Proliferated Warfighter Space Architecture
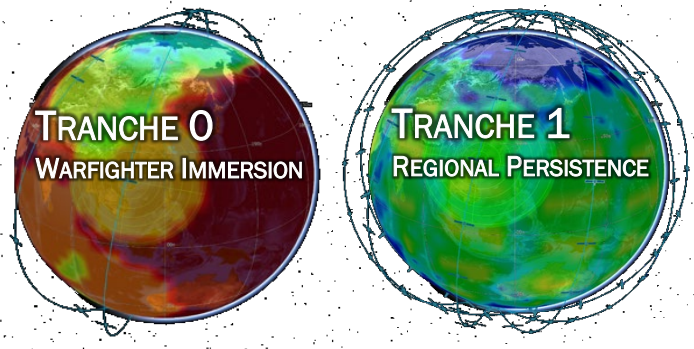## Transport Layer

Mission

Speed. Delivery. Agility.

The Proliferated Warfighter Space Architecture (PWSA) Transport Layer will provide multi-band global communications access and persistent encrypted connectivity for warfighter missions. The Transport Layer will be the space **backbone for the Joint All Domain Command and Control (JADC2)** infrastructure with **low-latency data transport**, **sensor-to-shooter connectivity**, and **tactical satellite communication (TACSATCOM) direct to platform.**

A Constellation Designed to Bring Persistent Access to the Warfighter

The Transport Layer will be a proliferated constellation of hundreds of space vehicles (SVs), in low-Earth orbit (LEO). With each 2-year spiral of the PWSA, called "tranches", additional Transport Layer SVs are deployed to add resilience and targeted technological enhancements.

- **Tranche 0 Transport Layer (TOTL)**, the Warfighter Immersion Tranche (FY23), will demonstrate the capability to pass wideband and tactical data to/from ground, through the constellation to the warfighter, and send/receive wideband data from space-based sources external to the Transport Layer.

- **Tranche 1 Transport Layer (T1TL)**, the Initial Warfighting Capability (FY25), will provide global communications access and deliver **persistent regional** encrypted connectivity in support of warfighter missions around the globe.
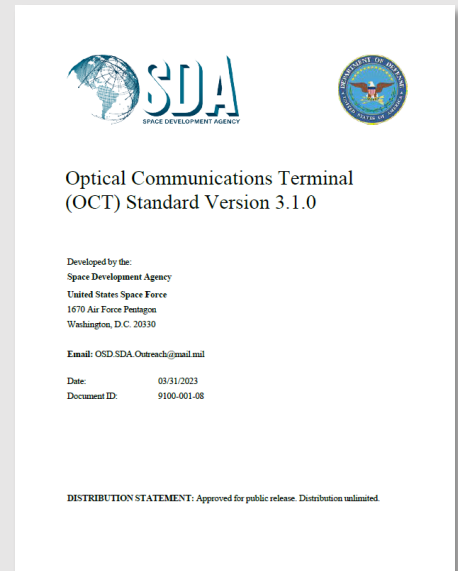

TRANCHE 0 — WARFIGHTER IMMERSION
TRANCHE 1 — REGIONAL PERSISTENCE

Transport Layer Constellation Summary	TOTL	T1TL
Total Space Vehicles	20 SVs	126 SVs
Orbital Planes	2	6
Orbital Altitude	1000km	1000km
Inclination	81^0	81^0

An Interconnected Constellation

The Transport Layer constellation will be a globally accessible mesh network that can route data from any connected source node to any connected destination node. This network, known as the **Network Established Beyond the Upper Limits of the Atmosphere (NEBULA)**, will use high-speed optical and radio frequency (RF) links onboard the Transport SVs to achieve high data rates at extremely low latencies.

Optical inter-satellite links (OISLs) will interconnect the Transport Layer constellation via optical communication terminals (OCTs). The OCTs will provide connectivity from each Transport Layer SV to other OCTs that are compliant with the current SDA OCT Standard. Other OCTs may be located in the following systems:

- Optical ground terminals (OGTs) serving as **ground entry points (GEPs)**
- Space-based **mission partner assets** for multiple mission applications
- OCT-equipped **airborne, maritime, and land-based operational platforms** for tactical data transfer
- Other **commercial systems** supporting DoD missions and/or requirements (e.g. commercial ISR assets)

Optical Communications Terminal (OCT) Standard Version 3.1.0

Developed by the:
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The SDA OCT Standard (pictured above) and SDA NEBULA Standard provide vendors and partners design and networking requirements to enable the interoperability of the PWSA .

Capability Provided by the Transport Layer to the Warfighter

The Transport SVs are equipped with several communications payloads that enable high data-rate connectivity between the SVs, other layers of the PWSA, ground segment, in-theater user terminals, and external mission partners.

- **Ka**-band uplink/down link capability for direct downlink of mission data and command & control
- **S$_{TTC}$**: Backup commanding if the primary Ka-band link is down or the SV is experiencing anomalies
- **Tactical Data Links** (e.g. Link 16) to terrestrial terminals, and platform-mounted terminals spanning air, land, and maritime domains
- **OCTs** providing connectivity from each Transport SV to other OCT-equipped platforms
- SDA network interfaces compliant with current SDA **NEBULA** Standard
- Battle Management Command, Control & Communications (**BMC3**) multi-mission module (M3) for combined mission data processing and exploitation needs.
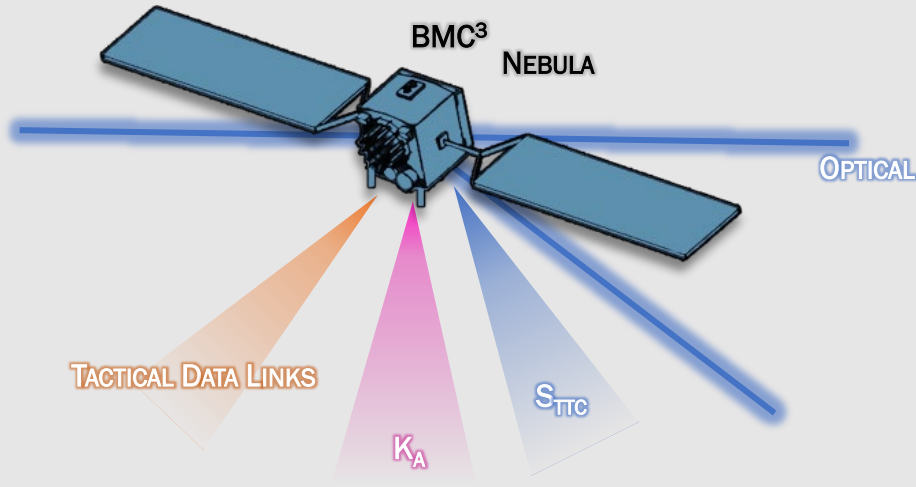
A Look Ahead

Tranche 2: Global Persistence Delivered to the Warfighter

Tranche 2, set to begin launching in fiscal year 2027, will both replenish and enhance the capability provided by Tranche 1 by increasing the overall number of SVs and by introducing new capabilities (e.g. new tactical data links, new waveforms).

Technical Areas of Interest

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

- Optimized control of modulation techniques (including wide-band or narrow-band operations)
- Simultaneous transmit and receive technologies
- Communications security functions (e.g. frequency hopping)
- Unique state of the art waveforms
- Space implementation of tactical data links
- Automated dynamic networking and routing techniques