

Dear Reader,

Hoping you had a relaxing summer; we are back with some interesting news reflecting once again the need to adapt to changing threats. The boundary between civil and military technologies and products is increasingly disappearing as a result of galloping creativity.

The ones of you who are curious to know more on different topics should appreciate the direct links to the original documents, which in turn will lead you to really interesting and broad studies.

1 Applications of AI and data	2
2 Autonomous systems and robots	3
3. Connectivity.....	6
4. Energy	8
5. Human capacity enhancement.....	10
6. Sensors	11
7. Computing Power	12
8. New Weapons	13
9. Manufacturing.....	16

We wish you an interesting read.

Foresightly Yours,



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1 Applications of AI and data

1.2	<p>Indian Defence Research and Development Organization (DRDO) develops new facial recognition systems</p> <p>A new Ministry of Defence (MoD) report indicates that DRDO has developed several new facial recognition systems for base and public security. (source)</p> <p><i><u>Assessment:</u></i> The Indian MoD recently released a report entitled “AI in Defence”, which revealed the existence of several new facial recognition systems, including the Facial Recognition System under Disguise (FRSD) developed for the Indian Army. FRSD relies on AI algorithms to identify individuals from patchy low-resolution surveillance camera feeds. It is anticipated to be deployed in restricted / secure zones for live video surveillance, though it can be deployed in public places to identify security threats. The report observed that “face recognition in the wild on surveillance camera feeds is a difficult problem to solve . . . this problem becomes even more challenging to solve with the added complexity of various facial disguises, crowd occlusions, and varied illuminations.” In addition to the FRSD, the report revealed other facial recognition systems, including “Project Seeker” designed for population monitoring, surveillance and garrison security and Silent Sentry, a “facial recognition capable, 3D-printed, rail-mounted robot” that can be installed on fences and anti-filtration obstacle systems (AIOS). The fourth system included in the report is a driver fatigue detection system. Some observers have expressed concern over the increasing use of facial recognition systems by the MoD, noting that facial recognition systems can be inaccurate in the best of environments and should not be combined with other sources to identify and act against perceived threats.</p>
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1.2	<p>Russian MoD opens AI weapons research centre</p> <p>During the Army 2022 Expo held outside Moscow, the head of Russia’s military’s innovative development department announced the standing up of an organization dedicated to developing weapons that incorporate artificial intelligence has been established further signalling Russia’s interest in military applications of AI. (source and source)</p> <p><i><u>Assessment:</u></i> Plans to create the new department were originally announced in May 2021. The formation of the department was confirmed by Alexander Osadchuk during a plenary session at the expo entitled “Artificial Intelligence. National consolidation in the name of creation.” Osadchuk announced that “to intensify work on the use of artificial intelligence technologies in the interests of creating weapons of military and special equipment, a department for the development of artificial intelligence technologies has been created.” The chief of the newly established department, Vasily Yelistratov, relayed to TASS during the expo that the on-going conflict in Ukraine was influencing the organization’s focus on “making weapon systems more efficient and smarter.”</p>
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2 Autonomous systems and robots

2.1

UK Royal Air Force (RAF) ends Mosquito loyal wingman program

The UK RAF announced it was ending its Mosquito “loyal wingman” aircraft technology demonstrator. The surprising announcement constitutes a shift in direction for the RAF’s attritable aircraft development efforts rather than a halt to loyal wingman development ([source](#) and [source](#))

Assessment: The RAF released an announcement on 24 June that the Mosquito technology demonstrator would be halted in the design phase. The announcement came less than six months after the MoD awarded a £30 million contract to Spirit Aerospace Systems UK to design and manufacture a prototype of a loyal wingman aircraft over the next three years. The unexpected announcement constitutes a shift in direction in the UK’s efforts to build a force structure mix that includes more attritable uncrewed aircraft. In comments made in advance of the Farnborough Air Show outside of London in July, Chief Air Marshal Mike Wigston noted that the UK seeks to acquire a smaller loyal wingman UAS on a much faster timeline than Mosquito’s development would allow. The MoD’s Rapid Capabilities Office (RCO) is now tasked with organizing a “fly-off” between potential solutions later this year. Loyal wingman UAS are inexpensive (typically between \$2 million and \$20 million) autonomous aircraft that operate in conjunction with a crewed aircraft, acting as forward sensors, weapons or electronic warfare platforms, decoys, or in any number of other roles depending on the UAS’ mission systems. They are considered a potentially powerful force multiplier for air forces that will allow operations in contested environments with decreased risk to human life and expensive crewed systems.



