

Next Generation Space Defense

MILSATMAGAZINE

December 2024



Cover image provided by:
Hughes
Artistic rendition of the
Hughes JUPITER 3 satellite.

**ACHIEVE
SPACE & SPECTRUM
SUPERIORITY**

Enterprise	Beam Budget	Beam Budget LEO/MEO	BestPath
Veryfiling	FlexCap	Satmotion API	Alusat
Controlsat	Vectorsat	Intergeo	Interleo
Orbisat	LEO NMS	CleanRF	EO Master

**SATCOM, EW/SIGINT
SDA & GEOINT
IN ONE VIEW**

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Simon Payne
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Dan Makinster
Technical Advisor

Curt Blake
Senior Columnist

Chris Forrester
Senior Columnist

Karl Fuchs
Senior Columnist

Rick Lober
Senior Columnist

Contributors

Comtech Editorial Team
Raghunandon Janardhan
Kratos Space Editorial Team
Brandon Lackey
Alvaro Sanchez
Brad Smith
Michael Weixler

Integrasys: From Strength To Strength..... 4
Author: Alvaro Sanchez

Space Systems Command Briefing: Rocketing To The Future..... 10
Author: Brad Smith

Today's Military Is Pursuing Communication Networks 14
That Deliver Uninterrupted Information Access
Author: Raghunandon Janardhan

Redefining Military Satellite Connectivity With Virtual Ground 18
Authors: Kratos Space Editorial Team

A Look At Comtech's Defense Strategy 22
Authors: Comtech Editorial Team

Unveiling A Dark Ship-To-Ship Transfer Near The Strait Of Malacca 24
Author: Brandon Lickey

ND SATCOM: Year In Review..... 26
Author: Michael Weixler

Advertisers

Advantech Wireless Technologies 7

AvL Technologies 9

Comtech..... 5

CPI..... 21

iDirect Government 3

Integrasys 1

SatNews Digital Editions 15

SmallSat Europe 2025 28

SmallSat Symposium 2025 19

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A visualization of a satellite network in space. A large satellite with solar panels is in the foreground, with several other smaller satellites scattered across the field of view. A network of white lines connects the satellites, forming a complex web. The Earth's surface is visible in the background, showing continents and oceans.

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INTEGRASYS: FROM STRENGTH TO STRENGTH

A YEAR OF SUCCESS

Author: Alvaro Sanchez, Chief Executive Officer

We remain deeply committed to Ukraine, enhancing the safety and security of their warfighters and platforms. The invaluable feedback from warfighters has enabled us to advance our offensive and defensive electronic warfare (EW) technologies. These systems now offer lighter, more power-efficient, and highly effective solutions to combat emerging multidomain threats, including sophisticated jamming and anti-jamming capabilities.

Our four new products address issues faced by both the commercial and government operators.

LEO NMS



Satellite networks have undergone significant changes over the past few years, largely driven by the rise of large Low Earth Orbit (LEO) constellations.

Starlink, with its thousands of satellites supporting diverse applications and markets, has revolutionized the industry. **OneWeb**, a smaller

In the defense sector, we have forged strong partnerships with customers and other contractors, achieving notable milestones. We joined a *Next-Gen Fighter Aircraft* consortium, securing multiple projects in this cutting-edge domain. Additionally, we were awarded a prime contractor role to develop the **EU Satellite Jammer** technology, designed for training purposes or the temporary denial of selected services. Our advancements in *Earth Observation (EO)* now include the use of optical and SAR imaging to identify and characterize military objects from space.

We also secured government projects focused on *Digital Twins of the Enterprise*, enhancing operational modeling and simulation, and contributed to the secure connectivity of the **IRIS2 European Union (EU)** multi-orbit satellite constellation, reinforcing European space capabilities.



Furthermore, we initiated the delivery of **Quantum Key Distribution (QKD)** solutions via satellite, providing next-generation, secure, communication technologies. These achievements highlight our commitment to innovation in defense and multidomain operations.



New

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LEO constellation, has also made strides, and the landscape will soon include **Kuiper**, **Telesat Lightspeed** (recently funded), and the **IRIS2 Spacerise** consortium (Eutelsat, Hispasat, and SES), with others likely to follow.

As a result, many modern networks now consist of bandwidth (Mbps) sourced from thousands of satellites across multiple orbits, owned by different operators and utilizing various frequencies. This marks a significant shift from just a few years ago when networks were often limited to bandwidth from a handful of geostationary (GEO) satellites and, in some cases, **O3b's** Medium Earth Orbit (MEO) constellation.

To address these complexities, we developed the **LEO Network Management System (NMS)**. This solution was inspired by customer feedback regarding the challenges of integrating numerous Starlink satellites with traditional network infrastructures. While Starlink served as the inspiration, LEO NMS is orbit- and provider-agnostic, capable of managing multi-orbit, multi-vendor, and multi-frequency networks within a single orchestration platform.

LEO NMS provides comprehensive network control, enabling users to monitor performance at all levels—from individual terminals to entire networks of thousands of terminals. Its intuitive, web-based interface simplifies orchestration, maintenance, and optimization of multi-orbit and multi-frequency satellite networks.

The system includes tools to automate and manage up/down speeds, quality of service (QoS), service level agreements (SLAs), time-to-resolution metrics, payment and invoicing, and even contract brokering and cross-sales. All features are accessible via a fully redundant public or private cloud.

Additionally, LEO NMS includes a DoD/MoD portal (such as a Virtual Network Operator, or VNO), allowing operators or service providers to offer their customers secure, filtered access to monitor and manage their own networks. This ensures flexibility, security, and functionality for both commercial and defense users.

BestPath



With the exponential growth in satellites driven by LEO constellations and the rapid expansion of multi-orbit options, selecting the optimal connectivity path has become a complex challenge. To address this, we developed **BestPath**, a groundbreaking technology built on our EM&C system to ensure reliable connectivity.

BestPath enables users or systems to effortlessly evaluate multiple link budgets, options, and scenarios for purchasing or connecting. It simplifies and automates network selection, purchasing, design, and orchestration while providing backup capabilities and executing decisions in real time.

The ideal connectivity path is identified in less than one second, based on pre-set criteria and real-time inputs specified by the user, such as QoS, SLAs, satellites, antennas, beams, latency, power, bandwidth, and cost.

Each link is optimized for individual customers and tailored to diverse scenarios, with flexibility to meet any requirement. Automatically generated reports document the reasons behind the chosen path, ensuring transparency.

BestPath is invaluable for selecting both primary and backup links, whether due to service disruptions caused by adverse events, electromagnetic interference (EMI), power outages, cyberattacks, or the movement of ships, planes, or vehicles.

It is particularly effective in military applications, where electronic warfare (EW) systems and dynamic environments demand rapid and adaptive connectivity.

BestPath seamlessly integrates with **FlexCap** for capacity management and resource orchestration, and its APIs enable smooth integration into other systems to automatically adjust bandwidth as needed.



Accessible via a web-based platform, it offers users the convenience of managing connectivity from anywhere.

Orbisat

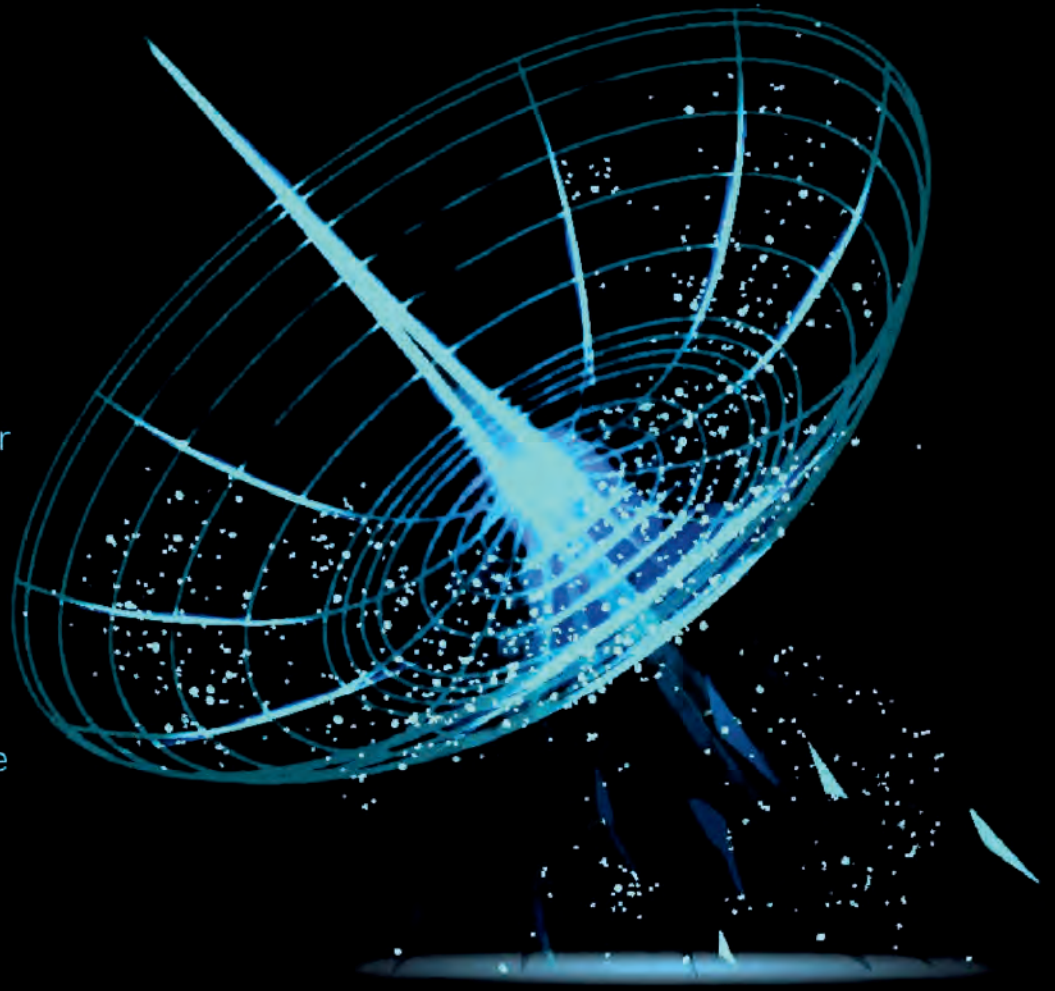
LEO constellations bring not only expanded bandwidth and connectivity options but also unprecedented congestion. Space is now more crowded than ever, with congestion increasing daily as new satellites are launched and mission failures generate additional debris.

