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**GMC**



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● ● *If you would like to supply information for future issues of GMC please contact Crispin Littlehales*

Photo courtesy Shutterstock

# Contract signed for new Anti-Submarine Warfare Frigates ●●

The Dutch Ministry of Defence, Damen and Thales have signed the contract for the design, construction, and delivery of four Anti-Submarine Warfare (ASW) Frigates; two for the Netherlands and two for Belgium. The agreement was signed on HNLMS Karel Doorman by Defence State Secretary Christophe van der Maat, Damen Shipyards Group CEO Arnout Damen, Damen Naval Managing Director Roland Briene, and Thales Netherlands CEO Gerben Edelijn during the first day of the Sail Den Helder maritime festival.

The ASW frigates are the replacements for the current Karel Doorman Class multipurpose frigates. They can be deployed for multiple tasks; however, the emphasis will be on anti-submarine warfare. The ships will have hybrid diesel-electric propulsion and will be designed to sail as quietly as possible, to avoid detection by submarines as much as possible. On board will be a comprehensive suite of sensors to detect submarines.

Dutch State Secretary Christophe van der Maat: "The acquisition of the ASW frigates is taking place in the way I prefer: through intensive cooperation, between countries, armed forces, and industry. In time, the result will be an innovative and powerful weapon system. This will benefit us as direct users, but also Europe and NATO."

"This is a wonderful project and a special new chapter for our Damen Naval division," said Damen

Shipyards Group CEO Arnout Damen. "We are proud to be building these beautiful frigates and look forward to working with the many, mostly Dutch, partners and suppliers on this project. With these launching customer projects, we retain vital knowledge in our own country and thus maintain our place in the world's top tier of complex naval construction. More importantly, the crews of the Dutch and Belgian navies get state-of-the-art frigates to carry out their crucial tasks."

"We are delighted that Thales has again been selected to supply sensor and fire control systems for a new class of ships for the Royal Netherlands Navy," said Gerben Edelijn, CEO of Thales Netherlands. "The crew of the ASW frigates will be able to rely on our ultramodern Above Water Warfare System that provides effective defence against current and future threats. Together with the German F126 ships, the Belgian and Dutch ASW frigates will use identical, advanced technology for their defence and protection of high-value objects."

The frigates will measure 145 metres in length, with an 18-metre beam. They will have a draught of 5.5 metres at a displacement of 6,400 tonnes. On board, there will be room for a 117-strong crew and capacity for additional personnel to sail with them. Among other things, the ASW frigates will be equipped with an Under Water Warfare Suite (UWWS), an Above Water Warfare System (AWWS) and underwater decoys. The ships will be armed with a 76mm gun, MK54 torpedoes, Rolling Airframe Missiles (RAM) and the Naval Strike Missile. The frigate can also accommodate other weapons, such as more powerful missiles and High Energy Lasers. There are also unmanned craft and aircraft on board for use on and under water as well as in the air.

Roland Briene (Damen Naval Managing Director), Arnout Damen (Damen Shipyards Group CEO), Christophe van der Maat (Defence State Secretary), Gerben Edelijn (Thales Netherlands CEO)

Roland Briene (Damen Naval Managing Director), Arnout Damen (Damen Shipyards Group CEO), Christophe van der Maat (Defence State Secretary), Gerben Edelijn (Thales Netherlands CEO)

The entire project is a joint operation with the Dutch Ministry of Defence, with some of the work to be carried out by the Ministry itself. Arnout Damen continues: "We have almost 150 years of knowledge, skill, and technology to coordinate and execute the design and construction of complex naval vessels. This is done not only in the Netherlands, but also at our yard in Romania, where the hulls will partly be constructed." These hulls then come to Vlissingen for further completion, the installation and integration of weapon systems and, ultimately, commissioning of the frigates for deployment to the Belgian and Dutch navies.

The current Multipurpose frigates of the Karel Doorman Class were built from 1985 by Damen Naval (then called Koninklijke Maatschappij de Schelde). Between 1991 and 1995, eight M-class frigates were delivered, six of which were eventually sold to other countries, including two to Belgium. With the end of the service life of these ships in sight, the Netherlands and Belgium decided to jointly replace the ships with these ASW frigates. The first ship is expected to be delivered in 2029.

**GMC**



●● Photo courtesy Thales



# Boeing completes T-7A first flight with US Air Force ●●

Boeing and the US Air Force completed the inaugural flight of the service's first T-7A Red Hawk, marking the start of the engineering and manufacturing development (EMD) phase of the program.

During the 1 hour and 3 minute flight, US Air Force Maj. Bryce Turner, 416th Test Squadron, and Steve Schmidt, Boeing T-7 chief test pilot, validated key aspects of the aircraft and demonstrated the power and agility of the Air Force's first advanced trainer to be digitally designed, built and tested. The aircraft is one of five EMD aircraft that will be delivered to the Air Force Air Education and Training Command for further testing.

"The stable performance of the aircraft and its advanced cockpit and systems are game changers for US Air Force student pilots and instructors alike," said Turner, whose grandfather and father were both US Air Force fighter pilots. "We've come a long way in training since my family role models flew."

The T-7A's vibrant red tails are a tribute to the Tuskegee Airmen, the first African American US military aviators who flew red-tailed fighters during World War II.

The T-7A will enhance warfighter training through:

- Improved pilot readiness: The all-new advanced pilot training system uses high resolution ground-based training systems and simulators to deliver robust and realistic integrated live, virtual and constructive training capabilities.
- Safety: Model-based engineering enabled testing throughout the aircraft's design and build to help ensure safety before the first flight. The T-7A's cockpit egress system is the safest of any trainer.
- Flexibility for any mission: With open architecture software and digital fly-by-wire controls, the T-7A supports training for a wide variety of fighter and bomber pilots and can evolve as technologies, threats and training needs change.

"This first flight with the Air Force represents our team's commitment to delivering a new level of safety and training for fighter and bomber pilots," said Evelyn Moore, vice president and program manager, Boeing T-7 Programs. "We remain focused on engineering ways to better prepare warfighters for changing mission demands and emerging threats."

"This is an exciting time for the entire team," said Col. Kirt Cassell, US Air Force T-7A Red Hawk program manager. "The Red Hawk's digital design integrating advanced training capabilities will drastically improve pilot training for the next generation of fighter and bomber pilots."

The T-7A moved from firm concept to flight testing in 36 months. A combination of model-based engineering, 3D design and advanced manufacturing increased first-time quality by 75 percent and reduced assembly hours by 80 percent.

In 2018, the Air Force awarded Boeing a \$9.2 billion contract for 351 T-7A advanced trainers, 46 simulators and support. The T-7A will replace the Air Force's aging T-38 aircraft.

