

MQ-9B SkyGuardian



General Atomics Brings the Future of Unmanned Systems to JUSTAS

BY JOETEY ATTARIWALA

Canadian defence requirements have long articulated the need to augment Canada's persistent ISR and strike contributions supporting the defence of North America and deployed operations. Currently, Canada has no persistent UAS capability to support domestic or expeditionary coalition tasking.

Canada's JUSTAS (Joint Unmanned Surveillance and Target Acquisition System) Project has been tasked with finding a solution to this "need". Prime Minister Justin Trudeau recently responded to questions regarding Canada's potential use of "drones" saying, "We've looked at a broad range of tools and opportunities that we have, to invest in the kinds of things that are going to be necessary in the future."

General Atomics Aeronautical Systems, Inc. (GA-ASI) is offering its new MQ-9B SkyGuardian as a certifiable solution to this long-standing requirement. "With Canada's

new defence policy, we believe MQ-9B SkyGuardian is the best solution to deliver multi-mission capability, a sustainable Arctic presence, interoperability with existing Royal Canadian Air Force [RCAF] assets and Five Eyes [FVEY] and NATO allies, all with low acquisition cost and sustainment," said David Alexander, GA-ASI's president of Aircraft Systems.

In addition to addressing the Canadian security requirement, GA-ASI will also involve Canadian industry in sustainment of the system and development of new capabilities for MQ-9B and other Predator series systems.

UNMATCHED CONFIGURABILITY

As a truly multi-mission aircraft, the MQ-9B SkyGuardian and its nine hardpoints offer unmatched configurability to meet an operator's mission requirements. In a basic ISR configuration, the MQ-9B will likely have an L3 WESCAM MX series EO/IR sensor, a high performance 360° multi-mode maritime radar to support Arctic patrol and maritime surveillance missions, and the GA-ASI Lynx Multi-mode Radar.

With type certification being a key operating feature for a MALE (Medium Altitude Long Endurance) UAS within civil airspace,



GA-ASI President Dave Alexander (center) and CEO Linden Blue (right) hosted a group international dignitaries in January 2017 for the unveiling of the MQ-9B SkyGuardian at the GA-ASI test facility in Gray Butte, Calif.

GA-ASI began looking at the feasibility of certifying the MQ-9A. The result was that this option would be too invasive and cost-prohibitive. The company embarked on an internal investment to improve upon the system architecture of the MQ-9A and develop the brand new, type-certifiable MQ-9B SkyGuardian, which has now been officially designated MQ-9B PROTECTOR by the U.S. Air Force (USAF) and U.K. Royal Air Force (RAF), both of which are part of the Five Eyes alliance, along with Canada.

The MQ-9B SkyGuardian is GA-ASI's most advanced Remotely Piloted Aircraft (RPA) to date, leveraging the mature system architecture of the legacy MQ-9A operated by the USAF, and it incorporates additional capabilities and enhancements supporting mission capability, global industrial expertise, and unfettered access to national and international airspace. Current MQ-9 series users include the United States, United Kingdom, Italy, France and Spain.

The MQ-9B's NATO STANAG 4671-compliant design includes lengthened 24m wings with provisions for additional

fuel, lightning protection, anti-ice and de-ice, Automatic Takeoff and Landing Capability (ATLC), multi-band redundant Beyond Line-of-Sight (BLOS) communications, and Sense and Avoid (SAA) and Due Regard Radar (DRR) Systems. The MQ-9B SkyGuardian's type certifiable design, its FVEY/NATO interoperability, and its system architecture is all based on over 2 million flight hours for the MQ-9A family of aircraft.

SPECIAL MARITIME CONFIGURATION

The MQ-9B can also be configured for maritime operations. GA-ASI developed a maritime radar kit containing a 360° multi-mode maritime radar fielded on U.S. Department of Homeland Security Predator B aircraft. This same kit can also be fitted to MQ-9B's centerline hardpoint. SkyGuardian can support a host of maritime radars facilitating long-range surveillance, coastal surveillance, small target detection, and search and rescue operations and the maritime kit can host a range of radars, including those manufactured by Raytheon

or SELEX. Maritime configured aircraft would also be fitted with the Automatic Identification System (AIS) transponder to aid in the positive identification of vessels.

