



# THE NEW LARGE AIRCRAFT TEST FACILITY AT TYNDALL AFB



JOHN R. HAWK, PE  
Senior Engineering Advisor  
Materials and Manufacturing Directorate  
Air Force Research Laboratory

MICHAEL J. McDONALD, PE  
Principal Engineer  
Applied Research Associates



# Purpose



- **Purpose of a New Large Airframe fire mockup was to:**
  - Characterize fire extinguishment on larger aircraft like the A-380.
  - Determine the effects of obstacles such as large engines and escape slides to fire fighting.
  - Evaluate and compare effectiveness of existing and new fire trucks in combating fires on these larger aircraft.
  - Assess performance of elevated waterways and penetrators at higher elevations.
  - Determine effectiveness of emergency access to aircraft interior.





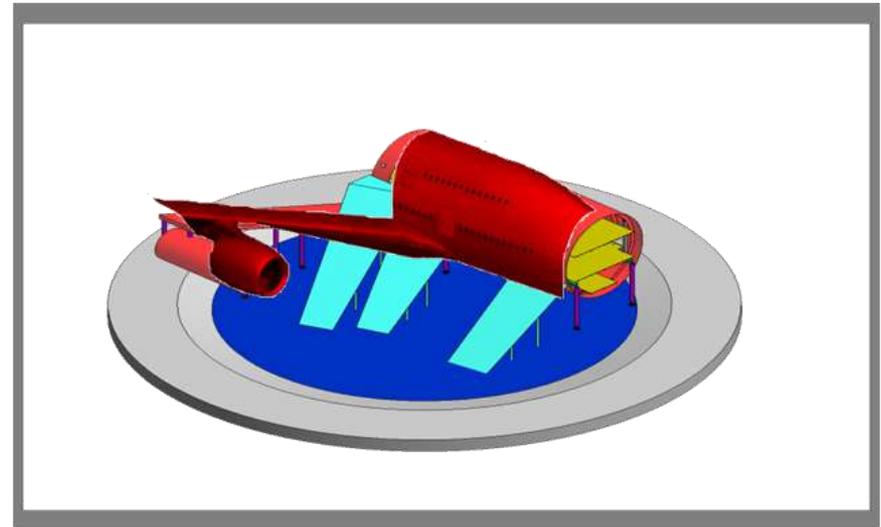
# Design Criteria



- Develop a Full Scale Mockup of a portion of the A380 Aircraft
- Use the existing 100 ft diameter fire pit
- Include as much of the aircraft as possible
- Include portion of a wing, escape slides and one engine nacelle to evaluate barriers to extinguishment



- Include all three levels: cargo, deck, and doors
- Elevation set to maximum (empty aircraft) relative to surrounding ground
- Include sacrificial panels of aircraft skin for penetrator exercises