**GMC**



●● Photo courtesy Boeing

# Satellite Evolution Group launches Branded Mobile App

Satellite Evolution Group has for the last several months been tinkering with ways to bring us all closer together and we know you are a hard-working bunch with little time to spare. That's precisely why we created a new Mobile App that places industry news and commentary in the palm of your hand 24/7.

Available in both Android and Apple format, our SatEvo Mobile App delivers Daily News Updates, Feature Stories, Interviews with High Level Executives, Market Analysis, and Push Notifications relating to relevant industry developments. You can even access special content that's not available on our general web platform. We've also created dedicated groups to enable interaction with like-minded members of the space and satellite community through a secure networking platform that is easy to use.

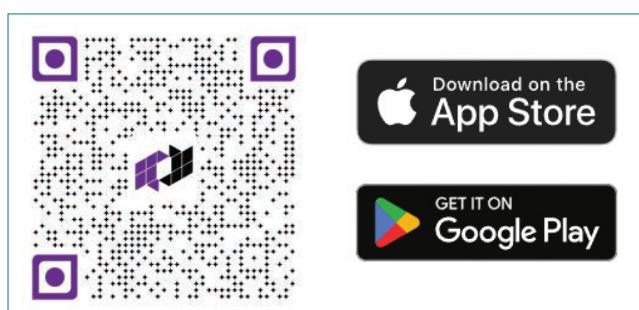
Richard Hooper, Publishing Director said: "Statistics show that the average adult spends on average more than three hours per day on their mobile device, and satellite industry professionals are no different. Our new Mobile App will deliver Daily News Updates, Dedicated Features/Q&As, Market Reports and Push Notifications relating to relevant industry news and events. Via Push Notifications we are getting closer to a direct interaction with our loyal readership and audience, and will be able to deliver industry updates and news in a split second."

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## iRocket contracts with US Space Force to transform how launch vehicles are powered

Innovative Rocket Technologies announced that it signed a contract with the US Space Force Space Systems Command (SSC). Under the contract, iRocket will further develop its highly reusable rocket engine, which will transform how launch vehicles are powered with clean, sustainable propellant and 24-hour turnaround launch cycles. The contract, in the amount of \$1.8 million is funded through AFWERX, the innovation arm of the Department of the Air Force and a Technology Directorate of the Air Force Research Laboratory (AFRL).

Designed for delivering payloads to multiple orbits including LEO, GEO, and the moon, the iRocket Shockwave launch vehicle will also be used for critical cargo delivery for national security and humanitarian aid missions. Under the Space Force contract, iRocket will perform a full-duration static fire test for 120-180 seconds to demonstrate its 35,000 lbs. thrust reusable engine that runs on an environmentally safe combination of liquid oxygen (LOX) and methane fuel.

The contract is a Tactical Funding Increase (TACFI), which continues development following the July 2020 Phase II SBIR contract, during which iRocket successfully demonstrated three operation modes of its innovative booster engine: Augmented, Unaugmented, and Landing mode. The engine enables the Shockwave launch vehicle to land both the first and second stages, including the fairing, and is designed for immediate reuse.

"We believe this contract extension is a clear endorsement of the value our technology brings to national security missions," said Asad Malik, founder & CEO of iRocket. "The AFWERX mission is to help the Space Force benefit from innovation coming out of private sector companies such as iRocket. Our launcher meets the need for lower launch cost and increased operational tempo in delivering assets to orbit and because of its highly controllable autonomous vertical landing capability, the Shockwave vehicle also meets the need for fast, secure, point to point cargo delivery on the ground."

Unlike other launch vehicles that are considered reusable, the Shockwave engine was purpose built for frequent reuse, like an airplane engine. The LOX/methane combination burns clean and doesn't cause residue or build up that needs to be removed before relaunch and its single combustor design produces low turbine temperatures for reliability and easy maintenance.

Targeted for 300 to 1500 kg payloads, the Shockwave launcher is 125-foot tall and has a nine-foot diameter. Its vertical takeoff configuration enables inland launch capability. iRocket previously received a Phase I & Phase II contract with the Space System Command in Albuquerque, N.M., and the Air Force Research Lab at Wright-Patterson Air Force Base, Ohio. The company plans to launch its first vehicle in late 2027.

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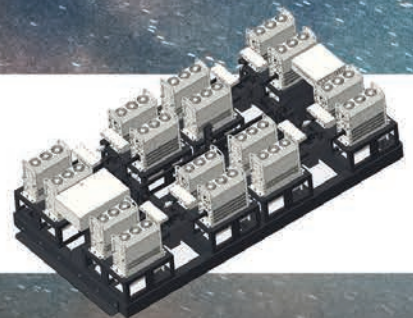
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● ● Greg Porter, Senior Systems Architect at Sev1Tech

# Supporting government and military innovation ●●

Digital thread and digital twin technology is addressing challenges such as training, production speed and quality, problem prediction, cost, and complexity for both satellite and aerospace operations. We sat down with Greg Porter, Senior Systems Architect at Sev1Tech to find out not only how NASA is using this exciting new approach but also how digital thread and digital twin technology can revolutionize military operations.

*Crispin Littlehales, Executive Editor, Satellite Evolution Group*

**Question: When was Sev1Tech established and what services does the company provide?**

**Greg Porter:** Sev1Tech was established in 2011 and we currently have a staff of around 1,000 people who provide IT-based competencies and mission and management services. Our IT offerings span modernization, cloud computing, development security operations, data operations, artificial intelligence (AI), and machine learning (ML). We also offer cyber protection and security as well as digital engineering. In addition to professional services, space operations, aerospace science and engineering, and force protection, our mission and management services include such things as C5ISR.

While our customers are primarily government, we have a large commercial division. That said, a lot of our commercial work is satellite-based which, in turn, supports the government.

