The Big Read   Aerospace & Defence

The age of drone warfare is disrupting the defence industry

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Rapidly evolving technology designed by smaller players is challenging the dominance of sluggish industry giants

Sylvia Pfeifer and **John Paul Rathbone** in London and **Christopher Miller** in Kyiv 13 HOURS AGO

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In a secret brick workshop on the outskirts of a frontline town in eastern Ukraine, soldiers Bohdan and Vlad are hard at work making killer drones. The small factory has a 3D printer to make the components needed to turn technology designed for fun or aerial photography into a deadly weapon.

The use of unmanned aerial vehicles (UAVs) in Russia's war in Ukraine has escalated rapidly in the past two years. Bohdan, who asked to be identified by first name only, recalls demonstrating the inaugural FPV (first-person view) suicide drone attack to a foreign television crew in June 2022, four months after the Russian invasion. He strapped on goggles to view the video feed from the vehicle, then piloted it over the front line. In a sequence now familiar from hundreds of similar videos since posted online, the final frames are of the surprised faces of Russian troops as the drone closes in.
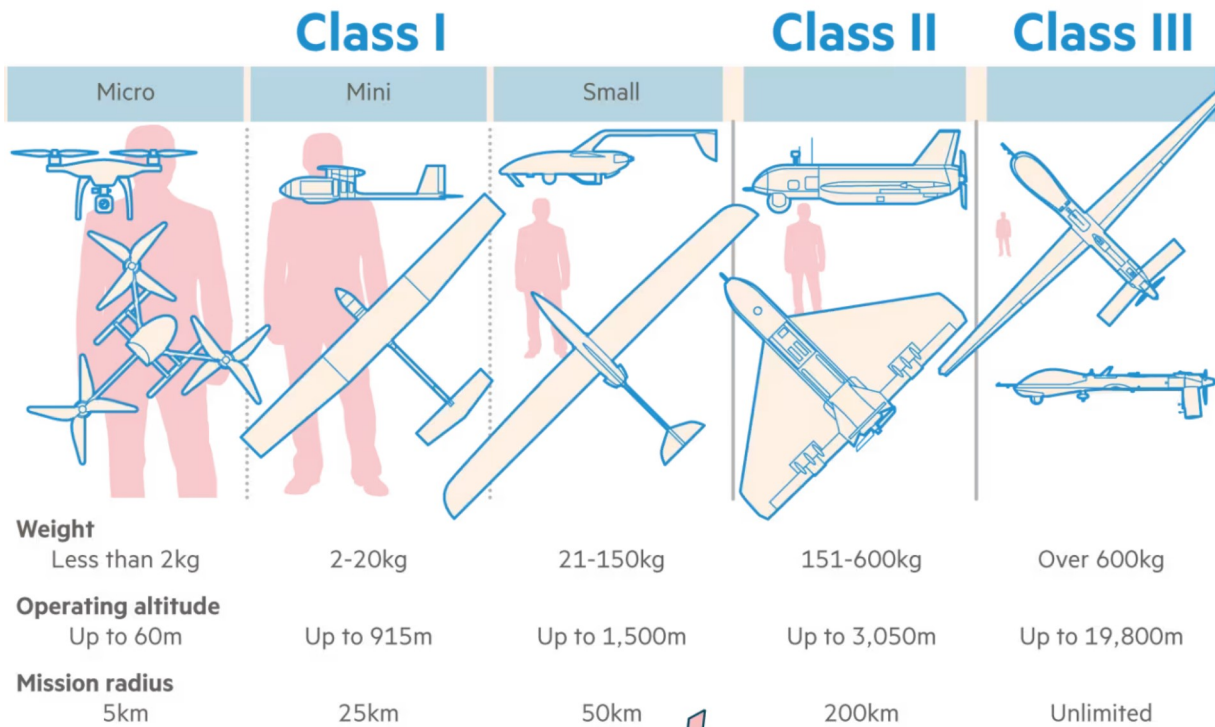
Today their workshop is just one cog in what has become one of Ukraine's most important industries. The invasion has taken drone warfare to new heights of intensity and frequency. Crucially, the cheap yet effective FPV attack drones have helped plug some of the artillery shell shortages that have plagued the Ukrainian army over the past year. The country says it has gone from having just six drone makers before the invasion to more than 200, capable of churning out a million drones a year.

