WHITE PAPER

JUNE 2024

AireonFLOW™ for ATFM

This white paper will show the advantages of integrating AireonFLOW ADS-B data into ATFM systems.

Introduction

The synopsis of this paper outlines the challenges faced in achieving accurate demand predictions for efficient ATFM. It will be shown how the easy integration of Aireon's space-based ADS-B data into ATFM systems can enhance the accuracy of demand predictions leading to effective ATFM. The case for a white paper on this topic is compelling as the need for accurate demand predictions is required for optimized ATFM.

Problem Definition

For ATFM units to enact efficient ATFM, the best possible data needs to be presented to the flow manager. The flow manager needs the latest up-to-date information such as weather conditions, airspace capacity, CNS serviceability, and demand predictions for flights entering airspace sectors or arriving at airports. Demand and capacity balancing is carried out when demand is seen to be exceeding the capacity of a resource (airspace, aerodrome); for this to be effective, accurate capacity declarations and demand predictions need to be made. Arrival times translated to demand predictions, need to be as accurate as possible to inform the flow manager if a ATFM measure should be implemented or not and what the scope of the ATFM measure should be.

In some instances, departure times for flights are not known to an ATFM system, and the ATFM system will assume the flight is airborne at the filed estimated time of departure which could result in very inaccurate demand predictions. Further to this, ANSPs generally have surveillance coverage limited to their own area of responsibility (AoR) resulting in limited position reports of flight positions outside this surveillance coverage. This presents a challenge as ATFM systems need continual flight position updates from point of departure to destination to compute accurate Estimated Time Over (ETO) and Expected Time of Arrival (ETA) for sector boundaries and aerodromes. Even though a departure message is received, flights could experience headwinds, or ATC required deviations from the flight plan route (route and/or speed) resulting in changes to the Estimated Elapsed Time and consequently to the ETOs and ETAs of the flight. This leads to inaccurate demand predictions.

Typically, ANSPs do not share position reports of flights to downstream ANSPs (surveillance data is not shared) therefore some ATFM systems have become reliant on third-party ADS-B data suppliers for position reporting. ADS-B data sourcing has been from terrestrial based receivers, this leaves large gaps in ADS-B coverage such as over oceanic and remote airspaces where terrestrial receivers are absent, again leading to inaccurate demand predictions.

Should the demand prediction be inaccurate, an inappropriate ATFM measure could be implemented. Alternatively, no ATFM measure is implemented — in both instances flights could be held unnecessarily on the ground or in holding patterns and/or are subject to excessive speed control and radar vectoring in the arrival TMAs.

Within an ANSP, surveillance coverage data may be available from multiple sources (ADS-B, SSR, etc.), which creates integration challenges for ANSPs as this can be complicated and costly.