The MQ-9B can also be configured for Signals Intelligence (SIGINT) missions. Payloads can include Electronic Support Measures (ESM), Radar Warning Receivers (RWR), and a variety of SIGINT packages. The aircraft will also be capable of using the Link-16 military tactical data exchange network.

Future capabilities for the MQ-9B include communications relay, anti-submarine warfare, electronic attack, ballistic missile defence, and more. Weapons capability will be available on the MQ-9B SkyGuardian and will leverage the proven precision strike capability of the MQ-9A Reaper which is typically armed with 500-pound GBU-12 Paveway II laser guided bombs, and/or AGM-114 Hellfire missiles.

"MQ-9B fulfills a number of the objectives laid out in the recently released Canadian Defence Policy, but the benefits it brings goes way beyond that," Aria Mahdion, GA-ASI Business Development Lead for Canada,



SkyGuardian builds on the success of previous GA-ASI RPAs like the MQ-9A Reaper, seen here

Photo: Joetey Attariwala

recently told CDR. "It would provide Canada with a new low cost/high value capability that supports civil and military applications, and its Arctic patrol mission would be a significant contribution to NORAD."

The primary mission of JUSTAS will be the defense of Canadian territory, including the Arctic and maritime approaches.

DEFENDING CANADA'S ARCTIC

In an interview with CDR earlier this year, Lieutenant General Michael Hood, Commander, Royal Canadian Air Force, responded to a question regarding the status of the JUSTAS project this way, "You've probably heard me say I have not been disappointed with the fact that the program was delayed because of the uniqueness of the Canadian environment and the Arctic, and off our coasts. Technology is now increasing, certainly in the MALE type UAVs where we see solutions that would work in the environmental conditions that we would have to operate."

And, it's true, the challenges that JUSTAS faces in the Arctic include sub-zero

temperatures, limited high-bandwidth SATCOM coverage, and inhospitable conditions that prevent traditional staffing and logistics approaches. Designed for all-weather operations, the MQ-9B specifically addresses these challenges in the Arctic. It is equipped with a proven ice protection system and while MQ-9B is not yet fielded, the wing and tail electro-expulsive de-ice and engine air inlet anti-ice capabilities have been successfully employed with the U.S. Military.

Furthermore, MQ-9B offers a BLOS SATCOM data-link capable of operations above 70° north, while maintaining command and control from anywhere on earth. MQ-9B's 3,000 nautical mile mission radius combined with a new BLOS ATOL system allows for launch and recovery of the aircraft from a hospitable forward operating base. The BLOS ATLC reduces the crew needed at the launch and recovery site.

"Reduction in manpower is a big consideration for operators," said GA's Mahdion. "We feel the SATCOM launch and recovery capability, coupled with a small expeditionary footprint will yield significant

savings to all operators, and that's important when operating over the long distances you have in Canada. The Mission Control Element



CAE's Armstrong says his company's partnership with GA-ASI makes the MQ-9B SkyGuardian "the ideal platform for conducting surveillance and delivering the combat capability Canada needs for the JUSTAS program"



This MQ-9B SkyGuardian flew from Laguna Airfield at Yuma Proving Grounds, Ariz., through U.S. National Airspace, to GA-ASI's Gray Butte Flight Operations facility near Palmdale, California and the flight represented an important step towards SkyGuardian certification

and associated satellite infrastructure could be established at the Main Operating Base, negating the need for satellite infrastructure at the Forward Operating Bases [FOB]."

