Quick Look Analysis of Broadband Aeronautical Data obtained from the Kuiper Airborne Observatory

by

Edgar Satorius, Brian Abbe, Martin Agan
Jet Propulsion Laboratory, California Institute of Technology, Pasadena, Ca

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KAO Experiment Configuration

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ACTS
Antenna Tracking Performance (Ku Flight 8-25-95)

AIRCRAFT ROLL ANGLE

RECEIVED PILOT LEVEL

Time (seconds) at about UTC 1995 Aug 26, 09:14
Coherent Pilot Power and Cumulative Fade Distributions
for 12 October 1995 starting at 15:08:00
Approximate Fit Between Coherent Pilot Power Cumulative Fade Distribution and LOS Model for 12 October 1995 between 16:10:00 and 16:30:00 (0.1 sec sampling)

\[ x = \text{fade level (dB)} \]

- = data
solid = app. theor.
\[ K_{\text{est}} = 25 \text{ dB} \]
Coherent Pilot Power and Cumulative Fade Distribution for a typical K-Band Land Mobile Satellite Channel (Humpherys & Rice, 1996)

Time Series

Cumulative Fade Distribution
Noncoherent Pilot Power and Altitude for 12 October 1995 starting at 15:08:00
Altitude, Noncoherent Pilot Power and Received Power in the Data Channel at the FT for 12 October 1995 starting at 15:08:00
Noncoherent Pilot Power and Altitude for Various Days

08/29/95 93:08-

09/21/95 02:20-

10/04/95 01:22-

08/29/95 03:08-

09/21/95 02:20-

10/04/95 01:22-
Rockwell Saberliner Flight Test Data for Take-off and Climb to Altitude

[Graph showing various flight test data metrics such as SNR, Elevation, Pitch, Roll, Yaw, and Azimuth over time.]

Time of Day

Altitude (ft), Yaw (°), Azimuth (°)
Preliminary Conclusions

-Received pilot power data characterized by slowly varying amplitude (< ± 2.5 dB) during aircraft ascent/descent:
  - Antenna tracking does not “appear” to be the cause, but final determination can only be made after antenna pointing error data are extracted.
  - Temperature-induced changes in Rx/Tx gain is a possibility.
  - Atmospheric attenuation is not likely since a lot of the flights were conducted under clear sky conditions.
  - Shadowing/scattering from the tail structure may contribute.
  - ACTS steerable beam (SB) pointing does not appear to be the cause, e.g., on 10/12/95 the SB was initially pointed to Moffett Field and was incrementally moved about 6 steps every five minutes in an easterly direction in response to the GPS inputs -- similarly for the other days.
  - Comparable variability in received pilot power is not observed on ascent in the Rockwell Saberliner data set - but aircraft is much smaller.

-Received power in the data channel at the fixed ground terminal reveals similar variability:
  - Changes in received power at the ground terminal during ascent are not synchronous with the changes in received pilot power at the aircraft but are of the same magnitude (lack of synchronicity possibly caused in part by the difference in propagation frequencies).
  - This variability in received power at the ground station is consistent with either temperature variations in Rx/Tx gain or the aircraft or propagation-related phenomena.

-Over < 10 min time scales and at level altitude, pilot propagation can be characterized by LOS propagation with large Rician parameter (>25 dB).

-Work is on-going to better understand this airborne propagation channel.