INTERNATIONAL AIRCRAFT MATERIALS FIRE TEST FORUM MEETING MINUTES

March 5-6, 2019

Hosted by Gulfstream, Savannah, Georgia, USA

TUESDAY, MARCH 5, 2019

Magnesium Alloy Testing Update – T. Marker (FAATC)

Development of new flammability test for magnesium alloy components used in inaccessible areas.

Burnthrough Round Robin – Phase 3 Update – T. Salter (FAATC)

Purpose of Phase 3: standardize fuel nozzle. Phase 3 status: data has been received from two (2) of the participating labs. Tim presented these results.

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

Shroud Study background: reduce test disparities among burn labs. Tim described the shroud design and assembly.

Cargo Shroud Round Robin Study: test shroud in different lab environments to demonstrate shroud effectiveness – no two burn labs are the same. The FAATC used the sonic burner for their tests as part of this study. Anticipated outcome of RR study: may incorporate shroud into cargo liner test method based on RR study test results and feedback from forum members. Current status: 6 labs agreed to participate. Additional participants are welcome (contact Tim Salter).

Sattayatam: have you thought about incorporating video and looking at flame profile differences for passes and failures? Salter: that's a good idea. We can do that.

Sonic Burner Seat Cushion Test: Air Shroud Development and Round Robin Study – T. Salter (FAATC)

Shroud: same purpose as cargo shroud. This shroud is open on flame side. Round Robin is currently on hold. We are currently looking for Round Robin participants.

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

Addresses topics not previously documented anywhere else. All of the footage has been shot and is in final stages of editing for release. Video delayed due to 2018-2019 government shutdown. Video will be available on FAA Fire Safety website when finalized.

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

Industry is currently using legacy oil and propane burners for powerplant testing. FAATC is recommending oil burner be used for powerplant test. Thermocouple Round Robin: initiated by Resonate Testing Lab through Powerplant Task Group. Four thermocouple types to be evaluated.

Comparative testing with Park burner vs. Sonic burner: AC 20-135 calibration requirements are being used. Photos of these set-ups were shown. Campbell: is there going to be any resolution on heat flux and temperature for the other test methods? Salter: We are working on that. Campbell: it

seemed like many labs are having to jack up heat flux. Question: what kind of heat flux were you getting? Salter: 5500 BTU per hour. Copper tube.

Vertical Flame Propagation (VFP) Test Update March 2019 – T. Emami and R. Whedbee (FAATC)

Flat vs Round Duct Testing in VFP: Three (3) samples were tested per material shape. Results of these tests were presented. Jensen: was the duct tested round? Whedbee: Yes, it was completely round when we tested it.

Comparing VFP to the 12-Second Vertical Bunsen Burner and RHP (John Reinhardt Data): graph comparing results for ducting material in the three (3) tests was presented.

Marlin's (Marlin Engineering) Coil in VFP 3 Housing Heat Flux Comparison: Marlin heater, VFP 3 Heater, Marlin Coil in VFP 3 Heater assembly were compared. We have to complete this before we conduct a Round Robin.

Heater Assembly Technical Drawings are underway. A set of these drawings have been given to the FAATC Metal Shop to produce the heater assembly to ensure drawings/instructions are thorough.

Heater vs No Heater Testing was conducted.

Thermoplastic Tests: results of two samples were presented.

Question: do you measure pre and post on thermoplastic coupon? Whedbee: yes. Question: when you are doing comparisons with and without the furnace, are you doing any testing with wiring? Whedbee: no. Question: would you consider doing wire testing in that? Whedbee: yes, we could consider that.

New: Concept Equipment VFP.

Radiant Panel Update – S. Rehn (FAATC)

Steve reviewed the *Aircraft Materials Fire Test Handbook* changes made: all references say "refractory board" with a recommendation of Superwool Plus at the beginning.

Radiant Panel Aging Study: need to add guidance about when to replace the electric panel. Condition likely depends on type of material tested and when it was used. Seven (7) electric panels will be tested: 2 brand new, 1 in use, 4 old and out of use.

Air gaps around drawers: previously studied in 2016-2017. Triumph also ran tests. Question: radiant panel characteristics of panel: are there any recommendations? Rehn: we are looking for a material that will be borderline to run with these aging panel tests. We are still looking for that material – that's what led us into this.

