

IFE hardware, software and system technology constantly develops. Innovative products are coming on to the market that allow airlines to generate stronger levels of ancillary revenues and allow them to offer connectivity for free. Meanwhile the cost of the equipment is declining.

Developments in IFE hardware and systems

Developments in in-flight entertainment (IFE) equipment and technology continue to advance. The approach in recent years has been to enhance the total passenger experience by improving engagement and communication with the passenger en route to the airport, during check-in and passage through the airport, and even post-flight, right up to arrival at destination. The ability to do this is being enhanced through airline-branded software or apps, hosted on passengers' personal electronic devices (PEDs).

Airline apps provide a variety of information, including: flight status; electronic boarding passes; luggage tracking; information on connecting flights; and reward points or bonus mileage schemes. More advanced apps allow passengers to browse IFE system content and reserve choices, and choose in-flight meals and drinks.

There is also opportunity to generate ancillary revenues. The ability to generate in-flight sales was limited, but is now improving. The cost of making in-flight shopping available was high compared to the volumes sold and revenues generated. There has also been the long-term problem of credit card fraud.

Detailed analysis of passengers' IFE selections, in-flight shopping behaviour, and responses to in-screen advertising has provided the necessary information to alter ancillary revenue content provided by IFE systems by not posting low-demand items. This first step has boosted sales. External connectivity satellite communication (satcom) systems have boosted airlines' confidence in real-time credit card transactions during flight. Nevertheless, installation of a satcom system may not be the choice when the increased fuel burn caused by the drag of the satcom's antenna is taken into

consideration. Developments in near field communication (NFC) mean that live credit card in-seat shopping will be possible. This system comes with the credit card security of personal payment insurance (PPI), and can operate without an external connectivity system being fitted on the aircraft.

IFE systems, technology and hardware are becoming more diverse and sophisticated. Until recently, IFE systems were either traditional embedded or wireless systems. Each of these categories was sub-divided into systems with and without external connectivity. Wireless systems can be further sub-divided into those that provide portable devices to passengers, and those that operate with PEDs. A new category of portable wireless IFE systems has emerged that provides a cheaper option to the installed wireless system, and may persuade more airlines to provide IFE services.

Seatback & embedded IFE

Despite the increasing acceptance of wireless IFE systems as a low-cost option, the traditional embedded IFE system is still popular with legacy airlines in particular for premium cabins. However, technological developments are allowing links between passenger PEDs, seats and the embedded IFE system to further advance the experience of all passengers. Thales has developed a proof-of-concept, high-technology business-class seat that uses a variety of new technologies. The first of these is NFC, which has been used by Thales to provide a secure, short-range

Thales has developed a proof-of-concept business class seat with several new technology features. This includes a NFC reader for secure credit card transactions. A main feature is a docking port of passenger PEDs, and the used of NFC, to transfer data into the embedded IFE system.



datalink between a passenger's PED and the IFE system embedded in the seat.

The complete system allows a business-class passenger using an airline app hosted on a mobile device to choose from the aircraft's IFE system before boarding. This can be as early as in transit to the airport or after check-in. A passenger can also pre-order meals and drinks before boarding. This information is held on a mobile device, and when a passenger boards, they place the mobile device in the seat's docking port. With NFC capability, a passenger's IFE and menu choices are automatically downloaded to the IFE system in the seat. The information on menu choices is passed to flight attendants, while the IFE selections are held in the embedded IFE system in the seat.

While this business-class seat is only a proof-of-concept design, it is expected to enter service in the next few years.

This is one of several technological developments where IFE and on-board systems are seeing an increasing level of personalisation. Passengers are being given more freedom to make a wider variety of choices via airline apps.

The development of NFC for in-flight use should be a major step in technology to facilitate an increase in in-flight credit card transactions. UK IFE hardware component provider IFPL has developed

an in-seat or seatback NFC terminal designed to allow in-seat shopping using contactless credit card transactions.

"The terminal is a small device that will fit in the back of an economy-class seat alongside the IFE screen," says David Thomas, vice president of business development at IFPL. "The terminal allows the passenger to make real-time payment for goods available via the IFE system with a variety of payment systems, including credit cards, Apple Pay and other NFC payment wallets. We initially developed the system together with Thales for its IFE embedded systems, and are in discussions with other IFE vendors to further deploy this technology."

