



Advanced Explosive Ordnance Disposal Robotic System (AEODRS)



Industry Awareness Day
6 October 2011

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

UNCLASSIFIED//FOR OFFICIAL USE ONLY

Agenda



 **Welcome - PMS-408/TECHDIV/APL**

 **Contracting Officer's Comments - IHD Contracts**

 **AEODRS Overview - PMS-408/TECHDIV**

 **Review Of Draft Statement Of Work - TECHDIV**

 **Review Of Evaluation Information - IHD Contracts**

 **Wrap-up - TECHDIV/APL**



Purpose

-  **Update industry on the status of the contracting approach for an Integrator to lead the integration and fielding of Increment 1 of the Advanced Explosive Ordnance Disposal Robotic System**
-  **Provide overview of the program to date**
-  **Receive feedback from industry**

Contracting Officer Comments



Today's remarks by Government officials involved in the AEODRS Industry Day should not be considered a guarantee of the Government's course of action in proceeding with the program. The information shared today reflects current Government intentions and is subject to change based on a variety of circumstances including internal and external comments. The formal solicitation, when issued, is the only document that should be relied upon in determining the Government's requirements.

Agenda



 **Welcome - PMS-408/TECHDIV/APL**

 **Contracting Officer's Comments - IHD Contracts**

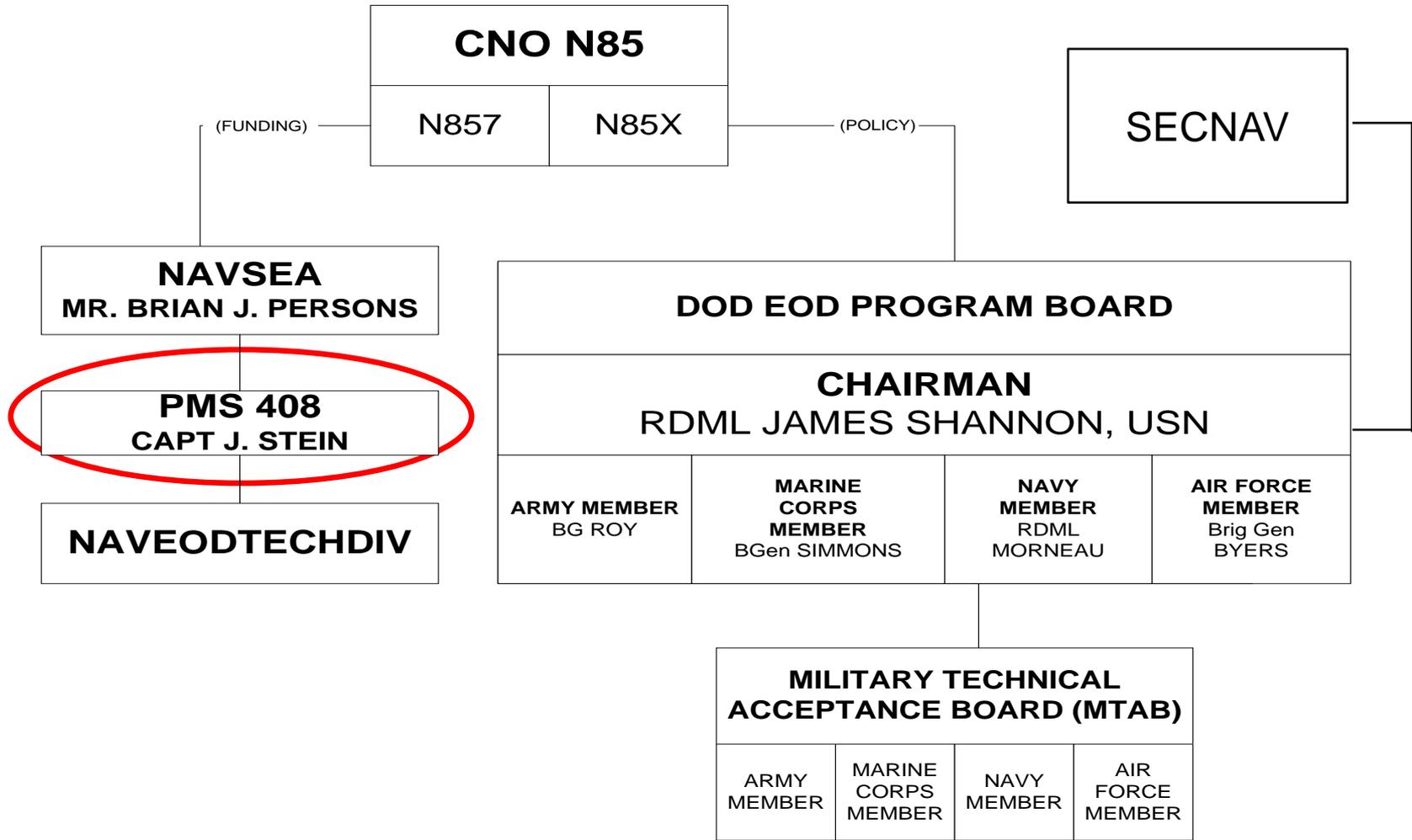
 **AEODRS Overview - PMS-408/TECHDIV**

 **Review Of Draft Statement Of Work - TECHDIV**

 **Review Of Evaluation Information - IHD Contracts**

 **Wrap-up - TECHDIV/APL**

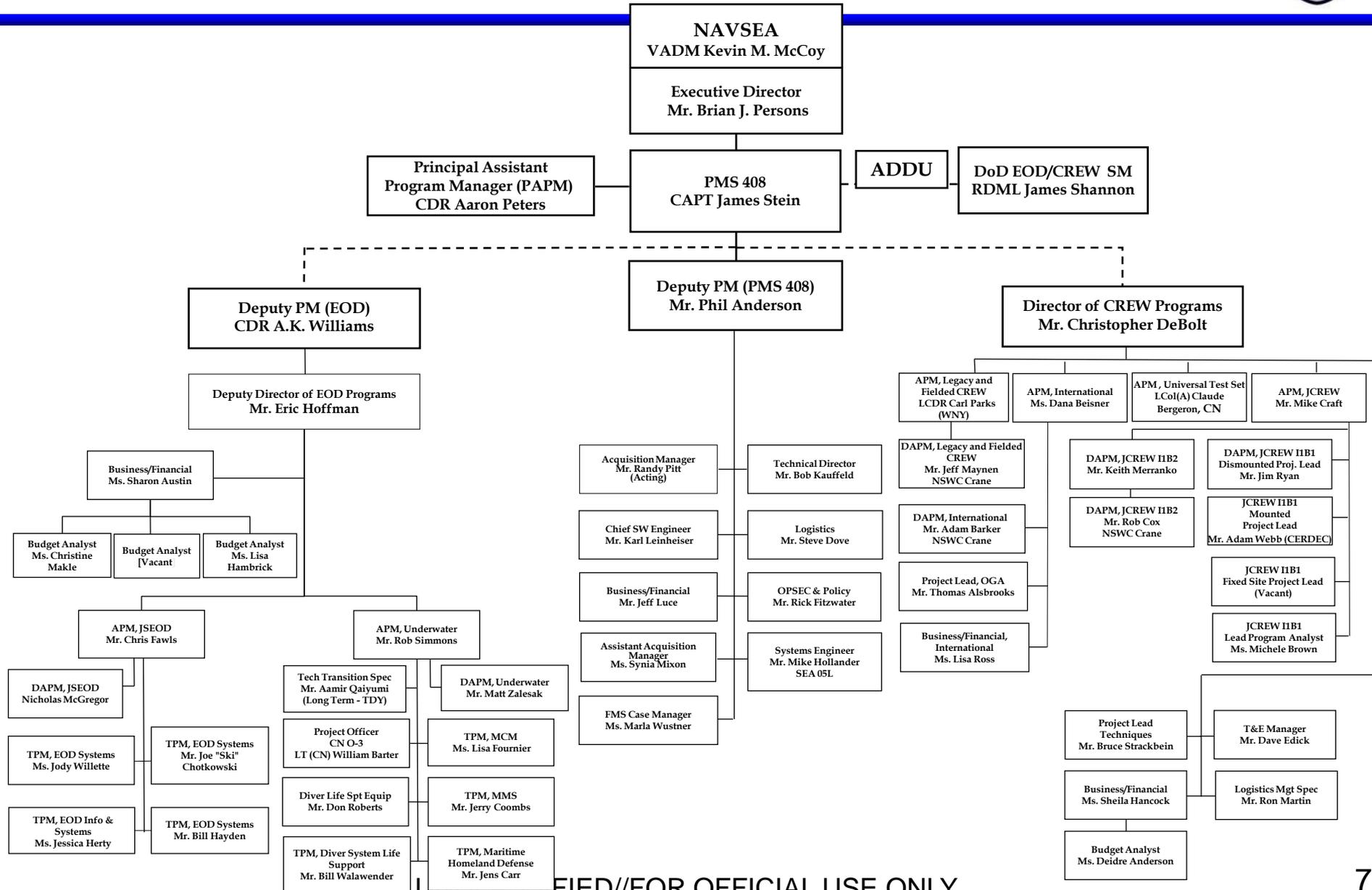
Joint Service EOD Technology



**CNO (N85) is Resource Sponsor for all PMS-408(EOD) RDT&E and OPN.
CNO (N43) is Resource Sponsor for all PMS-408(EOD) O&MN.**



