Burnthrough and NexGen Burner Update

Federal Aviation Administration

IAMFTWG

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Robert I. Ochs

Genesis of the Next Generation Fire Test Burner

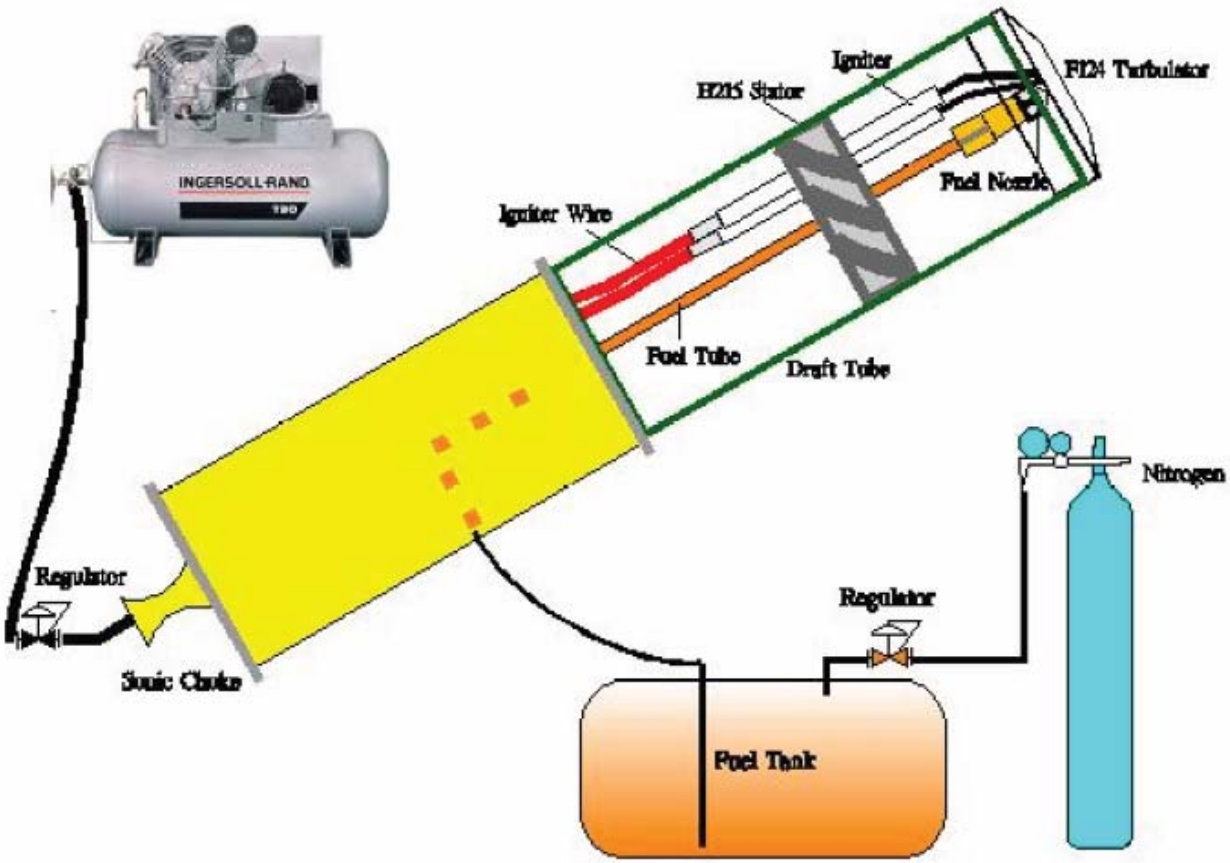
- **During development and implementation of the Thermal Acoustic Insulation Burnthrough Rule, it was discovered that the Park DPL 3400 was no longer in production**
- **Options**
  - Find another commercial off the shelf oil burner
  - Develop a new burner that will not suffer the same fate

