INTERNATIONAL AIRCRAFT MATERIALS FIRE TEST FORUM MEETING
Hosted by EASA, Cologne, Germany
June 18-19, 2019

TUESDAY, JUNE 18, 2019

Various Project Updates – T. Marker (FAATC)

Tim reviewed the following:
Ninth Triennial International Aircraft Fire and Cabin Safety Research Conference, October 28-31, 2019, Resorts Casino-Hotel, Atlantic City, New Jersey
Handbook Update Procedure
Brief info on HR2, VFP, Evacuation Slide (these will be covered in detail during this meeting).
Fuselage Fire Penetration Resistance Research at FAATC: Tim explained this type of test and described the FAATC test facility. He provided some photos of the test rig and setup. A schematic of the thermocouple locations was shown. Tim mentioned the Aeroflot Sukhoi Superject 100-95 Accident, 5/5/19. Danker: was there any 25.856 on this aircraft? Marker: I do not believe so.

Development of Flammability Test for Magnesium Components Use in Inaccessible Areas – T. Marker (FAATC)

Current Test Parameters: Radiant Panel Test
Chapter 26 of Aircraft Materials Fire Test Handbook
Interlab Study: 8 labs / 3 types magnesium alloy (EL43, EL21, ZE41) / 25 samples of each.
At the IAMFTF meeting in Savannah (March 2019) we learned about the EDM Electrical Discharge Machining process to produce .025 samples. FAATC has sent a company in NY enough material for the interlab study participants to test. Campbell: was there an intention, after the RR of the three materials and you have an agreement on one of those materials, can it be written in as an approved material or do we have to go through the process? Marker: I believe each company will have to go through the process for that material. We have seen differences from batch to batch. Canari: we (EASA) have received similar requests for magnesium use in seats.

Burnthrough Round Robin – T. Salter (FAATC)

Insulation Burnthrough Test Method Round Robin: evaluate sonic burner configuration update in Chapter 24 of the Aircraft Materials Fire Test Handbook. Tim described the Phases of this study. Currently in Phase 3: 9 labs participating, 4 have returned data so far. Tim reviewed the test results from these 4 labs. Lab to Lab Reproducibility was also reviewed for these 4 labs. FAATC test lab results for Phase 3 were also reviewed. Sattayatam: have you thought about incorporating a video? Salter: we are looking into that. Danker: any work at all with Carlin burners? Salter: I do not think so, but I would have to go back and double-check. Marker: it might be time to improve your test rig with some springs or something to prevent the stretching of the wires. Salter: I have been talking about this with Paul (technician) about options for this such as hanging weights on the wires to keep them taught. We are going to look into this.

Sonic Oil Burner Testing and Sonic Burner Video Update – T. Salter (FAATC)

Cargo Liner Test: Shroud Round Robin: 10 liner samples per lab, 5 to be tested with shroud, 5 to be tested without the shroud / 18 labs participating.
Some of the test results from 4 participating labs were presented. We are waiting to get more data back from the other participating labs before we can move forward. Question: the four labs you showed data for - were they all the same material? Salter: yes. Originally, we were going to send out all the same material to all the participating labs.

Sonic Burner Seat Cushion Test – T. Salter (FAATC)

The Seat Cushion Shroud is being developed (it is a modified version of the cargo liner shroud). We are waiting on shipment of test samples and looking for labs to participate in this Round Robin.

Sonic Burner Assembly and Operation Video Update – T. Salter (FAATC)

Focused on sonic burner assembly and operation. Viewing planned for Seat Task Group meeting. Final version will be posted to the FAA Fire Safety website (www.fire.tc.faa.gov).

Insulation Burnthrough Video: We are currently working on an instructional video for the insulation burnthrough test method. Marker: where are you going to put the video on the website? Salter: good question, maybe we need a video section on the website so it's easy to find any videos we have on the website.

Update for Oil Burner Testing of Powerplant Components – T. Salter (FAATC)

Current Status/Plan: SAE Thermocouple Round Robin Testing completed.
Composite material testing Round Robin
Conduct internal comparative testing of Park vs Sonic.
Heat Flux

Thermocouple Round Robin: Campbell: did you actually get the 4500 Btu/hr with the 2000° on your burner? Salter: we were able to achieve but it was actually higher. 1/8" sheathed thermocouple showed the largest drop in temperatures after cycling. 1/16" sheathed TCs showed the smallest drop in temperature after cycling. Smaller diameter TCs read higher temperatures compared to larger TCs.

Composite Material Evaluation (Spirit Aero): investigation to determine if this test may be used as means of comparing burner flame intensity from lab to lab /attempt to improve test result reproducibility.

Comparative Testing with Park Burner: sonic burner operating parameters will be adjusted such that it will be equivalent to the Park Burner. We are planning to do this testing after return from this meeting.

Propane vs. Oil Burner Heat Flux: we plan to do comparative testing utilizing legacy oil burners and propane burners.

