

Next Generation Space Defense

# MILSATMAGAZINE

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**Curt Blake**  
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**Karl Fuchs**  
Senior COLUMNIST

**Rick Lober**  
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**Authors**

---

**Joe Chan**

**Joakim Espeland**

**Tom Hennessey**

**Kratos Editorial Team**

**Rick Lober**

**Salouda Moutaoufik**

**Doreet Oren**

**David Pesgraves**

**Lisa Soddors**

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# GILAT SATELLITE NETWORKS YEAR IN REVIEW

*Shaping the future of  
global security*

*Author: Doreet Oren, Senior Director Product  
Marketing & Corporate Communications*

**The digital transformation of military operations continues to shape the future of global security. Today's modern militaries move faster, smarter, and with greater precision than ever before, based on information systems that consume high bandwidth. They require a high level of transmission security and secrecy for military COMMs/C5ISR operations.**

This new paradigm, the net-centric battlefield, is achieved by implementing a globally interconnected broadband communication network (including infrastructure, systems, processes, and people) that speeds up 2-way communications and increases situational awareness. Terrestrial communication is no longer sufficient; satellite communication (SATCOM) is required to meet these growing needs.

## **Gilat's Strategic Focus on the Defense Market**

Gilat Satellite Networks Ltd. delivers globally proven, advanced SATCOM solutions for Defense and Government Applications to help countries solve complex operational challenges. Furthermore, Gilat offers government and military organizations a set of advanced SOTM/SOTP solutions for connectivity everywhere throughout the battlefield and any operations arena.

Gilat's SATCOM solutions have been designed specifically to meet the needs of today's net-centric battlefield, including flexible, secure platforms for huge amounts of data and high-bandwidth applications to connect soldiers, platforms, and terminals across land, sea, and air; continuous and resilient connectivity to ensure that information is available when, where and how it is needed; with all necessary technology, equipment, applications, products, and solutions under one roof.

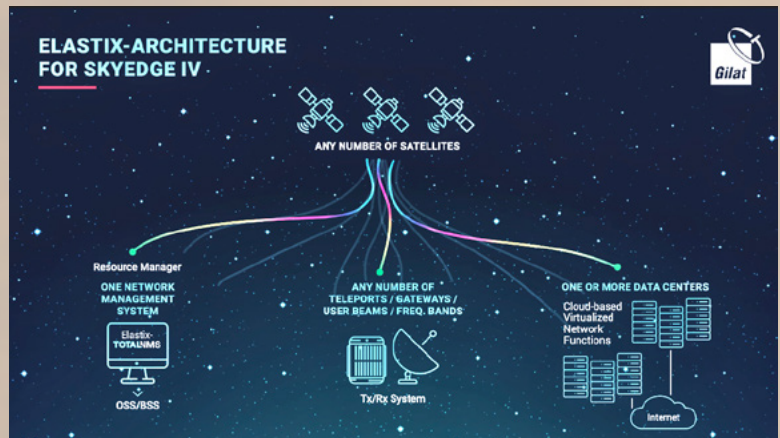
Gilat offers a one-stop-shop that includes cutting-edge ground segment equipment for satellite networks, modems, antennas, and BUCs all powered by our innovative technology. Gilat also offers an industry-leading network management system. Gilat's offering combines unmatched technical know-how and field experience to help militaries and governments deploy and operate their network infrastructure while reducing the total cost of ownership and lowering risk.

Gilat's military SATCOM expertise and operational experience position Gilat as an excellent choice for today's modern militaries as shown in the company's strategic activities during 2023:

## **SkyEdge IV**



**SkyEdge IV** is Gilat's next-generation multi-service platform built with our new, advanced **Elastix-Architecture**. Our new platform is designed to provide the best ground segment solution for the Elastix Era of multi-orbit **Software-Defined Satellites (SDS)** placed in multi-orbit (**GEO and NGSO**), providing very high capacity over thousands of concentrated beams focused on specific needs.



SkyEdge IV provides military-grade security based on **TRANSEC & FIPS** standards for multiple applications including **Communication-On-The-Pause (COTP)**, **Communication-On-The-Move (COTM)**, unmanned systems, manpacks, and armored fighting vehicles.

SkyEdge IV is a highly elastic platform that enables, together with SDS, the creation of programmable **Software-Defined Networks (SDN)** that support on-the-fly changes to optimally address dynamic network changes.



### Security must be based on TRANSEC & FIPS standards

The Elastix-Architecture is a cloud-based distributed architecture, enabling the ability to split between transmission functions located in the gateway and data processing SW-based functions which can be flexibly deployed on cloud servers located anywhere in the network.

Gilat developed two unique VSATs specifically to address the special needs of military and government organizations:

**SkyEdge IV Aquarius** is an ultra-high-performance family of VSATs providing security forces with ruggedized terminals that can be deployed on vehicles or carried in a backpack, ensuring seamless connectivity for both on-the-move and on-the-pause missions. It further delivers reliable beyond-line-of-sight (BLoS) connectivity between command and tactical levels, allowing a seamless flow of information. Our resilient networks provide true interoperability, drastically reducing the time between decision, implementation, and evaluation. In addition, Gilat's low SWaP systems allow military and border patrol teams to exploit the full potential of long-endurance missions with airborne, maritime, and land-based communications.

**SkyEdge IV Taurus-M** is a fast-to-deploy, lightweight, easy-to-operate, and low SWAP (Size, Weight, and Power) military modem ideal for armored fighting vehicles and man-pack deployment. Compliant with MIL-STD-810F standards, Gilat's SkyEdge IV Taurus-M answers market demands for the smallest, ruggedized, high-performance modem for mobile satellite communications. Setting a new standard for mission flexibility, the Taurus-M delivers highly available high-speed satellite communications for on-the-move (SOTM) and stationary operations. It is the smallest modem on the market today which offers these capabilities. It enables government agents and warfighters to accomplish their critical missions, offering rapid connectivity to data, voice, and telephony, even under the harshest conditions.

Global satellite operators **Intelsat** and **SES** have already selected Gilat's SkyEdge IV to support new satellites. SES will use the SkyEdge IV platform to simultaneously operate with its **SES-17** satellite and its upcoming second-generation NGSO constellation, **O3b mPOWER**. Intelsat will use the SkyEdge IV platform to provide expanded capacity from the **Intelsat IS-40e** satellite.

Gilat also received initial orders for the SkyEdge IV Aquarius modems from two leading defense system integrators in the U.S. These are the first steps in establishing a significant channel for Gilat's next-generation modems based on U.S. government demand.

### Acquisition Of DataPath

Earlier this year, Gilat signed an agreement to acquire **DataPath Inc.**, a leading U.S. Defense Satellite integrator.



DataPath has more than 25 years of experience in integrated communications and information technology and is a market leader in trusted communications systems, services, and end-to-end solutions for mission-critical operations. DataPath is a U.S.-based expert systems integrator with a strong focus on the **Department of Defense (DoD)** and **U.S. Government (USG)** sectors, bringing leading competencies in systems engineering, software development, and mechanical engineering.

These attributes have enabled DataPath to secure and maintain their continual presence in the provision and sustainment of MILSATCOM systems, such as portable ground stations and related services.



### Unmanned Airborne Vehicles

Gilat's BlackRay Airborne family of UAV/UAS/RPA solutions consists of highly integrated airborne SATCOM terminals with minimal *size, weight, and power (SWaP)*. Ideally suited to the needs of long-endurance *Beyond-Line-Of-Sight (BLoS)* operations for UAVs of all sizes, *BlackRay* terminals enable high throughput communications for military or commercial applications. They comprise best-of-breed antenna, high-performance modem, and BUC technologies developed and manufactured by Gilat. Modular system design facilitates customization to meet customer specifications in short time frames. Gilat closed a multi-year, multimillion-dollar strategic agreement with a major defense company and a world-leading UAV manufacturer. Gilat will provide its next-generation *BRP60* terminal for unmanned aerial vehicles.

### Solid-State Power Amplifier

Gilat's U.S.-based subsidiary, *Wavestream*, launched *Endurance*, a new line of high-power, "always-on" *Solid-State Power Amplifier (SSPA)* products. It is positioned to lead the industry in linear power with its gateway-ready, fully redundant design that ensures the maximum available power for multiple carrier inputs.

The 500W Ka-Wideband *Block Upconverter (BUC)* covers military Ka- and commercial Ka- frequency bands and features hot-swappable components for a truly "always-on" satellite communication solution. *Endurance* is unique in its ability to replace existing SATCOM solutions currently serviced by *Traveling Wave Tube Amplifiers (TWTAs)*.



The U.S. DoD is already evaluating this SSPA for a significant SATCOM program. Once certified, Gilat expects follow-on orders valued at millions of dollars per year in the coming few years and the ability to pursue additional U.S. DoD and commercial programs.

Also in the U.S., a system integrator selected Gilat's newly launched *Defense Hub Network SSPAs* for a U.S. Army SATCOM project. With this achievement, Gilat expects follow-on orders of millions of dollars in the coming years and the ability to pursue other U.S. Army programs with an addressable market of more than \$100 million dollars.

### Meeting The Needs of Defense Organizations Today and Tomorrow

Wartime and tactical missions often take forces into unfamiliar territory crawling with unpredictable and unknown threats. Access to real-time intelligence on the ground — where and when troops need it — can make all the difference between a successful and an aborted mission.

Gilat continues to dedicate strategic resources to providing defense organizations with the technology, expertise, local presence, and support they need to meet their current and future military needs.

[www.gilat.com](http://www.gilat.com)

*Author Doreet Oren has been with Gilat since 2012 and is responsible for defining product positioning, solution messaging, go-to-market strategies, market research, and analyst relations. Ms. Oren has over 20 years of industry experience, and has held management positions in R&D, Product Management, Product Marketing and Solution Marketing for international high-tech companies. In this capacity Ms. Oren contributes to product and solution definitions and is responsible for delivering the company's vision to the media and analyst community. Oren publishes thought leadership articles in renowned international journals and speaks at numerous industry conferences worldwide. Oren received a BSc in Computer Science from George Washington University and graduated from the Modern Marketing Program at the Recanati Graduate School of Business Administration, Tel Aviv University.*



**Doreet Oren**



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# GOVERNMENT SATELLITE REPORT (GSR)

NRO, industry unite for space-based intelligence architecture

Author: David Pesgraves, GSR



The adversarial threats posed to the United States on-orbit are greater now than they have ever been in the nation's history. Simply put, the jobs of military and Intelligence Community leaders are getting far more difficult to accomplish.

That was the sentiment expressed by the Deputy Director of the National Reconnaissance Office (NRO), Major General **Christopher Povak**, at a recent [Schriever Spacepower Forum](#).

