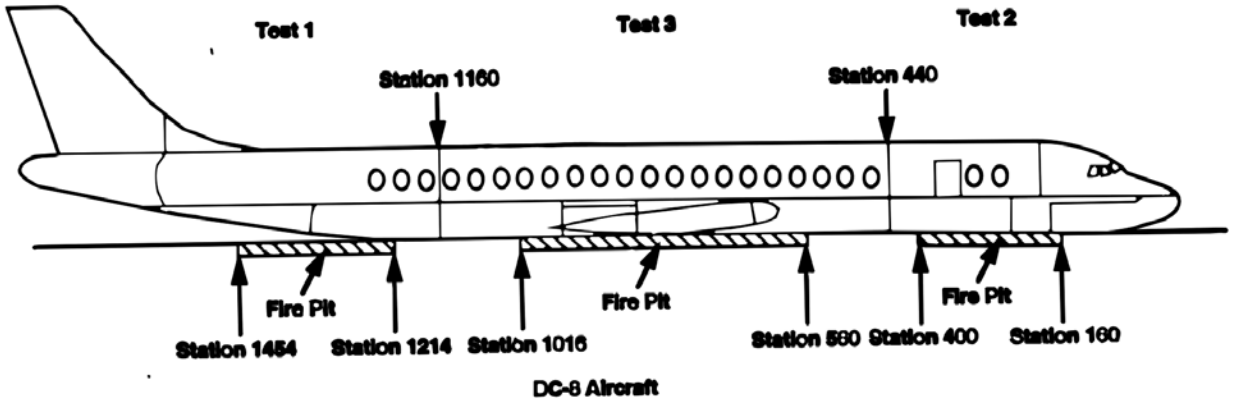
Development of a Burnthrough Test Standard For Thermal Acoustic Insulation

