



THE SKY'S [NOT] THE LIMIT

General Atomics Aeronautical Continues to Push RPAS Boundaries



Certi fiable Predator B: Enabling

Firefighting. Flood monitoring. Border patrol. Humanitarian assistance. Manufactured by General Atomics Aeronautical Systems, Inc. (GA-ASI), Predator® B Remotely Piloted Aircraft Systems (RPAS) conduct these and many other challenging missions in support of domestic operations within the U.S. National Airspace System (NAS) on a routine basis, and have done so for over a decade. Predator B has reshaped the aviation landscape within America's borders and has been accepted in the NAS because it is reliable and has an instrument-rated pilot-in-the-loop. The U.S. Government's interest in this aircraft continues to soar primarily due to the military's successful routine use of Predator B/MQ-9 Reaper® in a variety of operating environments worldwide. Since this particular RPAS is remotely operated, the aircraft has become America's go-to aviation asset, allowing the military to facilitate dangerous long-endurance missions without risk to pilots' lives. Additionally, Predator B can remain airborne for over a day – far greater than manned jets.

Federal agencies continue to lean on Predator B in the NAS for its life-saving capabilities. NASA's Ikhana (Predator B) was used extensively to aid local firefighters in Southern California in 2007. Since 2005, the U.S. Department of Homeland Security has operated Predator B to help monitor the U.S. northern and southern borders, as well as the



Installation of the Due Regard Radar, distinguished by a reshaped nose, provides non-cooperative air traffic detect-and-avoid capability

western Atlantic and Caribbean Sea. Predator B serves as a force-multiplier and regularly performs border surveillance missions in the NAS under Certificates of Authorization (COAs).

While Predator B has saved scores of lives in America supporting civil authorities, it was designed originally to answer military needs – often satisfying urgent national requirements – and has amassed over one million flight hours in operational service

with Air Forces of the U.S., UK, Italy, and France.

Certi fiable Predator B – Enhancing RPAS Reliability and Airworthiness

In order to fully exploit Predator B's ever-expanding capabilities, it must be capable of operations in non-segregated airspace, integrating seamlessly with manned aircraft. It follows that Predator B must be certified to meet similar "design and build" safety standards and requirements as manned aircraft, and have systems that are equivalent to the "see-and-avoid" capability of an on-board pilot, such as a Detect-and-Avoid (DAA) system. GA-ASI has developed the Certifiable Predator B (CPB) RPAS to meet these goals.

GA-ASI's Certifiable Predator B aircraft will meet the requirements of its European customers, and, in cooperation with the FAA, will subsequently meet American domestic airworthiness certification standards.

GA-ASI designed CPB in order to offer a certifiable RPAS, and in doing so, significantly extended Predator B's already impressive endurance and range, further increasing its operational flexibility. CPB's 79-foot wing span accommodates an increase in endurance from 27 to over 40 hours. The wings integrate two additional hardpoints, increasing the number of external stores/payload-carrying stations to nine (four under each wing and one under the centreline).



Predator B testbed flying with the long-span wings that provide Certifiable Predator B with over 40 hours of flight endurance

Operations in National Airspace



CPB's design is driven by the needs of U.S. and European airworthiness regulations. The aircraft's parts and materials are traced via a "paper trail" that explains their manufacturing processes. For example, the RPAS uses approved materials to extend its fatigue life that enhance its maintainability, while extending the airframe's design life from 20,000 to 40,000 flight hours.

Additional hardware and software upgrades are being made, such as a flight data recorder, more robust flight control software, and anti-icing/de-icing systems, allowing operations in adverse weather. Additionally, the aircraft is designed to survive bird and lightning strikes.

CPB also features an Automatic Takeoff and Landing System (ATLS) based upon GA-ASI's Gray Eagle ATLS, which has conducted tens of thousands of successful take-offs and landings.

Certifiable Predator B is highly modular and is easily configured with a variety of payloads to meet mission requirements. The aircraft includes a state-of-the-art DAA system radar developed by GA-ASI called the Due Regard Radar (DRR) that ensures safe separation with non-cooperative aircraft.

Keys for Unlocking International Airspace Access: Certifiable Predator B and DAA/DRR

While aircraft position-transmitting systems integrated into CPB (such as Traffic Alert and Collision Avoidance System (TCAS) and

Automatic Dependent Surveillance – Broadcast (ADS-B)) enable detection and avoidance of like-equipped aircraft, not all aircraft are fitted with such position-transmitting systems. The GA-ASI developed DRR compensates for this by enabling detection and avoidance of aircraft not equipped to transmit TCAS or ADS-B signals. In fact, the DRR is able to detect aircraft at ranges greater than a pilot's eyes would allow, increasing airborne safety. TCAS, ADS-B and DRR system information combine to provide the pilot with avoidance advisories in the ground control station, giving the pilot situational awareness across the same field-of-view as that of a manned aircraft. The DAA system's avoidance advisories allow manoeuvring by the pilot or automatically, ensuring safe separation of aircraft.

