THE BUSINESS CASE FOR AERONAUTICAL INFLIGHT TELECOM SERVICES

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ABSTRACT

The fruition of wireless personal telephony and data services during commercial flights has recently experienced a significant interest from the passengers requiring coverage in the sky, from mobile operators willing to extend the coverage to potential high revenue market niches and from airlines fighting for market shares and additional income in the turbulent and deregulated aeronautical transport segment. This paper, consolidating the know how gained in the project Wireless Cabin [1] where all authors participated, and taking into account current trends, estimates the business case for such services and illustrates a consolidated business model.

INTRODUCTION

The successful introduction of cellular telephony and other personal wireless services to passengers on board commercial flights requires balancing the business relationships between the different players. After the pre-commercial research phase during the Wireless Cabin project, now there is a much better idea of what the business relationships will likely to be. Of all possible services, the "killer application" making the business case possible, is probably cellular telephony, because it gives the highest revenues and is a service accessible by all passengers who normally carry a mobile phone on board, while Wi-Fi access with laptops is limited to a fraction of all passengers. The business model for Wi-Fi on Board does not differ from the terrestrial counterpart and has been extensively analyzed. This paper therefore focuses on the business case for Mobile Telephony (Outgoing and Incoming Calls), Messaging (SMS, MMS, E-Mail) and Data traffic (GPRS/EDGE).
This analysis is independent on the actual cellular technology on board, either 2G GSM, CDMA or 3G and assumes a satellite connection to the ground.
Figure 1 below describes one possible system architecture. There are of course several alternatives, but the business case does not depend upon any particular one.

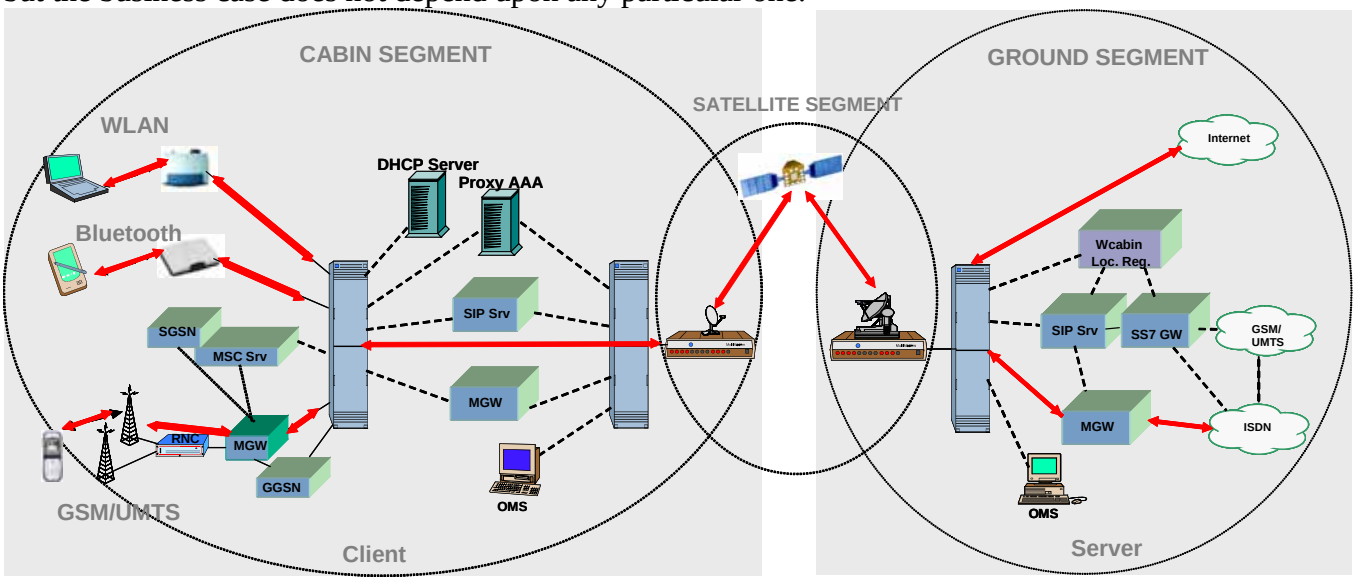

Fig 1 - Wireless Cabin System Architecture

The paper describes the generic business model, the role of the various actors, and discusses issues such as tariffs, roaming, billing and two equally valid alternatives for charging. A final section estimates, as an exercise, the revenues expected in one particular scenario where also data services are taken into account.