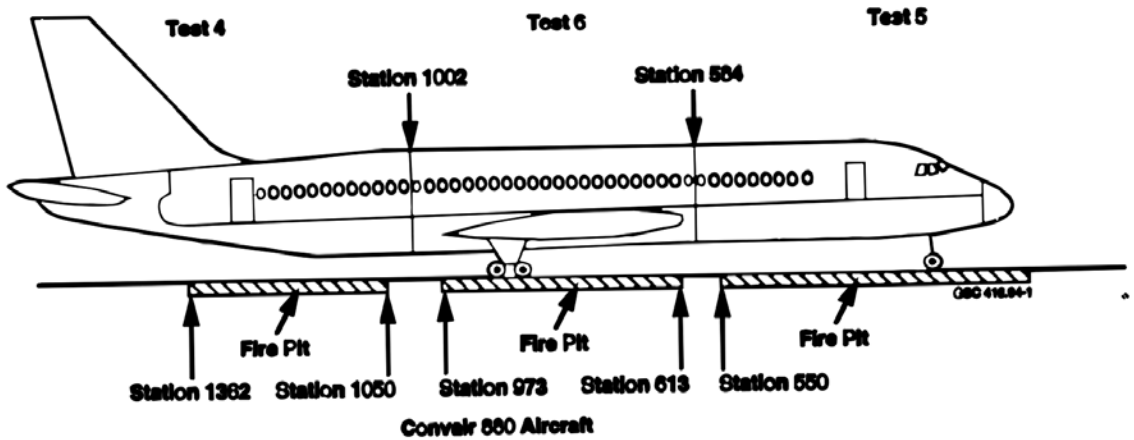
Tim Marker

FAA Technical Center

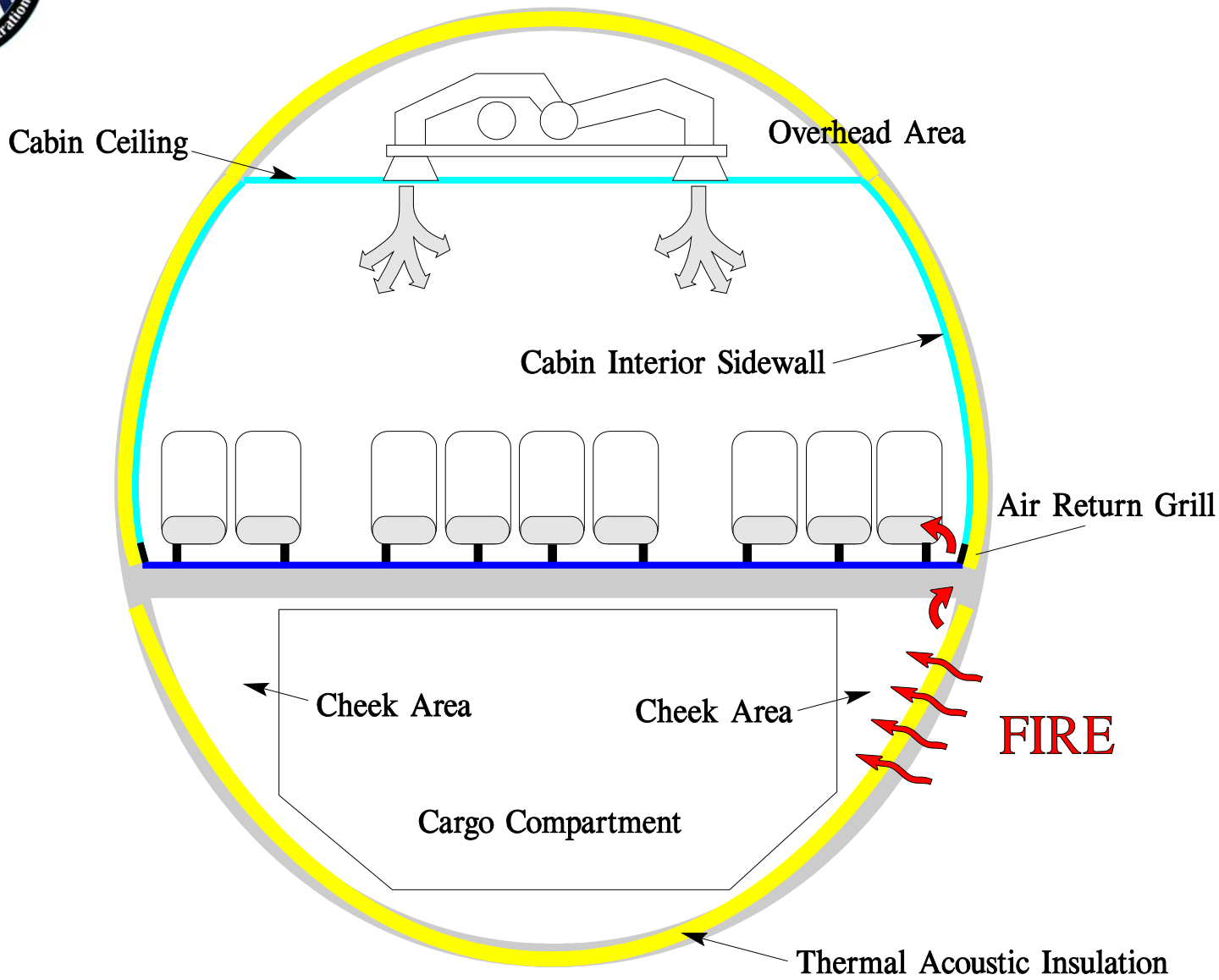
Manchester 737 Accident, 1985

Full-Scale Testing of Surplus Aircraft

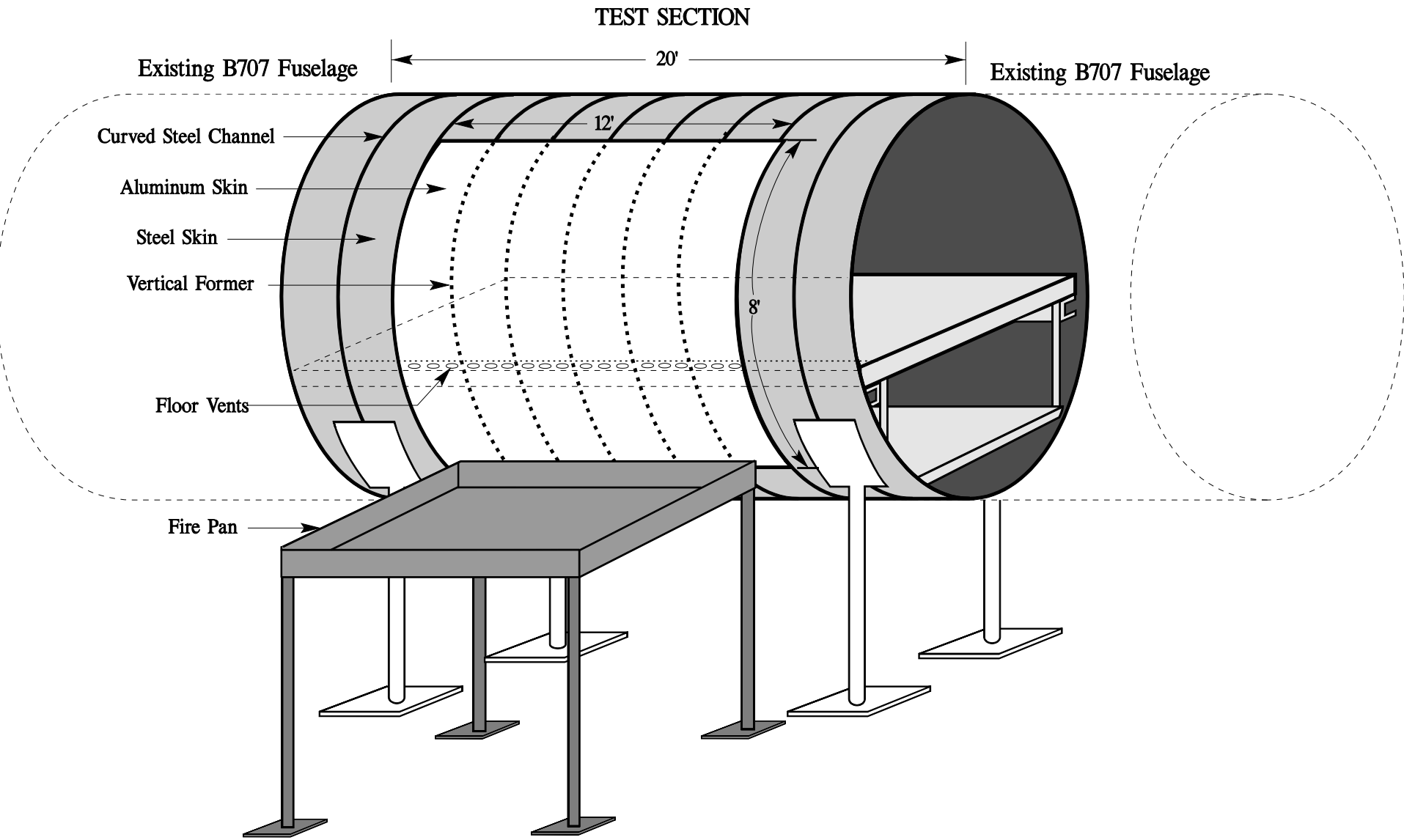




Burnthrough Entry Paths

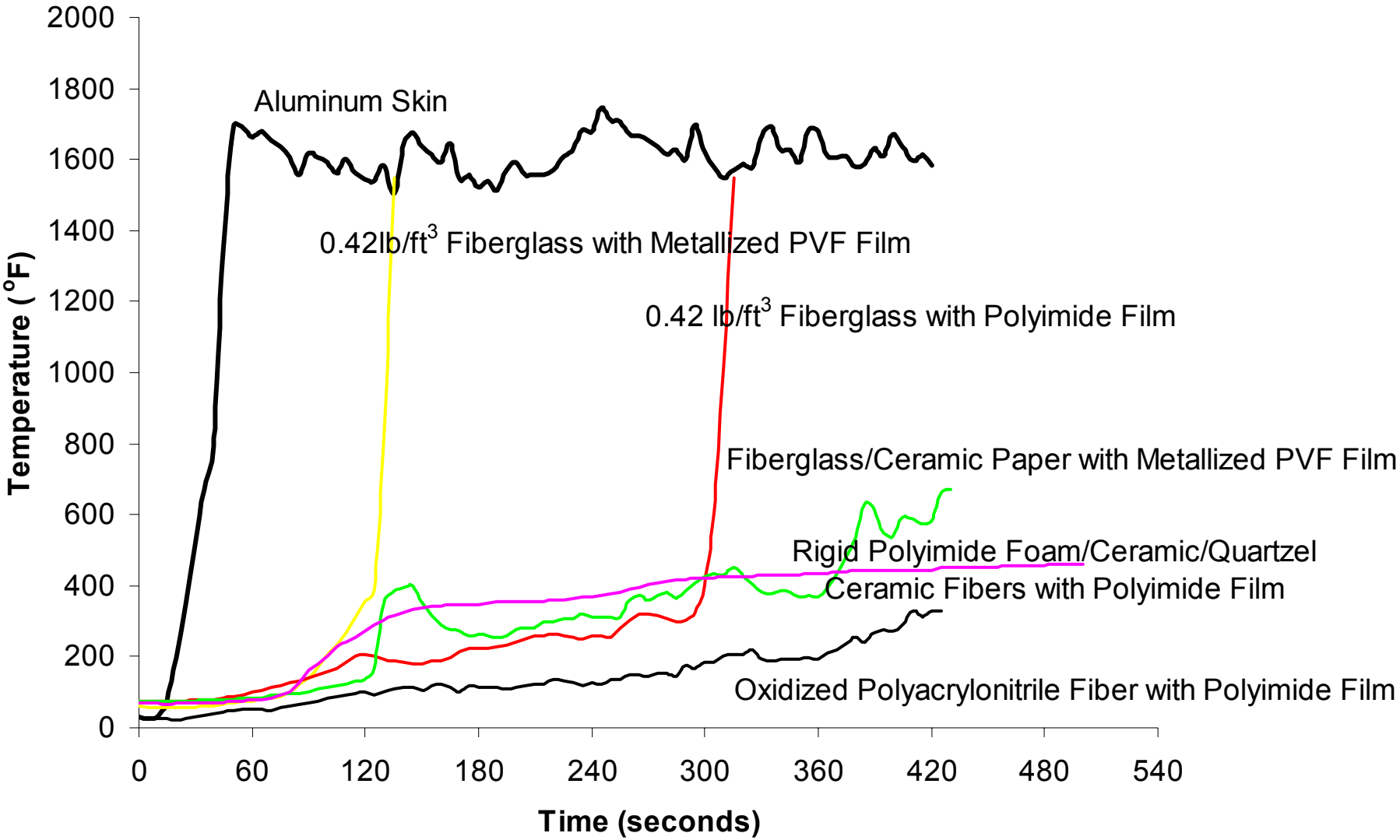


Full-Scale Burnthrough Test Rig



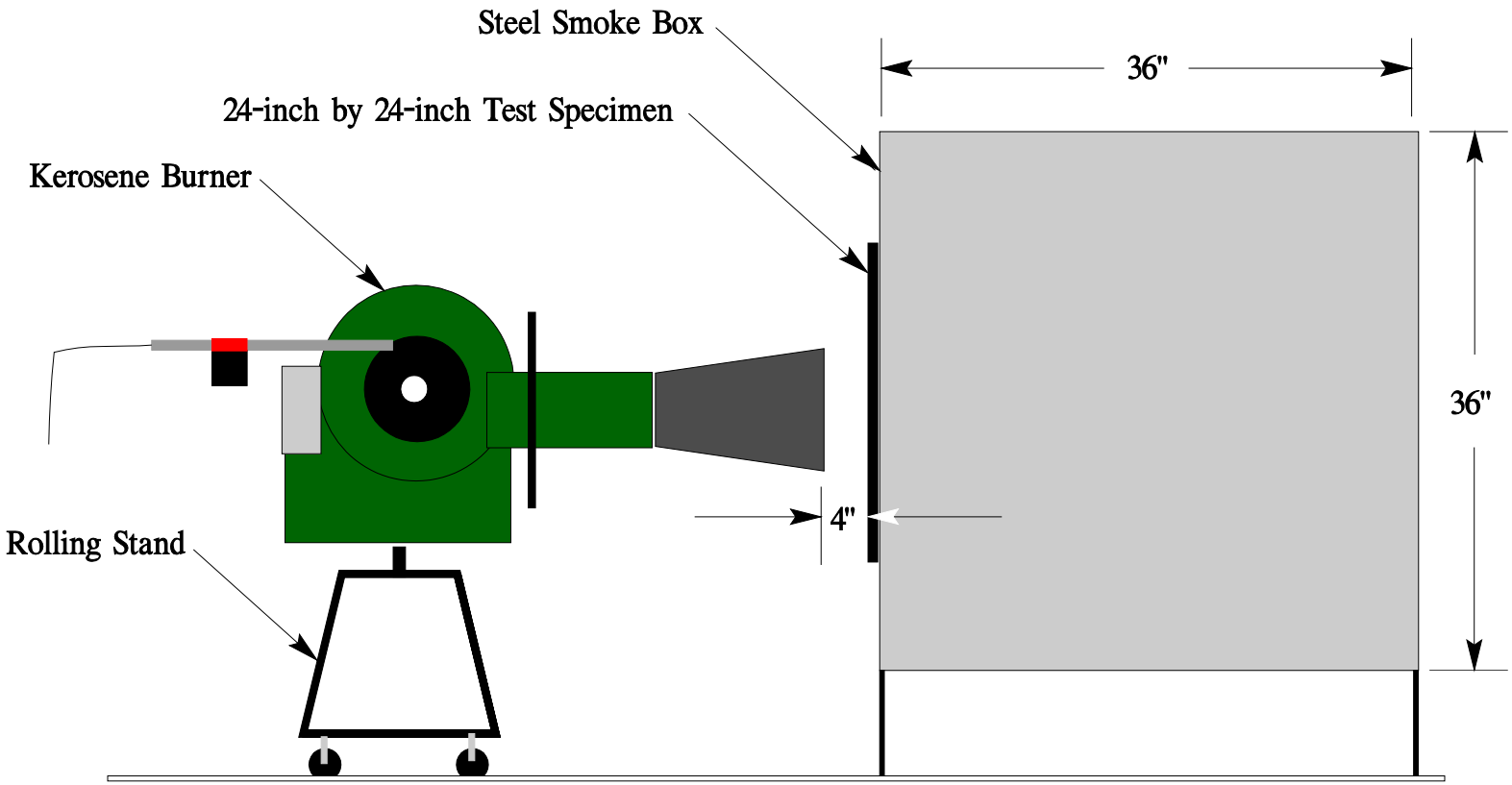
Full-Scale Testing at FAA Tech Center

Full-Scale Test Results Using Various Materials

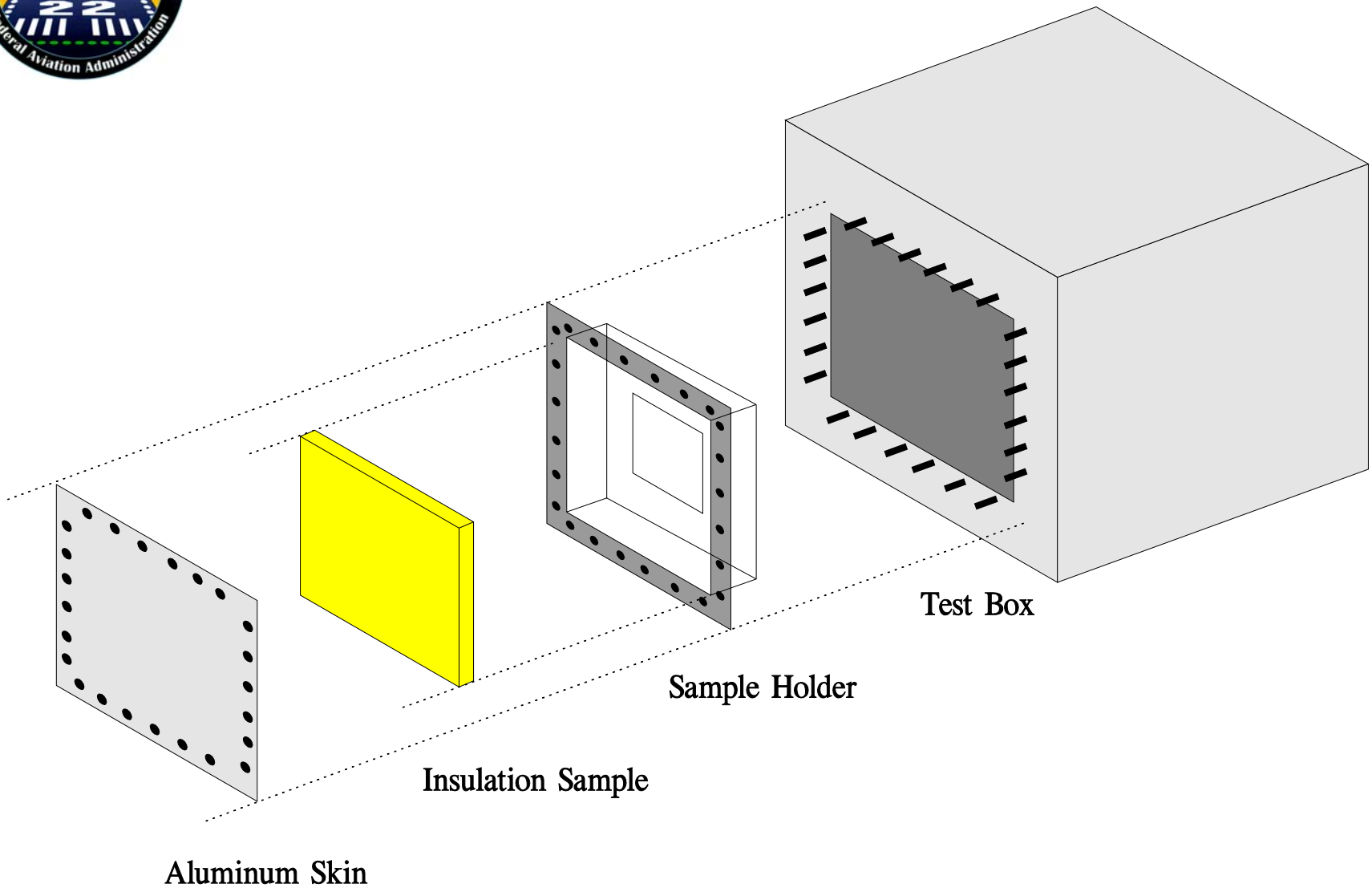


Laboratory Scale Test Development

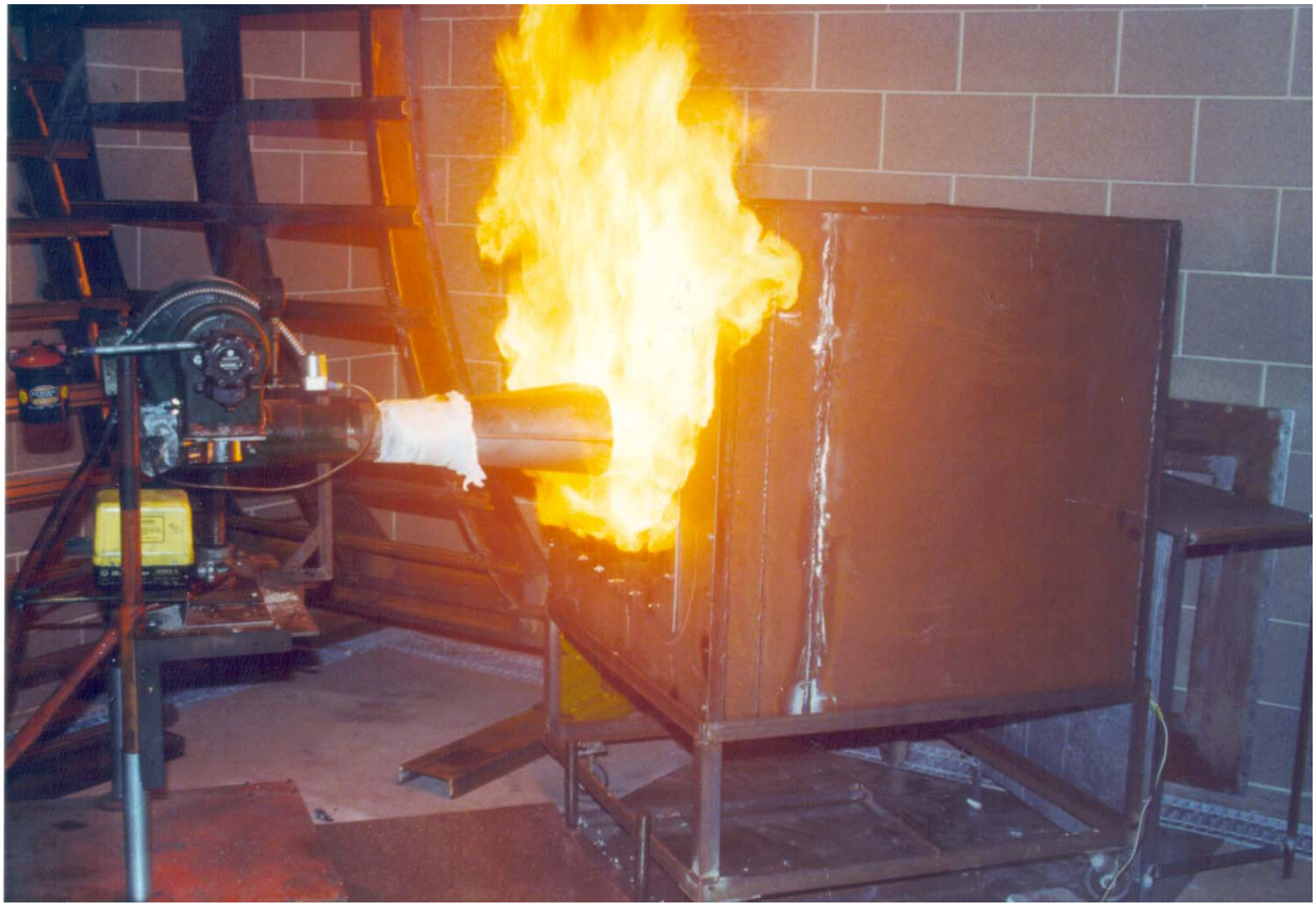
Initial Lab-Scale Burnthrough Test Apparatus