"In Kyiv, everyone you need to see — from an antenna maker, to a software programmer or [a defence] official — works within 20 minutes of everyone else," says Lorenz Meier, whose US-based company Auterion is developing software to power swarms of autonomous Ukrainian-made drones that can communicate with each other. "The cycle times on developing and deploying new technologies are very, very low."

This rapid proliferation of a potent new battlefield technology is shaking up the established hierarchy of the world's defence industry, where large contractors have

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Classes of unmanned aircraft

	Class I			Class II	Class III
	Micro	Mini	Small		
Weight	Less than 2kg	2-20kg	21-150kg	151-600kg	Over 600kg
Operating altitude	Up to 60m	Up to 915m	Up to 1,500m	Up to 3,050m	Up to 19,800m
Mission radius	5km	25km	50km	200km	Unlimited

Some current operational examples

UK company Malloy Aeronautics supplies transport drones to UK forces

The Bayraktar TB2 is a heavier and longer-ranged Turkish combat drone operated by Ukraine since 2019

Switchblade is a small loitering munition built by the US and in service with Ukraine

Ukraine uses cheap but very effective first-person view (FPV) attack drones against Russian troops and vehicles

Altius 600 is another US-built and Ukraine-operated loitering munition

Sources: UK Ministry of Defence; companies; FT research
© FT

Traditional weapons programmes take years, sometimes decades, to develop and rely on substantial government budgets as well as large research and testing facilities. By contrast, drones are cheap, lethal and quick to make, helping to level the field between smaller players and established industry giants.

Ukraine shows that "time to market and a more agile development are important", says Micael Johansson, chief executive of Sweden's defence champion Saab. "Instead of developing a perfect product that may take many years, building products fast that can be tested, modified and tested again is important. Speed is crucial."

It is not just the industry that needs to change. Government defence departments will have to transform how they buy weapons to keep up with the much faster development cycles of increasingly software-defined weapons and autonomous systems driven by artificial intelligence. For a start, officials will have to look outside their usual pool of suppliers to involve smaller companies, many of which come from a technology background.

The lesson is already being learnt. "If Ukraine has taught us anything, it is that . . . we need to go faster," General Sir James Hockenhull, head of Britain's Strategic Command, told a London audience of military officials and industry executives this year.

For governments, the final result could be the holy grail of defence planners: a genuine revolution in military affairs.

Although drone warfare has come of age in Ukraine, the use of UAVs during conflict is not new. The first rudimentary types, such as the Kettering Aerial Torpedo "Bug", were developed by the US and the UK during the first world war, although none were used in combat.

Reconnaissance drones were first deployed by the US at scale during the Vietnam war, after which other countries began to invest more heavily into unmanned aerial technology. But it was the advent of cheap, often Chinese-made drones, combined with rapidly adaptable and increasingly AI-powered software, that showed how UAVs could change the character of war. This became clear during the 2020 Nagorno-Karabakh conflict, when Azerbaijani forces used drones to devastating effect against Armenian tanks and logistic bases behind the front lines.

Ukrainian soldiers Vlad and Bohdan in their drone-making workshop in the Donetsk region © Christopher Miller/FT

Technicians assemble first-person view attack drones. Such weapons have helped relieve some of the artillery shell shortages that have plagued Ukraine over the past year © Thomas Peter/Reuters

Since then, their use has only accelerated. Ukraine now fields large fleets of drones that can home in on Russian targets using autonomous navigation and AI software that is more resistant to electronic jamming by the enemy.

