NexGen Burner for Seat Cushion Fire Testing

International Aircraft Materials Fire Test Working Group

October 21, 2009

Atlantic City, NJ

Outline

- Background
- Objective
- NexGen Burner Configuration
- Results
- Future Work

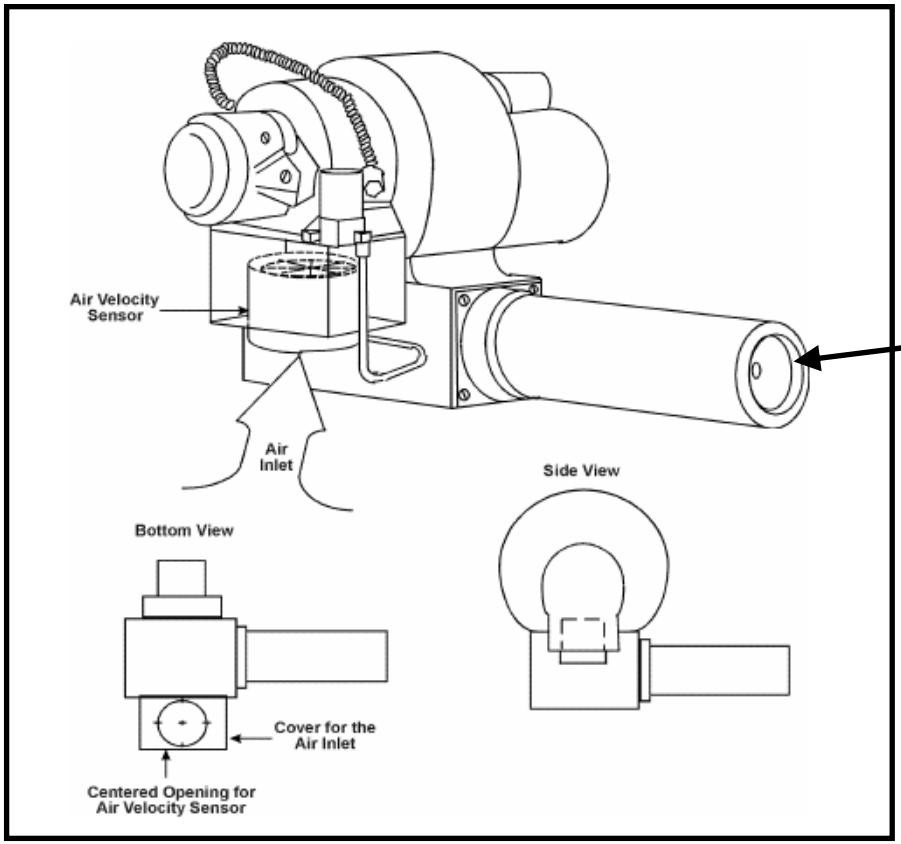
Background

- **Lack of availability of burners for seat cushion fire testing has resulted in the need for a readily available, equivalent burner**
- **The NexGen burner has already been found to provide equivalent results to the Park burner for thermal acoustic insulation burnthrough testing**

Objective

- **Configure a NexGen burner to achieve seat test performance similar to a Park burner calibrated to standards set in chapter 7 of the Aircraft Materials Fire Test Handbook**
  - Fuel flow rate of 2.0 gph ± 0.1 gph
  - Equivalent to an inlet air flow of 67 ± 4 cfm
  - 30-second average heat flux of at least 10 BTU/ft^{2}s
  - Flame temperatures of at least 1800°F on 5 of 7 thermocouples and at least 1750°F on at most 2 thermocouples
  - 30-second average of 7 thermocouples at least 1800°F

