PEO USC Science and Technology Directorate

Portfolio and UMAA Overview

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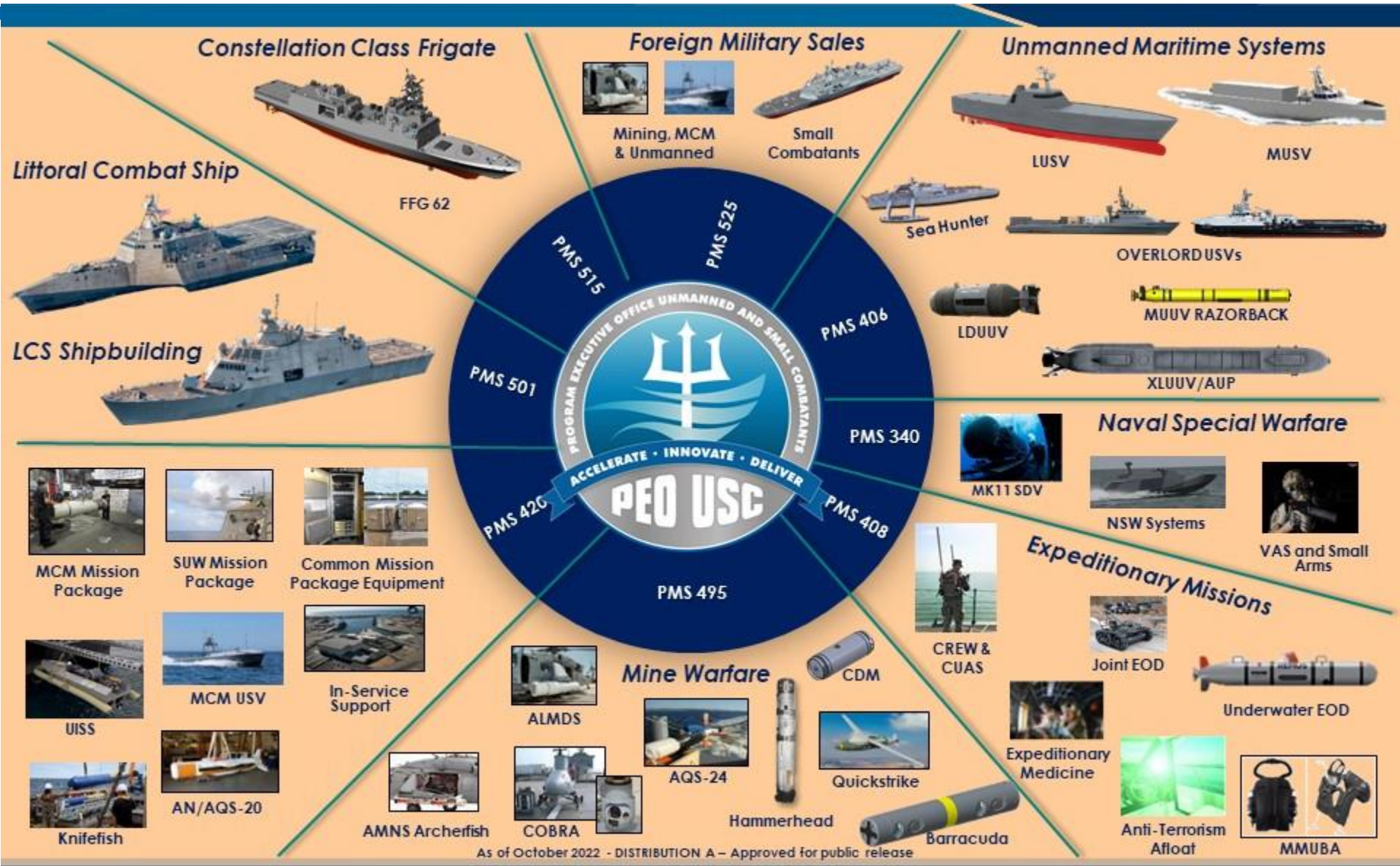
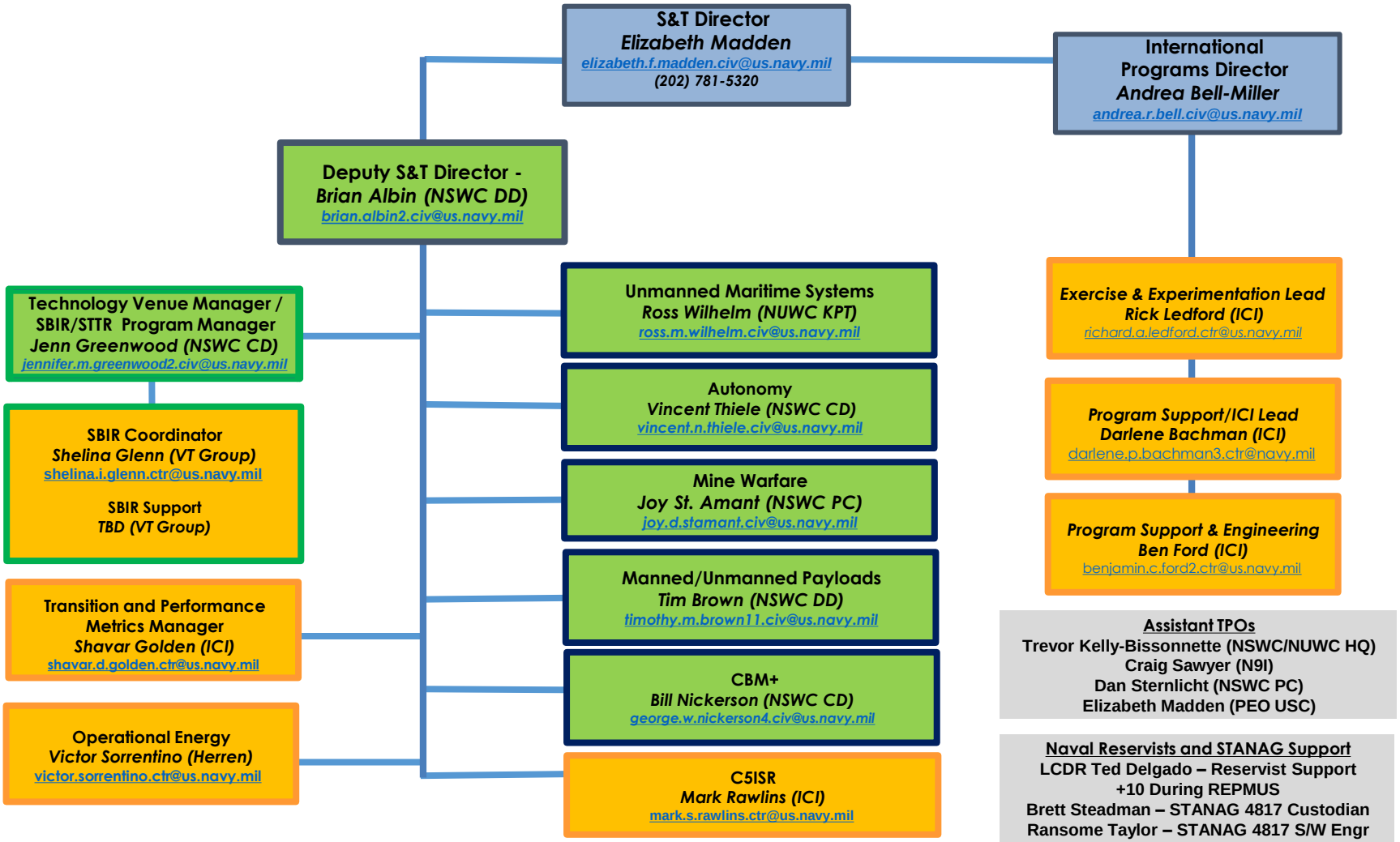
PEO USC Portfolio



