Personal Cell Phone Use Inflight

AirCell Presentation to the WAEA Technical Committee July 30, 2002

(Updated November 12, 2002)

Why all the interest?

There is a market demand, the technology exists, and the regulatory hurdles can be cleared.

Passenger Benefits

- Meets a market demand
- Low cost communications
- Billed to user's monthly plan
- Use of their own phone

Airline Benefits

- Dramatic weight savings
- Revenue opportunity
- Customer satisfaction

Today's Topics*

1. Present Regulatory Environment
2. Technologies
3. AirCell's Selected Approach
4. Progress To Date
5. Next Steps
6. Summary

*** Continental U.S. Focus**

1. Present Regulatory Environment (FCC & FAA)

FCC Prohibits Inflight Use of Cell Phones

"Operations - Aircraft Usage
Section 22.925 of the Commission's rules, 47 CFR Part 22, provides that cellular telephones installed in, or carried aboard airplanes, balloons, or any other type of aircraft, must not be operated while the aircraft is off the ground."

Source: FCC Website, 7-23-02 (full text provided in Addendum)

Reasoning behind the FCC Ruling

Cell phones at altitude …

- Line-of-site communications to many cells
- Incompatible with ground frequency re-use pattern
- Causes interference with voice channels

Note: AirCell operates under an FCC waiver, having proven non-interference with the terrestrial network.

FAA Position on PEDs/Cell Phones

"(Advisory Circular 91.21-1A) … prohibits the operation of PEDs (Personal Electronic Devices) aboard U.S.-registered civil aircraft …

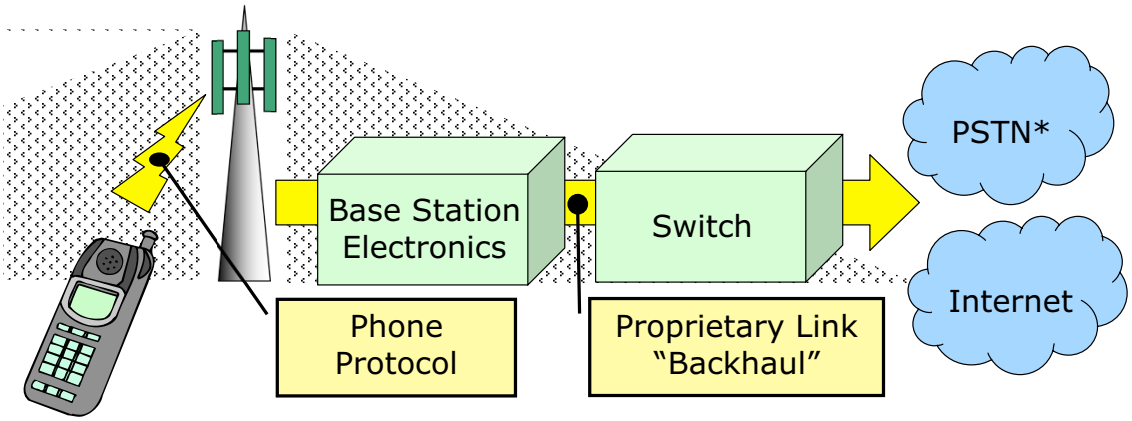
… allows for the operation of PEDs which the operator of the aircraft has determined will not interfere with the navigation or communication system of that aircraft …"

Source: FAA Advisory Circular 91.21-1A (full text provided in Addendum)