Figure 1: A rendering of the two BAE attritable UAS solutions displayed at the Royal International Air Tattoo in July 2022 that are now being put forward to meet the UK’s shifted loyal wingman development strategy. Source: BAE Systems [via The Drive](#)

2.2	<p>Russia training commercial and hobbyist drone operators to fight in Ukraine</p> <p>Russia has established a new training centre in Donetsk to train civilian drone operators to operate military drones in the conflict in Ukraine in response to high personnel losses in combat (source)</p> <p><i>Assessment:</i> Commercial operators trained at the new centre in Donetsk will not formally join the military but will support military operations, further blurring the already sometimes unclear line between combatants and non-combatants both in Ukraine and in modern conflict. An unnamed founder of the centre told Russian language media outlet Argumenty i Fakty that “a completely different approach is needed than when training a civilian pilot . . . It is necessary to train people in interaction with the unit, work with other attached forces, and coordinate work in combat crews.” The move reflects Russia’s high personnel losses during the conflict. It also reflects the increasing importance of small drones to the fight in Ukraine as well as to the future fight more broadly (as discussed in more detail in the New Weapons section below). According to <i>Defense One</i>, Russian forces have lost at least 600 small, tactical drones in the conflict. As Samuel Bendett, an expert on Russia’s military and a Senior Fellow with the Center for New American Security, noted “both sides are now using large numbers of DJI and similar [small] drones and they are now starting to lose their drone operators to adversary counterstrike, adding to the importance of creating a pipeline of trained individuals capable of working in combat.”</p>
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2.3	<p>A record—and a UAS—come crashing down</p> <p>US Army testing of Airbus’ Zephyr drone ended abruptly when the solar-powered aircraft crashed after flying for a record 64 straight days. (source)</p> <p><i>Assessment:</i> Aviation website Simply Flying reports that the aircraft crashed on August 19 after losing contact with its ground control station. The US Army Futures Command has paused further testing and demonstration until 2023 pending a review of all the flight data related to the “incident” as well as the over 1,500 hours of data collected on the Zephyr’s flight performance from its launch on June 15 until the end of testing on August 19. The 64-day flight shattered the previous UAS endurance record of just less than 26 days. The Zephyr has a wingspan of just over 82 feet but also weighs less than 166 pounds and is designed to fly in the earth’s stratosphere between 60,000-70,000 feet using solar panels on the wings to power its flight and mission systems. High-flying exceptionally long-endurance pseudo-satellite UAS are increasingly valuable for militaries seeking to build redundancy in communications networks and to establish persistent intelligence, surveillance, and reconnaissance (ISR). They are also valuable to commercial communications providers. For example, a joint venture between Japan’s SoftBank and the US drone maker AeroVironment known as HAPSMobile will deploy a network of High-Altitude Platform Stations (HAPS) flying in the earth’s stratosphere to provide wireless telecommunications coverage to “areas that lack even basic wireless communications and provide the additional bandwidth needed to support the emerging 5G standard and the Internet of Things.” HAPSMobile first tested the SunGlider UAS in 2019.</p>
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2.4 Taiwanese “flying mortar” drones sent to Ukraine via Poland

800 Revolver 860 vertical take-off and landing (VTOL) combat drones made in Taiwan have been “donated” to Ukraine’s military. The system’s innovative design allows it to carry and launch up to eight 60 mm mortar rounds consecutively. ([source](#) and [original source in Polish](#))

