Intelligent Robotics and Autonomous Systems (IRAS)

IRAS Office, Capabilities Development Directorate
HQMC, Combat Development and Integration

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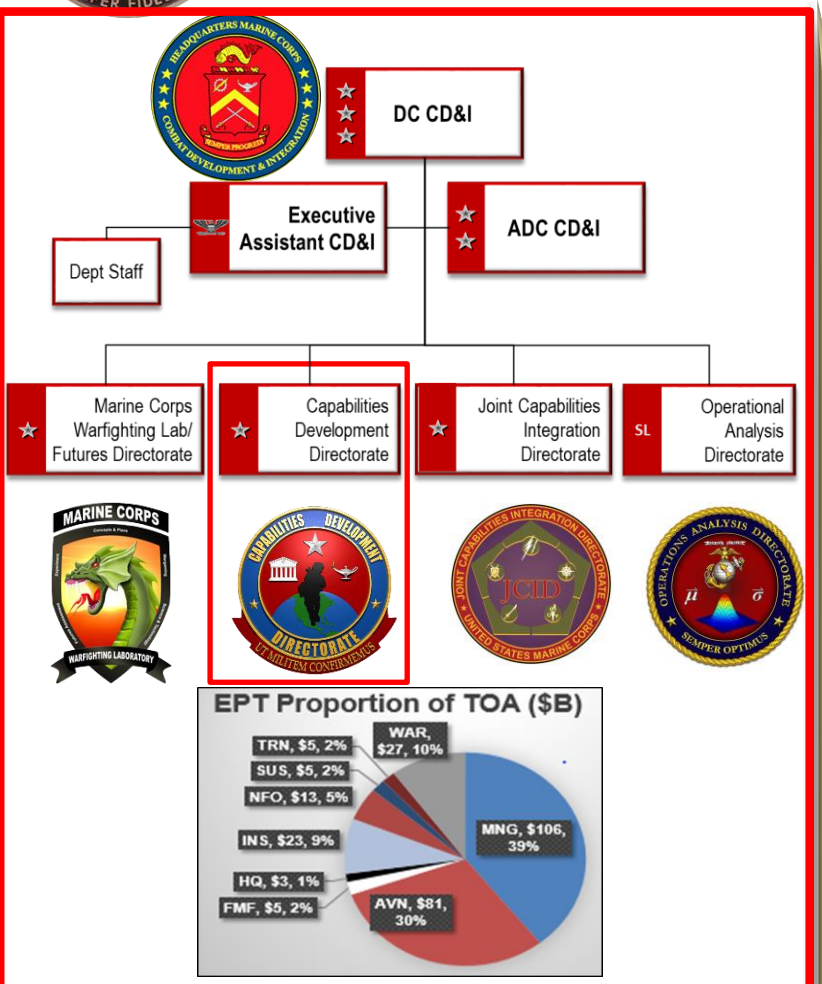
Outline

- Capabilities Development Directorate (CDD), Combat Development and Integration (CD&I) Role and Mission
- Force Development Process
- Strategic Importance / IRAS Principles
- Initiatives / Lines of Effort (programmatic and S&T)
- IRAS across the MAGTF
- Vision / Desired End-state / Goals
- IRAS Command and Control
- Challenges to Address

Who Is CDD And What Do We Do?



The Capabilities Development Directorate analyzes, develops, and integrates requirements and capabilities across DOTMLPF-P through Marine Corps force development processes that provide for integrated Service-wide capabilities solutions, current and future, anticipating strategic challenges and opportunities for the nation's defense.

USMC Force Development System

Figure 1-1: USMC Force Development System Overview (Level 0)

Strategic Importance of IRAS

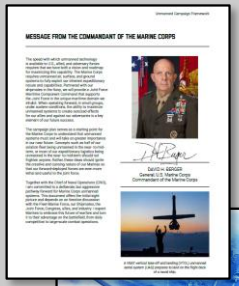
Strategic Guidance

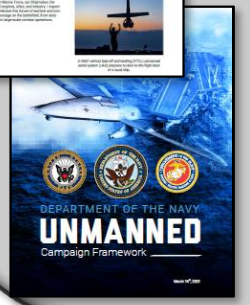
"Both commercial and military technologies will advance rapidly and proliferate the global technology landscape. These capabilities alone may not ensure military victory, but creative application will shape the outcome of any contest.."