Equivalent Air Flow Rate

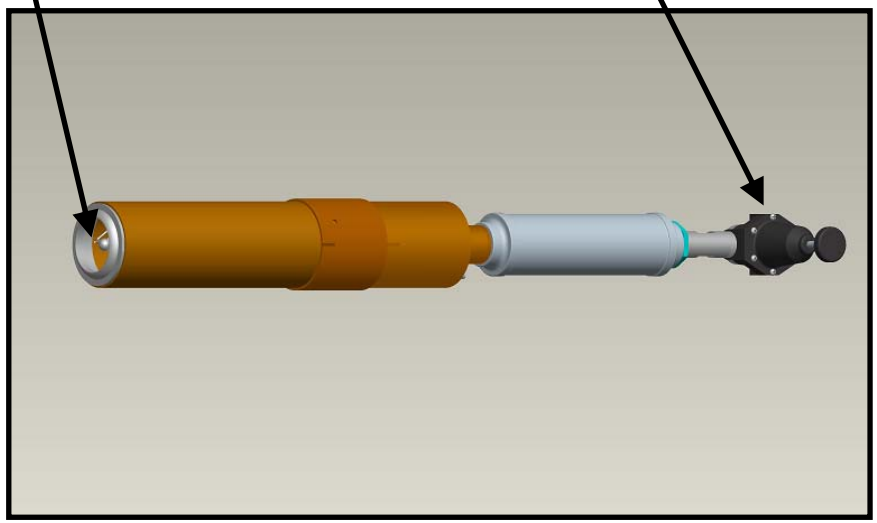


Inlet Air Flow:

67 cfm ≈ 1800 fpm in 2.625 in^2 air flow meter (HH30)

Exit Air Flow ~ 1600 fpm

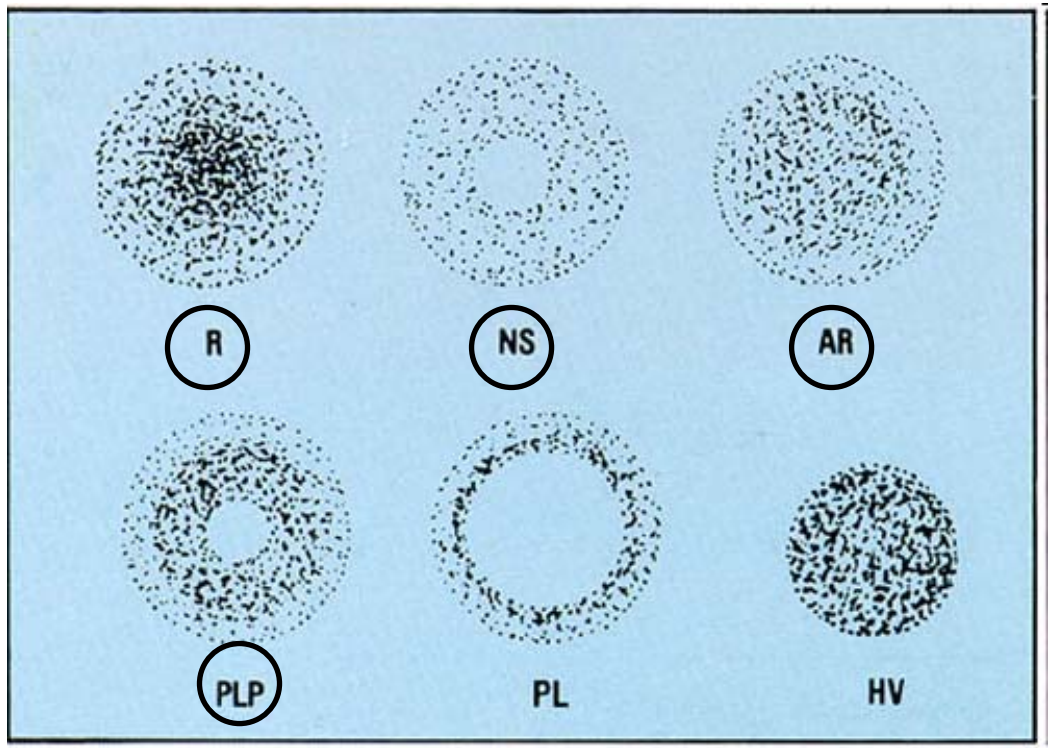
Resulting Sonic Choke Inlet Pressure:47 psig



Note: Exit flow measurements taken with turbulator on

Fuel Flow Rate

- **Fuel flow rate is dictated by**
  - Specific nozzle used
  - Inlet fuel pressure
  - Fuel viscosity
- **Several nozzle types were attempted**
  - R: Solid
  - NS: Hollow
  - AR: Special Solid
  - PLP: Semi Solid