Assessment: Polish media outlet WP Tech reported on 18 August that 800 of the drones known as a “flying mortar” were donated to Ukraine via intermediaries in Poland. Representatives of the system’s manufacturer DronesVision stated that the “complex and changeable international situation” means that it could only confirm it ships to customers in Poland, though the company did acknowledge that some of its products “should have already participated in battles” in Ukraine. The Revolver 860 weighs 42 kg and is 1.35 m in diameter. When fully loaded with 60 mm mortars it has a range of 20 km and an endurance of 25 to 40 minutes. It has a unique design allows its 8-position drum to rotate and release each mortar shell one at a time. [A video posted on DronesVision’s website](#) shows a Revolver 860 sequentially release eight disarmed mortars in 16 seconds.

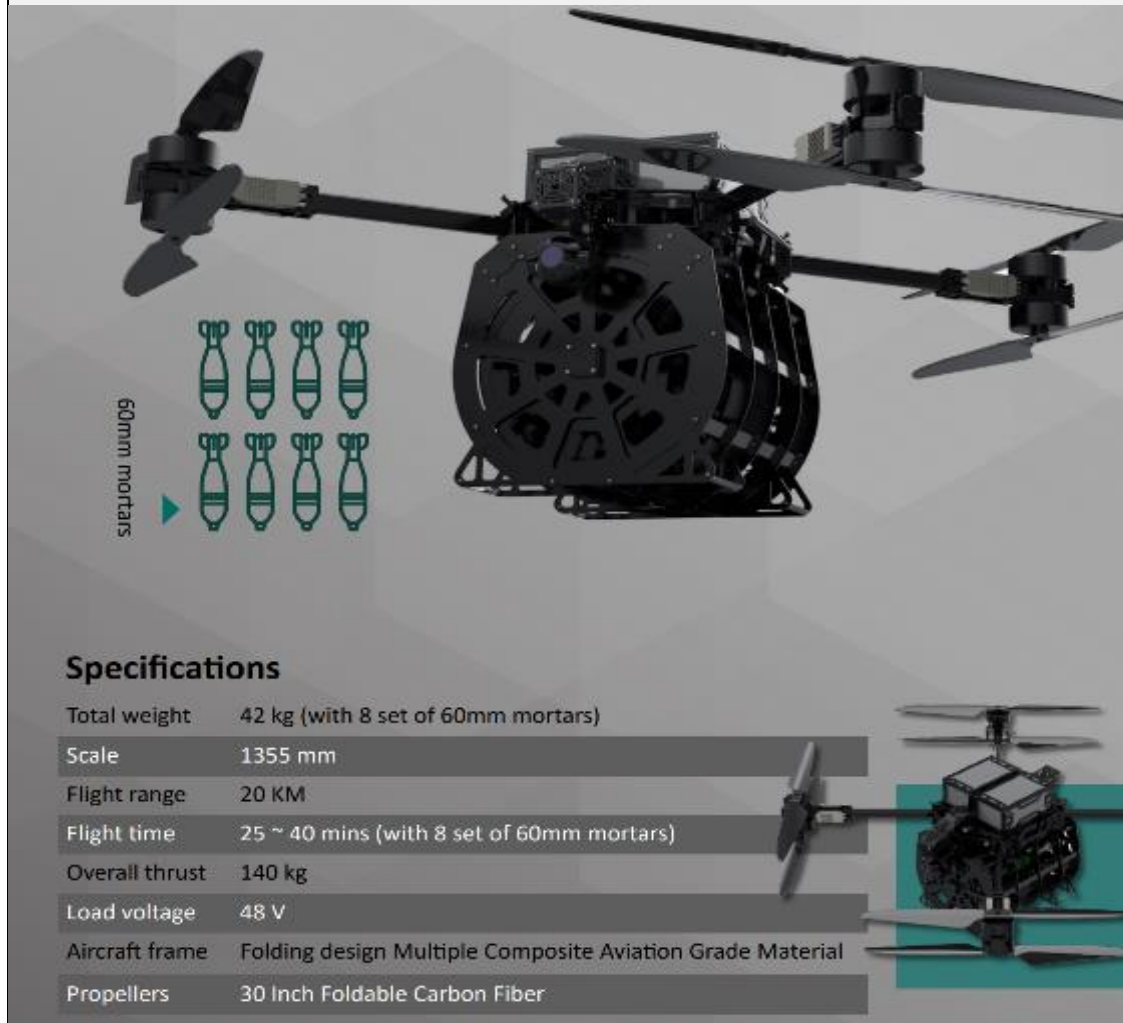


Figure 2: An image and specifications of the DronesVision Revolver 860 VTOL drone.
 Source: [DronesVision website](#)