2022 National Military Strategy

"By exploiting the technical revolution in autonomy, advanced manufacturing, and artificial intelligence, the naval forces can create many new risk-worthy unmanned and minimally-manned platforms that can be employed in stand-in engagements to create tactical dilemmas that adversaries will confront when attacking our allies and forces forward."

Commandant's Planning Guidance, 2019





"The Marine Corps requires unmanned air, surface, and ground systems to fully exploit our inherent expeditionary nature and capabilities. Partnered with our shipmates in the Navy, we will provide a Joint Force Maritime Component Command that supports the Joint Force in the unique maritime domain we inhabit."

General David H. Berger, CMC, Department of the Navy Unmanned Campaign Framework, 2021

Global Conflicts

Armenia-Azerbaijan

- **Inexpensive, off-the-shelf Israeli and Turkish drones UAS drastically shifted battlefield advantage**
- **An estimated $1B worth of Armenian equipment destroyed by UAS**

Ukraine-Russia

- **Massive and adaptable impact of commercial off-the-shelf technology**
- **Necessity propelled rapid innovation, with minimal training or experience**

Israel-Hamas

- **IDF using networked, collaborative, autonomous UAS to locate targets, direct airstrikes, gather intelligence**
- **Leveraging advances in artificial intelligence-driven combat**

USMC IRAS

Marines will capitalize on technological advances to grow from platform-centric to a capability-centric approach where IRAS are employed by trained specialists that contribute to all domain operations.

The Principles of Martial Robotics

- The human element of armed conflict remains central in the use of IRAS
- IRAS augment or obviate human processes without replacing the warfighter
- Marines must fight at machine speed, or face defeat at machine speed

IRAS Concept Development Strategy

- Develop a lethal, agile, mobile, and resilient force
- Deliver performance to the warfighter at the speed of relevance
- Increase interoperability and all domain awareness across the joint force
- Recognize and treat data as a strategic resource
- Increase transparency and cooperation with international, government, industry, and academic partners

USMC Programmatic IRAS Efforts

Today | Near Term | Mid-Term | Future

Air

- **Group 3 UAS** RQ-21
- **MUX MALE** Increment I
- **MUX MALE** Increment II
- **MUM-T** TACAIR
- **MUX MALE** Next
- **ULS-A** Large
- **Ship-Capable UAS** Ancillary Omen / VBAT
- **ExTUAS** Maritime ISR
- **MR / ME** RQ-20 Puma
- **SR / SE** Quantum Vector
- **OPF** Hero 30 / 120
- **LR / LE** Stalker
- **ULS-A** Medium
- **ULS-A FoS** Maritime Focus
- **ExTUAS** Maritime ISR
- **Group 1 UAS** InstantEye
- **Micro VTOL** Vesper
- **Nano VTOL** D40 / Black Hornet
- **ULS-A** Small
- **SR / SE** Skydio / Sky Raider