Recognizing space as a contested operational domain, the **U.S. Space Force** has emphasized the urgency for updated Space Domain Awareness (SDA) and Space Surveillance and Tracking (SST) systems. In response to this pressing need, we developed **Orbisat**.

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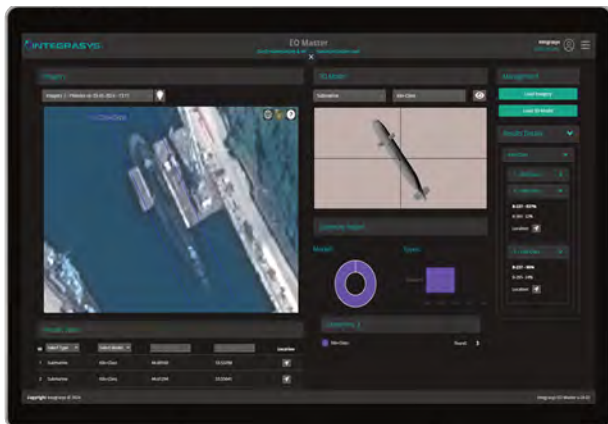
Orbisat, pictured above, is an API-driven solution designed for seamless integration with radars, telescopes, optical sensors, classified systems, and onboard GPS to enhance surveillance accuracy. It integrates with proprietary and public subsystems to enable tracking, collision avoidance, telemetry, maneuverability detection, Telecommand & Control, and the identification of undocumented objects in all orbits, including deep space.

The system connects to public databases such as **Celestrack** and **Spacetrack** and continuously updates using integrated antennas that monitor and measures S-band links during orbit and the launch and early orbit phase (LEOP). Its advanced monitoring capabilities detect unidentified objects under the noise floor with minimal data, ensuring comprehensive coverage of all threats.

In potential collision scenarios, Orbisat works with TT&C to automate maneuvers, avoiding risks efficiently. It also analyzes foreign object behavior to assess potential threats, taking space situational awareness a step further.

Orbisat isn't just an SDA/SST solution, it's a comprehensive system of systems designed to automate the protection of space infrastructure. In an era where a single major collision could have devastating consequences, Orbisat ensures proactive and reliable space safety measures.

EO Master



In the extremely time-sensitive world of geospatial intelligence (GEOINT), timely identification of objects is crucial. **EO Master** integrates artificial intelligence (AI) and machine learning (ML) into image processing to enable image characterization within milliseconds of it being downloaded.

EO Master is integrated with AI/ML libraries and algorithms for vast real-time analysis. The image is compared with millions of 3D models on file and a huge amount of synthetic data trained. For defense application, it can incorporate the latest global military platforms for precise comparisons.

Currently, EO is provided by both optical and synthetic radar (SAR) systems, but the tools to use each of these are proprietary, on many occasions with not sufficient certainty and precision. EO Master is the first system to utilize both options for object characterization.

The user interface is an easy-to-use graphical user interface (GUI), allowing government and other users without deep technical knowledge to identify the immediate impact of natural disasters, identify traffic and population patterns, and for defense applications compare real vs fake objects.

GEOINT has many uses. It is a powerful tool for environmental monitoring, video resolution is so high now, that even changing leaf patterns can be identified.

For the military, GEOINT is literally "the eyes in the sky," indicating troop buildup and movement, as well as identifying armaments on the ground or illegal fishing, trafficking or immigration.

Our Success

This has been exceptional and we credit much of our success to close communication with customers. They may buy a product, but they get a trust relationship. We're there when needed, listening to their requirements to develop products meeting the latest warfighter needs.

Our success is evident not only through long-standing customer relationships but also through the numerous technology awards we've won, including the **MSUA Satellite Innovation of the Year** award for three consecutive years, thanks to our dedicated team of engineers committed to innovation for the warfighter's benefit.

www.integrasys-space.com



About the author

Álvaro Sánchez, Marquis of Antella and CEO of Integrasys, is a software and industrial engineer, with a Master's Degree in Business from ESIC Business School (Spain). He has worked at Integrasys since 2011, initially in engineering then management and sales executive roles where he was successful in growing both revenue and profit, before becoming CEO in 2018. In 2021, Sr. Sánchez took on the role of Professor, teaching "Introduction to Business Management" for the AI degree at the IE University (Madrid), thus achieving his goal of helping others. In 2021, he was named by SSPI as one of the 20 under 35 Space Professionals. His current focus is on growing Integrasys, developing new products, forging alliances with other defense and commercial organizations if appropriate, as well as partnering with MoDs and DoDs. In addition, he is also focused on geographical expansion with the opening of two new offices, one in London and one in Ukraine, during the last 18 months.



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— SPACE SYSTEMS COMMAND BRIEFING —



Defining our future.



Honoring our past.

ROCKETING TO THE FUTURE

Seven Decades of Space Systems Command's Launch Vehicle Innovation

Author: Brad Smith, Space Systems Command Public Affairs

When a spacecraft soars aloft from U.S. spaceports in California or Florida, odds are its success rides on the more than 70 years of experience in launch vehicle development and operations by what is today the United States Space Force's Space Systems Command (SSC).

"This is rocket science, right?" said Brig. Gen. Kirstin L. Panzenhagen, program executive officer for SSC's Assured Access to Space, (AATS) responsible for final approval authority for all launches from Florida's Eastern Range, including from NASA's Kennedy Space Center. "Developing rockets, designing them, producing them, flying them – this work is hard."



Brigadier General Kirstin L. Panzenhagen

Space Systems Command, headquartered at Los Angeles Air Force Base (LAAFB) and responsible for Vandenberg Space Force Base (SFB) in California and Patrick Space Force Base (SFB) in Florida, is the U.S. Space Force (USSF) field command responsible for acquiring and delivering space capabilities for the U.S. and its allies. This includes managing a \$15.6 billion space acquisition budget for the U.S. Department of Defense (DoD).

SSC's heritage goes back more than seven decades, to the U.S. Air Force's Western Development Division (WDD), established in 1954 to lead the development of missiles and satellite launch vehicles for the United States Air Force (USAF).

These have ranged from the Cold War-era Atlas and Titan projects to the Evolved Expendable Launch Vehicle (EELV) programs of the 1990s to today's National Security Space Launch (NSSL) and Rocket Systems Launch Program (RSLP) efforts.

These launch vehicles include a mix of liquid-fueled rocket engines and solid fuel rocket motors, as first stages, boosters, and upper stages, experts said.

"Gen. Sam Greaves, a former SSC commander, often told me 'Without launch, the critical satellites that SSC fields would effectively be museum pieces ... no better than potted plants' and I couldn't agree with him more," said John Steinmeyer, executive director of the Assured Access to Space (AATS) program office at SSC and a veteran of space launch for more than 35 years. "We execute launches for the Space Force but also other DoD agencies. All these organizations' collective success is really dependent upon our success, and we are fortunate to have a great record in that regard."



An Atlas 2 launch, historic photo courtesy of Lockheed Martin.



John Steinmeyer



MANY ROLES IN SUPPORT

With a workforce of more than 20,000, SSC delivers capabilities through six program executive offices, including **AATS**, that supports national space needs that range from satellite payloads to launching those satellites that are used for space-based early warning, **intelligence, reconnaissance, navigation (ISR)**, and communications, and for both military and civilian users, officials said.

"As the primary acquisition hub of the Space Force, SSC is charged with understanding the ever-evolving threat, delivering capabilities to counter it, and determining how to leverage those capabilities to succeed," said **Lt. Gen. Philip Garrant, commander of Space Systems Command**. "Space is woven into almost every aspect of our daily lives."



Lieutenant General
Philip Garrant

In turn, SSC's AATS team procures launch services and delivers on-orbit capabilities via satellites used by the U.S. military's various combatant commands, intelligence agencies, civilian services, and the commercial space industry.

"This is our core launch mission ... responsive and reliable launch," said Panzenhagen, who, in addition to her role as AATS PEO, also serves as director of the Eastern Range and director of SSC Launch and Range Operations. "When we think about the geopolitical environment we're in today, with great power competition, the ability to operate in tactically relevant timelines is critical - not just for being able to put assets on orbit that our warfighters and our intelligence community need, but for the deterrent aspect of having that capability."

SSC's workforce of military, civilian, and contractor personnel also manages range sustainment programs in support of the DoD and commercial launch customers. These facilities include Vandenberg SFB, Patrick SFB, Cape Canaveral Space Force Station, and the associated Eastern and Western ranges, all of which must be maintained to support DoD, civil, and commercial launches.