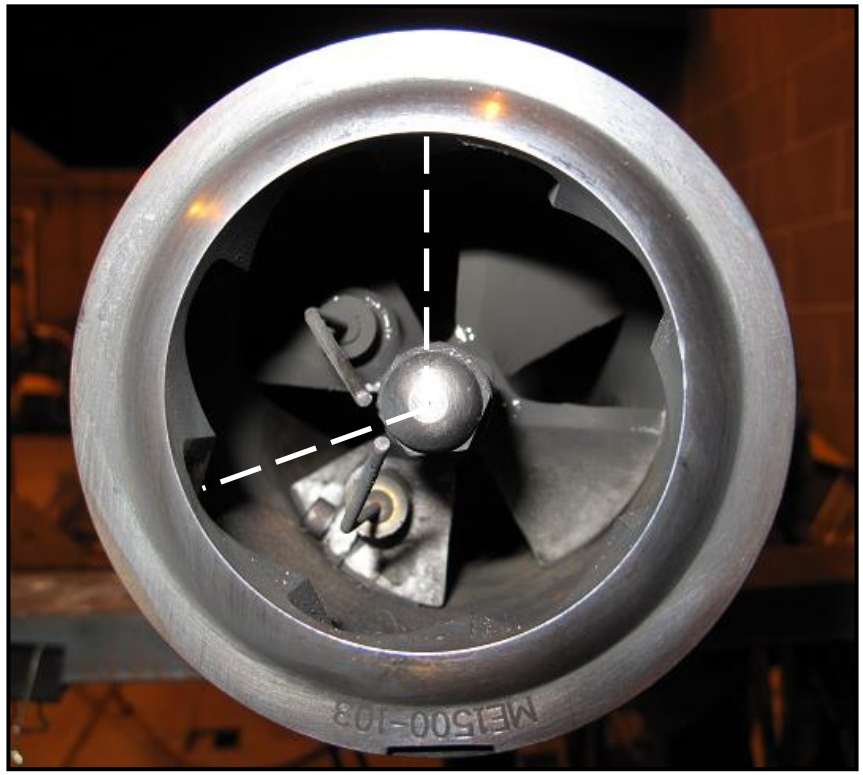


www.monarchnozzles.com

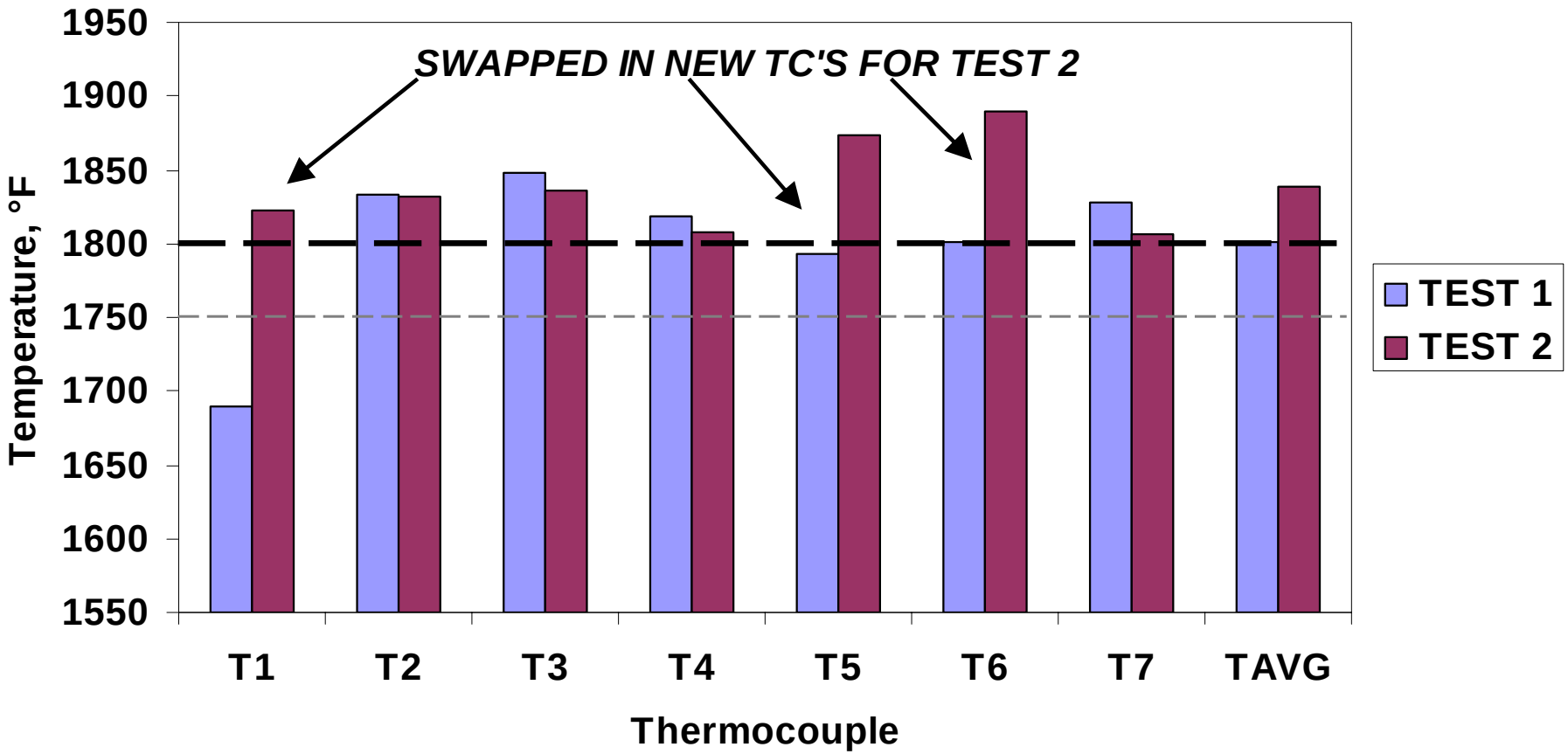
NexGen Burner Settings

- **Fuel Nozzle**
  - 2.25 gph-rated 80° PLP @ 95 psig → 2.03 gph
- **Stator Distance**
  - 3 1/16” back from nozzle tip
- **Stator Clocking**
  - Approximately 262° from vertical
- **Air Flow**
  - Sonic choke inlet pressure = 47 psig → 1600 fpm exit velocity

