



SPACE DEVELOPMENT AGENCY

DELIVERING CAPABILITIES

SEMPER CITIUS

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WHO WE ARE

- Constructive Disruptors – always question status quo, change agent when necessary
- Space Development, Acquisition & Operations Professionals laser-focused on program execution and delivery
- Direct Reporting Unit in the USSF with mission, authorities, and autonomy to deliver warfighting capabilities to our joint forces on the ground

WHY WE DO IT

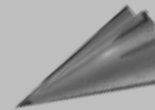
- Our customers asked for it.
Minimum Viable Capability (MVC) for each tranche endorsed by our Warfighter Council (WFC)
- The threat demands it.
National strategies call for action to deliver capabilities ahead of great power competition threats

WHAT WE DO

Proliferated Warfighter Space Architecture (PWSA), a resilient, military sensing and data transport capability via proliferated space architecture



Beyond-Line-Of-Sight (BLOS) targeting for time-sensitive ground and maritime targets



Hypersonic and advanced missile threat warning and tracking

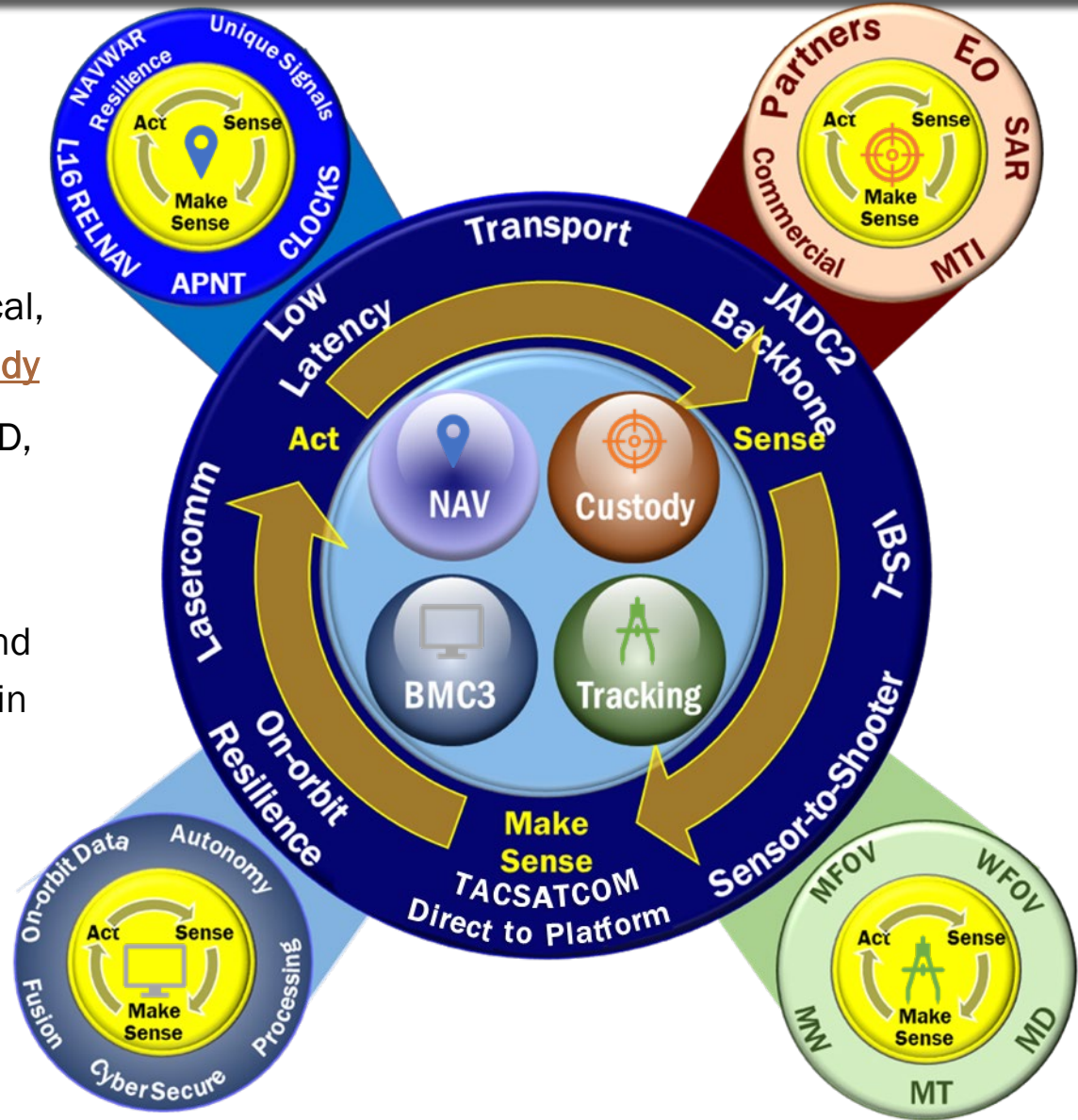
HOW WE DO IT

- Proliferation and Spiral Development
- Harness commercial space practices and technologies
- Trade performance \geq MVP, control costs to delivery on schedule
- Focus on execution, zero tolerance for distractions or unnecessary effort
- *“Semper Citius”*

