INTERNATIONAL AIRCRAFT MATERIALS FIRE TEST WORKING GROUP MEETING

Hosted by the European Aviation Safety Agency (EASA) Cologne, Germany

June 7-8, 2017

Agenda:

WEDNESDAY, JUNE 7, 2017

-Welcome – Tim Marker (FAATC) / EASA Greeting and Logistics – Enzo Canari
-Participant Introductions
-Magnesium Alloy Test, Development of Advisory Material – T. Marker (FAATC)
-EASA CRI on Magnesium – Enzo Canari (EASA)
-Cargo Liner Test/Airflow Study/Seat Test – (FAATC)
-Burnthrough – R. Ochs (FAATC)
-VFP Update – R. Ochs (FAATC)
-Inaccessible Area Materials Flammability – R. Ochs (FAATC)
-Radiant Panel Update – S. Rehn (FAATC)
-RTCA Update – S. Rehn (FAATC)
-Evacuation Slide Test – T. Marker (FAATC)
-HR2 Update – M. Burns (FAATC)
-Effects of Voltage Fluctuations on Heat Flux Study – (Boeing)
-Policy Statement/Flammability Standardization Task Group Update – Michael Jensen (Boeing)
-Task Group Meetings Session I:

Magnesium Alloy – T. Marker
VFP Composite/Ducting/Wiring – R. Ochs
Radiant Panel – S. Rehn
OSU/HR2 – M. Burns
Approved Material List – S. Campbell

THURSDAY, JUNE 8, 2017

-Task Group Meetings Session II:

Magnesium Alloy - T. Marker
Cargo/Seat – FAATC
Wire Insulation – R. Ochs
RTCA – S. Rehn
OSU/HR2 – M. Burns
Policy Statement/Flammability Standardization TG – M. Jensen

-Task Group Reports
-Characterization of OSU Airflow Using Particle Image Velocimetry – R. Ochs (FAATC)
-FAA Aircraft Certification and Regulation Reorganization – J. Gardlin (FAA)
-Comparison Study: Teclu Burner versus 2- and 6-Gallon Oil Burner – P. Busch (Airbus)
-Fire, Smoke, & Fumes Final Report and Database – R. Hill (FAATC)
-SAE G-27 Lithium Battery Packaging Standard Development – Update – R. Hill (FAATC)
-Protection Against Hydrogen Fire Update – R. Hill (FAATC)
-EASA Materials-related Rulemaking Activity – Enzo Canari (EASA)
-Additional Discussion / Next Meeting / Closing

June 7-8, 2017 Materials Meeting Minutes:

WEDNESDAY, JUNE 7, 2017

Magnesium Alloy Testing, Development of Advisory Material – T. Marker (FAATC)

Tim Marker provided an update on the FAATC work on the development of a flammability test for magnesium components located in inaccessible areas. 161 tests have been conducted to date. 36 of these tests have been conducted since the March 2017 Materials Working Group meeting. FAATC has been working on a sample holder for the machined samples, since they do not lay flat. We finally tried a truncated perimeter sample holder (photo available in Powerpoint presentation) after numerous configurations and trials. Tim reviewed the results of the tests conducted. Summary: 3x6" sample size, 0.025-inch thickness is working pretty well. Future work: continue with experimentation with sample holder needed to prevent curling or lifting. Campbell: was there a minimum thickness usage? Marker: no, not right now. The 0.025 is about the thinnest material that would be used from what industry has told me.
Handbook Chapter 25 Update: 25.4.6 Sample Coatings – Tim reviewed this section and the update to it. A number of questions and comments arose regarding testing anodized and inorganic coatings. Tim suggested further discussion on this topic in the Task Group meeting. Spencer: have you tried using the VFP for this? Marker: we tried the VFP, and the sample really bows towards the heater. The radiant panel seems to work a little bit better.
Development of Advisory Circular on Magnesium: Tim reviewed the topics that are under consideration to be included in the AC.
Tim reviewed the topics for discussion during the Task Group meeting on June 7. Jensen: have you looked into alternate methods of machining to get change surface roughness or flatness? Marker: no, we haven't other than what we are using now. HP Busch: is there a special surface roughness or cleaning of oxide surface? Marker: we haven't yet, but that may be something that can be worked into the standard.

