

Ohio University Flight Test Support to the FAA Loran-C Program

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Presentation Outline

- **Directed Task Areas**
- **Resources Provided**
- **Overview of Results**



Directed Task Areas

- **Flight Testing**
- **Support to the FAA Technical Center**
 - » **Loran-C Data Collection System**
- **P-static Effects/H-field Antenna Investigation**
 - » **Data Collection/Analysis**



Resources Provided

- **Aircraft**
 - » **Beechcraft V-35A Bonanza**
 - » **Beechcraft C-90SE King Air**
- **Custom Project Equipment Development**
 - » **Loran-C Data Collection System**
- **Special Aircraft Flight-Test Configuration**
 - » **Project Dependent**



Aircraft



V-35A Beechcraft Bonanza



Bonanza Characteristics

- 165 Kts. Cruise
- 15,000 Ft. Service Ceiling
- Unpressurized



TYPICAL ILS PRECOMMISSIONING EQUIPMENT SET-UP



C-90 SE Beechcraft King Air



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King Air Characteristics

- **240 Kts. Cruise**
- **26,000 Ft. Service Ceiling**
- **Pressurized**
- **Twin Turboprop**



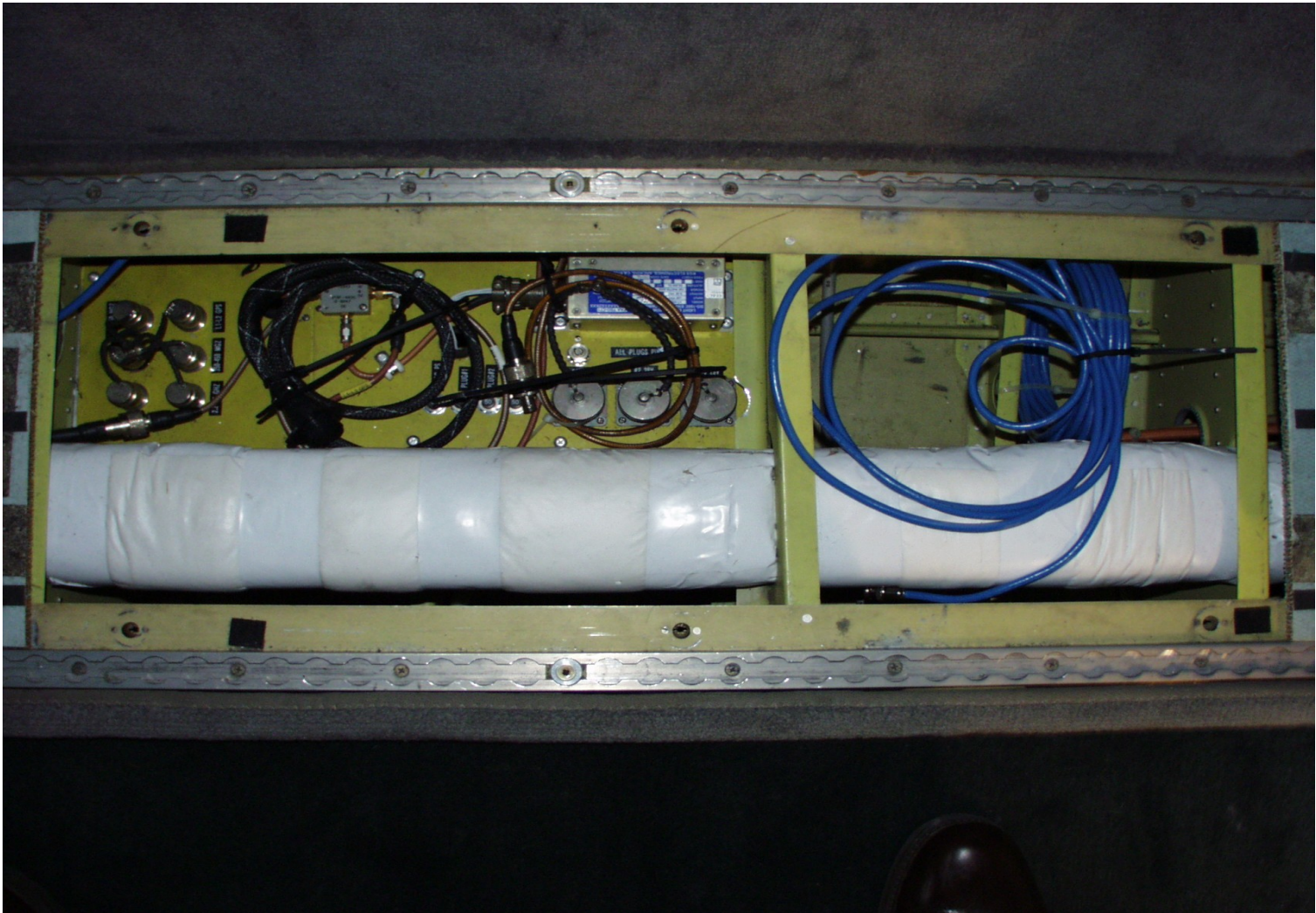
King Air Interior



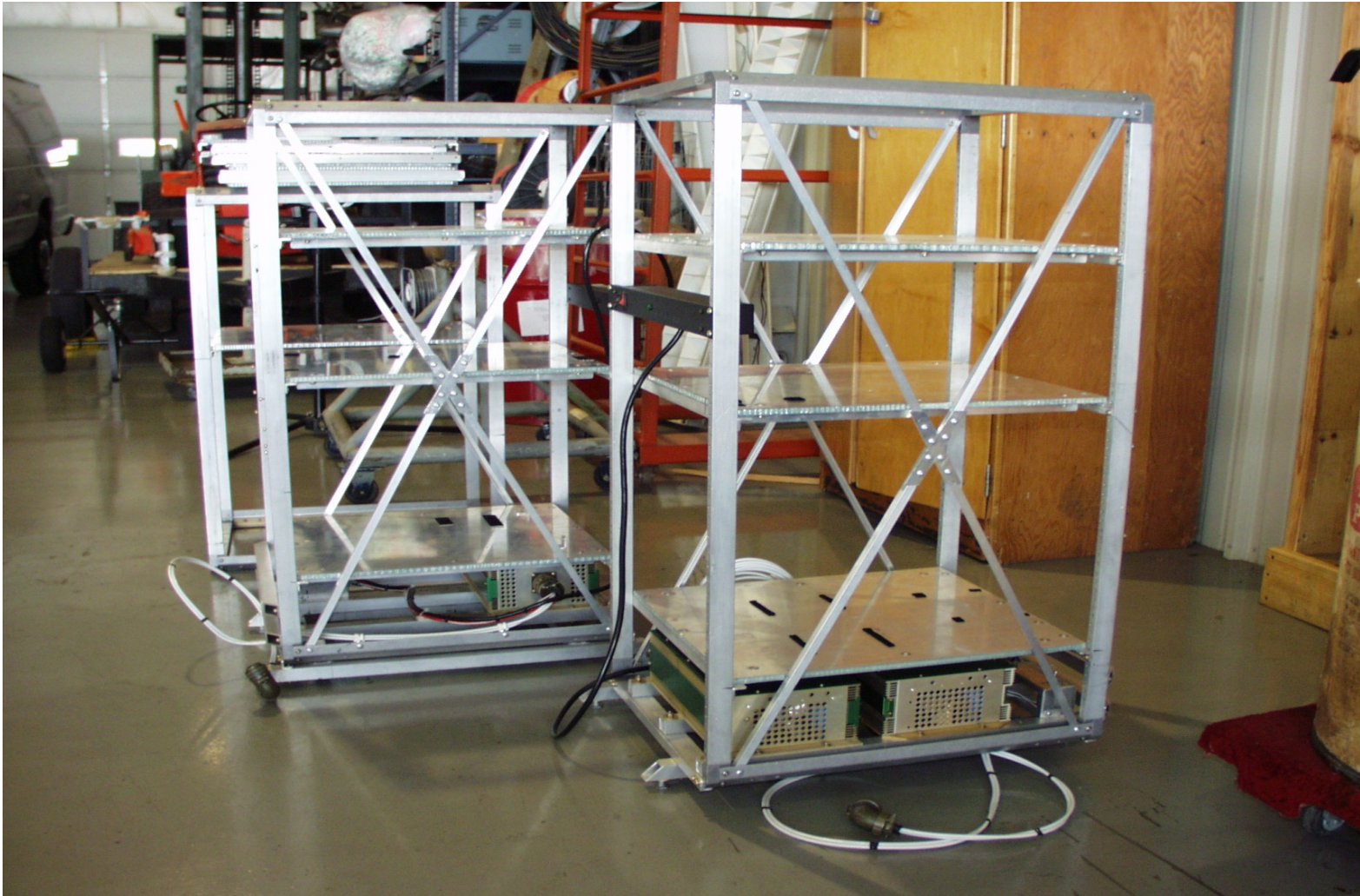
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Antenna/Power Access