Campbell: Cantilevers burnthrough mechanism – it seems like there is a lot of stress being put on it? Salter: I have not had time to test this yet. It is a way of comparing burners. Campbell: It seems like the rule came out and the way to demonstrate was the propane? There was no rule change but a lot of things had to change. Salter: I do not know the exact answer to that question. I believe that is what Scott Johnson (FAA) has been working on and what the SAE A-22 Committee has been working on. Question: especially in general aviation, we have a lot of applicants that ask why they have an oil burner. Canari: EASA had a number of projects in which we have accepted the propane burner, and we have to reconcile all of this with a test that can be used by all TC holders. Salter: this is a round robin that was sponsored by Spirit Aero (a member of the SAE A-22 Committee). Anglin: would the removal of the propane burner require an NPRM? Salter: that is a Regulatory issue. Canari: it is a difficult situation to fix. Campbell: has there ever been a powerplant failure of materials certified with a propane burner? It has worked for decades and now we have to go back and change all of these designs. Marker: I think that is a fair line of questioning, but I don't have the answer for it. Tim Salter is looking at trying to standardize the oil burner for these tests in coordination with the SAE A-22 Committee. Campbell: it is great that Tim is working with that Committee.

Vertical Flame Propagation (VFP) – T. Emami (FAATC)

We are currently gathering material for a Round Robin to test repeatability.

Tina provided the background on use of VFP test for wiring. It is a much more severe test for wiring. Sleeving: no current test method. Securing samples during test – alumina substrate.

Ducting tests: all tests were conducted using VFP 3 heater assembly.

Varying Foam Duct Testing: various tests performed of a foam duct material – flat and round and half size ducts / various thicknesses / testing in progress / FAATC cut notches to fit larger round ducts in sample holder (photo shown) / 30 samples of each diameter were tested: 1", 2", 3", 4" / all samples had thickness of ¼".

Comparison of Tubes of Different Diameters: the 2" diameter tube post test, with the back seal taped, 30 tests were conducted / average 1/75 inch burn length / 20% standard deviation
3" diameter tube / average 2.0 inch burn length
4" diameter – this material melted, so we decided to stop testing this material.

Wire Testing: purchased wire M81044 in sizes: 4, 6, 10, 12, 14, 16, 20, 22. Burn length of 14-gauge wire average = 9.875 inches. We need to design a sample holder for varying size wires. FAATC met with VFP manufacturers to design a uniform radiant heater.

A round robin is still planned when the heater work is completed. A form was created for labs in round robin to use. Campbell: is the duct testing going to be a design feature test or a material test? In terms of standardization. Emami: to understand how the test is going to work with this. Marker: are you still going to continue calling it the VFP, because it is a burn length test? Anglin: Tim makes a good point, it could be confusing to people who haven't been involved from the development of the VFP test. Campbell: when you do the tests of the different wire gauges, it would be good to know what changes with each thickness of wire. Emami: I will note that.

<u>Development of a Standardized Radiant Heat Source for the VFP Test</u> – Ray Bashford (Concept Equipment Ltd.)

Ray gave a brief description of the three manufacturers' heaters and background on differences between these. This led to the formation of this VFP heater subgroup with the FAATC and these three manufacturers. Ray reviewed the outcomes of the late April 2019 subgroup meeting. The manufacturers' were united in wanting to use heat flux as the validation criteria. FAA not keen on using heat flux. It was agreed to use a 1" (25.4 mm) diameter heat flux gauge to provide validation of furnace designs by all manufacturers and the FAA. The heat flux target threshold should be 1.75-1.85 W/cm^2 at 3" from sample. An Inconel tubular element, 0.265" Diameter +/- 0.015" will be used.
Future Work: FAA will modify their furnaces to comply with the agreed upon Furnace 2 specification. Manufacturers will update their furnace designs to comply with Furnace 2 specification and build prototypes ready for further comparison tests. The furnace specification will be updated as things move along.

<u>Radiant Panel Insulation Test</u> – S. Rehn (FAATC)

Handbook Update – June 2019: Steve reviewed the changes made to Radiant Panel Insulation Test Handbook Chapter in June 2019.

Electric Panel Aging Testing: (we are looking for borderline material to test). Temperature set point steadily increases to obtain same heat flux as panel ages – eventually leads to more material failures. Biggest difference seems to be black paint on surface. Photos of four old FAATC panels were shown. Proposed Study for Radiant Panel Aging: test 7 electric panels / panel set point / looking for borderline material to test. Backing Board Study: reported problems with certain foam materials that melt and stick to the backing board affecting subsequent tests / Zotefoams organized a study with the FAA and Wulfmeyer / 2 of the 3 labs

reported results so far. FAATC results for 25 mm samples (30 foam samples each) were reviewed. Zotefoams conducted ANOVA analysis of these results. Wulfmeyer results for 25 mm samples (30 foam samples each) were reviewed. Results from FAATC and Wulfmeyer for 3 mm samples were reviewed. We are awaiting Zotefoams test results for comparison. Conclusion: 25 mm foam samples with Superwool 607 and Super Firetemp® M backing boards had higher after flame times and significantly more failures than Fermacell® backing board in FAATC testing. Campbell: what were the observations of tests you did comparing backing boards? Rehn: you could definitely tell the two boards were different: Superwool® 607: the material would melt into the backing boards. Campbell: did the materials that failed puddle in place? Rehn: the pilot burner would burn away the melted material for the two solid boards. The Superwool® 607- it would stay in place.