BUSINESS MODEL

Several papers have been produced on the possible business models [5, 8, 10]. We refer here to the consolidated actual view. For simplicity we just refer to the business model for GSM Telephony, SMS and GPRS/EDGE based data services. At appropriate times during the flight, passengers will be allowed to switch on their phones and thanks to the picocell on board the Aircraft connected to the ground via Satellite, will roam into the AirCom provider network, as if they were in a different country. Issues regarding licensing, interference, legal intercept and security are not considered here, see [2,3,4] for reference.

Tariffs for passengers are expected to be in the same order of the maximum charged values when they are roaming to the farthest possible country with respect to their home mobile network operator, thus perceiving calling from an airplane as calling from a very remote area. Current values range between 3-5 Euros per minute. While it is clear that too high tariffs may discourage passengers from using the service, nevertheless calling at 10000 m high has no alternatives, and especially business users are less price sensitive. It is important not to start by dumping the price too much at the beginning, otherwise the overall business case may become critical.

The major actors in the business case are (1) Passengers, (2) Airlines, (3) Mobile Network Operators (**MNO**) and (4) Satellite Operators

The question that often arises is: *Who will operate the service?* The table below summarizes pro and cons for the above four categories.

On board Operator	Advantages	Disadvantages
Airline	One stop shopping for passenger	Not really in telecom business. Has to make roaming agreements with all MNOs and will be felt as a new competitor. Passenger billing can only be done bound to ticket price/prepaid cards or on board billing is needed
Mobile Network Operator	Has already roaming agreements in place with others operators.	Airlines are not willing to give exclusivity on board to one operator. Other MNO may get in conflict and roaming relationships can even be jeopardized or need to be renegotiated. It is not easy for an MNO to install a BTS on board without the involvement of the aeronautical industry and authorities.
Aircraft Manufacturer	Easy contacts with Airlines, with aviation authorities	Has to get into roaming agreements with MNO. Not really in telecom business.
Satellite Operator	Has already a similar role, but is just restricted as a carrier.	Needs to get into the roaming agreements with MNO, and upgrade the role from carrier to service provider

The current trend is to have one new actor called the AirCom provider. This provider has no "native" customers, it will just provide access service on board and therefore will not be seen as a "nasty" competitor by the MNOs. Examples of these providers are OnAir (a JV by SITA Airbus and Tenzing), the Telenor ARINC alliance offering the AeroMobile service, and Connexion by Boeing.

This independent provider however will have a challenging task of setting up roaming agreements with almost all MNOs worldwide, otherwise a significant part of the business is lost and no universal service can be offered to the passengers from launching date.

MNOs can be divided, as shown in the next table, into three categories:

MNO Categories	has own customers	owns/outsource network
Traditional (MNO)	Yes	Yes
Virtual (MVNO)	Yes	No
Access (MANO)	No	Yes

The AirCom in our case belong to the category of Mobile Access Network Operator (MANO). In the future MANOs can play an important role in Mobile networks in providing coverage in remote areas, indoors or in galleries and associating with one (or more) traditional MNOs as a sort of franchising. Traditional MNO have already built their networks in developed countries to cover what they were interested to cover. The resting territory, mountain areas, remote islands, galleries, subways, parking lots, etc may be the business of MANO with interest to the area to be covered (local communities, parking lot owners, ship owners, oil and gas platform companies, etc)

Perhaps no other situation of Telecom service provisioning is as complex as ours. In terrestrial mobile networks, operators could start giving service without having relationships with other parties, with the exception of the incumbent operator. As they wanted to offer their customers services abroad, they have started roaming agreements and business relationships with other mobile operators. In our case, more parties are needed to offer services, namely the Satellite Operator, the Airline, etc. The picture below depicts these complex relationships showing in solid arrows the money flow.

