

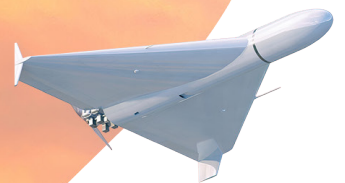


INTELLIGENCE SERIES



The Evolution of Unmanned Systems:

Use, Counters, Future Capabilities, and Market Dynamics



JANES

The evolution of unmanned systems: Use, counters, future capabilities, and market dynamics

- Drawing on operational examples from Ukraine, Europe, and the Middle East, this webinar explores the accelerating use of unmanned systems, the rapid evolution of counter-UAS capabilities, and what these developments mean for future operations and defence markets
- With unmanned technologies progressing at different rates across different domains, *Janes* experts, **Tom Barton**, **Amael Kotlarski**, **Georgios Salapasidis**, and **Ben Conklin**, breakdown the divergent maturity levels of unmanned platforms and the implications for military planning, procurement, and industrial strategy

Ben Conklin: We work everywhere across the unmanned system space: how it’s used, how we counter it, what are the future capabilities and market dynamics. We have brought together a team of experts who work in all those areas.

One of the things that we’re going to talk about is this overall trend of the rapidly evolving nature of the unmanned threats and it is an equally fast-paced race to counter those exact threats.

Speaking to many of you about this

challenge, we’ve recognised that it’s hard to keep pace with this volume of change and this pace may outstrip your team’s ability to confidently track capabilities, assess relevance, and act fast with decision-grade data.

What we’re going to do now is we’re going to really dive into these key trends. I’m going to start off with Amael Kotlarski to take us through some of the trends he’s seeing in unmanned equipment and help us understand how they’re being employed.

Amael Kotlarski: Sure thing. I’m going to take you through the three main trends that we’ve observed. The first one starts with us starting to see the realisation of the ‘unmanned mothership’ concept, which is a concept that’s been around for some time. As with lots of things we’re seeing around the unmanned space, a lot of that is materialising in Ukraine. Some of it is experimental still, some of it is conceptual, some of it is actually being used at different scales.

In the sea are some of the first concepts that have been realised and we’ve seen USVs being

employed or evolved into drone motherships. Ukraine has experimented with this concept for a number of years with the Sea Baby and Magura, using them as deployed strike FPVs [first-person views]. In some cases, they are radio frequency controlled, while in other cases they are tethered using fibre-optics, which is a more recent development in the FPV world.

The Russians are following suit. We’ve noticed a platform called the Skorlupa, which is a tethered USV controlled by fibre-optic cable, able to deploy and control a number of fibre-optic FPV strike drones from its flight deck that’s built upon it.

In the air we’re also seeing experimentations with motherships. For example, Ukraine’s Fire Point FP-1 has been observed recently carrying two FPV drones in an over-wing configuration.

We’ve seen the Russians experiment with their Geran 2 one-way attack UAVs [unmanned aerial vehicle] and there is lots of experimentation going on there, including carrying FPV strike drones on its back.

It is unclear whether this is a few enterprising Russians experimenting with a specific

configuration or if it’s going to become something of a norm. That remains to be seen in a very fast evolving world of unmanned aircraft.

The Russians have also experimented with some smaller one-way attack UAVs as motherships. For example, the Molniya-2 has been observed carrying two FPVs on the wing recently.

Then we have some things happening in the ground aspect. As always, the ground domain seems to lag a little bit behind the air and naval domains, which reflects how difficult UGVs [unmanned ground vehicles] and the UGV spaces is. It is a lot more difficult to implement reliable solutions in this area, especially in terms of autonomous land navigation, communications, and line of sight.

The ground poses a lot more challenges in that area, but we’ve seen, for example, a Russian concept known as Impulse-PVO, which is an Impulse-M UGV tracked UGV that has been built as essentially a sort of mobile counter-UAS system with one UGV carrying a direction finder, a radar, and electronic warfare jammer-type payload. Another example from Ukraine is a UGV carrying a number of Yolka small counter-UASs [unmanned aircraft systems]. This is a concept that is becoming prevalent in Ukraine and elsewhere, including recently in the Middle East, where Ukraine has been called upon to help certain nations out with the Iranian threat. Those are some of the sort of examples that we observed around Ukraine but there are other examples being thought about around the world.

One example is the Jiutian: a large Chinese fixed-wing unmanned air vehicle, somewhat similar in size to a Global Hawk, so a fairly large platform, which has been recently test flown, I believe, last year. That has been also demonstrated or at least conceptualised with a large sort of swarm-like payload bay where they were able to deploy a large number of small UAVs from its bay.

