Radiant Panel Update

Presented to: International Aircraft Materials Fire Test Working Group Meeting
By: Steven Rehn
Date: 3/16/2016

Introduction

- **Round Robin**
  - Most of the test results are in.
- **Air Flow Study**
  - Varied openings around the sliding platform to test how it affected air flow and test results.

Round Robin

- **Materials sent out to 27 labs (including FAA)**
- **23 Responses so far**
- **12 samples for each lab**

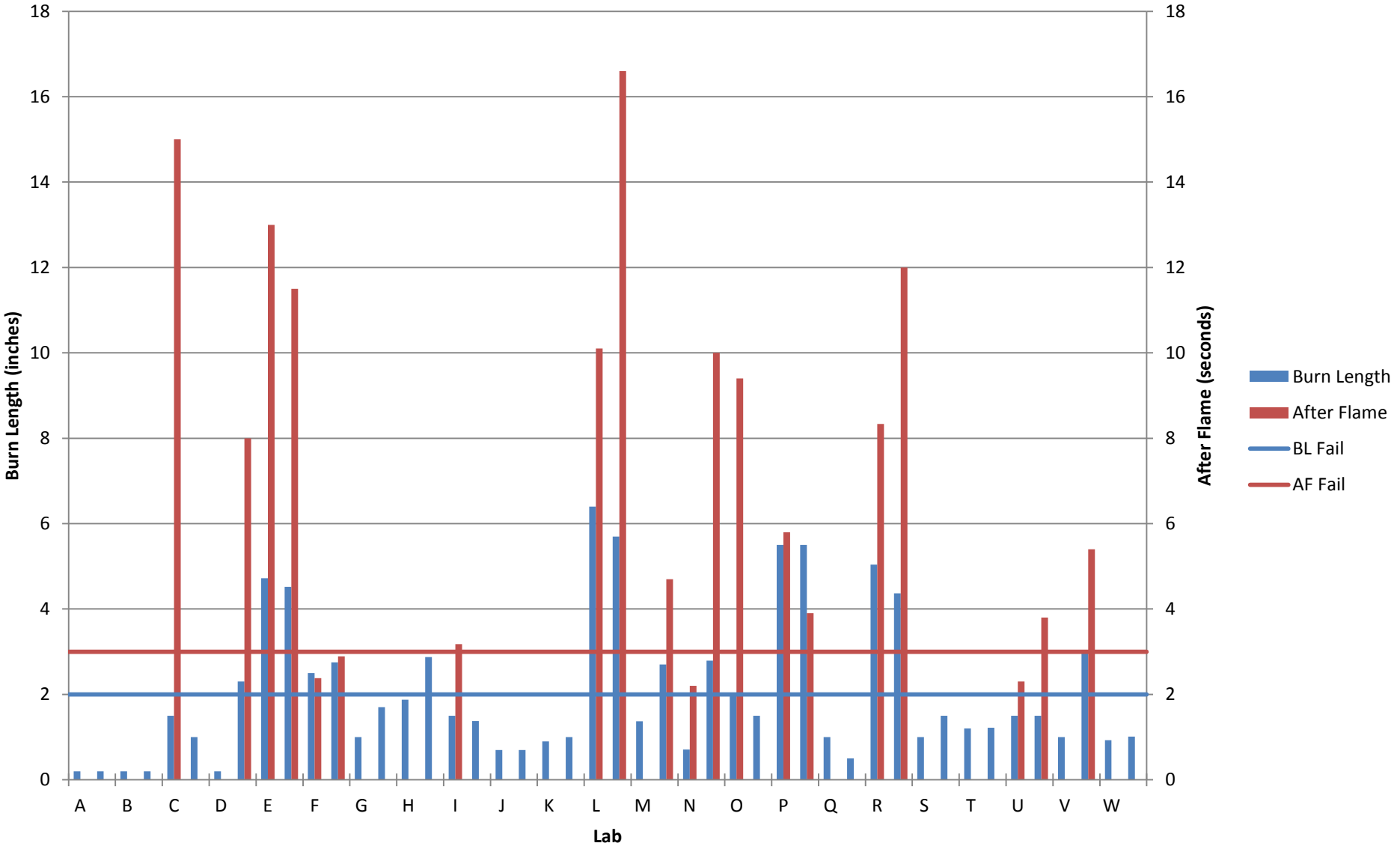
Data Sheet

Test Date	
Dimensions of Room (L x W x H)	
Distance Between Top of Chamber and Exhaust Hood	
Preconditioning Time (hours or days)	
Lab Ambient Temperature (°F or °C)	
Lab Ambient Humidity (rel. %)	
Heat Flux Averaging (sec. or min.)	
Heat Flux at Zero Position (BTU/ft^2*sec or W/cm^2)	
Stabilization Time (minutes)	
Radiant Panel Set Point (°F or °C)	
Chamber Temperature at Calibration (°F or °C)	
System Upset Check Heat Flux (BTU/ft^2*sec or W/cm^2)	
Air Velocity at Chimney Exit with Radiant Panel On	
Air Velocity Under Right Side of Sliding Platform	
Air Velocity Under Left Side of Sliding Platform	

