

The capability, in both hardware and software has changed dramatically in recent years. This is driven by the importance of PEDs and passenger behaviour. Airlines are having to change their approach to IFEC.

# The cabin IFE&C platform & its potential

Over recent years, the landscape for in-flight entertainment and connectivity (IFEC) solutions has changed dramatically.

Driven by the importance of passenger electronic devices (PEDs) as universal tools, and supported by the growth of connectivity capacity to and from the aircraft, the industry is realising there is a shift in the infrastructure required to deliver the most effective IFEC experience.

## Changes in pax behaviour

Passengers have increasing demands in the IFEC environment, driven by everyday experience at home where dual-screening becomes commonplace. It is also where social media engagement is equally frequent in the background or in parallel to any other activity.

At the same time, an always-connected lifestyle, and expectations of instantaneous results that come with it, result in different attitudes towards the IFEC product than most passengers had even two years ago. Moreover, this is not only from millennials, digital natives or iGens. Passengers wish to be in control, preferably via their own PEDs. This inevitably results in efforts to enable pairing of the embedded IFEC system with the passenger's PED, up to the point where the PED becomes the controlling master device, and the embedded screen is merely a processing and display servant device.

In line with this is a trend towards more proactive management of content by the passengers, including pre-flight selection, self-curation and

personalisation for content on-board. Self-curation could be either that passengers use the airline or content service provider's (CSP) hub to collate play lists, or they simply board the aircraft with all the content they want to consume preloaded on their PEDs, to then be consumed on their own devices or on the embedded screen after pairing.

Passenger shopping and spending behaviour is also changing, or rather could change, if airlines were prepared to fully embrace the opportunities. Airlines could operate more as retailers, offering more touchpoints, products and services for the whole journey rather than just selling seats. In particular, opportunities for upselling, either at the airport or on-board are substantial, partly because passengers are in a different, less frugal and more decisive mindset in the air than on the ground. The airline mantra should be to offer the right product for the right passenger at the right time via the right device or channel.

## Change in airline approach

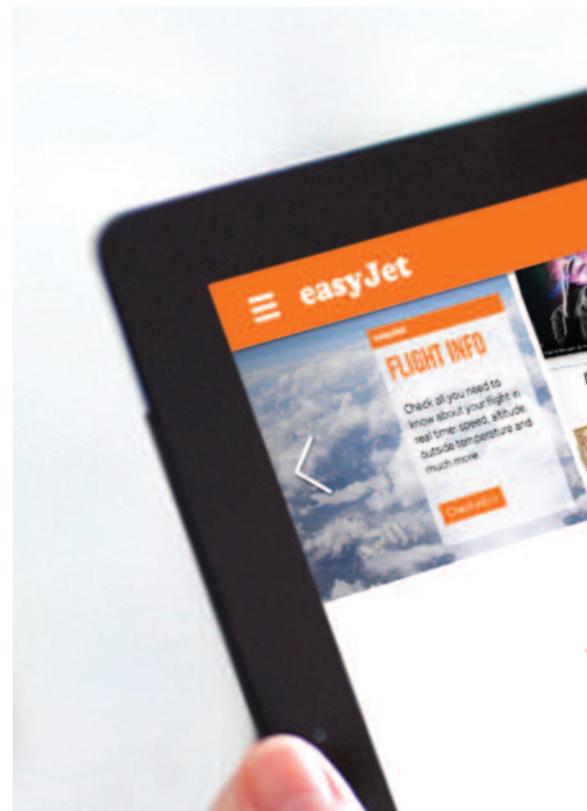
Airlines realise that there is a need for a more holistic and wider definition of passenger experience, resulting in considerations for the total journey.

