WHITE PAPER

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AireonFLOW™ for Long-Range 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 Estimated Time of Arrival (ETA) of long-range flights for efficient LR-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 LR-ATFM. The case for a white paper on this topic is compelling as the need for accurate demand predictions is required for optimized LR-ATFM.

Air traffic flow management systems hold great potential for air navigation service providers to improve overall operational efficiency in their airspaces. However, the addition of the AireonFLOW data into that network can add even greater functionality, including better demand prediction capabilities, delay optimization, and reductions in greenhouse gas emissions. These benefits are further amplified for LR ATFM.

Problem Definition

As air traffic levels continue to grow, ANSPs are increasingly seeing the value in adding new technologies into their operations to better manage their airspaces, particularly when balancing the short-range and long-range flights in an FIR. The need for LR-ATFM is required for optimized ATFM in most parts of the world to equitably distribute delay to as many flights as possible. Currently, in most instances, where ATFM measures are required, delay is only apportioned to domestic flights which absorb all the delay while long-range flights are exempted from delay.

Due to demand exceeding capacity in terminal maneuvering area (TMA), there are instances where long haul-flights are held in holding patterns and/or are subject to excessive speed control and radar vectoring in the arrival TMA, because today long-range flights are not included in ATFM measures. In addition, continuous descent operations (CDO) are limited, flights are leveled off in the descent resulting in extra fuel burn. These delaying tactics and inefficient operations could be prevented if early predictions of delays can be anticipated and LR-ATFM measures are implemented. These enroute LR-ATFM measures could include Miles/Minutes in Trial or the issuance for Calculated Time Over (CTO) for airspace boundaries. However, flow managers are reluctant to issue such measures when flights are a long distance from destination as the demand predictions are not accurate.

It is recognized that for an ATFM measure to be effective, 70% of the flights transiting the constrained airspace or arriving at the constrained destination airport need to be apportioned some delay. This ensures that the delay for individual flights is kept to a minimum and delay is shared among as many flights as possible. In many countries there are enough domestic flights to make up the 70%, however, there is an increasing need to include international flights in ATFM measures to distribute the delay more equitably, hence the application of LR-ATFM measures.

Many ANSPs cannot reach the 70% requirement therefore are compelled to include international flights in ATFM measures. This was shown in instances where there are no domestic flights (Doha, Singapore, Dubai, Hong Kong China) and all flights included in an ATFM measure would have been international and in many instances more than 8 hours flying time from destination. ATFM cannot be effective in instances like this without the implementation of LR-ATFM.

ANSPs have surveillance coverage limited to their own area of responsibility (AoR). 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 Estimated Time of Arrival (ETA) for sector boundaries and aerodromes. These times are used to produce demand predictions which flow managers use for ATFM implementation. Currently, an ATFM system may receive a departure message (reception of departure messages via the AFTN network are erratic), the next time a position report will be received occurs when the flight enters the surveillance coverage of the ANSP. Flights could experience headwinds, ATC required deviations from the flight plan route (route and/or speed) resulting in changes to the Estimated Elapsed Time (EET) of the flight. Without continual position reports the demand predictions presented to the flow manager could be significantly different and as stated early, accurate demand predictions are critical to effective ATFM implementation.

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 3rd 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.