**Question: How does digital thread and digital twin technology work?**

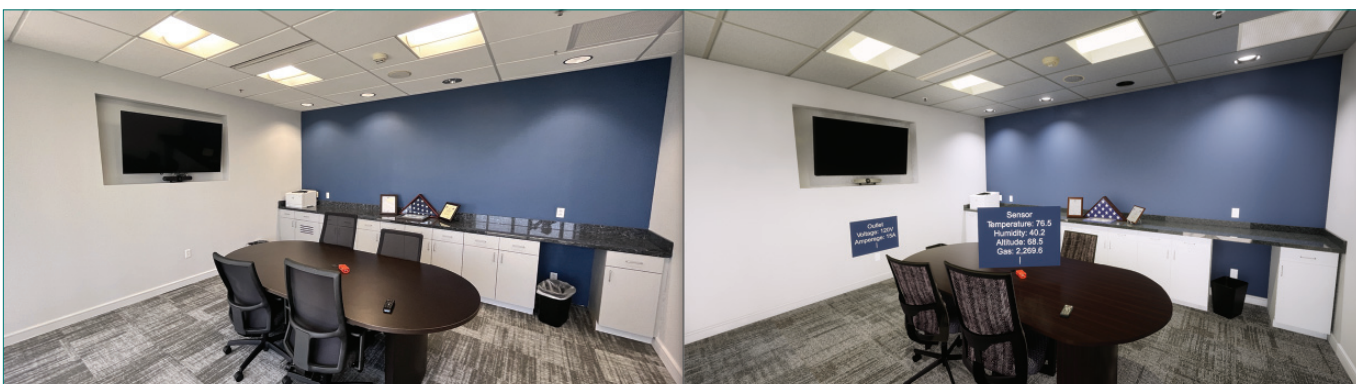
**Greg Porter:** I would define a digital thread as a data driven architecture that links together information generated across a product lifecycle. It works by exposing metadata from disparate systems to link information that shows the intra and inter model relations. This in turn provides a holistic end-to-end view of the data across your entire organization.

Digital twins are done in different ways by different companies. Here at Sev1Tech we build the most photorealistic digital twin possible. When you look at one of our digital twins, it should appear as if you are in that physical space, looking at that object.

**Question: How can digital thread and digital twin technology address challenges such as training; production speed and quality; problem predictions; and cost as well as complexity of aerospace systems?**

**Greg Porter:** Our digital twin platform offers a suite of capabilities that improve personal training and job preparation. They include access to online tooling or machinery, manuals, training documentation, as well as the development of canned videos that demonstrate production, maintenance, or repairs. There is augmented reality training which walks the user through individual tasks that

# GMC Q&A



● ● Digital twin office model





● ● Photo courtesy 3rdtimeluckystudio/Shutterstock

need to be performed. We can also combine all those elements to create machinery simulators that can track how an operator performs with a piece of equipment in a real-life scenario and then throw curveballs at them to see how they would react to unexpected situations. All such elements can be made available either at one's desk or out in the field to supplement on the job training.

As for production, speed, and quality, when questions arise, the documentation and engineering processes are all tied together. They are available to whomever needs it right when they need it. That goes back to the digital thread which serves as the authoritative source of truth for all the data that goes into the digital twin. As a result, the technology greatly impacts facility improvements, tooling, management, and production planning because you've got that link to the digital thread which has the real-time documentation, real-time models, and real-time information systems that are feeding back into your digital twin.

One of the ways we help with problem predictions is through sensors. We tie real-world sensors, which can provide live

feedback on machine operation, into our digital twin. We tie that in with predictive AI algorithms that we embed into our digital twin. When problems arise, those sensors alert crews when something needs to be replaced or repaired.

Because the technology enables you to combine training, the ability to increase production speed and quality, as well as to predict problems before they happen, you're reducing your cost for those systems and for your overall manufacturing process. You are also reducing complexity because you're giving that real-world training to technicians.

Add in the HoloLens augmented reality aspect coupled with a live communication link within the digital twin and it's possible for an engineer at a different site to enter the virtual environment with the technician out on the floor. That means that the engineer could draw and interact right in the technician's environment to help solve an issue.

**Question: How is that done?**

**Greg Porter:** If I am wearing a HoloLens, which is the augmented reality space, I wouldn't physically see the other engineer but he or she could draw a circle around my computer screen and then walk me through something. I'm seeing what they draw in real time, in my physical space, but it's a virtual object that they're drawing.

**Question: Do you have a productized solution or is each solution customized?**

**Greg Porter:** We do have to model for every use case, meaning if there's not blueprints available, we'll take 3D laser scans of the physical space and the physical objects. Then we create the 3D models for that. The software used on the back end to do all that can carry across between different programs and different use cases so we're not rebuilding that every time. The same goes for the digital thread.

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that our digital thread technology can connect to virtually any software that has an application programming interface (API). This means our customers don't need to purchase a proprietary software suite and migrate all their existing data models and workflows into the new software.

**Question: Are there other challenges to adopting digital thread and digital twin technology?**

**Greg Porter:** We do see that some people do not realize the full benefit and potential of having both the digital thread and the digital twin. Even when manufacturing is not involved, a digital thread is still very useful because you are still able to understand how each of your data interacts and affects each other from end-to-end. In a manufacturing use case, you can then throw the digital twin on top of that to get that full real-time view into your environments. People do need to change the way they think about things, but once a person understands the potential a whole new world of possibilities opens.

**Question: Why is this approach so beneficial for the satellite and space industry?**

**Greg Porter:** One aspect of the digital twin which makes it very useful for the satellite industry is that during the manufacturing process, you can model and work in the digital twin space and simulate things far more quickly and cost effectively than building a physical representation. Once a satellite is deployed, it's important to understand how that satellite is operating. It's important to know if it is going to experience an outage and if there is something that can be done to prevent such an event. A digital twin can give you the ability to see all of that, not only in real-time, but also in the future. Because you are collecting that data, you can calculate the historical data and you are able to predict and prescribe fixes before they even happen.

**Question: Is this kind of technology being used by the military yet?**

**Greg Porter:** There is a huge case for digital thread and digital twin technology when it comes to the military. It is being used in different facets of the military right now. In fact, the military spent a billion US dollars on Microsoft's HoloLens. They've been exploring different ways on how to get a return on their investment. I think a big piece of that is through digital twins and it can be used for training on how to set up equipment out in the field. Instead of working with the physical equipment, they could work with holographic images and get that training accomplished without ever needing to touch the actual equipment. This would save on costs and opens different avenues of communication out in the field. If a soldier is wearing a HoloLens or some other augmented reality type goggle,

**"I would define a digital thread as a data driven architecture that links together information generated across a product lifecycle. It works by exposing metadata from disparate systems to link information that shows the intra and inter model relations. This in turn provides a holistic end-to-end view of the data across your entire organization."**

someone back at base could draw or write or interact within their physical space.

