



Vertical Flame Propagation Test Update

International Aircraft Materials and Systems Fire Test Forum

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**Federal Aviation
Administration**

Vertical Flame Propagation (VFP)

Proposed new test method for non-metallic, extensively used materials located in inaccessible areas, i.e.:

- Composite skin, structure, and sub-components

- Wires (insulations/jackets/sleeving)

- Duct materials



VFP Manufacturers



Marlin Engineering



Concept Equipment



Deatak

Today's Topics

- Heat Flux Gradient upon a sample
- Heat Flux Gauge holders



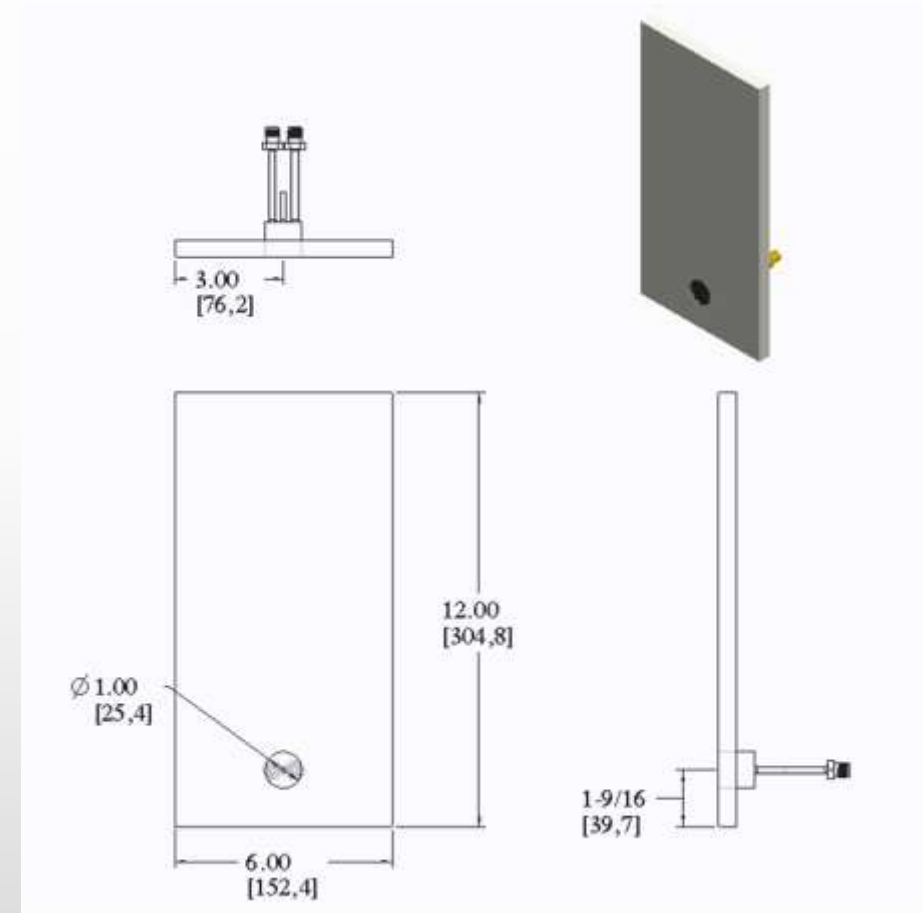
Radiant Heater Review

- Learned previously that the current heater design needs improvement
- A solution to this issue is a radiant heater that is built upon a required heat output instead of a required build
 - This will give slight freedom in design but still hold on certain parameters such as heater body diameter and heated area.



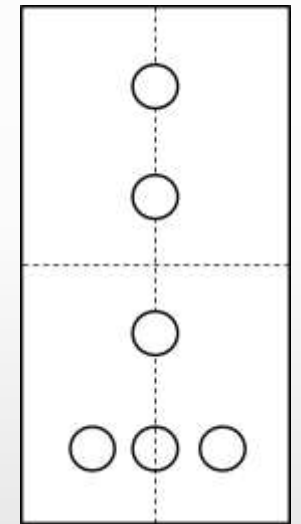
How the VFP is Currently Calibrated

- The VFP currently has one location for calibrating the heat flux of the radiant heater before testing materials.
- This is to be set at $1.80 \pm 0.05 \text{ W/cm}^2$



Heat Flux Mapping Upon Sample

- Ideal for the requirement of the *build* for the heater, not frequent calibration for the user
- This would mean the user would do this mapping calibration every:
 - 6 months or 1 year
 - When a new heater is installed
 - The heater is physically moved