Elsewhere, Rheinmetall is working on the Luna NG, the Turks have the Aksungur, which is a carrier-type drone. Quantum systems is working on a system called the Sparta. A number of countries outside Ukraine are also looking at the conceptualisation of the drone mothership and are also developing or operating FPV mothership solutions developed from hexacopters (large, eight-bladed UAVs) because

Left: A screengrab showing *Janes* new product offering for unmanned and counter unmanned equipment and interconnected intelligence.

Janes: 2043598

The panel of Janes experts



Amael Kotlarski
Senior analyst and editor of Janes Weapons: Infantry



Georgios Salapasidis
Head of platforms and unmanned systems



Tom Barton
Head of news for Europe, the Middle East, and Africa



Ben Conklin
Head of new products and innovation

‘Epic Fury’.

We’ve seen a number of countries start to imitate that sort of form factor, size, and configuration from China, Pakistan, and even in Europe with MBDA on its one-way effector, which resembles very closely the Shahed with some changes to its form factor.

That kind of delta-wing system likely will remain one of the most popular types of class three one-way attack UAV for sure, but one that traces its roots back almost two decades now.

Finally, we’re starting to see an interesting trend being referred to as the ‘DIY cruise missile’, starting off with Ukraine’s Fire Point with the FP-5 Flamingo, which Ukraine has referred to as a large sort of UAV, although I think some observers would call it more of a traditional cruise missile.

It sort of blends the line, but the idea is that they’re able to build a large sort of one-way attack munition leveraging existing capabilities that they had to manufacture cheaply and effectively.

It’s not the most advanced thing in the world. It’s large, and the airframe is crude. It uses repurposed general-purpose bombs as its warhead, but it can be made cheaply, and it really leverages what Ukraine can do and what it can do quickly.

We’re starting to see in the West as well the idea percolating and being mimicked. For example, quite recently the French carmaker Renault partnered with another French defence company called Turgis & Gaillard to propose to the French DGA, the French government procurement agency, a project called Chorus with the idea of developing a sort of a 3,000 km range one-way attack munition equipped with a 500 kg warhead.

The idea specifically is to design this drone or pseudo cruise missile, from the ground up to fit directly into existing supply chains and manufacturing capabilities of Renault as the car maker.

So rather than this idea that’s been percolating since the war in Ukraine of considering how we get GM to start building PAC 3 Patriot missiles, probably the better idea is how do you get GM to design a munition that fits into its car assembly plant and leverage its expertise and its supply chains as best it can to do that.

It’s an experiment in France: the DGA will say it’ll buy several, but it’s more about a proof of concept of how industry can scale into the unmanned world and also the cheaper munition world, so certainly something to keep an eye on and with that, I’ll hand it over back to Ben, who hopefully will show you how

The procurement and industrial policy would require some domain-specific strategies to avoid the risk of misallocating resources

the new product really fits into that ability to track these sort of trends.

Ben Conklin: That’s really fascinating as we think about how this equipment is evolving and this fast-paced world is quite difficult to keep track of in terms of the evolution of the equipment that we took a look at a second ago, but of course we have an events team that does a really fantastic job of keeping on top of many of the events that were described here when this equipment is being used either in test situations or in real world activities.

You can see the key events that are coming in, understand the impact of them and what you’ll see here is this ability to quickly see the unmanned system pattern, basically identifying what kinds of systems are being employed and what their role is, along with getting into the detail of these events.

Every single event that *Janes* captures and enriches comes from our analysts research through open source reporting. Then, of course, they enrich it with all the *Janes* foundational intelligence, such as the actors and the equipment being used.

With this focus on unmanned systems, we want to really bring those together to represent and help you understand the patterns and help you understand the trends in these events, but also really quickly get important information and vital context around those events.

With that, we’re going to sort of take a little bit of the pivot. I’m going to ask Tom about how he sees the development of these counter-unmanned systems. How do we develop these effective counters to these new types of threats while dealing with all the complex problems of volume, low cost, and a potentially deadly platform.

Tom Barton: I’m on the other side of it from Arael in this massively rapidly evolving field of military equipment. It is astonishing and this new platform is our way to keep abreast of some of these astonishing developments.

A few cherry picked examples just to try and illustrate some of the the main categories in sort of counter-UAV systems as governments and militaries try to struggle with this idea of ‘how do we deal with these mass

attacks that we’ve seen in the Middle East and Ukraine without bankrupting ourselves’ and in a way that actually is effective and hopefully future proofed?

In May this year we saw APKWS, the advanced precision-kill weapon system with 70 mm rockets. Many of them were refitted with seekers. They were being supplied, it was announced, to Israel and the US allies in the Middle East.