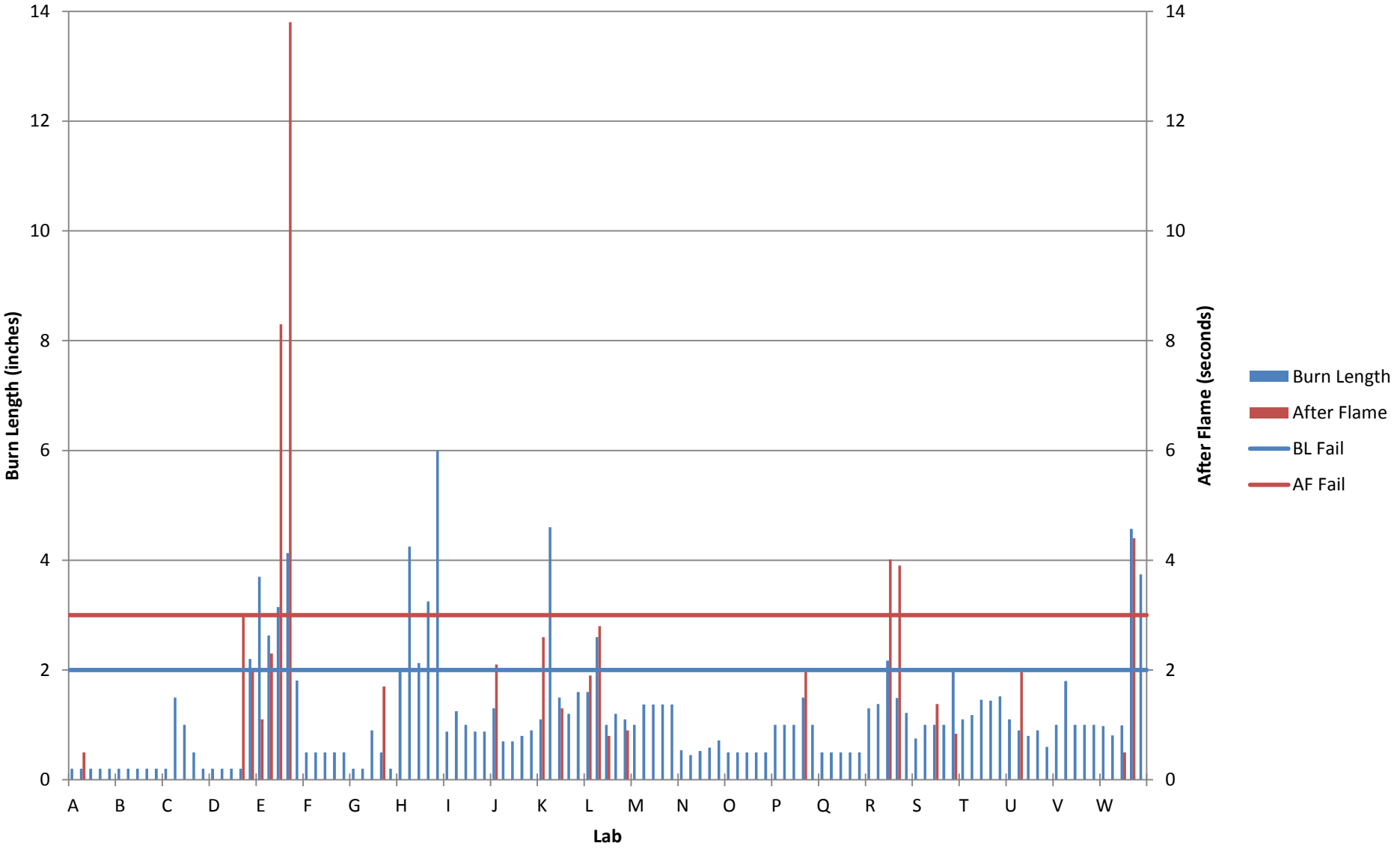
Material Testing	Burn Length (inches)	After Flame (seconds)	Comments
Sample 1			
Sample 2			
Sample 3			
Sample 4			
Sample 5			
Sample 6			
Sample 7			
Sample 8			
Sample 9			
Sample 10			
Sample 11			
Sample 12			

System Recheck Heat Flux (BTU/ft^2*sec or W/cm^2)	
Time to Recheck Measurement (minutes)	