2. Technologies

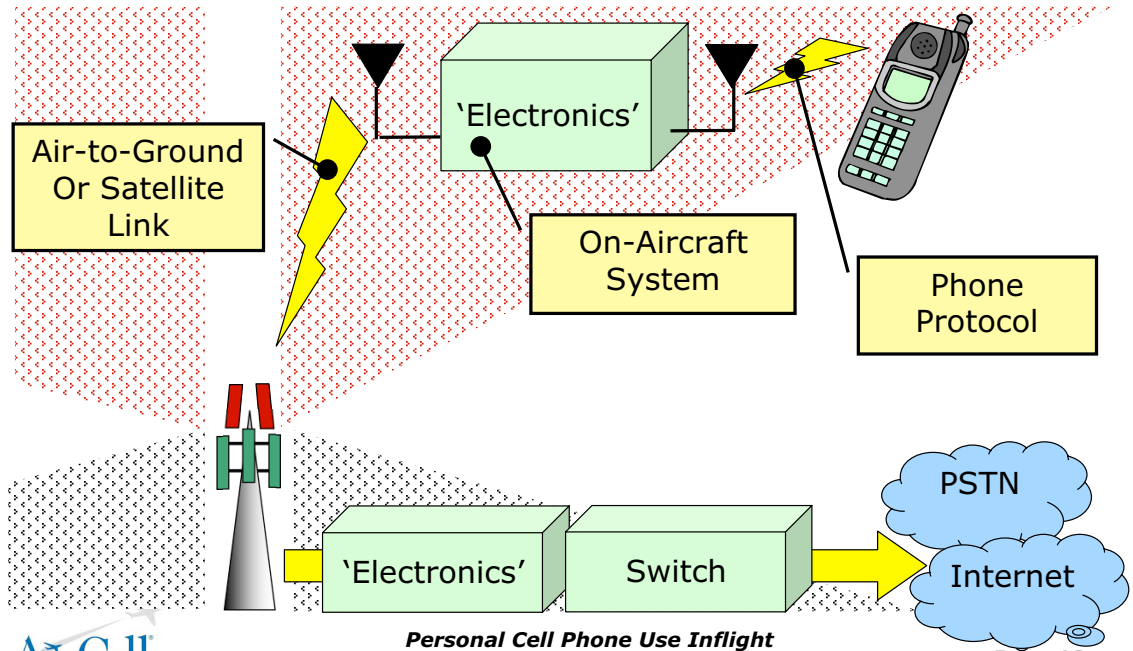
Phone Protocols
On-Aircraft Systems
Air-to-Ground Functionality