PMS 408 Organization



Program Management Office EOD/CREW (PMS 408)



PMS-408 provides Acquisition and Life Cycle Management of:

- Joint Service EOD Programs
- Joint CREW Systems
 - Ground based EW Force Protection Systems
- Underwater EOD Programs
 - Small UUVs / MCM Systems
 - Marine Mammal Systems
 - Life Support / Salvage Systems
 - Maritime / Homeland Defense Systems

Responsibilities include Budgeting, Development, Production, In-service Engineering, and Operation and Maintenance Support

Marine Mammal Programs

Deployable MCM and Force Protection Assets



Joint Service EOD Programs



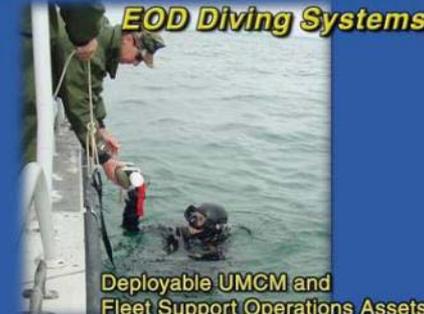
Rapid Response Forces for IED/UXO Incidents

Small UUV Programs



Deployable UUV Assets to Support VSW MCM and EOD Missions

EOD Diving Systems



Deployable UMCM and Fleet Support Operations Assets

The EOD Mission Requires Specialized Systems and Equipment:

- Exploration and Reconnaissance MCM
- Low Visible Operations
- Low Signature (Magnetic and Acoustic)
- Operation in Harsh Environments
- Small, Mobile, Deployed EOD Forces

EOD Mission

Eliminate Explosive Hazards Which Jeopardize Operations in Support of the National Security Strategy (Peacetime, Wartime, Operations Other Than War)

EOD FUNCTIONS

DETECT/LOCATE
ACCESS
DIAGNOSTICS
(IDENTIFY/EVALUATE)
RENDER SAFE
NEUTRALIZE
RECOVER
EXPLOIT/INTEL
DISPOSE



EOD THREAT AREAS

IMPROVISED EXPLOSIVE DEVICES (IED)

UNEXPLODED ORDNANCE (UXO):

- SURFACE/AIR
- UNDERWATER

CBRNE:

- IMPROVISED WMD (CHEM/BIO/NUCLEAR)
- NUCLEAR MUNITIONS
- CHEM/BIO MUNITIONS

Threat IED and UXO are Constantly Evolving in Complexity, Diversity, and are More Widely Encountered than Ever Before