Initial Lab-Scale Burnthrough Test Apparatus

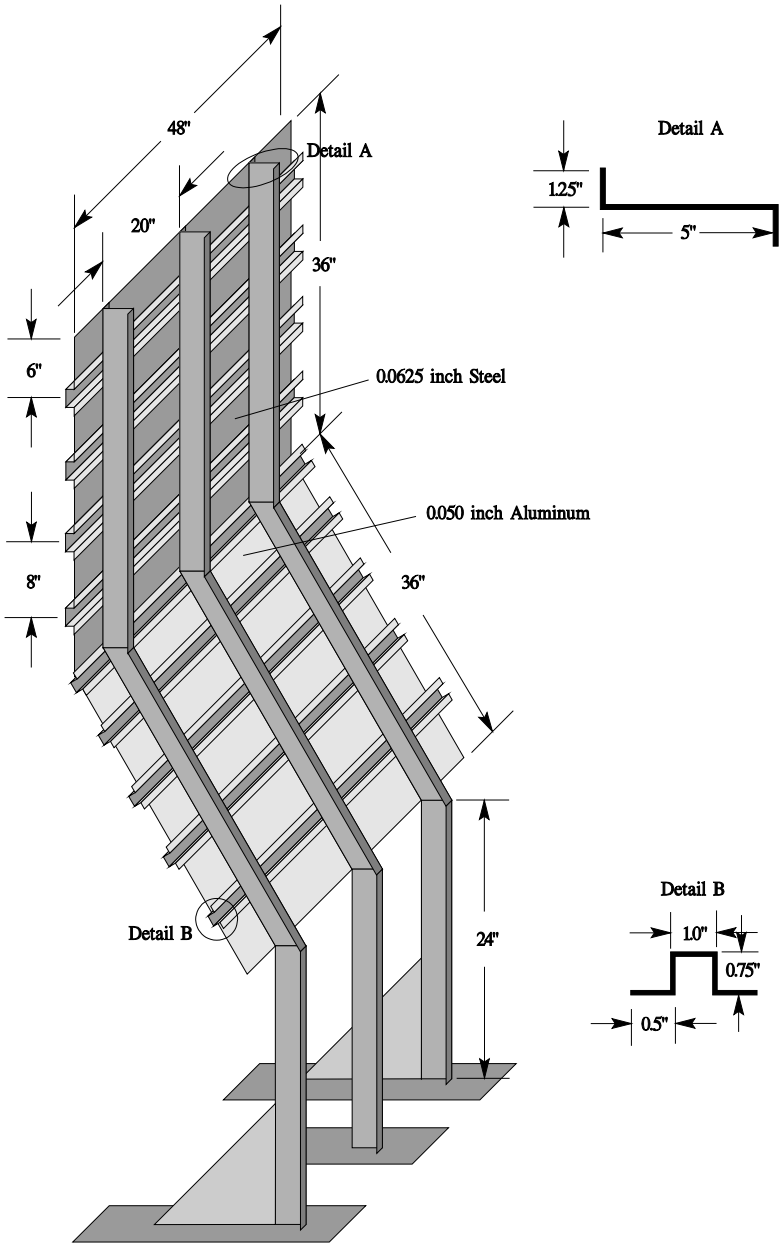


Initial Burnthrough Testing

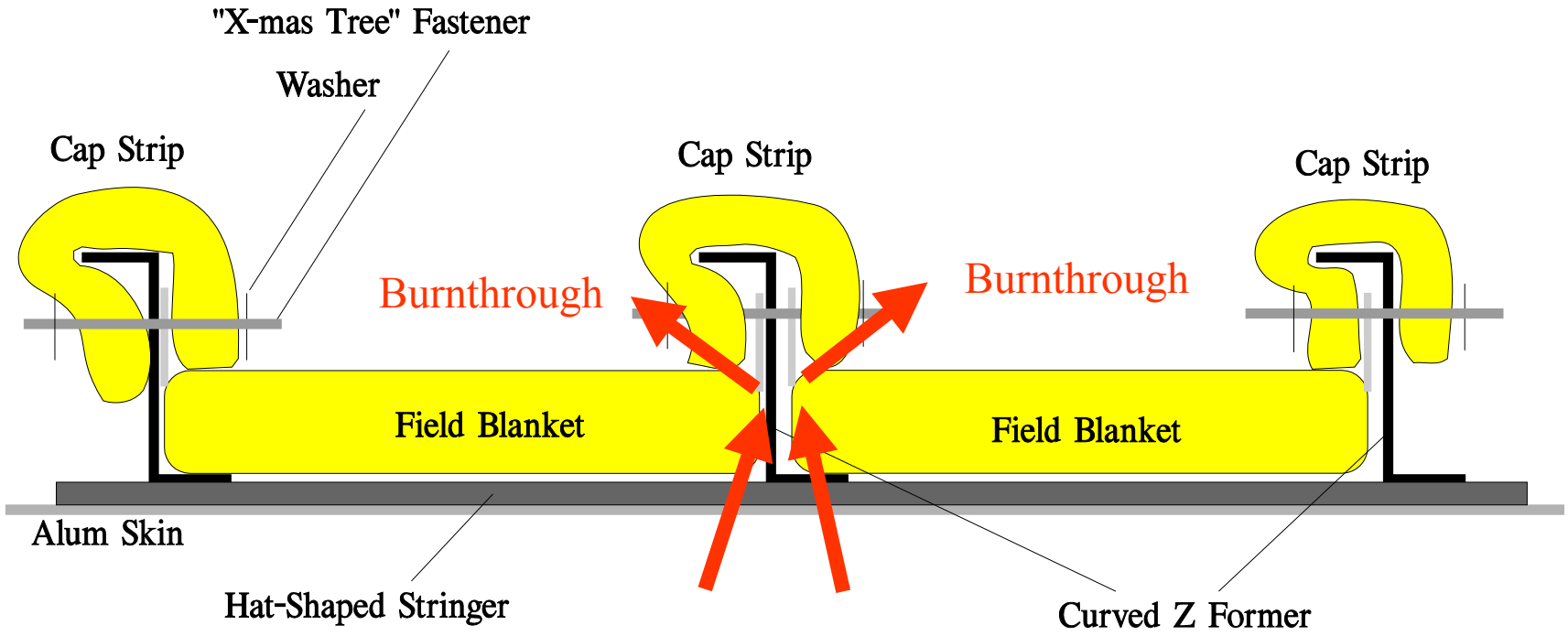


Second Generation Curved Test Frame

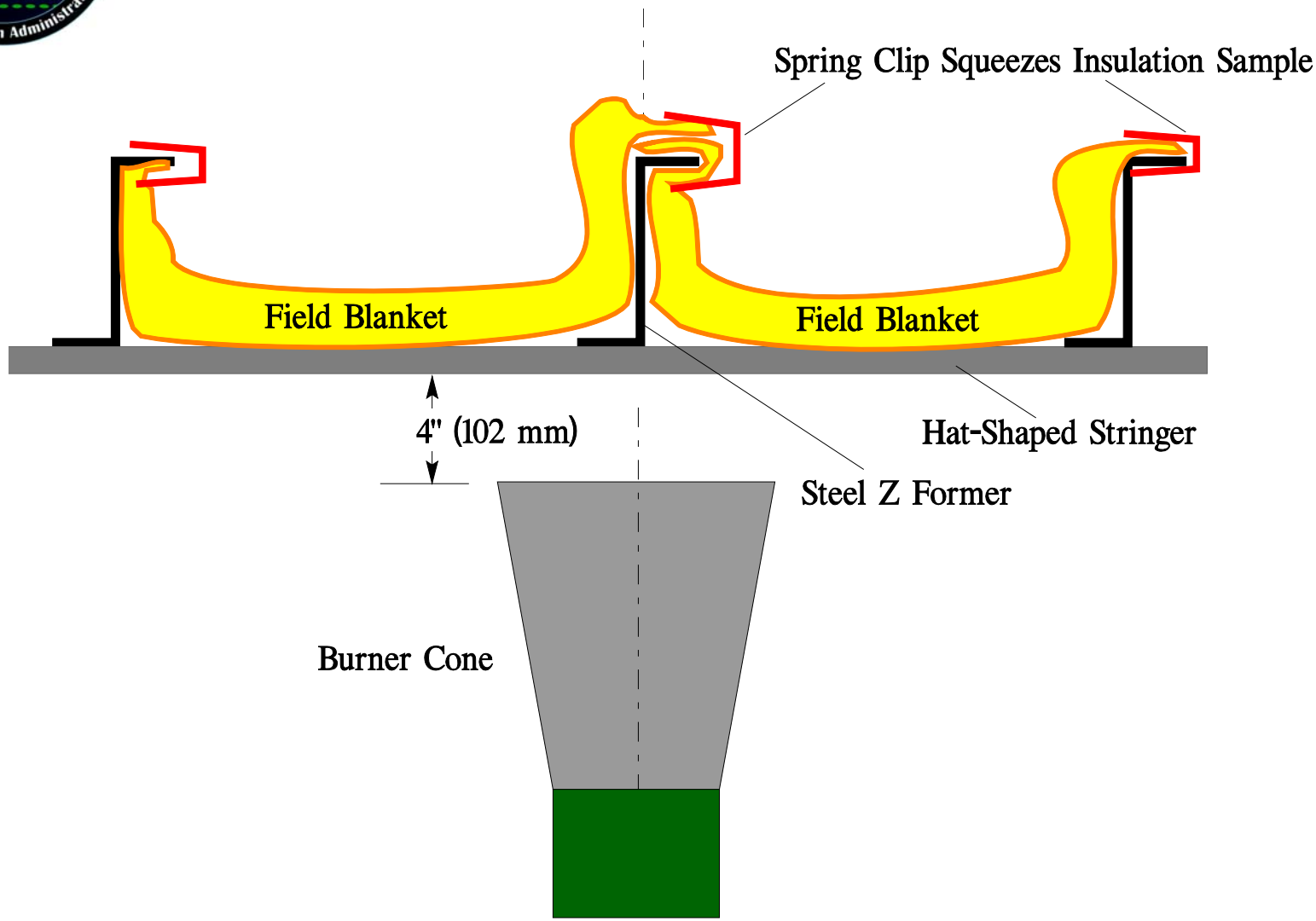
Third Generation Frame with Aluminum Skin



Initial Blanket Installation Method



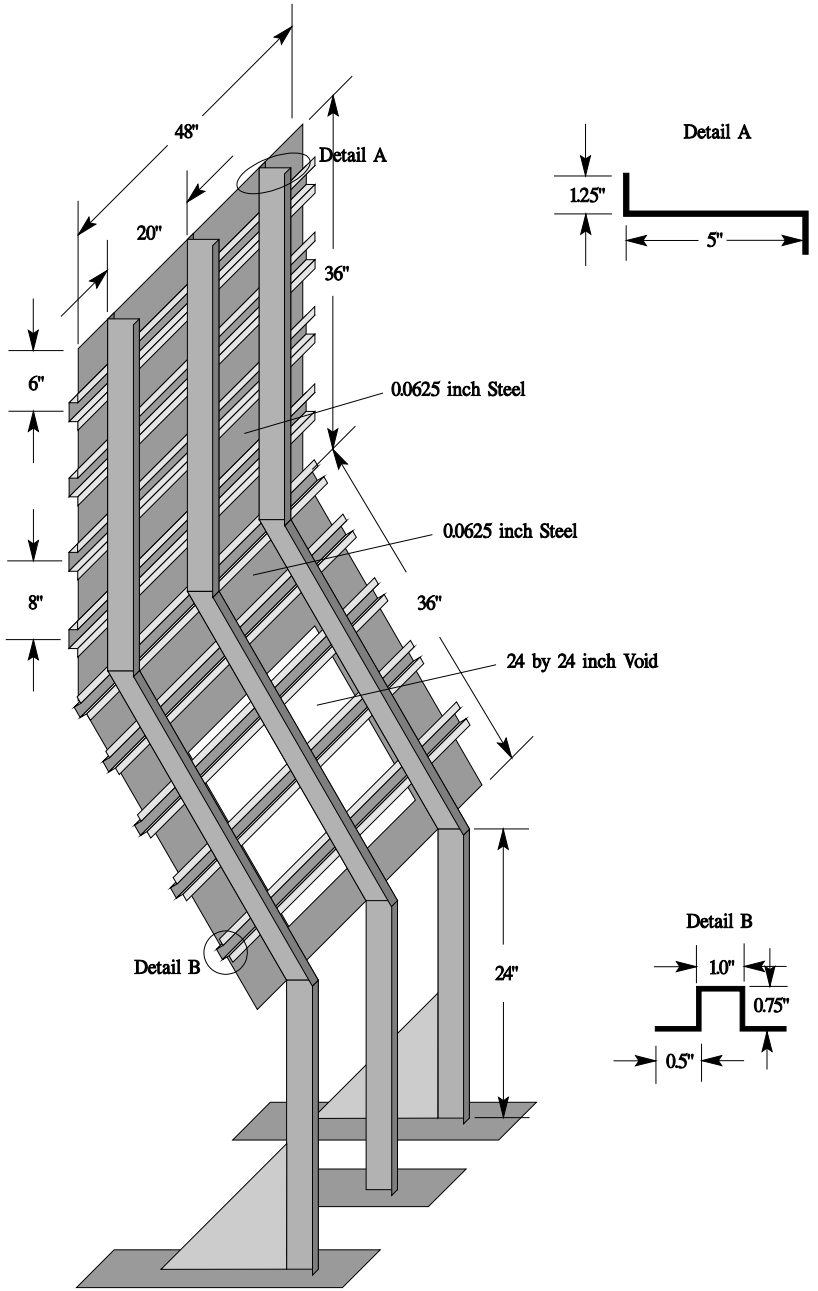
Overlapped Installation Technique



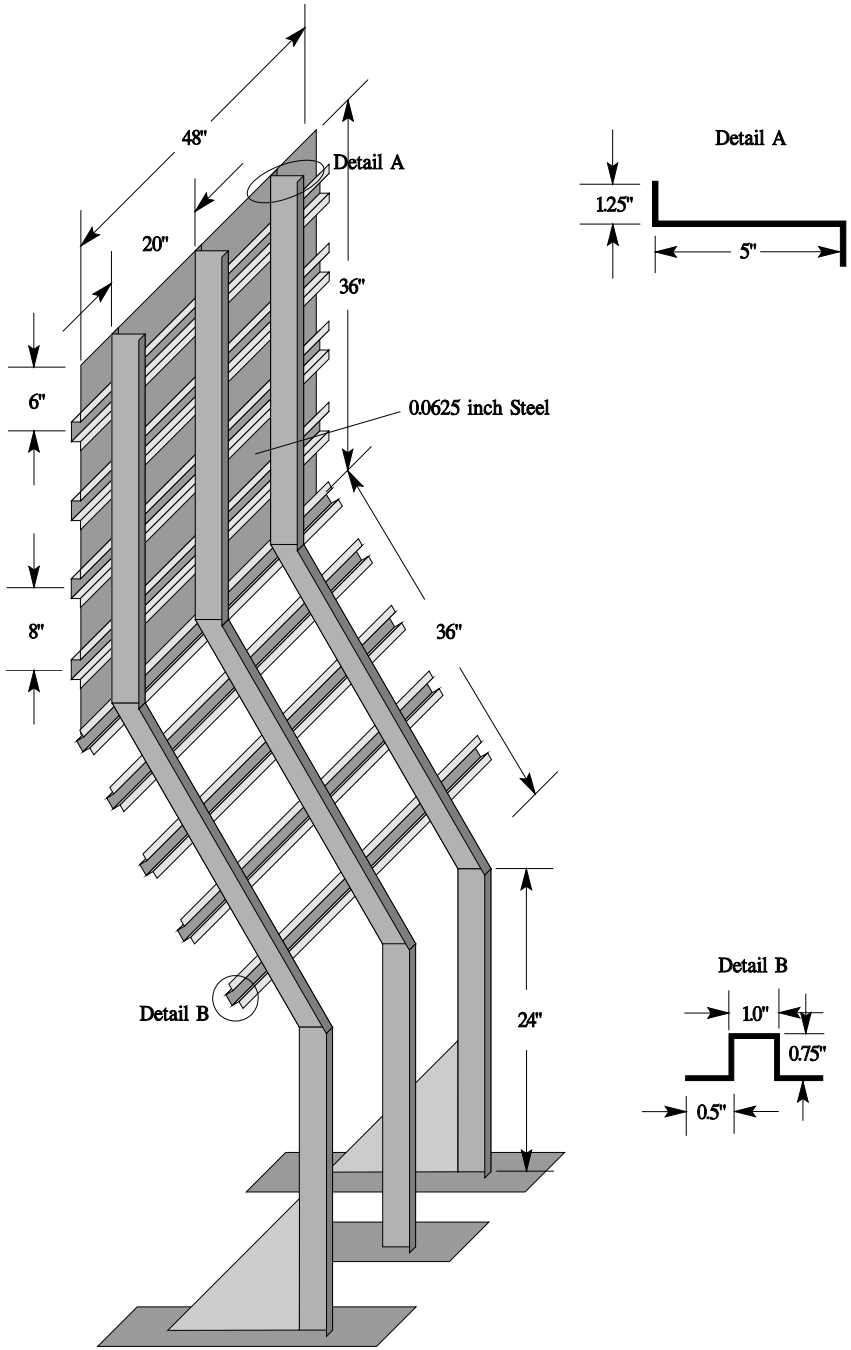
Overlapped Insulation Attachment

Third Generation Test Frame

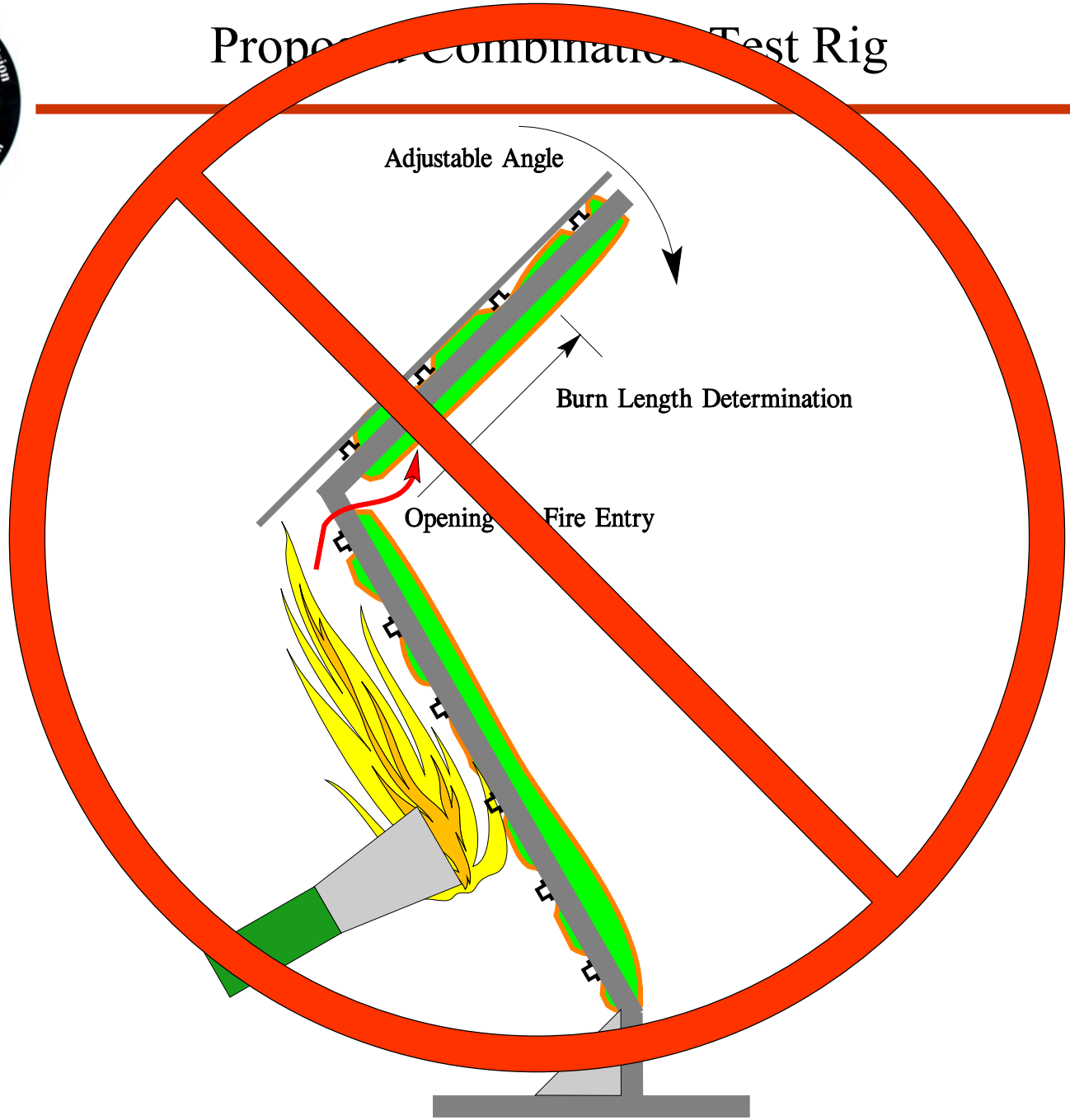
Third Generation Frame With 24- by 24-inch Void



