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

Federal Aviation Administration

Presented to: International Aircraft Systems Fire Protection Working Group

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Presentation Overview
Major Discussion Points

- **Purpose**
- **Test Conditions**
- **Project Status**
- **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

Purpose

- FAA invoked "Part B" of MPSe rev04
  - generally,
    - "part B" is pertinent testing to demonstrate the proposed certification criteria from MPSe "part A" are plausible on an airframe
    - invoked due to differences between (a) the halon-replacement candidate, its use, and/or its measurement, and (b) the state-of-the-art[1]
  - the subject candidate differs from the state-of-the-art
    - is a solid aerosol fire extinguishing agent
    - utilizes a different quantifying concept & analyzer

1. State-of-the-art is defined by the use of halon 1301, stored in a bottle having a pressurized/gaseous ullage, is delivered/injected to the nacelle fire zone by tube, and its distribution within the volume is measured with a Statham-derivative gas analyzer.

Full-scale Demonstration Testing, Solid Aerosol

Test Conditions

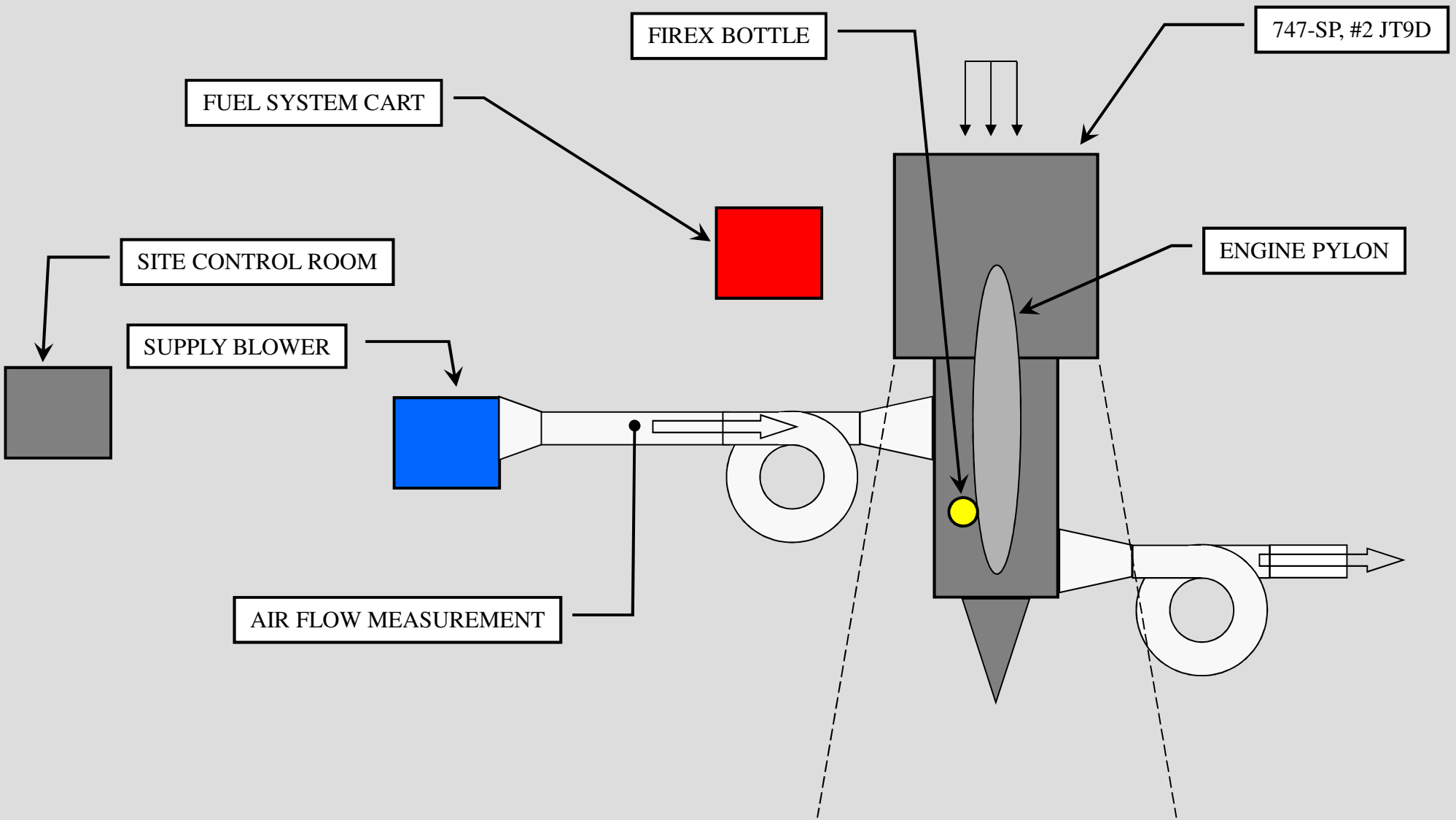
- Using a JT-9D engine on the FAA-owned 747-SP
- JT-9D nacelle forcibly ventilated externally from atmosphere
  - air mass flow ≈ 0.5 kg/s (1 lbm/s)
  - engine run will precede each test to “heat” the nacelle
- Fire threats are spray- & pool-based, fueled with JP-8
- Industry is providing firex system & concentration analyzer
  - sodium bicarbonate-based solid aerosol
  - optical system used to measure agent distribution