In his comments during the event, Gen. Povak explained that the decades-long era of the U.S. being the undisputed leader in space technology, "...is no longer the case."

Global superpowers such as Russia and China are closing the technology gap between themselves as well as the current capability set the U.S. employs. While near-peer adversaries continue to heavily invest funds and manpower to the development of capable military space systems, they are also demonstrating aggressive actions in space that could pose real threats to U.S. systems.

"Today, several nations...are actively developing ground and space-based weapons specifically designed to interfere with or destroy our systems in space," said Gen. Povak. "These counter-space capabilities include missiles and weapons systems designed to deliver direct energy, electronic warfare, and cyber attack defense – all of which threaten our ability to freely access and operate in space."

With adversaries growing and fielding their arsenal of anti-satellite capabilities, and developing space-enabled lethal weapons systems, Gen. Povak admits that they are, "...gaining on our technology advantage at a rapid pace."

However, Gen. Povak assured the forum audience that the [National Reconnaissance Office](#) (NRO) remains the world leader in developing and operating space intelligence capabilities and that the agency is prepared to stay abreast of the threat and will also ensure U.S. dominance in the space domain.

## NRO + Space Defense

According to Gen. Povak, the NRO is responsible for the research and development, acquisition, launch, integration, and operation of the nation's vast constellation of space-based *intelligence, surveillance, and reconnaissance* (ISR) capabilities.

"As a defense agency and an element of the Intelligence Community, the NRO collects intelligence and information to support national level and Department of Defense missions," Maj. Povak explained. "Overall, NRO's mission is to work with our partners to gain and maintain the nation's intelligence advantage during peacetime and throughout periods of crisis and conflict around the world."

As part of its response to the rapid growth of adversarial capability and presence in the space domain, Gen. Povak said that the NRO is advancing U.S.



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space-based capabilities through the employment of cutting-edge technologies that provide real-time, situational awareness and intelligence to analysts, policymakers and warfighters faster than ever previously possible.

According to the general, a critical component of these situational awareness and intelligence chains are the commercial partners in the satellite and space industries.

### Bringing The NRO + Industry Together

Gen. Povak views commercial satellite data as an especially critical source for situational awareness and intelligence, due to its unclassified and shareable nature. He considers the partnership between industry and the NRO as a valuable tool to continue to rely upon, and highlighted the benefits derived from a modern, hybrid intelligence architecture — pointing to the role commercial satellite imagery played in intelligence gathering throughout the early moments of the Russia-Ukraine conflict.

“Fortunately, the NRO is already building the largest and most capable, diverse and resilient overhead constellation in our history,” said Gen. Povak. “Within the next decade, NRO expects to quadruple the number of satellites we currently have on-orbit, with different sizes and different orbits for commercial and national.”

He explained these satellites will deliver more than 10 times as many signals and images than are being collected today.

“The proliferation and diversification of our architecture will provide increased coverage, greater capacity and resilience, and more timely delivery of data,” he said. “Such improvements will increase the competence and the relevance of NRO capabilities, which are already the world’s standard of excellence for space-based ISR.”

Industry has been hard at work in assisting the NRO in the agency’s mission of maintaining space-based ISR dominance. According to Gen. Povak, the

commercial marketplace for ISR capabilities has significantly grown over the past decade, and the NRO has led contracting efforts with both traditional and new commercial ISR providers.

“Now, we have an array of a community of industry partners that are working hard to get some of these commercially-available products into our architecture,” Gen. Povak explained. “I think the benefits of commercial is not them on their own; it’s how they’re integrated with our infrastructure.”

Gen. Povak noted that space will always continue to be a battleground of constant competition for information advantage, but that the NRO will ensure that the U.S. will maintain its dominance in the domain.

“Today, the NRO’s space-based ISR capabilities are without a doubt the best in the world,” he said. “However, in an era of growing competition, our imperative is to develop the technologies, tools, capabilities, and space-minded expertise to stay that way.”

[Select this link](#) to view the video to hear more about how the NRO is uniting with industry partners to create its hybrid intelligence architecture and also learn about the capabilities of [SES Space & Defense](#).

This article was first published on [GovSat](#) and is republished with permission of GovSat and [SES Space & Defense](#).



Author David Pesgraves is a Staff Writer for GovSat Report, in addition to several other online publications dedicated to defense, military, and federal government agency technologies.



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# TRANSFORMING MILITARY COMMS THROUGH LEO CONNECTIVITY



Author: **Rick Lober**, Vice President and General Manager, Defense and Government Systems Division (DGSD), Hughes Network Systems, and Senior Columnist, *MilsatMagazine*

**For military forces in the field, establishing a long-distance communications link has never been simple. It has typically involved a technician with a portable terminal setting up a small satellite dish, and then pointing the dish at exactly the right spot in the sky to connect to a geosynchronous satellite (GEO). Only after obtaining a good signal could the team communicate with anyone outside the range of their portable radios.**

However, that is about to change — dramatically.

Advances in ground antenna technology have led to satellite antennas that are small and flat, rather than dish shaped. At the same time, a new generation of satellites operating close to Earth can send signals capable of being picked up with a flat antenna configuration, technically called an *electronically steerable antenna* (ESA).

These new, *Low Earth Orbit* (LEO) constellations can deliver connectivity with lower latency than a traditional GEO satellite. The antenna does not have to be pointed in any specific direction. As long as the antenna has a clear view to the sky, it will connect to the LEO constellation.

One of the new LEO constellations is operated by **OneWeb**. Hughes was an early investor in OneWeb and, now, as a OneWeb distributor and partner of choice, can deploy LEO connectivity as part of a military network or enterprise solution.

With more than 600 satellites in orbit, OneWeb can deliver a signal virtually anywhere, with enough throughput to allow military and other users to send and receive not only data and audio, but also full-motion video transmissions using a flat, portable antenna.



What sets these apart from ground systems that use a traditional satellite dish is their mobility, ease of setup and reliability. An ESA can be mounted on a vehicle and used while in motion, unlike a dish antenna that must stay in one spot and be pointed exactly at the satellite to maintain the connection.

While GEO satellites stay in a fixed spot relative to the Earth, LEO satellites pass rapidly overhead. The ESA is designed to use the nearest LEO satellite, and then shift to the next satellite when the first one orbits out of view. Satellites in the constellation pass users seamlessly from one satellite to another, so there is no loss of connection or noticeable disruption to the user.

One feature of the OneWeb network is that it can prioritize users and offer service levels in line with the requirements of the **Department of Defense (DoD)**. In the event of signal jamming on one satellite, OneWeb can move lower priority users to make room on other satellites for high-priority customers, such as the DoD.

Hughes engineers are finalizing the designs for aero versions of the single-panel ESA that can be used on small aircraft, both manned and unmanned. These should be available in the second half of 2024. These antennas will be similar in size and power to the planned, single-panel ESAs soon to be available for mobile ground units, but will be designed to fit the curved body of an aircraft with little negative impact on aerodynamics.



Hughes and other companies have done a lot of research into how a single, flat-panel ESA could be designed so that it could switch back and forth between LEO and GEO constellations — that has presented several challenges.

The primary issue is that GEO satellites are so far from Earth, more than 22,000 miles, and require large dishes to pick up the signal. From the ground, the ESAs are too small to generate the power needed to send a signal back to a GEO spacecraft.

Another issue is that there may not be much customer demand for a single antenna that could connect to satellites in both orbits. Simply using two different antennas may be the most practical way to obtain both types of connectivity.

Today's warfighters need to be able to carry out missions in any environment. In highly contested domains, fast and reliable internet connectivity is essential to receiving and transmitting valuable intel in real time.

As government and defense agencies explore the power and potential of LEO services, ESAs will be key in enabling this game-changing connectivity for warfighters across the globe.

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*Rick Lober, vice president and general manager of the Defense and Government Systems Division (DGSD) at Hughes Network Systems, LLC (HUGHES), leads the company in serving U.S. Federal, state and allied defense and intelligence organizations worldwide with advanced SATCOM solutions, commercial and Department of Defense (DoD) purpose-built systems, network management and software defined networking, ground and airborne communications on the move, 5G terrestrial and all company classified programs.*



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# SATELLITE MANUFACTURERS STUCK IN ORBIT

*With underinvestment in digitization technology*

*Author: Tom Hennessey, Chief Marketing Officer, iBase-t*



**Today the global military satellite market is a \$14.44 billion industry, according to *Precedence Research*. While it might seem that the sector is at the forefront of technological innovation, the reality is somewhat different.**

According to *iBase-t's A&D Digital Manufacturing Productivity Snapshot* research, 97% of A&D manufacturers, including satellite manufacturers in the U.S. and the UK, say the industry has suffered from an underinvestment in digitization and that now is the time to improve supply chain efficiencies and create a productivity advantage.

Considering the complexity and risks involved, it is alarming that a majority of manufacturers continue to use paper-based processes (88%) and spreadsheets (57%). The fact that major satellite projects are potentially being run on spreadsheets, or pen and paper, creates a huge cause for concern.

At best, this approach can cause inefficiencies and lead to mistakes. At worst, it could lead to project failure and space leaders losing their jobs. Notably, almost half (48%) of respondents say a lack of investment in new technologies and processes has resulted in them losing business — alarm bells should be ringing across the industry.

## **Getting A Tighter Grip On Supply Chains**

A lack of digital maturity has become a serious roadblock to productivity in manufacturing in the satellite sector.

Although Industry 4.0 advancements have proven critical to sustaining operations during the pandemic, most manufacturers grapple with a lack of system and process maturity and this is preventing them from leveraging operational data for business intelligence and smarter decision-making. Being able to convert critical data into actionable improvements is pivotal to true digital transformation.

While this lack of digital maturity impacts many areas of satellite manufacturing, one area in particular that requires close attention is the supply chain. In this industry, it's absolutely mission-critical that organizations are able to manage a highly regulated manufacturing environment, and complex production processes.

Manufacturers require strong control and visibility over lot and serial tracked parts for all materials, components and subassemblies, from 'cradle to grave.' Full traceability is essential if manufacturers need to look back and check whether they have used a certain component or material, that they have been alerted may be faulty or out of compliance.

To optimize performance, satellite manufacturers must also carefully track how each supplier is contributing to their enterprise. Are suppliers causing problems, or are they enabling success?

It's important to view supplier management as an ongoing process, rather than a one-time project. It requires continuous optimization to maintain top performance, and centralized communication with suppliers is essential.

However, today there is an overreliance on email and paper-based communications, which is not only inefficient but can also lead to significant quality issues.

### Digital Tools Unlock Intelligence

Satellite manufacturers must act now and invest in digital, or else they run the risk of falling behind the competition.

A Manufacturing Execution System (MES) can make all the difference. By placing an MES front and center of digital operations, manufacturers can address the data concern, unlocking real-time visibility and intelligence, while enjoying improved control.