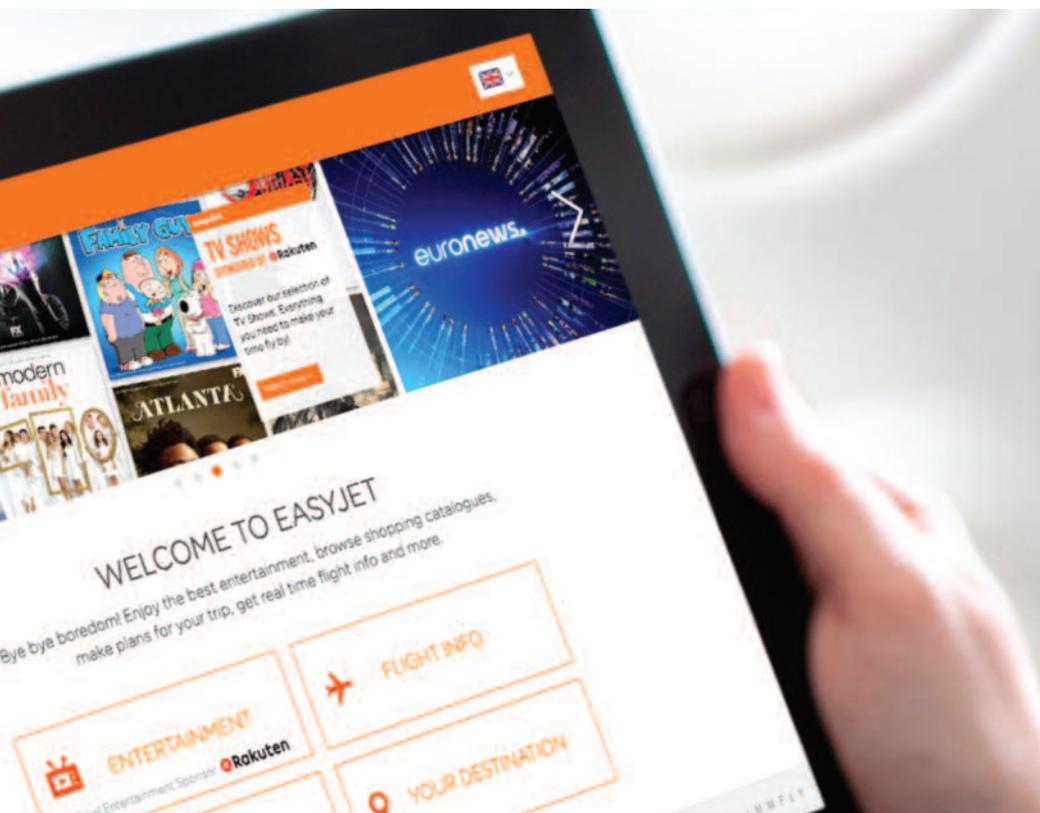
Underlying this is a fundamental shift over the past decade towards passenger experience during the flight and throughout the journey.

Airlines also talk about digital transformation as a requirement for the overall business. The aircraft and ultimately the passenger and their behaviour will be part of this digitalisation process. Subsequently,

airlines address the passenger's digital experience in addition to, or rather over and above, passenger experience. Not surprisingly, airlines realise that the current and future cabin product, and with that the IFEC, needs to be at least engaging, if not empowering the passenger so that time on the aircraft is perceived as valuable. Airlines are, therefore, also focusing more on generation and utilisation of data around the passenger's digital experience as the foundation to product development, as well as personalisation for the passenger.

With newer aircraft, such as the A350 and 787, as well as with availability of smarter systems, emergence of the internet of things (IoT) on the aircraft is inevitable, as is the wish to effectively use data from passengers and airlines, and those data generated by and between hardware components. This growing data lake can be used in a variety of ways, many of which have not yet been discovered. As a result, there is a huge scope for growth in analytical products to turn these data into usable information. This increased amount of data, generated by more and more varied data-gathering devices and processes, will be accompanied by an ever-increasing amount and variety of malware. Subsequently, the need for operators to really embrace cyber security grows. Unfortunately, many airlines have not realised that recent regulatory requirements, such as the EU NIS directive (May 2018), affects them with penalties, rather than the system houses or hardware providers that the airlines have been relying on.