As of October 2022 - DISTRIBUTION A – Approved for public release

Organization Chart



Assistant TPOs
Trevor Kelly-Bissonnette (NSWC/NUWC HQ)
Craig Sawyer (N9I)
Dan Sternlicht (NSWC PC)
Elizabeth Madden (PEO USC)

Naval Reservists and STANAG Support
LCDR Ted Delgado – Reservist Support
+10 During REPMUS
Brett Steadman – STANAG 4817 Custodian
Ransome Taylor – STANAG 4817 S/W Engr

What is UMAA?

A PMS 406 initiative to standardize interfaces to enable interoperability of system software for all USV and UUV programs

UMAA's goal is to "realize" a shared services approach:

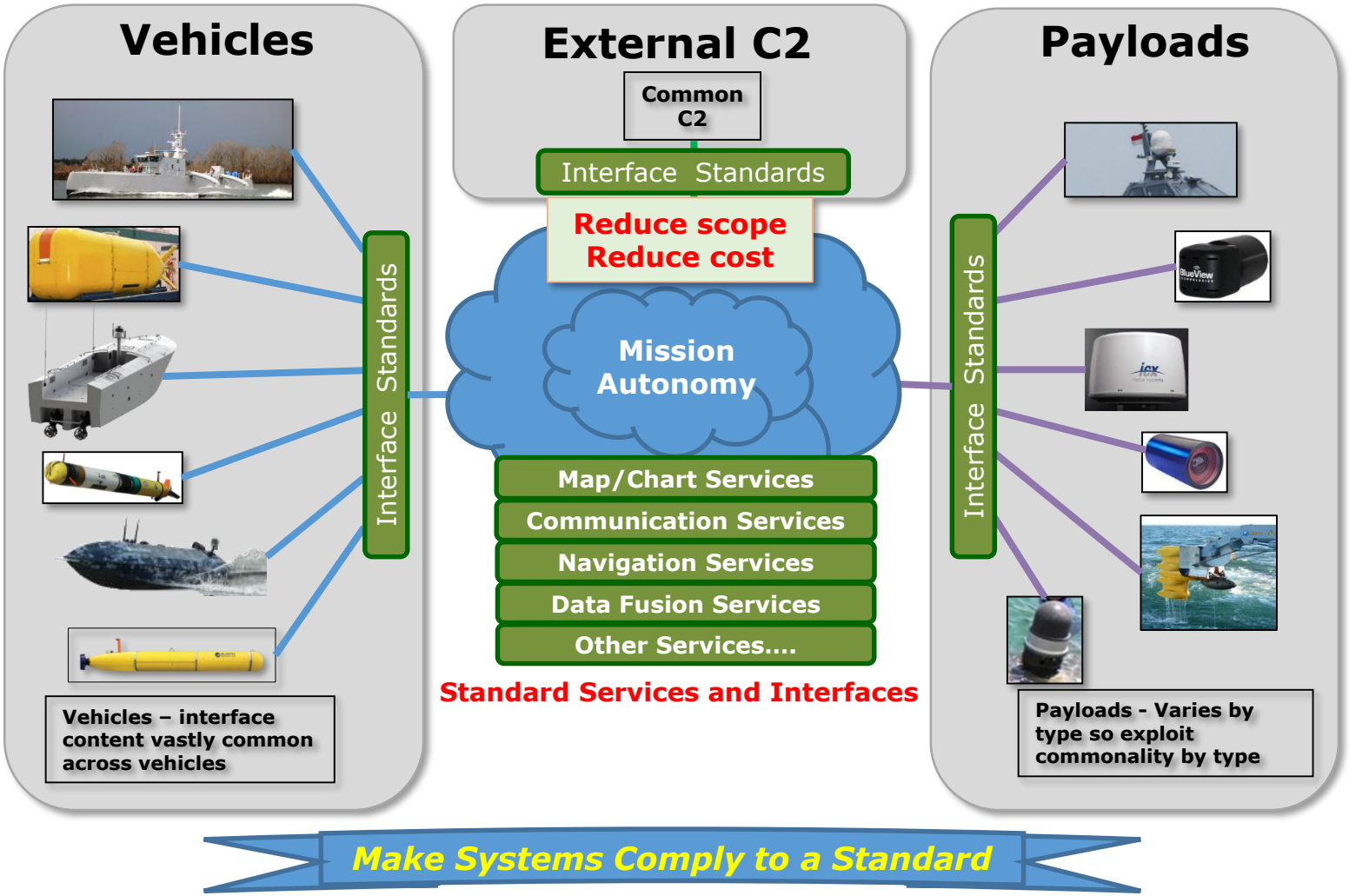
- **Enable software reuse across programs and platforms**
- **Provide government-owned interface definitions to enable software interoperability**
- **Enable the development of best-of-breed software components with standard interfaces**
- **Enable industry contribution at a software component level versus only at a system level**