In another example, in September 2025, we saw Poland with Russian UAVs in the airspace there. Many of them were brought down with very high-end very expensive air-to-air missiles, but what has rapidly dawned on most people now that this is not sustainable, not from a cost perspective and not from an inventory perspective because once you’ve shot those missiles that are USD20,000 Shaheds, they’re gone.

These laser-guided or basically guided APKWS systems are an example of a way air forces with pods on fighters that can hold a decent number of rounds that can then go up, take out a good block of maybe an incoming wave of one-way attack UAVs, return back, and perhaps with some of the speed of these systems be able to come back and have another go. That’s one of the things we’re seeing. Another is lasers. In May 2025 the Israeli MoD announced its first successful test operational intercepts using the Iron Beam system. There are plenty of others available, many of them in the test and trial phases.

Many people on this call will know about DragonFire. We’ve seen China’s Silent Hunter system as another example. There are many with potential and huge promise here, [with systems that are] very cheap per shot as many people have been discussing.

But there’s potentially some big hurdles with laser systems. For example, weather can still affect them a lot and the rate of fire because essentially you can shoot one laser beam at a time.

There is a dwell time on the target, which you have to wait until you can bring that system down and that varies per system and then essentially after a certain number of shots, there’s a cool-off period because the laser equipment can get too hot. So potentially a lot of promise, but also a lot of hurdles there.

In May this year the name Merops started to pop up more and more. We saw the US at the start of hostilities with Iran this year, buying thousands of those to try and help protect their forces in the Middle East.

Before that though, they had been supplied to Ukraine, and they’d been tested in places like Romania on NATO’s eastern flank. This is an interceptor UAV and we’ve seen more and more of those.

The Octopus is another example being produced, in a collaboration between the UK and Ukraine. A lot of them are essentially tail sitters, vertical take off and then it’s getting up to speed really fast to be able to bring down things like Shaheds. Obviously, they’re more complex and you want to try and keep the cost down.

So you want to try and keep the cost of your seekers down and you want to try and keep them light and mobile to try and get them with limited range to the place where you need them most. There are evolving concepts of operations around some of these counter UAVs, and interceptor drones, but it is looking like many countries are investing in these now as a potentially good way to try and and take on these systems.

In April this year we saw a Frankenberg Mark I, essentially Frankenberg itself is a company in the Baltics, and they are describing it as a counter-UAV missile.

We saw one of those fired from a UAV in a trial involving an Airbus and that was an interesting use of a counter-UAV system essentially in a sort of drone-on-drone or a sort of air-to-air kind of role. There are a number of examples of development efforts for quite cheap, sort of minimalistic missiles that are just good enough to be able to bring down UAVs.

You know, relatively simple but adequate seekers. They don’t need huge amounts of fuel in them and they can be dispersed and then connected together into counter-UAV systems. Very interesting ones to watch. There are questions around how accurate can you make them when you’re trying to minimise these cost considerations? Is range going to become a problem in time? There are a lot of interesting things in the development of those categories.

Finally, let’s not forget the gun systems. They are still very much out there. In April this year we saw Sweden buying the Trident Mark II system. Many people will know about Sky Ranger, things like Skynet, and some of these legacy systems are being adapted and upgraded as well for this role with better sensors and with the cheapness of

the ammunition itself. Even if it’s got better proximity and programmable ammunition like a head ammunition that can fragment at the right point, you’re still looking at it being a potential successor and still being around for a while yet, especially in more short-range air-defence scenarios.

So, yes, a little reminder of some of the topography of the efforts there to try and counter some of these UAVs and that too I think is going to be reflected in our system as we think about the potential of Shaheds and one of the main places they come from, which is Russia.

Ben Conklin: Thanks for taking us through that. I think as you point out, there’s a wide range of different investments in this area and lots of different ways that we will look at it.

I’m going to show you a couple of those ways right now and they precisely drill in on what we were just talking about.

The way we group and understand them is by the manufacturers, but I think one of the ways that we find to be useful to understand the direction of the market and how money is being spent, what requirements are being made, is to look at it through these sort of key countries and this will be for all the countries that we currently forecast around.

We also examine the capabilities of state and non-state actors today and then to drill in to give you a good example of let’s go ahead and

do that. Let’s take a look at Russia. What we’re doing here is integrating the different analysis data sets that we have around Russia specifically, so some of the events analysis and equipment and then helping drill into the nature and type of investment in the country where they’re focused on and budgets along with an overall assessment of their capabilities.

So, bringing that information together with sort of that country lens and if you think about all these different developments, these categories of vendors that are producing the equipment along with the actors that are employing it will give us different ways that we can understand the dynamics at play.

