



ROBOTIC SYSTEMS JOINT PROJECT OFFICE NDIA ROBOTICS QUARTERLY

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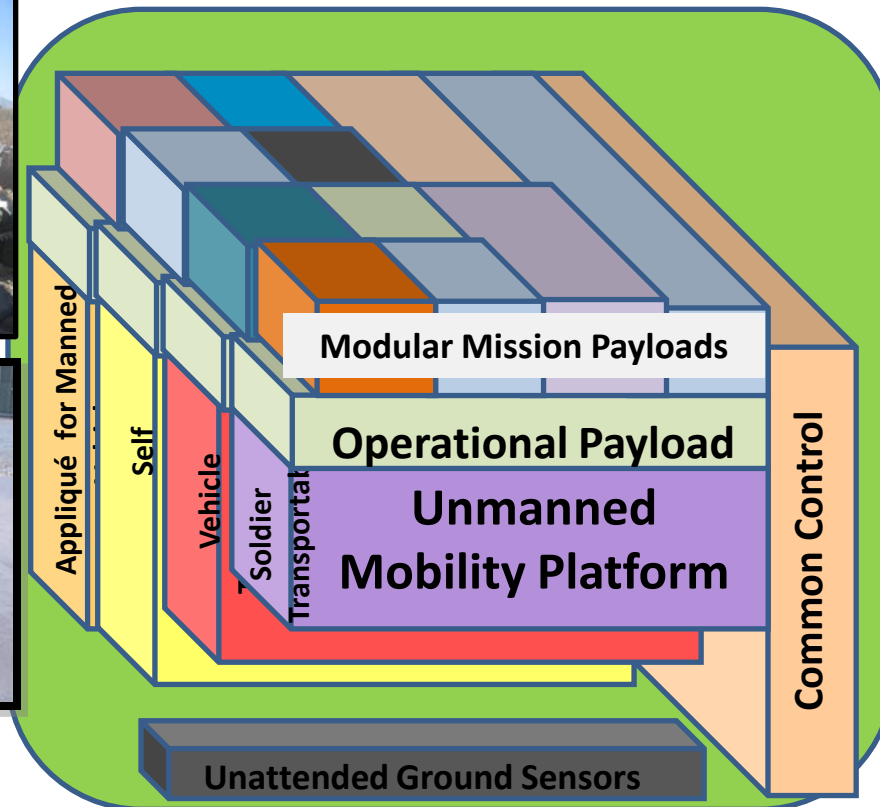
16 June 2011



Robotic Systems Joint Project Office

Full Life Cycle Management for Army/USMC

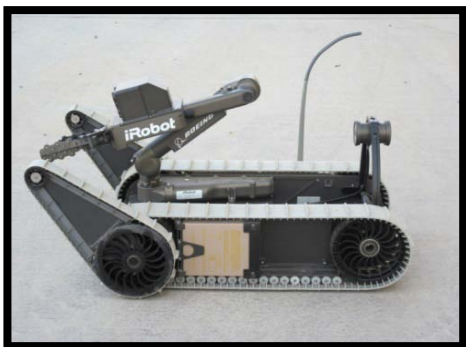
- ◆ 600+ robots in Iraq, 2100+ robots in Afghanistan
- ◆ RS JPO provides support directly to the Warfighter through
 - ◆ Joint Robotic Repair and Fielding (JRRF) Activity CONUS
 - ◆ Joint Robotic Repair Detachments (JRRDs) OCONUS





PEO-GCS Robots Currently in Combat

Mini-EOD
(SUGV-310) (260)



PackBot Family (1100) 510



MARCBot
(350)



TALON Family (1000)



M160 (40)





Accomplishments and Warfighter Support

- ◆ Robotic Fleet Management
 - ◆ 600+ robots in Iraq, 2100+ robots in Afghanistan
 - ◆ RS JPO provides support directly to the Warfighter through:
 - ◆ Joint Robotic Repair and Fielding (JRRF) Activity CONUS
 - ◆ Joint Robotic Repair Detachments (JRRDs) OCONUS
- ◆ Stand-off for interrogation and blow in place
- ◆ Deploy and operate from inside route clearance and other vehicles
- ◆ Entry control points
- ◆ M160 Successes
 - ◆ Adaptations for new uses
 - ◆ Route clearance