Ground

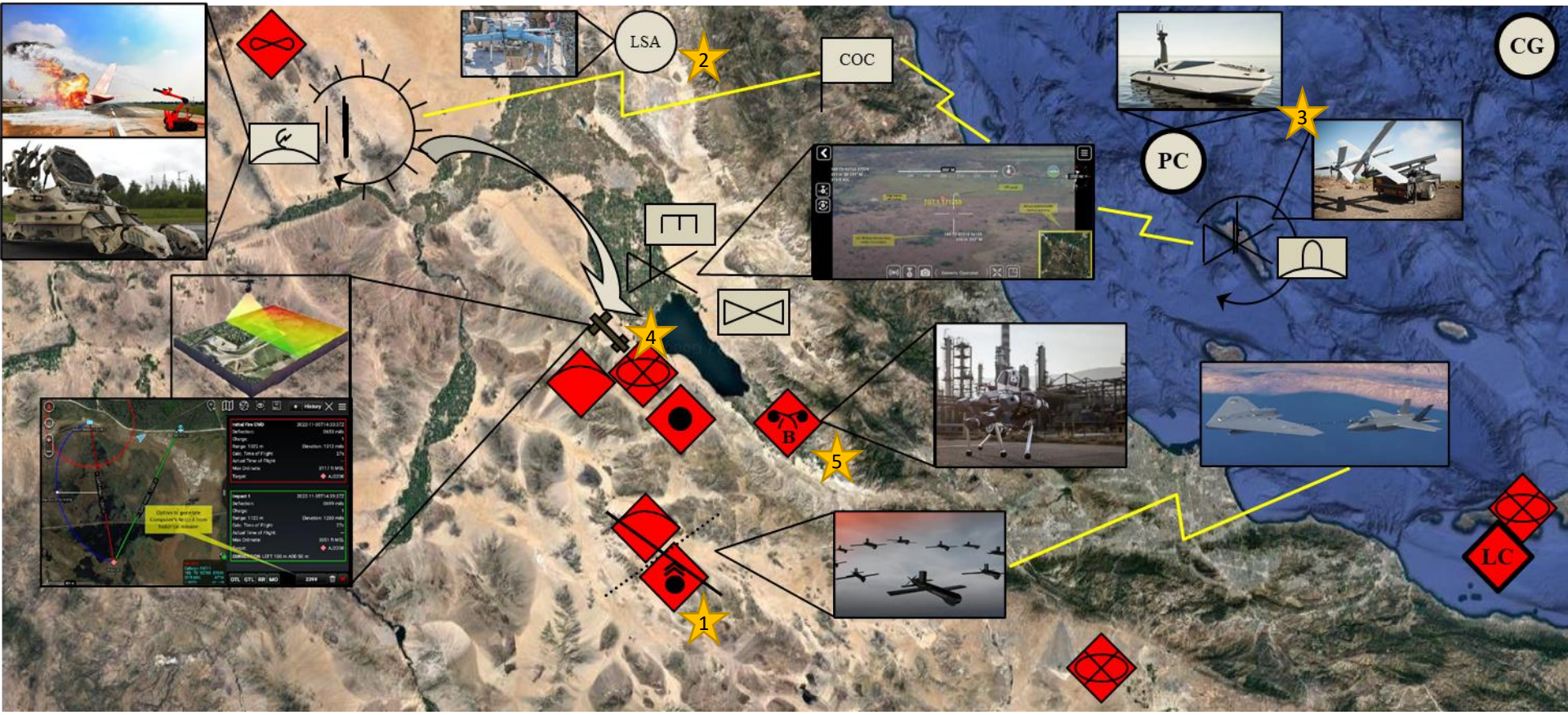
- **Small Micro** Throwbot
- **Med Robot** Ghost V60
- **Med Robot** Ghost V40/V25
- **Small Nano** Bounce
- **Other Purpose** Terrestrial Snake
- **ROGUE-Fires** NMESIS
- **LUGV** Patrios
- **RCV-L**
- **UGV FoS**

Maritime

- **LRUSV**
- **LEON** ROV
- **LEON** USV
- **UUV FoS** LPV / Dive
- **LEON** UUV
- **LRUSV**
- **LEON** AUGV

- Service Divestment
- RDT&E (S&T Effort)
- Bridging Solution
- Fielding (PoR)
- Upgrade (PoR)
- MARSOC Only
- FMF and MARSOC