Revised EASA SC on Use of Magnesium Alloys for Passenger Seat Components – Enzo Canari (EASA)

In 2015 EASA issued Special Conditions applicable to the A350-941 to allow the use of magnesium alloys for seat components. Enzo reviewed these Special Conditions as available on the EASA website. He then discussed the revised Special Conditions applicable to the A350-941. Interpretive Material related to the revised Special Conditions was reviewed. Future Steps: publish revised Special Conditions on the EASA website by the end of September 2017. EASA is ready to discuss the applicability of the same Special Conditions and of similar interpretive material to the use of magnesium alloys for parts of interior components other than seats. Jensen: does EASA or the FAA have any regulatory requirements restricting or prohibiting the use of magnesium other than in seats? Canari: Whatever we apply to seats, we will apply to other interior components. Campbell: is there a parallel effort on the FAA side as well? Canari: This is an example of a project EASA started. HP Busch: are there any activities in other groups for fire fighters because normally they use water-based extinguishing methods, and that is not helpful. Canari: the way I see it, it may be that under certain circumstances you need special procedures. At the moment, we have the

full-scale testing by the FAA. Marker: water works, but you just need a lot of it. Marker: to address Scott's question: if we develop an AC, that would be our parallel effort.

Cargo Liner Test/Airflow Study/Seat Test – T. Marker (for T. Salter) FAATC

Tim Marker reviewed the background and purpose of the cargo liner test airflow study conducted in an attempt to minimize test results between labs. Photos of the small scale test cell that Tim Salter was conducting these tests in were shown (photos available in Powerpoint presentation). Interlab study results: different results from each lab, multiple unknown variables, multiple data formats, extensive time on return of results, and no clear correlations. Interlab study was not practical. Tim Salter decided to design FAATC airflow study allowing for multiple test cells designs and greater control of test variables. The recent testing performed in the large scale test lab was reviewed. The future test plans were reviewed. Campbell: I've seen labs with large test labs that do not run an exhaust during the test. This is just an observation. You can see airflows generated by the thermals.
Aircraft Materials Fire Test Handbook Chapter 7 and 8: air velocity limited measured at test sample (for sonic burner only) – New for Chapter 7 (seat cushion test) 100 ft/min vertical maximum, 50 ft/min horizontal maximum. Define supplemental information: An example of one possible means or method of meeting the test requirements. Supporting or additional information for test operator. FTH Updates: Chapter 7 the additional information and updates were reviewed including seat test rig design details for Chapter 7; recommended hotwire anemometer models for test cell airflow measurement. Campbell: on the 50 and 100 ft/min how are you measuring that? You are just measuring airflow from the hood? Marker: yes, I think he is measuring it from each corner. I think he has specified in the Chapter where to measure. Campbell: what are the flow rates with the burner on? Does it dwarf it? Marker: I don't think it dwarfs it.
Seat Cushion Sonic Burner Video Status: the final video will be completed by the October 2017 Materials WG meeting. The filming is complete and editing is underway. The Seat Task Group will preview the video during this week's Task Group meeting.
Planned Research and Work: continue with the airflow study; sonic burner related instructional videos; release of Cargo Liner AC document in the future. Question: when are the Handbook updates going to be taking place? Marker: They should be posted to the FAA Fire Safety website soon.

Dick Hill announced that the FAATC Fire Safety website is now smart phone ready.

Burnthrough Round Robin – R. Ochs, PhD (FAATC)

2017 Comparative Test Series: in progress, 11 labs participating. Phase I results to date were presented. Summary: 7 out of 11 labs have submitted results. So far, data looks good.

VFP Update – R. Ochs, PhD (FAATC)

VFP 3.0 was introduced at the March 2017 Materials WG meeting. It has a smaller footprint, controlled air inlet, double-door system to keep backside smoke out of lab, and larger viewing windows. Rob reviewed photos of the VFP 3.0 design features (available in Powerpoint presentation). We did a few comparisons in the VFP 3.0: propane vs. methane flame profile comparison. FAATC got new ribbon burners. FAATC will loan one to Boeing and one to Airbus for installation in their current VFP 2 machines. PIV

setup measured mean velocity fields for current VFP burner and Marlin burner. Summary: continue development and testing of VFP 3 (work with equipment manufacturers to build commercial versions); find materials for comparative testing with new machines; standardize test method procedure. Jensen: have you looked at ducting? Ochs: we have done as much as we could. We found there are ways to put different types of duct materials in the VFP. There are always ways to handle them.

