Real-Time Flight Tracking at Azul Linhas Aéreas

Felipe Starling, IT Manager Flight Ops Solution, Azul Linhas Aéreas outlines a 100% global, real-time aircraft flight tracking project
While this article is ultimately about flight tracking, an important and pertinent topic today, readers will need a context in which to put the flight tracking information. So, perhaps the first thing I should do is to explain something about the airline that is the subject of this article.

**AZUL LINHAS AÉREAS**

**Azul at a Glance**

We believe we are the fastest-growing, most profitable and best positioned airline in Brazil.

- #1 in destinations served (over 100)
- #1 in on-time performance in Brazil 2017 (OAG)
- #1 in customer satisfaction
- #1 on 71% of routes served
- #1 in departures (~one third of departures in the country)
- #1 in passengers and flights per capita in Brazil

**FIGURE 1**

From commencing operations in 2008 (figure 1) and now ten years old, Azul has grown organically and by acquisition. In 2012 Azul acquired Trip Airlines which was, at the time, the largest South American airline in terms of number of destinations. 2013 saw Azul starting a program to introduce Next-Gen aircraft across the fleet with orders placed for 63 Airbus A320neos and 33 Embraer ERJ-E2 second generation. Partnerships were established in 2015 and 2016 with United Airlines in the USA and HNA in China. 2017 saw the airline’s IPO being listed on both the New York Stock Exchange as well as in Brazil. As things stand today, Azul serves more than 100 destinations and is the number one operator on 71% of the routes it serves as well as being number one in departures with one third of departures in Brazil. Azul is also number one in Brazil for on-time performance and number one for customer satisfaction.

Looking more widely at the Brazilian aviation market (figure 2), in the period 2007 to 2016, the market doubled with Azul being responsible for half of that growth.

**FIGURE 2**

That’s all against a background of the number of domestic flights per capita in Brazil being pretty low compared to a comparable South American market such as Colombia or a mature market such as the USA. The inference is that there is a...
great deal of opportunity to expand and exploit that market. That said, Azul already has a presence in a lot of cities in Brazil (figure 3 — places marked in blue).

**Market and Route Leadership**

Azul is strongly positioned in Brazil, with strong presence in underserved markets...

Out of the 98 cities that Azul serves in Brazil, 61 have populations in excess of 1 million people and, also of the cities Azul serves, the airline is number one in 68 of them. All that is achieved with a fleet of mixed aircraft types. Azul operates 34 ATRs, 70 Embraer E-Jets and 8 A320neos which will rise to 35 by 2020 as aircraft on order, see above, are delivered. These are appropriately sized aircraft for the Brazilian market and fit well with Azul’s process of opening a market with an ATR service, then developing that market to the point where it will warrant the use of the larger E-RJ aircraft and, hopefully, eventually, the A320neo. There are also some small cities in Brazil, a huge country, that will only ever in the foreseeable future justify the ATR aircraft. So, as you can see, the size of aircraft is really important in this market. Also, the ATRs are usually used on routes with an average stage length of under 500km while the E-Jets average stage length is nearer 800km while the A320neo fleet serves routes with an average stage length of nearly 1,500km.

The next generation aircraft have some financial advantage over the Embraer e-95 that is currently in the fleet and Azul expects the CASK (Cost per Available Seat Kilometer) to reduce as the next generation aircraft enter service. In fact, we already have achieved a 29% CASK reduction using the A320neo. What that means is that all the 56 seats colored yellow in the seating plan in figure 4 overleaf, and additional to the seating available on the E-RJ are, literally, at no extra cost.

Also, because Azul has a strong position in Brazil and significant market penetration, there are 31 cities that Azul serves with international connections, two...
“...a lot of work has been invested by ICAO (International Civil Aviation Organization) to generate a Global Aeronautical Distress & Safety System (GADSS) with ‘Aircraft Tracking’, ICAO Annex 6.”

and a half times as many as our nearest competitor, made possible also by Azul’s partnerships with other airlines in the US, Europe and China. Although predominantly a low-cost airline, Azul operates modern aircraft with generous services and better than average features and facilities such as legroom which we believe to be one of the reasons why we have been growing so fast (the A330s used on Azul’s international services have facilities such as the sky sofa) and which have been recognized with a number of independent awards (figure 5).