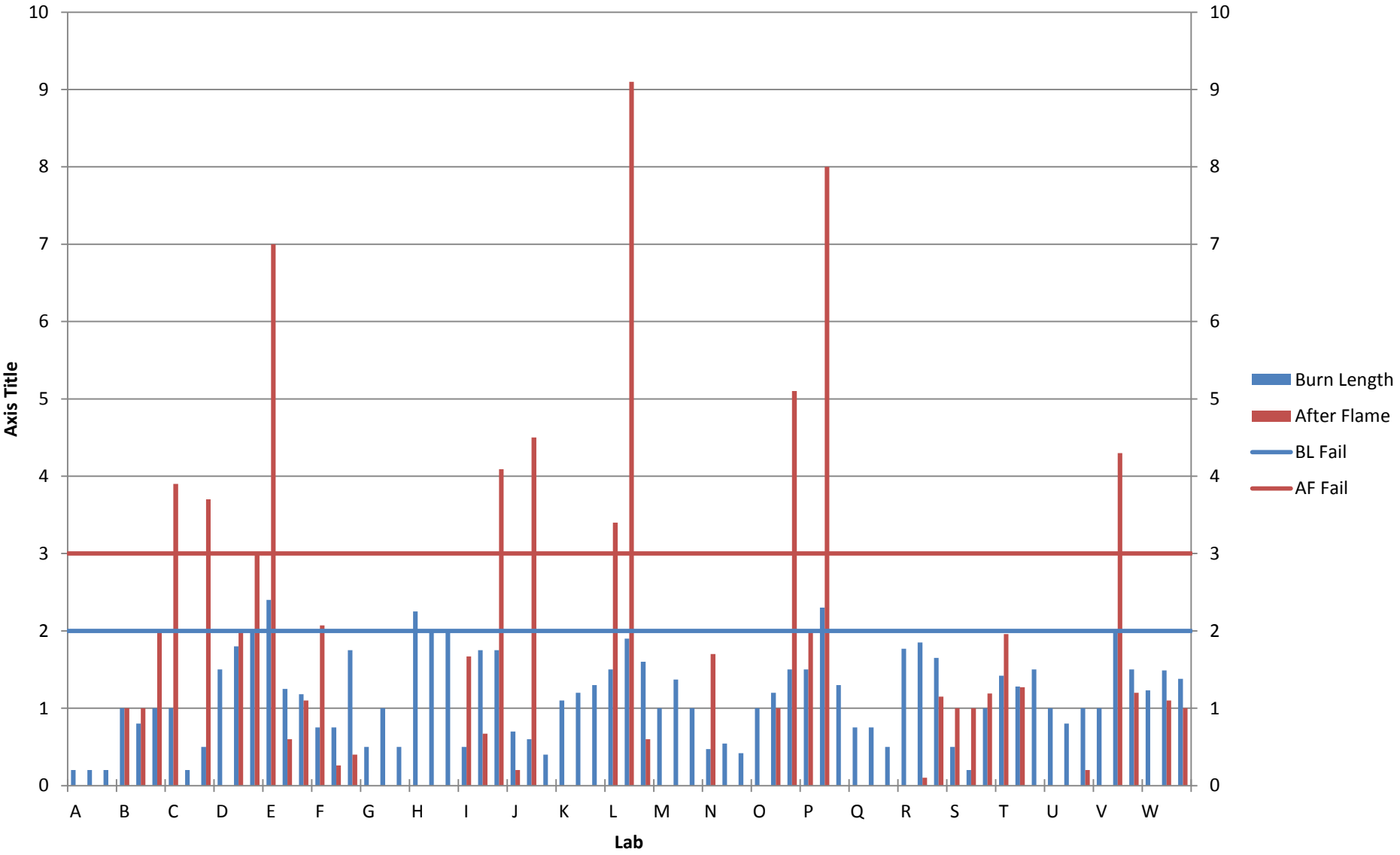
Metalized PEEK

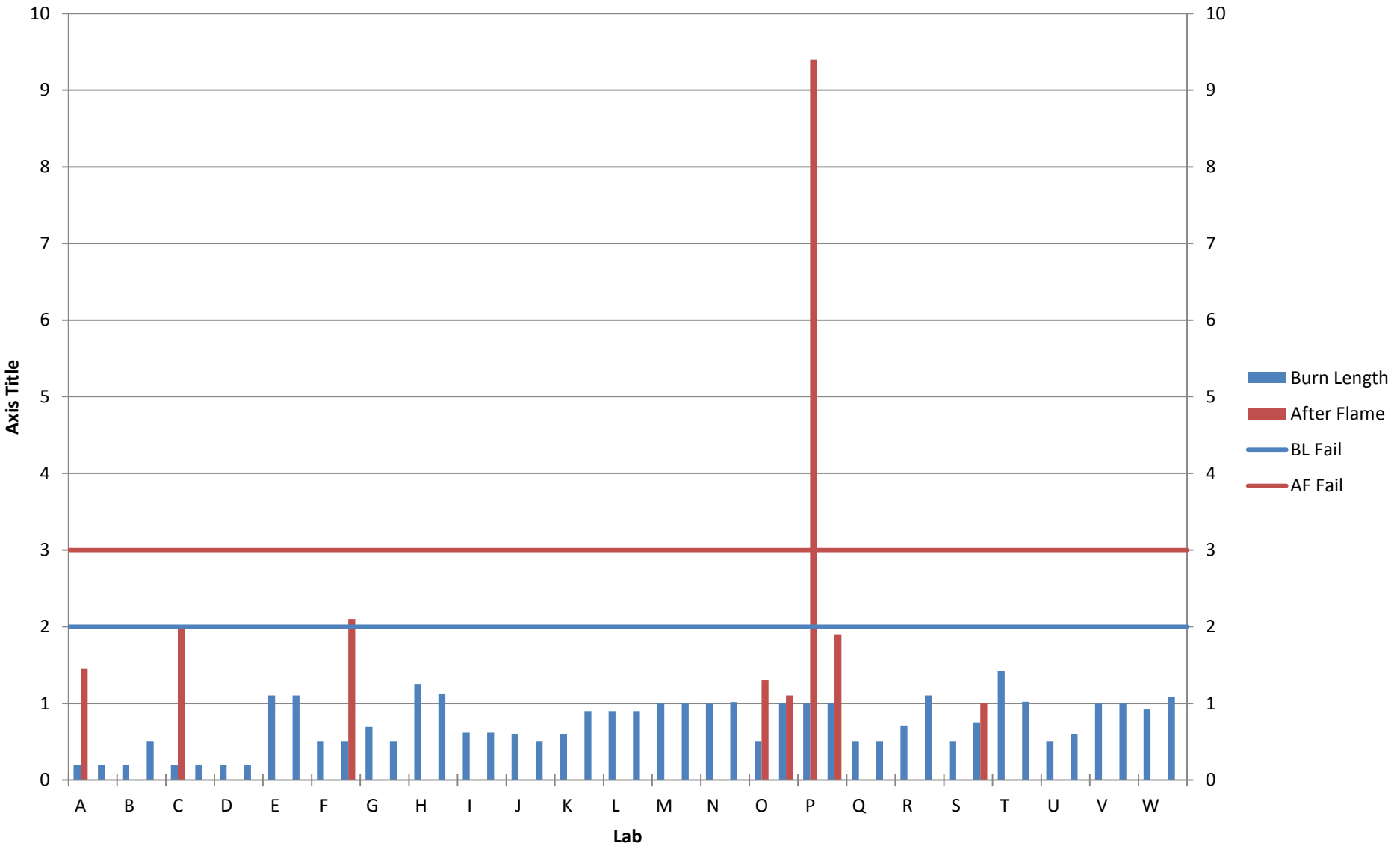


Unmetalized PEEK



Metalized PEEK w/ Tape




Polyimide
Axis Title
Lab
A
B
C
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F
G
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9
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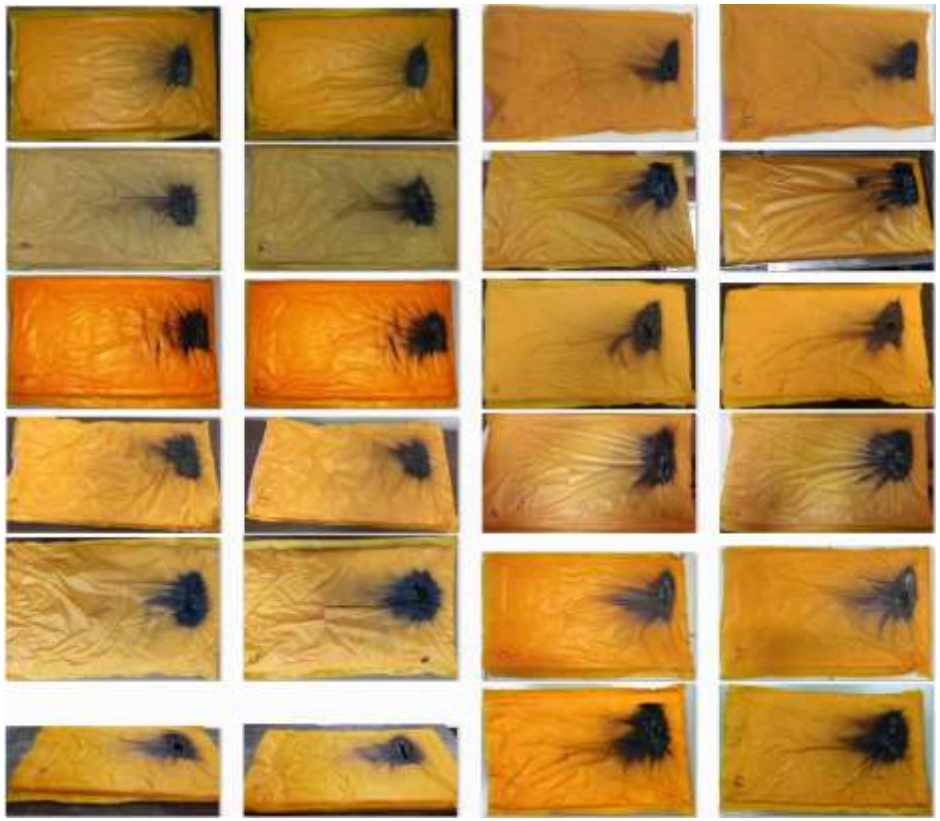
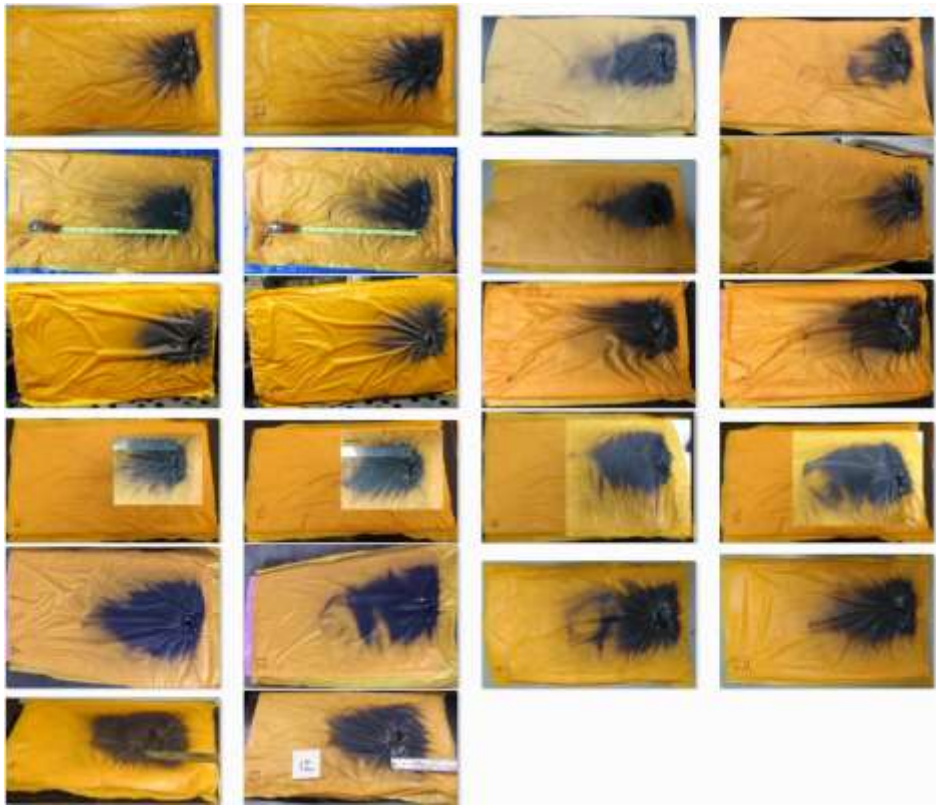
Burn Length
After Flame
BL Fail
AF Fail