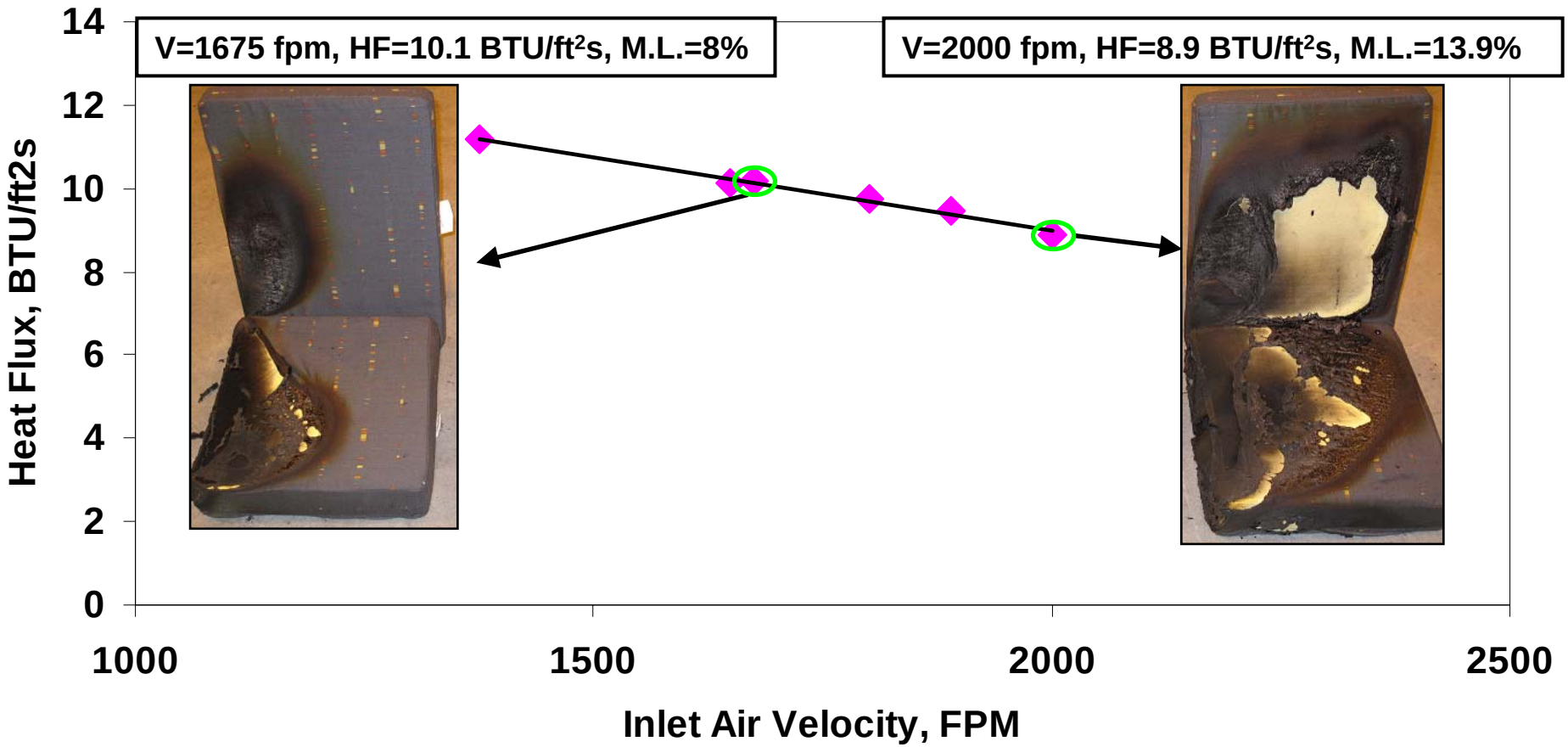
Stator Clocking Measurement Example



Measured Flame Temperatures



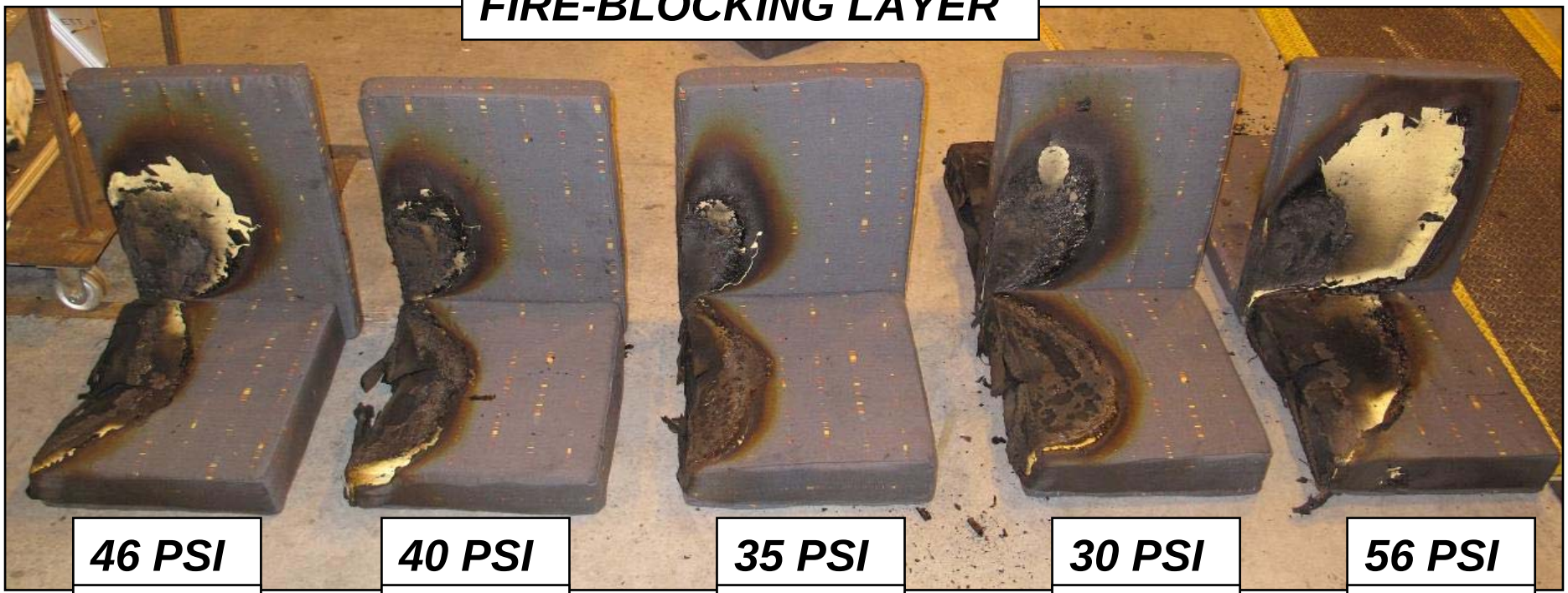
Heat Flux



- In an unrelated study on the Park burner, heat flux was measured with a Gardon gauge at varying inlet velocities
- The heat flux was found to *decrease* as the inlet velocity was *increased*
- The subsequent comparative test showed that velocity has a significant impact on test results