# Construction



Layout

## Installation of Support Columns





# Construction



Installation of Beams





# Construction



Skin and Gussets





# Construction



Fuselage Top and Decks

Wing





# Construction



Slides





# Finished Product





# Design Features



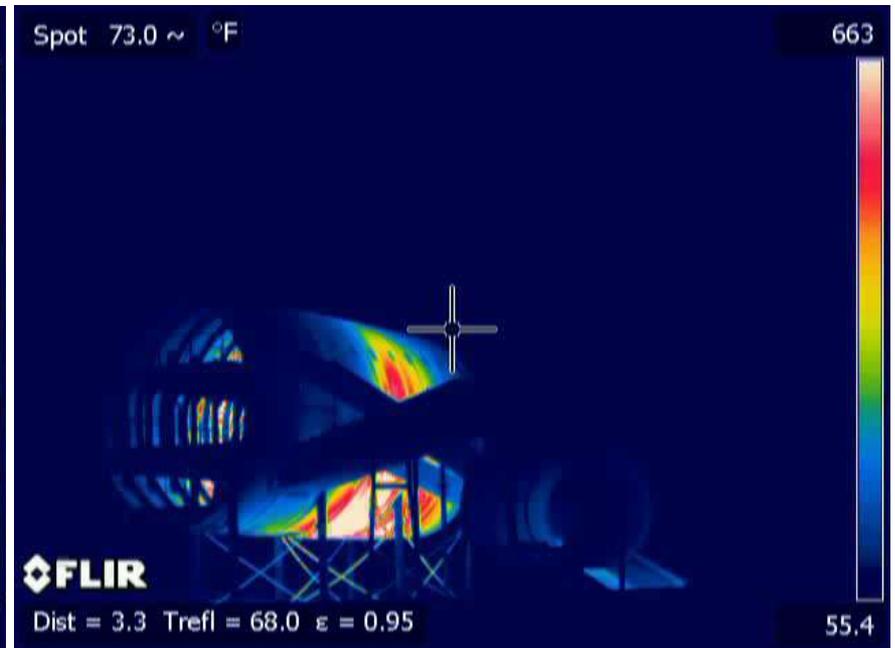
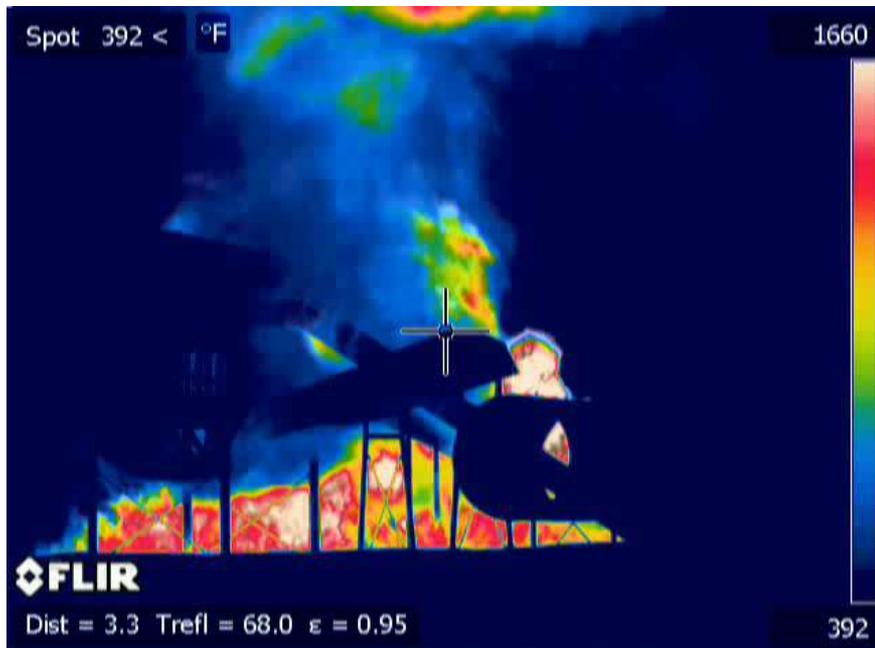
- **All support structures except legs are protected from flame**
- **Legs are filled with water to absorb heat during fires. Sacrificial zinc anodes and corrosion inhibitor in the water minimize corrosion.**
- **Slides can be assembled on the left side**
- **Designed to withstand Category 2 hurricane (110 MPH wind)**
- **Interior fires possible**
- **Penetrator panels at each deck level**
- **Six passenger doors and one cargo bay door**
- **Goodyear slides can be attached at door locations**
- **53 thermocouple locations**
- **Important Dimensions:**
  - Fuselage length: 60 ft
  - Fuselage width: 23.3 ft
  - Fuselage height: 27.5 ft
  - Belly height above pit: 10.3ft
  - Weight: 230,000 lbs



# Possible Future Uses



- Interior intervention access vehicle demonstrations
- Emergency slide improvements
- Egress exercises
- Thermal model verification
- Cargo and passenger compartment fires





# Summary



**The NLA Mockup provides a unique capability  
for equipment and procedural evaluations**



# Previous FAA/AFRL Projects



## Agent Development And Testing



## Low Reach Bumper Turret Systems



## Hydrochem



## Elevated Waterways and Penetrators



## NFPA 414 Acceptance Criteria Performance



## Active Suspension Systems



## VAPERS/DEVS





# The AFRL Fire Research Team





# What We Do

- **Our Team**

- Electrical, Mechanical, Civil, and Chemical Engineers, Fire Protection Technicians, Chemists, Occupational Health, Safety, and Toxicology Specialists.

- **Research Topics**

- Large Scale Hydrocarbon Fires
- Ultra High Pressure Water and AFFF Fire Fighting Studies
- Munitions Fire Suppression
- Protective Clothing
- Characterization of New Agents and Equipment
- Halon 1211 and 1301 Replacement
- Composite, Oxidizer Enriched and Metal Fires
- MIL SPEC Screening and Aquatic Toxicity
- Modeling and Simulation





# Customers, Associations, and Collaborations



**NC STATE UNIVERSITY**



Marine Corps  
MARCORSYSCOM

FAA



NASA  
Johnson MSFC

ESTCP



HQDA/ACSIM



USACE/CETAC



AMSJM-SF

NRL

Navy & Marine Corps



China Lake

NAVSEA-Crane



Elkhart Brass  
Fire Fighting Equipment





# Success Stories



- **Agent Development**

- Ultra High Pressure Foam/Water
- Developed and Validated Dual Agent Nozzles (Foam/Dry Chem)
- Evaluated Alternatives for Ozone Depleting Agents

