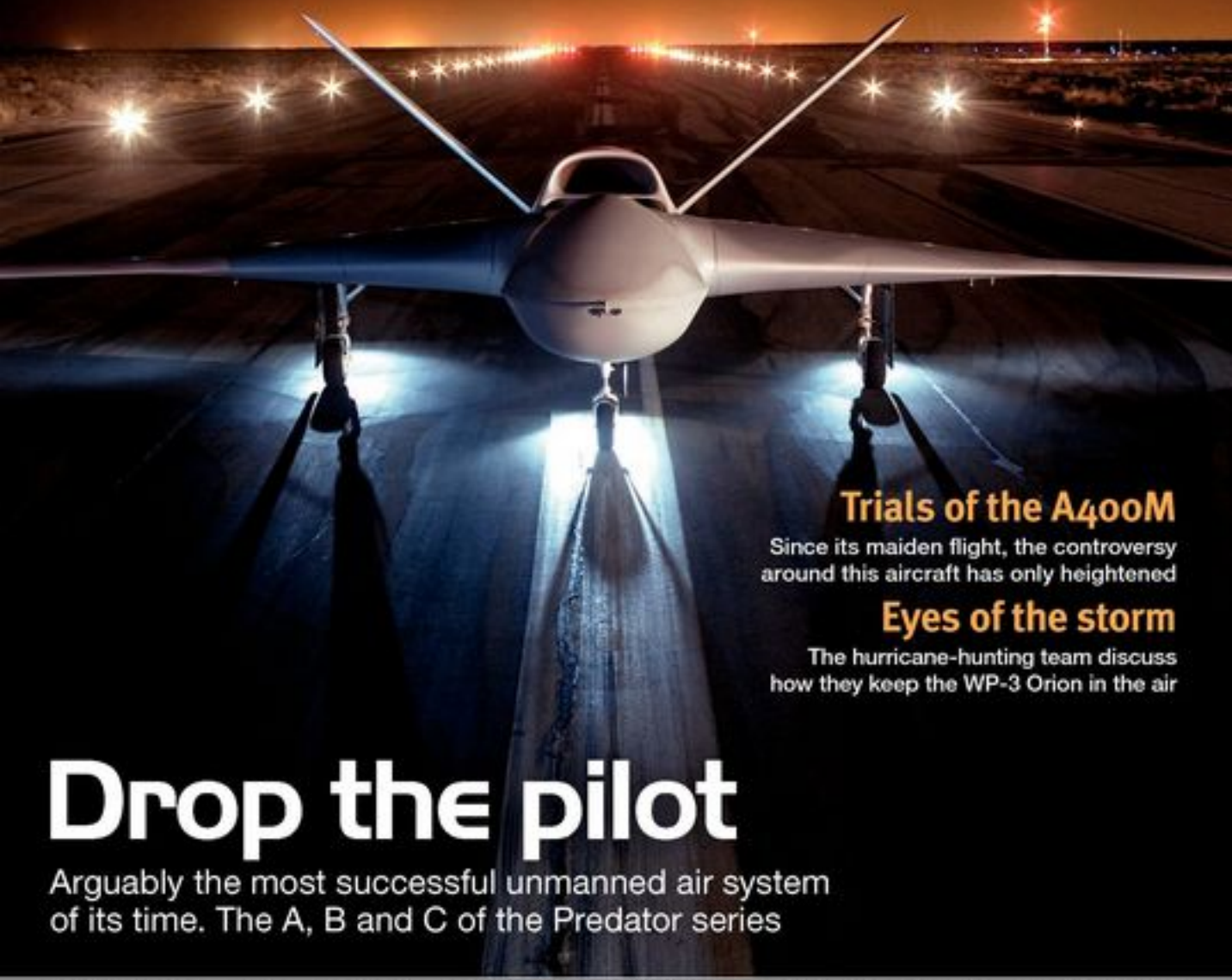


AEROSPACE TESTING INTERNATIONAL



Trials of the A400M

Since its maiden flight, the controversy around this aircraft has only heightened

Eyes of the storm

The hurricane-hunting team discuss how they keep the WP-3 Orion in the air

Drop the pilot

Arguably the most successful unmanned air system of its time. The A, B and C of the Predator series

Air-breaking UAS

THE PREDATOR-SERIES UNMANNED AIRCRAFT SYSTEM IS THE MOST SUCCESSFUL AND CAPABLE CRAFT OF ITS TYPE. IT HAS EVOLVED THROUGH MANY VARIATIONS, TAKING IT TO THE PREDATOR C TODAY

BY SCOTT NYBERG

Since 1993, General Atomics Aeronautical Systems (GA-ASI)'s Predator series unmanned aircraft systems (UAS) have supported US and coalition forces worldwide, amassing over 900,000 cumulative flight hours. Predator series aircraft are currently averaging more than 28,000 flight hours per month, a number that continues to increase.