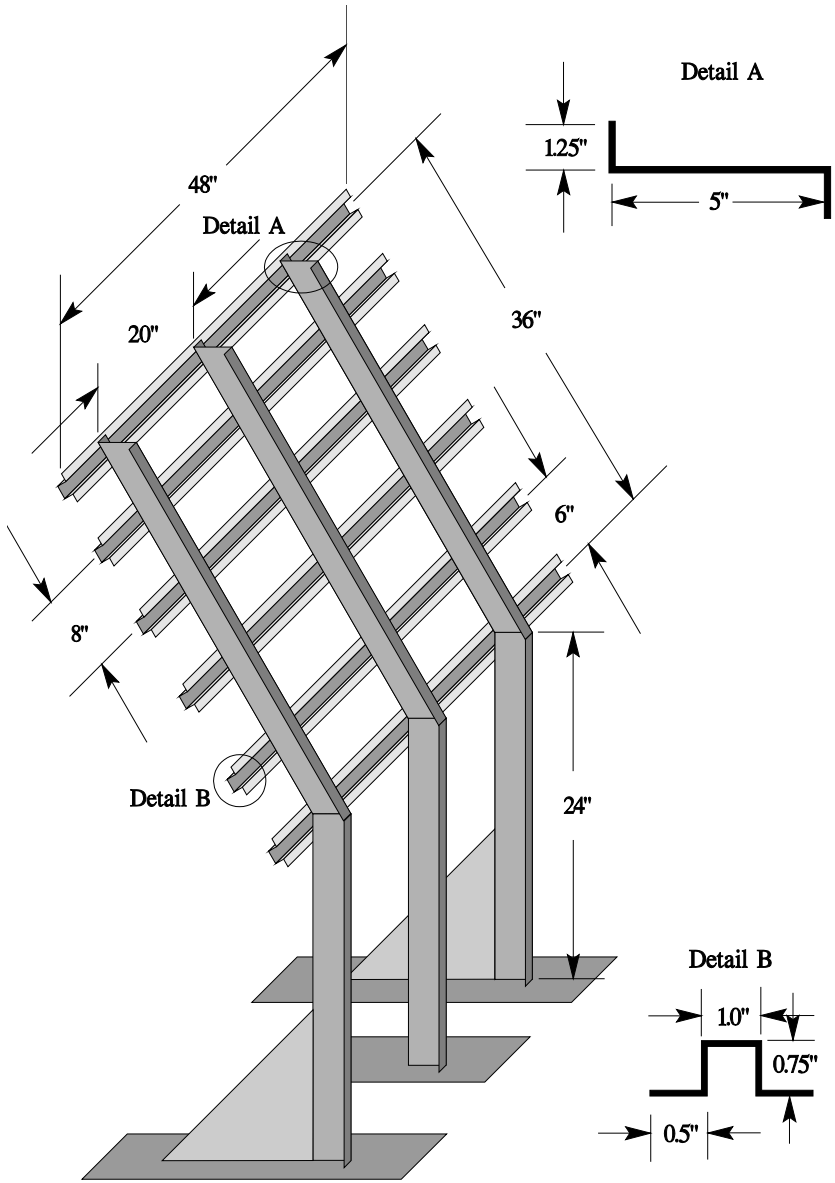
Third Generation Frame Without Lower Skin



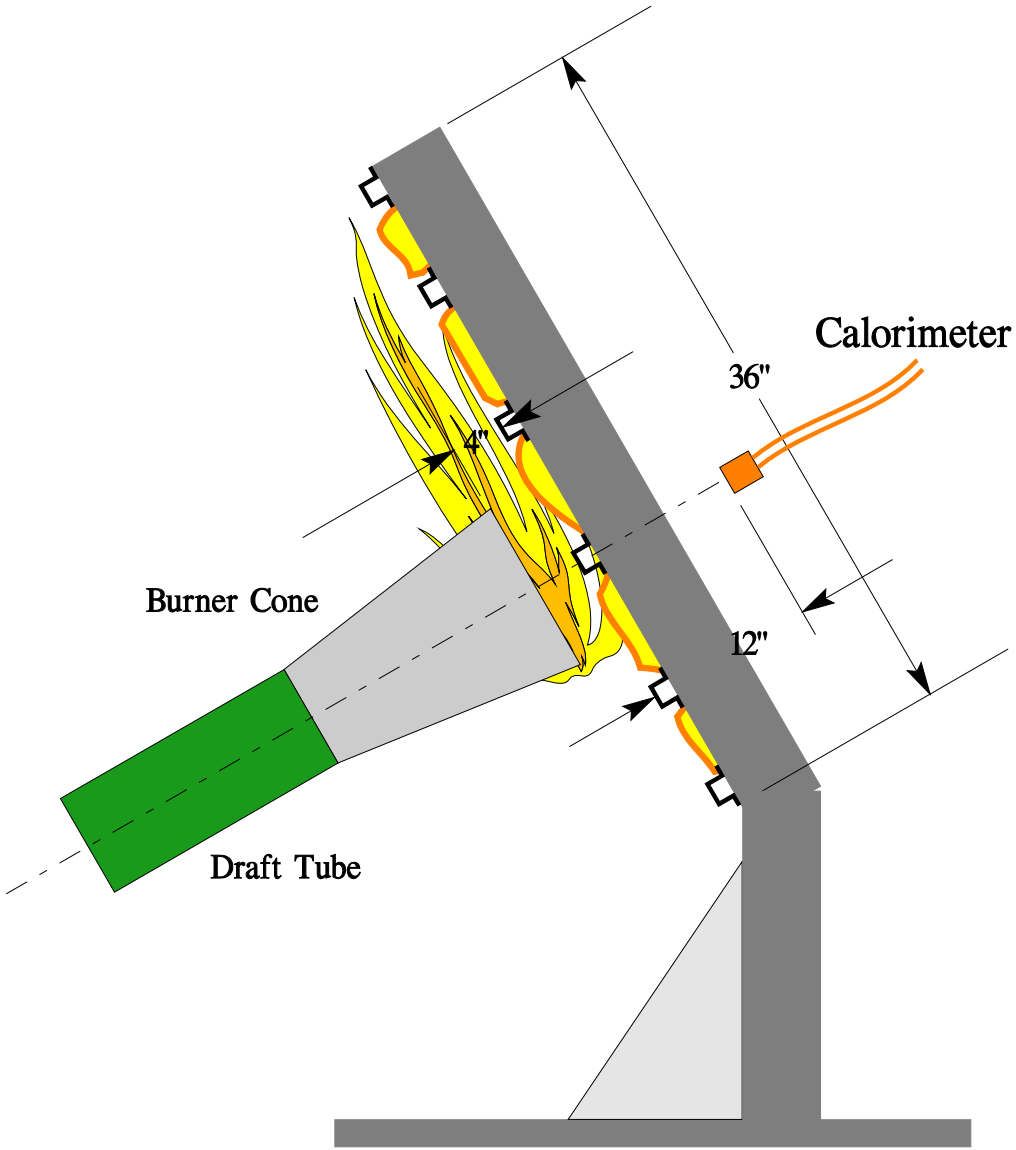
Propo[illegible] Combinati[illegible] Test Rig