Terrestrial Cellular Architecture



*Public Switched Telephone Network

Generic Airborne Cellular Architecture



2. Technologies

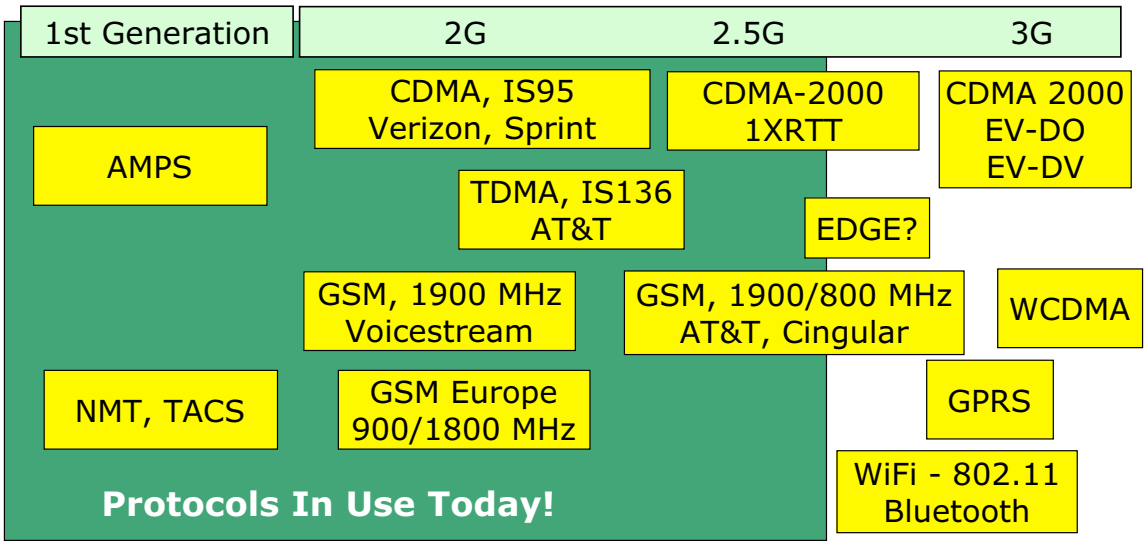
Phone Protocols

On-Aircraft Systems
Air-to-Ground Functionality

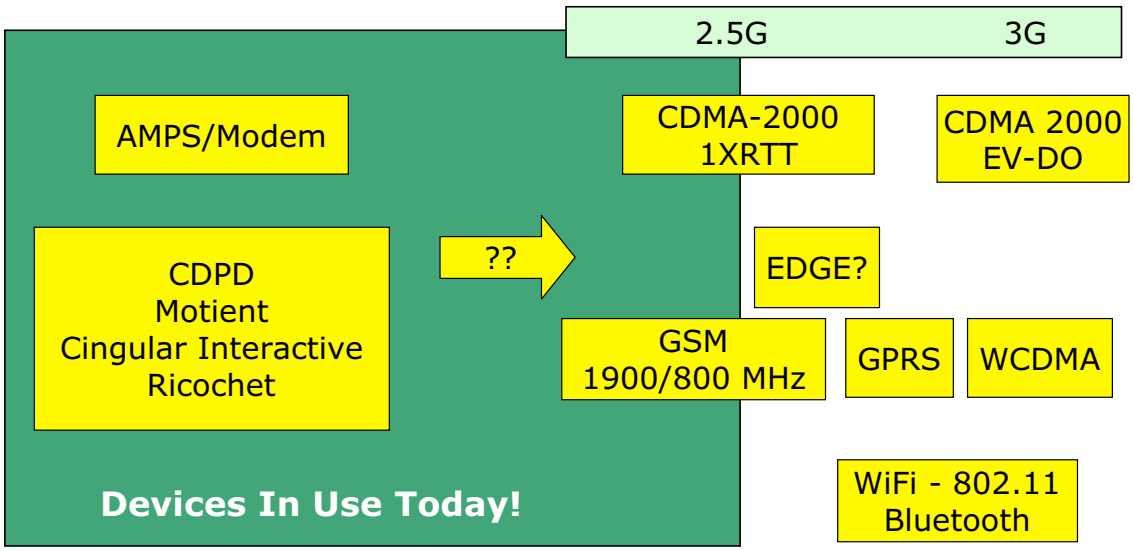
Phone Protocols In Use Today

- **AMPS**
  (Advanced Mobile Phone Service - Analog)
- **CDMA**
  (Code Division Multiple Access - Digital)
- **TDMA**
  (Time Division Multiple Access - Digital)
- **GSM**
  (Global System for Mobile communications - Digital)
- **iDEN**
  (Integrated Digital Enhanced Network - Digital)
- **Also Multiple Frequency Bands**
  (Now 800/900/1800/1900 MHz; Future 700/1750/2100 MHz)