Currently Fielded EOD Robotic Systems



MK 1 MOD 0 ROBOT, EXPLOSIVE ORDNANCE DISPOSAL

MK 1



MK 2 MOD 0 ROBOT, EXPLOSIVE ORDNANCE DISPOSAL

MK 2



MK 3



Currently Fielded Robotic Systems



💣 **Current EOD Robots are Modified Commercial Products**

💣 **Different Operator Control Units**

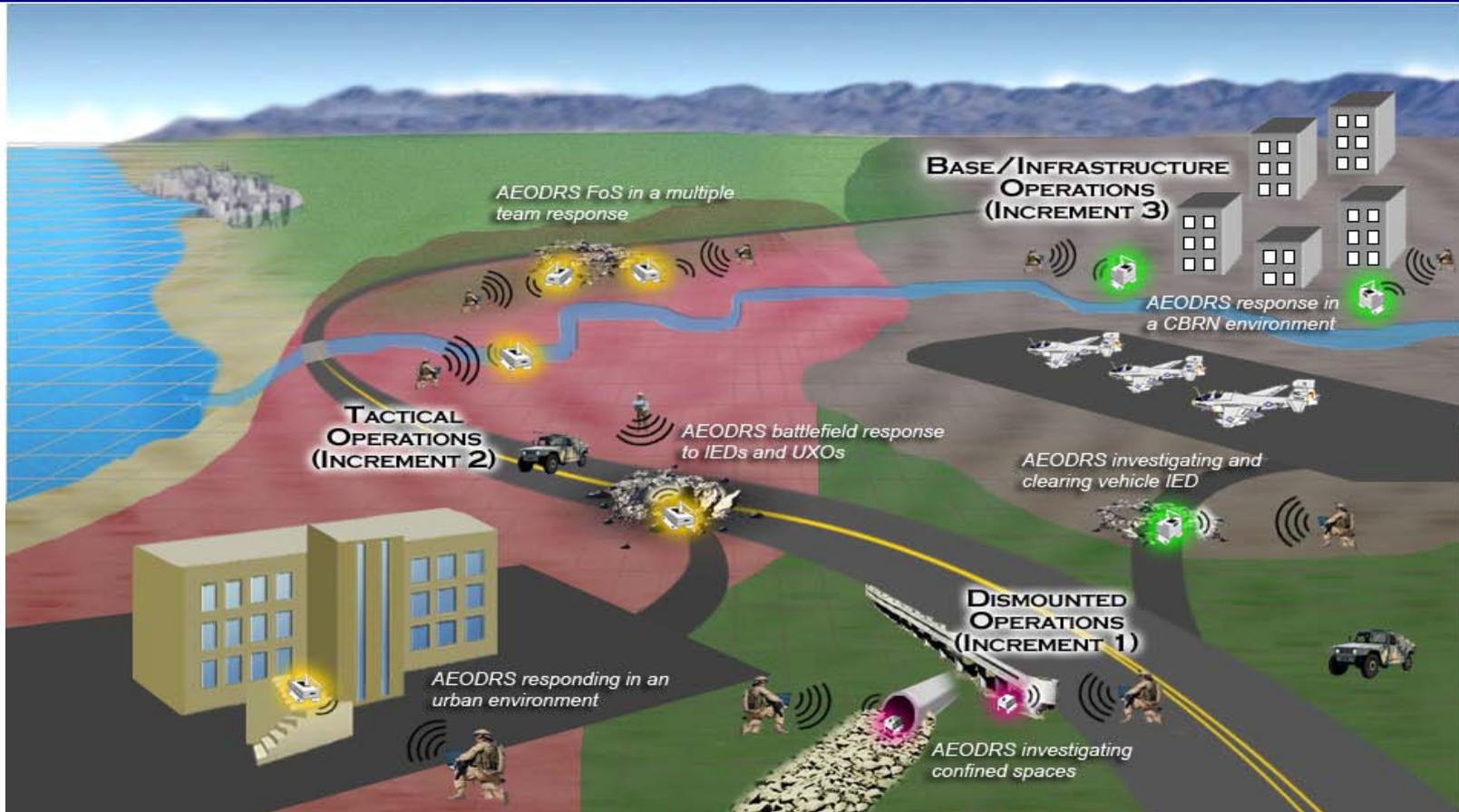
💣 **Limited Autonomy**

💣 **Different Architectures and Designs**

- Logical
- Electrical
- Physical

💣 **Company Proprietary Software**

Advanced EOD Robotic System (AEODRS)



Increment 1: Dismounted Operations

- Back-packable
- Reconnaissance and assessment (to 100m)
- Smallest Unit (<35 lbs)
- Fills Capability Gap

Increment 2: Tactical Operations

- 2-man portable
- Down range reconnaissance and prosecution assessment (to 1000m)
- Unit size (<165 lbs)
- Replaces existing robot class

Increment 3: Base/ Infrastructure

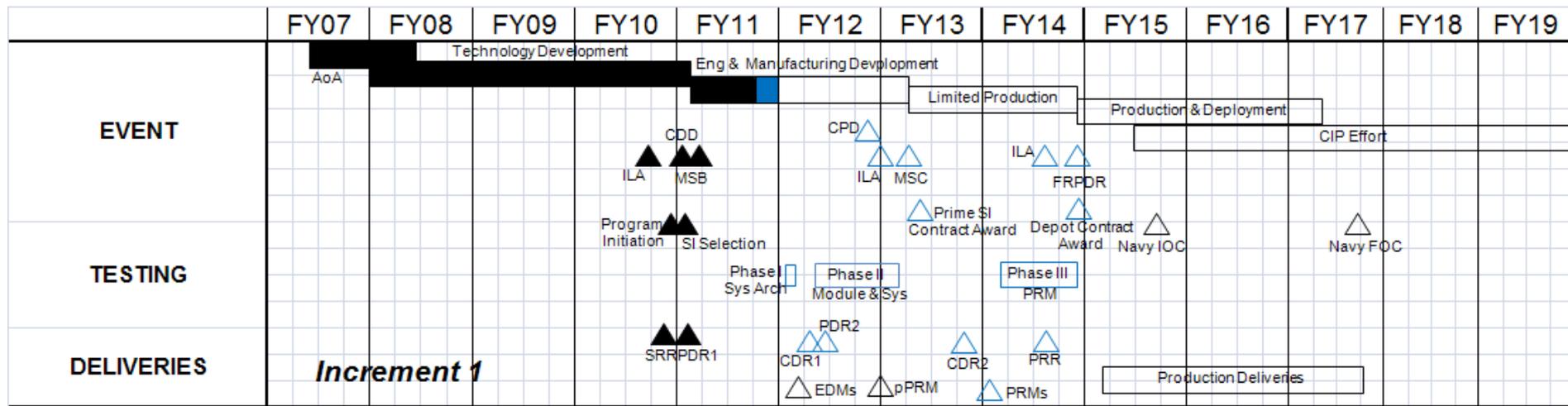
- Trailer transportable
- Provides heavy lifting capability
- Largest unit size (750 lbs)
- Replaces existing robot class