RTCA Development of a New Flammability Test for Electronic Boxes – S. Rehn (FAATC)

RTCA-DO160H: draft due to committee in Spring 2020. Steve described the programmable line burner. The draft test procedure: a drawing of the burner will be added and a few other items will be added, and the draft test procedure will be sent out again to Task Group for review/comments. Round Robin: Box contains 4 circuit boards. Photos of each circuit board were shown. Burner placement is somewhat subjective. After discussions, we agreed to 4 burns, one for each PCB (printed circuit board). We do not have bill of materials. All boards were same height. Same flow rate for all tests. If flames escape box for greater than 12 seconds, it is considered a failure. Photos of the test results for the 4 PCBs were shown. Videos of some of these tests were shown.
Burner Placement Exercise: will be done after this IAMFTF meeting. This will go out to entire Task Group. Campbell: when the flames went through, was it verified? Anglin: in previous meetings we discussed a worst case test to certify a box, so it would be more user friendly. Are we still looking at those for part of this activity? Rehn: I am not sure we can go with a standard box for this. I am not really sure you can say this box design is good and you can put anything you want in there. Anglin: you did a lot of research on the hole size. Rehn: we can talk about it more in the Task Group meeting. Marker: your burner placement exercise seems a bit troubling, because you got 4 different answers when you sent it out before. Rehn: some labs decide to be more conservative. Question: you are working towards one test instead of testing all the material in the box? Is this increasing the level of testing? Is this method increasing the level of safety we have now? Rehn: this does seem to be a little more severe than we have now. Canari: the intention was to be able to test the box without testing the components separately. Campbell: what we would like is to have a design guide for the box, there has to be some methodology for designing the box, so we don't have to test every time we change one board. Rehn: it is something we can talk about in the Task Group meeting.

Flow Visualization in the OSU – T. Emami (FAATC)

Create an adjustment to the current OSU apparatus to create an even flow. Photos of clear OSU Flow Visualization test apparatus were shown. The new test setup was described. New tube placed in OSU (aluminum version placed in OSU). Vane Anemometer Measurement Location (cold OSU) photo shown. Pressure Measurements (cold OSU) were taken. Tina reviewed various temperatures taken in hot OSU with and without new air distribution tube. Heat Release for four (4) samples with and without the new air distribution tube installed were reviewed. Johnson: did you calibrate the radiant heat, and did you have to adjust the heaters at all? Burns: the total if you added the two power settings was equal, but the ratio between the upper and lower globars was even. Brian: are you sure you were getting the same quantity of airflow in both setups? Burns: yes. Question: why do you have such a high temperature with the new addition? Emami: it is a lot. I think it is a good discussion point for the Task Group.

HR2/OSU Update – M. Burns (FAATC)

Initiative: to improve OSU (HR2 development)
Goal: improve repeatability/reproducibility
Objective: standardized/simple and easy

HR2 Calibration: Mike described zero/span calibration procedure.
HR2 Voltage Control System: 4/29-30/2019 new equipment/features installed in FAATC HR2 apparatus.
HR2 Placeholder Document Update: revisions to Stability / Heat Flux / Radiation Source / Determination of the Calibration Factor (Kh) and procedures. Mike reviewed the updates to nominal operating procedures in the back of the document.

HR2 Oxygen Depletion R&D: FAATC purchased Teledyne B1 0_2 Sensor (Galvanic Fuel Cell Type) / SM-AFR Wideband Sensor Kit. Teledyne B1 0_2 Sensor – very poor resolution / SM-AFR Wideband Sensor Kit – could not read any percentage 0_2 change. We will talk more about this in the Task Group.

Next: complete TRL activities as needed / continue observing calibration data over time / continue new prototype heater development for globar replacement.

HR2 Development -TRL 5 Update – B. Johnson (Boeing)
In review: reproducibility challenges persist.
Introduction: HR2 Goal: Define a robust method to determine peak and total heat release that improves repeatability and reproducibility when compared with OSU. TRL = NASA Technical Readiness Level model used for this. Brian reviewed the changes made prior to TRL 5 Phase II and the TRL 5 Phase III Test Plan.
TRL 5 Test Results: Brian discussed these results.
Next Steps: Evaluate the Gate 5 Exit Criteria / Potential way forward: proceed to TRL 6 or stay in TRL 5.
TRL 6 – focus is reproducibility / multiple HR2 machines needed.
Brian reviewed the items to be discussed during today's Task Group meeting. Question: what is our reasonable target for COV? Johnson: That's a great question for discussion during the Task Group session. Mooj: decorative panels were only decorative, are you now looking for other constructions as well for the next TRL? Johnson: the decorative did not stick. We saw some bubbles and that may have affected the burning behavior. Mooj: are you looking for other constructions other than honeycomb panel? Johnson: yes. The transfer tape we tried did not give us the rates we were looking for. Johnson: let's talk about alternatives in the Task Group session. We want to introduce as little variation in the materials from the manufacturing process.

HR2 Zone Heater Development Update and HFG Calibration Unit Update – Martin Spencer (Marlin Engineering)

Background: zone heater was developed to eliminate globars and to provide a more uniform and safer heater assembly. First prototype used two heating zones.
A three-zone unit was developed and will be sent to the FAATC upon return from this meeting. Johnson: are you still using less power? Spencer: I am estimating that it will take a lot less power.