Phone Protocol Chaos

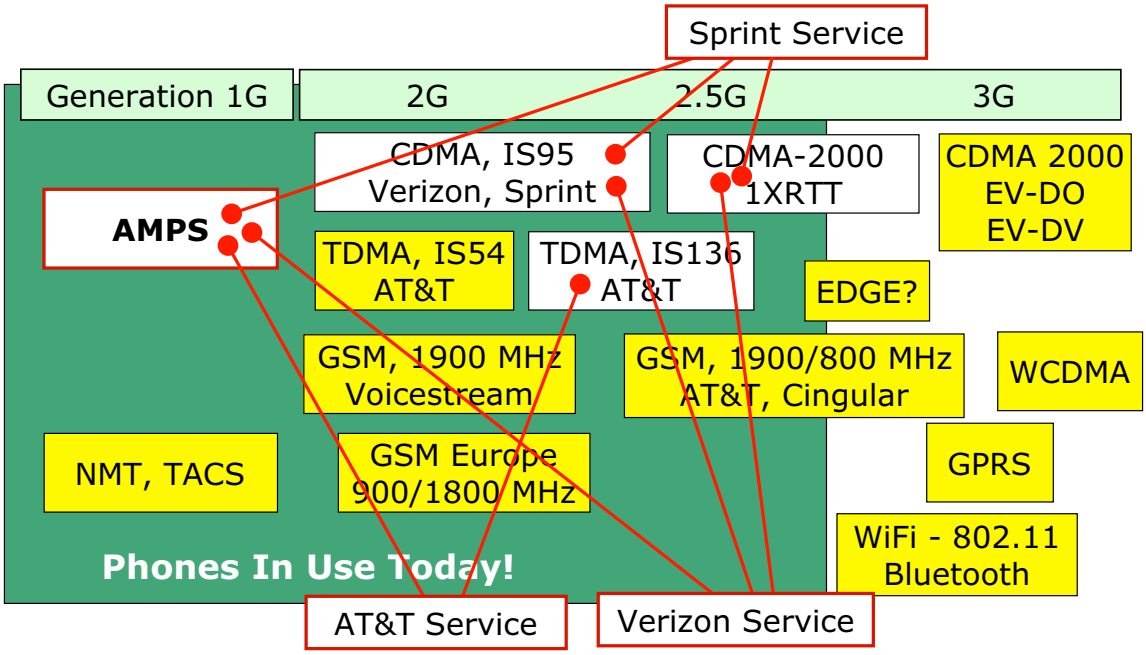


PDA* / Pager Protocol Chaos



* Personal Digital Assistant

AMPS - The Common Nationwide Protocol



Pros & Cons for Airborne Use

CDMA, TDMA, GSM, iDEN	
Pro	**Good urban coverage - high growth, pervasive (1)** **Spectrally efficient (high capacity)** **Market presence of 67% (dual-mode phones, all types)** **Multiple levels for transmit power**
Con	**Poor rural coverage (1)** **Requires complex and expensive airborne system** **Doppler limited (speed)** **Receive/Transmit (RT) timing limited (distance)** **No air-to-ground network to match these technologies** **More difficult issues for Electro Magnetic Interference (EMI)** **Fractured market, no one format is emerging as dominant** **Finite life, 2-3 more evolutions before 3G interoperability(2)** **Market presence only 12% (digital-only phones)** (1) Not an airborne issue (2) Varying opinions on when/if 3G will occur. No Std technology

Pros & Cons for Airborne Use (continued)

AMPS	
Pro	**Good nationwide coverage** **Extended life expectancy for analog - FCC extended the mandatory AMPS service requirement five more years. Can continue longer at discretion of cell carriers. Heavy reliance on analog for nationwide coverage, many users and applications (OnStar, etc.)** **Simple and cost-effective airborne system** **EMI issues scoped & manageable** **Common denominator for most service providers** **Market presence 88% (dual-mode & analog only)** **Existing and compatible air-to-ground network** **Existing 800 MHz digital licenses require AMPS service**
Con	**Spectrally inefficient (low capacity-to-bandwidth)** **Finite life, analog will eventually be replaced by digital*** *Wide diversity of comments/opinions to the FCC regarding life of AMPS

