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DEVELOPMENT OF A STANDARDIZED RADIANT HEAT SOURCE FOR THE VERTICAL FLAME PROPAGATION FLAMMABILITY TEST

Presented to: IAMFTF, Cologne

By: Ray Bashford

Representing:
Concept Equipment Ltd.

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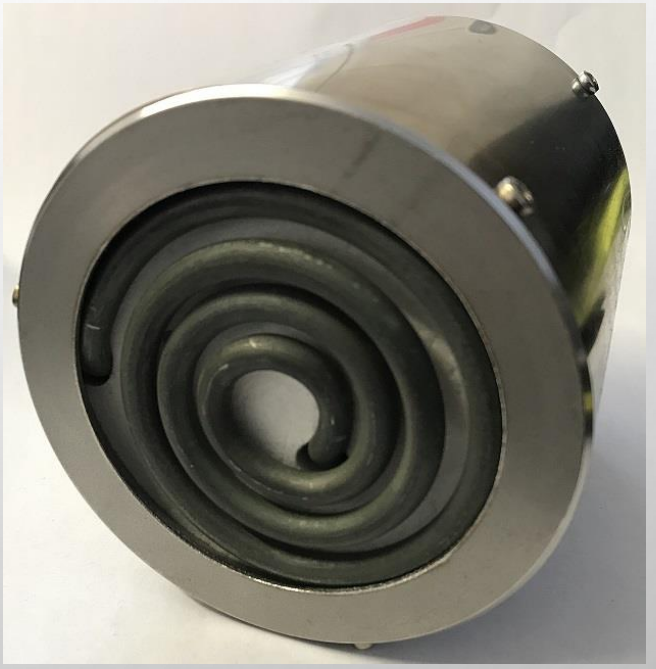
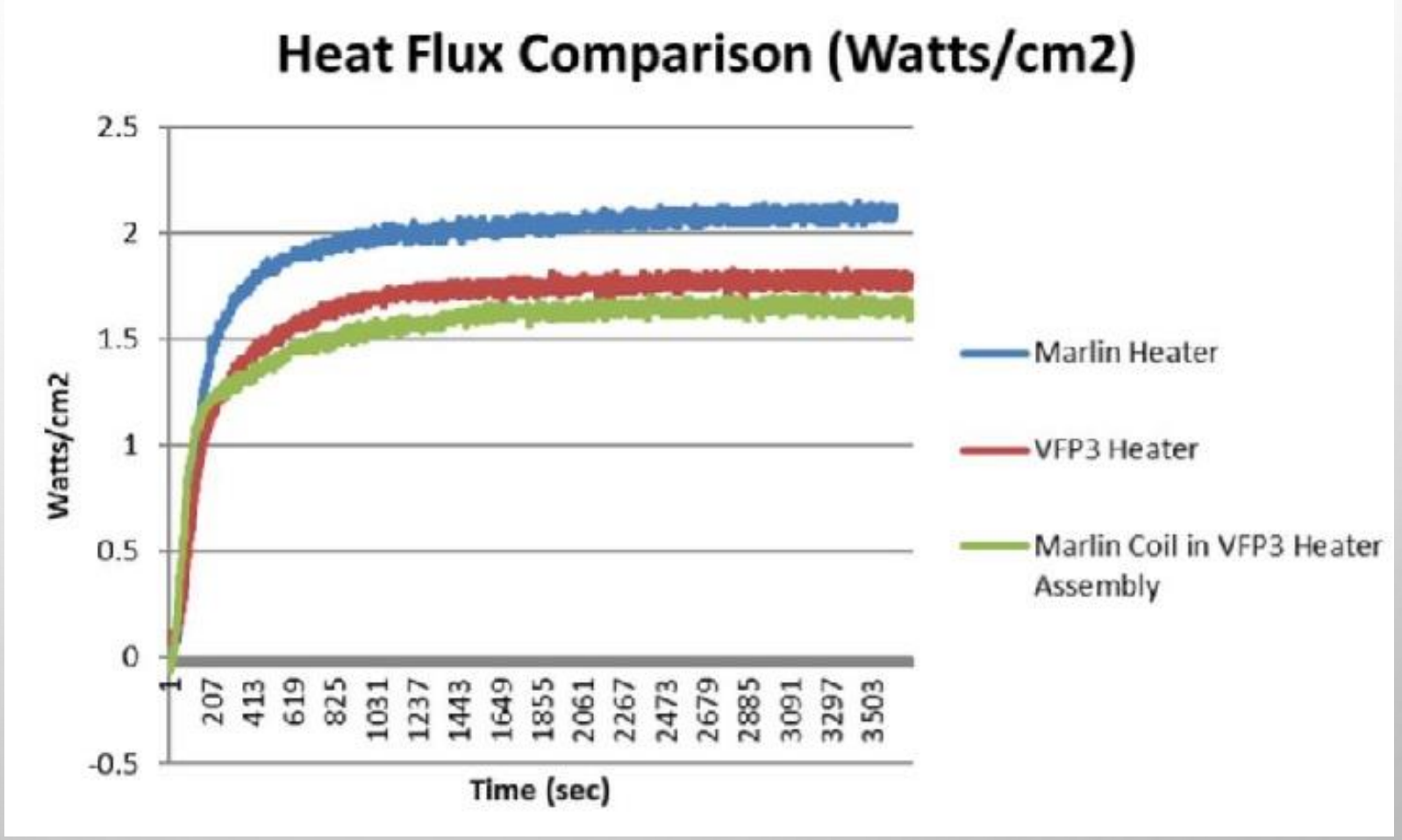