Developed on GA-ASI internal funding, DRR will enable Certifiable Predator B to meet the requirements to fly in non-segregated airspace. DRR is comprised of a two-panel Active Electronically Scanned Array (AESA) antenna and a Radar Electronics Assembly (REA). AESA technology allows the DRR to track multiple targets while simultaneously continuing to scan for new aircraft.

GA-ASI has partnered with the FAA, NASA, and several other aerospace companies to ensure that a DAA capability becomes reality. NASA is providing its Predator B "Ikhana" aircraft for DAA testing while the

FAA's Airborne Collision Avoidance System-X unmanned (ACAS XU) RPAS collision avoidance algorithm leverages GA-ASI's DRR to detect and track non-cooperative aircraft.

GA-ASI is leading the design, development, and flight-testing of a full DAA capability in concert with an enhanced command and control data link technology, both of which will be integrated into CPB. The DAA and the enhanced data links will be standardized in the U.S. Additionally, the DAA and data links will be evaluated in support of NASA, which is gathering the critical data necessary for the FAA to finalize its technical standards for RPAS flight within the NAS.

In the summer of 2015, GA-ASI flew the company's prototype DAA system on-board NASA's Ikhana aircraft. NASA will conduct future tests in the summer of 2016, for which DRR will be integrated, demonstrating a standardized system. Notably, GA-ASI's TCAS II is auto-coupled to Ikhana's triple redundant flight computer to enable automatic collision avoidance manoeuvres, and could prove critical in the unlikely event that the data link is lost. To address this issue and to increase data link reliability, GA-ASI is standardizing both Line-of-Sight (LOS) and Beyond-Line-of-Sight (BLOS) satellite communication systems for command and control by making them more robust, as well as helping to define protected aviation frequency systems.

Key Characteristics Comparison

Distinguishing Elements	Predator B Block 5	CPB / Guardian Eagle
Maximum Gross Take-Off Weight	10,500 lbs (4,763 kg)	12,500 lbs (5,670 kg)
Wing Span	66 ft (20 m)	79 ft (24 m)
Length	36 ft (11 m)	38 ft (11.6 m)
Fuel	3,764 lbs (1,707 kg)	5,972 lbs (2,708 kg)
Endurance	27 hrs	>40 hrs
Automatic Take-off and Landing System	No	Yes
De-ice	No	Yes
Lightning Protection	No	Yes
Fire Detection and Mitigation	No	Yes
Active Lift Control (spoilers)	No	Yes
Certifiable materials and processes	No	Yes
Damage tolerant airframe and radomes	No	Yes
Flight Data Recorder	No	Yes
Detect and Avoid System	No	Yes

Certifiable Predator B: Meeting the Standards for European Airworthiness Certification



GA-ASI developed Certifiable Predator B to meet the airworthiness certification requirements of its European customers. The company has collaborated with RUAG and the LufABw (military aviation authority) in Germany. The lead customer of CPB is the United Kingdom, which currently operates MQ-9 Reaper. GA-ASI has been involved with the UK on RPAS certification issues, including a two-year risk assessment/reduction contract under the Ministry of Defence (MoD) Scavenger programme, which was subsequently renamed Protector. These efforts continue to support the expected procurement of 20 or more platforms.

As a baseline for the development of CPB, GA-ASI began with the technical airworthiness requirements set out in NATO and U.S. standards. When designing CPB, GA-ASI also factored in the safety requirements of

the UK's MAA (Military Aviation Authority) for overall system design. Stakeholders in the MAA approval process include the UK Civil Aviation Authority (CAA) and the National Air Traffic Service (NATS).

While these agencies are UK-specific, they work closely with pan-European organizations such as EASA (European Aviation Safety Agency). RPAS certification is the responsibility of each nation, and each country works to similar guidelines within the overall NATO and EASA framework.

Certifiable Predator B Proof-of-Concept Takes Off

In February 2016, GA-ASI conducted the first flight of Predator B Extended Range (ER) Long Wing, retrofitted with improved long-endurance

wings featuring greater internal fuel capacity and additional hardpoints for carrying external stores. Its 79-foot wing additionally serves as proof-of-concept for Certifiable Predator B and represents the first of its airframe components to be produced. GA-ASI plans to conduct a series of flight tests of a prototype CPB aircraft in 2016, leading to the first flight of a production aircraft.

Currently operating worldwide, Predator B represents a proven capability. Flying around-the-clock, the aircraft delivers persistent surveillance and essential situational awareness for defence forces worldwide, as well as for first responders and border agents in America. Building upon the success of Predator B, the development of Certifiable Predator B promises to push RPAS technology to new frontiers.

General Atomics Aeronautical Systems, Inc.

Christopher Ames, Rear Admiral, U.S. Navy (Ret.)
Regional Vice President, International Strategic Development, Europe
christopher.ames@ga-asi.com
+1 (858) 525-6388



www.ga-asi.com