STRAIGHT TALK ABOUT

Satcom & HSD

Editors' Notes

Aircraft communication and data capabilities are changing quickly. The airborne telephone technology that has been in use over the last several decades has evolved significantly and additional changes continue to occur at a rapid-fire pace.

Aircraft cabin communications systems are available at higher speeds and offer better coverage. Voice telephones and high-speed data systems, including Internet and other data transfers, are available via satellite and broadband networks. Domestic U.S. and international coverage is available. Private Branch Exchange (PBX) and wireless cabin networks are also a possibility.

With the continued development of FANS 1/A, safety voice services provide the capability to allow ATC to communicate with the aircraft through an Iridium or Inmarsat satcom. Unlike a traditional satcom phone system, safety voice services would be integrated with the pilot and copilot's headset allowing for ease of use. While this system is not currently supported, safety services over Inmarsat/ Iridium are inevitable.

Keeping up with these frequent product and service changes is like tracking an ever-moving target. Finding the perfect marriage of form and function is paramount to a successful aircraft communications investment. Consequently, many do not feel confident in choosing the best solution for their aircraft. This booklet, Satcom & HSD, is Duncan Aviation's response to that need.

Duncan Aviation's mission is to be your source for aviation answers and solutions. This booklet gives you access to basic aircraft communication information. It is designed to provide easy-to-understand information and answer operators' most basic questions. We cannot cover everything, though, so please contact us to discuss systems that fit your exact requirements.

Note: As stated above, the world of aircraft communications is changing rapidly. We are monitoring the market and updating this booklet on a regular basis. To see the latest version, go to *www.DuncanAviation.aero/straighttalk*.

Straight Talk about

Satcom & HSD

What is SATCOM? 3

What is HSD? 15

Information about PBX and Security 23

FANS 1/A Overview 27

FAQs 31

Key Terms 37

What is SATCOM?

Satcom

Satcom systems use satellites positioned in space for voice and data telecommunications. Modern communications satellites use both geo-stationary orbits and low-Earth polar orbits depending on the service network infrastructure you choose.

How Does it Work?

The basic satellite system consists of space and ground components. The space segment consists of the orbiting satellites and the ground segment is made up of control stations that maintain the satellites' health in orbit and gateways that provide the interconnecting link to the ground-based telecommunications networks.

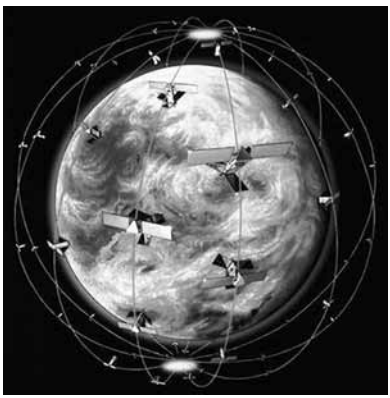
The Big Players:

While there are many government and commercial Satcom services, the number of providers for business aviation is limited; the two major players are Iridium and Inmarsat. Several companies have also made inroads into airborne communication by utilizing the Ka and Ku satellite communications bands for television and broadband signals. They are still relatively underutilized. Please see our Frequently Asked Questions and Key Terms pages for more information on Ka and Ku satcom.

Iridium

Iridium is a provider of complete worldwide satellite voice and data covering the oceans, airways and even the Polar Regions. The Iridium constellation uses 66 cross-linked satellites (plus seven spares) which create its network of global coverage. The satellites orbit the Earth at an altitude of 485 miles. They circle the Earth once every 100 minutes, traveling at a rate of 16,832 miles per hour. Each satellite is cross-linked to four other satellites; two satellites in the same orbital plane and two in an adjacent plane.

On the ground, Iridium's network includes gateways in Arizona and Alaska; a satellite network operations center in Virginia; a technical support center in Arizona; and four tracking and control stations in Canada, Alaska, Norway and Arizona - all interconnected by advanced fiber-optic and broadband satellite links.



The large number of fast-moving satellites with multiple overlapping spot beams minimizes missed connections and dropped calls.

More information can be found at the Iridium website: *www.Iridium.com*.

Iridium Today:
Due to the constellation architecture, Iridium provides worldwide voice communications, but currently is limited in its data rate ability, simply due to the age and original architecture of the satellites themselves.

Pertinent Details: Because the call has to go up to the orbiting satellite and come back, a slight delay does occur. This is called a “clipping effect” for data and a “voice delay” for telephones. The voice delay is around .25 seconds. The Iridium network is truly global, with no holes in coverage. Iridium systems are far less invasive for aircraft installation/retrofit, although they are more susceptible to interference by other onboard systems.

Iridium in The Future:
The current Iridium service is predicted to remain fully operational until approximately 2014, however industry experts see its lifespan lasting much longer. Iridium has developed a next-generation satellite constellation named “Iridium NEXT.” NEXT is being developed with an architecture offering the same voice services and a higher-powered data transfer system with backward compatibility for existing users. The Iridium NEXT satellite constellation will begin launching in 2015, and will be fully deployed by 2017.

For answers to specific questions, please refer to Iridium Questions, page 32.