"It's not just the mobile service tower, it's not simply the vehicle-specific integration buildings; it's everything else in the spaceport," Panzenhagen said. "Think about roads, bridges, airfields, ports, power, information technology, water - all of those things."

Those tasks, of course, tie directly to SSC's larger mission of delivering integrated and resilient space capabilities for the United States and its allies, especially in the face of looming challenges from China and Russia.

"China is no longer a future threat; they're a threat today," Garrant said. "They launched their 1,000th satellite into orbit in September, and they're heavily investing in counter space capabilities, with the intent to present a serious threat to U.S. national security interests in, from, and to space."

MISSION ASSURANCE

Along with SSC's budgetary and acquisition roles, program management and mission assurance are key elements of what the organization brings to the table, officials said.

"When it comes to space launch, the work is very, very hard," said **Col. James Horne, a senior AATS officer**. "No matter how easy a launch looks, it is a controlled explosion and there are thousands of things, if not more, that have to go right for it to be successful - but only one thing has to go wrong for it to potentially fail."



Colonel James Horne

Those capabilities have led to an enviable track record: DoD-led satellite launches, managed by SSC or its predecessor organizations, **have not had a launch failure for some 25 years**. Three failed National Security Space launches across 1998-99 led to a deep review of launch vehicle and spacecraft design and practices, and strengthened the emphasis on mission assurance, SSC experts said.

"This is the government looking into the design, the processes of the launch vehicle provider (company), to make sure that our 'no fail' missions are going to be launched successfully," said Panzenhagen, who, in her quad-hatted role, is also responsible for organizing, training and equipping government personnel at bases in California, Florida, and New Mexico, among other locations.

The Defense Department defines mission assurance as processes "to protect and maintain critical assets and capabilities supporting the DoD's military-essential functions. It focuses on resilience, risk reduction, and integration of protective measures to ensure the continued function and readiness of the DoD in the face of various threats and hazards."

As important as that work is, when it comes to what SSC and AATS do, there are different levels of the organizations' oversight of launch providers, based on the needs of a given launch and the capabilities of a given spacecraft, officials said.

"There are varying levels of mission assurance, meaning varying levels of what we'll say are government checks into the design, the companies' processes, companies' performance," Panzenhagen said. "There are a lot of government checks on our 'no fail' missions."

MANAGING MULTIPLE LAUNCH VEHICLE PROGRAMS

In 2024, the SSC/AATS team has simultaneously managed acquisition and support of launch vehicle operations under essentially two main programs: **National Security Space Launch (NSSL)** and the **Rocket Systems Launch Program (RSLP)**.



The NSSL program currently has three launch providers on contract: **SpaceX, United Launch Alliance (ULA)**, and **Blue Origin**. SpaceX manufactures the **Falcon 9** and **Falcon Heavy**, which have been in use for NSSL launches since 2018 and 2022, respectively. ULA and Blue Origin are bringing on new designs: ULA's **Vulcan Centaur** and Blue Origin's **New Glenn**.

The latest iteration of NSSL, **Phase 3**, uses an innovative acquisition strategy that consists of two main elements. The first, called **Lane 1**, uses an **indefinite delivery/indefinite quantity (IDIQ)** to procure commercial-like launch services at varying degrees of mission assurance based on the satellite's risk tolerance.

"As the primary acquisition hub of the Space Force, SSC is charged with understanding the ever-evolving threat, delivering capabilities to counter it, and determining how to leverage those capabilities to succeed." - USSF Lt. Gen. Philip Garratt, commander, Space Systems Command.

- 2) The 1990s-era evolved expendable launch vehicles, which led to the Atlas V and Delta IV in the early 2000s that were phased out in 2024;
- 3) The newest launch vehicles, developed under the NSSL and RSLP efforts.

The second, designated **Lane 2**, uses an **indefinite delivery requirements (IRD)** contract to procure "no fail" missions and requires launch providers to meet all NSSL needs, including the capability to launch from both ranges and reach all orbits, among other requirements.

Lane 1 is currently executing the first annual IDIQ on ramp, allowing a tailored risk posture according to the mission, increasing resilience and innovation, and reducing costs. This is expected to grow each year as more companies achieve their first flights, officials said.

The ULA design had its first two launches in 2024, largely as developmental missions and Vulcan Centaur's first NSSL mission is expected in the coming months. Blue Origin aims for a test launch — not an NSSL mission — of New Glenn in roughly the same period.

All three of the current NSSL vehicles have, or are expected to be, launched from the Eastern and Western ranges.

The RSLP program, designed for smaller satellites, has 12 companies under contract, including the three that are currently providing launch vehicles for NSSL, as well as [ABL Space Systems](#), [Aevum](#), [Astra](#), [Firefly](#), [Northrop Grumman](#), [Relativity Space](#), [Rocket Lab](#), [Stoke](#), and [X-Bow](#). The smaller payloads mean some launches could be mounted from [NASA's Wallops Island](#) complex in Virginia or other sites, along with the two main spaceports in California and Florida.



Firefly Aerospace's Alpha FLTA003, carrying the VICTUS NOX satellite for the U.S. Space Force's Space Systems Command, successfully lifted off Sept. 14, 2023 from Space Launch Complex 2 West (SLC-2W) at Vandenberg SFB. Photo is courtesy of Firefly Aerospace.

"We want to bring more launch providers online, and the reason we want to do that is for resiliency. The more companies, the more different types of rockets we have, the more supply chains we're dealing with, and this helps us work around any issues that may come up," said Panzenhagen, whose team oversaw more than 90 launches in 2023 from Florida alone. "For us, more is always better, in order to make sure that our nation has assured access to space."

THE FOUNDATION FOR SUCCESS

Launch veterans credit the organization's lengthy history as paving the way successes today. Specifically, many cite the work of [Gen. Bernard Schriever](#), an aeronautical engineer who successfully led the Air Force's missile and satellite projects and brought systems engineering — a collection of technical management processes and technical processes applied through the acquisition lifecycle - and mission assurance to the forefront.

"We've been launching rockets, as either the Air Force or now the Space Force, since the 1960s — that's our roots, that's our culture, that's where this whole thing started," said [Col. Horne](#), who has also served as an ICBM "missileer" or launch specialist for almost three decades. "That deep heritage of innovation, of calculated risk-taking, of pushing the envelope - all of that is what we carry forward today."

SSC's launch vehicle heritage splits — roughly — into three eras:

- 1) The USAF ballistic missiles (*Thor, Atlas, and Titan*) of the 1950s, converted into space launch vehicles for the 1960s and beyond

NASA's historical launch vehicles — the **Saturn** rockets of **Project Apollo**, the **space shuttle**, and the current **Space Launch System (SLS)** — resulted, largely, from different programs than those led by SSC and its predecessors.

Although USAF personnel have had key roles in many NASA programs, including the successful Apollo lunar landings and many of NASA's planetary science missions. Today, SSC and AATS work closely with NASA to reduce launch risk for both the DoD and civil programs, officials said.

"We're all highly dependent on the same resources," Steinhilber explained. "Successes or failures in one organization certainly affect the others, so we try to work fairly closely with the other agencies ... it only makes sense that we collaborate."

SSC has also been deeply involved in the development of multiple upper stage projects, including the long-lived **Centaur** upper stage, fueled by liquid hydrogen (see sidebar). That vehicle grew out of research by both the USAF and NASA in the late 1950s and remains in active service today, including as the second stage of the new Vulcan launch vehicle.

"Which is really significant," said retired [Air Force Maj. Gen. Thomas Taverny](#), who served as vice commander of Air Force Space Command and today is chairman of the [SSC Heritage Center's Foundation](#). "We've adapted it, implemented new technology, it's launched on many different systems, and so it has been a pretty incredible system with a legendary lifetime. We've learned a lot; a lot



of mistakes are made early on, but you can learn from history, and we have built the current high level of success on the shoulders of the people and programs that came before."

CONNECTIONS FUEL THE FUTURE

It is that depth of experience and achievement — on past, current, and future projects, and stemming from the development and acquisition of launch vehicles and spacecraft to operational support at the launch centers — that SSC's Guardians, Airmen, and civilian staff draw from regularly to meet today's challenges, officials said.

"These incredible achievements inspire us to be bold, have courage, and be innovative, which is especially important as we operate in an era of great power competition," Garratt said. "We stand on the shoulders of greatness, (whose achievements) stand as reminders of the grit, perseverance, and willingness to take risks that are required for us to continue to succeed."

From Apollo to Today: Space Systems Command's Enduring Upper Stage Expertise

Author: Brad Smith, Space Systems Command Public Affairs

Multi-stage launch vehicles are complex systems that use different elements for different purposes to lift a satellite or other spacecraft from the Earth's surface into orbit and beyond.

In a general sense, at liftoff, the first stage fires to propel the rocket into orbit. Once on-orbit, the upper stage provides the in-space propulsion to set the spacecraft on a precise trajectory. All elements of a launch depend on hundreds if not thousands of components functioning flawlessly, and in a precise sequence, timed down to the second or less.

"Even when you know you've done everything possible to mitigate risk — space launch is just a really, really hard business," said **Col. James Horne, a senior officer with Space Systems Command's Assured Access to Space organization** and a veteran of almost 30 years of missile launch experience. "Every liftoff I hold my breath until we've separated the spacecraft, which is a really long time to hold your breath, sometimes."

A crucial element of any launch vehicle program (see accompanying story) are the upper stages, experts said; Space Systems Command (SSC) has been instrumental in the development of these spacecraft since the 1950s, when the organization's predecessor, the U.S. Air Force's **Western Development Division**, was established to lead the development of missiles and satellite launch vehicles for the Air Force.