THE PROLIFERATED WARFIGHTER SPACE ARCHITECTURE: A GLOBAL WEAPONS SYSTEM



- **Vision:** Space-based systems of systems providing surveillance and targeting as a service
- **Cornerstones**
 - Mission partner (National, tactical, commercial)-based target **Custody**
 - 24/7/365 **Tracking** (MW, MT, MD, fire control quality information)
 - On-orbit, cyber secure **BMC3**
 - Alternate Position, **Navigation** and Timing providing critical anchor in GPS-denied environments
- **Enabled** by a proliferated, resilient, low-latency, global, mesh **Transport** network
- **Advanced** by infusing ecosystem-wide **Emerging Capabilities**



Tranche 0 (FY22) – *Warfighter immersion:* Demonstrates the feasibility of a proliferated architecture in cost, schedule, and scalability towards necessary performance for beyond line of sight targeting and advanced missile detection and tracking.

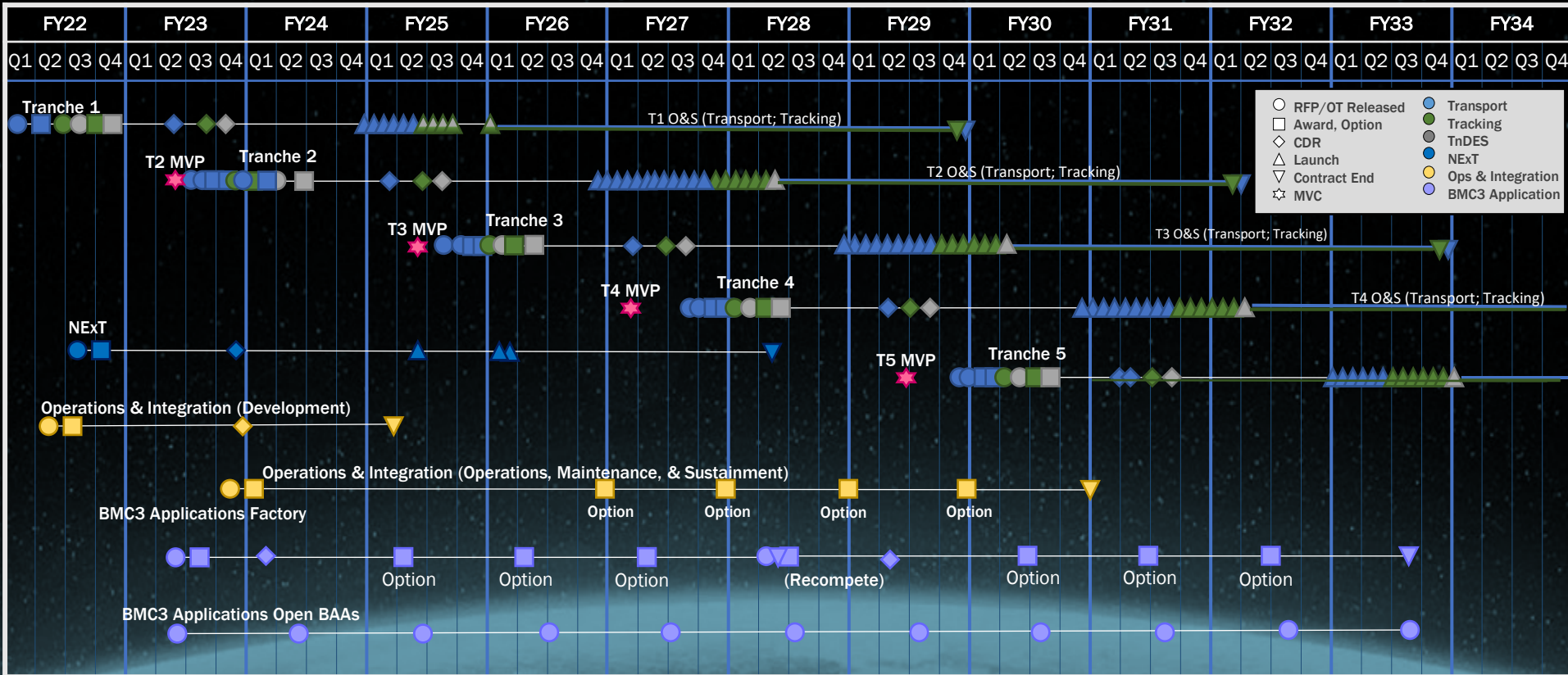
Tranche 1 (FY24) – *Initial warfighting capability:* Regional persistence for Link 16, advanced missile detection, and beyond line of sight targeting plus demonstration of UHF and S-band tactical satellite communications.

Tranche 2 (FY26) – *Enhanced warfighting capability:* Global persistence for all in Tranche 1 plus demonstration of advanced tactical data link(s) and future proliferated missions.

