RV(M) VICTORY/IOP Case Study

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The overall classification level of this brief is: UNCLASSIFIED

We drive the future of the Marine Corps

Agenda

- Overview of Robotic Vehicle Modular RV(M)
  - Expeditionary Modular Autonomous Vehicle
- Concepts of modular payloads
- VICTORY
- IOP
- Conclusion

Robotic Vehicle Modular (RV(M))

Description: Robotic Vehicle (Modular) is a multi-purpose Unmanned Ground Vehicle (UGV), hosting modular payload architecture and providing the ability to rapidly change out payloads for a variety of missions.

Goal: Provide an Expeditionary Landing Team (ELT) with a highly mobile, MV-22 transportable, multiple payload, tactical-scale, platoon-level, infantry support Unmanned Ground Vehicle (UGV) to be utilized in a multitude of missions.

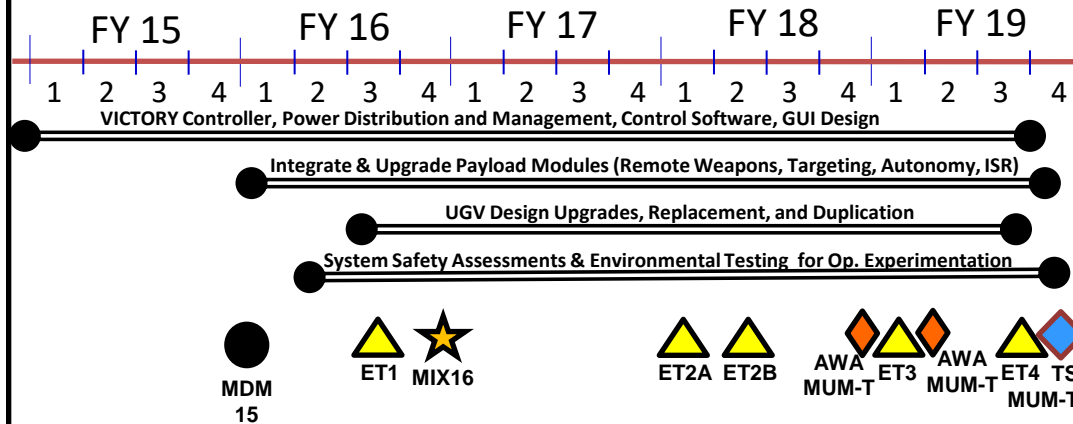**Performer(s):** MCWL, ONR 30, NSWCDD, TORC, ARDEC, Pratt Miller

S&T Thrust Areas: MAGTF Fires, C4ISR, Autonomy/Robotics, Maneuver, Logistics, Force Protection

Marine Corps Operating Concept Linkages:
- *Refine the concept of manned-unmanned teaming (MUM-T) to integrate robotic autonomous systems (RAS) with manned platforms and Marines. Develop CONOPs that support and embrace RAS as a critical enabler. (pg. 16)*
- *Exploit man-machine interface and manned-unmanned teaming to overcome challenges in urban terrain. Develop fires solutions that enable precise effects in compartmentalized terrain. (pg. 21)*
- *Incorporate as quickly as possible unmanned ground vehicles across the MAGTF to enhance survivability, increase lethality, and reduce manpower requirements. (pg. 22)*
- *Explore MUM-T technologies for logistics applications. (pg. 23)*

Stakeholders: MCWL, MCCDC, FMID, JGRIT, DGRA, JCRAS, ONR 30; DTRA, ARDEC, TARDEC, NSWCDD, TORC, PME

Timeline:

	FY 15	FY 16	FY 17	FY 18	FY 19
	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4

VICTORY Controller, Power Distribution and Management, Control Software, GUI Design

Integrate & Upgrade Payload Modules (Remote Weapons, Targeting, Autonomy, ISR)