Objectives

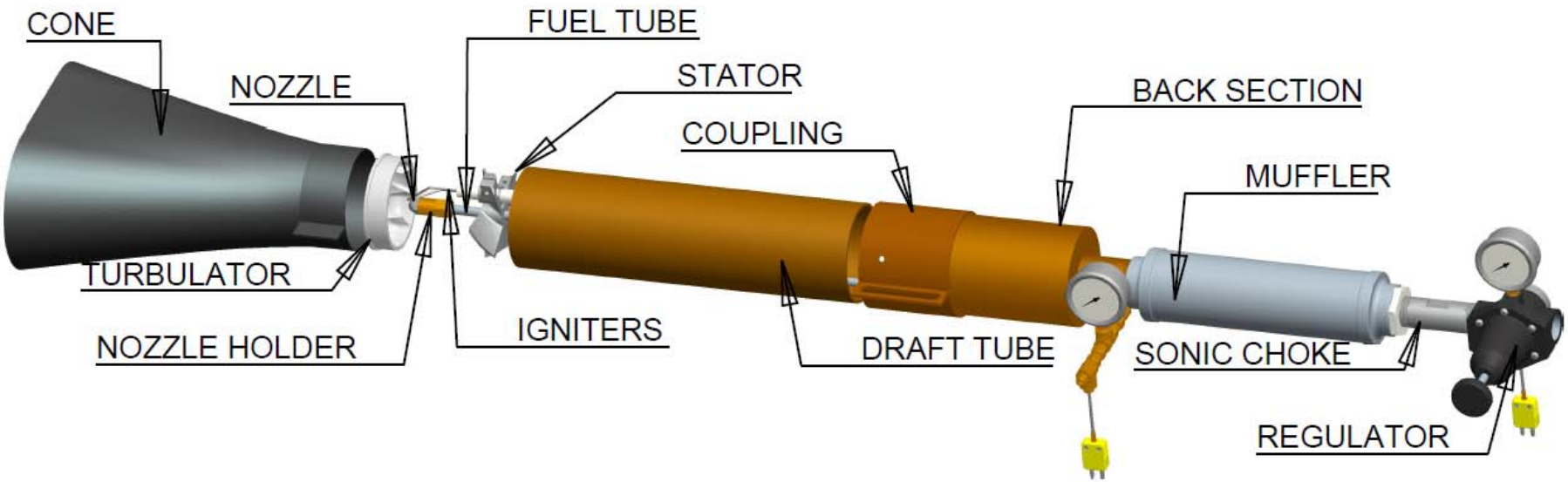
- **Design a fire test burner that can be constructed in-house with easily obtainable components**
  - Simple design
  - Simple operation
  - Simple maintenance
- **Burner output must be comparable to the Park DPL 3400**
- **Burner should achieve a higher level of repeatability and reproducibility**
- **Burner should be versatile and easily adaptable to any of the fire tests calling for a “modified gun-type burner”**

Initial Concept

- **Compressed air metered with a sonic nozzle**
- **Fuel provided by a pressurized fuel tank**
- **Utilize original Park DPL 3400 components**



