ULTRA | Intelligence & Communications

Miniaturization to the Max: How next-generation micro devices are driving new, more powerful UAVs

Overview

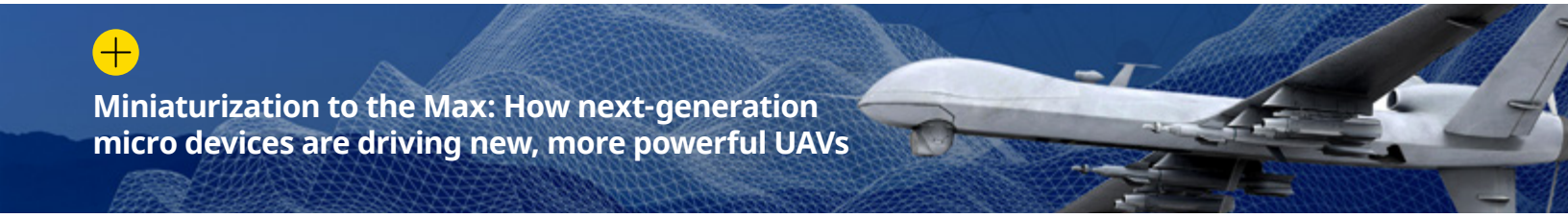
Unmanned Aerial Vehicles (UAVs) and Unmanned Aircraft Systems (UASs) have seen explosive growth and evolution just in the last few years, and it's a trend that is gaining momentum almost daily. Unmanned aircraft in the military have increased the amount of data available to troops on the ground exponentially, and commercial users are constantly devising new applications.

Where will UAVs go from here? We're going to explore current trends in military and commercial usage and look at one particular technology that UAVs are driving: miniaturization. Smaller craft require smaller componentry to expand their capabilities while allowing for improvements in size and weight.

We'll talk about both military and civilian application of UAVs, focusing on the future of such applications and how componentry is shrinking to keep up with demand.

Military Sees Explosive Growth in UASs

In its 2020 Budget, the Pentagon asked for billions of dollars to research, build and field new UASs. The hottest trend in military unmanned vehicles is counter-UAS technology which aims to counteract and defeat an enemy force's use of UASs. This development process requires smaller and lighter unmanned systems, unlike programs like PATRIOT. These size reductions necessitate improvements in Size, Weight and Power (SWaP) and component miniaturization. Component vendors must keep pace with demand, fueling the industry's rapid evolution.



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The US Department of Defense (DoD) also intends to expand its Air Force MQ-9 Reaper UAS program dramatically, as well as funding the Navy's MQ-25 Stingray Unmanned Carrier Aviation program. These systems will serve as part of a Carrier Air Wing, and they are intended to refuel aircraft in-air in addition to providing a superior Intelligence, Surveillance and Reconnaissance (ISR) landscape. In early June, the US Navy demonstrated Stingray's capabilities when it successfully refueled a Navy F/A-18 fighter jet in midair, showing that the Navy will keep or exceed its ambitious goal to have working demonstration units by the end of 2021.

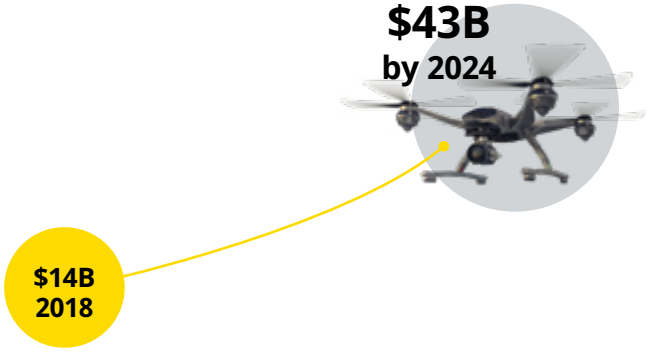
It doesn't stop there, however. Also in its 2020 budget, the DoD requested $3.7B for unmanned systems that can operate in contested airspace and provide the data needed to increase information capabilities.

Unmanned systems remain a top priority for the military which is also investing heavily in Artificial Intelligence (AI) and Machine Learning (ML) technology to create a more complex and accurate picture of what's going happening on the ground (or on the water or in the air).

The needs and concerns of the military are rapidly evolving as they pivot from asymmetric/low intensity urban terrorist events to large scale near-peer multidomain operations requiring innovative strategies, technology and equipment.

While there is no doubt that the military is one powerful force demanding rapid innovation in miniaturization to fit smaller UAVs, the civilian world is just as motivated to continue the lightning development pace.