UGV Design Upgrades, Replacement, and Duplication

System Safety Assessments & Environmental Testing for Op. Experimentation

MDM 15 — ET1 — MIX16 — ET2A — ET2B — AWA MUM-T — ET3 — AWA MUM-T — ET4 — TS MUM-T

# Robotic Vehicle Modular RV(M)

Modular Payloads

VICTORY Background

Initiative Goal: *Create a network-based architecture for integration of electronic systems on [manned] Army and Marine Corps ground vehicles*

- Network Infrastructure
- Shared HW (computing, networking, GPS, etc.)
- Shared data services
- Management services
- Access control services (authentication and authorization)
- Data Protection (IA, network attacks)
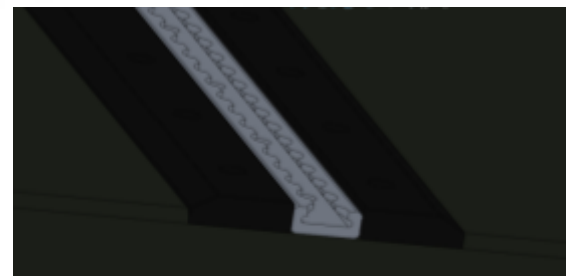

data bus-centric design
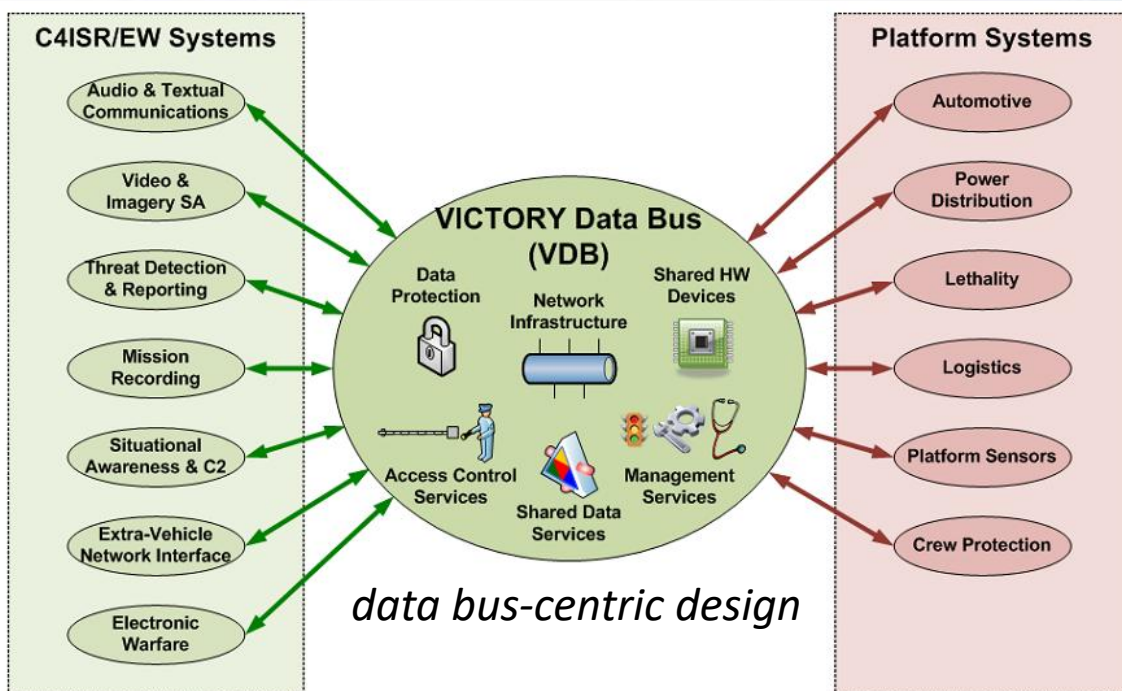
Minimum for VICTORY support:

- VICTORY compliant Ethernet switch
- Time and position shared services
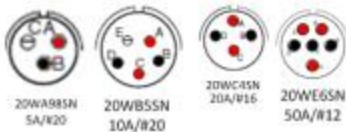- VDB management services
- VICTORY shared processing unit