Advanced EOD Robotic System (AEODRS)



- 💣 Acquisition Category (ACAT) IVM Program of Record
- 💣 Milestone Decision Authority – NAVSEA
- 💣 Milestone B Approval – December 2010
- 💣 Provides Joint Forces with an EOD capability to respond to Unexploded Ordnance (UXO), Counter Improvised Explosive Device (C-IED), and Weapons of Mass Destruction (WMD) missions
 - Comprised of three system variants fielded in an incremental approach
 - All systems use a Government-owned common system architecture & interfaces
- 💣 Systems comprised of components capable of being developed by independent entities through a competitive procurement process
 - Modular/Plug and Play components
 - Effort to maximize business competition
 - Foster new and innovative ideas

Program Schedule AEODRS Increment 1



Increment 1 Requirements Overview

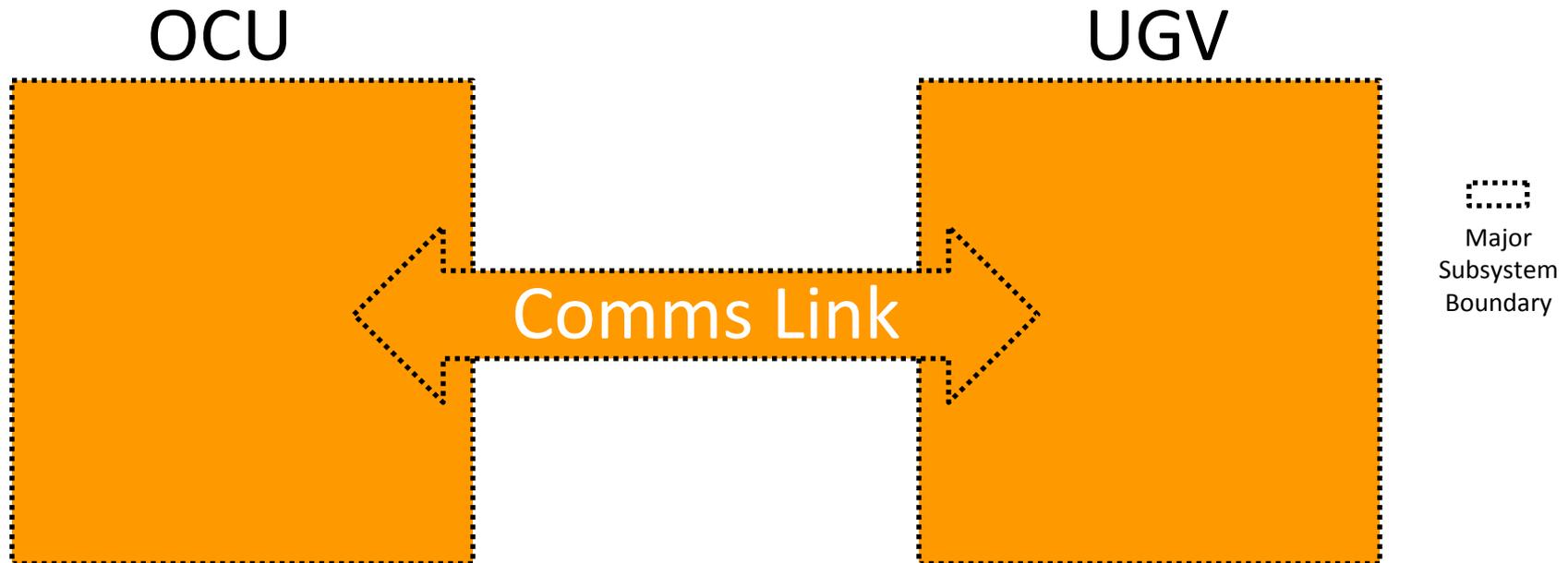


Dismounted Operations

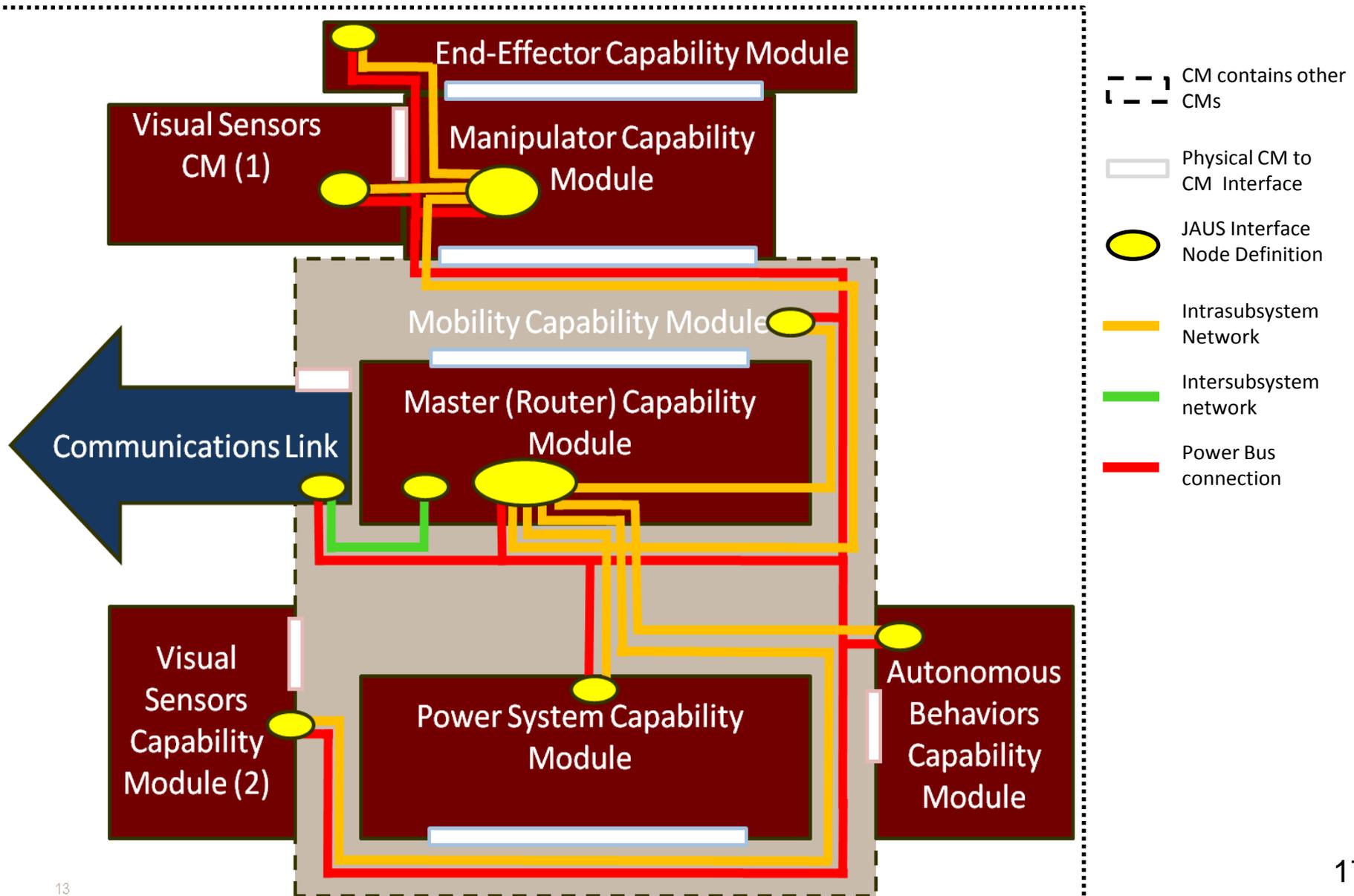
- **Back-packable, 35 lbs not including backpack (KPP)**
- **0.80 Operational Availability (KPP)**
- **720 hrs MTBF (KSA)**
- **100 meter range**
- **6 hour endurance**
- **4 DOF manipulator, 5 lbs lift at full extension**
- **8 mph vehicle speed**
- **Able to travel through 18 inch culvert**
- **No stair climbing**

Increment 1 Subsystems

