The incredible, connectable AID and its future in aviation

A detailed look at how the modern AID can improve airline operations, profitability and the passenger experience.

Collins Aerospace
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CONNECTED AVIATION TODAY

Letter from the author

William Baumgarten

As digital services and connectivity have become essential to everyday life, access to routers that connect disparate devices to the internet has become a central enablement tool in our lives.

The advanced capabilities and functionality that come with connectivity are also in high demand on the go, which is why the aircraft interface device (AID) is a growing trend in commercial aviation.

The primary purpose of the AID is to aggregate information from the aircraft's systems and make that data easily consumable by applications— and to the users that need it. The AID pushes this data to where it's needed while simultaneously providing communication channels for the aircraft and its crew.

Essentially, an AID installed on an aircraft functions much like the router in your home, coupled with a firewall for protection. Once installed, it interfaces with its systems and provides information to users, whether it's the flight crew or cabin crew. It also functions to send aircraft data to those who may need it on the ground.

In this eBook, I'll explore the benefits that AID solutions bring to airlines and passengers, the new capabilities inherent in modern AIDs, and the considerations that airlines should keep in mind when weighing AID purchasing decisions.

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CHAPTER ONE

The benefits of modern AIDS across the aviation ecosystem

As the tool that enables aircraft connectivity, the AID is responsible for many of the benefits that have been attributed to a more connected aviation ecosystem.

To think of it another way, the AID is to the airline's data landscape what the opposable thumb was to the evolution of our ancestors. It enables the airline to come to grips with a vast range of data and how to use it most effectively.

Let's explore some of the different ways in which the AID can benefit every stakeholder in the aviation industry, from the airlines to the passengers.

SAFETY, SUSTAINABILITY AND MAINTENANCE

The AID provides several benefits. It plays a vital role in reducing airfield incursions. It does this by providing incredibly accurate aircraft location information for the flight crew. The AID enables the same GPS signal and position information the aircraft sends to the electronic flight bags (EFBs) used by pilots. This allows flight crews to see their precise location on moving maps, giving them the situational awareness to more safely navigate even the most complex and bustling airports under adverse conditions, such as dense fog.

Flight safety departments can also use flight information from the AID to increase safety in other ways. Data and information produced by the aircraft systems is used to improve the operation of the aircraft. For example, is there a history of unstable approaches in one particular airport? What caused that? The data captured and distributed by the AID can help identify the problem, find the source of the problem, and be used to make changes that can make everyone safer.

The AID also offers efficiency and sustainability benefits. Increased situational awareness allows pilots to visualize and follow their taxi paths more accurately. Inefficient taxi paths waste both time and fuel, so making them more efficient helps to increase the airline's operational efficiency while also saving money and reducing carbon emissions.

Inefficient taxi paths are one problem facing airlines, but they're far less impactful than flying inefficient flight paths. Luckily, the AID also enables solutions like Collins Aerospace's Flight Profile Optimization (FPO), which can evaluate potential flight paths based on real-time data sources, such as weather and airspace restrictions and recommend more efficient flight paths to the pilot via their EFB.

These more efficient flight paths can lead to significant cost savings. They also reduce the impact of carbon emissions and expedite flights, benefiting airlines and passengers.

Finally, the AID can make it possible to get systems data off of the aircraft – which opens the doors to many of the advanced and proactive maintenance capabilities that airlines seek to implement. By enabling aircraft maintenance crews to access and analyze aircraft system data while the plane is still in flight, they can proactively identify the source of an issue before it becomes a problem.

Having a team ready and waiting to perform necessary repairs when the aircraft lands allows them to replace parts nearing end of life before they cause problems, and the aircraft needs to be taken out of service.

OPERATIONAL EFFICIENCY AND CUSTOMER EXPERIENCE

The AID also delivers benefits that don't involve sustainability, flight safety, or aircraft maintenance. These include helping to turn flights around faster, decreasing delays and even improving the travel experience by helping users understand and address passenger feedback in real time.

The AID can make dispatchers and airline operations professionals more aware of what's happening with the aircraft and enable them to streamline and optimize operations. For example, the AID can share the exact aircraft location, allowing dispatch and operations teams to know precisely when it will land, where it is on the ground and when it will arrive at a gate. This can ensure that the necessary crew and personnel are ready and waiting to get passengers and baggage off the aircraft, which expedites disembarking.

From there, operations professionals can begin to see exactly what has been done to the aircraft to prepare it for its next flight. Has fuel been loaded? Are the cargo doors closed, indicating that baggage has been loaded onto the aircraft? Giving dispatchers and operations professionals access to this information in real time can reduce aircraft turnaround times, decrease delays and increase efficiency.

