

Full-scale Demonstration Testing with a Solid Aerosol Fire Extinguishing Agent, Initial Discussion



Federal Aviation
Administration

Presented to: International Aircraft Systems Fire
Protection Working Group

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Presentation Overview

Major Discussion Points

- **Purposes**
- **Test Circumstances**
- **Various Views of the Test Article**

References within this presentation to businesses, their services and/or products does not constitute endorsement.



Full-scale Demonstration Testing, Solid Aerosol

Purposes

- Additional testing is needed to complete an assessment of a solid aerosol fire extinguishing agent per MPSe rev04¹
 - MPSe rev04 composed of 2 parts

MPSe Rev04 part & applicability	Character of test environment	Number of test conditions	Outcome
"A" required for all	generic	4	Concentration design criteria (% for a residence time)
"B" as needed	"high" fidelity	determined case-by-case	Plausibility of design criteria in "end-use" environment

- “Part B” contingency is the decision of the authority having jurisdiction; typically based on the candidate agent’s similarity to the “state-of-the-art”

¹ MPSe revision 04, http://www.fire.tc.faa.gov/pdf/systems/MPSeRev04_MPSeRev04doc-02submtd.pdf



Full-scale Demonstration Testing, Solid Aerosol

Purposes

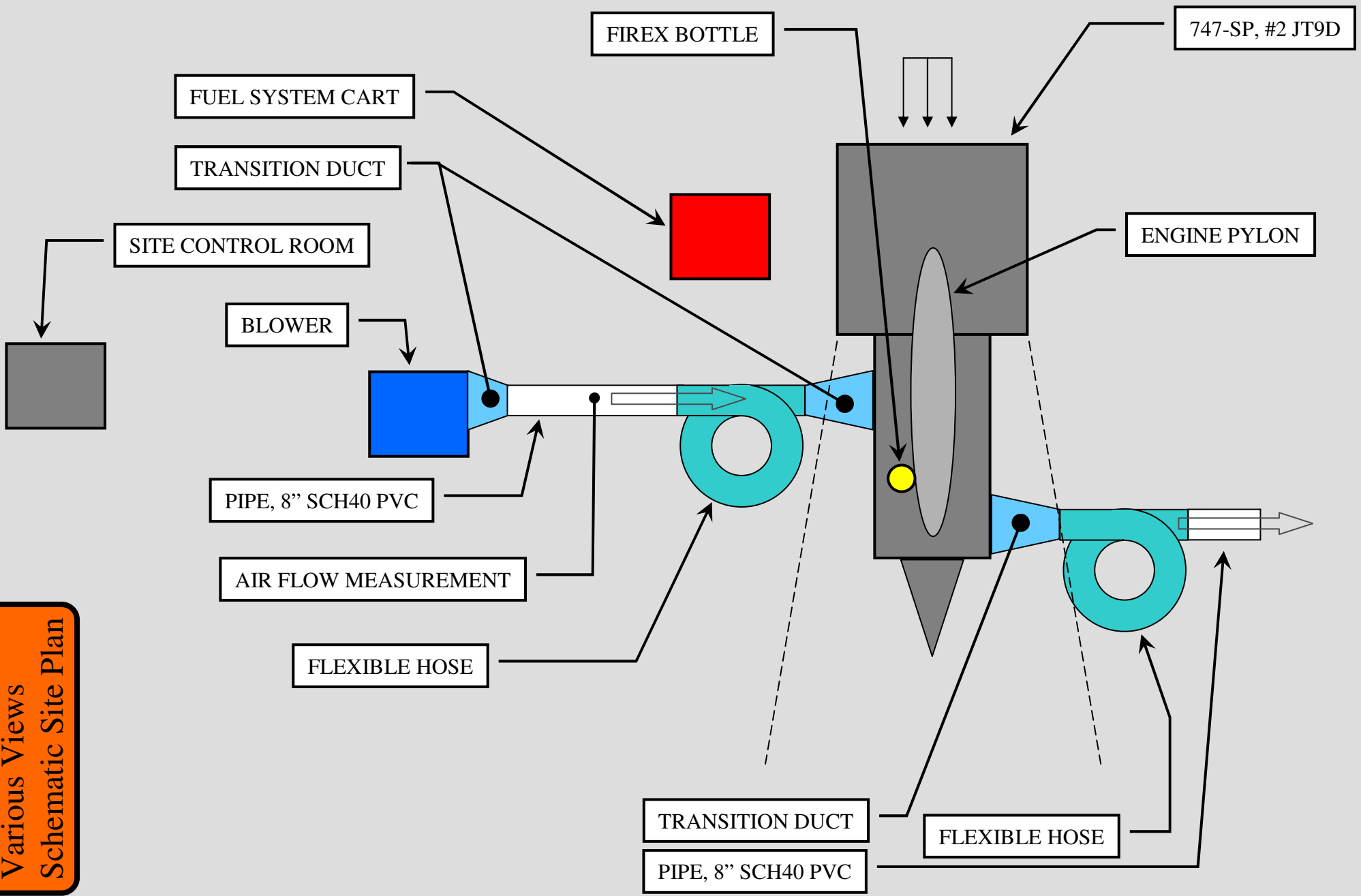
- MPSe rev04 “part B” testing will proof-test the firex agent’s design criteria identified from the generic “part A” testing
 - Invoked by the FAA due to dissimilarities with the “state-of-the-art”
 - evaluated agent is stored/delivered in solid phase; halon 1301 is liquid/gaseous
 - solid aerosol concentration analyzer is largely dissimilar to Statham-derivatives
 - Will employ a “demonstration” test methodology
 - challenge is based on reasonable fire threats in a “high” fidelity environment
 - agent will be delivered to test environment satisfying “part A” design criteria
 - “part A” design criteria are considered acceptable with “part B” fire extinguishment

