IOP compliant (same as NGB CBRNe)
  - Laptop Control Unit

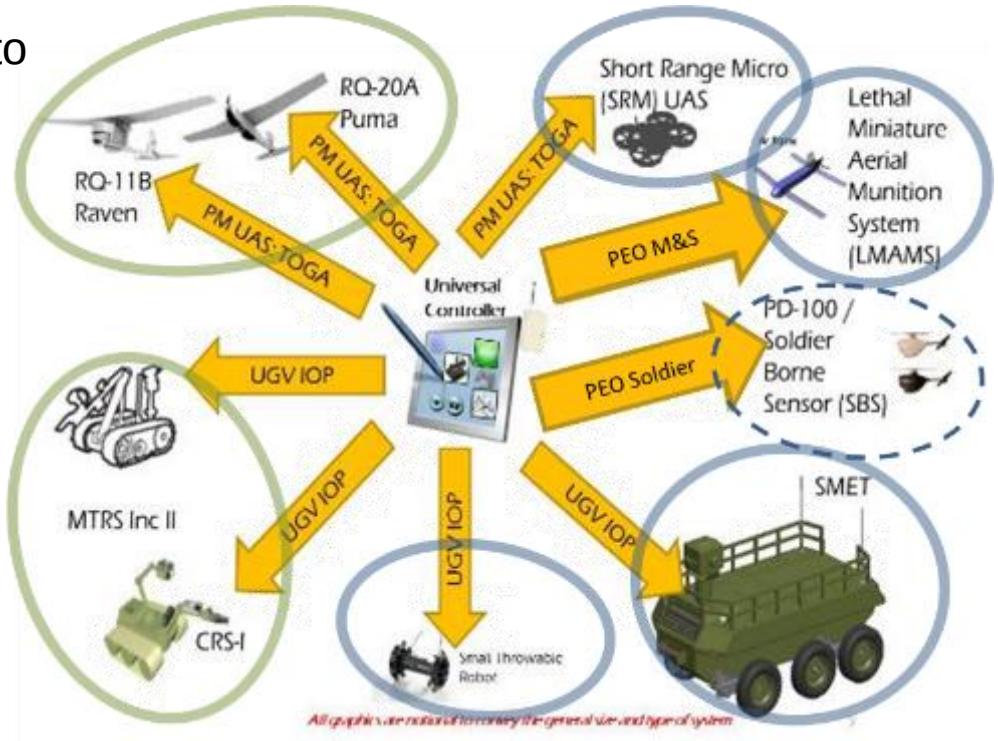
Talon 5A



Universal Controller Strategy

Vision: Controller(s) which meets or exceeds CRS(I) threshold while leveraging Better Buying Power emphasis areas:

- Provide draft technical requirements to industry early and involve industry in funded concept definition
- Modular Open Systems Architecture
- Interoperability
- Organic engineering capabilities
- Extensibility & Commonality
- Cybersecurity
- Commercial Technology
- Supportability & Maintainability



Programs of Record

RAS* Identified PORS

Architecture Supported

*RAS – Robotic and Autonomous Systems

Risk Mitigation:

- **Controller and Software demonstrations (Sept 16 and Jan 17) to mature MOCU4 software to handoff/operate on multiple controllers controlling multiple platforms**
- **Robotic Enhancement Program (REP) authorized purchase of Bokam, TRC-Lite controllers and UAS controller (TOGA H-GCS)**

CRS(I) Weight Estimate

Shipping Container

CRS(I) System

CBRN Payload Interface: *Mounting Bracket*

ENG/EOD Payload: *Scraper/Hook*

Standard Payload: *Camera/Illuminator*
Lanyard
Subterranean NLOS (tether)
Manipulator Arm/Gripper
(full functionality of arm to pick up object)

CRS (I) Mobility Base Platform (MBP)

MBP Cameras
Cables and accessories
Processor
Power Source
Radio
Speaker
Microphone
Stair Climbing

OCU
Processor
Memory
Power Source
Cables and accessories

Secondary Display
(Not part of 25 lb weight; packaged with EOD/Engineer Payload)

Radio & Environmental Case

Hand Controller
Dexterous Controls
Built-in Display
Speaker/Microphone

2 person lift

< 32 lbs

< 25 lbs

< 10 lbs

< 2.5 lbs

Does Not Include: MOLLE Pack, CBRN Sensors

****The items listed are meant to provide information regarding the allocation of the weight requirements as listed in the CRS(I) performance specification and is not an all inclusive list.***