Giorgios, we obviously collaborated a lot on this. One of the things that I really think was interesting in our immediate discussions that I want to bring up with this group is, you know, when people talk about an ‘unmanned market’, which is actually how you see it represented a lot in other publications. Do you think this is actually a helpful way to think about it or is it obscuring things that might be better understood through the warfare domains?

Georgios Salapasidis: It is tempting to treat the unmanned market as a single technological category, but that obviously blurs a crucial reality that unmanned systems, airborne, land, surface maritime, and undersea domains, they

sit at very different levels of technological and doctrinal maturity and that drives very different production and procurement dynamics.

For example, the UAV market is the most mature domain and we’re talking about three decades of operational use at scale, a validated, combat-proven doctrine, a functional and global industrial base.

There are challenges in this market, including survivability against counter-UAS systems, scaling of production especially for the small UAVs and supply-chain security where commercial components dominate, but in general, the UAV market has all the characteristics of a mature and competitive market. It is price driven, with a large number of suppliers spread around the globe.

It is going through a transition phase right now, of course, because it’s now splitting between the high-volume, low-cost production of systems and the low volume, high and expensive exquisite systems production. That is something that I will attend later.

Contrary to the UAV market, the UUV [unmanned underwater vehicle] market, for example, shows low to medium maturity. It is the operational environment that imposes some very significant constraints in this market, which also increases the technological requirements and the cost of developing communications and navigation technologies.

Endurance is also an issue for UUVs, but



A downed Shahed-136, which was discovered by the police in March 2024 in Vinnitska Oblast in central Ukraine.



An image of the Advanced Precision Kill Weapon System, armed on 9 Squadron RAF Typhoon aircraft deployed from RAF Akrotiri.

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equally important, the UUV doctrine is still evolving, which means that the discussions around the doctrine shape and reshape the deployment and procurement approaches.

The end result of all of this is that the supplier base for UUVs is relatively small, and the significant portion of spending goes to research and development. *Janes* estimates that about 40% of what’s being spent right now on UUVs goes to development and prototyping.

Now *Janes* estimates that in the next five years, we’ll see production increasing for small and medium UUVs and we expect major growth in the early to mid [20]30s when large and extra-large UUVs may reach some state of maturity.

The sibling market USVs [unmanned surface vehicles], we consider them to be a medium maturity market. They are moving much faster and one of the reasons is because the operating environment is less hostile, but it is also that there is a very broad range of missions: ISR [intelligence, surveillance, and reconnaissance], mine warfare, anti-submarine warfare, strike.

Most importantly there is a strong shift in USVs towards modular payloads on multimission platforms and there is a trend of accelerating integration of commercial technologies into USVs.

Janes estimates that 60% of the total programme value for USVs is going to come from these multimission platforms.

There are challenges there, again: autonomous navigation in congested sea lanes, long-range propulsion, reliability, and doctrines are still maturing for USVs as well.

But in general, that combination of modular architectures and the integration of commercial components, this is really widening the industrial base, which means that market concentration on the supplier side will be reduced because we’ll see more and more suppliers coming into the markets with offerings.

All in all, the USV market is one of the fastest growing markets in the unmanned world. We see a combined annual growth rate of around 15%.

The last market is UGVs. This is the least mature of the unmanned markets. The toughest barrier is reliable autonomous off-road navigation, but there are also issues with target discrimination in cluttered environments and the doctrine right now is very far from being mature so adoption is slow.

Procurement takes place at very low volumes, and these are primarily for trial and experimentation and meaningful growth is expected after the early 2030s.

What we expect is the first phase of this growth to concentrate around logistics, casualty evacuation, maybe route clearance. We believe that 30% of this market will be for logistics vehicles because the concept is a bit simpler and some basic technological concepts like ‘follow the leader’ are already there.

There’s no high requirement for autonomous concepts around lethality and most of the logistics will happen on road, not off road, which is great.

The bottom line is there is no single unmanned market. Each domain has very distinct constraints, timelines, and different investment logic. The procurement and industrial policy would require some domain-specific strategies to avoid the risk of misallocating resources and the risk of having unrealistic expectations.

Ben Conklin: That’s really logical. I love how we sort of started in the air, dove deep into the ocean, came back to the surface and climbed to shore.

I think as you point out that each of those environments have distinctly different characteristics, distinctly different requirements and in fact, there’s no solution that solves all of them at the same time, right?

So that the market then of course follows the capabilities is really logical. I think one of the things that Tom was talking about earlier that kind of intrigued me that I think you’ll have some items you can add is this idea of sort of manufacturer innovation, different ways of operating actually can dictate the outcomes that can be delivered.

It’s interesting to me as you kind of look at that concept more broadly, you know, how do you characterise these important structural changes that are happening in the market today and how does that shift in terms of production, procurement, etcetera? How are these things used and how and what does the future really look like?