Initially, we had more failures when the gaps were closed, and now there are more failures with the gaps open.

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. Superwool 607 and Fermacell Gypsum Fibreboard Greenline were used in this study. Results of these tests were presented. Conclusion: we need a borderline material for testing panel aging. More testing still to be done. Question: gaps – are you going to specify the gap distance for

the new rule? Rehn: I said a ¼" minimum. We may need to be more specific. Question: heat flux calibration redline wasn't mentioned? Rehn: we can discuss that in the Task Group. Question: At Boeing, we see this as a more stringent requirement. We would like to propose different wording. Rehn: we can talk more about it in the Task Group. Question: backing board study: are you still investigating the use of Fermacell? Rehn: yes, we are still investigating.

RTCA Update/Round Robin – S. Rehn (FAATC)

New test method for electronic boxes. It will be added to RTCA-DO160H. Round Robin: four labs received identical boxes. Burner placement has been an ongoing discussion. Each lab will have the same burner placement for the Round Robin testing. Four burns were agreed upon for each box – one for each PCB. Campbell: is the capacitors blowing up a function of materials or charge? Rehn: I think it is materials, some are not designed to vent and some vent out. We can talk about what to do when the burner goes out (this is what happened in Test 2 – PCB 3 when the lithium battery exploded and extinguished the burner flame) during the Task Group meeting. Future testing: we still have to test PCB 4. The other three labs will begin testing soon. Question: any plans to have the box actually powered up? Rehn: no, we don't have plans for that. Campbell: what will be the guidance to know if you will have one burn, two burns, etc., number of PCBs? Rehn: if we knew all these PCBs were the same material, we probably would not have to do all of these tests. We wanted to do as many tests as we could. Question: what is the pass/fail criteria? Rehn: flames escaping the box for 12 seconds.

Characterization of OSU Airflow Using Particle Image Velocimetry – T. Emami (FAATC)

A photo indicating measurement location was shown. Preliminary tests were conducted in the OSU on 4 samples. Question: are the holes in the tube in the same alignment with the distribution plate? Emami: no, they are 45 degrees off.

Heat Release Rate Updates – M. Burns (FAATC)

Mike reviewed the OSU Metal Temperatures, OSU Internal Temperatures and OSU Exhaust Gas Temperatures. HR2/OSU Power Data – power difference between the two. HR2 Ramp Down Calibration – calibration repeatability testing. Bias in calibration approach results in artificially higher HR values.

HR2 Calibration: research new zero/span calibration approach. Question: is there going to be a maximum and minimum on thermal response? Burns: it would probably be a range, yes.

Globar Voltage Monitors: not too many labs monitor globar voltage or current throughout the day. FAATC installed DP20 voltage monitors (x2) on OSU and HR2. Maintain confidence in power even after HFGs are removed just prior to testing.

Prototype Heater Development: Zones: Three (3) [upper, center, lower]. Isolated from internal air stream.

HR2 Development – Status and Plan – B. Johnson (Boeing)

NASA Technical Readiness Level (TRL) model adopted. HR2 is in TRL 5 – Repeatability. TRL 5 Test Plan: 30 randomized samples of 3 homogeneous coupon types. Two test locations – two instruments. Brian reviewed the HR2 Changes Prior to TRL 5 Retest. TRL 5 Retest: 30 randomized

samples of 3 homogeneous coupon types. We will test at Everett, WA, and FAATC in NJ. We plan to retest in May 2019, so we can present findings at June 2019 IAMFTF meeting.

Heat Release Supply Voltage Control Update – M. Spencer (Marlin Engineering) for Y. Behboud (Boeing)

Voltage Round Robin Status Update: 22 labs participating (13 domestic, 9 international). 18 of 22 labs completed. The full Round Robin report should be completed in June 2019.

Martin discussed the heat release supply voltage control current system. Schall: we have been looking at it from a voltage perspective, what about looking at power/current? Spencer: did Boeing look at this? Boeing: No. Spencer: We can do that.