3. Connectivity

<p>3.1</p>	<p>Classified information leaked as part of video game arguments</p> <p>Reporting during the period revealed that classified material on British, French, and Chinese tanks were posted on forums for a tank fighting video game as part of player efforts to win on-line arguments and convince developers to make the game more realistic. (source and source)</p> <p><u>Assessment:</u> The merging of the virtual / digital and real worlds is an increasingly noticeable component of modern military and national security dynamics (see the April DEFTECH Scan that discussed Ukraine’s “doxing” of Russian spies and soldiers). Reporting from the summer, demonstrated another example of these intersections. In late May, a player of the on-line free-to-play military vehicle combat video game “War Thunder” posted an image of a Chinese DTC10-125 tungsten penetrator sitting on a technical document describing the specifications of the projectile, presumably as part of an effort to convince gamers to add more fidelity to game design. However, the posted information is classified and was quickly removed. According to <i>UK Defence Journal</i>, the specification document provides information about “the armour penetration figures against both composite and RHA armour, muzzle velocity at ambient temperature, and dispersion.” This is the third time in 2021 and 2022 that classified material about a tank featured in the video game has leaked online. Previously, players claiming to be part of British and French tank units posted the user manuals for the British Challenger 2 and French Leclerc S2 respectively to inform designers and win an on-line argument about tank performance. Tank experts are sceptical that the training manuals contain sensitive information, noting that the manuals are distributed widely and that both tanks have been exported to other nations. Still, the potential for more serious breaches does exist as enthusiastic gamers seek to win arguments in the digital universe. As Sonny Butterworth, land platform senior analyst with defence intelligence company Janes noted, “if publications keep getting leaked, something that looks innocuous could be quite important to someone who knows what to look for.”</p>
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3.2

The electronic warfare (EW) contest in Ukraine is crucial to Ukraine’s ability to target Russian forces in a timely manner

The Royal United Services Institute (RUSI) released a report entitled “Ukraine at War: Paving the Road from Survival to Victory” that includes insightful commentary on the contest unfolding in the electromagnetic spectrum between Russian and Ukrainian forces. ([source](#))

Assessment: The report begins with analysis of Russia’s artillery use before providing an assessment of the critical battle in the electromagnetic spectrum. According to the authors, “if Ukraine is to defeat Russian fires through a combination of range and precision, its armed forces need a kill chain that can identify and communicate the location of Russian targets.” However, this kill chain is “hindered by Russian EW complexes which are integral to Russian concepts of operation.” The report points out that the lack of Russian EW success at the outset of the conflict is “not indicative of Russian EW capabilities.” Russia’s EW effectiveness has improved since the start of the conflict, though the authors do find that “the Russians have had very limited success in denying Ukrainian communications.” Where Russia has had more success, though, is in “disrupting, limiting the accuracy of positioning, and slowing down vital kill chains and imposing significant limitations on Ukrainian reconnaissance in depth” As a result, “a means of countering Russian EW is thus necessary to enable Ukraine to conduct timely and accurate reconnaissance”, including a radar-homing seeker payload for explosive-laden UAVs.

