

International Aircraft Materials Fire Test Working Group Meeting

Seat Cushion Test Method Update

Presented to: International Aircraft Materials Fire
Test Working Group, Indianapolis,
Indiana

By: Tim Salter

Date: October 16-17, 2012, Indianapolis



Federal Aviation
Administration



Previous Meeting Items

- **Finalized sonic burner settings for Park replacement**
- **FAA test results have shown new settings will allow sonic burner to reproduce Park test results**
- **Looking into stator/turbulator alternatives which could simplify sonic burner setup and increase repeatability in test results**

Summary for this Meeting

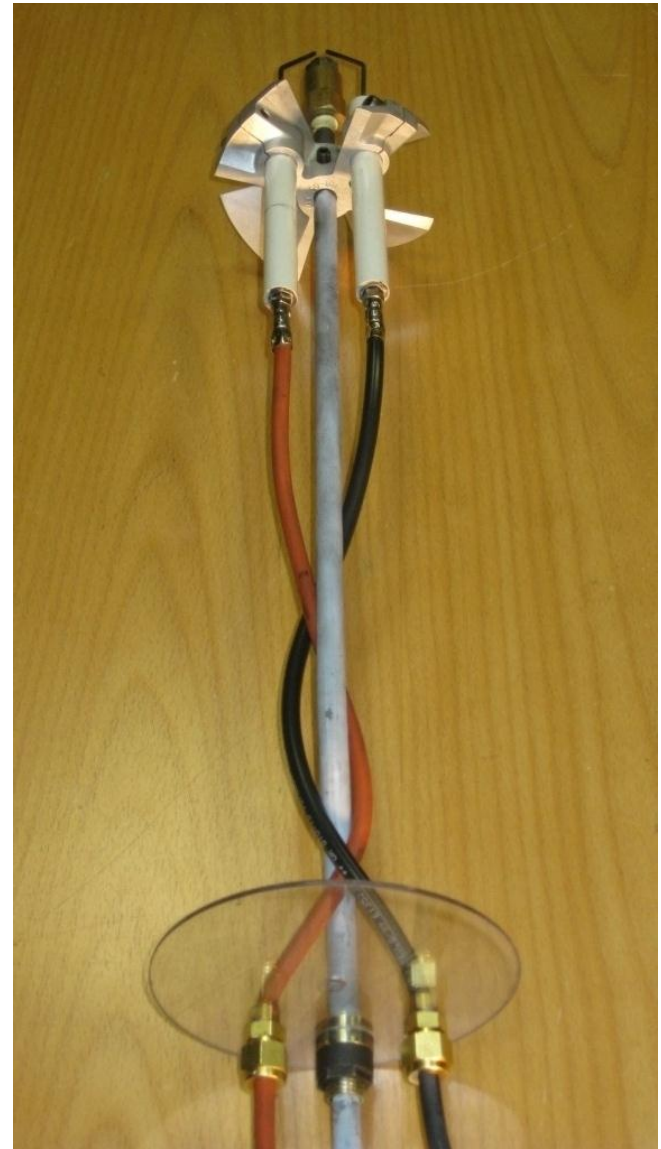
- **Continue work with seat burner settings**
 - Ignition wire positioning
 - Igniter positioning
 - New stator and nozzle settings
- **Standardize leather seat cushion restraints**
- **Round robin update**
 - 5 of 8 labs have completed testing

Current Seat Burner Settings

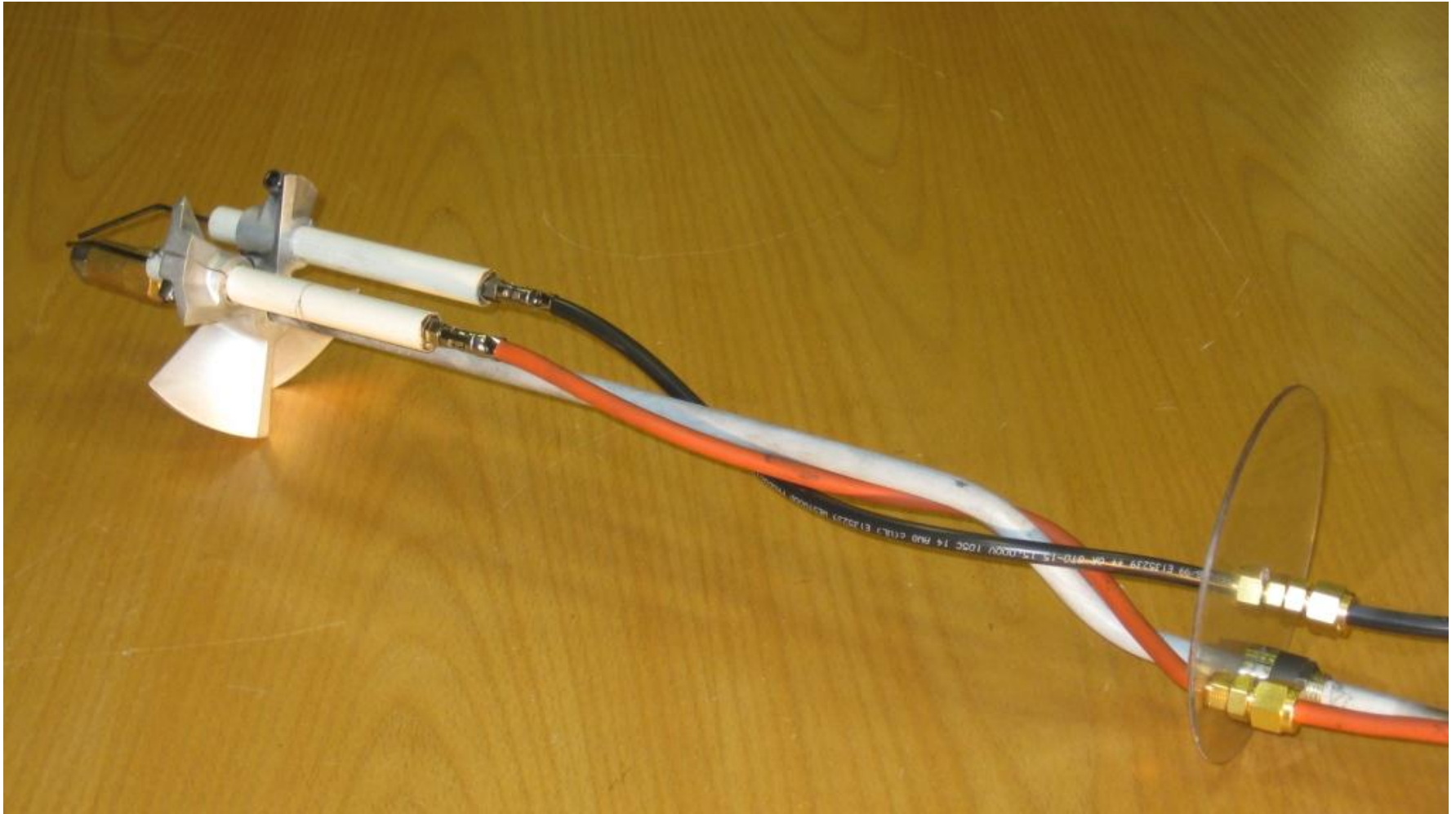
- **Recommended Nozzle: Delevan 80°B 2.0 gph**
- **Nozzle Depth: 3/16"**
- **Stator Depth: 2 11/16"**
- **Stator Angle: 0° (igniter centerline from vertical)**
- **Igniter Position: (see pictures)**
- **Ignition Wires: (see pictures)**