NexGen Burner Design

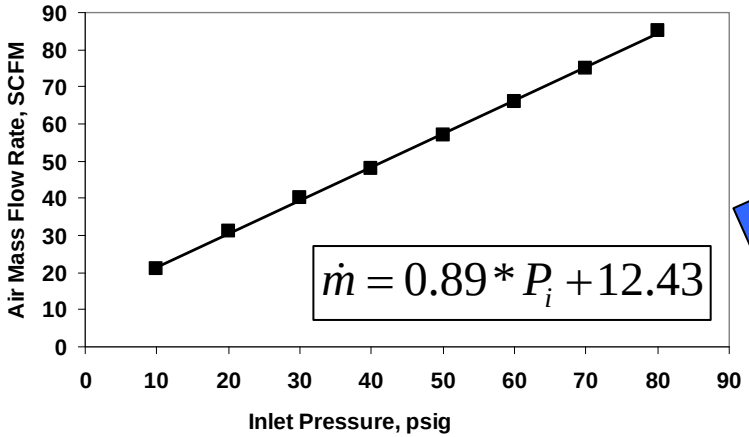


Burner Control

Air Flow

+

+



Fuel Flow

+

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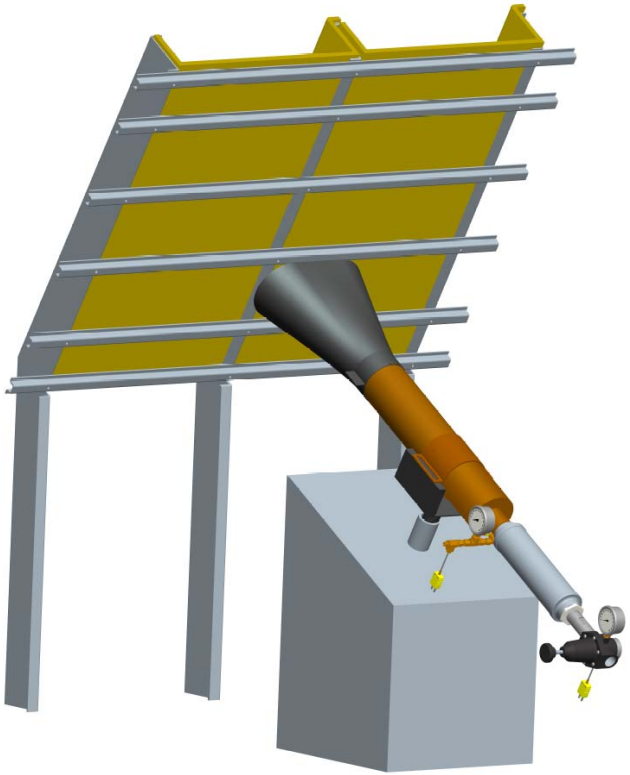
Regulated and conditioned air and fuel to burner

