



**Federal Aviation
Administration**

International Aircraft Materials Fire Test Working Group Meeting

Task Group Session on Revised Cargo Liner Test

Presented to: International Aircraft Materials Fire
Test Working Group, Toulouse, France

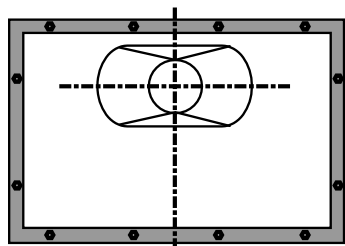
By: Tim Marker, FAA Technical Center

Date: June 20-21, 2012



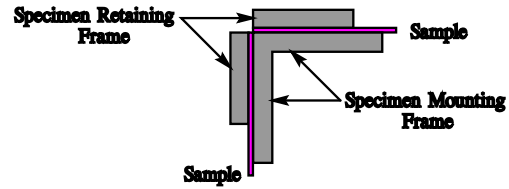
Main Objective: Transition from Park Burner to Sonic Burner



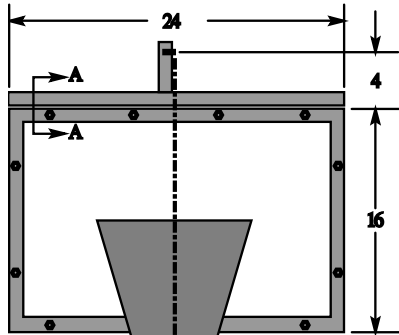


Top View

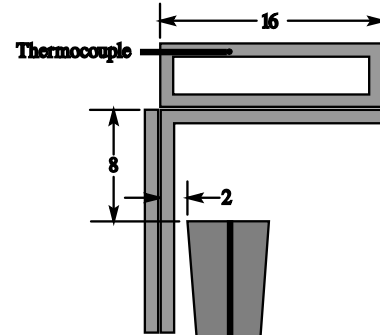
Horizontal and vertical specimens are clamped in place on all edges between angles as shown in View A-A



View A-A



Front View



Side View

Burner Cone

Burner Assembly

Sonic Orifice

Initial Step: Baselining of Park Burner

1. Generate calibration temperature results with FAATC Park burner apparatus

- Results will be used to calibrate Sonic burner apparatus

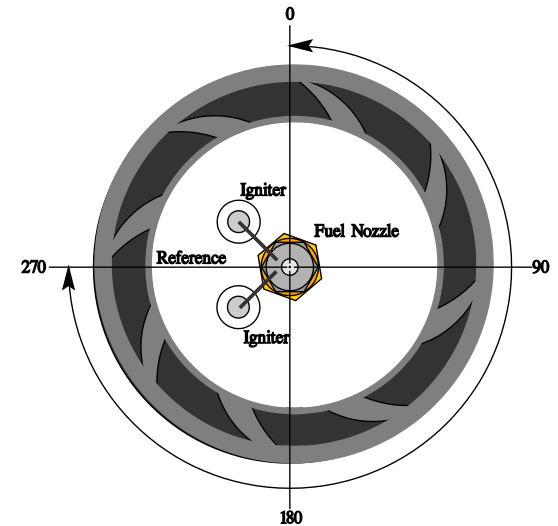
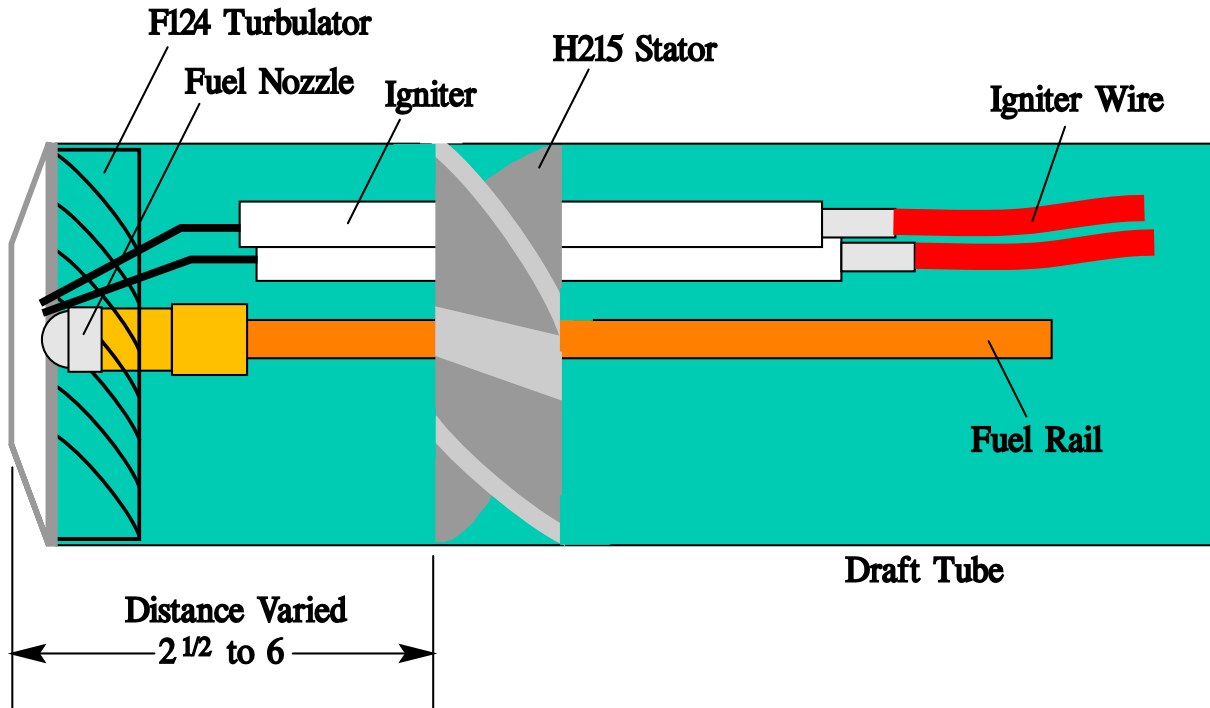
2. Generate test results with FAATC Park burner apparatus