Polyimide

1-12



13-23



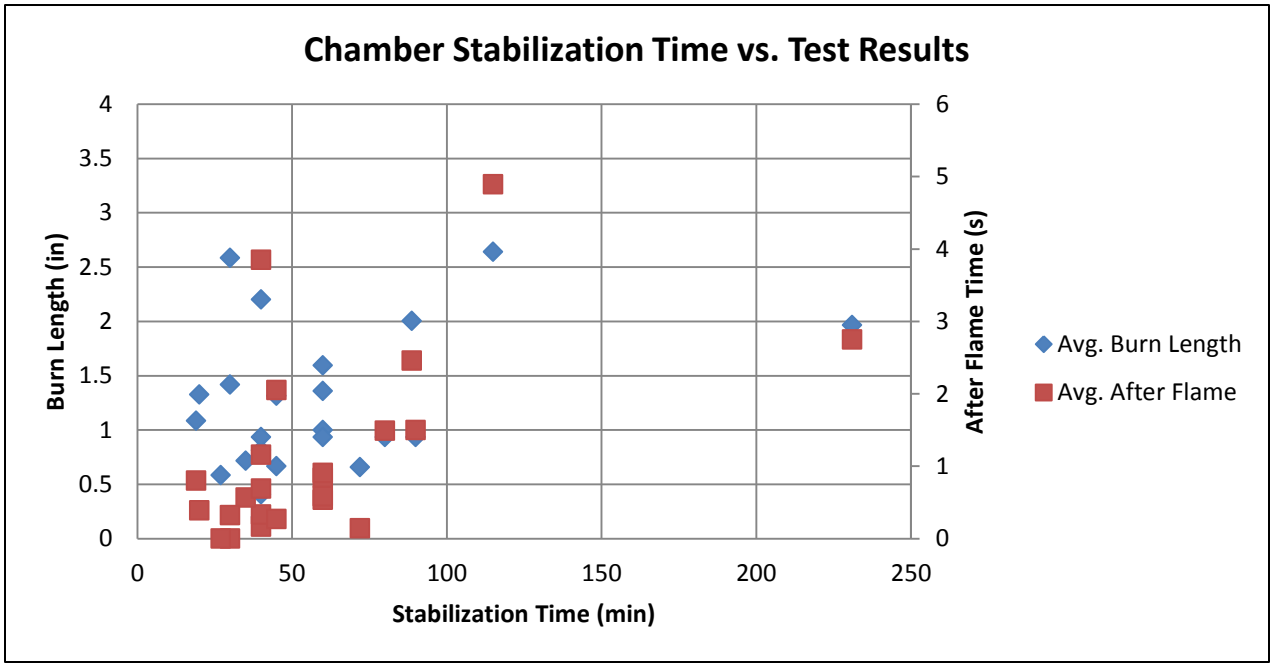
Polyimide

FAA's test result

- Same test, completely different results.

Analysis

- **Some Radiant Panels took a very long time to heat up**
- **New handbook states it must be calibrated in 90 minutes or less**
- **Long stabilization times are a sign of an old or worn out panel**



Air Flow Study

- **New handbook has a larger drawer length compared to the current handbook.**
- **This was done to allow less air to flow into the chamber during testing.**
- **Larger drawer isn't necessary – the openings around the drawer are what we need to standardize.**
- **We ran some tests to see how changing the size of these openings affects calibration and test results.**

Air Flow Study

- **Normal openings around the FAA's radiant panel**

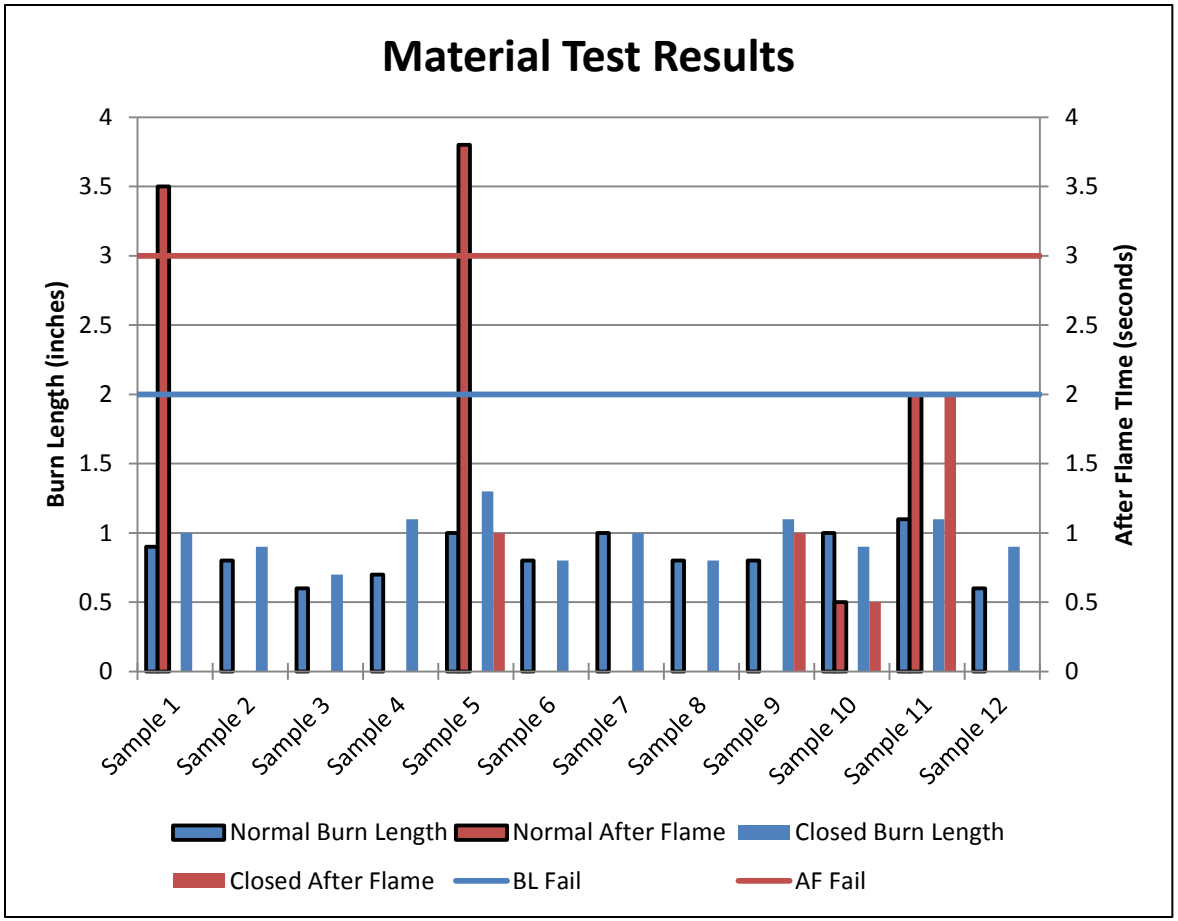
Left	Right	Front	Back
5/16”	1/8”	0”	2.25”