These designs have varied, from the **Transtage** and **Agena** of the 1950s (used until the 1980s) to the **Delta Cryogenic Second Stage (DCSS)**, used with the **Delta IV** launch vehicle developed for the **Evolved Expendable Launch Vehicle (EELV)** programs of the 1990s and which flew its last mission in 2024, to the **Falcon 9** second stage acquired by the Space Force for the current NSSL program.

All have had many firsts and successes, experts said, but perhaps the standout upper stage — certainly for longevity — is the Centaur, a family of liquid hydrogen-fueled upper stages that has been placing U.S. spacecraft into Earth orbit and beyond since 1965. The program — which made its 274th successful flight on October 4, 2024 — has been, and remains, an integral part of missions led by the U.S. Space Force and its predecessor organizations.

"The Centaur is deeply rooted in our history," said **Col. Michelle Idle, SSC's deputy commander**, and a veteran of three decades in military space assignments. "It has put many of our capabilities up to orbit. Time and time again, the Centaur has delivered."



Colonel Michelle Idle

Idle spoke at the recent dedication of an exhibit of a Centaur III upper stage and its associated **RL10** rocket engine at Los Angeles Air Force Base (LAAFB), the culmination of a multi-year partnership between the Space Force, the Air Force, industry partners, and SSC's Heritage Center, which supports the command's public history and educational missions.

"Centaur's not only been a long-living system that has continuously been updated with new technology, but it's also been a pretty darn reliable system that's operated with a high success rate ... over 92%," said retired **Air Force Maj. Gen. Thomas Taverney, who serves as chairman of the Heritage Center's Foundation**. "The Centaur, the RL10, have been pretty much hand-in-glove with Space Force and its predecessors since the '60s, getting critical satellites to orbit and still is there, helping us do our job."

The Centaur stage and the RL10 engine on display at LAAFB were used for various testing and research purposes over the life of the program. Both were donated by United Launch Alliance (ULA), which provides satellite launch services for the Department of Defense. ULA is the corporate descendant of **Convair**, which developed the Centaur in the 1960s, as the product of research by the government, industry, and academia.



A Centaur III upper stage and its associated RL10 rocket engine arrive at LAAFB

"Centaur was the first cryogenic upper stage featuring hydrogen and liquid oxygen, so that we could fly longer, more intense, and higher-energy missions," said **Marcus Nichols, a former Air Force officer who served at LAAFB** and who currently works as ULA's senior manager in Southern California. "We've evolved the Centaur over time to make it the most capable high-energy upper stage in the business, servicing national defense and powering missions to every planet in the solar system — and Pluto."

Historically, the Centaur was developed through a series of partnerships between the Defense Department, NASA, and industry, including **NASA's Glenn Research Center** (formerly the Lewis Center) in Cleveland, Ohio. The spacecraft was — and continues to be — used for a variety of space projects, both military and civilian. On the civilian side, the programs include:

- **Atlas-Centaur:** The original Centaur configuration, used on Atlas rockets from the 1960s-1980s. Launched NASA's Surveyor, Pioneer, Viking and Voyager spacecraft
- **Titan III-Centaur:** Used on Titan rockets in the 1970s, with a larger 4.3 m diameter tank. Launched Helios, Viking and Voyager
- **Titan IV-Centaur:** Used on Titan IV rockets in the 1990s/2000s, with the widened Centaur-G and Centaur-T variants. Launched Cassini to Saturn
- **Atlas IIAS-Centaur:** Improved Atlas-Centaur used in the 1990s, with a stretched Centaur stage. Launched the joint NASA-European Space Agency Solar and Heliospheric Observatory, or SOHO
- **Atlas III-Centaur:** Transitional Atlas version in the early 2000s; used the new Centaur III upper stage. Launched Mars Odyssey
- **Atlas V-Centaur:** Current Atlas version, with the Centaur upper stage. Has launched New Horizons, Juno, OSIRIS-REx and many other spacecraft

The Centaur's flexibility in integrating with different launch vehicles has been key to its longevity, experts said. The Centaur continues to fly regularly as the upper stage for Atlas V rockets and is used as the upper stage for the new Vulcan launch vehicle.

"The Centaur, also known as America's workhorse in space, serves as an engineering marvel, representing decades of innovation and achievement in aerospace technology," said **Lt. Col. Sean Granier, commander of the 61st Civil Engineering Logistics Squadron**, who also spoke at the dedication event. "Space is not just the final frontier; it is a realm where our dreams take flight, and where teamwork, across disciplines, leads to ground-breaking discoveries."

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 \$15.6 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 and/or follow on [LinkedIn](#).





TODAY'S MILITARY IS PURSUING COMMUNICATION NETWORKS THAT DELIVER UNINTERRUPTED INFORMATION ACCESS

HYBRID COMMUNICATIONS INCLUDING SOFTWARE-DEFINED INTELLIGENT NETWORKING WILL ENSURE NO SINGLE POINT OF FAILURE

Author: Raghunandan Janardhan, Vice President, [Hughes Defense and Government Systems](#)

Over the last few years, U.S. military decision makers have recognized that their unique, siloed communications networks will not provide the resilience needed across today's contested battlespace.

Each system uses a different technology that does not provide users with an easily accessible backup capability if a system or network is disrupted. [Department of Defense \(DoD\)](#) leaders are transforming their strategies based on this circumstance since military teams cannot fulfill their missions if they are disconnected.

The DoD is starting to implement a hybrid mix of communications technologies, including both commercial and military solutions, that can talk to each other to ensure no single point of failure in their communications architecture. This redundancy is very valuable, but many of today's military networks cannot ensure access to these transports in real time, when the user needs it most.

Commercial satellite communications providers have created intelligent, software-defined networks with autonomous network orchestration that leverages the redundant transport paths, so all users have resilient services and stay connected.

The Hughes Defense team has worked with the DoD to develop and demonstrate this flexible network orchestration that can keep information moving at mission speed to help connect people, weapons, sensors and other critical resources.

DOD IS TRANSFORMING SATCOM FOR GREATER RESILIENCY

The DoD uses many different satellite communications networks to support global operations, including the **Defense Satellite Communications System**, the **Wideband Global SATCOM**, the **Advanced Extremely High Frequency System**, the **Mobile User Objective System**, as well as other networks and commercial SATCOM networks.

These disparate, unique systems have helped to keep the DoD's communications secure and resilient. In the last few years, decision makers have realized that operating these separate systems is a disadvantage because adversaries can disrupt one or more systems and disable military operations.

GovCIO reported comments from **Colonel Nathan Vosters**, director of requirements, resources, and programs (S8) for [Space Forces – Indo-Pacific](#) during October's [TechNet IndoPacific](#). He believes that bespoke and insular systems will no longer be part of the military's cybersecurity posture.

The DoD has learned that commercial industry can enhance its national security architecture very quickly by supplying more satellites with many innovative and secure capabilities.

DoD has been working with commercial providers to create a resilient, flexible SATCOM architecture for all these capabilities. This started in 2017 when the [U.S. Air Force Space and Missile Systems Center \(SMC\)](#) launched the **COMSATCOM Pilot Program**, where several

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commercial providers helped assess the ideal hybrid SATCOM architecture and how diverse systems could work together to enable more flexible and resilient military satellite communications.

In second phase activities, [Hughes](#) built on recommendations from the first study to explore how an interoperable system solution can be implemented effectively. Hughes produced a new [Terminal Management Agent \(TMA\)](#) software implementing [Flexible Modem Interface \(FMI\)](#) standard for demonstration and evaluation.



HM400

Hughes demonstrated the TMA/FMI technology to the DoD using a ground terminal with an auto-tracking antenna, spanning three satellites, three modems and two service providers. Hughes then demonstrated the TMA/FMI and [Enterprise Management and Control \(EMC\)](#) technologies with full [Primary, Alternate, Contingency, Emergency \(PACE\)](#) planning and [Situational Awareness](#) using a Hughes software-defined [HM400](#) modem and a [GetSat Ku-band aero antenna](#) with a video sensor and a [Comtech DMD-2050E](#).

In 2022, the [DoD CIO Office](#) issued the [Enterprise SATCOM Management and Control Implementation Plan](#) as guidelines for EMC that will support resiliency and interoperability objectives across commercial and DoD satellite communication systems.

This plan also helped establish foundational capabilities necessary for the ongoing future [SATCOM Force Design](#), including increased reliance on commercial SATCOM. While this collaboration was taking place, [General John W. Raymond](#) issued the "Fighting SATCOM" strategy, stating that this architecture needs to deliver enterprise SATCOM capabilities to the Commander of the [United States Space Command](#), to support joint warfighters across the full spectrum of conflict, at the speed of relevance, and in contested, degraded, and operationally limited environments.

HYBRID SATCOM AND WIRELESS ARCHITECTURE WITH AUTOMATION ENSURE FLEXIBLE, REAL-TIME COMMUNICATION

To support these goals of interoperability and resilience, the redesigned, hybrid communications architecture will need to provide user access to a mix of communications technologies, including both commercial and military solutions from SATCOM as well as advanced terrestrial 5G wireless technology.

These capabilities will expand the amount of capacity available globally and in specific, 'hot' regions, using the global reach of [Low Earth Orbit \(LEO\)](#) satellites and the extremely high capacity available from state-of-the-art [Geostationary Equatorial Orbit \(GEO\)](#) satellites, including the [JUPITER 3 \(Hughes/EchoStar\)](#) satellite.