Dispatchers can use this information to enable more data-driven decision-making while the aircraft is in flight. For example, let's say the aircraft needs to be diverted from its predetermined flight path. The dispatcher can reference the amount of fuel still available on the aircraft and make better, more informed decisions about how much longer that aircraft can fly and where it should be diverted to.

REAL-TIME RESPONSE

Social media discussions and discourse can significantly impact an airline's reputation. Many passengers go to social media when they're unhappy with their air travel, posting videos and status updates about the delays they're experiencing, the problems they're having on their flights, or the lack of transparency they're getting into flight cancellations.

Unfortunately, airline personnel who see complaints often have little or no visibility into what's happening on a particular flight or at a specific airport. This makes it challenging to digest complaints online and take appropriate action to remedy the real-life situation in a timely manner.

However, the AID can help. I've heard stories about airlines fielding social media complaints about cabin temperature. For example, sometimes passengers can be sitting on flights with cabin temperatures set too low and they turn to Facebook, Instagram or X to discuss how uncomfortable it is.

With the AID, airline personnel on the ground can monitor aircraft systems in flight. Now, there is a way for airlines to see these social media posts while the flight is still in the air. Airline personnel who see the airline's social media handles online can now check to see what's going on with the flight and reach out to the flight crew to make changes in real time, helping improve passenger comfort.

Today, it's no longer acceptable to only have resilient, high-bandwidth connectivity in our homes. Connected aircraft are revolutionizing the aviation industry. The AID is essential in making that connected aircraft a reality, and it will only become more mission critical as it gains new functionality and capability.

CHAPTER TWO

How edge computing makes modern AIDs even better

Considering the substantial benefits of AIDs, it's somewhat surprising that only about one-third of commercial airlines have embraced them. Many of the early adopters are data-driven, tech-savvy airlines, or smaller airlines operating in places where labor costs are higher.

I believe the reason why some of these smaller airlines have been the first to embrace the technology is simply a result of not having a large staff – forcing them to find ways to increase efficiency and automate the retrieval of aircraft system data.

However, the adoption of AIDs is starting to accelerate. This is partly because more new aircraft are being delivered with an AID already installed. But we're also beginning to see AID holdouts purchase and install them on the older aircraft in their fleets as they see the efficiency and automation benefits from the AID on their new aircraft deliveries.

The AID concept isn't necessarily new – it's actually been around for more than a decade. So, why are airlines just now taking the plunge and spending the time and money to purchase and integrate AIDs? It's most likely due to the new generation of AIDs that have even more functionality thanks to the integration of edge computing.

COMPUTE MORE, TRANSMIT LESS

There are two very good reasons why airlines would want AIDs that can aggregate and process aircraft system data at the edge:

1. Faster decision-making: As the number of sensors and connected systems in the aircraft increases, the amount of data that needs to be aggregated, disseminated and exploited for actionable intelligence rises exponentially. Finding actionable insights from this data becomes incredibly difficult – akin to trying to find a needle in a haystack.

   If the AID is more intelligent and capable of running algorithms, it can use that data at the edge and determine when to alert the flight crew and personnel on the ground. If a sensor identifies that a system is acting differently or if an incident occurs that may impact the aircraft, the AID can identify that trigger an alert to those that need to know and identify the appropriate data to send to the users to enable review and corrective action.

   Without the ability to access and analyze it, the AID would effectively transmit a mountain of data. That data would have to be sorted through by humans or computers on the ground. Only then would they discover the issue. By doing the analysis locally, the AID speeds decision-making and helps airline personnel make more data-driven decisions.

2. Less data to transmit: While aircraft on the ground can utilize 5G and airport Wi-Fi networks for connectivity, airlines still rely on satellite services to provide connectivity in flight. Unfortunately, unlike terrestrial networks, satellite is expensive, and the user pays for the capacity they use.

   The major benefit of the AID is allowing all parties to monitor aircraft system data that need it – including personnel on the ground. Satellite services would need to be used to transfer that data from the aircraft in flight to maintenance crews, operations personnel, and flight dispatchers on the ground.

   If a large amount of data is being transmitted, this would quickly become prohibitively expensive. However, if a simple alert is triggered and transmitted, the cost to the airline remains small. The AID can save airlines a lot of money in expensive satellite services by doing the data analysis on the plane and then only transmitting alerts or red flags to the ground.