Inmarsat

Inmarsat Today:
Inmarsat is the traditional international satellite service provider. Inmarsat presently offers a number of voice and data services including Aero H, H+, I, M, Swift 64 and their popular SwiftBroadband high-speed data service. Swift 64 and SwiftBroadband systems are commonly used in larger corporate aircraft with voice and data options. This is mainly due to the size of the high-gain antenna system normally installed on the tail of the aircraft, although there have been some smaller antenna options developed recently.

In the past few years, Inmarsat has launched its three fourth-generation SwiftBroadband (I4) satellites, which were operational in the Fall of 2008. SwiftBroadband offers voice and data transfer rates of up to 432kbps and is available globally except for extreme Polar Regions.

Inmarsat in The Future:
The safety capabilities of Inmarsat's system are designed to be fully compliant with the International Civil Aviation Organisation's (ICAO) plans for an integrated global traffic management system. A pillar of the ICAO's strategy is a global, air-to-ground and ground-to-ground network called the Aeronautical Telecommunications Network (ATN), to increase safety and improve management of aircraft. ATN is intended to carry data from a number of systems - including

VHF datalink, Mode-S secondary surveillance radar and satellite communications - to provide seamless global information transfer among air traffic management providers, aircraft operators, service providers and passengers. ATN is being introduced over several years. In the interim, Inmarsat-based FANS 1/A avionics and the ACARS (Aircraft Communication Addressing and Reporting System) datalink protocol is being used to support communications on oceanic flights.

In August 2010 Inmarsat awarded Boeing a contract to build a constellation of three Inmarsat-5 satellites as part of a U.S. $1.2 billion worldwide wireless broadband network called Inmarsat Global Xpress. The three Inmarsat-5 (I-5) satellites will be based on Boeing's 702HP spacecraft platform. The first is scheduled for completion in 2013, with full global coverage expected by the end of 2014. The satellites will operate at Ka-band in the range of 20–30 GHz. Each Inmarsat-5 will carry a payload of 89 small Ka-band beams which combined will offer global Ka-band spot coverage. There are plans to offer high-speed inflight broadband on airliners.

More information may be found at:
www.Inmarsat.com/swiftbroadband.

Safety Services

Air Traffic Control Service – Position Reporting:
When making a trans-oceanic flight, it is important to have reliable position reporting. VHF range is inadequate. HF Voice, while in common use, is spotty and unreliable. There are now several services that are certified for use of position reporting (FAR 91.511, 135.165 and AC91-70 contain HF guidance). Inmarsat Aero-I, H, and H+, HF DataLink and more recently, Iridium, are all ICAO SARPS qualified.

Automatic Position Reports through the Satcom are known as ADS-C and require no pilot interaction. The Contract in ADS-C means that ATC will control the reporting system. There can be up to 5 separate ATC contracts at any one time.

Voice Safety Services:
Safety voice services is a capability that allows ATC to contact the aircraft through the Satcom or the aircraft to contact ATC through the Satcom. This requires the Satcom to be interfaced with the CVR, which is usually done through the audio panels. Because of this, either the FMS CDU must be an MCDU capable of dialing the Satcom or there must be an external dialer attached to the Satcom to allow communication through the crews' headsets. This must be a dedicated channel to the cockpit (the same is true for the datalink), which means the cabin Satcom channels must be separate. A telephone handset does not meet this requirement. The current ground-based portion of the Inmarsat network will require upgrades to make this function viable. Because of this, it is currently not certified for use.

Please contact Duncan Aviation for a listing of qualified systems.

Medical Service – Crew/Passenger Safety

Passenger health while airborne is another safety concern. Aircell and MedAire provide a service that allows flight crew and passengers to communicate directly to emergency room physicians at MedAire's 24/7 MedLink Global Response Center. With special training in remote airborne diagnosis and treatment, the physicians provide real-time medical advice to help people manage any medical issues that occur during the flight. MedAire service is available with Iridium and Inmarsat telephones. For answers to specific questions, please refer to Inmarsat FAQs, page 33.

Comparing Apples to Apples

Iridium

Number of Users:
500,000+

Satellite Quantity:
66 satellites plus multiple in-orbit
7 backup satellites

Low-Earth Orbiting (LEO)

Orbital Height:
485 miles

Orbital Period:
1 hour, 40 minutes

Satellite Weight and Size:
1,500 pounds
14 feet long/3.5 feet high

Spot Beams:
48 per satellite (30 miles in diameter per beam)

Frequencies:
Downlinks: 1616-1626.5 MHz
Uplinks: 1616-1626.5 MHz

Data Transmission Rate:
2.4-10 Kbps

Satellite Lifetime:
2015 – 2017 Current Generation
2015 – 2025 Iridium NEXT

Inmarsat

Number of Users:
400,000+

Satellite Quantity:
I3: 5 satellites I
4: 3 satellites

Geo-Stationary (GEO)

Orbital Height:
22,000 miles

Orbital Period:
Stationary

Satellite Weight and Size:
I4: 13,200 pounds
23 feet long/10 feet high

Spot Beams:
I3: 1 global, 7 spot beams
I4: 1 global, 19 regional, 228 narrow

Frequencies:
1525.0-1559.0 MHz
1626.5-1660.5 MHz

Data Transmission Rate:
432 Kbps

Satellite Lifetime:
10+ years


What is HSD?

