



2013/2014 OSU Round Robin Update

Project Leaders

Yaw Agyei – BR&T Flammability
Mike Burns – FAA Tech Center

Boeing Support

Amy Lautenbach
Dan Slaton
Greg Hooker
Hank Lutz
Yonas Behboud
Chris Ballew
Lisa Fring

Special thanks - Lufthansa Technik

Tim Luebcke
Christian Siry

Agenda

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- **About Project**
 - Background
 - Purpose
- **Participants**
- **Conducting Round Robin**
 - Phase 1
 - Phase 2
 - Testing
 - Results / Analysis
- **Next Steps / Future Updates**

About Project - Background

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■ **2012 FAA Round Robin**

- General round robin conducted every 2-3 years
- 36 heat release units
- Collected machine operating parameters
 - Calibration constant
 - Manufacturer
 - Air supply
 - Gas pressure
- Units operated based on lab's normal practices

■ **March 2013 –Task Group Meeting (WA, USA)**

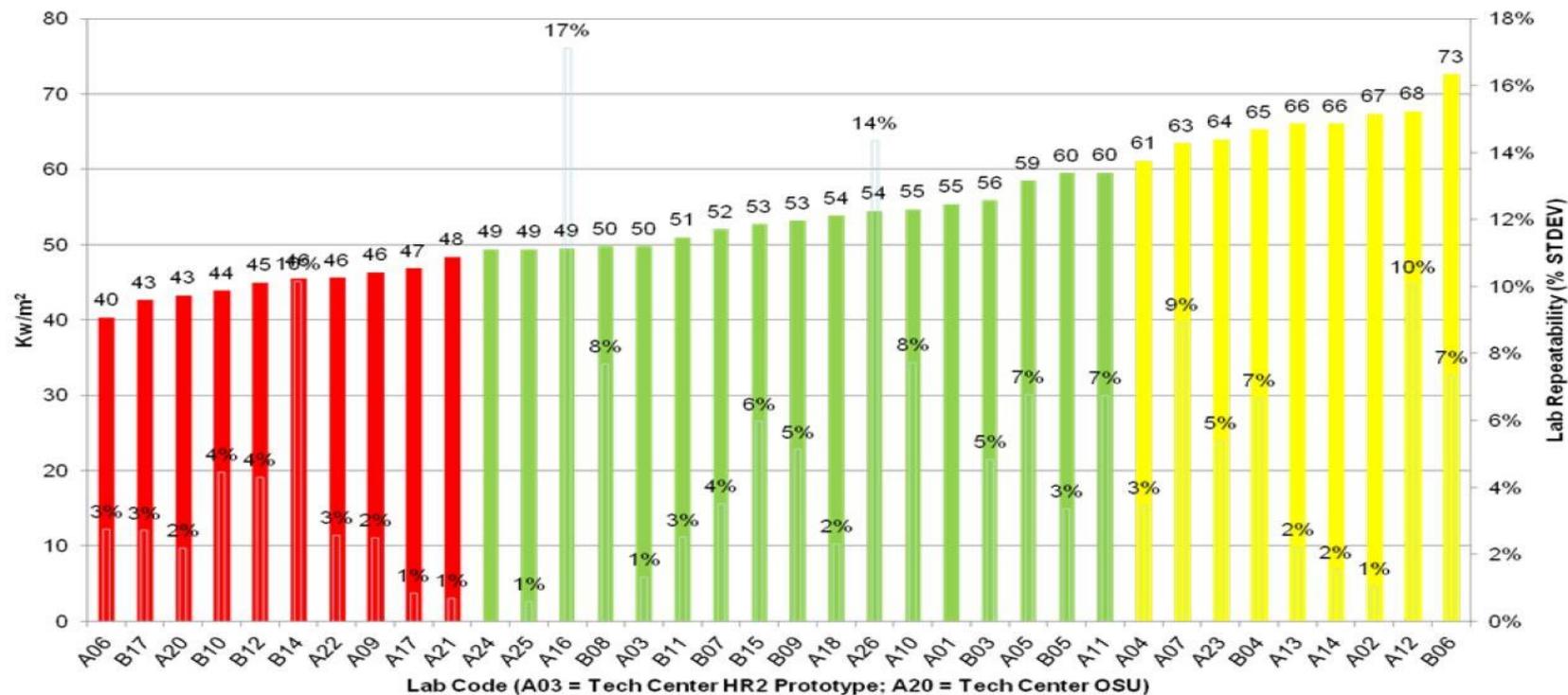
- Analysis of results presented by Boeing (Ben Grogan and Shobo Basu)

