Combustion Potential

Nature & Behavior Of Fire In A Compartment

Presented to: International Aircraft Systems Fire Protection Forum

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Federal Aviation Administration

Objective

- **To understand the effects that dimensions, fuel flow and air flow have on combustion inside of an engine nacelle type compartment.**

- **The data acquired from this project will be used to provide an expeditious and small-scale validation method for CFD fire modeling.**

Background

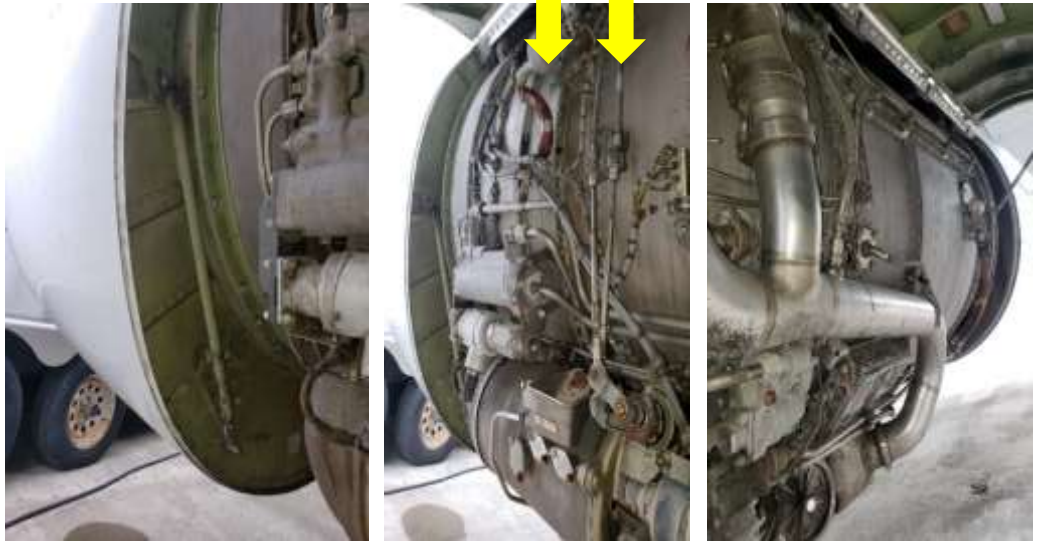
- **The space between an aircraft's engine and its nacelle houses many lines carrying fluids that are flammable.**
- **These fluids include fuel, hydraulic fluid, and oil.**
- **Engine nacelles are typically ventilated with forced airflow usually from free stream air outside the aircraft to limit the accumulation of flammable vapors.**
- **Fire tests are an integral part of the process of designing a fire safe environment**
- **Fire modeling allow the analysis of specific fire dynamics at a significantly reduced cost**