OSU Guidance Document Development – Y. Agyei (Boeing)

Collaborative effort of IAMFTF OSU Task Group. Document to provide commonality on previously unaddressed, misunderstood, and/or unspecified parts of OSU specifications. Goal is reduce variation between test labs. Yaw reviewed the draft Operations/Maintenance Section created by Boeing. Next Steps: draft Sections for Manufacturing and Installation. Continue development activities to improve machine performance.

Vertical Bunsen Burner Flaming Drips – S. Campbell (SAFRAN)

Aircraft Materials Fire Test Handbook – Chapter 1: Section 1.2.3: "If the succeeding flaming drips reignite earlier drips that flamed, the drip flame time reported is the total of all flaming drips." I have never encountered anyone who tries to add them all together.

14CFR 25.1713(c) Bunsen Burner 60-degree Wire Test Applicability: what is applicable? Just electrical wire? What about shrink-wrap tubing? Can heat shrink tubing over a wire be considered a small part? We know wires cannot be considered a small part but what about tubing? It would be great if we could standardize it.

What do you think about bringing up topics like these?

Heat Release of Engineered Gaps – S. Campbell (SAFRAN)/T. Livengood (Collins)

Large exposed panels/constructions of cabin interior monuments and seats required to meet heat release and smoke often have other large panels/constructions hidden, but not bonded, behind them.

Resilient Material: Thomas described proposed test method to show resilience and reviewed results of proposed 'resilience test'. The Test Recommendations were reviewed. Imamura: who says we can actually use this methodology? Campbell: we hope this material will go into the Aerospace Recommended Practice (ARP) for seats. We think we can formalize this into a seat method, and the next level is working with the regulators at the cabin level. I do not know exactly where this would go for cabin level.

Waste Compartment Fire Containment MOCs and Test Harmonization – S. Campbell (SAFRAN)

Fire Load Discussion: we want to replace the cigarette box with something like a clear, plastic cup. Accufleet analyzed airline trash from selected U.S. and non-U.S. airlines, and American Airlines provided a list of airline catering items to help select replacement for the cigarette box.

We developed trash density exercise, and initial results of 3 companies' test trash density showed: up to 16% difference in trash weight, up to 81% difference in trash density. We need more data, and we will discuss the next actions during our Task Group meeting. Explore alternate fire loads.

What needs to be 45-degree Bunsen burner test compliant? Mortise and tenon panel joints – NO.

Are there any exclusions for waste compartments? PS-ANM-100-00016 addresses exclusions for 'special' waste compartments under 0.5 cubic feet in volume.

Additive Manufacturing Task Group – T. Krause (Airbus)

FSTG-like approach to additive manufacturing. Infill: reduction of weight by maintaining outer form. Images of the infill patterns tested at Airbus were shown. Results of 12-second vertical Bunsen burner tests were presented. Slaton: do these have a skin on them? Krause: no. Question: they are the same density just different pattern, correct? Krause: yes, they all have roughly the same density. 60-second Bunsen burner tests were conducted on these samples, also. Question: have you reached the point in the testing where the Ultem™ has been coated with paint or any other coating yet? Krause: not at this point.

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

FAATC tested solid 3-D printed material. Steve reviewed the flame time results of tests conducted at FAATC. Future work: We need to test different infill percentage next: compare to Airbus testing of Ultem™ 9085. Question: all samples drip? Rehn: yes. Imamura: All samples drip one drip on top of the other? Rehn: I had to put some samples out manually.

Material Change Similarity Update/Baseline Correction Work – D. Slaton (Boeing)

Task Group Goal: develop guidance using the Microscale Combustion Calorimeter (MCC), utilize the MCC method to compare the flammability properties, and validate MCC similarity process. Dan discussed an excerpt from draft guidance 8.f. Next steps: complete case studies; review the FAA regulatory focals for approval, adoption of new process. Campbell: what test methods are you finding correlation with MCC? Slaton: OSU and Bunsen burner are the two we are focusing on for these case studies. Campbell: the goal is to say this methodology is a predictor? Slaton: yes. Question: is there any interest to use the MCC method in the sandwich structure? Slaton: yes, that's much more complicated but hopefully we will get there someday. Another great opportunity for MCC is quality control testing.