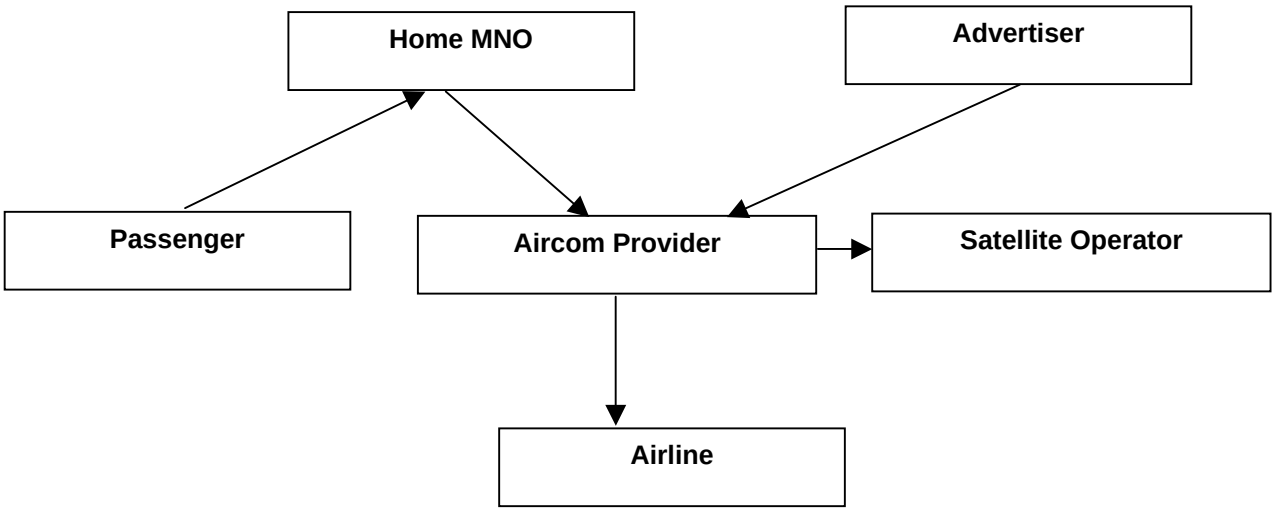

Fig 2 - Single Model : Single Passenger Relation with Home MNO

The Passenger will pay as usual to the Home Mobile Operator, which in turns will pay back the AirCom provider. This subject has also to pay the Satellite Operator and the Airlines with agreements that can be based upon minutes of traffic, nr of SMS, Volume for GPRS/EDGE or

charged by Flight, monthly rates, etc. The Airlines will be themselves users for calls generated by crewmembers and for backing up non-mission critical data transmission in case of need. Therefore some revenues will be generated for the AirCom by the Airlines and settlement needs to be calculated, but in general the money flow is from the AirCom towards the Airlines.
The AirCom provider has roaming agreements with passenger's home mobile network operators.
The business model includes also an advertiser, for example one hotel or rental car chain willing to send SMS to Passengers flying to a certain destination, expecting them to use their services. The advertiser will in turn pay a fee to the AirCom provider, and reimburse the calls (toll free numbers will be likely disabled) or SMS sent for booking to the passengers when they are checking out of the hotel or returning the rental cars. Relationships with a carrier for connecting to the terrestrial fixed and mobile networks are not considered here for simplicity.

Another business model can be envisaged if one wants to separate the air segment and the ground segment in terms of charges for the Passenger.