“……aircraft operators have a responsibility for aircraft tracking and to maintain a ground-based record of the four dimensional (4D) position of an individual aircraft in flight, the 4D position report including time, latitude, longitude and altitude.”

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CASE STUDY: AZUL LINHAS AÉREAS

and to maintain a ground-based record of the four dimensional (4D) position of an individual aircraft in flight, the 4D position report including time, latitude, longitude and altitude. The aim of this ICAO standard is to reduce the potential search and rescue area in the event of an incident, to 6NM (nautical miles) radius.

The target dates for implementation of these standards for aircraft tracking are that by 8th November 2018 (later this year) airlines should have in place, for aircraft in the air, a system that will generate a 4D position report every 15 minutes. Thereafter, by January 2021, autonomous distress tracking will be introduced and that report generation will need to be every minute. Fortunately, the system that Azul Linhas Aéreas has adopted for this purpose, FlightTracker from SITAONAIR, is already capable of supporting the ground based component. Space Based ADS-B is a key component for the provision of 4D position reports every 1 minute supporting the distress tracking standard required by ICAO.

So, looking at Azul’s progress in this matter, in 2015 there was one person per shift who was responsible for flight tracking. Today, every dispatcher is responsible for tracking their own flights. The challenge that we face in Brazil is that there is not full coverage across the country for VHF at flight level FL180 but, for the Embraer, Airbus A320 and wide-body A330 there is full coverage across the continent because their flight level is above FL200. However, it is necessary to solve this problem and the solution at which we arrived was to implement FlightTracker from SITAONAIR. Not only does it fulfil the requirements of ICAO GADSS but also it does not require any significant re-engineering of the aircraft. Let me explain.

FLIGHTTRACKER: SPACE-BASED ADS-B

FlightTracker is a space-based ADS-B (Automatic Dependent Surveillance — Broadcast) solution powered by Aireon. Azul does not need to put anything in the aircraft but will enjoy the benefit of global coverage, including those areas where there are gaps in VHF coverage (see above) as well as coverage for Oceanic areas. How it will work is that the space-based ADS-B will be added to FlightTracker and aircraft positions will be identified as such within the application. Importantly, no changes are needed to the aircraft in order to use the application which is very valuable because if, say, we had to install some satellite communication technology, that would require that the aircraft be taken out of service or a maintenance event be extended which would mean significant cost implications to do that.

Data about the aircraft’s position is passed to FlightTracker using the existing web service from FlightAware and all existing FlightTracker alerting functions are available against this data. That means that alerts can be set up with changes of rules or anything that the airline needs. Importantly, this all allows the airline to meet GADSS without increasing the costs of ACARS/SATCOM messaging purely for position reporting. Also, Azul does not need to have an Iridium contract because everything is undertaken by and handled through SITAONAIR.
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FlightTracker currently uses a combination of position sources to maximize coverage, including: Terrestrial ADS-B; Various FANS (Future Air Navigation Systems) based communications, ADS-C (Automatic Dependent Surveillance — Contract), CPDLC (Controller-Pilot Data Link Communication) and AFN (Aeronautical Facilities Notification); ACARS; and Radar. As already mentioned and importantly, the system is specifically designed to provide aircraft tracking using existing on-board equipment which matters in terms of cost for the solution. The Alert Module in FlightTracker continually tracks each flight automatically and generates a warning when an aircraft triggers certain defined conditions. Alerts can be set up to suit the airline’s needs and to trigger various actions, including uplinks to the aircraft; also messaging actions can escalate as the severity of the condition changes and, in more critical cases, FlightTracker can automatically set up an ADS-C contract for FANS equipped aircraft to provide an additional 1 minute position reporting option for the remainder of the flight.

HOW THE FUTURE WILL LOOK
In figure 6 you can see what we expect for the future when there is full global coverage with satellites.

Space Based ADS-B
Initial satellites are already in service with remaining deployment over the coming months.

Constellation will comprise 66 satellites with 9 in flight spares and additional ground spares.

Provides 100% Global cover including Polar, Oceanic and other remote areas.

FIGURE 6
The satellites are not yet fully deployed but will be by the end of the year to meet ICAO requirements and to deliver the full FlightTracker solution.