WEDNESDAY, MARCH 6, 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. Machining Discussion. The FAATC is now in possession of 360 test samples for the interlab study, purchased from Luxfer in 2018. The samples are 0.125-inches thick, and must be milled to 0.025 inches for the testing. This will be a very time-consuming and labor intensive effort to mill all of these samples to the proper thickness. During the process, 80% of the material will be wasted. The FAATC polled the Task Group members on any input they had to reduce the burden of the milling process or perhaps suggest alternate

methods. The Task Group members indicated the vacuum table and milling method previously used by the FAATC was typical, but one member suggested Electrical Discharge Machining (EDM) as a possibility. EDM uses a thin, electrically-heated conductor to pass through the material. The method is primarily used to slice foam and other like materials, but more recently has been used to slice aluminum. The FAATC felt that it was worthwhile to do some investigation into the feasibility of using this method. One benefit of employing this method would be a reduction in waste, as it may be possible to first slice the samples in half, essentially doubling the number of test samples.

ACTION: FAATC to investigate feasibility of using EDM to reduce thickness of samples.

Another Task member asked if the existing 0.125-inch thick samples could be pressed or rolled out to the desired thickness. A representative from Luxfer indicated that this methodology is not possible, and would result in alteration of the material.

2. Interlab Study Discussion. The 360 samples supplied by Luxfer would be distributed to 6 different labs, 60 samples each (3 different alloys, 20 samples per alloy). As mentioned, this will be a sizable effort by the FAATC to mill down all of these samples for distribution to the various labs. During the discussion, the FAATC pointed out that none of the 6 labs who plan to participate in the interlab study have (as of yet) conducted any magnesium flammability tests using the radiant panel. The FAATC was concerned that the data obtained during this interlab study may not be accurate or consistent due to inexperience by the labs participating. The FAATC suggested conducting a smaller initial effort to allow the labs to gain experience before running the full 60 tests using milled samples. As such, the FAATC inquired into the possibility of obtaining a smaller quantity of thinner samples of EL43 (previous discussions have indicated EL43 could be produced in reduced thickness, eliminating the need for costly and time-consuming milling).

ACTION: Luxfer (formerly Magnesium Elektron) agreed to determine their ability to roll thinner samples of EL43 that would not need additional milling.

As mentioned, the original interlab study included 6 labs, each testing 60 samples. During the Task Group discussion, two additional labs (Honda labs and Skandia) offered to participate in the study. The FAATC suggested the study would benefit from the 2 additional labs (8 total), and simply cutting back the number of samples to 45 samples per lab. The Task Group members concurred with this.

ACTION: FAATC to fabricate 2 additional sample holders to send to the additional labs.

3. Chapter 26 Discussion. 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 recently updated in February 2019 to include additional drawing details after a review by Boeing. One item that will require further investigation is the requirement that a sample may not begin to burn prior to a specific time. The FAATC had originally set this limit at 60 seconds, but during the review by Boeing, they correctly indicated that based on past data, several failures of EL43, EL21, and ZE41 alloys would result if the limit was 60 seconds. The FAATC concurred with this finding, and agreed to revisit the time limit, once the interlab study was completed. The data obtained during the study will allow a more accurate determination for this time criteria. The FAATC also recommended that the prospective interlab study participants review Chapter 26 and provide comments to the FAATC on any issues.

Task Group Report for OSU Flow Visualization (PIV)
Prepared by Tina Emami (FAATC), Task Group Lead
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- A new air distribution tube was tested in the lower plenum of the OSU, task group members suggested that if there was more than the current 10 holes in the air distribution tube that it might perfect the flow even more.
- It was suggested to try to measure the airflow in the lower plenum with the airflow tube in, if possible.
- It was noted that the thermocouple wires are still in the lower plenum and to make sure that the readings aren't affected by this new design. It was suggested to bend the thermocouple wires upwards above the holes that are in the new air distribution tube to achieve better readings.