IRAS Across the MAGTF



1 Hunter/Killer employment with SUAS/OPF/Enablers

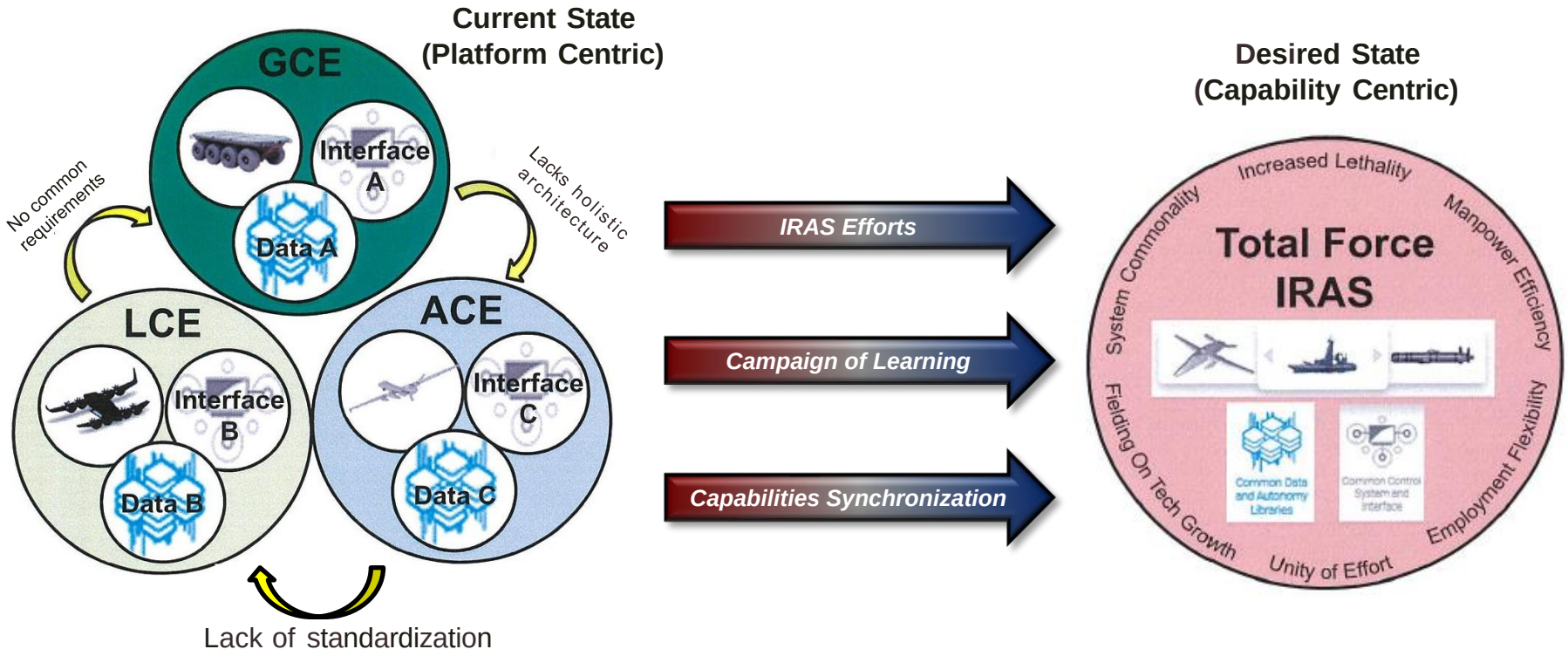
2 TRUAS/ULS-A Logistic resupply

3 EXTUAS employment

4 Sense to Strike (RSTA/Payloads)

5 Integrated Robotics

IRAS Vision



- Adversaries are presenting new operational and tactical problems to disrupt current military efforts
- Lethal, low cost, highly proliferated technology provides a reverse offset for the adversary that generates an outsized warfighting advantage
- The Marine Corps must find ways of operating in the adversary WEZ in a cost-effective and risk-worthy manner, while placing adversary capabilities at risk, across the competition continuum

Desired End State

Current Paradigm

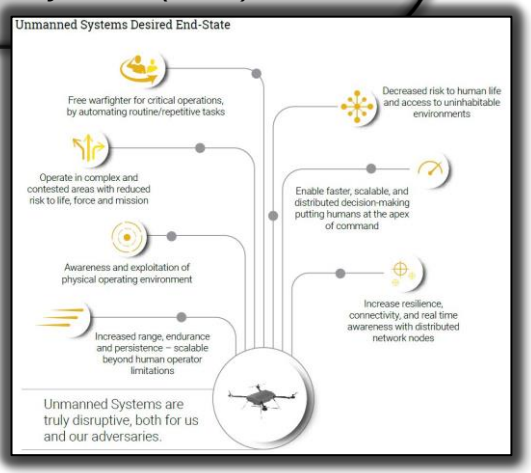
- *Operator Intensive*
- *Many controlling one*
- *Human IN the loop*
- *Distinct manned and unmanned capabilities*
- *Limited options for the MAGTF*
- *Minimal integration with Naval and Joint Force*
- *Limited system compatibility*

