The Value of Surveillance

From the outset of air traffic control and RADAR in the 1940s, surveillance has transformed the safety of our skies in ways that have been immeasurable. The ability of air traffic management personnel to watch over our skies has enabled both the security of our borders and the growth of an industry worth many billions of dollars per annum, which few of us could imagine living without.

Since the 1940s technology has advanced and so have the needs of Air Traffic Management (ATM) to provide a safe, orderly and expeditious flow of traffic. ATM providers are re-engineering the services they provide to meet the inexorable rise in traffic, and are seeking to leverage the value of surveillance in airspaces where traditional line-of-sight surveillance isn't available. Doing so will benefit safety, air operators, the travelling public, aviation stakeholders and governments alike.

The scope for leaders and visionaries to engage the industry in this change has never been greater. NATS and NAV CANADA have jointly embarked on a "game-changing" endeavour in Gander-Shanwick oceanic airspace that demonstrates how air traffic surveillance service will transform the world's busiest oceanic airspace, the North Atlantic Region (NAT). This change will bring breakthrough improvements for air traffic service (ATS) performance as well as to safety, efficiency and to the predictability and flexibility of the airspace for aircraft operators.

What is ATS Surveillance?

ATS surveillance service is clearly defined by the International Civil Aviation Organisation (ICAO) but, put simply, it's the ability to reliably and in near real-time detect key flight attributes such as position, level and intent. Current NAT operations do not have surveillance but use position reports to track aircraft. Satellite based communications systems such as Future Air Navigation Systems (FANS) are used to automate these reports and increase their frequency. While this is an innovative use of communications it is nevertheless unable to match the dynamism of ATS surveillance.

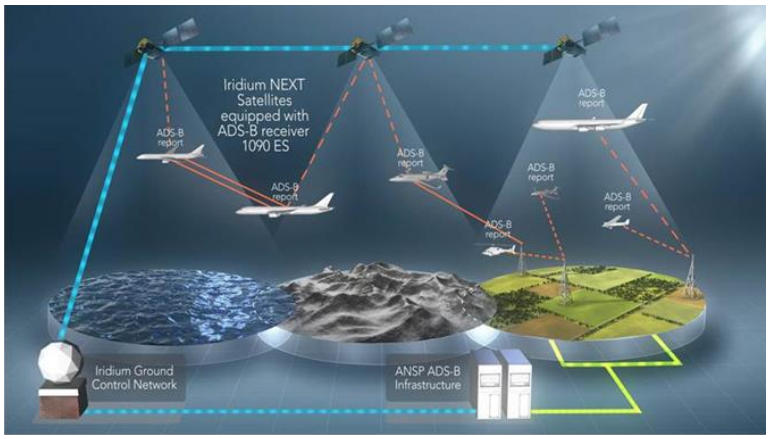
Surveillance is an integral part of a complex air traffic ecosystem. Alongside communications and navigation, it forms three significant pillars that drive ATM performance of our airspace, alongside other key elements, including safety management, flight management and regulatory systems and the environment to deliver safety and efficiency.

ADS-B – 21st Century ATS Surveillance

ADS-B has been developed as a discrete, near real-time air traffic services surveillance system. Major ground-based ADS-B investment programs have been undertaken in Australia, Canada, many European countries and the United States. Closely linked to the ICAO Aviation System Block Upgrade (ASBU) program, the major ATM Change Programs of SESAR and NextGen have adopted equipage

mandates from 2020 to harmonise ATS surveillance systems and capabilities. Airlines have responded positively with over 90 per cent of traffic in Gander-Shanwick airspace equipped with ADS-B transponders already.

ADS–B requires no pilot or external input. The system automatically pulls data from the ADS-B equipped aircraft's navigation system and periodically broadcasts it for detection by ATM providers and other airspace users.



While ADS-B receivers have traditionally been located on the ground that is now changing. Shortly, ADS-B sensors located on low earth orbiting satellites will perform similarly to ground-based systems, but will open the door to seamless global coverage by providing line-of-sight well beyond the limits of ground-based networks.

For the high traffic density of NAT oceanic operations, satellite based surveillance will provide surveillance coverage with the performance necessary to enable ATM service providers to meet the needs of rising traffic levels and the expectations of those airspace customers who expect a safe, flexible and predictable cost-effective service.

Practical Benefits of ATS Surveillance

Initial deployment of ATS surveillance service will see ADS-B data used alongside data link communications technology, to safely reduce the minimum safe distances between aircraft. These reductions are being developed and validated by the ICAO Separation and Airspace Safety Panel (SASP) following which they will be recommended to the ICAO Air Navigation Commission (ANC) for incorporation as a global procedure into the PANS-ATM. Once incorporated, this will enable the reach and benefit of this change to extend far beyond the NAT.

To complement these reductions, ADS-B surveillance provides earlier notification of safety events, improved situational awareness and flight tracking by air traffic controllers (ATC) and more options to intervene when changes to the ATM plan are necessary.

