The equipping of aircraft to provide passengers with WiFi and cellular signals in the cabin is gathering pace. Airlines are beginning to determine the revenue that can be generated from use of in-flight mobile phones and the internet. Aircraft connectivity also has financial benefits for other airline departments.

Generating revenue from in-flight phones & technology products

Ancillary revenues continue to grow in importance for airlines. Ancillary products can be divided between on- and off-aircraft products. There are now a growing number of technology-related, on-aircraft products, or products relating to the passenger's in-flight experience, that generate revenue for airlines. These use items such as in-flight phones, smart phones, personal digital assistants (PDAs), and the internet. Their utilisation allows several in-flight products to be used, including: voice calls using the passenger's own mobile device; SMS (text) messages; and data services, which require a large exchange of data, and include e-mail and the internet. Connection to the internet also allows passengers to enjoy shopping, audio, video and gaming, all of which have the potential to generate revenues for airlines.

Cabin technology

Most of the products in this group require and rely on some level of signal and connectivity outside the aircraft. There are two types of connectivity between the aircraft and the outside, and two types of signal inside the aircraft cabin.

Connectivity outside the aircraft is: direct to the ground; air-to-ground; and via satellite communication (SatCom). The two types of signal used inside aircraft cabins are cellular and WiFi.

External signals

Air-to-ground communication is only practised in the US, because it requires a network of ground transmitters so that the aircraft can receive a continuous signal. The airline also needs clearance from each country it flies over to provide signals inside the cabin, and an air-to-ground system is complicated when flying over several countries. Aircell exclusively provides air-to-ground signals for airlines in the US.

Despite the difficulties of providing ground-based transmitters and requiring clearance from each country, Aircell's air-to-ground service is in the process of being expanded to Canada, Mexico and the Caribbean.

There are three or four levels of SatCom. The first, and the cheapest, is provided by Iridium. This has the narrowest bandwidth, provides a slow rate of data transfer and is really only sufficient for e-mails and the in-flight use of credit cards.

Inmarsat provides the second level of SatCom. There are two Inmarsat offerings: Inmarsat Classic and Swift Broadband. Inmarsat Classic is the minimum standard level of SatCom required for extended-range twin-engine operations (Etops) and trans-ocean operations, and is the standard equipment fitted on the A330/A340, A380, 747, 777 and 787.

Inmarsat Classic has a data transfer rate of only 10Kb per second, and when used only allows voice calls and SMS text messages.

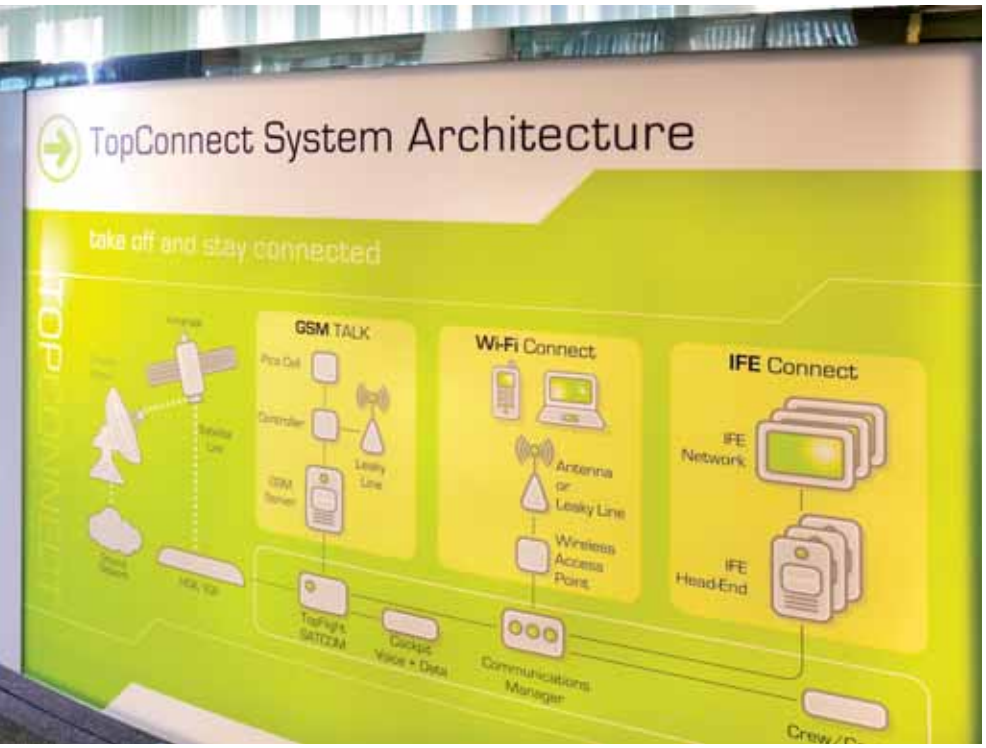
The second class of Inmarsat is referred to as Swift Broadband. This has a data transfer rate of 432Kb per second. It allows a higher number of simultaneous voice calls, and also allows data services, such as the use of Blackberries for e-mail and the internet, as well as accessing the internet on a laptop from a cellular signal with the use of a general packet radio service (GPRS) card.

