VERIZON AIRFONE

Presentation to
John Muleta, Chief of Wireless Telecommunications Bureau
Regarding

WT Docket No. 03-103
"Air-to-Ground Service Rules"

October 7, 2004

Outline

- Public Interest Goals → Broadband
- Verizon Airfone Proposal → "Exclusive Use"
- Problems with Band-Sharing Proposals
- Incumbency Issues
- Conclusions

Broadband is the Goal

- Consumers want in-flight access to the same kinds of broadband services they get on the ground.
- Airlines want broadband to improve operational efficiency.
- Law enforcement agencies want broadband for safety and national security purposes.
- Broadband service must be high-quality and available from takeoff to landing ("deck to deck" service).
- Satellite operators (Boeing, Inmarsat, ARINC) already offer or are planning to offer broadband services, and ATG rules must be changed to allow terrestrial alternatives.

Importance of "Deck-to-Deck" Service

- Full service (voice, data, video) required from take-off to landing ("deck-to-deck" service).
  - "Deck-to-deck" permitted today for narrowband via seat-back phones on commercial flights
  - Available today for narrowband services to private, military and governmental aircraft (50% of Airfone customers)
  - Required on commercial flights for official airline and law enforcement communications
- Band-sharing proposed by AirCell and Boeing would preclude "deck-to-deck" delivery of Broadband ATG.
  - Both admit interference will limit service below 10k feet.

Verizon Airfone Proposal

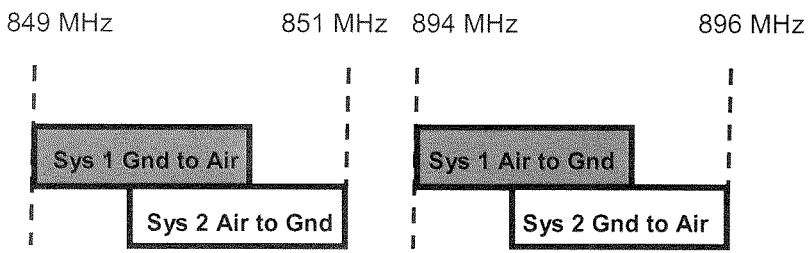
- Airfone needs sufficient unencumbered spectrum to deliver Broadband – that is the business imperative.
  - Flexibility to innovate and respond to market forces
  - Protection from interference that impedes delivery of high-quality advanced services to consumers
- Infrastructure vendors unanimously agree that minimum of 3 MHz is required and band sharing won't work.
  - Airfone's plan supports rapid deployment of Broadband ATG using "off-the-shelf" technology.
- Flexible, exclusive licenses are the only way to get Broadband to ATG customers. (PCS model)

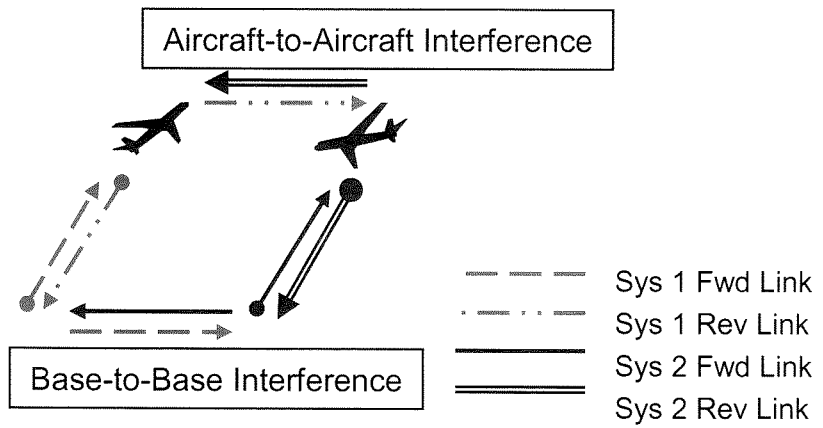
AirCell & Boeing Proposals

- AirCell and Boeing propose band-sharing arrangements that would have up to four licensees share the ATG band.
- Each relies on equipment that is not available today.
- Each relies on inflexible and highly prescriptive rules that would restrict technology choices and service evolution.
- Neither would allow delivery of Broadband ATG.

Reverse Banding (Cross Duplex)

- Air-to-ground and ground-to-air assignments are reversed, resulting in significant potential for interference.