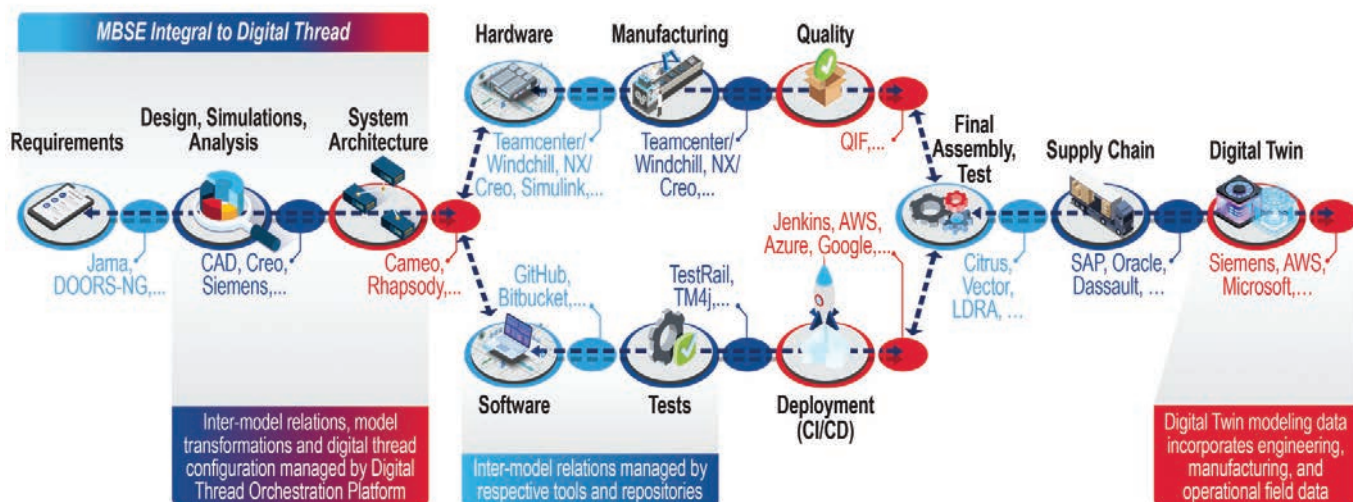
**Question: What are you hearing from NASA?**

**Greg Porter:** You cannot talk about NASA and digital twin technology without mentioning John Vickers, the director for the NASA division called the National Center for Advanced Manufacturing (NCAM). He is credited for coining the term "digital twin" and has long been a huge proponent of the technology.

Sev1Tech is working directly for John Vickers on building a digital twin of the Michoud Assembly Facility which is where NASA builds its rockets. We're directly supporting the Artemis program, including the core and upper stage rocket as well as the Orion crew capsule. NASA's goals are to improve the efficiency and the quality of maintaining not only the facility but also managing the needs of the NASA programs which will ultimately lead to decreased downtimes, improved communication, and lower costs. Sev1Tech's vision is to expand across NASA. We would like to see all the agency's sites incorporate digital twins. We believe that is possible, using the digital thread, to be able to connect the entire NASA ecosystem together.

**Question: How do you see aerospace technology for NASA and the military unfolding in the next 1 to 5 years?**

**Greg Porter:** I see an increased speed and evolution of technology and iteration of design and desire. Over time, we're going to learn more about how to accomplish things which, in turn, is going to inspire us to do more and explore more avenues that we haven't even dreamed of yet. Sev1Tech's role is to continuously leverage the technologies available and to develop new technologies to meet the unique needs and challenges of NASA as well as our other customers. The benefits realized through utilizing the digital twin at the Michoud Assembly Facility is going to lead to broader implementation of the system across other NASA facilities and programs. **GMC**





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● ● Tugs escort the Royal Navy Type 45 destroyer HMS DUNCAN out of harbour. Photo courtesy Kevin Shipp/Shutterstock

# How LEO services can provide the boost needed for recruitment and welfare ● ●

Seafarers face many challenges to their physical and mental health due to working in a risky occupation with high job demands, long working hours, poor social support, and prolonged periods of time out at sea. While this applies to both civilian and military seafarers, naval personnel face further stresses. These include additional limitations on their ability to communicate with loved ones for operational purposes and the changes in operational tempo faced by many NATO nations over the last few years.

*Paul Gudonis, Group Chief Commercial Officer, NSSLGlobal*

## **The stresses facing seafarers are only likely to increase.**

The 2021 Integrated Review underscored the need for an “expanding [Royal] Navy, armed with the latest weaponry, equipped with the latest tech, deployed more around the world to meet the UK’s expanding horizons”. Further, with the Indo-Pacific tilt, the pacing threat of China, and a resurgent Russia – as mentioned in the 2023 Integrated Review Refresh – it is clear that the Royal Navy, the Royal Fleet Auxiliary and the Commando Force, as well as their equivalents across NATO, are going to spend increasing time deployed at sea.

These changes are happening at a time when personal freedoms and associated digital access are expected by younger generations. As a result, many navies and commercial shipping companies are looking for ways to improve welfare communications and provide more support for crew mental health. For example, the Royal Navy’s offline mental health platform, HeadFIT, was launched so crew could access self-help even when technically “disconnected” for operational reasons.

The challenges associated with mental health issues onboard extend beyond the military to all maritime organizations

around the world. This has led the UK Government to allocate £2.4 million for projects supporting the maritime sector, and specifically seafarers’ mental wellbeing.

The Sailors’ Society’s recent 2022 Cadet Report, which provided insights into Generation Z cadets—those born between 1996-2010— from around the world, showed that 57 percent already had scores suggesting anxiety. Most believed loneliness would be the main cause of any mental health issues they faced, and 79.5 percent said their choice of shipping company depended on how it treats seafarers.

Equally, commercial maritime and naval crews at sea need a way to continue with education and training programs for technical and leadership courses while at sea. Many of these now have a good deal of online content available, which benefit from crew, shore-based mentors, and teachers all being able to regularly access the material.

## **The value of a LEO hybrid network service**

Communications at sea have been provided by satellite for over 50 years. They have been key for both operational and welfare services, in addition to positioning and navigation. Generally, communications for major maritime platforms have been provided by Geosynchronous Orbit (GEO) satellites, delivering a broadband style service from a few Kbps to multiple Mbps. However, Low Earth Orbit (LEO) satellites are not a new proposition.

In fact, the first LEO satellite was the Soviet Sputnik 1 launched over 65 years ago in 1957, and Iridium launched its first LEO constellation 26 years ago in 1997. While earlier LEO satellites provided low single-digit Kbps, more recent Iridium NEXT satellites provide hundreds of Kbps of resilient service to a user.

Newer services are now available thanks to significant investments in broadband high throughput LEO satellites, which offer fibre-like high-speed low-latency connectivity of about 100 Mbps.

These services can enable high throughput at a reasonable





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● ● Paul Gudonis, Group Chief Commercial Officer, NSSL Global

cost and, if configured appropriately as part of a hybrid solution, allow for operational and welfare services to be separated. This protects welfare services for crew members, enabling more contact with their loved ones back home, via messaging and video services. In addition, crew members can enjoy more home comforts, like catching up on their favourite shows and movies, online gaming, or using social media.