REDUCING MANNING AT FOB

SkyGuardian will incorporate SATCOM Auto Takeoff and Landing Capability (ATLC), and divert capability to help minimize the aircraft's Launch and Recovery Element (LRE) footprint, thereby reducing manning requirements at FOB. This capability would allow Canada to operate the SkyGuardian from a Main Operating Base and only require a small team of maintainers with a laptop at expeditionary or FOB bases. The benefit is that all pilots and sensor operators can be centrally located and can work from a certifiable Ground Control Station (GCS). The certifiable GCS works by segregating flight critical systems from the aircraft's mission systems. The GCS can support manual pilot-in-the-loop to fully automated operations.

MQ-9A aircraft currently operate on a Military Flight Release (MFR) scheme, which is restrictive in the national airspace because

there is no type certification behind the aircraft. This greatly limits where these aircraft can fly in domestic or friendly airspace.

Conversely, if an aircraft is certified, a country can issue a Military Flight Certificate that allows it to conduct "file and fly" operations in domestic airspace. In essence, certification is an enabler to access national airspace systems, and offers greater flexibility and capability than what an MFR provides. Of course, this issue is relatively moot when it comes to military combat operations since the military would control the airspace and provide aircraft separation.

However, this becomes much more complex when a system like the MQ-9B and its 6,000 nautical mile ferry range comes into play. This kind of range means it could travel through multiple controlled / country airspaces prior to even getting on station for a military operation. For domestic operations, the value of certification means an aircraft can integrate into national airspace and would no longer have to segregate from manned aircraft enabling a variety of civil mission applications.

A GROUND-UP REDESIGN

The MQ-9B is a ground-up redesign of the previous variants in order to achieve certifiability to fly in non-segregated airspace and to integrate seamlessly with manned aircraft. GA-ASI expects the SkyGuardian to achieve certification in 2019, when the aircraft will initially meet NATO STANAG-4671 airworthiness standards, and will subsequently meet domestic airworthiness certification standards in cooperation with the U.S. Federal Aviation Administration (FAA). This is no small feat as numerous technologies and design attributes need to be consistent for production aircraft.

To ensure certifiability, GA-ASI has had to change some of its manufacturing methods in order to have repeatable processes and procedures, and it has also changed some of the composite materials it uses. To significantly improve the integrity of the airframe, all MQ-9B aircraft will be constructed with certified composite materials using riveting and bonding processes that yield a service life of

40,000 hours, which is double that of the MQ-9A aircraft.

In order to meet STANAG-4671, FAA, and European Aviation Safety Agency (EASA) requirements for all-weather capability, MQ-9B incorporates de-ice, anti-ice, and lightning protection. These are essential capabilities required for a certifiable aircraft to operate in the national airspace, and is particularly important in countries like Canada, where the weather can be harsh and often unpredictable.

ROBUST SUITE OF SENSORS

MQ-9B also incorporates a very robust suite of sensors for its Detect and Avoid system to operate in non-segregated airspace. These consist of Traffic Collision Avoidance System (TCAS), Automatic Dependent Surveillance-Broadcast (ADS-B), and an optional Due Regard Radar (DRR) system. These systems combine to provide the pilot with avoidance advisories in the GCS, thereby giving pilots situational awareness across a similar field-of-view as that of a manned aircraft.

"We are working with NASA and the FAA to validate the recently released Minimal Operation Performance Specification for UAS (Unmanned Aircraft System) flight in the national airspace," said Mahdion. "Our system is being used to validate that, and we anticipate that we'll be the first to complete and certify our Detect and Avoid system with Due Regard Radar."

The SkyGuardian's wings have been extended to 79 feet in order to accommodate additional fuel capacity and provide greater lift. This yields a flight endurance in excess of 40 hours. The wing extension also adds two additional hardpoints for a total of nine external stations that can accommodate a maximum external payload of 4,000 pounds.

"The new wing allows us to carry 6,000 pounds of fuel," said Mahdion. "We recently completed an endurance test flight of our prototype MQ-9B aircraft in an optimized ISR configuration [EO/IR sensor and radar] where we achieved a 48.2 hour flight. We're now beginning to measure endurance not in hours, but in days."