Data Communications Solutions

In today's world, broadband data services are becoming more of a necessity. It is very difficult to conduct business effectively without broadband. Many information and entertainment services are and will be available through a high-speed data link. Many of the systems and services that provide voice satellite communications mentioned earlier in this booklet can also provide data transfer services to aircraft. Some are very slow (and not well suited for most applications). Others are reasonably fast, but very expensive.

The good news is that there are some exciting new services in the marketplace and even more on the horizon which are both fast and reasonably priced. In the following pages you will learn about the services that are here now and those that will soon be available for our industry.

Iridium:
Iridium is not recommended for Internet/data services. The original Iridium aero service did not anticipate the need for Internet access. There were a variety of technical reasons for this, but principally, it was because the focus was on voice and the movement of data involved many technical challenges. Iridium is capable of a low data rate of 2.2 to 3.8 kbps average. It may be increased to 10 kbps with very aggressive voice compression and decompression algorithms. Iridium NEXT, is expected to provide data rates of up to 1.0 mbps, and opens up the possibility of supplying airlines with higher-speed service than currently on offer from the company, while retaining low costs, according to Iridium.

Inmarsat (Swift64):
Within the Inmarsat system, the first-generation high-speed data service is Swift64 Mobile ISDN. The dedicated 64 kbps Mobile ISDN service brought a range of applications, including video-conferencing, e-mail and high-volume data transfer to the cabin. With each channel being 64 kbps, bonding multiple channels increases the throughput in 64 kbps intervals, with a maximum

bonding capacity of four channels or 256 kbps. A more cost-efficient way to gain data speed is through the use of data compression techniques. The installation of a compression system on the aircraft coupled with the appropriate service provider may increase the data rate to nearly double the basic rate.

Many corporate jets had been fitted with routers and networks that allow business travelers to connect their notebook PCs to intranets or the Internet via Swift64. Many of these systems are currently being retrofit to the newer generation SwiftBroadband system.

Inmarsat SwiftBroadband:
The latest generation Inmarsat SwiftBroadband service uses the small high-power spot-beams of fourth generation (I4) satellites to supply bandwidth more comparable to that of terrestrial broadband services. Optimum SwiftBroadband performance requires high-gain aircraft antennae to achieve the greatest speed. SwiftBroadband service is also available through smaller antennae at a lower, but useable, data rate. A single SwiftBroadband channel alone will offer 432 kbps. Similar to the Swift64 solution discussed earlier, the use of compression can increase the data rate for one channel up to 1 mbps.

Typical applications of SwiftBroadband include short messaging (SMS), e-mail, Internet access, VPNs, transfer of data and images, video-conferencing, streaming-video and voice communications (including voice over internet protocol referred to as VOIP).

SwiftBroadband can be integrated with embedded in-flight entertainment systems and other wired and wireless networks in the cabin to allow passengers to communicate from their own PDAs and laptops. Via a standard IP service, a corporate network with a secure VPN can connect at speeds up to 432 kbps. This same speed is used for e-mail, browsing or other office applications. For applications where quality of

service is paramount, such as live video or video-conferencing, SwiftBroadband offers a streaming IP service up to 256 kbps on demand. You have the flexibility to choose the data rate on a case-by-case basis, depending on your application.

Aircell Broadband:
Aircell (who has changed its name to Aircell, a Gogo company) has developed and marketed its Gogo-Biz high-speed data technology based on air-to-ground communications. Aircell broadband supports high-speed Internet, e-mail and corporate VPN access in flight, as well as VOIP telephony. Aircell broadband installation includes two lightweight bottom-mount antennae which fit nearly every aircraft, and the associated avionics units are small enough to locate inside or outside the pressure vessel.

Highlights:

- DSL-like connection speeds. Up to 3.1 peak mbps (MegaBits Per Second).
- Uses cellular ground stations to provide coast-to-coast Continental-U.S. coverage.
- Nationwide service above 10,000 feet.
- Integrates with Aircell Axxess Iridium phone system, or stand-alone.
- Works with laptops, smartphones, PDAs, BlackBerrys®, Androids, as well as other mobile wireless devices.
- Includes 802.11 b/g wireless access point (certification via STC).
- Future expansion into Alaska, Canada, Mexico.
- VOIP telephony functionality.

Ku- and Ka-Band Solutions:
Over the last few years there have been several companies developing communication and broadband solutions using the Ku- and Ka-band frequency spectrums via existing communications Satellites. Ku- and Ka-band communications have the ability to provide much better broadband speeds and

bandwidths than Inmarsat. However, in some cases, this form of communication can be more susceptible to atmospheric conditions. The equipment size is also large and similar to that for the Inmarsat-based equipment. Rockwell Collins' eXchange with ARINC SKYLink Broadband service is a real-time, two-way high-speed Internet service using Ku-band frequencies. Hughes Electronics, ViaSat, Thales, Panasonic, Boeing, are several others and finding their way into this market as well.