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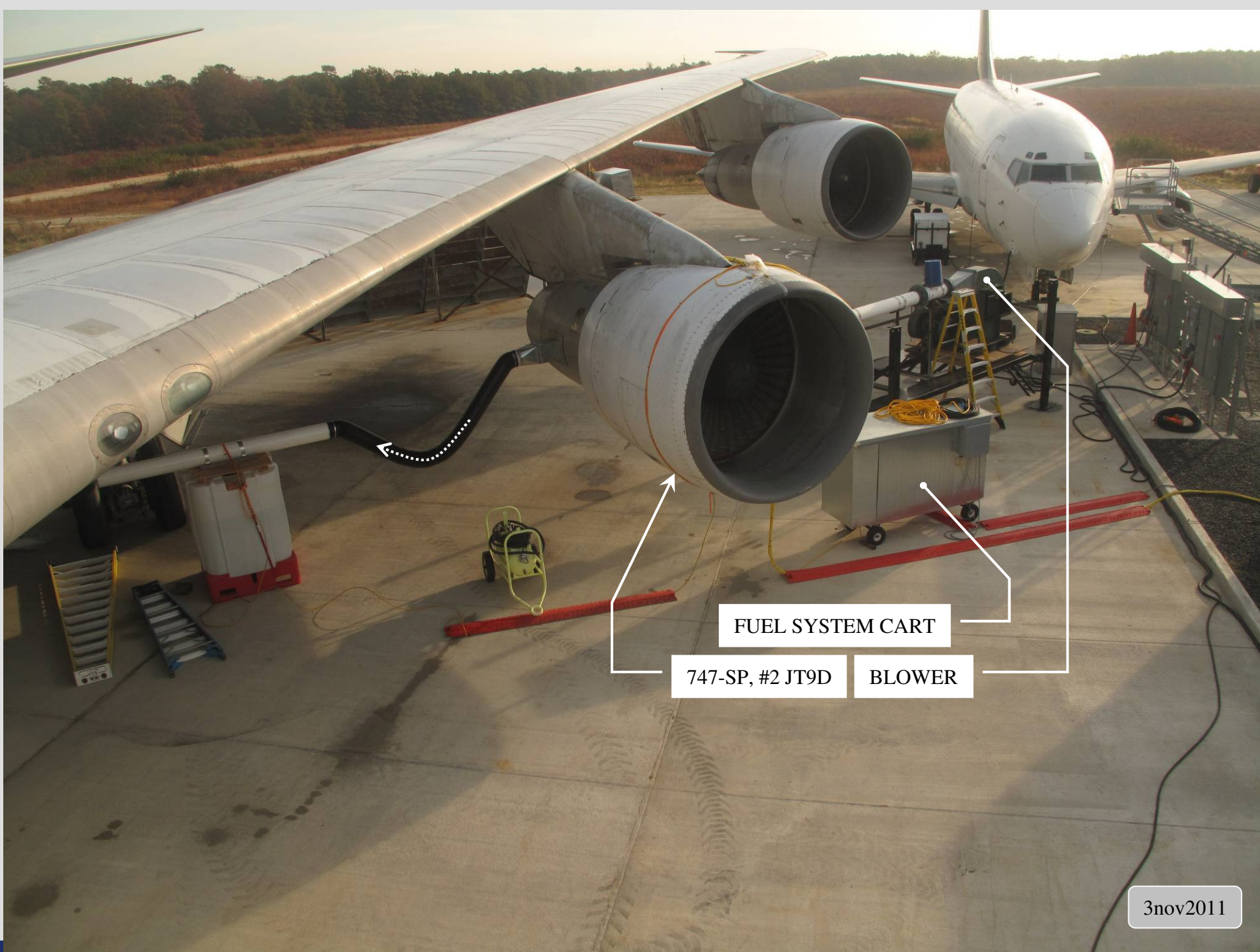
Test Circumstances