This increased capacity will deliver much-needed redundancy, but the DoD architecture will deliver more benefits by adopting the seamless connectivity model used in today's terrestrial wireless communications architecture. Current wireless services are not delivered by separate,

silos systems; wireless networks are interoperable so users can access many open-standards technologies and providers, giving users more levels of service and quality of service.

Users expect that they will be able to use their devices even if a network has an outage. Wireless providers quickly access another tower or another system to ensure seamless, real-time communications. For enhanced military readiness and mission success, the DoD needs to provide military SATCOM and wireless users with real-time access.

MILITARY USERS ARE SEEING HOW FLEXIBLE NETWORK ORCHESTRATION WORKS TO SUPPORT PACE PLANNING FOR REAL-TIME COMMUNICATIONS

Beyond having communications redundancy, military teams worldwide know they need to maintain operability, interoperability, and continuous communications regardless of the operating conditions and the redundant communications paths on their network.

Developing PACE communications plans help organizations prepare to deploy various backup communications capabilities in out-of-the-ordinary situations, giving options for redundant, reliable communications capabilities if primary capabilities are disrupted or degraded. PACE plans can become a game changer if the plan's stages can be automated. In today's fast-paced, electronic battlespace, PACE plans need to provide more resilience and speed of deployment beyond just giving multiple paths.

As mentioned by the U.S. Army during a recent event, the network provides the underlying structure to ensure that all users, weapons, sensors and other nodes worldwide stay connected. The network must work without users having technical expertise in repairs, upgrades and scaling up and down.

Agile, [software-defined networking \(SDN\)](#) will integrate, synchronize, and orchestrate all these communications networks so they can anticipate and realign assets in near real time.

For the DoD, an SDN would enable a network administrator to shape traffic from a centralized control console without having to touch individual switches and deliver services to wherever they are needed in the network, without regard to what specific devices a server or other hardware components are connected. The key technologies for SDN implementation are functional separation, network virtualization, and automation through programmability.

Hughes is working with various military users to demonstrate how software-defined network management and orchestration can become the game changing capabilities they need. The technologies ensure resiliency and uninterrupted communications using hybrid networks, even if there is interference or an outage on their network.

- [Defense Experimentation Using Commercial Space Internet \(DEUCSI\)](#), managed by the [U.S. Air Force Research Lab \(AFRL\)](#), is exploring how to augment military communications by leveraging the growing commercial satellite internet industry. Hughes is supporting AFRL in developing a flexible SATCOM network which can integrate government, military and commercial satellite constellations and bandwidth for



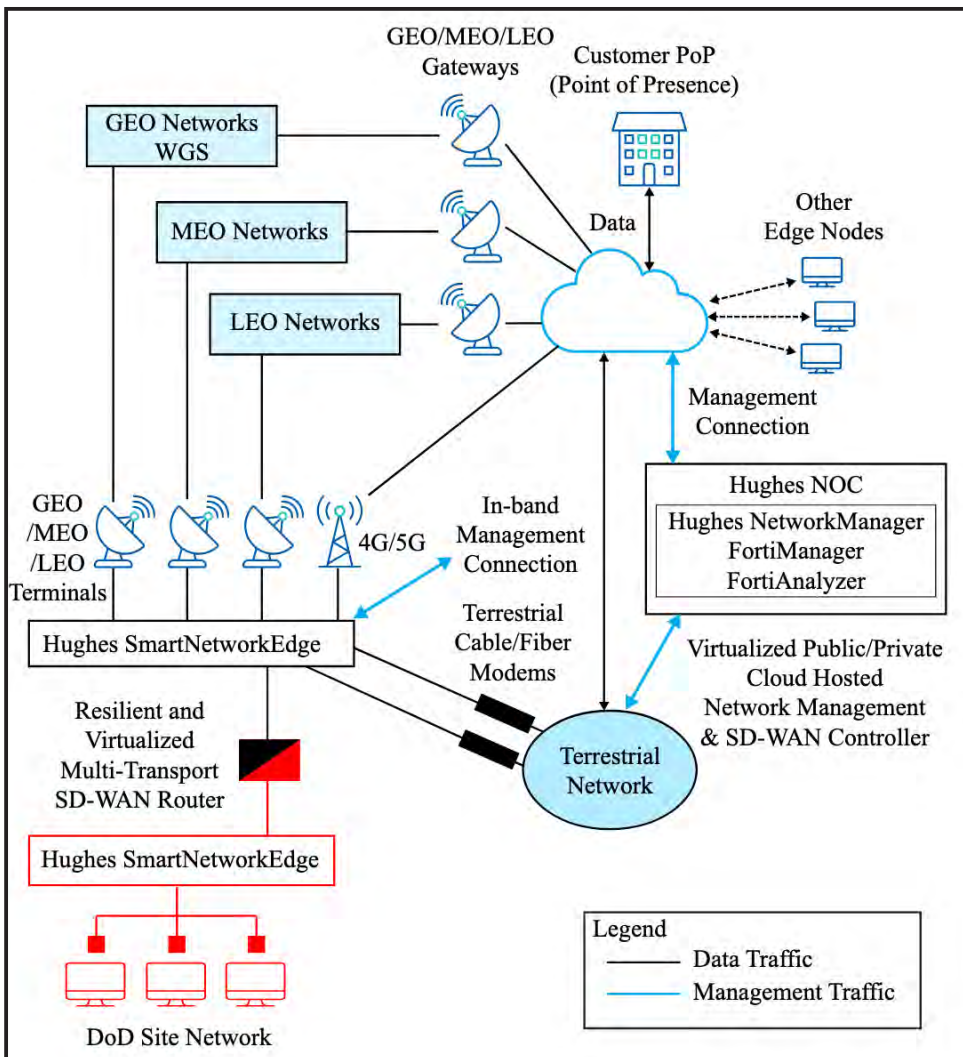
Artistic rendition of the Hughes JUPITER 3 satellite on-orbit, courtesy of the company.

encrypted and non-encrypted communications and data sharing. Hughes is supporting AFRL in developing a flexible SATCOM network which can integrate government, military and commercial satellite constellations and bandwidth for encrypted and non-encrypted communications and data sharing. Using many bands and technologies, users will gain access to critical data in real time, even in disrupted, disconnected, intermittent and low-bandwidth circumstances. This AFRL project will take primary, alternate, contingency, emergency (PACE) communications planning to another level supporting ground- and air-based missions.



- The EchoStar team, led by Hughes, demonstrated, software-defined network capabilities at the U.S. Navy's Whidbey Island Air Station (NASWI) and in Hawaii. This demonstration showed the U.S. Navy our highly flexible and resilient mission planning capabilities automatically

switching communications paths to ensure uninterrupted access to situational awareness information. The powerful Network Management System (NMS) and Smart Network Edge (SNE) technologies dynamically planned and provided common operating pictures for situational awareness that supported Automated Primary Alternate Contingency Emergency (APACE) planning. This software-defined capability changed the communications path, Quality of Service (QoS), and various time/space-based resource commitments to speed up changes and access to the network's SATCOM resources. Essentially offering a communications path that is always "on the net."



Agile, software-defined networking and orchestration for SATCOM and other wireless technologies like 5G will simplify the integration and synchronization of these hybrid communications networks. DoD will have more flexible, scalable networks to ensure more resilient, real-time communications. This capability will also help the DoD adopt other commercial innovations, like the modular Open RAN 5G networking project at Fort Bliss.

Integrating these commercial technologies can provide benefits that siloed systems cannot--optimized flexibility and control that warfighters and commanders require. Automation will offer dynamic PACE planning by leveraging an AI-based rules-based engine, delivering real-time monitoring of transport links, and enabling one or more active transports based on the platform and its deployment of the radios and terminal. In the U.S. and globally, national security requires near-real-time situational awareness and communications for mission success in contested environments.





Figure 1: The virtual ground will connect military and commercial operations for a competitive edge.

REDEFINING MILITARY SATELLITE CONNECTIVITY WITH VIRTUAL GROUND

Authors: Kratos Space Editorial Team

TRANSFORMING GROUND WITH SOFTWARE

Traditional satellite ground stations are based on decades of customized hardware built for a singular mission or purpose. However, adversaries are driving traditional ground stations to quickly adapt in form and function.

To stay ahead, military ground systems require advanced capabilities that are flexible, scalable and capable of supporting multiple missions. A commercially available, fully software-defined satellite ground system that leverages virtualization, orchestration, cloud computing and open architecture will be a way for the military to maintain its competitive edge. The seamless integration of **LEO**, **MEO** and **GEO** satellites provides a level of resiliency previously unattainable in military satellite communications.

SOFTWARE-DEFINED SOLUTIONS FOR NATIONAL DEFENSE

At the 2024 *Space Symposium*, **Kratos** announced that the company's fully virtualized *satellite communications* (SATCOM) ground system, **OpenSpace®**, was employed as part of **BlueHalo's** milestone demonstration for the **U.S. Space Force (USSF) Space Rapid Capabilities Office (RCO) Satellite Communication Augmentation Resource (SCAR)** program.

Kratos' **OpenSpace Platform** is an important component of the backend system that will pair with **BlueHalo's BADGER** adaptive phased array product to provide multi-beam, multi-orbit mission operations.

Additionally, the **Space Development Agency (SDA)** announced an approx. \$117 million contract to Kratos for **Advanced Fire Control Ground Infrastructure (AF CGI)** to support demonstrations and potential future operations under the agency's **Advanced Fire Control (AFC)** effort. As a new member of **#TeamSDA** and the **AF CGI** vendor, Kratos will lead a team of industry performers to provide a common, enduring ground infrastructure and resources to minimize cost and complexity for multiple **AFC** prototype efforts.