HFG Calibration: Marlin Engineering has been developing a new calibration unit in conjunction with the FAATC to provide a more economical calibration process while meeting the latest FAA guidelines. FAATC evaluated the first prototype. Some changes in software were made and unit performed well. Boeing Metrology, Tom Valenti, reviewed and provided suggestions/input. Marlin Engineering making changes and Tom Valenti will review revised version.

Bunsen Burner – Again (Update)? - Scott Campbell (Safran)

Handbook 1.2.3 Drip Flame Time – Scott discussed this at Savannah IAMFTF meeting (March 2019) and proposed a wording revision.
Bunsen Burner 60-Degree Wire Test Applicability: what is applicable? Just electrical wire? Many additional questions arose after this presentation. There is nothing in the Aircraft Materials Fire Test Handbook about how to test any of these.
Recommend an update to Part 25 Appendix F Part 1 to clarify 'applicable paragraphs'. Update Handbook Chapter 4 to standardize testing for all of these components.

Waste Compartment Fire Containment MOCs and Test Harmonization – Scott Campbell (Safran)

Scott gave brief background on reason behind this work. Last meeting Task Group discussed shimming gaps and solutions. Shimming Guidelines were reviewed. Current fire loads were discussed. Accufleet did a study of airplane waste bin contents to use when updating fire load. More data needed. Trash Density: does trash density impact the fire containment test results? We don't know that yet.
Seals and Sealant: what needs to be 45-degree Bunsen burner test compliant? Mortise and tenon panel joints-no.
Chapter 10 of the Handbook, Section 10.5.1. TSO-C184 is different.
Any exclusions for waste compartments?

Engineered Gap Proposal – Scott Campbell (Safran)

"Proposal for Finding Compliance When Evaluating Gaps Between Panels" - Scott mentioned this. This Proposal will be available on the FAA Fire Safety website with the minutes/presentations from this IAMFTF meeting.

Additive Manufacturing Task Group – Thomas Krause (Airbus)

Issue: PEI has lower after flame time. Several parameters were discussed: printing directions/raster angle/layer thickness/thickness/infill (%). Thomas reviewed results of tests conducted since the March 2019 IAMFTF meeting in Savannah. Summary: lower infill (generally) leads to higher burn length and after flame time. Campbell: do we know what the average infill production parts being made today? Krause: I use 100%.

Vertical Bunsen Burner Testing of 3-D Printed Materials – S. Rehn (FAATC)

Test of solid 3-D printed material in vertical Bunsen burner (VBB). Ultem® Support Material / 0.060 inch thick samples / printed in three (3) orientations: flat (XY), sideways (YZ), and standing (ZX) / attempting to find worst case scenario to simplify future testing. Steve reviewed the results for these: burn length and drip flame time. Comparison: Ultem® vs. Nylon-12.
Summary and Future Work: Ultem® showed some difference in printing orientation. Ultem® Support seems to be a good candidate for a 'borderline' material. FAATC will test difference thicknesses and infill percentage next.

Evacuation Slide Test – S. Rehn (FAATC)

Steve reviewed results of recent FAATC tests. Heat Flux Gauges (HFG): paint on surface of HFG not uniform on all three. Mike Burns repainted them to make paint uniform. Heater and HFG Comparison results were presented.

Small Scale Test and Criterion for Flammability of Aircraft Cabin Materials – M. Anglin (Boeing)

Small changes in the composition of certified aircraft cabin materials are often needed due to unavailability of the original components or environmental regulations. Review of microscale combustion calorimeter (MCC). Matt reviewed FAATC MCC results of various materials. FAATC did a number of Case Studies and is looking for a few more Case Studies. Contact Rich Lyon at FAATC (Richard.e.lyon@faa.gov).
Summary: FAA-Industry fire test group is developing a process for comparing material formulations/ new approach involves using fire growth capacity. Canari: who is going to lead the Task Group at Boeing now? Keith Couliard and Louisa will work on this.

WEDNESDAY, JUNE 19, 2019

Task Group Reports

Task Group Report for Magnesium Alloy Flammability Test
Prepared by Tim Marker (FAATC), Task Group Lead
Email: Tim.Marker@faa.gov

1. Interlab Study Discussion. The FAATC took delivery of 360 magnesium alloy test samples from Luxfer in early 2019. The samples were supplied at a thickness of 0.125 inch, necessitating a machining process to bring them down to the required test thickness of 0.025 inch. At the previous meeting in Savannah, there was a suggestion to explore the possibility of using Electrical Discharge Machining (EDM) to slice down the samples. A representative from Luxfer located an EDM machine shop willing to experiment with the magnesium alloy test samples. After several trial runs, the facility was contracted to perform the EDM process on a portion of the supplied test samples. Once complete, the FAATC will be in possession of 200 samples of EL43 alloy, in the correct thickness of 0.025 inch. The FAATC will supply 25 samples to a total of 8 laboratories participating in the study. The labs include FAATC, Boeing, Airbus, CEAT, Accufleet, Govmark, Skandia, and Honda. The FAATC will also explore the possibility of sending additional alloys for EDM processing.

In addition to the initial 200 samples, Boeing has offered to supply 3 additional types of magnesium alloy for the interlab study. Boeing is currently in the machining process, and will be sending along the samples to the FAATC once complete. The FAATC will divide these samples and ship to the 8 labs for inclusion in the study.