- **Fire Fighting Equipment**

- UHP Pumps, Turrets, Nozzles, and Agent Proportioning Systems
- Improved Vehicle Suspension Sys.
- Improved Elevated Waterway Systems Including Penetrators
- Created All-Weather Operating System (DEVS)
- Improved Air Deployable Equipment
- Enhanced Individual Fire Protection and Safety Equipment



# Success Stories

- **Weapons System Fire Protection**

- Improved Composite Aircraft Fire Crash Recovery Knowledge
- Synthetic Fuel Fire Evaluations and Experiments
- Developed Fire Protection System for ABL

- **Facilities Fire Protection**

- Simplified Fire Model Predictive Tools
- Improved Deployable Tent Materials
- Improved Hangar Fire Detection
- Characterized combustion of JP-8 Fuels to Replace JP-4
- Developed Ultra High Speed Munitions Deluge Systems





# Facilities & Capabilities

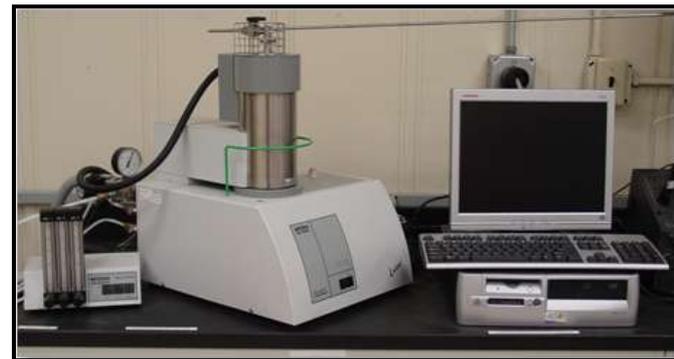
## Small Scale Research Laboratory

### • Equipment

- Standard Laboratory and Walk-in Hoods for Controlled Fire Burns
- Fourier Transform Infrared (FTIR) Spectrometer: Standard and Open Path FTIR
- Gas Chromatograph/Mass Spectrometer
- Residual Gas Mass Spectrometer
- Plasma Arc Spectroscopy Equipment
- Cone Calorimeter, High Heat Flux Equipment
- Tensiometer(s): Drop Volume (Dynamic) and Static
- Langmuir Blodgett Trough
- Thermo Gravimetric Analyzer (TGA)
- Materials Fire Characterization Equipment

### • Types of Tests

- Fire Agent Testing Program
- Contaminant Evaluations
- Composite and Polymer Combustion Dynamics





# Facilities & Capabilities



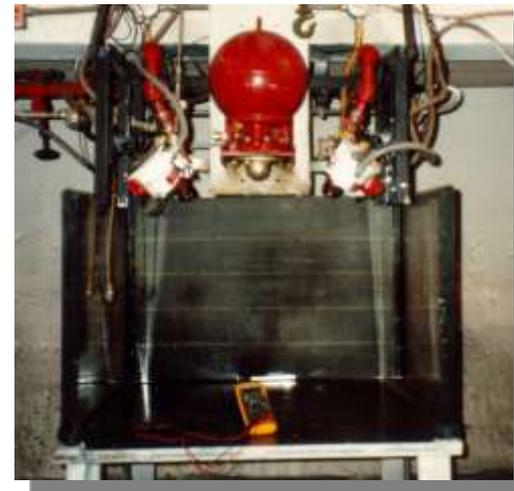
## Energetic Materials Research Facility

- **Capabilities**

- Designed for Small Scale Blast Evaluations
- Visible and IR Cameras
- High Speed Digital Photography
- Environmentally Controlled Effluents

- **Types of Tests**

- Pyrotechnic, Propellant, and HE Combustion Characterization
- Munitions Fire Spectral Analysis
- Response of High Speed Flame Detection/Suppression Systems





# Facilities & Capabilities



## Medium Scale Fire Research Facility

- **Capabilities**

- Indoor Medium-Scale Fires
- Environmentally Controlled Ventilation and Gas Scrubber System
- Flexible Fire Evaluation Configuration

- **Types of Tests**

- Composite Aircraft Burns for HAMMER IPT (Hazardous Aircraft Materials Management Emergency Response)
- MIL SPEC Agent Extinguishment and Burn Back
- Agent Testing
- UL class A and B Extinguisher Tests





# Facilities & Capabilities



## Full Scale Fire Research Facility

### • Capabilities

- Two 100 ft Diameter Fire Pits with Aircraft Mockups
- Meets All Environmental Directives
- JP-8 and Propane Fires
- Pool and 3-D Fires
- Vehicle Garage and Equipment Workshop
- Conference Room

### • Typical Experiments

- Realistic Carbon Based Fuel Fire Scenarios
- Fire Fighting Agents, e.g. AFFF, Halon, PKP
- Fire Truck Equipment on Large Fires
- Hand Line Equipment on Medium to Large Fires
- Combined Agent Fire Fighting System/Air Deployable/Droppable Equipment