*Airline apps and onboard portals are core elements for passenger engagement throughout the journey. A user-friendly and functionality-rich digital passenger experience allows the airline to keep the connected passenger in 'their' domain. The app may even become the go-to solution for all travel requirements.*

Availability of artificial intelligence (AI), combined with machine-learning capabilities, allows for a more sophisticated and deep analysis of the data that is flooding operators. In particular for ancillary revenue generation, airlines see huge potential for these data. Therefore, calls for airlines to become more like retailers than transport operators become louder.

Some predictions indicate that ancillary revenue will become the main source of profitability for many more airlines than the several low-cost carriers that are already experiencing this phenomenon. This goes hand-in-hand with personalisation of the passenger experience. Now that there are so many data available on passenger behaviour and experience, a data-centric approach allows travel to be further merchandised. AI and the cloud infrastructure enable a level of analysis and segmentation of passengers that can enable airlines to develop digital merchandising to a degree previously impossible, provided they have the organisational agility, integration capabilities and IT platforms to provide support. There is a large range of available technologies that will allow airlines to generate ancillary revenues and increased profits. One example for digital travel retail platforms is a product by Retail in Motion, whose premise is to 'radically change the travel experience for airlines, crew and passengers alike' by enabling every touch point the airline has with the passenger through a connected digital interface.

In conjunction with the passenger experience focus, airlines are looking in

more depth at passenger wellbeing, which has moved on from recommendations for exercising at the seat to possibly having passengers ingest electronic chips in their food that would report on their health. The increasing lengths of ultra-long-haul flights (17 or more hours) have airlines focusing more on passenger wellbeing beyond providing comfortable seats.

Inevitably, the overarching technology to this total journey focus is connectivity. This, therefore, takes a priority role in cabin infrastructure. It is rapidly becoming a basic utility rather than a luxury. Subsequently, wireless networks are becoming the default in-cabin communication infrastructure. Having established that position, the next question concerns satisfying the exponential growth of bandwidth consumed by each passenger, as well as the similarly exponential growth of applications that use the cabin wireless network (from cabin crew and maintenance applications to usage of the network for the aircraft IoT). The WiFi network has to handle this increased data throughput in this densely populated metal tube.

Bernd Knobe, managing director of connectivity consultancy at P3 aero systems, comments: "The wireless cabin network will become a more difficult bottleneck for the delivery of a superb passenger service than the industry currently envisions. Cabin IoT and the always-connected passenger will quickly saturate less efficient networks."

The industry focus will inevitably shift from how much capacity can be delivered to and from the aircraft, to how

the WiFi network can manage and securely deliver all these data. A company that has seen this emerging bottleneck early is VT Miltope. The company's solution portfolio has evolved from offering simple cabin access points to provision of an optimised and cyber-secured wireless cabin network.

Another important trend is the increasing differentiation of passenger demographics to which airlines react by increasing personalisation of service offerings. This focus on product differentiation results even in notions of abandoning a universal design approach for all things in the cabin, looking instead at particular passenger sub-groups. One example is the FUCAM initiative. FUCAM is an acronym for Future Cabin for the Asian Market, and is a nine-partner research consortium that aims at developing a conceptual cabin interior design dedicated to the Asian markets in the year 2025 and onwards.

One important consideration that has been neglected by cabin system or infrastructure providers, or only addressed as an afterthought, is the changing role of the cabin crew, which has evolved from a security necessity to filling the role of on-board concierge (Air New Zealand) and true brand ambassador. Cabin crew usually are the airline employees with whom the passenger has the most face-to-face contact, and who can deliver the airline's aim of providing a more personalised passenger experience.

The industry provides a multitude of solutions to enable crews to accomplish that, including smart trolleys, crew tablets



and wearables that display critical passenger information while communicating face-to-face. There is a plethora of technologies and data that help the crew to facilitate the passenger experience. These include providing guest service information in real time via travel guides, and real-time duty-free transactions delivered to an address of the passenger's choice via back-office inventory updates. One example is mCabin from Lufthansa Systems whose purpose is to drive digitalisation of crew processes. Such platforms offer the cabin crew, before and during the flight, information on individual passenger data, such as seat location, frequent flyer status, preferences, special requirements, recent events, as well as airline operational data, such as the passenger manifest.