Kratos' involvement in federal programs this year demonstrates why the military is increasingly adopting software-defined solutions. These software systems promise enhanced flexibility, enabling rapid adaptation to evolving mission requirements.

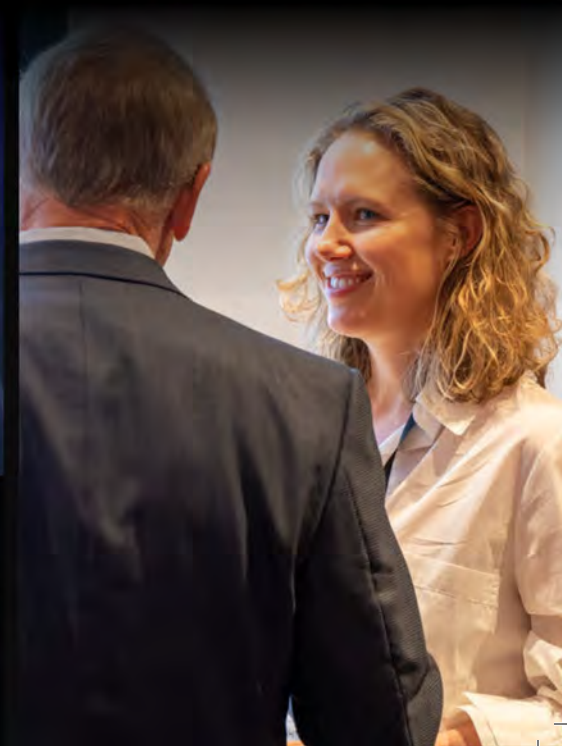
THE ROLE OF 5G AND EMERGING TECHNOLOGIES

Kratos also forged new ground this year with its partnerships to develop **5G-NTN** (non-terrestrial network) solutions for satellite connectivity. The high-speed, low-latency capabilities of **5G** enhance ground station performance, enabling real-time data processing and edge computing.

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Figure 2: 5G enhances accessibility and reduces latency in military operations, giving a strategic edge in modern warfare.

This technology is revolutionizing battlefield connectivity, offering rapid deployment capabilities and extending internet access to remote regions, such as the coverage provided by terrestrial 5G networks.

This software-driven approach enables faster deployment of new capabilities, ensuring military systems remain responsive and mission-ready.

ADVANCING MILITARY RESILIENCY THROUGH SOFTWARE

Kratos successfully demonstrated a fully virtualized SATCOM ground system for the **U.S. Army's Program Executive Office Command, Control, Communications-Tactical (PEO C3T)**. Using the OpenSpace® platform, the demonstration showcased real-time adaptability to dynamic battlefield environments.

DRIVING COST EFFICIENCY AND AFFORDABILITY

During the **2024 Air, Space & Cyber Conference**, Kratos Vice President, **Robert "Otis" Winkler**, emphasized the importance of affordability and survivability in military technologies. A virtual ground addresses these challenges by reducing the reliance on hardware upgrades and replacement, instead relying on software updates to manage diverse satellite system. This approach not only minimizes cost, but also streamlines resource management across military networks.



Figure 3: OpenSpace® brings versatility and adaptability to the satellite ground network.

BRIDGING MILITARY AND COMMERCIAL SECTORS

Phil Carrai, President of the Space, Training & Cyber Division, Kratos, moderated a panel at the Milsat Symposium, focusing on the convergence of commercial and military sectors in a multi-orbit, multi-mission network environment.

The panel highlighted the growing need for seamless communication between commercial and military systems, enabled by open architecture adhering to industry standards. Such integration allows military operations to securely exchange data across commercial satellite networks and facilitates the unification of LEO, MEO and GEO satellites from diverse constellations.

This convergence underscores a pivotal shift in defense strategy, where the integration of commercial capabilities enhances military operations.

By leveraging open standards, the military can deploy systems that are interoperable and resilient, ensuring secure and efficient communication in dynamic scenarios.



As 2025 approaches, the advancements driven by Kratos and its technology signal a shift in military ground system operations. By embracing software-defined solutions, the military will not only future proof its operations, but ensure it remains agile, resilient and ready for what's next.

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A LOOK AT COMTECH'S DEFENSE STRATEGY

Authors: Comtech Editorial Team

In the age of strategic competition, the United States and its international partners face rapidly evolving threats as they pivot toward potential engagement with near-peer adversaries.

Significant technological developments, particularly in cyber warfare, **electromagnetic spectrum operations (EMSO)**, and precision fires, are fast becoming more accessible to opponents, thereby threatening to change the delicate landscape of global security and power dynamics.

According to Comtech's Chief Strategy Officer and President of the Company's Satellite Network Technologies business, **Daniel Gizinski**, today's threat landscape looks wildly different from that of five to 10 years ago.

"There's been a dramatic adjustment, both in terms of the capabilities and how and where they're being deployed," he explained. "We've seen some pretty significant developments as a result of innovations and change, and over the last several years, we've had the opportunity to look at very different levels of what's possible and what can be done. And from a product development and program fielding perspective, this change has put a lot of emphasis on how we design and develop products that can last over a long-term period in the field."

According to Daniel, the pivot toward strategic competition presents an "enormous challenge" to the **U.S. Department of Defense (DoD)** and its international partners as they look to build and design products capable of being fielded for the next 10 to 25 years.

To support the warfighter of today and in the future, **Comtech** continues to focus on upgrading legacy systems as well as the development of emerging, next-generation technologies.

"The net result of this change has been a shift away from the development of bigger, more expensive, more hardened systems including advanced wideband waveforms and satellites capable of tolerating levels of spectral interference towards enormous investment in building out resilience in connectivity," Daniel explained.

"Resilience on the battlefield lies in the diversity of multiple networks capable of providing the necessary levels of connectivity to route traffic via the best available network. Ultimately, the goal isn't necessarily to keep a network running at all costs—it's to keep data getting to the right place at all costs. And there are sometimes more efficient ways to do that, and you must bake in that headroom and that ability to adapt via software updates to maintain pace with a rapidly changing threat," he added.

UNIQUELY POSITIONED

Consequently, Comtech continues to focus efforts on a series of technology areas of interest to support DoD and international partners.

Focus areas include **Assured Communications** and **EMSO**, with Daniel explaining how the company remains "hyper-focused" on the transition away from heavily stove-piped satellite systems toward digital satellite ground infrastructure and other capabilities that allow the warfighter to rapidly reconstruct networks based on the requirements of any given day.

Similar sentiments were shared by Comtech's Executive Vice President of Business Development and Sales, **Roly Rigual**, who explained how Assured Communications can support operations against near-peer adversaries today and in the future.



"It's been a long time since the major powers have had to 'fight to get to the fight' so assured and protected communications are more important today than ever," Roly explained, highlighting the proliferation of multi-orbit (LEO, MEO, and GEO) constellations.

"It's just starting, but there's a lot of technology that still needs to be developed and deployed alongside the relevant standards supported by the ground infrastructure. I believe Comtech is in a very good position to help the customer solve these challenges," he said.

In terms of EMSO, Comtech has focused on developing new understandings and techniques over the past decade, particularly relating to improved coordination of electronic attacks and electronic support through communications.

DUAL USE EXPERTISE

As it continues to support DoD and international partners, Comtech benefits from expertise in both commercial and defense markets.

"As a company that's got its roots in dual-use technology development, we design a lot of cutting-edge commercial technologies with a unique set of abilities and capabilities to develop defense articles," Daniel explained.

"I wouldn't necessarily say one is universally ahead of the other, but having a foot in both camps allows us to take clever commercial innovations and bring them to the defense market and vice versa."

Daniel highlighted satellite and troposcatter communication solutions as two of the most relevant dual-use capabilities that, when stitched together, can offer DoD and international partners significant value across a battlespace.

Specific Comtech successes include the [U.S. Army's Enterprise Digital Intermediate Frequency Modem \(EDIM\)](#) program, which has its roots in commercially developed technology. Awarded a contract in October of 2023, Comtech is on track to deliver an initial tranche of systems to the army in the coming months.

Elsewhere, Comtech continues to support a resurgence in **Troposcatter** technologies across the U.S. Army, U.S. Marine Corps, and international partners.

"Troposcatter was viewed as legacy technology-heavy, expensive, and hard to deploy. But it's been fun to see the look of realization and appreciation that sets in with certain customers when they realize the art of the possible with modern solutions," Daniel said.

Furthermore, Comtech is in the process of rolling out a next-generation of satellite modems capable of supporting exquisite platforms such as combat air aircraft.

"We recently received an award to bring some of the most advanced military jets into the overall network, so this is a pretty exciting growth opportunity and part of a new modem family we're in the process of releasing over the next six or so months," Daniel said.

Finally, Comtech remains dedicated to ensuring customers benefit from 'Zero Trust Architecture' as they move away from traditional network-centric infrastructures towards more data-centric models.

"One of the biggest challenges we see is bridging legacy and new networks together. I think everyone likes to imagine that we will flip a light switch and have zero trust architecture rolled out next year, but it's going to be a 10-plus year roll-out process," he concluded.

As the contemporary operating environment continues to change, so, too, must connectivity products and solutions over the long term to ensure the warfighter benefits from truly resilient communications.

Only increasing levels of investment and diverse inventories of products and concepts of operation will support those who need it most as they continue to observe uplifts in asymmetric warfare around the world.