- Results will be used to correlate sonic burner (B/T times and temp vs. time plots)
- 3 styles of liner and 1 PAN felt have been tested
- 2 additional materials also tested

Next Step: Setting Up Sonic Burner and Calibration

- Calibration runs were conducted to determine an approximate starting point for the stator position
- Initially, the stator was tested in 8 different axial locations on the fuel rod, over a 3.5 inch range, in increments of 0.5 inches
- The stator was rotated through 4 different rotational orientations at each position
 - = 32 unique stator positions tested
- It is necessary to vary both parameters as they have a combined affect on the flame
- The data was reviewed to determine an approximate “starting point” for stator settings
 - Based on flame temperature profile, or most even flame
- Best performance was shown to be with the stator face located ~3.0 inches from turbulator exit plane

Initial Sonic Burner Settings and Calibration



8 Positions (2.5, 3.0, 3.5, 4.0, 4.5, 5.0, 5.5, 6.0) X 4 Angles (0°, 90°, 180°, 270°)

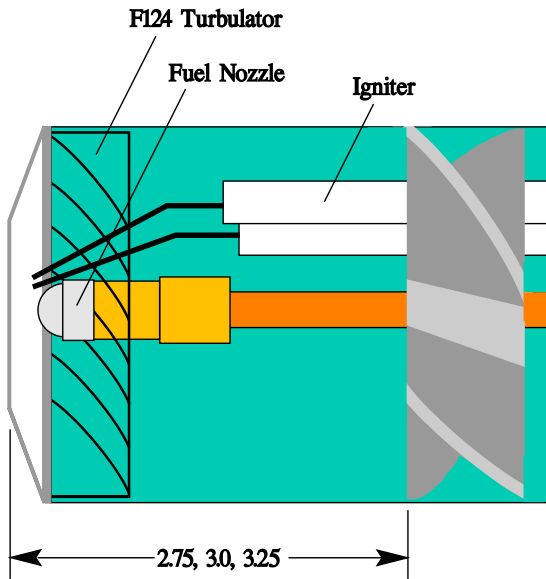
= 32 Combinations

Refining Sonic Burner Settings

- Burner then tested using a number of smaller adjustments
- Stator face to turbulator exit plane varied:
 - 2.75, 3.0, and 3.25 inches (3 positions)
- Stator rotational position on fuel rod
 - 0-360° in increments of 45° (8 positions)
- Nozzle depth from turbulator exit plane
 - 5/16, 7/16, and 9/16 inches (3 positions)
- Total of 72 unique combinations tested