#### What is driving recent demands for LEO connectivity?

The surge in demand for LEO connectivity reflects growing expectations from crew members and better awareness from employers about the importance of mental health. Naval jobs can take a significant toll on mental health, with long periods of separation from families and friends. The work is often dangerous, involving high-risk situations that can lead to high stress levels and anxiety. This combination of stress, isolation, and lack of access to mental health support services can contribute to depression and increases seafarers' risk of poor and unhealthy coping strategies. Ultimately, this can then lead to serious personnel issues and retention difficulties.

The importance of on-board connectivity has been demonstrated across military and commercial maritime as far back as 2017, when the seafarers' trade union, Nautilus International, published a survey showing that 80 percent of its 22,000 members considered communications an integral collective bargaining issue, second only to improved pay. It also highlighted that almost two-thirds (63 percent) would consider moving to another shipping company that offered better connectivity.

These demands were exacerbated during the height of the COVID-19 pandemic, which shone a light on the importance of prioritizing crew wellbeing, as many faced longer periods of isolation due to imposed restrictions and extended contracts. Many had concerns over the health of family and friends at home, which were made worse for those unable to call, message, or even just enjoy being distracted by the entertainment of a show, film, or online game.

Generation Z crews have grown up accustomed to having instant access to technology and connectivity, and following the pandemic they feel more empowered to articulate their needs.

Together, these forces have pushed the need for LEO services to the forefront of maritime considerations as a viable solution that meets welfare and operational needs and supports the retention of personnel.

#### How does LEO support mental health and operational outputs?

Although ships have long provided some form of crew welfare services, including phone calls and television content, access has been limited. LEO services provide a step change in high throughput connectivity combined with low latency, which means crew members can access Wi-Fi and download speeds like those provided by home broadband. This can be done affordably by the company, the individual, or a blend of the two. This, in turn, provides numerous benefits to the physical and mental welfare of those on-board. For example:

- **Real-time communication:** Personnel have more options for staying in touch with their loved ones and support networks while at sea, which can help reduce feelings of marginalization, isolation, and loneliness.
- **Mental health support:** Improved access to mental health support services, such as telemedicine and tele-counselling, enables crew members to connect with mental health professionals and receive support for issues like depression, anxiety, and PTSD.
- **Enhanced safety:** Better connectivity means physical wellbeing can be further safeguarded through real-time tracking and the monitoring of ships, weather data, and emergency response services. This can help prevent accidents and ensure quick response times in the event of an emergency. Remote monitoring of seafarers' health and well-being through wearable technology and sensors can be used to monitor vital signs and detect early indications of health issues. This helps seafarers receive timely medical attention and prevent any health issues from escalating.
- **Training:** LEO services provide potential for crews to engage in virtual training – especially useful in cases where members are out to sea for extended periods of time. On-demand access to training resources allow crew members to maintain or advance their skills and knowledge at sea, supporting their development and encouraging career advancement. It can also be used to help establish best practices that promote crew and crewmates' safety.

#### Why LEO service capabilities should be part of a hybrid network solution

There's no doubt that LEO services can provide value, but relying solely on LEO satellites is a risky strategy that puts operational priorities in conflict with crew welfare, as data-use for one negatively impacts the other. That is why it is best to separate these systems by pairing LEO services with a guaranteed VSAT solution that can offer a committed information rate (CIR), ensuring mission critical operations are not compromised, while also protecting the high-throughput connectivity most suited to provide well-being support services.

By combining LEO and VSAT services, large quantities of data can be exchanged at broadband speeds, real-time communications are enabled, and remote monitoring is made possible for operational matters – all without affecting crew services. In the past, vessels have had to return to port for this level of connectivity, costing time and, subsequently, money.

#### Not all LEO satellites are created equal

Before committing to a solution, the vessel and its crew members' needs must be considered to ensure that the chosen service is fit for purpose. For example, while most network operators manage regulatory access into ports – not all do. Maritime operators need to consider whether they need a solution with built-in access, as using these solutions in ports without pre-approval can lead to significant issues down the line.

They also need to think about the operational conditions that their solutions will be used in, ensuring the equipment in place has been built to withstand such environments. Additionally, a CIR is crucial for most professional-grade



operations, making sure connectivity for both operational and welfare purposes is never compromised.

LEO services have the potential to mitigate the growing recruitment and retention issues faced by many in the maritime industry, including naval forces. They can help address the welfare problems that have arisen because of challenging working conditions and a hazardous job that often requires long periods away from home. But this is not a standalone service; to be implemented correctly it needs to be fused with a network service that guarantees connectivity for mission-critical operations.

Delivered with the right resilience, support and assurance, emerging LEO constellations are providing options for maritime

operators that enable operational efficiencies, increased safety, and security, greatly improved on-board morale, and longer-term retention. This means they can invest in both their crew and long-term planning.

Officers and crew for both commercial maritime and defense organizations will be able to see that they are working for an employer that cares for their welfare. Contact with home will only be restricted when operational tasks dictate, rather than because the vessel simply doesn't have the bandwidth. Crew and officers will also have the ability, where practical and affordable, to catch up on sports and movies, play online games, access social media, video and voice calling, and even get remote training to promote safety and career advancement.

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● ● Photo courtesy anek.soowannaphoom/Shutterstock





● ● Koen Willems, VP EU Programs and Government Relations, ST Engineering iDirect

# Addressing the challenges of MilSatCom networks ●●

The communications and connectivity requirements of governments and militaries are rapidly evolving. ST Engineering iDirect has developed a novel approach that enables users to manage increasingly complex SATCOM networks. We spoke with Koen Willems, the company's VP EU Programs and Government Relations, to get the details.

*Crispin Littlehales, Executive Editor, Satellite Evolution Group*

**Question: When it comes to satellite communications, the needs of both the government and defense sectors have become increasingly complex. What are you seeing as the key challenges?**

**Koen Willems:** In recent years, the government and defense sector has seen some significant changes in terms of its communications and connectivity requirements. There has been an increased complexity of ground segment satellite networks. In addition, a large number of constellations are being launched, in multiple orbits, with more sophisticated satellites and more On-the-Move/On-the-Pause applications—and there's a need to deploy them on a global scale.

There's also been the convergence of networks, integrating different access technologies and preparing the ground for 5G. This is all happening against a backdrop of an increased amount of multi-domain security threats, especially cyber and electronic warfare, and a lack of Suitably Qualified and Experienced Personnel (SQEP). Not all government and military entities have the knowledgebase, experience, or resources to manage these increasingly complex SATCOM networks and often partner with other nations for satcom. This is especially true of smaller nations.

**Question: What is ST Engineering iDirect doing to address these challenges?**

**Koen Willems:** At ST Engineering iDirect, we have recognized this evolution in requirements and have responded by developing a new approach which we call Resilient Integrated Solutions or RIS. This is a complete end-to-end MilSatCom solution that can be tailored to specific needs. We can leverage our vast ecosystem of best-in-class partners to be the one-stop shop for baseband equipment as well as other supporting services and innovative capabilities.