Ignition Wires

- New wire length and positions minimize airflow disturbance
- Standardized wire positions to minimize variability in burner performance and data results
- Improved repeatability



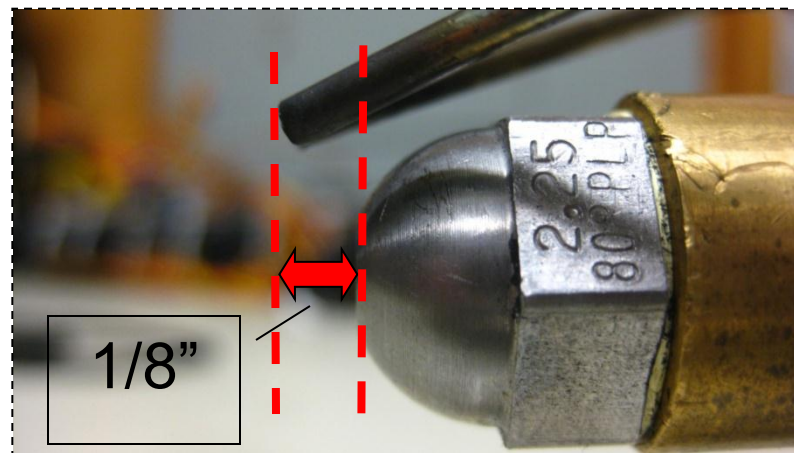
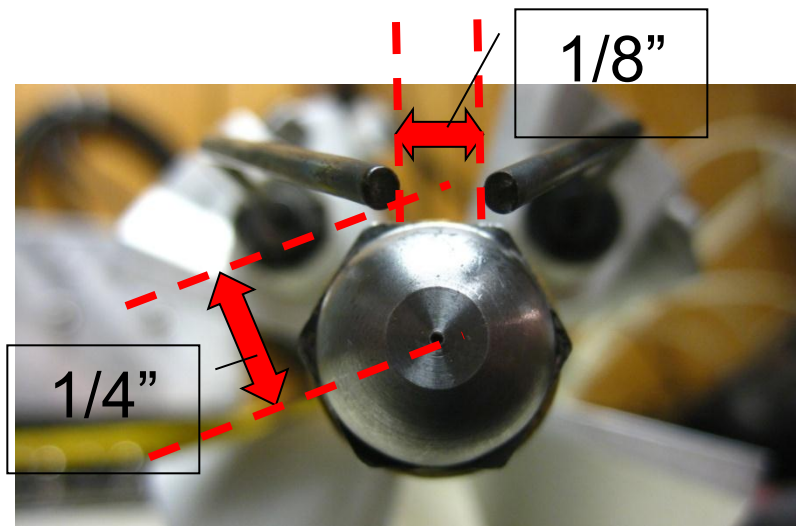
Ignition Wire Positions