- There are 3 major subsystems for the Increment 1 System: The Operator Control Unit (OCU), The Unmanned Ground Vehicle (UGV), and the Communications Link (Comms Link) that bridges them.



Generalized Architecture of UGV



Architecture



Logical

- JAUS/SAE AS-4 based
- Distributed Control

Service	Message	Type	Description
Skid-Steer Driver	SetSkidsteerTrackDriver	Input	This message commands open-loop platform motion control of a skid-steer platform, by specification of proportional efforts for port and starboard track drives.
	SetSkidsteerVelocity	Input	This message commands closed-loop platform velocity control of a skid-steer platform, by specification of linear and rotational velocity.
	QuerySkidsteerTrackDriver	Input	This message requests a report of current commanded port and starboard propulsive efforts.
	QuerySkidsteerSpecifications	Input	This message requests a report of platform specifications specific to skid-steer vehicles.
	ReportSkidsteerTrackDriver	Output	This message provides a report of current commanded values of port and starboard propulsive efforts.
	ReportSkidsteerSpecifications	Output	This message provides a report of platform specifications peculiar to skid-steer vehicles.

Architecture

💣 Electrical

- Communications Bus – Gigabit Ethernet
- Power
 - Dismounted Variant – 24 VDC power bus

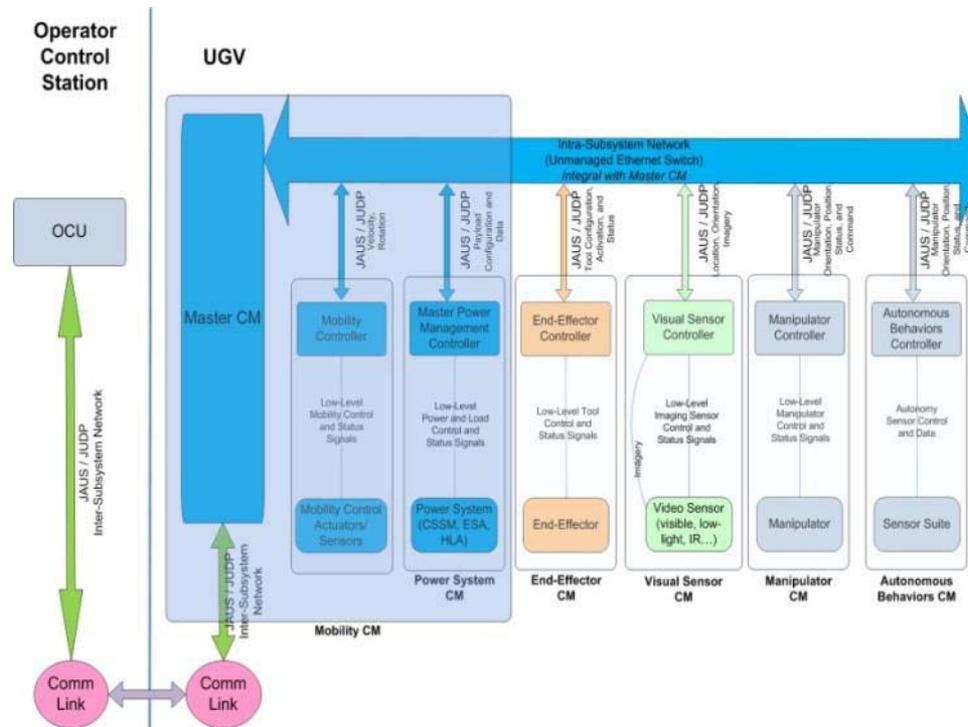
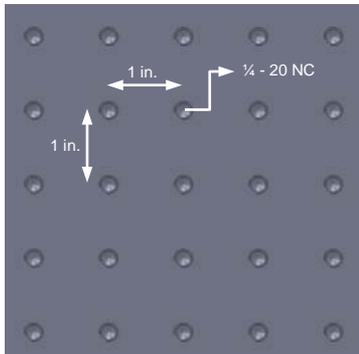