The NFC device provides necessary security for airlines, since IFPL has designed the system to meet tough off-line and on-line payment card industry (PCI) standards. This helps prevent credit card fraud and eliminates fraud exposure to the airline, regardless of whether the transaction is completed on or off line. The system allows passengers to spend up to a particular limit per transaction, which will be in line with most items available via in-flight shopping.

"The NFC payment device is expected to enter service on an Airbus during summer 2017," says Thomas. "The system allows passengers to shop, order and pay at their own convenience

extending the in-flight retail opportunity. This may lead to increased in-flight ancillary revenues."

Value of a transaction is also not necessarily limited to the same amount as a typical contactless transaction on the ground. IFPL has recently announced it has partnered with Alcineo and has developed NFC with 'PIN on screen', which removes the current payment limit and extends the ability of airlines to sell high-value items without taking on the liability of fraudulent transactions.

"Airlines can acquire both systems through the IFE system hardware providers," says Thomas. "We understand that some airlines have already included NFC readers in future system requirements. Another benefit of IFPL's NFC system is that it provides two-way data transfer of small packets of data, allowing systems to talk to each other, which could include a passenger's preference and personal data. This provides the opportunity for airlines to truly personalise the IFE and retail experience based on personal preferences and history, similar to online entertainment and retail today."

The NFC device protects and separates payment data from all other data and information. The combination of payment and personal data will allow airlines, with supporting distribution

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channels, to provide home delivery further by extending the opportunity of inflight retail and generating higher sales revenues. Airlines realise that they are in a unique position of having access to passengers who can be in a seat for many hours. The key is to leverage this into additional revenue, and IFPL's NFC payment and personalisation terminal is one critical part of the chain.

In addition to the NFC technology, Thales has designed other new features for its proof-of-concept business-class seat. Thales has developed an immersive sound system that can be incorporated into the seat wings of seats. Passengers do not always like listening to audio content and watching movies and television using headphones. The immersive sound system is a speaker system that directs sound toward a passenger's ears, without any surrounding sound spillage. A passenger can listen to music at high volume, and a person in an adjacent seat will not hear it.

Thales' next generation of seat development is Digital Sky, a very large seatback screen, about half the size of the back of the seat in premium classes. This high definition screen will enhance the quality of the IFE system on offer.

Another development by Thales is its airline app portal. This is an on-line tool that airlines can use to choose apps for systems and branded apps. The portal

shows airlines ideas how to further develop apps to take full advantage of all technologies available.

IFPL has also developed other components for embedded IFE systems, and has recently launched a USB-A power port for charging PEDs for use in wireless IFE systems. While wireless systems negate the need to install seatback screens and IFE systems, passengers nevertheless need a charging port for their devices, since they can lose all battery charge after just a few hours. "The latest change in consumer devices is the adoption of the USB-C jacks 3.1. The USB-C demonstrates a different, smaller shaped socket or plug to USB-A and -B, while the 3.1 standard denotes higher power and data rates to that of USB 2.0 and 3.0, or original USB," says Thomas. "The power jacks that many airlines started with were USB, and these typically had a power rating of 5W. These took a long time to charge devices. The higher power USB 2.0 has been recently introduced, which increased data and power capability. These are generally 480 megabits per second (Mbps) and a power rating of 10W for USB 2.0, and 5 gigabits per second (Gbps) and 10W for USB 3.0.

USB 3.1, which typically is supplied with a USB-C connector, offers a significant upgrade to USB 2.0 as the USB 3.1 standard can provide. This has up to

100W of power and 10Gbps data speeds, depending on its configuration. USB-C 3.1 has the ability to power many more devices. More devices will use USB-C 3.1. There is the possibility that the USB-C outlet will remove the need for an AC power outlet in passenger seats.

IFPL is working with customers to design components, such as power ports and audio jacks, into passenger seats. IFPL has also designed and is patenting its USB-C Rapid Fit jack. This contains a removable cassette that contains the USB-C socket, and not the expensive electronics. This means it is an easy and low-cost replacement should the socket become damaged, and ensures minimum disturbance to aircraft downtime.

IFPL has also developed noise-cancelling, triple-pin Breakaway audio jacks. IFPL's Integrated Noise Cancelling Audio Module (INCAM) technology allows noise cancelling in the jack rather than the headset. This keeps the headset cost low, while providing an enhanced audio experience for the passenger.

In addition to providing external noise cancellation, the jacks are held in place by magnets, which IFPL is calling MagSignal, and which virtually eliminates customer-induced damage, extending the life of the headset and the jack. The floating magnets ensure a signal is maintained at all times.