Action: FAATC to distribute test samples to 8 labs once the EDM process is complete.
Action: Boeing to supply additional samples to FAATC for inclusion in the interlab study.
Action: FAATC to fabricate 2 additional sample holders to send to Skandia and Honda.

2. Randomization Discussion. The FAATC and Boeing have recently collaborated on interlab studies for the new HR2 heat release rate apparatus. During this effort, Boeing has implemented a randomization process to prevent certain parameters from influencing the test results. Boeing has offered to assist the FAATC during the magnesium alloy interlab study by implementing the randomization process on the test samples being shipped.

3. Test Plan. The test method for evaluating the flammability of magnesium alloy for inaccessible areas was inserted into the Aircraft Materials Fire Test Handbook as Chapter 26 in October of 2018. The chapter was updated in February 2019 to include additional drawing details after a review by Boeing. The FAATC will develop a test plan for the interlab study, based on the Chapter 26 test method currently in the Handbook. The test plan will include specific instructions, details, and a spreadsheet to record the data.

The data obtained during the study will allow a more accurate determination of the pass/fail criteria that currently exist. The FAATC also recommended that the prospective interlab study participants review Chapter 26 and provide comments to the FAATC on any issues.

Action: FAATC to develop test plan and circulate to the participating labs.

Task Group Report for Vertical Flame Propagation (VFP)
Prepared by Tina Emami (FAATC), Task Group Lead
Email: Tina.Emami@faa.gov

- Thermoplastics

    - There was a discussion as to whether or not thermoplastic materials should be tested in the VFP. The task group members voiced that thermoplastics should continue to be tested in the VFP, but by watching the test with detail.
    - Suggestions were made to put tick marks inside of the VFP in order to watch and see where the flame rises to, instead of how the material melted after the test is complete.
    - Suggestions to add wires to the front of the sample holder were made, in order to restrain the material from flopping into the ribbon burner.
- Intumescent materials
    - There was a discussion as to testing with intumescent materials in the VFP. The nature of the material is to expand when heated, and when it does in the VFP it expands into the ribbon burner and puts out the flame.
    - In order to work around this it was suggested to place the ribbon burner at a further distance from the sample just for the intumescent materials.
    - It was also suggested to test these materials with a shorter impingement time.
    - These suggestions will be further looked into.
- Wires
    - It was mentioned that Rob Ochs has previously tested many types of wires in the past, we will look further into this.
    - Different types of sample holders were suggested to be able to test with many different gauge sizes of wires.
- Flat vs Round Duct Testing
    - The FAATC still has tests that they need to run in order to confirm what is the best for this method, but mentioned that we would prefer to test flat ducts only.
    - The task group brought up that some ducts are made with one size, and changing this would be extremely costly.
    - Other task group members mentioned that flattening most ducts should be simple and is required in other tests of various applications.
    - Different suggestions such as sandwiching the material in a mesh grid can aid the round material in remaining flat during testing.

Task Group Report for Air Flow Visualization (PIV) in the OSU
Prepared by Tina Emami (FAATC), Task Group Lead
Email: Tina.Emami@faa.gov

Many suggestions were made in this task group as to how to improve the air flow. These include suggestions such as placing 8 independent inlet tubes to go straight upwards towards the 8 hole plate, assuming the 120 hole plate will even them out.
A suggestion of using a smoke machine instead of PIV powder was made, but this would prove difficult as adding another inlet would affect the airflow and pressure that would normally go through the machine.
There was a suggestion that the air could be moving on the side walls of the OSU and not the middle, giving the 0 airflow readings.
Moving forward, FAATC will take airflow measurements in the OSU with a hot wire anemometer instead of the vane anemometer that was used. This will show a much more precise measurement.

Task Group Report for Heat Release Rate Test
Prepared by Mike Burns (FAATC), Task Group Lead
Email: mike.burns@faa.gov

HR2 Heat Release Rate Apparatus

1. <u>Cooled vs. Non-cooled exhaust</u>

A brief background discussion was presented to task group members as a general status update concerning the present HR2 heat release rate test apparatus. In the October forum, concerns were raised over the exhaust section of the HR2 (non-cooled as compared to the cooled OSU). Is the HR2 hotter or produce higher HR values than OSU? More data was requested by task group members as a way of moving forward.

As a result of data generated at the FAATC the decision was made to continue forward with the non-cooled exhaust configuration.

2. New calibration method:

   Calibration data was discussed showing a very repeatable calibration routine, however, the calibration factor was proven to be incorrect using the current 'ramping' calibration method. A new approach using a 'zero' and 'span' method was discussed that seemed to fix the problem. Test data was shown using both the ramping and zero/span calibration factors again illustrating the flaw in the calibration ramping approach.

   Since full scale gas flow will change from 4 SLPM to 3 SLPM, the Thermal Stability Temperature requirement will change from 420 +/- 20 Degrees C to 380 +/- 15 Degrees C and the pass/fail calibration range for the Calibration factor from 18 +/- 2 W/deg C to 17 +/- 2 W/deg C.

3. Voltage monitoring (globar):

   Data was presented to task group members discussing the benefits of voltage monitors for globar power. A voltage range from min to max heat flux (3.5 +/- 0.05 W/cm2) was shown to be less than 2 VAC.