Task Group Report for Vertical Flame Propagation (VFP)
Prepared by Tina Emami and Rick Whedbee (FAATC), Task Group Leads
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- Ducting:
  - Discussion of flat vs round ducting occurred and it was suggested that the document could specify the minimum diameter of a sample if it can't be made into a flat lay-up.
  - It was noted that testing is still to come for varying degrees of curvature.
- Radiant Heater
  - All VFP manufacturers agreed to come together and work on a design they can all agree on in order for every test lab to obtain the same exact radiant heater.
  - There will be a sub meeting between FAA and the manufacturers to design the best heater.
  - Each aspect of the heater will be specified thoroughly with tolerances for repeatability.
  - The topic of maintaining calibration long term is still to be discussed and determined.
  - The manufacturers have already come together to begin discussing designs.
- Thermoplastics
  - There was an agreement within the task group that while testing with thermoplastics, weight loss should not be a measurement point in this test. We will continue with only measuring burn length as of now.
  - There was a discussion on adding restraints to the sample holder to prevent thermoplastics from dripping into the ribbon burner and clogging it. Different designs were discussed and FAATC will test and look further into this.
  - There was a local agreement and reminder that the operator must observe the test as the sample is burning in order to note the highest flame attachment point.
- In the October meeting there was a local agreement to move forwards with a Methane flame. Since then, an email was sent out asking the group if this is sufficient and there were no objections so the group has officially now decided to move forwards with using Methane gas over Propane.
- Long term: We still need to test with and address wire sleeving and conduct more wire tests.

Jensen: any consideration on tubing as opposed to ducting, is this in or out of the scope of the NPRM? Gardlin: regulatory scope? Jensen: yes. Gardlin: as we sit here today, the way I would envision a future standard is to include air ducts but not tubing.

Task Group Report for Heat Release Rate Test
Prepared by Mike Burns (FAATC), Task Group Lead
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HR2 Heat Release Rate Apparatus

1. Cooled vs. Non-cooled exhaust

   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

2. Instrumentation and analysis of temperatures throughout the HR2:

   In an effort to identify differences in temperature between the cooled exhaust (OSU) and the non-cooled (HR2) the FAATC OSU was instrumented with thermocouples throughout. Initially, baseline conditions were monitored (no flame) followed by burning known flow rates of Methane (pilot burners & a 4 SLPM flow condition). Finally some materials were tested. The OSU was modified to have the ability to be configured in the cooled and non-cooled exhaust using mass flow meters and valving for independent airflow control. The FAA technical center OSU was instrumented with thermocouples and configured to operate in a single (HR2 simulation) and dual flow (Standard configuration) condition to capture metal skin temperatures as well as internal air temperatures for comparison. Data showed that although skin temperatures were vastly different between the two configurations, internal air temperatures were not. Comparative power data was also shown to be very similar between the HR2 and OSU.

   Calibration data was then 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˚C to 380˚ +/- 15˚C and the pass/fail calibration range for the Calibration factor from 18 +/- 2 W/˚C to 17 +/- 2 W/˚C. There was discussion of possibly incorporating a 90% thermal response criteria but this needs to be looked into further.

   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/cm^2) was shown to be less than 2 VAC.

3. Upper Thermopile Noise issue:

   Data was presented to task group members concerning random step changes in the thermopile signal (no flame condition). Suggestions were made to the Tech Center in hopes of finding a solution to this problem. Work to continue an effort to resolve this issue and hopefully data to be presented soon.

4. 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 FAATC showed data using a sampling system and probe with Galvanic fuel cell, however the O_2 analyzer did not have the resolution needed for smooth data in the 21% to 20% oxygen range (0 to 75 kW/m2). The TC will look into using an insitu probe (Bosch Wideband sensor system). Work to continue and hopefully data to be presented soon.

5. 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. If possible, the FAATC will install equipment on its HR2 for research purposes. Work to continue and hopefully data to be presented soon.

6. TRL5 Activity
   Brian Johnson of the Boeing Company presented updates to TRL test activity. Target is retesting in May 2019 assuming we can get all listed preparations completed including:
   - Finding and addressing the cause of the noise in the upper Thermopile signal
   - Determination of new baseline and ensuring return prior to next test
   - Marlin voltage control system installed in FAATC 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

7. New Prototype Heater Development
   Task group members discussed new prototype heater data presented at the meeting. Discussion included ways of improving the prototype heater design manufactured by Marlin Engineering. In a future 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. Discussions also included possibly adding a lateral control feature on the heater. 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.

OSU Heat Release Rate Apparatus

1. OSU Voltage Round Robin Update
   The Boeing group discussed updates to the current OSU voltage round robin and were hopeful to present final findings at the June forum in Cologne, Germany.