One new aspect of cabin safety, which is being linked to cabin crew work, is the increasing use of in-cabin cameras. Some original equipment manufacturers (OEMs) are considering potential deployment of hundreds of cameras across the aircraft, presumably including one for each seat group. Cameras seem to be an appropriate technology in the case of terrorism threats or air rage.

## Evolution of cabin hardware

There is an overall trend towards convergence of technologies and systems. Components and systems that used to be separately procured or installed are now complete and interdependent elements of cabin architecture.

An airline's requirement for lesser,

smaller and lighter hardware remains constant. Complementing this need are developments in software and data domains where considerations for virtualisation of cabin domains or the storage, processing and analysis of data in the cloud are of increasing importance.

In light of these trends, the multifunctionality of PEDs and their dominance as the 'life-hub' for many passengers, has emerged as a benefit for airlines, but possibly not for all the system houses.

Cabin infrastructure is evolving, especially with respect to seating classes. Premium economy has been very successful. At the same time, first class is either disappearing (Emirates 777-200LR) or getting smaller to make room for business class and premium economy. Some operators, however, especially those competing in the premium segment, go beyond first class by offering suites. Considering the space these products occupy, they appear to be more of an aspirational incentive for frequent fliers, rather than actual revenue generators.

Airlines, OEMs and design houses are also looking at how to use spaces, such as the lower deck or crown, to enhance passenger experience. In these parts of the aircraft anything from sleeping areas to social or exercise facilities is possible.

There is also a rapid development regarding seating. The seat is being considered as a personalised living space in line with the overall trend for personalisation. Innovative solutions emerge that optimise cabin usage, including tablet-friendly (Skycast) and flexible, foldable and moveable seats to

*Embedded IFE systems will, for the time being, remain a key element of the passenger engagement especially on long-haul flights. They will operate in addition to, if not controlled by, the passenger's own device.*

increase seat width, aisle space and armrest space, as well as to provide armrests that can be lowered to allow for better access for less mobile passengers. There are also other innovative solutions that involve turning seat-groups into family spaces, or offering individual pods.

Overhead bins also are being optimised, such as bulking out the lid to allow for larger items (FAC.com).

Aircraft lighting is also evolving. Variable mood lighting is used to create a more soothing passenger experience. At the same time, window shades become electronically dimmable and there are concepts for eliminating windows altogether and projecting, for example, the outside world onto the cabin wall. A windowless fuselage would have multiple benefits, including simplified aircraft construction and weight saving, as well as interior design possibilities. Emirates is using projected windows on the walls in centre suites of first class on its 777-300ERs. In this case, camera technology projects images from the outside of the aircraft onto the interior walls.

Galleys, monuments and toilets become more sophisticated and differentiated. Kiosks, social areas, self-service coffee machines or even single urinals all allow for extension of the more personalised passenger experience beyond boundaries of an individual seat.

A major technological change that affects the airline cabin is evolving connectivity. It is important to differentiate between external and internal connectivity, that is, datalinks to the outside and the internet, either via satellite or air-to-ground solutions; and the system for wireless data transmission in the cabin, a type of intranet within the aircraft. For the latter there are, apart from WiFi, other wireless technologies that can deliver data, such as near field communication (NFC), Bluetooth, zigbee, and potentially LiFi (light transmissions).

A technology required to support the move towards enabling passengers to use their own PEDs is the supply of electrical power to the seat. Similar to a train, passengers now expect to be able to charge their devices. In the old IFEC system world, power systems for passengers were installed as an afterthought and were formerly referred to as peripherals. The core of the system was seen as a server and possibly a storage device. In the modern, passenger-centric world, peripherals have become

more important because airlines have realised their value as part of the passenger experience.

## IFEC evolution

There are several trends in IFEC solutions that accompany this shift.