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Relevant content

An overall problem with IFE systems and content is that technology certified for use on aircraft is often years behind what is available on the ground. This can include games hosted on the IFE server. The application to in-flight use is governed by what can be certified for use on the aircraft. One objective behind Thales' app portal is to reduce the gap to months rather than years.

IFE system supplier Arconics has been working on a mass-capacity server for installation on embedded and wireless IFE systems. "Loading movies involves the airline and content service provider getting a licence from a film studio that published the film," says Michael Reilly, vice president of entertainment services at Arconics. "A film studio gives an airline and IFE service provider a film file to be loaded onto the aircraft's IFE server. The file is sent to the IFE platform builder to be integrated with the IFE software, and the hardware is shipped to the airline for installation, which takes 40-90 days.

"The problem is that this takes too long for today's market," adds Reilly. "Content needs to get on board aircraft IFE servers much faster. There are many cases when movies and documentaries that are relevant to recent current affairs and global events appear on IFE servers long after public interest has waned.

"A high-capacity server will allow a much larger library of movies and other visual and audio content to be held on the server," continues Reilly. "This will allow content to be enabled or disabled, thereby negating the need to regularly update the server installed on the aircraft. We have also designed this high-capacity server so that new content can be sent to it via on-ground connectivity systems that use cellular or WiFi connectivity. A high bandwidth and data transmission rate are needed to update and load large quantities of content. The bandwidth required and the data usage is smaller when licences must be turned on or off."

The Arconics high-capacity server system will be deployed by the first airlines in mid-2017. It will be integrated with Arconics' wireless IFE system.

Portable IFE

Portable wireless IFE systems, or 'roll on, roll off' systems have been launched over the past year by several system vendors. The main advantages are that little or no physical installation is needed, since the server is a small box of about 2Kg that can be placed in a holding bracket located in an overhead bin.

Lufthansa Systems announced the launch of its portable IFE system at the AIX Expo in Hamburg in April 2016. "A small, 2Kg box holds the server, content, the WiFi signal transmitter and the battery," says Jan-Peter Gaense, director of project and certification for BoardConnect at Lufthansa Systems. "The unit runs on AC power. The WiFi signal is provided by a mobile steering unit (MSU), which is basically the same as a wireless access point (WAP).

"The system can stream up to 50 passengers at the same time," adds Gaense. "Three units are needed on an aircraft, such as an A320 or 737-800. Main advantages of a portable system include not requiring any physical installation, or supplemental type certificate (STC) for use on the aircraft. This means that an entire fleet can be equipped with the system overnight. Our first customer Eurowings put the system into service in August 2016. Moreover, the time from selection to implementation and going live is only about three months. It has lower hardware and installation costs than a conventional wireless system with an installed server.

"The server in the 2Kg (4.4lbs) box has the same content as embedded and other wireless IFE systems, including Hollywood movies, magazines, games, a moving map facility, audio and visual," continues Gaense. "It also has the ability to sell ancillary revenue products."

Portable IFE systems have also been launched by Bluebox Avionics and Arconics. "Our portable wireless IFE system is one of our new products that we launched in the last year," says Kevin Clark, chief operating officer. The Bluebox Avionics IFE system has the same configuration as Lufthansa Systems' hardware. The main box can serve up to 50 passengers at once. It measures 25cm by 15cm by 20cm and weighs 1.8Kg (4lbs), including the battery.

"This box has the same capacity as the server on a traditional wireless system," says Clark. "We have added features, including a wireless moving map display, and destination guides."

For airlines, the advantage of the system is that it is a low-cost and quick way to install an IFE system that creates its own wireless network. Installation and implementation time is six to eight weeks, including the time to get an airline's user interface prepared. Another advantage is that it can be removed easily and quickly if the airline upgrades to a conventional wireless or embedded system. This is an important consideration, since an airline will have to use a system with an installed server if it requires external connectivity. "When hardware for the external satcom and air-to-ground connectivity systems is installed, it makes sense to also install a conventional wireless or embedded IFE system with an installed server," says Clark. "Another useful feature is a removable battery, which means that the IFE boxes themselves do not have to be removed for charging. Instead a replacement battery can be fitted in situ."

Clark says the recent launch of the Bluebox Avionics IFE system has been followed by interest from airlines, and the system will enter service shortly.