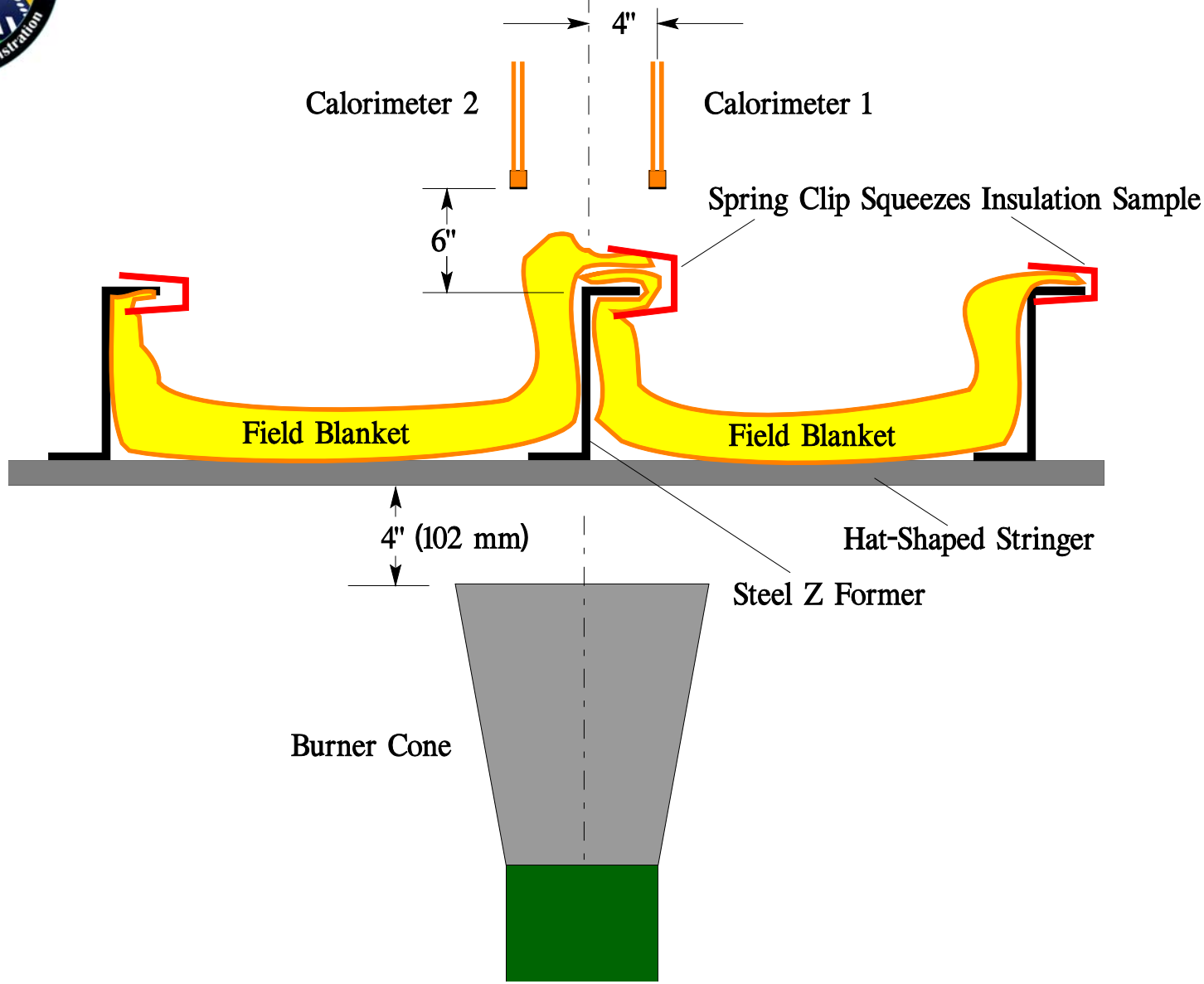
Finalized Test Frame



Heat Flux Measurement on Backface of Samples



Heat Flux Measurement on Backface of Samples



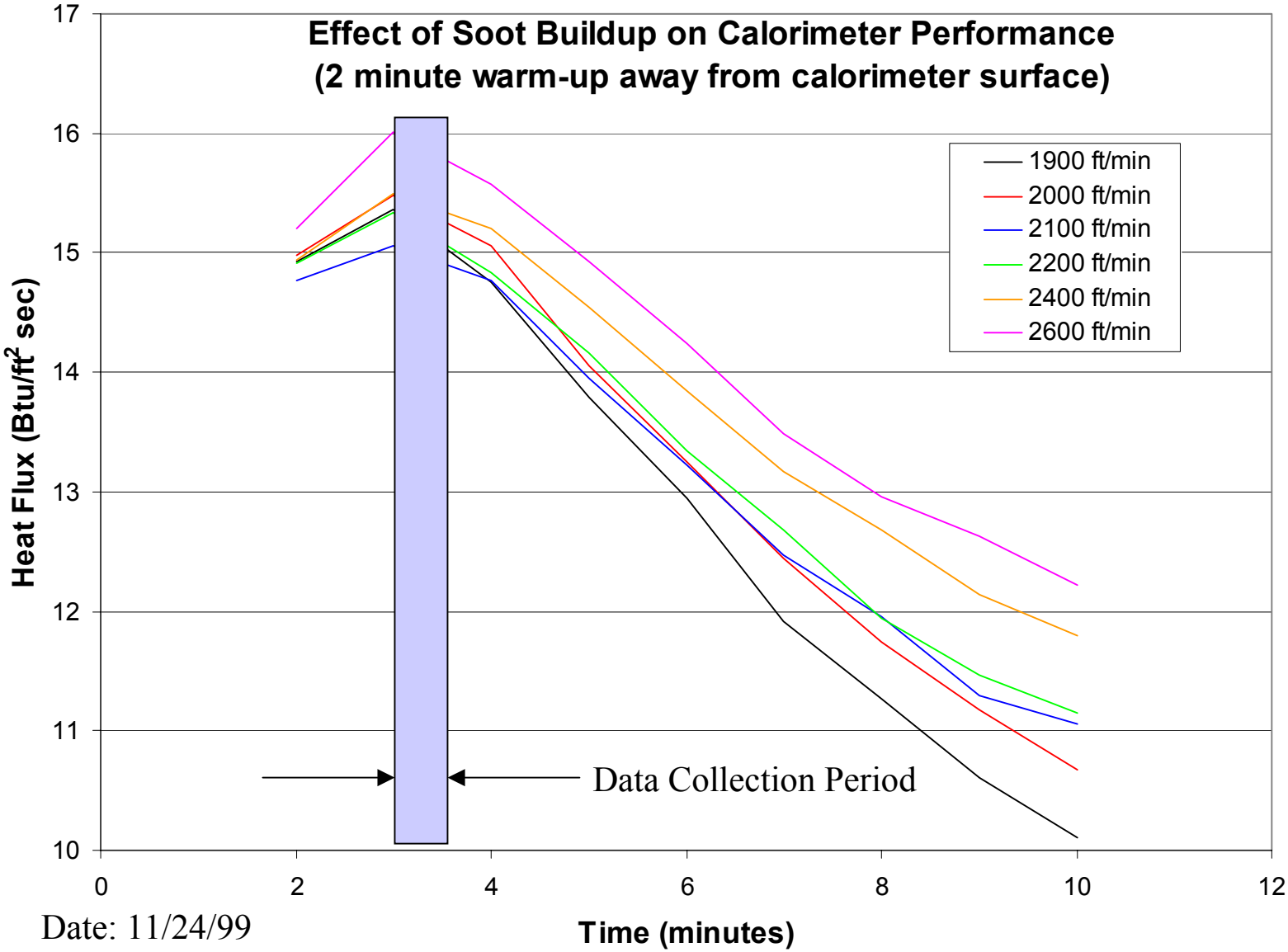
Finalized Test Rig

Typical Blanket Installation on Test Rig

Laboratory-Scale Test
Refinements to Calibration and Test Procedures

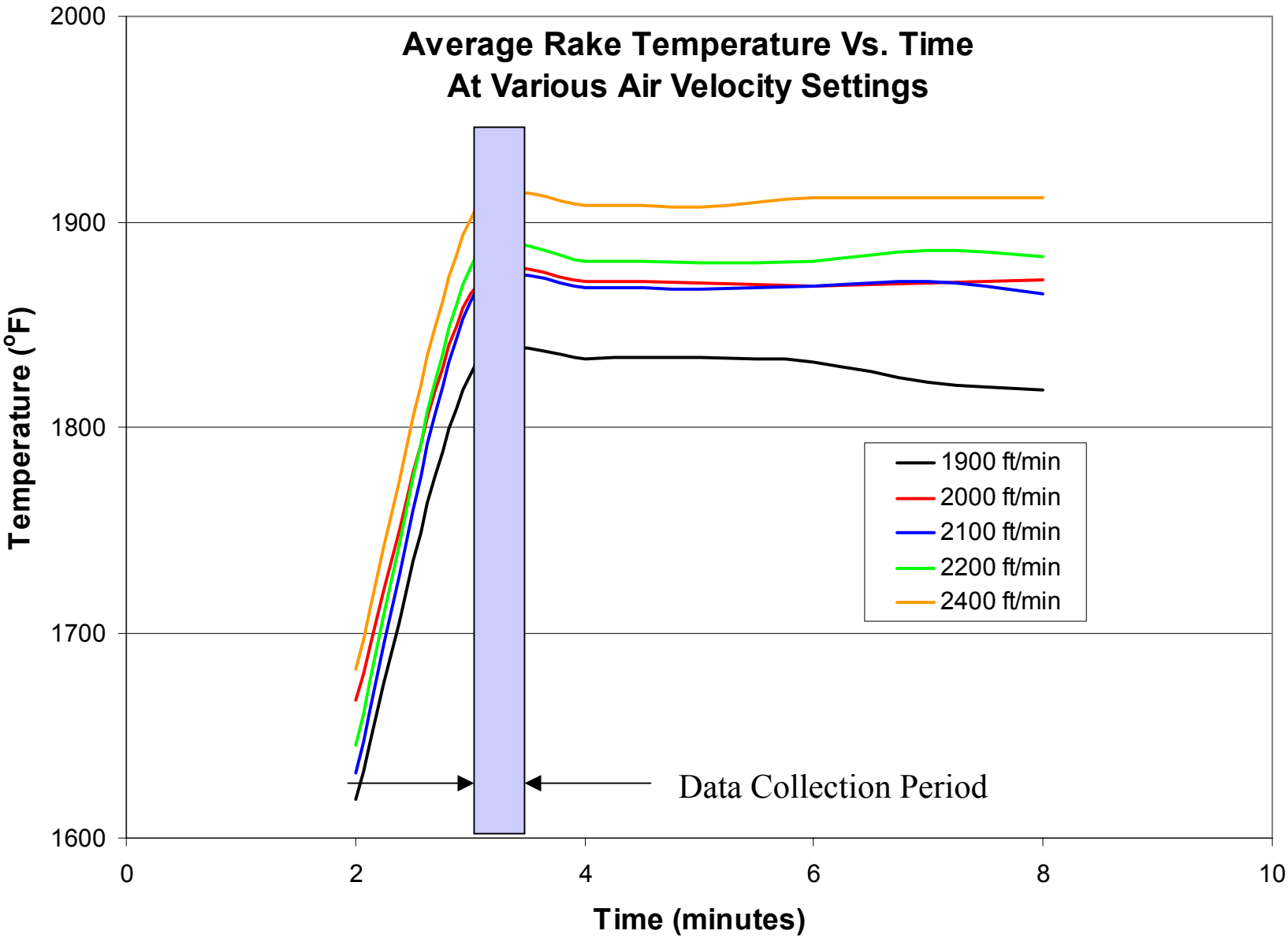
Individual Calibration Rigs

Data Collection Procedure is Critical

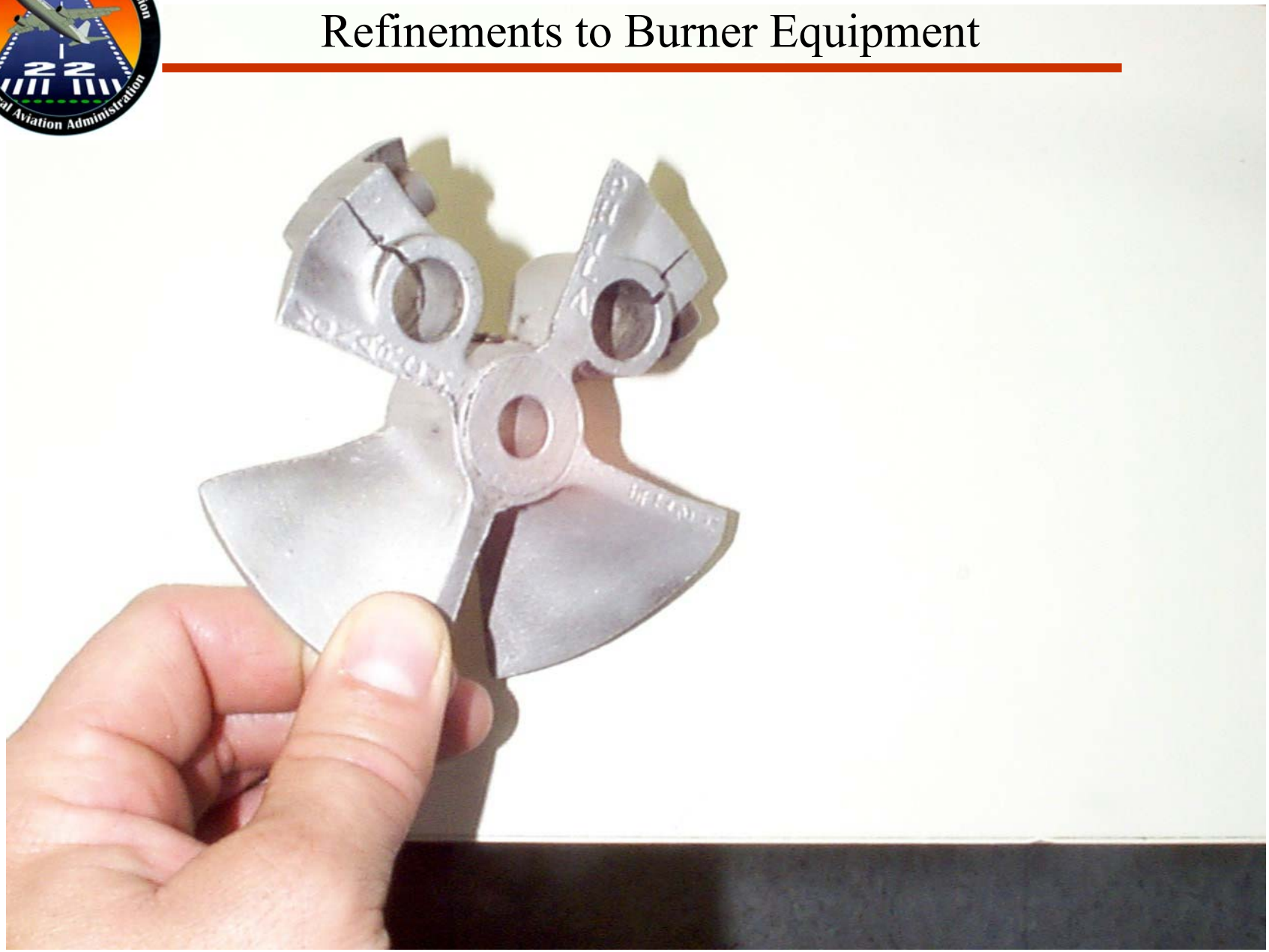


Date: 11/24/99

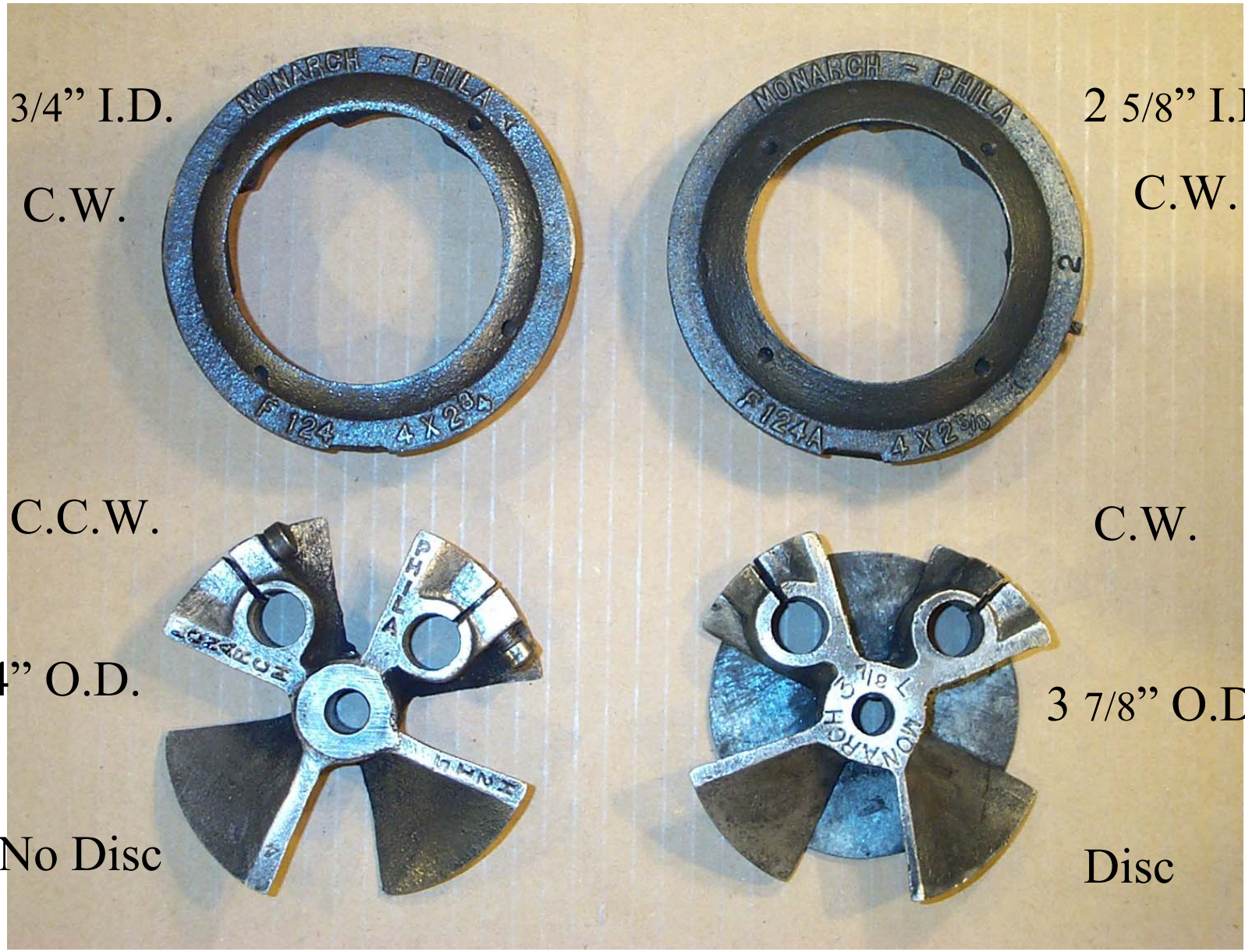
Data Collection Procedure is Critical



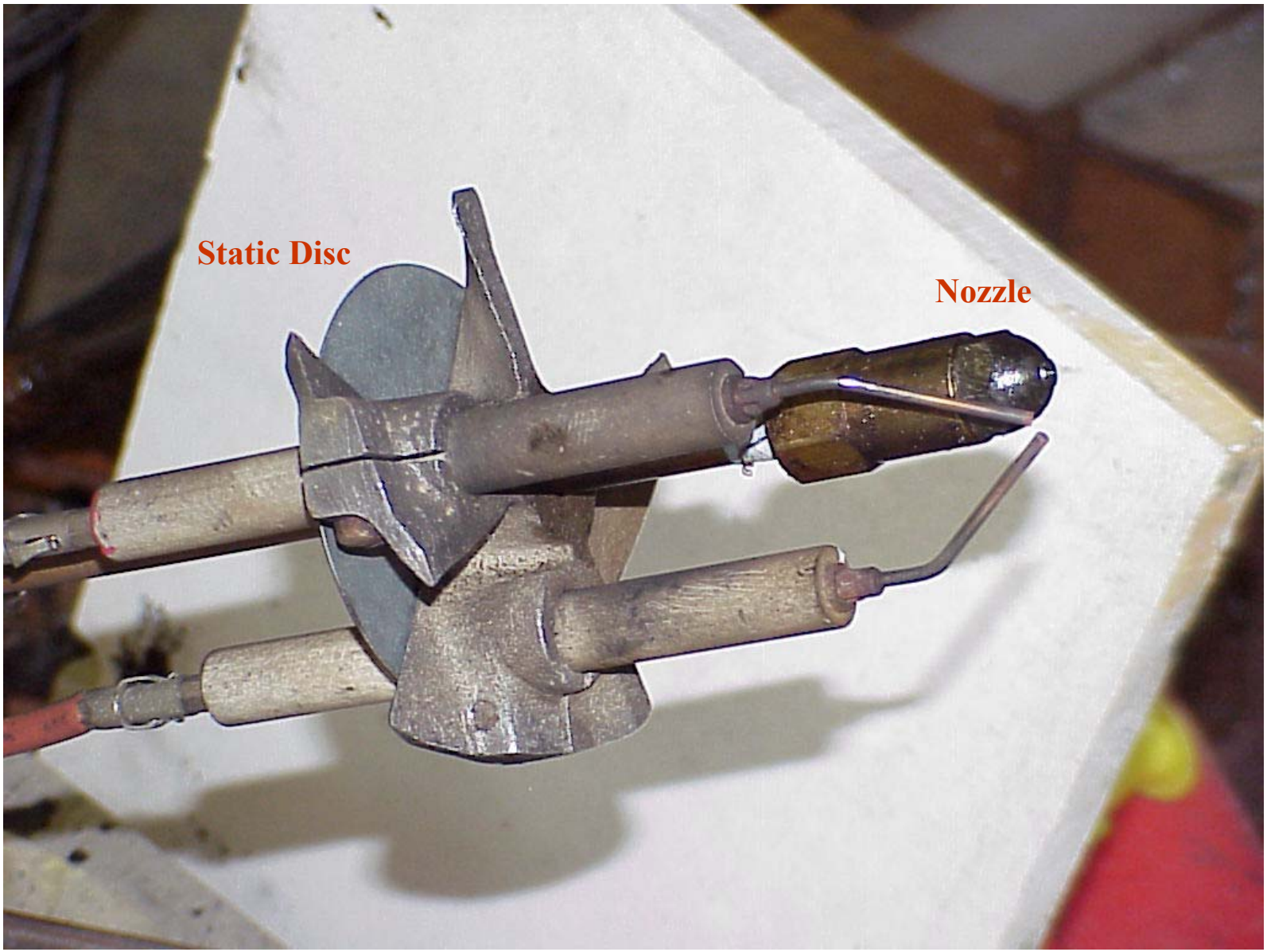
Laboratory-Scale Test
Refinements to Burner Equipment