Inaccessible Area Fire Tests on Composite Structure – Update – R. Ochs, PhD (FAATC)

Large scale CFRP skin and structure test fixture. Study propagation of fire from bay-to-bay with and without cooling. We designed a rig that represents typical carbon fiber frame structure. A photo of a typical carbon fiber structure and the FAATC built structure were shown for comparison. Rob explained how he figured out heat transfer calculation and presented an example of the calculation. Next steps: continue testing on heat transfer apparatus.
We are going to start an Inaccessible Area Wire Task Group up again in this week. The Task Group will meet to discuss examples of design configurations of small or non-extensively used wires. These wires, if determined to be non-extensively used, would not pose a significant flame propagation threat. Rob had contacted labs for input and only heard back from one lab. Jensen: our problem is typically boxes. Ochs: that would be more the RTCA. Jensen: the things that concern me are the sleeving , tie straps, etc., that hold the wires in place in inaccessible areas not the wires themselves. Ochs: we will discuss all of that in the Task Group meeting tomorrow.

Radiant Panel Update – S. Rehn (FAATC)

The results of last year's round robin varied widely. The biggest difference between machines was the gaps around the drawer which allow outside air to flow in. There is nothing the Handbook about what size these gaps should be.
Air Flow Study: determine the effect these air gaps have on this test method. Steve described the tests conducted in the air flow study. Four labs participated in this testing. It's been observed that radiant panels get hotter as they get older. All the data was sent to Boeing for analysis. Tom Little at Boeing did analysis of the test results. Conclusion: thermocouple array showed the lowest temperature when fully closed. Temperature increased with more airflow allowed into chamber. Fully closed performed poorly in 3-position calibration check. Fully closed had the most failures. No statistical difference between labs and air gap settings. HP Busch: did you check air velocity on the exhaust? Rehn: I did before, but I did not include it in this presentation. HP Busch: did the other labs measure it? Rehn: I don't think the other labs measured it.

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

At the March 2017 Task Group meeting, it was decided to split the testing into two parts: Determine limits of box design that will not need to be tested and finalize test method for boxes outside these limits. Several tests for the first part have been conducted. We had flow controller problems with the second part. A photo of the programmable line burner used was shown. Minimum airflow to sustain a flame: thermocouple to monitor if flame went out. We started with 6 3mm holes and kept adding more and more holes for each test. We made very slow progress in sustaining a flame. A prior question we had was if a flame could start small and slowly increase in size because the heat produced could

pull in more outside air, so we increased the flow rate to test this. Hole Pattern Testing was conducted. FAATC built box with replaceable top to test different hole spacing and sizes to determine the minimum required for flames to escape the box. Conclusion: not as easy to sustain a flame as expected but flammable gases can escape more easily. We need to test with actual printed circuit boards or simulated.

Evacuation Slide Test – T. Marker (for D. Do) FAATC

Tim reviewed the tests Dung Do has conducted at the FAATC with 3 radiant heaters. He has done calibration tests and slide material tests. The results of the material tests were presented. Conclusion: the revised test method will specify the use of solid coil heaters with either of two part numbers (included in presentation). Tim explained the revised test method. Dung Do will write a final report on this test program, and we will include the revised Chapter in the Handbook.

Heat Release Rate Updates – M. Burns (FAATC)

Thermopile modification: 5 hot thermocouples input to DAQ (TC_{hot}). One reference thermocouple was used. Thermopile Change Recommendation: good thermopile mV/temperature correlation; stable temperatures in lower plenum area. Manufacturer's software mods: install new calibration routine which will include calibration/validation of results; calculate the average of the 5 hot TC's then subtract reference temperature and display as thermopile temperature rise. Mike reviewed the calibration/system validation. This is for HR2.
DOE Test Plan (Round II): randomize 4 main parameters – no materials tested. Mike described the data that will be collected. Mike explained how the DOE is conducted.
HR2 Status: Next the manufacturers are currently working hardware/software changes (Marlin Engineering/DEATAK).

Effects of Voltage Fluctuations on OSU Heat Flux Density – Yaw Agyei (Boeing)

Yaw described the procedure used in the Boeing lab to record the voltages. The next steps were reviewed. Campbell: did you measure incoming air temp? Agyei: we monitored it throughout the tests, and it was within range throughout.

Policy Statement/Flammability Standardization Task Group Update – Michael Jensen (Boeing)

Michael reviewed the status of this Task Group's activity since the March 2017 Materials Working Group meeting. A review of items requiring additional work/discussion was given. A list of new Items (in work) was reviewed. Hill: you documented everything for FSTG #1 as a report, do you plan to do that for this FSTG? Jensen: Yes. Campbell: would such a report include the data for which items/areas that weren't accepted? Gardlin: it's up to you what you publish. Hill: I would suggest you separate the accepted and rejected items into two separate sections in the report.