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Payload-to-Vehicle Interface

- **This was part of the original RV(M) modularity concept, consisting of electrical, mechanical and software definitions.**
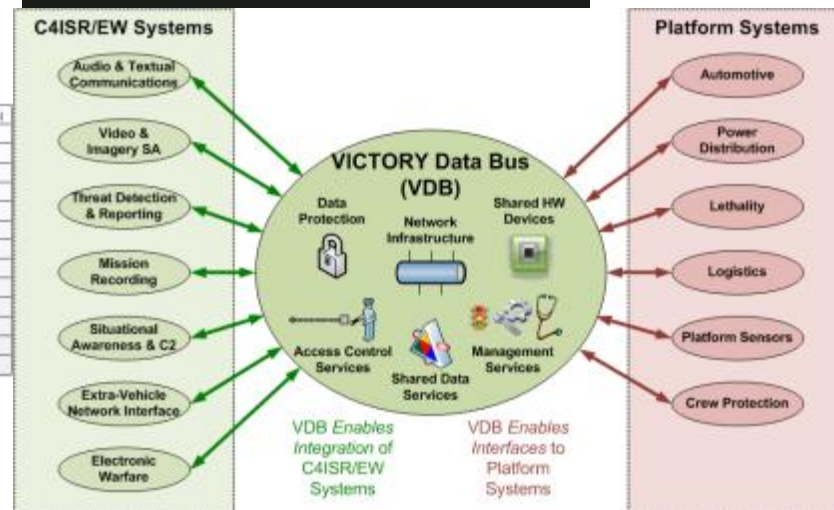
IOP Composition

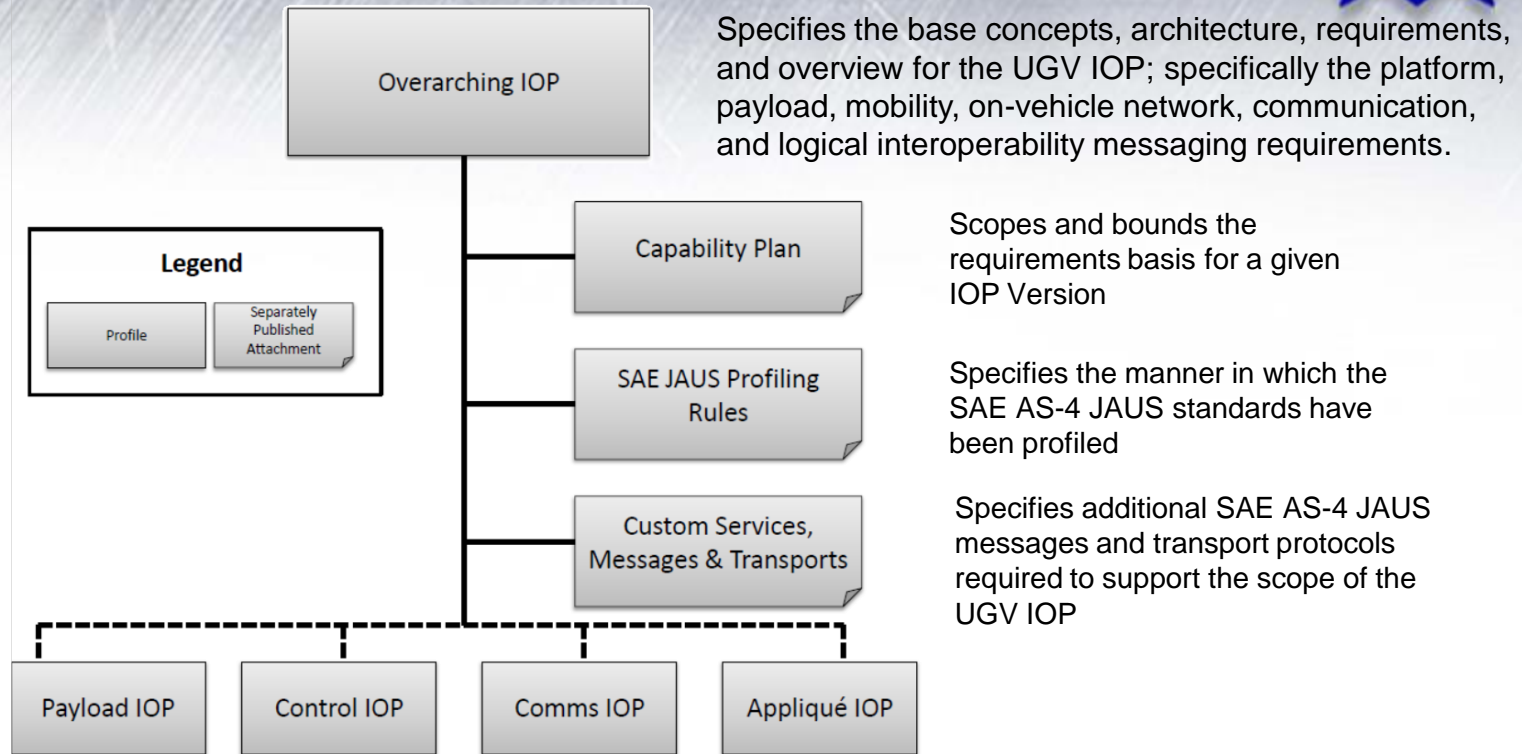Overarching IOP — Specifies the base concepts, architecture, requirements, and overview for the UGV IOP; specifically the platform, payload, mobility, on-vehicle network, communication, and logical interoperability messaging requirements.