4. Energy

4.1

US Army seeks different batteries for electrification

The Army's push toward electrifying its tactical vehicle fleet is driving research into new battery types to help optimize the advantages of hybrid and electrified tactical vehicles

Assessment: The [US Army's 2022 Climate Strategy](#) laid out an objective to have begun transitioning to hybrid electric tactical vehicles by 2035 and to begin integrating fully electric tactical vehicles by 2050. But developing batteries is critical to recognizing the benefits of tactical vehicle electrification, such as increased range, silent watch capability, improved handling, and the ability to use vehicles to charge other equipment. The Army's Ground Vehicle System Center (GVSC) is now working on a higher voltage battery known as the Modular High Voltage Battery with a range of 50 to 600 volts. Laurence Toomey, branch chief for the energy storage team at the GVSC, stressed the importance of the modular approach for vehicles that are in most cases still being conceptualized: "rather than focusing on a specific battery for, say, a specific platform, because we don't have any platforms quite yet, we're focusing on developing a common module that can be scaled." The need for the modular battery to meet military survivability requirements, including nuclear hardening, shock and vibration, and extreme operational conditions, will drive the cost of this system up, however. The cost concern has led the Army to partner with the US Navy and commercial industry on the JumpStart for Advanced Battery Standardization effort designed to leverage existing commercial electrical vehicle technologies to accelerate electrification of the Army's tactical fleet.



Figure 3: The US Army is not the only military organisation seeking to develop electric tactical vehicles. In August, the Australian Ministry of Defence revealed an electrical Protected Military Vehicle (e-PMV), also referred to as the electric Bushmaster, during the Chief of Army Symposium. The vehicle "[brings the benefits of electric vehicles to the battlefield, being quieter than its combustion counterparts, and I look forward to seeing it perform in fields trials](#)", according to Australian Defence Assistant Minister Matt Thistlethwaite. Source: Australian Department of Defense

4.2 Boom Supersonic forms partnership with Northrop Grumman, releases new design, secures important commercial sale

Commercial aviation company Boom Supersonic announced a partnership with defence contractor Northrop Grumman to apply its supersonic flight technology to military missions at Farnborough Air Show where it also released a new design for its Overture supersonic aircraft. In August, American Airlines confirmed an order of 20 Overture aircraft. ([source](#) and [source](#))

Assessment: Boom and Northrop Grumman will work together to develop a new supersonic aircraft based on its Overture supersonic aircraft to carry out special military missions such as rapid reaction, disaster relief, and, potentially, VIP transportation. The Overture commercial aircraft is still in the design phase but is designed to fly at supersonic speeds with the potential to reach Mach 1.7 (1,304 mph). Boom Supersonic founder and CEO Blake Scholl stressed the importance of speed on the battlefield of the future, noting during the show that “time is a strategic advantage in high-consequence scenarios.” Also at Farnborough, Boom revealed a new design for Overture to make it simpler and easier to maintain. The new design features a gull wing design with four engines sitting behind the passenger compartment. The previous design had only three engines.

The company has gained considerable momentum over the last year, securing an order for 15 Overture aircraft from United Airlines in 2021 and, more recently in August 2022, receiving a commitment from American Airlines for 20 Overture aircraft. The company expects Overture to take its first flight in 2026 and to enter commercial service in 2029, though [some observers](#) have expressed concerns about this ambitious timeline.



Figure 4: Boom Supersonic's new Overture design. Source: [Boom Supersonic website](#)