WEDNESDAY, JUNE 8, 2017

Task Group Reports:

Magnesium Alloy Task Group – T. Marker

Task Group Report for Magnesium Alloy Flammability Test
(from meeting held in Cologne, Germany June 7-8 2017)

Provided by Tim Marker (FAATC), Task Group Lead

1. Continue with the development of a flammability test for magnesium alloy used in inaccessible cabin areas. The FAATC discussed the results of the most recent tests conducted using the radiant panel apparatus and thin magnesium alloy test samples. Over 161 tests have been conducted to date (36 since prior meeting). A majority of the tests were conducted using 0.025-inch thickness samples, which were laid flat on top of ceramic fiber board prior to being inserted into the radiant panel test chamber. The FAATC concluded that test repeatability could be improved by preventing the thin samples from warping when exposed to the heat and ignition source. Numerous sample holder concepts were conceived and tested to determine the most appropriate methodology. A 3-sided perimeter-style sample holder frame, with one of the edges truncated, seemed to provide the best results. The sample holder is simple and effective, keeping the edges of the sample from curling, and also keeping the sample at the correct distance from the radiant panel and pilot ignition. Heat transfer to the magnesium alloy test sample to the steel sample holder is minimal. Results from these tests also lined up fairly well with initial test results when the samples were laid flat on the ceramic board without restraint. The Task Group participants agreed that the FAATC should continue development of this sample holder with additional testing of EL43, EL21, and ZE41 magnesium alloy samples. Testing will focus on the time at which ignition begins, to determine if a required minimum allowable ignition time should be implemented into the standard. The proposed standard will also include a maximum allowable weight loss, calculated by determining the difference in pre- and post-test weights, divided by the pre-test weight, expressed as a percentage. Once the test methodology is determined to be repeatable, a new “strawman” procedure will be written up by the FAATC for future placement in the Fire Test Handbook. The draft procedure will be circulated to Task Group participants for their comments.

2. Development of an Advisory Circular (AC) for magnesium alloy use in the cabin. Task Group participants agreed that an AC would be a very useful document in the future use of magnesium alloy components in the cabin. The AC would be based largely on work done by the FAATC and discussed at previous IAMFTWG Task meetings. The AC would include guidance on the use of magnesium alloy in both seat structure and other cabin areas, including inaccessible areas.

3. Lack of current research projects involving magnesium alloys submitted to airworthiness authorities. Mag Specialties (Michael Castro) questioned why there was not more interest in the use of magnesium for cabin applications, given the huge potential for weight savings, and resulting operational cost savings.

EASA pointed out that despite the progress made on the development of appropriate flammability tests for magnesium alloy, there were still no formal proposals submitted to the airworthiness authorities on magnesium alloy use. Over the past 10 years, the authorities (FAA and EASA) have assisted industry in removing barriers to the use of magnesium in the construction of cabin components, namely aircraft seat frames. The FAATC suggested that industry could collectively direct their efforts to higher level airline representatives during trade shows, for example. It is possible that many representatives from the airline industry are not aware of recent developments allowing the use of magnesium in the construction of seat frames and other cabin components. The Task Group participants agreed that the industry as a whole needed better exposure. EASA (Enzo Canari) agreed to reopen the previously closed Certification Review Item (CRI) for magnesium alloy use in passenger seats for the Airbus A350, which would provide a better description of the approval process for prospective applicants planning to use magnesium alloy in this application.

Cargo/Seat Task Group – T. Marker

Seat and Cargo Task Group Meeting
June 8, 2017 EASA Headquarters, Cologne, Germany

Provided by Tim Marker (FAATC) who covered Task Group Meeting for Tim Salter

The seat task group reviewed a preview of the seat cushion test method instructional video currently in production. Task group members then asked questions and provided feedback based on the video preview. Below are the questions or suggestions provided by task group members followed by answers to each item. There were approximately 25 WG members in attendance. The seat task group was run by Tim Marker.

Items observed in video:

1. Additional footage is required in many areas.
- This was a preview to the video. The missing footage will be included in the completed video.

2. At 13:30, there seems to be a sudden stop in video (should be edited for final version).
- This will be edited and corrected in the final video.

3. At 15:20, why did you move the assembly with burning cushion back in front of the burner when you used extinguisher? Why not leave it where it was?
- The test had ended after 5 minutes. The sample test frame was repositioned back under the exhaust hood to take the final weight of the sample before extinguishing. The sample weight must be measured in the test position for the FAA TC seat burner setup due to its particular design. It is not necessary that the seat be repositioned for extinguishment.

4. No mention of issue where burning/charring on bottom of cushion that extends to frame on opposite side (17 inches) constitutes a failure. This was a big point of contention, but there is no mention of it in the video.
- The missing footage will be included in the completed video.

5. Thermocouple rake using a frame is not required. Only requirement is that the tips of the thermocouples are located at a specific location. Mention that frame is not required to hold thermocouples.
- Will include additional information in final video.

