Aircell Axxess Cabin Communication Systems For Aircrafts

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Abstract

In today's scenario, every activity needs comfort, and most importantly which saves time. The Aircraft being first of its kind, doesn't serve all needs of passengers. Especially most of the passengers like to stay in touch in flight. All the electronic gadgets once entered into the aircrafts are asked to be switch off. There won't be any communication with the outside world. Imagine surfing the web, making online dinner reservations, arranging ground transportation, reserving a tee time by Wi-Fi-enabled laptop, PDA or dual-mode Smartphone – or simply having a clear, uninterrupted phone conversation – before the passengers touch down. This paper describes about Aircell's ATG 4000 high-speed Internet unit for business aviation which operates over an air-to-ground (ATG) link. It interfaces with the company's network-neutral Axxess cabin system, which supports multiple channels of worldwide voice and narrowband data service via the Iridium satellite network

Keywords

Air to ground system, swift broad band unit, data interface unit, Antenna, Router, Transceiver.

1. Introduction

The airline industry is comprised of commercial airlines, air cargo providers, business jets, and smaller general aviation aircraft. The primary interest of commercial airliners is to increase contributions to their business. In addition they are likely to be attracted to the idea of a service that helps them differentiate themselves from the competition. As winner of an exclusive FCC frequency license in 2006, Aircell has built a revolutionary new mobile broadband network for commercial and business aviation. Aircell is the single point of contact to outfit aircrafts with the most advanced airborne communications today and tomorrow. With a total of more than, 6000 customers worldwide, Aircell is the undisputed leader in global airborne communications. The Aircell Network provides airlines with connectivity to operations and a path to enhanced cabin services such as video, audio, television and more. The Aircell 3G network includes many ground towers strategically positioned around the country that provide data rates to the cabin that average around 2.2 Mbps.

2. Beginning of Aircell

Once upon a time, Boeing had a brilliant idea to combine its satellite savvy and plane-building expertise into a separate business division that would carry high-speed signals from geostationary satellites into receivers that it would custom-fit into its own and others' planes. While it was clear that satellite-based Internet access was workable, the cost structure Boeing had established was not.

As the industry shook itself out, and firms like Panasonic Avionics and OnAir also tried to figure out models that would work, the FCC finalized a plan to transform access in American skies.

The FCC had approved limited air-to-ground (ATG) radiotelephone service in the 1980s for in-flight calling, and then offered licenses to six firms in 1990. Few launched commercially. In the end, only AirFone, ultimately run by a division of Verizon, was left standing, charging dollars per minute for calls and low-speed dial-up data. Its use of a sliver of bandwidth was inefficient in two directions: as an analog service, it was capable of handling only 10 calls at a time, making

poor use of the spectrum; by the end of its life, only two to three calls were made on each flight.

The FCC decided to auction off the 4MHz (in the 850MHz band) allotted to this service for digital air-to-ground use to provide services to passengers and airlines. It was assumed that Internet service would be the primary purpose, supplemented by onboard cellular base stations (so-called picocells) potentially providing voice, text, and data links for hardware without built-in WiFi. But airlines might piggyback on the system for non-critical communications, too.

In 2006, the FCC created a wacky kind of auction in which bids were accepted on different plans for splitting the band up into pieces. The winner was the most sensible offering: one firm paid for 3MHz and another for 1MHz. (The bandwidth was divided into 1.5MHz and 0.5MHz paired uplink/downlink channels.)

Aircell won the larger chunk. The firm had spent nearly 20 years trying to convince the FCC to allocate air-to-ground spectrum for provide greater competition and better utility. From a more exact business perspective, Aircell received a significant investment before the auction by a private-investment firm that created a separate spectrum-holding company to bid on the auction.

3. Aircell Technology

Air-to-ground communications have a variety of advantages over air-to-space connections. Aircell had already built a network for general aviation (non-commercial, private) phone and other services, so it had experience. It was able to use existing cellular facilities used by other telecoms with antennas pointing up instead of around. Aircell could also own its equipment instead of lease usage, as with satellites.

3.1. Air-to-ground technique

Aircell's air-to-ground technology makes use of as much off-the-shelf gear as the company could manage. The 1.5MHz available for uplink and downlink transmission was close enough to the 1.25MHz used by EVDO Rev. A to be a good match. The raw speed is 3.1Mbps downstream and 1.8Mbps upstream.