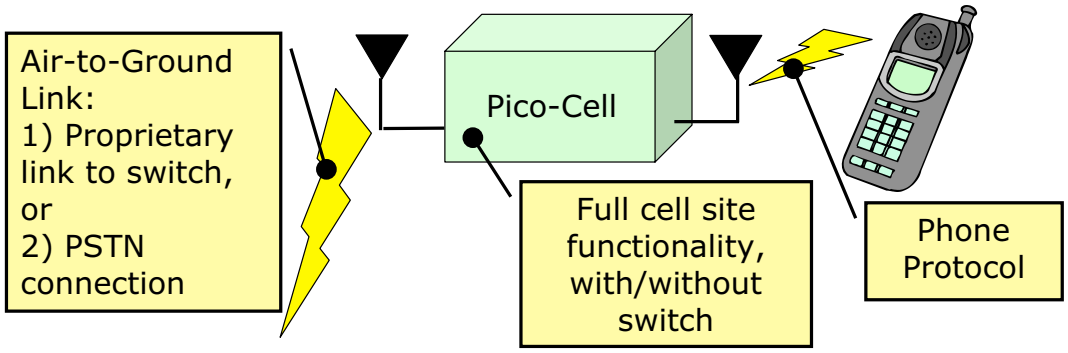
2. Technologies

Phone Protocols

On-Aircraft Systems

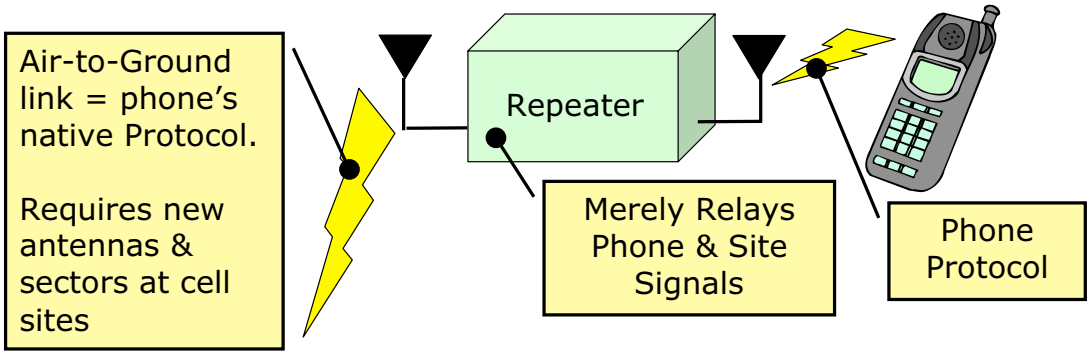
Air-to-Ground Functionality

On-Aircraft Pico-Cell



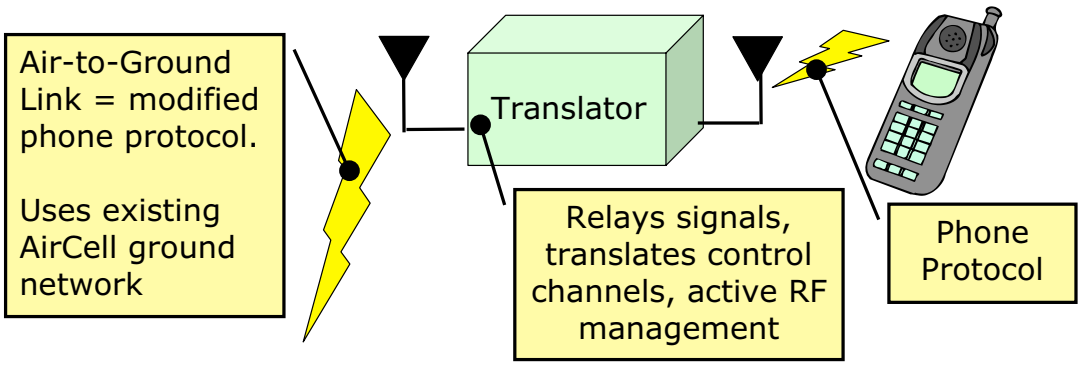
+ Supports native protocol of phone
+ Multiple choices for Switch/PSTN link
- Complex and expensive hardware
- All the technology is on the aircraft
- Capacity is set by airborne hardware

On-Aircraft Simple Repeater



+ Simple and low cost hardware
+ Could support multiple phone protocols
- Would require ground site modifications
- Illegal, no RF/interference management

On-Aircraft Translator



+ Simple and low cost airborne hardware
+ Supports native protocol of phone
+ Capacity is determined by ground site
- Supports only one protocol & freq band

2. Technologies

Phone Protocols
On-Aircraft Systems

Air-to-Ground Functionality

Air-to-Ground Functionality/Choices

Pico-Cell (switch included)
Functionality: PSTN connection
Choices: NATS, Inmarsat Satcom, Iridium Satcom, AirCell network

Pico-Cell (switch not included)
Functionality: A-G link is a wideband connection (T-1 like)
Choices: No obvious choices

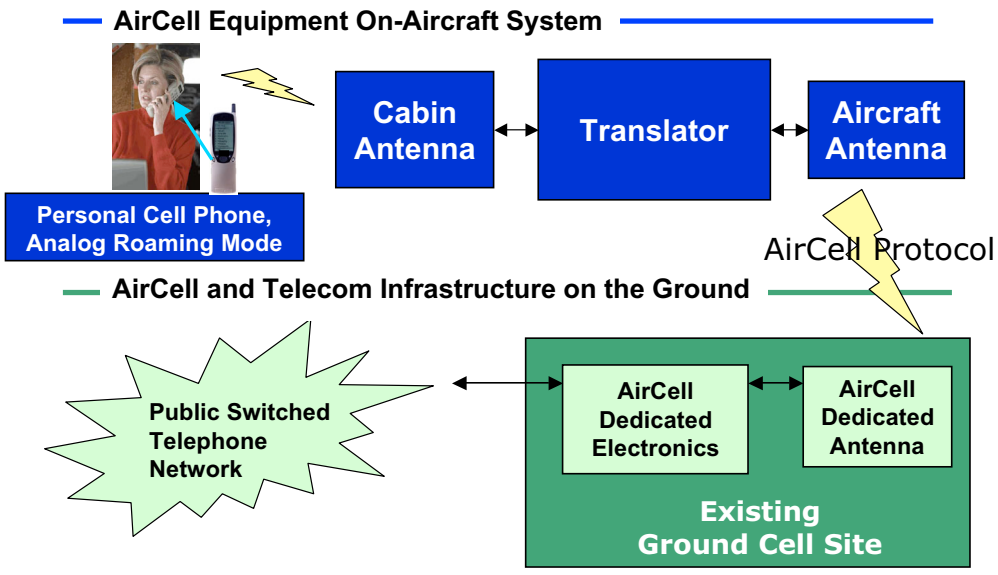
Air-to-Ground (continued)

Simple Repeater
Functionality: A-G link is native phone protocol
Choices: No ground network available
Note: Interferes with terrestrial cellular network