Full-scale Demonstration Testing, Solid Aerosol

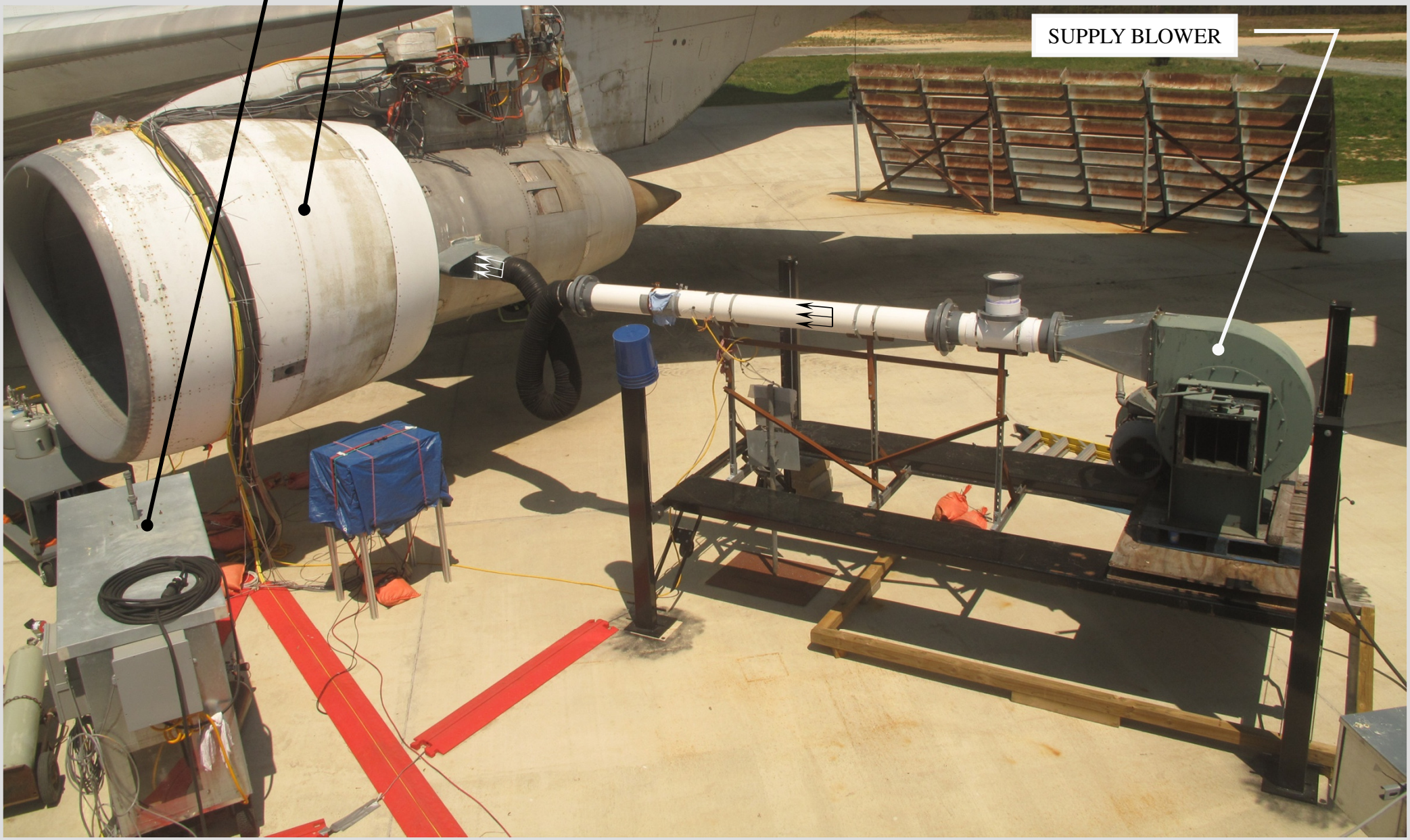
Project Status

- Currently nearing the end of the “build-up” phase
  - industry decided to use a JT-9D located at the FAATC, May 2011
  - complete external engine nacelle ventilation, Oct 2011
  - finalize aircraft engine use, Nov 2011
  - complete spray & pool fire threats, Feb 2012
  - firex agent distribution, completion imminent; begun Feb 2012
- Anticipating :
  - completion, Jun 2012
  - draft report into publication process, Sep 2012

