

Dear Reader,

In this edition of the deftech.scan, you might suddenly realise that autonomy of machines for some tasks in the field of operations has become – and not *will* become - a reality. If some of you might still have doubts, it is time to acknowledge that the types of experimentations being conducted worldwide leave little uncertainty to it.

As Jules Verne stated “Whatever a person can imagine, one day someone will realize it.” It is therefore paramount to anticipate which use cases, the hows and the whys will these new technology-enabled realities be fielded.

Of course, not everything is today perfect enough, precise enough or reliable enough, but it clearly shows that what was science-fiction just yesterday is suddenly becoming a reality you have to concretely deal with **today**.

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We wish you an interesting read.

Foresightly Yours,



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1. Applications of AI and data

<p>1.1</p>	<p>Israel deploys ‘Smart Shooter’ weapon to West Bank</p> <p>The Israeli armed forces have installed a remote-controlled gun turret that uses AI targeting at a checkpoint in the city of Hebron. The deployment of the system is part of a broader effort to improve Israeli armed forces’ ability to deal with crowds and protests. (source and also source)</p> <p><u>Assessment:</u> The weapon can fire less-than-lethal munitions including stun grenades, tear gas, and sponge-tipped bullets rather than live ammunition. It has been installed over a checkpoint on Shuhada Street that has been the focal point for Palestinian demonstrations and clashes between Palestinians and Israel Defence Force (IDF) personnel. The system has been developed by Israeli company Smart Shooter, a company that designs and manufacturing systems that use AI-enabled targeting to find and lock on potential targets. Company founder and CEO Michal Mor told i24 news in 2020 that the company’s goal is “to enable all infantry corps to benefit from precision weapons. Whatever the soldier’s experience or mission, our system allows him not to make mistakes when he fires and to hit the target without fail.” The deployment of an autonomous weapons system—even one that fires less-than-lethal munitions and for which decisions to engage are taken by humans—has understandably created concern among observers and, especially, among human rights activists. Issa Amro, a human rights activist from Hebron highlighted the risks associated with the placement of the system “in the centre of a heavily populated area, with hundreds of people passing by. Any failure of this technology could impact many people.” Israel has previously deployed AI-enabled facial recognition systems as part of surveillance and security efforts in Palestine.</p>
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Figure 1: The Smart Shooter system installed at a checkpoint in Hebron. The remote-controlled system is equipped with an autonomous targeting system. An IDF spokesperson has clarified that the system is part of broader efforts to confront « people disrupting order in the area » and that the pilot deployment « does not include remote control of live gunfire. » Photo : Twitter Screengrab

<p>1.2</p>	<p>British Army trials drone swarms</p> <p>In September, the British Army successfully completed tests designed to experiment with a single drone operator controlling multiple drones simultaneously. The “breakthrough” test was funded by Army Headquarters, the nano-Unmanned Aerial Systems (n-UAS) project. (source)</p> <p><u>Assessment:</u> The Army used two different UAS systems during the demonstration. The first was the Atlas, for which one operator controlled four drones on a tablet via individual manual mission taskings. The second was the Elbit system, which allowed a single operator to control up to six drones, creating autonomous mission taskings, meaning that the operator can task individual drones to carry out a mission in conjunction with one another or to carry out individual tasks. Beyond demonstrating the feasibility of human control of multiple UAS, the test also trialled possible mission sets for the drone swarms, including using the swarm to provide intelligence, surveillance, and reconnaissance for a 24-hour defensive posture in a fixed position. The test is viewed as an initial step in expanding British Army use of drones for surveillance and communication. Dominic Ferret, the lead UAS engineer for the project explained that “in the future we want one operator to control six, twelve, thirty, forty or more drones as part of a more integrated swarm.” The test was also notable because it was the first time the British Military Aviation Authority has approved the operation of a swarm by one operator, marking an important regulatory achievement as well that could further open up the potential for additional testing and expanding capabilities and operational concepts.</p>
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Figure 2: A screenshot from a British Army video that shows the operational concept of a swarm of drones providing ISR for a fixed defensive position over a 24-hour period. source: British Army