The antennas improve throughput, thus eking out more bandwidth from existing signals, and bonding two

modems together allowing double the bandwidth. Between the protocol update, the antennas, and the two modems the 9.8Mbps of raw bandwidth could produce four times the net throughput as the current system. That could net out to 8Mbps to the plane and 2 to 3 Mbps on the return loop.
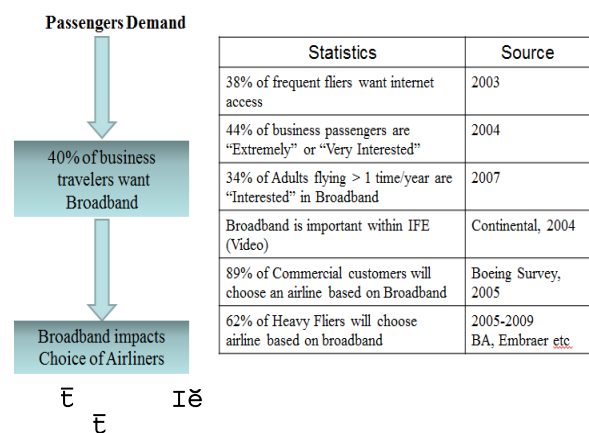
3.2. Satellite servicing

The Aircell broadband link uses direct air-to-ground technology instead of satellites, and the benefit of this approach manifests itself all the way through the system.

Aircell doesn't require expensive, geosynchronous satellites to operate. It uses off-the-shelf wireless technology and significant elements of existing ground-based infrastructure (towers, backhaul, power sources, etc) already in use by consumer wireless companies. The system requires very little power, so the aircraft antenna is small, affordable, and easy to install.

3.3. In-flight internet across the globe

The biggest problem with using cell phones in planes, of course, is picking up the mobile signal. The answer is a picocell: a small base station designed to use whatever backhaul is available to communicate with the data network and billing systems on the ground. It's the same concept as the femtocells carriers make available for the home, like the (erroneously named) AT&T 3G MicroCell, but are more likely to be sophisticated.

4. Drive towards connectivity

Passengers Demand

Statistics	Source
38% of frequent fliers want internet access	2003
44% of business passengers are "Extremely" or "Very Interested"	2004
34% of Adults flying > 1 time/year are "Interested" in Broadband	2007
Broadband is important within IFE (Video)	Continental, 2004
89% of Commercial customers will choose an airline based on Broadband	Boeing Survey, 2005
62% of Heavy Fliers will choose airline based on broadband	2005-2009 BA, Embraer etc.

40% of business travelers want Broadband

Broadband impacts Choice of Airliners

5. Design Approach

Aircell cabin communication system mainly consists of:

1. Iridium antenna
2. Two SBB (Swift broadband units) units (one as optional/standby)
3. CES system (Cabin Ethernet system),
4. Inmarsat Filters
5. Telecommunication router.

The Aircell airborne design approach is very different than the traditional approach offfered by Boeing, Airbus etc. Aircell's model is dramatically less complex, less expensive, and more flexible.

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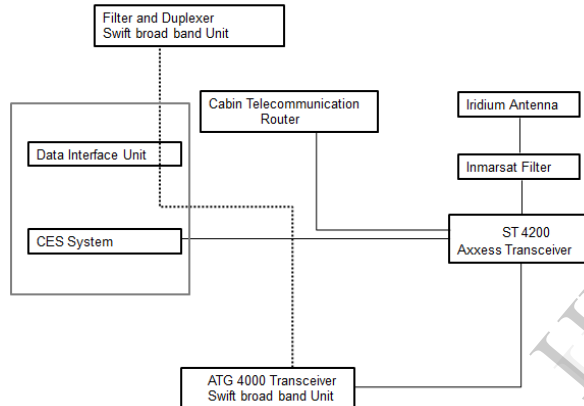
5.1. Swift Broadband Unit

In addition to the exclusive Aircell High Speed Internet system has its satellite-based Swift Broadband solution for global service. This product is powered by Thrane & Thrane.

The key benefits of Aircell broadband system are:

- High speed data connection supports full-scale internet surfing, email and corporate VPN (Virtual private network) access in flight.
- Speeds of up to 332 kb/s (IGA), 432 kb/s (HGA)
- Connection for up to six laptops (wired via RJ45)
- Low price installation due to lean design
- No long downtime due to EASA (European Aviation Safety Agency) validation

- It makes use of as much off-the-shelf gear as the company could manage

5.2. Iridium Satcom Systems

Iridium Satcom system has two filter options, one with single filter and one with dual filter.

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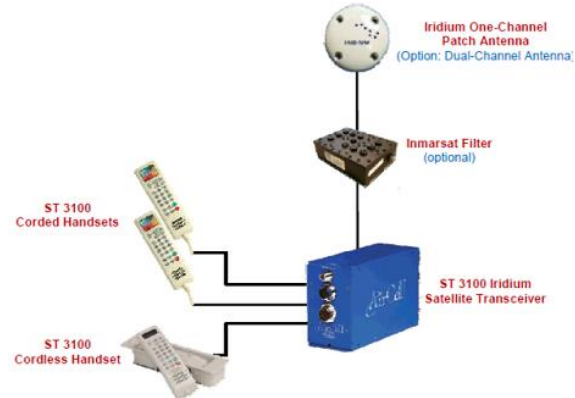
For optimum operation with Aircell Swift broadband, aircell offers a complementary Inmarsat Filter.