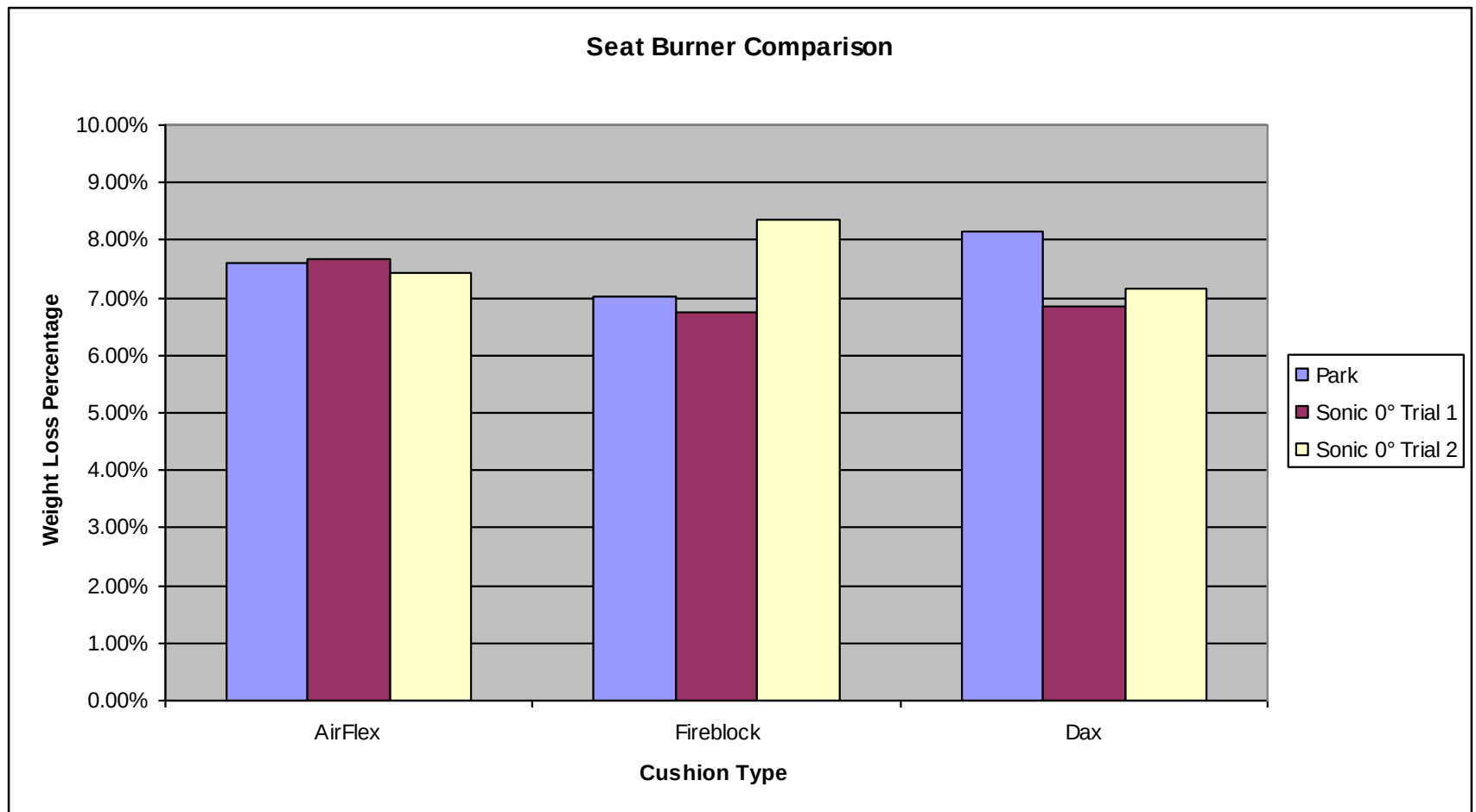
Igniter Positions

- **Standardized igniter positions**
- **Gap between igniters**
 - $\frac{1}{8}$ "
- **Nozzle center to igniter**
 - $\frac{1}{4}$ "
- **Nozzle face to igniter**
 - $\frac{1}{8}$ "

*Diagrams shown only for igniter tip spacing



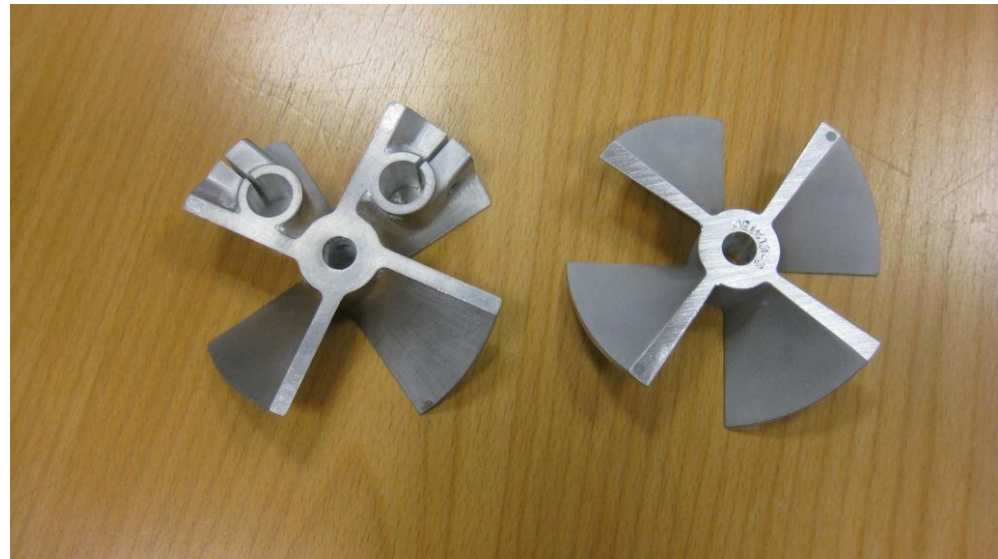
Seat Cushion Testing



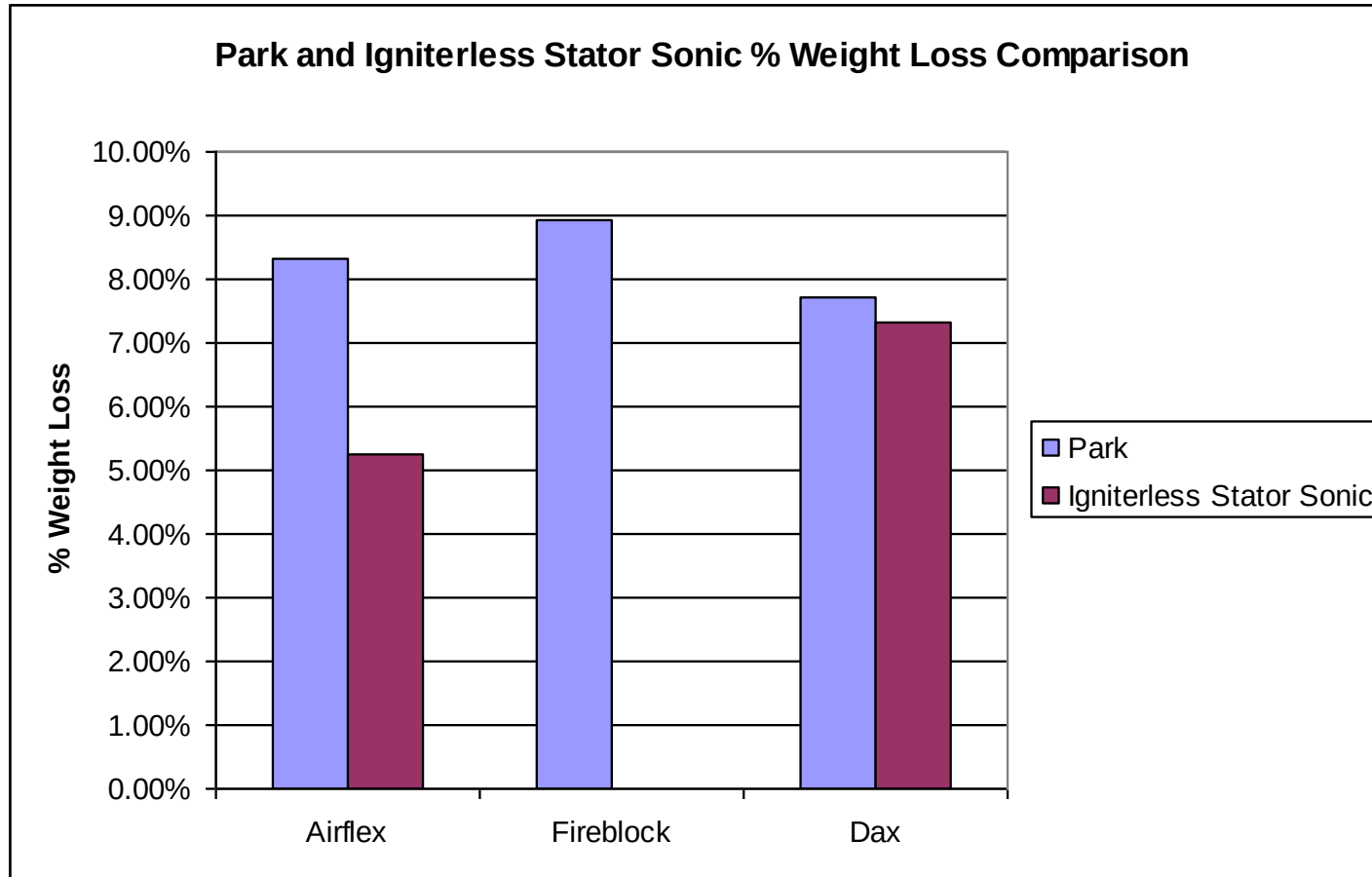
- 3 of each cushion type tested per trial

