Robotics Portfolio Overview
to
NDIA Robotics Division
25 AUG 15

Bryan J. McVeigh
PM Force Projection
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 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

**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.

Source for All Listed Objectives: TRADOC Pam 525-3-1, Army Operating Concept, Appendix C-2.
• Evolutionary approach toward delivering autonomy enabled Warfighter capabilities to reduce operational risk
• Technology (software & hardware) enhancements are seamless & affordable to field standoff capability & intelligence to existing systems
• Deliberate management of program risk
• Affordable & timely programs
• Modular, open architecture design philosophy
• Innovative industrial base & acquisition environment
PEO CS&CSS Robotics Overview

Man-Transportable Robotics System Mark II (EOD)

M160 Light Flail

Route Clearance & Interrogation System

Mine Protected Clearance Vehicle (MPCV)

High Mobility Engineer Excavator, Type I (HMEE-I)

Semi-Autonomous Control

Robotic Enhancement Program

Common Robotic System Individual

Man-Transportable Robotics System Increment II

Leader/Follower

Husky Mounted Detections System

Non-Standard Equipment

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

Squad Mission Enhanced Transport

Automated Convoy Operations

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MTRS Inc II Base and Payload Configuration

MTRS Inc II CPD 15 May 2013

**CBRN Payloads (Chemical Units)**
JPM Nuclear Biological Chemical
(PEO Joint Bio Chem Defense)

**Common Payloads (All Users)**
PdM Unmanned Ground Vehicles
(PEO CS&CSS)

**Autonomous Mine Detection System**
CDD, Independent CARDS #06061, (9 JUL 09) (Payload)

**Robotic Deployment System**
PM Assured Mobility Systems

**Base Platform**
IOP V1.0 Compliant

**CBRN Sensors**
CBRN Sensors for Application on Unmanned Systems ICD, 23 FEB 06, CARDS #028-06 (Payload)

**Radios**
Firing Circuit

**Manipulator**
Single-Shot Disrupter

**Fiber Optic**
Autonomous Mine Detection System

**Optics**
PdM Counter Explosive Hazard, (PEO Ammo)

**EOD Payloads (for MK2)**
EOD

**Engineers**

**MTRS Inc II RFP release targeted for 2nd QTR 2016**

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Route Clearance & Interrogation System Capability Overview

- 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.

- RCIS Type II to follow, leveraging technology and architecture from the RCIS Type 1 program

RCIS Type 1 RFP release targeted for 3rd QTR 2016
**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. CRS-I will include a Common Controller.

**Addresses the Following Operational Capabilities Gaps:**
- Standoff short range Intelligence, Surveillance, & Reconnaissance (ISR)
- Remote Chemical, Biological, Radiological, and Nuclear (CBRN) detection
- Explosive Obstacle Counter Measure (EOCM)
- Explosive Ordnance Disposal (EOD)
- Future Users: Engineer, CBRN, INF, EOD

**RFP release targeted for 1st QTR 2017**

*DISTRIBUTION STATEMENT A: APPROVED FOR PUBLIC RELEASE: DISTRIBUTION IS UNLIMITED.*
• How do we support different radios?
• How do we support different control standards?
• How do we minimize controller weight?
• How do we optimize between optimal control of each system & user interface commonality?
Universal Controller Strategy

• Vision: controller(s) optimized in terms of the following characteristics:
  – Weight
  – Open Architecture
  – Ergonomics
  – Extensibility & Commonality
  – Cybersecurity
  – Application Based
  – Supportability & Maintainability

Need industry’s help in making this a reality
Universal Controller – Initial Concepts

Universal Controller –
Battalion & Below Assets to Control

Soldier Systems
- LMAMS
- Soldier Borne Sensor (SBS) – PD-100

Air Systems
- Short Range Micro (SRM) UAS
- Puma
- Raven RQ-11B

Ground Systems
- UAS TOGA
- UGV IOP
- SMET
- CRS-I
- MTRS Inc II
- Small Throwable Robot