Organizations that have already adopted MES have had a head-start, not just in embracing innovation, but also in channeling it toward achieving bespoke goals and aims, ensuring more sustainable decision-making moving forward.

When also connected with *Supplier Quality Management (SQM)* and *Maintenance, Repair and Overhaul (MRO)* solutions, the result is a holistic, connected and strategic disruption of all aspects pertinent to manufacturing excellence. This creates a framework for collaborative supplier quality, and eliminates the problems caused by email and paper-based communication.

### Taking Action With Your Digital Investment

The incorrect tools cause inefficiencies and that can result in costly mistakes as well as leaders losing their jobs.

It's been more than ten years since spreadsheet errors contributed to JP Morgan Chase losing \$6 billion in the *London Whale incident*. This lack of digital maturity could cause equally damaging outcomes in the manufacturing industry.

As satellite manufacturing accelerates, there has never been a more important time to relinquish paper-based systems and spreadsheets and leverage the power of digital technologies to gain a productivity advantage.

From improving efficiency, productivity and performance to attracting the next generation of talent, the benefits are clear for those who want to get ahead of the competition.

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Author Tom Hennessey is the Chief Marketing Officer at iBase-t.



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# KRATOS YEAR IN REVIEW



## Better decisions... sooner...

*As we look ahead to 2023, it's worth pausing for a moment to reflect on the last 12 months and highlight the capabilities Kratos is using to support the warfighter through our global RF sensor network.*

Kratos continues to improve on its commercial services enhancing **Space Domain Awareness (SDA)** by leveraging its global network to provide faster and more accurate RF data to fill critical gaps.

### Current Real-World Applications – Ukraine

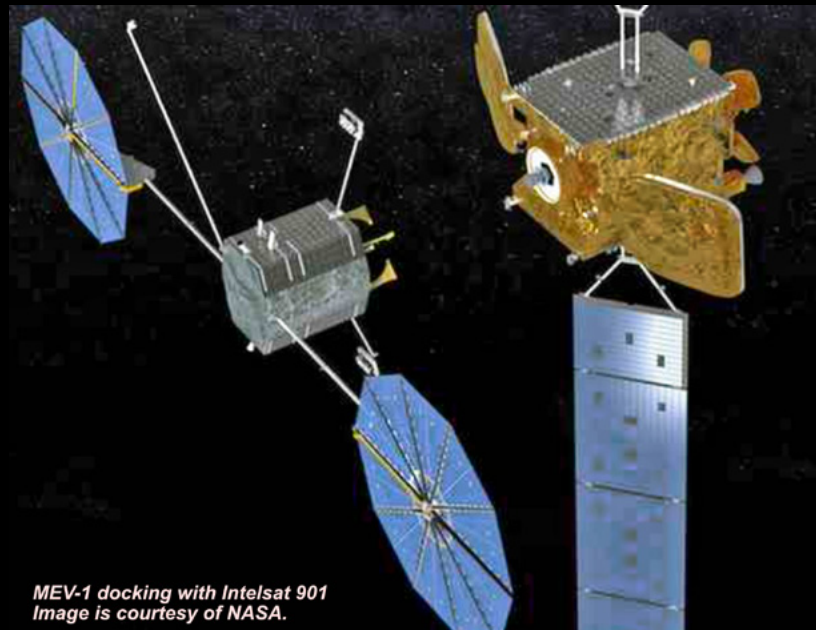
The ongoing dramatic changes in the technology and business surrounding space activities are having a significant impact on space remote sensing.

The Ukraine's reliance on **Starlink** heightened global awareness regarding the impact of commercial space operations on conflicts on the ground. The Ukraine war has increased interest in the value of commercial services, especially cyber and remote sensing. Kratos capabilities are particularly well suited to address demand for RF SSA data.

This past year, **Hugh White**, the company's Senior Director of Space Domain Awareness, spoke at the **Military Space Situational Awareness Conference** in London. Addressing Kratos' advances in commercially available RF SDA capabilities that are delivering real-world mission impact, he focused on the capabilities of RF SDA in the **Rendezvous and Proximity Operations (RPO)** space arena.

RPOs are an example of a dual-use technology. On one end there are mission extension vehicles, such as the **MEV-1**, that is docked with **Intelsat 901** to service and reposition it.

On the other end, there are **ASAT** weapons with kinetic kill capability. For missions across the RPO spectrum, accurate and commercially available RF SDA data is key for providing transparency to allied governments and commercial spacecraft operators.



MEV-1 docking with Intelsat 901  
Image is courtesy of NASA.



Kosmos-2504 lifts off from Plesetsk on March 31, 2015.  
Image credit: russianspaceweb.com

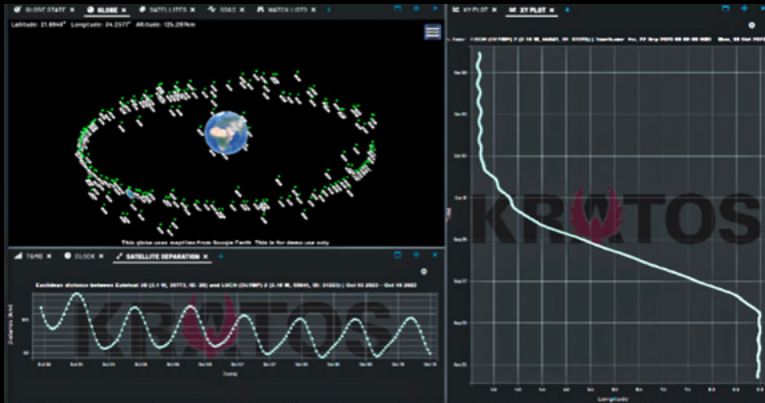
Russian Ministry of Defense

## Participation Of RPOs In Conflict

Hugh discussed the use of RPOs in contested domains, specifically the Russian satellite known as *Luch Olymp*. While it is ostensibly part of Russia's Luch communications relay satellite, Luch Olymp has demonstrated a different purpose by maneuvering into more than 25 different orbital slots and continually making close approaches on commercial and state-owned SATCOM vehicles. This has caused many to speculate Luch Olymp's mission is a co-orbital SIGINT collector.

### Unexpected Neighbor in Space

In July of 2022, Kratos SDA analysts saw Luch execute a sudden 63,000-kilometer relocation drift. The satellite positioned itself next to *Intelsat 37E*, and on October 31st, 2022, came within 4 kilometers of the Intelsat spacecraft. Precise data like this is crucial for operators, such as Intelsat, so they can respond appropriately and fly their satellites safely when confronted with a non-cooperative intruder entering into their orbital slot.



**Kratos Common Operating Picture (RF COP) revealing orbital slots relocation by Luch 2 satellite.**

Incidentally, this satellite repositioned itself almost six months before the Russian escalation near the Ukraine. The positioning of space assets is a key step in preparing for conflict. Warfighters know this and use the precise tracking of satellites, combined with an understanding of satellite missions, as valuable data warning of adversary intent.

### Situational Awareness Is Not Just About Where

SDA recognizes that the significance lies not only in the location of a satellite but also in its ongoing activities. Monitoring RF links can help in assessing intention. Since Space *Electronic Warfare (EW)* is one of the reversible effects that are especially important in a limited scale conflict such as Ukraine, Hugh said it is no surprise that we've seen a massive uptick in jamming in this theater.

Kratos has been using its global sensor network to detect and attribute satellite uplink jamming since 2010 and has observed more instances of deliberate interference in the last year than in the previous ten years combined. Kratos SDA analysts processed more than 300 unique, RF interference events in 2023 alone. This is Space EW on an unprecedented scale.

### Real-World Mission Impact

Warfighters are using commercial RF SDA to learn in real-time what MILSATCOM communication links are being targeted and degraded. Just as commercial overhead imagery is being used to inform decisions on the battlefield, commercial RF SDA geolocations are used to understand where adversary jammers are located and what mitigation options are available. Commercial RF SDA is being used to understand changes in Space EW techniques and tactics and inform responsible parties on how best to mitigate them.

In space, tracking enemy spacecraft helps anticipate their actions and safeguard our nation's and our allies' space assets. In communication, analyzing satellite bandwidth reveals adversary movements and communication methods, while space electronic warfare support enhances awareness of targeted and degraded communication. On Earth, commercial RF SDA helps locate intentional jammers to address electromagnetic interference.

SDA has become vital to mission success given the increase in commercial space activity and the escalating number of international actors influencing the dynamic theater.

### Kratos Global RF Sensor Network

Kratos owns and operates the world's most precise commercial ground network of RF sensors. Strategically positioned apertures around the globe enable precise and persistent RF sensing, providing insight for missions in defense, intelligence and commercial operations.

The global deployment of more than 170 sensors are capable of pinpointing satellite locations within 100 meters. The global network covers L-, S-, C-, X- and Ku-bands. Kratos' state-of-the-art OpenSpace® Platform manages and controls the status of the global network.

Learn more about Kratos and the RF SDA commercial products and services available by going to [www.kratosdefense.com/sda](http://www.kratosdefense.com/sda).



## Kratos Global Sensor Network

**170+ RF SDA SENSORS WORLDWIDE = 22 SITES**  
Supported by a 24/7 Network Operations Center located in Colorado Springs.

4 Sites	6 Sites	12 Sites
<p><b>Satellite Tracking and Maneuver Detection</b></p> <ul style="list-style-type: none"> <li>• 360° GEO belt coverage</li> <li>• 30-minute revisit rate</li> <li>• Typical accuracy of 100m or better</li> </ul>	<p><b>Signal Survey and Characterization</b></p> <ul style="list-style-type: none"> <li>• 360° GEO belt coverage</li> <li>• 4-hour revisit rate</li> <li>• 2 THz and 150K carriers/day</li> </ul>	<p><b>Electromagnetic Interference Detection</b></p> <ul style="list-style-type: none"> <li>• 62 satellites continuously monitored</li> <li>• 10-minute revisit rate</li> <li>• 170K transponders/day</li> </ul>
		<p><b>Signal Geolocation</b></p> <ul style="list-style-type: none"> <li>• Global geolocation coverage</li> <li>• Typical accuracy is 5km or less</li> <li>• 5 reference emitters</li> </ul>

# LIABILITY IN THE ORBITS

## The challenge of assigning responsibility

Author: Saloua Moutaoufik, International and Public Relations, Share My Space

**Since Yuri Alekseyevich Gagarin's historic space travel in 1961, it has become evident that space serves as a pivotal frontier for human exploration and scientific progress as well as a potential catalyst for heightened geopolitical tensions and confrontations.**

With the development of space-based weaponry and *anti-satellite technology* (ASAT), the militarization of space can no longer be disregarded. While space has been a realm of confrontation, whether technological or military, the absence of clear, international regulations and liability frameworks has the potential to escalate conflicts.