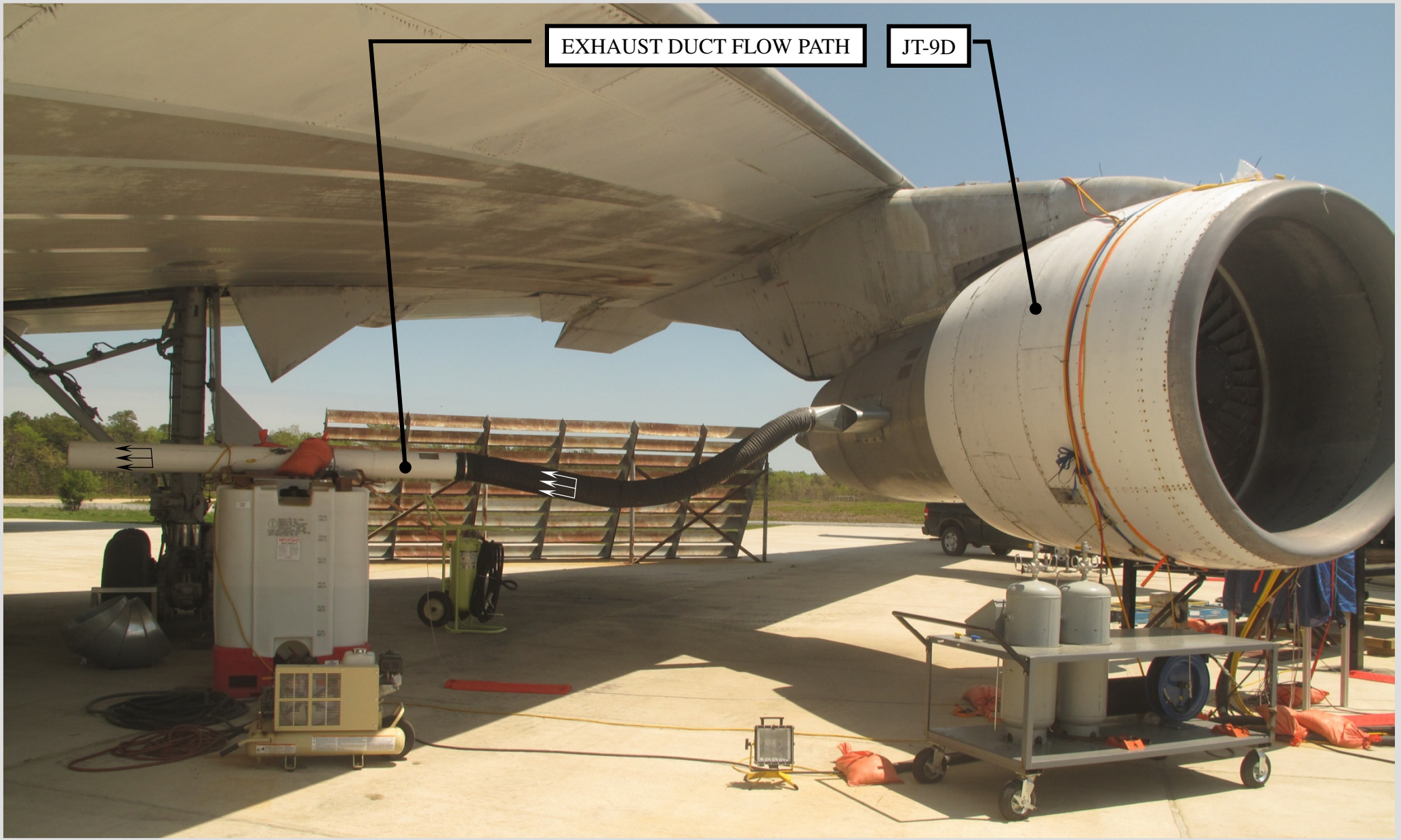
Various Views, Schematic Site Plan



Various Views, Nacelle Ventilation, Supply

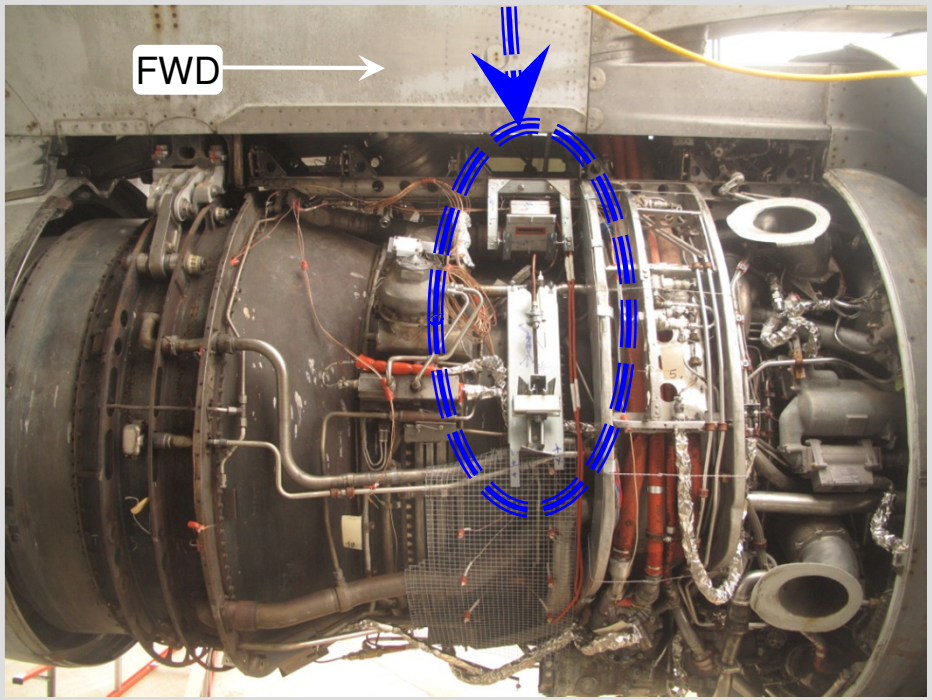


Various Views, Nacelle Ventilation, Exhaust