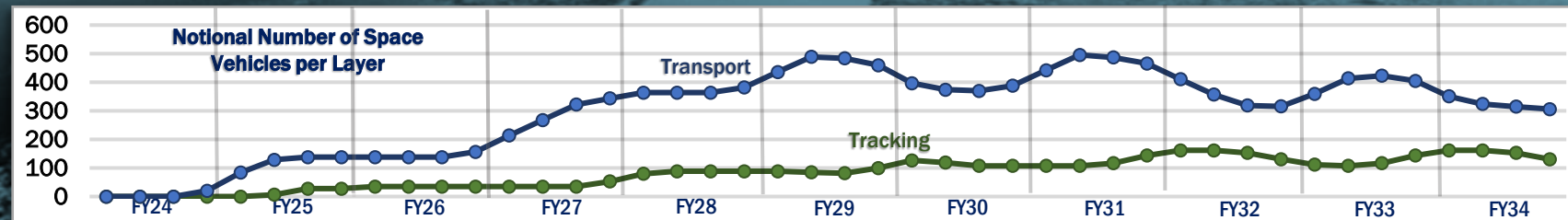
Tranche 3 (FY28) – *Sustained capability:* Advanced improvements over Tranche 2 plus future warfighting applications. This includes better sensitivity for missile tracking, better targeting capabilities for BLOS, additional PNT capabilities, advances in lasercom, protected RF communications, and advancements in autonomous operations.

Tranche 4 (FY30) – *Autonomous operations:* continual advances across the architecture.

PWSA DEPLOYMENT



BMC3: Battle Management Command, Control, Communications
PWSA: Proliferated Warfighter Space Architecture
NExT: PWSA Experimental Testbed
TnDES: Tranche n Demonstration and Experimentation Systems



DELIVERING CAPABILITY



PWSA Layer	Tranche 0 (ILC FY23)	Tranche 1 (ILC FY24)	Tranche 2 (ILC FY26)
<p>Data & Comm Transport</p>	<p>Periodic regional access</p> <ul style="list-style-type: none"> Low latency data connectivity Data directly to tactical elements Dissemination to theater targeting cells 	<p>Persistent regional access</p> <ul style="list-style-type: none"> Low-latency data connectivity Data directly to tactical elements Dissemination to theater targeting cells Tactical satcom / IBS demo 	<p>Persistent global access</p> <ul style="list-style-type: none"> Low-latency data connectivity Data directly to tactical elements Dissemination to theater targeting cells Tactical satcom / IBS
<p>Advanced Missile Tracking</p>	<p>Periodic regional access</p> <ul style="list-style-type: none"> For detection & tracking of HGVs Early flight demo for targeting quality data 	<p>Limited global access MW/MT capability</p> <ul style="list-style-type: none"> For detection & tracking of HGVs & other conventional and advanced missile threats Targeting quality data MFOV fire control demo in operational system 	<p>Complete global access MW/MT capability</p> <ul style="list-style-type: none"> For detection & tracking of HGVs & conventional and advanced missile threats Targeting quality data
<p>Custody</p>	<ul style="list-style-type: none"> Demonstrate multi-phenomenology sensor fusion (ground-based) Demonstrate on-orbit fusion (ground-assisted) 	<ul style="list-style-type: none"> Periodic regional access with multiple sensing types via mission partner contributions Demonstrate on-orbit fusion 	<ul style="list-style-type: none"> Periodic global access with multiple sensing types via mission partner contributions Enhanced on-orbit fusion
<p>Navigation</p>	<ul style="list-style-type: none"> Optical Comms Ranging demo Demonstrate PNT fusion Link-16 navigation demo 	<ul style="list-style-type: none"> Operational PNT resilience via PNT fusion PNT Situational Awareness SDA PNT service (Optical, Ka, Link-16) 	<ul style="list-style-type: none"> SDA PNT Service demos (L-Band, TACSATCOM)

SDA's business model supports the use of **commercial space technologies and capabilities** and **commercially owned and operated services** to *develop, augment and improve* the PWSA



Spiral Development

SDA Incorporates new technologies and capabilities every two years



Competitive Marketplace

SDA predictably solicits for new capabilities through competitive solicitations



Interoperability

Development of standards and open systems architecture



Affordability

Acquisition of commercial commoditized spacecraft and purchasing at scale to drive down cost