UMAA defines interfaces for common autonomy services for unmanned surface and undersea vehicles

- **UMAA enables the development of "software services" akin to software "libraries"**
- **UMAA enables the reuse of software services across programs that are developed as UMAA compliant**
- **UMAA specifies protocols leveraging the "Data Distribution Services" (DDS) Standard and expanding to enable interoperability**
- **UMAA is NOT "plug and play" - system engineering beyond the scope of UMAA is required for full interoperability of UMAA services**
- **UMAA does NOT implement or provide software (except for examples, i.e., reference implementations)**

Interface Standards Approach

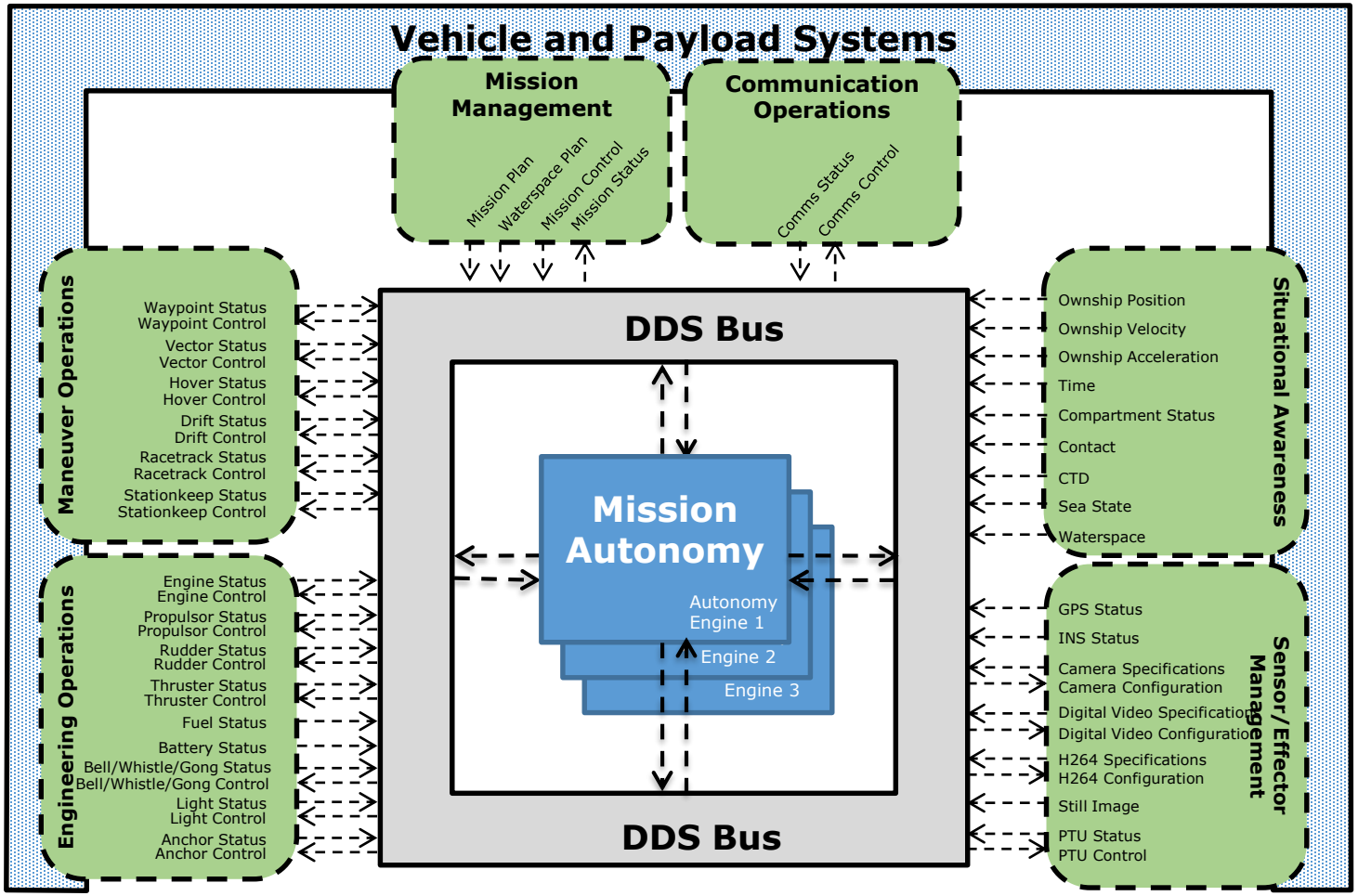
Motivation behind UMAA



Shared Services Approach

Motivation behind UMAA

Green shows notional services available on a shared DDS bus

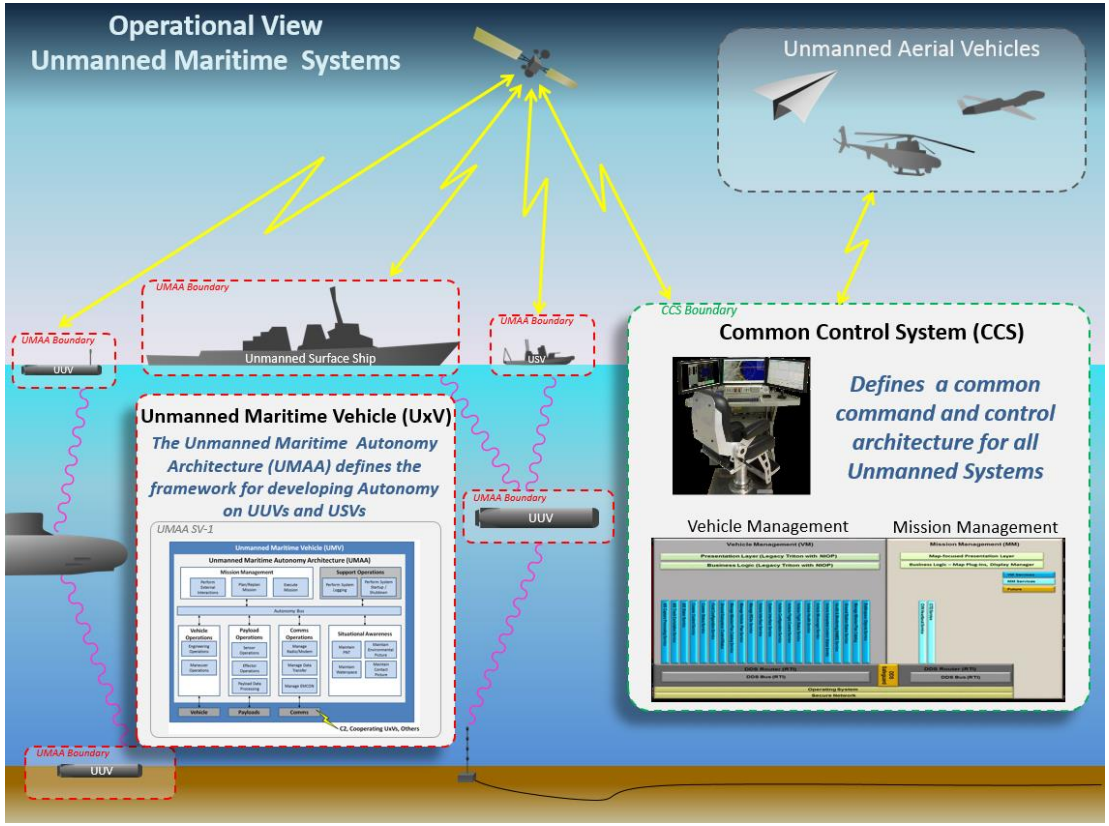


Unmanned System Standards

- **Joint Architecture for Unmanned Ground Systems (JAUGS)**
  - OSD charter established JAUGS WG 1997
  - OSD updated charter established JAUS WG 2002
  - JAUS governance transitioned to SAE AS-4 Committee 2004
  - Original stakeholders – Ground robotics
- **UAS (Unmanned Aircraft Systems) Control Segment (UCS) Architecture**
  - OSD charter established UCS WG 2009
  - UCS governance transitioned to SAE AS-4 Committee 2015