Georgios Salapasisdis: The biggest structural change today and for the near future

is probably the manned-unmanned teaming concept and how this is also driven by the rise of attritable systems. By attritable systems, we mean platforms that are recoverable, low cost, and they’re designed with the assumption that some of them will be lost. And if they are indeed lost, that would not jeopardise the mission or break the budget. End users would be buying the systems because they obviously expand essential range and weapon reach.

They also complicate the enemy’s targeting because they produce more targets for the enemy, but they also absorb risk because they keep the crewed assets out of harm’s way and that reduces the political cost of losses. But what I believe really matters in this case is that they also change the cost calculus, and by that I do not mean just the cost exchange ratio, which is the dollar-to-dollar assessment of the cost of neutralising a threat.

But what also matters is industrial depth, which in this case is the ability to replace those losses very quickly and attritable platforms are expected to be produced in large numbers and in several batches. That will come handy because it will be used to saturate the enemy defences and because these batches will repeat every year or two, there will be enough time and opportunity for the suppliers to insert technologies that are crucial to maintain that edge capability. That could be autonomy, sensor sensors, EW [electronic warfare] resilience, and others.

While attritable systems obviously will change the kind of capabilities that are fielded, they will also change the market itself because they could reshape how production, procurement, and competition operates.

So production economics could invert because defence production will move towards high-volume, low-cost outputs at industrial scale, which means that factories, supply chains and skills may move closer to what we are currently witnessing in the automotive and consumer electronics industry.

Procurement cycles will compress, which means that governments will have to change so that they can test the systems faster, they can certify the systems quicker, and they will need to organise iterative buying. Contracting will focus on several batches and competition after every batch, so there won’t be too many of those large and very long contracts in duration.

For the supplier side, the revenue stream may change because it will move from those prolonged maintenance contracts to more frequent and consistent orders of replenishments.

In general, the industry may be polarised

because on the one hand you have those low-volume exquisite systems and on the other hand, you’ll have that high-volume, low-cost systems. In between there will be a middle area where some systems remain, but these may be too expensive to lose but not good enough to keep. Some of the medium-altitude long-endurance UAVs that we currently operate, fall exactly in that middle area between these two poles.

From an international point of view, the market will grow because countries, even mid-sized countries, will be forced to make some very key industrial decisions.

If a country cannot produce these attritable systems domestically, they may face the risk of severe strategic dependence, which will only become worse during wartime because this is where you need all these replenishments.

For all these reasons, *Janes* expects that this sub segment that spreads along multiple domains of unmanned, will become one of the fastest growing areas. Our figure is more than 20%: it could really prove to be a disruptive technology for the whole market.

These kinds of disruptive technologies, rapid market growth, constant technological evolutions, I believe all these are really the context behind our new unmanned product. Would you agree, Ben?

Ben Conklin: I actually really think that your explanation is exactly what we’re talking about, particularly how the use, employment, and the tactics and doctrine that are defining the application of these actually traces all the way back to new methods in manufacturing and new approaches to the market.

And that concept of a continuum of capability where people like to look at both ends, but actually that middle is so interesting.

So with that, I’m going to go ahead and start asking a couple of questions that I’ve seen from this audience. One of these I basically fully expected and I think each of our panellists will have very interesting thoughts on is sort of the idea between sort of command driven, operated unmanned systems that are operated by humans still very tightly controlled versus automation and where you see the future going.

I’m assuming it’s not a simple binary answer, but I think it’s very interesting. So maybe Tom, you could start.

Tom Barton: Yeah, I’m sure that we will all have thoughts on that. It is as fascinating as it is mind-boggling at times and the role of automation, you try to sort of get a zeitgeist of what is going on amongst governments, militaries,

manufacturers, you know, what is being claimed and what is actually being achieved can be sometimes quite tricky to tease apart.

But from my impression, I think a fully automated end-to-end sort of targeting chain where somebody sets a UAV to go and hit a target 500 km away and then walks away from their desk to go and get a cup of coffee and doesn’t think about it anymore. We’re not there yet. That is still in the test and trial phase, but from what I can understand, some actors and companies are getting close.

It was public comments this week and we saw Ukraine’s minister of defence talking about their work with Palantir. They did not say that they’ve cracked that particular nut, but clearly it’s no secret that that government is one of the most advanced in trying to think about that.

Indeed, needs must on a front line where there are so many potential targets and you are presenting so many potential targets to your opponent to try and automate as much of that as possible can be a matter of survival.

So you’re looking at things like pixel lock, which for smaller UAVs, essentially one of the more mainstream uses so far is that in the last few sort of 100-200 m of its flight, rather than risk being jammed, that UAV is going to switch over to a small database usually that will have a recognised imagery of potential targets and it would use that as its terminal navigation rather than relying on a datalink back to the operator that may already have been lost. That’s quite crucial on that small level.

