

The Market for Wireless In-Cabin Aeronautical Communications

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ABSTRACT

In this paper, analysis of the market demand, including consideration of value chains and the underlying business case, for wireless services within a commercial airline cabin, is presented. The different perspectives of passengers, airlines and equipment manufacturers, provide a complex background from which the technical requirements for the proposed services must be derived. This paper highlights the importance of understanding the target markets before developing a technical solution. By way of example, this paper presents a selection of findings made during the initial market surveys and analyses their impact on the technical design. This paper also considers aspects of value chains and business models that underpin the commercial take-up of the wireless cabin concept.

INTRODUCTION

The world is becoming increasingly connected – the advent of the Internet, mobile telephony and mobile computing has made it easy to access information from anywhere in the world, with some of these services becoming an integral part of modern business life. People are increasingly adopting an “always on” attitude, where they expect to be in contact with work, friends and family on a 24 hour basis. One place where this ubiquitous access is not yet available is in passenger airliners. However, this is about to change. The WirelessCabin project, supported by the European Commission, is working towards designs, standards and a demonstrator to provide connectivity in flight. The technology will be based upon emerging standards including UMTS for mobile telephony, with 802.11 and Bluetooth for mobile computing devices. The key attraction is that passengers should be able to use their own equipment (mobile phone, laptop or PDA) to access the offered communications services.

Wireless access is seen as the key to mass adoption of these services, principally because of the large operational savings that these technologies will offer the airlines but also because of the rapidly increasing use of wireless technologies in consumer devices. The WirelessCabin project is primarily focused on ensuring that these wireless technologies can operate successfully together within the environment of an aircraft whilst meeting flight safety standards. However, the project also has to consider the wider impact of passenger demand, changing wireless communications standards and evolving airline business requirements.

This paper presents part of the early work undertaken by the WirelessCabin project, specifically, the analysis of the market demand for such services. Market surveys and face to face interviews were used to derive data on the type of services demanded, how those services might be used and how they might be paid for. This information has been analysed to provide valuable insights that have directly impacted the design of the WirelessCabin demonstrator. Furthermore, the findings allow the services to be designed in a way that makes them most attractive to airlines and their associated business partners, maximising the chances that the technical approaches developed under the WirelessCabin project are adopted by the target industries.

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The technical concepts behind the WirelessCabin project are described in more detail in [1].

MARKET OVERVIEW

The market demand for wireless services in aircraft stems from a number of different sources, including :

- **Airlines** – Since the tragedy of September 11th 2001, the airline industry has suffered a major downturn. Part of this has been the result of a general economic slowdown in the world’s developed economies caused by a loss of business confidence. More directly, people fearing terrorist activity have been avoiding the use of airlines, preferring instead to conduct their international meetings utilising technologies such as video conferencing. The reduced number of business travelers is a source of major concern to most airlines who are expending significant effort on initiatives to attract these premium passengers back. Several airlines have already identified the provision of data connectivity as one such measure. Correspondingly, service companies are being formed to meet this demand. However, most such airlines are currently looking at data connectivity only (i.e. they are not providing voice) and are using wired connections to

the passenger's equipment, missing the potential benefits offered by wireless solutions.

The second major driver for airlines is the concern over aircraft safety. Airlines have found that an increasing proportion of passengers travel on their aircraft whilst carrying some form of personal electronic device (PED). Such devices include computers, personal digital assistants (PDAs), mobile phones, personal video players, portable games consoles and many other similar devices. Many of these PEDs emit at radio frequencies, with the potential to interfere with aircraft systems such as navigation. Although airline policies dictate that such devices should not be active during an aircraft's flight, many airlines admit that it is almost impossible to enforce this requirement. Airlines, faced with increasing concerns from passengers about aircraft safety, are keen to demonstrate that their aircraft are immune to emissions from PEDs. Part of the benefit of investigating wireless services within an aircraft is that potential problems with avionics systems will be identified and mitigated, allowing new aircraft to be designed to be robust to such forms of interference and older aircraft to have sensitive systems updated or replaced in order to meet the same ends.