In this case the following *split model* applies:

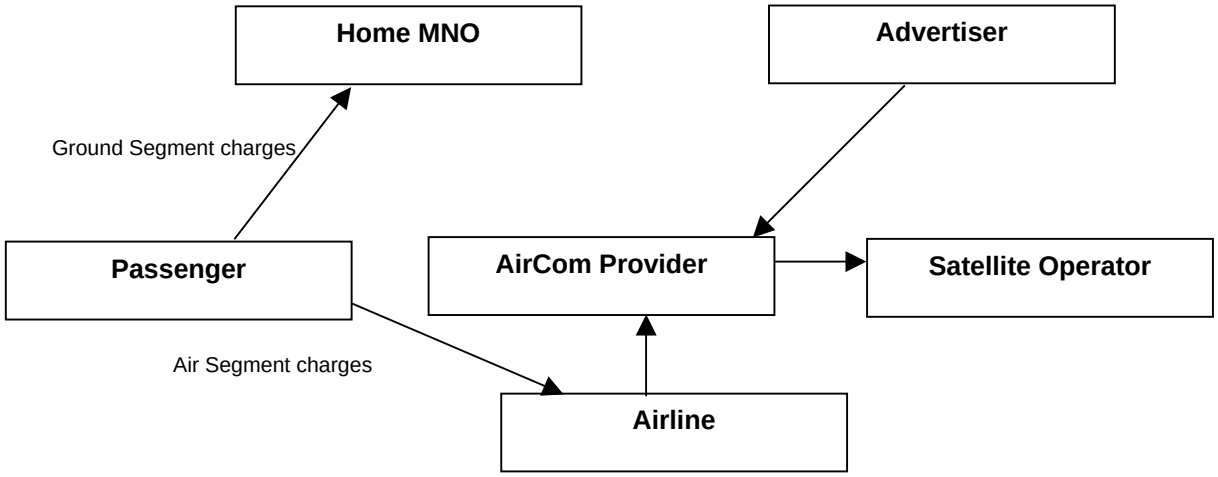

Fig 3 - Split Model : Double Passenger Relation with Home MNO and Airline

Why is this model considered? While getting roaming agreements between peers MNO is not a big problem (as it is considered a win-win relationship and normally the balance that one MNO has to pay to another one is small compared to the total value of the revenues generated by the calls), the AirCom may not be in such a peer position when negotiating with MNOs. If it will prove difficult to get the roaming agreements, the AirCom provider can go for the split model. The AirCom (or the Airline in this case) will account for charges related to the Air Segment, remotizing a roaming scenario. If the satellite earth station is in a certain country, the AirCom provider will make agreements with one of the MNOs of that country where the satellite gateways are located. The AirCom provider will then provide the necessary extension of this interface inside the Aircraft. The passenger will pay the usual roaming charges applied by his mobile operator when roaming with the operator chosen in the satellite gateway location country, plus will have to pay to the AirCom provider the extra charges for the air segment. In this case a real time onboard billing system such as described in [7,11] can be used to charge the passengers for the extra costs before disembarking. This model is attractive, however it may be difficult for the passenger to understand this split of charges for a single service, and he/she may not be aware of the satellite network topology, ground system location and therefore may get confused when checking the bill.
An advantage of the split model is the possibility for the AirCom to be autonomous in defining charges for passengers. In the single model, tariffs are set by the MNO and while the AirCom will try to harmonize all tariffs, it is ultimately the MNO choice to apply them for their passengers. In

the split model tariffs are the solely responsibility of the AirCom or the Airline who can choose to apply a single price for the space segment for all passengers, regardless their home MNO tariffs.

BUSINESS CASE

AirCom

Revenues expected for the AirCom in the single model are originated by the MNOs and Advertisers. Costs are coming from Satellite Operators and Airlines. The Satellite Operator costs are high, because there are not many available having global coverage of flight routes. Perhaps the traditional ones were designed to carry voice traffic, (Iridium, Globalstar, Thuraya) but the newest one have more data traffic in mind, assume a non symmetrical channel between user terminal and satellite, and while having higher bandwidth are therefore less suited to support traditional cellular telephony traffic. Minimization of the satellite link costs is therefore a must for the AirCom provider. Airlines costs can probably be negotiated just to cover the Airline operational costs and adding their margin. A “pay as you grow” mechanism with the Airline may be already in place, since more calls means in general more passengers, i.e. more revenues for the Airlines anyway.
Revenues from MNO depend upon the roaming agreements. As said before, it may be a good percentage of the tariffs the end users pay. In order to exploit fully the business case the AirCom provider should try to negotiate with MNO on a case-by-case basis. When the MNO has a lot of users and potential passengers, i.e. there is a high demand for this service the AirCom provider can get the best deals. Probably the contracts will include also some KPI to be met by the parts. In most of the cases these will result in penalties having to be paid by the AirCom provider to the MNO for lack of coverage or channels due to the Satellite link. It is crucial here to map back these penalties towards the Satellite Operator. Revenues from advertisers are a brand new area of income for the AirCom provider. It is likely that, considering the high target passengers, these revenues can be a substantial portion of the overall business case.