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Unveiling a Dark Ship-to-ship Transfer Near the Strait of Malacca

Author: Brandan Lickey, Senior Product Marketing Manager, HawkEye 360

BACKGROUND

The Strait of Malacca, a roughly 500 mile narrow waterway linking the Indian Ocean to the South China Sea, has been a critical maritime chokepoint for centuries. Its importance lies in the fact that it facilitates the passage of over 90,000 vessels annually, or nearly 200 ships every day, carrying roughly one-third of global trade.

This traffic volume makes it one of the most significant global shipping lanes, particularly for energy supplies, as a substantial portion of the world's oil transits through the Strait. Consequently, the vast volume of traffic also makes it susceptible to a host of nefarious activities.

The Strait faces significant geopolitical and environmental challenges. The increasing tension between major powers has introduced complexities around the security and control of this vital maritime passage. Additionally, territorial disputes in the nearby South China Sea further exacerbate security concerns.

The littoral states, particularly Indonesia, Malaysia, and Singapore, have worked to establish joint naval patrols and information-sharing mechanisms to counter these threats, but the underlying geopolitical tensions remain constant.

THE CHALLENGE

Given the Strait is located near some of the worlds most contested maritime regions, it's a common flashpoint for bad actors to obscure the movements of vessels involved in illegal activities like oil smuggling, sanctions evasion, or illegal *ship-to-ship* (STS) transfers. With these congested waterways, it's difficult to monitor legitimate vessel activity – let alone those who intentionally try to evade detection.

For example, vessels might turn off their AIS or spoof their location to avoid detection during covert operations, such as smuggling oil to sanctioned countries. The sheer number of vessels navigating the waterway combined with gaps in traditional vessel monitoring pose significant threats to maritime security.



CASE STUDY

RF DATA AND ANALYTICS REVEAL DARK SHIP-TO-SHIP OPERATIONS

HawkEye 360 conducts RF collections over the Strait of Malacca through the anchorage northeast of Johor, Malaysia, to monitor for high-risk vessel activity.

During the month of August, HawkEye analysts observed suspicious activity from two vessels of interest: *Itagua* (MMSI: 620999528) and *Shanaye Queen* (MMSI: 533132105). Leveraging HawkEye's *Vessel Identification analytics*, analysts were able to detect and identify the two dark vessels in close proximity, indicating a probable ship-to-ship transfer.

VESSEL CONTEXT

Itagua: The ultimate beneficial ownership information from IHS via [Equasis](#) indicates *Itagua*, a Comoros-flagged tanker, is owned and operated by BLUE OCEAN MARITIME CONSULT (domiciled in the UAE) and ITAUGUA SERVICES INC (domiciled in Liberia). Flag targeting information from the [United States Coast Guard \(USCG\)](#) indicates Comoros as a high-risk flag administration.

Targeted Flag Administrations

High Risk

Belize	Bolivia
Comoros	Curacao
Italy	Latvia
Republic of Korea	Saint Vincent and the Grenadines
Tanzania	Togo

Medium Risk

Antigua and Barbuda	Bahamas
China	Cyprus
Panama	Portugal
Vanuatu	-----

* Administrations not targeted last year.

Flag Administrations Removed From The List

Canada	Turkey
Isle of Man	-----

Source: <https://www.dco.uscg.mil/Our-Organization/Assistant-Commandant-for-Prevention-Policy-CG-5P/Inspections-Compliance-CG-5PC-/Commercial-Vessel-Compliance/Foreign-Offshore-Compliance-Division/Port-State-Control/targeted/flags/>

Shanaye Queen: Open-source investigations from **Lloyd's List** identified SHANAYE QUEEN, a Malaysia-flagged Tanker, loading probable Iranian oil in January 2022. Ultimate beneficial ownership information from IHS via Equasis indicates the vessel is owned and operated by ALYA MARINE SDN BHD (domiciled in Malaysia) and SHANAYE SHIPPING PVT LTD (domiciled in India).

ANALYZING HISTORIC VESSEL VOYAGES

On July 25, AIS records indicate Itagua began travelling through the Gulf of Oman, continuing through the Arabian Sea in the Gulf of Bengal where HawkEye was conducting RF collection campaigns. As it traveled through the Strait of Malacca, HawkEye's Vessel Identification analytics independently detected and identified the vessel by recognizing its radar characteristics three separate times.

On August 6, AIS records indicate Shanaye Queen left port in China and traveled southwest through the South China Sea. HawkEye 360 independently detected and identified the vessel using its radar characteristics seven separate times.



IDENTIFYING DARK SHIP TO SHIP TRANSFERS

Around the same time frame, HawkEye 360 detected multiple marine radars just north of the two spoofed locations. Using Vessel Identification analytics, HawkEye established with high confidence that the radars match the RF characteristics of Itagua and Shanaye Queen.

Now that the precise locations of these vessels were established, HawkEye analysts were then able to reference **Planet** imagery to corroborate that the two vessels were conducting dark ship-to-ship operations.

Furthermore, analysts also referenced imagery in the two locations of apparent AIS spoofing and confirmed no ships were present at the time they were reporting.

Following the probable exchange, Shanaye Queen returned to port in Beijing and Itagua returned to port near Dubai.

CONCLUSION

The Strait of Malacca is a vital maritime route, but its importance makes it a target for illicit activities that threaten global security and trade. This case study highlights the challenges of monitoring vessels in such congested waters, especially when potentially nefarious tactics like AIS spoofing are used to evade detection.

HawkEye 360's RF data analytics successfully identified dark **ship-to-ship** (STS) transfers, demonstrating the effectiveness of advanced monitoring technologies where traditional methods fail.

Combining RF analytics, satellite imagery and vessel identification provides a strong solution to maritime security challenges. These tools enhance security and deter future offenses by detecting and verifying illicit activities. As geopolitical tensions and global trade grow, securing the Strait of Malacca will remain crucial.

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Commercial Imagery and Information. Presentation contains no "Technical Data." Contains Information that is Only Representative of Information that can be Produced from the Use or Operation of a Defense Article.

Author Brandan Lickey is a seasoned marketing professional with nearly a decade of experience developing go-to-market strategies, managing product launches, and leading promotional campaigns across industries such as network security, critical infrastructure security, and data analytics. As the Senior Product Marketing Manager at HawkEye 360, he oversees the promotion of the company's portfolio of space-based data and analytics products. Brandan excels at translating complex technical features into compelling narratives, driving successful product adoption and market expansion. He is also a published author, contributing to industry outlets such as Power Magazine and the Association for Supply Chain Management. Brandan holds certifications from Pragmatic Institute (PMC-III), the Product Marketing Alliance (PMA), and Pendo.io. Additionally, he earned a B.S. in English with a concentration in Technical and Business Writing from Radford University.



ND SATCOM: YEAR IN REVIEW

Author: Michael Weixler, Head of Strategic Business Development

In 2024, **ND SATCOM** demonstrated its drive and ambition with a multi-faceted approach: new product launches, new marketing campaigns and strong strategic investments in the next generation of highly secure and resilient products and networks. In turn, metrics ranging from total revenue to customers trained grew, reflecting a robust business environment.

We kicked off 2024 with our new website, which impressed our customers with its modern design and ease of use...

www.ndsatcom.com.

At events such as **AFCEA** in Bonn and **MSPO** in Kielce, as well as with campaigns for our defence portfolio, we raised brand and product awareness in 2024. The part of the ND SATCOM exhibit that garnered the most attention at all events was the **Multi-Band FlyAway Terminal MFT 1500** with its variants: manual and motorised, military frequency bands and integrated antenna control by the embedded **SKYWAN** modem.

The unique feature of this terminal is its wind resistance; operating in very strong winds and severe storms. At subsequent events, we presented versions of the larger trailer-based transportable terminal used by some **NATO** partners. It was definitely an eye-catcher.

The next major event for the ND SATCOM team was our **NDS Factory Event** in June. With the motto "Xperience the NDS Factor" as part of our new image campaign, we opened the doors in Immenstaad to our customers from all over the world. The live demo "direct-from-helicopter" video stream was one of the highlights and surprised our guests.

At the panel discussion of the popular topic "How good is your satellite network without security?", our partners participated with valuable insights. We also presented the new NDS image video for the first time, which continues the story from the 2019 campaign and reflects the different business units of ND SATCOM (Broadcast, Government and Defence). This generated a lot of excitement and interest.

FOSTERING STABILITY AND GROWTH

The key financial figures for 2024 are up again compared to the previous year. The support business, including the **Integrated Logistics Support (ILS)** for our **Business Unit Defence**, was the solid foundation for this successful year.

Over a number of years now, the business has proven to be highly profitable and resilient even against unpredictable events such as Covid. As much as the Ukraine war is a humanitarian catastrophe, the increase in defence spending in Europe in the last years and the commitment of NATO and Europe to continue to build on this approach in the coming years will result in further business growth and opportunities.

INSTALLING RELIABILITY

For challenging deployments for a large governmental network, we demonstrated a new resilient network design based on **SKYWAN** capabilities, including additional geo-redundant and site-redundant DVB-S2 hubs.

Together with the SKYWAN production partner we increased the volume and the number of units delivered to customers. The stellar performance of 100% on-air stability of installed SKYWAN networks and no station downtimes this year underscored again our claim "Installing Reliability."

Our strong and stable product portfolio gave the team room to focus on new research activities, new product development, and pilot demonstrations in sensitive SATCOM-use cases.

SERVING EXISTING CUSTOMERS AND DEVELOPING NEW MARKETS

SKYWAN is a reliable solution in maritime SATCOM networks on ships where our "NDS Factor" has a long history that we will extend to "at-the-water-surface" and "below-the-water-surface." We achieved our first proof-of-concept with a SKYWAN solution targeting submarines.