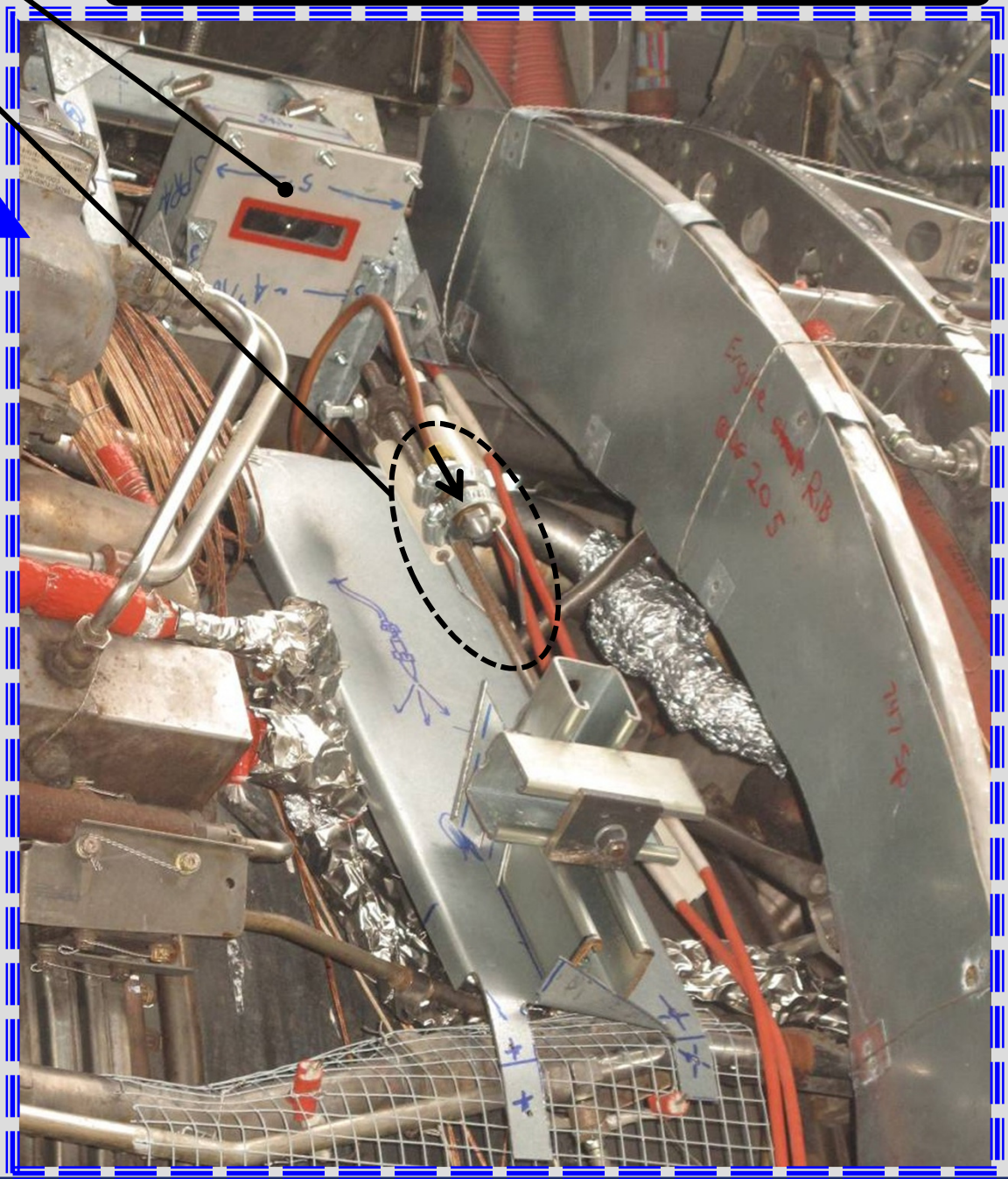


CAMERA, SPRAY FIRE

FUEL SPRAY NOZZLE &
ELECTRICAL IGNITION ARC GAP



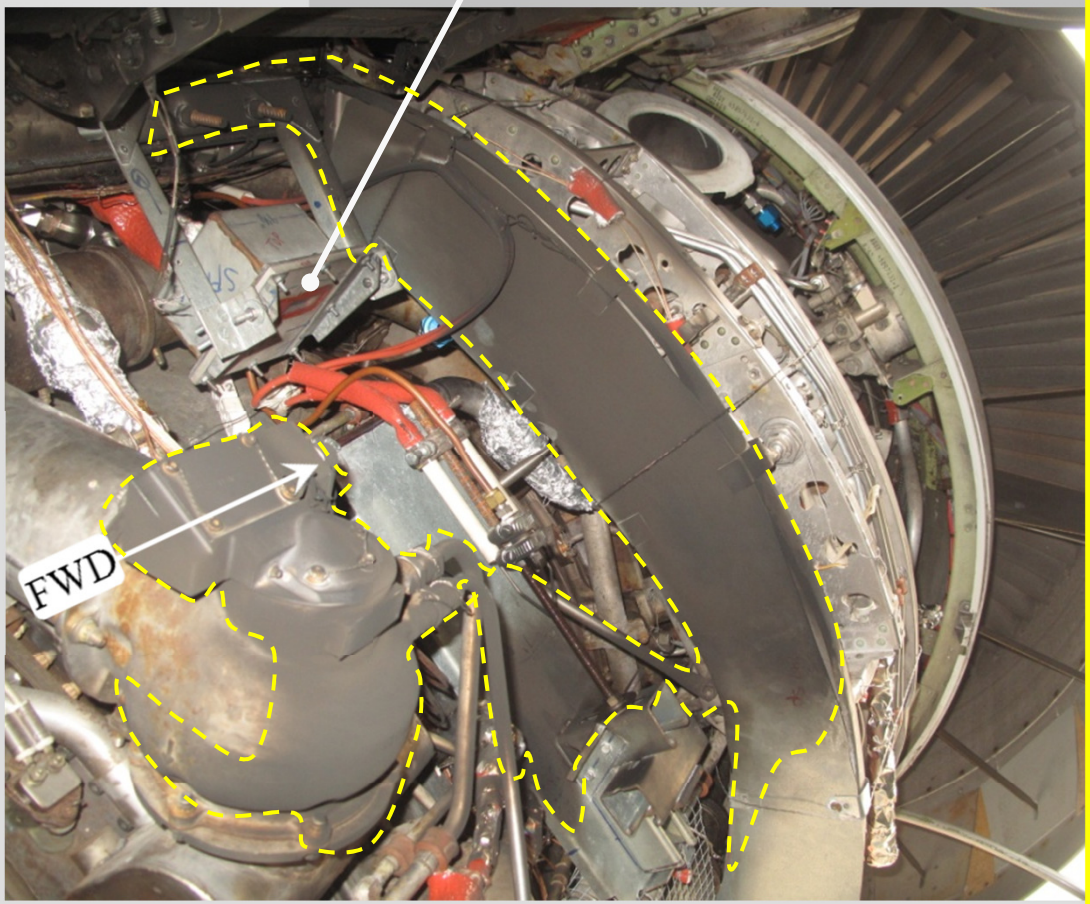
Various Views, Nacelle Fire Threat, Spray ("new")