The absence of comprehensive measures to control potential military aggressions in space raises several pressing questions. For instance, in the event that one country attacks a foreign asset, *how can responsibility be assigned? Which international court would rule over such a case? How can the international community interpret the UN Charter in a way that allows for its enforcement in the context of space?*

According to **Article 2.4 of the United Nations Charter**: “All Members shall refrain in their international relations from the threat or use of force against the territorial integrity or political independence of any state, or in any other manner inconsistent with the Purposes of the United Nations.”

This article embodies a fundamental principle of international law: the prohibition of the use or threat of force in international relations. Nevertheless, this provision is counterbalanced by **Article 51**, which recognizes the legitimate right of self-defense in response to an armed attack.

While the UN Charter does not explicitly mention space, these principles can be extrapolated. Considering the absence of geographical limitations, these principles can be extended to space.

However, it is essential to acknowledge that international law does include specific provisions pertaining to space under the **Outer Space Treaty (OST)** that states that the moon and other celestial bodies must be used exclusively for peaceful purposes.

**Article 4 of the OST** stipulates: “States Parties to the Treaty undertake not to place in orbit around the earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, install such weapons on celestial bodies, or station such weapons in outer space in any other manner. The moon and other celestial bodies shall be used by all States Parties to the Treaty exclusively for peaceful purposes. The establishment of military bases, installations, and fortifications, the testing of any type of weapons, and the conduct of military maneuvers on celestial bodies shall be forbidden...”

In order to address military aggression effectively, there is a need for further clarification; to define what actions may be considered contrary to peaceful purposes, particularly when the boundaries are blurred, as is the case with direct-ascent ASAT tests.

For instance, *should anti-satellite tests against one's own assets be regarded as hostile if the resulting debris poses a threat to other satellites? Would such actions be categorized as acts of violence?*

As for now, the United Nations General Assembly has called for the prohibition of ASAT test. However, this is far from being a legal condemnation.

Consequently, it becomes evident that international law does not adequately address the mitigation of space debris resulting from military activities in space. Furthermore, in addition to the legal ambiguity surrounding the use of force in space, another question can be posed in regard to the existence of a liability system if force does indeed occur.

With the increasing number of actors and assets in space, these concerns become more pronounced. The **United Nations Convention on International Liability for Damage Caused by Space Objects**, adopted in 1972, primarily focuses on damages caused to airspace or Earth's surface by launches, neglecting on-orbit incidents. This omission leaves urgent issues such as satellite collisions and debris creation unaddressed. Expanding liability coverage to encompass all potential incidents could prevent unauthorized use of force in space.

As access to space has become more affordable, the actions of private companies engaged in (*potential*) hostile activities can become a fundamental issue. The majority of space law has been crafted by and for a handful of spacefaring nations. With the proliferation of commercial activities on-orbit, from satellite servicing to future space tourism missions, the ability of existing legal precedents to adequately address current challenges is questionable.

In October of 2023, the **Federal Communications Commission** sanctioned, for the first time, a company that failed to respect its de-orbit plan. While the legal issue creates a noteworthy precedent for space sustainability and safety, the issues of jurisdiction and liability are even more complex when it comes to hostile and aggressive behavior.

*Is the legal framework under which private actors operate solely based on the laws of their home country, or should it adhere to international norms and regulations, in relation to a sovereign nation?*



Horsehead Nebula x #32387  
 Credit: Anata Ebin



*Photo taken by Share My Space proprietary telescopes. The satellite shown (light streak) is the RASCOM A (NORAD 32387) which was launched in 2007 from French Guyana. The nebula in the background is the Horsehead Nebula (Barnard 33), which is located within the Orion constellation. This scene was visible during 120 seconds, allowing to showcase a number of details on both the nebula and the surrounding gas clouds.*

This ambiguity creates a liability gap where assigning responsibility and blame becomes intricate. Of course, this is not a new issue as similar challenges arose during the Iraq war with private contractors.

Nevertheless, irrespective of the commercialization of space, the fundamental issue remains that the current soft law framework does not provide incentives for states to act peacefully. States can generate hazardous debris or de-orbit their assets through uncontrolled reentries without fearing any major legal consequences or worse engage in unpeaceful operations.

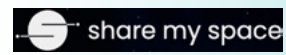
As the future unfolds, states will need to safeguard their national interests while still maintaining liability in case of misconduct. This imperative is likely

to become more pronounced as non-consensual space activities become more prevalent.

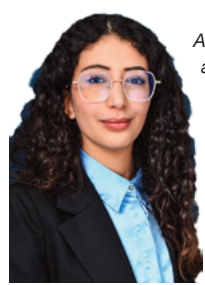
With the goal of avoiding escalation in violence, space situational awareness companies, such as **Share My Space**, have a role to play. Sharing valuable information with operators and governments can enhance confidence in neighboring space activities and reduce risks of misunderstanding.

Share My Space advocates for responsible space conduct that is compliant with international norms of behavior and work activity to promote guidelines for peaceful operations.

[www.sharemyspace.space](http://www.sharemyspace.space)



*Photo of a Share My Space's observation station, courtesy of the company.*



**Saloua Moutaoufik**

*Author Saloua Moutaoufik is an international relations and security graduate from Sciences Po Paris. She's been working for Share My Space, a space situational awareness company for a year, initially in the Paris office and then since July in the Austin, Texas one. She's been responsible for public and industry relations, engaging the space ecosystem to increase awareness around the need for comprehensive debris mitigation solutions*

# COMMAND CENTER

## ED SLATER

Senior Vice President,  
Sales and Marketing,  
OneWeb Technologies

Ed Slater is the Senior Vice President, Sales and Marketing at OneWeb Technologies, a leading provider of secure and commercial satellite



Ed Slater

communications connectivity for applications and wireless technologies globally. In this role, he is responsible for leading the development and implementation of the sales distribution and marketing strategy.

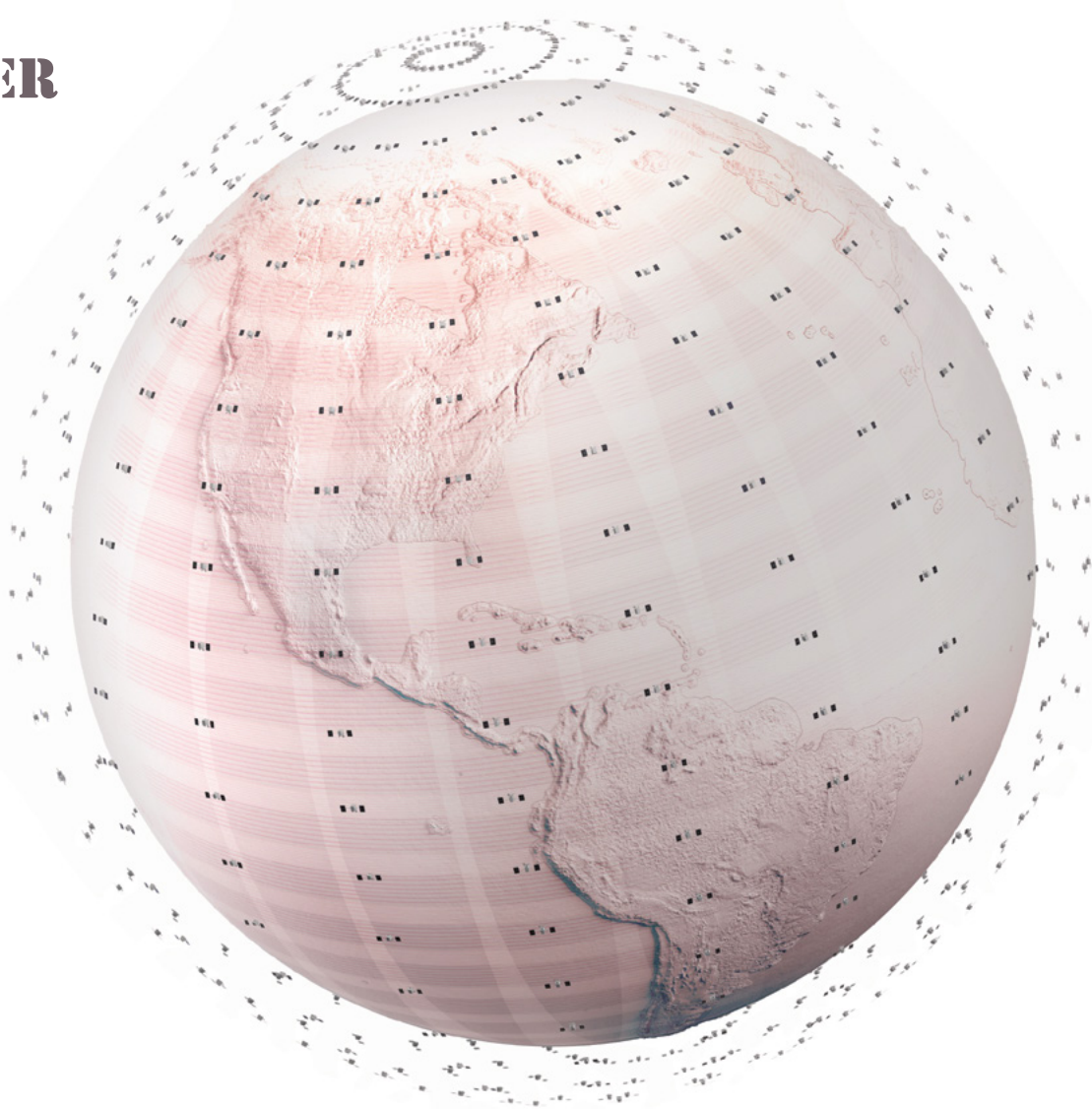
Mr. Slater has more than 25 years of experience in satellite communications, both as an operator and in commercial delivery, previously holding senior positions in the USAF and the commercial sector. Most recently, Mr. Slater was Senior Director of Sales at OneWeb Technologies, after previously serving as the company's Director, Partner Development.

Mr. Slater brings a wealth of prior experience in satellite communications, government business development, partnerships and operations to OneWeb Technologies. Prior to OneWeb Technologies, he was Director, Government Aviation at OneWeb and held multiple government business leadership positions at Satcom Direct Communications, the largest provider of Inmarsat L-band services to the Department of Defense (DoD).

He has experience leading teams responsible for customer support, activations, contract management and sales, servicing all branches of DoD as well as the State Department, FBI and other Federal Agencies.

