Honeywell

Using Cell Phones In Flight

A glance around on a commercial flight just before the doors are closed or immediately after landing, reveals a lot of passengers making last minute cell phone calls or picking up messages that have arrived during the flight. It has long been one of Honeywell's objectives to find a method to allow customers to use their own cell phones to make and receive calls and text messages during flight. The advantages of customers being able to use their own cell phones means that, unlike the seat back phones, they will be familiar with its method of operation, they can use their own number for making and receiving calls, and the costs of calls will be billed to their home cell phone account. Honeywell's ambition is to make cell phone use in flight commonplace with no differences between calls made in the air and calls made on the ground, while at the same time ensuring there is no interference with aircraft electronics or with the terrestrial cell phone networks the aircraft passes over.

To some, the use of cell phones on aircraft may not seem to be a positive development, and the thought of phones ringing and passengers talking throughout a long haul flight is not appealing However, it is possible, with technology developed by Honeywell, to mitigate the effects of these disturbances caused by cell phones. For example, it is possible to inhibit incoming calls during a night flight, restrict calling to text messages only or prohibit cell phone use altogether for certain parts of a flight.

This document will provide some insight into the problems faced in allowing cell phone use in flight and how Honeywell and its development partners can solve those issues.

What's the Problem with Cell Phones in Flight?

From the announcements heard at the beginning of a commercial flight, many assume that the cell phone ban is a Federal Aviation Administration (FAA) restriction to prevent interference with aircraft systems. In fact, the FAA does not ban the use of cell phones in flight. Because a cell phone is classified as an intentional transmitting device, the FAA recognizes that interference with the aircraft is possible but leaves the decision on safe cell phone usage to the aircraft operator.

In the U.S., the Federal Communications Commission (FCC) is responsible for the ban on cell phones in flight. They have recognized that cell phone signals can travel relatively long distances by line of sight creating the potential for interference with cell phones using the same frequencies on the ground. Most modern cell phones will raise and lower their power output based upon instructions from a base station. A cell phone on board an aircraft is likely to be operating at or near maximum power levels due to its distance from a base station. Many densely populated areas have cell towers closely spaced to provide good coverage and channel availability. This means that, from an aircraft, a cell phone can "see" many base stations and may cause congestion in the cell phone network through the signaling it may exchange with any cell towers within range.

Given these issues, why would the FCC or FAA want to allow the use of cell phones at all? One reason is that usage is becoming more difficult to control. A recent survey suggested that as many as 20 cell phones on every flight remain on because passengers have forgotten to turn them off. Also, computer wireless systems such as Bluetooth and 802.11 wireless LANs have been certified for use in flight, and some cell phones can use these radio frequencies and protocols for phone calls in wireless "hot spots." It is difficult for flight crews to check every phone in the cabin and understand the various potential operating modes of each individual cell phone.

One potential solution, currently in development by Honeywell's business jet cabin systems division, is to allow use of these types of devices in flight but equip the aircraft with a means to control their operation and prevent any interference with the aircraft or systems on the ground.

Cellular Networks

One of the key questions facing aircraft equipment manufacturers is which cell phone technologies airborne cell phone systems should support since it may not be economically viable to provide support for all options. In the U.S., there are a number of competing technologies used by different cellular operators. AT&T, T-Mobil and Cingular are examples of GSM operators, while Verizon and Sprint use CDMA and Nextel's networks use iDen technology.

If we consider the total cell phone subscribers worldwide, GSM technology is a clear leader.