Air Flow Study

- **Closed off Left and Rear gap**

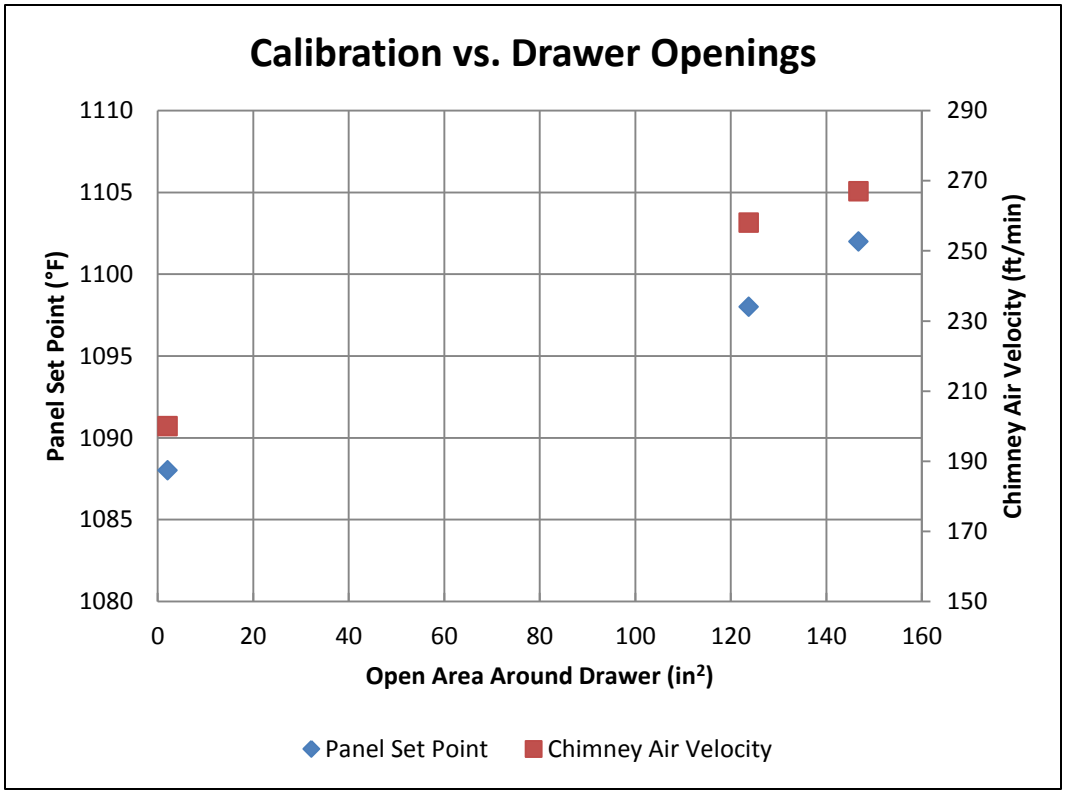
Air Flow Study

	Normal Around Drawer	Closed Around Drawer
Open Area Around Drawer(in^2)	123.77	2.09
Panel Set Point (°F)	1102	1092
Heat Flux (BTU/ft^2s)	1.502	1.504
Chamber Temperature(°F)	369	385
Chimney Air Velocity (FPM)	265	205

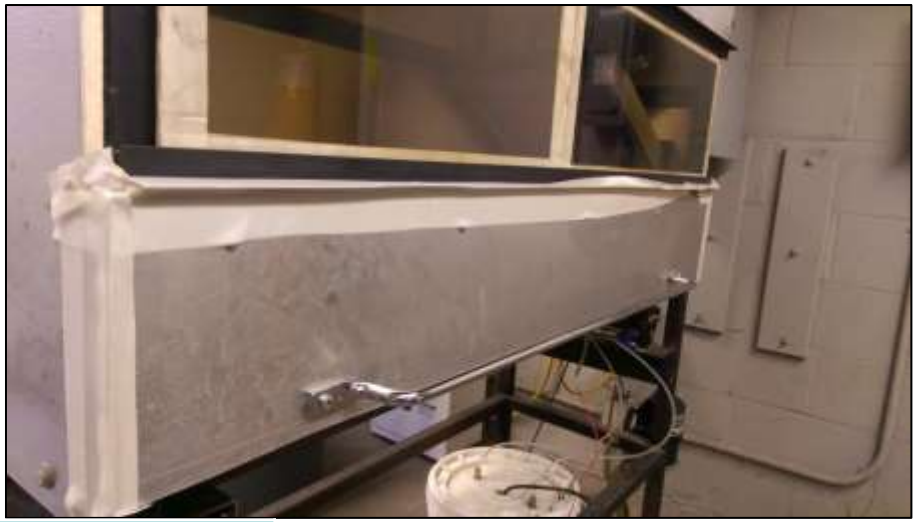


Air Flow Study

	Closed Around Drawer	Normal Around Drawer	Open w/ 2” Gap on Left
Open Area Around Drawer(in²)	2.09	123.77	146.77
Panel Set Point (°F)	1088	1098	1102
Heat Flux (BTU/ft²s)	1.501	1.497	1.498
Chamber Temperature(°F)	377	360	371
Chimney Air Velocity (FPM)	200	258	267