Mr. Slater retired from the USAF in 2014 as a SMSgt. as Superintendent, Air Force One Communications. During his military career, he served in the 99th Airlift Squadron, traveling the globe in support of the U.S. Vice President, cabinet members, DoD leadership and federal agencies. He also served in the Presidential Airlift Group (PAG), where he led airborne communication for U.S. Presidents Bush and Obama. While at the PAG, he ran multiple programs to modify communications and enhance the technology and capabilities of Air Force One. During his 14 years at Andrews AFB, he was qualified on 747B, C-32A/B, C-20B/H, C-37A aircraft as both an instructor and evaluator.

Mr. Slater holds a Bachelor of Science degree in Information Technology Management from American Military University.



*Good day, Mr. Slater. Thanks for taking the time to offer us your insights. Would you please tell us how you initially became interested, and involved, in the satellite communications (SATCOM) industry?*

### ED SLATER

When I was in the U.S. Air Force (USAF), I learned firsthand that ensuring our warfighter's safety and security ultimately boils down to providing them with critical access to the data and information they require when it matters most. It became clear that communications were an essential component to any operational strategy.

I became interested in satellite communications solutions as an opportunity to help provide our military and government access to the essential connectivity, confidence and visibility that they require for successful global missions. For obvious reasons, terrestrial cellular networks were not an option in austere, contested, degraded and operationally-limited environments – and satellite communications (SATCOM) provided the infrastructure when terrestrial was unavailable.

Today, commercial SATCOM solutions not only enable this vital lifeline on the battlefield, but also help meet the demand for increased bandwidth as military technology becomes more sophisticated and requires more of it.

*How did your career in the U.S. Air Force (and thank you for your service) prepare you for entry into the world of SATCOM and MILSATCOM?*

### ED SLATER

In the early 2000s, my military career required that I travel the globe to serve in the 99th Airlift Squadron supporting the Vice President of the United States, cabinet members, Department of Defense (DoD) leadership and federal

agencies. I later served in the Presidential Airlift Group (PAG), where I was responsible for all airborne communication for the Office of the President of the United States, serving both President Bush and President Obama.

At PAG, I led multiple communication modification programs bringing new technology and capabilities to Air Force One. From the time I began my career in the USAF to my retirement to the commercial sector, it has always been clear that rapid and secure communications between military personnel and intelligence operatives is imperative, no matter the mission or the location.

Whether it be securing the travel of our Commander in Chief in the air, or the safety of our warfighters on the ground, satellites have proven imperative for global communications. And prior to the U.S. Space Force taking over, the USAF was previously in charge of procuring these communications. We understood the value of satellite communications for the military and that now translates over to the important work we do at OneWeb Technologies today.

***Please explain what OneWeb Technologies encompasses and the services provided by the company.***

#### **ED SLATER**

OneWeb Technologies is a leading provider of Low Earth Orbit (LEO) satellite services for the U.S. government, and its allies. Our satellite communications solutions provide accurate, rapid information to the U.S. government, which is a fundamental component of decision making on and off the battlefield.

We are committed to offering our customers more choice, and that means we take a broader and integrated approach to developing our COMSATCOM solutions. This open approach allows us to offer the best multi-orbit (geosynchronous, GEO, middle-earth orbit, MEO, and LEO) solutions that meet the U.S. DoD's exact requirements.

Our nimble, open and customized approach to developing and tailoring solutions makes OneWeb Technologies highly attractive for mission-critical applications – be it for connecting warfighters, enabling broadband and IoT connectivity to crewed and uncrewed platforms.

***What is the firm's relationship with Eutelsat OneWeb?***

#### **ED SLATER**

OneWeb Technologies is the U.S. proxy company to OneWeb and a leading provider of LEO satellite services for the U.S. government, and its allies, in the rapidly evolving field of satellite communications. OneWeb Technologies was specifically formed to meet the demand for secure satellite communications here in the U.S., and as a wholly owned subsidiary of our foreign-based company, we can work directly with U.S. agencies.

Recognizing that our customers' needs are unique, OneWeb Technologies customizes capabilities on top of OneWeb's global LEO satellite constellation to offer the U.S. government and its allies the secure, robust and resilient connectivity they require. We are focused on providing differentiated low-latency, high-throughput, communications meeting the demanding expectations of government users.

Now, with the recent announcement of the merger of OneWeb and Eutelsat, OneWeb Technologies can expand the capabilities that we are able to offer our customers. We are very excited about the possibilities of what we will soon be able to offer.

***Why should the U.S. Government (USG) and the nation's allies work with OneWeb Technologies? What pluses does your company offer over competing firms for USG business?***

#### **ED SLATER**

OneWeb Technologies' focus is 100 percent on the government market and supporting our partners. The investments we are making to advance our low-latency LEO technologies will benefit governments greatly, providing them access to secure, robust, and resilient new connectivity capabilities faster than they can do themselves.

Government and commercial collaboration is certainly not new in the satellite industry, but OneWeb Technologies takes a unique approach to the delivery of our secure and trusted services. The U.S. government is our number one priority. We view ourselves as a partner of the government and invested in making their objectives ours.

OneWeb Technologies is committed to transforming the communications landscape and enabling connectivity data security, velocity, and surety solutions that meet the evolving needs of government users. OneWeb Technologies is also committed to developing and delivering customized solutions that fit its customers' precise needs.

As mentioned, this includes the ability to offer multi-orbit satellite services (LEO, MEO and GEO) so that our customers can benefit from added resilience and redundancy to ensure they are always connected. This makes OneWeb Technologies highly attractive for mission-critical applications, be it for connecting warfighters, enabling broadband and IoT connectivity to manned and unmanned platforms.

***What channels enable the military/agency/government (MAG) to access OneWeb Technologies' services?***

#### **ED SLATER**

OneWeb Technologies was awarded the U.S. Space Force's p-LEO contract. Being a prime contractor opens up the opportunity for us to help agencies – such as the Air Force, Navy, and Army – to take advantage of our innovative SATCOM technologies and solutions. In addition to being a p-LEO prime contractor, OneWeb Technologies is also a LEO distribution partner to several of the GEO operators that were also awarded on the p-LEO contract.

In addition, we believe in the power of collaboration and that integrated solutions are more resilient and powerful. To that end, OneWeb Technologies has completed 16 distribution agreements with partners from around the satellite industry, including GEO satellite operators, system integrators, antenna manufacturers and small businesses.

***What is Proliferated Low Earth Orbit (p-LEO)? Is OneWeb Technologies engaged in this technology? If so, why is this significant and what routes will the company take to support p-LEO?***

#### **ED SLATER**

The USSF's Commercial Satellite Communications Office (CSCO) overhauled its procurement procedure for commercial satellite communications services (COMSATCOM), replacing the system with a model that consolidates both provider contracts and military customer requirements. As mentioned, this new model allows the CSCO to consolidate contracts and gives military agencies a more holistic view of available COMSATCOM providers' capabilities. This program enables government users the ability to act more rapidly and offers flexible access to customized IT solutions and emerging technologies from a diverse pool of commercial satellite providers.

Our award as a prime p-LEO contractor establishes a "pre-competition" award of sorts and is a significant milestone for OneWeb Technologies making us a trusted partner to the U.S. government. From our perspective, this means less competition, and opens more opportunities for us to work with the U.S. Space Force in connecting our troops.

Now, as a prime contractor in the p-LEO program, OneWeb Technologies is able to add customized capabilities on top of OneWeb's constellation to offer the U.S. government and the secure connectivity they require.

***What are some of the future communications needs of the U.S. Department of Defense (DoD) and the U.S. Space Force (USSF)? What can we expect from commercial MILSATCOM companies to meet these future requirements?***

#### **ED SLATER**

Government demand for satellite broadband continues to increase as satellite communications have become an even more critical element of the US military's strategy. The shift in the U.S. DoD's approach to their COMSATCOM procurement process is a key indication of this. This means our forces can benefit from the innovation of our commercial systems, without the upfront investment and ultimately our warfighters have the access to the crucial connectivity, data and information that they require on the battlefield.

The type of SATCOMs needed by the U.S. military is also changing; it is shifting to more robust, resilient, and lower-latency systems to support autonomy and faster decision cycles. Plus, our military users expect their devices and networks to work just as fast as they do outside of government. It used to be that we would take government technologies and implement them commercially, and now it is the government that is benefiting from the speed and power of commercial innovation.

*The company has successfully engaged in several successful demonstrations for government agencies. Please tell us about these events and the agency's response to these exercises?*

**ED SLATER**

Recently, our team attended the Shadow Warrior Tech Summit, presenting our capabilities to Joint and Special forces units, along with demos of partner Kymeta Corporation's U8 communications-on-the-move (COTM) offering as well as the OneWeb FoldSat LEO Ku OW Mil foldable and person-portable user terminal manufactured by Inster Group.

We also collaborated with Kymeta and Viasat to demonstrate the seamless integration of a multi-orbit, LEO and GEO solution to deliver high-bandwidth, reliable communications for our U.S. Marine Corps. The demo took place during the U.S. Marine Corps' 1st Air Naval Gunfire Liaison Company (ANGLICO) "Exercise Red Flag," and showcased that interoperability across multiple plans is possible. This type of integration is a primary component of the 1st ANGLICO's PACE plan, and a growing expectation from the U.S. military.

That demo came on the heels of the successful conclusion of several demonstrations with MITRE and the Department of the Air Force's Program Executive Office for Command, Control, Communication and Battle Management (PEO C3BM) during the U.S. Indo-Pacific Command "Exercise Northern Edge" in Alaska at the Joint Pacific-Alaska Range Complex (JPARC).

These demonstrations were well received and we were pleased to have the opportunity to showcase these powerful new LEO connectivity capabilities for military operations – while on-the-move or stationary.

*When you review your career in this industry, what missions or projects truly bring a sense of satisfaction to you?*

**ED SLATER**

Not sure I could name just one project, as I am fortunate to have had an incredible career.

A couple of highlights that stand out to me include my first duty station in the USAF, where I was a Communications System Operator on JSTARS. When I arrived at JSTARS, the Wing hadn't even achieved Initial Operational

Capability. I was able to be a part of the process to demonstrate the aircraft, crews, maintenance, and support could deploy and execute the mission. This is an experience few people get to be part of, and I am proud to have been one of those people.

The Air Force One mission was an incredible experience with hardworking, focused, mission-driven airmen. It's difficult to put into words what its truly like. The pride of the PAG I think is unmatched, the "No Fail Mission" really changes the way you think and approach tough and complex problems.

In my civilian career, OneWeb was an amazing experience. I initially joined OneWeb in 2019 and experienced both the lows and highs of bringing that constellation to market. One of the highs of course was the Trustcomm acquisition, which created OneWeb Technologies where I sit today.

More recently, the merger of OneWeb and Eutelsat creates an opportunity for OneWeb Technologies to strengthen the capabilities. Now the pace is picking up, satellites are up, more terminals are coming to market and expanded coverage is rolling out.