But just as drones have radically changed the battlefield, their increasing ubiquity is also changing the defence industry as newer players are emerging as challengers to established companies such as Lockheed Martin, Raytheon and BAE Systems, the so-
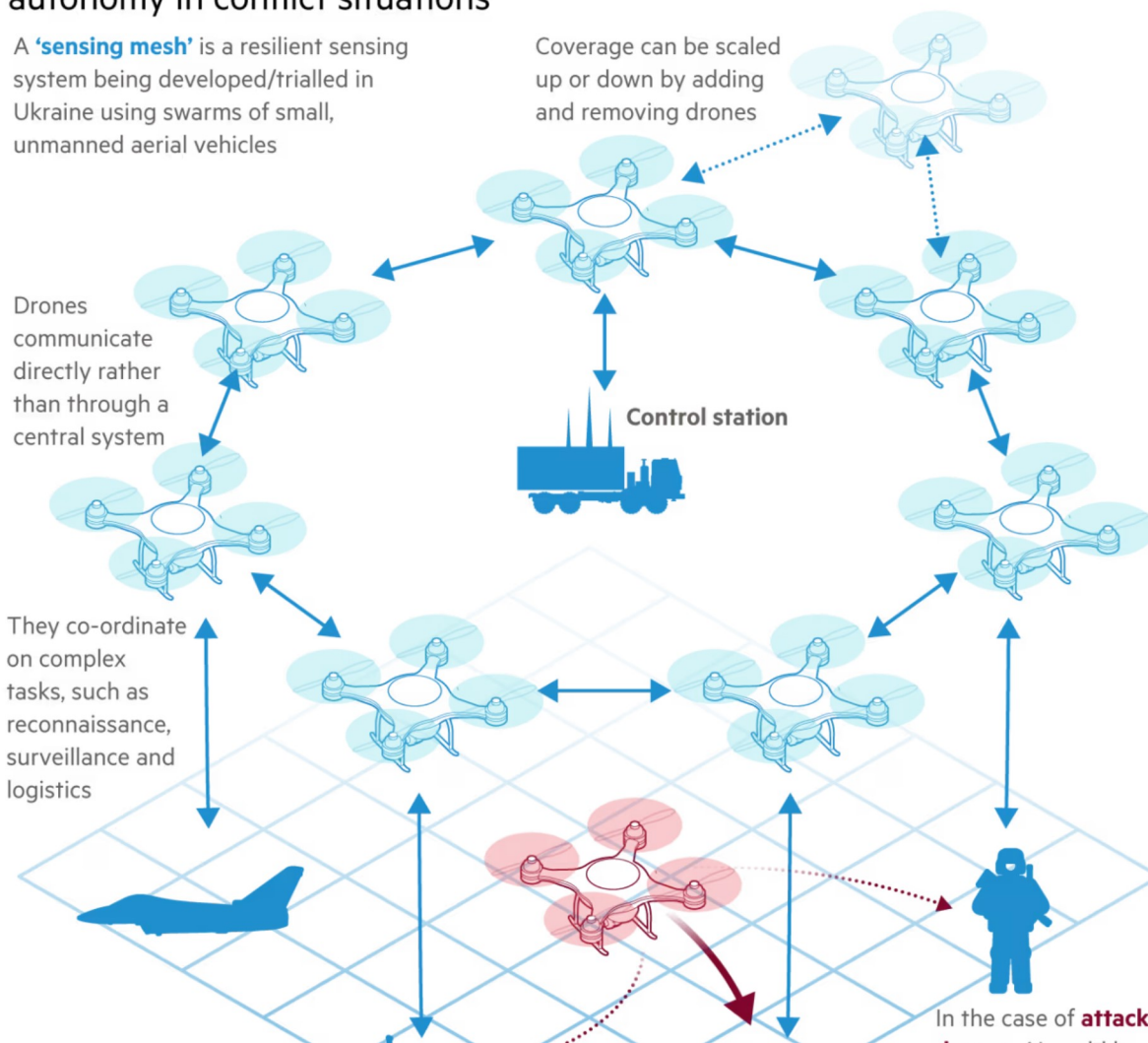
called primes that have dominated the sector for decades.

"The irony is the large primes have been dabbling in this market, [but] they have had fits and starts," says Byron Callan, managing director of research group Capital Alpha Partners. Lockheed, for example, developed the MQM-105 Aquila in the late 1970s to serve as the US Army's first battlefield remotely piloted vehicle, but the programme was ultimately cancelled.

Among the upstarts are AeroVironment, a small US defence contractor that gained prominence after its Switchblade "kamikaze" drone became an early symbol of Ukraine's resistance. Founded in 1971 in California, AeroVironment is now headquartered near the Pentagon in Arlington, Virginia, and has secured multiple government contracts. Church Hutton, the company's senior vice-president of government affairs, says it is seeing "interest on the part of the [US] government seeking to accelerate their procurements in some ways to match the speed of industrial innovation".

How drones could use autonomy in conflict situations

A 'sensing mesh' is a resilient sensing system being developed/trialled in Ukraine using swarms of small, unmanned aerial vehicles

Coverage can be scaled up or down by adding and removing drones

Drones communicate directly rather than through a central system

Control station

They co-ordinate on complex tasks, such as reconnaissance, surveillance and logistics

In the case of **attack**

drones, AI could be used for autonomous navigation and target selection

© FT

Technology start-ups that have already made inroads into the industry include US data analytics group Palantir Technologies, which has a market cap of $58bn, Rebellion Defense of the US, and Europe's AI defence specialist Helsing, which is in the process of another fundraising round that could value it at $4.5bn.