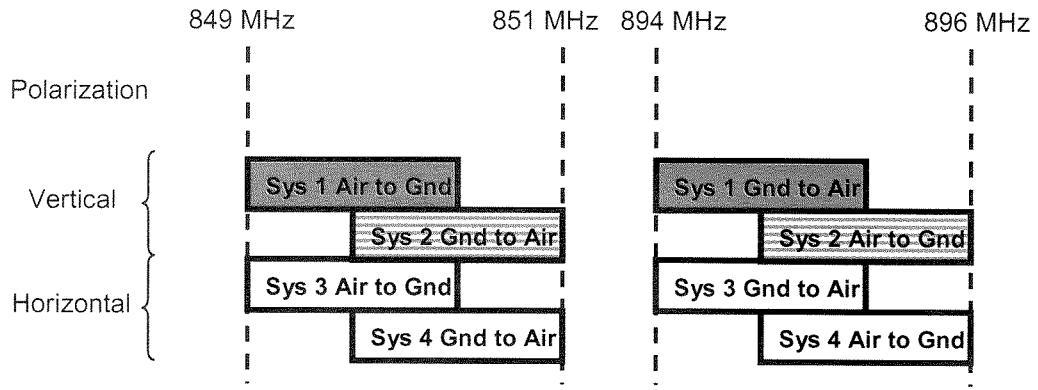
- AirCell proposes strict rules to minimize interference, which would preclude delivery of Broadband ATG.
- Even under these restrictions, ATG licensee would be subject to **substantial interference from Navy radar**.

Navy Radar Interference

- Current ATG band plan was specifically designed to avoid interference from Navy radar.
- In 2004, coastal base stations near San Diego, CA, Charlotte, NC, and St. Simons Island, GA received severe interference, resulting in service outages.
- Interference would be more severe for cross duplex, since interference would be to aircraft which has radio horizon of about 250 miles compared to about 30 miles for a base station.

Cross Polarization

- AirCell recommends the use of cross polarization, in addition to reverse-banding, to permit up to four systems to coexist.



- Can't ensure polarization purity in mobile environment.
- Can't monitor polarization isolation to know when objective isn't met.
- Cross polarization results in unacceptable noise levels at the base station, and **<u>would preclude service in areas around airports</u>**.

Inflexible Operating Requirements

AirCell and Boeing propose:

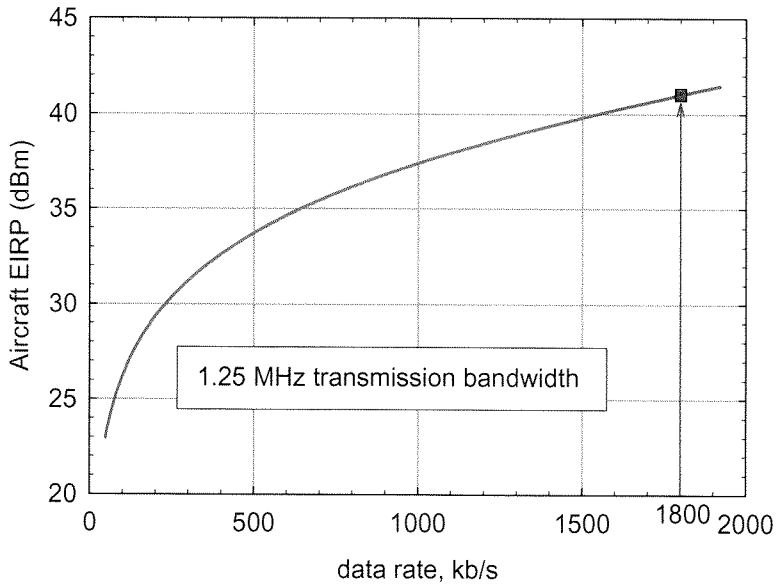
- Use of **specialized antennas** that are not commercially feasible, and would not address all interference concerns.
- **Strict power limits** that would severely limit data rates (48 kbps) and preclude the delivery of Broadband ATG.
- **Mandatory base station separation** (102 mi) that would permit only one provider to serve airports, constrain system growth, and require the FCC to manage the process for locating ground stations.

Impact of Strict Power Limits

- Strict power limits will severely limit data rates provided over ATG networks.
- As the data rate increases, the level of the signal relative to interference and noise in the system must increase.
  - Expressed as "Signal to interference plus noise ratio" (SINR)
- As a result, a high data rate system has a high SINR and a correspondingly high transmit power.
- In AirCell's analysis, its proposed 23 dBm limit corresponds to a total reverse link rate of 48 kbps – clearly not broadband. (AirCell, Mar. 11, 2004)

Impact of Strict Power Limits

- Per AirCell, a 48 kbps reverse link requires 23 dBm EIRP.
- This graph shows the EIRP required vs. data rate for constant link loss.
- 1.8 Mbps would require an aircraft EIRP of 41 dBm, which would result in interference to forward link of competing system under band sharing scenario.
- With additional link losses, higher EIRP would be required.



Note: Derived from Airfone's analysis of Aug. 17, 2004.

Impact of Strict Power Limits

- Band sharing would severely limit the data rates delivered to the customer.