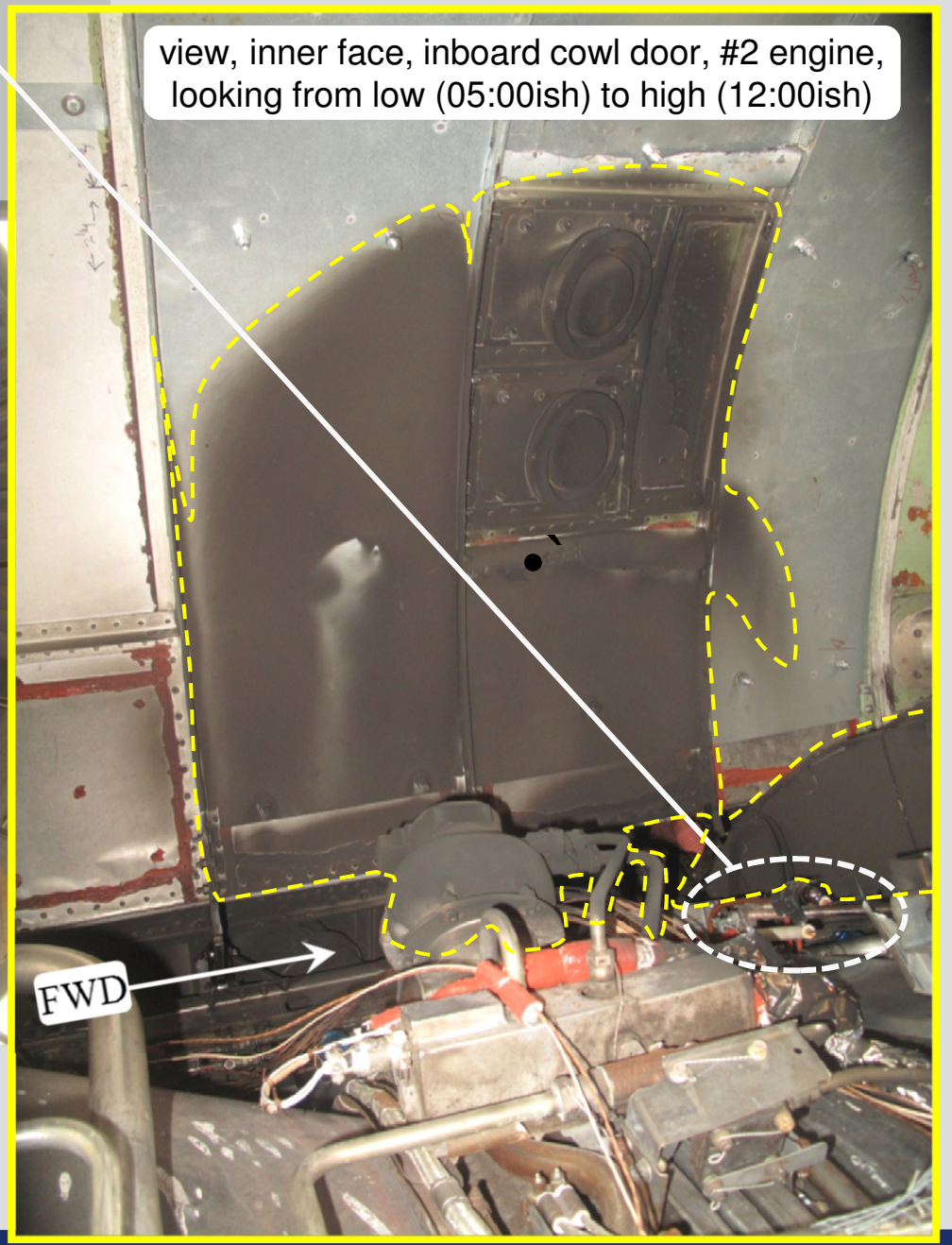


Various Views, Nacelle Fire Threat, Spray (after 1ST fire)

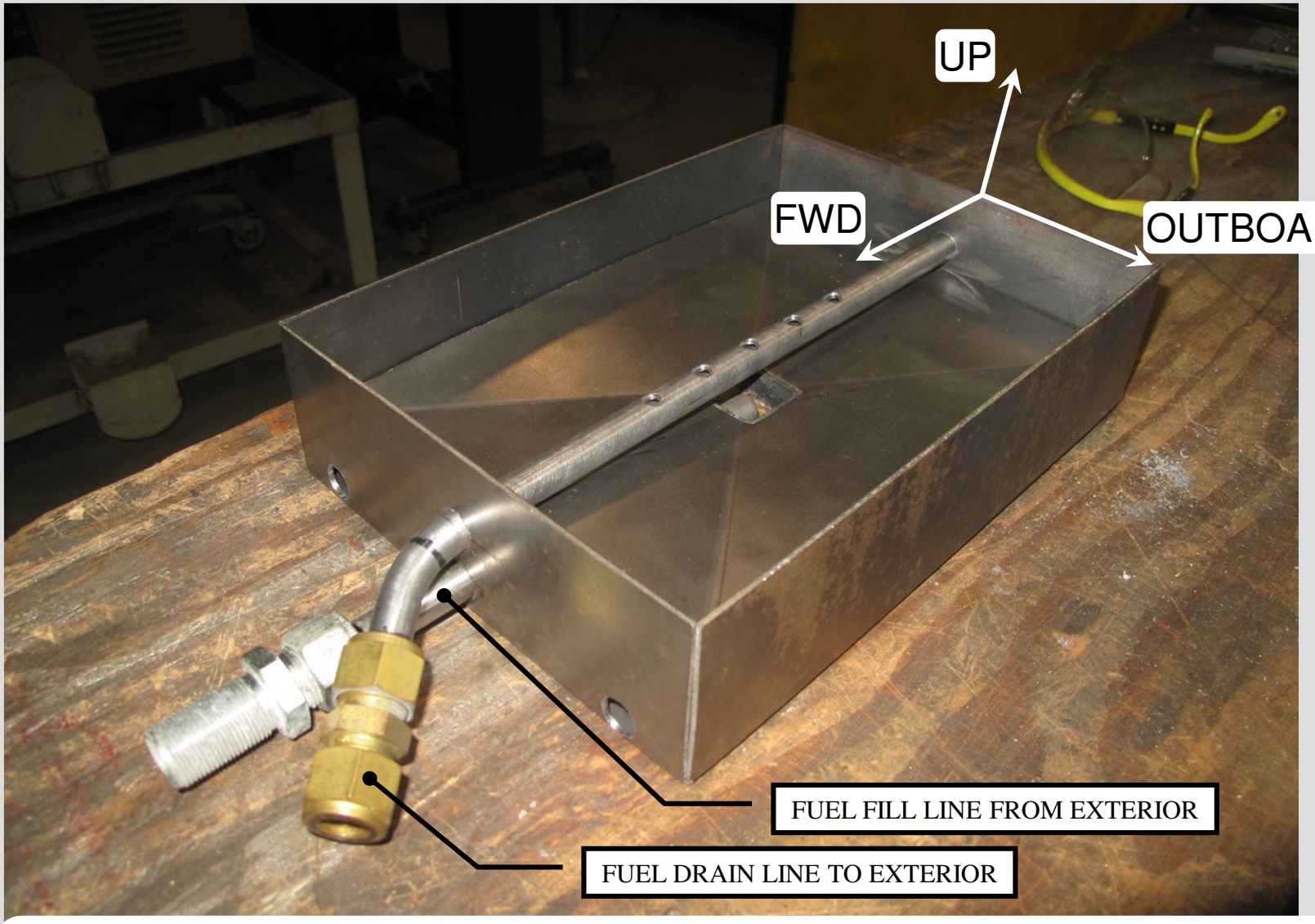
FUEL SPRAY NOZZLE &
ELECTRICAL IGNITION ARC GAP