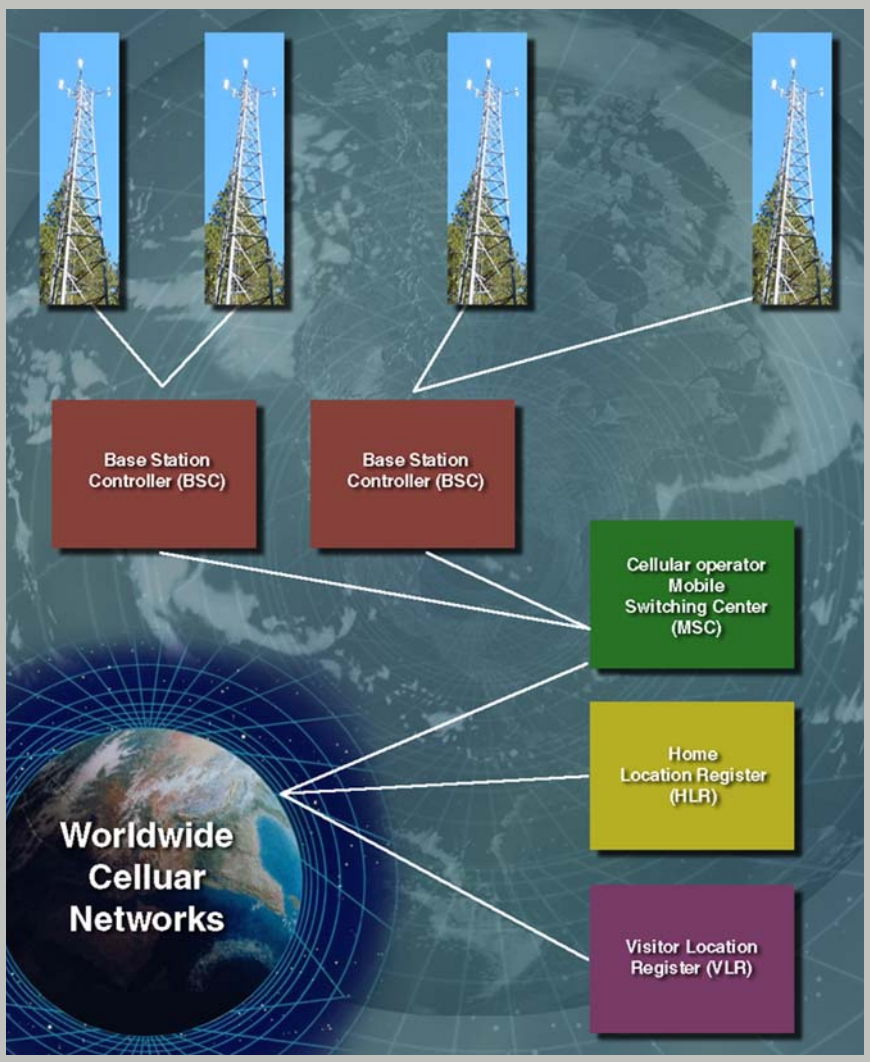
Total Worldwide Subscribers:
GSM - 73.01% (over 1 billion)
CDMA - 13.85%
TDMA - 6.99%
PDC - 3.96%
IDen - 1.17%
Other - 1.02%

However, the U.S. offers a somewhat different picture:

Total U.S. Subscribers:
CDMA - 44% (about 73 million)
GSM - 35% (up 85% from 2003 to 2004)
TDMA - 13%
IDen (Nextel) - 8%

Honeywell's strategy is to focus on GSM initially with the intention to expand coverage to CDMA technologies as demand increases. With the introduction of dual and tri-band phones capable of working on CDMA, GSM and TDMA networks, it may not be necessary to support more than one technology.

GSM Cellular Network Architecture



In simple terms, the Base Station Controllers (BSC) are responsible for managing the channels, power levels and signaling exchanges between individual mobile phones through the base station towers that provide the actual radio link for phones within each cell. The mobile switching center controls a number of BSC.

Associated with each network operator is a database of its subscribers: the Home Location Register (HLR) and the Visitor Location Register (VLR), which records roaming users (or visitors) who have roamed onto the operator's network. These facilities allow the network to support its own and other operators' subscribers for billing and management purposes. Each operator usually has roaming agreements with a number of other operators in order to provide these functions.