The campaign "Under-The-Rotor" for our SKYWAN helicopter solution was ongoing in parallel to the approval processes and flight demonstrations, such as at our Factory Event in June with a live video transmission from the starting helicopter to a large video wall.

EXTENDING THE PORTFOLIO OF SOLUTIONS AND PRODUCTS

As a VSAT modem company, we have kept our promise of providing SKYWAN maintenance over the product life cycle.

To further increase our Ka-band sales we worked on the upcoming **Ka4GOV** — our motorised Ka-band antenna with integrated SKYWAN. We presented this new antenna model in late May at Cabsat2024 and to the commercial broadcaster community in September at IBC fair.



New capabilities were added to the **Antenna Control Unit Series ACU 6000**. This was integral to the **MFT1500** where the ACU logic was merged into the SKYWAN modem to reduce components, cabling and "Size, Weight and Power" (SWaP), and to increase usability and reliability.

In the domain of secure networks, we had international guests from **LuxGovSat, Cysec/F** and **GISS/PL** on our Factory Event panel discussion: "How good is your satellite network without security?"

In addition to these valuable insights, ND SATCOM is actively working on a **Quantum** pilot project (driven by the QuNET initiative and funded by the German Federal Ministry of Education and Research) to demonstrate **Quantum Key Distribution (QKD)**-based encryption using SKYWAN.



Resiliency and security are addressed in the international **SIGMA** project (an EU/EUSPA funded programme for GOVSATCOM) using SKYWAN in a multi-band, multi-satellite scenario with cellular 5G multi-path links for public safety organisations. The SIGMA project is ongoing with live demonstrations planned with selected end users in European countries in the coming months.

Late in 2024 we received a research grant from the **German Federal Ministry of Interior and Community** to develop a deployable 5G **Stand-Alone (SA)** infrastructure for public safety organisations. It will demonstrate 5G Stand-Alone cells with roaming capabilities between deployed ad-hoc cells where cell interconnection is either via a fully-meshed SKYWAN backbone or via microwave links.

ND SATCOM OUTLOOK: XPERIENCE THE NDS FACTOR

Not only did ND SATCOM grow its business in 2024 but also its staff. With offers accepted by young people for training and study as well as the hiring of experienced applicants, we successfully rejuvenated our team to continue to provide the superior level of innovation and service our customers seek.

Our ideas to design and produce new integrated solutions with partners resulted in challenging test and demonstration activities in Europe and on other continents. We "Live the NDS Factor" every day.



Last, but not least: At the June Factory Event, we presented to key partners the first operational setup of **SKYWAN 5G** with its more powerful successor — **SKYWAN 7X**.

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CHANGING MINDSETS ON GOVERNMENT SATELLITE PROGRAMS

Author: Piers Olsen, Chief Executive Officer, Olsen Actuators and Drives



Satellites are the lynchpin of communications for the military and deliver the secure and remote connectivity that is so critical to military operations, but the military is not making strides forward in satellite technology. Instead, that is coming from the private sector where New Space is quickly emerging.

It represents the re-birth of the industry, where an array of entrepreneurs, some from familiar tech giants with billions to bankroll their projects, and some from small start-ups that want to give new concepts a try.

Over the last decade space has come alive again and this has also led governments to be forward thinking in terms of how this New Space phenomenon could potentially feed into defence projects.

This new age of space has brought with it an acceleration of projects. These companies don't want to hang around. They need to prove their concept and make money, and as a result, the time taken from the drawing board to launch has been cut considerably. This sector has an agility that government programs have never had.

GEOPOLITICS

The complexity of the geopolitical environment has taken a huge turn in recent years, Instability is the common denominator in regions across the globe with conflict continuing in Ukraine, the Middle East, tensions between the U.S. and China and the rise of nationalism and protectionism increasing.

Space is playing a more central role in defence than it ever had previously. Satellites gather information, they allow secure communications in the most hostile of environments, they are highly flexible and difficult to disable, and they are recognized as a priority in defence systems.

However, to benefit from advancements in satellite technology, governments must learn to be more agile and to take a leaf out of the New Space book, by pushing innovation, differentiating their space-based systems, lowering costs and reducing inefficiencies.

TAKING RISK IN THEIR STRIDE

In the past, the space sector itself has been notoriously risk-averse, to the point of slowing itself down. Lead times on satellite manufacturing were years long. Budgets were pushed to the limit and the technology that eventually made its way to orbit was often outdated quickly, necessitating a new project and the cycle starting all over again.

Government and defence satellite projects have a reputation for lengthy and complex procurement processes, notoriously long lead times and wallet-busting budgets. The need for high reliability in space systems has also led to a highly risk averse culture where provenance is paramount to avoid any failure.

However, this mindset is evolving as developments in satellite technology from the New Space community prove that satellite development projects needn't be so long and drawn out.

Look at the satellite industry today. Spacecraft development is speeding up, especially in **Low Earth Orbit (LEO)**, where New Space companies are turning projects around at record speed.

The use of software defined payloads is enabling operators to configure their satellites on-orbit, to change their profiles so that they can serve different applications across different regions with steerable beams.

This is game changing technology, enabling an industry that previously had to literally design a new satellite to fulfill a certain job description to operating a flexible payload that can remain relevant for its entire lifespan.

Space players were once dependent on a small handful of launch operators to get them where they needed to go.

However, today we see the emergence of highly successful players such as **SpaceX** and **RocketLab** and many more that are in development that promise less expensive, rapid access to space and rideshares that spread the launch cost.

This means that spacecraft manufacturers can trial technology much more easily and be assured of their ride into orbit. The net result is more of an appetite to try new things — and take more calculated risks.

NEW ATTITUDE TOWARD DESIGN

The need for new technology in the field is urgent, and to ensure that this happens there needs to be a re-focus of the defence sector to concentrate on speed, not complexity.

The defence industry has deeply ingrained ways of working and that is not going to be easy to change, but the ability to use a more agile design process will result in new technology reaching the field faster.

This can be achieved by adopting a process of iterative design, rather than the traditional waterfall process that relies upon sequential steps.

An iterative design process is the process of continuously improving a concept, design or product. The creation of a prototype enables teams to conduct constant tweaking of the product through repeated adjustment cycles. There is an element of improvement gained through every cycle, taking the design team closer to the end goal at every step.

In the iterative design process, failing is an important part of the process. We've all borne witness to the failures of SpaceX rockets, for example. The team can brush failure off and simply carry on. It is an acknowledged part of the process.



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This cycle is much faster than the waterfall model and promotes efficiency, timeliness, cost-effectiveness and makes it easier to manage risk.

A NEW APPROACH TO COMPONENTS

Military satellite projects rely heavily upon a reliable component supply chain and have previously used a lot of bespoke components within their projects. Components require large non-recurring costs to produce with expenses, such as R&D and testing, and this can limit the potential suppliers that can compete to produce them and can create a lack of competition.



Olsen Actuators manufacturing facilities.

Commercial-off-the-shelf (COTS) components are at the very foundation of New Space manufacturing. Companies are striving to keep costs down while offering a high level of performance and using components that can withstand the rigors of the space environment. It's a true balancing act.

However, this once again highlights a shift in mindset. Where space players were once reluctant to use COTS components and brought development in-house to avoid risk, today NewSpace players are focused on managing risk and are turning to COTS to ensure cost-effective and fast realization of their projects.

By building a robust portfolio of high quality, space-rated off-the-shelf components, they are enabling agility and flexibility. Critically, they are adopting an assembly-line mentality, where the components they are using in their designs are tightly matched with the manufacturing process.

If this approach can be adopted by defence organizations, it would streamline the process and access to components will become much faster, simpler and cost-effective.

Already, component manufacturers have designed and tested their products specifically for the space environment. They have already made the investment in the R&D, the integration, the clean room and the project management. They have the engineering staff available.

They offer quality in production and economies of scale, and many are already flight proven. The products undergo intensive testing for shock, vibration, cooling and radiation and other environmental testing. This may result in a more expensive cost per unit, but the hard work is taken out of it.

If a more tailored approach is needed, customized components can be offered, and these fall somewhere in between COTS and in-house developed products. They are essentially COTS, but they are adapted for specific use cases.

Here, manufacturers work with the client to understand their requirements and then make changes to the original commercial component. This means that the customer avoids lengthy in-house development, design resources and project management plus associated validation testing risks.

Buying in components, such as motors, drives, encoders, actuators and roller screws, also means that the client can focus resources on systems engineering and application design solutions.

A reputable component manufacturer will be able to provide traceability of all their products, which is often a critical consideration for government satellite projects. Assurances can be put into place that ensure that the COTS components selected can run the course of a mission, can cope with the space environment, and can meet size and weight requirements.

ADOPTING NEW SPACE THINKING

The way we think about satellite manufacturing is changing and it's time for governments and

defence organisations to transform their way of thinking about how their programs should be delivered.

A new level of collaboration is required between component manufacturers and government entities, so that a new level of engagement can be fostered to support a new design process. This way, we can define a new era of military satellite manufacturing.

If we can heighten awareness of the streamlining that can take place and work closely with defence organizations to understand their requirements, we can ensure that our components meet and exceed expectations.

COTS does not mean cutting corners. It simply means that components are available as and when they're needed, customized or not, and that satellite projects can come to fruition, and do the job in the field that they are required to do today, rather than suffer delays and the danger of becoming obsolete.

A nimble mindset will help to vastly reduce lead times and deploy new technology quickly, where it is so critical to mission success.

www.olsenactuators.com



Olsen Actuators & Drives are situated on the prestigious Sci-Tech campus at Daresbury with access to world-class facilities