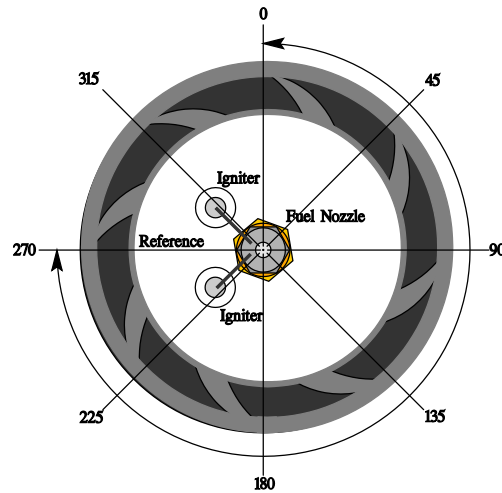


Refining Sonic Burner Settings

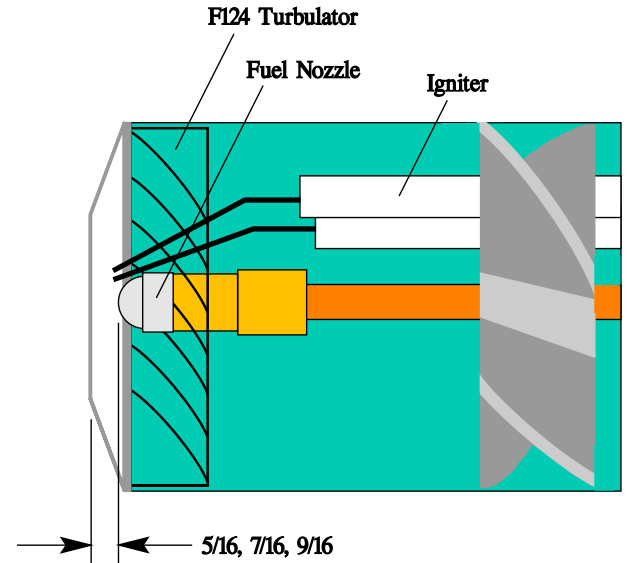


3 Positions

X



8 Angles



3 Depths

X

= 72 Combinations

= LOTS OF DATA

Continue Refining Sonic Burner Settings

- Stator/nozzle position combinations were selected which showed adequate flame properties
 - Temperature distribution
 - Repeatability
 - Full, even flame coming from cone (visual)
- Of the 72 positions tested, only 10 seemed adequate for further testing
- The burner was then returned to these 10 settings and tested multiple times to prove repeatability
- The 10 positions were then reduced to 2 or 3 possible selections

Ignition Wires

- Ignition wires previously wrapped around fuel rod
- No standardized length or position for wires
- Position of wires can impede or redirect airflow within the draft tube and can affect the flame characteristics

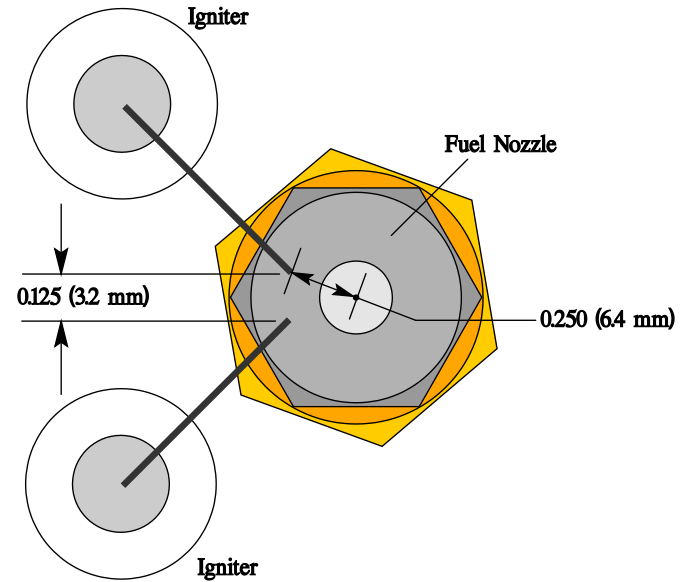
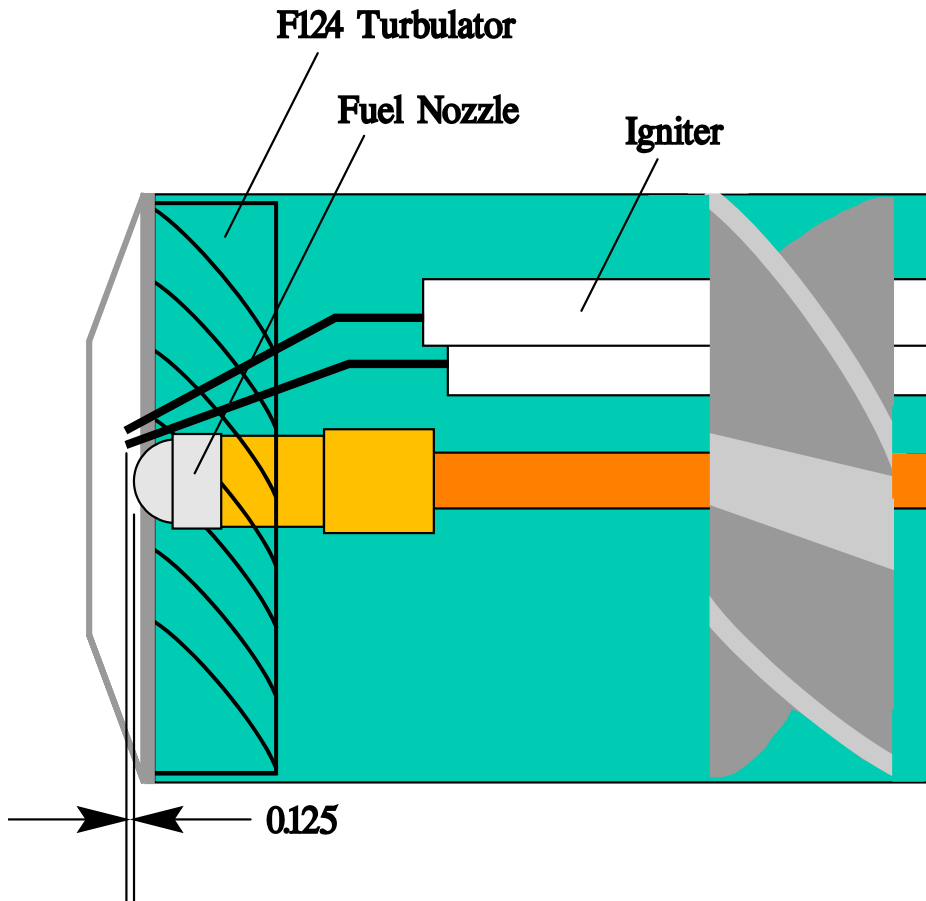


