

Proliferated Warfighter Space Architecture (PWSA)



Ground Segment

Mission



Speed. Delivery. Agility.

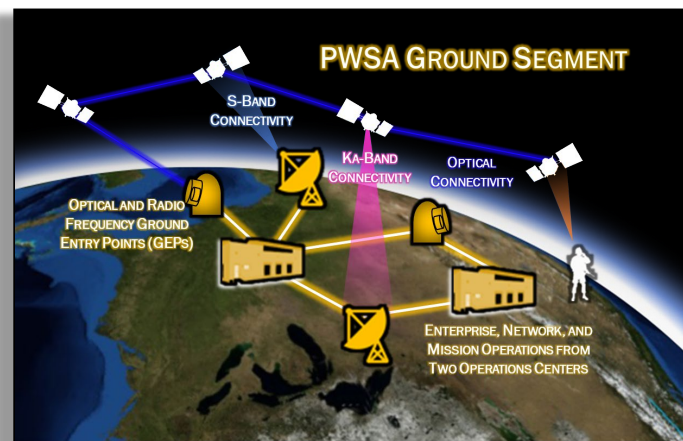
The Space Development Agency's Proliferated Warfighter Space Architecture (PWSA) delivers space-based communications and sensing capabilities to the joint warfighter in support of missions worldwide. The PWSA Ground Segment provides a common, resilient ground support infrastructure necessary to enable the space-based capabilities of the PWSA.

PWSA Ground Segment

The PWSA Ground Segment provides continuous, 24/7 operational support to the PWSA Space Segment. The Ground Segment consists of the following:

- Operations centers (OCs) and multiple cloud environments
- Ground entry points (GEP) (radio frequency, optical)
- Integrated and resilient networking architecture
- External interfaces to PWSA mission partners and users

Additionally, the PWSA Ground Segment includes the necessary hardware and software framework to host battle management command, control, communications (BMC3) functionality. This functionality includes mission-specific processing, and execution of on-orbit and on the ground applications.



The PWSA Ground Segment provides the essential infrastructure to enable the space-based capabilities of the PWSA to transmit, receive, process, exploit, and disseminate data.

Operation Centers

PWSA operations are supported by two functionally equivalent, geographically separated OCs. SDA OCs receive and process service requests and mission data. They also manage and monitor the PWSA Space Segment to deliver the requested services. The OCs perform the following functions:

- **Enterprise Management:** Monitoring overall architecture status and health, interfacing with external networks
- **Network Management:** Monitoring and maintaining PWSA network performance
- **Mission Management:** Processing and executing user requests (e.g., connecting to Link-16 network, or Ka-band tactical users)
- **Payload Data Management:** Receiving, processing, and distributing space vehicle mission data
- **Constellation Monitoring:** Monitoring constellation status/health reporting, anomaly resolution, collision avoidance



Photo Credit: www.grandforks.af.mil



Photo Credit: home.army.mil

The SDA OCs (pictured above) are located at Grand Forks, N.D. (SDA-North) and Redstone Arsenal, Ala. (SDA-South).

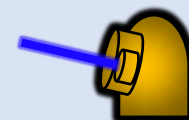
Ground Entry Points

A GEP is a fixed location that provides connectivity between the PWSA Space and Ground Segments:

- The PWSA Ground Segment leverages a global network of GEPs to enable 24/7 global access to the PWSA Space Segment.
- The SDA OCs maintain connectivity with each GEP via secure, low-latency, high-throughput terrestrial communications.

Radio Frequency Antenna

Optical Ground Terminal



The PWSA will leverage both radio frequency and optical GEPs

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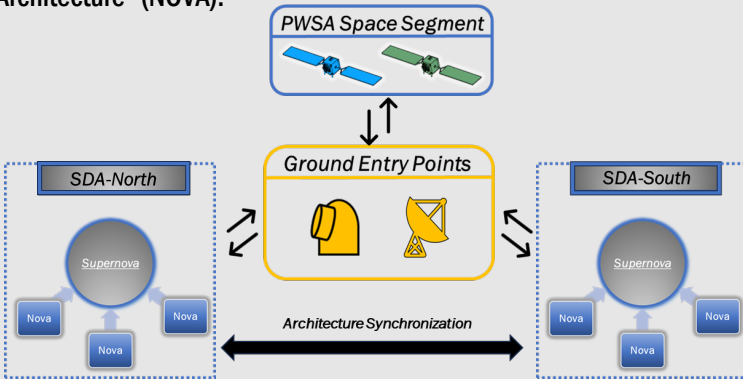


Ground Segment

An Integrated Architecture

From NOVA to SUPERNOVA

PWSA space vehicle vendors develop their own software systems to operate their SVs, each called a “NEBULA Operations – Vendor Architecture” (NOVA).



The “SDA Unified Planning Environment and Resources for NEBULA Operations – Vendor Agnostic” (SUPERNOVA) manages the overall PWSA architecture, to include internal and external user interfaces. Once the SVs are operational, the SDA OCs will integrate each vendor NOVA into SUPERNOVA.

SDA NEBULA Network

The PWSA Space and Ground Segments, as well as external user interfaces, are connected by a dynamic integrated networking architecture called Network Established Beyond the Upper Limits of the Atmosphere (NEBULA). The SDA NEBULA Standard is publicly available on sda.mil.

Agile Software Development for Rapid & Iterative Capability Delivery

- SDA’s spiral development paradigm enables iterative delivery of software capability.
- Ground Segment uses *Software Acquisition Pathway* to facilitate rapid and iterative delivery.
- BMC3 capabilities, deployed in the PWSA Ground Segment, leverage agile software development, DevSecOps, and lean practices.
- Security is pushed to the left, or sooner on the schedule – allowing for more rapid software approval
- Warfighter Integration Cell engages users actively to meet highest priority needs.

A Look Ahead

The initial PWSA Ground Segment baseline is established by PWSA Tranche 1 Operations and Integration (O&I) and will continue to evolve with the deployment of future PWSA tranches:

- The Ground, Management, and Integration (GMI) effort will expand, enhance, and evolve existing PWSA Ground Segment capabilities.
 - GMI will enable the onboarding of PWSA through Tranche 2*, via an extensible ground architecture, while maintaining ongoing operational support to Tranche 1.
- In the future, on-orbit BMC3 functionality will enable the execution of dynamic and autonomous network and mission management functions through onboard multi-mission modules onboard select Transport Layer Space Vehicles.

Advanced Fire Control Ground Infrastructure (AFCGI)

SDA’s Advanced Fire Control (AFC) program will deliver integrated space and ground elements to demonstrate advanced fire control missions, show military utility, demonstrate scalability, and provide a pathfinder for future proliferation of AFC capabilities. Separate from the PWSA Ground Segment, the AFC Ground Segment will provide a common ground infrastructure to support AFC programs such as the Fire-Control On-Orbit Support to the Warfighter (FOO Fighter or F2) prototype systems as well as follow-on prototype systems.

*Tranche 2 will follow the deployment of Tranche 1. Tranche 2 will continue to proliferate Tranche 1 capabilities, as well provide targeted enhancements and new mission sets.