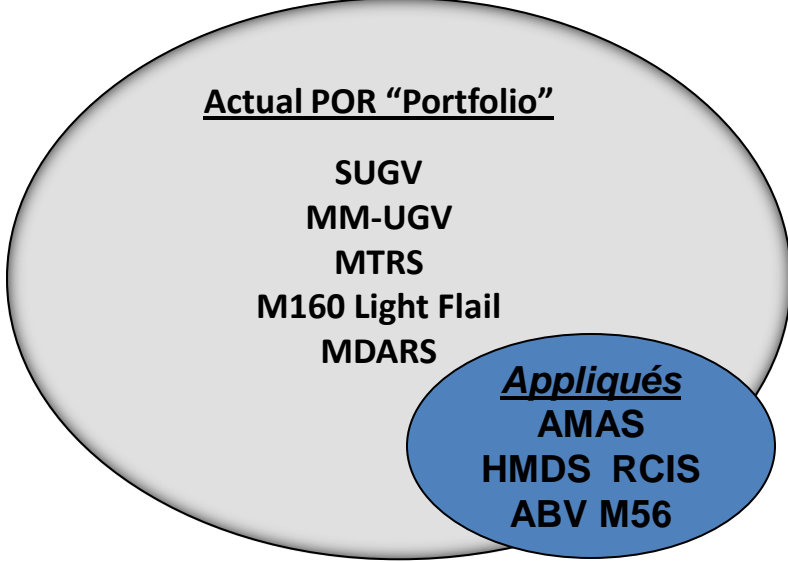
Portfolio of Unmanned Ground Vehicle Efforts

- MCoE**
- SUGV INC I&II
 - MM-UGV
 - S-MET
 - Common Controller

- EOD**
- AEODRS
 - Small, Medium, Large
 - MTRS

- REF**
- WorkHorse
 - ThrowBot
 - PackBot
 - MARCBot

- MSCoE**
- Husky Mine Detection System w Robotic
 - Man Transportable Robotic System INC II (MTRS)
 - Robotic Clearance Interrogation System (RCIS)
 - Area Clearance Family of Systems (Light-Medium Flail)
 - Autonomous Delivery of Engineer Payloads (ADEP)
 - USMC Assault Breacher Vehicle (ABV) w Robotic Control
 - Mobile Detection Assessment Response System (MDARS)
 - M56 Coyote Smoke Generator Carrier w/ Robotic Control