Illustration of Capability Module Concept of Common Architecture

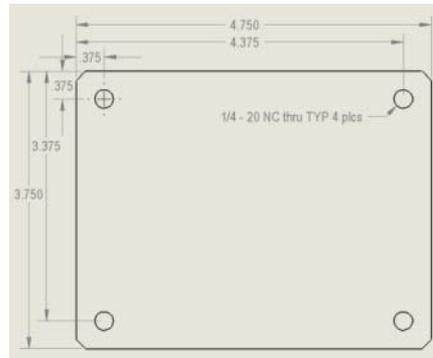
Architecture

Physical

- **Mounting - Simple pattern of 1/4-20 threaded holes**
- **Exterior Connectors - MIL-DTL-38999L Series II Connector**

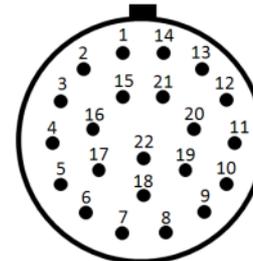


Exemplary 1/4 - 20 NC threaded hole pattern on a 1 inch x 1 inch grid spaced on center



Area allocation for the Manipulator CM – Mobility CM interface

Looking into receptacle - Master keyway at nominal position

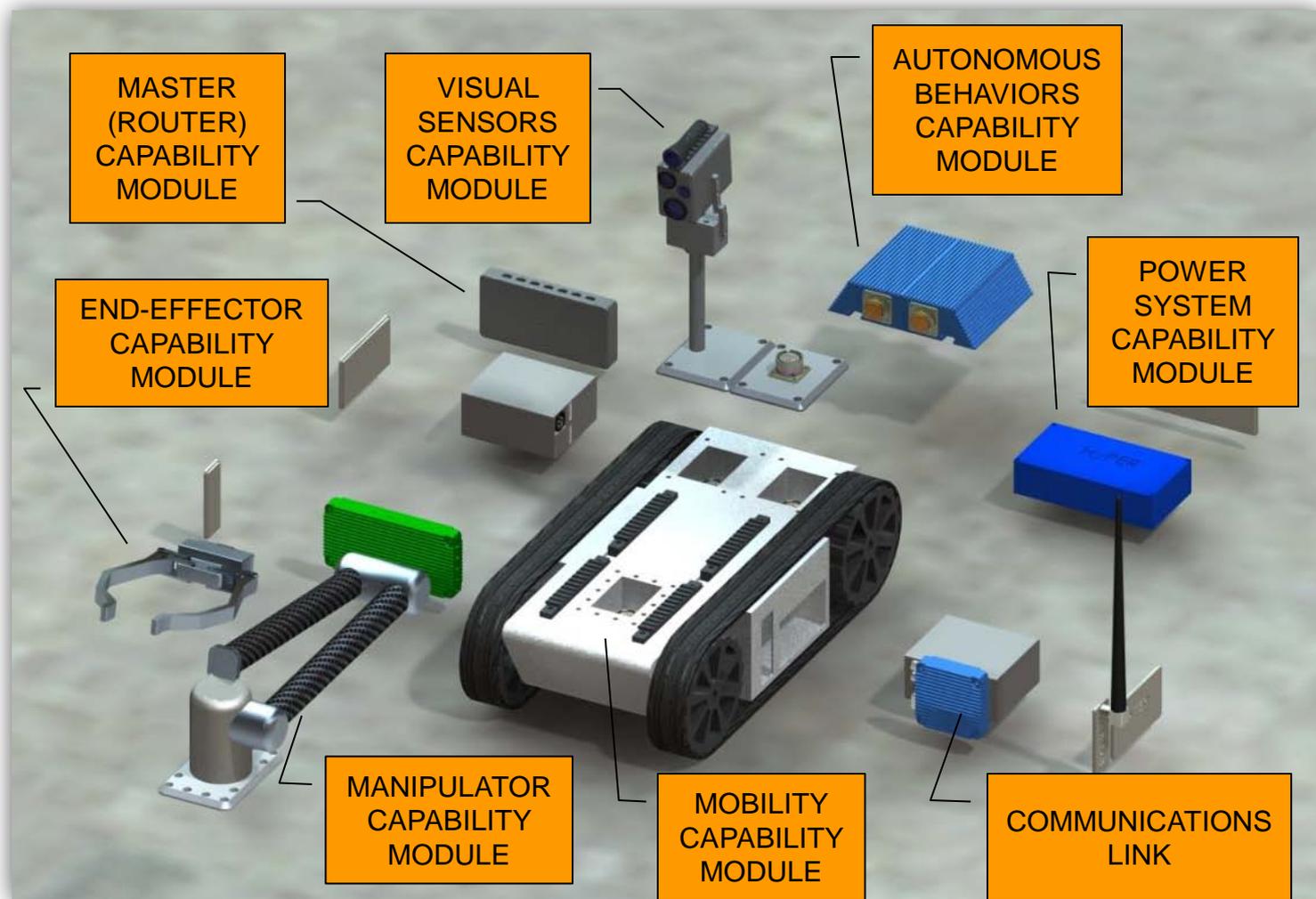


Insert Arrangement 12-35

Common pinout for external Mobility CM interfacing elements

Pin #	Signal Name	Pin #	Signal Name
1	Data_A-	13	Data_B-
2	Data_C+	14	Data_A+
3	Data_C-	15	Data_D-
4	Power_GND	16	Power_GND
5	Config_A	17	Config_C
6	Power_24V	18	Power_24V
7	Power_24V	19	Config_D
8	Power_24V	20	Power_GND
9	Power_24V	21	Data_D+
10	Config_B	22	Power_GND
11	Power_GND		
12	Data_B+		

Increment 1 UGV Concept



Technical Documentation



System Performance Specification

- AEODRS Increment 1 Performance Specification

Subsystem Performance Specifications

- AEODRS Performance Specification for Communications Link Subsystem
- AEODRS Performance Specification for Handheld Operator Control Unit Subsystem

Capability Module Performance Specifications

- AEODRS Performance Specification for Mobility Capability Module
- AEODRS Performance Specification for Master Capability Module
- AEODRS Performance Specification for Power Capability Module
- AEODRS Performance Specification for Manipulator Capability Module
- AEODRS Performance Specification for End Effector Capability Module
- AEODRS Performance Specification for Visual Sensors Capability Module
- AEODRS Performance Specification for Autonomous Behaviors Capability Module