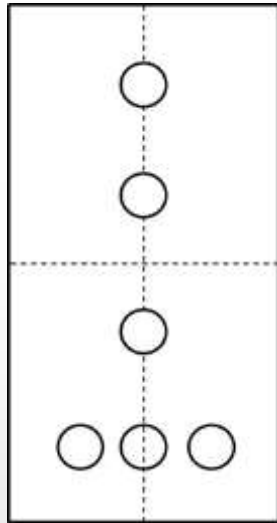
Heat Flux Mapping Upon Sample

- Note that the board used for each location has only one slot for the heat flux gauge
- This ensures a more stable reading



Heat Flux Gradient Testing

In order to test the practicality of the heat flux gradient measurements, 5 machines participated in measuring the heat flux gradient of their heaters.

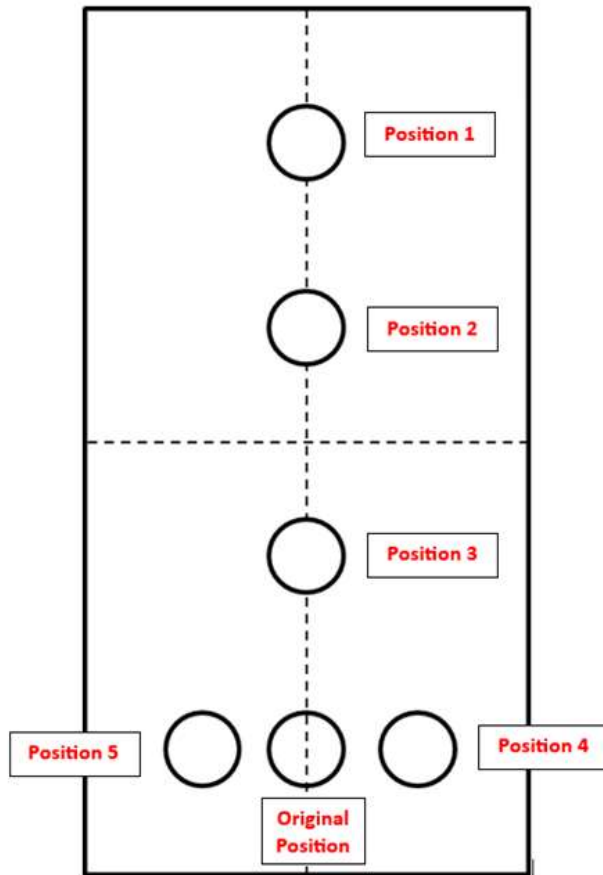