That can be replicated up in a slightly adjacent example what we’ve seen again in this last week Ukraine published what it says is some of the developments that Russia has been making with its Kh-101 air-launched cruise missile, but many of these can map across.

So for example, apparently the Russians have been making gains with their own use of AI [artificial intelligence] and sort of over time, satellite-generated imagery that is then compared by processing on the missile to try and work out in the last stage of its flight. We could be talking about 50 km that it’s trying to compare. ‘Oh yeah, that’s the right bridge. Oh no, that’s not the right bridge’. Then a correct course and move to bring itself into the target. Obviously, you can see that potentially being used on some of the longer-range UAVs as well.

Georgios Salapasisdis: I completely agree with Tom. What I would add is that this brings us to the very popular discussion about AI and how this links to the autonomy of these



The Security Service of Ukraine has unveiled two new variants of the Sea Baby USV. Security Service of Ukraine: 2088916

vehicles. I would say that the uses of AI for autonomy, these are not domain neutral so it really differs between airborne platforms, land, and sea. For example, computer vision for aerial target identification, AI-enabled path planning for UGVs, acoustic signature classification for UAVs. Yes, there is a lot of work that’s happening in all of these to use AI and let the system do some decision making, but the reality is that data alone to train the systems are not always there. So there is an abundance of data for airborne platforms that has been collected for years and years. There is less of that for underwater platforms and for land platforms, UGVs, as my colleague Amael mentioned earlier, things are even more difficult.

There is even less information about those. That creates a significant gap that has been recognised by governments and suppliers. The most advanced players in the UGV segment recognise that right now, the last tactical measure as it is called, which is that area close to the front line where the UGV has to go. This is a very dangerous area. It will be under constant observation by enemy assets and the UGV itself will have literally zero situational awareness.

That means that if we cannot achieve the maximum autonomy, we have to connect it somehow with a man in the loop and to do that, the plan is to set up an entire system of urban platforms that will provide situational awareness and will also act as a communications relay so that the UGV is connected with somebody who actually controls it.

That tells us something about where we stand right now. The industry understands that we’re not there yet, as Tom said, and they are trying to compensate for these challenges by working on the traditional combined arms

kind of principles. So we’re not there yet, but we’re using several methods to get there.

Amael Kotlarski: One thing, if I could add, I think one of the final dimensions that we’ve talked a lot about the technology involved in this. One final thing to consider as well is as some of the technologies mature on this, the computer visual algorithms that allow us to discriminate and identify the human-shaped target, for example, or a human-shaped target equipped with what looks like a rifle. These things have been around for quite a while. But fundamentally, I think there’s also at the higher level an ethical and legal consideration about autonomy, especially when it comes to kinetics and use of kinetic force.

There is certainly throughout the West, honestly a palpable revulsion with the idea of being able to give full autonomy to lethal weapon systems so everyone wants a human in the loop. Everyone needs to have a human being press that button. If lethal force needs to be taken. There’s also a legal aspect to it. Who do you hold to account when things go wrong when a mistake happens?

Human beings can go to court. What would you do if an AI model made a mistake and what would be the legal ramifications of that?

I know that in wartime perhaps that’s less of a consideration when, for example, if you look at Ukraine, I don’t think that’s the primary top of their concerns right now when they’re experimenting with a UGV and other forms of automated systems. But for the time being, the West is not at war or at least, depending on which definition you use in terms of certain recent events, but that consideration still dominates. So, it’s still a significant factor. That is a guiding

principle as to how we develop these technologies as well and we’ll likely put the brakes a little bit on full autonomy on that front.

Ben Conklin: That makes a lot of sense. We’re going to go in a slightly different direction, but actually it’ll be interesting to connect this to what you’re saying. One of the other questions we got was the idea of if you compare state actors and non-state actors, is there any innovation coming from the non-state actors? Is it either in the development of the systems or more in the tech, the TTPs [tactics, techniques, and procedures]? Are we seeing anything like that? And if so, that might in fact change some of these rules and some of the thoughts around that future threat.

Amael Kotlarski: I think the first time we ever saw a drone being weaponised to drop grenades and munitions, it was in Iraq and it was ISIS who were doing it, so non-state armed groups [NSAGs] actually were the pioneers, unfortunately in what would become the weaponisation of drones.

Now plenty of people think that it was going to happen anyway. The circumstances meant that ISIS were the first ones to actually start experimenting with it. Back in the battle of Mosul, they understood not only the power of it as a weapon but as propaganda as well, because of course, drones have cameras and you can then propagate the footage, which we saw explode with Ukraine.