View Of Engine Components

Left Cowl

Left side of engine

lines carrying flammable fluids



View Of Engine Components

Right side of engine

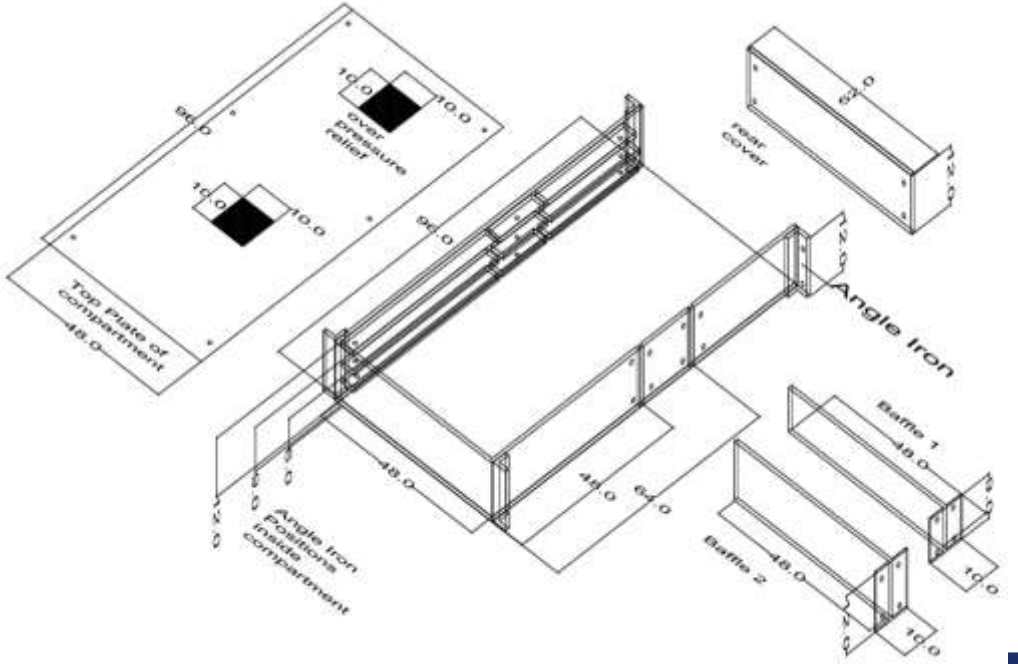
Bottom of engine

Method

- **Fabricate a compartment that will mimic the space between an aircrafts engine and the engine's nacelle.**
- **Assess the effect of fuel (JP-8) delivery in the compartment by varying the flow of fuel into the compartment.**
- **Assess the effect of air flowing through the compartment by varying the air supplied or by varying the size of the vent exit port.**
- **Assess the effects of the compartment dimensions by varying the distance between the upper and lower plate.**

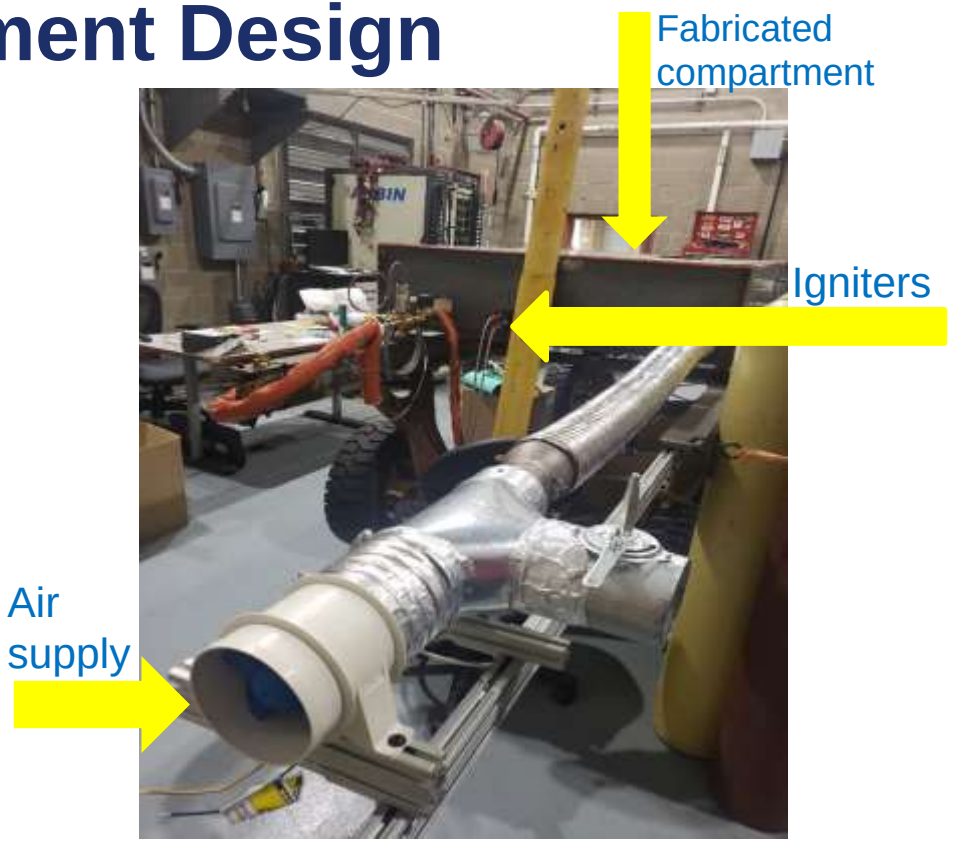
Compartment Design

- **Adjustable rectangular compartment to simulate the variable space in the engine's nacelle**
- **maximum dimensions of 96" x 48" X 12"**
- **Minimum dimension of 48"X 48" X 6"**
- **Pressure release panels at the top of the compartment**



Compartment Design

- **A blower is connected to the compartment.**
- **An igniter is centered inside the front panel of the compartment.**
- **The compartment is also outfitted with a fuel delivery system.**
- **A vent is located on the side panel of the compartment.**