- **Passengers** – People are becoming increasingly used to having near instantaneous access to telephony and messaging services. Such services are commonly provided by mobile phones. With the advent of so-called “3rd generation” (UMTS) mobile phones, the range of services available is set to grow. Correspondingly, the user's dependence upon access to such services is also set to increase. Similarly, wireless connectivity for computers is allowing business to reduce infrastructure costs and their workforce to become more mobile. Telecom operators are putting wireless “hotspots” in a variety of public places, including airports, stations and retail outlets. Increasingly, the public is expecting to be able to access data and voice services, via phone or laptop, wherever and whenever they want. This “always on” society is leading to a demand from airline passengers, especially business travelers, to maintain their connectivity during a flight, especially on long-haul flights.
- **Service Operators** – Service operators such as mobile phone operators, Internet Service Providers (ISPs) and satellite operators are always looking for ways to increase the number of their subscribers. The opportunity to provide services in aircraft, especially at premium rates, is very attractive to them. In addition, there are a number of broader business propositions, based on the provision of an aircraft service, that could be very attractive to such operators.

For example, by providing voice and data access in the airport, the aircraft and the passenger's destination hotel, the operator captures a very significant part of a traveler's communications service requirements, increasing their brand presence, customer dependence and the potential to charge premium rates for the services.

- **Equipment Manufacturers** – A wide variety of equipment manufacturers are keen to see wireless technology adopted, ranging from makers of mobile phone handsets and laptop computers to suppliers of wireless access stations. The ability to access voice and data anytime, anywhere, becomes a compelling reason for consumers to buy new or replace old equipment. The fact that such services are available in an aircraft reinforces the ubiquity of access that such devices offer.

THE MARKET SURVEYED

Part of the early work within the WirelessCabin project includes a market survey, where airline passengers, airlines, operators and equipment manufacturers were consulted. The airline passenger audience for the Wireless Cabin is very large and diverse. It was found to be most effective to conduct an online survey, which allowed contact with large numbers of respondents from around the world. In parallel, a series of interviews was arranged with service / equipment providers e.g. content providers, airline communications systems manufacturers and mobile phone operators. The number of airlines prepared to consider WirelessCabin was much smaller and, given the commercial sensitivity of development in this area, it was found that they didn't respond well to a survey by whatever means. It was found that a variety of different approaches were needed, ranging from telephone interviews and e-mail questionnaires to face-to-face interview. The majority of telephone and face-to-face interviews took place in the UK but was supplemented by focus groups and workshops undertaken in Germany.

The results presented herein represent only a small sample of the findings made during this research and focus on the findings of the passenger survey as other results are more commercially sensitive. A full report will be published by the WirelessCabin consortium later in 2003.

The passenger survey had nearly 300 respondents, mostly located in Europe but with significant numbers of respondents located in the US or Asia Pacific. Approximately half of the respondents regarded themselves as business travelers, typically making 10 flights a year. Approximately 80% of the respondents travel using standard class fares, highlighting the fact that wireless services should not be solely directed at business and premium class passengers.

One of the first and fundamental questions to passengers was to ask the current importance, in their view, of providing voice and data connectivity and whether the provision of such services would effect their choice of airline. Figure 1 provides the answers from our survey.