User Equipment Racks



USCG Academy PC-104 Loran-C Receiver



Custom Project Equipment Development



Loran-C Data Collection System

- **NovAtel OEM4 GPS/WAAS Receiver**
- **Logs Data from Three Loran Receivers**
- **Deployed Aboard FAA Tech Center N49 Convair-580 Aircraft**



Loran-C Data Collection System

- **Loran-C Receiver Mix**
 - » **Legacy (Apollo 618 / BFG-7201)**
 - » **LOCUS SatMate (All-In-View)**
- **NovAtel OEM4 GPS Receiver**
 - » **Data Collection Time-Tagging**
 - » **GPS/WAAS-Corrected Truth Source**



Loran-C Data Collection System File Structure

OEM4 GPS/WAAS Receiver Record

| \$GPS Time, Latitude, Longitude (WAAS corrected)
| WAAS Parameters
|

BFG-7201 Loran-C Receiver

| \$GPS Time, Latitude, Longitude (WAAS Corrected)
| GPS Time, Latitude, Longitude (BFG-7201 derived)
| BFG-7201 Hex Output String (unparsed)
|

UPS/AT Apollo 618 Loran-C Receiver

| \$GPS Time, Latitude, Longitude (WAAS Corrected)
| GPS Time, Latitude, Longitude (Apollo 618 derived)
| ASCII data elements as available (1-3 seconds)
|

LOCUS SatMate Loran-C Receiver

| \$GPS time, Latitude, Longitude (WAAS Corrected)
| GPS Time, Latitude, Longitude (SatMate minimum error ellipse)
| SatMate data stream (1-2 seconds)
|



Loran-C Data Collection System

500 Watts - 110 Volt
19" Rack Mountable
17.5" Stack

1RU	Locus SatMate Rx
3RU	Loran Legacy Rx
5RU	Cyber Research 650 MHz Pentium III CPU With LCD
1RU	Keyboard