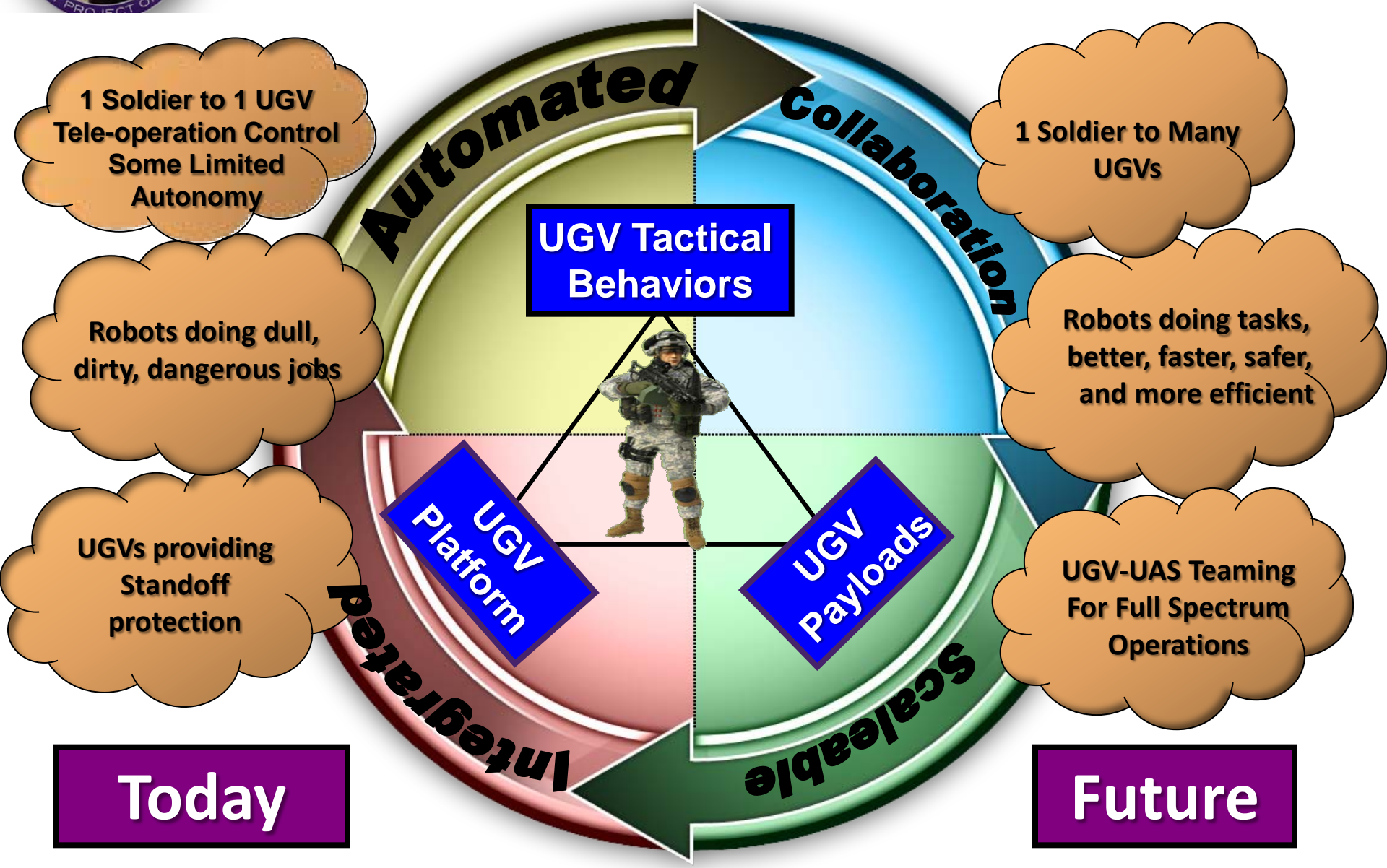
- SCoE**
- AUTONOMOUS MISSION APPLIQUE' SYSTEMS (AMAS)
 - AGILE Technology
 - Convoy Active Safety Technology (CAST)

- JIEDDO**
- Ghostship
 - Sentinel Scout
 - SANDI
 - RedShirt
 - RMDS (Husky Appliqué)

- RS-JPO**
- M160 Light Flail
 - FASTAC
 - Talon 3/4/3B
 - PackBot (Scout)
 - MARCBot
 - Mini-EOD
 - Throwbot
 - Dragon Runner