Technical Documentation



Architecture Overview Documentation

- AEODRS Common Architecture Description Document
- AEODRS Autonomous Behaviors Architecture Description Document
- AEODRS Power System Architecture Description Document

Interface Control Documentation

- Interface Control Document for Communications Link Subsystem
- Interface Control Document for Handheld Operator Control Unit Subsystem
- Interface Control Document for Mobility Capability Module
- Interface Control Document for Master Capability Module
- Interface Control Document for Power Capability Module
- Interface Control Document for Manipulator Capability Module
- Interface Control Document for End Effector Capability Module
- Interface Control Document for Visual Sensors Capability Module
- Interface Control Document for Autonomous Behaviors Capability Module

Technical Documentation



Miscellaneous Documentation

- AEODRS Common Information
- AEODRS Common Architecture JAUS Extension Services

Documentation is collectively known as the AEODRS Documentation Package

- Version 1.0 released on 4 Feb 11
- Version 1.1 released early Oct 11
- Version 1.2 to be released prior to potential Increment 1 Integrator RFP

EMD System Integration



- 💣 System Integrator for Increment 1 Engineering & Manufacturing Development Phase (EMD) is The Johns Hopkins University Applied Physics Laboratory (JHU/APL)
 - Navy University Affiliated Research Center (UARC)
 - JHU/APL is subcontracting the development of five of the capability modules (CM) and OCU hardware
 - Government is developing the OCU software, the Autonomous Behaviors CM, the Power System CM, and the Comms Link
- 💣 The integrated system will be known as the pre-Production Representative Model (pPRM)

EMD Subsystem and Capability Module Developers



UGV Capability Modules

- Mobility CM – MacroUSA/Northrop Grumman
- Master CM – RE2
- Manipulator CM – RE2
- End Effector CM – RE2
- Visual Sensors CM – Chatten Associates
- Power System CM – Applied Research Lab (Penn State)
- Autonomous Behaviors CM – SPAWAR/APL

Comms Link – NAVEODTECHDIV

Handheld OCU

- Software – SPAWAR MOCU
- Hardware – Industry TBD

AEODRS vs. Status Quo



Architecture

- AEODRS - Major interfaces within each variant will be defined and configuration controlled by the Government who will make the interfaces “open” to all CM and Subsystem competitors
- Status Quo – Major interfaces within the system are manufacturer specific or “closed;” OEM decides who to release proprietary interface data to

Technology Infusion

- AEODRS – Open architecture promotes future technology infusion in a truly competitive environment
- Status Quo – Technology infusion generally occurs in a sole-source environment with the OEM

AEODRS vs. Status Quo



- 💣 This is not to imply that AEODRS will not make use of COTS and will not benefit from past “lessons learned”
 - CMs and Subsystems are not being developed from “scratch”
 - The state-of-the-art for many CMs and Subsystems (e.g. platform, manipulator) is sufficient to meet AEODRS performance requirements.
 - Development funding is focused on modification of COTS to conform to AEODRS architecture.
- 💣 Proprietary Issues
 - CMs and Subsystems remain proprietary to their respective companies
 - Government places CMs and Subsystems under high-level configuration control similar to configuration management strategy used for MK 1 and MK 2

Agenda



 **Welcome - PMS-408/TECHDIV/APL**

 **Contracting Officer's Comments - IHD Contracts**

 **AEODRS Overview - PMS-408/TECHDIV**

 **Review Of Draft Statement Of Work - TECHDIV**

 **Review Of Evaluation Information - IHD Contracts**

 **Wrap-up - TECHDIV/APL**

Agenda



- 💣 Welcome - PMS-408/TECHDIV/APL**
- 💣 Contracting Officer's Comments - IHD Contracts**
- 💣 AEODRS Overview - PMS-408/TECHDIV**
- 💣 Review Of Draft Statement Of Work - TECHDIV**
- 💣 Review Of Evaluation Information - IHD Contracts**
- 💣 Wrap-up - TECHDIV/APL**

Agenda



- 💣 Welcome - PMS-408/TECHDIV/APL**
- 💣 Contracting Officer's Comments - IHD Contracts**
- 💣 AEODRS Overview - PMS-408/TECHDIV**
- 💣 Review Of Draft Statement Of Work - TECHDIV**
- 💣 Review Of Evaluation Information - IHD Contracts**
- 💣 Wrap-up - TECHDIV/APL**

Wrap-Up



- **All questions and answers will be recorded and posted to FedBizOpps within 30 calendar days**
 - <https://www.fbo.gov/>
- **RFP planned to be released in March 2012**



Questions?



Backups



PMS-408 Stakeholders

- 💣 **DOD Executive agent for Military Ground-Based CREW Technology**
 - Currently assigned to SECNAV
- 💣 **Single Manager for EOD and CREW**
 - Currently assigned to Commander, NSWC (RADM Shannon)
- 💣 **Milestone Decision Authority**
 - ASN-RDA for ACAT II programs
 - NAVSEA for ACAT IV programs
- 💣 **OPNAV**
 - N85 - RDT&E and OPN Resource sponsor for EOD and JCREW 3.3 programs
 - N4 - O&MN Resource sponsor for EOD and JCREW 3.3 programs
- 💣 **User Representatives**
 - CENTCOM
 - NECC - Navy
 - Army
 - Air Force
 - Marine Corps





Joint Service EOD Programs

Capability Description

- Established by DoD Directive 5160.62 - Navy is the single manager for all the services.
- Provides RDT&E, procurement, and life cycle support for specialized systems, equipment and procedures required to support the EOD mission.
- Provides for development of EOD Render Safe Procedures (UXO/IED).
- Supports WMD/IED Countermeasures (CM) with operational and technical information; exploiting, replicating and analyzing threat WMD/IEDs; disseminating TTP and CM information; and providing 24/7 technical reach-back for deployed forces.
- Respond to CENTCOM EOD Urgent Operational Needs