The highest level of currently available Satcom is Ku-band, which will have a data transfer rate of five to 25 Mb per second. This is sufficient to permit a large number of simultaneous calls in addition to a high volume of data transfer through the internet, and to allow up to 24 passengers to browse the internet and watch live TV at the same time.

Aircraft will have varying standards of SatCom hardware according to their delivery dates. Older examples of a particular type are likely to be fitted with Inmarsat Classic equipment, while more recent aircraft may be equipped with Swift Broadband or Ku-band hardware. The cost of updating an aircraft to Swift Broadband and Ku-band is $300,000-400,000.

Internal signals

The US has proposed a ban on wireless voice calls for passengers on US airlines and aircraft flying over US airspace. This means that, while the proposed ban is considered, airlines have so far considered it to be uneconomic for them to equip their aircraft to provide a cellular signal in the aircraft cabin. "A cellular signal allows voice calls, SMS and data services (through GPRS/EDGE)," explains Adla Worobec, chief commercial officer at Aeromobile. "While airlines in the US have installed onboard WiFi networks on more than 1,000 aircraft, they have not been in a position to install on-board cellular networks due to a lack of regulatory framework from the Federal Communications Commission (FCC) and Federal Aviation Administration (FAA). WiFi data services, such as e-mail and browsing the internet, are popular with passengers on US aircraft but require a WiFi-enabled device: either a laptop or smartphone. US airlines have expressed interest in also being able to offer cellular data services such as SMS and e-mail access using mobile roaming. Data services are still in their infancy with respect to



The technology for providing cabin signals to allow the use of mobile phones and access to the internet is complex. All aircraft will require installation of some hardware and equipment for both external and internal signals.

aircraft ancillary products - a cellular platform which can provide data services to the widest possible number of passengers using all mobile devices, could potentially give a significant boost to ancillary revenues."

In other parts of the world, airlines have cellular signals in the aircraft cabin to make wireless voice calls, send and receive SMS messages, and use data services such as e-mail and internet access on phones and PDAs. These can be regular mobile phones; or smartphones, like iPhones, that can access the internet and send and receive e-mails. The internet can also be accessed via a laptop that is equipped with a GPRS card using cellular signals.

"So far, cellular signals have only been used by airlines for voice calls and SMS messages. The maritime industry is ahead of airlines, and data services now account for about 30% of total revenue for cellular providers in this industry because of the fast growth in the use of the internet and e-mails by passengers," says Pal Bjordal, president and chief executive officer at AeroMobile. "We expect to see the same pattern of growth in data services in the airline industry. It could represent as much as 50% of revenue generated in the future."

Additional products are also possible through the use of cellular signals, including: real-time credit card authorisation, which permits a range of other services; and value-added services, such as advertising, directing passengers to websites, and offering destination-specific products such as hotels and theatre tickets.