Revised Stator

- **New stator eliminates igniters and ignition wires in draft tube**
- **Intended to simplify burner settings and setup**
- **Attempt to reduce non-symmetrical airflow in burner draft tube, and increase test result consistency**



Revised Stator



Revised Stator

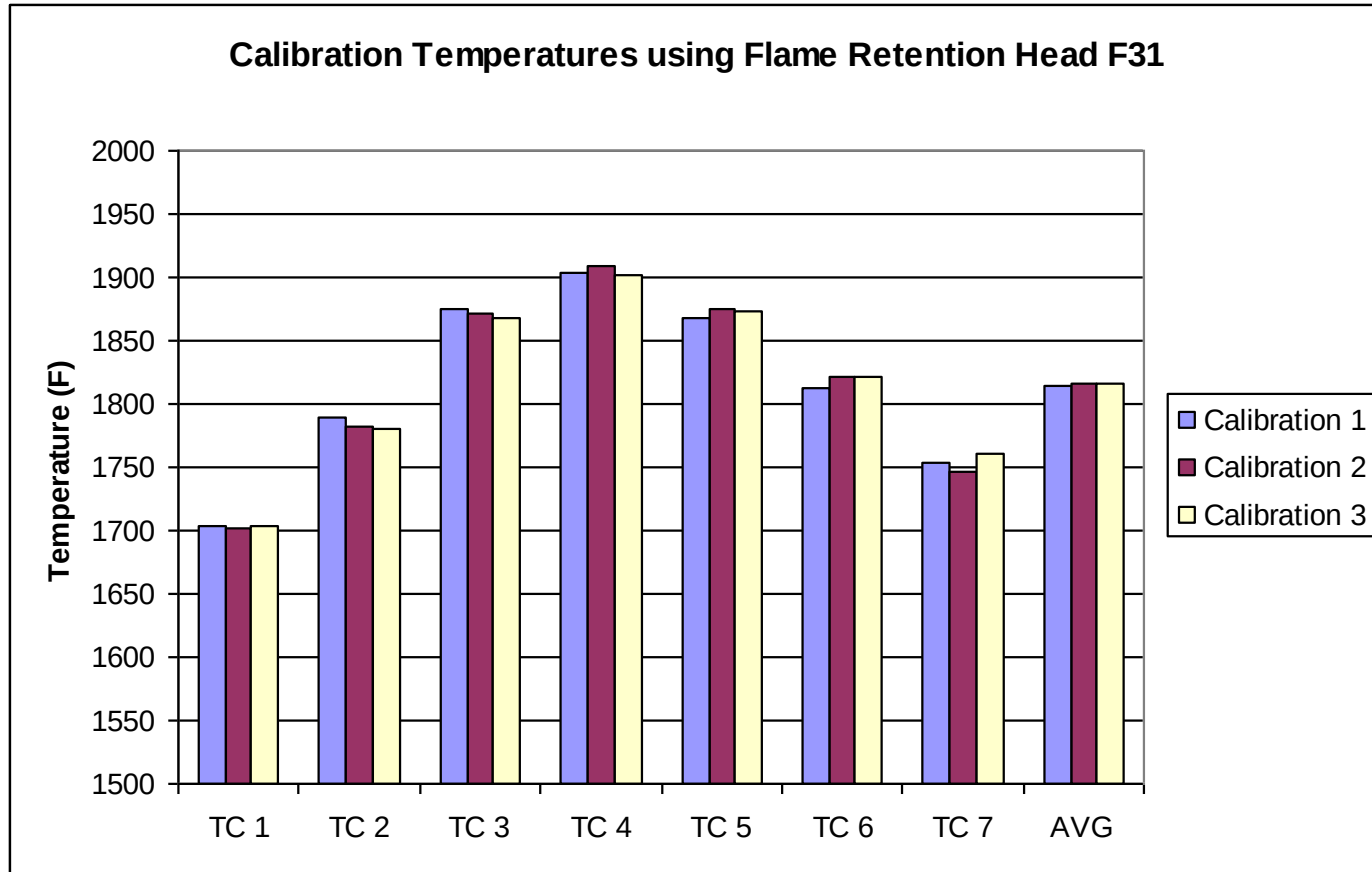
- **Test results did not correlate well with Park test results**
- **Dax foam weight loss correlated well with Park burner results, but Airflex weight loss was significantly less than Park results**
- **Igniterless stator requires external ignition**
- **No further testing was pursued**