4. Upper Thermopile Noise issue:

   Data was presented to task group members concerning random step changes in the thermopile signal (no flame condition). Data was presented showing the repair of a faulty mass flow controller which was the cause of the issue. This issue has now been resolved.

5. Oxygen Depletion R&D:

   Data was presented to task group members concerning an inexpensive and less complicated way to use oxygen depletion in place of thermopile technology. The FAA TC showed data using a sampling system and probe with Galvanic fuel cell, however the O2 analyzer did not have the resolution needed for smooth data in the 21% to 20% oxygen range (0 to 75 kW/m^2). The TC also looked into using an insitu probe (Bosch Wideband sensor system). Data showed that this type device could not measure in the necessary range. This work will no longer be pursued.

6. Voltage Control Hardware R&D:

   Data was presented to task group members concerning the Marlin Engineering approach to accurate control of voltage and power to globars. The FAATC installed the equipment on the HR2 for research purposes. Data is being generated showing this systems effectiveness. Work to continue.

7. TRL5 Activity

Brian Johnson of the Boeing Company presented updates to TRL test activity. Prior to completing this retesting in May, the following items were installed/corrected:

- Finding and addressing the cause of the noise in the upper Tpile signal
- Marlin voltage control system installed in FAA TC HR2
- Voltage monitoring setup pre/post-transformers
- Installation of air flow meter between MFC and HR2
- Log to monitor data of multiple parameters during testing

Final TRL5 test results were presented and discussed by task group members. As a result of improved repeatability in HR2 test results (2 of 3: time to PHRR and 2-minute THR) the decision was agreed upon to continue onto TRL6 looking into reproducibility. Effort is underway to increase the number of HR2 units throughout industry to accomplish this. The short term goal is to get a minimum of 4 units operational.

8. <u>TRL 6 Development</u>

- TRL 6 requires multiple HR2 instruments. Deatak (Mike) indicated they would be working with FAATC to make their unit operational in the very near future. Boeing conversation in progress.
- Airbus (Christian) mentioned that they would be setting up their HR2 in the early fall timeframe.
- Deatak (Mike) mentioned that they are pursuing a voltage control / conditioning system and should have a prototype in place by August 2019.
- Zodiac (Allard, Bart) suggested a potential new coupon for standardized testing that may produce results closer to the 55 peak / 55 2-min total HR target. Boeing (Brian) will follow-up with discussion and potential evaluation plan.
- FAATC (Mike) will explore elimination of the mass flow controller using a sonic choke or some other static method in combination with a mass flow meter to monitor airflow into the chamber.
- Marlin Engineering (Martin) discussed the potential for a kit to convert OSU to HR2 though the transition may be irreversible.
- Question raised (Yaw): what is the tolerance of the HR2? This question has elements of repeatability as well as reproducibility. For example, given a standard coupon, what are the min/max HR results that should be produced?
- Suggestion to measure coupon weights in the next round of testing (Tim). Also if possible look into additional data that can be gathered from results such as peak width.

9. <u>New Prototype Heater Development</u>

Task group members discussed new prototype heater data presented at the meeting (Marlin Engineering). In a future revision to the first prototype design, the quartz glass will be given more room in the fixture to allow for expansion to prevent cracking. For better uniformity control a third zone would be added to allow for control of upper, mid and lower power settings of heating elements. To help prevent warpage more stiffening would be added to the panel and a more rigid millboard would be used able to handle the high heat capacity (prevent cracking). Marline Engineering is continuing this effort as time permits.

NEXT

- The FAA Tech Center will work with Marline Engineering and DEATAK to update the new calibration method.
- Develop test plan for next phase of TRL activity including sample type and quantity.
- Gather historical methane gas calibration data for HR2 tolerance determination.

- A Sonic choke will be installed in the HR2 unit as a way to possibly replace the need for a mass flow controller (inlet air). Work to continue.
- Gather test data using the rev.2 radiant heater (globar replacement).

Task Group Report for Seat Test
Prepared by Tim Salter (FAATC), Task Group Lead
Email: Timothy.Salter@faa.gov

Task group participants viewed a final rough cut of the Sonic Burner Operation and Assembly Instructional video. The video was well received based on feedback provided by the group. The final video will be posted on the Fire Safety Website in a new section of the website for videos. The seat test shroud round robin was also discussed. Those who wished to participate provided contact information on a signup sheet. Seven of the members have agreed to participate in the study. Samples are currently on order and will be shipped to labs with a shroud once the samples arrive at the Technical Center. There was some concern expressed regarding the lack of information in the current seat test AC document regarding similarity. Heiko Nussel will be working to form a potential task group focused on developing guidance for similarity in seat testing.

Task Group Report for Burnthrough Test
Prepared by Tim Salter (FAATC), Task Group Lead
Email: Timothy.Salter@faa.gov

It was noted that the current guidance in Chapter 26 of the Fire Test Handbook suggests operating the burner at a fuel pressure of 120 psig. This guidance assumes the fuel nozzle is rated at 5.5 gph and can be misleading. A correction to the text in Chapter 26 will be made to make it clear that the fuel flow rate must be calibrated to the correct 6.0 gph +/- 0.2 gph regardless of the required fuel pressure and fuel nozzle used. There was discussion regarding the current Phase 3 of the Sonic Burner Insulation Burnthrough study. It was noted that two of the four labs which have returned data are experiencing significantly longer burnthrough times than the other labs and are not consistent with previous test results. Tim Salter is planning to visit these labs to determine the cause for the extended times to burnthrough for the PAN test samples.