There are several generations of cellular technology. GPRS is 2G; second generation, Edge is 2.5G, UMTS is 3G and LTE is 4G. Smartphones are at least 2G, and many are 3G.

While wireless voice calls are currently not permitted on aircraft flying over the US, US airlines do provide WiFi signals in aircraft cabins. It is still possible for passengers to use WiFi on appropriately enabled phones to access the internet or use e-mails. WiFi signals in the aircraft cabin are exclusively provided by Aircell through its GoGo system, which has a licence to supply all carriers operating in the US. It costs $50,000-100,000 to modify an aircraft with the Aircell system.

WiFi signals in the aircraft permit mobile phones, smartphones and PDAs to use the internet. This in turn allows passengers to use portable gaming, audio, video and TV. WiFi is the way of more commonly accessing the internet with a laptop computer. Live TV and films are also better served with a WiFi signal in the aircraft cabin, since it has a wider bandwidth.

While data services are still in their infancy in all other parts of the world, airlines in the US have extensively embraced Aircell's GoGo WiFi system. Delta has equipped 554 aircraft, and about 1,200 aircraft have been modified to date.

In addition to its mainline fleet, Delta announced in November 2010 that it would also be installing Aircell's GoGo WiFi system on its regional jet fleet. This will include E-175, CRJ-700 and CRJ-900 aircraft operated by Delta's regional affiliates. This totals 223 aircraft, and will be available in both cabin classes on the aircraft. This will increase the number of Delta aircraft with WiFi on board to 772.

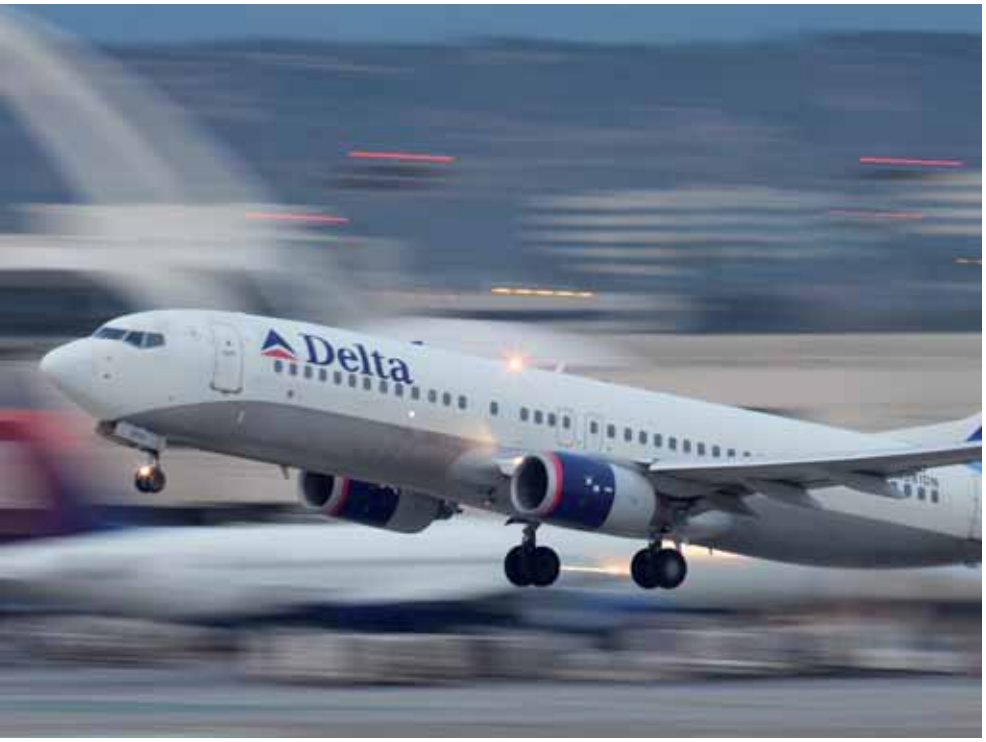
The Aircell system is relatively simple, because the only other parties involved are the airlines. Aircell charges the passengers direct, and then pays a portion to the airlines. The rate for logging on to the WiFi signal is $12.95, so the take-up rate by passengers is relatively low. Aircell also charges $5.95 for passengers to use iPhones via the WiFi signal.