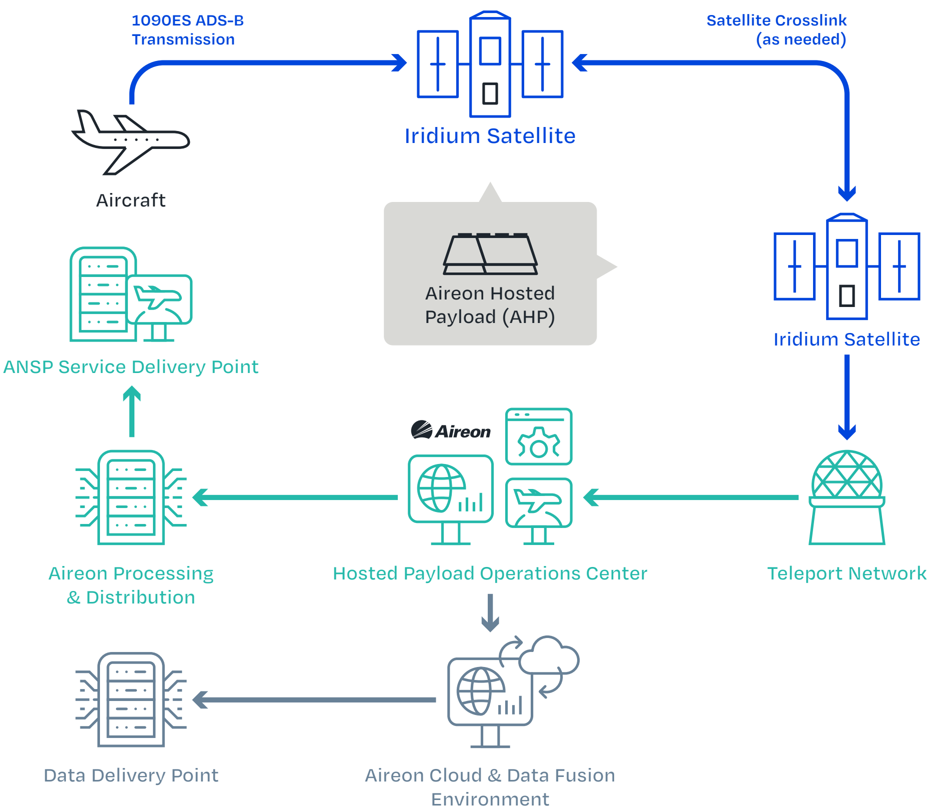
High-level Solution

By integrating AireonFLOW global spaced-based ADS-B data into ATFM systems, continuous position reports from a single data source from point of departure to destination will be received enabling accurate trajectory modeling leading to up-to-date ETOs/ETAs and demand predictions.

Description of AireonFLOW

Aireon's ADS-B system is made up of two segments: the Aireon Space Segment and Aireon Ground Segment. The Aireon Space Segment utilizes Iridium's NEXT Constellation of 66 satellites distributed in six polar orbital planes. Each satellite contains the Aireon Hosted Payload (HPL) that receives, demodulates, and transfers ADS-B messages from each equipped aircraft to the Aireon Ground Segment via the Iridium main mission payload. Data sent by the Aireon Hosted Payload to the main mission payload is routed over crosslinks between Iridium NEXT satellites and downlinked to an Iridium teleport. On reaching a teleport, downlinked data is routed via a terrestrial network to the Ground Segment.

FIGURE 1
Aireon's space-based ADS-B network



The Aireon Ground Segment is comprised of the Hosted Payload Operations Center (HPOC) and the Aireon Processing and Distribution (APD) center. The HPOC provides all the functions required to monitor and control the Aireon Hosted Payload, including telemetry monitoring, failure recovery, and remote configuration. The APD provides all processing of ADS-B mission data, mission planning and payload tasking functions (such as antenna and target scheduling), and delivery of mission and status data to ANSPs.

In addition, the APD provides Aireon ADS-B data for non-air traffic control purposes. The Aireon Commercial Data Services (CDS) system leverages the rich Aireon ADS-B data set available from the global surveillance network to provide customized air traffic surveillance information for non-operational uses. The data available may be customized for a consuming system by applying geographic, time, and aircraft filters.

AireonFLOW is a data service that provides Air Traffic Management (ATM) surveillance quality data within a designated primary AOR and, typically, up-to 3000 NM beyond (the "Long-Range Area Service Volume") to support A-MAN. Customers can define their Long-Range Area Service Volume to meet their unique operational objectives.

Leveraging Aireon's streaming platform, customers will receive a stream of space-based ADS-B data. In their AoR, the customer will receive a data stream of all available aircraft.

Description of a typical ATFM system

A typical ATFM system can ingest surveillance data, one being ADS-B data, and the system will use the departure time and position report supplied by the ADS-B data and carry out trajectory modeling. The position of the flight, flight plan route and predicted winds are used to calculate the downstream times. The trajectory modeling process will occur every time a position report is received from Aireon. The system will use these times to populate a traffic situation display, bar graphs showing demand and capacity and flight list with all relevant predicted downstream times. This is presented to the flow manager in various formats assisting him in his decision-making processes.

Solution Details

Aireon will supply a filtered stream of global ADS-B data as described in the "Description of AireonFLOW" above. This data is only sourced from the space-based satellite network (99% coverage) which requires no integration with other surveillance data. The data is transmitted via the internet in CSV format allowing for easy integration into the ATFM system. Departure times for flights will be sent enabling trajectory modeling from the time the flight departs.

While long-range flights may not be included in ATFM measures they do contribute to demand predictions, receiving upstream position reports of long-range flights and short haul flights will ensure accurate demand predictions. Should all flights be included in ATFM measures and there is a downstream constraint requiring an ATFM measure, airborne flights can be issued accurate CTOs. With the continued position updates ATFM measure amendment is carried out with more confidence by the flow manager. This amendment could be a revision for a CTOT (for flights that have not departed) or a CTO for airborne flights.

Benefits of the Solution

Departure times and continued position reports result in optimized ATFM processes. With accurate information being presented to flow managers, they will be able to implement appropriate ATFM measures. These optimized ATFM measures will result in reduced holding on the ground at departure airfields and less airborne holding, speed control and radar vectoring in the arriving TMA. Should ATFM measures include long-range flights the continued position reports of these flights will result in issuance of accurate CTOs enabling delay absorption to take place during the enroute phase of flights. Over time, airspace users will anticipate less arrival delay resulting in uplifting less fuel for the previously constrained sectors. Pressure on approach controllers and pilots will be reduced as there will be less requirement for airborne holding, radar vectors, and speed control.

