MQ-9B SeaGuardian®

Dominating the Skies, Securing the Seas

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White Paper

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Executive Summary

The purpose of this white paper is to inform Canada's Department of National Defence of the MQ-9B SeaGuardian® by General Atomics Aeronautical Systems, Inc. (GA-ASI) and demonstrate why it is an ideal solution for maritime defence in a time of rising global tensions. As worldwide disputes escalate, the demand for advanced defence systems continues to grow.

Canada has extensive maritime responsibility, spanning the Atlantic, Pacific, and Arctic oceans. With this crucial duty, Canada must protect its sovereignty, economic interests, and maritime environment. As geopolitical tensions and climate change increasingly affect the Arctic region, Canada must reinforce the North while aligning with its defence policy of deterrence. Additionally, modernizing polar defence capabilities supports Canada's broader goal of achieving the North Atlantic Treaty Organization (NATO) benchmark of allocating two percent of its gross domestic product (GDP) to military spending.

Canada's current patrol methods to monitor Arctic waters can be strengthened through the acquisition of the MQ-9B SeaGuardian® by GA-ASI. SeaGuardian is the first remotely piloted aircraft system (RPAS) in its class to have anti-submarine warfare configurations that can address the increasing threat of enemy submarines in Arctic waters.

SeaGuardian has several features that can benefit the reach and responsiveness of the Canadian Armed Forces (CAF) in the North:

- Seamless integration in military and civil airspace
- Reliable, all-weather surveillance and identification capabilities
- Total visual situational awareness 24/7, specifically useful in low-light conditions
- Intelligence, surveillance, and reconnaissance (ISR) data collection improves tactical decision-making by gathering information on selected emitters
- Proactive submarine detection with the ability to classify and track submarines
- Persistent submarine tracking and enhanced underwater surveillance
- Safe and reliable operations in a polar environment

In addition to these benefits, SeaGuardian overcomes many of the limitations of Canada's current methods to monitor Arctic waters. SeaGuardian has more on-station time, lower operational costs, and greater fuel savings when compared to manned maritime patrol aircraft.

While SeaGuardian does not replace manned methods to patrol Arctic waters, it is a versatile, highly modular RPAS that can be used by the CAF to enhance its manned-unmanned polar missions and overall reach and responsiveness in the region. GA-ASI has developed SeaGuardian, the first RPAS of its kind, which has anti-submarine capabilities, longer endurance, lower operational costs, and greater fuel economy.

For more information on SeaGuardian, please visit: https://www.ga-asi.com/remotely-piloted-aircraft/mq-9b-seaguardian

For General Business and Media Inquiries with GA-ASI, please call: (858) 455-3000

Glossary

Acoustic Signature	Sound characteristics emitted by an object, such as a submarine, in an underwater environment. It is used for the detection and identification of sonar operations.
Automatic Identification System (AIS)	Part of the Maritime Wide Area Search (MWAS), it is a tracking system used for target correlation and identification. It is useful for maritime purposes to identify a ship's name, type, origin, destination, and configuration.
Baseline	Low-water lines along the coast, islands, rocks, and low-tide elevations that act as a reference point for measurements of areas of the sea.
Electronic Support Measures (ESM)	A military intelligence technique used for electromagnetic surveillance.
Electro-optical Infrared (EO/IR) Imaging System	A sensor technology that spans both visible and infrared wavelengths to capture visual and thermal imaging.
Exclusive Economic Zone (EEZ)	An area of the sea that includes and ranges beyond the territorial waters. It extends 200 nautical miles from the baselines. A state has sovereign rights to this area.
Icebreaker	A ship that is designed to break a channel through ice.
Intelligence, Surveillance, and Reconnaissance (ISR)	An integrated intelligence and operations function for military applications. It refers to the coordination acquisition, processing, and provision of information.
Lynx Multi-Mode Radar	A radar system that provides high-resolution imagery that can be captured through clouds, rain, smoke, fog, or dust.

