Unmanned aerial systems (UAS), drones – whatever your preferred term, it’s undeniable that we’ve come on in leaps and bounds since Nikola Tesla patented an idea for remotely operated vehicles (RPAs) in 1898 (United States Patent and Trademark Office, patent #US000613809). While Tesla’s prediction that the actualisation of UASs would ultimately end warfare, “for by reason of its certain and unlimited destructiveness it will tend to bring about and maintain permanent peace among nations,” has not come to pass, it’s certainly provided an exceptional tool in the armoury for military groups the world over, in addition to being a major boon for humanitarian operations in the wake of disaster.

It’s often said that UASs were originally designed for military missions too dull, dirty or dangerous for humans (the three Ds), but today, thanks to the incredible technology breakthroughs from government, commercial and academia alike, we’ve gone far beyond that. While the traditional applications for UASs were largely military and governmental, new uses like product delivery, testing scientific principles, agricultural, and aerial photography are becoming much more mainstream. Lately, we’ve seen a spate of consumer-grade UASs launched to market as enthusiasts demand products they can use themselves for social media applications and even UAS racing. Today, civilian UASs vastly outnumber military UASs.

The adoption of UAS technology by consumers has resulted in some interesting consequences, particularly in enhancing the range of UAS expertise available. While consumer-grade UAS are obviously unsuitable for military applications, the increased rate of development means new technologies are being produced by commercial innovators, and an increasing number of engineers are becoming accustomed to designing, manufacturing and programming such devices. This can only be positive for the future of military UAS development.

In a world of social media where people increasingly live out their lives online, having the ability to share 4K video footage of your exploits as captured aerially from your personal UAS is (arguably) a great benefit. However, when it comes to national security, keeping the country safe, and recovering from a natural disaster, it’s the military-grade UASs that are making all the difference. Accordingly, even the highest-spec UASs are under a near-constant state of development to enable more capabilities than ever before, ensuring increased communications, resilience, power and longevity.

General Atomics announces latest Predator B iteration: SkyGuardian

General Atomics Aeronautical Systems (GA-ASI), an affiliate of General Atomics, is one of the world’s leading providers of UAS for the US military and global commercial applications, and constantly strives to deliver more with every product iteration. The company’s Predator A, Predator B Reaper, Gray Eagle, Predator C Avenger and Predator XP systems have paved the way for new capabilities for government and military groups.

GA-ASI’s latest UAS project is the Type-Certifiable Predator B (TCPB) variant, recently named ‘SkyGuardian.’ The MQ-9B UAS is a highly modular system that is easily-configured with a variety of payloads to meet complex mission requirements. It carries a state-of-the-art Detect and Avoid (DAA) system including space, weight and power provisions to enable the retrofitting of an airborne Due Regard Radar (DRR) for operation...
in non-cooperative airspace. Compared to the Predator B Reaper, SkyGuardian will have improved structural fatigue and damage tolerance, more robust flight control software, and enhancements that enable operations in adverse weather conditions.

In November 2016, following four years of development, GA-ASI announced that SkyGuardian had completed its first flight test at the Gray Butte Flight Operations Facility. “The first flight of our Certifiable Predator-B aircraft is a major milestone in our progression towards delivering a RPA that meets all NATO airworthiness requirements,” said Linden Blue, CEO at GA-ASI. “The CPB is the first RPA system of its kind to be compliant with an international type-certification standard, and can therefore be more easily integrated into civil airspace operations around the world.”

The UAS will be offered in several configurations, including an unweaponized maritime patrol variant to support open-ocean and littoral surface surveillance for border patrol, coast guard, and disaster relief missions. This variant has been dubbed the SeaGuardian.

SkyGuardian is compliant with NATO’s UAV SYSTEM AIRWORTHINESS REQUIREMENTS (STANAG 4671) and the UK’s DEFStan 00-970. GA-ASI has also collaborated with the LufABw (German Military Aviation Authority) to define airworthiness for German airspace. Qualification testing for type certification will continue for another two years; GA-ASI has built three aircraft and two airframes for full-scale fatigue and static testing to satisfy requirements.

The first SkyGuardian UAS are expected to be delivered in 2018 to customers including the UK’s Royal Air Force.

**DARPA develops Gremlin project**

The Defense Advanced Research Projects Agency (DARPA) is part of the US Department of Defense (DoD) and is responsible for the development of emerging technologies for military applications. The group has made great strides in delivering game-changing military capabilities such as stealth technology and precision weapons. One of DARPA’s current projects is the Gremlins programme, which envisions large numbers of low-cost, reusable UASs, dubbed Gremlins, that can be launched and retrieved mid-air. The Gremlins would be launched in groups from existing large military aircraft, including transport aircraft, bombers, fighters and small fixed-wing platforms. Once the mission is completed, the Gremlins would be retrieved with a C-130 transport aircraft. Each UAS, which can be prepared for reuse within 24 hours, has an expected lifetime of around 20 uses. The project’s goal is to deliver coordinated, distributed capabilities, improving operational flexibility at a lower cost than is available today. Primarily, the Gremlins would act as an intelligence, surveillance and reconnaissance (ISR) platform that could become a sensor network that works in conjunction with other platforms to receive imagery.

According to DARPA, technical areas up for exploration during the programme include:

- Launch and recovery technique, equipment and aircraft integration concepts;
- Low-cost, limited-life airframe designs; and
- High-fidelity analysis, precision digital flight control, relative navigation and station keeping.