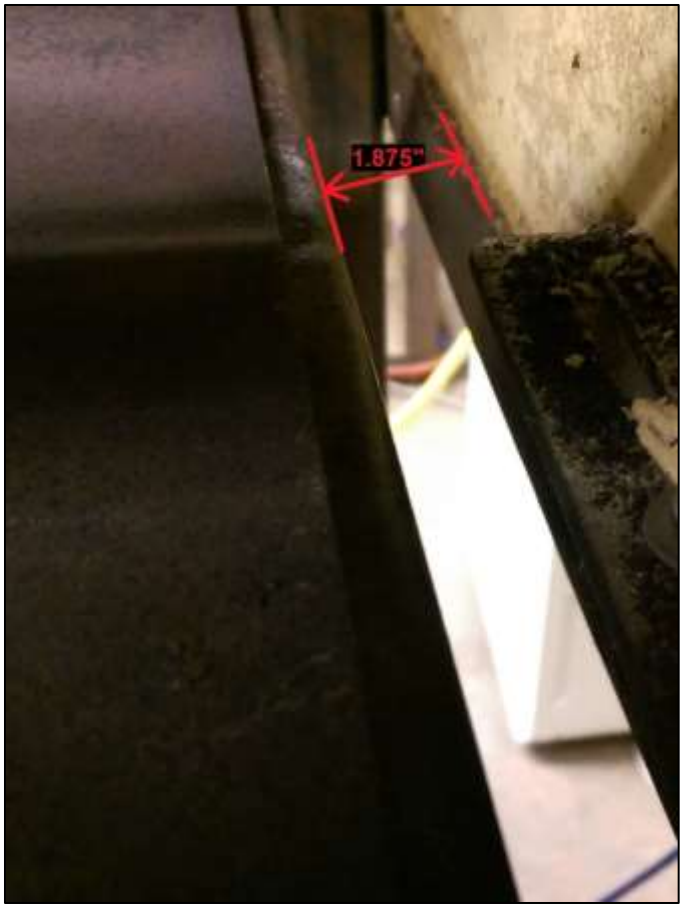
Air Flow Study



Gaps Around Drawer Closed	Normal Gap Above Drawer	Drawer Taped Shut
Open Area Around Drawer(in^2)	2.09	2.09
Panel Set Point (°F)	1088	1088
Heat Flux (BTU/ft^2s)	1.501	1.495
Chamber Temperature(°F)	377	445
Chimney Air Velocity (FPM)	200	173

Air Flow Study

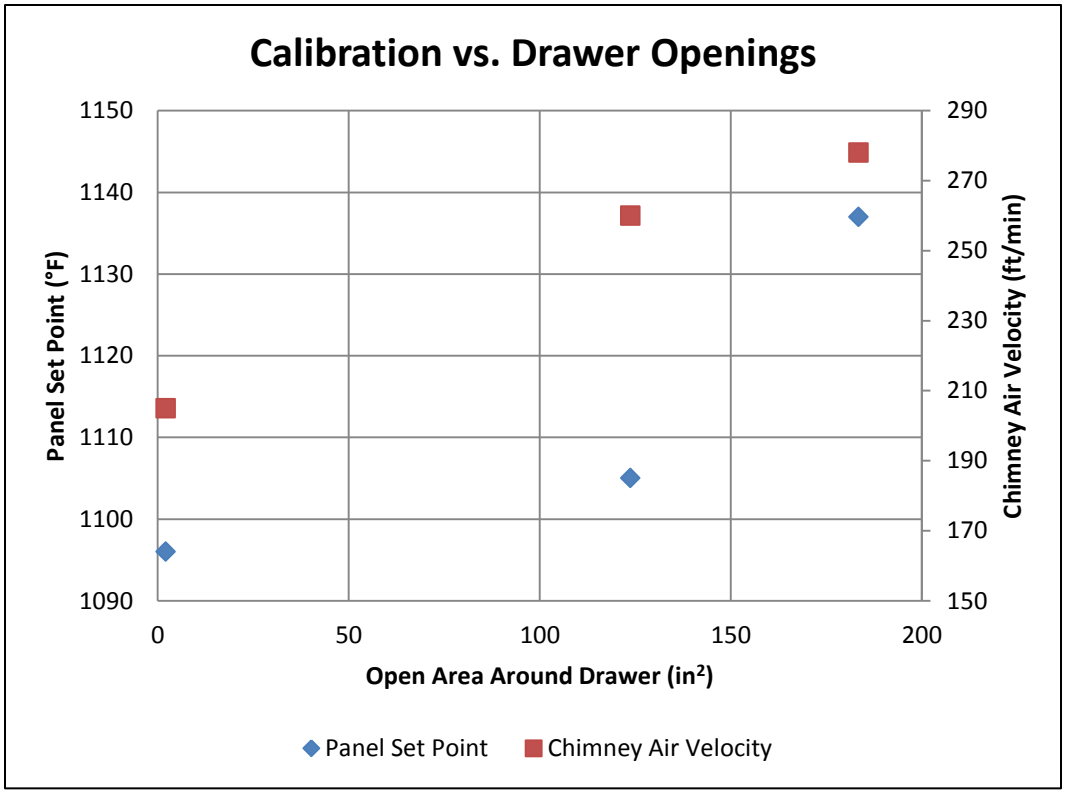
2.125” Left Gap



1.875” Right Gap

Air Flow Study

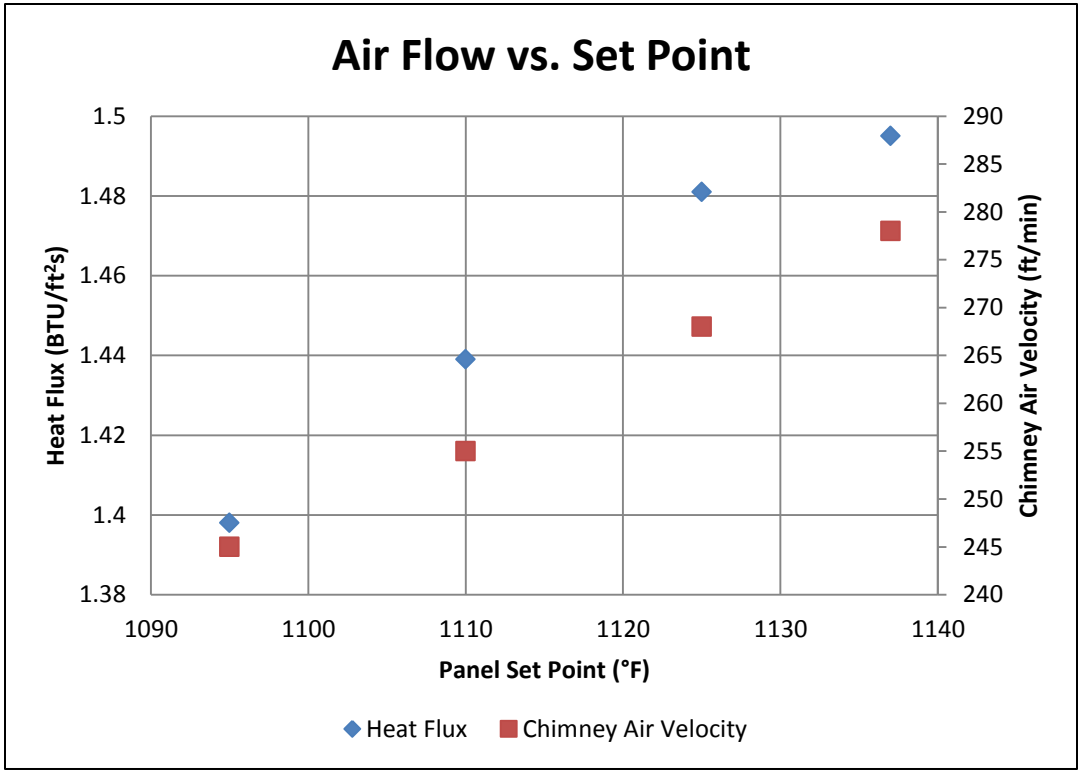
	Closed Around Drawer	Normal Around Drawer	Open w/ ~2” Gap on Each Side
Open Area Around Drawer(in^2)	2.09	123.77	183.44
Panel Set Point (°F)	1096	1105	1137
Heat Flux (BTU/ft^2s)	1.501	1.502	1.495
Chamber Temperature(°F)	381	366	425
Chimney Air Velocity (FPM)	205	260	278