For answers to specific questions, please refer to the FAQs, page 31.

Wi-Fi:

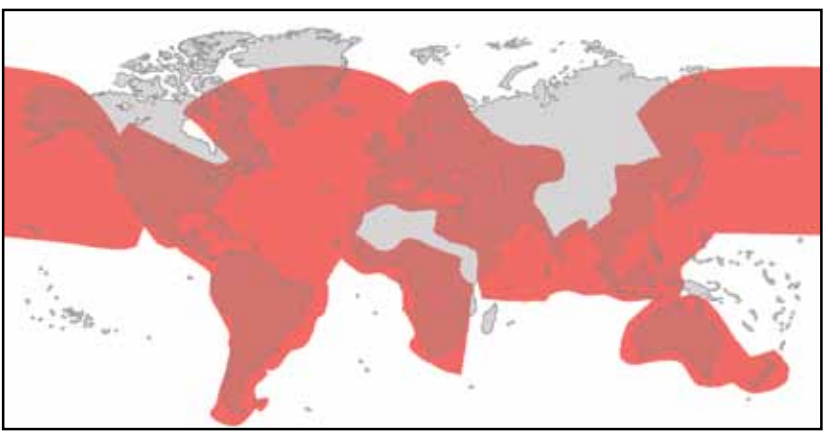
This would be a good time to discuss the tangled web which has been airborne Wi-Fi. If you've flown with a commercial airline, you know the drill. Turn off all pagers, electronic games, MP3 and CD players, laptops and the like once the cabin door is closed, until the plane gets above 10,000 feet. The rules are the same for corporate aircraft. But do you know the real reasons why you have to follow these rules? The actual regulation can be found in FAA Advisory Circular AC 91-21.1B.

There are still unknowns about the radio signals that portable electronic devices (PEDs) and cell phones give off. These signals, especially in large quantities and emitted over a long time, may unintentionally affect aircraft communications, navigation, flight control and electronic equipment. The regulations also let operators independently determine if passengers can use PEDs not specifically mentioned by the rules. An operator must show a device does not interfere with safe operation of the aircraft during all phases of flight. In its oversight capacity, the FAA ensures that the operator complies with regulations by reviewing the results of the tests and its analysis of pertinent data. Compliance with the regulations by performing the testing takes place in the form of a Supplemental Type Certificate (STC) for the use of Wi-Fi, which adds certification costs and the

possibility of extended downtime if an STC does not exist for your particular aircraft type.

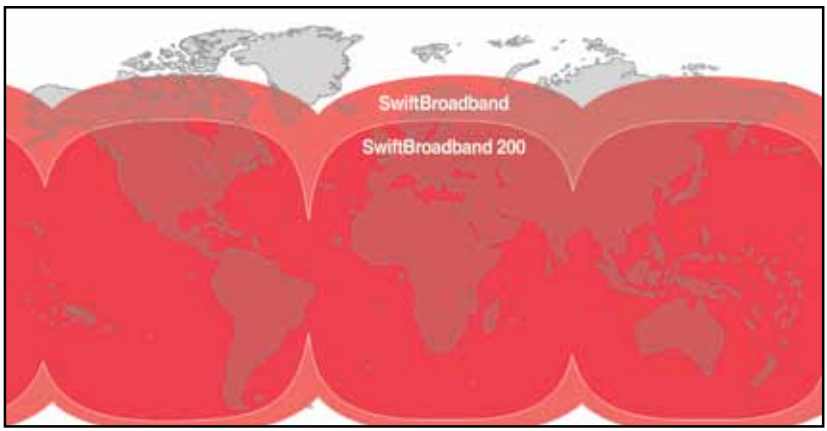
Over the last several years, airlines and business jets alike have responded to travelers' requests for inflight Internet access by installing Wi-Fi systems that passengers can access (for a fee) using their laptop computers, Blackberries and other devices with a Wi-Fi chip. For each model of aircraft a Wi-Fi system is to

Aircell: A high-speed ground-based network.



ViaSat Yonder: A multi-regional, high-speed Ku-band satellite network.

be used on, a manufacturer must get FAA certification for the system and the airline must get FAA operational approval (both via STC methods). The approvals include testing to show the equipment performs its intended function and doesn't interfere with any aircraft systems during all phases of flight. Typically, airborne Wi-Fi equipment mimics its earthbound counterparts: routers, Ethernet cables, access ports and other communications hardware, all permanently installed in the airplane.



Inmarsat SwiftBroadband: A near-global/multi-regional, intermediate speed satellite network.

Iridium: A worldwide, narrow- and intermediate-band satellite network.

Information about PBX & Security

PBX and Cabin Management Functions

Integral to the telephone and high-speed data systems in a typical corporate aircraft is the requirement for convenient interface and proper interaction of all the devices that are installed or may be carried onto the aircraft.

Integration is typically achieved through an avionics unit known as a Private Branch Exchange (PBX). The PBX should contain all the analog and digital busses as well as wired and wireless Wi-Fi routers. The PBX is selected to best fit the users' needs. When selecting a PBX, we recommend planning for growth of the system.