Maritime Wide Area Search (MWAS)	A mode of the Lynx Multi-Mode Radar that can detect ship traffic and integrates Automatic Identification System (AIS) information. It is used for maritime operations, including coastal surveillance, search and rescue operations, and long-range surveillance.
Remotely Piloted Aircraft System (RPAS)	An unmanned aircraft that is piloted from a remote ground control station. It can be equipped with a variety of mission kits, including anti-submarine warfare.
Signals Intelligence (SIGINT)	Intelligence derived from electronic signals and systems used by foreign targets.
Sonobuoy	A floating device that is dropped from aircraft or ships that use sonar to detect underwater submarines.
Sonobuoy Dispensing System (SDS) Pod	An airborne device attached to SeaGuardian's wing station designed to store and release sonobuoys.
Sonobuoy Monitor and Control System (SMCS)	An integrated platform on SeaGuardian to manage the deployment, operation, and data processing of sonobuoys.
Tactical Data Link	Secure communication protocols used in the military to exchange information between platforms and command units.
Territorial Waters	An area of the sea that extends 12 nautical miles out from the baselines. It is a part of a state's sovereign territory.

1. Introduction

The purpose of this white paper is to inform Canada's Department of National Defence of the MQ-9B SeaGuardian® and demonstrate why it is an ideal solution for maritime defence in a time of rising global tensions. As worldwide disputes escalate, the demand for advanced defence systems continues to grow.

Today, more than 110 armed conflicts affect several regions around the world [1]. In the last four years, global conflict has increased by 64%, notably with the start of three major conflicts in Ukraine, Gaza, and Myanmar coupled with ongoing violence in countries with high rates of conflict [2]. Conflict rates have continued to deteriorate since last year and over the past five years [2]. Global unrest is rising with a growing number of regions facing heightened levels of conflict and instability.

Amid this atmosphere of global uncertainty, Canada updated its defence policy with the release of *Our North, Strong and Free: A Renewed Vision for Canada's Defence* in the spring of 2024. This policy recognizes Canada's need for a strong military to address increasing global instability and rapid technological advances. The defence policy review determined that the threats identified in its 2017 policy *Strong, Secure, Engaged* are escalating and evolving faster than expected [3]. In response, Canada is making new investments to meet these expanding demands.

More than ever, Canada is realizing the call for increasing military spending. Canada will spend an estimated 1.37% of its GDP on defence in 2024 [4]. Over the course of the 2024 NATO Summit, Canada faced mounting pressure from NATO allies to reach the defence spending target of two percent of GDP as part of its international obligations. On the final day of the NATO Summit, Prime Minister Justin Trudeau announced Canada's commitment to meet the NATO two percent spending target by 2032.

The rise of global conflict and NATO two percent highlight the need for innovative military technology. The acquisition of SeaGuardian would contribute to the broader strategy of meeting Canada's defence spending goals while enhancing its military capabilities. Investing in SeaGuardian would be cost-effective and operationally efficient, offering advanced capabilities to address emerging threats in maritime security.

This white paper will explore the following sections:

- Canada's Need to Modernize Maritime Defence
- Introducing MQ-9B SeaGuardian®
- Features and Benefits of MQ-9B SeaGuardian®

2. Canada's Need to Modernize Maritime Defence

The challenges facing the Arctic, including climate change and an increasing presence of foreign actors, are driving the need to modernize maritime defence in the North while aligning with Canada's defence policy of deterrence and holding to its commitment to NATO's two percent target.

2.1 Canada's Extensive Maritime Responsibilities

Canada has the longest coastline in the world. Its territorial waters extend 12 nautical miles (about 22.2 km) from the baselines. Beyond the territorial waters, Canada has an exclusive economic zone (EEZ) that spans 200 nautical miles (about 370.4 km) from the baselines, covering areas of the Atlantic, Pacific, and Arctic Oceans (Figure 1). Canada has sovereign rights to explore and economically exploit the EEZ [5].