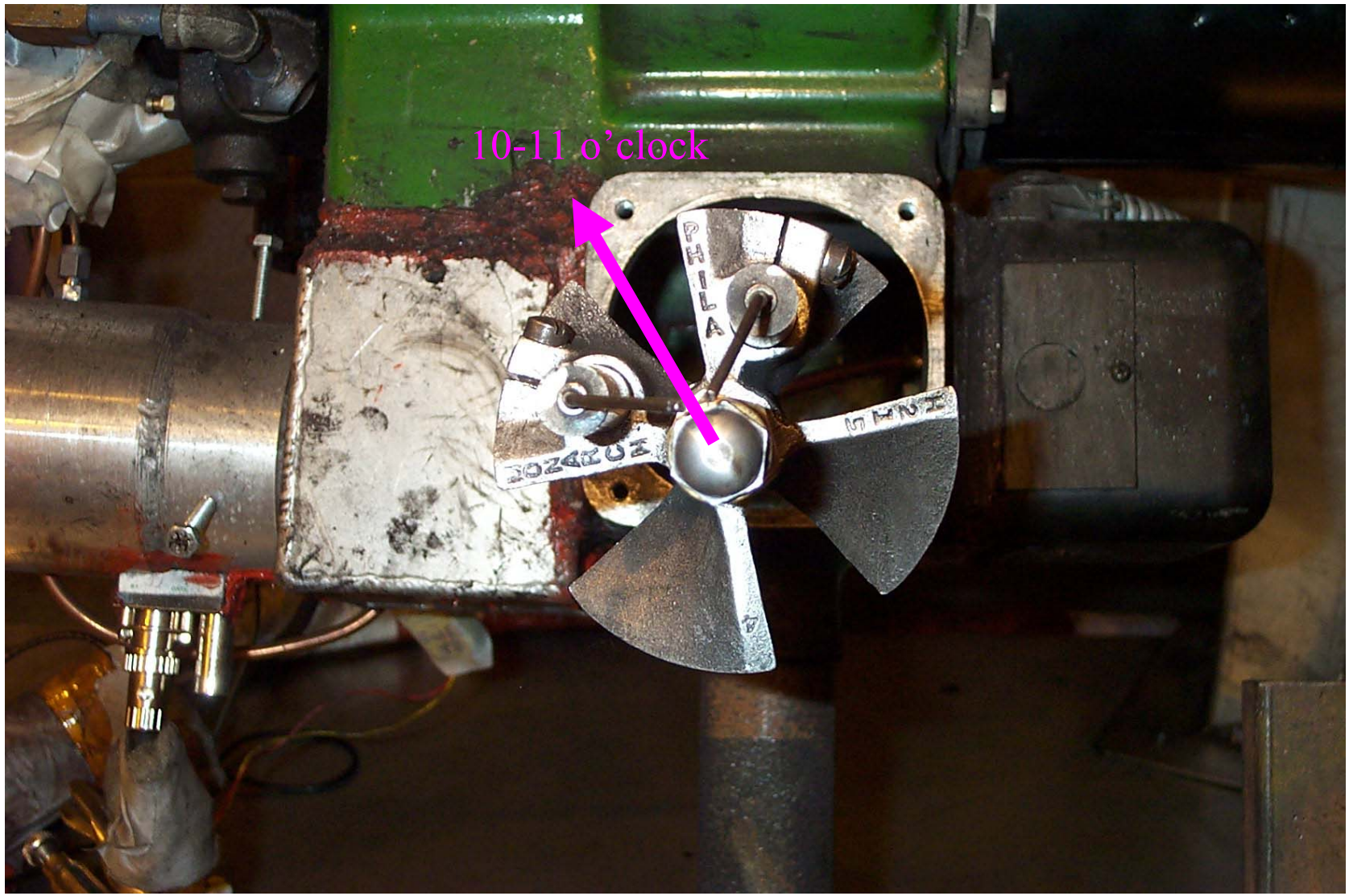
Different Types of Stators



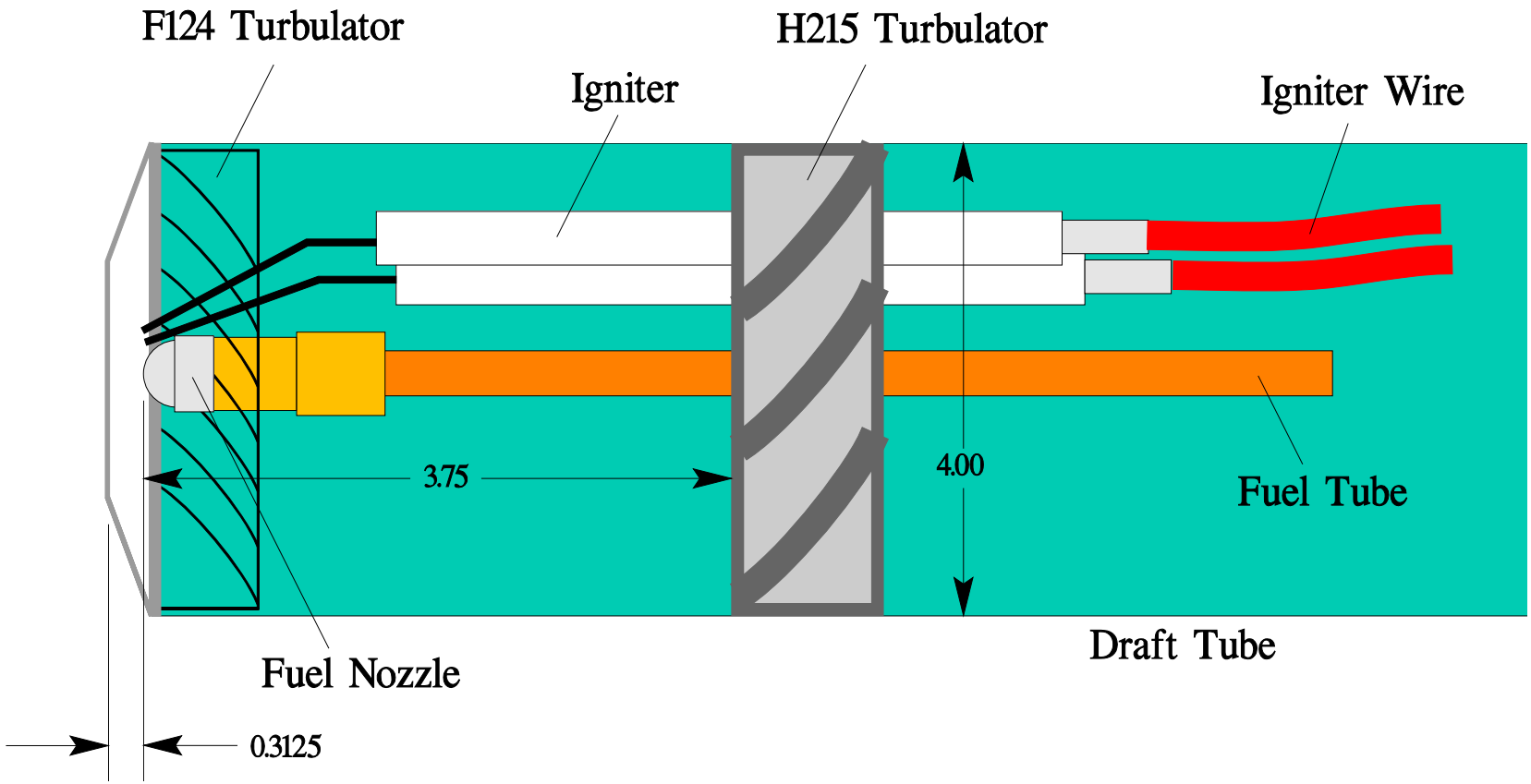
Monarch H215 Internal Stator with Static Disc