Flame Retention Head

- **Eliminates the need for a stator and turbulator**
- **Fits on end of sonic burner draft tube**
- **Initial test results show potential**

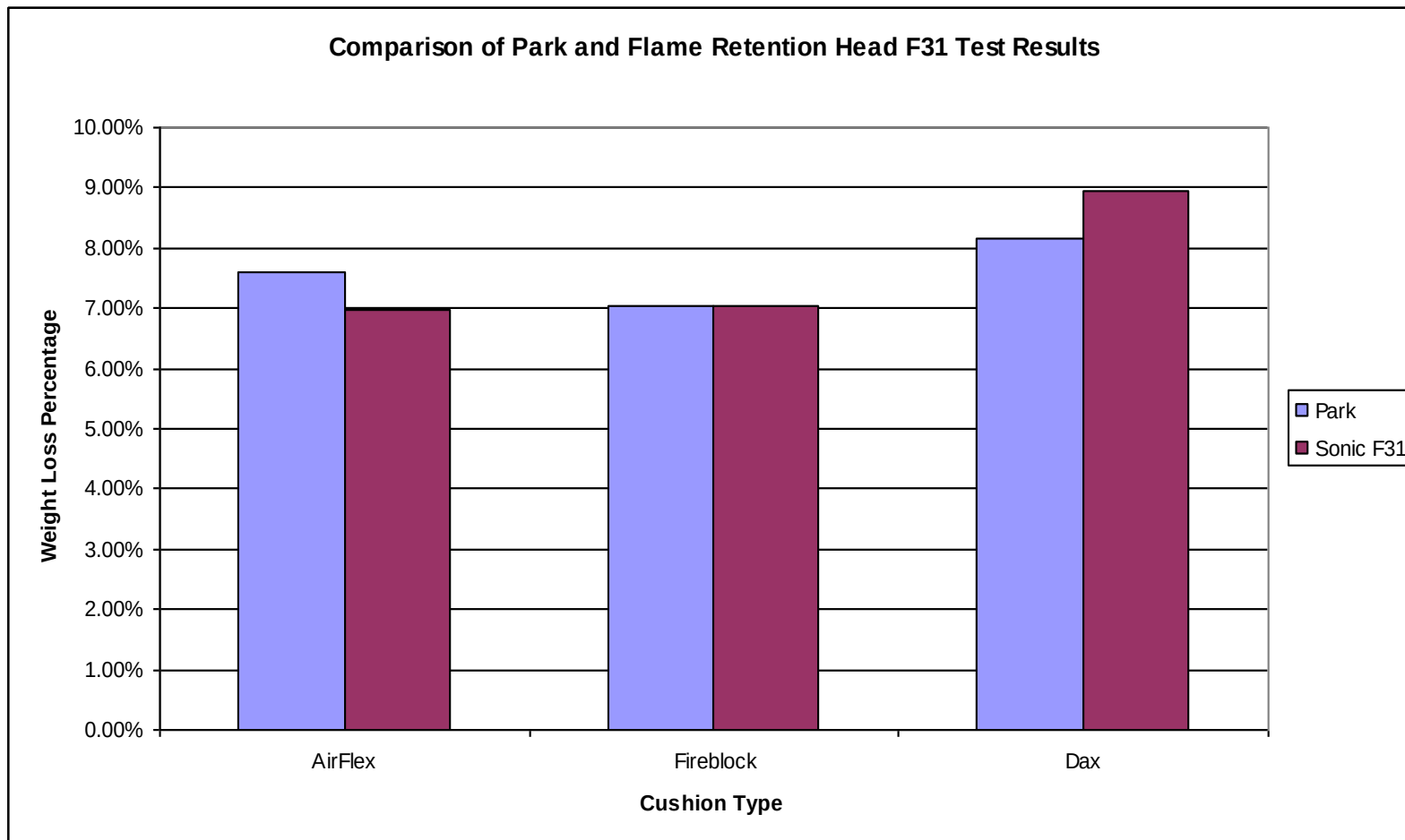


Flame Retention Head



- **Extremely low variation of temperature**
- **Less than 1°F variation of averaged temperatures**

Flame Retention Head



Leather Cushion Restraints

- **Industry has asked that a standardized method of restraining leather seats to the burn rig be developed**
- **Work had been performed in the past, but no final conclusions had been made**
- **Data has shown that there is not necessarily a correct or incorrect method of restraining leather cushions**
 - However, restraints should not impede the flame

Leather Cushion Restraints

- **Items to consider**
 - Number of restraints
 - Spacing of restraints
 - Type of restraint (safety wire, hook and loop, etc.)
- **Goal**
 - Devise a method of restraint to maximize repeatability, but not overcomplicate restraint method in order to keep sample preparation time to a minimum

Leather Cushion Restraints

- **Restraint Method #1**
 - 4 safety wire loops on vertical cushion
 - 3 safety wire loops on horizontal cushion
 - Wires evenly spaced 5 inches apart
- **Advantages**
 - No favoring one part of the cushion (even spacing)
 - Multiple wires securely restrain cushions
- **Disadvantages**
 - More wires take longer to prepare sample rig