Legend
- Profile
- Separately Published Attachment

Capability Plan — Scopes and bounds the requirements basis for a given IOP Version

SAE JAUS Profiling Rules — Specifies the manner in which the SAE AS-4 JAUS standards have been profiled

Custom Services, Messages & Transports — Specifies additional SAE AS-4 JAUS messages and transport protocols required to support the scope of the UGV IOP

Payload IOP — Specifies the payload classification, standards, requirements, and conformance approach

Control IOP — Specifies the Operator Control Unit (OCU) logical architecture, standards, Human-Machine Interface (HMI) requirements, and conformance approach

Comms IOP — Specifies the communications standards, requirements, and conformance approach

Appliqué IOP — Specifies the appliqué systems classification, standards, requirements, and conformance approach

*Mark Mazzara, PM Force Projection IOP Brief25 April 2016

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RV(M) – EMAV u-VICTORY Approach to Open Architecture
(*Modified from Mark Mazzara IOP Brief25 April 2016)

Semi-Autonomy Kit

IOP/VICTORY

Operator Controller

IOP/VICTORY

Modular "uVICTORY" Approach
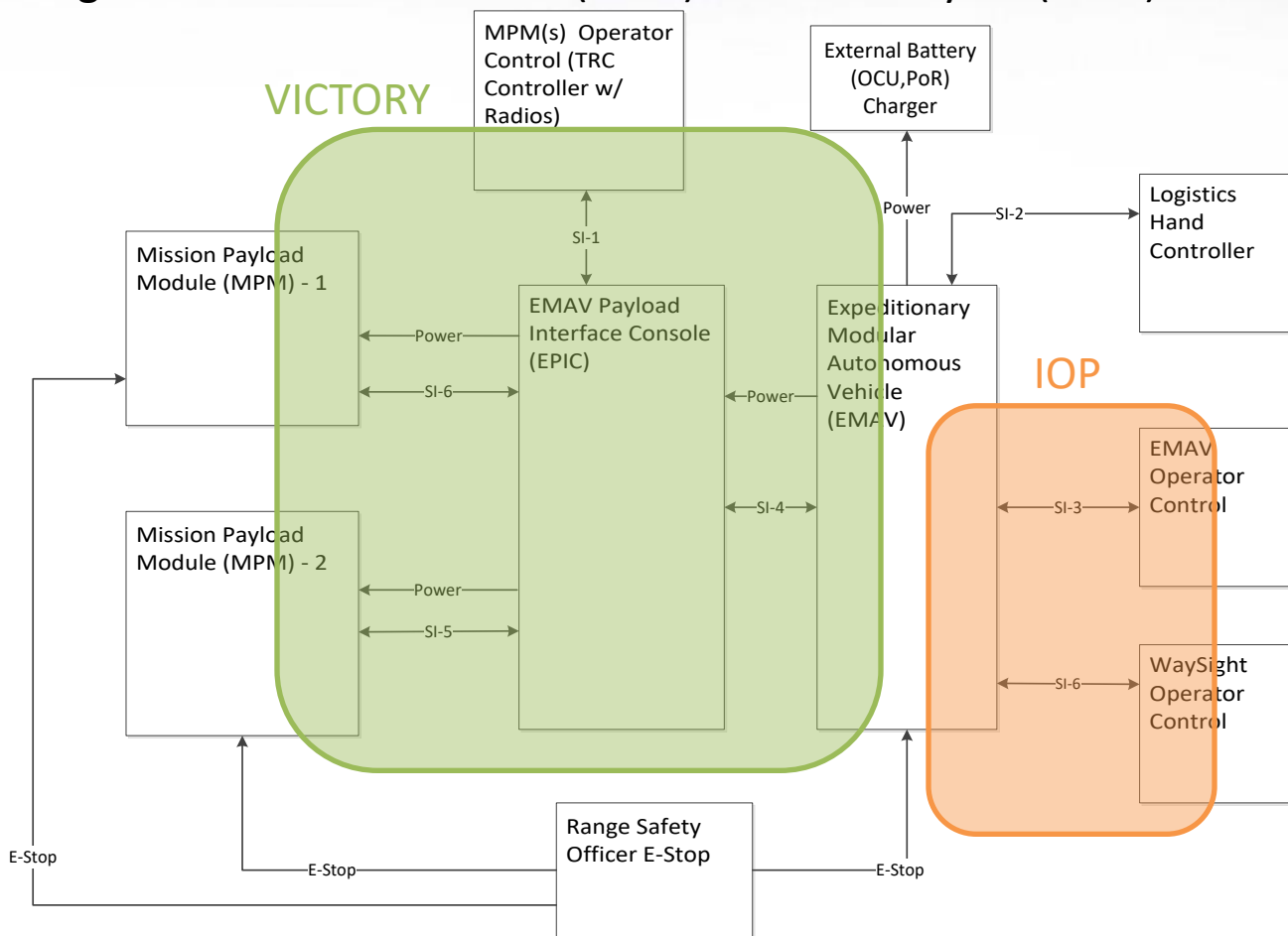
Translation Algorithms

VICTORY

U-VICTORY

Vehicle and Payloads

Robotic Vehicle Modular (RVM) - Interoperability

Overall approach to modularity / common interoperability:
1. VICTORY for C4ISR/EW and Platform interfaces for modular payloads
2. IOP for Warfighter Machine Interfaces (WMI) to Autonomy Kit (A-Kit)

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Conclusion

- **VICTORY for C4ISR/EW, Weapons and Platform interfaces for modular payloads**

- **Using the TARDEC produced VICTORY SDK**

- **Use of PM Force Protection IOP for UGV Command & Control**
  - VICTORY Service-based (pub/sub) architecture and SOAP based management messaging not suited for UGV C2
  - IOP better suited for this.

- **IOP for Warfighter Machine Interfaces (WMI) to Autonomy Kit (A-Kit) and Selected Payloads**

- **Additional Services/Component Types for RVM: TBD**
  - Laser System (undefined/new)
  - Data Logging (experimental)
  - Camera Gimbal (updated)