How would these edge computing benefits work in the real world? Let's look at two entirely possible scenarios involving real issues impacting aircraft.

FALLING (TOO) HARD FOR YOU

We've all been on flights that ended with a somewhat stiff landing. These hard landings aren't just uncomfortable – they may be a bit worrisome for passengers. They can also have a negative impact on the health of plane components and systems.

If the airplane lands too hard and the G-forces on the landing gear exceed a certain limit, structural damage could result. This damage could lead to a future incident or the need to take the aircraft out of service for replacement parts and repairs.

Unfortunately, there is no real way of determining immediately if a landing was too hard on an older aircraft. It's ultimately up to the pilot's discretion to alert maintenance crews and airline operational personnel if they think the landing could have resulted in damage.

If the aircraft systems indicate an overly hard landing, the AID could identify that and send an alert to engineers and maintenance crews. Those crews could review the aircraft data sent from the AID and then be ready and waiting for the aircraft when it arrives at the gate to conduct any required inspections and ensure there was no structural damage. This could minimize incidents and identify issues before they become problems in the future.

This is a great example of how the AID could benefit airlines, but there's an even better one.

STOP GUESSING

The flaps on the wing extend during takeoff and at lower speeds. They eventually retract when the plane reaches a certain speed and altitude. However, it is possible to fly the plane too quickly when the flaps are extended. This results in a flap overspeed exceedance that can negatively impact the aircraft.

The potential damage caused by a speed exceedance is proportional to the aircraft's speed. Exceed the optimum speed by a few knots, and the aircraft will probably be fine. Exceed it by 100 knots, and you could rip those flaps right off the wings.

I heard an interesting story about one particular flight involving a long-range widebody aircraft. The flight crew reported a flap overspeed exceedance on the climb-out but weren't sure just how fast they were going when it occurred. They estimated the speed when radioing to the engineers on the ground, and those engineers thought that the aircraft had a significant overspeed situation.

Concerned about the severity of the event, the engineers recommended that the flight crew dump fuel and bring the passengers back to its departure airport. This was incredibly expensive for the airline, which had to house the passengers overnight and fly them out the following day.

Later on, upon analysis of the aircraft system data, they identified that the flight crew overestimated their speed during the occurrence. There was a very low chance that the aircraft had sustained major damage; it could have kept its original flight plan and continued to its destination.

If there had been an AID with edge computing capabilities on that flight, it would have analyzed the aircraft system data in real time. It could then have alerted the engineers of the severity of any flap overspeed exceedance, along with the data necessary for them to determine if it was significant enough to cause a problem. This would have eliminated the guesswork and kept the aircraft flying to its final destination – which it would have reached with no incident.

AIDs are beneficial to airlines. They improve sustainability, increase operational efficiency, and deliver better passenger experiences, which ultimately impact a passenger's perception of the airline. And while many passengers are relatively understanding when flight delays are driven by weather or air traffic control delays, acceptance of delays driven by maintenance issues is often different. That makes today's AIDs all the more valuable, as they help an airline reduce and avoid delays through proactive routine maintenance.

This new generation of AID solutions with edge computing capabilities can accelerate and improve decision-making by delivering important information – and only important information – when and where it's needed. But what should an airline look for in an AID solution?

CHAPTER THREE

Three considerations for choosing an AID solution

The AID is not a new concept. The two-thirds of airlines that have yet to adopt the technology are starting to learn what others in the industry have already discovered: that a new generation of AID solutions integrated with edge computing capabilities are helping airline personnel make better, more data-driven decisions faster than an airplane can fly.

While many of today's new aircraft are being delivered by the manufacturer with an AID solution already installed, there is a massive ecosystem of unconnected aircraft across the fleets of many airlines around the globe. With the potential to improve operational efficiency, enhance passenger experience, enable proactive maintenance, and increase sustainability, airlines are looking to connect these aircraft with AIDs.

But which AID solution should airlines choose? And what capabilities, characteristics, and functionality should airlines be looking for when evaluating AID solutions? Here are three considerations that I feel are important to keep in mind when choosing an AID.

- **A focus on cybersecurity**
  Any IT or cybersecurity professional can tell you that a system that becomes connected is almost immediately a target for malicious actors. For this reason, any AID solution an airline implements on their aircraft must be developed with a focus on cybersecurity.

  AID solutions should be built to meet all current cybersecurity standards and with all current security best practices in mind. They should also be certified and accredited to demonstrate that they're safe and trustworthy. But that's still not enough.