It already started with the Nagorno-Karabakh conflict between Armenia and Azerbaijan, where especially Azerbaijan used the drone imagery as part of its war effort on the propaganda front. Something to consider as well, not just about the kinetic effect of UAVs, but also their propaganda, the propaganda value.

We’re seeing it, for example, Hezbollah are releasing reels of their FPVs striking IDF vehicles recently. You’re seeing that as well with non-state armed groups in the Sahel. ... JNIM [Jama’at Nusrat al-Islam wal-Muslimin] in Mali has been using FPV drones. We saw it in Syria, we’re seeing it in Myanmar as well. So I’d say the NSAGs were the first innovators. More recently, NSAGs have been copying what they’ve been observing, especially what’s being done in Ukraine.

So Hamas on the 23 October attack were using drones to drop munitions a little bit. It didn’t last particularly long, but it formed the original part of their attack.

So that’s that’s a tactic we saw again, ISIS developed this tactic and we saw it used en

masse in Ukraine by both sides: initially the Ukrainians, but the Russians also caught up on that. Now it’s the use of FPV drones. We’re seeing radio frequency-controlled ones, but now increasingly tethered using fibre-optic-cable drones, so they’re certainly looking at what’s happening.

There’s an interesting argument to be had about the proliferation of such tactics and technology given the fact that a lot of it is commercially off-the-shelf.

The Ukrainians and the Russians are communicating a lot if you know where to look for how they’re building these things. You have entire Telegram channels of guys filming or showing how they’re putting these things together. Anybody with a little bit of know-how and access to munitions or the know-how to kind of modify them can essentially do it themselves. So the barrier of entry is fairly low and NSAGs are clearly looking at what’s going on as much as state actors are, so less innovation from the NSAG side at the moment.

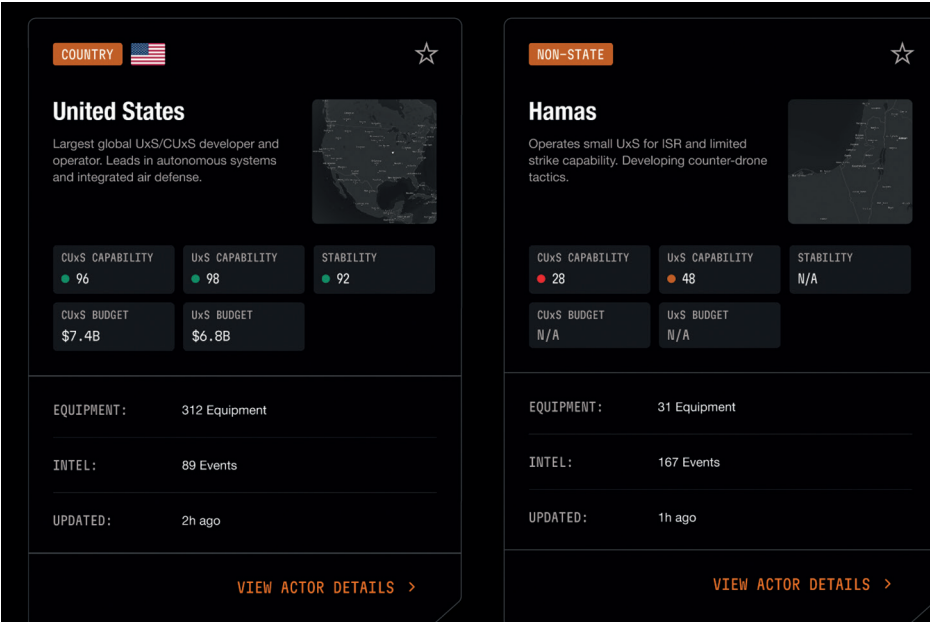
They’re more, they’re more followers about what’s going on, but they are seemingly rapidly adapting and copying what they’re seeing in Ukraine far more quickly, frankly than state actors because state actors are still busy testing and evaluating and qualifying and that kind of stuff, even though things have accelerated.

So NSAGs are reacting very quickly, although I’ve not yet seen any major innovations, but then again, I think Ukraine is still the crucible in which innovation is happening in this domain more so than anywhere else in the world at this stage.

Tom Barton: I think we see in areas where the airspace is not as heavily contested as places like Ukraine, I’m thinking of some of the conflicts in North and East Africa that I think a lot of these state and non-state groups in these quite dispersed conflicts are realising the potential value of intelligence surveillance, and reconnaissance, often of higher standard systems, which may come from undisclosed benefactors perhaps to some of those groups.

If they can get their hands on a medium-altitude long endurance system, then they can actually get themselves for the first time some kind of long look ahead to try and plan their own offensives or to try and pick out targets that they’ve never had before.