5. Human capacity enhancement

5.1	<p>“Owning the heat”: US Department of Defense (DoD) seeks advantage in adapting to extreme environments</p> <p>The DoD’s Deputy Assistant Secretary for Environment and Energy Resilience made comments on 19 August that emphasized the importance of developing both concepts and equipment that will facilitate operations in environments likely to be several degrees hotter than those experienced today. (source)</p> <p><i>Assessment:</i> Richard Kidd compared the need for new equipment to help military personnel to operate in extreme heat to the need in the past to develop new equipment to better operate at night. According to Kidd, “if you go back 30, 40 years, we were concerned that we couldn’t operate at night and there was a significant investment in night vision. Now the United States military can operate day and night, all our assets . . . looking forward to a hotter world . . . we need to be able to own the heat the same way we own the night.” Climate change is already affecting the US military readiness as soldiers and national guardsmen spend more time fighting extreme weather and coping with extreme heat. Kidd noted that the DoD has already begun exploring capabilities such as “tactical cooling” and increased investment in shelters and “places of cooling respite” to manage the increased risk of extreme heat and high humidity, which will pose “a significant risk to [personnel] welfare.”</p>
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5.2	<p>US Army seeking more soldier-connected technology</p> <p>The US Army has established a new process to engage small technology business that can integrate a range of modern technologies to “optimize the ground soldier’s ability to shoot, move, and communicate.” (source)</p> <p><i>Assessment:</i> The effort is known as the Ground Soldier Technology Workflow, Integration, and eXperience (GS-TWIX). It seeks to find small business that can integrate the range of innovative technologies and capabilities the Army has been attempting to bring online in recent years to connect data to troops through improved sensors and networking capabilities. One of the main requirements for the GS-TWIX effort is to be able to integrate the Integrated Visual Augmentation System (IVAS). IVAS has featured in previous DEFTECH scans both for its innovative vision and promise as well as, more recently, for technical challenges integrating the Microsoft HoloLens augmented reality headset and the launching of a DoD audit of the program. GS-TWIX contractors must also supply a technical report on Chemical Biological Radiological and Nuclear (CBRN) Defense integration as part of the process as part of a broader effort to improve the resilience of integrated systems if exposed to CBRN threats.</p>
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6. Sensors

<p>6.1</p>	<p>French Ministry of Defence advances development of counter-IED sensor</p> <p>A report from the French Defence Innovation Agency (AID) reveals the organization is developing a counter-IED sensor that merges three detection methods. (source)</p> <p><i>Assessment:</i> Army Recognition reported in August 2022 that the French AID is evaluating systems as part of a multi-sensor detection of improvised explosive devices program managed by Thales and the Franco-German Research Institute of St. Louis (ISL). The concept involves installing sensors to detect electronic circuits and electrical wires present in an improvised explosive device as well as changes in infrared signature of suspected objects. The three technologies were integrated on a VAB armoured vehicle in 2021 in anticipation of a test campaign in 2022. According to the AID’s latest activity report, “Eventually, these technologies could be integrated into the future operating system.” Previously, ISL developed an on-board change detection system that could detect “almost invisible modifications” that have appeared on a previously travelled route. IEDs featured prominently in the Afghanistan conflict, and French forces have also been targeted with IEDs in Mali. Laurent Lagneau, of the French language defence and security news website opex360, has observed that “no matter how strong the armour, the quantities of explosives that were used in Mali [...] is such that, in any case, even the best-armoured vehicle cannot protect the soldiers who are there”, clearly establishing the need for increased detection for future conflicts.</p>
<p>6.2</p>	<p>UK blocks sensor deal with Chinese company</p> <p>The UK government blocked a deal to transfer sensitive vision-sensing technology to a Chinese company on national security grounds, providing another example of the deepening intersections between commercial industry and technologies and national security and defence activities and capabilities (source)</p> <p><i>Assessment:</i> The agreement was made between the UK’s University of Manchester and Beijing Infinite Vision Technology Company. According to its website, the Chinese company provides renderings, animation, and virtual reality to visualize architectural and construction projects. The company had sought to acquire a license for the Scamp-5 and Scamp-7 vision sensors, which perform computations and deliver “high-speed and low-power consumption” that enables “new embedded-vision applications in areas such as robotics, VR, automotive, toys, [and] surveillance”, according to the BBC. UK Business Secretary Kwasi Kwarteng intervened in the deal because the sensors “could be used to build defence or technological capabilities which may present national security risk to the United Kingdom.” China’s prominent military-civil fusion strategy provides guidance on and mechanisms for the transfer of commercially acquired technologies to the military and security apparatus, raising concerns about transfer of sensitive technologies to Chinese companies. Indeed, the UK decision was made roughly two weeks after MI5 Director Ken McCallum and US FBI Director Chris Wray made a joint appearance in July in London to inform governments, companies, and individuals of their agency’s shared perception of the scale of China’s multi-faceted technology acquisition and theft efforts.</p>