About Project - Background

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■ 2012 Round Robin Results

- Peak Heat Release Rate (honeycomb panel)
- 53 kW/m² avg, 40 - 73 kW/m² range



■ Conclusion

- Few correlation seen between independent parameters
- Identified several equipment/setup parameters that affect variability
- Not enough test data to explain variability
- Future round robins should exercise better control, test more coupons, gather more information

About Project - Purpose

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- **June 2013 – Manchester, UK**
 - Boeing proposed a more controlled round robin
 - Setup
 - Calibration
 - Testing
 - Analysis

- **Purpose** – pinpoint major sources of variability in OSU Heat Release testing

- **Objective for participants**
 - Set all units in similar conditions
 - Record all operating parameters
 - Test more samples

Participants

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- **26 participating labs**

- **31 participating units**

The word "Merci" is written in a blue, elegant cursive script.The word "Bedankt" is written in white, bold, sans-serif font on a pink rectangular background with a blue and white checkered border and a pattern of small white swirls.The word "Danken" is written in a blue, stylized font with a blue oval background.The word "Gracias" is written in a blue, stylized font with a green vine-like border.The words "THANK YOU" are written in a blue, 3D block font on a black background.

AIM Aerospace - Renton, WA, USA

AIM Composites LTD - UK

Airbus Operations - France

Boeing – Everett, WA, USA

Boeing – Seattle, WA, USA

Boeing - South Carolina, USA

CD Zodiac - CA, USA

CTA Aeronautical - Spain

Delsen Testing Laboratories - CA, USA

DLR – Germany

Evonik Roehm – Germany

FAA Tech Center – Mike Burns, NJ, USA

Govmark – NY, USA

Herb Curry – IN, USA

Isovolta AG – Austria

Isovolta Inc – OR, USA

Jamco – Singapore

Krueger Consulting LLC – WA, USA

Lantal Textiles – Switzerland

Lufthansa Technik – Germany

Rescoll – France

Schneller – Ohio, USA

Sell GmbH - Germany

Testcorp – CA, USA

Zodiac Aerospace – WA, USA

Conducting Round Robin

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- **Phase 1 – set units in similar condition**
 1. Heat flux gauge calibration
 2. Cleaning and maintenance checklist
 3. Unit pressure measurements

- **Phase 2 – Setup and Testing**
 1. Cleaning and maintenance checklist
 2. Heat flux density calibration
 3. Determination of Calibration Constant using Wet Test Meter
 4. Survey
 5. Testing