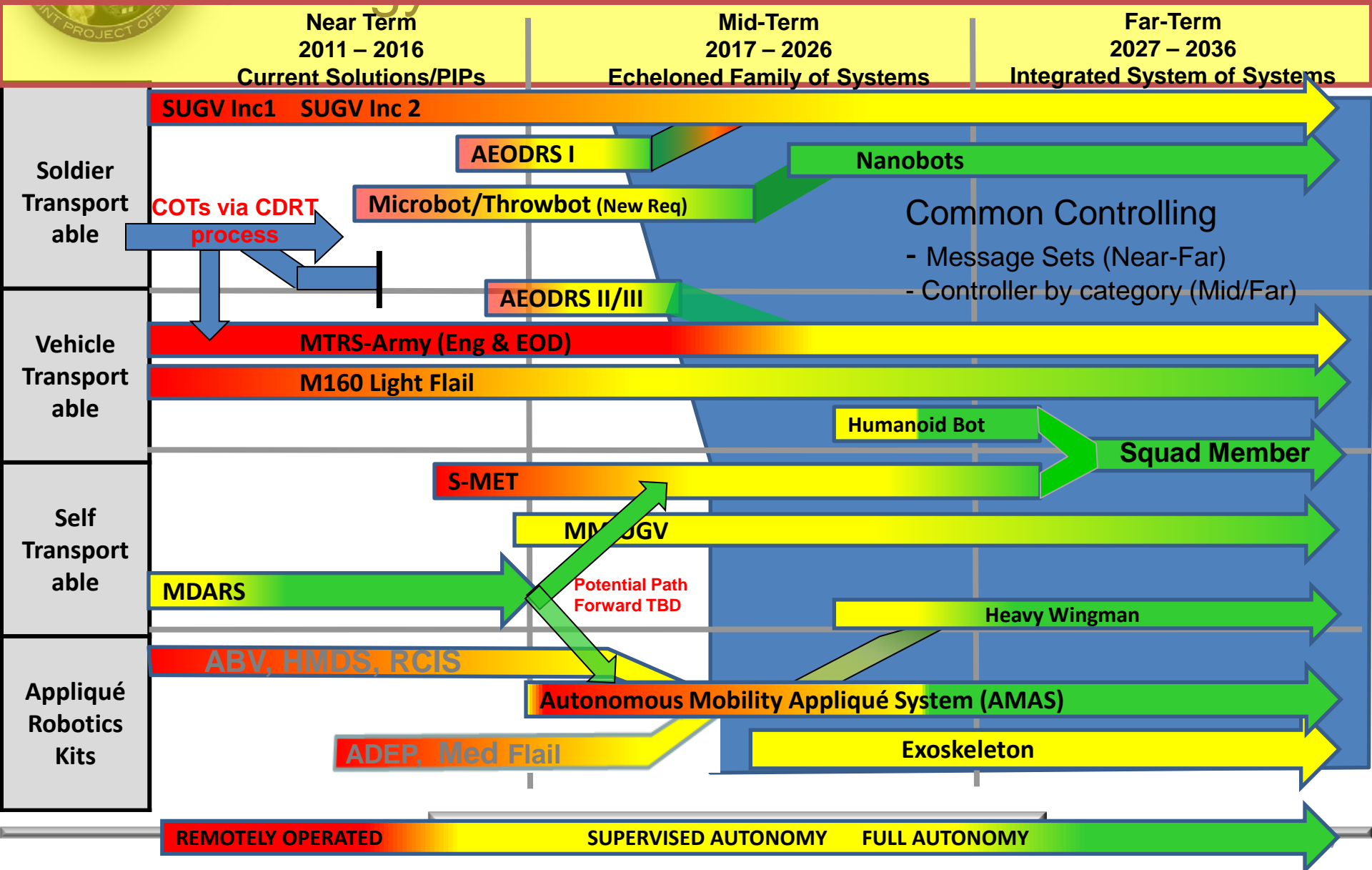


Future UGV Capabilities





Unmanned Ground Vehicle Program Strategy





Prioritized Capability Overview

TRADOC UGV Development Priorities

- 1. C-IED / Explosive Ordnance/Hazard (Engineer, EOD Operations)**
 - Detect, Mark, Neutralize, Render Safe (EOD)
- 2. Maneuver Force Equipment Transport**
 - Equipment Transport to Lighten the load for dismounted operations at platoon and below; focus on I-BCTs
- 3. Recon / Surveillance**
 - CBRN – Payload vs. Specific Platform (Detect, Mark, Neutralize)
 - Jamming – Payload vs. Specific Platform
 - Comm Relay – Payload vs. Specific Platform
- 4. Breaching / Clearing**
- 5. Lethal / Non-Lethal (Offense / Defense)**
 - Policy, Sensor Capability
- 6. Sustainment**

(Sustain Logistics CO/BN & above)

 - Logistics Convoy - Payload vs. Specific Platform vs. Ldr/Follower
 - Casualty Evacuation – Payload vs. Specific Platform
 - Materiel Handling Equipment
 - Arm/Refuel (POL Delivery)



Lighten the Load

- Manned Vehicles
- Unmanned Vehicles
- Exoskeletons
- Animals



SMSS (OX)



GATOR



MULE



EXO-SKELOTEN



Real Mule



Big Dog

Leadership • Service • Innovation



Funded Systems in Development

Common Mobility Platform (CMP) Counter-IED and Lethal Variants

- ◆ Autonomous Navigation System (ANS) has demonstrated “stand-alone” capabilities – potential to use as common robotic appliqué to enable scalable autonomy for existing platforms
- ◆ Potential to leverage capabilities for multiple platforms and future Multi-Mission Unmanned Ground Vehicle

Small Unmanned Ground Vehicle (SUGV) XM1216

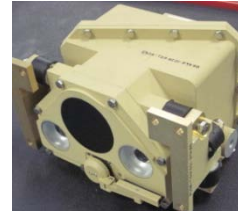
- ◆ First Unit Equipped will be 3rd Brigade of the 1st Armored Division scheduled in April 2011