The combination of ATS surveillance service and faster, more timely and automated communication is expected to enable the safe implementation of significant reductions in separation standards. This will create much needed capacity within the most fuel efficient portions of the NAT, an area that changes daily to reflect winds, temperatures and customer preferences.

Increased capacity will bring with it an improved ability to provide safe flight trajectories that more closely match User Preferred Routings (UPRs) and greater opportunity for step-climbs and descents. Crucially, the volume of airspace now available will permit significantly greater predictability and flexibility for planning these operations, resulting in greater assurance for further efficiencies, including reduced contingency / fuel uplift penalties for airline operators.

It is expected that further benefits can be enabled for airspace customers on intra-regional routes, in particular for those fixed ATS routes between Spain and Ireland. The benefits of ADS-B alongside existing communications and new ATM tools and processes achieve an alternative means of compliance to the NAT data link mandate (DLM).

Transition to ADS-B

The transition to new separation standards must always be managed safely. NAT programs to reduce longitudinal and lateral separation minima (RLongSM and RLatSM) have provided great learning. The transition from non ATS surveillance airspace (ADS-C) to ATS surveillance (ADS-B) airspace must permit the gradual reduction in separation standards to achieve the target for this airspace from a distance of around 60-80NM to 15NM.

ATS Surveillance – Beyond Implementation

The transformation of the Gander-Shanwick air traffic ecosystem from one of position report enabled compliance monitoring to the provision of ATS surveillance service will generate considerable benefits. The earlier detection of, and recovery from, ATM non-conformance through enhanced situational awareness of precise aircraft locations, will improve safety and the ability to better respond to unexpected events (i.e., hazards, weather, or emergency situations).

Alongside these changes in separation standards, other operational changes will be made. The proportionate and beneficial use of the twice-daily fixed Organized Track Structure (OTS) routes for the peak trans-oceanic traffic is expected to remain, eventually contracting and giving way to a daily network of UPRs. This destructuring of airspace will further support operational flexibility and predictability and readily sustain the expected growth in traffic volumes and patterns.

Following initial NAT implementation, the value of surveillance will rapidly develop as ANSPs accelerate their destructuring of airspace to leverage the benefits from reduced separation standards and airlines gain experience in operating in this more efficient, flexible and predictable manner.

With predictable and increasingly homogenous service now the norm, innovation and collaboration between airlines, airports, network managers and ANSPs will expand beyond the core ATM and fuel efficiency models into the wider aviation value chain. At the heart of this will be a data driven, system-wide, information sharing environment where improved access to key flight data make our major airspaces safer and more efficient to operate within.

The graphic below illustrates the progressive evolution of benefits from space-based ADS-B.

Value of Surveillance

Benefits	Space Based ADS-B & CPDLC		
	Implementation	Development	Future
Early Detection of Emergency Transponder Codes	✓	✓	✓
Reduce Gross Navigation Errors	✓	✓	✓
Improve Flight Disruption Recovery	✓	✓	✓
Variable Mach/Econ Speed	✓	✓	✓
Predictable Climbs/Descents	✓	✓	✓
Reduce Contingency Fuel	✓	✓	✓
Enable Steep Angle Trajectories	✓	✓	✓
Enable 15nm Crossing/Joining Tracks	✓	✓	✓
Shorten Flight Air-Times	✓	✓	✓
Transition of OTS		✓	✓
Reduce ADS-C Position Reports		✓	✓
Reduce Greenhouse Gas Emissions	✓	✓	✓
More Predictable Flight Planning	✓	✓	✓
Leverage System Wide Information Sharing		✓	✓
Reduce Complexity Through Harmonization of Operating Environment		✓	✓

✓ Partial benefits ✓ Fully realized benefits

Within this period, ATS surveillance service will facilitate the coalescence of oceanic and domestic en-route operations to provide a single seamless service across large volumes of airspace, bringing with it opportunities for ANSPs to deliver increased service resilience and efficiency for all stakeholders.

Summary

The innovative deployment of ADS-B into space to provide ATS surveillance service in oceanic and remote areas will transform ATM services, both in, and beyond the North Atlantic, bringing unprecedented value to airlines, ANSPs and the travelling public alike.

This will see reduced separation standards and improvements to airspace that will deliver a safer, cleaner, more flexible and predictable operating environment capable of meeting changing traffic patterns and customer choice in an agile and sustainable way. But that's not the end of our journey, it's only the beginning.

NATS and NAV CANADA are committed to leverage the deployment of space-based ADS-B to transform our services, and to deliver the customer value and benefits we've identified.

Through mutual cooperation we will jointly lead and inspire our industry, to set new expectations of safety and service efficiency that, without ATS surveillance service, we struggle to even dream of.

The value of surveillance in the 1940s wasn't measured in financial terms, but in transformational ones. The value of surveillance within the North Atlantic, while important to measure in dollars, will more importantly be to transform our airspace to a point where, without surveillance, our services are truly unimaginable.