ACQUIRING CAPABILITIES AT SPEED

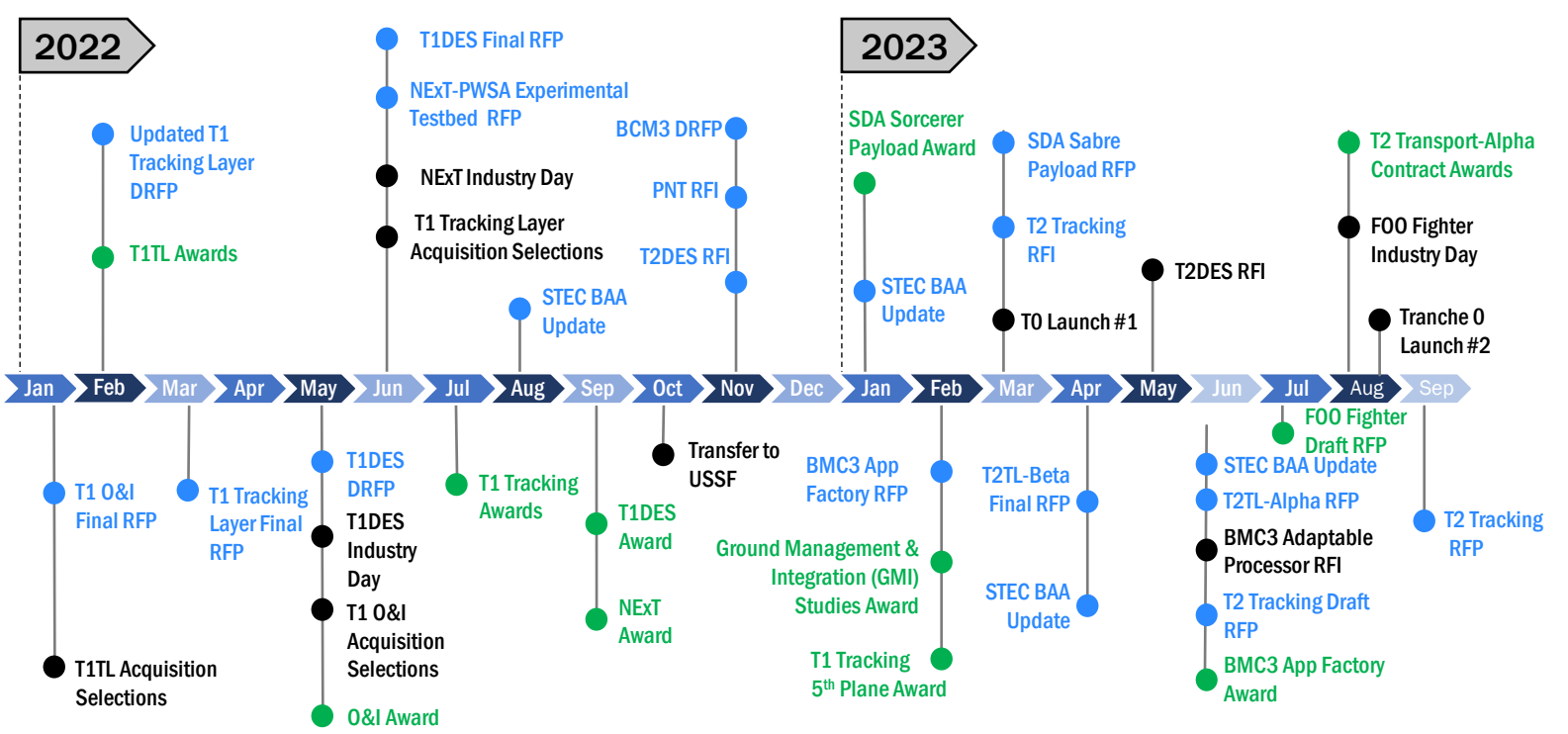


111 days on average from Solicitation to Contract Award

Solicitation
Contract Award
Other

- FY 2020-2021**
- 6 RFPs Published
 - 15 Contract Awards
 - 13 RFIs Released
 - Prototype Infrared Payload
 - Multi-Band OPIR Payload
 - OISL Demo
 - Deterrence Study (x2)
 - MSAP (x3)
 - SBIR Phase 2
 - Tranche 0
 - Transport (x2)
 - Tracking (x2)
 - Launch