- Defining “high” fidelity environment
 - Must present geometry, flow, & thermal challenges of a real engine
 - Team elected to use a JT9D engine on the FAATC 747-SP
- JT9D nacelle forcibly ventilated from ambient atmosphere
 - Mass flow ≈ 0.5 kg/s (1 lbm/s) @ $T \approx -6 - 10$ °C ($\sim 20 - 50$ °F)
 - Engine run will precede each test to “heat” the nacelle
- Fire threats are spray- & pool-based, fueled with JP-8
- Industry is providing firex system & concentration analyzer
- Data collected will include visible behaviors and numerical temperature, pressure, & concentration measurements

Various Views
Schematic Site Plan



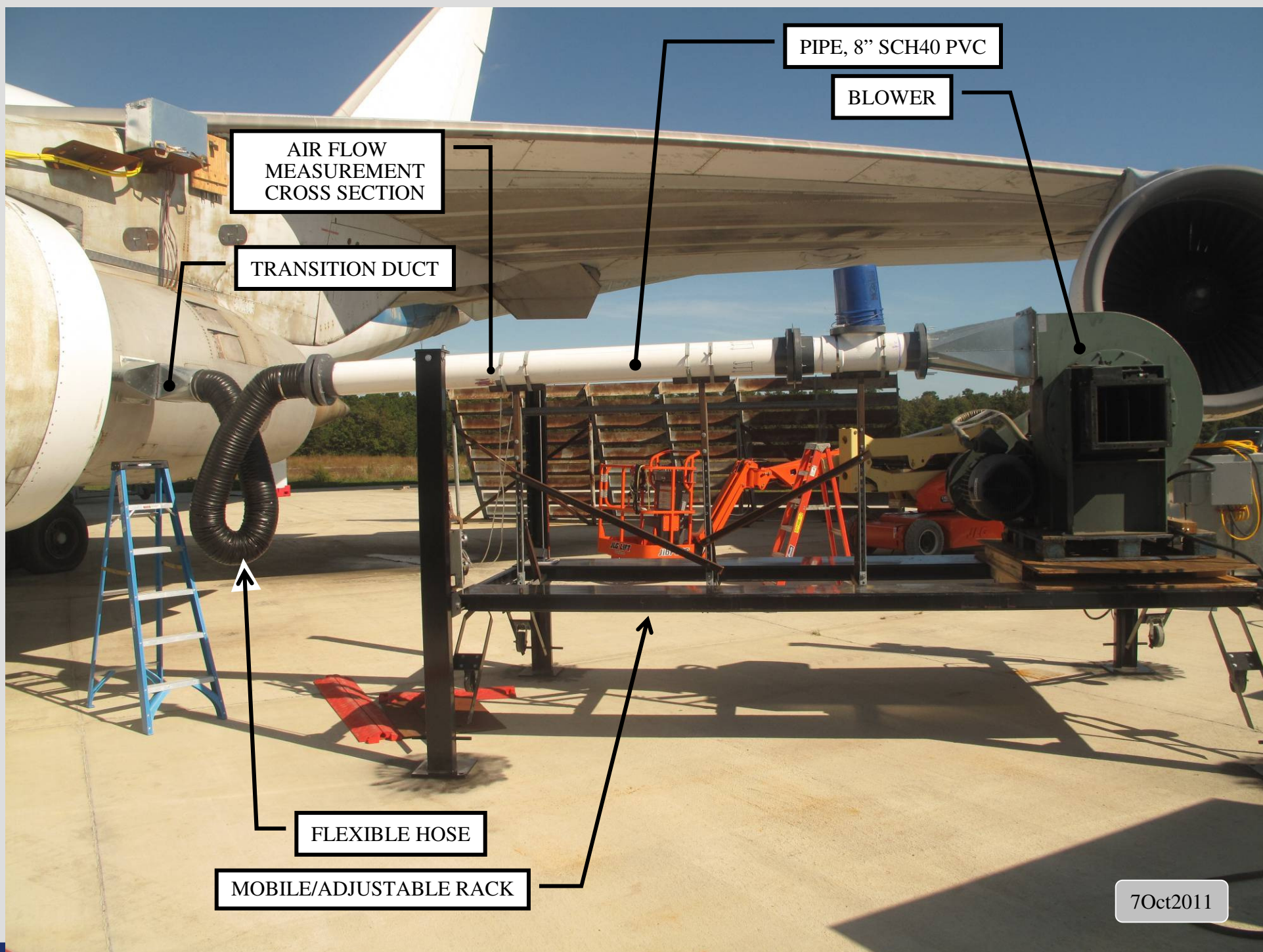
Various Views
Site Image



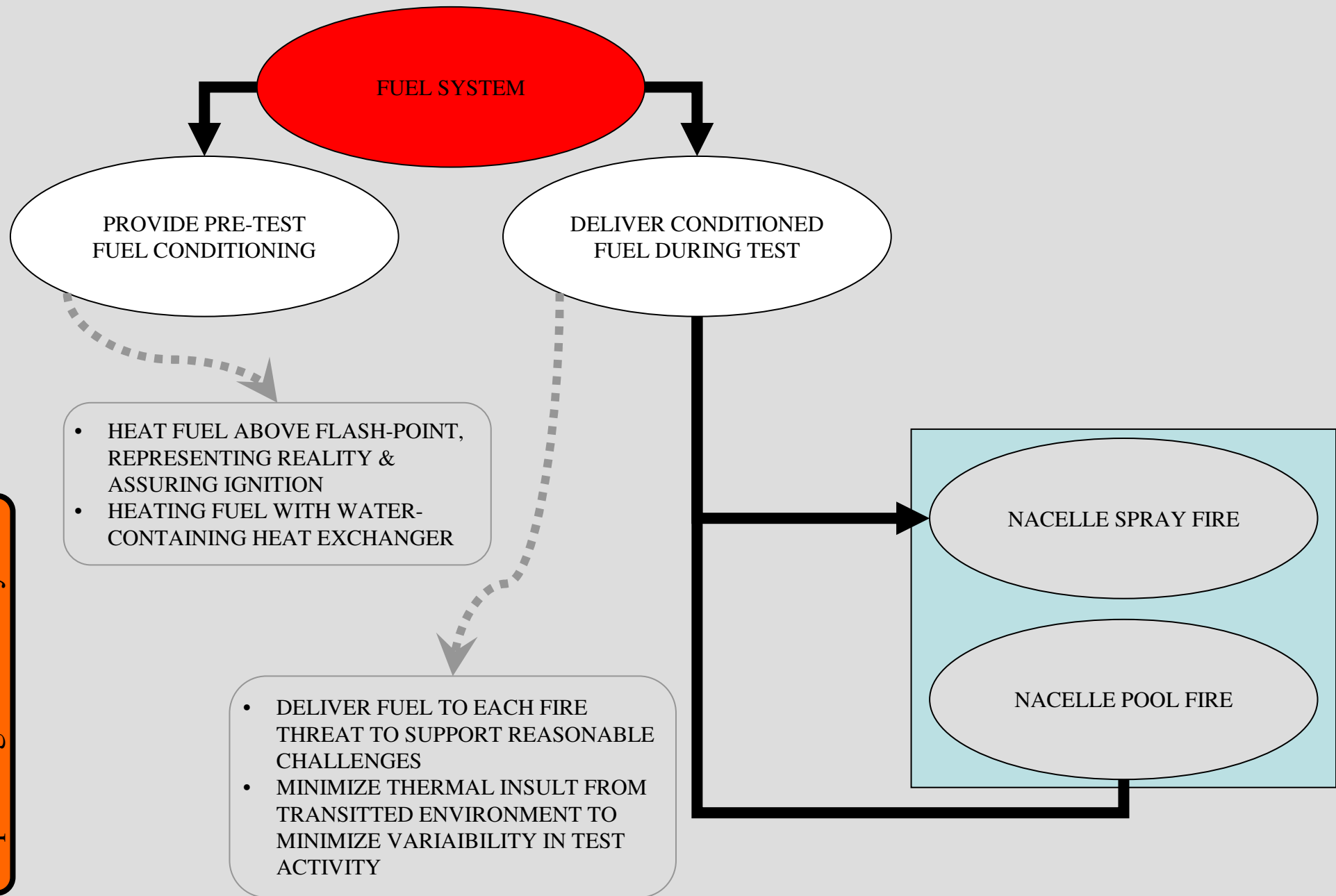
FUEL SYSTEM CART
747-SP, #2 JT9D BLOWER

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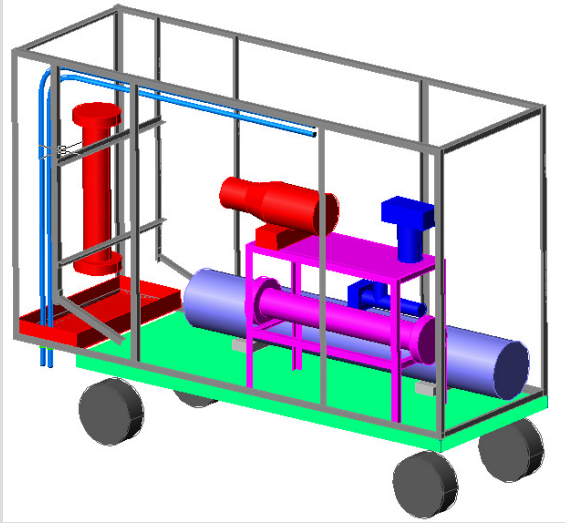
Various Views
Nacelle Ventilation Supply



Various Views
Explaining the Fuel System



Various Views
Showing the Fuel Cart



- RED COMPONENTS RELATED TO FUEL STORAGE, FLOW, & SPILL CONTAINMENT.
- DARKER BLUE COMPONENTS RELATED TO WATER JACKET (STORAGE, HEATING, & FLOW).
- PINK COMPONENT RELATED TO HEAT EXCHANGER COMINGLING WATER & FUEL.



Various Views
Pylon-mountings & Cowl Penetrations



REGION TO PASS EXTERNAL
UMBILICALS INTERNALLY

TELEMETRY CONNECTIONS

MOUNTING PLATE, FIREX BOTTLE



End

- **Acronyms, definitions, short-hand notations**

FAATC = FAA W.J. Hughes Technical Center

MPSe = Minimum Performance Standard for Halon Replacement in Civil Aircraft Engine Nacelle & APU Compartments

PVC = plastic material, polyvinyl chloride

rev = revision

sch = schedule, reference to pipe size called out for plumbing purposes, traceable to ANSI B36.10