They’re seeing a slight chance to try and get some of that amazing intelligence that they’ve seen some of their state appointments over the years have and that is interesting in that it seems to more and lesser degrees the battlefield



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is becoming more transparent for everyone and it’s going further and further down the scale of those with less technology and less money.

Ben Conklin: Sophisticated ISR, tapping in pennies on the dollar compared to the old systems. So there is one other elemental pull from that trend with the non-state groups as well. We don’t see it yet, but what we see is increasing concern by large law enforcement agencies and others who are actually becoming more interested in counter systems, major world events and things like that.

So it’s also changing a little bit of the buyer for the counter-unmanned market and changing a little bit and opening that up. As well as the threat evolves, the response might actually change to who needs to be thinking about protection and maybe opening that up a little wider. That’s without even talking about prisons and other things like that.

So it’s definitely an interesting environment without really clear boundaries. One of the things we haven’t really talked a lot about, we mentioned that we talked about ISR, talked a lot about kinetic activity using unmanned systems, but are we seeing any sort of low-cost, high-volume systems being used for things like electronic warfare or helping support things like precision fires?

Tom Barton: I don’t think quite so much, you know, when you think of that kind of system, one of the things that springs to mind is that

the UK’s attempt with something called Storm Shroud, but you couldn’t describe that as low end. Essentially it’s a very advanced electronic support measures system that can go in and either spoof or jam its way to help other cruise missiles or other UAVs get into their targets.

I think that is still when you’re talking about sort of stand-in systems like that, it’s one of the chief use cases, but as far as I can tell, that’s still quite a tricky thing to pull off. I suppose some of them it’s just the sheer scale. If the sky is full of small UAVs, it is hard to know what to look at first.

Georgios Salapasidis: We don’t see a lot of those, but we do forecast many of those. So we would expect to see small- and medium-sized systems to be used for electronic warfare, for communication relays, for targeting.

In fact, I could even say that for targeting specifically, there is a trend to democratising precision targeting. These days you need a platform that costs between USD20 million and USD120 million to do some proper precision strike. In the future, you would have that with significantly less.

I think this whole concept of adding an electronic warfare module on a small or medium UAV or UGV is very attractive as a concept.

It’s not extremely challenging from the technological point of view, but it will require a lot of work from the command-and-control point of view because you will have several assets out there carrying out these operations. It will



A counter-unmanned aerial system is hooked to a battery to charge for its next flight near Lipa, Poland, in November 2025.
US Army/Sgt Jacob Kohrs, 10th AAMDC: 2092117

require a very dense network with a lot of information circulating to be able to effectively use those. Remember, many of those, for example, electronic warfare can be put in good use when they are properly, but they can really work against you if they are not properly employed.

So yes, there is obviously a market out there for those both on land and air and in fact, many of the manned/unmanned teaming projects that are now in development also include attritable platforms that will specifically do, for example, electronic warfare and we forecast those as well.

Amael Kotlarski: I think those are definitely the high end, especially the sort of the loyal wingman types accompanying sort of high-end fifth- and sixth-generation jets. I think from a small drone perspective, you're going to start having issues with swaps and size, weight, and power. The ability to integrate those systems onto a small drone, fratricide is also always an ever-present problem with electronic warfare.

I think Georgios is right. The more interesting aspects right now are more in the comms side of things using drones as relays.

The Ukrainians have been doing that to extend before they started rolling out the fibre-optic cables, they were using relay drones with repeaters to be able to extend the range of their radio frequency-controlled ones. That I think is attractive and potentially also a solution to some of the difficulties encountered with UGVs. I was actually reading an article about a recent exercise in Latvia where they tested UGVs. For those who don't know, Latvia is 50% forest, so the operating UGVs and drones in the dense forests and canopies was a nightmare. Apparently even Starlink would often lose contact because of the canopy. This idea is potentially using a repeater drone to fly over the UGVs to help with line of sight for the control signals, things like that. I think electronic warfare will probably be reserved for the more high-end boutique sort of unmanned world. I think that the cheaper mid-tier one will do other jobs essentially. Electronic warfare is a bit of a complicated one to integrate into that realm.

Ben Conklin: With that, I think we're going to go ahead and wrap this up. One observation I

have from this discussion is that I kept hearing the word recent: recent trend, and I think that the theme I take away from that is this is a rapidly evolving environment, so almost everything we've talked about today is in fact a recent trend.

It can help us forecast the future, but as always that forecast will evolve as we see these trends evolve as well. So stay tuned, look for more updates from us in the future on this exact topic, and if you're interested in a consolidated view of all this information that's updated regularly. 



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