2. Autonomous systems and robots

2.1	<p>China’s Extra-Large Uncrewed Underwater Vehicles (XL-UUVs) spotted</p> <p>Two People’s Liberation Army Navy (PLAN) XLUUVs were spotted at the PLAN base in Sanya, Hainan island in commercial satellite imagery provided by Maxar Technologies. This may be the first indication of a larger XLUUV program designed to support PLAN efforts to redress perceived vulnerability in the undersea domain (source)</p> <p><u>Assessment:</u> The two vessels reportedly have been present since March – April 2021 but have only come to light in recent weeks. The two vessels are of different sizes and designs, indicating the potential for a competitive trial of different prototypes or demonstrators or of two separate programs. The first XLUUV is around 16 meters long and two meters wide. It has a streamlined bow and at its tail it appears to have two propellers in a side-by-side arrangement, linking it from a design standpoint to the HSU-001 Large Displacement UUV, which is believed to be in service with the PLAN. The XLUUV appears to be more than twice the size of the HSU-001, however. The second XLUUV is simpler and slimmer in form. It is around 18 meters long. Both systems are reminiscent of XLUUV designs that have been developed in the United States. The first one resembles the Orca XLUUV, which is currently being developed by Boeing, while the second, simpler design resembles Lockheed Martin’s contender in the same US Navy’s XLUUV competition won by Boeing. The United Kingdom also has an active XLUUV development program. XLUUVs are expected to play a significant role in the future of naval operations, especially for China, which has long sought to redress a perceived vulnerability to the United States, in particular, in the undersea domain. XLUUVs can carry out a range of missions, most crucially ISR, at longer ranges and for longer durations than smaller UUVs or uncrewed surface vehicles.</p>
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2.2	<p>Ukraine uses surface and airborne uncrewed systems in attack on Sevastopol base</p> <p>Ukrainian forces used suicide / kamikaze uncrewed aerial systems (UAS) and uncrewed surface vehicles (USV) in an attack Russian media outlet RIA Novosti called “the most massive since the beginning of the special operation.” (source)</p> <p><u>Assessment:</u> On 29 October, several Ukrainian UAVs and USVs attacked targets located at Russia’s Sevastopol naval base, including the <i>Admiral Makarov</i> Project 11356 frigate. The <i>Admiral Makarov</i> is the Black Sea fleet’s current flagship, replacing the <i>Moskva</i>, which was sunk by Ukrainian forces earlier in the conflict. The Ukrainian armed forces have released video footage of the attack taken by cameras aboard several USVs involved in the attack. Conflicting reports have emerged about whether the <i>Admiral Makarov</i> suffered any damage in the attack, though Russian sources have confirmed that the minesweeper <i>Ivan Golubets</i> suffered minor damage in the assault, which also included attacks on the harbour itself that lead to damage to a floating net boom in Yuznaya Bay at the port. The Russian Ministry of Defence released a statement claiming that “the attack involved nine unmanned aerial vehicles and seven autonomous maritime drones” and that all aerial systems were destroyed. The Russian MoD also blamed British forces for training Ukrainian forces how to carry out such attacks. The British MoD strongly denied the accusation, calling it an “invented story” and accused Russia of “peddling false claims of an epic scale.”</p>
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2.3	<p>NATO experimenting with maritime uncrewed systems</p> <p>NATO held two separate naval exercises off the coast of Portugal in September designed to experiment with a range of uncrewed aerial, surface, and underwater systems. The exercises reflect NATO’s growing interest in uncrewed systems and their capacity to counter an expanding set of maritime missions and threats (source)</p> <p><u>Assessment:</u> The Robotic Experimentation and Prototyping using Maritime Uncrewed Systems (REPMUS 22) Exercise was held from 15 – 22 September while Exercise Dynamic Messenger 22 took place from 23 – 30 September. REPMUS 22 was led by Portugal and integrated approximately 120 uncrewed assets alongside crewed vessels into a single network. The Dynamic Messenger 22 exercise involved 1,500 personnel from 16 member states operating 18 ships and 48 uncrewed vehicles. It was conducted jointly by NATO’s Allied Maritime Command and Allied Command Transformation. The exercise included executing counter-mine, port protection, anti-submarine warfare, and counter-terrorism missions in an effort to “showcase opportunities for allies to see where they may want to invest in the future”, according to Vice Admiral Guy Robinson, chief of staff for NATO’s Allied Command Transformation. Pairing crewed assets with uncrewed assets, especially USVs and UUVs is seen as an effective way to more affordably cope with a growing range of undersea and other maritime threats, including increasingly suspicious activities against critical undersea infrastructure. For example, on 26 September, as the Dynamic Messenger 22 exercise was taking place, the Nord Stream 1 and 2 underwater pipelines were sabotaged by a still undetermined actor. While the United States and others have blamed Russia for the sabotage, Russia has countered by blaming, alternatively, the United States and United Kingdom. Approximately a month later, undersea communications cable off the Mediterranean coast of France and near the Faroe and Shetlands Islands off the coast of Scotland were cut as well.</p>
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2.4	<p>Greece unveils indigenous surveillance drone</p> <p>Hellenic Aerospace Industry (EAB) and the Aristotle, Thessaly and Democritus universities displayed their jointly developed multi-role Archytas vertical take-off and landing (VTOL), fixed wing UAV during the Thessaloniki International Exhibition held in September. (source)</p> <p><u>Assessment:</u> The reveal of the Archytas was relevant for at least two reasons. First, the development of an indigenous UAS could help Greece fill a growing need for monitoring borders and boundaries, especially given the recent escalation in tensions with neighbour (and advanced drone manufacturer) Turkey over contested airspace and territorial claims in the Aegean Sea. The system can fly up to 300 kilometres at a cruise speed of 120 km/h for a max duration of four consecutive hours. It is designed primarily for the surveillance role but can carry light weaponry. Second, the development of the Archytas reflects the continued increase both in the demand for uncrewed systems and the desire of countries to use this growing demand as a means of building more capability in their own domestic industrial bases both to meet local and international demand. Niklos Koklas, director of research and design at EAB told <i>Defense News</i> that the system “had already sparked the attention of several other countries besides Greece, formulating an outstanding commercial prospect.” Development Minister Adonis Georgiadis also raised the importance of domestic development of critical capabilities such as UAS during comments in April 2022, observing that: “EAB can play a leading role in the critical field of high technology, something that seems to be the future of the way the countries defend themselves.” The first pre-production system is expected to be manufactured by December 2023 with a first flight in March 2024.</p>
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Figure 4: Greece displayed a model of the multi-role Archytas VTOL fixed wing UAS during the Thessaloniki International Exhibition. Source: EAB