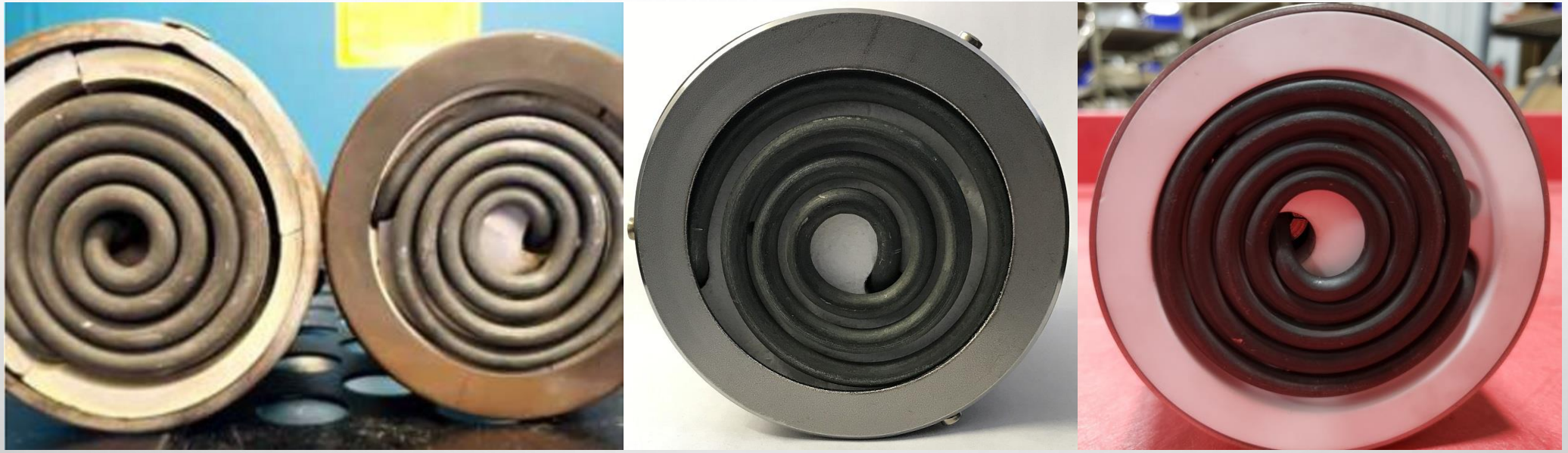
BACKGROUND

- At the last meeting in Savannah, tests showed differences in heat flux at the sample surface, between the two FAA furnaces and the Marlin production VFP Furnace.
- The plot opposite showed a 15.25% difference between VFP3 and Marlin's furnace when set to 706 Watts.



- In the task group discussion, there were concerns about being able to achieve consistent radiant heat to the sample, using a fixed power setpoint only.

FAA VFP3 MARLIN ENG. CONCEPT EQUIP. DEATAK INC.



- Different designs and packaging of the furnace would very likely give differing radiant heat exposures to the sample.
- The aperture size at the front of the furnace, the use of baffle plates, venting features etc. would also have an affect on the output of the furnace radiating to the sample.