Traditional IFE systems were developed especially for long-haul flights, initially based on keeping passengers content during a flight, while passenger engagement was not a consideration. Narrowbody aircraft were often equipped only with overhead displays every eight or nine seat rows. Apart from offering minimal entertainment (moving map, sometimes a film) passengers could play the safety video.

IFEC systems have generally evolved from being server- or head-end-centric towards becoming passenger-centric. There is an intermediate evolutionary step when systems are seat-centric. An interesting side aspect of this evolution is that system components that used to be called peripherals (such as passenger control units, power plugs, and control devices for passenger amenities) become central to system considerations. This is because they are the interfaces that significantly determine the quality of the passenger experience.

The emergence of larger PEDs, such

as the iPad or similar devices, led to development of in-cabin portable IFEC solutions. Often these were initially planned as back-up devices in case passengers experienced difficulties with the embedded IFE.

Recent systems are more passenger-centric, driven by what the passenger wants or expects, rather than by what is technologically possible as per old IFE systems. A new version of such a system is Zodiac's Rave Ultra. In addition to playing content that is stored locally in the in-seat device, the system has a system control unit (SCU) that is connected via the ethernet backbone to each in-seat screen and stores additional data and content that can be accessed from each seat. The concept is Rave Cloud where Rave Ultra enables content file-sharing between seats. This is effectively the same principle as cloud computing with a distributed storage and processing system. As these files are transferred and not shared, there is no latency problem as in traditional server-centric systems.

To the airlines, rapid evolution of the PED over the past decade is a benefit. Using these devices offers passengers the comfort of an individual environment, while at the same time reducing the risk of dissatisfaction that comes with provision of relatively fragile hardware in the passenger seat. Seats with functionally

overloaded and non-intuitive passenger control units on awkward retractor mechanisms are never as good as the user interface that passengers are used to from their smartphones. Unsurprisingly, passenger hardware takes a much more prominent role in more recent systems, with interfaces as the key aspects that solution/system designers need to consider. Whether these are graphic user interfaces on the embedded screen or the way the USB port is accessible, these interfaces are a key factor in how user-friendly a passenger perceives the system.

Underlying this is a wireless infrastructure allowing relatively easy installation of a variety of solutions and services in the cabin. There are many types of wireless system in the market, and it is important to note the differences.

There are systems that feed in-seat embedded screens wirelessly, effectively like older embedded IFE systems, with only content being transmitted wirelessly to the individual seat. These systems benefit from wireless content uploads that can occur in the background from a head-end server, while the passenger enjoys the cached content on the embedded screen.

There are also wireless systems that have a head-end server, but no screens embedded in the seats. These systems rely on feeding content from the server

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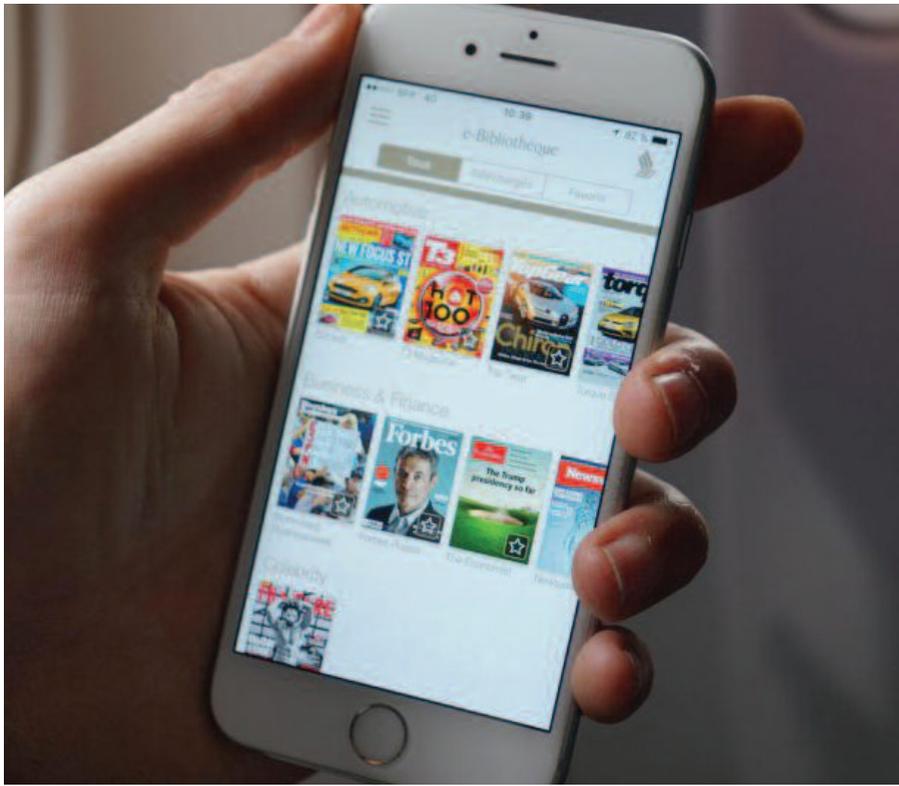
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directly to passenger PEDs.