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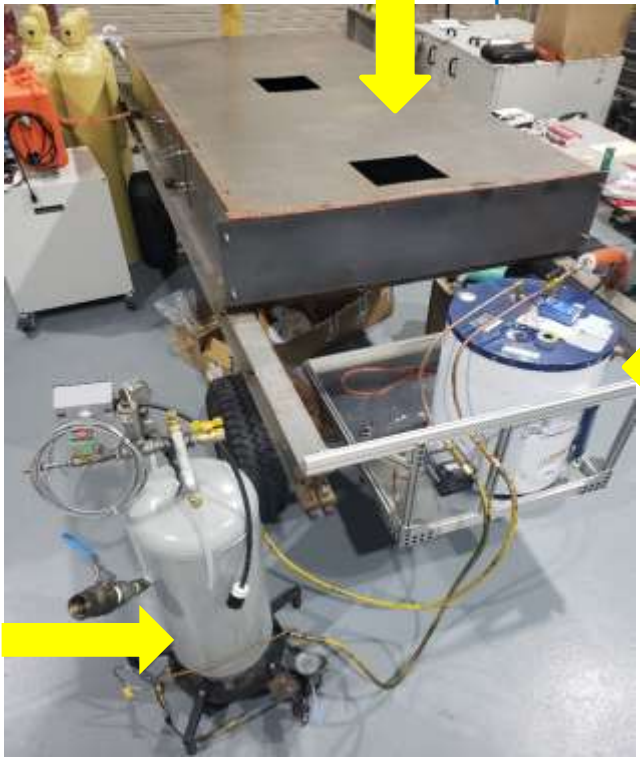
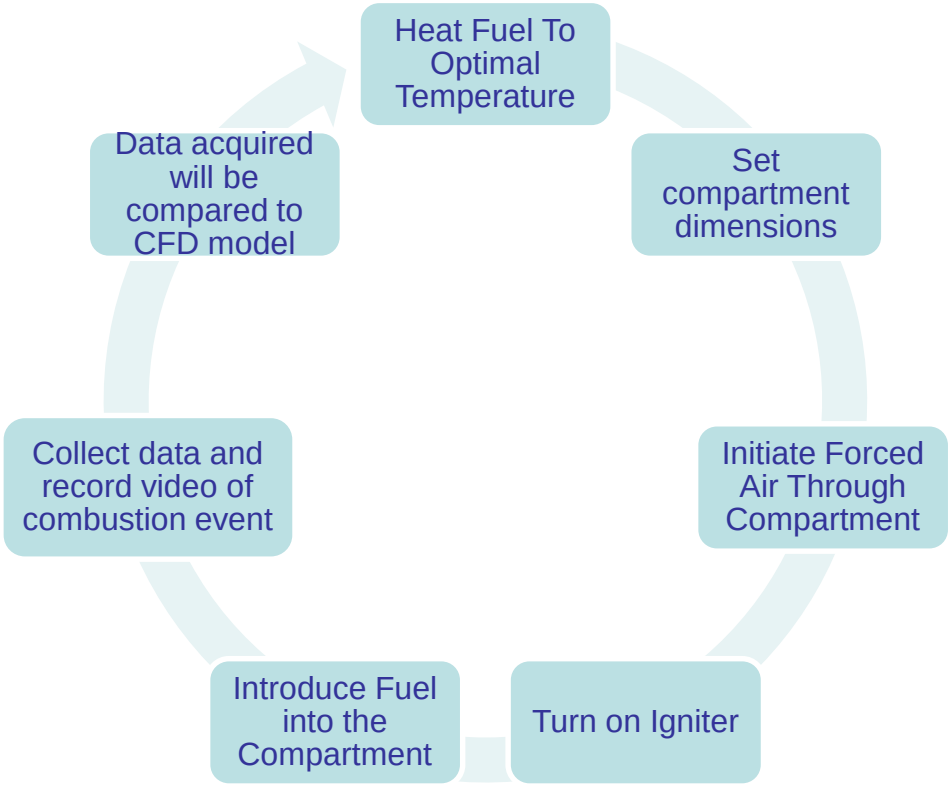


Recordable Data

- **Rate of fuel delivered (fuel flow) to the compartment from the nozzle. GPM**
- **Temperature of the fuel delivered to the compartment when it leaves the fuel heater. °F**
- **Rate of air flowing to the compartment from the blower. CFM**
- **Oxygen levels in the compartment. %**
- **Temperature profile or thermal mapping of the compartment via thermocouple grid.**
- **After Flame extinguishment time after fuel delivery has been stopped.**

Test Path



Acknowledgements

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DIAKON SOLUTIONS

THANK YOU

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