  - SAE charter updated UxS Control Segment (UCS) 2015
  - Stakeholders
    - Common Control System (CCS)
- **UCSMDE (Multi-Domain Extension)**
  - OSD promoted UCS for the maritime domain 2013
  - Evolved over the next few years by Community of Interest (COI)
- **The Object Management Group (OMG) Data-Distribution Service for Real-Time Systems (DDS) used is an open international middleware standard using publish-subscribe communications for real-time and embedded systems.**

UMAA Scope

Standardizing common control and standardizing autonomy services provides an extensible solution for operators and developers to engage with increasing autonomy capabilities



- Common Control System (CCS) is a separate initiative from UMAA to establish the operator control system
- UMAA scope is confined to the onboard capabilities in a vehicle including the ability to collaborate autonomously with other vehicles

UMAA Products

UMAA Product Hierarchy

Governing Documents

- Architecture Design Description
- Governance
- Compliance Specification

Models

- Data Models
- Service Specifications
- DevOps Pipeline Tools

Interface Definition

- Interface Control Document (ICD) / Interface Definition Language (IDL)
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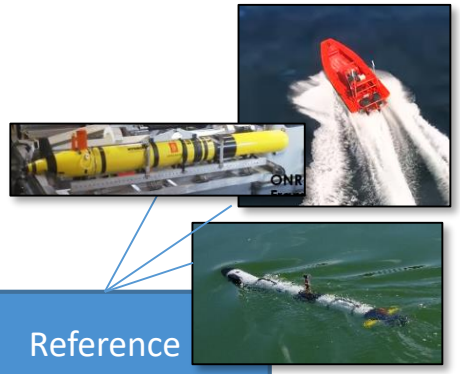
- . . .