2. OSU Guidance Document Update
   Yaw Agyei from the Boeing group discussed updates to the current OSU Guidance Document development work.

   - Boeing presented standard coupon data showing heat release peak data from three units within 3% of industry average (light brown panel).

    - Repeatability and reproducibility improvements are benefits of on-going activities to standardize OSU testing at Boeing for over 10 years
    - Procedures, process to standardize testing drafted into lab standard operating procedures. SOP shared with industry as guidance document.
- Boeing shared drafted operations / maintenance section of OSU guidance document.
- Section 3 of OSU Guidance document
    - Includes daily preparation procedures in Boeing labs
    - Includes weekly tasks to check unit performance
    - Includes monthly tasks to maintain units
- Section 1 (manufacturing), section 2 (installation) of guidance document will be drafted in near future
    - Section 1 led by Marlin Engineering
    - Section 2 led by Marlin Engineering / Boeing
- Task group members requested copies of guidance document – distributed after the meeting via email
- Requested OSU guidance document material from task group

NEXT

- The FAATC will work with Marlin Engineering and DEATAK to update the new calibration method and changes to pass/fail criteria.
- Efforts to resolve the thermopile noise issue will continue.
- Tasks needed to be completed for the next phase of TRL activity will be addressed.
- OSU Voltage Round Robin data will be compiled for presentation in June
- OSU Guidance Document will continue to be developed with input from all task group participants.

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

One of the main points of discussion was about guidance material for the new line burner test method to ensure it will be simpler than the current Bunsen Burner test method. We do not want a situation where a small change to an electronic box that won't affect flammability will lead to testing the entire box again. There will need to be guidance material written that states that different circuit designs on a PCB of the same material previously tested will not need to be tested again as long as no potential ignition sources are added such as a lithium battery or capacitor. Also if there is a change in the material placed in a box it can probably just be tested in the Bunsen burner without testing the whole box again since that is the current standard.

The other main topic discussed was the round robin testing we have in progress. The round robin test brought up a few issues with the draft test method. With four labs involved, we had three different answers for burner placement for testing. None of the test plans for burner placement were necessarily wrong though; the two that were the same essentially represented the bare minimum testing requirements while the other two decided to be more conservative in their testing. Another problem was that we did not have a bill of materials so we did not know if each board was made of the same material or not. However, we agreed that we still need more specific instructions on burner

placement to make testing more repeatable, such as what to do if there is no circuit board that can be removed when needing to test a part of the box with the highest fuel load.

The round robin testing also led to discussing lithium batteries inside boxes. We concluded that any box would have to be tested with all internal parts in place, including batteries, but there may also be other regulations that apply to lithium batteries over 2 watt·hours. Another situation discussed is what happens if the burner extinguishes in the middle of a test. The most conservative approach would be to restart the test completely, but then the board tested would be exposed to flames for a longer time than normal. Another approach would be to continue the test where it left off, but since unburned methane will be leaked into the box after the flame goes out, it is required that the box is flushed with air before retesting. This will also allow the burnt circuit boards to cool down making the test less stringent if it is continued where the previous test stopped. Therefore we will most likely add that the test needs to be restarted from the beginning in this situation.

Plans for the future include finishing the round robin and analyzing and discussing the test results to determine any changes that need to be made to the line burner test method. After making additions to the burner placement section of the test method, we will also put together an exercise of creating a drawing of a box to send to all members of the RTCA task group and have everybody determine burner placement independently. This should help us further refine the burner placement section.

Task Group Report for Radiant Panel Test
Prepared by Steve Rehn (FAATC), Task Group Lead
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The first topic of discussion was the test results that showed more material failures with the air gaps around the drawer in the radiant panel apparatus set at about 2 inches compared to 0.5 inch. This was something that we previously studied and decided to set minimum openings so the chamber is not completely closed off. Previous results showed more failures with the openings around the drawer closed than open, but these new results showed the opposite. Therefore we may need to set maximum openings as well. There was not much interest in the group in studying this topic further but we will probably run additional tests in order to have a larger sample size and because we have a lot of material to test with.