I. The exercise included UAVs, USVs, and UUVs teaming with crewed vessels to practice several missions to enhance capacity to detect and respond to a growing list of undersea threats. Photo: NATO Maritime Command

3. Connectivity

3.1	<p>New app lets Ukrainian citizens help fight “web-centred war”</p> <p>Ukrainian volunteers have developed an app that will allow Ukrainian citizens to report sightings of incoming Russian drones and missiles, increasing the amount of time Ukrainian forces have to track and intersect enemy air threats. (source)</p> <p><u>Assessment:</u> Recent Russian air and missile strikes against civilian targets have underscored some of the limitations of Ukraine’s air and missile defence capabilities, especially against the low-flying threats from drones and cruise missiles. Russian attacks have involved the launching of hundreds of cheap, Iranian-made Shahed -136 drones into Ukraine’s cities and civilian infrastructure. While many are shot down, some have gotten through, in part because they can be difficult to detect until they are approaching their target, reducing the amount of time Ukrainian forces have to respond to the salvos. Moreover, while the drones are relatively loud and slow, the attacks are frequently launched at night and fly over remote locations, making it even more difficult to get adequate warning. In response, Ukrainian armed forces have developed an app that allows for Ukrainian citizens to press a single button to relay the location of a spotted drone to the country’s military. Gennady Suldin, one of the designers of the project, noted that the objective was to get “the entire population” to help spot incoming attacks in the “web-centric war” unfolding in Ukraine. The ePPO app took five months to develop and only works in conjunction with the Diia government app through which Ukrainian adults can store their identity card, driver’s licence, and other official documents digitally. It currently is only accessible on Google Android phones, but Apple is expected to approve the app soon.</p>
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3.2	<p>Singapore establishes fourth service: Digital Intelligence Service</p> <p>The new DIS service was established on 28 October and is entrusted with the mission to defend the peace and security of Singapore from evolving and increasingly complex threats in the digital domain. (source)</p> <p><u>Assessment:</u> During an inauguration ceremony for the new service at the SAFTI Military Institute President Halimah Yacob stated that changes in the security environment necessitated the establishment of a service that would lead the defence of Singapore’s interests and national security in the digital domain. President Halimah also reiterated that “in the past decade, we have witnessed many attacks on other countries, not through traditional armed conflicts, but through the digital realm. The impact of these digital attacks is real and can result in disruption of essential services, data theft and even local elections.” The move is another reflection of the increasing blurring of the lines between activities in the physical, real-world domain and the digital domain and the impact that digital threats can have not just on militaries but, more importantly, on societal and political cohesion. Singapore has long based its national security on the concept of Total Defence, which stresses the importance of building societal, cyber, and digital resilience in the face of increasing “hybrid” threats. Brigadier-General (BG) Lee Yi-Jin was selected to lead the new service, which will now stand aside services dedicated to the land, air, and sea domains.</p>