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

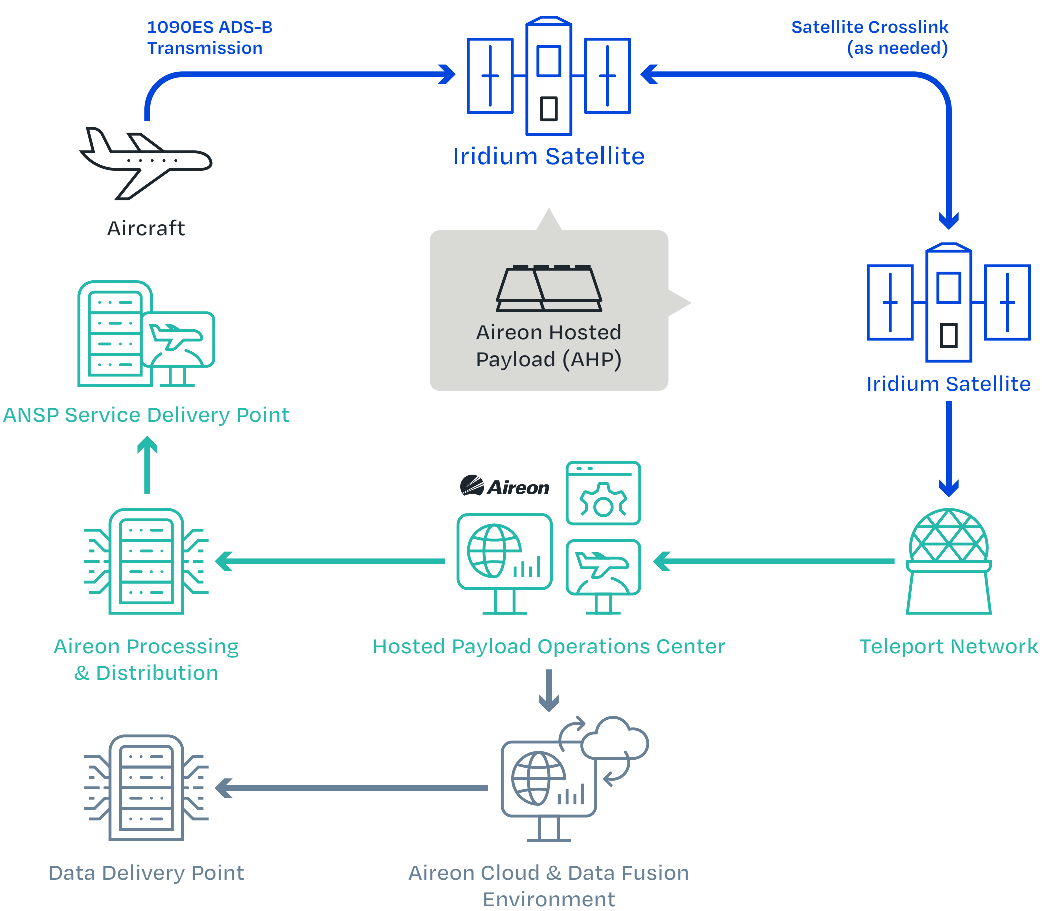
High Level Solution

By integrating AireonFLOW global ADS-B data into ATFM systems, continuous position reports will be received enabling accurate trajectory modeling leading to up-to- date ETOs/ETAs and demand predictions resulting in more optimized flights, enhanced safety and lower environmental impact.

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



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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 ATFM processes 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 — AireonFLOW. In their AoR, the customer will receive a data stream of all available aircraft.

A typical ATFM system can ingest surveillance data, one being ADS-B data, the system will use the position report supplied by the ADS-B data and conduct 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 down-stream times. This is presented to the flow manager in various formats assisting him in his decision-making processes.

