



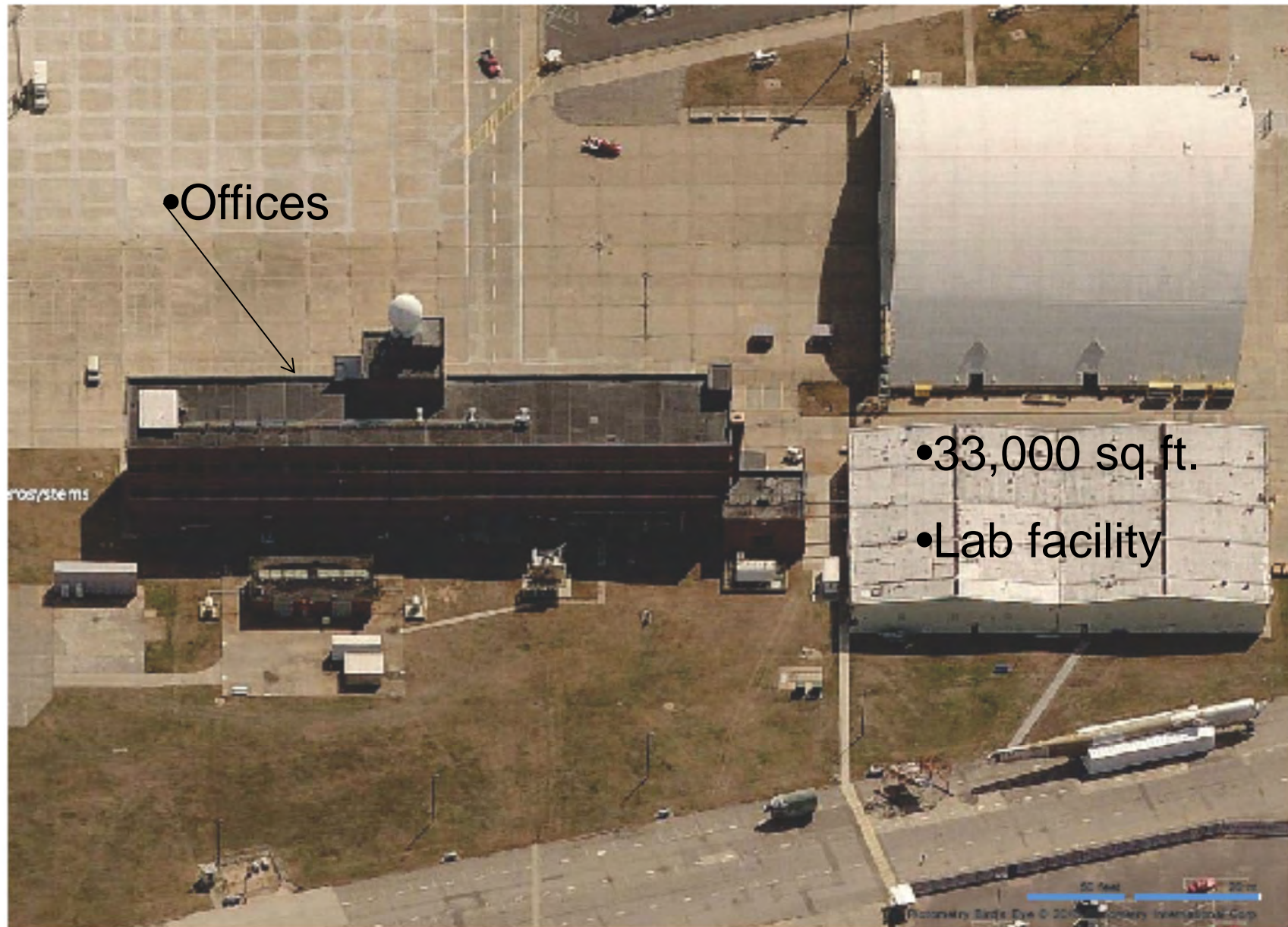
WICHITA STATE
UNIVERSITY

*NATIONAL INSTITUTE
FOR AVIATION RESEARCH*

Environmental Test Labs



www.niar.wichita.edu/environmental



•Offices

•33,000 sq ft.