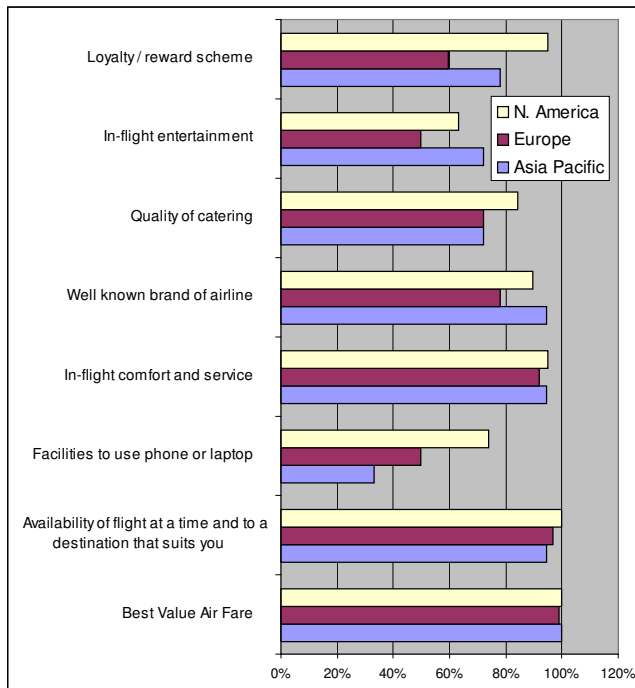


Figure 1: Factors passengers thought important to their choice of airline.

As expected, the most important factors effecting an passenger’s choice of airline is the value of the air fare and the availability of flights at a time and to a destination that suits the passenger. Overall, the demand for support to use a mobile phone or laptop onboard an aircraft is the lowest in terms of passenger demand although this answer is to be expected when placed in the context of the other factors presented in the survey (passengers would not be expected to place wireless services above cheap airfares or availability of flight). However, the number of respondents that thought connectivity was an important factor came to just over half of the respondents - this is a very encouraging result showing clear latent demand. The level of interest can also be considered as high given that this particular concept is new to many passengers – at the moment, no airlines offer a full data connectivity service (there are a small number of trials about to start) or the facility for passengers to use their own mobile phones onboard an aircraft.

An interesting trend observed in the results is the regional variations in the demand for services. Specifically, the demand for voice and data connectivity is much stronger in the US and least sought by passengers in the Asia Pacific region. This difference is supported by anecdotal evidence that suggest that US passengers are very keen to maintain contact with their place of work, via voice and data

services. The fact that the demand for such connectivity is differentiated across regions of the world may represent a major operational issue for large airlines – aircraft fitted with the facilities to support voice and data connectivity may find that they under-utilise these services in parts of the world, impacting the business model that supports the provision of these services and causing significant fleet management problems.

An important question from the point of view of technical design is to understand the type of services that passengers would be most likely to use. The respondents of our survey were asked to identify which of a large list of potential services were important to them. Figure 2 provides the answers from our survey.

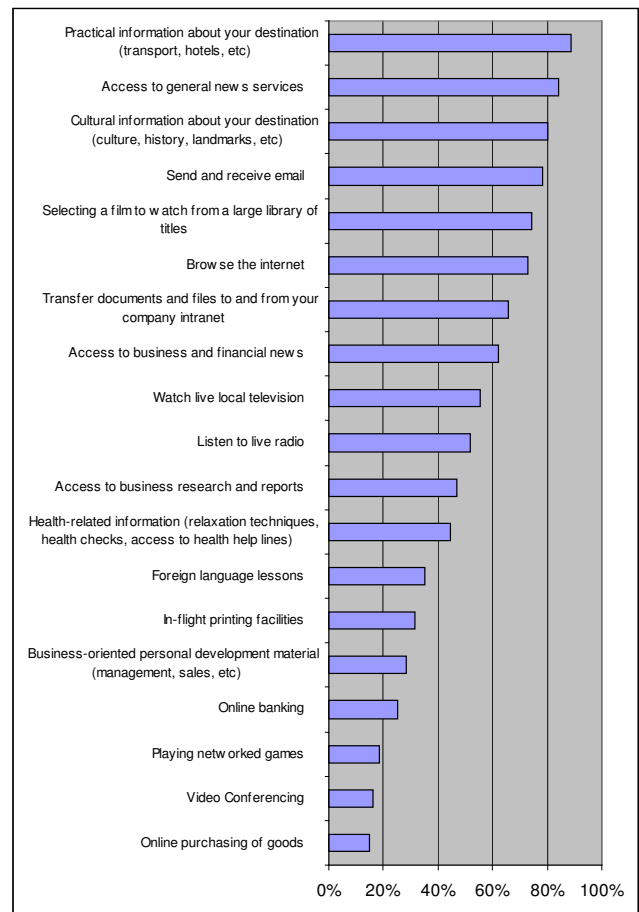


Figure 2: Services that passengers thought important to use onboard an aircraft.