Providing essential situational awareness for the war fighter, the MQ-1 Predator is used in a variety of combat missions, to include intelligence, surveillance, and reconnaissance; targeting, forward air control; laser designation; precision strike, and bomb damage assessment. First flown in 1994, Predator has accumulated almost 700,000 flight hours, with over 85% of its time

spent in combat operations. It is the first weapon-equipped UAS and features precision air-to-ground weapons delivery capability with Hellfire missiles. The reliable UAS has the highest operational rate in the USAF. Predator is also operational with the US Navy and the Italian Air Force. Selected by *Air and Space Magazine* as one of the top 10 aircraft that changed the world, Predator's success was the catalyst for GA-ASI and subsequent development of the sophisticated Predator B and next-generation Predator C UAS.

Predator B, the overview

Commonly referred to as MQ-9 Reaper by its USAF and UK Royal Air Force customers, the turboprop-powered Predator B was developed with GA-ASI funding and provides greater capabilities than Predator.



The vertically-oriented V-tail of the Predator C deflects radar and shields the 4,000 lb thrust Pratt & Whitney PW545B engine exhaust's infrared signature

First flown in 2001, Predator B is an improvement in performance and reliability of the battle-proven Predator UAS. Featuring operational flexibility, the multi-mission Predator B has an endurance of over 30 hours, speeds greater than 240 KTAS (knots true airspeed), can operate up to 50,000ft, and has a 3,850 lb (1,746kg) payload capacity that includes 3,000 lb (1,361kg) of external stores. It is twice as fast as Predator, carries 500% more payload, and has nine times the horsepower. Predator B provides a long-endurance, persistent surveillance/strike capability for the warfighter.

The aircraft is equipped with a fault-tolerant flight control system and triple redundant avionics system architecture. Predator B is engineered to meet or exceed manned aircraft reliability standards.

Predator B is powered by the flight-certified and proven Honeywell TPE331-10 turboprop engine, integrated with Digital Electronic Engine Control (DEEC), which improves engine performance and fuel economy.

The Predator B multi-mission aircraft is modular and is easily configured with a variety of payloads to meet mission requirements. Predator B is capable of carrying multiple mission payloads to include: EO/IR, Lynx SAR/GMTI, multimode maritime surveillance radar, electronic support measures (ESM), laser designators, and various weapons packages.

This aircraft has been acquired by the USAF, US Navy, US Department of Homeland Security (DHS), NASA, the Royal Air Force (RAF), the Italian Air Force, and soon others.

The development

Development of Predator B began as a GA-ASI funded internal research and development (IRAD) effort in 1998. The goal for the program was to take Predator technology into the jet age – flying higher, faster, and carrying more payload. Both military and commercial applications for Predator B were envisioned and two versions were designed: a turboprop aircraft that could climb to 48,000ft and had 32 hours of endurance, and a turbojet aircraft that could ascend to 60,000ft and had 18 hours of endurance. The first flight of the turboprop-powered Predator B occurred in February 2001. Through agreement with the USAF, the turboprop-powered aircraft was selected over the flight-ready turbo-jet variant. Two of the turboprop prototypes were produced and delivered to the USAF for early deployment.

During January 2004, the USAF initiated Predator B's formal development program, where the aircraft entered the system design and development (SDD) phase. The 'deliverable' from the Predator B program was a complete weapon-equipped system to be used by the USAF.

In February 2006, GA-ASI acted to support the USAF's Predator B Early Fielding initiative. The Air Force wanted an increased capability, production-capable Predator B in the war fighter's hands sooner rather than later, so it approved a rapid production of an early system capability to support the Global War on Terror (GWOT).

To accommodate the requirement, an engineering team rapidly adapted its systems engineering processes to satisfy compressed development, testing, and delivery timelines. In parallel with the early fielding efforts, Predator B SDD work continued simultaneously, with a separate engineering team dedicated to fulfilling the requirements of the SDD contract. This team was responsible for creating the Predator B Block 1. This parallel path enabled GA-ASI to continually mature Predator B's system capabilities, which would later be retrofitted into already-deployed aircraft to improve their system effectiveness.

Predator follows a conventional launch sequence from a semi-prepared surface under direct line-of-sight control. The take-off and landing length is typically 2,000ft



“The team produced and delivered the first developmental Predator B to the USAF less than one month after receiving the early fielding directive”

Execution of the Predator B early fielding effort required close coordination between the USAF and GA-ASI on many developmental aspects of the system. System development tasks had to be re-prioritized and initial Predator B capability requirements established in concert with plans for subsequent phased upgrades. The Air Force and GA-ASI also planned to mitigate the re-allocation of development test (DT) assets. Additionally, the team accelerated technical order, development, and certification. Issues surrounding planning and support for accelerated training and logistics were also resolved.