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<p>3.3</p>	<p>Electronic warfare at the tactical edge</p> <p><i>Shepherd Media</i> published an informative feature detailing the challenges associated with dismounted electronic warfare (EW) operations at the tactical edge. (source)</p> <p><u>Assessment:</u> The article, authored by EW specialist Dr. Thomas Withington, takes a creative approach to demonstrating the complexity associated with dismounted land forces carrying out EW missions by asking the reader to “imagine a conflict raging on the outskirts of London” and placing the conflict in the “genteel county of Berkshire, to the west of the capital”, an area that has been plunged into a vicious civil war.” The author then explains what types of EW missions forces might undertake to combat insurgent efforts and explains the challenges with carrying these missions out at the tactical edge. Key challenges include those associated with geography, the laws of physics, size, weight, and power (SWaP), human error, enemy response, and, perhaps most notably, avoiding detection. Dr. Withington argues that even if dismounted land forces are effective in jamming enemy operations, success will not only be short-lived but also likely put the EW forces at increased risk. The act of jamming “could reveal the blue force’s hand to the red force. Once revealed these techniques ‘can be countered quite easily through change of spectrum, implementation of radio silence, employment of new frequencies, or even the use of landlines or infrared communications systems’ to outflank the jamming.” Moreover, as Torsten Duesing, business case manager at EW specialists Plath, told Withington, “as soon as you start jamming, you risk being spotted.” Ultimately, the article assesses that “dismounted EW can be a complex mission influenced by a range of factors. Mission planning is vital to exploit geography to make good potential equipment shortcomings, and equipment like ECM and jammers must be optimised for portable SWaP . . . Expect further refinement of this highly nuanced mission set in the coming years.”</p>
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4. Energy

<p>4.1</p>	<p>China achieves electromagnetic breakthrough</p> <p>Chinese state media has reported that the Institute of Electrical Engineering at the Chinese Academy of Sciences has successfully completed a super-speed electromagnetic test during which a one tonne train-like object was propelled to 640 mph, approximately 80% of the speed of sound and a new world record. (source and source)</p> <p><u>Assessment:</u> The record-setting test took place in Jinan, in China’s eastern Shandong province. Reporting stressed the significance of the test for fighter jet catapults, maglev trains, and space launchers. Indeed, China’s newest aircraft carrier, the Fujian, which started sea trials earlier this year is the first of China’s three carriers to be equipped with an electromagnetic catapult to launch aircraft. The electromagnetic launcher should allow for heavier aircraft to launch from the ship’s deck. The United States’ Nimitz and Ford class carriers are equipped with electromagnetic catapults as is the French carrier, <i>Charles de Gaulle</i>. The South China Morning Post also reported that Chinese scientists are exploring electromagnetic launch systems for space missions and highlighted the utility of the test for magnetic levitation (maglev) / high-speed trains.</p>
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Figure 5: A photo of the test train and track at the facility in Jinan, China. Photo: CCTV, via South China Morning Post

<p>4.2</p>	<p>General Atomics developing hybrid-electric engine design</p> <p>The company is developing the potentially “game-changing” engine for the stealthy MQ-Next drone, concept art for which was revealed at the Association of the US Army (AUSA) exhibition in Washington, DC in October</p> <p><u>Assessment:</u> Mike Atwood, the senior director of advanced programs with General Atomics’ (GA) aeronautical systems described the hybrid-electric engine as a “completely disruptive technology” that will greatly extend the range and endurance of future UAVs. David Alexander, president of GA aeronautical systems, told <i>Breaking Defense</i> that the hybrid electric powered MQ Next could have up to 60 hours endurance without having to be refuelled, a sufficient amount to “cover the South China Sea.” In addition, the aircraft will be able to take off from a 3,000-foot runway, meaning that when it does need to be refuelled it can do so at smaller bases that are less vulnerable to air and missile threats.</p>
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5. Sensors