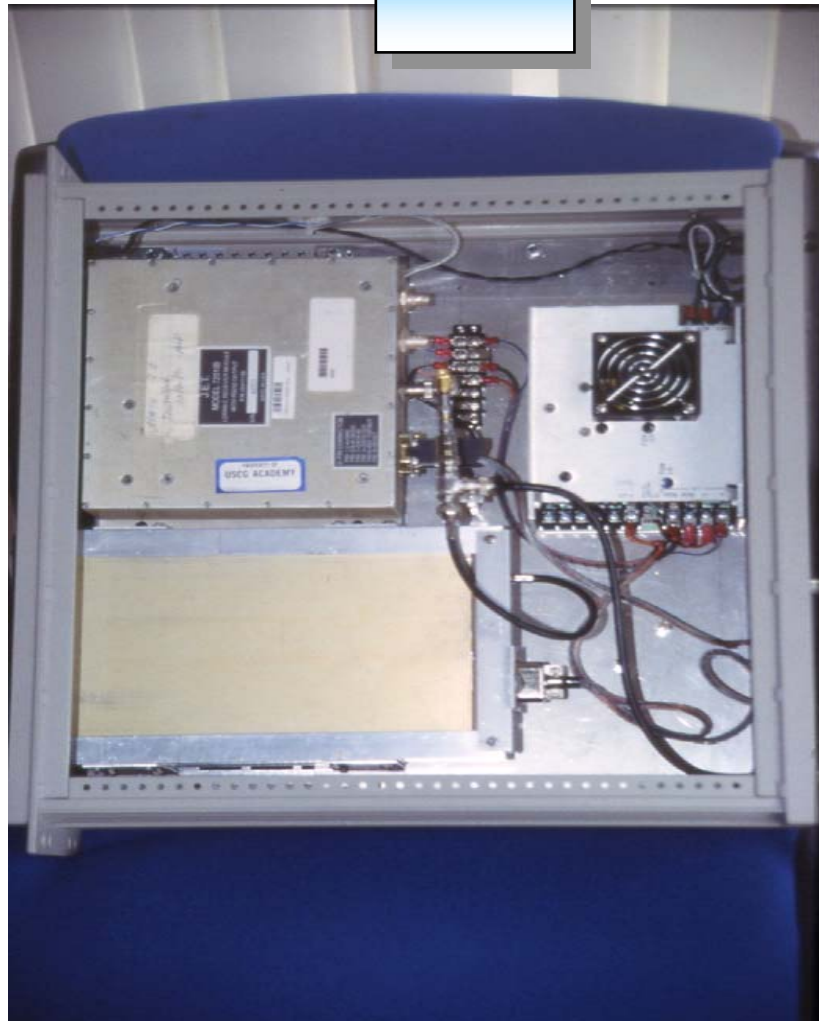
Loran-C Data Collection System



Legacy Loran-C Receiver Unit



Legacy Unit Equipment Layout



LORAN-C H-FIELD ANTENNA DATA COLLECTION SYSTEM



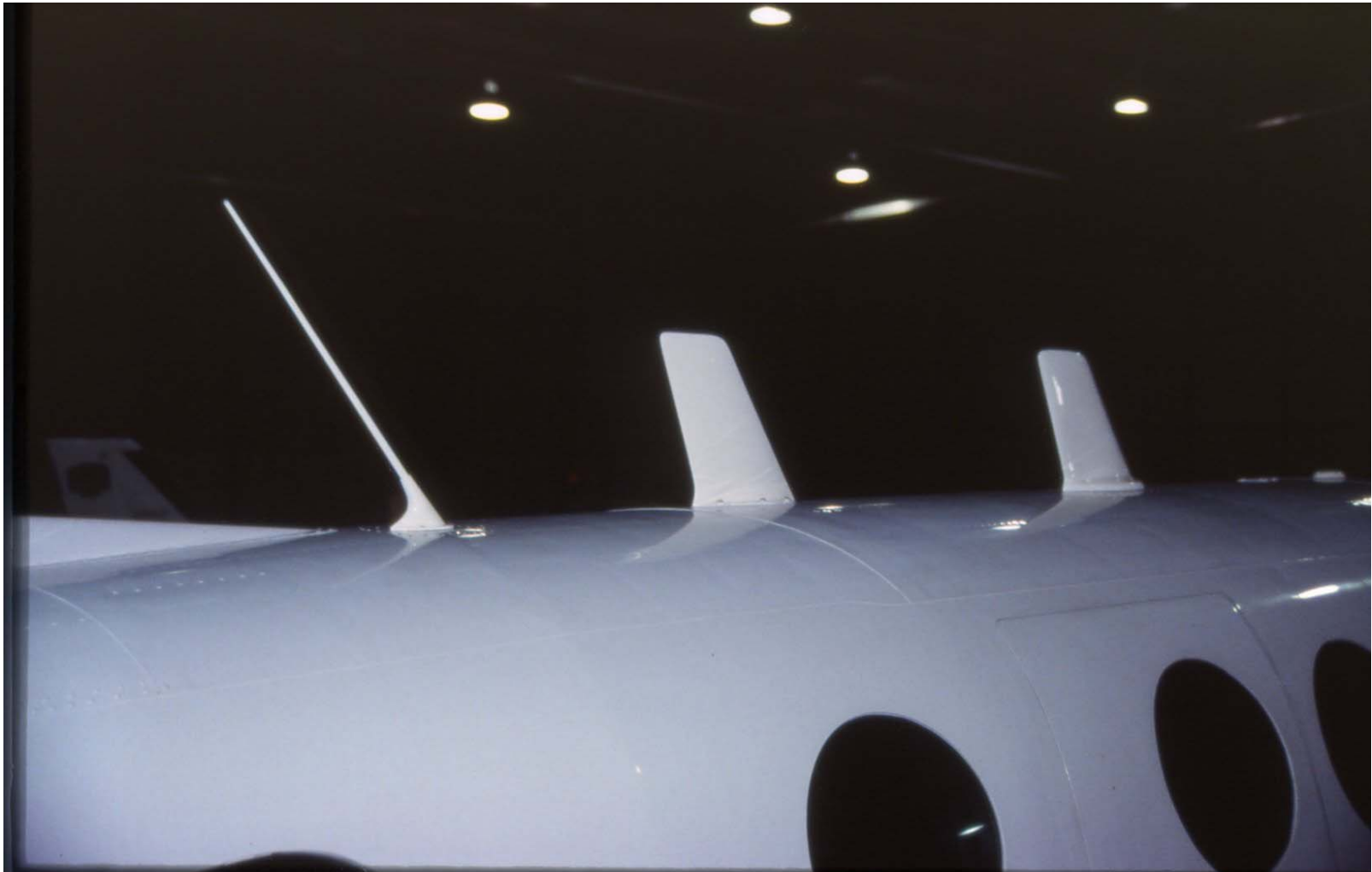
Flight-Test Configuration King Air



H-Field Antenna (Modified KA45B)