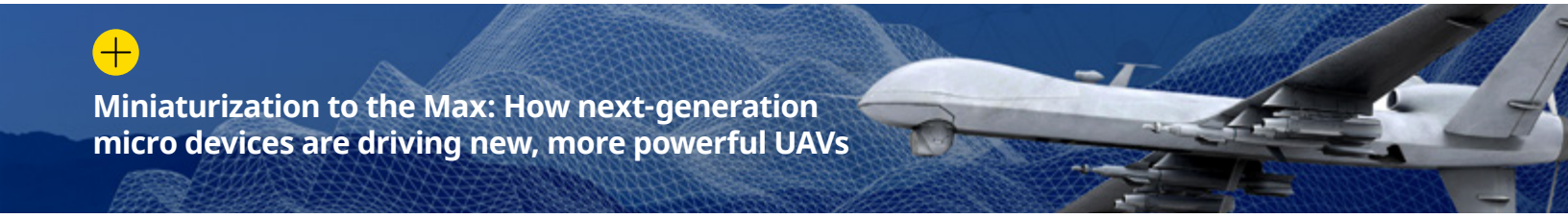
Civilian Unmanned Applications on the Rise



With the global market for UAVs reaching $43B by 2024, it should be abundantly clear that commercial drones are still experiencing an unprecedented surge in popularity.

It's not news that Amazon would like to invest in UAV deliveries, but what other civilian use cases exist for this technology? Some commercial sectors are looking at another delivery model: large package or freight delivery. As UAVs grow stronger and more powerful, many in the industry are proposing they replace trucks and rail as a primary delivery model once freight reaches its destination hub.

This commercial enthusiasm is fueled by Urban Air Mobility (UAM), a model proposed by NASA for increasing the usage of UASs in urban environments. UAM provides a vision of the future where UAVs are used for much more than deliveries; it also promotes the use of unmanned vehicles in passenger conveyance. Airport shuttles and urban transportation are two primary use cases that come into play here. Some have even argued that one day soon "air ambulances" will be able to deliver medical aid to the public in record-breaking time, with potentially life-saving effects.



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However, there are many hurdles to urban use of unmanned vehicles. One is the negotiation of safe airspace – ensuring a vehicle has room to take off, land and maneuver without encounter obstacles. This is especially true for fully autonomous units.

Another consideration is more civic-minded. How do operators ensure that the noise and disruption of UASs doesn't detract from the lives of the citizens they're meant to assist? Finally, operators must contend with existing FAA regulations and current airspace usage. NASA believes these challenges are all surmountable providing cities, government and industry work together to implement UAM.

Miniaturization Trends Fueling UAS/UAV Development Potential

To understand the immense value of miniaturization in our ability to deliver on the promise of unmanned vehicles, it's important to know that every aircraft carries with it a vital suite of instrumentation. This is true of jumbo jets, orbital rockets and UAVs. A large airliner has apparently ample room for instrumentation, but even its providers must make it all fit within a large but confined space. UAVs, even smaller ones, must also be outfitted with the right instruments to detect the environment, identify and overcome environmental factors and more.

In the military, especially, there is great concern over payloads. One UAV could (and does) hold multiple payloads in the nose or tail, or under the wings. Space is cramped, so miniaturization gets these UAVs off the ground and allows them to accomplish their missions. When you're working in the instrumentation of a UAV, you're in close quarters. It isn't possible to just "shrink" existing payloads and expect them to work like their full-sized counterparts.

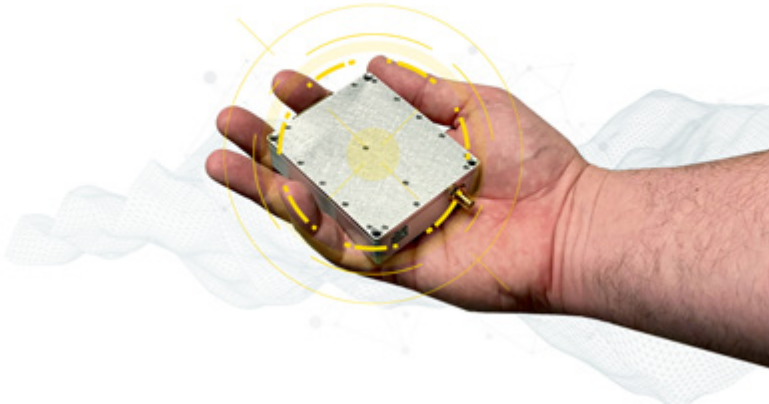
At the same time, military organizations are eager to fit increasing numbers of payloads on each UAS or UAV. Each payload provides vital information and data that helps ground, sea and air units understand the landscape of the operating theatre. The more payloads, each accomplishing a different end result, the more data you have, and the higher your chance of success.