GA-ASI was awarded a contract for Phase 1 of the Gremlins programme in March 2016, and is also developing the small Gremlins vehicles, capable of carrying a 60lb payload and a one hour time-on-station at a range of 300nm.

DARPA recently moved to Phase 2 of the Gremlins programme, wherein GA-ASI and Dynetics were awarded US$21 million each to lead two independent teams to complete preliminary designs of full-scale technology demonstration systems, and to perform risk-reduction tests of individual system components.

“The Phase 1 programme showed the feasibility of airborne UAS launch and recovery systems that would require minimal modification to the host aircraft,” said Scott Wierzbanowski, Program Manager at DARPA. “We’re aiming in Phase 2 to mature two system concepts to enable ‘aircraft carriers in the sky’ using air-recoverable UASs that could carry various payloads - advances that would greatly extend the range, flexibility, and affordability of UAS operations for the US military.”

The Gremlins programme is expected to deliver an in-air launch and recovery demonstration in 2019.

**Leidos tests new UAS notification service**

Incidents of UASs operating in commercial or military flight paths, wreaking havoc and putting lives and operations at risk, have been rife in the last few years as UAS have become more affordable and more widely-used. In April 2017, an incident was reported when not one, but two, drones had a near-miss incident with a commercial Airbus A320 flight coming into land at Heathrow Airport, compromising the safety of the aircraft and everyone on board. A full investigation was carried out, but the UAS operators could not be traced.

While many countries have laws governing the protection of commercial airspace from unauthorised vehicles (in the UK, it is against the law to operate UAS above 400ft or near airports or airfields, among other restrictions), American defence company Leidos has gone one step further to resolve the problem with the development of the Leidos Notification Service, announced in March 2017.

The new system is described as being able to safeguard space by sending automatic notification of UAS operations to relevant groups.

The service is being tested as part of the Federal Aviation Administration (FAA) UAS Pathfinder Program with Burlington...
Northern Santa Fe (BNSF) Railways in an effort to explore concepts for beyond line-of-sight operations for small UASs. The service will resolve overlaps (deconfliction) between high-speed military aircraft and UAS operations across military routes.

“In addition to the traditional methods of inspecting railways, unmanned aircraft provide an efficient, cost-effective way to maintain their tracks,” said Mike Glasgow, Leidos Fellow, Notification Service Chief Architect. “This process ensures all applicable parties and aircraft in the area are informed ahead of their UAS operations for safety.”

The Internet-based service is accessed by UAS operators, who can file flight plans for UAS operating areas. The service automatically generates and sends all the required notifications to relevant military personnel, general aviation pilots that will be flying in the same area, and also issues a ‘Notice to Airmen,’ which alerts pilots to potential hazards.

The Leidos Notification Service, an extension of the UAS Operating Area system available on Leidos’ website, is being implemented for UAS operations over sections of railroads in New Mexico. The company plans to expand the programme to support other UAS operators in the near future.

“Our Flight Service program provides a range of safety-oriented services to more than 80,000 members of the general aviation community across the country each week. This UAS notification and deconfliction service broadens that safety mission by providing pilots with the information needed to avoid conflicts as more and more unmanned aircraft take to the skies,” said Paul Engola, Senior Vice President of Transportation and Financial Solutions at Leidos Civil Group. “We will continue to develop concepts and capabilities that enable safe integration of UAS into the airspace.”

**Thales launches UAS traffic management service**

Another company seeking to meet the growing need for UAS traffic management services is Thales, which, in March 2017, announced the launch of ECOsystem UTM, an advanced solution for UAS Traffic Management (UTM), with technology from partner Unifly. The solution will incorporate Unifly’s Validation Engine, a software application that conducts real-time validation of UAS flight plans, into Thales ECOsystem, a decision-support platform for improved aviation operations. ECOsystem enables air navigation service providers (ANSPs), airlines and airport operators to plan, monitor, manage and assess aviation operations for better results through a suite of tools and predictive analytics. As well as optimising local operations, ECOsystem enables global optimisation through data sharing and collaborative applications.

“The number of drones is growing exponentially,” said Marc Kegelaers, Chief Executive Officer at Unifly. “Safely integrating such a large number of drones in the airspace is a challenge. This will require a UTM system that provides a high level of automation as well as a seamless integration into the world of ATM. Thales and Unifly will collaborate to achieve just that.”

ECOsystem UTM integrates UAS registration, pilot registration, flight planning, and regulatory/business rules with geospatial and meteorological information, enabling adaptable workflows for managing UAS operations, as well as customisable situational awareness using tools like map overlays, terrain views and 3D projections. The UTM application and data enable automated flight authorisations as well as real-time alerting and intervention in emergency situations. According to Thales, ECOsystem UTM will support the rapidly-growing demand for UAS operations in both line of sight and beyond line of sight, while ensuring the public’s safety, security and privacy. Unifly’s unique validation engine software uses geographically linked data to determine the safety of any intended flight. The Validation Engine is designed to process very large amounts of data, and validation occurs in real-time, both during the flight planning process as well as during the actual flight. Parameters include UAS position, airspace, local legislation, no-UAS zones, geo-fenced areas, weather, obstacles, roads, as well as other manned and unmanned traffic.

![General Atomics SkyGuardian](image-url)
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