The Honeywell/Altobridge Solution

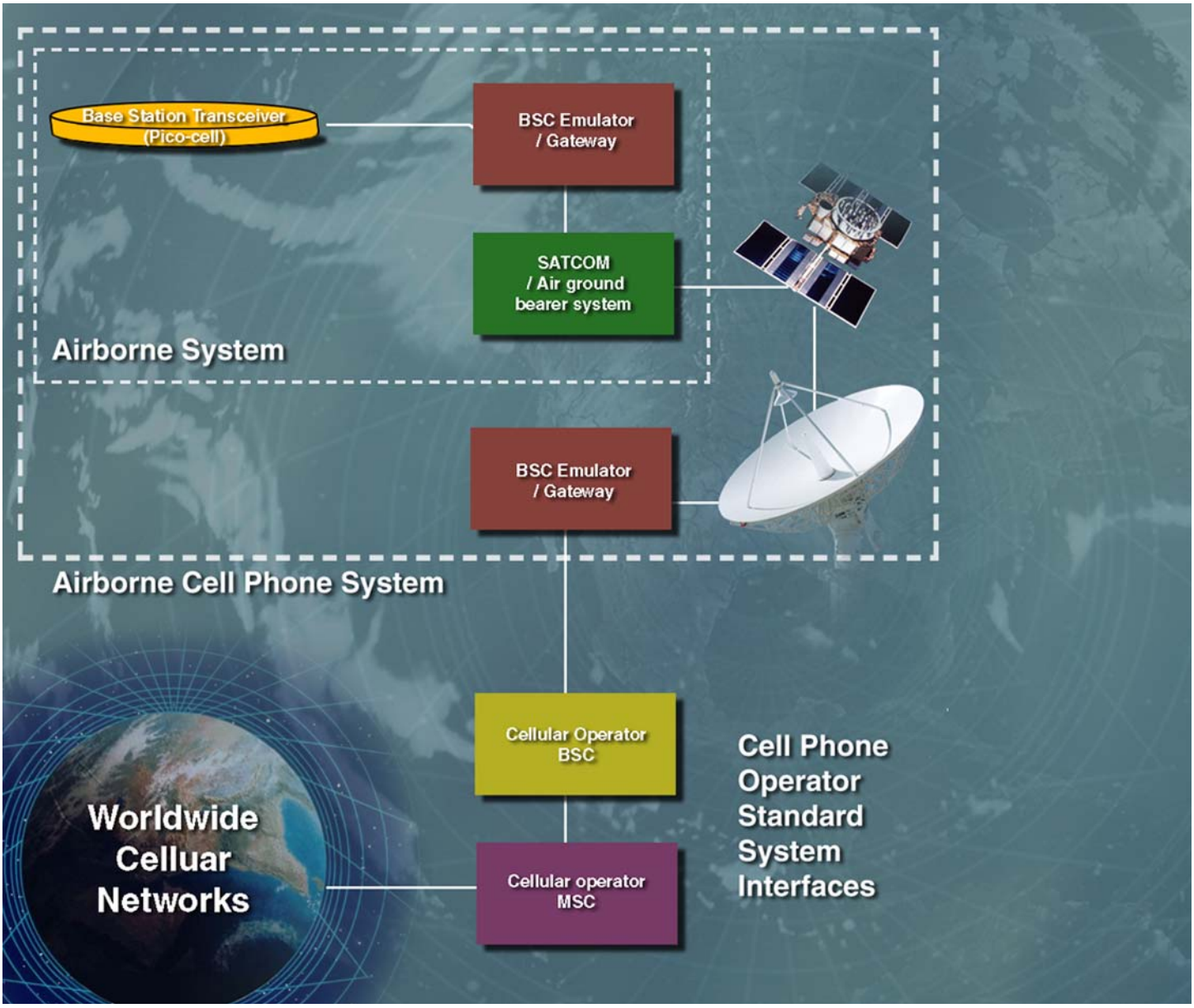
Airborne System

The airborne system consists of:

- A GSM pico-cell, capable of supporting 8 simultaneous cell phone calls, but configured to operate at very low power levels. It can be configured to support either US or European GSM phones.
- Software running on a cabin server system that controls the pico-cell and provides the gateway between the cellular network protocols and the SATCOM or other bearer system used to communicate with the ground. Voice calls can be mapped on to the bearer system channels and signaling takes place over the air to ground bearer between the BSC emulation software and the equivalent Base Station Tranceiver (BTS) emulation system on the ground.
- The air to ground bearer system which can be any suitable voice or data system capable of providing the relevant quality of service levels.

Ground System

The system on the ground makes use of standard air to ground bearer ground stations to deliver calls and signaling data to the BTS emulator / gateway. This ground-based element translates signaling into standard cellular network protocols and provides any transcoding necessary to make the voice signals intelligible to the cell phone networks. The BTS emulator appears to the host cell phone operator as a standard BTS and uses the same protocols as a BTS to make and receive calls and text messages.



Flight Experiments

Honeywell and Altobridge have identified two key issues that must be overcome in order to develop a commercially viable working system.

First, in order to avoid interference with ground-based networks and the aircraft's avionics systems, it is necessary to command the supported on-board phones to operate at very low power levels. However, the ground networks themselves are transmitting at much higher power levels and, at some aircraft altitudes, would swamp the signaling between the pico-cell and the on-board mobile phones.

Second, signaling between the base station and the base station controller in standard cellular networks requires fairly high bandwidth (in the US, such connections are typically implemented using T1 fixed links). Using normal air to ground communications services, bandwidth is usually extremely limited and more expensive per minute than terrestrial networks.

Honeywell Cabin Management, Systems and Services recently conducted its first system installation and flight test in August 2004 in order to prove that the system works in a real air to ground environment and to carry out extensive monitoring to determine under what conditions the system will encounter problems. Over a period of one week, the levels of interference generated inside and outside the aircraft were monitored, both from the pico-cell and on-board mobile phones. In addition, the interference levels generated by normal ground-based cellular networks to phones and base station operation within the aircraft were measured.

The initial system installation and tests were a success. Calls to and from GSM phones on the aircraft were made and large amounts of technical data have been gathered to assist in the continued development and optimization of airborne cell phone systems.

Find Out More

For more information on Honeywell's Airborne Cell Phone System, visit us online at www.honeywellcabin.com. Additional information on Altobridge technologies is available at www.altobridge.com

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