Ignition Wires

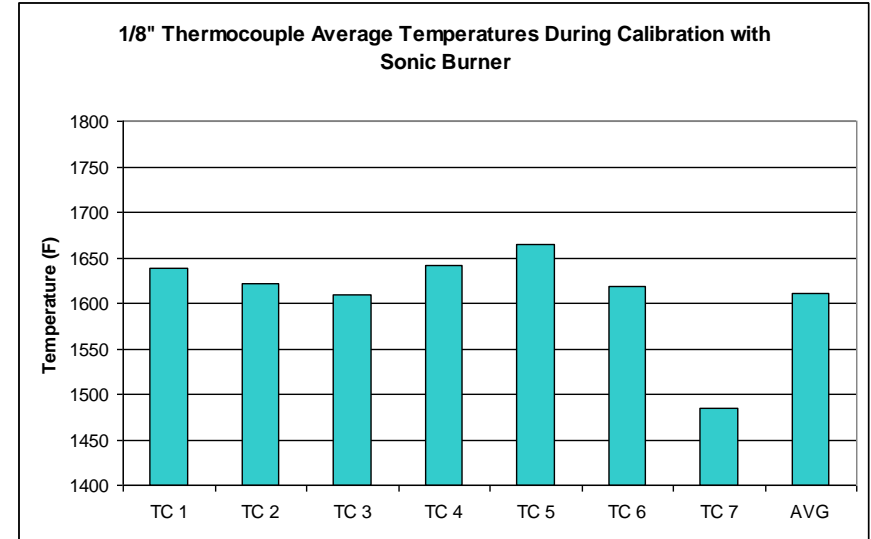
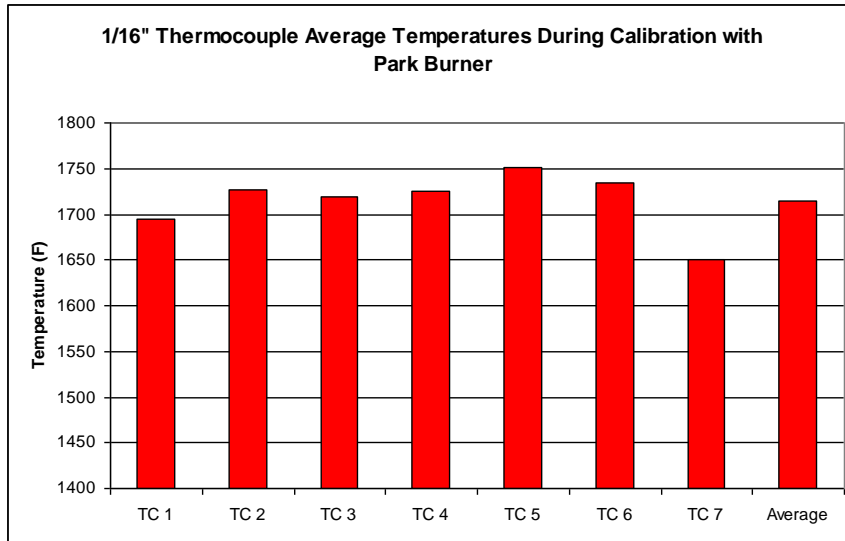
- **New wire length and positions minimize the airflow disturbance**
- **Standardized wire position minimizes variability in burner performance and data results**
- **Improved repeatability**