We then discussed the backing board study we have in progress. Some people had concerns about why we are using the Fermacell board since it is much more conductive than the Superwool 607 and it could pull heat away from the test sample. However, this Fermacell board has already been in use in Europe for about 15 years because the older Kaowool M boards we previously used are illegal. Fermacell was deemed to be equivalent without any testing to prove it. Last year, we added requirements of the refractory boards to the handbook based on the specifications of Superwool 607 and Kaowool M boards, but Fermacell doesn't fit these requirements because of its higher thermal conductivity. This backing board study is being done to determine if Fermacell really is equivalent and if we need to change the definition in the handbook.

We also had a few other ideas to test regarding this study. One such idea was placing a sheet of aluminum foil on top of the backing boards for materials that could melt so the molten material does not stick to the backing board. Aluminum is very thermally conductive but since foil is so thin it can't absorb much heat, so it may not affect the test results. Another idea is to try another type of refractory board that has better insulation properties than Fermacell but isn't fibrous like the

Superwool. We had a volunteer willing to supply a material like this and we will do more testing with it.

The handbook was the last topic of discussion. There are a few parts that need to be updated or changed to better reflect current testing. The requirements for refractory boards added to the handbook included thermal conductivity and density. Density is probably not needed, it is only required that it is a rigid board and the thermal conductivity number is still being studied. It would be helpful if "refractory board" was added to the definitions section at the beginning to help clarify what is being referred to every time "refractory board" is mentioned. It should also be written that the boards insulating the walls of the chamber and boards placed under the test sample don't necessarily have to be the same material as long as the material meets the requirements spelled out in the definition of refractory board. The "Pilot Burner" section of the handbook currently states that it must be a "Bernzomatic" torch and gives specifications of its construction. The name brand "Bernzomatic" should be removed so any company can make a pilot burner with the same specifications. We could also add some wording that says you are allowed to use safety wire to hold down test samples that lift up and distort from the heat of the panel as long as the safety wire does not interfere with the test. However this may be better suited to add to the Advisory Circular.

Plans for the future include finishing the current backing board study, running the same tests with a new backing board that may work better, and possibly conduct some further testing depending on how the results turn out. The FAA is also still searching for a "borderline" material to complete comparison testing of old and new electric panels to determine any differences between them.

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

Christine Applegren of Gulfstream gave a keynote presentation about her involvement with SAE and ASTM committees that are concerned with (mechanical) testing of Additive Manufacturing materials. The slides will be sent out to the Task Group members. Thomas Fabian of UL has prepared a report on Additive Manufacturing with a lot of information on UL94 flammability testing in relation to certain printing parameters. He will distribute it to the Task Group.

After discussing the Vertical Bunsen Burner results with ULTEM 9085 and reduced infill, it was suggested to move to "sandwich" layups. These coupons would be similar to the open weave patterns already tested, but bottom and top would be complemented by layers with 100% infill. Stratasys has offered to support the group activities with coupons. They will also look into the possibility of sponsoring spools to the FAA TC and provide information with regards to conditioning them. Steve Rehn has agreed to repeat the Nylon 12 tests after applying those conditioning rules. Ralph Buoniconti from SABIC suggested trying ULTEM 1010 which is also available for the Fortus printers.

The group chairs will start writing up a draft policy based on ULTEM 9085. It will be in the direction of the wording used for Policy Statement items.

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

1/ Propose to replace the cigarette box with an additional large paper cup. Many Airlines are going "green" and using one more large paper cup is most efficient.
2/ The trash study conducted by Jim Davis was enlightening!
3/ The trash density exercise showed with 4 labs reporting a range from 30-112% difference from the lowest density lab. Safran Premium Galleys volunteered to design a metal box to evaluate the impact of density in a waste compartment fire containment test.
4/ Agreed that the regulations do not require a waste trash can to meet a 45-degree burn through test unless the compartment is placarded to have the waste can installed.
5/ Seals and sealant used to prevent fire egress should meet a 45-degree burn test.
6/ Alternate fuel loads will be investigated such as UL fire load models.
7/ Will schedule a WEBEX in April for further discussion and actions.

Drip Flame Time question, Marker: do you plan to put some language on the flaming drips that we can include in red in the Handbook Chapter? Campbell: I can take that on.

Report for Engineering Gaps
Prepared by Scott Campbell (SAFRAN CABIN)
Email: Scott.Campbell@zodiacaerospace.com

Meeting presentation was well received.
Process can be proposed to be included in the Policy Statement AC during the comment period.