Future Paradigm

- ✓ *Enhanced automation and autonomy*
- ✓ *One controlling many*
- ✓ *Human ON the loop*
- ✓ *Manned-Unmanned Teaming (MUM-T)*
- ✓ *Networked across multiple domains*
- ✓ *Diverse suite of options for the MAGTF*
- ✓ *Capabilities integrated with the Naval and Joint Force*
- ✓ *Open mission systems (OMS)*

IRAS Desired Endstate

- The MAGTF and integrated Naval Force are provided with an array of integrated UxS; increasing lethality, efficiency, awareness, and survivability.
- UxS are networked and integrated with capabilities across operational domains (air, ground, surface, sub-surface).
- UxS leverage Modular Open Systems Architecture (MOSA) to enhance interoperability; enabling the rapid integration and fielding of advanced technologies.



Source: DoN Unmanned Campaign Framework

The Marine Corps requires highly complex systems that are extremely simple to operate

IRAS Goals

Near-Term (Next 3 years)

- Increase situational awareness
- Lighten the physical burden
- Improve sustainment
- Facilitate movement
- Enhance Force Protection
- Common user interfaces





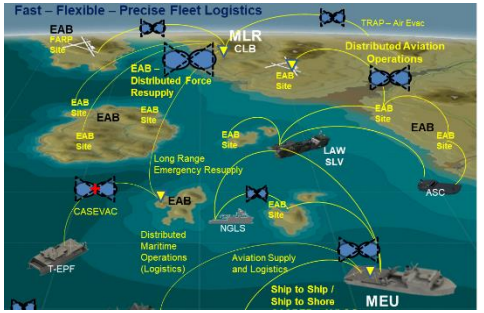

Mid-Term Priorities (3-5 years)

- Increase situational awareness with advanced, smaller and swarming IRAS
- Lighten the load with physical augmentation
- Improve sustainment
- Improve maneuver with unmanned combat vehicles and advanced payloads
- Connected multi-domain architectures




Far-Term Priorities (5-10 years)

- Enable manned and unmanned teaming (MUM-T)
- Scalable sensors, scalable teaming to support MUM-T
- Advancements in machine learning
- Large Aerial Logistics Connectors and other large UAS

IRAS Command and Control

Today — Un-Fix from 1:1
- *Multi-System Control (same T/M/S)*
- *Operator IN/ON the Loop*

2025 — Un-Fix from System
- *Multi-System Control (different T/M/S)*
- *Operator ON the Loop*

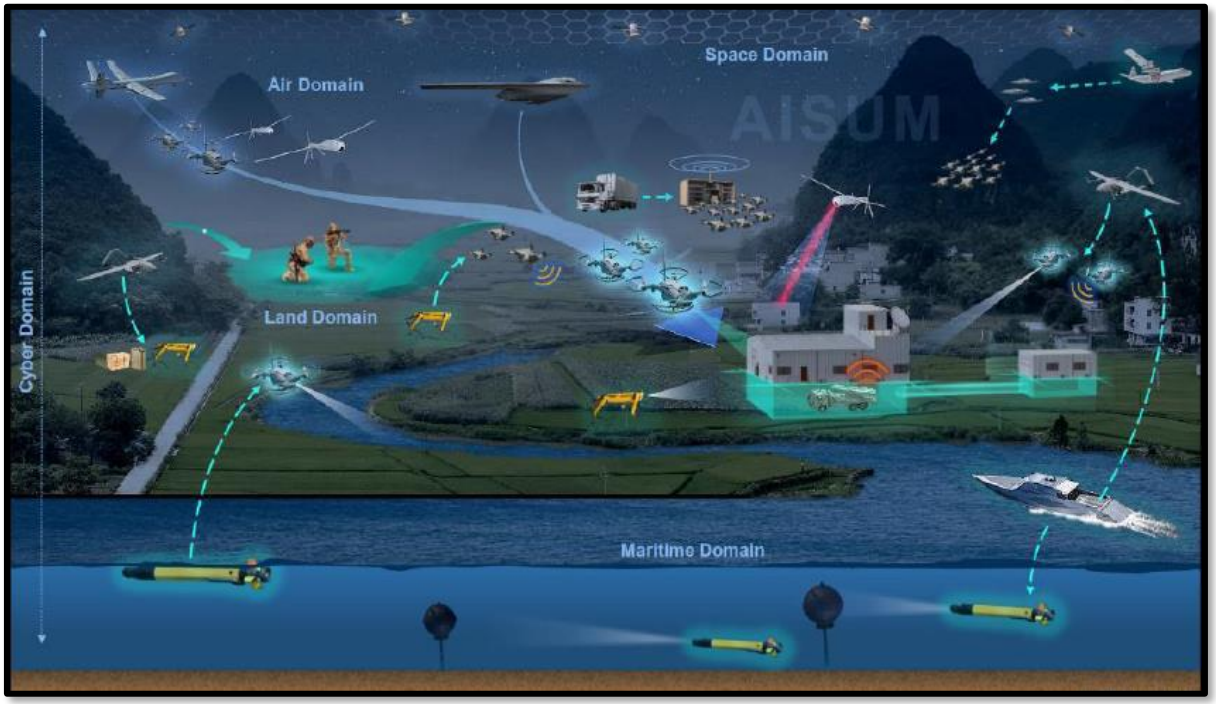
2030 — Un-Fix from Site
- *Distributed Control*
- *Operator ON/OUT of the Loop*