Igniter Positions



Final Sonic Settings: Calibration

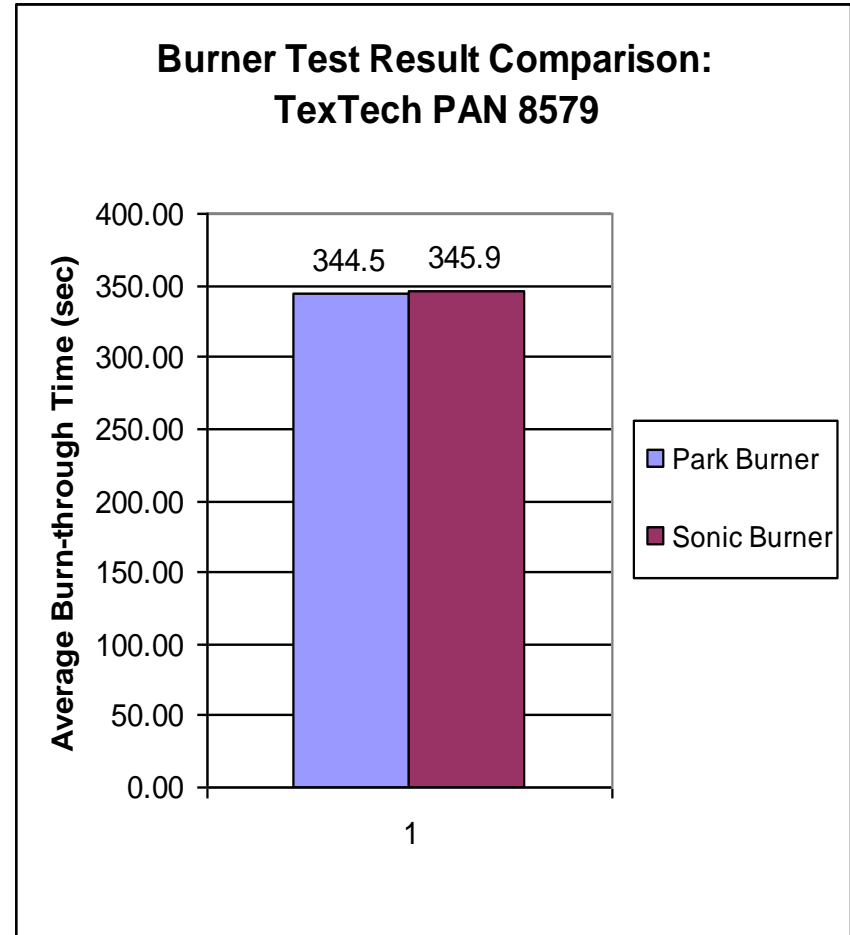
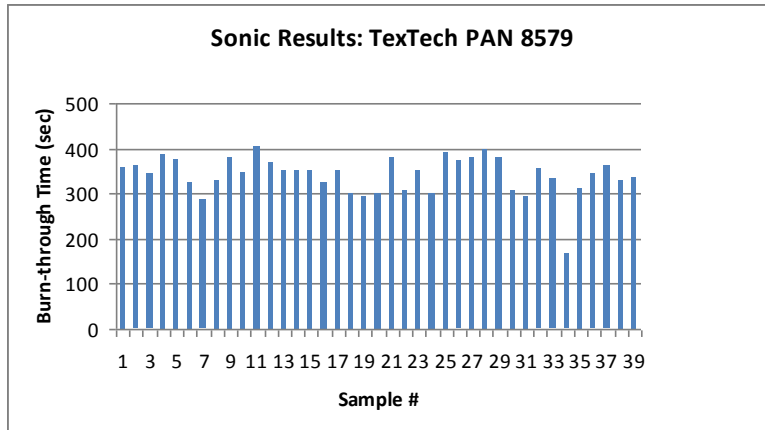
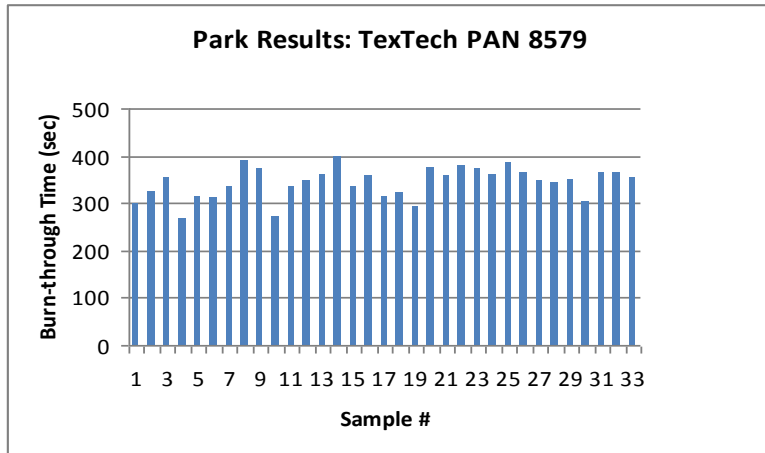