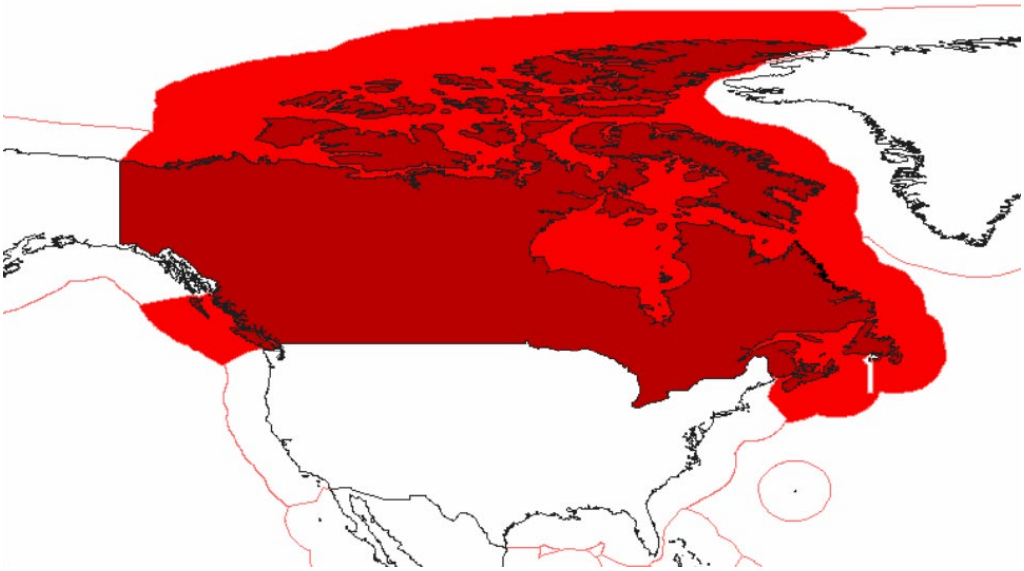

Figure 1: Canada's exclusive economic zone (EEZ) and territorial waters [6]

These waters are critical for Canada's national security, economic interests, and environmental protection. As geopolitical tensions in the Arctic grow, the Arctic is becoming a focal point of Canada's maritime strategy due to its strategic location and resource-rich environment.

2.2 Emerging Threats in Canadian Waters

Our North, Strong and Free recognizes the disproportionate impact on the Arctic due to climate change. The polar ice cap previously protected the region throughout the year. But, by 2050, the Arctic Ocean could become the fastest shipping lane by significantly shortening routes between Asia, Europe, and North America [3]. The melting ice caps are transforming the Arctic into an increasingly contested region with the potential of new emerging shipping lanes and access to untapped resources.

Increased Russian military activity, as well as Chinese vessels and surveillance platforms mapping and gathering data, have been detected in the Arctic [3]. Russia continues to develop its military presence by investing in new bases and infrastructure. Russia also possesses a strong naval presence with submarines, naval warships, and an icebreaker fleet [3]. Though not an Arctic nation, China wants greater power in the region by 2030 through the steady growth of its navy and the expansion of its investments within the Arctic region [3]. As the Arctic becomes more accessible to foreign states, Canada faces new security challenges and must ensure its military has the tools to protect Arctic sovereignty and maintain regional stability.

2.3 Canada's Policy of Arctic Deterrence

These trends directly influence Canada's future of defence. *Our North, Strong and Free* identifies credible deterrence as the strategy to defend the Arctic against new and escalating threats [3]. As part of this strategy, Canada plans to build up its presence, mobility, and responsiveness in the Arctic through a network of northern operational support hubs, a fleet of airborne early warning aircraft, coastal and underwater sensors, a satellite ground station, enhanced foreign intelligence capabilities, and new tactical helicopters [3]. Additionally, Canada's international partnerships, including its membership in NATO, strengthen the Arctic's defence as the region becomes a strategic priority for allied security.