Varying rates are charged depending on the length of time the service is used for. Virgin America, for example, charges different rates for access via laptops compared to access via handheld devices such as iPhones, Blackberries and other smartphones. For access with laptops, rates are $4.95 for flights up to 90 minutes, and up to $12.95 for flights longer than three hours. Monthly and 30-day passes are also available at $30-35. Rates for access via handheld devices are similar to laptops for shorter flights, but lower for longer sectors and 30-day passes.

"Airlines operating in all other parts of the world will probably want to provide both cellular and WiFi signals in the aircraft cabin, so that they can provide a seamless service with being on the ground," explains Bjordal. "Cellular signals are better for everything done on phones and smartphones, and passengers pay for the service when they are billed by their phone company, making the service simpler. WiFi is better for large data volumes, but passengers have to log on to start with and pay with a credit card. WiFi is probably more appropriate for passengers that want to use laptops on long-haul flights. Both types of signal will probably be required by most airlines in the long run, because passengers will want to use handsets and laptops in the same way that they use them on the ground."

Data services on aircraft outside the US have only recently started to be accepted. OnAir started operations with its first customer Oman Air in late 2010. Lufthansa will start to offer WiFi and cellular services on 125 of its long-haul fleet with the Aeromobile and Panasonic system. Panasonic will charge $21.95 for a 24-hour use, allowing passengers to use the service on successive flights, and $10.95 for a single hour's log-on. It will also charge $8 per hour for WiFi connectivity for mobile devices.

To date, the four hardware providers have received orders to equip more than 2,000 aircraft. Most of these are for Aircell's WiFi system for US airlines. It has orders to date for more than 1,400 aircraft; the largest being from Delta for 772 aircraft. It has also equipped AirTran's



Delta Airlines is now committed to modifying its entire jetliner and regional jet fleet, totalling 772 aircraft, with Aircell's GoGo WiFi system.

entire fleet of 138 aircraft, and 190 of American's fleet. Other airlines have ordered equipment for small numbers of their fleet for trial purposes. AeroMobile and Panasonic to date have combined orders to equip more than 400 aircraft.

The cost of modification (from $50,000-100,000 for Aircell's GoGo system, to $300,000-$400,000 for Inmarsat Swift Broadband or Ku-band), plus the on-going direct cash operating costs of fuel and maintenance incurred because of the modification, has to be considered against the revenues that could be generated from the various ancillary products the airlines are able to offer.

In-flight phones

The two main providers of in-flight phone services are OnAir and AeroMobile. Both now provide cellular and WiFi signals in the aircraft cabin. The cellular signals effectively provide a roaming service in the aircraft cabin, so that OnAir or AeroMobile act as the on-board GSM service providers for the passengers. The typical cost to the passenger is $1.50-4.00 per minute and depends on the roaming charges of the passenger's home mobile service provider. OnAir or AeroMobile receive a portion of the roaming revenues from the home mobile providers, which they share with the airline. The airline's share is ultimately less than 50%.

OnAir has generally found that both types of signal are required and used on long-haul aircraft, whereas passengers tend to use only phones and smart phones that utilise cellular signals on short-haul aircraft. "Passengers use WiFi signals on long-haul flights because that is when they have enough time to use laptops. Smartphones are sufficient for most short-haul services," explains Stephan Egli, chief commercial officer at OnAir. "This will probably change, however, since later versions of the iPad are now becoming more popular and replacing laptops in many cases, and iPads can access the internet via use of cellular signals.