This is an amazing time to be in the satellite industry and to be part of bringing a capability to market that will support the U.S. warfighter.

[onewebtechnologies.net](http://onewebtechnologies.net)



*OneWeb Technologies Inc. is a commercial satellite communications (SATCOM) services provider, offering resilient fixed and mobile solutions to the U.S. government and its allies. As OneWeb's U.S. proxy organization, OneWeb Technologies has access to an operational, robust 600+ global low-earth orbit (LEO) satellite constellation, and offers a customer-first, adaptable and consultative approach to developing customer solutions. The company provides Committed Information Rates (CIR), contracted Service Level Agreements (SLAs), a 24/7 Managed Service Operation Center (MSOC), and offers traffic prioritization through a Global Access Network (GAN) that meets or exceeds U.S. government security mandates.*



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# QUADSAT YEAR IN REVIEW

Author: Joakim Espeland, Chief Executive Officer



***The satellite industry has ushered in a new era where space and ground segments are becoming significantly more complex as the industry pivots to meet consumer demand for high-speed connectivity and high availability.***

At the same time, space has become the new frontier for security and defence. The geopolitical situation is changing and countries around the globe are stepping up defensive and preventative actions in response to the evolving threats to military satellite systems. All of this is activity driving the need for improved testing programs.

## ***The Threat In Space Has Become Real***

The current geopolitical situation has brought a growing awareness of the threats in space.

While space has been a potential target for many years, we are starting to see real actions and tests that could have a catastrophic impact on the entire space environment.

From ASATs to jamming and cyber-attacks, the defence industry is constantly working to protect its military satellite systems from threats, and attacks from adversaries.

Of course, the industry hasn't been sitting on its laurels and there are already a huge amount of counter measures developed, and being developed to keep the

environment safe. It is not surprising that it is an area where we are seeing a lot of innovation, from better tracking to interference monitoring, and of course, improving testing.

Drone technology is another area where we are seeing a huge amount of innovation due to the enormous volume of drones being used in modern warfare. This is leading to higher production volumes, as well as better reliability and optimized costs.

While a lot of this innovation is being driven by necessity, it will be crucial to ensuring the defence industry can continue to use space in a secure and reliable way.

While testing ground equipment doesn't stop the aggressive actions, it does ensure governments and defence entities can ensure their systems are performing optimally at all times.

While the industry is mostly on board with testing pre-operation, testing throughout the life-cycle and in real situations has historically been far more challenging.

It is arguably more important in a defense situation than any other operation when you consider the challenging situations under which these systems operate and the ongoing threats that might cause degradation.



At the same time, as drone technology continues to improve, we will likely see new applications emerging that are perhaps not possible with today's systems, as well as improved functionality for existing applications.

At **Quadsat**, this year has seen a massive pick up in interest for what we can provide from the defence industry. This included working the Danish Navy to perform a technical demonstration of the Quadsat testing solution in a real operational environment.

The pilot project demonstrated the system's ability to measure antenna radiation diagrams on board vessels.

The demonstration also showed the potential for the system to be used for testing and calibration of other Navy equipment, such as radars, EW and a range of other RF equipment.

### ***Moving Toward Standardized Test Procedures***

At the end of 2022, we reached a major milestone when the **SOMAP (Satellite Operators Minimum Antenna Performance)** group confirmed that they could accept ground station antenna measurement results obtained via our drone-based antenna verification system.

Consisting of some of the largest operators (**AsiaSat, Eutelsat, Inmarsat, Intelsat, and SES**), this agreement on approved testing procedures is critical for the industry, meaning tests can be setup as needed based on specific requirements that will meet the needs of multiple operators.

When SOMAP was first created, it was totally revolutionary and instantly changed the game for antenna manufacturers, teleport operators, and satellite operators alike, making the process of testing far less time-consuming.

We are seeing a lot of movement in the industry to reduce that further and that can only be achieved through closer industry-wide collaboration and new testing methodologies.

This is about to get more challenging as we are already seeing the first Flat Panel Antennas coming to market. Given how vital these antennas are for many of the LEO applications, this number is about to grow significantly, however as of now there is no common testing procedure in place.

These antennas cannot be tested in the same way as parabolic antennas and given many will be used for **Comms-on-the-Move (COTM)**, it will be even more important for them to be tested insitu.

With all of this activity on the horizon, we are noting a great deal of interest in how we can help define new test methodologies for both existing, and next-generation services.

### ***Quadsat Is Democratizing Testing***

Perhaps the most important milestone for us as a company was the launch of a productized version of our solution. Previously only available as a service, customers can now acquire their own version of the Quadsat system, obtain the necessary training and then conduct their own tests as, and when, needed. This has enabled us to truly democratize regular testing, giving the industry a more-cost efficient way to access antenna test and measurement.

While we continue to offer the service for those customers that require it, we have signed our first customers and partners for the productized version and look forward to continuing to grow our partner ecosystem. This version of the Quadsat system has also enabled us to focus more time on the next product developments.

Earlier this year we announced the ability of our drone system to emulate orbital passes of a LEO or MEO satellite as seen from the antenna on the ground.

This means that the system can generate virtual passes from any direction and at any elevation angles to perform tracking tests, wherever the antenna is located.

We are continuing to work on new features and frequency ranges, so watch this space for updates coming soon.

Improving testing capabilities is critical if the industry is to mitigate disruptions, deliver seamless connectivity, and remain competitive in the face of competing technologies, such as 5G, 6G and IP.

As we head toward 2024, we look forward to further expanding our operations and enhancing the Quadsat product range, so that we can take RF testing and diagnostics to the next level.

[www.quadsat.com](http://www.quadsat.com)



*Author Joakim Espeland is an entrepreneur, electrical and mechanical engineer, satellite field engineer and examiner. Joakim developed QuadSAT from idea to start up to current success story.*

# COMMAND CENTER: MATT TIRMAN

*President, Satellogic*



**Matt Tirman**

Matt Tirman serves as the President of Satellogic and brings more than 20 years of experience in technology and aerospace from across the U.S. government and international markets. As President, he leads the operational execution of Satellogic's strategy and business plan. Prior to this appointment, Mr. Tirman held the position of Chief Commercial Officer, where he began laying the groundwork for Satellogic's early entry into the U.S. market.

Before joining Satellogic in 2021, Matt served as Head of Government at Descartes Labs, a leading provider of geospatial and multi-sensor analytics, where he revenue growth and customer delivery across defense and intelligence clients. His previous roles include Chief Commercial Officer at PlanetRisk, where he was responsible for delivering enterprise geospatial risk analytics and customized big data solutions to Global 1000 customers; Chief Executive Officer and founder of Access Global, a consulting firm providing executive management, sales, and business development solutions in foreign markets across EMEA and Asia; Vice President and Managing Director at Strategic Social, a technology and services firm operating frontier markets across the Middle East and North Africa that he helped grow to more than \$40M in annual revenue before it was sold to Constellis in 2014.

Additionally, Matt has served as an analyst for the US Department of Defense on cooperative Research and Development and as a speechwriter for senior military leadership in Washington D.C. and Baghdad, Iraq. He holds a master's degree in Defense and Security from Lancaster University and a BS in Political Science from East Carolina University.

## **Company update**

Satellogic recently announced its redomicile to the U.S. with a new focus on expanding business within the U.S. market and Matt Tirman was appointed the President and is overseeing the firm's U.S. strategy.

***The U.S. government seems to be streamlining its processes for working with commercial providers -are we likely to see governments relying on commercial operators more?***

## **MATT TIRMAN**

There is growing concern that the U.S. would lose its lead in spaceflight which opened the door for more contracts with commercial operations. What we saw this month was the U.S. Senate Subcommittee on Space and Science addressing the red tape with the regulatory framework called "Part 450."

The [United States Space Force \(USSF\)](#) has been building a broader strategy for procurement of commercial services over the past year to ultimately have a "commercial space reserve" and the organization is working on a commercial strategy, or blueprint, as to how this will integrate commercial satellite services into routine military activities.

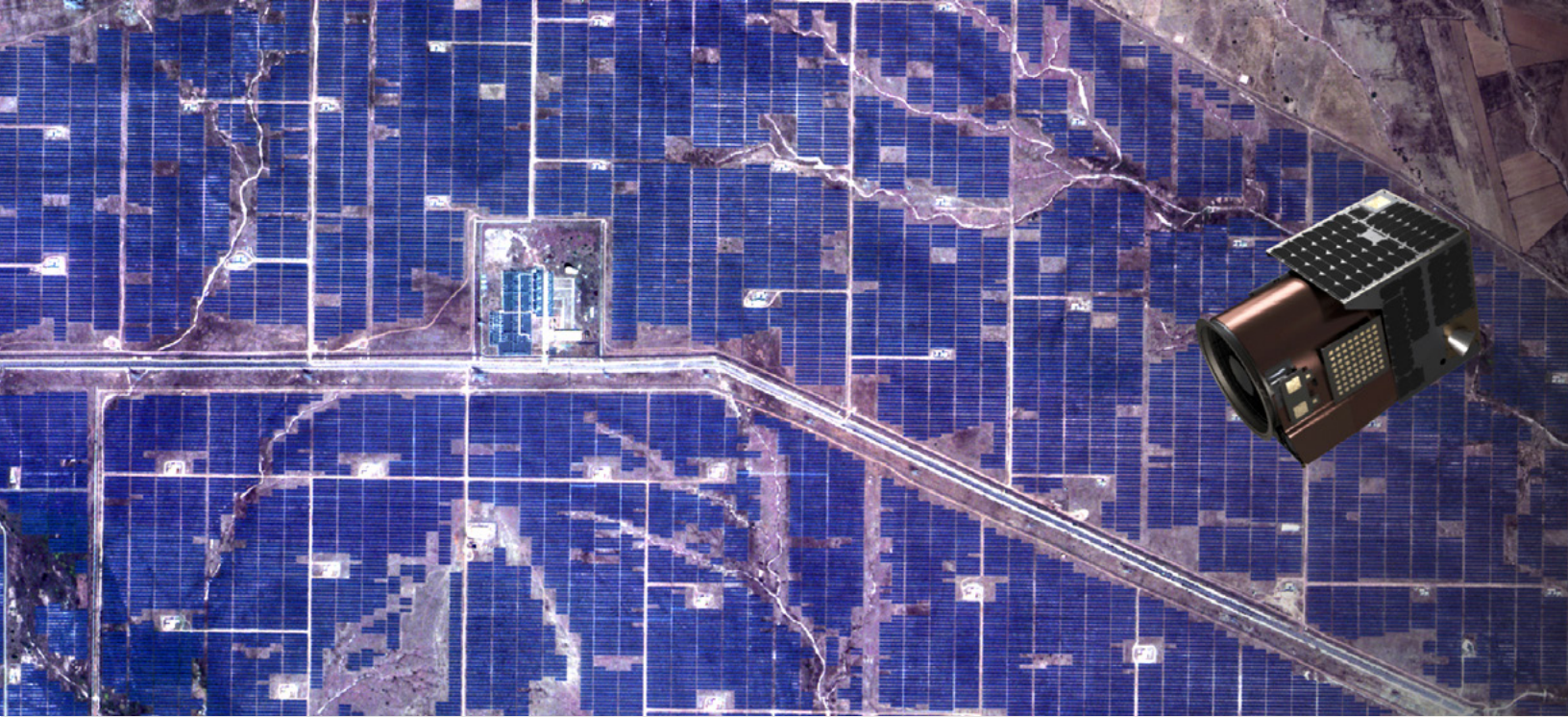
Commercial systems continue to prove as a critical partner to national capabilities. The expansion in various [Earth Observation \(EO\)](#) related contracts, such as the upsizing of the [National Reconnaissance Organization \(NRO\)](#) and [National Geospatial-Intelligence Agency \(NGA\)](#) contracts, and establishment of the USSF, are but a few examples of opportunities shaped by commercial providers.