Task Group Report for Cargo Liner Test
Prepared by Tim Salter (FAATC), Task Group Lead
Email: Timothy.Salter@faa.gov

Currently, four labs participating in the cargo liner shroud round robin have completed testing and returned data. The group agreed the shroud does make for a more stable backside condition by reducing the influences of air movement around the test sample. Members were concerned what effect the shroud might have on materials that will burnthrough during the 5-minute test period. It was suggested that additional testing be performed with the shroud using PAN felt materials which have good burnthrough repeatability. Testing will be performed at the FAA Technical Center and samples will also be provided to participating labs. Testing with the shroud is also planned for cases where the backside of the material ignites. The purpose of this would be to determine what effect the shroud may have in the event of backside burning.

Task Group Report for RTCA (Electronic Boxes Test)
Prepared by Steve Rehn (FAATC), Task Group Lead
Email: Steven.Rehn@faa.gov

The first topic of discussion was the test results from the round robin. The main concern from the test results is the current pass/fail criteria of flames escaping the box for more than 12 seconds being considered a failure. In some of our test results it was difficult to determine whether flames were escaping or not. One lab said they could see flames with the lights off but not with the lights on, and it was difficult to determine the exact amount of time flames were escaping for.

The FAATC will be running more tests with the same material with the lights on and off and also with material placed above the box to see if it ignites. The telecom industry test method on which our method is based specifies placing a UL94-V0 material above the box as an indicator for pass or failure. If it ignites it fails, if it doesn't it passes. We may have to move to a similar criteria but it would likely be with a material that passes the 12-second vertical Bunsen burner test.

The burner placement exercise that will be sent out to the task group was discussed. The draft test method, instructions, and detailed pictures and descriptions of each of the four boxes will be sent to all participants and they will determine where they would place the burner, and how many burns would be required to test each box.

Other future testing was discussed to better determine the maximum ventilation on a box that would not need to be tested. The FAATC previously conducted test in which hole sizes and number of holes on the top of a box were varied to determine how much opening is required to allow flames to escape. Some correlation was found between the percent open area and when flames escape but we'd like to expand on that work. Hopefully it will lead to adding ventilation designs to the test method that would not need to be tested because they don't have enough ventilation to allow flames to escape.

Marker: burner placement exercise: what if results come back again and labs are still doing it differently, are you going to add some language to tighten it up?
Ohnimus: Wouldn't it be better to have something more objective than lights on/off in the box, such as temperature measurement, etc.? Rehn: we are following the telecom industry testing procedure – a reference material is placed above the box - the challenge is finding a material that does not ignite immediately. I will look into this. Question (comment): I would also go with a more quantitative approach for this testing.

Task Group Report for Radiant Panel Test
Prepared by Steve Rehn (FAATC), Task Group Lead
Email: Steven.Rehn@faa.gov

The main topic of discussion was the reduction of the heat flux tolerance for calibration being reduced from ±5% to ±1%. This was originally proposed in October 2017 as a way to improve the reproducibility of test results across all labs. The FAA completed testing in the Spring of 2018 showing that a polyester material failed more often at a 5% higher heat flux calibration and less often at a 5% lower heat flux calibration than standard. Ten samples were tested at each level, there were 3 failures at 5% lower heat flux, 5 failures at the standard heat flux, and 7 failures at 5% higher heat flux, along with a corresponding increase in after flame times and flame propagation. The most recent radiant panel insulation round robin showed that every lab had the ability to calibrate within the narrower ±1% tolerance. It was also an action item at the end of the March 2018 and June 2018 task group meetings for every participant to check with their labs to make sure the tighter tolerance was achievable with their radiant panel apparatus. Every lab except one stated that it was achievable and attempts were made to assist that lab in improving their heat flux measurement. Boeing argued that reducing the tolerance changes the test because it increases the minimum heat flux required. The FAA disagreed because the target heat flux calibration value is still the same.

The heat flux tolerance reduction to ±1% was made permanent in the Handbook shortly before the June 2019 Materials Fire Test Forum. However, at the task group meeting there was a lot more pushback from participants saying the ±1% tolerance is too narrow to consistently reach so we may have made the change too soon. The ±1% tolerance has since been changed back to red in the handbook following the meeting, and we will have more discussions to decide how to move forward.

Another point brought up was that you can't have a tolerance on the heat flux measurement that is narrower than the accuracy of the heat flux gauge. However, the gauge we use is the Vatell TG1000 which has an accuracy rating of ±3% of the full scale range, which is 0 – 5 W/cm^2. A ±3% error of 5 W/cm^2 is ±0.15 W/cm^2.

An error of ±0.15 W/cm^2 at the calibration value of 1.7 W/cm^2 is ±8.8% which is already higher than the ±5% tolerance that is in the handbook. The FAATC contacted Vatell and they confirmed that this calculation was done correctly. The FAATC has tested many gauges and have never seen changes even close to 8.8% between them, but that is all they are guaranteed for.