A last category for wireless IFE systems is the completely portable IFE. In the last year this segment has outgrown other sub-markets in the IFEC sector. The appeal is clear. These are one-box solutions that can be used without a supplemental type certificate (STC), and can be stored in overhead bins. They are practical for operators that want a light IFE solution, typically narrowbody operators that have not yet offered any IFE solution beyond magazines. These solutions are also becoming interesting to smaller aircraft, such as regional turboprops, thereby opening completely new markets for IFE. Key players in this market are AirFi, Lufthansa Systems, Bluebox, Immfly and Inflight Dublin.

Key success factors for growth in those portable systems are the speed with which they can be deployed, not installed, across multiple fleets, and low maintenance costs. In terms of value, this is probably an optimal solution.

There are already evolutions of this product. One is to develop a new solution that is brought on board, yet connected to the aircraft's power system. This solution will overcome the sometimes challenging battery exchange. Other offsprings of these new systems are those intended to offer some external connectivity, probably in the lower bandwidth end, enabling usages, such as messaging services or live e-commerce solutions.

External cabin connectivity is a major topic that is beyond the scope of this article, although it has been previously addressed in this publication. Briefly, external cabin connectivity was initially

deployed as a side product with the establishment of the Connexion by Boeing service. Basic WiFi networks deployed then had the sole purpose of distributing the thin internet signal that reached the aircraft through first-generation satellite connectivity. Such connectivity recently has grown rapidly through deployment of more powerful satellites (L-, Ku, Ka-band), as well as air-to-ground (ATG) connectivity over land masses.

As IFEC systems evolve, suppliers of such solutions also evolve. IFEC system houses focus much more on the software side of their solution, rather than the hardware platform. Hardware is becoming less important. Many of the avionics components that were key technologies in the past as the backbone of proprietary IFEC systems are gradually moving towards being commoditised in systems with a more open architecture.

Not surprisingly, several newer system houses offer multiple, alternative hardware architectures (UGO). They are hardware-agnostic because the real value being provided in the IFEC sector is the content to the passenger and not the hardware to the airline.

Some system vendors see their role changing from being a service provider for passengers or airlines, to becoming an entry platform for the aircraft cabin as a market for third-party solutions that create and operate various applications. Examples are apps that passengers can run on PEDs. SITAOnair recently started to focus on APIs as a tool to allow its service platform to be used by various, often yet unforeseen, third-party solutions. The same applies to Lufthansa

*Wireless IFE systems allow for almost the same rich content - from movies via newspapers to games - as embedded in-seat IFE systems at a fraction of the cost.*

Systems, with its Boardconnect Plus solution that offers an open platform architecture for third-party vendors to use or develop new onboard digital services.

A final element of IFEC architecture that is rapidly evolving is content. Complementing developments on the system side towards a more passenger-centric view, the content world is evolving at a similar pace.