Future — Un-Fix from Domain
- *Multi-Domain Ecosystem*
- *Operator ON/OUT of the Loop*

Automation / AI / ML, Resilient Datalinks, Divestment of Legacy Structure

Operational Architecture

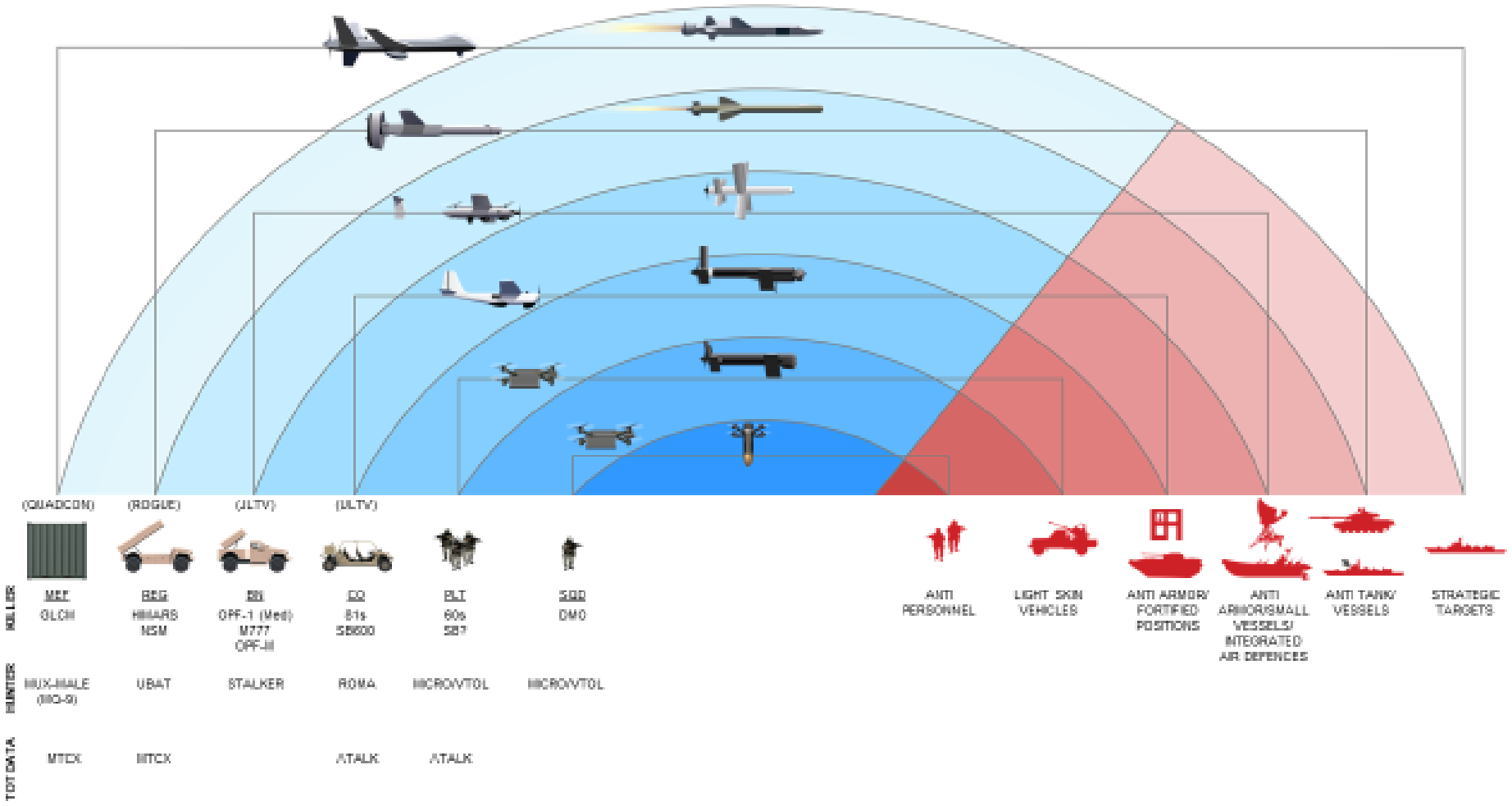
- ***Global Cloud-Based AI "Brain" / Umbrella***
  - *Data dissemination in real-time to and from robots*
  - *Robot-to-robot machine learning*
- ***High Bandwidth Communications Pathways***
  - Satellites
  - Cellular
  - MANET
- ***Machine-to-Machine Communications Links***
  - Swarms
  - Constellations