These devices include but are not limited to:

- Satellite transceivers (ie. Inmarsat, Ku, Ka or Iridium).
- Broadband terrestrial transceivers.
- Telephone handsets (wired or Wi-Fi).
- Personal notebook or laptop computers.
- Wi-Fi cell phones and handsets.
- Fax machines.
- Printers.
- PEDs (ie. iPad, iPod, SmartPhones, Tablets).
- Airshow or moving map displays.
- Electronic flight bags (EFBs).
- Flight management, ACARS, FANS 1/A systems.

Security

When talking about voice security, it is common to hear the term Virtual Private Network (VPN). A VPN is a communications network tunneled through another network and dedicated to a specific system. One common application is secure communications through the public Internet, but a VPN need not have explicit security features, such as authentication or content encryption. VPNs, for example, can be used to separate the traffic of different user communities over an underlying network with strong security features. Keep in mind that enabling VPN reduces potential throughput for data transmission, thus resulting in slower data speeds. Inmarsat and Iridium are reasonably secure even without VPN. We recommend that you consult your company's IT department to determine the level of security required. Your service provider can work out the details with your IT department.

VPN continuity while in-flight has been shown to be very stable when the aircraft is connected to a single broadband source. However, when changing sources, it is likely that you would need to re-boot your VPN. For example, perhaps your aircraft is connected to the Gogo Biz network over the continental United States and the aircraft begins to travel off-shore. If the aircraft is properly equipped, the system will switch from Gogo to Inmarsat without any notification. However, if you have a VPN connected during the switch, it is likely that the VPN will disconnect and you will need to log-in again.

FANS 1/A Overview

FANS 1/A

Future Air Navigation System is a format of communication for CPDLC. Aeronautical Telecommunication Network (ATN) FANS 1 was originally developed by Boeing and later adopted by Airbus (FANS A). FANS 1/A uses an early version of protocol that has been used for 15 years by the airlines.

In the early 1980s The International Civil Aviation Organization (ICAO) became concerned with the aging infrastructure and the inherent faults with traditional air traffic management methods. In an effort to increase aircraft safety and limit the amount of human error ICAO developed a council to investigate ways to increase safety. This council was charged with studying new technologies and operational concepts for the future of air traffic management and future air navigation systems (FANS).

One of the functions of FANS is that it permits air traffic controllers to monitor aircraft which are not in radar range and to speak directly to an aircrew in a clearer manner. Traditionally, position reporting has been accomplished via High Frequency Radio (HF). HF systems have a reputation for high cost and unreliability due to the high transmit power requirements and that atmospheric conditions can greatly affect their performance. The incorporation of a FANS compliant Satcom (level D certification) addresses these concerns by providing a more reliable and dedicated voice and datalink channel which is available regardless of distance to ground station. The two satellite networks available for FANS at this time are the Inmarsat and Iridium networks. While Inmarsat does not offer coverage in the highest of latitudes, it does permit the incorporation of a high speed internet source for passengers while overseas and is certified for voice safety services.

There are currently in excess of 1,000 FANS 1/A-equipped commercial and military aircraft operating around the world. Data link services are being provided in most of the world's oceanic airspaces and also in some trans-continental and domestic airspaces. The majority of these services are currently accessed by FANS 1/A equipped aircraft. FANS work stations continue to be installed in many ground facilities around the world.

Aircraft equipage depends on the aircraft type and the options selected by an operator when purchasing the aircraft or selecting retrofit equipment. FANS 1/A is a cornerstone system which will be required in several regions around the world as a part of worldwide NextGen (Next Generation Air Traffic Control) initiatives.

Duncan Aviation's Straight Talk about FANS 1/A can provide more details about FANS 1/A and CPDLC. Visit *www.DuncanAviation.aero/straighttalk/fans* to download a copy.

Frequently Asked Questions

MagnaStar Questions

I have a MagnaStar, what should I do now?
The MagnaStar C2000 has been a telephone system onboard aircraft for more than 20 years. It is a digital, ground-based system which is likely to be phased out. It is important to understand that Airborne Broadband services can exist onboard aircraft regardless of whether or not a Magnastar system is installed.

MagnaStar is going through some time-related procedures as it begins to phase out of service. These are illustrated in the timeline below.

Timeline

- **January 1, 2009**: LiveTV takes over operations of the network and announces continuation of service to Magnastar customers. It is not clear how long LiveTV will continue to offer service.
- **December 2008**: Verizon Airfone ends MagnaStar services. Also, in 2008 Verizon transfers its remaining customers to LiveTV LLC (an affiliate of JetBlue).
- **December 28, 2007**: Verizon sends another letter to customers indicating ongoing negotiations are taking place with LiveTV LLC for continuation of service.
- **April 30, 2007**: Verizon meets its deadline with the FCC and states its intentions to reduce the network from 4 MHz to 1 MHz by December 2007 (SB #15 is required).
- **March 19, 2007**: A third letter is issued, extending the network another year, changing customers' buying decisions!
- **Beginning 2007**: Verizon coverage in Canada was terminated. This was never officially announced.
- **October 31, 2006**: FCC broadband license was issued to Aircell.
- **September 2006**: Verizon sends a second letter stating the network will extend through 2007.
- **July 2006**: Verizon sends the first letter, stating that the service will end, sending shock waves through the industry.
- **May 13, 2005**: FCC decides to reallocate the frequency spectrum and grants Verizon a five-year extension using

reduced bandwidth. June 2006: FCC auction completed; Aircell emerged the winner. Two years after, Verizon has to vacate 75% of the spectrum, reducing the amount of channel space, causing congestion on the network.