CASE STUDY

EUROCONTROL

On the 28th February 2020, Aireon and EUROCONTROL signed a 10-year agreement for the provision of AireonFLOW. The intention was to enhance flow management capabilities across EUROCONTROL's 41 European Member States and two Comprehensive Agreement (CA) States contributing to improve predictability, capacity, environmental impact supporting sustainable growth throughout the European region.

FIGURE 1
ADS-B coverage (shown in green) prior to the implementation of AireonFLOW data.

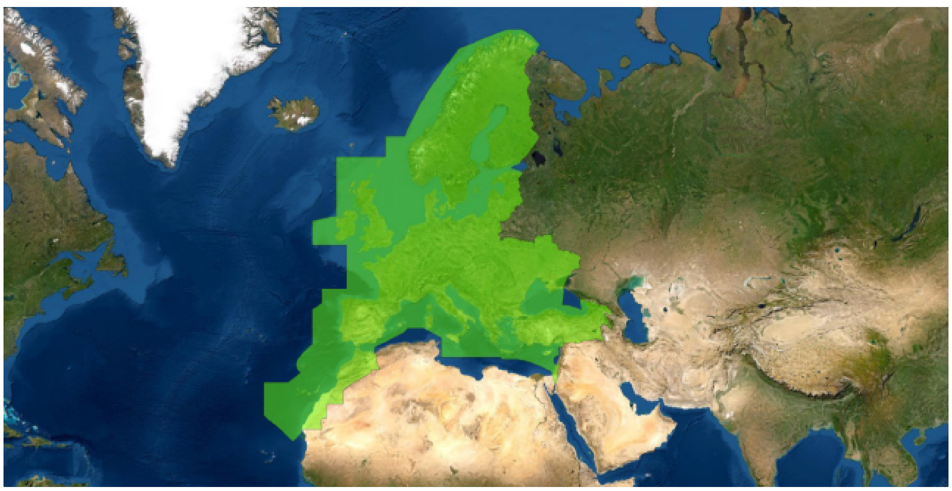
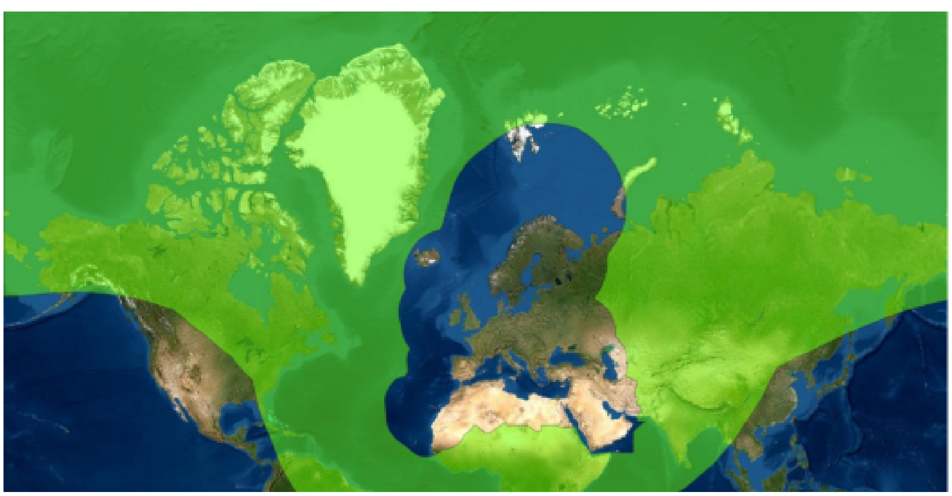


FIGURE 2
ADS-B Coverage subsequent to the implementation of AireonFLOW data.



Using AirenFLOW data has led to significant improved accuracy in demand predictions by up to 20%. While the Network Manager (NM) is not applying ATFM Measures to long-range flights, having accurate position reports of long-range flights is contributing to accurate demand predictions, hence assisting flow managers in implementing the most effective ATFM measure. This has led to enhanced safety, efficiency, increased capacity, and improved environmental initiatives. The gains to the ATM network are supplying the airspace users, and consequently passengers, with less delays and more predictable travel.

Summary

More accurate demand predictions are now a requirement by ANSPs to present flow managers with the most up-to-date information enabling them to implement the most appropriate ATFM measures. Surveillance coverage for entire flight sectors has been a challenge. With the integration of AireonFLOW, which supplies surveillance coverage from departure until destination, gaps in surveillance have been eliminated.