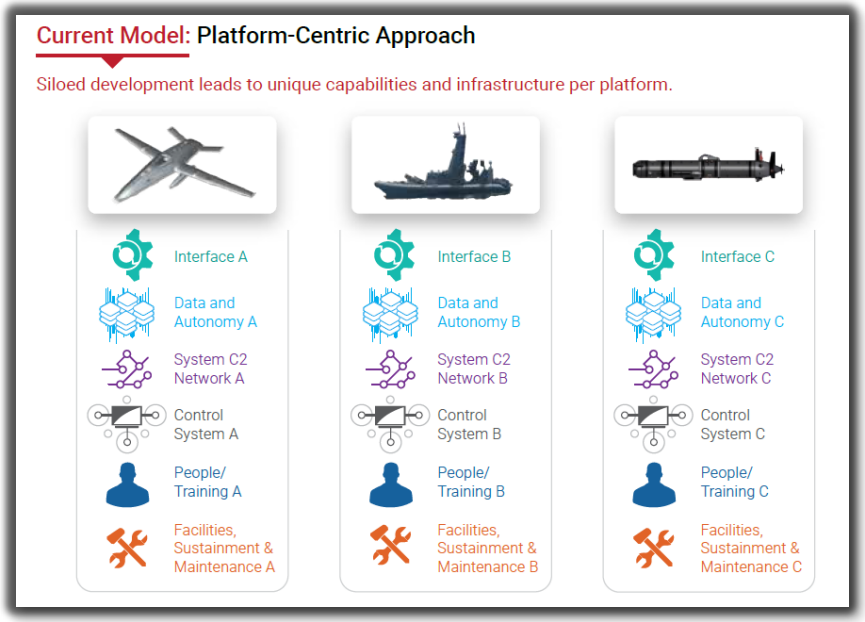
Source: Air Force Special Operations Command (AFSOC) – Proposed AI for Small Unit Maneuver (AISUM) OV-1

Marine Corps Operational Architecture must leverage automation, AI / ML, and rapidly emerging technologies to unlock human capital and create a resilient, networked ecosystem of UxS across all domains

IRAS at Echelon (UAS example)



Challenges to Address



- Historic hardware-oriented approach (must transition to a software-intensive enterprise)
- Required data to fuel machine learning (ML) is often stovepiped, messy, or disregarded
- Funding processes are annual cycles and create delays in integration of new technology
- Acquisition and fielding practices are rigid and sequential, inhibiting rapid innovation
- Programs remain bound to proprietary software and commercial data solutions
- Software updates can take days, weeks, even months
- No holistic training solution or MOS for the employment of these systems

Questions?