•Lab facility

rosystems

50 feet 20m

Proximity Earth Eye © 2016 Proximity International Corp

Overview of Capabilities (Testing)

- NIAR Environment Test Lab is unique in the United States (and possibly the world) in the total breath of test, design and certification services provided

- Environment Testing
- Specialized Mechanical Testing
- Direct Effects of Lightning
- Radome
- EME Full Vehicle Testing
- Burn Testing
- Bird Gun
- Ballistic
- Consultant DER Services
- World Class Training

Overview of Capabilities (Personnel)

- NIAR's mission is the improvement of the aviation industry, not simply to run a test and provide you the data. We are a force in the industry in all areas.
- NIAR ETL is staffed with aviation design and certification experts in the area of environment qualification and certification, especially in the area of EME
 - We don't just know the procedures and rules, in most cases, we run the committees that write them

Overview of Capabilities (Personnel)

- RTCA
 - SC-135 (DO-160)
 - Change Coordinators for sections 1,2,3,9,10,11 and 21
 - Membership since 1990 (DO-160C, Change Notice 2/3 and on)
 - » Wrote large sections of Section 20, 21 and 22
 - » Technical lead for reverberation testing and calibration
 - » Technical lead for conductive testing and calibration
 - SC-202 Task 5 (DO-307)
 - Task Group Leader for Back Door Effects
 - Task Group Leader for Test Procedure for Front Door Effects
 - SC-228
 - Task Group Chairman for WG2
 - SC-234 (DO-XXX)
 - Committee Chairman

Overview of Capabilities (Personnel)

- SAE
- AE-4
 - Chairman of committee currently drafting EMI compliance document
 - Task Group Chairman on ARP5583 Section 7, Level A System Test Requirements
- AE-2
 - Chairman
 - Task Group Lead on ARP5415, Section 8, Level B Systems
 - Task Group Lead on Part 23 Level A System Generic Test Levels (HIRF and IEL)

Overview of Capabilities (Personnel)

- FAA EEHWG Committee
 - Member of Executive Committee, Technical Lead on HIRF and Task Group Leader on Lightning
 - Wrote both HIRF and IEL rules
 - NPRM, AC, Environment, Users' Guide
- FAA ARC for Large Transport Fuel System Lightning Protection
 - Chairman
- FAA ARC for Portable Electronic Devices
 - Technical lead for Front Door / Back Door Tolerance Requirements

Overview of Capabilities (Personnel)

- Consultant DER
 - Currently three(3) consultant DERs on staff
 - One DER with Electrical systems, HIRF, Lightning, Electrical Bonding, EWIS, EMI (Parts 23/25/27/29 and 35) ticket (25 years)
 - Two DER with HIRF, Lightning, Electrical Bonding, EWIS, EMI (Part 23/25) ticket (40 years combined)
- Chief Engineer
 - 33+ years of Aircraft design and Certification experience
- EME Engineers
 - 9 BS degreed engineers on staff (EE, Physic, ME)
 - 6 AA degreed or certified technician on staff
 - 12-15 Engineering Students

Environmental Testing

Environmental Testing (RTCA DO-160)

- Section 4 – Temperature and Altitude
 - Full DO-160G Capabilities
 - All Categories (A, B, C, D, E, & F)
- Section 5 – Temperature Variation
 - Full DO-160G Capabilities
 - All Categories (A, B, C, S1 & S2)
- Section 6 – Humidity
 - Full DO-160G Capabilities
 - All Categories (A, B, & C)

Environmental Testing (RTCA DO-160)

- Section 7 – Operational Shocks and Crash Safety Impulse and Sustained G
 - 50 lb table
- Section 8 – Vibration
 - Full DO-160G Capabilities
 - All Categories
 - NIAR can also design and build test fixtures for vibration testing
- Section 9 – Explosion Proofness
 - Full DO-160G Capabilities
 - All Categories

Environmental Testing (RTCA DO-160)

- Section 10 – Waterproofness
 - Full DO-160G Capabilities
 - All Categories
- Section 11 – Fluids Susceptibility
 - Full DO-160G Capabilities
 - All Categories
 - Fluids are dependent on UUT requirements can be ordered as needed
- Section 12 – Sand and Dust
 - Working towards full capabilities (starting February 2016)
- Section 13 – Fungus
 - (available for service with partner Lab)
- Section 14 – Salt Fog
 - Full DO-160G Capabilities
 - All Categories

Environmental Testing (RTCA DO-160)