"Of course in the US, airlines only have WiFi signals, and these are provided exclusively by Aircell," continues Egli. "Outside the US, our airline customers typically offer cellular signals on their short-haul fleets, and we basically offer a roaming service in the aircraft. Passengers' phones find the network. The signal is provided by a cable in the cabin ceiling, which is linked to the antenna that picks up the external signal via Inmarsat SatCom. SatCom provides global connectivity, and we offer second generation Inmarsat: Swift Broadband. This provides a high enough data transfer rate to allow a high number of simultaneous calls, SMS messages and connection to the internet. Widebodies are generally already equipped with Inmarsat Classic for navigation purposes, so airlines only have to make a simple upgrade to swift broadband. These upgrades and modifications are usually performed in C checks. SatCom hardware will have to be installed on most short-haul aircraft, because this equipment is not provided as standard for navigation. Widebody aircraft, or those used for long-haul, will also have WiFi signals in the cabin, which requires further upgrades."

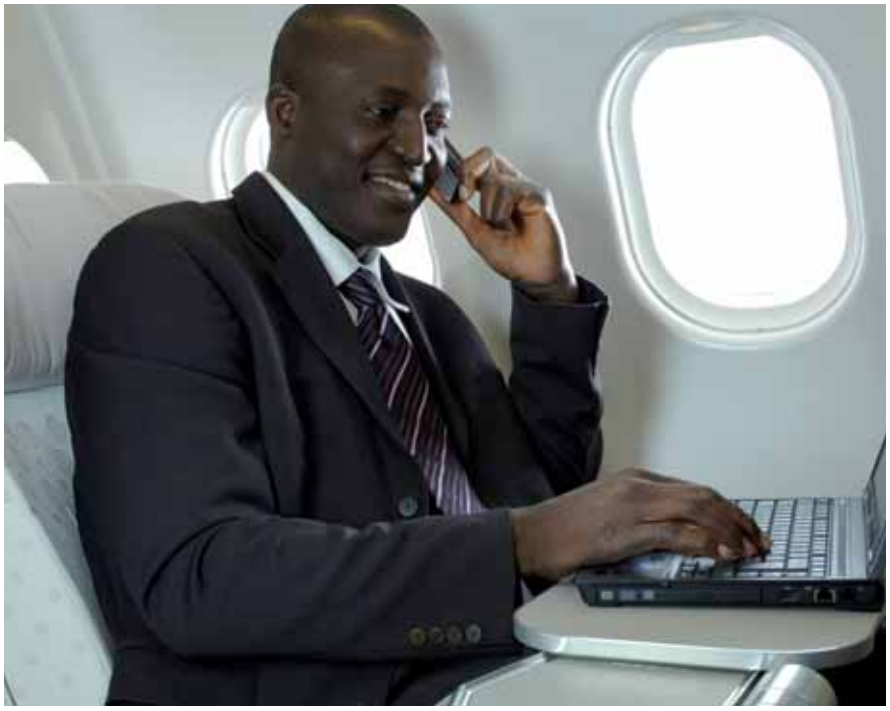
Egli explains the problem is that premium-class passengers now expect these signals as part of the on-board service. "It is still possible to charge for logging on to WiFi signals, and passengers are billed by their GSM mobile provider for using cellular signals," continues Egli. "We have agreements with more than 300 mobile phone providers, and we share a percentage of the revenue with the airline. Some airlines are now offering cellular signals free of charge, rather than using them to generate revenue. Airlines are charging for use of WiFi signals, although it is usually offered as a complimentary service to premium-class passengers. Passengers that do have to pay for the service, connect to the WiFi by paying with a credit card.

"Providing both types of signal gives passengers the best choice, although 90% of them choose their phones for ease of use. Only business passengers use laptops, and while these may still be used for work, they are increasingly accessing the internet with iPhones and iPads, so there may not be a need for WiFi signals in the future," adds Egli.

"Our technology allows 12-24 simultaneous voice calls, depending on the equipment installed for the external signals," continues Egli. "So far, we have experienced no limitations because the average call length is about three minutes. It is relatively easy to increase capacity for more simultaneous calls. Also, while calls are being made, other passengers can be using blackberries, smartphones and laptop computers. Connection to the internet is therefore made at the same time as several simultaneous voice calls."