Loran A-16 Whip / 2nd VHF Comm Antenna



Flight-Test Configuration Bonanza



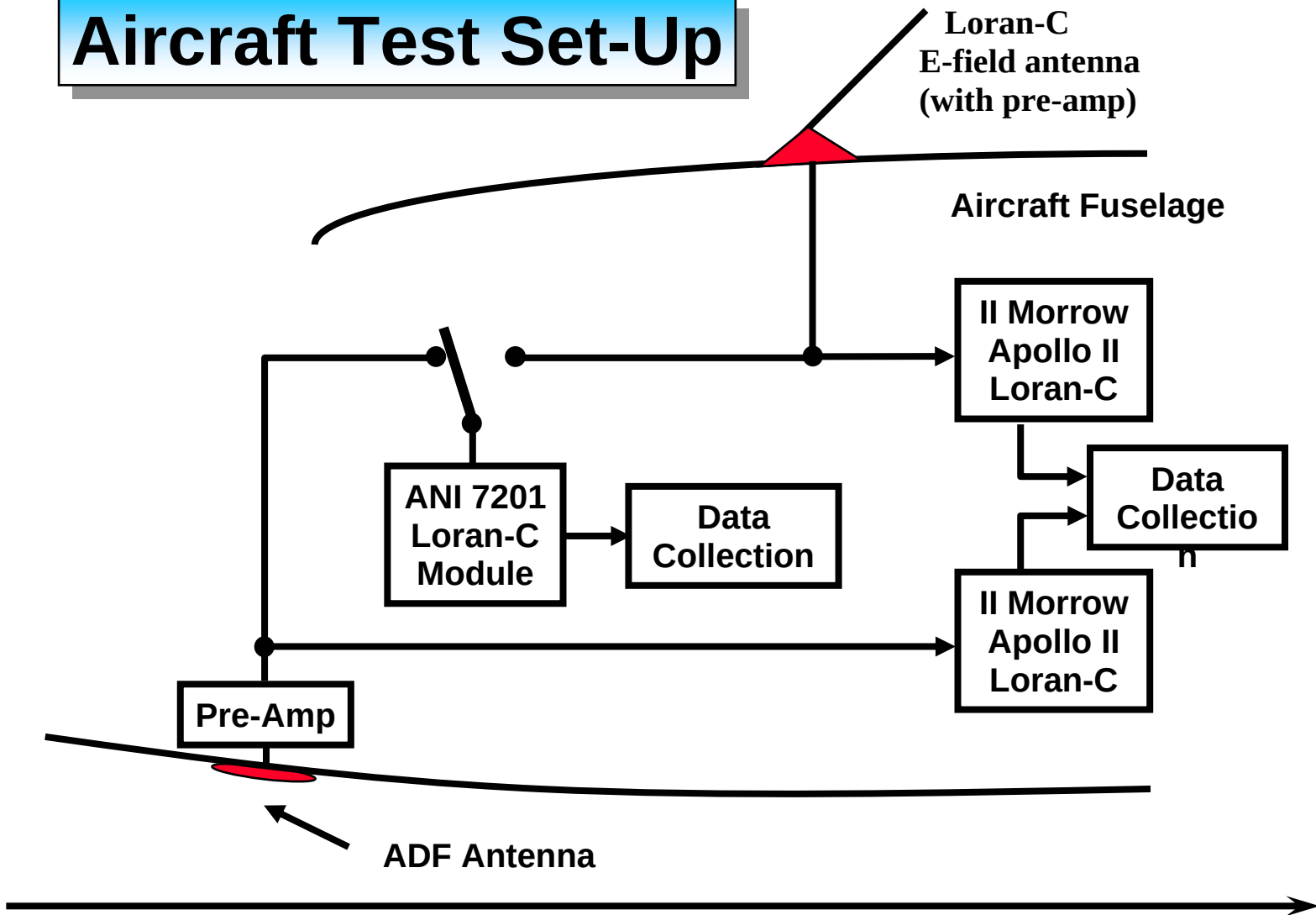
H-FIELD (BENDIX-KING TSO'D ADF) ANTENNA MOUNTING