CAMERA, SPRAY FIRE



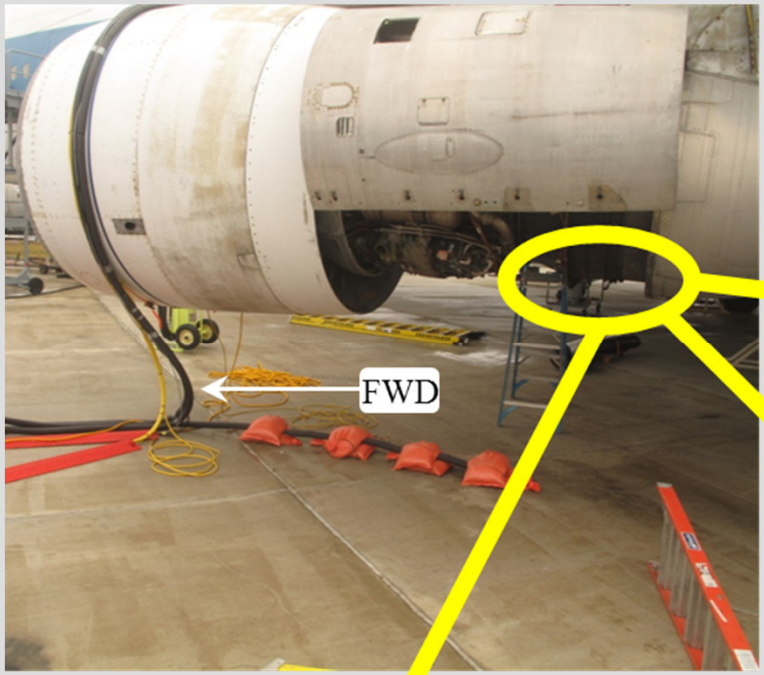


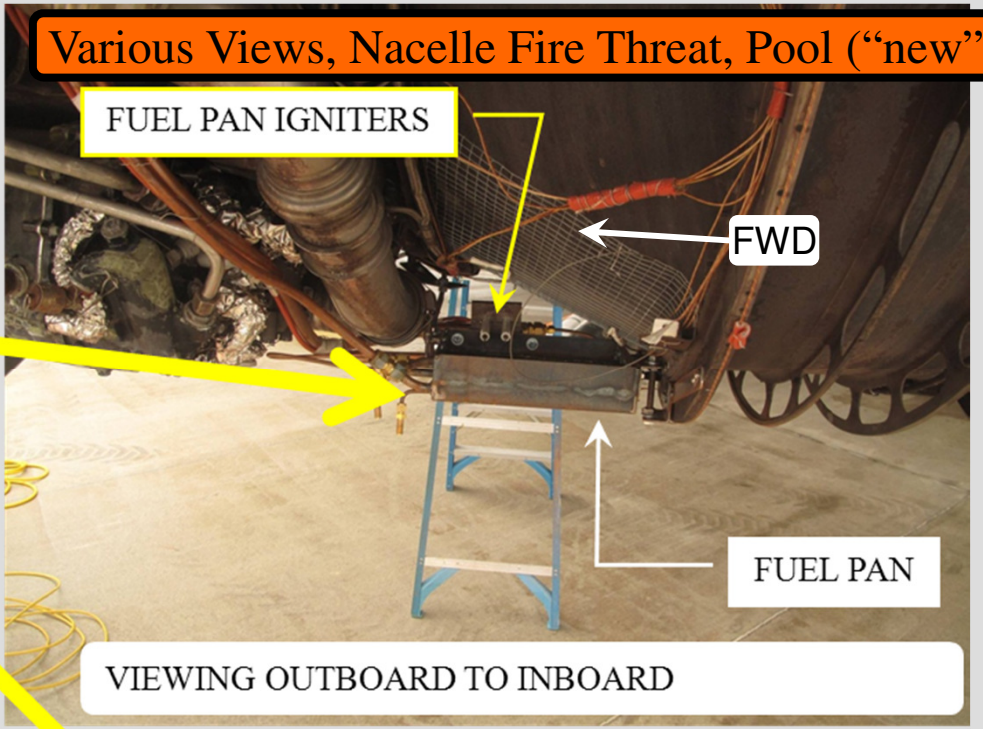
Various Views, Nacelle Fire Threat, Pool, Fuel Pan