The first aircraft using OnAir's system was operated in 2007 in a trial to test the on-board technology. Singapore Airlines (SIA) selected OnAir to equip 43 of its widebodies. "Airlines have new aircraft on order, and most of these will have capability. Airlines are also equipping young and medium-aged aircraft, but not older examples," says Egli. "We have 35 customers overall, and 11 of these are already operating our system. British Airways has equipped its A318s that fly transatlantic operations from London City airport. Emirates has selected our system for all its A380s, and other customers include: TAP Air Portugal, Oman Air, TAM, Aeroflot, Saudia, Egyptair and Royal Jordanian. Interest in in-flight phone systems is growing, and we are looking at a large number of requests. We see the number of aircraft equipped to provide cabin signals doubling each year."

AeroMobile, together with Panasonic



Accessing the internet with a laptop computer can be made either by using a GPRS card to connect to a cellular signal, or by connecting to a WiFi signal. Outside of US airspace mobile phones can be used by utilisation of cellular or WiFi signals.

Avionics Corporation, similarly offers both cellular and WiFi signals in the aircraft cabin. "We only use Inmarsat or Ku-band for external connectivity," says Bjordal. "Most of our customers operate internationally. The cellular signal is provided by us, and is known as eXPhone. We co-operate with Panasonic, which provides the hardware to generate a WiFi signal known as eXConnect. Panasonic provides all the necessary hardware for both types of internal signal, while Aeromobile provides the roaming service inside the aircraft.

"We prefer to operate with Inmarsat Swift Broadband or Ku-band," continues Bjordal. "These two types of connection have enough data capacity that allows voice calls together with data services. Together with this, we have roaming agreements with more than 220 mobile phone providers and regulatory approvals to operate the service over 145 countries. We have recently added 20 countries, and the list is now comprehensive enough for all of our customers to have continual coverage most of the time across their route networks. We do have some blind spots where it is not possible to make voice calls, however. The US is the obvious one, but we also do not have agreements with Russia, India and several Latin American and African countries.

"Although some airlines are offering the connectivity to differentiate their services from other carriers that have not yet equipped their aircraft, airlines are more likely to charge for the service when the majority of their fleet is equipped," continues Bjordal. "The revenue potential comes from voice calls, but also SMS messages and data services; which include e-mail and internet browsing. Data services are currently non-existent in our case, because aircraft have so far only been equipped for voice calls. We do, however, expect the use of data services to experience high revenue growth and account for a large portion of revenue in the future, especially for long-haul aircraft. The first data-enabled aircraft will be one of Lufthansa's widebodies, which will be modified in the next few months."

Aeromobile customers include: Emirates, with up to 179 aircraft; Lufthansa, for 125 of its international fleet; Virgin Atlantic; and Cathay Pacific, for the whole of its fleet. Overall, Aeromobile has commitments to equip more than 400 aircraft with Inmarsat Classic and Swift Broadband, and Ku-band.

Statistics reveal the attractiveness of the service to passengers. The highest recorded number of passengers using the cabin signal was 227, on an Emirates flight from Dubai to Manila in 2010. The highest number of calls made on a single flight is 140, also recorded on an Emirates flight, from Dubai to Nice in 2010. A sample of flights shows that the number of calls made from passengers ranges from three to more than 10, while the number of SMS messages ranges from just two to more than 20. One attraction of aircraft connectivity is that calls can also be received by passengers; with numbers ranging from two to six per flight.

An average of at least six calls per flight, each about three minutes in length, means revenue will be received from only about 20-60 minutes of calls per flight. A small additional amount of revenue will be received from SMS messages.