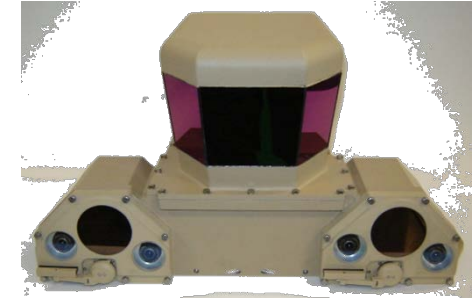


Autonomous Navigation System (ANS) Providing Unmanned Navigation for MM UGV

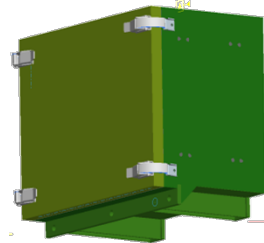
- LIPM: LADAR Imaging Perception Module
 - LADAR + Stereo Visible, IR, and Low Light cameras for 3D imaging
 - Autonomous driving, remote operations, detecting objects, terrain, ranging
 - Support Situational Awareness
- IPM: Imaging Perception Module
 - Mono Visible, IR, and Low Light cameras
 - Support Situational Awareness
- MMWR: Millimeter Wave Radar
 - Tracking in rain/fog/smoke
 - Early warning for approaching vehicles with high closing rates
- GPS/INS: Global Positioning System / Inertial Navigation System
 - Position, velocity, and attitude determination
- ACS: ANS Computer System
 - Hardware Sensor Processing
 - SoSCOE interface
 - Path planning
 - Video processing
 - Object processing
 - Speed and curvature commands
- Self Cleaning
 - Central reservoir, pump
 - Interior tubing
 - Sensor mounted nozzles



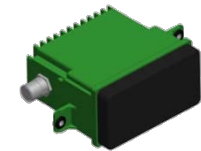
Imaging Perception Module (IPM)



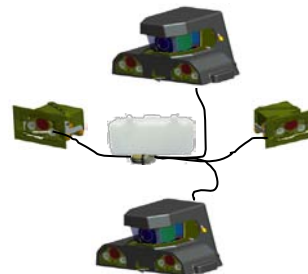
LADAR & Imaging Perception Module (LIPM)



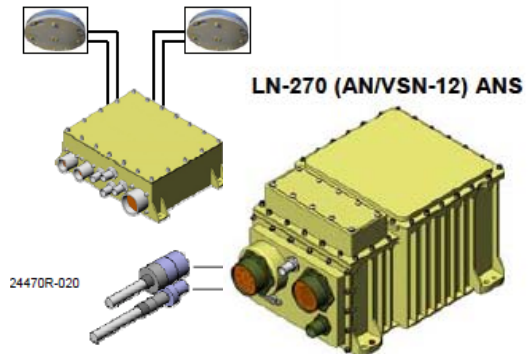
ANS Computer System (ACS)



Millimeter Wave (MMW) RADAR



Self Cleaning



LN-270 (AN/VSN-12) ANS

GPS/INS



ANS: Help Needed with Technologies

- Negative Obstacle Detection
 - Detection Limited by Sensor Heights
 - Ground Height Algorithms Improvement
- Driver (Smart or Aided Tele-Op) Aids
- Human Detection and Classification Algorithm
- Low Cost LADAR Development
 - LIPM MTO in staffing
 - Detector Producibility
- Simulation for Operational Test Support
 - Design of Experiments (DOE) to examine environmental conditions
 - Determine measures of effectiveness/performance for military utility
 - Reduce operational test iterations and cost
 - Access robustness of algorithms across a wide range of conditions
 - Performance in Degraded Environments: snow, rain & fog
 - Mobility Hazard Conditions: mud, water & ice
 - Testing Autonomy, Success / Failure Criteria

Increment 2 SUGV: Final Product to be completed in FY 2012

GPCS (HMS, GPS, Antenna)