Additional Heater in the Averages

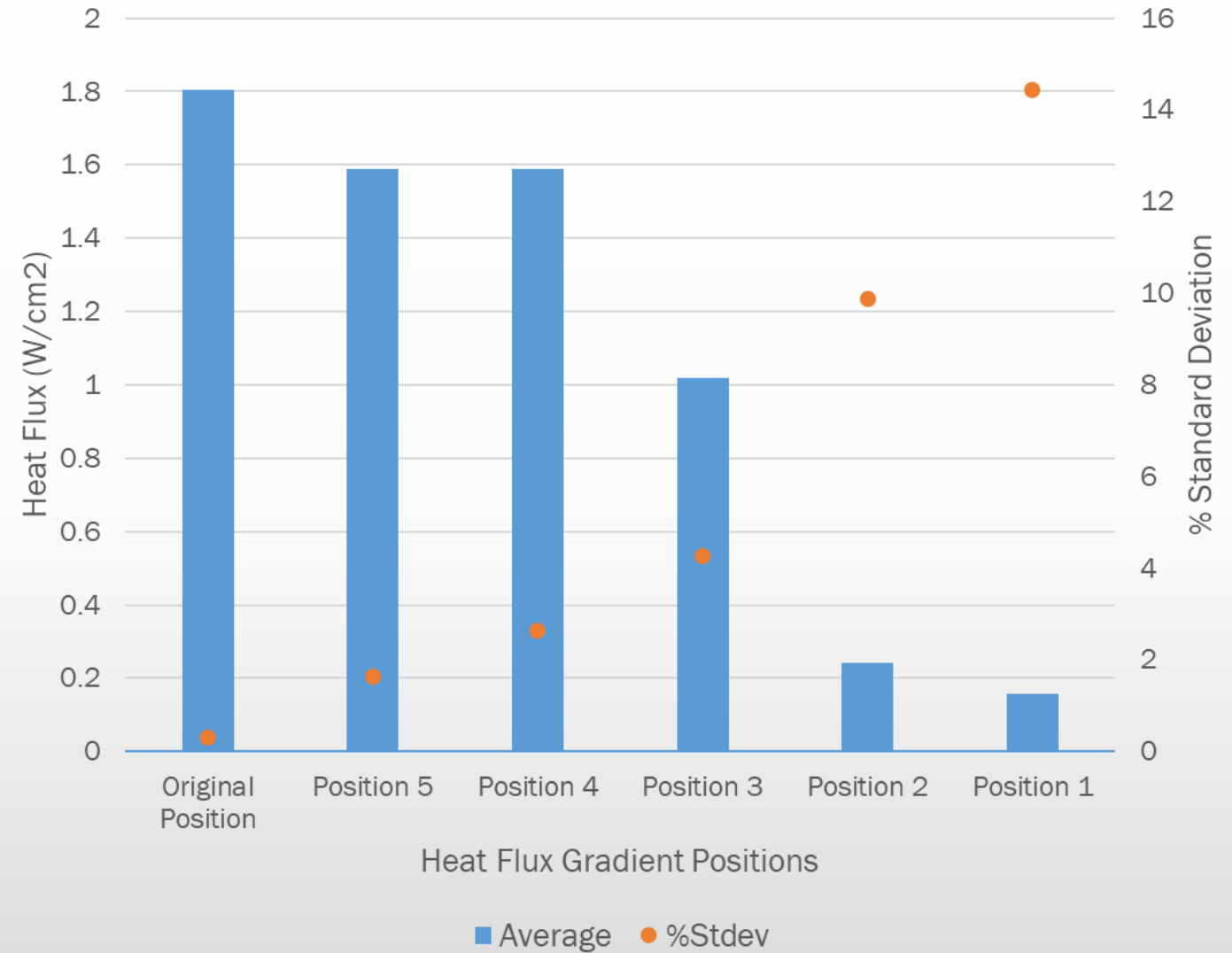
- In addition to the traditional VFP heaters, a newer style heater measurements were taken as well
- This is included in the averages listed



Average Heat Flux Between Labs

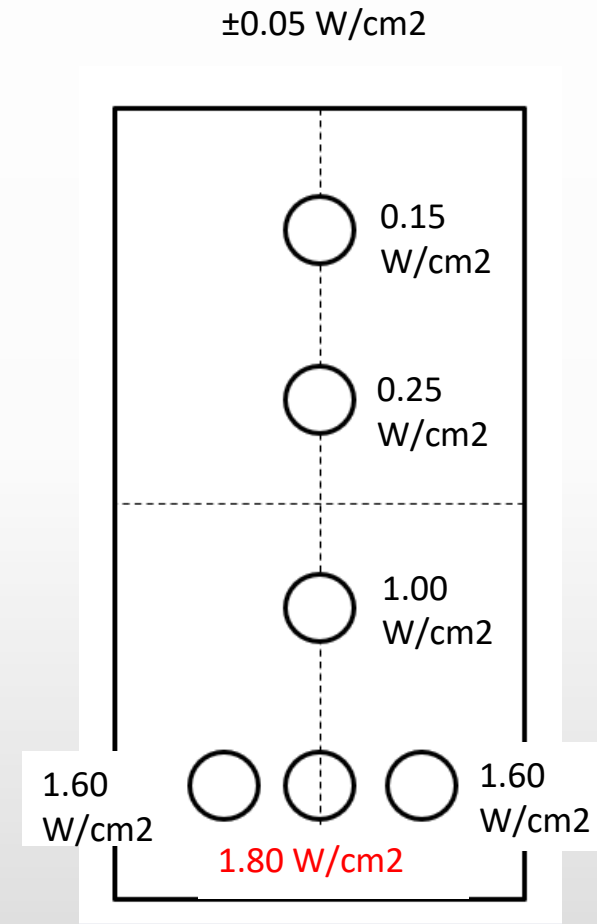


Point of View: Observing behind the refractory board, the rear end of the heat flux gauge facing the user. User facing the VFP machine.