Thermal/Acoustic Insulation Burnthrough

14 CFR 25.856(b)

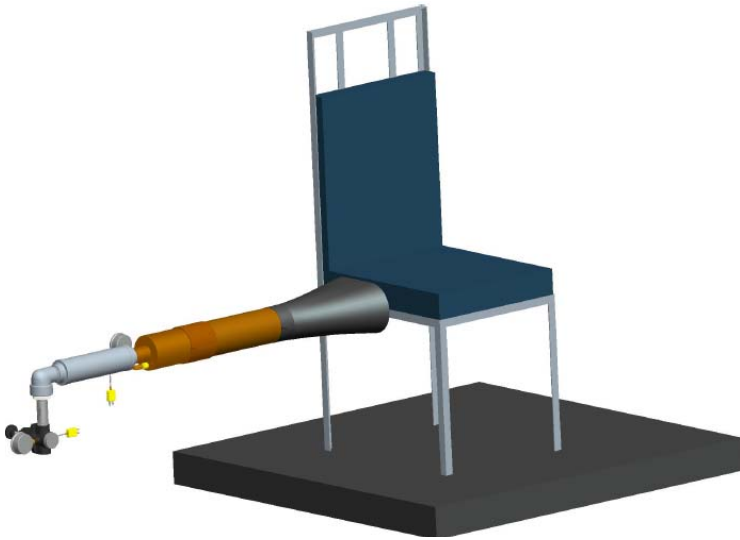


Cargo Liner Burnthrough

14 CFR 25.855

Seat Cushion Flammability

14 CFR 25.853



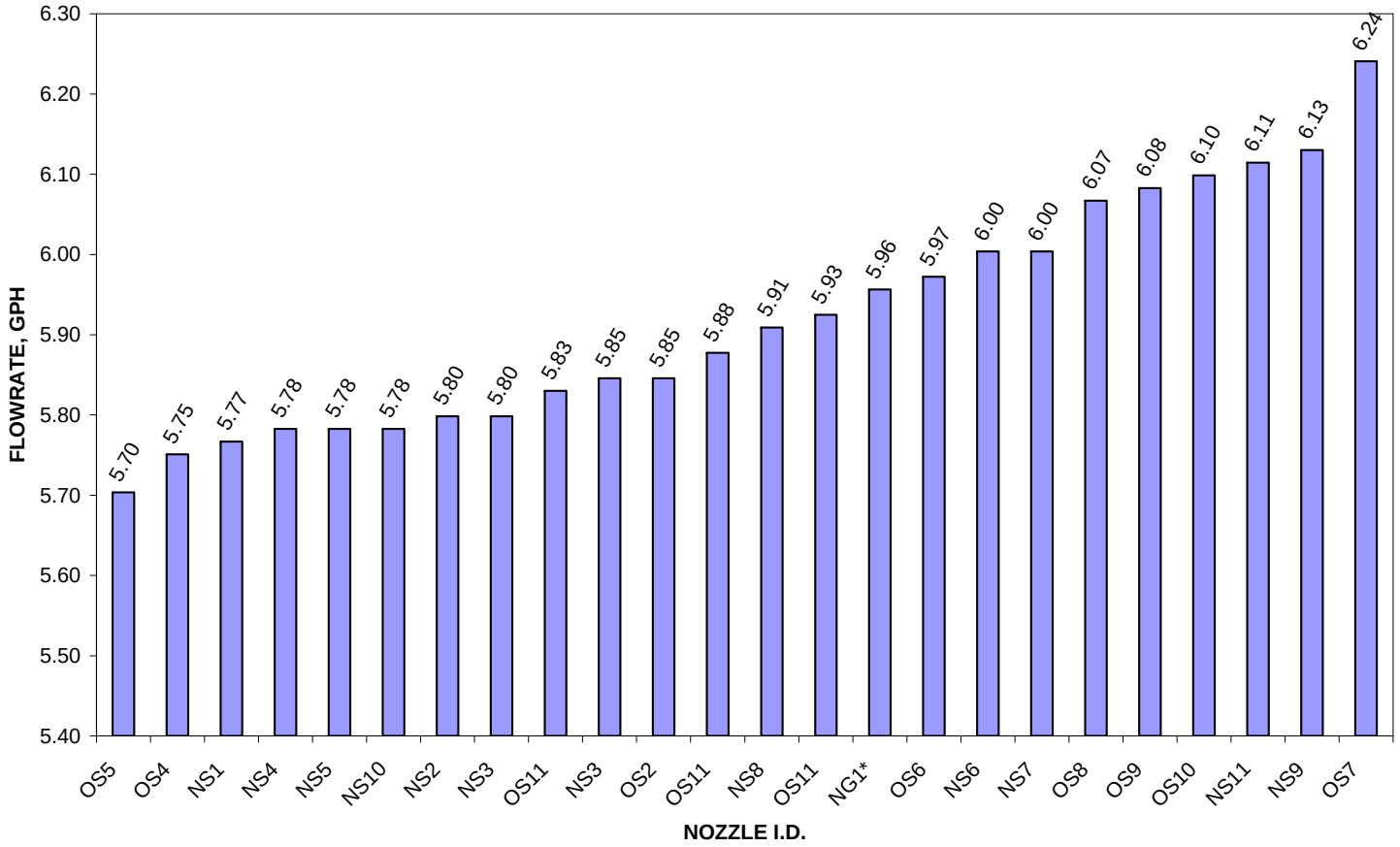
What's New

Spray Nozzles

- **Discussed with a spray industry expert / representative**
  - Industry standard on flowrate is about ±10%
    - 2.0 gph nozzles -> 1.8 - 2.2 gph
    - 6.0 gph nozzles -> 5.4 - 6.6 gph
  - Typical orders include thousands of nozzles, if FAA were to have a specially produced nozzle, price would be very high
- **Received 25 2.0 gph and 25 6.0 gph spray nozzles from Everloy (Japan)**