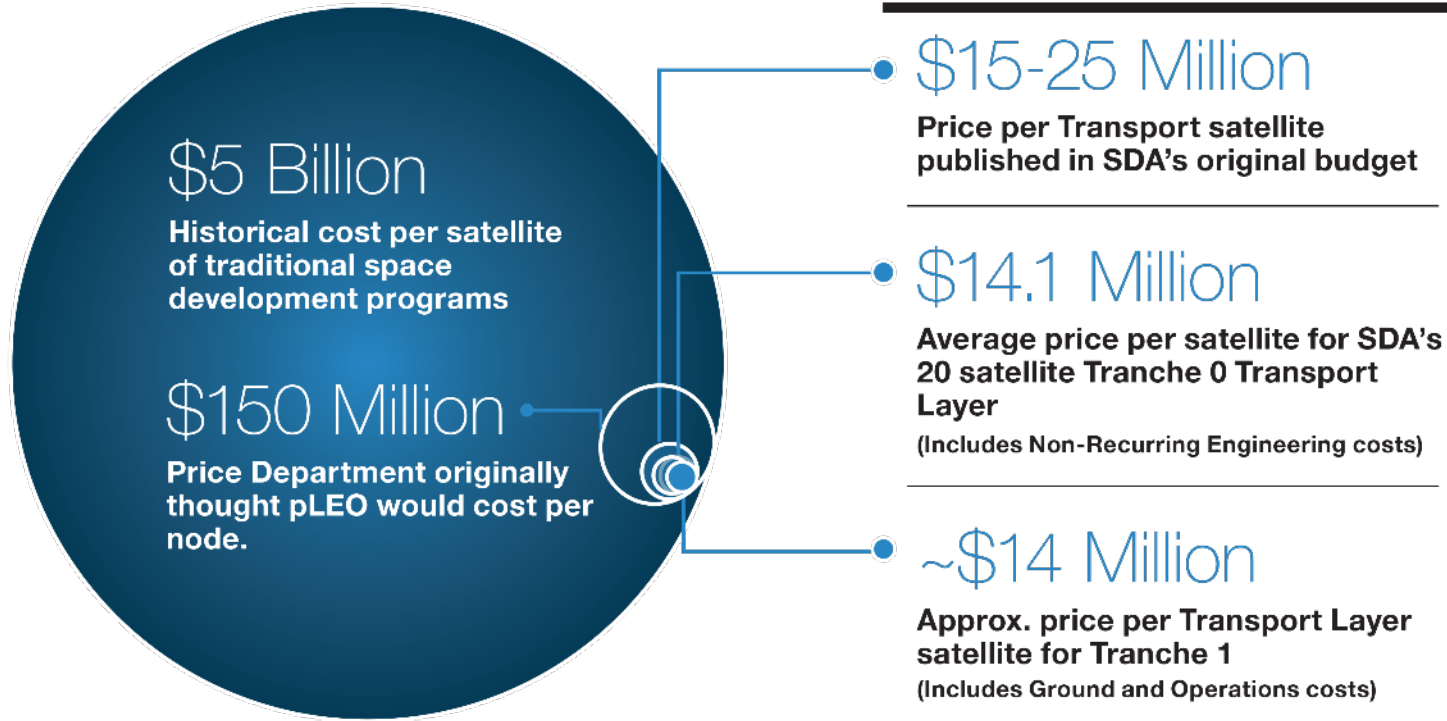
- 18 OTA Signed
- 31 SBIR/SITR Signed



BMC3: Battle Management, Command, Control, and Comms
OISL: Optical Intersatellite Link
STEC: Systems, Tech, & Emerging Capabilities

SDA IS ACCELERATING DEFENSE SPACE CAPABILITY DEVELOPMENT BY NAVIGATING ACQUISITION PROCESSES AT SPEED

DELIVERING CAPABILITY AT AN AFFORDABLE COST



SDA IS ON PACE TO DELIVER INITIAL SPACE TRANSPORT CAPABILITIES ON THE AGENCY'S ORIGINALLY-ADVERTISED SCHEDULE AT A PRICE POINT ONCE DEEMED UNACHIEVABLE



TRANCHE 0

WARFIGHTER IMMERSION

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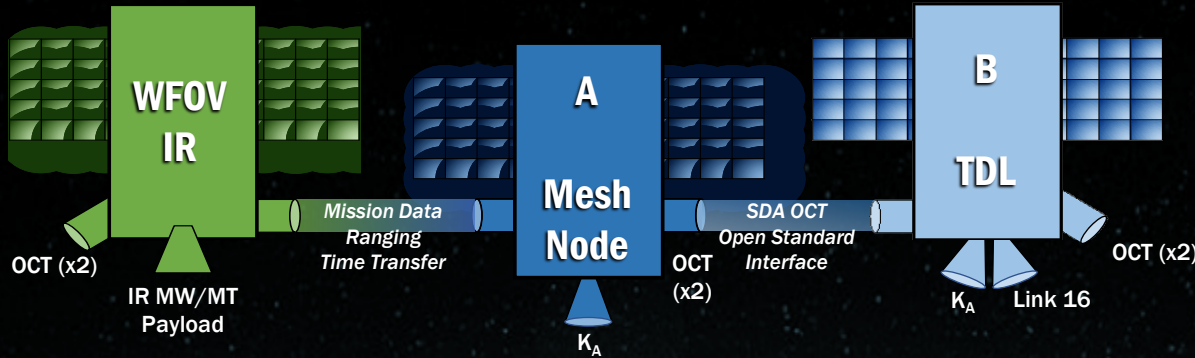


SDA TRANCHE 0 ARCHITECTURE OVERVIEW



TRACKING LAYER

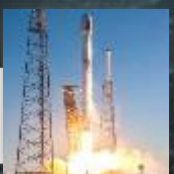
TRANSPORT LAYER



- TRANCHE 0 CONSISTS OF
- 8 WFOV IR SVs
 - 13 GROUP A MESH NODE SVs
 - 7 GROUP B TDL SVs
- DISTRIBUTED IN 2 ORBITAL PLANES



- ✓ Launch 1: April 2023
- ✓ Launch 2: September 2023
- ☐ Launch 3: Fall 2023



SLC-4 East
Vandenberg AFB, CA

OCT: Optical Communication Terminal
IR: Infrared
TDL: Tactical Data Link
WFOV: Wide Field of View

SDA's TRANCHE 0 TEAM



GROUND SEGMENT



TRANSPORT GROUP A

YORK
SPACE SYSTEMS

6 SATELLITES

TRANSPORT GROUP B

YORK
SPACE SYSTEMS

4 SATELLITES

TRACKING WFOV

SPACEX

LEIDOS SENSOR

4 SATELLITES

LOCKHEED MARTIN

7 SATELLITES

LOCKHEED MARTIN

3 SATELLITES

L3HARRIS

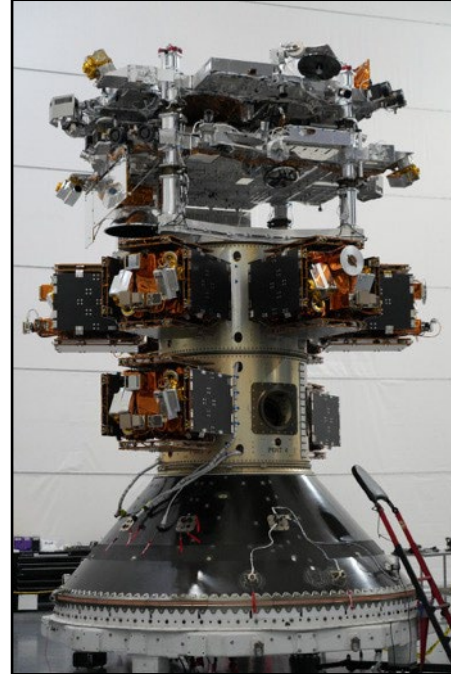
L3HARRIS SENSOR

4 SATELLITES

THE ROAD TO TRANCHE 0 LAUNCH 1



Tranche 0 Space Vehicles being prepared for delivery. (Image Credit: York Space Systems)