5.1

UK Ministry of Defence trials autonomous vehicle with sensor technology

Scientists with the Defence Science and Technology Lab (DSTL) successfully tested an autonomous uncrewed ground vehicle as a platform for sensors designed to detect chemical and radiological materials and reduce risk to human operators. ([source](#))

Assessment: The Hybrid Area Reconnaissance and Survey (HARS) field trial took place over a period of five weeks and tested the ability of an autonomous uncrewed Viking ground vehicle to effectively detect hazardous materials. The Viking was outfitted with a sensor payload that included two mass spectrometers to identify deposited chemicals on the ground; 2 vapour sensors to detect volatile chemicals; and a gamma radiation spectrometer to detect and identify radiological hazards. The concept includes placing this payload on a “modular pallet” so that it could be deployed on other platforms in addition to the Viking. The tests demonstrated the ability of the vehicle to detect hazardous materials and then to respond to the environment the sensors have detected by, for example, delineating the area of contamination, keeping human operators away from harmful chemicals and emissions. DSTL’s HARS Trial lead scientist Andy Martin articulated “some of the key challenges associated with the system”, including “taking personnel out of the loop and ultimately driving and using sensors that are designed to be operated by personnel producing sufficient automation in the system to allow that to be done remotely and autonomously.”



Figure 6: Screenshot from a DSTL video describing the tests depicting the Viking UGV with the modular payload of sensors. Source: DSTL

6. New Weapons

6.1	<p>Chinese scientists claim a maintenance breakthrough that will allow hypersonic weapons to be launched from aircraft carriers</p> <p>The scientists say they have developed a means of sustaining the highly sensitive and delicate materials and coatings associated with hypersonic weapons even as these systems are exposed to the corrosive elements associated with maritime environments. (source)</p> <p><i>Assessment:</i> The scientists published their findings in the Chinese peer-reviewed journal <i>AeroWeaponry</i> on October 1. The paper reinforces the importance of logistics and sustainment to the process of developing a deployable and usable military capability and how it can in some instances constrain the use cases of particularly types of weapons systems. According to the researchers, hypersonic weapons components and coatings are more sensitive and vulnerable to damage during transport than materials associated with other weapons systems. “When the damaged part is exposed to the ocean humidity with salt and mould, failures such as moisture absorption, expansion, deformation, blistering, debonding or peeling can occur to the heat-resistant coating.” Previously, the process for repairing defects was time consuming, but the Chinese research team now claims to have developed a method using a unique sealing material that will simplify the process and reduce the time associated with sustainment of hypersonic weapons significantly. The ability to launch hypersonic weapons from aircraft carriers or, more likely, aircraft launched from aircraft carriers will greatly extend the range of these systems.</p>
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6.2	<p>French Navy to focus on electronic warfare to counter new anti-ship threats</p> <p>A <i>Defense News</i> feature report detailed the French Navy’s increasing interest and investments in electronic warfare capabilities as part of a layered and integrated approach to ship defence. The story highlighted several possible alternatives to meeting an increasingly challenging anti-access / area denial (A2/AD) environment. (source)</p> <p><i>Assessment:</i> The development and proliferation of advanced anti-ship missile capabilities has increased the vulnerability of ships at sea, forcing navies to consider new alternatives to ship defence. The French Navy is increasingly “betting on” a variety of electronic warfare approaches. Kinetic interceptors and longer-range anti-ship and land attack weapons are certainly part of the defensive mix; however, these capabilities can be expensive, difficult to successfully integrate and operate, and can also be overwhelmed by salvos of lower cost threats. Electronic countermeasures offer, according to a French naval captain interviewed for the story, “a significant operational gain for a relatively low operating cost.” Among the options discussed in the feature was the use of drone decoys that involve a drone or set of drones equipped with jammers that can attract incoming missiles away from the ship. While multiple French companies are actively developing drone decoys, there is no active French Navy program for drone decoys. Moreover, while this approach can be effective, use of decoys typically means a missile has defeated other means of interception and is now close to the ship. Means of electronic interference and directed energy weapons were also referenced as part of a wholistic ship defence solution, though there are challenges with detecting new threats—especially relatively fast-moving ones—in an electromagnetic environment that is congested by the proliferation of sensors and new communications devices.</p>
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7. Manufacturing