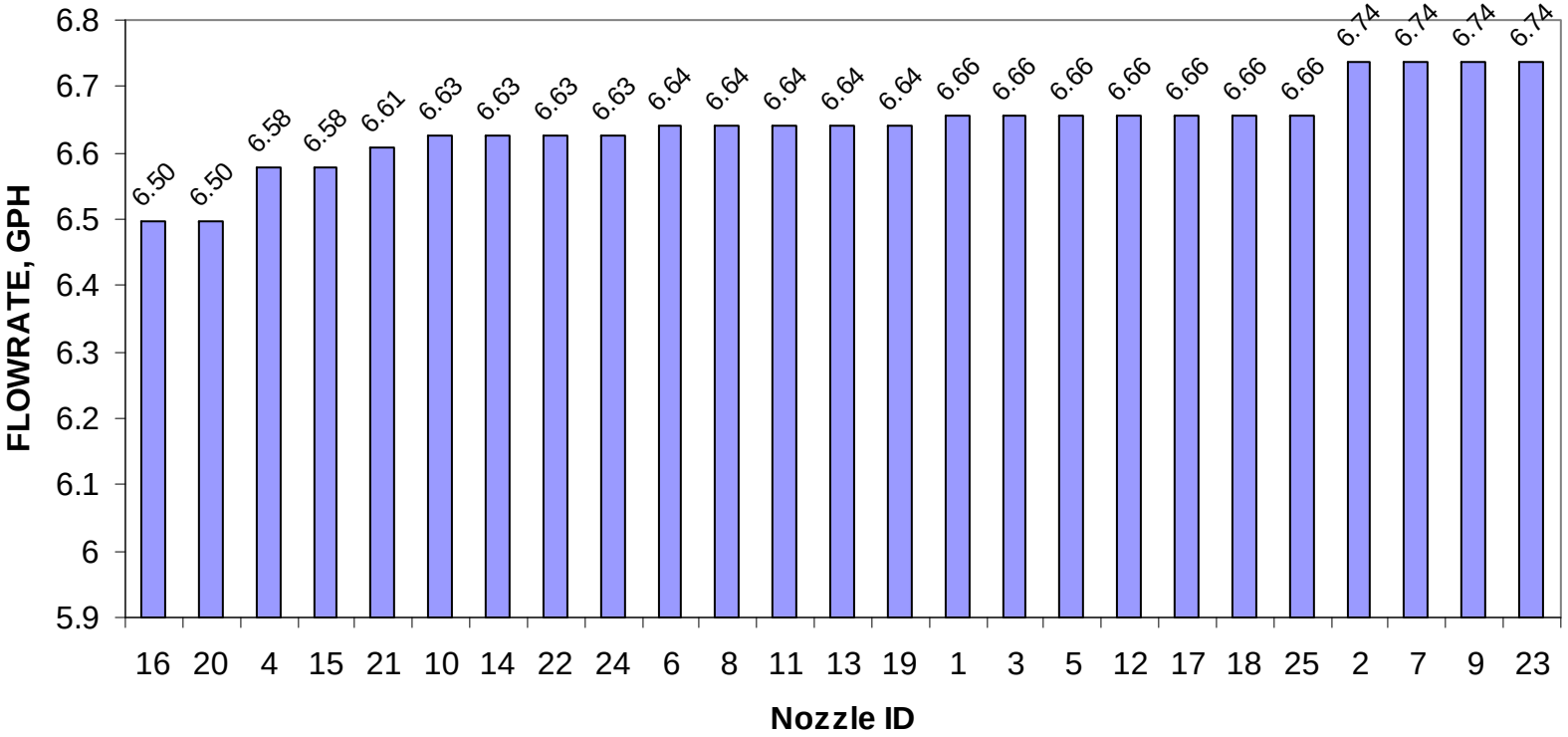

Monarch
Delavan
Everloy
2.00

Monarch Spray Nozzles



- **Average: 5.92 @ 120 psig**
- **%SD: 2.46%**

Everloy Spray Nozzles



- **Average: 6.64GPH @ 100psig**
- **%SD: 0.91%**

Everloy Nozzle

$$F_2 = F_1 * \left(\frac{P_2}{P_1}\right)^{.5} \Longrightarrow P_2 = P_1 * \left(\frac{F_2}{F_1}\right)^2$$

F_1 = calibrated flow rate at P_1 (6.6 gph)

F_2 = desired flow rate at P_2 (6.0 gph)