- All thermocouples must read at or above 1600°F
- It is likely that the sonic burner shows lower temperatures due to using 1/8" thermocouples
- Sonic test results still show higher temperatures

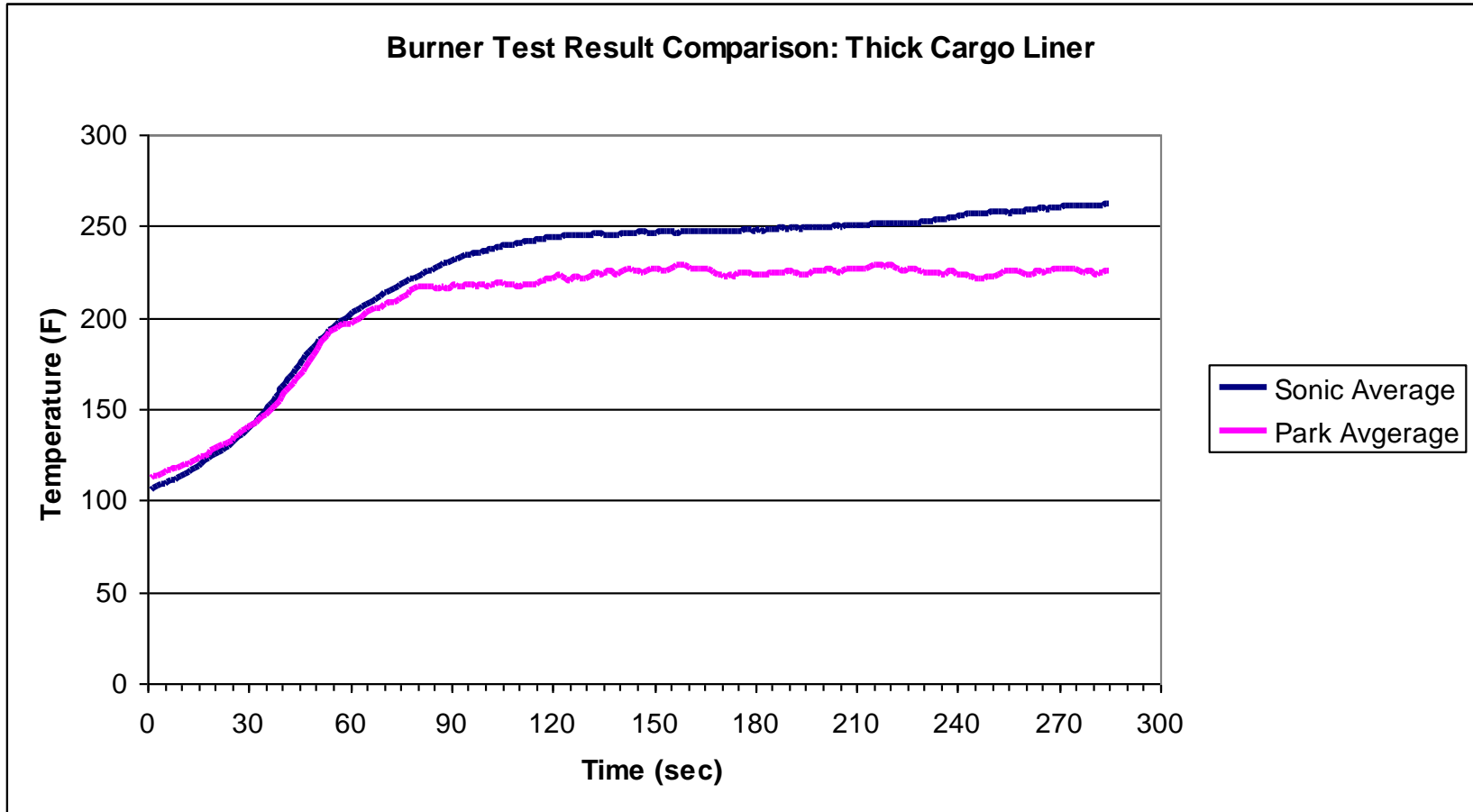
Final Sonic Settings: Testing

- **TexTech PAN 8579**
 - Park Burner: 33 samples tested
 - Sonic Burner: 39 samples tested
- **Thick Cargo Liner**
 - Park Burner: 10 samples tested
 - Sonic Burner: 12 samples tested