2.4 Canada's Need to Strengthen Arctic Sovereignty

Modernizing Canada's defence capabilities in the Arctic is critical to maintaining a strong presence, supporting the policy of deterrence, and aligning with Canada's broader goal of reaching its military spending target of two percent of GDP. Currently, the CAF rely on manned patrol vessels and maritime helicopters to monitor Arctic waters [3]. These methods face the following constraints in monitoring such a vast, remote region:

- **High operational costs**—manned patrol craft require substantial financial resources for maintenance, fuel, and personnel.
- **High personnel requirements**—large, highly trained crews are needed to operate the patrol craft.
- **Limited reach**—manned patrol craft require more fuel and may have restricted endurance, particularly in harsh conditions.

In addition to these constraints, *Our North, Strong and Free* identifies the growing presence of enemy submarines in the North [3]. These underwater threats emphasize the need for advanced detection capabilities for new military procurements in the Arctic.

An unmanned, maritime-focused system is essential, offering the following advantages:

- **Submarine detection**—the ability to detect enemy submarines.
- **Cost-effective**—less expensive to operate than a manned aircraft system.
- **Reduced personnel requirements**—fewer personnel are required to operate, alleviating strain on Canada's defence force.
- **Enhanced efficiency**—extended on-station hours, lower fuel costs, and designed to perform in extreme conditions.

3. Introducing MQ-9B SeaGuardian®

MQ-9B SeaGuardian® is a remotely piloted aircraft system (RPAS) by U.S.-based General Atomics Aeronautical Systems, Inc (GA-ASI) with specialized configurations for maritime operations. It is the maritime variant of MQ-9B SkyGuardian® RPAS. The optional mission kits, including Anti-Submarine Warfare (ASW), signals intelligence (SIGINT), and tactical data link, make the SeaGuardian modular [7]. MQ-9B SeaGuardian® is highly versatile and capable of both civil and military operations.

For a list of specifications on SeaGuardian, see the following table:

Table 1: MQ-9B SeaGuardian® Specifications [7]

Characteristic	Specification
Wingspan	24 metres
Length	11.7 metres
Powerplant	Honeywell TPE331-10 Turboprop
Max Gross Takeoff Weight	5670 kilograms
Fuel Capacity	2721 kilograms
Payload Capacity	2155 kilograms (external), 363 kilograms (internal)
Max Endurance	30+ hours
Max Altitude	40,000 feet above mean sea level
Max Airspeed	210 knots true airspeed

Currently, the government is acquiring eleven MQ-9B SkyGuardians with anticipated delivery in 2028 and full operational capacity in 2033 [8]. The $2.49 billion contract includes eleven RPAS, six ground control stations, a new ground control centre, and other associated equipment to support the SkyGuardian RPAS [8]. This acquisition in SkyGuardian facilitates further investment in SeaGuardian because both RPAS are compatible with the same operational infrastructure.

3.1 Anti-Submarine Warfare System

With the ASW configuration, SeaGuardian can continuously protect waterways, shipping lanes, chokepoints, and allied forces against the threat of submarines [9]. The ASW kit uses sonobuoy dispensing system (SDS) pods and sonobuoy monitoring and control system (SMCS), making SeaGuardian the first RPAS in its class to carry and deploy sonobuoys. SeaGuardian can track submarines while maintaining awareness of the maritime environment.

The dimensions of a single SDS pod are 392.2 cm by 106.7 cm by 76.2 cm (Figure 3). An empty SDS pod weighs 132 kg, and when filled with sonobuoys, it can weigh up to 340 kg. Each pod can carry and dispense up to 10-20 sonobuoys. SeaGuardian has four wing stations that can hold up to four SDS pods, which provide a carrying capacity of 40-80 sonobuoys.