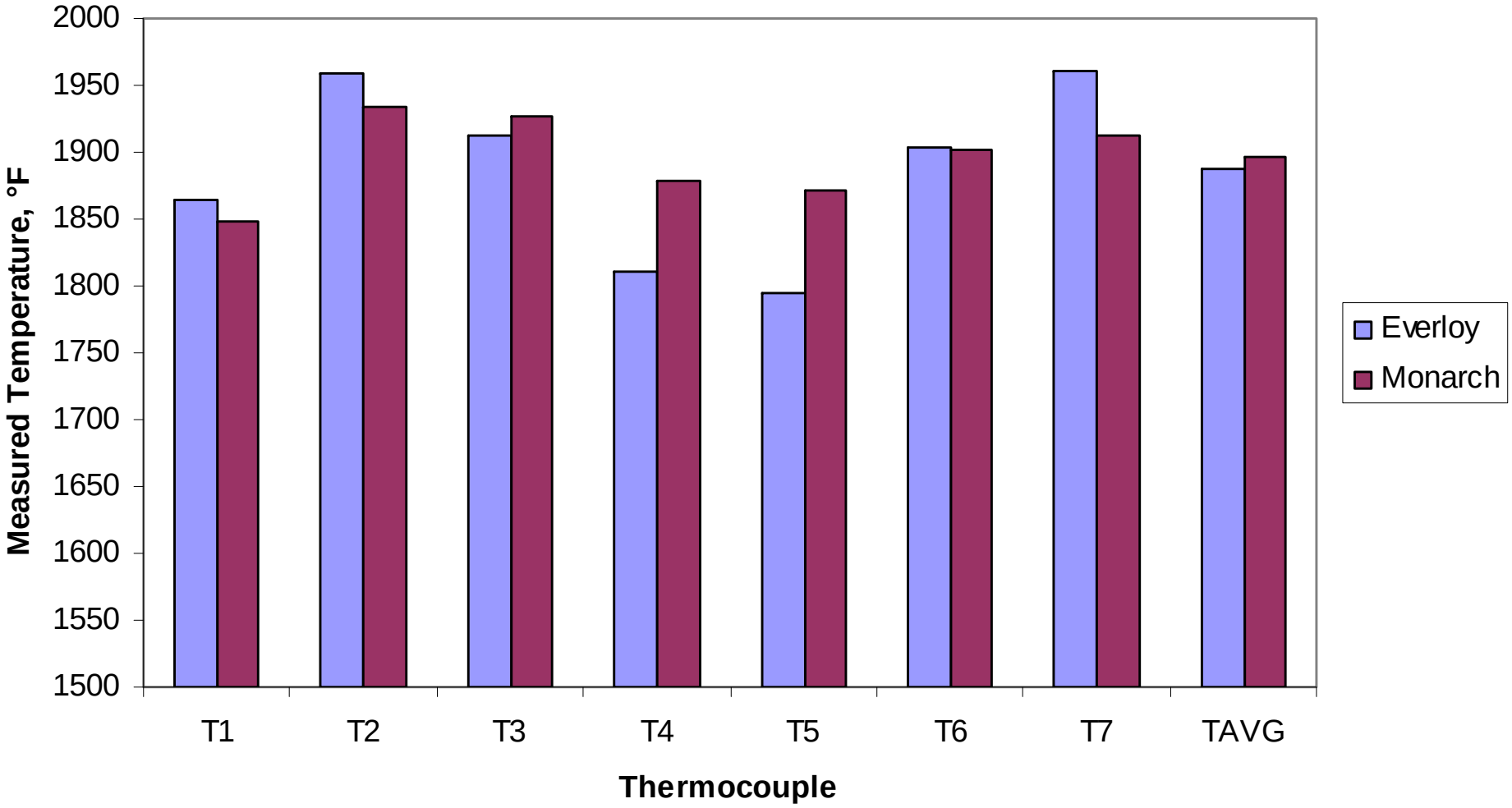
P_1 = calibrated nozzle pressure (100 psig)

P_2 = pressure to deliver F_2 (unknown)

