Proliferated Warfighter Space Architecture (PWSA)
🖥 Battle Management Layer

SDA SPACE DEVELOPMENT AGENCY

Mission ◎ ⋏ ⊠ 🖥 ⌖ 🔭

Speed. Delivery. Agility.

SDA's Battle Management Layer provides automated space-based ground-coordinated battle management command and control, tasking, mission processing, and dissemination to support time-sensitive kill chain closure.

The BMC3 Capability in PWSA Tranche 1

BMC3 modules provide the hardware and software framework designed to host mission-specific applications across the PWSA.

In Tranche 1, the Initial Warfighting Capability Tranche (FY23), Transport vehicles will host BMC3 modules. Initially, these modules will be used to provide on-orbit network management, mission management and data management.

SDA's Battle Management layer leverages the DoD's Adaptive Acquisition Framework for Software Development, with a focus on agile acquisition processes and will be deployed continuously throughout the mission life of the Tranche 1 vehicles based on user needs.
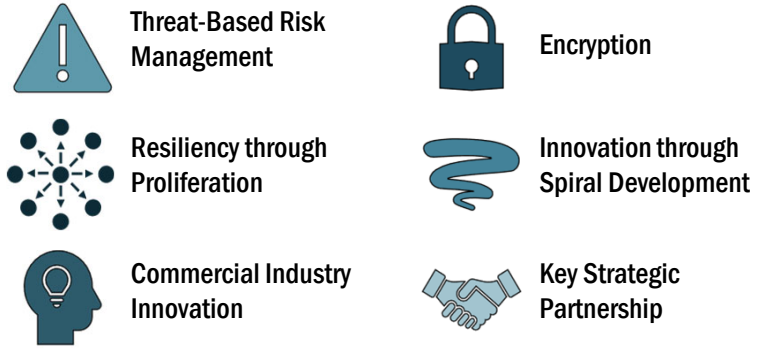
Users of the Battle Management Layer include:
- SDA constellations and capability layers (e.g., Transport, Tracking, Navigation)
- PWSA Operation Centers
- Functional and geographic combatant commands
- Warfighters at the tactical edge

PWSA Space & Ground Segments: Cybersecurity Strategy

Cybersecurity is a top SDA priority. The PWSA Cybersecurity Strategy (CSS), provides strategic guidance to ensure the implementation of robust security measures in response to current and emerging threats.

The PWSA CSS is based on six topical themes:

- ⚠ Threat-Based Risk Management
- 🔒 Encryption
- Resiliency through Proliferation
- Innovation through Spiral Development
- 💡 Commercial Industry Innovation
- 🤝 Key Strategic Partnership

SDA utilizes a novel approach to cybersecurity, seeking cyber resiliency versus compliance. SDA, reviews threats to both space vehicle and ground segments then selected controls to mitigate and provide countermeasures to those threats. The resulting control set is then tailored to the SDA mission/platforms and communicated as requirements to space vehicles vendors.
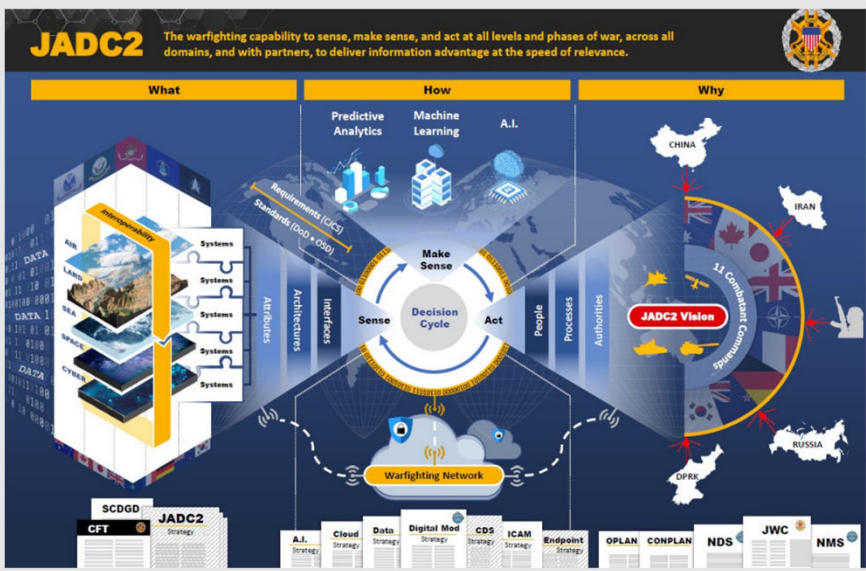
BMC3 mission management applications will enable Joint All-domain Command and Control (JADC2)

The Battle Management Layer capabilities are focused on Joint All-domain Command and Control (JADC2) and kill chain modernization. In response to warfighter requests, artificial intelligence/machine learning (AI/ML) algorithms are used to "learn" the significance of data being passed through the PWSA and will make determinations on how the data are provided and with what prioritization.

To accomplish this, the Battle Management Layer manages an integrated system response to evolving warfighter needs by making high-level decisions on prioritization of tasking and allocation of communication, sensor, and compute resources.