Also discussed was the backing board study that is currently ongoing. The FAATC's results showed that Fermacell® backing board may allow certain materials to have less after flame time and less failures than the other backing boards tested that have better insulation properties. Wulfmeyer's results were less conclusive and no material samples failed with any backing board. Zotefoam's results should be ready soon and hopefully will be conclusive.

The handbook was changed recently to set a maximum thermal conductivity of the refractory board material used in the walls of the apparatus and the backing boards. The limit is set well below the thermal conductivity of the Fermacell® material so it would essentially ban Fermacell® if the change is made permanent. However, this could cause problems because several insulation materials have been certified and are in-use that were tested using Fermacell® as a backing board. We need to have discussions with regulators to determine what happens to materials that were tested with Fermacell if the handbook change is kept in place.

Task Group Report for Fire Containment
Prepared by Scott Campbell (SAFRAN CABIN), Task Group Leader
Email: Scott.Campbell@safrangroup.com

The task group met and agreed on following test procedures:
1/ Size and placement of shims
2/ Test Trash minimum conditioning
3/ Materials required to meet the 45-degree burn through Bunsen burner test
4/ Recommended data logger set-up
5/ Trash ignition process
6/ Will propose general test check list for the day of testing that can be adapted for different labs.
7/ Proposed to replace the cigarette package with an additional large paper cup.

We will have a task group Webex meeting in the next couple of months and will plan for a break out session during the triennial conference in October. We will send out more detailed minutes to task group members. We intend to markup chapter 10 of the FTH with proposed test related wording proposals by the next meeting in October.

Next, we will focus on fleshing out our list of similarity methods of compliance.

Task Group Report for Additive Manufacturing
Thomas Krause (Airbus), Task Group Lead
Email: Thomas.Krause@airbus.com

Participants: ~30

Steve Rehn's presentation was discussed in regard to the surprising information that his latest material printed on a Stratasys FDM machine showed an enhanced burn length and after flame time in the XZ direction. This was inconsistent with all results so far obtained with ULTEM 9085 CG. It was clarified that the latest material was not ULTEM 9085 CG, but the support material for the ULTEM, a polyether sulfone (PES). It was decided to move on with this material; Steve has proposed testing different thicknesses and infill.
The group also discussed polycarbonates of which Steve had tested a material available for the Fortus 450mc. Given the unreliability in terms of after flame / self-extinguishment, it was decided not to follow that path any longer.

Reduced infill led to increased after flame time and burn length in the XY plane for ULTEM 9085 CG. Hence, Thomas will now extend this to YZ and XZ. A variation in thickness will be added, too. In an effort to investigate whether certain groups of polymers show similar proneness to the same printing parameters, ULTEM 1010 CG will be introduced as a second PEI. Lufthansa Technik will select suitable variations together with Steve and Thomas and test them in their lab. Stratasys will supply the coupons. SABIC will provide comparison values of injection moulded coupons.

The group will have a WebEx before the Triennial and a task group meeting may be arranged during the conference. The different work streams will remain to be coordinated by Steve, Ralph and Thomas and telecons with a reduced audience for specific tasks will be held.

EASA Update – Enzo Canari (EASA)

EASA Part 26 – 26.156 Thermal or acoustic insulation materials.

Update of CM-CS-004: Flammability Testing of Interior Materials was published on 16 October 2013. In 2017, EASA and FAA received proposals from the Flammability Standardization Task Group (FSTG). EASA will update this to include allowance to use only the FSTG proposed MOCs that have been reviewed and found acceptable by EASA and the FAA.

CM (Certification Memoranda) on miscellaneous flammability topics: public consultation Q3 2019 (SAE ARP6199A is an acceptable MOC with the seat HR/SE / Magnesium alloy for seat / additive manufacturing).

Additional Discussion:

VFP continuing work with manufacturers.
Thomas Krause brought up the possibility of doing a TRL with the VFP. I spoke to Matt Anglin regarding this.

Heiko: most of the topics are linked to initial cert and development, but the design and modification of aircrafts are still not so clear with our existing rules concerning seats. We have a lot of topics concerning seats that are not so clear for us. We have new seats and new materials for seats that the existing rules do not give enough guidance for. I recommend we form another Task Group on this similar to what we did on the Policy Statement. I already talked to Enzo on this topic. There is a lack of guidance on these. Marker: Would you organize some slides on these concerns for proposal at the next meeting?

Action Plan Worksheet proposal - Thivi Edrisinha (Gulfstream Aerospace)

I have a proposal for this group. Action Plan Worksheet proposal – a way to track and manage projects and tasks. This is an easy way to know what each Task Group is about and TG members, and results. This would provide a quick snapshot of what each Task Group is doing. This would be in addition to the Task Group Summaries included in the meeting minutes. Marker: maybe do a test run with one of the Task Groups as a pilot trial and see where it goes.

Next Meeting:

There will be no fall 2019 meeting due to October 28-31, 2019 Triennial Conference at Resorts Casino-Hotel in Atlantic City. Some IAMFTF Task Groups may meet during the week. Task Group leaders will notify members after Task Group meeting date/time is confirmed.

Spring 2020 IAMFTF Meeting:

March 10-11, 2020
Hosted by Boeing (Mobile, AL) and University of South Alabama

Location: University of South Alabama
Mobile, Alabama