## Update For Sonic Burner Coordination For Use Of Testing Powerplant Components

Presented to: International Aircraft Systems Fire Protection Forum (IASFPF)

By: Aeon Brown

Date: October 2023



Federal Aviation Administration

#### Introduction

 Non-regulatory meeting to share experience with users of the Sonic Burner

 Continue comparative studies of the performance of the Sonic Burner compared to that of the legacy burners



#### Background

- The FAA and industry has been working to adopt the Sonic Burner for powerplant testing
- Concerns of repeatability of performance
- Concerns of high heat flux



#### **Burners Studied At The FAA Tech Center**

• Park 3400 DPL

FAA Sonic Burner

Carlin Burner









Federal Aviation Administration

#### **Calibration Parameters**

- Described in AC 20-135
  - 2000 °F average flame temperature
  - 4500 BTU/ft<sup>2</sup>-hr. Minimum heat rate



## **Determination of Sonic Burner Settings**

 Observe the performance of a legacy burner

 Configure the Sonic Burner to produce similar results

#### 0.125" 2024-T3 Aluminum





#### **Test Plan**

- Conduct a series of burn through tests of Aluminum Panels with the Park Burner at the prescribed calibration parameters
- Calibrate the Sonic burner to replicate the performance of the Park burner
- Replicate the performance of the Park Burner with the Carlin Burner at the prescribed calibration parameters.



## Flame Temperature Calibration Method

- Allow 2-min warmup/stabilize
  flame
- Move burner into prescribed position in front of Thermocouple Rake
- Allow flames to soak thermocouple rake for 2-min before monitoring temperatures of each thermocouple once every second averaged for 30-seconds





## Heat Flux Calibration Method

- Allow 2-min warmup/stabilize
  flame
- Move burner into prescribed position of heat transfer measurement device's copper tube
- Start 3-min average of btu recording after flames have soak copper tube for 2-min or a reading of 4500 BTU has been achieved





## **Sonic Burner Settings**

Fuel Pressure	Air Pressure	Fuel Flow Rate	Air Flow Rate	Delavan Nozzle
(PSI)	(PSI)	(GPH)	(CFM)	Type
100±1	52±1	2.5	57	Type W/80º/2.5GPH



#### Calibration Results Average Flame Temperature

Avg Flame Temp Park Vs Sonic Vs Carlin





#### Calibration Results Heat Flux

Average Heat Flux Park Vs Sonic Vs Carlin





## Calibration Results Burn Through Time

Burnthrough Time Park Vs Sonic Vs Carlin





# Image Comparison of Burn Through between Burners

#### **Park Burner**

#### **Sonic Burner**

#### **Carlin Burner**







#### **Observation**

- Sonic Burner can be calibrated to replicate performance of the Park Burner
- Sonic Burner Calibration temperatures were approximately 15 – 50 degrees less than prescribed 2000 °F
- Carlin Burner burned through the aluminum sample faster than the Park, and Sonic Burner
- Park, and Sonic Burner has similar burn through of the aluminum panel.
- Carlin Burner burns small hole in the lower left quadrant of the sample



## **Future Study**

- Investigate the flame retention head of the Carlin Burner
- Investigate other options of heat flux mapping other than single line copper tube





#### **Contact Information:**

#### Aeon Brown 609-485-4365 Aeon.S.Brown@faa.gov