Leather Cushion Restraints

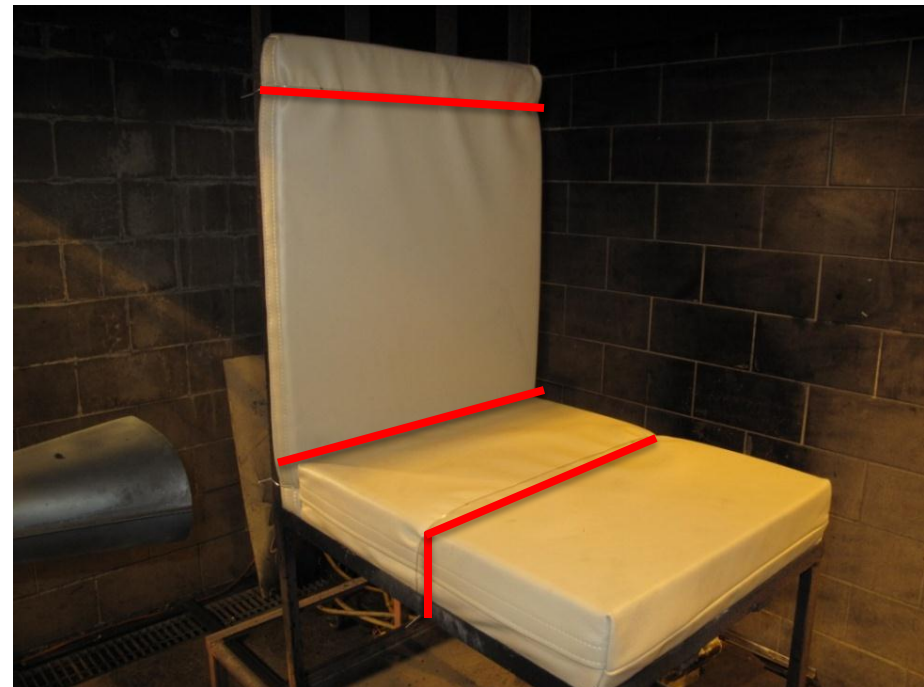
- **Restraint Method # 2**
 - 2 safety wire loops on vertical cushion located approximately 2” in from top and bottom
 - 1 safety wire loop on middle of horizontal cushion
- **Advantages**
 - Fewer wires reduce sample rig preparation time
- **Disadvantages**
 - Fewer wires used to restrain cushion may have impact on test results

Leather Cushion Restraints

Restraint Method #1



Restraint Method #2

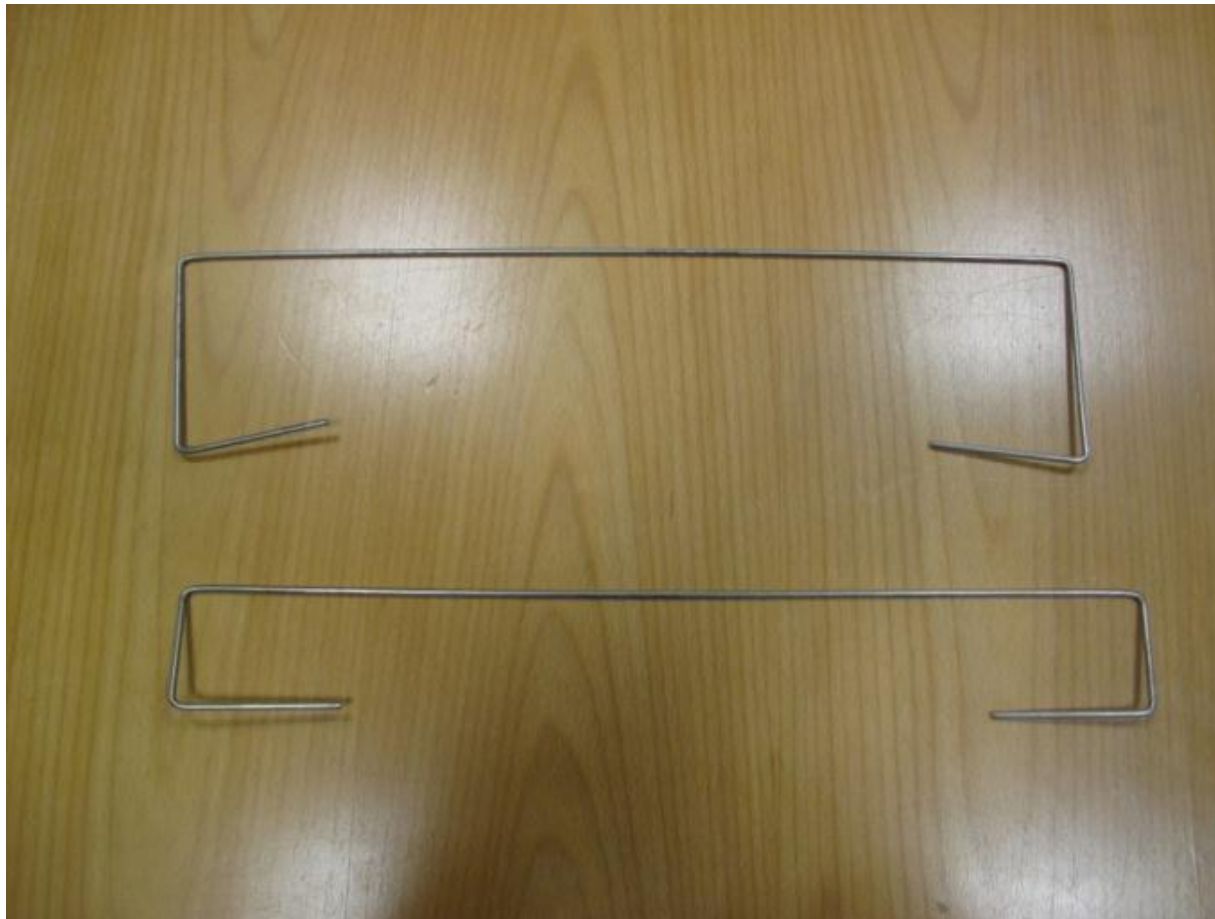


Leather Cushion Restraints

- **Restraint Method # 3**
 - Multiple stainless steel welding rods used to “clamp” cushion to test rig
- **Advantages**
 - Reduce sample rig preparation time
 - Reuse restraints for multiple tests
- **Disadvantages**
 - Heavy gauge wire/rod may impede flame