***Commercial satellite operators seem to be advancing rapidly — what applications are coming out of the commercial sector that are of most interest to government clients?***

## **MATT TIRMAN**

In 2022, a record number of commercial satellites were deployed — 2,325 — and the private sector is historically a stronger engine for innovation as well as for lower costs and increased capabilities.

When looking at reliability, flexibility and redundancy, one example would be the U.S. Army — a large user of satellite data — has a goal of decentralizing data sharing. Remote sensing is a priority for U.S. government use during national security emergencies. Also, exceptional, high-resolution, EO capture capability with the best geospatial data quality, all at the lowest cost, must be attained.



**Satellogic has been recently granted a remote sensing license from NOAA. Please explain how this positions Satellogic in the U.S. Market?**

**MATT TIRMAN**

We filed an application to license our constellation with NOAA as part of expanding business in the U.S. market, better positioning Satellogic to compete for U.S. government and allied contracts.

Earlier this year we noted the FCC launch the Space Bureau to improve coordination among agencies and commercial providers to make it easier for new companies to get the authorizations they need to enter the market.

The EO market, particularly U.S. regulated contracts, are capacity-constrained. Satellogic is uniquely positioned to fill this gap with its high-capacity, high-resolution constellation.

**Will the redomicile change operations and what is the expected timeline?**

**MATT TIRMAN**

We plan to complete the conversion during the first half of 2024 and this will be paired with our granted NOAA license application. This will enable Satellogic to start manufacturing in the U.S., thereby expanding our manufacturing capacity and accelerating our aim to deliver daily, global remaps.

**Satellogic already has a GEOINT contract in the works – what will that focus on and how this was organized pre-NOAA license?**

**MATT TIRMAN**

Satellogic, through our Federal partner network, has been connected with a variety of U.S. government projects.

**Your Asset Monitoring and Constellation-as-a-Service (CaaS) businesses have gained momentum, contributing to a 33% growth in revenue for the first part of this year — are there any changes here with the redomicile?**

**MATT TIRMAN**

As we look to 2024 and beyond, our continued growth will be in Asset Monitoring, Constellation-as-a-Service, and our Space Systems — which we anticipate will contribute considerably.

**There are some 133 commercial space companies that provide their services to the U.S. military — none of which have had automatic protection provided by U.S. Space Command. Are there any concerns that your spacecraft could become a target by non-allied nations?**

**MATT TIRMAN**

The U.S. intelligence community and DoD are increasingly reliant on commercial satellites for imagery and other critical data. Since Russia's invasion of the Ukraine, commercial space companies have provided critical intelligence and communications services to Ukraine and that nation's allies, and Russia's military has threatened to target commercial systems.

The U.S. is working to 'better enable protection of commercial remote sensing space assets' The NRO, the NGA and [U.S. Space Command \(USSPACECOM\)](#) recently signed an agreement to improve threat intelligence sharing with commercial satellite operators.



[satellogic.com](https://satellogic.com)



# SPACE SAFETY

## Challenges and developments

Author: Joe Chan, Chairman and Executive Director



**SPACE DATA**  
ASSOCIATION

*There can be no denying that the global space industry has experienced a significant growth rate in recent years.*

According to a report by the **Space Foundation**, in 2021, the industry grew at its fastest rate since 2014, with an impressive, year-over-year growth rate of 9%.

This growth has been driven by a number of factors, including advancements in technology, increased demand for space-based services, and the emergence of new players.

The industry is no longer dominated by traditional government space agencies and large aerospace companies.

Instead, a new generation of private companies and startups are entering the market, offering new services and products.

These companies are leveraging advances in technology and new business models to offer services such as satellite internet and remote sensing.

As the industry continues to expand, it's bringing new and exciting opportunities for companies and individuals, as well as playing an increasingly important role in our economy and society.

However, as space becomes busier, the risk of damage to satellites from an in-orbit collision with other space objects increases.

Space safety is critical for the space industry because without it, the successful and sustainable operation of spacecraft, satellites, and other space-related activities cannot be maintained. Improving and maintaining space safety is however, not without its challenges.

### *The Problem With Debris*

It stands to reason that as the number of objects on-orbit increases, so does the amount of debris created by defunct satellites, rocket stages, and other objects.

Although there are systems in place for tracking debris over 10 cm, our ability to detect and track smaller pieces of debris is limited. This is where the problem rests, as even smaller objects, less than the size of an orange, have the potential to still cause significant damage to satellites and spacecraft.

To put this into perspective, consider the damage a moped traveling at 50 kph would do in a collision — that would certainly would be significant.

Compare this with an object traveling in space that is only as big as a paperclip, such as a tiny fleck of paint from a spacecraft and weighing just one gram.

That moped and the fleck of paint would both impact with the same kinetic energy and could cause an identical level of damage upon impact.

When taking this into account, it's clear to see that even small pieces of debris pose a significant threat to active spacecraft, satellites and other human spaceflight operations.

Detecting and tracking debris, particularly small pieces, is challenging for a number of reasons, in part because it is just plain difficult to see with existing systems, but also because of the complexity around the constantly changing orbits of objects in space.



### Detection + Tracking

**Space situational awareness (SSA)** is critical in ensuring the safe and efficient use of space. During recent years, we've seen significant technological developments in the field of space surveillance and tracking systems. These systems use radar and optical telescopes to track and monitor the position and movements of objects which makes for much more accurate warning systems.

When this data is combined with mathematical models that take into account the effects of various factors, such as the Earth's gravity and solar radiation pressure, it's easier to predict the future positions of space objects with a high degree of accuracy. Better detection and tracking of objects in space will enable more accurate assessment of the probability of collisions, which in turn will help satellite operators to avoid unnecessary avoidance maneuvers.

Another important development is the use of **artificial intelligence and machine learning (AI / ML)** algorithms. These technologies help to analyze vast amounts of data from space surveillance and tracking systems, so that patterns can be identified and potential collisions predicted.

In addition, the use of advanced communications systems, such as satellites and laser communications, have made it possible to transmit data and information from space to ground stations in real-time. These systems allow for far more accurate and timely SSA, enabling faster response to potential collisions or other hazards.

The use of advanced sensors and imaging systems have also played a big use of high-resolution cameras and other sensors have significantly improved the

ability to detect and track objects in space, and to gather information about their size, shape, and composition. This information can be used to identify and classify objects, and also to determine their potential threat level.

The sustainability of the space industry is dependent on the ability of operations to be carried out as safely as possible. The potential fallout from a collision could well be disastrous because it could result in hundreds or even thousands of new pieces of debris being thrown into orbit. This is why it is so critical that we improve space safety and develop much more effective and reliable SSA systems.

To accomplish this, we need to continue to develop technology that provides us with the required detecting and tracking capabilities. SSA capabilities must be upgraded into the 21st century — otherwise, the sustainability and further expansion of the space industry could be at risk of more than collisions.

The time has come for technology to catch with to the crucial need of reliable SSA to ensure safety in space.

[www.space-data.org/sda/](http://www.space-data.org/sda/)

*Author Joe Chan is the director of Flight Dynamics at Intelsat. He oversees the FDS operation and engineering of more than 70 geostationary satellites that Intelsat currently operates. He has been with Intelsat for 24 years. Prior to joining Intelsat he worked at Goddard Space Flight center on the TOPEX/POSEIDON and Mars Observer projects.*



# — SPACE SYSTEMS COMMAND BRIEFING — DATA TRANSPORT

*SSC working to modernize, improve and build resiliency into space and ground architecture*

*Author: Lisa Sodders, Space Systems Command*



***The world increasingly depends on data — from the GPS signals that navigate location for first responders to shipping, agriculture, and hosts of other industries, to timing signals that help secure financial transactions, to the missile warning and intelligence information that aids warfighters in the field.***

While the United States has long enjoyed a competitive advantage through its space-based satellite systems, several factors have created the need for a multi-faceted push within the **U.S. Space Force (USSF)** to modernize data transport, with **Space Systems Command (SSC)** as the key driver.

Previously, U.S. satellite communication missions were spread out among the military branches. With the creation of the USSF, those missions are now consolidated under one branch to ensure unity of effort.

Factors driving modernization efforts include rapid improvements in technology that have expanded capabilities; the explosive growth in the number of on-orbit satellites, particularly in **Low Earth Orbit (LEO)**; new partnerships with allies and the commercial space industry; and the need for more resilient systems that can withstand threats from adversaries.

*“Many of the components of our data transport system have worked very well, for a very long time,” said Colonel Peter C. Mastro, senior materiel leader, Tactical Command, Control and Communication Delta at SSC. “But now, we’re on the brink of a data transport revolution and SSC is working hard to create a stronger, faster and more resilient system that can meet the threat now — and adapt to the demands of the future.”*

Mastro’s work focuses on getting commands to satellites and the connection between satellite ground systems and the satellites on-orbit, as well as the movement of data across terrestrial lines that connect USSF missions together.

Satellites and the ground systems that support them provide a wealth of critical data: **position, navigation and timing (PNT); intelligence, surveillance and reconnaissance (ISR); missile warning and missile defense; communications, weather; and research and development (R&D).**



**Col. Peter Mastro**

It's not just about providing data during a conflict; a host of other government agencies — from the **National Reconnaissance Office (NRO)** to the **National Oceanic and Atmospheric Administration (NOAA)** — depend on data provided by the USSF.

The backbone of the system is the **Satellite Control Network (SCN)**, which was first established in 1959. The SCN is a worldwide system of 19 antenna stations in seven separate geographical locations that track **Department of Defense (DoD)** and other government agencies' satellite locations, collect data on the satellites' status and send control commands to various sub-systems. SCN is also an important part of launch support and provides emergency support for lost or out-of-control satellites.