Reference Implementations



Published Feb 2019, released as Distro A in March 2020

Posted on Distro D website for industry access*

Published for government and industry partners as the basis for testing and verification

Formalized as NAVSEA Technical Publication T0300-BE-IDS-010

Used internally by UMAA team, available to programs as needed

Posted as available

Formal releases published at regular intervals, developmental releases published continuously (DevOps pipeline)

* Originally hosted on Defense Intelligence Information Enterprise (DI2E), now transitioning to Naval LIFT

UMAA Resources

- **Public release UMAA specifications available for download at:**

  https://www.auvsi.org/unmanned-maritime-autonomy-architecture

- **Instructions for Government / Gov Contractors (former "dist D") specifications at AUVSI link**
- **Autonomy baseline (ABL) available as GFE for development of PMS-406 autonomous systems**
- **PEO USC Autonomy S&T Lead: Vincent Thiele / vincent.n.theile.civ@us.navy.mil / (757) 675-0580**

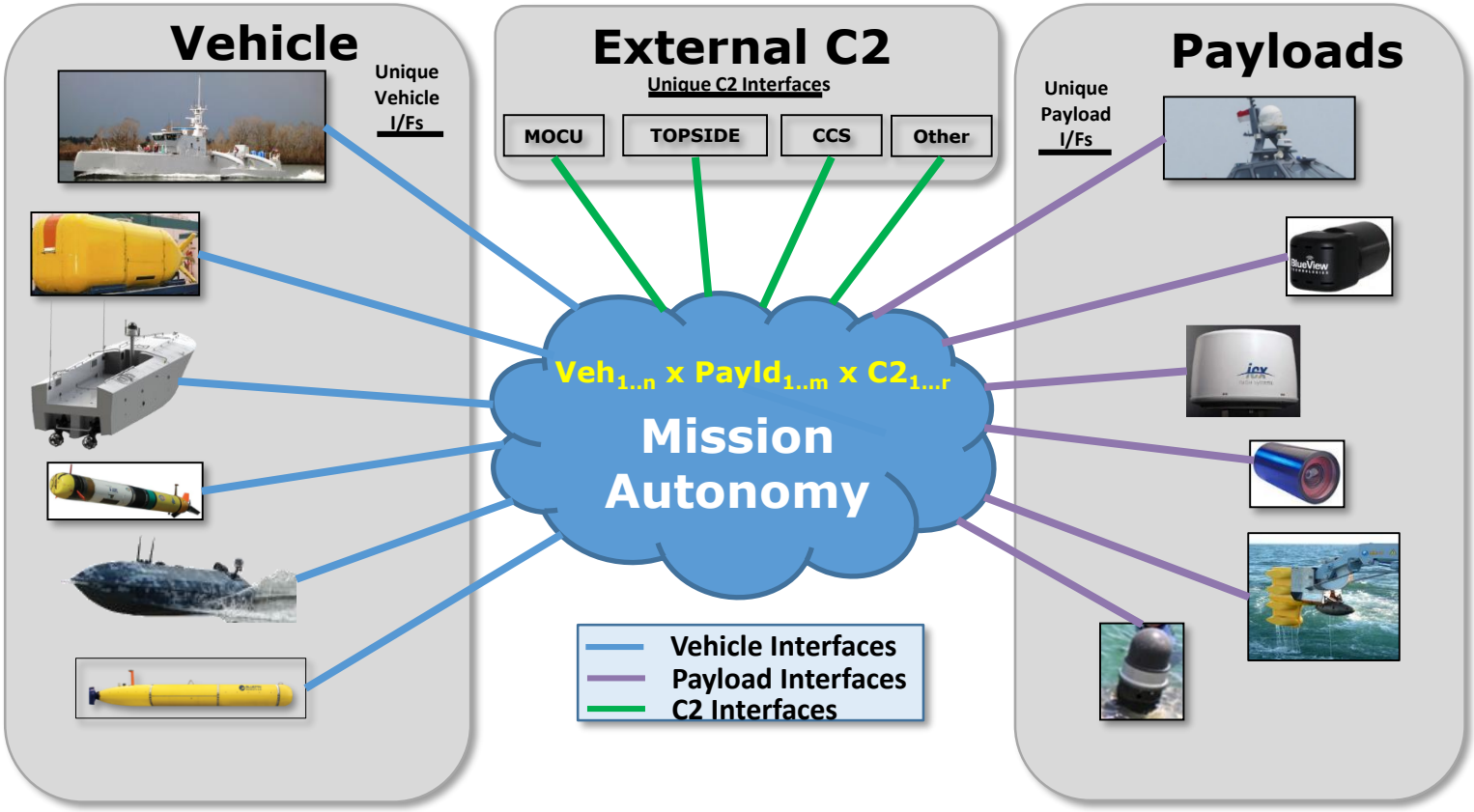
PEO USC Maintenance S&T

- **Unmanned maintenance up to size of Orca likely to be more like aviation than ship**
  - O / I / D level maintenance provided outside shipyards
    - Contracted or Government I level maintenance
    - Government (warfare center) Depot maintenance
  - Prototype medium surface ships under contract with commercial boatyards. POR concept TBD
  - LUSV maintenance concept TBD, but expect some level of shipyard maintenance to be included
- **Conditions Based Maintenance+ (CBM+) for FFG62**
  - Design heavily reliant on MBSE approach
  - FFG62 CBM+ system is called Mission Readiness Support System (MRSS)
  - Integration of MRSS data for availability planning still in development
  - POC: Bill Nickerson / (301) 227-0321 / george.w.nickerson4.civ@us.navy.mil