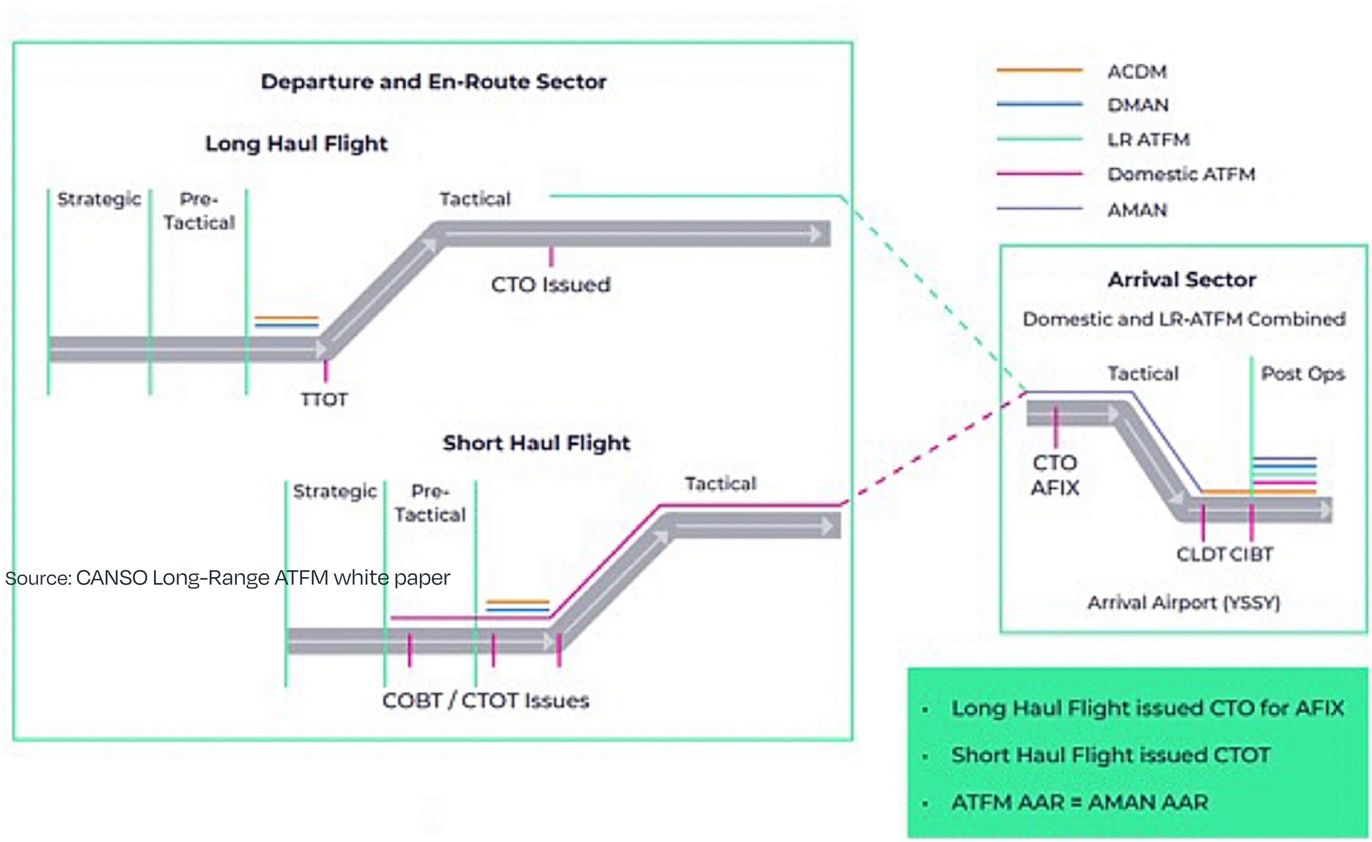
Solution details

Aireon will supply a filtered stream of global space-based ADS-B data as described in the "Description of AireonFLOW" above. This data is only sourced from the space-based satellite network 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.

With continual position reports received for flights, ANSPs will have accurate demand predictions including predictions for long-haul flights enabling ATFM measure implementation, for short-haul and long-haul flights. Should there be a downstream constraint requiring an ATFM measure to be implemented after a long-range flight is airborne, the continued position reports ensure that accurate Calculated Time Over (CTOs) are issued to the long-range flights. 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 Calculated Take Off Time (for flights that have not departed) or a CTO for airborne flights.

Figure 2 shows how all flights will be included in the ATFM measure, short-haul flights receive CTOTs, and long-haul flights receive a CTO for a sector boundary/way point/ arrival fix. In this instance an Arrival Manager AMAN system is shown, however it is not a necessity for implementation of LR-ATFM.

FIGURE 2
LR-ATFM Concept



Source: CANSO Long-Range ATFM white paper

Benefits of the solution

Departure times and continual position reports result in optimized ATFM processes. This will include effective LR-ATFM implementation enabling both domestic and long-haul flights in ATFM measures. More equitable distribution of delay is now possible with the domestic flights encountering less delay.

Being able to issue long-haul flights with enroute ATFM measures will reduce holding times, radar vectoring, and speed control in destination TMAs. CDO will be enhanced as less leveling off of flights will be encountered. This could be achieved by long range flights reducing speed enroute to comply with CTOs issued by the downstream ANSP. Of course, this will have significant impact on fuel and CO2 emission savings.

Over time, airlines will anticipate less TMA 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.

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 measure. As LR-ATFM procedures are being introduced requiring surveillance coverage for entire flight sector has been a challenge. With the integration of AireonFLOW, which supplies surveillance coverage from departure until destination, gaps in surveillance have been eliminated enabling easier implementation of LR-ATFM.