There are seven principal benefits that this new approach brings to government and military users:

- **One-stop-shop** offering ground segment technology and services ranging from baseband to terminals, gateways, and (hybrid) satcom solutions for military end-users.



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Q&A



- Embracing the complexity of MilSatCom networks with **innovative technologies** and **as-a-service offering** allowing military end-users to focus on their core tasks.
- Increasing security and resiliency of MilSatCom networks through a **multi-layered security & resiliency** approach.
- **Integration services** expertise to install, operate and maintain end-to-end (hybrid) MilSatCom networks.
- Design and productization of **secure waveforms** and adjacent **baseband and network elements**.
- **Seamless connectivity** by supporting next-gen MilSatCom global networks and **multi-orbit** assets addressing multiple dispersed theatres of operation on land/sea/air.
- Agility through **fully integrated terminals, gateways, and antenna systems** in orchestration with baseband and networking technologies.

**Question: Resilient Integrated Solutions (RIS) includes your baseband equipment for MilSatCom Networks along with your Evolution Defense platform. Can you drill down and provide some technical details?**

**Koen Willems:** RIS is built upon the foundation of the Evolution Defense platform which features the highest levels of security, resiliency, agility, performance, network optimization and encryption, remote commissioning, and network monitoring. RIS also features terminals, antennas, gateways and RF elements to provide secure communications and information assurance. This includes manpacks and mobile earth stations and an extensive range of RF products, terminal and gateway technologies and integration services.

We know how critical security is to our customers and we have developed Multi-Layered Security to build layers of defense to detect, mitigate, prevent, and predict threats as well as network layers for resiliency to switch between networks when interference or jamming arises.

This includes a network management system, spectrum monitoring, and geolocation services that can identify potential threats; signal excision technology and network diversity to ensure persistent communications; transmission security (TRANSEC) and information assurance capabilities that ensure systems remain secure. Through enabling evaluation of current and historical data, the RIS suite of technologies also supports prediction of future interferences and threats.

For mission-critical communications, a PACE approach

(Primary, Alternate, Contingency, Emergency) for redundant means of communications can be achieved by leveraging hybrid networks from satellite communications to terrestrial such as the Unified Communications System (UCS). The UCS is a fully IP-based radio communications system that provides secure, reliable multi-media communications by connecting classic radios to mobile smartphones to leverage common apps for situational awareness, quick-to-deploy tactical, or connect workgroups with a mobile command post. The UCS network and gateway diversity, waveform innovation, and next-generation terminals are all elements that can be integrated into the PACE approach.

**Question: There is a lot happening in space with the launch of thousands of satellites across all orbits along with the convergence of the telecom ecosystem. What do governments and military need to do on the ground to take advantage of all these new satellite capabilities and innovations?**

**Koen Willems:** We are already starting to see the launch of multi-orbit satellite constellations and this trend is set to continue. Over the next five to ten years, these constellations will be up and running with new flexible payloads that can be launched and configured later to a specific use case or reconfigured depending on demand. But, to unlock the capabilities that NewSpace offers, ground systems must be equally dynamic and tightly integrated to dynamically allocate space resources as and where they are needed.

If we combine this with what's happening in the telco arena with the rollout of 5G, this is sending us in a new direction and the ground segment has to do one clear thing: make life easy for the end user. This means eliminating the complexity and ensuring a high-quality, secure end user experience. This is a complex technological move forward. The ground segment will deliver an absolutely seamless user experience for the user so that it doesn't matter which satellite they are using, whether it's a GEO, MEO or LEO satellite, and whether they move from one orbit to another – it just happens. And it happens on one platform and at the lowest possible TCO.

It will be critical for the government and defense sector to have the right technology partners in place to enable them to address these requirements. With over 35 years of ground segment innovation, we are the market leader in the government/







defense, enterprise, mobility, and broadband markets. Our best-of-breed technology, equipment, and services work in orchestration to achieve seamless connectivity and information assurance that is critical for government and defense users.

**Question: What are the challenges that must be overcome by ground segment providers to make New Space capabilities a success?**

**Koen Willems:** The changes going on in space encompass a lot of new elements, new capabilities, and new innovations. It's extremely important that our industry now figures out how we take advantage of this. Satellites now have terabit levels of capacity. New LEO constellations with hundreds and even thousands of high-capacity satellites form a network together. That's where orchestration of capacity resources and synchronization with the ground segment becomes critical. Satellites are becoming more capable. Whilst they used to be static, with an unmoving beam and custom built to serve regions and applications, today they feature standardized, fully programmable, and fully digitized payloads.

As the ground segment industry, we need to ensure that the innovation is in place to tightly integrate space and ground to realize these capabilities. This will be achieved by enabling networking and orchestration technologies to work in unison across multi-orbit satellite, terrestrial, and mobile networks to enable truly seamless service. We call this a multi-access, multi-orbit, multi-service platform. This orchestration will allow access over LEO, MEO, GEO, and terrestrial links to provide more flexibility and higher scalability.

We will also need to implement standards which will enable us to interoperate and virtualize the ground segment. For example, we are heavily engaged with DIFI (Digital IF Interoperability Consortium) which plays an important part of the interoperability challenge when it comes to virtualizing modem technology. However, there are many other aspects to interoperability. The integration of satellite networks with terrestrial networks, for instance, requires interoperability at the management and orchestration layer. Here, the standardization work being done within 3GPP is very promising. Again, standardization on how these different components should interface is currently being examined.

Another area is space/ground convergence. We've just announced a strategic partnership with satellite manufacturer Airbus Defence and Space to enable tighter space-to-ground integration and promote technology and vision for the future.

Both our companies will draw on our long history of collaboration, experience, and proven technology to focus on areas of innovation that will benefit satellite operators' time-to-market. Areas of focus will include the fully digitized Onesat GEO satellites; NGSO constellation programs; the identification of existing and emerging use cases; the corresponding end-to-end solution architecture and future standards. We have already collaborated with Airbus on ESA's Free Hopper project, which aims to validate the technical maturity of advanced DVB-S2X beam-hopping using the DVB-S2X standard for large European initiatives. This is a great way to advance our relationship for the benefit of our customers.

**Question: How do you see all of this unfolding and how long do you think it will take?**

**Koen Willems:** This will not happen overnight. There are many different things that need to align. Ground systems must push towards a standardized, cloud-based service delivery that is driven by three key technology enablers: orchestration, standardization, and virtualization.

At ST Engineering iDirect, we have been working towards this for some time and have been engaged in key Proof of Concept demonstrations.