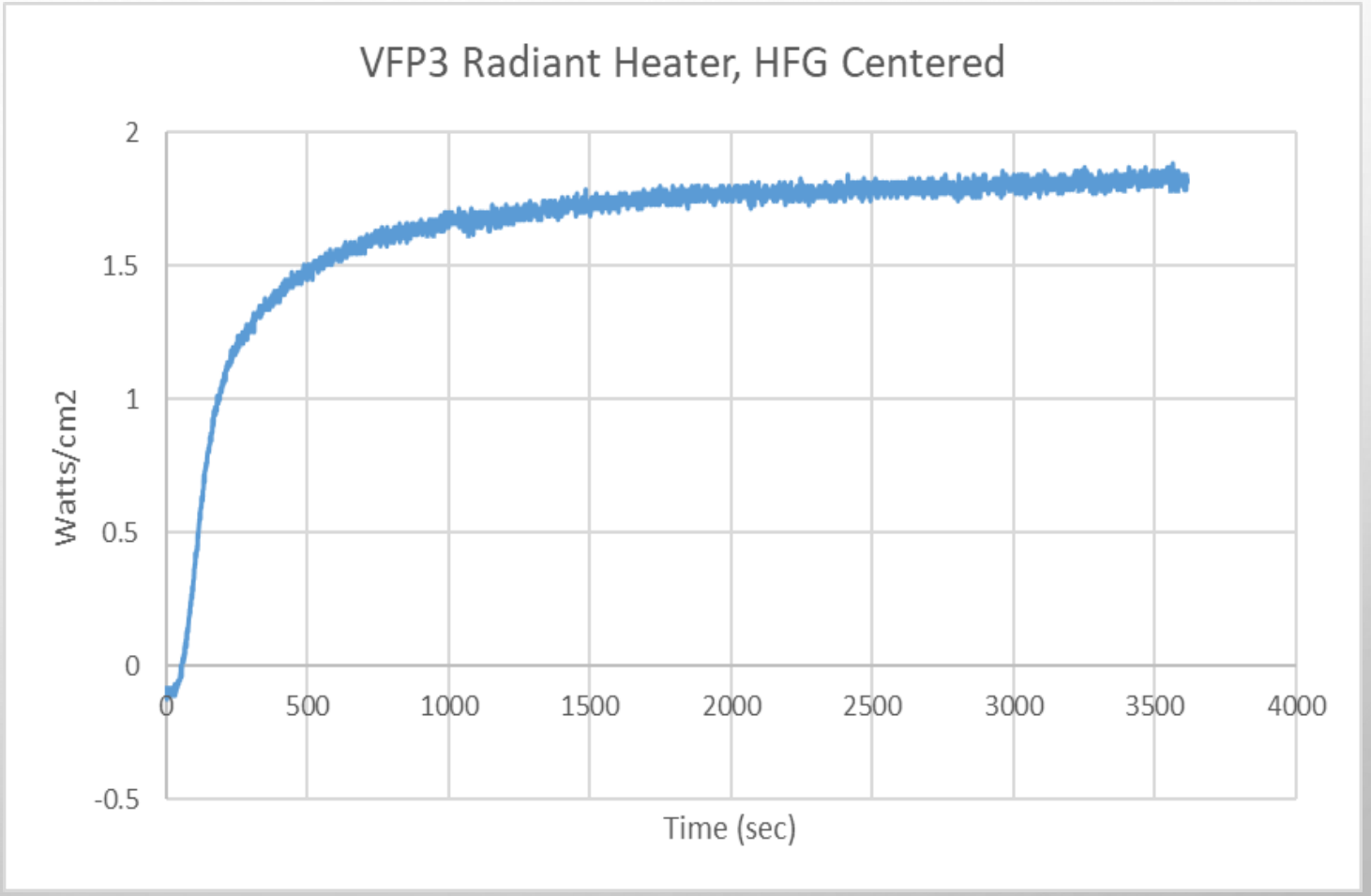
- Positions of cold zones would potentially have an effect as well.
- Concerns over drifting of the power control method were also discussed.

FAA VFP3 | MARLIN ENG. | CONCEPT EQUIP. | DEATAK INC.