Early fielding success

Responding to the service's urgent request, the team produced and delivered the first developmental Predator B to the USAF less than one month after receiving the early fielding directive. The second Predator B with early fielding capability was delivered the following month in March 2006. Two additional early fielding configuration aircraft were delivered in February 2007.

The parallel development effort, the Predator B Block 1 program, was delivered in March 2007. Following that, GA-ASI doubled its monthly aircraft production rate.

The team's engineering ingenuity, resourcefulness, and focused commitment were critical to success of the early fielding initiative. Shades of the program remain as the SDD program is still progressing concurrently with continued aircraft production and deployment. As such, the company continues to manage capability insertion as it is developed.

The warfighter

Predator B has revolutionized the battlefield, providing operators with 24/7 all-weather/day-night persistent situational awareness, combined with an onboard precision strike capability – and all without putting a pilot at risk. Its 30-hour airborne endurance and wide-area intelligence/surveillance/reconnaissance (ISR) coverage capabilities provide an unblinking eye in the sky, giving warfighters an unprecedented transparency across the battlefield.

Predator B's streaming video can be shared with forces on the ground, as well as with

A weapons bay allows internal carriage of 500 lb bombs with GBU-38 JDAM tail kit and laser guidance system



higher headquarters, ensuring that potential threats are visible to forces in proximity. Similarly, its Lynx Synthetic Aperture Radar provides continuous high-resolution photographic-quality images in any weather. A true force multiplier, Predator B's ISR capabilities enable it to relieve manned aircraft less well-suited to the task. It has demonstrated the ability to independently find, fix, track and, if required, conduct a time-sensitive strike against a fleeting target, or support the timely engagement by a manned aircraft.

Predator B provides warfighters with the size, weight, and power to integrate multiple payloads simultaneously, with capacity for growth through an open modular architecture. Acquisition by coalition forces further enhances training, support, and logistic synergies accrued through interoperable aircraft systems.

Supporting civil missions

In addition to military missions, Predator B is operated by US DHS to safeguard national borders and (soon) its maritime approaches from illicit activities. The same Predator B airframe can be re-purposed quickly into a maritime surveillance configuration with the addition of a digital 360° surface search radar. The craft's maritime surveillance capability has supported mission demonstrations for US Customs and Border Protection, the US Navy, US Coast Guard, Canadian Defence Forces, and the Australian government.

DHS has employed Predator B in a variety of crisis response missions following hurricanes and floods, leveraging the aircraft's surveillance capabilities to conduct damage assessments, help locate survivors, and assist



in disaster recovery efforts. NASA uses its Predator B with a sophisticated infrared sensor on its wing to map the intensity and movement of large fires, sharing the information to ensure best use of firefighting resources and streaming video to firefighters on the ground for expanded situational awareness and increased safety.

Predator C

Similar to Predator B, Predator C Avenger was developed through funding of GA-ASI. Its unique design, reduced signature, and speed increases its survivability in higher threat environments and provides potential customers with an expanded quick-response armed reconnaissance capability. The first flight of Predator C occurred in April 2009. The aircraft is currently in flight test.

The high-speed, multimission Avenger is a long-endurance, medium- to high-altitude UAS

that can perform wide-area surveillance, time-sensitive strike missions over land or sea, and a host of other challenging military missions. The aircraft has much higher operational and transit speeds than other Predator series aircraft, resulting in quick response and rapid repositioning for improved mission flexibility and survivability.

Avenger is an advanced next-generation UAS. The jet-powered Predator C is equipped with a Pratt and Whitney PW345B turbofan engine capable of producing 4,800 lb installed thrust. The engine is designed for greater fuel economy and features class-leading fuel consumption components. Avenger can operate at speeds up to 400 KTAS, a maximum altitude of over 50,000ft (15,240m), and has 20 hours of endurance. Its payload capacity enables it to carry multiple sensors, while its weapons bay can house 3,000 lb of precision munitions.

The Avenger employs the same materials and avionics as Predator B and is likewise controlled from and fully interoperable with GA-ASI ground control stations. Avenger's low cost and advanced capabilities make it a good choice for swarm tactics where affordable quantities count in a successful outcome.

GA-ASI now expects to get the go-ahead from FAA to start tests of the Predator C Avenger at Edwards Air Force Base test range in California. According to reports chairman and CEO Neal Blue, "We anticipate receiving approval from the FAA in the immediate future to fly into the Edwards AFB range so that we may complete full envelope flight testing." ■

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