  Any AID solution should be subjected to rigorous penetration testing to ensure it is resistant to the ever-evolving and increasingly sophisticated threat landscape facing modern aviation. It should also be monitored in real-time to ensure that no unauthorized individuals are attempting to gain access to the aircraft.

- **Edge computing capability**
  While integrating any AID solution can help airlines by aggregating system data and making it accessible to stakeholders and decision-makers, an AID with edge computing capabilities can enable much more.

  By aggregating and analyzing aircraft system data at the edge, the AID can quickly identify problems and alert those who need to know. Also, since the AID is parsing through mountains of data on the aircraft and only sending alerts, there's no need to pay to transmit a large amount of data from the aircraft in the air to airline personnel on the ground.

  Edge computing capabilities turbocharge the AID and turn it into an engine for making faster, more data-driven decisions. By identifying important information and alerting key personnel about anomalies or incidents, the AID prevents airline personnel from being overloaded with data. It also prevents important information from falling through the cracks.

- **More than one thing**
  Many modern AID solutions can do only one thing or connect only one thing. For example, they may aggregate aircraft system data and push it to only the flight crew's EFB. Or they might only be able to record flight safety data and make it accessible to safety personnel.

  In the last two chapters, I outlined numerous ways the AID can benefit airlines. I also identified many different organizations and stakeholders within an airline that could benefit from having access to aircraft system data. If an AID can only do one of these things, airlines effectively leave benefits and capabilities on the table.

  They might be able to improve flight safety but not increase flight path efficiency – minimizing costs, cutting carbon emissions, and avoiding flight delays. They might be able to make aircraft system data available on the EFB but not enable preventative, proactive maintenance by pushing alerts and important system data to maintenance personnel on the ground.

  Retrofitting an older aircraft with an AID solution takes time and costs money. If an aircraft is going to be taken out of service to have an AID installed, that AID should deliver a significant return on investment. The best way to ensure that the AID pulls its weight is to purchase and install an AID that can perform many different functions across the entire aviation ecosystem.

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Appendix

AIRFIELD INCURSIONS

According to the Federal Aviation Administration, an airfield incursion involves any occurrence in the airfield runway environment that involves an aircraft, vehicle, person, or object on the ground that created a collision hazard for an aircraft intending to land or preparing for take-off.

ELECTRONIC FLIGHT BAG (EFB)

An EFB is a device that hosts applications that allow flight crews to perform a variety of functions that were traditionally accomplished by using paper products and tools. An EFB can perform basic flight planning calculations and display a variety of digital documentation, including navigational charts, operations manuals, and aircraft checklists. This advanced system is also equipped with the ability to display an aircraft's position on navigational charts, depict real-time weather and perform many complex flight-planning tasks.

FLIGHTHUB

A recently-released electronic flight folder (EFF) solution accessible from an aircraft's EFB, Flighthub centralizes data sources and workflows for pilots and airlines, coordinating the life cycle of an entire flight from start to finish. This EFF solution puts the information that pilots need directly at their fingertips when they need it – ensuring that they don't have to go hunting for essential information across multiple EFB applications when time is of the essence. FlightHub gives users fast and easy access to a wide ecosystem of flight information, from preflight documents, such as flight plans and weather information, to postflight summaries with actual timing and fuel burn reports.

FLIGHT PROFILE OPTIMIZATION

A flight path optimization tool that is built into the FlightHub EFF solution, Flight Profile Optimization (FPO) leverages flight path information taken from multiple aircraft and ground sources to deliver real-time route recommendations throughout a flight to help airlines increase efficiency, reduce fuel costs, and decrease CO2 emissions.

GLOBALCONNECT

GlobalConnect is a managed digital service that enables a single communications solution in which new internet protocol links – such as broadband satellite, Wi-Fi or cellular – work seamlessly and interchangeably alongside the legacy Aircraft Communications Addressing and Reporting System (ACARS). This service enables the highly secure, bidirectional exchange of data between the aircraft and ground operations, including aircraft maintenance and performance data, and supports data feeds to the growing number of mobile applications that are being used by flight crews.

INTELISIGHT AID

The InteliSight Aircraft Interface Device is a data management technology from Collins that allows airlines to share aircraft data with ground-based teams. The AID captures, records, stores, encrypts and securely sends aircraft data to Collins' GlobalConnect ground platform, where it's automatically offloaded after each flight. This provides airlines with near real-time access to data that can be used for safety analysis, troubleshooting, and other purposes.

For additional information on any of these technologies, solutions, and terminologies, reach out to Collins at commercial-aviation@collins.com.

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