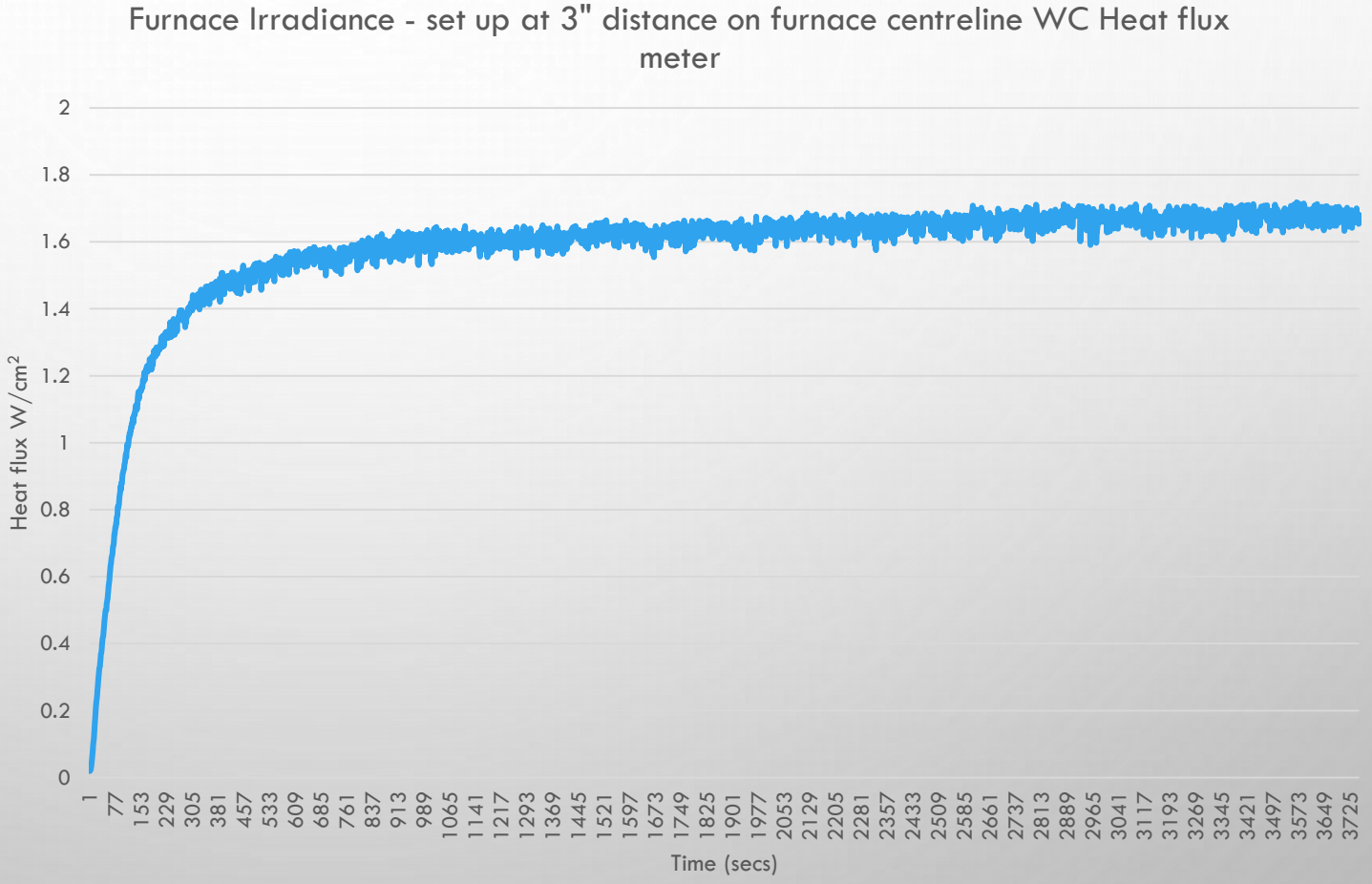
- It was suggested that a sub task group was created between the FAA and the manufacturers to look at potentially generating a common design to avoid these concerns.