Integrated Space Vehicle stack (Image credit: SDA)



SpaceX Falcon 9 at Vandenberg Space Force Base launch pad. (Image credit: SpaceX)

Satellite Specifics

- Total of 10 Tranche 0 Satellite Vehicles to be launched
 - 8 Transport Vehicles (3SVBs, 5SVa); Developer: York Space Systems
 - 2 Tracking Vehicles; Developer: SpaceX
- Launched into a ~1000km deployment altitude at 80-82 degrees inclination

Launch Details

- Launch Vendor: SpaceX
- Launch Vehicle: Falcon-9R
- Location: Vandenberg Space Force Base, Calif.

THE ROAD TO TRANCHE 0 LAUNCH 2



Tranche 0 Space Vehicles being assembled.
(Image credit: Lockheed Martin)



Integrated Space Vehicle stack
(Image credit: SpaceX)



SpaceX Falcon 9R at Vandenberg Space Force Base launch pad. (Image credit: SpaceX)

Satellite Specifics

- Total of 13 Tranche 0 Satellite Vehicles launched
 - 11 Transport space vehicles (4 SVBs, 7 SVAs); Developers: Lockheed Martin and York Space Systems
 - 2 Tracking space vehicles; Developer: SpaceX
- Launched into a deployment orbit and will be raised to ~1000km orbit at 80-82 degrees inclination

Launch Details

- Launch Vendor: SpaceX
- Launch Vehicle: Falcon-9R
- Location: Vandenberg Space Force Base, Calif.

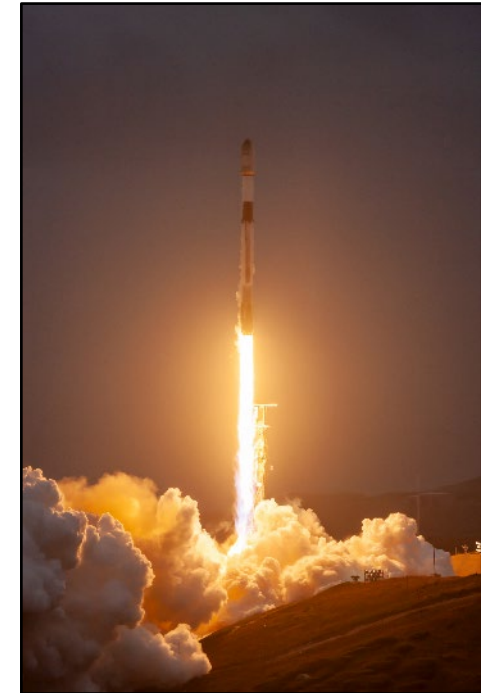
T0 LAUNCH 1&2 SUCCESS SUMMARY




- On April 2, 2023, SDA successfully delivered the first 10 satellites of Tranche 0 on orbit.
 - Approx **30 months** from order to orbit for Transport satellites.
 - Even shorter timeline (approx. **27 months**) for Tracking satellites.
- September 2, 2023, SDA delivered an additional 13 Tranche 0 satellites on orbit for the PWSA.
 - Continue to drive schedule and cost down, resulting in a cost of approx **\$15 million** per Transport satellite.
- Highlights SDA's collaborative and creative approach, working with various government and industry partners to move quickly.
- Continue to demonstrate SDA can maintain schedule to deliver enhanced capabilities every two years.



Successful T0 Launch 1 April 2,
around 7:29 am PT
(Image Credit: SpaceX)



Successful T0 Launch 2 September
2, around 7:26 am PT (Image
Credit: SpaceX)



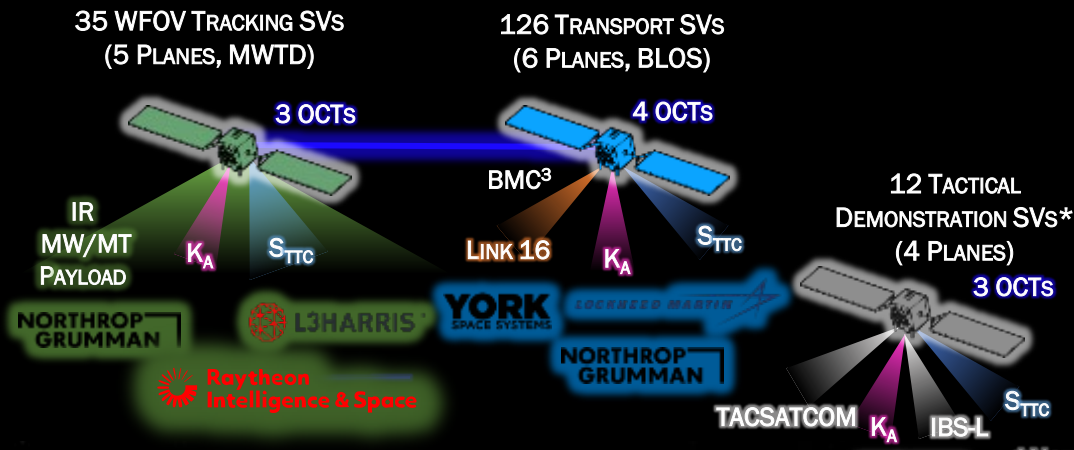
TRANCHE 1 INITIAL WARFIGHTING CAPABILITY