Final Sonic Settings: Test Results



Final Sonic Settings: Test Results

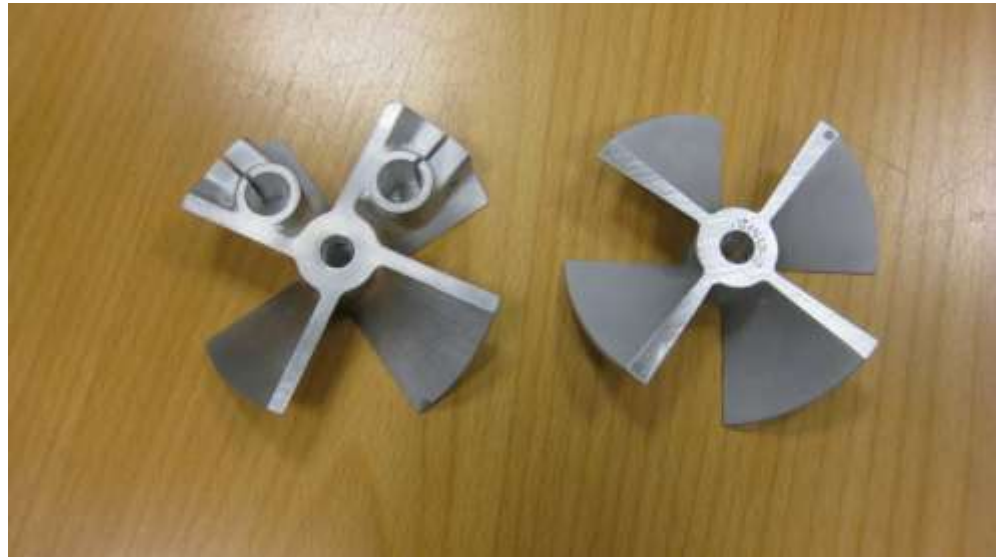


Final Sonic Settings: Conclusion

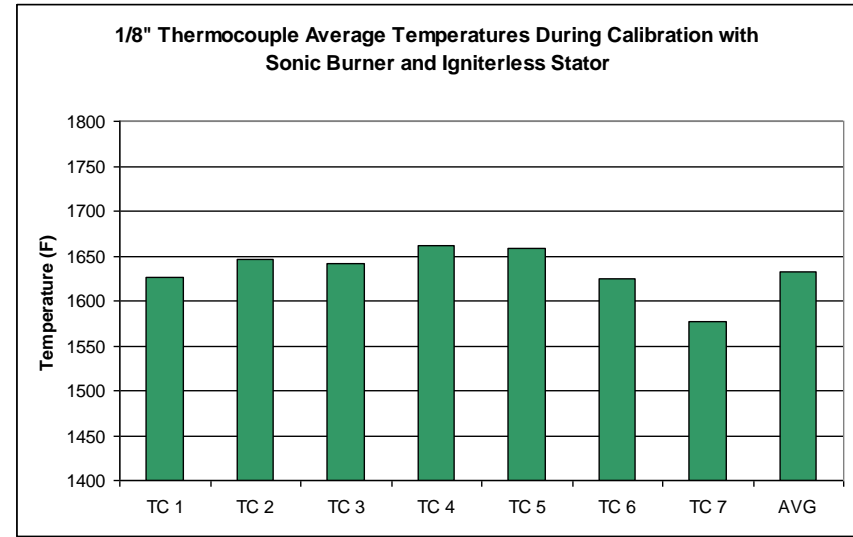
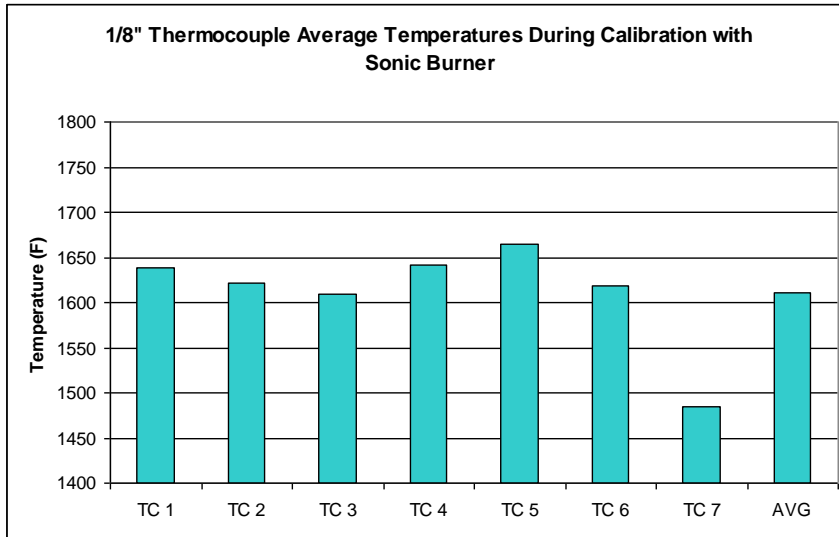
- **Calibration temperatures are lower than Park calibration temperatures**
- **Temperature readings during cargo liner testing show higher back-face temperatures using sonic burner versus Park burner**
- **Test results show that these settings will allow the sonic burner to perform well as a suitable replacement for the Park burner**