Systems of Today

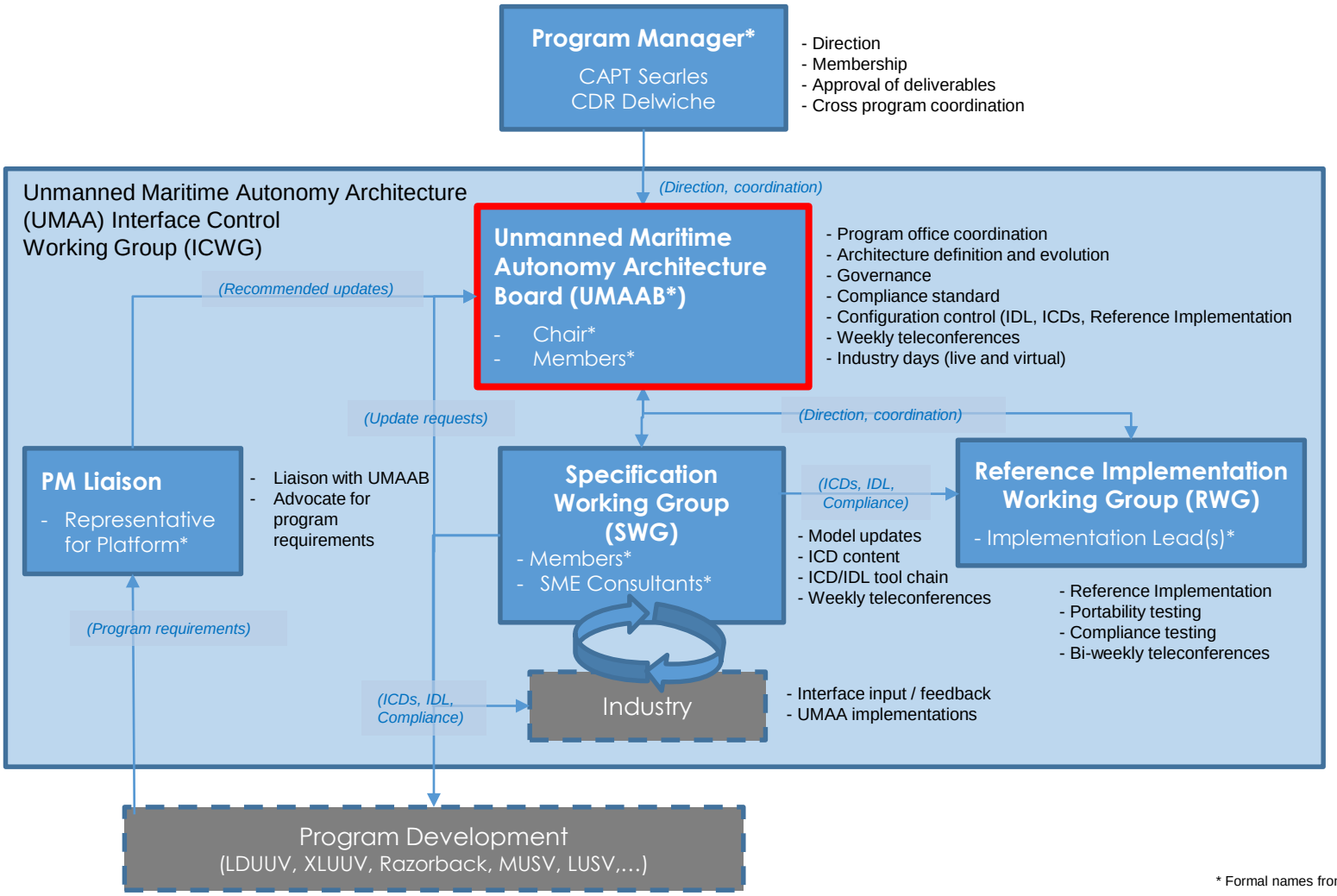
Motivation behind UMAA

(pick one of each)



Currently develop a specific solution for each: vehicle – mission – payload – C2 combination