The results presented in Figure 2, show that e-mail, Internet access and video on demand are amongst the services in greatest demand. Interestingly, the information most sought after relates to the passenger’s destination and general news services. Services least demanded by passengers included e-commerce services and video conferencing.

These results, amongst others, are being fed into the design of the WirelessCabin solution. Knowing that the system

will need to provide e-mail and Internet access, data volume calculations may be made, ensuring the design of the system will allow the passenger's demands to be met. Access to information on destination, including data on connecting flights, local transport services, hotel locations, as well as local events and cultural information, may be cached onboard the aircraft. The ability to cache content on the aircraft is an important factor in the passenger's onboard experience – with broadband connectivity becoming a common experience for many users in their office and home, expectations of fast response times for Internet and e-mail is becoming commonplace. Because the aircraft has to use its satellite link to connect the passenger to terrestrial services, even with high data rate connections such as Inmarsat's BGAN service, it is important to make effective use of the bandwidth available. By understanding the likely passenger demand for certain types of information, gained from the passenger survey, the WirelessCabin designers can take into account which services should be cached and which require live data feeds, balancing the two to provide the passengers with the best overall service.

VALUE CHAINS AND BUSINESS MODELS

A good business model is essential to the success of the onboard services provided on the aircraft. Many pitfalls of the early implementations of terrestrial wireless LANs have been attributed to unsound business models, so it is essential to capitalize on the experience gained in these environments. To create a business model, the value chain needs to be created and understood. In general, the value chain for wireless services in aircraft is very complex. Not only is the number of participants involved greater than in the terrestrial Wireless LAN scenario, but the offering of services requiring licensing (e.g. UMTS), and the fact that the network is moving across national and international boundaries, further complicates matters.

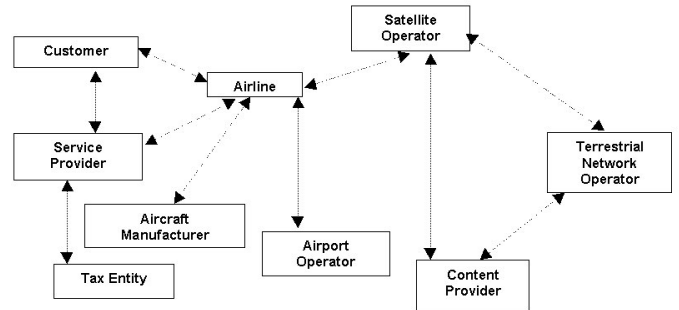
A. Participants

In Figure 3, the participants potentially involved in the Wireless Cabin value chain are shown. Not necessarily all parties will be present in all situations.

The **customer** is the prime member of the value chain. They will probably have an existing business relationship with a service provider (UTMS operator, ISP or Wireless services operator) and with the airline (they bought the ticket and are flying).

The **Airline** is promoting the service in order to collect revenues directly from charges levied for service access or indirectly through increasing market shares (i.e. creating "sharshift" where passengers will change airlines to access the services) – the ability to offer passengers a chance to become more productive and to stay in touch with business, family and friends during flights is likely to

become an important selling point for future airline services.



Business Model Actors

Figure 3: The participants in one possible value chain for provision of wireless services.

The airline will also become a major user of the WirelessCabin services, using it for non mission critical communications, for crew, for maintenance, to remotely download the In Flight Entertainment System and for additional security (e.g. "virtual black box"). Many such applications are being considered by airline companies and aircraft manufacturers. The airline may choose to own the infrastructure (as some shops or hotels do in the case of terrestrial wireless LANs), or may choose to give a third party the right to operate the onboard network. The latter option represents a major business opportunity for mobile telephone operators and Internet service providers.

Airport operators are already offering wireless LAN communications access at major international airports for passengers. The provision of such services will undoubtedly play a role in stimulating demand for wireless access on the aircraft, whilst creating some technical challenges regarding handover of connections from terrestrial services to aircraft services.