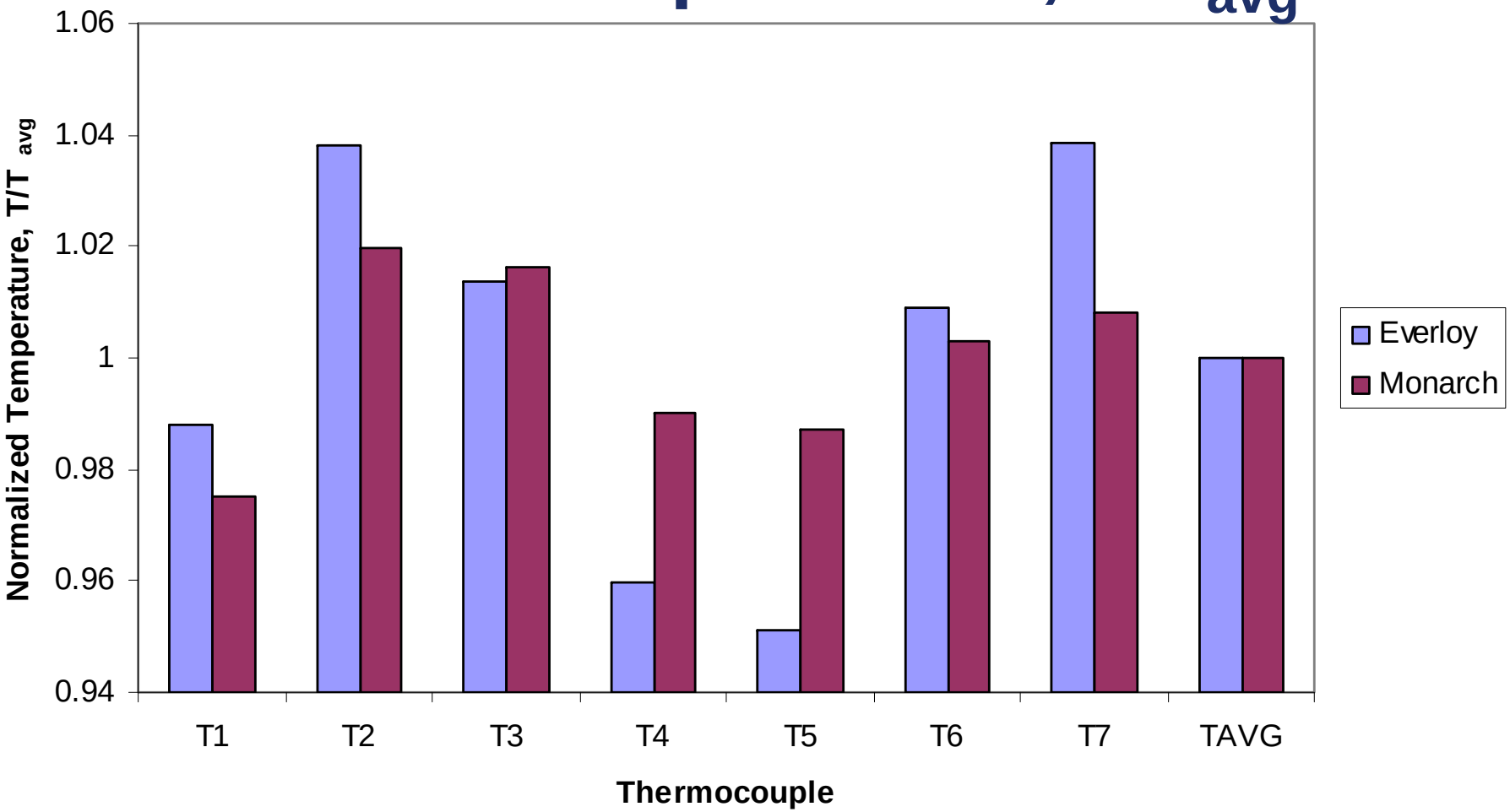
$$P_2 = 82 \text{ psig}$$

Nozzle ID	*Pressure, psig*	*T Start*	*T Final*	*mL/min*	*GPH*
1	100	51	44	420	6.66
1	82	51	44	385	6.10

Everloy vs Monarch: Flame Temperature



Normalized Temperatures, T/T_{avg}



Summary

- **Everloy nozzles have more consistent flow rates than Monarch nozzles**
- **Everloy nozzle spray produces similar average measured flame temperature to Monarch nozzle spray**
- **Everloy nozzle spray seems to be more hollow than Monarch spray, but also seems to be very symmetric**

Planned Work

- **A large quantity of TexTech PAN material (8579 and 8611) has been ordered for comparative testing at FAATC and round robin tests for interested NexGen-Burnthrough labs**

Planned Work (cont.)

- **Items for comparative testing**
  - Relocation of regulator-choke-muffler
  - Sonic chokes of different throad diameter
  - Fuel nozzles
    - Everloy 6.0 hollow
    - Delavan
      - 5.50, 6.0, 6.50 gph hollow, solid, and all purpose
  - Cones
    - New cone vs. weathered cone
    - Flanged vs. unflanged
    - Thickness / steel type
    - Exit plane shape

Questions?

Contact:

Robert Ochs

DOT/FAA Tech Center

BLDG 287

Atlantic City Int'l Airport

NJ 08405

robert.ochs@faa.gov

1 609 485 4651