Iridium Questions

Why did Iridium choose Low-Earth Orbit (LEO) satellites?
Iridium chose LEO satellites because this configuration offers a number of benefits to customers. Unlike geo-stationary (GEO) satellites, which hover above the equator at an altitude of 22,300 miles, the Iridium constellation of 66 satellites are in orbits at an altitude of only 485 miles. This orbital configuration provides the following benefits over systems based on other orbital configurations: lower cost to build and launch satellites; no significant transmission delays; small, handheld pagers and phones (versus laptop-size terminals); lower transmit power resulting in longer battery life; and complete global coverage, including all oceans and all land areas including the Polar Regions.

How large is Iridium's service coverage area?
The Iridium network is the only communications system providing true global communications coverage including oceans and all land areas, even the Polar Regions. The Iridium system blankets the Earth, connecting global satellite coverage with local ground-based wireless services and public-switch systems.

What type of phone number will I receive?
The Iridium satellite phone operates using a 12-digit international phone number assigned by your selected service provider. Some service providers can supply a normal 10-digit number and electronically manipulate it into its 12-digit international number.

If you buy two phones, can they share a service plan?
No. Each phone is required to have its own SIM card to operate.

Each SIM card has a unique phone number, and each phone number would need to be set up on an individual service plan. However, one SIM card can be transferred between two or more handheld phones, if it is from 9500 to 9500, from 9505 to 9505 or 95A to 95A.

Can I dial into my Internet Service Provider (ISP) using an Iridium phone?
Yes, you can dial into your ISP using dial-up data. For greater reliability, utilize an access phone number in the greater Phoenix, Arizona, U.S., area.

How does someone call me on my Iridium phone and what do they pay?
Callers simply dial your Iridium phone number, which will be an international call with rates set by their phone company. The Iridium country codes are 8816 and 8817.

Do you need an Iridium phone number to use Iridium's satellite service?
Yes.

Inmarsat Questions

Does the Inmarsat service work everywhere on the globe?
No. The North and South Poles are not covered by Inmarsat.

Are the Inmarsat phones secure?
Because they are digital in nature, phone calls via Inmarsat can be encrypted – turned into complex code – just as easily as any other form of data, using any one of various types of secure phone equipment. The most widely used standard for phone encryption is the US STU-III Secure Telephone Unit, which can take digitized speech from an Inmarsat terminal and instantaneously transform it into coded data for transmission. A similar unit at the receiving end decodes the data and turns it back into clear, high-quality intelligible speech. An Inmarsat call is just like a normal phone conversation, except that anyone tapping the line will get nothing but a stream of impregnable code. Government officials, diplomats, business people and anyone else who needs

guaranteed authenticity and protection against eavesdroppers can enjoy the assurance of secure communications via Inmarsat.

How many lines do I get to use?
Most Iridium and Inmarsat phones can supply anywhere from one to six lines (called channels).

Aircell (Gogo Biz) Broadband Questions

How does Aircell's broadband service work?
The Aircell broadband system is based on 3G cellular technology (EDVO), with a network of specialized cell sites on the ground communicating with aircraft in flight. An access point on the airplane will connect to your wireless device and route that communication to a ground site.

What type of devices will work with Aircell broadband?
Wireless devices that use the 802.11b or 802.11g Wi-Fi standard, including laptops, PDAs, BlackBerrys®, iPads, iPods, tablets, and portable gaming systems, will work with this service.

Since it's a ground-based service, where will it work?
The Aircell ground network currently blankets the U.S., so coast-to-coast service is available. Coverage will gradually be extended to the rest of North America – Alaska, Canada, Mexico and the Caribbean, as demand increases.

What is the difference between Broadband and Wi-Fi?
In your aircraft as in your home, there are likely three components to your broadband system. The first is the Broadband service itself which connects your home to the internet. Then you likely have two separate ways to access it. The first, being a wired connection which you would physically plug your device into. The second, being a Wi-Fi signal where your device connects wirelessly to the internet through a wireless router. It is important to distinguish between Broadband and Wi-Fi because there are different certification paths for them in an aircraft.

Key Terms

Aircraft Communication Addressing and Reporting System (ACARS) – ACARS is a digital datalink system for transmission of small messages between aircraft and ground stations via radio or satellite.

Airborne Flight Information Service (AFIS) – AFIS was created by Honeywell as a datalink service that works through your FMS system. AFIS-equipped aircraft have access to various types of information such as weather, flow reports, NEXRAD images and messaging. AFIS uses the ACARS Network for most of its services.