<p>7.1</p>	<p>The human dimension: US defence industrial base struggling to recruit, train, and retain necessary talent</p> <p>A review of quarterly earnings reports of major US defence contractors reveals pervasive concern about the effects of a tight labour market on their companies and broader defence industrial base. (source)</p> <p><i>Assessment:</i> The report drew on earning calls from and interviews with leaders from defence industry primes in the United States and revealed a general trend toward labour shortages and increased spending on compensation to attempt to recruit and retain the specialist talent required to develop and manufacture sophisticated defence systems. Raytheon Technologies’ CEO Greg Hayes revealed that compensation have contributed to a \$2 billion increase in company costs through the first three quarters of the year. According to Hayes, “the biggest inflationary impact really comes in compensation . . . given what’s going on in the marketplace today.” The rising costs of labour in a competitive market have not stopped firms from hiring personnel, but it has meant that there is gap between the personnel required and the labour available. Again, according to Hayes, “it’s not necessarily a capacity issue, it’s labour availability. I mean, how do you get trained welders working efficiently?” Recruitment and training are only part of the problem. Companies are also having a difficult time recruiting qualified workers in an industry in which the demands on workers—security clearances, controlled labour rates-- are not replicated in other industries. Eric Fanning, the head of the US Aerospace Industries Association (AIA), captured the dynamic, saying that the industry has “a retention issue, and the requirements levied on the defence industry are such that they decide to leave and go someplace else.” There are also knock-on effects for the supply chain, even when larger companies are able to remediate their labour challenges. General Dynamics’ chief executive Phebe Novakovic asserted on the company’s third quarter earnings call while GD has been able to stay open, “not all of the supply chain did. But we also lost a number of experienced shipbuilders, as well as experienced people, manufacturing folks in the supply chain.”</p>
<p>7.2</p>	<p>DoD wants to use additive manufacturing for hypersonic weapons</p> <p>The US DoD released a request for proposal (RFP) on 28 October through a program called Growing Additive Manufacturing Maturity for Airbreathing Hypersonics (GAMMA-H) that asks traditional and non-traditional defence suppliers to submit prototype proposals for developing hypersonic components using additive manufacturing. (source)</p> <p><i>Assessment:</i> Hypersonic weapon components must be able to operate under extreme conditions, given that the systems will reach and sustain speeds between Mach 5 and Mach 25 and also be capable of manoeuvre at these exceptionally high speeds. Additive manufacturing may offer a means of more easily developing these high-quality parts and reduce the number of components needed to build a weapon. According to Keith DeVries, deputy director of the Office of the Secretary of Defense’s Manufacturing Technology Program, DoD needs “to be pushing the envelope with materials produced using the additive manufacturing process. The science has proven its possible, but the practice is not widespread enough. GAMMA-H will encourage further adoption of ground-breaking technology.” Proposals are due on 12 December.</p>