Revised Stator: Description

- **New stator eliminates igniters and ignition wires in draft tube**
- **Intended to simplify burner settings and setup**
- **Should reduce abnormal airflow deflection and therefore increase test result consistency**

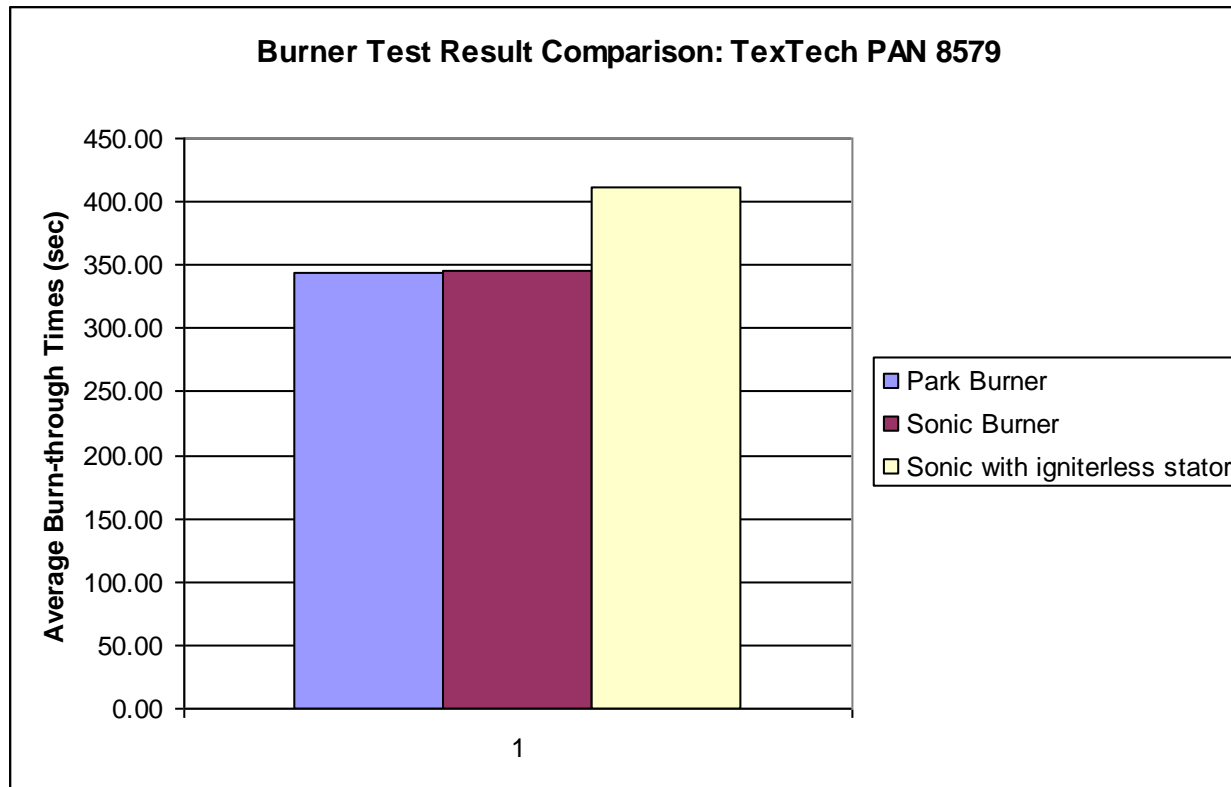


Revised Stator: Calibration



- **Igniterless stator shows little improvement with regard to calibration temperatures**
- **Did not demonstrate increased repeatability from one calibration to another**

Revised Stator: Test Results



- **Igniterless stator produces test results much different than Park burner or standard sonic stator**

Revised Stator: Conclusion

- **No noticeable improvement using igniterless stator compared to standard stator**
- **Requires external igniting system**
- **15 TexTech materials tested show longer burnthrough times compared to Park burner or standard stator sonic burner test results**
- **Unlikely revised stator design will be used for testing in the future**

Flame Retention Head: Description

- **Eliminates the need for a stator or turbulater**
- **Fits on end of burner draft tube**
- **Intial testing shows good potential**



Thermocouple Calibration

- Looking further into TC degradation and changing temperature readings
- Currently have TC calibration unit on order
- Possibly be able to predict level of temperature changes



Planned Activities

Finalize burner settings by conducting temperature calibrations



Complete testing of samples to ensure sonic equivalency to Park



Continue development/testing of flame retention head

Continue investigation of thermocouple degradation using calibration device

Conduct testing of various cargo design features to support development of advisory material

Conduct Round Robin?

Questions?