Internet-related

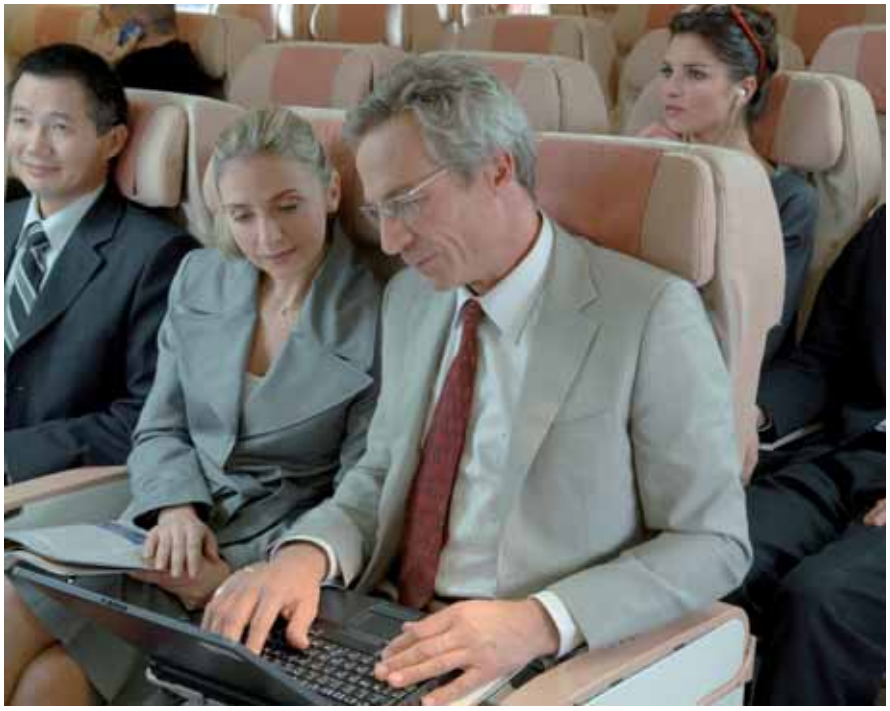
While connection to the internet is possible via a cellular signal from a laptop computer with a GPRS card, a range of products can be provided once there is an internet connection that provides a high rate of data exchange. This requires access to a WiFi signal. A high rate of data exchange is possible with a Ku-band SatCom connection, so modifying the aircraft becomes expensive.

A connection to the internet via a WiFi signal allows data services. Passengers can simply browse the internet as required, and send and receive large quantities of data via e-mail, as in the case of airline passengers on longer flights in the US. Data services are in their infancy on airlines outside the US, and Oman Air is the first to offer them, with OnAir. Lufthansa will also offer a WiFi service on its intercontinental fleet.

The products and services that are possible include some types of in-flight entertainment (IFE), live gaming, live TV, audio and video downloading, and shopping. While access to a WiFi signal generates revenue directly from passengers, these services will generate revenues indirectly from passengers in that airlines will receive commission from the providers of these services.

AviIT is one provider of equipment for IFE and in-flight shopping. Its Bluebox product is a portable device which airlines provide to passengers. "Most carriers provide them free of charge to premium-class passengers, and rent them out to other passengers, typically at $8 a flight," says David Brown, chief executive officer at AviIT. "The device allows passengers to watch movies, TV shows, select audio and play games. The content can also be preloaded, to include things such as adverts, and catalogues of shopping items.

"Bluebox devices require a wireless WiFi signal in the aircraft cabin, and this makes it all right for airlines in the US to use because of the Aircell system that provides WiFi," continues Brown. "The IFE part of the system does not require a wireless connection. Renting the devices to passengers generates quick revenue for the airlines, although space and weight constraints mean that it is not possible to carry a device for every seat on the aircraft. Airlines are finding that flights have to be at least three hours, and that 30-40 units per 100 seats will usually be rented. This level of take-up will justify the cost of providing the connection in the aircraft



Providing WiFi signals in the cabin can generate revenue for airlines by charging passengers a log on fee, and also by claiming sales commissions from purchases made by passengers shopping in-flight via use of the internet.

cabin, although several other ancillary revenue products have to be considered.