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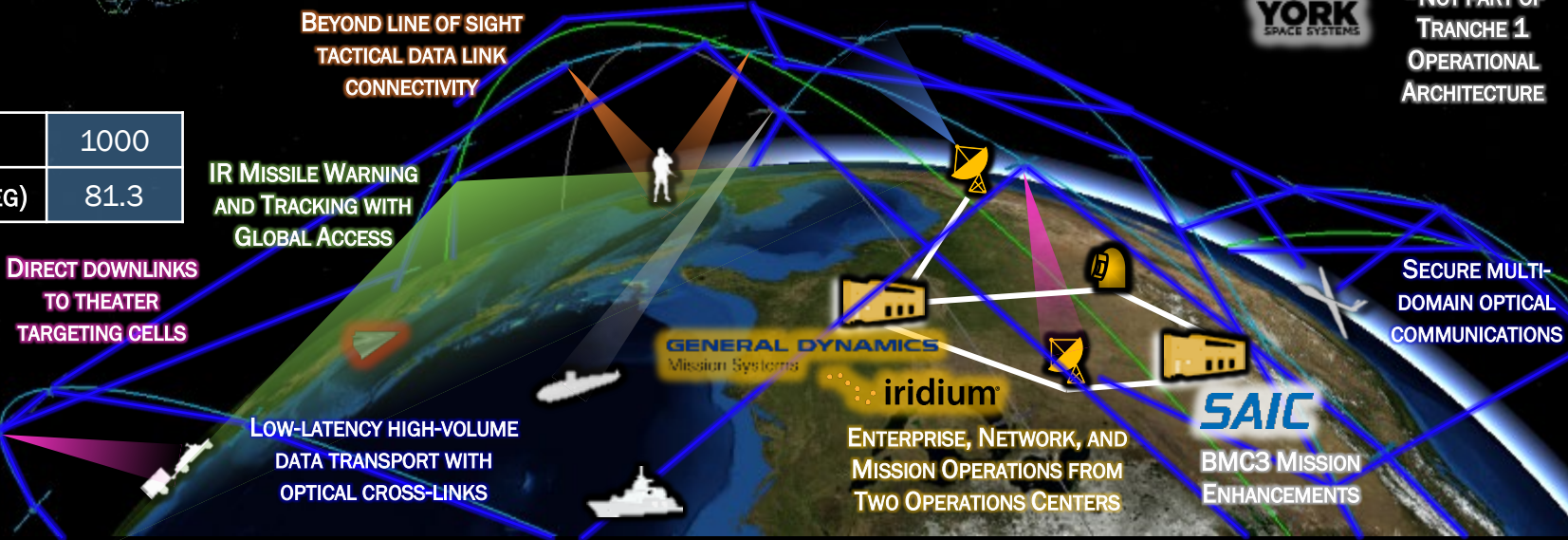


TRANCHE 1 PROLIFERATED WARFIGHTER SPACE ARCHITECTURE (2025)



*NOT PART OF TRANCHE 1 OPERATIONAL ARCHITECTURE

ALTITUDE (KM)	1000
INCLINATION (DEG)	81.3



Version: 2023-09-20

PWSA TRANCHE 1 TEAM



Transport

Tracking

O&I


BMC³

T1DES

YORK SPACE SYSTEMS 2 NOVA 42 SVs 5 yrs O&S	NORTHROP GRUMMAN 2 NOVA 42 SVs 5 yrs O&S	LOCKHEED MARTIN 2 NOVA 42 SVs 5 yrs O&S
NORTHROP GRUMMAN 2 NOVA 14 WFOVs 2 MFOVs 5 yrs O&S	L3HARRIS™ 2 NOVA 14 WFOVs 2 MFOVs 5 yrs O&S	Raytheon Intelligence & Space 1 NOVA 7 WFOVs 5 yrs O&S
GENERAL DYNAMICS Mission Systems 2 OCs 2 SUPERNOVA 5 yrs O&S		iridium® 8 K _a -band 2 S-band 4 OGTs
SAIC Secure Interoperable-middleware Layer (SIL) Application Factory	TBD – Multiple Various Mission Applications	
YORK SPACE SYSTEMS 12 T1DES SVs 2 NOVA 5 yrs O&S		



GEP: Ground Entry Point
 NEBULA: Network Established Beyond the Upper Limits of the Atmosphere
 NOVA: NEBULA Operations Vendor Architecture
 OC: Operations Center
 SUPERNOVA: SDA Unified Planning Environment and Resources for NEBULA Operations – Vendor Agnostic