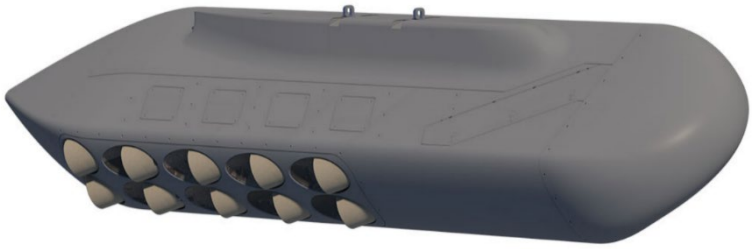

Figure 3: Detailed view of a single SDS Pod [9]

3.2 Anti-Submarine Capabilities

The figure below highlights SeaGuardian's key components as configured with the ASW kit:

Figure 2: MQ-9B SeaGuardian® configured with the ASW kit

- **Detect and Avoid System (DAAS)**—senses and evades nearby aircraft; adheres to NATO standards and meets civil air space regulations worldwide [10]
- **Lynx Multi-Mode Radar**—produces high-resolution imagery through clouds, rain, fog, smoke, or dust; includes a maritime wide area search mode (MWAS) that integrates Automatic Identification System (AIS) for target classification and identification [11]

- **Electro-optical Infrared (EO/IR) Imaging System**—detects, tracks, and identifies targets or objects in the visible and infrared spectrum
- **SIGINT/ESM**—enables signals intelligence, including electronic support measures, that collects intelligence, surveillance, and reconnaissance (ISR) data
- **Sonobuoy Monitoring and Control System (SMCS)**—receives and processes acoustic signatures transmitted by deployed sonobuoys
- **Sonobuoy Dispensing System (SDS) Pods**—carry and release sonobuoys; controlled by SMCS

4. Features and Benefits of MQ-9B SeaGuardian®

SeaGuardian meets the specific requirements of modern defence operations, confronts emerging threats, and supports Canada's strategic goals in the Arctic. The following table outlines the features and benefits of SeaGuardian, revealing how this RPAS will transform maritime defence in the North.

Table 2: Features and Benefits of MQ-9B SeaGuardian® (ASW configuration)

Component	Feature	Benefit
DAAS	Enables RPAS to detect and avoid nearby aircraft; Adheres to NATO standards and meets civil airspace regulations worldwide	Seamless integration in military and civil airspace
Lynx Multi-Mode Radar	Provides high-resolution imagery that can be captured through clouds, rain, fog, smoke, or dust; Through MWAS, it integrates AIS for target classification and identification	Reliable, all-weather surveillance and identification capabilities
EO/IR Imaging System	Identifies objects or targets in the infrared spectrum	Total visual situational awareness 24/7 and, especially, useful in low-light conditions
SIGINT/ESM	Offers signals intelligence capabilities to locate and track surface radars	ISR data collection improves tactical decision-making by gathering information on selected emitters
SMSC	Receives and processes acoustic signatures from sonobuoys	Proactive submarine detection with the ability to classify and track submarines
SDS Pods	Enables SeaGuardian to carry and release sonobuoys through SMCS	Persistent submarine tracking and enhanced underwater surveillance
De-ice/Anti-Ice System	Protects and maintains airframe performance from icy conditions	Safe and reliable operations in a polar environment

As demonstrated with these features and benefits, SeaGuardian can detect air, ground, surface, and subsurface targets, including surveillance balloons, maritime vessels, and submarines [12]. SeaGuardian uses low Earth orbit satellites to operate in northern regions, allowing pilots to control the aircraft from thousands of kilometres away on the ground [12]. Using its advanced satellite communications link, SeaGuardian delivers real-time intelligence to military authorities anywhere in the world. Combined with these benefits, SeaGuardian is designed to have a 40,000-hour service life.

In addition to supporting military operations, SeaGuardian can assist in civil matters, including monitoring Northern infrastructure and surveying the ongoing effects of climate change in the Arctic. SeaGuardian's capabilities also extend to search and rescue operations, where it can quickly help vessels in distress [12]. This RPAS operates in all weather conditions, day or night, and without putting human pilots or patrols at risk. Currently, Canada relies on maritime helicopters and vessels for these missions. SeaGuardian can improve search and rescue operations by providing improved efficiency and operational safety while increasing the speed of rescue efforts in remote regions.