Key Battle Management features for JADC2 include:
- Enhanced decision speed and maneuver at the tactical edge
- Support resiliency in contested environments
- Enable mission command for integrated long-range and non-kinetic fires
- Increased autonomy
- Improved, extended range situational awareness
- Sensor assets tasked to provide sensor data to the JADC2 cloud
- Leverage enabling technologies for MDO Integrated Air and Missile Defense
- Aggregate, process, and disseminate actionable data
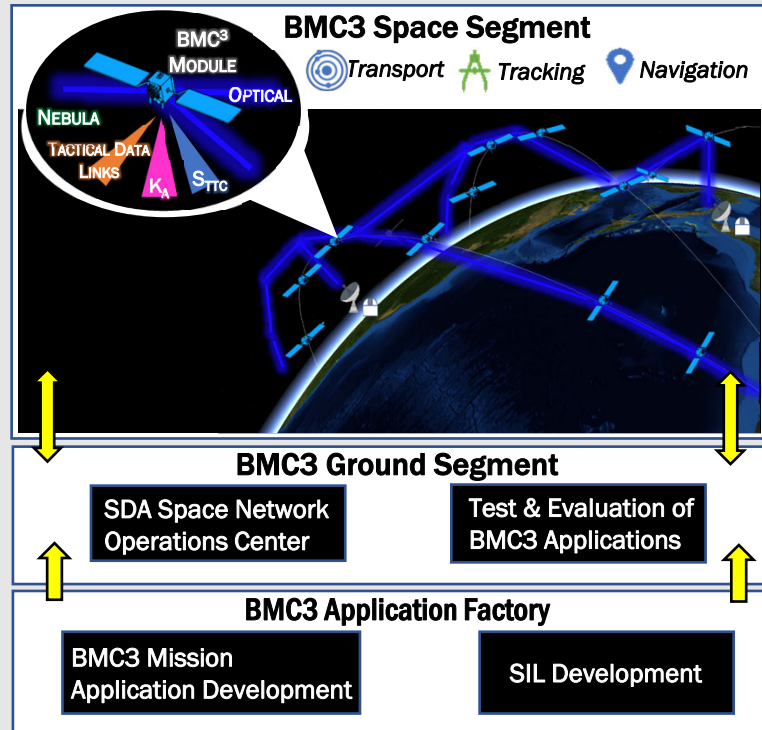
Capability Provided by the Battle Management Layer to the Warfighter

The Battle Management Layer will provide a compute fabric with networking capabilities for hosting telecommunication workloads, allowing operators to move applications more easily from ground-based Space Networking Operations Centers to satellites in orbit, enabling more efficient resiliency and network utilization.

The Battle Management Layer provides the Battle Management, Command, Control, and Communication (BMC3) ecosystem, which consists of:

- **Space Segment**: BMC3 hardware modules that reside on the Transport Layer space vehicles. Hosts BMC3 applications.
- **Ground Segment**: Coordinating applications, and BMC3 ground hardware for increased processing capability, integration, and testing
- **Application Factory (AppFac)**: the BMC3 AppFac is a DOD DevSecOps compliant software factory used to develop and validate BMC3 applications and services to both the space segment and the ground segment. Applications deployment is not dependent on PWSA Tranche deployment.
    - **BMC3 Applications**: "Massless payloads" which can be developed and deployed to perform network, mission, and data processing to provide tactically relevant capability to the Warfighter.
    - **Secure Interoperability Middleware Layer (SIL)**: A secure, operating environment for software applications developed in the application factory.

BMC3 Space Segment

◎ *Transport* ⚕ *Tracking* 📍 *Navigation*

BMC³ MODULE
OPTICAL
NEBULA
TACTICAL DATA LINKS
K_A
S_{TTC}

BMC3 Ground Segment

| SDA Space Network Operations Center | Test & Evaluation of BMC3 Applications |

BMC3 Application Factory

| BMC3 Mission Application Development | SIL Development |

A Look Ahead

Tranche 2: Global Persistence Delivered to the Warfighter

In Tranche 2, set to begin launching in 2027, the Battle Management Layer will host a multi-level security (MLS) function onboard a "Translator Sat" and will be able to submit tasking requests to commercial and mission partner satellites to track surface targets "left of launch." Therefore, Tranche 2 requires data fusion capabilities to accomplish critical missions.

TRANCHE 2
GLOBAL PERSISTENCE

Technical Areas of Interest

Each PWSA Tranche provides an opportunity to implement targeted enhancements to the Battle Management Layer. SDA is interested in exploring technical areas such as :

- Low-latency on-orbit mesh networks,
- Space Edge Cloud technologies
- Distributed command and control,
- Automated schedule optimization and sensor tasking,
- Onboard processing algorithms,
- Software architectures that enable on-orbit upgrades,
- Trusted autonomy and artificial intelligence,
- Enhanced cybersecurity,
- Improved performance and minimized size, weight and power of onboard processing hardware, and
- Improved modularity and interoperability of battle management functionality.

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