The company is also working with some big names in Canadian aerospace, including CAE, L3 WESCAM, GD Mission Systems and Pratt & Whitney Canada to deliver new and proven capabilities for GA-ASI's entire customer base. Key among the company's partners is CAE, who will provide in-service support and a comprehensive training solution for the JUSTAS Program.

Joe Armstrong is vice-president and general manager at CAE and for this report he told CDR, "CAE and General Atomics have established a close partnership in developing training solutions for GA-ASI's family of remotely piloted aircraft." He explained, "Our experience and expertise in operational and in-service support combined with world-class training solutions will help make the MQ-9B SkyGuardian the ideal platform for conducting surveillance and delivering the combat capability Canada needs from the JUSTAS program."

CAE PROVIDES MRO AS WELL AS TRAINING & SIMULATION

"CAE is our partner for simulation and mission training opportunities around the world," said Ben Brookshire, GA-ASI Industrial Cooperation and Offsets. "CAE's training expertise is a natural solution to meet the growing demand of our global customers."

GA-ASI will look to L3 WESCAM, based in Burlington, Ontario, to provide the EO/IR sensor that will supply the classic video footage relied upon by operators and decision makers. Integrating WESCAM's MX series EO/IR sensor also opens up global opportunities with other MQ-9B operators.

GA-ASI is also working closely with General Dynamics Mission Systems Canada. "We are integrating GD Canada's leading technologies to develop new mission capabilities not yet offered on any UAS," said Brookshire.

Canadian industry already holds a critical position in the future of General Atomics' next generation of UAS. Pratt & Whitney Canada jet engines power GA-ASI's Predator C Avenger aircraft today, and could power their forthcoming solution for the U.S. Navy's carrier launched MQ-25 Stingray program tomorrow.

The launch customer for the SkyGuardian is the United Kingdom which refers to the system as MQ-9B PROTECTOR. CDR spoke to Royal Air Force Group Captain Lyndon Jones, Program Director – PROTECTOR about his country's experience with SkyGuardian, "We're just about to enter 100,000 hours of operation with the Reaper, so we have lots of experience. We have been tasked with a follow-on deep and persistent ISTAR [Information, Surveillance, Target Acquisition and Reconnaissance] capability for the future that looks to the mid-2030's. So we're looking for long range, persistent wide-area surveillance, and the same precision strike

capability as we have on our Reaper. We also had a requirement that we wanted it to be certifiable, so a study was conducted and the certifiable Predator B was the only viable option that we could see for us to achieve the military type certification we need here in the UK."

THE RAF EXPERIENCE

According to the RAF, an aircraft needs to be certifiable to operate in UK airspace. From that perspective, the Military Aviation Authority needs to approve everything from the start of the design and all the way through manufacture, and to be able to underwrite its safety to be able to operate in unrestricted airspace.

"Being in right at the start with General Atomics gives us that opportunity to be able to meet all of the stringent UK laws and regulations that surround this to be certified. I know lots of countries are watching us do this, because they know that if we are able to meet the UK's stringent regulations then it will meet them anywhere else in the world," said Jones.

According to Gp Capt Jones, the "sovereign capability" was also a key factor in the UK selecting PROTECTOR. He explained, "That will allow us to put UK weapons onto the aircraft. At this moment in time we're planning on putting on MBDA's Brimstone which is a precision guided low collateral missile which has been very successful on other UK platforms. We're also looking at Raytheon's Paveway IV 500-pound class munition. Those are the two main weapons, but the best thing about PROTECTOR is we're looking to get the architecture right, so we know that if we want to, we can integrate many types of weapons onto that platform. We believe the design is right to be able to achieve that."

It's clear that once certified, the SkyGuardian will become the gold-standard for MALE RPAs. General Atomics has done painstaking work here to allow it to run the gauntlet of regulatory barriers with the ultimate goal of achieving success in certification which will allow the aircraft to safely operate in the national airspace. The United Kingdom may be taking the lead as the launch customer, but certainly Canada and Canadian industry could benefit by adopting the SkyGuardian for the JUSTAS project. ■

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