BENDIX-KING KA42A ADF ANTENNA



Aircraft Test Set-Up



Overview of Results



King Air

Westerly, Rhode Island

- **May 2001**
- **First Airborne use of modified KA45B**
 - » **USCG Academy PC-104 Receiver**
 - » **Loran Data Channel Tested**
- **Shakedown test on Loran Data Collection System**



King Air Alaskan Transit

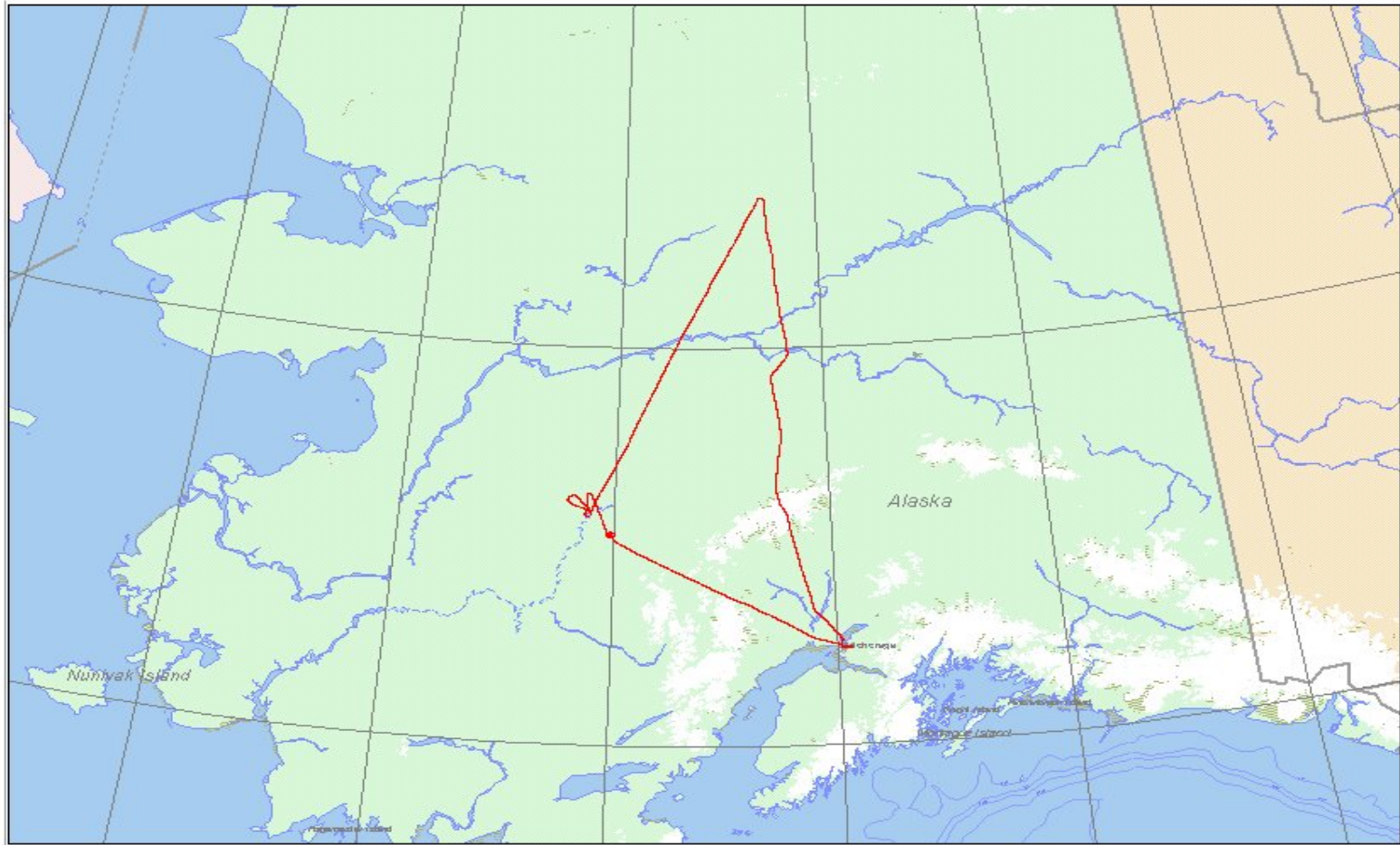
- **Late August 2001**
- **Loran Data Collection System deployed**
 - » **Legacy Data with GPS Truth**
 - » **SatMate not included**
- **Four-day roundtrip**
 - » **Athens – Seattle – Anchorage**
 - » **Anchorage – Reno – Columbus – Athens**
- **One-day Alaskan Trip**
 - » **Anchorage – McGrath - Anchorage**