- **Section 24 – Icing**
 - Full DO-160G Capabilities
 - All Categories: (A , B & C)
- **Section 26 – Fire, Flammability**
 - Full DO-160G Capability
 - All Categories: (A, B & C)

Specialized Equipment (Environmental)

- **Environmental Chambers**

- Russels 64 cu.ft Temp Chamber (CAT B icing; THA)
- Tenny 27 cu.ft Temp/Humidity/Alt
- Tenny 16 cu.ft Temp/Humidity
- Thermotron 37 cu.ft Temp/Humidity
- (2) Cincinnati Sub Zero 8 cu.ft Temp/Humidity
- (2) Auto Technology 15 cu.ft Salt Fog,
- Singleton 30 cu-ft Salt Fog
- Grieve 36" x 48" x 36" (+1200F) Oven
- (2) Russels 8 cu.ft Temp Chambers
- Large 12'W x 10'H x 48'L (-40F - +150F) Temp Chamber
- QualMark HALT Chamber (48" table – 80 cf)

- **High Altitude and Explosive Decompression Chamber**

- 3' x 3' x 3.5'h



Specialized Equipment (Environmental)

- **Shock and Vibration**

- Data Physics 12,000 lbf 3-axis - 24"x24" vibration table
- UD 20,000 lbf 3 axis - 48"x 60" slip table
- Vibration to DO-160G, Full Capability

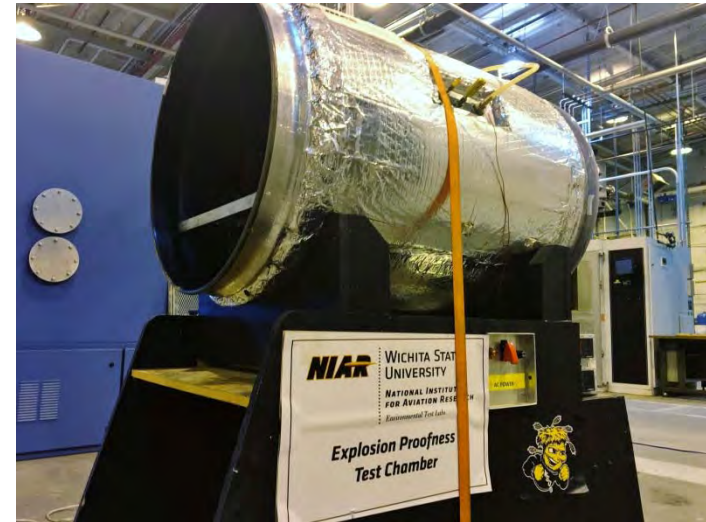
- **Sustained G**

- Rate Table 50 lbs
- Max Rate: 1000 deg/sec
- Mac Acceleration: 200 deg / sec
- Accelerometer Calibrations



Specialized Equipment (Environmental)

- Explosion Proofness
- Salt Spray
 - 3 chambers
- HALT Chamber



Electrical / Electromagnetic Testing

Electric Testing (RTCA DO-160)

- **Section 15 – Magnetic Effects**
 - Full Capability DO-160G Capability
 - both with a precision compass and calibrated milli-gauss meter
 - All Categories
- **Section 16 – Power Input**
- **Power Input**
 - Power Input, Voltage Spike, Audio Frequency Susceptibility, Induced Signal Susceptibility
 - All Categories for DC, Majority for AC

Electric Testing (RTCA DO-160)

- **Section 17 – Voltage Spike**

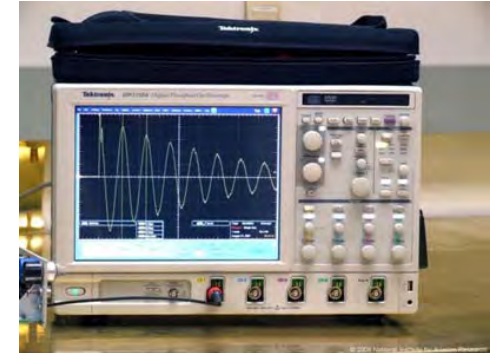
- Full Capability DO-160G
- All Categories

- **Section 18 – Audio Frequency Susceptibility**

- Full Capability to DO-160G
- All Categories
 - DC Testing limited by EUT DC current output of no more than 100A (150A if combined isolation transformers are used.) Limits in AC testing TBD.