- **Raw Data Analysis by Boeing**

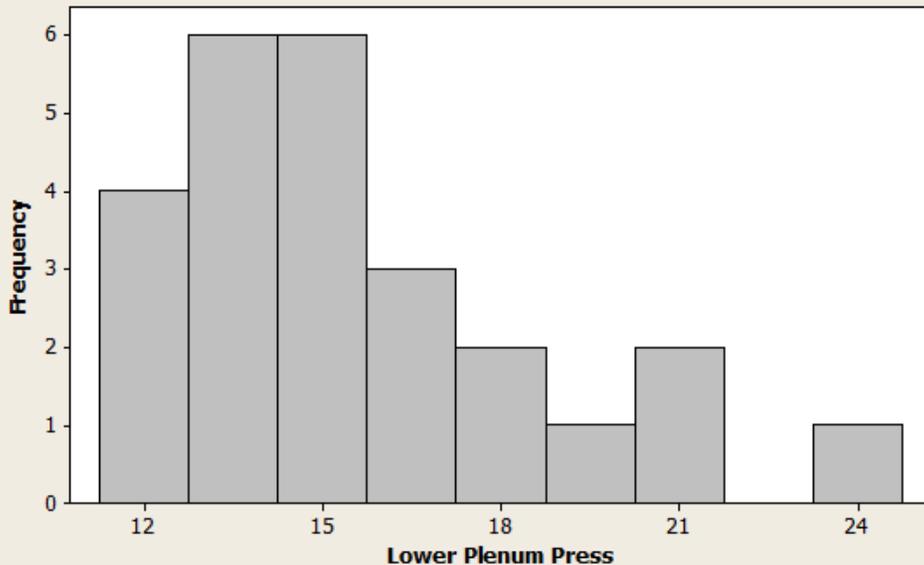
Phase 1 – Pressure Measurements

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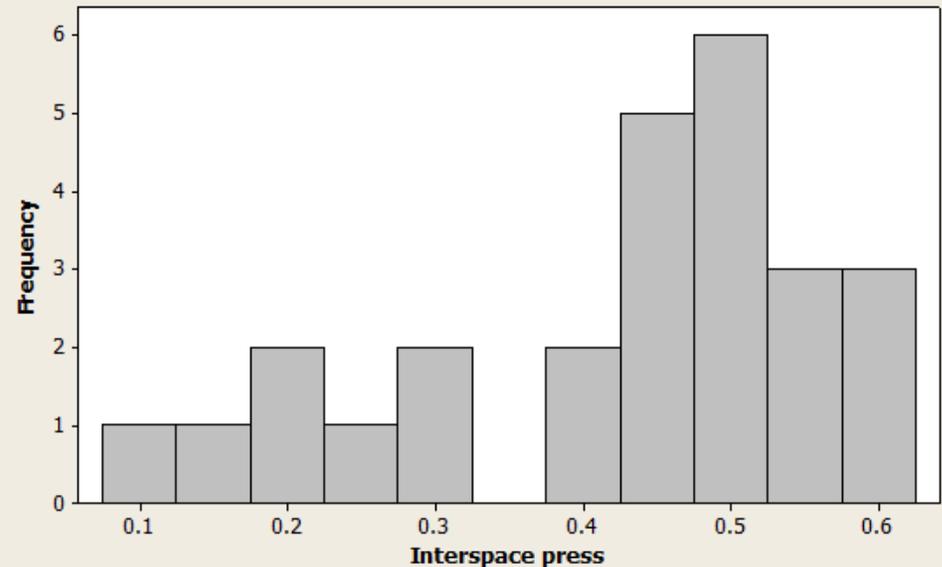
■ Specified ranges for unit pressure

- Supply Pressure (at upstream pressure port): 100 +/- 2 inH₂O
- Downstream Pressure (at downstream pressure port): 7 +/- 2 inH₂O
- Lower Plenum Pressure: 15 +/- 2 inH₂O
- Interspace Pressure: 0.5 +/- 0.15 inH₂O

Histogram of Lower Plenum Press



Histogram of Interspace press



Phase 2 – Operating Parameters

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HEAT RELEASE UNIT ROUND ROBIN UNIT PREPARATION RECORD SHEET (PLEASE INCLUDE UNITS)

Pressure Data Collection (inH ₂ O) (Phase 1)			Heat Flux Calibration (Phase 2)				
			Center (3.50 ± 0.05 W/cm ²)		Corner (3.50 ± 0.05 W/cm ²)		Thermopile glo-bars must be on (mv)
Measurement	Run	Reading	Run	Heat Flux	Run	Heat Flux	
Upstream Pressure			1		Top Right		NO Flames
Downstream Pressure			2		Bottom Right		Lower Pilot Only
Interspace Pressure	1		3		Bottom Left		Lower AND Upper Pilot
	2		Average		Top Left		
	3		Comments:				
	4						
	Average						
Lower Plenum Pressure	1						
	2						
	Average						

Wet Test Meter Calibration (Methane Gas) (Phase 2)