8. Space

<p>8.1</p>	<p>Bullseye: DART hits its mark</p> <p>The US National Aeronautics and Space Administration (NASA) successfully used a spacecraft to alter the trajectory of an asteroid in space, marking the first time in history that humans have purposefully changed the motion of a celestial object and the first full-scale demonstration of asteroid deflection technology. (source)</p> <p><i>Assessment:</i> The Double Asteroid Redirection Test (DART) program was managed by the Applied Physics Lab at Johns Hopkins University, which built and operated the DART spacecraft that slammed into the Dimorphos asteroid seven million miles from earth. Prior to DART impacting Dimorphos at approximately 14,000 miles per hour on 26 September, the asteroid orbited its larger parent asteroid every 11 hours and 55 minutes. This orbit time was reduced by 32 minutes, down to 11 hours and 23 minutes after the collision. The team had defined a minimum successful outcome as changing the orbit by 73 seconds or more, meaning that the test was more than 25 times more successful than the minimum level of success. NASA Administrator Bill Nelson observed that the test constituted a “watershed moment for planetary defence and all of humanity, demonstrating commitment from NASA’s exceptional team and partners from around the world.” The event also marked another first for NASA. It was the first time that both the Hubble and recently launched James Webb space telescopes were used to observe the same celestial event at the same time. Images taken by both satellites are being used as part of on-going research to better understand the effects of the collision.</p>
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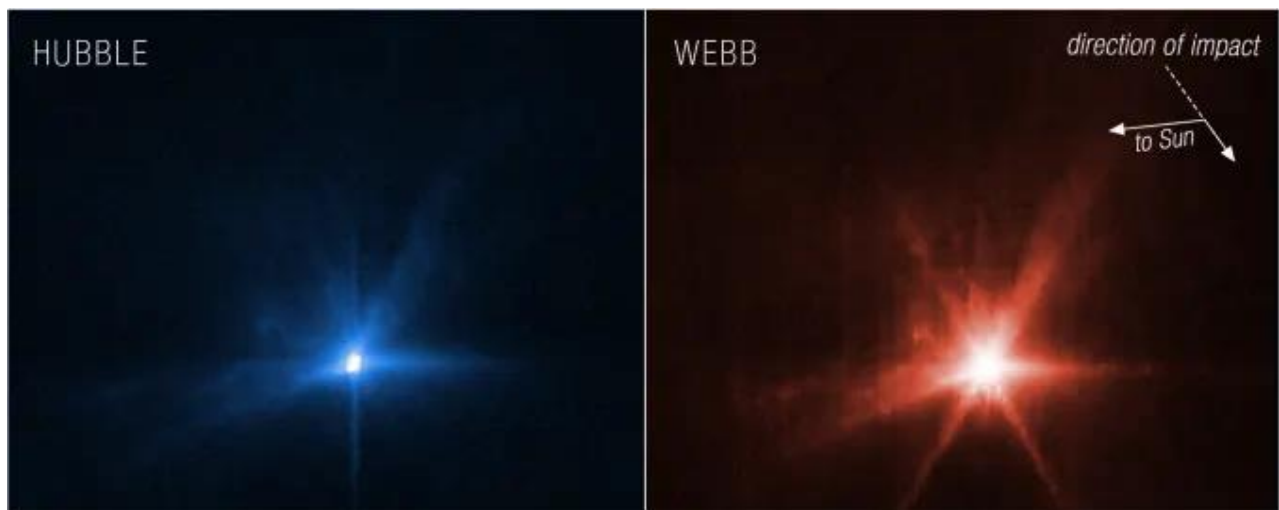


Figure 7: The DART spacecraft's collision with the Diomorphos asteroid on 26 September marked the first time that both the Hubble and James Webb space telescopes were used to observe the same event at the same time. The two telescopes picked up different wavelengths of light (infrared and visible, respectively), and NASA believes that that being able to observe data from multiple wavelengths will help scientists figure out if big chunks of material left Dimorphos' surface or if it was mostly fine dust source : NASA and [Engadget.com](#)

<p>8.2</p>	<p>Pentagon chasing dream of space delivered cargo</p> <p>The US DoD signed an agreement with Sierra Space, the developer of the Dream Chaser shuttle, to develop a spacecraft that can transport people and cargo anywhere on earth in less than three hours (source)</p> <p><u>Assessment:</u> The concept of using spacecraft for terrestrial point-to-point transportation of equipment, supplies, and even people is not necessarily new, though it has become more achievable in the last several years as more commercial space companies have invested in lower cost, reusable spacecraft. Sierra Space, a subsidiary of Sierra Nevada Corporation, developed the optionally crewed Dream Chaser largely to support NASA. The company is contracted to run seven resupply missions to the International Space Station starting next year. However, these technologies also carry potential military utility in greatly accelerating the amount of time associated with logistics and resupply. Going from potentially days or weeks for sealift and a dozen or more hours for airlift to under three hours could have a transformational effect on operational sustainment. One of the key elements of the collaboration between Sierra Space and DoD will be the development of operational concepts related to the use of spacecraft for terrestrial point-to-point transportation. For example, as <i>Popular Mechanics</i> emphasises, “Once a rocket travels to a crisis zone and unloads sorely needed ammunition, weapons, and human troops, how does it get back?” The current Dream Chaser is uncrewed and can transport up to 12,000 pounds of cargo into space. A future version is expected to be able to carry up to seven people.</p>
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