Along with changes in passengers' consumption behaviour (millennials, iGen) are changes in the way content is provided. The overarching theme is personalisation of content curation and delivery. This happens on various levels.

IFE content is moving away from global blockbusters and series towards more locally sourced content. Available content delivery techniques allow for faster update cycles, ultimately resulting in increased update frequency, including content updates per flight. Also subscription-based streaming platforms, such as Netflix, are increasing demand for regional and localised content.

Furthermore, geo-tainment, based on the display of a moving map, to offer dynamically localised content and relevant contextualised information is growing in importance. The potential for using the moving map to engage passengers is significant. The interactive ability to increase or decrease map granularity to identify points of interest and engage with vendors related to those through the connectivity the aircraft offers is tremendous. For younger passengers, digital natives, this part of the IFEC system, together with their own PEDs, is often all they need.

There are predictions that augmented reality (AR), in conjunction with geo-tainment, could bring dramatic benefits. Interactive maps on passenger devices or cabin monuments or even holographic projections are being considered. For example, AR maps that display points of interest along the journey in conjunction with personalised content, driven by a deeper understanding of passenger preferences and interests through integration and analysis of the available data, will allow for a more personalised experience. These maps could also be projected onto surfaces other than the PED or in-seat screen. Bulkheads, entrance areas or social/galley areas could benefit from such displays, for example via light projection technologies.

The general trend for the future of

*The evolution of moving map towards a geo-tainment platform will attract more passenger attention, especially because of its potential for ancillary revenue in combination with external connectivity.*

moving maps is that they will become more of a standalone feature, rather than being embedded into the IFEC system.

A move to offer a more personalised passenger experience is evident on the content side. Initial steps were taken several years ago when airlines started to allow passengers to select playlists before a flight. Meanwhile, airlines are theoretically in a position where, through AI and machine learning engines, their systems could identify patterns in passenger IFEC consumption behaviour and give content recommendations. Most airlines, however, are not there yet. This is why leading content service providers (CSPs) consider themselves as helpers for the airlines to achieve digital transformation. The increasing differentiation of passenger demographics means that airlines often struggle to understand what each passenger group wants and how to engage with them. Clever CSPs help the airlines to map out and navigate this complex landscape. Duncan Abell, vice president, creative at Global Eagle Entertainment, summarised the company's objective as to 'focus on requirements of the customer's customer'.

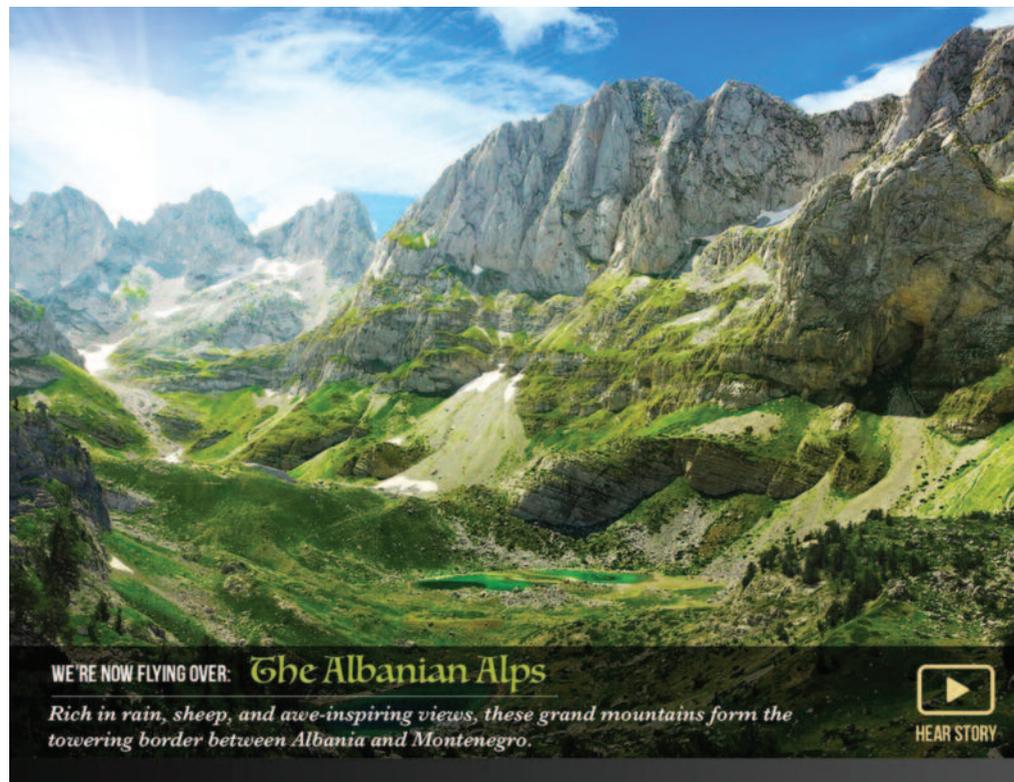
Another trend is the diminishing relevance of DRM-protected early window content. While it still has appeal, the availability of other forms of content gains importance. At the same time, smarter ways of enforcing DRM protection are emerging. Lufthansa Systems, for example, is offering browser-based playback of movies that are protected by DRM. This negates a previous requirement for the passenger to have an app pre-installed before the flight to watch DRM-protected content.