7. Computing Power

<p>7.1</p>	<p>Chinese supercomputer achieves breakthrough in AI</p> <p>During a virtual meeting of Principles and Practice of Parallel Programming 2022 conference, Chinese scientists claim to have run an AI program using the Sunway supercomputer that is as complicated as the human brain. (source)</p> <p><u>Assessment:</u> The Chinese scientists claim that the Sunway supercomputer ran an AI model known as “BaGuaLu” or “Alchemist’s Pot” with 174 trillion parameters, rivalling the number of synapsis in the human brain. The Sunway is the fourth most powerful supercomputer in the world, though it had previously been the most powerful from 2016 – 2018. The successful test, however, could move the Next Generation Sunway up the list again as reporting on the test indicates that the result places the Chinese computer “on the level with Frontier,” the US Department of Energy’s supercomputer considered the most powerful in the world. China’s supercomputing development, especially since 2016, has been notable, especially considering constraints on trade of sensitive technologies that have restricted the export of sensitive technologies to China. Supercomputers are used for rapidly processing data and for running models of complex systems. Their applications are broad with relevance for national security and defence in areas such as defeating encryption, developing autonomous systems, system design and engineering, weapons testing, and running complex wargames and simulations, among many others.</p>
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8. New Weapons

8.1	<p>Data and connectivity at the heart of the future effectiveness of squad weapons</p> <p>The US Army has selected Armaments Research Company to support the Next Generation Squad Weapons program by providing real-time data on the health and readiness of the system’s rifles. (source and source)</p> <p><i>Assessment:</i> The Next Generation Squad Weapons program will replace the standard-issue M4 variants in the US close combat force. New Sig Sauer rifles are expected to bring ergonomic improvements as well as signature-suppressing capabilities, data power transfer, and new rail designs. The program also includes a data-centric approach to weapons readiness and maintenance. Armaments Research Company’s platform will use an internet of things system to monitor individual weapons at scale. A company press release said that “the resulting insights will enable units to regularly assess weapons’ health, reduce failure rates, extend the lifetime of a weapon and optimize maintenance plans, enhancing performance and reducing cost.” Company CEO Michael Canty reinforced the value of data to the efficiency and effectiveness of the Army’s program, “with tens of thousands of new weapons as data sources in the field, we can optimize equipment safety and reliability, ultimately harnessing this data to save lives.”</p>
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8.2	<p>French government orders directed energy weapon to help protect 2024 Olympics</p> <p>The French government announced in June that it ordered one prototype of an anti-drone directed energy weapon system known as HELMA-P as part of an effort to strengthen security in advance of the 2024 (source and source).</p> <p><i>Assessment:</i> French company Cilas makes the High Energy Laser for Multiple Application – Power (HELMA-Pi) system, which is designed to neutralize small uncrewed systems up to one kilometre away in a matter of seconds. Cilas has claimed that the system has destroyed drones moving at more than 50 km per hour and under difficult tracking conditions. Operators can also use the system to neutralize improvised explosive devices. In a statement, the French MoD stressed the system’s ability to provide “a calibrated response to the drone threat, from dazzling the drone’s observation instruments to the neutralization of a mini or micro-drone by altering its structure, causing it to fall in a few seconds.” A ministry spokesperson also told Reuters that the system will be fully operational in time for the 2024 Summer Olympics, observing that the French Armed Forces “need to adapt to changing threats and the increasing ability of drones to escape jamming devices or conventional missile shields.”</p>
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8.3	<p>Proliferation and the small drone threat to security and defence operations</p> <p>France’s acquisition of HELMA-P is indicative of the growing concern in defence and security communities about the proliferation of small drones to hostile state and non-state actors. Two analyses published during the period highlighted the nature of the small drone threat to NATO and UK forces and the continued challenges associated with defending against this threat (source and source)</p> <p><i>Assessment:</i> Analysts from the Centre for War Studies at the London School of Economics and the Centre for Security Studies at ETH Zurich released a report during the period entitled “The Vulnerabilities of the Drone Age: Established Threats and Emerging Issues out to 2035.” The report provides valuable insights into the small drone challenge gathered over three NATO Science for Peace and Security funded workshops that analysed the global proliferation of drones to hostile state and non-state actors. The report’s analysis is segmented into three main sections:</p> <ul style="list-style-type: none"> • Drone Attack, which documents the nature of the evolving threats • Drone Defence, which stresses the challenges of counter-drone efforts • Future Threats and Opportunities out to 2035, which examines how drone swarms, autonomy, and artificial intelligence will shape the future threat. <p>Among the nine key findings was a warning about the increased use of drones in assassination attempts of NATO political and military leaders as well as the threat posed by unarmed small drones that can provide hostile actors with intelligence and surveillance these actors can use in other attacks. The report also insightfully argues that defending against drones consists of interdicting systems before they cause harm, but “drone countermeasures should always focus on capturing the human operator and weakening the industrial base, not just stopping the drone.” This assessment was echoed by commentary from RUSI analyst Samuel Cranny Evans entitled “As Small Drones Shape How We Fight, is the British Army Ready to Face Them.” The commentary argues that “as far as defeating them is concerned, it is better to destroy a UAV and its crew on the ground than to wait for it to be airborne.”</p>
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<p>8.4</p>	<p>“Big Spine” configuration of China’s workhorse J-10 fighter spotted, drawing speculation about new capabilities</p> <p>Photos of a new configuration of China’s medium-weight J-10 fighter jet with an enlarged fairing running along the length of the aircraft’s spine emerged online in July. The design adjustment could signal enhanced room for fuel or additional mission systems. (source)</p> <p><i>Assessment:</i> The new configuration could be a new variant—referred to online as J-10D. The US F-16 aircraft, to which the J-10 is frequently compared, has a similar big spine variant export known as the F-16D. The increased room on the top of the plane could house multiple potential mission systems. Most speculation has centred on it being the location for expanded countermeasure and electronic systems, though it could also house communications and passive sensors and the cooling systems needed to support these systems, according to <i>The Drive</i>. Another alternative is that the spine could be part of efforts to increase the J-10s human-machine teaming, allowing it to fly in conjunction with loyal wingman drones. It could also be a location for additional fuel, which would be especially important in the two-seater variants, which have less space for fuel storage. However, most commentaries surveyed for this report believe the new dimensions will house more sophisticated technical equipment. The US has exported the similarly designed F-16D to several countries including Pakistan, which also imports the Chinese J-10C, raising the potential that the modifications were either requested by Pakistan or that it could be exported to China’s export partners.</p>
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Figure 5: A leaked photo of the big spine configuration of the J-10. Source: Twitter via @Fighterman_FFRC