Alaskan Roundtrip Transit



One-Day Alaskan Trip



King Air Anchorage Deployment

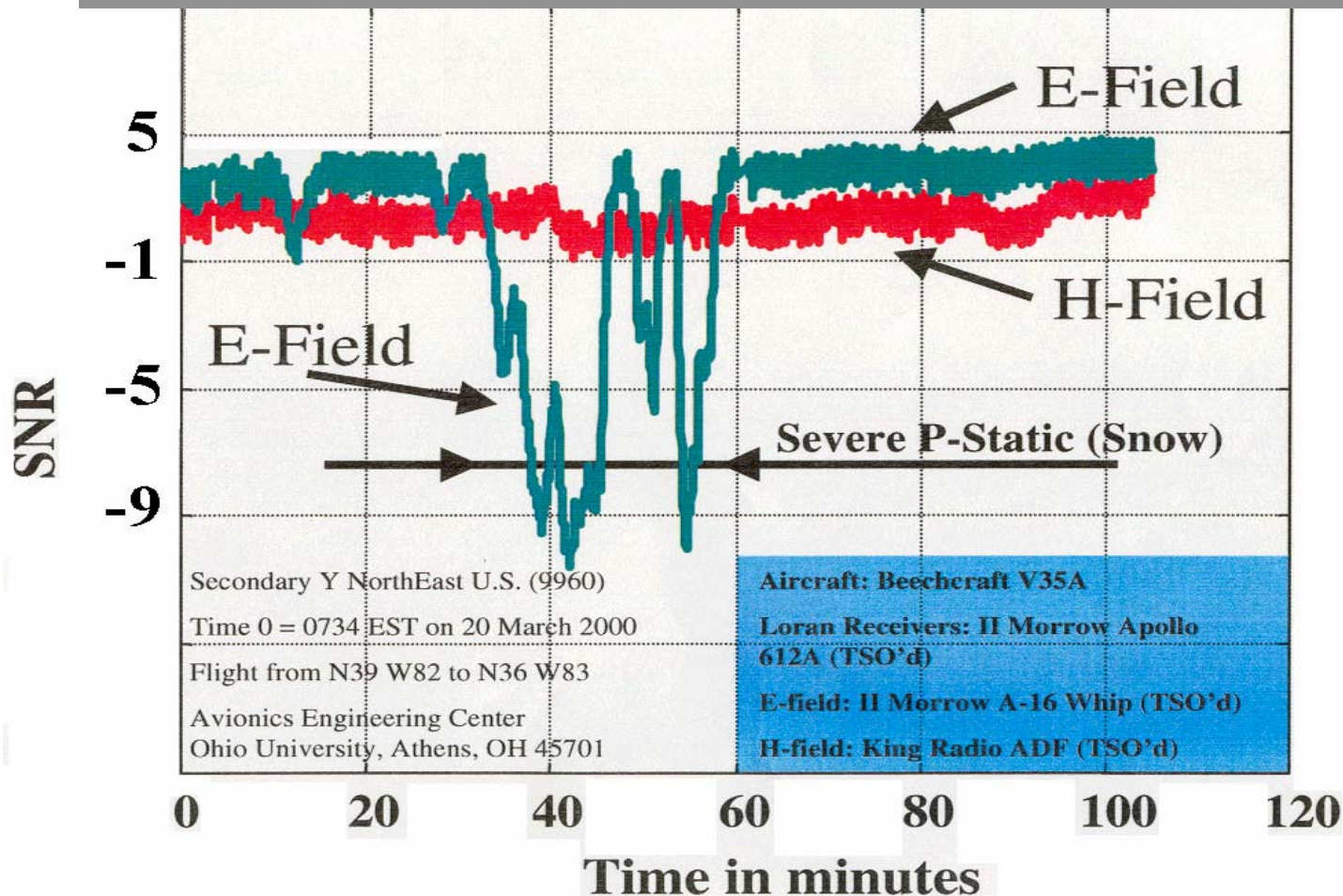
- **Loran Data Channel Equipment Aboard**
- **H-Field Operation Unsuccessful (Day 1)**
 - » **Aircraft Noise/Antenna Preamp Failure**
- **E-Field Operation Established (Day 2)**
 - » **Operations Generally Successful**
 - » **P-static problems in layers with precip!**