Airlines

The *Single Model* Business Case for airlines is about balancing operating expenses and revenues. On the Airline OPEX side, equipment cost, weight, power consumption, maintenance and other certification/qualification costs have to be balanced by revenues from the AirCom service provider and from the indirect increased market shares gained when offering cellular coverage against the competition. A single parameter to consider is the OPEX per passenger and per minute of flight. Stated this, the Airline may chose to get a markup over this parameter, or may go into a revenue sharing discussion with the AirCom service provider, sharing the risk but getting better revenues if the service goes beyond expectations.

In the *Split Model* the Airline gets the revenues directly from the Passengers, therefore will apply a markup to the OPEX and includes it into the ticket price or charge it before the passenger disembarks. As payment goods, alternatively, Frequent Flyer Miles can be used instead. In this case it is not excluded that some settlement between Airline and AirCom service provider will take place. The Airline may have to pay a percentage to the AirCom service provider. In some circumstances, if for example the Passenger will not be able to call during the flight because the equipment is not working, the Airline will have to reimburse the money to the passenger and asks for compensation to the AirCom service Provider.

Mobile Network Operators

It is the MNO responsibility to set up tariffs for their customers in the *single model.* However these tariffs cannot be very different from roaming tariffs, nor can be very different from one another. The AirCom provider will likely set up recommended prices but the last word is left to the MNO.

By negotiating fair contracts with the AirCom provider, the MNO will get additional revenues, and may get increased market share when their competitors will lag behind offering this service.

Taxation

An interesting case is the tax eligibility of these services and how taxation applies. This goes well beyond this paper and will be addressed in the future.

AN EXAMPLE: MARKET AND REVENUE ESTIMATION

The example shown here is a calculation of expected revenues in one single international route only, considering a mixed of voice and data traffic.
In general, the market niche while not comparable with terrestrial counterpart, is anyhow interesting considering the following amplifications factors

- The high spending profile of Passengers
- The observed increase in traffic generated when in constricted situations
- The additional value given to reachability of Passengers.
- The introduction of call generating advertisements on boards
- The introduction of additional high value, high bandwidth Multimedia Services

When coupled with the natural trend of increase of Flights, estimated at about 20% per year, thanks also to the introduction of low cost carriers, this gives the market good perspectives. Extensive studies have been performed in the project to forecast an elaborate in-flight traffic model. Out of this process, we briefly summarize some results on revenue estimation for a particular market segment and a specific geographic market, which have been gained implementing these traffic models. For details and background data material one may refer to [9].

The main AirCom services identified as important by airlines, service providers and passengers, are cellular telephony and Internet services (including email).

The major market is expected from short medium range flights taking between one and three hours. In fact it is well known that for longer flights, after an initial period where the Passenger emotionally is connected to the activities on the ground and therefore is very active, he/she prefers to eat, rest or look at entertainment programs, thus generating considerably less traffic.

In order to be conservative, this analysis was focused on one particular market worldwide for services, that of the flights between Europe and USA, covering then approximately the IATA zones 1, 2 and 3. We chose to base our customer profiles on a “consistent” set of tariffs and usage statistics of a country with a well-developed infrastructure and customer awareness, under the assumption of an existing wireless cabin infrastructure, supporting wireless Internet and GSM phone services. Of all the possible countries in these IATA zones we chose Germany.

A clear way of segmenting the market for AirCom services is to do it considering the class the passengers fly in and the scope of their journeys, i.e. according to the passengers that have the requirement for and the economic capacity to purchase a service of the AirCom ones. Considering the three possible classes, First, Business and Economy, the passengers having the highest need and surely the necessary resources to purchase an AirCom service are passengers flying First and Business or those flying Economy but being on a business trip.