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

There is currently a round robin underway which involves the use of the experimental air baffle used to reduce the influence of airflow near the test sample, and improve test results repeatability. A task group member asked if the shroud could be modified if there is interference with their test rig. The shroud may be modified for the round robin if necessary, but the modifications must be detailed in the test report. Currently, all labs will be testing the same liner material. However, some labs may be provided with a different liner type material as the round robin progresses. If a participating lab wishes to run tests on two different burners, (Sonic and legacy type) then extra samples can be provided. The shroud has only been tested using flat cargo liner samples. Testing samples that are more three dimensional has not been tested, but will be evaluated in the future. Labs should make a note in the data report if flashover occurs during sample testing. There was some concern that the addition of the baffle may increase the likelihood of flash over. This has not been seen in testing as of yet, but will be evaluated.

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

A final version of the new Sonic burner instructional video is currently being edited. All footage and narration has been completed. The video is expected to be released by mid-April 2019. The video will be posted on the Fire Safety website for online viewing or download. The video will also be presented at the task group meeting in June. A seat test round robin utilizing the experimental air shroud is in the works. The round robin is planned to begin once seat test samples have been procured.
Seat Cushion (Salter) question, Marker: timing of video? Salter: I'm confident it should be available on FAA Fire Safety website by the end of this month. I am just waiting on final cut from FAATC Video Lab.

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

Phase 3 of the burnthrough round robin is currently in progress. 2 labs have reported back with data at this time. It is expected that all labs have their data returned before the meeting in June. An update of the round robin will be presented at that time. All labs will be testing the same PAN felt material. Labs are to run the burner until burthrough of the material occurs. It is not uncommon for small "pinholes" to develop in the material, and allow a small flame to penetrate the sample. This is generally not considered a burnthrough. Burthrough failure occurs when a crack or fissure appears and allows the flame to penetrate. Labs have reported that it is not uncommon for the igniter (spark plug) in the burner cone to become fouled with soot, and prevent ignition of the air/fuel mixture. Labs are advised to properly gap the electrode on the igniter according to the instructions in the test method. A horsehair brush should be used before each use of the burner to remove soot buildup from within the cone and from the igniter.

Task Group Report for MCC Similarity
Prepared by Dan Slaton (Boeing), Task Group Co-Lead
Email: Daniel.B.Slaton@boeing.com

The MCC Similarity draft guidance is linked to the FAATC website. Task group members are requested to review and provide any comments to the draft. One member asked if this is only applicable to 25.853 as defined in the draft guidance. This procedure is currently applicable to any regulation and the associated test method and the guidance will be updated. Since the MCC is more precise that other flammability test methods, the statistical analysis method defined may be too stringent. Further discussion with statistical analysis experts is warranted. The task group had general discussion on surface preparation for the MCC. Although there is no defined method, the material should be processed in the same way as the end product before taking the MCC sample. There are opportunities to utilize the MCC comparison process for other scenarios and types of changes such as color, qualification of additional sources to a material specification, and facility qualification/validation. Think outside of the box for opportunities to utilize the MCC to validate the flammability performance of an end product. Industry members should consider supporting this task group with actual case-studies. The more case-studies that prove MCC can demonstrate the same trends as Bunsen burner, OSU, etc… the sooner we can finalize the guidance for regulators to approve.

Additional Discussion – T. Marker (FAATC)

Concepts/Ideas to think on:

Advance Availability of Presentations concept – FAATC may send inquiry about this.

Task Group Agenda available prior to the meeting.

Forum Member Presentations on Research - start these again?

Training Videos: Is there a preference for what training videos to be produced next?

Regulatory/Certification Discussion as an Agenda item?

Next Meeting:

June 18-19, 2019
EASA Headquarters
Konrad-Adenauer-Ufer 3
D-50668 Cologne, Germany

Ninth Triennial International Aircraft Fire and Cabin Safety Research Conference
October 28-31, 2019
Resorts Casino and Hotel
Atlantic City, New Jersey, USA

Official Conference Announcement coming soon.

Note: There will not be a regular Materials Forum Meeting in October 2019 due to conference. Some Task Groups may meet during conference week.