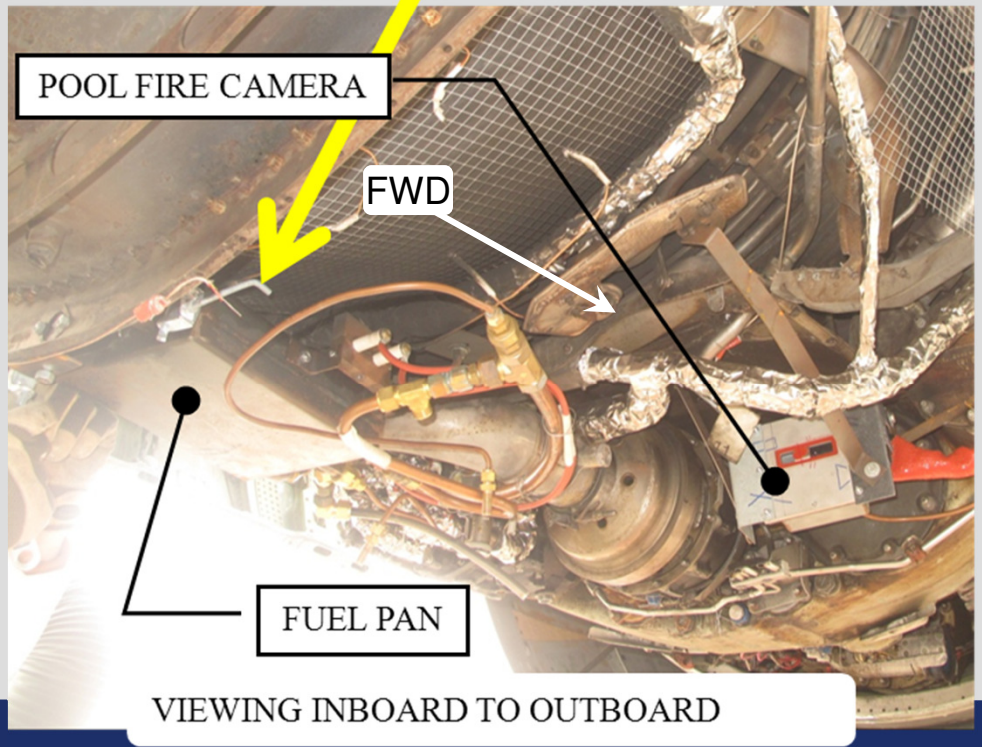


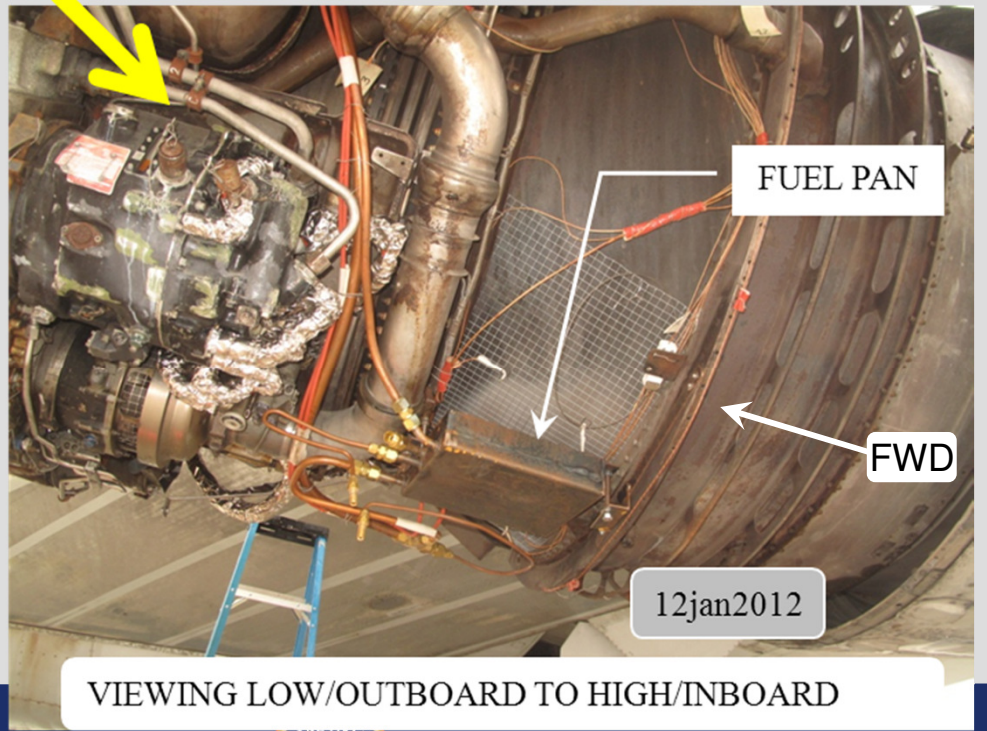
- Fuel pan is made from 14 ga steel & approximately 191 x 267 x 64 x mm tall (7.5 x 10.5 x 2.5 in tall)
- Fuel puddle depth approximately 13 mm (0.5 in) & freeboard (dry lip) height approximately 25 mm (1 in)
- Base of fuel pan is hollow permitting water flow from a water jacket

Various Views, Nacelle Fire Threat, Pool ("new")