Conditions		Calibration Data				
Measurement	Reading	Set Gas Flow (L/min)	Actual Gas Flow (L/min)	Thermopile (mv)	Average Calibration Factor (k _n) (kW/m ² /mv)	% Standard Deviation
Ambient Temperature		1				
Barometric Pressure		4				
WTM Water Temperature		1				
Water Vapor Pressure		6				
Comments:		1				
		8				
		1				
		6				
		1				
		4				

Phase 2 - Testing

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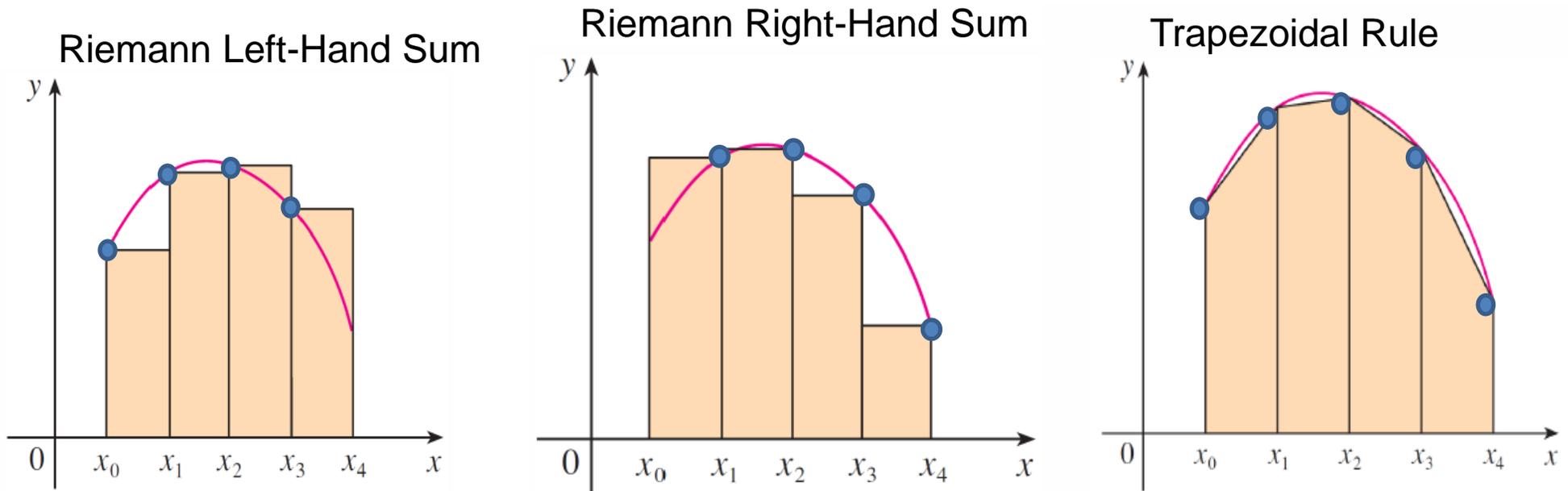
■ Test Runs

1. Baseline – noise in system
2. Honeycomb panel with decorative – representative of aircraft interiors (10)
3. 4 Ply pre-preq laminate – phenolic resin pre-impregnated glass fabric (10)
4. Aluminum with tape – standardized coupons from Lufthansa Technik (5)

Raw Data Analysis

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- **Send raw data files (.csv, .tst, .xlsx)**
 - Thermopile (mV) readings and calibration constant or HRR values
 - Riemann left hand sum method of integration for 2-min total



Next Steps / Future Updates

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- **Still time to join in the fun...**
- **Phase 1 benefits**
 - More unit leak awareness
- **Participants complete Phase 2**
 - 9/26 completed so far
- **Analyze data**
 - Assistance from experts at Boeing Math Group
- **Report findings at Summer conference**
- **OSU Task Group Meeting today**
 - Share phase 1 and 2 descriptive analysis
 - Participants able to compare units to others
 - Ideas on more detailed analysis
 - Answer questions