- **Section 19 – Induced Signal Susceptibility**

- Full Capability to DO-160G
- All Categories



Electromagnetic Testing (RTCA DO-160)

- **Section 20 – RF Susceptibility**

- **Conducted Susceptibility**

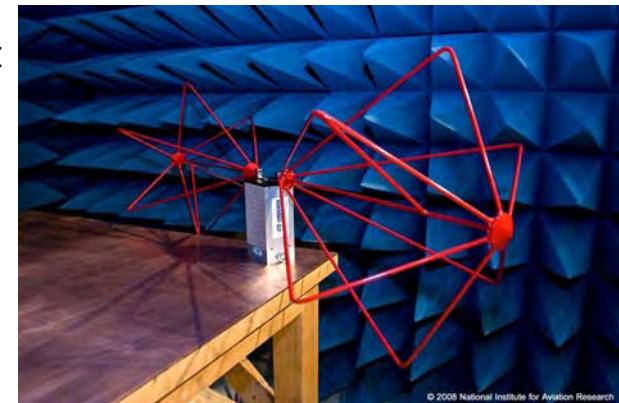
- Full Capability to DO-160G,
 - All Categories:

- **Radiated Susceptibility**

- Full Capability to DO-160G
 - All Categories except Category L in large reverberation chamber (limited to small test setups for category G)
 - All CW/SW categories in the semi-anechoic chamber (pulse testing in anechoic TBD)
 - Categories: B, D, F, G, L, R, S, T, W, & Y

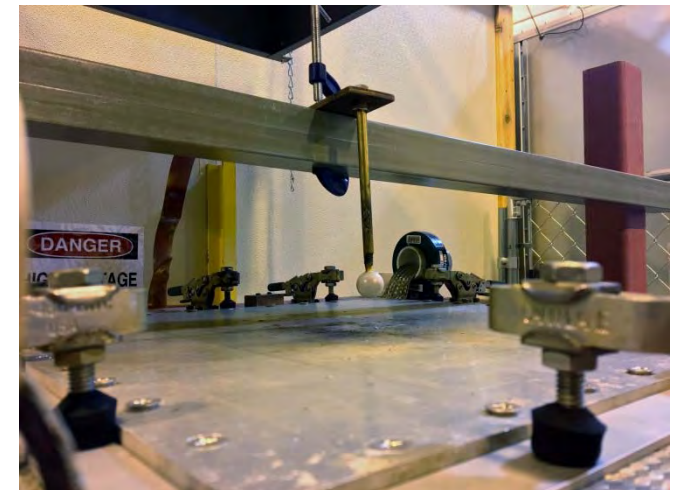
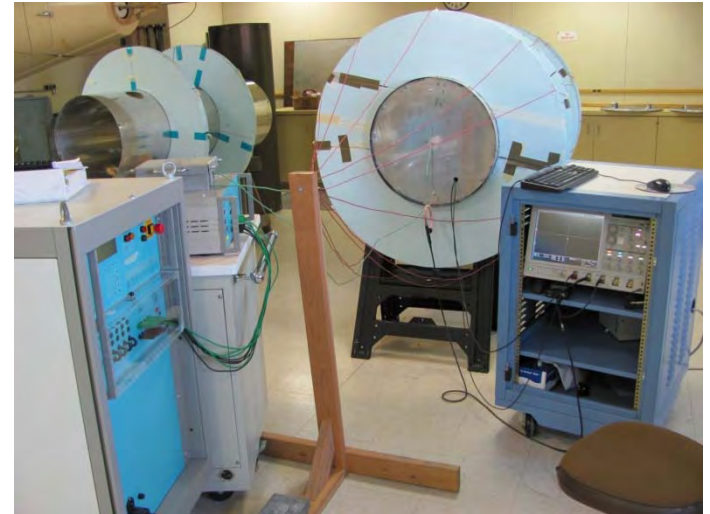
- **Section 21 – RF Emissions (B86/WSU)**

- Full Capability to DO-160G
 - All Categories
 - Both Reverberation and semi-anechoic



Electromagnetic Testing (RTCA DO-160)