5.3. Cabin Telecommunication Router and Handsets

The standard Aircell Axxess system includes two Iridium satellite communications channels for quality voice and narrowband data services. Through its integrated expansion ports, up to two additional Iridium channels can be added to suit the operator's needs. In addition, through the system's Ethernet port, operators can add a high-speed Inmarsat connection on a plug-and-play basis.

A cabin telecommunication router (CTR) provides high speed, in-cabin wireless connectivity for Wi-Fi equipments which include a full 802.11b/g Wi-Fi "hotspot" which, when paired with a broadband connection, can be used to operate personal laptops, PDA's (Personal digital assistant) and other Wi-Fi devices in the cabin.

Aircell Axxess' standard, FAA-certified handsets include large, color displays – an industry first – as well as advanced noise cancelling technology and standard ear bud/headset jacks for clear, quiet calling. The design philosophy is to allow an operator to equip an airplane with Aircell Axxess, and then have it be very easy to add capabilities and even to change networks to

take advantage of new technologies. This approach makes customers not to worry about being locked into a static set of capabilities. For example, an operator can use the system's two built-in Iridium channels today, and plug in their choice of broadband connections as faster and faster networks emerge in the future."

5.4. Axxess Transceivers

The ATG 4000 is a modular add-on to the Aircell Axxess cabin system. This integrated communications suite provides Aircell High Speed Internet service via the Aircell Network, as well as multiple channels of worldwide voice and narrowband data service via the Iridium satellite network – in a network neutral package.

The ATG 5000 is the next version of the Aircell High Speed Internet service which continues to grow at a rapid rate in business aviation and on commercial airlines. The ATG 5000 is a very efficient installation for customers that want high speed Internet service aboard their aircraft on a standalone basis. In some cases, customers prefer to add high speed Internet service alongside their existing voice equipment – and in others, high speed Internet service is all they need.

6. Placement of Aircell systems in Aircraft

The aircraft consists of different stations. The station numbers may differ with respect to the seating's, weight, type of aircraft etc. Usually the aircraft stations are characterized as:

- Cockpit
- Aft bulkhead (Right/Left)
- Rear bulkhead (Right/Left)
- Passenger Compartment
- Baggage compartment
- Tail

The component placement is as below:

- The TT-5006A Intermediate Gain Antenna (IGA) is installed on top of the tail.
- The TT-5016A High power Amplifier/Low Noise Diplexer HLD is installed in the APU compartment
- The TT-5040A Swift broadband Unit (SBU) is installed in the Pressurized area (Avionics Compartment)
- Option for Wireless Access
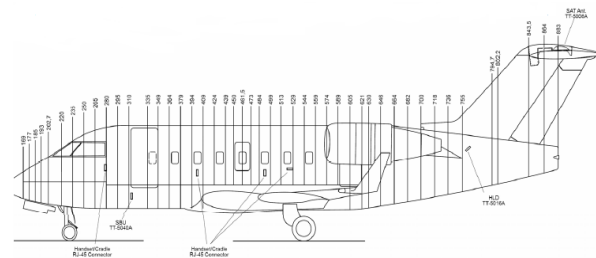
7. Conclusion and Future scope

For most owners, equipping a private aircraft with telephone capability will be an expensive extravagance. On the other hand, owners using light aircraft for business simply need the capability, regardless of cost. And if you need it, you'll have to pay for it. Internet access these days is potentially much cheaper for airliners to introduce than other items such as more personal space, bigger baggage allowances or better entertainment.

The aircell axxess system is now used excessively in most of the commercial/business aircrafts like Embraer, King-air, Boeing etc. With the successful flight in northern America, Itasca etc. now other manufacturer's in India are interested to utilize this facility.

One of Aircell's core design philosophies is CABIN SYSTEM (including handsets, wireless hotspot, in-cabin wiring, etc) as separate from the LINKs (such as Iridium, Inmarsat, Aircell broadband, etc) that connect the cabin to the ground. "Network neural" means that an Aircell Axxess operator can select and install the links that best suit their needs, and change anytime, without starting over.

With network neutrality, Aircell Axxess insulates from changes in networks over time, and let passengers take advantage of new technologies as they emerge. That entire operator needs to do is add a radio and an antenna and they can take full advantage of new network without changing any of their in-cabin equipment.

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