SeaGuardian overcomes the limitations of Canada's current methods to monitor Arctic waters. It has more on-station time, lower operational costs, and greater fuel savings when compared to manned maritime patrol aircraft (Figure 4) *[13]*. These numbers may vary depending on its configuration. SeaGuardian can serve as a complement to human-crewed patrol aircraft and naval vessels for manned-unmanned missions. Compared to manned options, SeaGuardian offers a substantial decrease in personnel and equipment needs, along with significantly lower costs and risks.

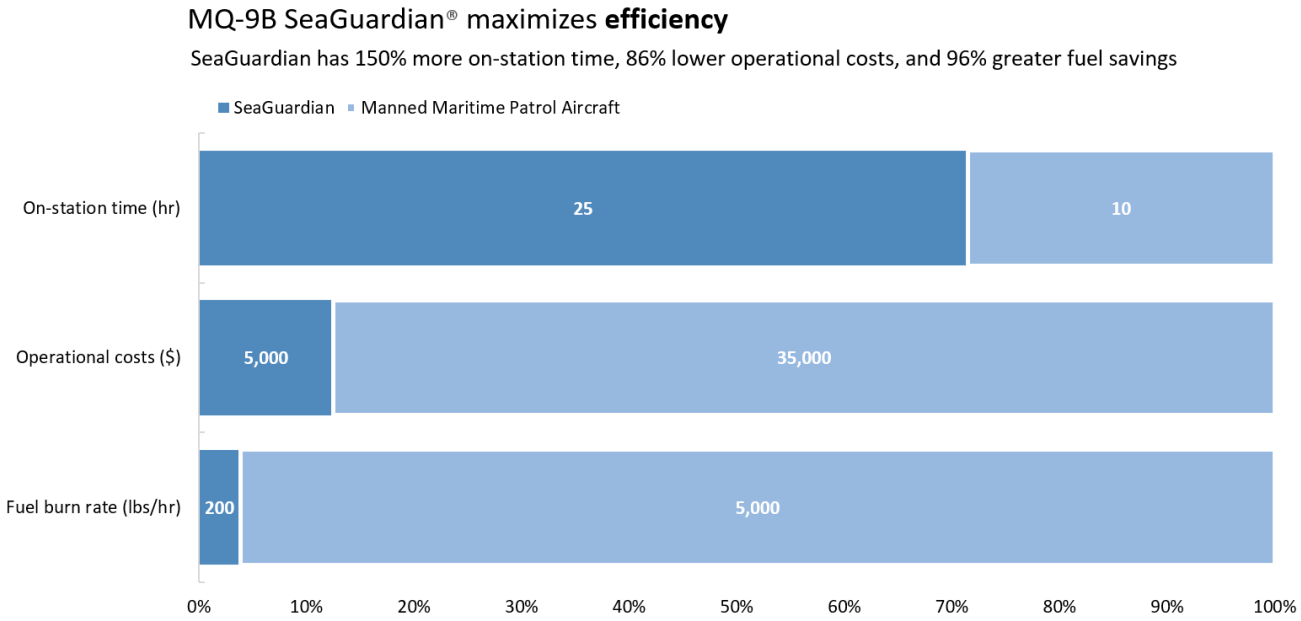

Figure 4: MQ-9B SeaGuardian® vs. Manned Maritime Patrol Aircraft

5. Conclusion

While SeaGuardian does not replace manned methods to patrol Arctic waters, it is a versatile, highly modular RPAS that can be used by the CAF to enhance its manned-unmanned polar missions and overall reach and responsiveness in the region. In line with its defence policy of deterrence, Canada is strengthening its military resources in the Arctic region. In a time of growing global unrest and unease, especially concerning the future of the North, Canada must look towards innovative military investments to protect its Arctic sovereignty and economic interests. The government's announcement to attain the NATO two percent benchmark by 2032 underscores this belief. GA-ASI has developed SeaGuardian, the first RPAS of its kind, that has anti-submarine capabilities, longer endurance, lower operational costs, and a more efficient fuel economy.

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