The **aircraft manufacturer** is an important part of the overall business model. Manufacturers can expect to sell more aircraft that are certified to operate with wireless systems, not only because of the business opportunities that are made available to the buyer of the aircraft but because the aircraft may be considered to be safer by being robust against radio frequency emissions. The aircraft manufacturer may also choose to be more ambitious and decide to operate and run the telecom infrastructure on board the aircraft on its own or on behalf of the airline. This is the case for Boeing which has created a subsidiary company, Connexion by Boeing, which offers data connectivity to airlines and their passengers.

The **service provider** can be a terrestrial service provider such a mobile operator or wireless LAN operator. Alternatively, a different type of operator, specializing in services in mobile vehicles, might be created.

The **satellite operator** is an essential part of the value chain as they provide the communications link between ground and air.

The **content provider** will provide multimedia content to the passengers and crew and maybe material for use with the onboard in-flight entertainment system.

Tax entities are there to collect tax on services. Hopefully these services may be considered tax free, but if not then services may be subject to the regulations of the countries where the aircraft is flying and/or transiting/stopping.

Finally the **terrestrial network operators** are the gateways to terrestrial networks, providing connectivity.

B. Business Relationships and Billing

Two examples of advanced commercial networks, namely wireless 3rd generation and wireless LANs, even if only recently reaching commercial maturity, can give useful insight into the definition of the business relationships between the participants. The generally accepted model is interconnect, with revenue sharing between the parties. Billing for services can be done according to a number of parameters: content and transport, the latter further subdivided into airtime, satellite connection time, volume, etc. For more in-depth analysis, see [2].

At some point the customer will have to pay for the new services. Charging can be based on several arrangements: a flat rate (all inclusive), a capped rate, up to a certain amount with charges for excess traffic, or a rate related to traffic. Since Quality of Service issues are likely to arise (QoS) they would also need to be taken into account in the billing system, making it considerably more complex to implement. It is also likely that part of the communications costs may be taken by a company willing to advertise to the passengers (including the airlines themselves). The important issue is to find a balance between all interconnected parties, avoiding some of the issues now occurring between network operators and service providers of multimedia services on GSM, GPRS and 3rd generation networks.

C. Payment Mechanisms

Depending on when the passenger is charged, billing systems can be divided into two categories: prepaid and postpaid, with the former gaining acceptance, especially by terrestrial mobile network operators. Prepaid billing is considered advantageous because the customers want to control the cost of using the services and the network operators get the benefit of payment earlier.

In the case of prepaid payments, the cost can be bundled into the ticket price or perhaps to the airline's loyalty scheme. The airline then redistributes the revenues

between the parties, needing a sophisticated system for settlement.

Real-time billing, requires a billing system onboard the aircraft, and in the case of payment made with credit cards, also a connection to the credit card institution for authentication. This might have the benefit of reducing fraud with credit cards in the air used for duty free purchases, currently a major problem for credit card companies.

Finally, in the Post Paid case, the Service Provider collects the payment from the end user, simply adding it to his/her bill, and redistributes the revenues between the participants.

IMPACT ANALYSIS

The impact of the market survey is obvious – the nature of the demand, together with the passenger, airline and operator's desire for particular services has a fundamental impact on the design of the aircraft system. Issues such as caching, the demands of voice compared to data, how and when passengers prefer to use this access, all have a strong influence on the design of the final system.

The value chain analysis and business modeling is also an essential component of the success of airborne wireless services. To ensure that the overall business case is viable, all members of the value chain need to be convinced that there is a realistic revenue-earning opportunity for them. Business issues such as revenue attribution, billing, and taxation will effect technical decisions such as connection handover, content and the data services provided.

CONCLUSIONS

This paper has presented, in brief, some of the commercial and business considerations necessary to support the creation of a new service, providing voice and data connectivity to airline passengers in flight. This paper illustrates why research into technologies that are targeted at commercial operations must consider the business environment within which they will be operating. They must do this at an early stage in their development, in order to ensure that the developed technology meets a genuine market need. More details of the project, including further details of the market research, are available at the project web site: www.wirlesscabin.com.

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