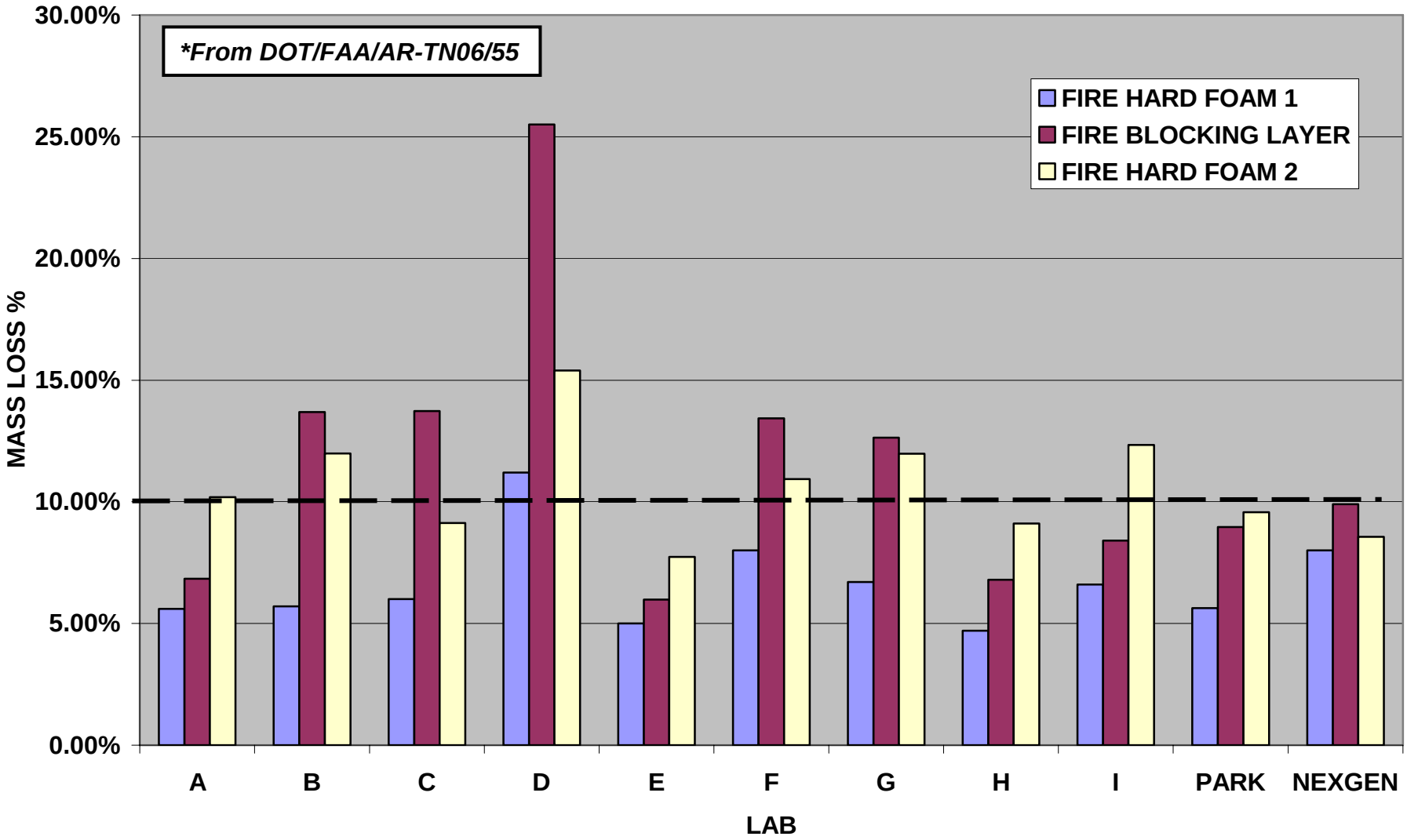
Seat Test Results vs Inlet Air Pressure

FIRE-BLOCKING LAYER



46 PSI	***40 PSI***	***35 PSI***	***30 PSI***	***56 PSI***
13.2%	***10.8%***	***8.87%***	***10.93%***	***15.79%***

COMPARISON OF NEXGEN BURNER WITH SEAT ROUND ROBIN 2006*



Summary

- **After much trial and error testing, the NexGen burner was able to achieve burner calibration according to the specifications in chapter 7 of the Aircraft Materials Fire Test Handbook**
- **The NexGen burner results compared well with the results from the seat test round robin described in DOT/FAA/AR-TN06/55**
  - Burner airflow reduced to 35 psig to achieve similar results to the Park
- **More cushions will be ordered to perform more thorough testing to determine the limits of burner settings**

Questions?

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