*"You can think about it like the Space Force is operating a drone — this drone (satellite) just happens to be on-orbit,"* Mastro said. *"You have to be able to send it commands to do things, to turn on payloads like the communication radios. Or, if it happens to have a camera on board or, for our missile warning satellites, an imager, point it in the right direction. And then you have to be able to monitor the satellite, that all the subsystems are working as we expect them to be. "That temperature readings are all staying in the bounds as they go around the earth and get exposed to the sun and then go into the shadow."*

Mastro continued, *"When you collect the data, you also have to contact the satellite. All of that data needs to get down to the ground and processed, typically through the mission-unique antennas we have."*

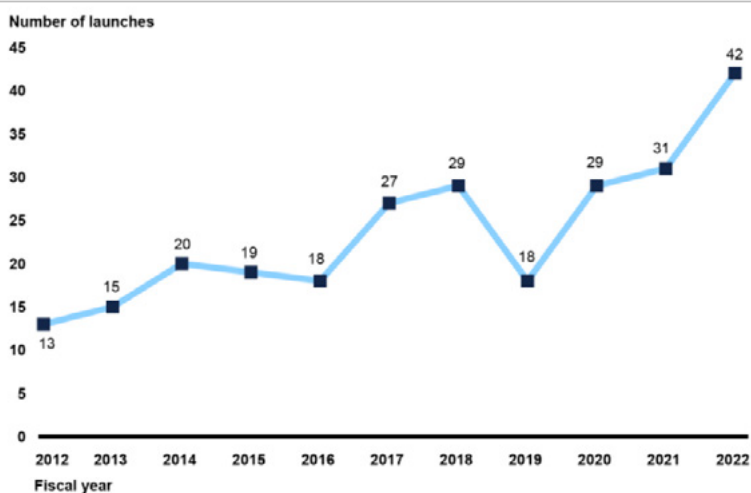
However, the SCN antenna stations communicate with satellites using parabolic antennas and can only communicate with one satellite at a time — and only within a limited window of time when that satellite is in range of the antenna. As the number of active payloads increases, demand for those communication slots is skyrocketing.

*"With the existing SCN antennas, they talk to one satellite at a time,"* Mastro said. *"And as we launch more satellites, that starts to put a capacity burden on the number of satellites that we can actually talk to."*

An April 2023 report from the **U.S. Government Accountability Office (GAO)** estimated that the SCN averaged more than 164,000 contacts with satellites per year, or about 450 a day.

The GAO also noted that the utilization rate for the SCN has averaged 75% over the last decade — exceeding the 70 percent level cited by USSF as the threshold used by the commercial industry to indicate the need for more capacity.

**Launches supported by the Satellite Control Network from fiscal years 2012 to 2022**



Source: GAO analysis of Space Force data and documents. | GAO-23-105505

**“** Getting commercial antennas connected into Space Force operations to a greater degree than we have right now is part of what we are trying to achieve. In many cases, commercial partners have been able to tailor a product to the military’s unique requirements for security — either for the end capability itself or the defense of that capability.

*Col. Peter Mastro, senior materiel leader, Tactical Command, Control and Communication Delta at SSC*

**”**

However, Mastro added that figure is an overall average capacity metric: there may be some specific geographic areas and times during which, *"the network may be maxed out, and there may be space vehicles that want a particular contact, and they are turned away from the SCN because there isn't capacity to help them."*

Priority is set by the **U.S. Space Command**, and if, for example, a communications satellite needs a slot at the same time one of the missile warning satellites requires access, then the communication satellite may need to wait for a later time slot, Mastro noted.

From 2021 to 2022, there were more than 15,000 *"conflict deletes"* where SCN operators were unable to accommodate specific requests, according to the GAO.

But USSF and SSC have launched multiple efforts to improve the way the Space Force can communicate with the increasing number of satellites, including expanding the number of antennas the USSF can access.

Under the **Federal Augmentation Services** system, USSF gets access to antennas owned by NOAA, and if those antennas are underused, the USSF is able to use them, Mastro said, adding, *"That way, the federal government is more efficiently using the resources that we have so we don't have to go out and buy more — we just better share what we have across our federal agencies."*

Another project underway is the **Satellite Communication Augmentation Resource (SCAR)**, a phased-array antenna that would be capable of as many as 10 simultaneous contacts. Unlike a parabolic antenna, a phased array panel has a flat panel that receives and transmits from multiple beams, Mastro said.

*"SCAR is a Space Force-built, Space Force-owned antenna — development and delivery is being run by the Space Rapid Capabilities Office,"* Mastro said. *"When they develop and deliver that, it's going to be absolutely outstanding and will drastically increase the number of simultaneous satellite contacts the Space Force will be able to do."*

SSC has continued to develop partnerships with the commercial space industry as part of its *"exploit what you have, buy what you can, and build what you must"* strategy, and that includes the field of data transport. But Mastro noted there are some limitations. *"We have been working to get access to more of the commercial network antennas that are out there. But there are a few things that Space Force satellites require that are difficult to find in the commercial market."*

One critical factor is that almost all USSF satellites communicate on a specific frequency for uplink and downlink and a specific waveform, **SGLS**. *(additional information on SGLS is available at this Space Foundation infosite link).*

Although USSF is adding more satellites to LEO to make their systems more resilient, it also has a number of satellites in **Medium Earth Orbit (MEO)** and **Geosynchronous Orbit (GEO)** and many of the available commercial antennas aren't sized — either in their physical size or their power — to handle transmissions to those orbits, Mastro said.

*"That waveform has been used by the Air Force, and now the Space Force for decades, and is not supported by commercial providers — outside of the Space Force, nobody really uses that standard,"* Mastro said. *"But nearly all of our satellites need to communicate in that waveform."*

*"As we look to expand out and get access to commercial antennas, we either have to only use those antennas to communicate to a very small number of Space Force satellites or you end up having to do things like modifying*

commercial antennas to meet your requirements,” Mastro said. “You could also change the satellites to communicate on a commercially used waveform, and the USAF/USSF has had efforts in the past to make that change. The entire point of going to commercial providers is that (the product) exists already and you can expand quickly. But if they don’t transmit or receive at the right frequency, then we can’t just use them as is.”

“We do believe getting commercial antennas connected into Space Force operations to a greater degree than we have right now is part of what we are trying to achieve,” Mastro said. “It’s just one example of how the Space Force operates differently than commercial industry that makes it a little more difficult than just saying we can turn it all over to commercial.”

However, partnering with the commercial space industry is an important way the Space Force can ensure that it has the newest, best, and most innovative technology, Mastro said, and in many cases, commercial partners have been able to tailor a product to the military’s unique requirements for security — either for the end capability itself or the defense of that capability.

One example of a successful commercial partnership has been **MeshONE-T**, a multi-node, software defined, wide-area network that partners with **Defense Information Systems Agency (DISA)**, as well as commercial providers of long-haul terrestrial communication to provide those data transport services to different mission areas that need it, Mastro said. DISA provides a global infrastructure for information sharing and communication, across the DoD.

The project originally started two years ago with **Sev1Tech** to develop a prototype for a modern, resilient, scalable, and secure data transport network.



This pathfinding effort is already integrating disparate mission systems’s data transport and provides a scalable foundation for future efforts to utilize across **Space Force, Air Force** and, ultimately, other branches of military service to achieve **Joint All-Domain Command and Control (JADC2)**.

“We are building out this Mesh network of long-haul data transport that has all the modern cybersecurity capabilities, has Zero Trust capabilities embedded in it, and it provides resilient pathways,” Mastro said. “Currently, it’s all terrestrial fiber optic paths, but we will be expanding into MILSATCOM connections as well as connections through commercial, proliferated LEO. So we will have even more diversity and resiliency in the way the Space Force moves data.”

Mastro said SSC has collected requirements from mission partners across the USSF and has been working to roll out capabilities to them. Currently, there are 17 worldwide deployed nodes at different bases around the world.

“So many programs out there have to figure out how to move data and turn to DISA,” Mastro said. “DISA is an outstanding partner in providing that support, but now with a program like meshONE-T, if there is any individual program that should be focused on their mission, they can turn to meshONE-T and meshONE-T can handle all the details around how to move that data. MeshONE can work with DISA, meshONE-T can work with the commercial satcom through proliferated LEO. And we can provide, in partnership with DISA, something that is even more resilient than the mission unique program would otherwise obtain.”

“If I wanted missile warning data, even though I’m on a U.S. Space Force base, I can’t plug into a wall jack and get SBIRS (Space Based Infrared System satellite) data,” said Lieutenant Colonel **Louis J. Aldini**, Materiel Leader, Information Mobility at SSC.



Lt. Col. Louis J. Aldini

“With meshONE-T, data is now more readily available to different mission users at USSF and other locations,” Aldini said. “You can plug into a meshONE-T node, and if SBIRS is a mission user on there, you’re that much closer to getting the data. We don’t allow instant access for cyber reasons, but just by offering that capability, we’ve shortened timelines down from months to possibly days. meshONE-T also provides enhanced data transport resiliency and path diversity across the architecture.”

“My office is focused on making sure data transport is more seamless and more of a commodity for multiple different missions to use, as opposed to having individual programs architect solutions for themselves,” Aldini said. “They hand over their needs and requirements and we provide the solutions.”

SSC also is taking a multiple-pronged approach to replacing the current, manually operated DOS-based SCN scheduling system, which has been in place since 1991, Mastro said.

“Sometimes with a capability like our antenna network, it is more difficult to get that high priority in funding decisions in comparison to some of the end operational capability,” Mastro said. “Over the years, there has been an under-investment in the SCN.”

Next year, SSC will replace it with **AST (AF(SCN) Scheduling Tool)** which will put the system on a modern infrastructure. After that, SSC will roll out **Enterprise Resource Manager (ERM)** a Cloud-based system “which will really automate the way we do scheduling, not just across government-owned antennas, but also across commercial and other federal network antennas,” Mastro said. ERM is expected to be launched sometime in 2028.

“We have a lot going on,” Mastro said. “We’re improving multiple pieces of it, all in parallel.”

Space Systems Command is the U.S. Space Force field command responsible for acquiring, developing, and delivering resilient capabilities to protect our nation’s strategic advantage in, from, and to space. SSC manages a \$15 billion space acquisition budget for the Department of Defense and works in partnership with joint forces, industry, government agencies, academic and allied organizations to outpace emerging threats. Our actions today are making the world a better space for tomorrow.

Contact Space Systems Command at [SSC@spaceforce.mil](mailto:SSC@spaceforce.mil) and follow on [LinkedIn](#).



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