Preferred Position of Igniters to Achieve Calibration

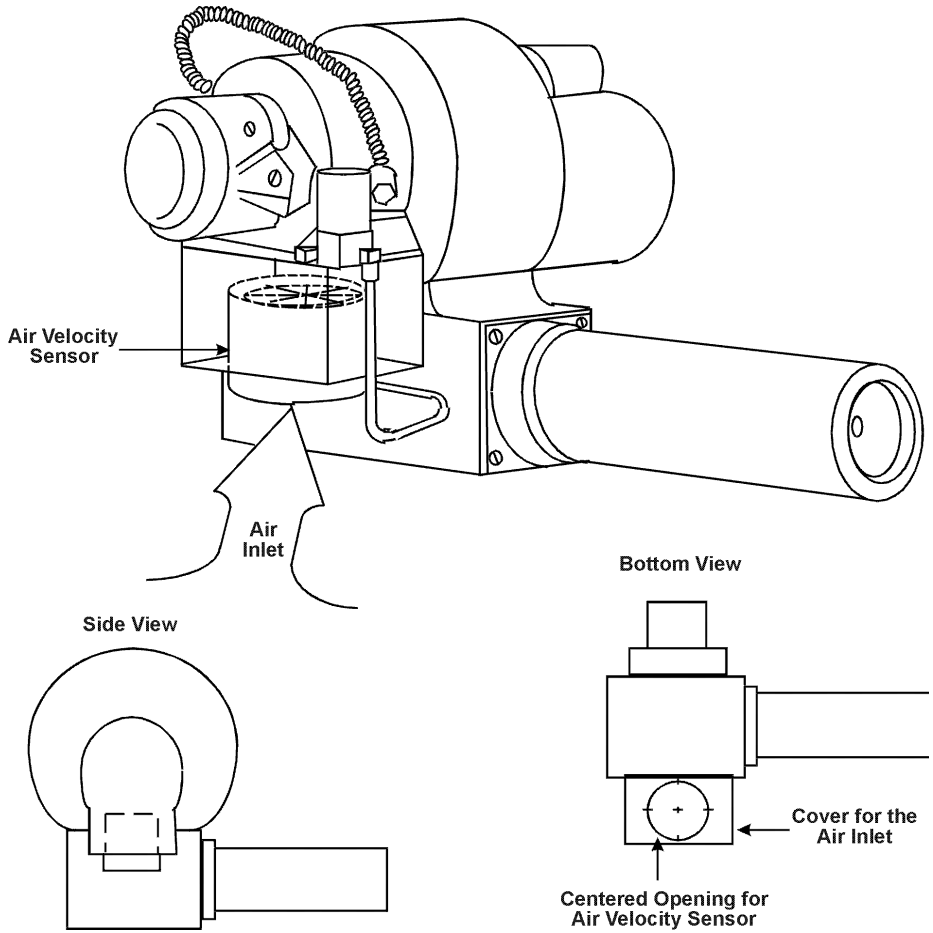


Fuel Nozzle Location

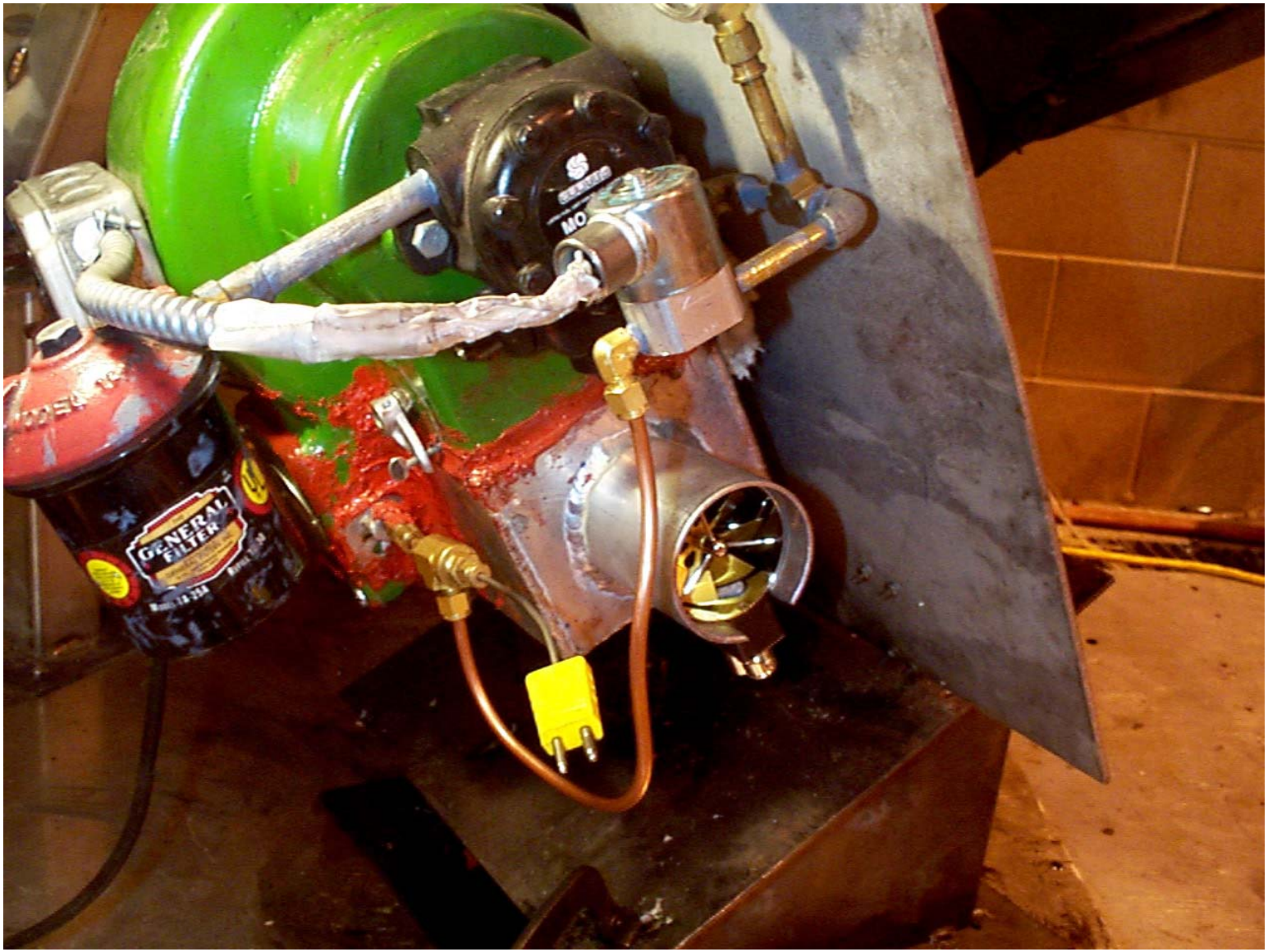


Laboratory-Scale Test
Measurement of Intake Air Velocity

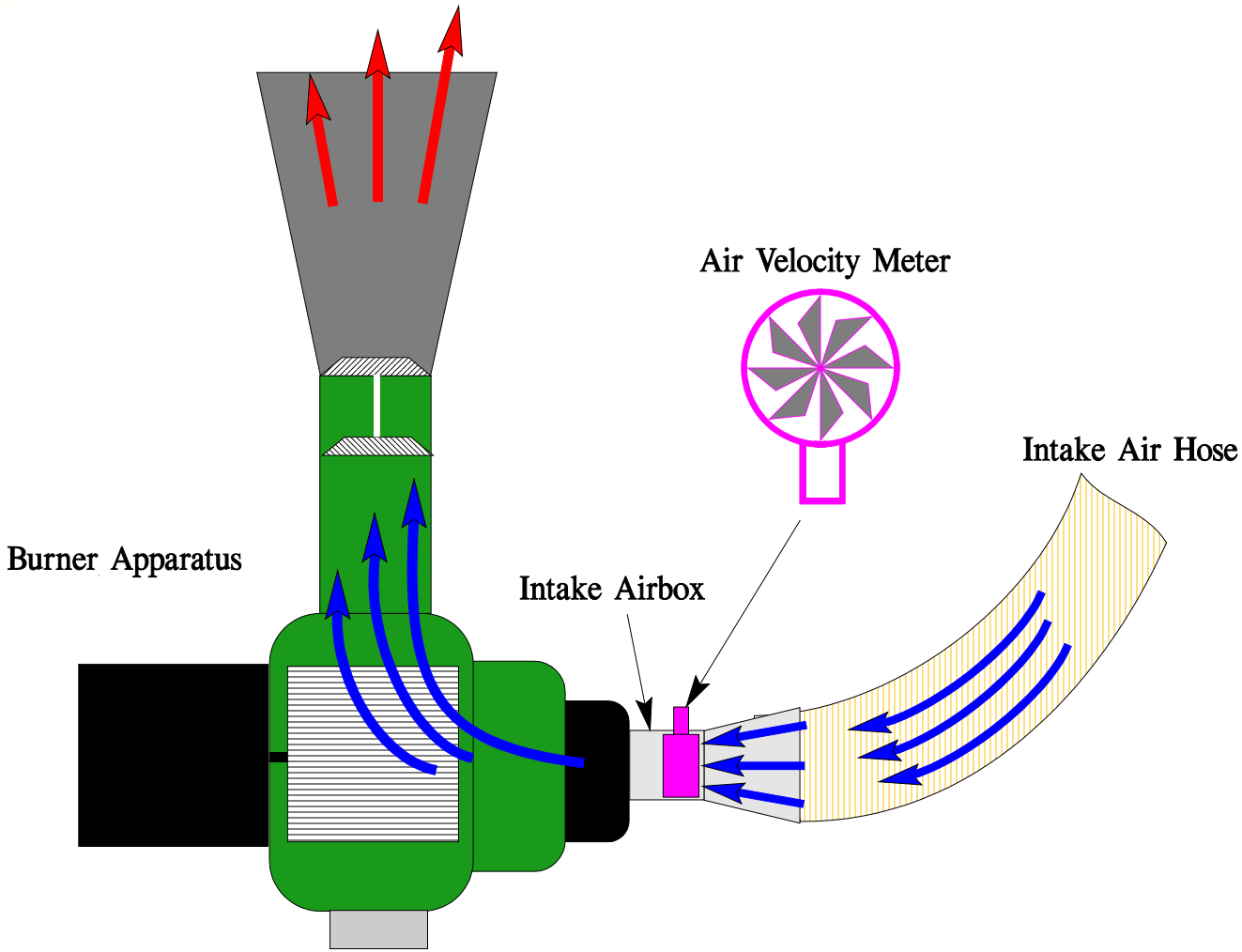
Park DPL Burner Air Intake



Intake Airbox Holding Air Velocity Meter



Intake Air Velocity Measurement System

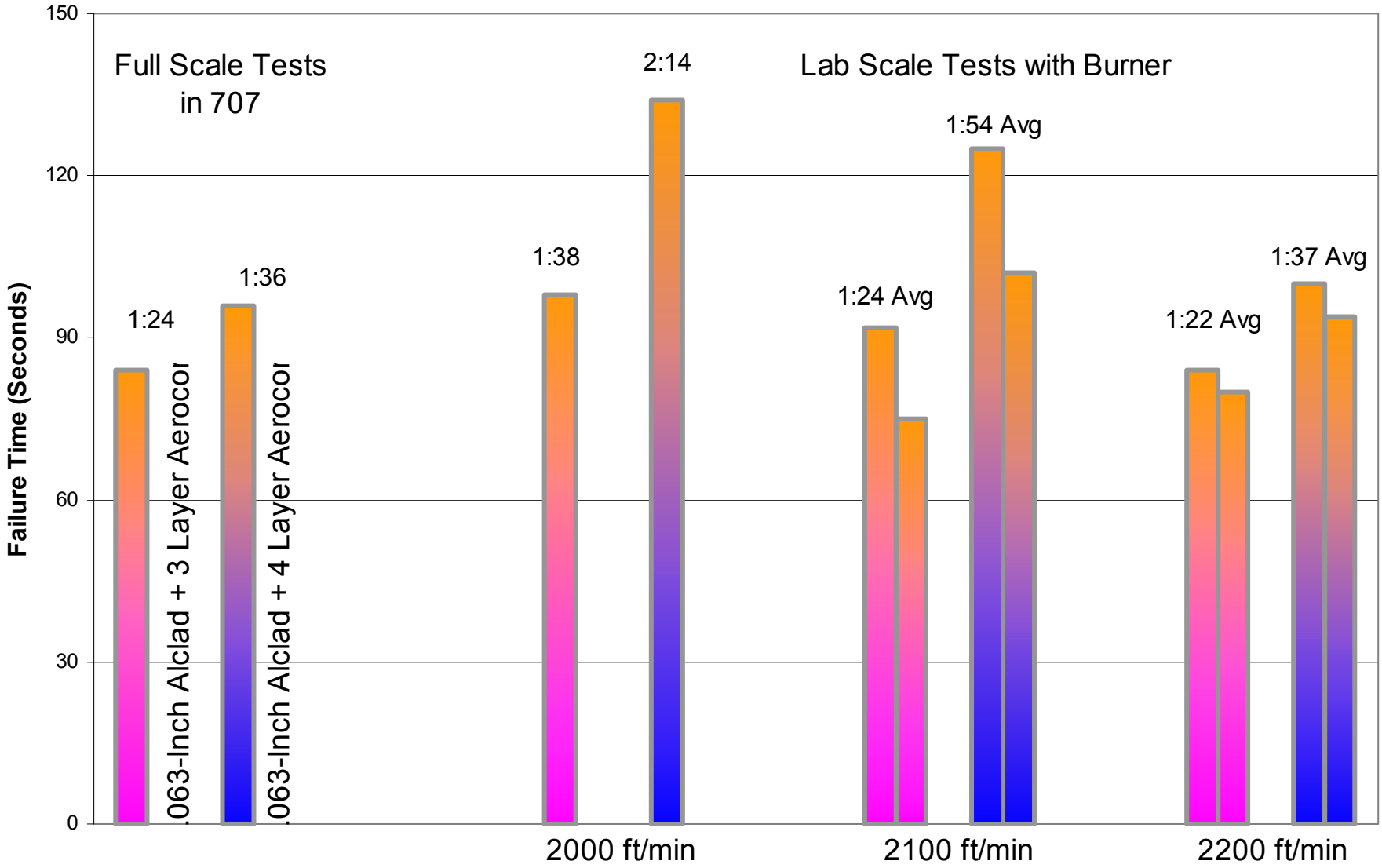


Primary Factors Influencing Calibration/Test Results

- Air Intake Velocity
- Fuel Flowrate
- Proper Burner Components/Adjustments
  (stators, position of igniters, correct fuel nozzle)
- Instrumentation (type/size of thermocouple, calorimeter type,
  method of collecting/reducing data)
- Fuel Temperature
- Environmental Conditions (relative humidity, barometric pressure)

Burner Correlation With Full-Scale Test Results

Correlation Using 6 GPH Burner (Full-Scale vs. Lab-Scale)



Round Robin Testing

Objective:

To identify and correct problems with proposed burnthrough test equipment to ensure similarity between labs

Methodology:

Prove similarity of test equipment between labs through testing of identical samples

Participants:

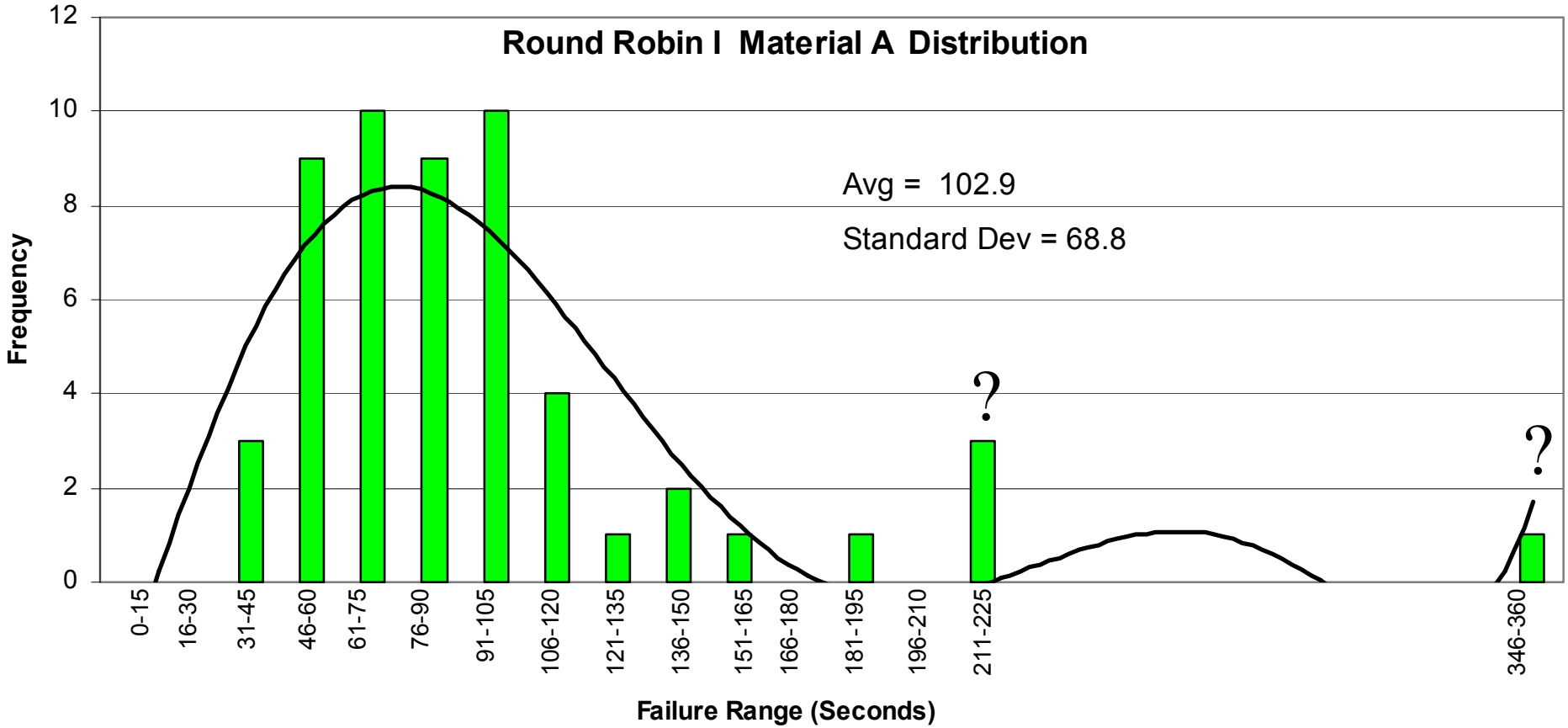
7 Domestic Labs, 3 European Labs

Status:

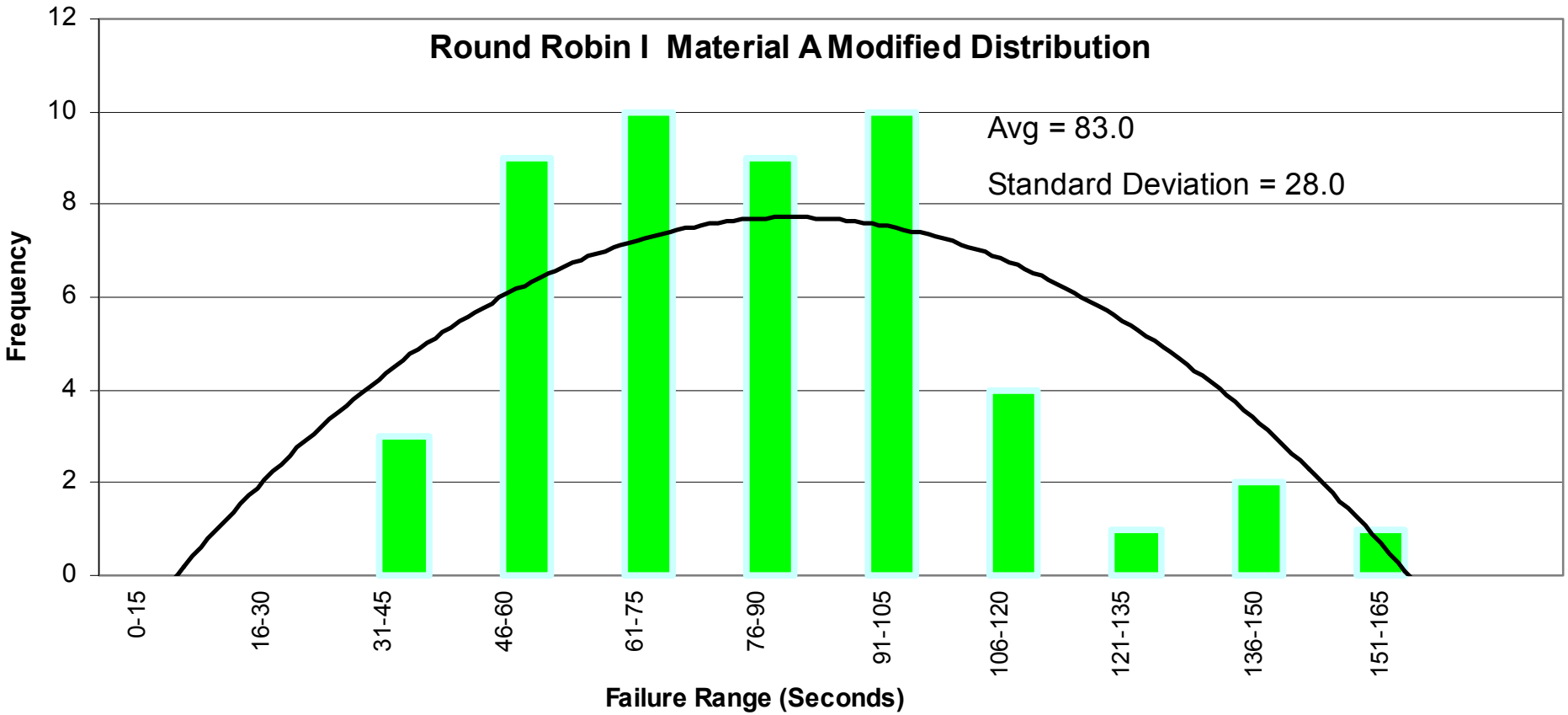
4 round robins completed

Additional smaller round robins scheduled

Round Robin I Histogram



Round Robin I Modified Histogram

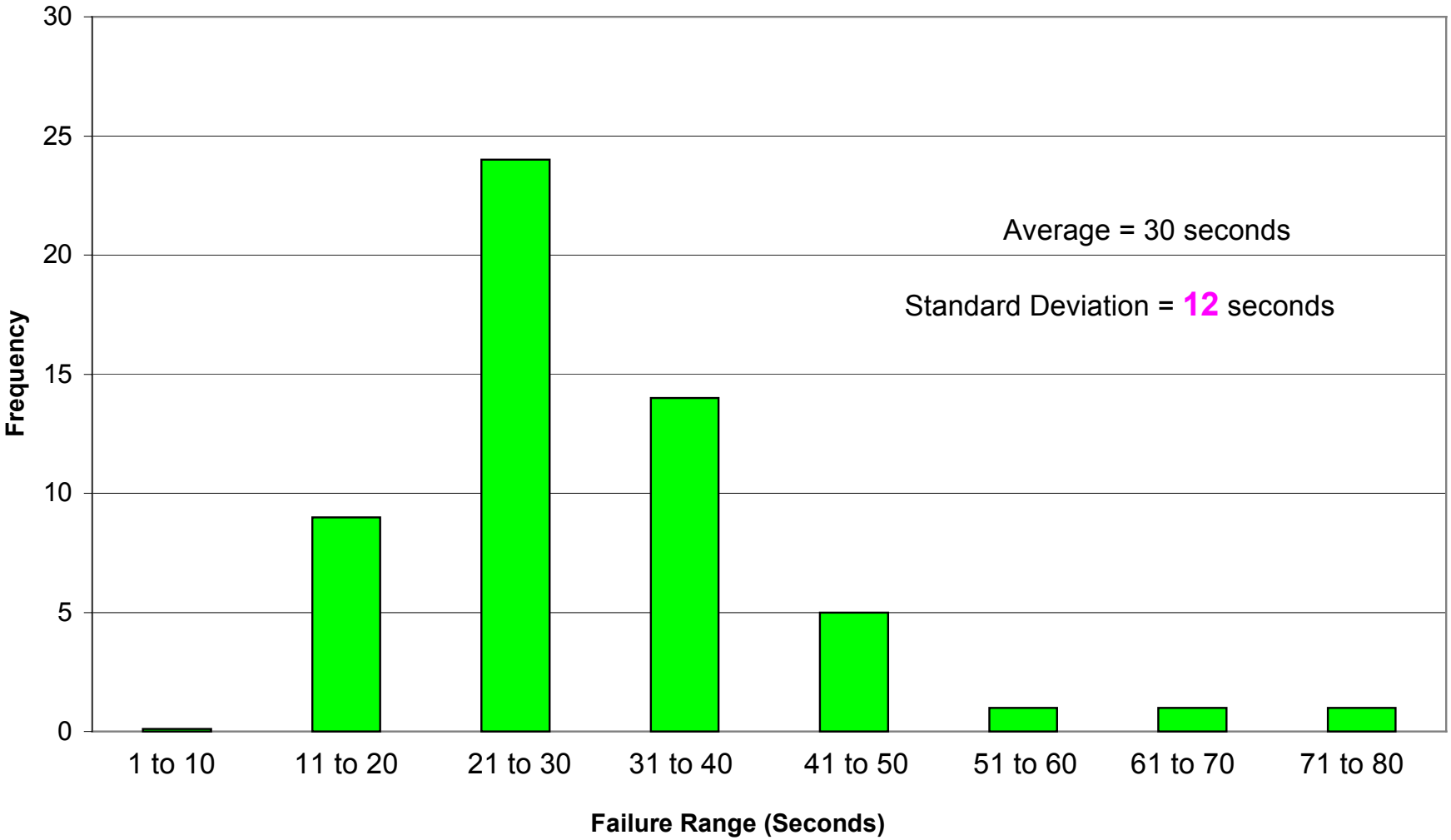


Variety of Burner Components Used in Early Round Robins

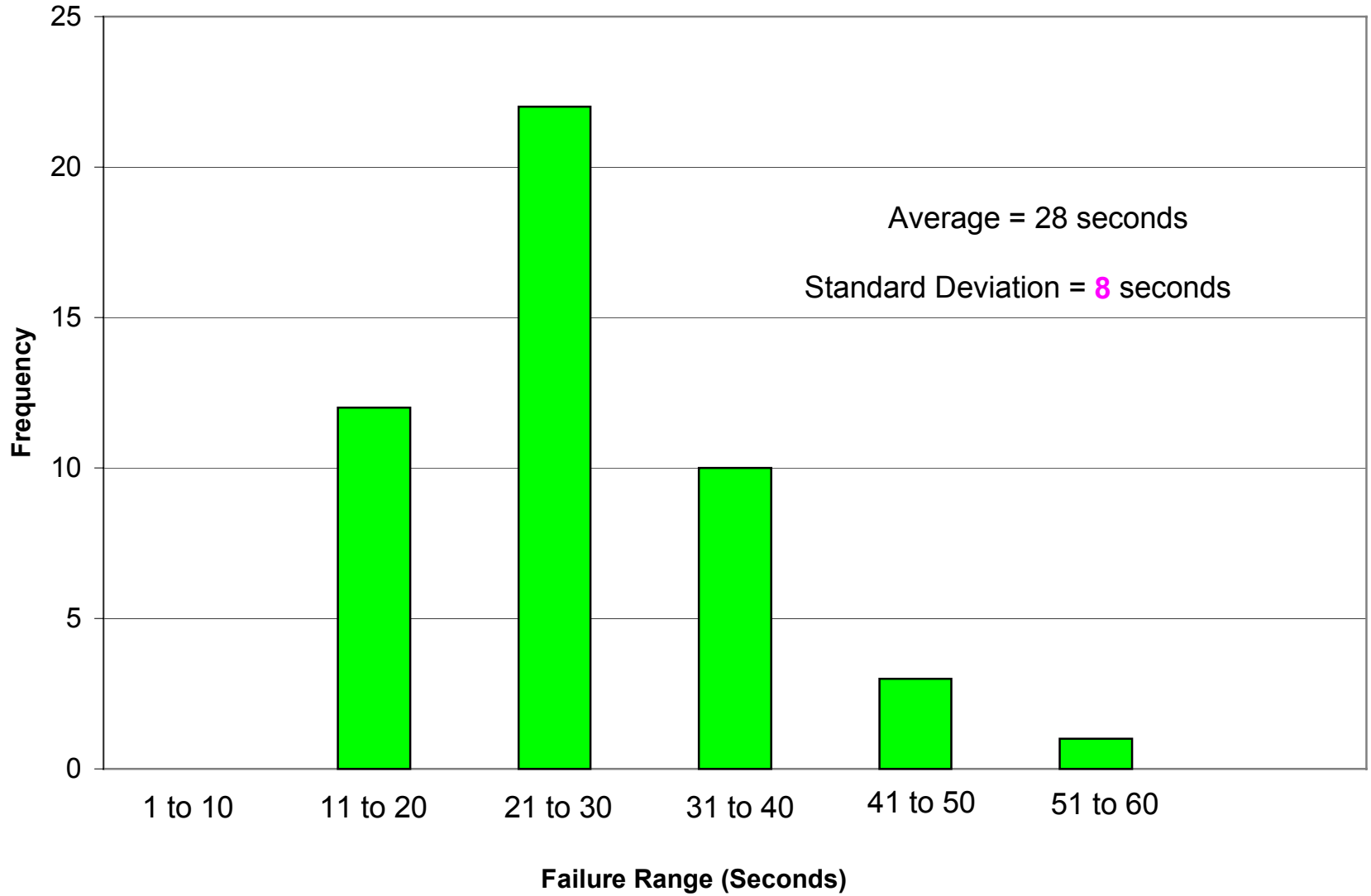
Round Robin I & II									
Lab Code (A-J)	Internal Turbulator Rotation	Internal Turbulator O.D. (inches)	Internal Turbulator Type	End Turbulator Rotation	End Turbulator I.D. (inches)	End Turbulator Type	Static Disc Used (Y/N)	Tabs Used (Y/N)	Nozzle Type
A	CCW	4.000	Monarch H215	CW	2.75	Monarch F124	Y	Y	Hago 6.00
B	CW	4.000?	Monarch 4L	CW	2.75	Monarch F124	Y	Y	?
C	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D	CW	4.000	Monarch 4 1/2 L	CW	2.75	Monarch F124	Y	Y	Monarch 2.00
E	CW	4.000	Monarch 4 1/2 L	CW	2.75	Monarch F124	Y	Y	Monarch 6.00 80° PLP
F	CW	3.875	Monarch 3 7/8L	CW	2.625	Monarch F124A	Y	Y	Monarch 6.00 80° PLP
G	CCW	4.000	Monarch H215	CW	2.75	Monarch F124	Y	Y	?
H	CCW	4.000	Monarch H215	CW	2.75	Monarch F124	Y	Y	Monarch 6.00 80° PLP
I	CCW	4.000	Monarch H215	CW	2.75	Monarch F124	Y	Y	Monarch 6.00 80° PLP
J	CCW	4.000	Monarch H215	CW	2.75	Monarch F124	Y	N	Monarch 6.00 80° PLP

Round Robin III									
Lab Code (A-J)	Internal Turbulator Rotation	Internal Turbulator O.D. (inches)	Internal Turbulator Type	End Turbulator Rotation	End Turbulator I.D. (inches)	End Turbulator Type	Static Disc Used (Y/N)	Tabs Used (Y/N)	Nozzle Type
A	CCW	4.000	Monarch H215	CW	2.75	Monarch F124	N	N	Monarch 6.00 80° PL
B	CCW	4.000	Monarch H215*	CW	2.75	Monarch F124	N	N	Monarch 6.00 80° PL
C	CCW	4.000	Monarch H215	CW	2.75	Monarch F124	N	N	Monarch 6.00 80° PL
D	CCW	4.000	Monarch H215*	CW	2.75	Monarch F124	N	N	Monarch 6.00 80° PL
E	CCW	4.000	Monarch H215*	CW	2.75	Monarch F124	N	N	Monarch 6.00 80° PL
F	CCW	4.000	Monarch H215	CW	2.75	Monarch F124	N	N	Monarch 6.00 80° PL
G	CCW	4.000	Monarch H215	CW	2.75	Monarch F124	N	N	Monarch 6.00 80° PL
H	CCW	4.000	Monarch H215	CW	2.75	Monarch F124	N	N	Monarch 6.00 80° PL
I	CCW	4.000	Monarch H215	CW	2.75	Monarch F124	N	N	Monarch 6.00 80° PL
J	CCW	4.000	Monarch H215	CW	2.75	Monarch F124	N	N	Monarch 6.00 80° PL

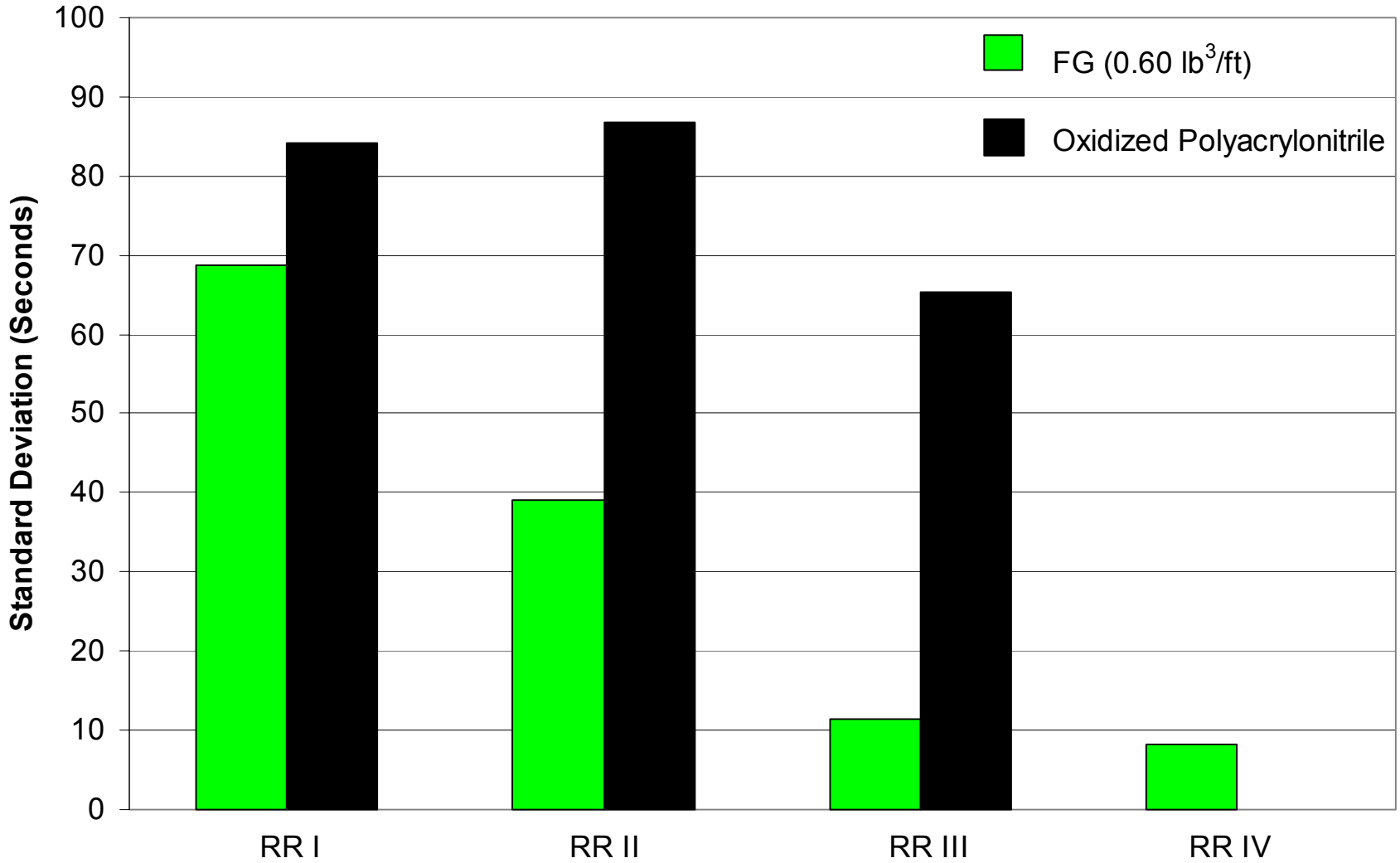
Round Robin III Histogram



Round Robin IV Histogram



Standard Deviation Trend



Conclusion, Round Robins I, II, III, and IV

Decreasing standard deviation trend result of:

Standardization of Calibration and Test Procedures

Standardization of Test Burner/Apparatus

Overall Increased Familiarization with Proposed Test Method

Future Considerations

Conduct additional round robin test series to fully refine test method

Calibration of heat flux transducers (completed)

Calibration of air velocity meters (current)

Standardization of air velocity measurement

Conduct laboratory scale tests to investigate installation requirements

Overlap at vertical formers

Overlap at horizontal seams

Attachment Methods

Conduct full-scale confirmation tests in support of Advisory Circular

Blanket Overlap Testing

Full-Scale Overlap Testing

Task Group Participants

Task Group Meeting: Wednesday morning 9:00

Becky Wulliman

Tom Tompkins

Anne Mansuet

Steve Morgan

Hank Lutz

Kurt Doman

David Erb

Jim Clyne

John Brooks

Dan Trahan

Khang Tran

Susahn Briggs

Yo Ishikawa

Alain Jacques

Bob Gardner

Chad Miller