Leather Cushion Restraints

Restraint Method #3



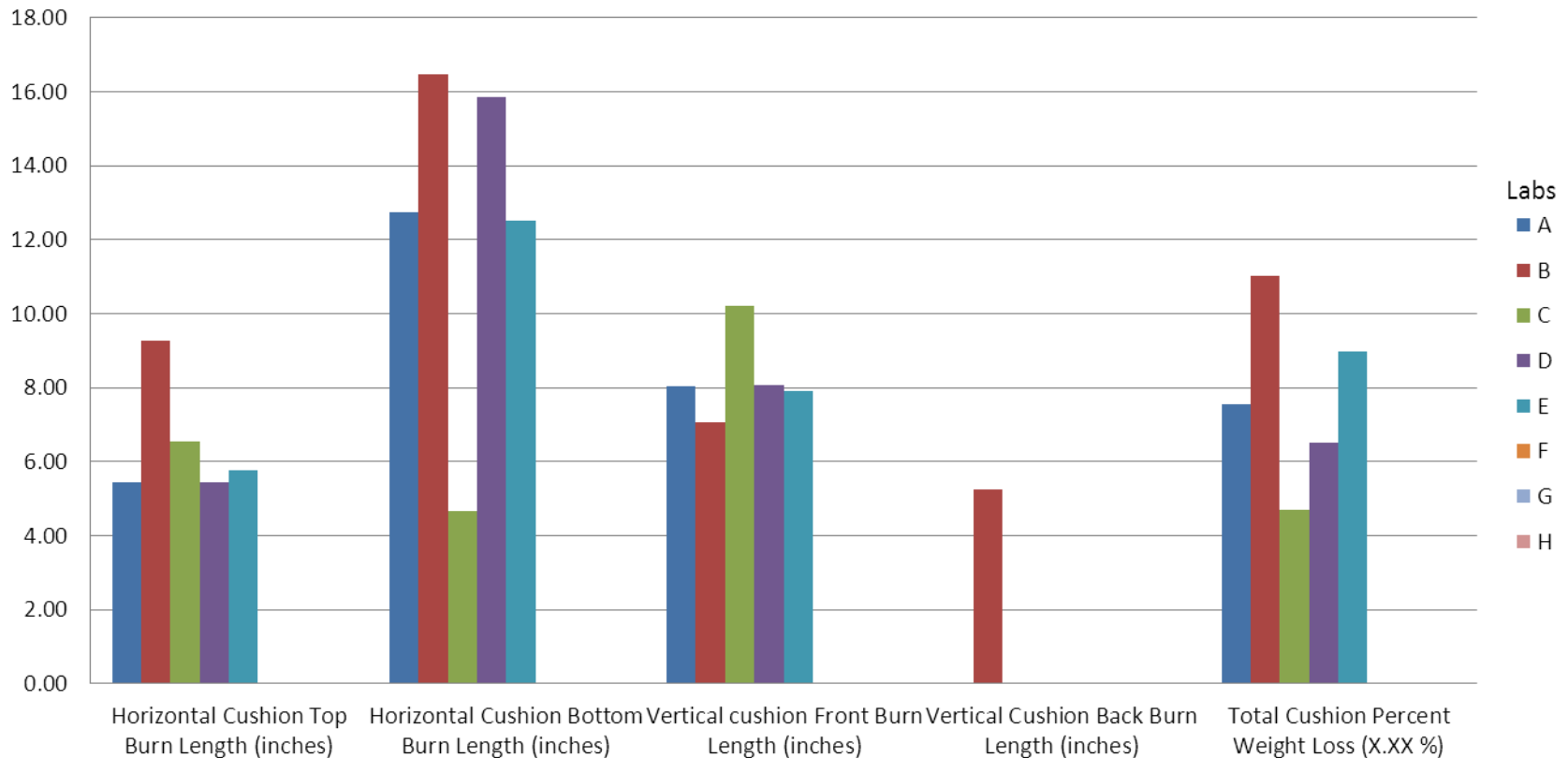
Round Robin Update

- Round robin ongoing since April 2012
- 8 labs are currently participating
- 5 labs have completed testing
- Each lab was provided with a Delevan 80°B 2.0 gal/hr fuel nozzle to use during testing
- Labs asked to setup burners using new settings developed by FAA
- Labs asked to calibrate using new 1/8” thermocouples
- Each lab will receive cushions for testing when FAA receives calibration data



Round Robin Update

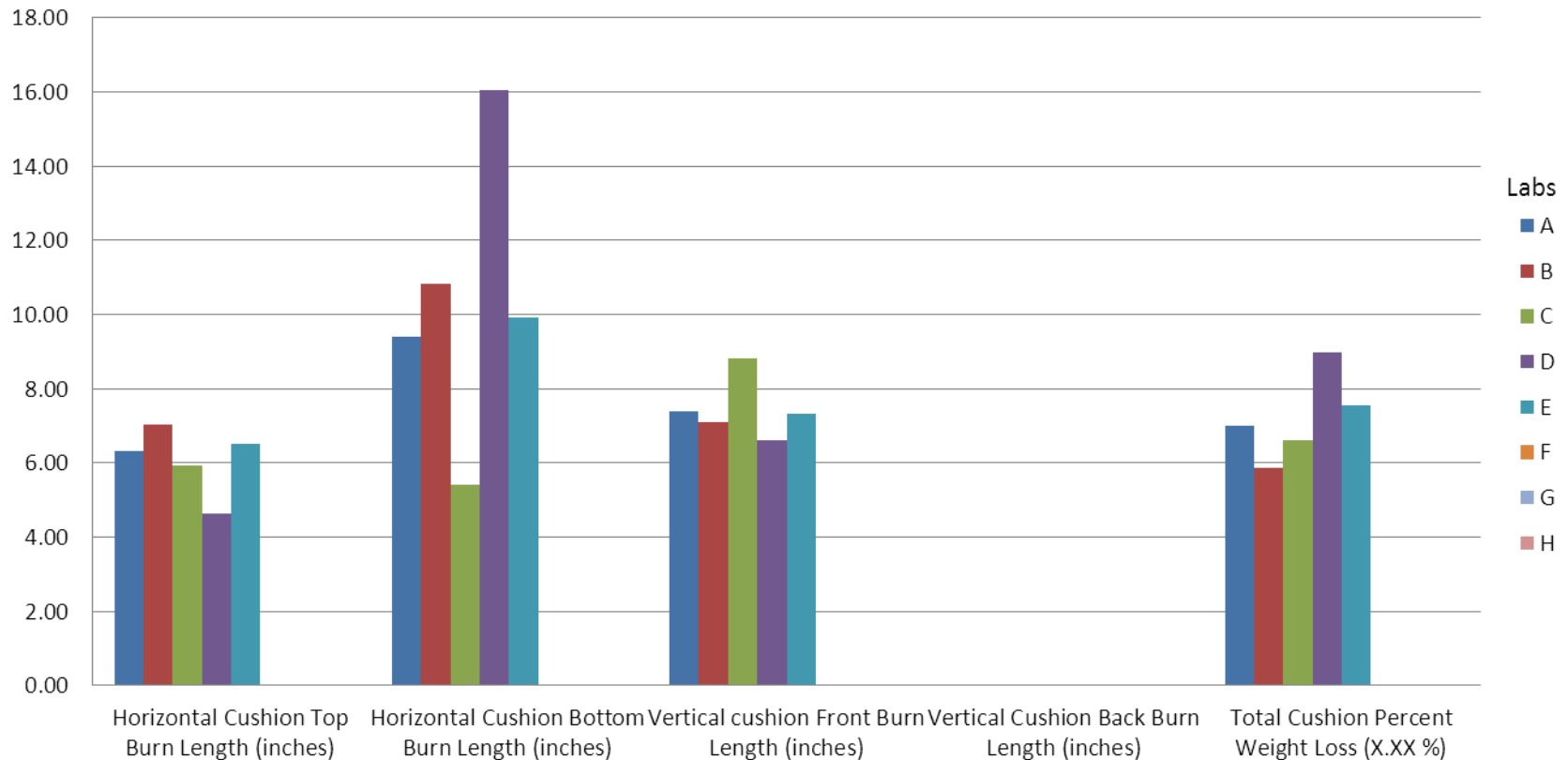
Fireblock Cushion Burn Lengths and Weight Loss Percent



