Analysis of the Effects of Atmospheric Noise on Loran-C

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Current Efforts

- DC-3 Instrumentation
 - ≻ Field Mill
 - Instrumented static dischargers
 - Reelektonika DataGrabbers
- Instrumentation calibration
 - > One week after TMB flight testing
 - \succ No changes to aircraft
- Flight Testing
 - ≻ TMB July 2005
 - Thunderstorm and p-static noise





DC-3 Instrumentation













TMB Flight Test July 2005

• Why Tamiami?

≻Frequent, isolated t-storms

- ≻Comparison to July 2004 King Air data
- Less cross-rate interference
- Flight test
 - ≻3 flights
 - ≻Ground data also collected
 - Stanford collected data during last flight





Instrumentation Calibration

- Performed the week of July 25th, 2005
- Equipment
 - ≻ HVPS
 - Static charge flood and collection fixtures
 - ≻ Field mill calibration plate
 - Ground data collection system
 - ♦ DGH digital meters
 - ➢ Aircraft data collection
 - ◆ DGH digital meters
 - ♦ Field Mill





Equipment Setup













Equipment Setup – cont.











Calibration Goals

- Aircraft should be tested in a configuration that is as close as possible to in-flight conditions
 - Discharge currents only flow through the static dischargers, which prevents the observation of antenna corona and static discharge from other aircraft components
- Static test goals:
 - ≻ Link P-Static levels (E and H-Field) to charging levels
 - Currents can be measured at each of the static dischargers voltage distributions over the aircraft cannot be measured and may vary up to several hundred kV (due to capacitance variations) even if the external charger does not output more than 35 kV)





(1 of 6)







(2 of 6)







(3 of 6)







(4 of 6)







(5 of 6)







(6 of 6)







Field Mill Calibration



Discharger Test (1 of 6)







Discharger Test (2 of 6)







Discharger Test (3 of 6)







Discharger Test (4 of 6)







Discharger Test (5 of 6)







Discharger Test (6 of 6)







Flight Test Results (1 of 17)

- July 12, 2005 flight test
 - ≻3.5 hour flight
 - Encountered several areas of significant p-static activity
 - ≻No significant lightning activity





Flight Test Results (2 of 17)







Flight Test Results (3 of 17)







Flight Test Results (4 of 17)



Flight Test Results (5 of 17)





Flight Test Results (6 of 17)



Flight Test Results (7 of 17)



Flight Test Results (8 of 17)



100 120 140 160 180

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Flight Test Results (9 of 17)









Flight Test Results (10 of 17)

- July 13, 2005 flight test
 - ≻1.5 hour flight
 - Avoided areas of p-static to only get lightning effects
 - Circled over the ground station for approximately 1 hour
 - Stanford recording data at the same time





Flight Test Results (11 of 17)







Flight Test Results (12 of 17)







Flight Test Results (13 of 17)



Flight Test Results (14 of 17)



Flight Test Results (15 of 17)







Flight Test Results (16 of 17)









Flight Test Results (17 of 17)









Conclusions (1 of 2)

- Calibration showed that the instrumentation was operating correctly
 - ➤A scale factor will be needed to account for total aircraft discharge currents
 - ➢ Fields on the aircraft in flight may be higher than recorded by the field mill





Conclusions (2 of 2)

- Significant p-static conditions were encountered during the July 12 flight
 - Results showed that the h-field is not significantly affected by aircraft charging
- Moderate-to-severe lightning was in the area for the July 13 flight
 - Effects are generally similar for both e-field and h-field
 - No significant impact on the ability to identify LORAN signals