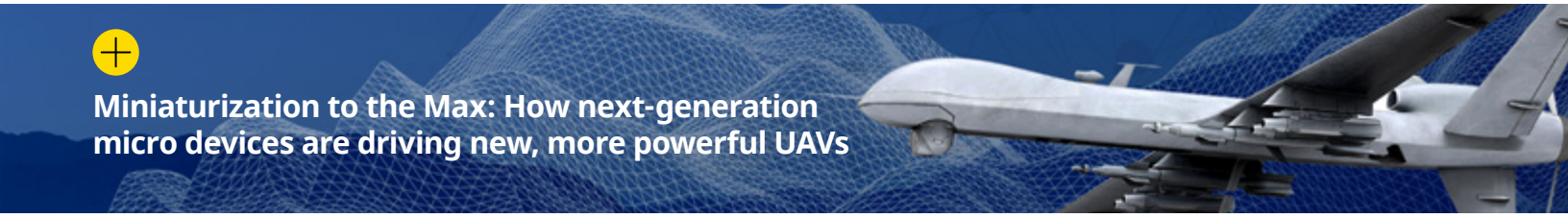
Trends in miniaturization are fueled by these specific needs, and industry is adapting quickly to provide small SWaP solutions.

Ultra: Miniaturization to the Max

Ultra specializes in small SWaP componentry for unmanned aerial systems. Our components can be found in a wide array of established and upcoming military programs. One component every manned and unmanned craft must have is Identification Friend or Foe (IFF). In a contested and congested airspace, it's vital to be able to quickly tell who is on your "team" and who is not. IFF solutions enable that distinction.

Ultra designed the Hawk IFF™ for deployment in both current and next generation platforms. This miniaturization reflects the trend toward ever-smaller UAVs and extends to traditional fixed and rotary wing aircraft. We've reduced the SWaP 20X to fit into the design of any airborne chassis, with a weight of 7.6 ounces. Remember the ever-increasing number of payloads that are outfitted on the noses, undersides and tails of aircraft? Hawk IFF makes it easy to free up space for additional instrumentation, extending the functionality of the aircraft.





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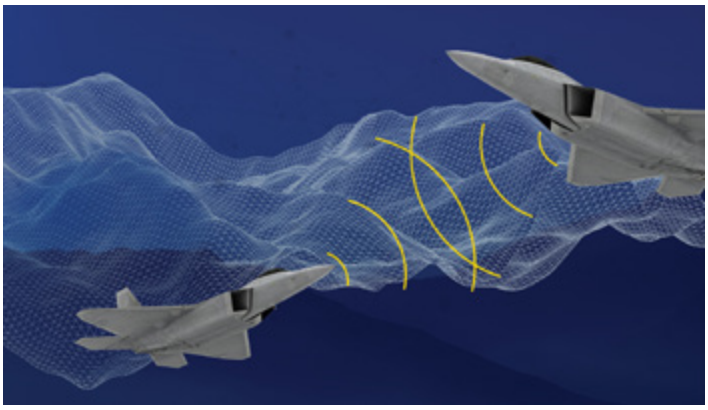

Security is also a prime driver. Ultra Hawk IFF supports all standard communications modes to ensure that data remains secure even in congested environments. Support includes standard civilian and military encryption modes: 1, 2, 3/A, C, S, 5, and ADS-B. This allows for open communication between allied forces.

In addition, traditional IFF devices had one antenna, and it transmitted downward, limiting the locations where they are installed. On the other hand, Hawk IFF possesses antenna diversity. It broadcasts a signal bi-directionally with dual antennas to allow for placement anywhere on the aircraft without sacrificing performance.

With up to 500w power, Hawk IFF has more than sufficient power to ensure communications connectivity with relevant ground assets and maintain command & control of airborne assets at all times.

Ultra's Hawk IFF engineering team has decades of experience in developing next-generation IFF devices, with the emphasis always on usability, innovation and execution.

Conclusion

The meteoric rise of unmanned aircraft will only continue to crest over the coming years. Whether it's delivering groceries or protecting our warfighters on the front lines, UAVs provide a valuable service – one that depends entirely on the successful miniaturization of key components.

IFF devices are required by the FAA for even very small UAVs, and the military has hundreds of unmanned projects whose success depends on how much instrumentation they can fit inside the vehicle. Ultra Hawk IFF eliminates those concerns for a key component, bringing decades of expertise to bear to solve one of the biggest technology challenges in UAVs today.

Learn more about
Ultra's Hawk™ IFF at
sales@ultra-us-gbs.com or
ultra.group/intelligence-communications

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