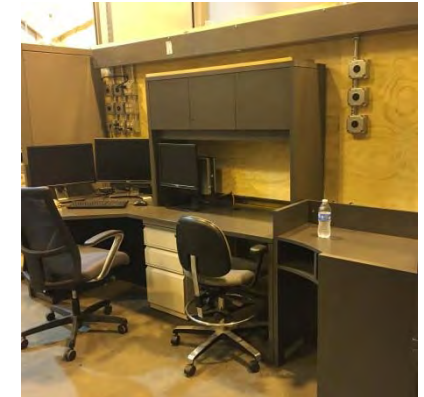
- Section 22 – IEL Testing
 - Component Indirect Effects
 - All Categories, all waveforms and test levels
- Section 23 – DEL Testing
 - Component Direct Effects
 - High Current Testing
 - Category 1A: 200KA
 - Category 2A: 100KA
 - High Voltage:
 - Category 2A (Swept Stroke)
 - Ignitable mixture and Photographic Test Method
- Section 25 – ESD
 - Full DO-160G Capability
 - All Categories (15,000V, 330 Ohms, 150pF)



Specialized Equipment (Electromagnetic)

- **RF Chambers**

- 17' x 20' x 12' Semi-Anechoic Chamber
- 20' x 17' x 15' Reverb (mode-stir) Chamber
- 25' x 20' x 15' Reverb (mode-stir) Chamber
- 6' x 10' x 8' Reverb (mode-stir) Chamber
 - For High field strength testing (Pulse CAT L)



Specialized Equipment (Electromagnetic)

- RF Amplifiers
 - CW
 - 10Khz – 400 Mhz : 1KW
 - 400 Mhz - 1 Ghz : 4KW
 - 1 Ghz – 18 Ghz : 500W
 - Pulse
 - 100Mhz – 1Ghz : 4Kw
 - 1Ghz – 18 Ghz : 2KW
- Lightning Generators
 - EMC-Partners Lightning Generator
 - Waveforms 1-5A
 - Test levels 1-5 for both pin injection and cable bundle

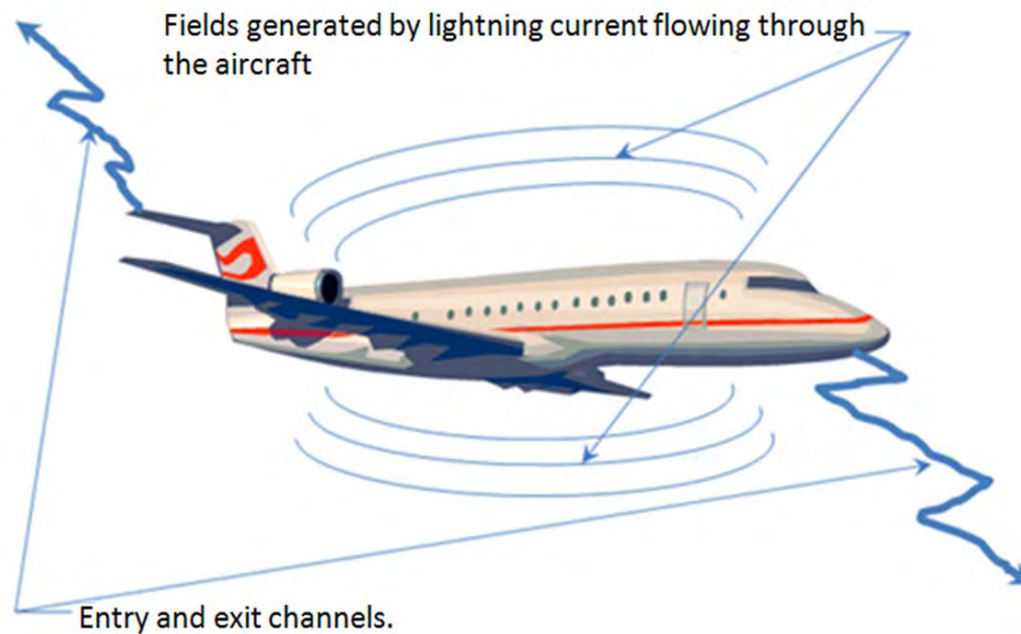
Additional Testing Capabilities

- **Ballistic Testing**
 - Pressure Bottles, accumulators, tanks...
 - Ballistic from 30 cal to 50 cal
 - 35 ft ceiling for drop testing
 - Bonfire testing of pressure vessels
- **Bird Gun**
 - Up to 600kts
 - 4-6 lb birds
- **Radome Transmissivity Testing**
 - Transmissivity Testing
 - DO-213 Standards
- **Firewall/Cowl/Pylon Burn Testing FAA 23/25 Fireproof 2000F Flame**
 - FAA Interior Burn per FAR 23.853/25.853
 - Material burn
 - Fire Proof and Fire Resistance Testing (2000F flame)