To date Bluebox has sold the Blue AI, its iPad-based portable IFE solution that pre-loads iPads with content. Bluebox AI is used on Hawaiian Airlines' A330s in business class. Hawaiian is now upgrading the tablets in business class to the iPad Pro, a larger tablet. This has a



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256Gb capacity, allowing it to hold up to 140 movies. This will increase with developments in digitisation. The airline has also installed new seats with holders for the iPad Pro. Clark maintains that it is fairly bold for an airline to have a tablet-based IFE system in business class.

Arconics has also launched a portable wireless IFE system similar to Lufthansa Systems and Bluebox systems that is due to go into service in January 2017.

Reilly feels the portable IFE system will suit low-cost carriers (LCCs) and other airlines that may have previously ruled out have an IFE system. "Airlines can use a portable system for its revenue-generating ability before committing to a full fleet installation, or a conventionally installed IFE system," says Reilly.

IFE solution as a service

As a new development to the configuration of IFE systems, IFE system vendor PaxLife has launched a new wireless system that it installs on a fleet for free, in return for 5-10% of ancillary revenues generated. This share increases if the revenues are strong. If the airline prefers, it can pay for the installation itself, and PaxLife will give it 50% of the revenues generated by the system.

"We have used available technology to create a new business model," says Gerald Schreiber, chief executive officer (CEO) at PaxLife. "The system hosts a lot of innovative apps to help airlines increase ancillary revenues, including targeted advertising at specific customers, and on-line payments.

"The system is based on PEDs with connectivity to access a variety of content from the server. The key to the business model is that the airline can generate enough profit from the system without investing in the equipment," emphasises Schreiber. "We calculate the profits as being sales revenues less the cost of goods sold, connectivity, and installation. The system works with just internal connectivity, but also with external

satcom connectivity. It requires a minimum of Iridium Classic L-band connectivity, but can also operate with Inmarsat swiftbroadband. However, satcom antennae have a large drag profile that increases fuel burn."

The system works through the PaxLife app, called Cloud 10, although it is branded as the airline's app on the passengers' PEDs. "Our initial customers are LCCs, and they do not have their own apps. The app includes some free content, while premium content is paid for," says Schreiber. "This includes movies. Revenues are generated from connectivity charges, premium content, adverts and on-line shopping. The mix of content paid for and not varies regionally. People in the Asia Pacific will not pay for content, such as movies, but accessing social media is very important for them."

Schreiber says that analysis shows that an average gross profit of \$0.63 is generated per passenger per flight. For 150 passengers at an 85% load factor, gross profit per flight is \$94, equal to \$170,000 per aircraft per year, compared to operating costs of \$51,000 per year for the system, content, connectivity costs and royalties. Capex of \$220,000 financed over five years will give the airline a five-year profit of \$370,000.

Free connectivity

"Bluetooth connectivity for aircraft cabins has improved considerably to the point where it now has a 100-metre range, and can connect 200 passengers simultaneously," says Ron Chapman, CEO at ASIQ. "We equip commercial aircraft for free with the Bluetooth access point, the satellite transceiver and a patch antenna. The system operates with Inmarsat or Iridium L-band, and while few narrowbodies have satcom systems for long-range navigation, we install the system for free. This makes it easy for airlines to decide to install the system."

The airline version of the product is called Flyer. The system is used for text

messaging, emails and connecting to other devices that also host the app. The system is being targeted at low-cost and tourist airlines, since these passengers have shown little enthusiasm for paying for connectivity. Most airlines can charge passengers \$10-30 to get access to WiFi for messaging and internet access. The take-up of this service is only about 6%.

The free service provided by ASIQ will result in a high level of uptake. The system only works when a passenger downloads the app to the PED, which is when they will discover the revenue-generating part of the app. "The app provides a passenger with an electronic discount coupon to 50 attractions at destination," explains Chapman. "These include restaurants, tours, theatres, museums and hotels. A passenger can download a coupon for every attraction on the app. These coupons are provided by the attraction provider, which not only provides the discount coupon to the passenger, but also pays a commission to ASIQ. Half of this commission goes to the airline. The attraction providers with the most prominent positions on the app also pay sponsorship fees to ASIQ.

"Overall, the system generates a sales commission from the attraction providers, and this encourages them to get the ASIQ Bluetooth equipment installed," continues Chapman. "The airline is incentivised to provide passengers with free text communications, which act as bait to get passengers to view attractions on the app, and download the discount coupons."

He adds that the product is most attractive to economy-class and tourist or charter airlines. Those passengers are loathe to pay for connectivity, so free text messaging will be attractive. ASIQ's main target market is narrowbodies, especially those operated in Europe in tourist markets. **AC**

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