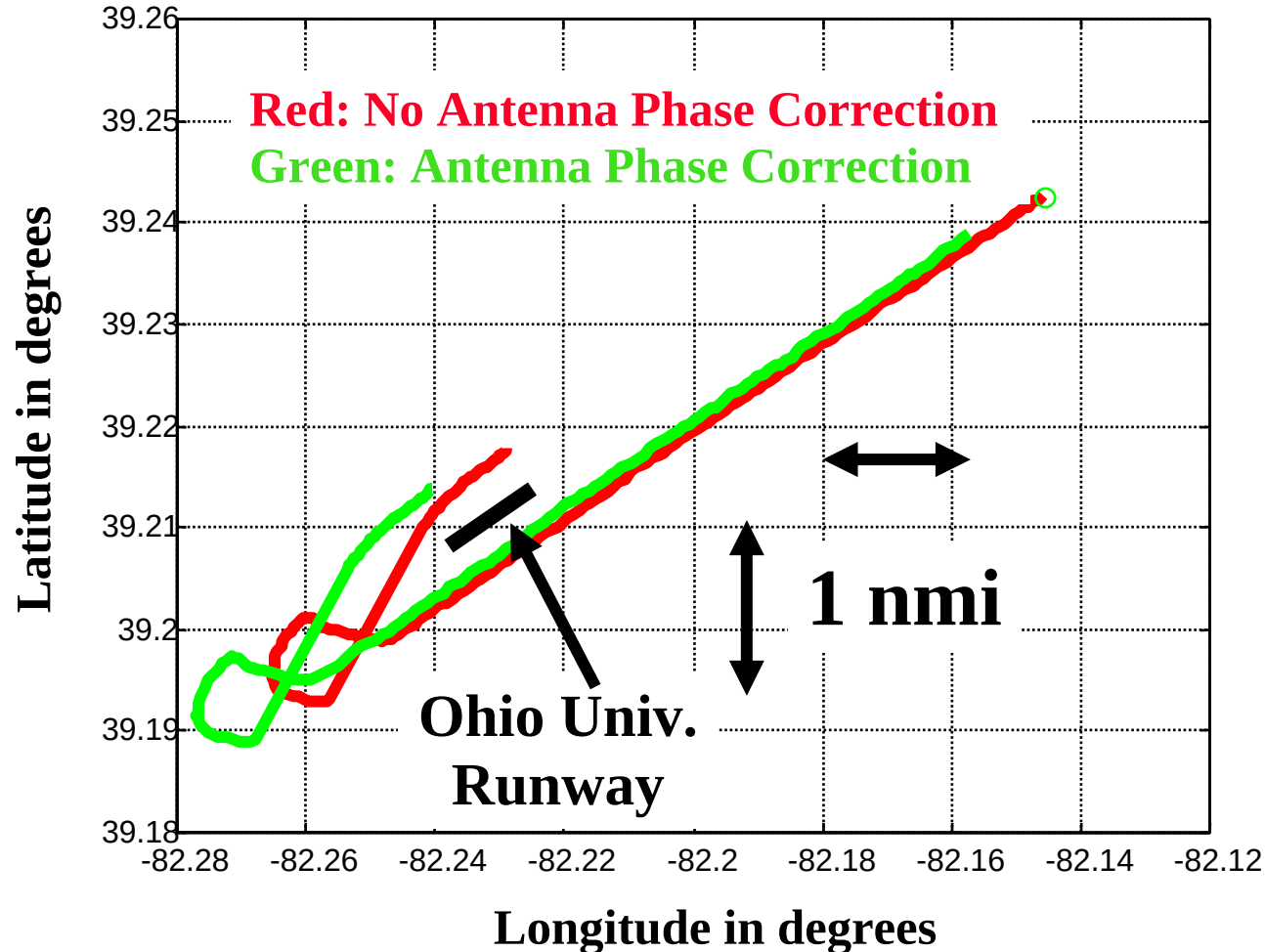
Bonanza – Previously Reported Results



P-Static Conditions (20 March 2000)



Loran-C H-Field Positioning - Approach



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