CM Transmitter
AN/PLT-5



AN/PDX-2 Radiac Set



T-Hawk UAS



MK 1 MOD 0



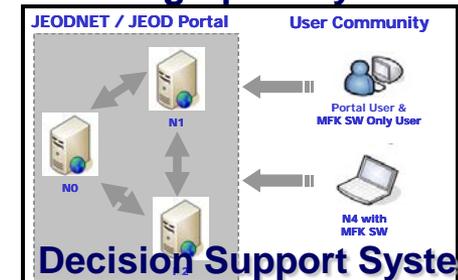
MK 2 MOD 0



Remote Fuze
Disassembly



Radiographic System



Decision Support System

Acquisition Strategy



- **Incremental Approach Selected to:**
 - **Reduce Technical Risk in the Areas of:**
 - **Common System Architecture Development and Integration**
 - **Robotic Subsystem Development and Integration and Interface Design**

- **Common System Architecture Development and Subsystem Development/Integration begins early in Increment 1**
 - **Bench Tested**
 - **Proven out using Engineering Development Models**
 - **Integrated into prototype (pre-Production Representative Model)**
 - **Placed into Limited Production**

- **Interfaces designed to allow for interchangeability**

- **Matured Systems Architecture and Lessons Learned from Increment 1 carried into Increments 2 and Increments 3**
 - **Included as Increment 1 Milestone B Exit Criteria**

Differences Between AEODRS and COTS



Architecture

- **AEODRS** - Major interfaces within each variant will be defined and configuration controlled by the Government who will make the interfaces “open” to all subsystem competitors
- **COTS** – Major interfaces within the system are manufacturer specific or “closed;” Original Equipment Manufacturer (OEM) decides who to release proprietary interface data to

Technology Infusion

- **AEODRS** – Open architecture promotes future technology infusion in a truly competitive environment
- **COTS** – Technology infusion generally occurs in a sole-source environment with the OEM holding most of the cards

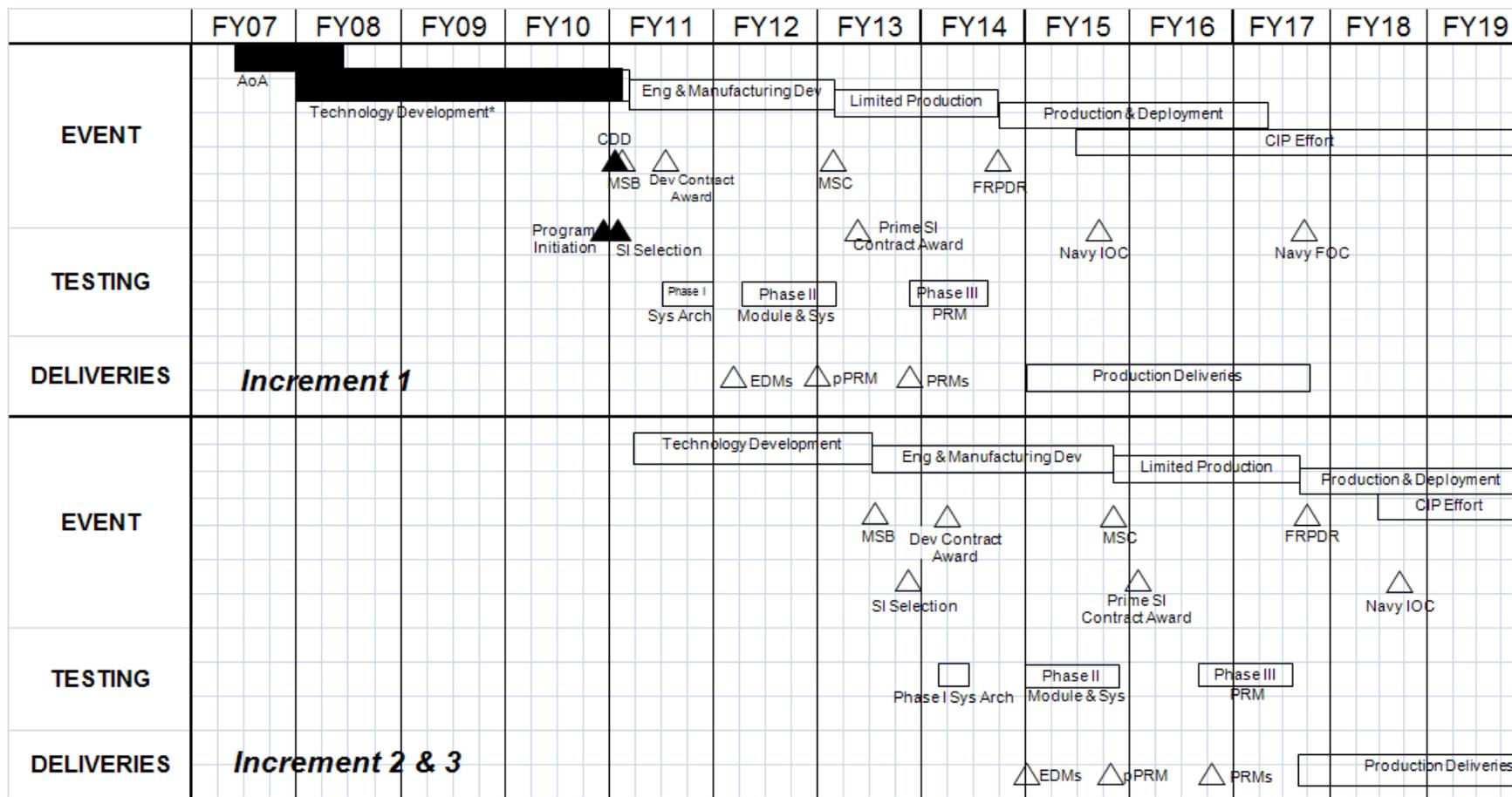
Differences Between AEODRS and COTS (cont'd)



- **AEODRS will make use of COTS subsystems and will benefit from past “lessons learned”**
 - Subsystems are not being developed from “scratch”
 - The state-of-the-art for many subsystems (e.g. platform, manipulator) is sufficient to meet AEODRS performance requirements
 - Development funding will be focused on modification of COTS subsystems to conform to AEODRS architecture
- **Proprietary Issues**
 - Subsystems remain proprietary to their respective companies
 - Government places subsystem under high-level configuration control similar to configuration management (CM) for MK 1 and MK 2 EOD Robots

Program Schedule

AEODRS Increments 1, 2, & 3



Joint Service EOD Business Model