9. Manufacturing

9.1	<p>3D Printing on naval vessels</p> <p>The United States' <i>Wasp</i>-class amphibious assault ship <i>U.S.S. Essex</i> became the first ship in the US Navy to 3D printed parts while at sea during the Rim of Pacific Exercise (RIMPAC), the world's largest international maritime military exercise. (source)</p> <p><u>Assessment:</u> The test at sea was an important step forward, according to Lt. Commander Nicolas Batista, the <i>Essex</i>'s Aircraft Intermediate Maintenance Department officer. Lt. Commander Batista also commented that "the capabilities of the 3D printer will enable <i>Essex</i> to become more self-sufficient. . . . [3D printing has become a priority] and it is evident that [it] will provide a greater posture in warfighting efforts across the fleet and will enhance expeditionary maintenance." Printing under conditions at sea can lead to parts that lack precision and accuracy. Perhaps the most interesting component of the test, though, was not the technology. Rather, it was the revelation that now that the capability has been effectively tested, the first group of sailors aboard the <i>Essex</i> will now be trained to use additive manufacturing / 3D printing in support of military supply chains, further reflecting the traction 3D printing has found within the US Navy and US. military. Indeed, reporting on the test indicated that the DoD is building personnel roles such as "Additive Manufacturing Technician", offering a viable career path in the military for those trained on 3D printers.</p>
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