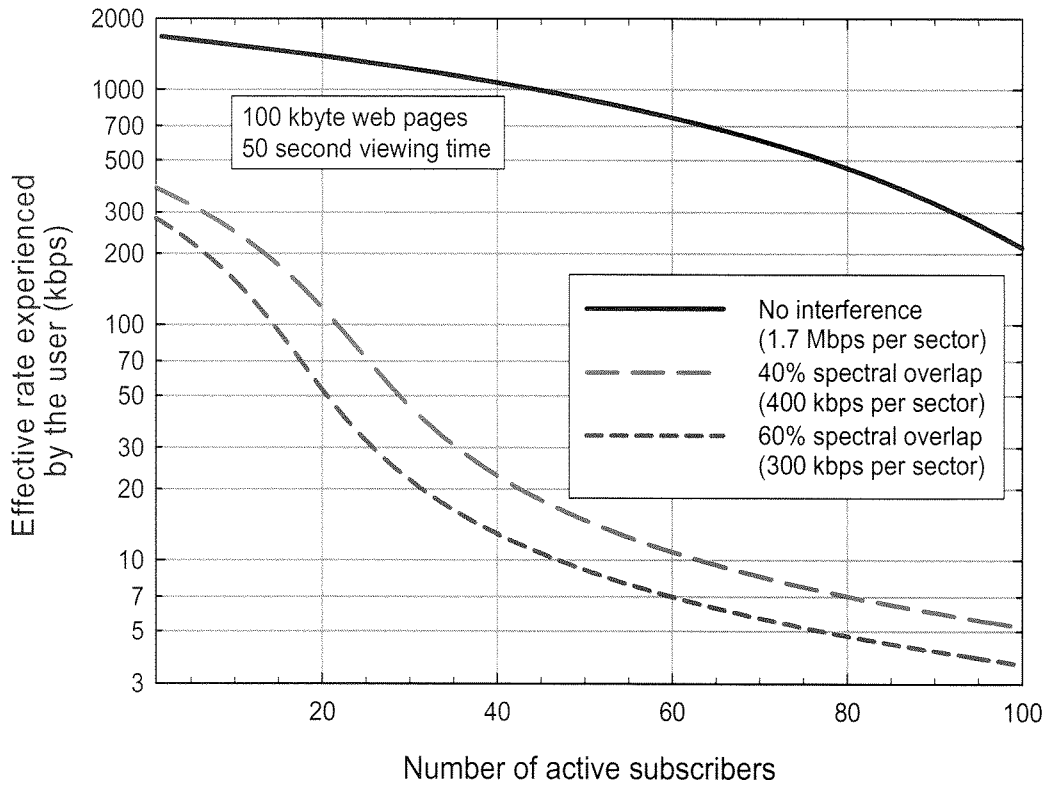
	3 Aircraft Per Sector With 15 Users Per Aircraft (kbps)	10 Aircraft Per Sector With 10 Users Per Aircraft (kbps)
No Interferers	990	212
40% Spectral Overlap	18	5.2
60% Spectral Overlap	11	3.7

Source: Telcordia study, Sep. 21, 2004. Analysis is a modification of Sep. 10, 2004 analysis and is based on a more detailed approach that uses modeling and simulation to account for data pipe congestion and transmission delay.

- Adoption of a band plan that results in overlapping licenses would effectively preclude the provision of Broadband ATG.

Determination of Effective Data Rates

- Effective rate experienced by user will always exceed average rate.
- If channel rate is changed, effective rate changes by a larger factor.



Source: Telcordia study, Sep. 21, 2004.

Impact of Mandatory Base Station Separation

- Base station separation is not an effective solution.
- Mandatory separation limits service near airports and advantages one service provider.
- Limitations would constrain system growth.
  - Generally restricts cell-splitting
  - Higher density deployment required near airports
- Limitations would permit only one provider to serve airports and provide “deck-to-deck” services such as official airline and law enforcement communications.
- Limitations would require FCC to manage process for locating ground stations.

Incumbency Issues

- Airfone has invested considerable time and money in pioneering the ATG service.
- Airfone should be allowed to continue its existing service for as long as the market supports it.
  - Right to a reasonable renewal expectancy
  - No revocation or arbitrary termination date
- If relocated, Airfone should be compensated for costs to relocate to comparable spectrum.
- Airfone should be permitted to bid on any ATG license.

Conclusions

- There is a high demand for Broadband ATG, and FCC rules must be changed to enable terrestrial alternatives to existing satellite-based services.
- Broadband service must be high-quality and available from takeoff to landing ("deck to deck" service).
- "Exclusive use" licenses are the only way to ensure provision of high-quality Broadband ATG service.
- Band-sharing scenarios proposed by AirCell and Boeing would undermine delivery of Broadband ATG.
- Commission must protect Airfone's incumbency rights.