The first is the virtualization of our modem with Microsoft Azure virtualization and cloudification for faster scale.

The migration towards virtualization and the cloud is taking place across every industry and every region as businesses look to accommodate the surge in bandwidth demands. At ST Engineering iDirect, we are also starting to move away from ground segment-based hub hardware towards infrastructure virtualization and the cloud. This will ultimately allow our customers to scale faster without the need for additional capex investments. Virtualization and cloudification will reduce overall operational complexity, enabling a fully digitalized ground network that can integrate within the telecom 5G fabric and provide access to cloud-based applications and management tools as well as improved performance and security.

In order to interoperate easily and to run in the cloud, satellite modems also need to become software defined. To enable that, we are currently working on the abstraction of the software modem functionality from the hardware. We entered into a partnership with Microsoft Azure Space to develop a virtualized modem that can be deployed on a Microsoft Azure HCI Stack based solution. Last year at World Satellite Business Week in September we announced the successful demonstration of a



highspeed virtualized SCPC demod capability by running it on commercial off-the-shelf hardware in the Microsoft Azure cloud. This demonstration also showcased the use of a digital DiFi RF interface instead of the traditional L-Band interface. In March 2023 we showcased the virtualized modulator capability, our second Proof of Concept (PoC) with Microsoft.

Our second PoC was with the DIFI standard. This demonstrated the interoperability of modems and Wavestream BUCs via a digital interface. This PoC implementation of the DIFI standard is an important milestone on our path to virtualization and the realization of the all-digital teleport. Our products with DIFI-compliant interfaces will simplify gateway designs and pave the way for a more flexible and fully virtualized ground infrastructure.

Our third Proof of Concept is on 5G core network integration. Until now, Satellite VSAT systems have been managed as standalone systems. Today, this is changing as some of the terrestrial standards are becoming dominant, such as the 5G/3GPP and the MEF standards. The use of standards will allow service providers to integrate satellite communication systems into an existing terrestrial environment that can be easily

managed as one, further aligning the operations. To help drive the 5G standard and the adoption of satellite forward, we are fostering collaboration among various ecosystem partners and participating in industry standards bodies. Along with a team of consortium partners (iNGENIOUS, SaT5G, SATis5 and OSMOSIS), we have been demonstrating 5G capabilities over satellite for a number of years. For example, we were the first to successfully demonstrate live, first-of-its-kind satellite integration into 3GPP network architectures.

With our partners, the iNGENIOUS Consortium, we have demonstrated a 5G Maritime IoT use case whereby we have successfully backhauled IoT sensor data being tracked from a shipping container on land and at sea over satellite to the cloud using a 5G Core. In this scenario, our modem behaves like a 5G UE to the integrated 5G core network and is being routed, controlled, and registered through the 5G Core GUI. Please watch this video <https://satellitevo.com/hwz> to find out more.

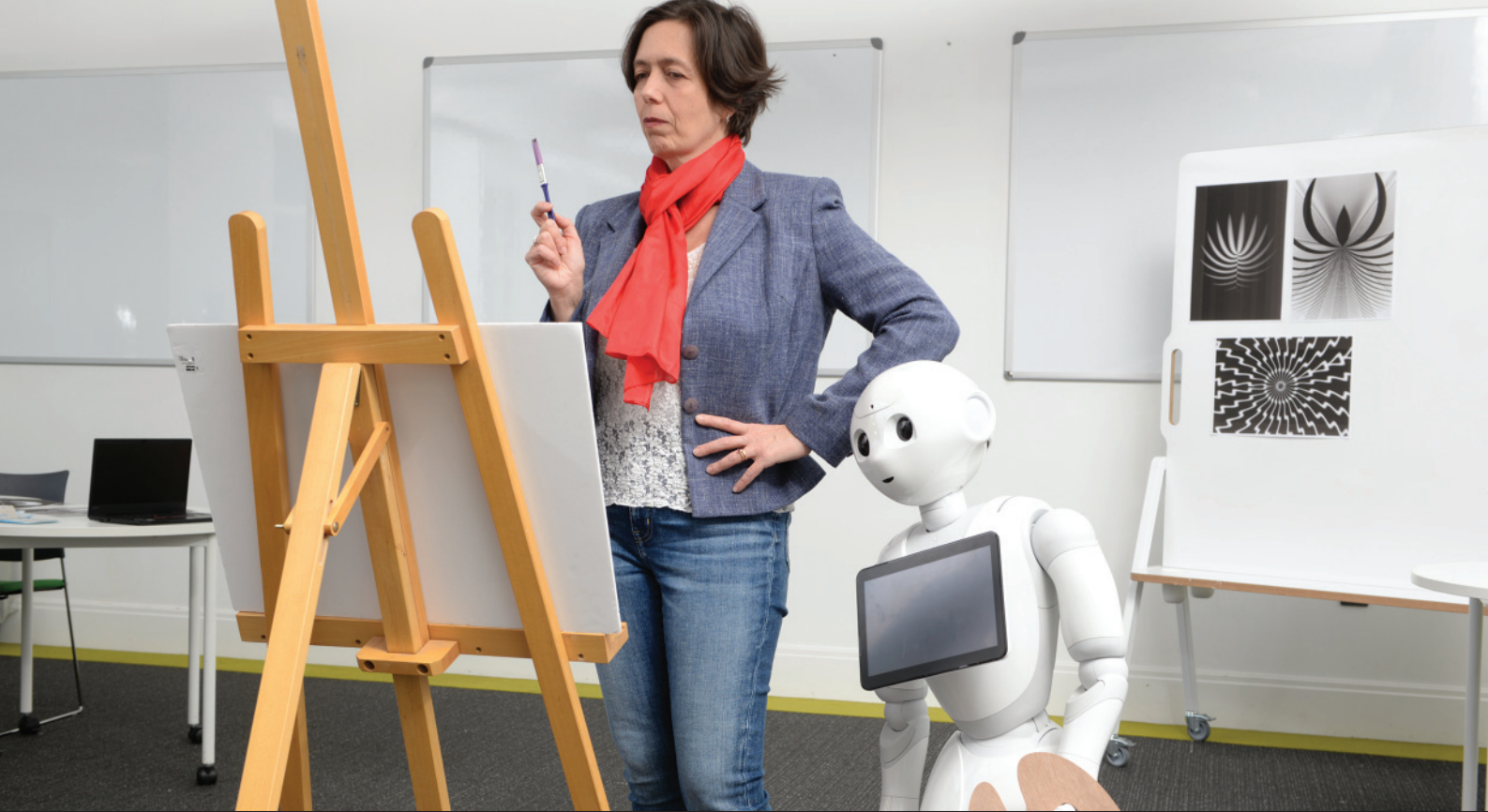
We'll continue to build on this work to achieve the ultimate goal of enabling the benefits of New Space to become reality here on the ground through technological innovation and collaboration.