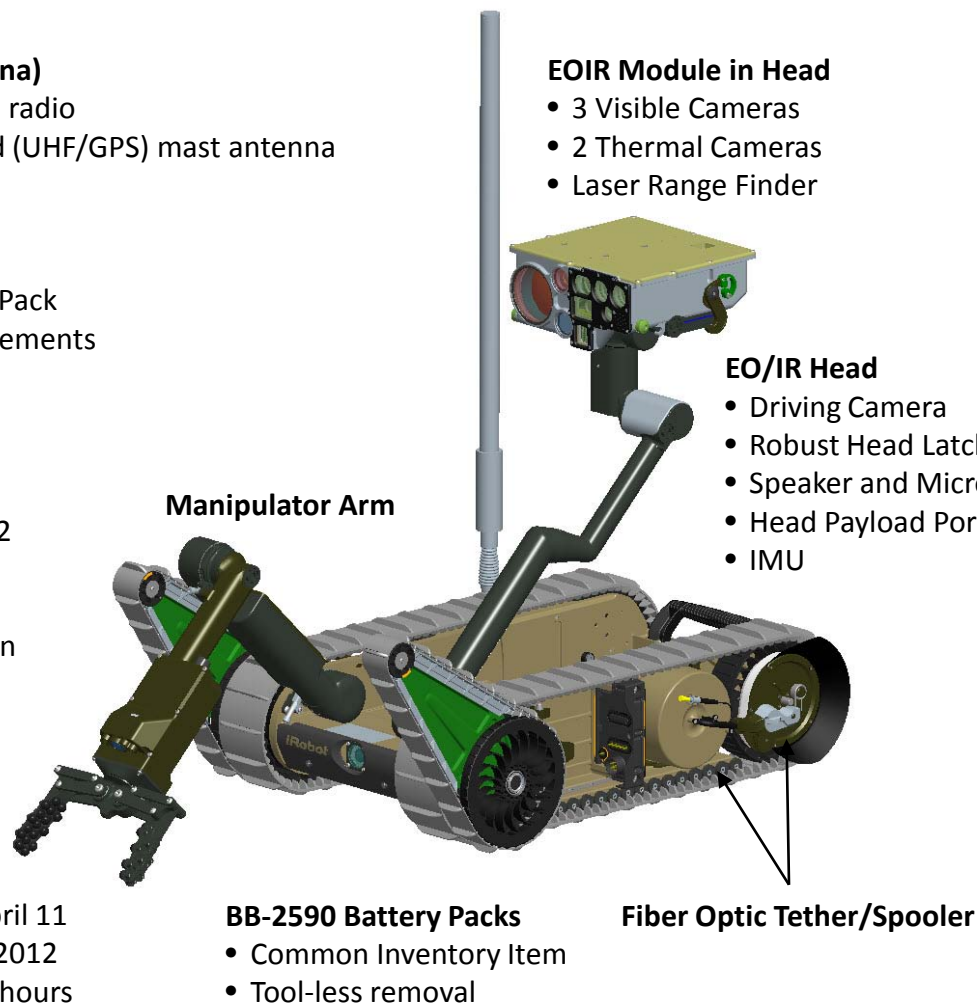
- HMS SFF-D-based UHF radio
- Head-height dual band (UHF/GPS) mast antenna

Chassis

- Fits in a Single MOLLE Pack
- Meets Mobility Requirements
 - Slopes
 - Steps
 - Subterranean
 - Water
- CPU Upgrade/AWARE 2
- Flippers
 - 360 Rotation
 - Obstacle navigation
 - Stair Climbing
 - Self-Righting
- Tool-less Removal

Increment One SUGV

- Fielding to 1st BDE: April 11
- Fielding to 2/3 BDEs: 2012
- RAM/MTBSA: over 84 hours vs. req of 42 hours



ETESS



Controller



CBRN payload



SUGV: Help Needed with Technologies

- **Radio/Non Line of Sight Communications:** 1000m LOS operational control requirement. Limitations with 19" antennas and power sources often prevent the SUGV from meeting the requirement
- **Latency/Bandwidth:** Current GPCS has 1.2 mbps (with ~450ms latency), to enhance effectiveness prefer 2 mbps for video/data with acceptable latency (*250 ms round trip or less*) to support vehicle control
- **Weight: 35lbs with 4lbs per payload.** Weight is critical to the Dismounted Soldier
 - Require assistance in finding low cost, lightweight yet durable material
- **Endurance/Operating Temperatures with Batteries:** BB2590, SUGV requires two batteries at 3.25lbs each, operating time six hours
 - Current Batteries are heavy and quickly degrade after 4°F
- **Manipulator Arm Development**
 - Non Lethal Deployment: Gripper and Arm to deploy Non-Lethal payloads
 - Weight: Need help with light weight solution. Current arm is 5.6 lbs.
- **Semi-Autonomous operations:** No current requirement but desired by the User
 - User is interested in means to reduce the workload of the Soldier



Back-ups