Due to the fact that for the tariffs and the usage of AirCom services there are no data available, we proceeded for each service as follows. As a first step we analyzed the usage and tariffs of the

corresponding terrestrial service, providing then the available budget for each market segment for this service. In a second step we applied the tariffs of the services that are regarded from the users as equivalent to the AirCom ones, in terms of deriving benefits, producing then revenues and traffic estimations from single users.

The influence of catalysts and inhibitors was of course considered. According to the available passenger budget, which is correlated to the class the passengers fly and to the task of the journey, different usage profiles were obtained. According to the number of the passengers of each type sitting in the aircraft, the average traffic and expected revenues were computed. In the following, all revenue figures are in Euro.

A SW tool named GroundBill, part of a Billing System suite (www.planebill.com) [11], can be used also to simulate the business by entering traffic figures and simulating traffic and revenues generated by flights. The tool allows for simulating different business models, and allows to bill for duration (calls), units (SMS) and volume (GPRS/EDGE) or any combination thereof.
According to the average cabin configuration of the airplanes flying North Atlantic routes, see table below,

	No. of Passengers in			Addr. Market		Achiev. Market	
Aircraft	First	Busin.	Econ.	Phone	Internet	Phone	Internet
A340	12	40	211	263	73	73	37
A380	22	96	437	555	162	162	81
B747	23	82	321	426	137	137	69
B767	19	48	168	235	84	84	42
B777	25	57	240	322	106	106	53
MD11	23	55	197	275	98	98	49

and to the fact that a flight connecting Europe and USA takes on average 9 hours. For such flights the following revenues (in Euro) are expected.

	Revenues: North Atlantic flights		
Airplane	**Telephone**	**Internet**	**Total**
A340	867	1´295	2´162
A380	1´925	2´835	4´760
B747	1´628	2´415	4´043
B767	998	1´470	2´468
B777	1´259	1´855	3´114
MD11	1´164	1´715	2´879

For the daily airline revenues we considered the whole time span of the flights Europe to USA, since passengers will remain awake, but only 20% of the time span of flights in the other direction, since passengers will try to sleep. We further assumed that aircrafts are on average used to 65% of their capacity. For the Internet revenues we expect the passengers working on board buy a 5 MB data package for 35€, since this is the most convenient alternative for their average daily Internet data flow, and still negligible compared to the daily costs of employees for a company. According to their fleets and to their scheduled flights, the daily revenues for the airlines deriving from AirCom services can be computed.

	Daily revenues from		
Airline	**Telephone**	**Internet**	**Total**
AA	28´139	62´180	90´319
BA	42´502	94´303	136´805
DL	28´413	62´783	91´196
LH	21´972	48´971	70´942

This leads on the basis of 365 days per year to the following yearly revenues

	Extrapolated yearly revenues		
Airline	**Telephone**	**Internet**	**Total**
AA	10´270´647	22´695´700	32´966´347
BA	15´513´271	34´420´595	49´933´866
DL	10´370´751	22´915´795	33´286´546
LH	8´019´762	17´874´415	25´894´177

Under the same assumptions, the global revenues for all airlines can be computed once knowing the complete worldwide flight schedule of aircrafts flying over the Atlantic Ocean.

Daily revenues: North Atlantic		
Telephone	Internet	Total
267´989	394´758	662´747

This leads on the basis of 365 days per year to the following yearly revenues

Extrapolated yearly revenues		
Telephone	Internet	Total
97´815´985	144´086´670	241´902´655

All presented figures have been in Euro. Due to our conservative assumptions, this revenue estimation can be considered as a fair baseline for the considered market segment and geographic region.

CONCLUSIONS

The Business Case for Mobile On Board Services to Passengers has been shown. With the help of an onboard Billing System [6,7] and of a Ground System Billing [11] system implementing all features illustrated in this paper the various scenarios have been simulated and analyzed. The *single model* and the *split model* have been analyzed. The Business case for the introduction of on board Wireless Cellular services to passengers looks promising.

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