UMAA Organization

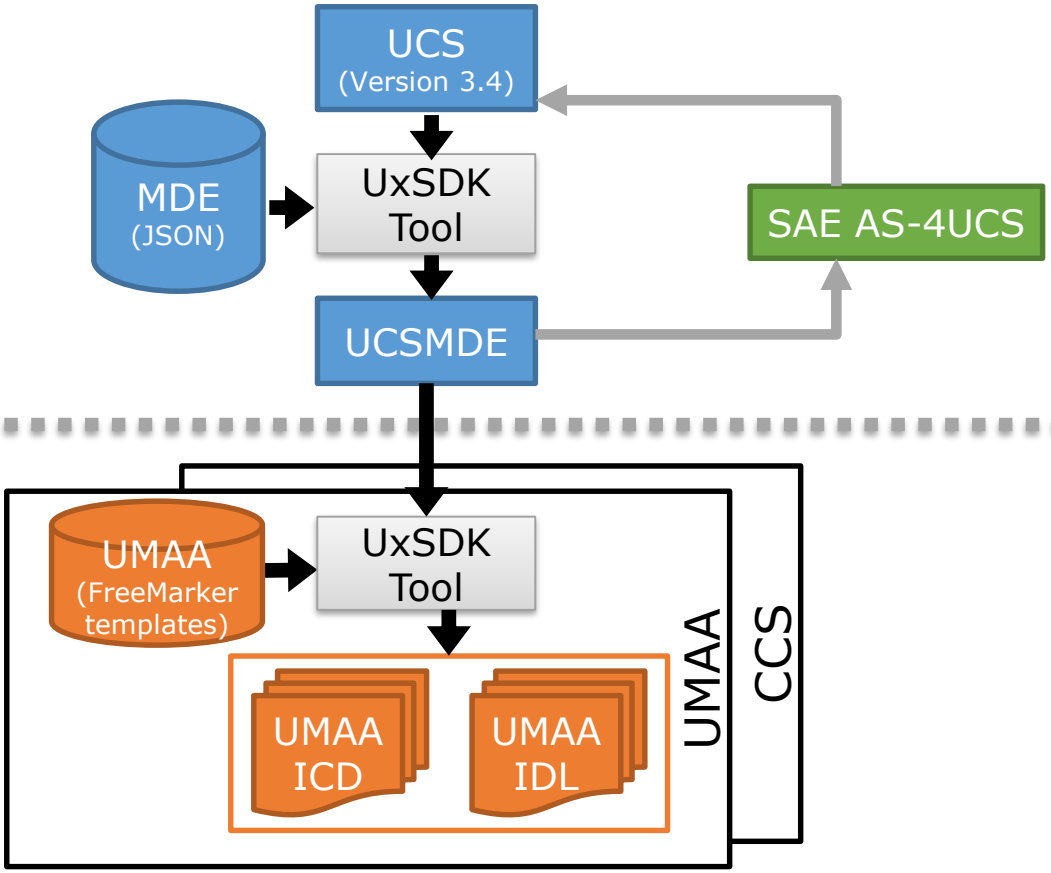


* Formal names from UMAAB charter

Alignment of UMAA and CCS

Platform Independent Model (PIM)

Platform Specific Model (PSM)



UMAA and CCS under one version of the UCSMDE model with path for alignment with latest UCS standard

UMAA Interface Control Documents

- **Interface Control Documents (ICDs) – contain the definition for services that are building blocks for autonomy**
- **ICDs will be extended over time – interfaces used in contractor-built services may be adopted into UMAA**

This is a service interface example comprised of multiple attributes

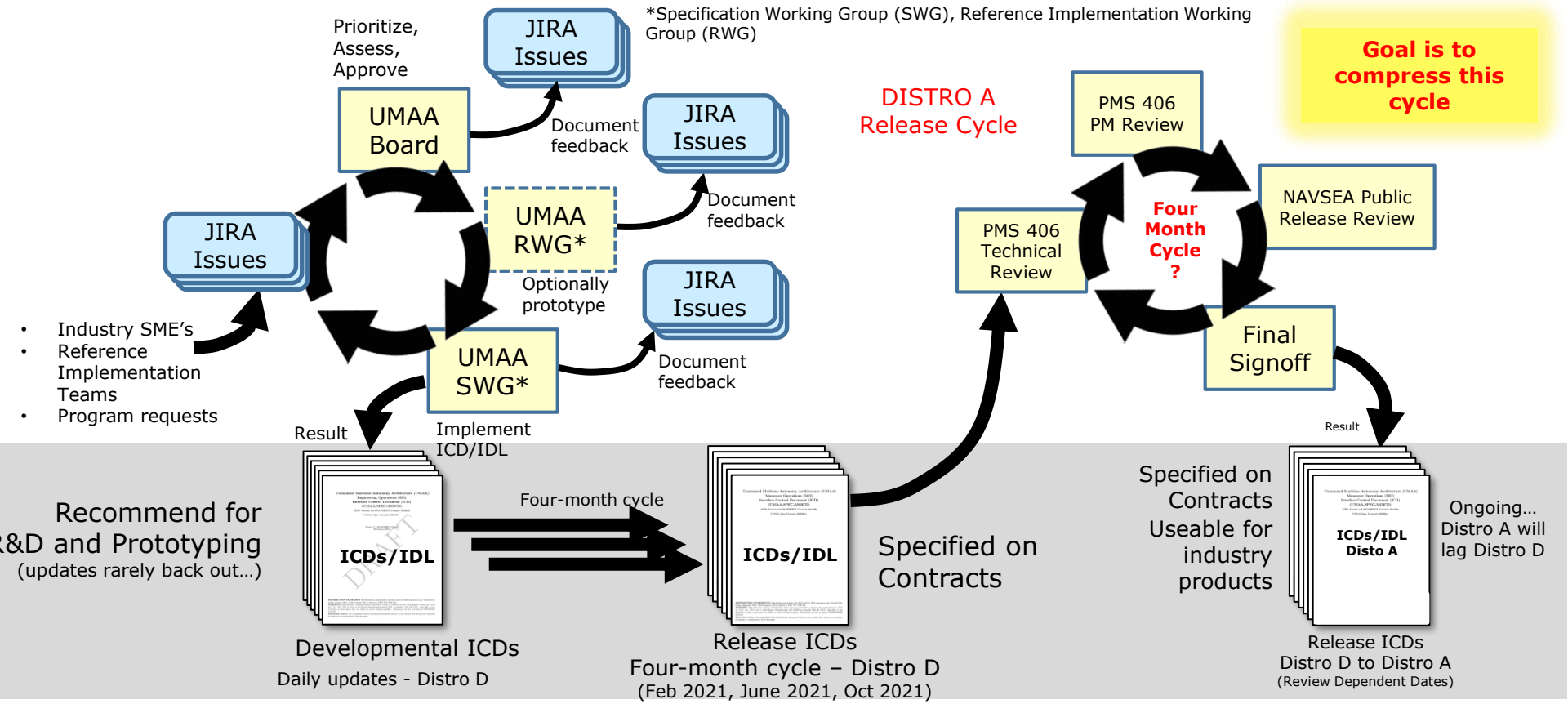
VelocityControlCommand

Attribute Name	Attribute Type	Attribute Description
Additional fields included from UMAA::UMAACommandType		
attitudeRate	OrientationVelocity3D	The desired rotational rate of the unmanned platform.
velocity	Velocity3D_PlatformXYZ_Tuple	The desired linear velocity (velocity X, Y, Z) of the unmanned platform.
commandType*	VelocityCommandTypeEnum	The desired velocity reference to be set for velocity command type.