SUB TASK GROUP MEETING

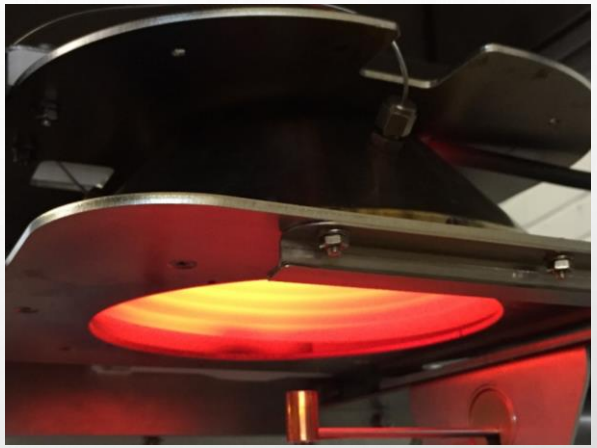
- Manufacturers and the FAA met at the Tech Centre at the end of April.
- Prior to meeting, the FAA performed a further test.
- This plot of FAA VFP3 furnace in the VFP chamber using a heat flux gauge on centreline of furnace, mounted in a dummy sample board.
- The results showed a maximum of 1.884 W/cm^2, and an average over last 60 secs of 1.825 W/cm^2.



- Concept presented a prototype furnace to the meeting for discussion.
- We ran same test to see how close we could get with a prototype furnace.
- 600W rated element in a VFP configuration. We achieved 1.718 W/cm^2 maximum at 571 Watts power.
- The average over last 60 seconds was 1.678 W/cm^2
- With 135 Watts less power, we got within 8% of the target average.
- This illustrated further that the design and packaging of the furnace is key.
- We discussed current heaters, FAA, Concept, Marlin and Deatak were all from different suppliers. The FAA furnaces were Newport, who are not involved in this project.



- Alternatives to the tubular elements were also discussed but the FAA wanted to retain the tubular element at this stage of development.
- Manufacturers were in agreement that it would be difficult to achieve a consistent radiant exposure to the sample, based on fixed power setpoint, even if we all attempted to manufacture the same ‘standard furnace’, as we would have no other parameter to adjust.



- We used the comparison of the standardised Nexgen burner. Standard parts and assembly but without the ability to adjust the fuel or air flow and without the thermocouple validation procedure.
- Therefore, we need to have a validation criteria other than a fixed power of 706 watts. The FAA were not keen on heat flux or temperature measurement.
- The manufactures' were united in wanting to use heat flux as the validation criteria.
- It has worked well in controlled environment applications such as NBS ASTM chamber, ISO5659-2 chamber, Cone calorimeter and Radiant Flooring Panel apparatus.
- Previous experience with OSU and Nexgen were argued to not be ideal applications for stable heat flux measurements due to the high turbulence environments.
- The tolerance for heater calibration used generally in fire testing was +/- 0.1 W/cm^2 , although NBS ASTM chamber was 2.5 +/- 0.05 W/cm^2.
- Concept, Marlin and Deatak all achieve this specification on their NBS and ISO chambers.

FURNACE II SPECIFICATION

- It was agreed to use 1” (25.4mm) diameter heat flux gauge to provide validation of furnace designs by all manufacturers and the FAA.
- Heat flux target threshold to be 1.75 – 1.85 W/cm^2 at 3” from sample.
- Inconel tubular element, 0.265” Dia. +/- 0.015” will be used.
- The nominal diameter of the spiral geometry shall be 3” +/- 0.13”
- Cold ends must not be visible on the radiant surface of the element.
- Outside housing shall be made from Stainless steel.
- Outer diameter of furnace remains at 4” with a fixed aperture at the front of the furnace of 3” +/- 0.1, exposing the radiating element.
- Radiant plane of the element will be 0.0625” +/- 0.0313 from the front face of furnace housing.
- Ceramic rings/discs will fill void behind the element in the furnace.
- An optional stainless steel reflector may be added behind element.
- An optional thermocouple may be added to assist the output power control of the furnace.

FUTURE WORK

- FAA will modify their furnaces to comply with agreed Furnace II specification
- FAA to then repeat previous heat flux test in the VFP chamber.
- Concept, Marlin and Deatak will update their furnace designs to comply with Furnace II specification and build prototypes ready for further comparison tests.
- The manufacturers will produce a dummy calibration board to hold the heat flux meter on the centreline of the furnace as well as three other vertical positions.
- FAA to run further tests to ascertain the required heat flux in the upper vertical positions and advise requirements to manufacturers.
- FAA and manufacturers to run comparison tests on updated furnaces using heat flux measurements in the VFP Chamber.
- Sub task group to meet regularly via WebEx, at normal meetings and in between meetings if necessary.
- Review and update furnace specification as required.
- Update Vertical Flame Propagation Test Construction Document as necessary.

QUESTIONS ?

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