Aircell Broadband – A network of sites proprietary to Aircell (Gogo Biz) across the U.S. which wirelessly link an airplane to the Internet. In the cabin, a Wi-Fi hotspot can enable passengers to connect to this high-speed link, to send and receive e-mail, chat, browse the Web and enjoy a wealth of Internet applications.

Broadband – Broadband in telecommunications is a term referring to a signaling method, which includes a wide range of frequencies which may be divided into channels. The wider the bandwidth, the more information can be carried.

Broadband Multi-Link (BBML) – Delivers Internet access via a broadband data channel between the aircraft and the ground through Ku-band. Data speeds are up to 3.5 mbps. BBML is the name that ARINC/Gulfstream gave the SKYLink service.

Ethernet – A type of network technology for local area networks (LANs); cable carries radio frequency signals between computers at a rate of 10 mbps.

Geo-stationary (GEO) – This refers to a satellite traveling in an orbit 22,300 miles (35,900 km) above the Earth's equator. At this altitude, the satellite's period of rotation, 24 hours, matches the Earth's and the satellite always remains in the same spot over the Earth.

High-Speed Data (HSD) – HSD is also known as broadband. In our industry, data rate speeds of 200 kbps or higher frequency are accepted as HSD.

International Mobile Organization (Inmarsat) – The company that owns and operates one of the largest satellite communications networks in the world. The network comprises a fleet of 10 satellites in GEO orbit.

Iridium – The only provider of global satellite voice and data with complete coverage of the Earth (including oceans, airways and Polar Regions). Iridium delivers communications services to and from remote areas using a constellation consisting of 66 Low-Earth Orbiting (LEO), cross-linked satellites and has multiple in-orbit spares. The constellation operates as a fully meshed network and is the largest commercial satellite constellation in the world.

Integrated Services Digital Network (ISDN) – ISDN is a circuit-switched telephone network system designed to allow digital transmission for voice and data over ordinary telephone copper wires, resulting in better quality and higher speeds than available with analog systems. More broadly, ISDN is a set of protocols for establishing and breaking circuit-switched connections, and advanced call features for the users.

Ku and Ka-Band – These "bands" are a portion of the electromagnetic spectrum in the microwave range of frequencies and are primarily used for satellite communications, most notably for fixed and broadcast services.

Private Branch Exchange (PBX) – This term comes from the 1940s, but in today's technology PBX has become the automatic Central Hub that incorporates switching and transfer duties for the telephone/HSD system.

Router – A device in a network that handles message transfers between computers.

Satcom – This term is generally understood to mean "satellite communications" in the aerospace industry.

Spot Beam – A spot beam is a satellite signal that is specially concentrated in power so that it will cover only a limited geographic area. Spot beams are used so that only Earth stations in a particular intended reception area can properly receive the satellite signal.

Supplemental Type Certificate (STC) – STC is a type certificate issued when an applicant has received FAA approval to modify an aircraft from its original design. The STC, which incorporates by reference the related STC, approves not only the modification but also how that modification affects the original design.

Swift64 – This Inmarsat service provides 64 kbps-per-channel bandwidth for applications such as voice, e-mail, Internet and intranet access. It is available with Mobile ISDN service and IP-based Mobile Packet Data Service (MPDS).

SwiftBroadband – This Inmarsat service provides broadband data communications via commercial communications satellites, including: IP-based data up to 432 kbps; 64 kbps ISDN circuit-switched data; voice; fax; simultaneous voice and IP data. This term is used in the world of aviation.

Voice Over Internet Protocol (VOIP) or Internet Telephony, Broadband Telephony, Broadband Phone and Voice Over Broadband (IP-PBX) – This is the routing of voice conversations over the Internet or through any other IP-based network.

Virtual Private Network (VPN) – A network that uses primarily public telecommunication infrastructure, such as the Internet, to provide remote offices or traveling users an access to a central organizational network. VPNs typically require remote users of the network to be authenticated, and often secure data with encryption technologies to prevent disclosure of private information to unauthorized parties.

Wireless Fidelity (Wi-Fi) – Wi-Fi is short for "wireless fidelity," an analogy of Hi-Fi for "high fidelity" audio. Radio-based LAN protocols, namely 802.11.

Sources

FAA Advisory Circular AC No. 91-21.1B. 25 August 2006

Getting Your Business Aircraft Online: The Executive's Guide to Airborne Communications. Aircell Business Aviation Services LLC. 2011. *http://www.aircell.com/files/brochures/GettingYourBusinessAircraftOnline.pdf*

High-Speed Internet Service for General Aviation. ViaSat, Inc. 2012. *http://www.viasat.com/broadband-networks/yonder/business-aviation*

Inmarsat SwiftBroadband High-speed, IP-based voice and data. September 2008

Ka Band. Tech-FAQ. Retrieved 14 Mar. 2012 *http://www.tech-faq.com/ka-band.html*

Ku Band. Tech-FAQ. Retrieved 14 Mar. 2012 *http://www.tech-faq.com/ku-band.html*

Live TV Airfone. Retrieved 29 Feb. 2012 *http://www.livetv.net/prod_airfone.html*