ICDs are "buckets" that contain groups of logically related service interface definitions

Mission Management (MM) | Situational Awareness (SA) | Sensor and Effector Management (SEM) | Maneuver Operations (MO) | Engineering Operations (EO) | Support Operations (SO) | Processing Operations (PO) | Communications Operations (CO)

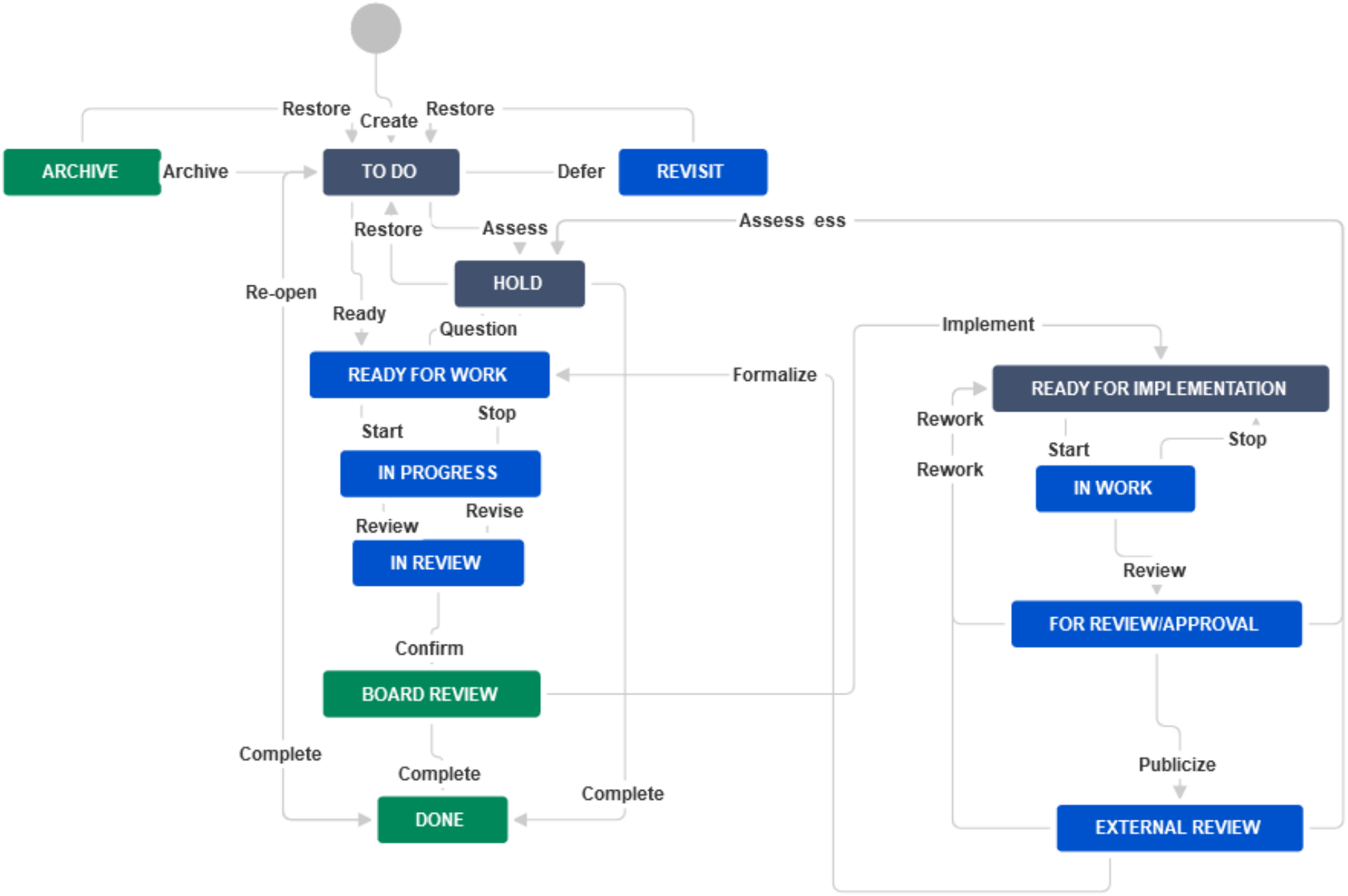
Release of ICDs and IDL



Industry Participation

- **Regularly scheduled industry forums (physical and virtual) – (275)**
- **Open participation model**
  - Direct industry involvement through standard industry tools
  - Atlassian tool set on Naval LIFT (Confluence, JIRA, Bitbucket)
  - Industry can submit updated requests
  - Industry can monitor evolution of UMAA standards via JIRA used by the UMAA board to specify updates and changes
  - Continuous posting of updated developmental products
- **Reference Implementation Working Group (RWG)**
  - Ongoing example code responding to industry input to help boot-strap industry implementations, e.g., UMAA (How-To's) in Bitbucket
  - Three RWG teams using UMAA ICD/IDL outputs

Process Workflow



UMAA Today

- **Released v5.2.1 April 20, 2022**
- **Moving to a more controlled process**
  - High-bar for breaking changes, requiring PMS 406 approval
  - Improved vetting and prototyping for new services
- **Transition from DI2E to Naval LIFT**
- **Collaboration with PMS 406 Autonomy Framework Working Group (AFWG) to group services into components**
- **Next Industry Day tentatively late Fall 2022**