"A WiFi connection can be used to access relatively simple shopping portals, such as the host airline's portal, as well as making live credit card transactions," continues Brown. "An additional external connection via SatCom allows passengers to reach a wider range of shopping portals via the internet. A problem, however, is that passengers are resistant to paying for internet access, although the use of data services on aircraft is in its early stages."

Guestlogix also provides an in-flight retailing platform, through handheld devices and the software required to manage the retailing process. "The system allows airlines to become on-board retailers. We have 30,000 handheld devices being used by 40 airlines around the world. These include Air Canada, KLM, Qantas, Garuda and Westjet," says Brett Proud, executive vice president of new markets and products at Guestlogix. "The shopping content can be provided via in-flight magazines or IFE screens, for example. The cabin connectivity means that credit card transactions can be made in real time. The most popular shopping products are tickets for ground transport and entertainment following the flight, and the content on our handheld devices has products relating to more than 200 destinations. Airlines generate revenue by charging a transaction fee to the passengers. The popularity of the system is underlined by the fact that out of 2.8 billion trips operated by the world's major airlines, our devices are working on about 1.0 billion of them, equivalent to a 40% market share. This number compares to about 850 million one year ago, and 700 million two years ago." The latest statistics show that the average spend per passenger on board the aircraft is $12-15.

An alternative to Guestlogix is On-board Retail. It provides handheld point-of-sale machines that are used by flight attendants to make real-time credit card transactions. It also provides the related software and background management to complete the in-flight shopping process. "The passengers are informed of the products available for purchase through in-flight and seatback magazines or IFE screens on the aircraft," says Dan Hayter, sales and marketing director at On-board Retail. "The most popular products are ground transport tickets, which can be printed by the machines. The aircraft connectivity means that credit card fraud is avoided, and is another return on investment made from equipping the aircraft. Interest from airlines is growing because yields and revenues are being squeezed as the traditional services are being unbundled."

Long-term economics

As described, the cost of modifying aircraft to have connectivity in US airspace is a fraction of the cost of modifying aircraft used in other parts of the world.

The return on investment for equipping an aircraft with Aircell's GoGo service is therefore relatively easy. A 10-year payback, for example, requires revenues of only up to $10,000 per year. This is equal to only a few dollars per flight, which can easily be covered by just a few passengers logging onto the WiFi signal. Additional revenues generated from commissions on shopping and other services will make the process profitable.

The return on investment of up to $400,000 for modifying an aircraft operating outside the US with Inmarsat Swift Broadband or Ku-band is harder to achieve. First, the revenues generated from voice calls and SMS messages are insufficient on their own to provide a return on investment. Additional revenues can be generated from providing data services and various other products through a WiFi signal, but this requires further investment for equipment and modification.

In addition to the cost of modifying the aircraft with a WiFi signal, there is the issue of how much revenue airlines are able to generate, and what tariffs they can charge. This is clear for US airlines using Aircell's GoGo system, since there are now orders to equip in excess of 2,000 aircraft with the system, including the whole of Delta's fleet. The tariffs charged and rate of take up by passengers is established, and airlines clearly view modifying aircraft as a worthwhile expense.

There is the issue of how successful airlines outside of the US will be in charging passengers to log on to WiFi signals. There is also the issue of how many passengers will actively use the internet for inflight shopping and other activities, and what commissions airlines can generate from these.

Airlines also have to consider the benefits that other departments can gain from aircraft connectivity. Interest in connectivity is now growing in flight operations, and maintenance and engineering departments, through the use of electronic flight bags (EFBs) and electronic technical logs (ETLs). Once connectivity is established, airline operations departments can make large savings from EFBs through reduced library management costs, fewer input staff, improved aircraft performance and more accurate fuel requirements, and more accurate engine de-rate calculations. Other issues such as in-flight diversions can be reduced, and better engine monitoring data can be obtained. The use of ETLs can improve aircraft technical despatch reliability and utilisation, and also reduce aircraft maintenance costs.

Once all these benefits are considered, then a case for investing the required amount to provide cellular and WiFi connectivity is easier to make. AC