TRANCHE 2

ENHANCED WARFIGHTING

CAPABILITY

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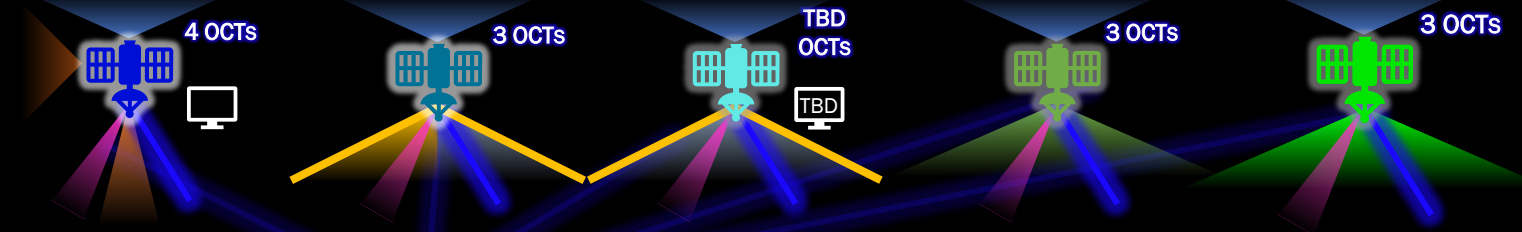
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PROLIFERATED WARFIGHTER SPACE ARCHITECTURE TRANCHE 2 (2027)



T2TL-ALPHA	T2TL-BETA	T2TL-GAMMA	T2 TRACKING – Mw/MT	T2 TRACKING- - FC/MD
100 SVs / 10 PLANES RESILIENT GLOBAL LINK-16	72 SVs / 6 PLANES GLOBAL TACSATCOM GLOBAL LEGACY BROADCAST	44 SVs / 4 PLANES ENHANCED TACSATCOM	48 SVs / 6 PLANES RESILIENT GLOBAL MW/MT	6 SVs / 6 PLANES PRELIMINARY FIRE CONTROL, MISSILE DEFENSE



LEGEND

Communications Systems

- S-BAND TT&C
- IBS-LEO
- LINK 16
- OPTICAL
- UHF TACSATCOM
- S-BAND TACSATCOM

Sensing Payloads

- PNT SA
- IR MWT
- IR FC

Processing Payloads

- BMC³



NEBULA

DIRECT DOWNLINKS TO THEATER TARGETING CELLS

IR MISSILE WARNING AND TRACKING WITH GLOBAL ACCESS

LOW-LATENCY HIGH-VOLUME DATA TRANSPORT WITH OPTICAL CROSS-LINKS

BEYOND LINE OF SIGHT TACTICAL DATA LINK CONNECTIVITY

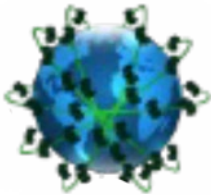
SECURE MULTI-DOMAIN OPTICAL COMMUNICATIONS

ENTERPRISE, NETWORK, AND MISSION OPERATIONS FROM TWO OPERATIONS CENTERS

TRACKING LAYER EVOLUTION

SDA Tranche 1 (2025)

LEO



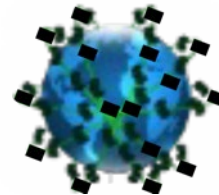
Initial global *access* capability

- **Polar coverage** for missile warning and tracking of HGVs and other advanced below-the-horizon threats
- **Near-global track custody** for radar cueing-quality data
- **35 SVs** in 5 planes



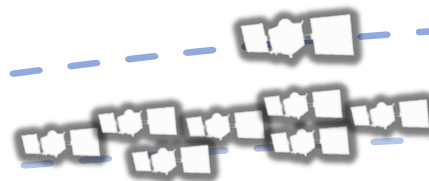
SDA Tranche 1 + SSC Epoch 1 (~2026)

LEO + MEO



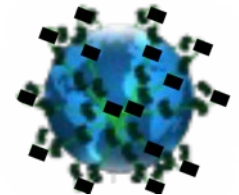
Initial global *coverage* capability

- **Addition of MEO** bolsters low-latitude coverage and track custody
- **Global track custody** for radar cueing and initial targeting-quality data
- **35 LEO SVs + MEO SVs** (2 planes)



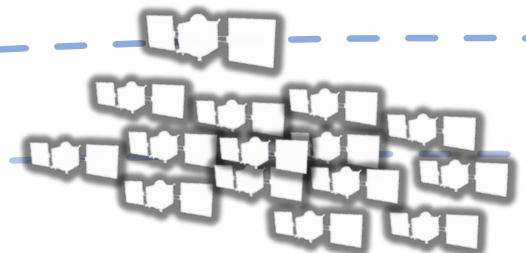
SDA Tranche 2 + SSC Epoch 1 (~2027)

pLEO + MEO



Robust global *coverage* capability

- **Global coverage** for advanced missile warning and tracking
- Near-global track custody for radar cueing and **stereo targeting-quality data**
- **89 LEO SVs + MEO SVs**



T1 Tracking Layer is the first step toward an accelerated Global MW/MT Capability

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In Latin, it means “always faster.” SDA recognizes that good enough capabilities in the hands of the joint warfighter sooner may be better than delivering the perfect solution too late. Because of this, it means we as an agency accept a higher level of risk, employ novel business models, and move to develop and field capabilities more quickly than you might see in “traditional” government agencies. We believe this builds resiliency into our people and our product—the Proliferated Warfighter Space Architecture.

When we say “semper citius,” we mean that we are moving at or ahead of the speed of the threat because we know the joint warfighter is counting on us.

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