Birdstrike Test Range – Under Construction – Scheduled March Completion



Specialized Full Aircraft Test Capabilities









Aircraft And System Level Support

- **Full Vehicle HIRF Transient Test/Analysis**
 - **ARP 5583**
 - **Low Level Swept Current (LLSC)**
 - This technique is used from 0.5 to 400 MHz to measure the current induced on an aircraft cable bundle
 - **Low Level Swept Field (LLSF)**
 - This technique is employed from typically 100 MHz to 18 GHz to measure the shielding/attenuation offered by the aircraft.
- **FCC Site License to perform testing (already obtained)**
 - **Ability to perform testing inside/outside an aircraft hanger**
 - Large “747” size test Hangar available for aircraft testing – Access to McConnell AFB Runway

Aircraft And System Level Support

- **Full Vehicle Lightning Transient Test/Analysis**
 - SAE ARP-5416 Section and ARP-5415
- The purpose of Lightning Transient Analysis, or LTA testing is to determine the electrical environment internal to the airframe in the event of a lightning strike.
- Lightning Transient Analysis (LTA) is the application of a simulated lightning attachment to the aircraft at a scaled level.. This data can then be extrapolated to represent magnitudes reached during an actual lightning strike to an aircraft and its components.

Aircraft And System Level Support

- Full Vehicle EMI Aircraft Testing
 - Per new SAE Document
 - EMI matrix development
 - Front end receiver measurement
- PED Tolerance Aircraft Testing
 - Per RTCA DO-307
- Precipitation Static Testing – 50kV and 120kV capability
- Hot Fuel - Wet/Saturated fuel
 - Fuel heated to lower flashpoint limit of fuel (Max 200°F)

Consultant Services

- FAA DER
 - 3 Consultant DERs on staff (Part 23, 25,27,29 and 35)
 - Assistance in test plans, design, certification, test witnessing, etc.
 - Electrical
 - EME (HIRF, Lightning, EMI, Electrical bonding, PEDs)
- Design and Certification
 - Assist with design review, aircraft integration, system design and integration and aircraft materials
 - Chief Engineer, 33+ years of Aircraft design and Certification experience

Training – DO-160

This training provides an in-depth training of all sections of DO-160, including an understanding of selection and application of categories, test procedures, application of certification rules, etc.

- NIAR has been selected by RTCA to develop and teach courses relating to DO-160.
- Four classes/year taught at RTCA in Washington, DC
- Conduct Training at selected sites (Seattle, Wichita, etc..)
- Offer courses at clients facility tailored to their individual needs and processes.
 - Classes are broken into two modules: Mechanical and electrical - 2 days each - Can take one or both



TRAINING – HIRF WORKSHOP

- This comprehensive workshop will provide an awareness of all aspects HIRF and Lightning systems and aircraft testing in regard to compliance to the existing rules.

- **Topics include:**

- Background and Why HIRF is important?
 - The FAA/European requirements to demonstrate compliance – FAA/EASA Harmonized HIRF and Lightning requirements
 - Equipment Qualification
 - Aircraft certification and testing
 - Pitfalls and problems
 - Design issues
 - Discussion of 25.981 Rule Revision Status
 - Discussion on PED tolerance Policy
- Class taught each Fall at NIAR and on-site by request

Environmental /EMI Test Technician Training

- This training is designed to familiarize the technician with the test set-up and the appropriate equipment as designated by the standards outlined in DO-160. Variations on standard set-ups to accommodate customer needs can be made upon request. Training on equipment and set-ups as designated by customer test standards can be given
- We have trained several groups for Industry Labs
- Class is taught at NIAR

Research

- Carbon Composite Shielded Coaxial Cable Evaluation
- Composite Fuselage Indirect Effects Lightning Testing
- Carbon Composite Shielding Effectiveness Evaluation
- Fuel Tank Fastener Data Base
- Development of “composite structure” fuel system “lightning” ignition source
- Development of lightning protection Data Base

Contact Information

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