Translator
Functionality: A-G link is modified phone protocol
Choices: Existing AirCell network

3. AirCell's Selected Approach

AirCell's Selected Architecture



Representative Aircraft System

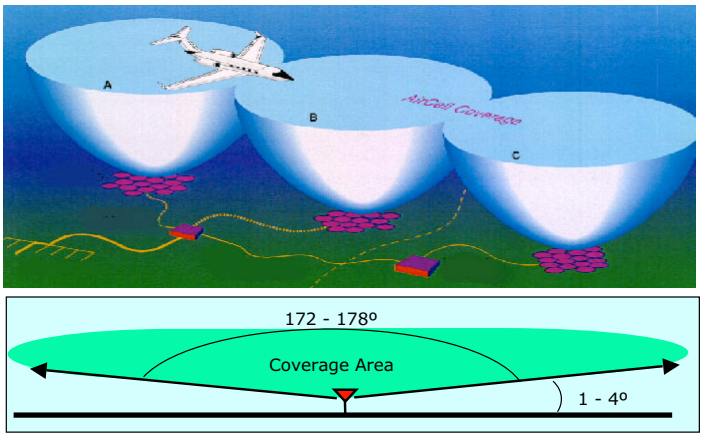
One of Several Options for the Cabin Antenna

Air-to-Gnd Antenna

Passenger/Crew Personal Cell Phone

Approx. Form-Factor for the Translator

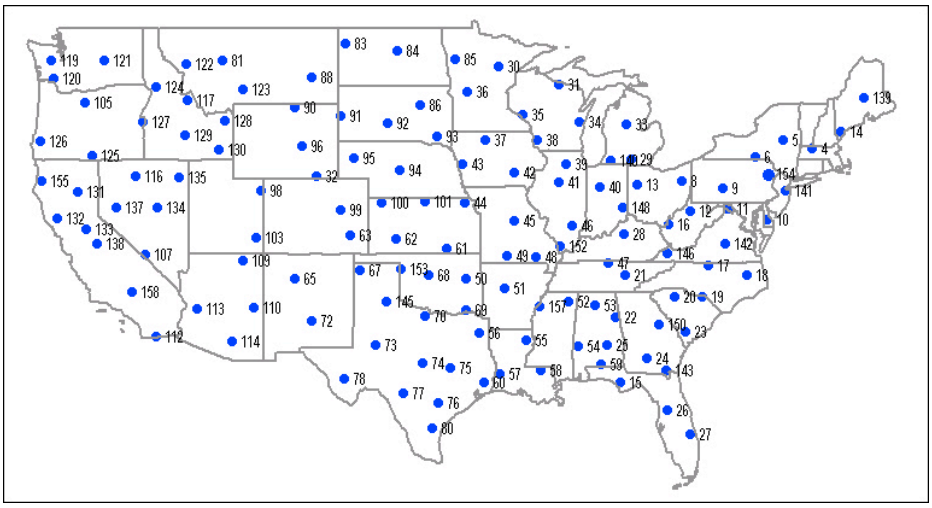
System Uses Existing Cellular Infrastructure, AirCell Antennas/Sectors



- 134 Sites, Spaced Approx. 165 Miles Apart

Site Locations

95% coverage for all continental U.S. air routes



4. Progress To Date

Progress To Date

- ❑ All candidate cellular technologies evaluated
- ❑ AMPS protocol selected
- ❑ Laboratory/test system has been demonstrated
- ❑ Work has begun on active RF management to prevent non-compliant phones from operating illegally.
- ❑ OEM & Airline meetings continue
- ❑ Substantial intellectual property developed

5. Next Steps

Next Steps

- AirCell with a trial/launch Airline (TBD)
  - Briefings to the FCC/FAA
  - Testing to prove non-interference
  - Determine features and configuration
- Continue to apprise the OEMs
- Initial hardware and trials - Early 2004
- Fleet deployments - Mid 2004

6. Summary

Summary - Personal Cell Phone Use Inflight

The time is right …

- ❑ The technology exists
- ❑ Regulatory issues can be addressed

Significant market demand, only if …

- ❑ Aircraft hardware is simple and low cost
- ❑ Low calling costs ($1.00 to $1.50 per min.)

With passenger & airline benefits

- ❑ Passenger connectivity & satisfaction
- ❑ Weight savings
- ❑ Revenue opportunity

AirCell®

In Touch-In Flight®