In line with the needs of millennials and iGen, the role of games as part of the IFEC is changing. Most of these passengers have high demands in terms of games, and would not be tempted by anything less than what they play at home. Industry predictions are that in the future there will be feature-rich multiplayer 3D games that passengers can engage in, enabled by external and internal connectivity.

## Conclusion

So where will all these trends and the evolution of the cabin lead us?

First of all, the baby-boomers in the decision-making roles at airlines and system houses need to realise that most of



the technologies described above are here now. They are not just good ideas for the future, they are ready now. Combined with the realisation of the changes in passenger demographics, the need to work on an aircraft cabin for the digital native is clear.

The foundation to this for the aircraft will be the continuous rapid evolution of connectivity. To that effect, the introduction of 5G will bring yet another drastic change to the connectivity capabilities to/from and within the aircraft which will have a substantial impact on the cabin IFEC infrastructure. Faster and bigger connectivity pipes will gradually enable the removal of IFEC related components such as wiring, seat electronic boxes or area distribution boxes, and in-seat screens, and so will allow the extension of the personal space for each passenger.

At the same time airlines will have to accept the idea that their contribution to the travel experience is becoming less prevalent and gradually moving towards becoming just one element of a rich and passenger-controlled journey.

Therefore, the cabin and especially the IFEC infrastructure questions of the future will be about what device, functionalities and apps does the passenger bring on board and how to let them use these most effectively. Enabling passengers to use their own devices for managing self-curated content, be it at home from own content or from the airline library, and to control the in-seat infrastructure, will enhance the passenger experience substantially and will allow airlines to achieve higher passenger satisfaction at lower costs.

Airline apps and portals on passenger PEDs will be the interface point. If these are user-friendly and effective to cater for the always-connected passenger, they will allow airlines to gather passenger and usage data that, if properly analysed and turned into contextually fine-tuned offerings, will allow for many more passenger touchpoints to drive ancillary revenues as the ultimate best way of generating profits.

At the same time the IFEC infrastructure should be seen as a platform for other services and providers. Cooperating with these organisations will reduce the airline's risk and ensure that they generate revenue purely from making their passengers available to these third parties.

In the future, apart from largely self-curated content, geo-tainment could be the main points for passenger engagement. To that effect geo-tainment with its multitude of connectivity-enabled opportunities is a great environment or canvas for which the airlines provide the background colour and on where others can enrich the picture.

For both of those the only "infrastructure the airlines will need to provide is a very robust Wi-Fi system in the cabin as well as superfast connectivity to the internet. The rest will be done by the passenger.

Maybe that way the airline can revive, albeit on a different level, the old travel experience where they were a vehicle to explore the wonders of the world.

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