Radiant Heat Flux Gradient

- Potential Heater Requirements based on the collection of readings
- Confirmation would be through inter-lab testing



Heat Flux Gauge Holder

At previous Task Group meetings, it was brought up that the heat flux gauge holder may have an impact upon the readings that are made



Heat Flux Gauge Holders

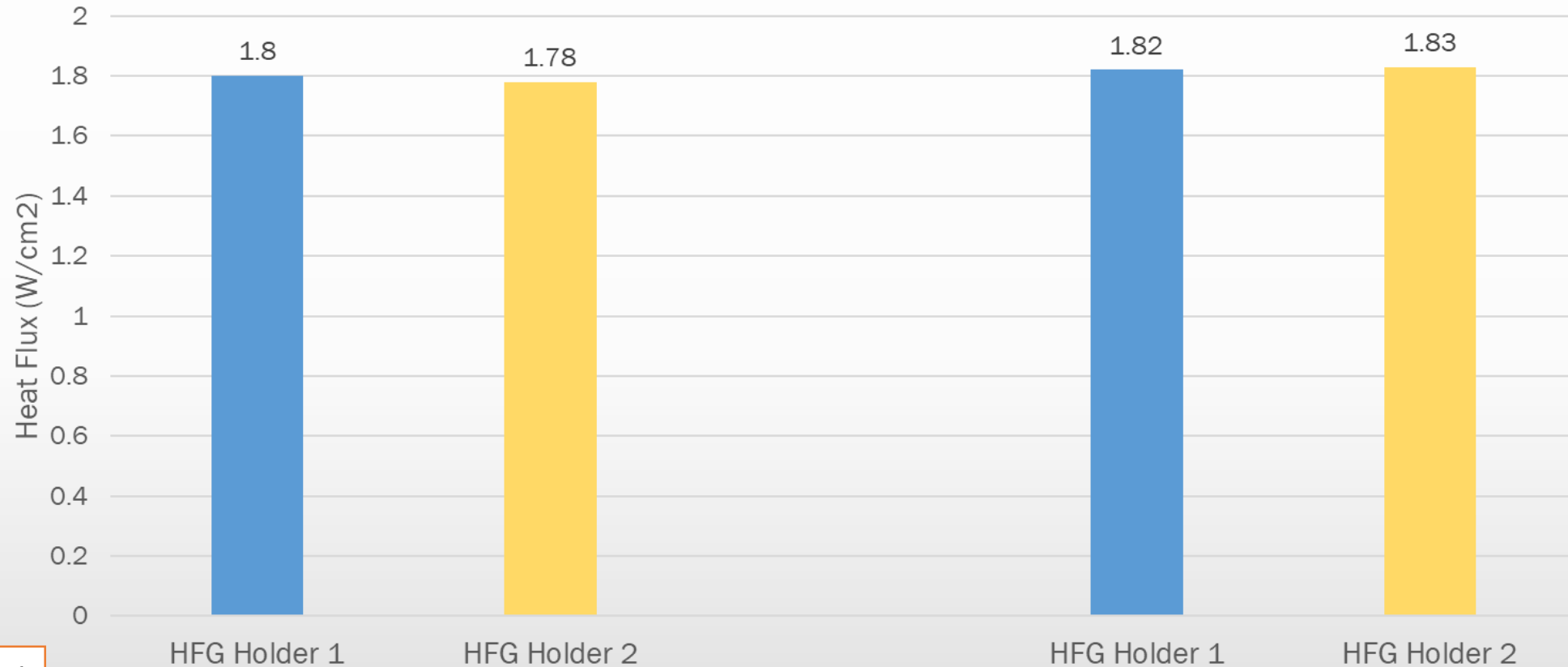


Heat Flux Gauge Holder Comparison

- One machine, one heat flux gauge, and two heat flux gauge holders were used.
- The first heat flux gauge holder was placed in the sample holder for 5 minutes as a pre-heat and then recorded heat flux for 5 minutes.
- The second was then placed in the sample holder, again pre-heated for 5 minutes and then recorded heat flux for 5 minutes.
- This was then repeated for two sets of data.
- Note: Room temperature was 85 °F during these tests. Although not ideal, readings taken were for comparative purposes, so it does not affect the ultimate result.

Heat Flux Gauge Holder Comparison

Differences in Heat Flux Gauge Holders



Assumption that the HFG water was heating up throughout this sequence of measurements.

Difference
 0.02 W/cm^2

Difference
 0.01 W/cm^2

Reminder: The tolerance on the heat flux is $\pm 0.05 \text{ W/cm}^2$



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Task Group Meetings Today

- 1:20 – 3:00 VFP Task Group Session 1
 - Atlantic Ballroom
- 3:30 – 5:00 VFP Task Group Session 2
 - Atlantic Ballroom



Questions?

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