SwiftBroadband Flexible IP connectivity. Retrieved 29 Feb. 2012 *http://www.inmarsat.com/Services/Aeronautical/SwiftBroadband/default.aspx*

The Global Network: Life Expectancy of Iridium's Satellite Constellation. Iridium. 2010 Rev 09/10

The Global Satellite Network: Satellite Constellation. Iridium. 2010 Rev 09/10

Satcom Service Providers

Telephone and data systems are only as good as your service provider. Like your ground-based service providers, the airborne service providers typically take care of the following:

A) Ensure your system is registered with the appropriate system provider.
B) Provide you with various service and billing plans to fit your needs.
C) Provide you with other services, such as one-number calling.

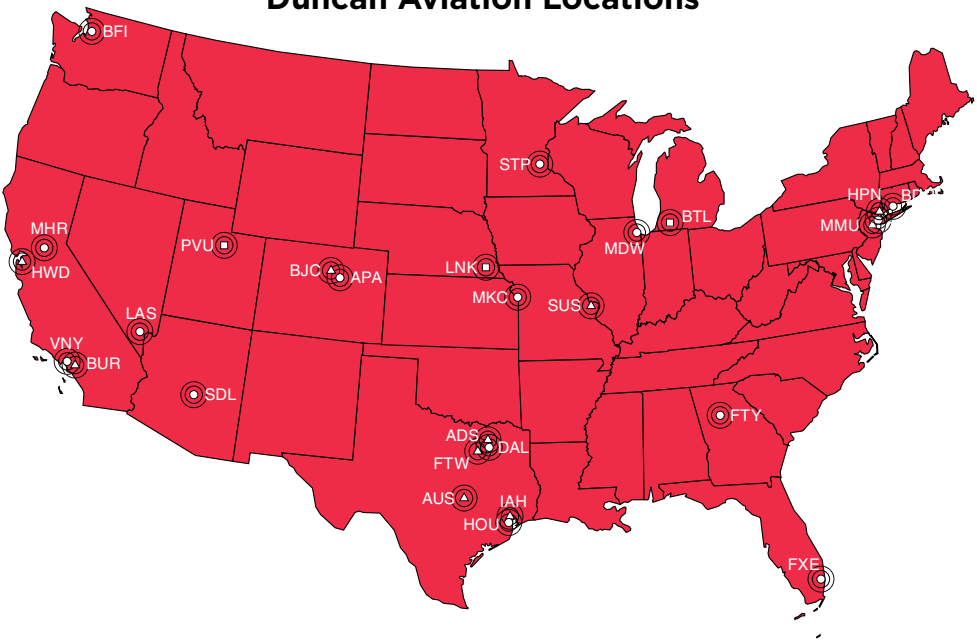
Like your ground-based systems, your service provider is there to ensure your system is operating at its peak efficiency and to provide you with understandable billing.

Duncan Aviation is familiar with most service providers and will furnish the appropriate contact information upon request.

Notes

Notes

Duncan Aviation Locations



SERVICE FACILITIES

L N K	Lincoln, Nebraska	800.228.4277	Complete
B T L	Battle Creek, Michigan	800.525.2376	Complete
P V U	Provo, Utah	877.771.2788	Maintenance/Install

AVIONICS INSTALL & LINE FACILITIES

A P A	Denver, Colorado	303.649.1790
B F I	Seattle, Washington	206.764.3962
B D R	Bridgeport, Connecticut	203.386.0111
D A L	Dallas, Texas	214.352.3468
F T Y	Atlanta, Georgia	404.227.9766
F X E	Ft. Lauderdale, Florida	954.771.6007
H O U	Houston, Texas	713.644.0352
L A S	Las Vegas, Nevada	702.262.6142
MDW	Chicago, Illinois	773.284.4600
M H R	Sacramento, California	916.231.0943
M K C	Kansas City, Missouri	816.421.1836
S D L	Scottsdale, Arizona	480.922.3575
S T P	St. Paul, Minnesota	651.209.8430
T E B	Teterboro, New Jersey	201.288.1550
V N Y	Van Nuys, California	818.902.9961

DUNCAN AVIATION COMPONENTS

Technical Support, Avionics, Instruments, Accessories, Propellers & Parts Support

800.228.1836
or
402.475.4125

WORK AWAY FROM STATION FACILITIES

A D S	Addison, Texas	214.352.3468
A U S	Austin, Texas	512.530.7050
B J C	Broomfield, Colorado	303.410.7053
B U R	Burbank, California	818.955.8413
F T W	Ft. Worth, Texas	817.740.9266
H P N	White Plains, New York	914.686.8294
H W D	Hayward, California	510.780.1640
I A H	Houston, Texas	281.821.2689
M M U	Morristown, New Jersey	973.326.1110
S U S	Chesterfield, Missouri	636.536.7090

RAPID RESPONSE AOG SERVICES

Expert In-Field Technicians, Fast 24/7 Dispatch, Airframe, Engine, and APU Support & Services

877.522.0111