Air Flow Study

- Openings Around Drawer: 2.125” left, 1.875” right, 2.25 rear

Set Point (°F)	1095	1110	1125	1137
Heat Flux (BTU/ft²s)	1.398	1.439	1.481	1.495
Thermocouple (°F)	385	395	410	425
Chimney (FPM)	245	255	268	278
Under Right Side of Drawer (FPM)	90	91	95	95
Under Left Side of Drawer (FPM)	65	60	65	65



- As the panel temperature increases, the air flow into the chamber increases causing you to need to increase the panel temperature further to compensate

Air Flow Study

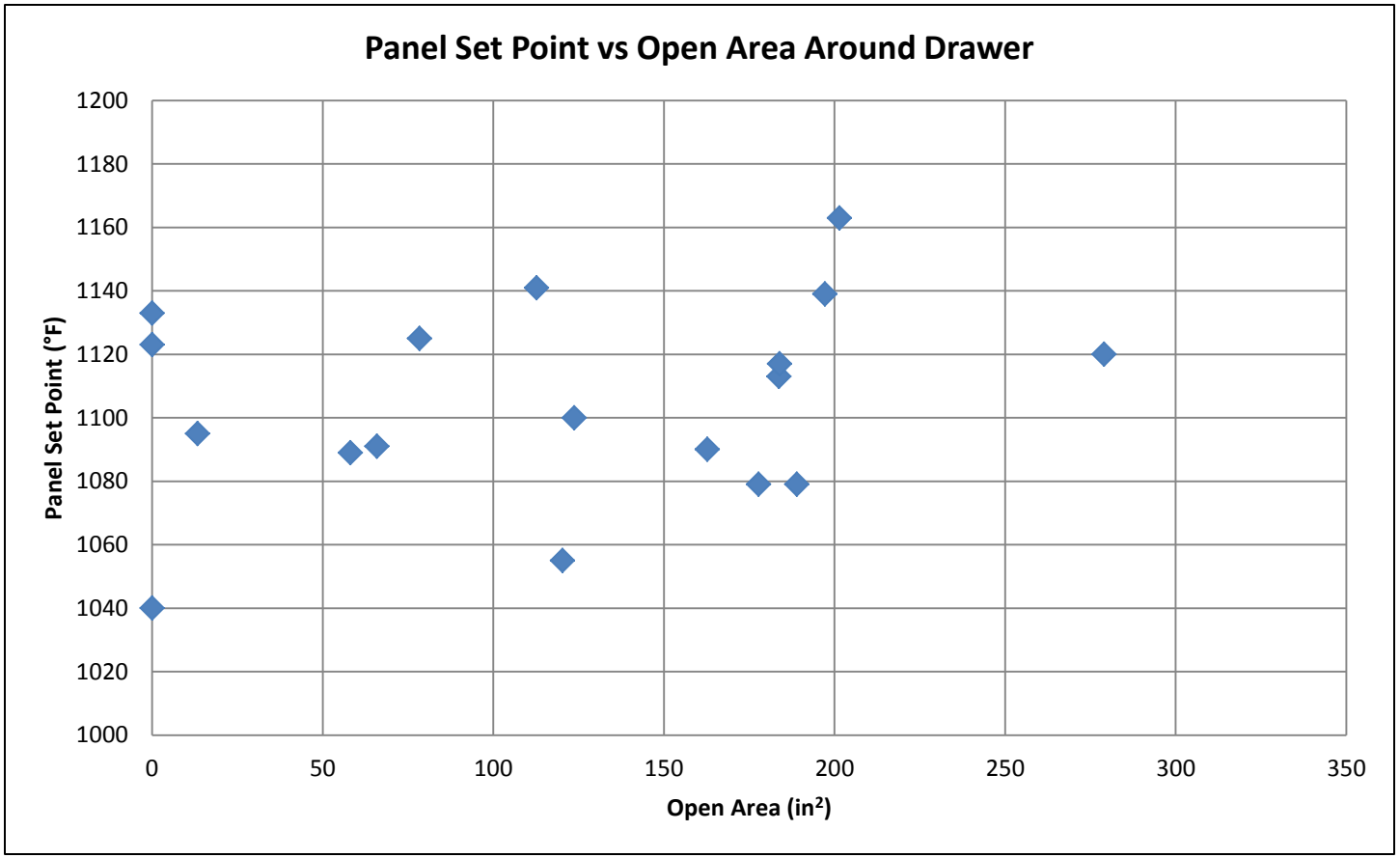
- **We tested a polyimide sample with our normal setup compared to fully open**