Anduril Industries, founded by Californian entrepreneur Palmer Luckey, is one of the biggest beneficiaries from rising demand from militaries for new technology. Hundreds of its Altius-600M attack drones have been bought by the Pentagon and sent to Ukraine's front line. Along with General Atomics, it was selected by the US Air Force to build and test drone prototypes for the next phase of the service's flagship collaborative combat aircraft programme, which seeks to build a fleet of unmanned aerial vehicles.

Anduril is already a significant player in its own right but the decision was seen as a pivotal breakthrough after the company triumphed over incumbents such as Boeing and Lockheed Martin. "Winning a major programme like that [was] a big moment," says Luckey. "We invested hundreds of thousands of dollars of our own money before the governments gave us anything."

Traditional players, jostled by the increased competition and all too aware of the industrial challenges, are responding — often by teaming up with the newcomers or taking over their smaller rivals.

There are "various ways of establishing collaborations, partnerships, doing direct or indirect investments, to complement internal technology development," says Johansson of Saab, which last year took a 5 per cent stake in Helsing. "Defence primes also have a role in supporting the start-ups to integrate their solutions into the peacetime procurement processes."

Gundbert Scherf, co-founder and co-chief executive of Helsing, describes the relationship with the primes as a mix of collaboration and competition.

The company, which specialises in AI-based software solutions for defence, has partnered with Saab and Airbus. In June last year, the German government selected Helsing and Saab to provide the new AI-enabled electronic warfare capabilities for an update of the Eurofighter jet. Airbus says it will also work with the company on AI for

update of the Eurofighter jet. Airbus says it will also work with the company on AI for its future Wingman system, where drones will operate with manned fighter jets.

BAE Systems' Malloy Aeronautics has designed a range of unmanned, electric heavy-lift quadcopter drones for logistics missions

James Cartlidge, then a defence minister, visits Malloy Aeronautics' Maidenhead site in February © Petty Officer Joel Rouse/MOD

"Defence will always be a hardware and a software game, but I think increasingly it

"Defence will always be a hardware and a software game, but I think increasingly it will be hardware-enabled but software-defined," says Helsing's Scherf. "The software will absorb a lot of the capability and complexity."

In the UK, BAE Systems took over start-up Malloy Aeronautics in February after a two-year partnership. Neil Appleton, a BAE executive who was appointed CEO of Malloy, says the UK giant is mindful of not smothering the entrepreneurial mindset of Malloy, which has developed a range of unmanned, electric heavy-lift quadcopter drones for short to medium-range logistics missions.

The plan is to grow Malloy from an "SME to an ME or a larger company", he adds. "If we do need to go and access a big pot of money . . . then we can approach BAE. Whether it's managing gaps in customer order books . . . or [for] capital investment."

Oriol Badia, chief operating officer at Malloy, who joined the company in 2016, says there has been a "bit of a change" since the acquisition in terms of the company's relations with defence departments.

"We had good contacts with end users [on the ground] and then somebody higher up liked our product," says Badia. Now "we have the ability to speak directly to the customer" about things like strategy. "We were out of the loop before."

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Some western governments point to a wave of initiatives as evidence that they are responding to rapidly evolving technology.

Last August, the Pentagon set up the Replicator initiative, which aims to field thousands of drones across multiple domains within 18 to 24 months. AeroVironment was among those selected in the first tranche.

Within just five months, the Pentagon had achieved what "normally takes the Department of Defense two to three years", according to Kathleen Hicks, the deputy secretary of defence in charge of the initiative.
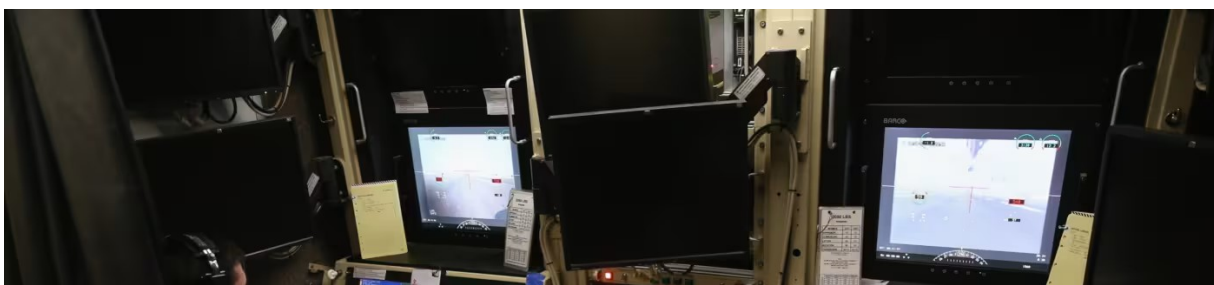
A US Air Force pilot and an operator prepare to launch an unmanned aerial vehicle from a secret base in the Gulf region © John Moore/Getty Images