- Lab A is data collected at FAA Technical Center

Round Robin Update

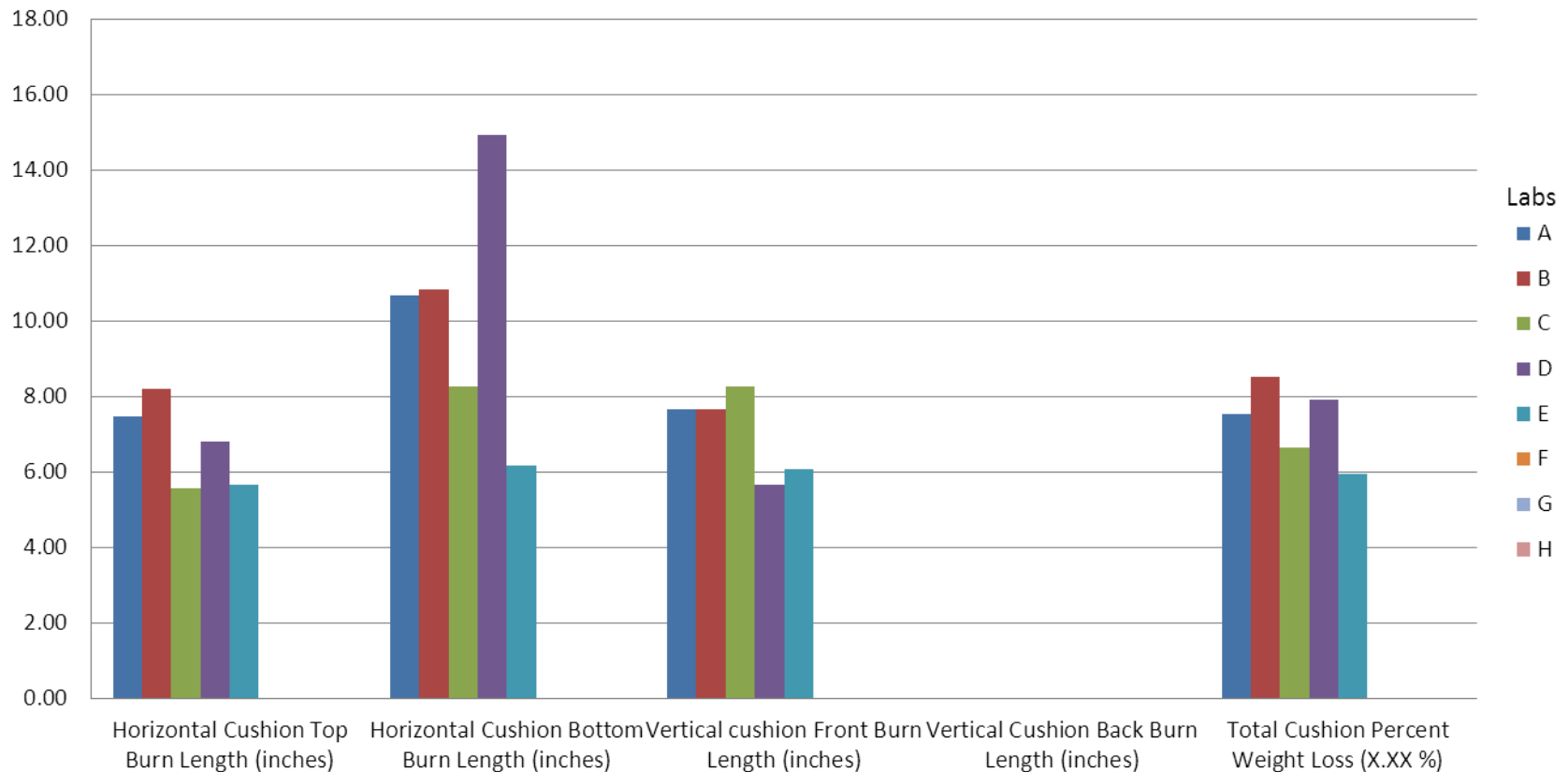
Dax Cushion Burn Lengths and Weight Loss Percent



- Lab A is data collected at FAA Technical Center

Round Robin Update

Airflex Cushion Burn Lengths and Weight Loss Percent



- Lab A is data collected at FAA Technical Center

Future Items

- **Complete round robin**
 - Gather and analyze data from labs
 - Refine burner settings as needed
- **Finalize leather seat restraints**
 - Need input from industry
 - Complete cushion testing
- **Flame retention head development**

Questions?