Normal openings around Drawer

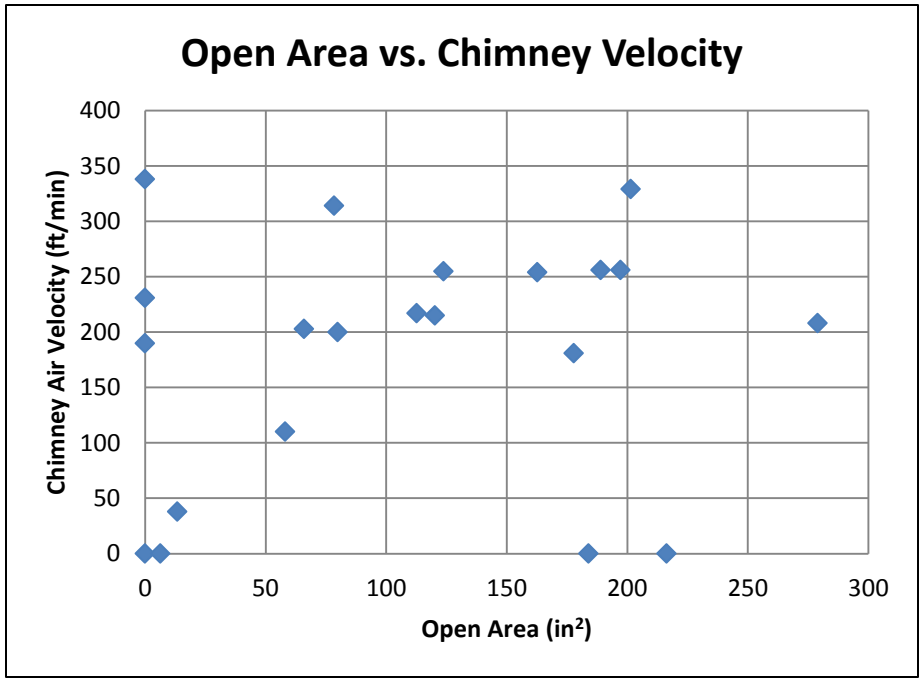
Fully open around drawer

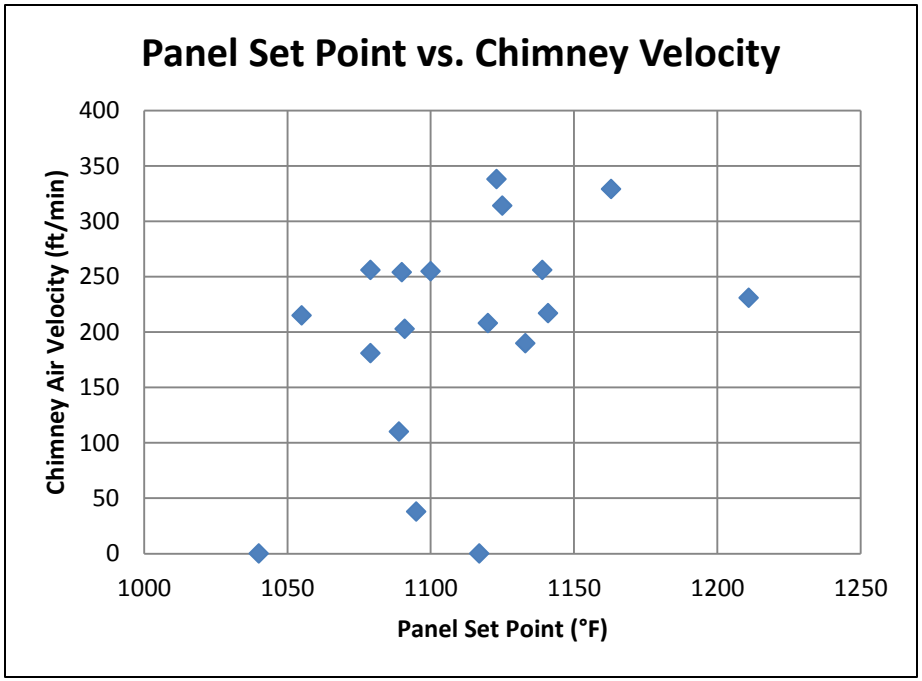
	Normal	Fully Open
Set Point (°F)	1105	1137
Panel Temp During Test (°F)	~1092	~1095

Round Robin Data

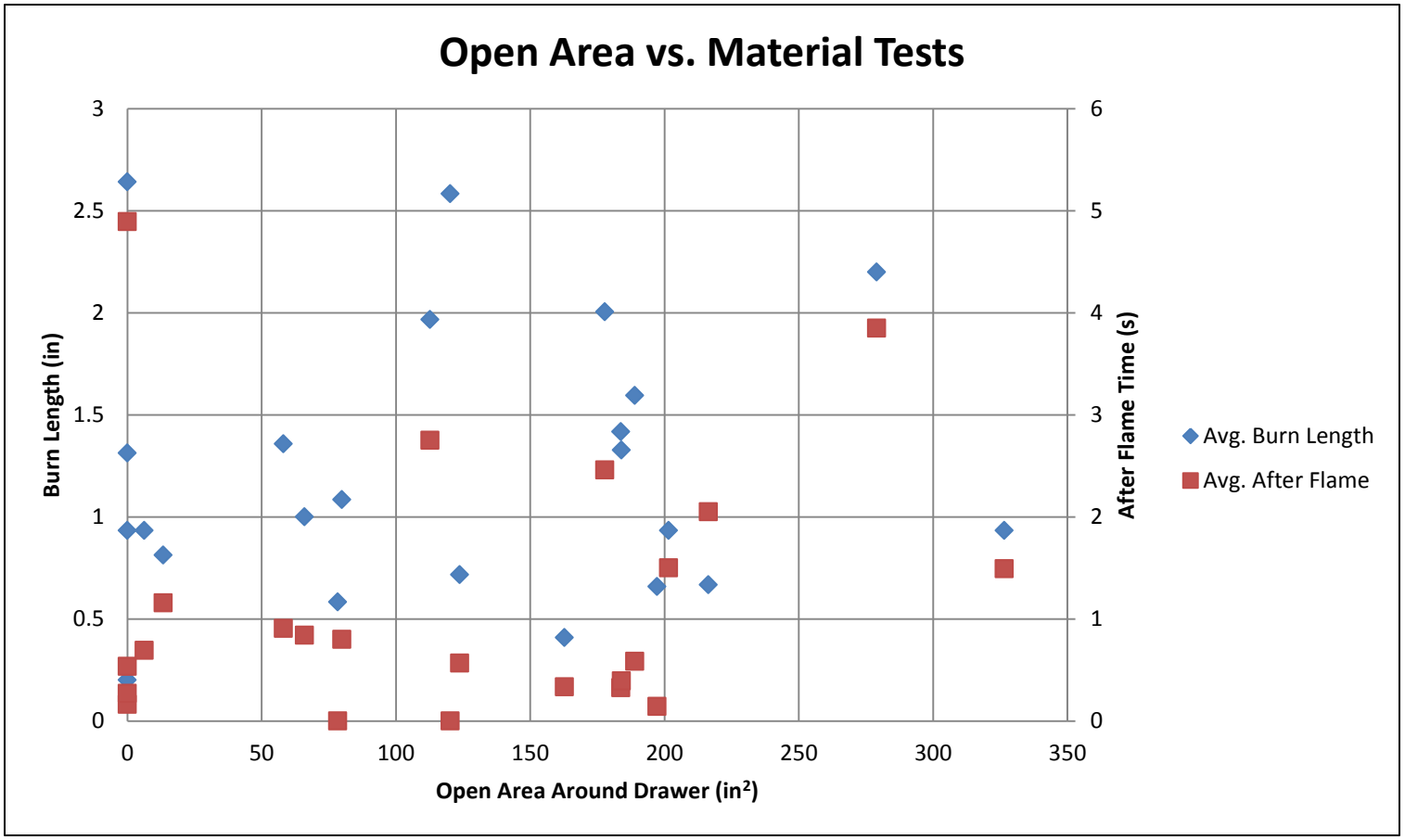


Round Robin Data





Round Robin Data



Industry Data

	Left Gap	Right Gap	Rear Gap	Front Gap
Average	1.44”	1.20”	1.44”	0.79”
Median	0.7”	0.375”	1.625”	0”

- We need to standardize these dimensions for the new handbook to get more repeatable test results between labs
- I think we should pick dimensions closer to the median than the average since the average was affected by a few outliers.

Questions?