An MQ-9 Reaper drone flies over a testing range in Nevada. The increasing ubiquity has shaken up the defence industry © Airman 1st Class William Rio Rosado/ABACA/Reuters

"If you're not sure what is more mind-blowing — how fast we did it or how long it normally takes — I don't blame you," Hicks said in a speech in January.

Although still well behind the US, European militaries are starting to catch up. The UK's Ministry of Defence has earmarked 5 per cent of its annual budget for research and development, equivalent to £2.7bn a year, with another 2 per cent of the budget to support promising military technologies and applied science.

A planned Defence Innovation Agency, loosely modelled on the US's Defense Innovation Unit, essentially a government-backed venture capital fund, will meanwhile help funnel that money to small and mid-sized companies to help promising technologies cross what venture capitalists call the "valley of death" and get adopted by core military programmes.

Nato, too, has started to change its procurement processes, forming an innovation accelerator, Diana, to foster collaboration with start-ups and other tech companies. It has also announced a Nato Innovation Fund focused on dual-use technologies.

"Our allies are looking at what is happening in Ukraine and they are looking to emulate some of that," says Andrea Traversone, the Nato scheme's managing partner, calling the conflict "a big driver for faster adoption".

However, for many defence newcomers who are seeing how fast war is changing in Ukraine, the initiatives are too little, too late.

"Why is the Nato fund only €1bn? Why not €10bn?" says Auterion's Meier, who fears that Russia and China, with their command and control economies, could pull ahead of the west when it comes to the modernisation of their militaries. "We are not doing enough."

One roadblock, some executives fear, is that new approaches will require a disruption to the present way of doing business, where large defence companies often had what competitors described as a cosy relationship with governments.

Real change would also mean abandoning the procurement model whereby military planners have tended to "gold-plate" requirements, leading to a process that was beset by cost overruns and lengthy delays.

"Sometimes we ended up paying twice or three times for a capability because we kept changing it," Britain's Hockenhull told reporters this year.

A drone is used as part of a reconnaissance exercise in Nanning, China © CFOTO/Sipa USA/Reuters

South Korean army drones are flown as part of a joint exercise with the US army in Pocheon, north-east of Seoul. Compared with traditional weapons, drones are cheap and quick to make © SeongJoon Cho/Bloomberg

Instead, under the UK government's new procurement model, the MoD aims to work more closely with industry to use "spiral development", through which new technologies will be deployed before they are fully ready and then adapted and modernised in the field.

"We have got to get much more comfortable with being iterative," Hockenhull said at the time. That "may also mean that we carry more risk in our force structure for a while, because we might not have everything that we thought we would".

Nevertheless, while recognising the need for speed, some officials say there is still a need for caution when it comes to doing business with tech companies. "We have to

watch out that we do not swap being dependent on the primes to being dependent on the tech companies," says one European official, alluding to the near monopoly status of many software giants.

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Other considerations also need to be taken into account, notably the "fundamental differences between peacetime and wartime procurement", says Saab's Johansson. "There are several important requirements regarding safety and security, storage life, procurement regulations et cetera, that become much less important in times of war. The defence industries must be able to support both these scenarios," he adds.

Most executives believe a successful defence industry will need to rely on both types of companies and both types of equipment, hardware and software.

Primes and start-ups serve different roles, argues Michael Schoellhorn, chief executive of Airbus Defence and Space. While start-ups develop "new technologies very fast", the industry still needs traditional contractors that bring "experience and resiliency".

Collaboration between the two sides is important, he adds, and cautions against "condemning everything that is old school".

Nevertheless, he concedes: "We must not be complacent — either we embrace disruption [and] speed or we lose our right to play."

Graphic illustration by [Ian Bott](#)