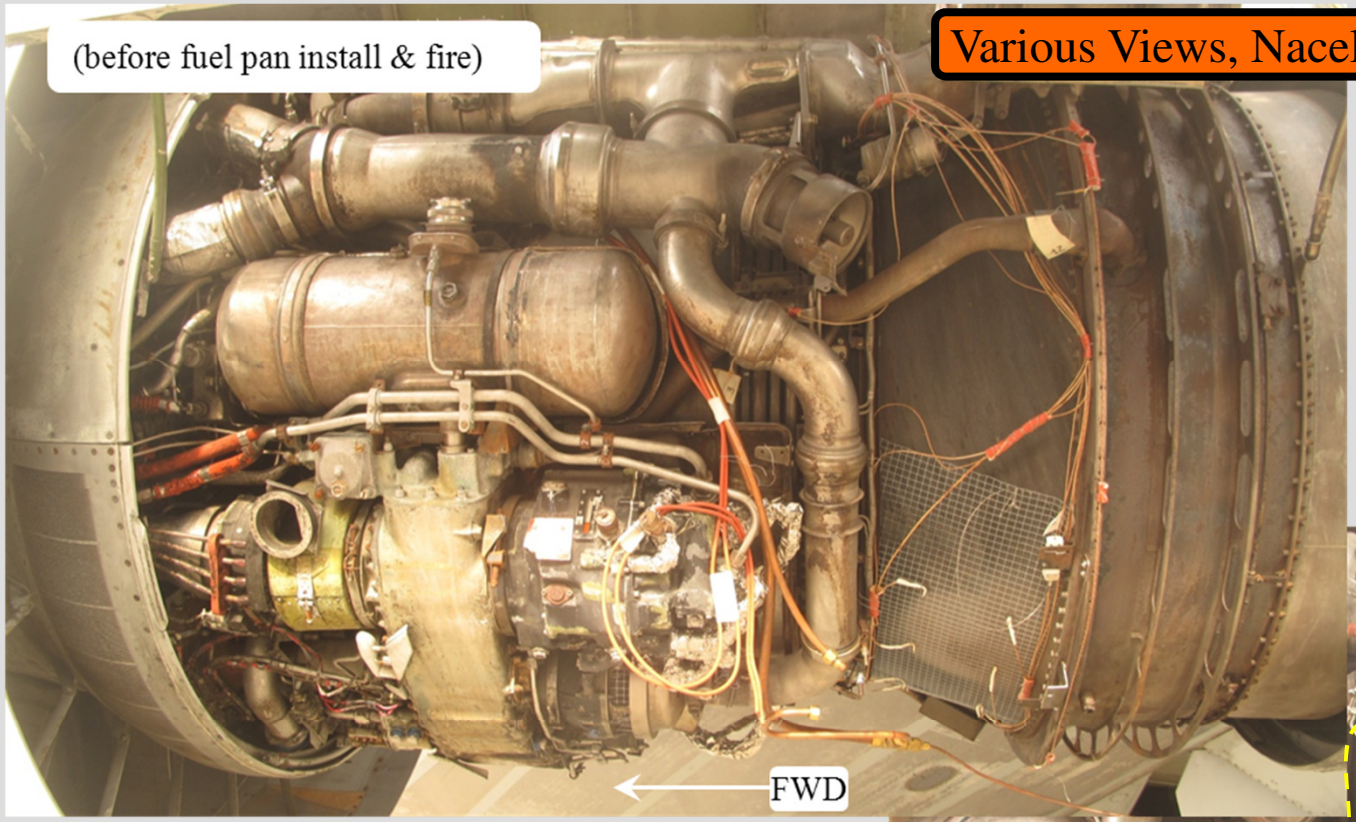


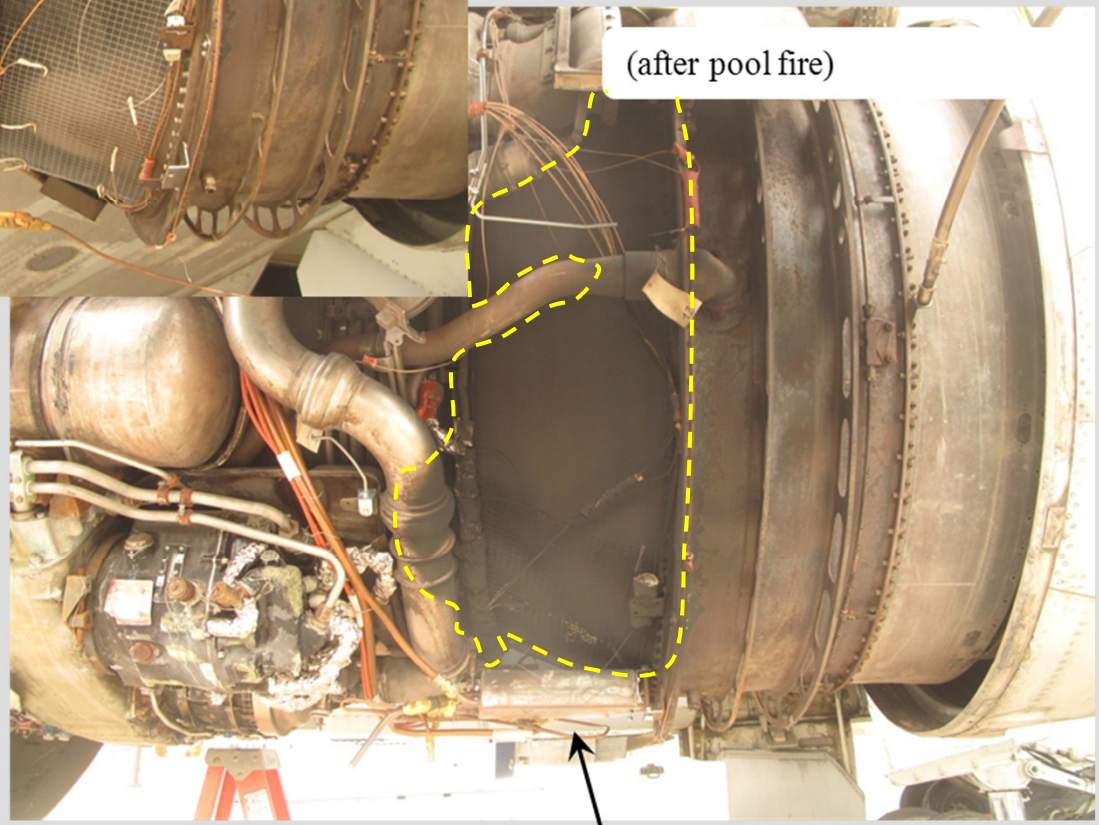






Various Views, Nacelle Fire Threat, Pool (after 1ST fire)





VIEWING OUTBOARD TO INBOARD

End

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

FAA = United States Federal Aviation Administration
FAATC = FAA W.J. Hughes Technical Center
firex = fire extinguishing or fire extinguishing system
FWD = forward
MPSe = Minimum Performance Standard for Halon Replacement in Civil Aircraft Engine Nacelle & APU Compartments
rev = revision