Acronyms:
- COE: Common Operating Environment
- CRS-I: Common Robotic System, Individual
- EUD: End User Device
- LMAMS: Lethal Miniature Aerial Munition System
- M/HH: Mobile/Hand-Held
- MOCU: Modular Operator Control Unit
- MTRS: Man Transportable Robotic System
- OSD: Office of the Secretary of Defense
- SBS: Soldier Borne Sensor
- SPAWAR: Naval Space Warfare Center
- TOGA: Tactical Open Government-owned Architecture
- UCS: Unmanned Air System (UAS) Control Segment
- UGV IOP: Unmanned Ground Vehicle Interoperability Profile

Is this the answer?
Director
Robotic Logistics Support Center

Non Standard Robots  O&S
Man Transportable Robotic System (MTRS) MKII  O&S
Man Transportable Robotic System (MTRS) MKII Recap  O&S

Non-Standard Robots

<table>
<thead>
<tr>
<th>Talon IIIB</th>
<th>Talon IV</th>
<th>PacBot 510 FASTAC</th>
<th>SUGV 310 Mini-EOD</th>
<th>Dragon Runner</th>
<th>First Look</th>
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MTRS EOD Robots

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<tr>
<th>MKII MOD0</th>
<th>MKII MOD1</th>
<th>MKII MOD2</th>
<th>MKI MOD0</th>
<th>MKI MOD1</th>
<th>MK5</th>
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**Problem:** Robotic technology is rapidly evolving. The standard requirements/acquisition timeline of 3 to 7 years increases the risk that robotic systems will be obsolete before it is fielded or more likely, before it even reaches Initial Operational Capability (IOC).

**Mitigation:** Evaluate small quantities of state-of-the-art robotic systems and/or payloads to inform the requirement and acquisition process.

**Concept:**
- Concept based off of Soldier Enhancement Program
- REP is a special project (not a full life cycle acquisition program)
- Uses a “buy-try-inform” methodology to better inform future Army requirements

**Experiment Focus:**
- Protect the Force
- Reduce Warfighter’s Workload
- Enable Situational Awareness
- Sustain the Force
- Enable lethal and Non-lethal Engagements
- Reduce Cost

**Operational Concept**

The S-MET should be capable of operating in three control regimes; tele-operation, semi-autonomous and autonomous. Semi-autonomous navigation will include wireless leader/follower and waypoint navigation. The speed of the S-MET will allow for the squad to maintain its momentum during all operations.

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**Mission**

The S-MET will lighten Warfighter’s load and sustain the force during ops. The S-MET will maneuver with the dismounted force and enable Warfighters to conduct continuous ops without the individual Warfighter carrying equipment required to conduct 96 hours of dismounted operations.
By Wire and Active Safety

**Required Upgrades (By Wire)**
- Steering
- Braking
- Dashboard
- Data Buses (I/O)

**Required Upgrades (Active Safety)**
- In-cab Camera (Bridge to ACO)
- Temperature Sensor
- Rain Sensor
- GPS and base maps (Bridge to ACO)
- DSRC (Bridge to ACO)
- Rear and Side Radars
- Wheel Encoders
- Forward Radar
- Display

Leader Follower Robotic Capability

**Required Upgrades (LF/Robotic)**
- LIDAR
- Tactical Radio
- Navigation Solution
- Cameras
- UWB Radios
- Fiducial Markers
- Computers

Provides Leader Follower Unmanned Capability to the PLS A1 Vehicle
Automated Convoy Operations

Provides optional unmanned capability to any manned vehicle; from driver assist to automated driving and navigation

A-Kit
Universal Brain

B-Kit
Vehicle Specific Connectors

C-Kit
Modular Sensors

Appliqué Kit
POCs

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Discussion Requirements
Universal Controller – Battalion & Below Assets to Control

- RQ-20A Puma
- RQ-11B Raven
- PM UAS: TOGA
- PM UAS: TOGA
- UGV IOP
- UGV IOP
- UGV IOP
- UGV IOP
- Universal Controller

- Short Range Micro (SRM) UAS
- Lethal Miniature Aerial Munition System (LMAMS)
- Nett Warrior EUD / MHH COE
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- PD-100 / Soldier Borne Sensor (SBS)
- SMET

All graphics are notional to convey the general size and type of system

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