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● ● Photo courtesy SergeyBitos/Shutterstock





● ● Aniko Ekart - Aston University Director of Research in the College of Engineering and Physical Sciences specialising in Artificial Intelligence

# Exploring mission-critical automation with an expert on ethical AI ●●

The release of ChatGPT and models like it have reframed our collective understanding of the technology's capability. Not only does its release prove the remarkable progress of artificial intelligence, it represents how deeply the technology can change our world. With many mission-critical processes that can be enhanced by automated ingenuity, our next steps are crucial to ensuring such pivotal innovation serves the common good.

*Laurence Russell, Associate Editor, Global Military Communications*

**On the 17<sup>th</sup> of May, Aston University unveiled plans** for Birmingham Innovation Quarter (B-IQ), a landmark science and technology hub for the British West Midlands, expanding the academic and commercial capacity of the school. In a press release, Aston Vice-Chancellor Chief Executive Professor Aleks Subic explains, "B-IQ represents an innovation ecosystem that will co-locate industry, business, entrepreneurs and start-up founders together with staff and students from academia, bringing digital cutting-edge research into a range of sectors."

Critical STEM funding like this aims to put technological nations around the world ahead of the curve on the emerging tech sectors that go on to define the next era of human history. To discuss the course of these crucial advancements, we spoke to Aniko Ekart, Aston University Director of Research in the College of Engineering and Physical Sciences specializing in Artificial Intelligence, about how these investments could fuel the AI revolution.

## The progress of AI

Many contemporary conversations around AI circle back to its profitability and labour-saving potential, though a core tenet of its purpose has long been its mission-critical applications. An AI that doesn't sleep and is capable of quick computation is perfect for all manner of reactive, customized, and reliable

applications. "By 2030," Ekart explains, "I anticipate far more reliable, personalized healthcare through body monitoring with embedded AI, more sustainable urban living smart city innovations, and powerful technologies bringing equity to disadvantaged people in unprecedented ways."

Landmark technologies like these and many more have been under development for many years now by many advanced economies seeking to be at the forefront of this new industry, which has only become more serious as artificial intelligence has continued to prove its disruptive capability.

Being a cornerstone of the supposed fourth industrial revolution, artificial intelligence allows us to place mission-critical tasks into automated hands. With the obvious potential to change the world, such systems have a great responsibility that we must be able to trust.

"To get this right, we need to ensure that before the release of any AI system, it has to be understood through thorough verification and testing, and we need to ensure the population that will work alongside these systems is educated about how they work so they aren't left behind the curve," says Ekart.

While AI is capable of performing many roles that humans cannot, such as deep space exploration, many more commonplace automated applications have been developed to consume human labour entirely. If our workforce isn't taught how to work collaboratively with AI, they don't have much chance of competing with it.

"I don't think there's such a thing as completely foolproof in





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this world, but there are many tools and mechanisms at our disposal as developers and innovators to prevent possible harms,” Ekart continues.

### Enshrining ethical AI

In 2021, a spate of high-profile redundancies at Google made international news as the company fired a few of its leading ethical AI staff, a move later copied by Microsoft, Meta, Amazon, and Twitter.

“I’ve been following some of these cases with interest,” Ekart admits. “Timnit Gebru at Google, in particular, as I felt that was the first in a series, followed by Margaret Mitchell at the same company with many more to follow.”

While these companies have stated that they maintain their interest in ensuring safety, the implications of the layoffs have led to much concern in the academic community. The release of ChatGPT, launched by Microsoft-backed OpenAI exemplifies those concerns.

“Seeing the sudden release of an AI system with no apparent consideration of the resulting consequences, as with ChatGPT, had responsible AI researchers astonished,” notes Ekart. “How can a programme that is not understood be released for widespread use? This is precisely what I believe an ethical team is supposed to try to stop. If we can’t trust them, they shouldn’t be out there.”

With an overwhelming commercial incentive to be the first developer to bring a radical new tool to market, due process and forethought are not compelling alternatives to companies with an opportunity of being recognized as tech pioneers.

“The ethical implications of a tool like ChatGPT alone are vast,” Ekart explains. “Let’s consider the proliferation of the written word. Cheating students, misinformation bots, poor quality journalism, churned out literature – these are all examples that have already come out of ChatGPT, deepening existing issues and societal divides, which may yet escalate into critical issues very quickly. Fixing these new issues will take more time and effort than ethical AI practices would have. Prevention is better than cure.”

Extrapolating these potential harms beyond the mere applications of a chatbot like ChatGPT out to the capabilities of a mission-critical tool in charge of shipping navigation, city management, or medical services has profound implications.

“I believe these systems must be thoroughly understood before they can legally be used by anyone to do anything,” Ekart states.

Of course, the most important automated mission-critical function we must get right remains AI weapons.

### Future-proof development

The case for caution in the development of artificial intelligence has already been evidenced, although the path forward is uncertain.

“From a civilian perspective, the easy solution seems to be to simply outlaw AI weaponry, but it’s questionable whether such regulation is even possible at the moment,” muses Ekart.

Regulation is no silver bullet, considering its effectiveness with cyber and chemical weapons, so no matter how seriously governments seek to guide or even slow the development of AI, the technology has far too much value to stakeholders to be effectively controlled. That’s why many academics instead insist on principles of white box transparency, as opposed to black box propriety.

When AIs make decisions, academics, journalists, and even consumers should possess the tools to see the back end and observe the system’s thinking as well as to recognize why and how it reaches certain conclusions. That way, we can uncover harmful biases, errors, and potentials for harm and publicize them. Historically, this hasn’t been an issue for computer scientists, though companies may be more sensitive to their products being open to criticism. Of course, if they have nothing to hide, they ought to welcome the transparency.

“Legislation is important, but we can’t wait for it,” Ekart warns. “I see myself as a pacifist, but I also understand the realities of the modern world and the military implications of artificial intelligence.

“We must operate under the assumption that AI weapons are under development because if they are and we aren’t prepared for them, the consequences would be dire. The development of defensive countermeasures against such threats must be prioritized while we have the chance.”

Counter Unmanned Airborne Systems (C-UAS) and Electronic Warfare (EW) solutions could be effective countermeasures against autonomous threats, but they only represent our last line of defense. If we take responsibility for AI today, there are a thousand more sane ways of stabilizing the next revolution in technology.

“Ultimately,” Ekart concludes, “the goal should be to harness the power of AI for the benefit of humanity, while keeping humans in control of deciding how and whether to delegate jobs to automation.”

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