6. No description of fuel nozzle. It may be helpful to describe what type (i.e., 80 degree PL, etc.).
- The missing footage will be included in the completed video.

7. WG member questioned whether or not the fuel temp during test can vary more than 5^{o}F from the fuel temp during calibration. No mention of this in the video.
- Fuel and air temps must remain within the specified temperature ranges. There is no additional requirement.

8. WG member suggested making a set of templates to conduct critical measurements, rather than fumbling with a tape measure. The video could show a measurement of the template first, and then additional footage showing the template in use.
- Templates will be included in the final video. The footage will be reshot and corrected.

9. WG member suggested words declaring that the 1700^{o}F temperature check is recommended, not required.
- This is stated in the narration, but can be added in text to the final video.

10. Make mention of the fact that the spark plug can be located on the underside of the cone, if you feel this is acceptable. I don't think it would make a difference in the output of the flame, but there may be a reason why we don't want it to be mounted here. From a logistical standpoint, moving it to the bottom makes sense, as there is less heat rising from the cone.
- I will need to run tests to ensure there is no difference, but this seems reasonable.

11. Measurement of the test cell airflow does not agree between the Handbook and the video.
- The recently updated Chapter 7 includes the correct airflow measurements.

12. Make it more clear when to measure the final weight loss (before or after extinguishment of the seat?). Not clear in video.
- Additional footage and information will be included in the final video.

13. Can the flat stock in the bottom and back of the frame be replaced by angle, to minimize warpage?
- No. The design of the seat frame will not change. This would inhibit the propagation of the flame on the bottom of the sample.

14. Is it a requirement that the weight loss be calculated instantaneously during the test, or can the cushion be removed from the seat frame after the test and weighed manually? I indicated that measurement during the test is the preferred method, to prevent excluding pieces of the seat that may stick to the frame, etc.
- It is allowable, but weight measurement is less accurate when transferring sample remains. Additional information will be added into the video for clarification.

15. WG member indicated it would be helpful of including video footage of burning droppings for the segment the video that discusses how droppings are excluded from the weight loss measurement.
- Good idea. This will be included in the final video.

16. WG member suggested double-checking to make sure dimension tolerances agree between Handbook and video.
- Will double check measurements.

17. Add video segment of rod restraint for testing leather cushions.
- This will be included in the final video.

18. WG member suggested adding a drawing or detail to address the height of the hood into the lab requirement area of the video.
- Recommendations regarding this subject will be included in the final video.

OSU/HR2 Task Group – M. Burns

Provided by Mike Burns (FAATC), Task Group Lead

OSU GUIDANCE DOCUMENT UPDATES

This effort is still a work in progress. If anyone would like to suggest ideas please submit them to chairpersons Yaw Agyei (Boeing), Yonas Behboud (Boeing) or Martin Spencer (Marlin Engineering).

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PIV (OSU)

Rob Ochs (FAATC) presented PIV data depicting airflow currents in a hot OSU.

HR2

The new thermopile design was discussed utilizing independent temperature readings (5 hot/1 cold) in place of the current thermopile mV output. This approach was well received and will be instituted going forward (placeholder drawings will be modified accordingly).

During the task group session exhaust gas temperature data was presented showing a slight spread in temperatures between the rear TC's (above globars) and the other three. I discussed R&D work using various mixing plates just above the upper pilot burner to try

to tighten the spread. Currently this does not appear to be a big issue but future research may need to be conducted.

There was discussion on the need for calibration of TC's (and frequency) which will be added on an annual basis. Work needs to be done to see if the thermopile stability requirement of +/- 2% Stdev needs to be adjusted or not.

There was much discussion on the new calibration ramping approach. This method was well received and will be incorporated. This process allows for a quick calibration of the HR2 (6 minutes) and includes a software validation feature comparing expected (theoretical) heat release values with what is actually generated (using a zero offset correction for MFC response time lag). This new calibration will require changes to the equations for heat release rate and the calibration factor Kh. Calibration repeatability testing to follow. HR2 manufacturers (DEATAK/Marlin Engineering) will continue calibration software/hardware updates as needed so this work can continue. The second phase of the DOE will be conducted once all modifications have been completed. A suggestion was made to monitor the voltage feeding the globars during this testing so I will look into adding that.

A new Watlow power controller option was discussed that may help control supply power fluctuation throughout the day (TBD). I reached out to a local heating manufacturer requesting a visit to the Tech Center to observe the current globar design of the HR2. Potentially there may be a replacement option but too soon to tell.

Lower plenum temperature stability testing was presented. May need more work to see if the lower plenum can be maintained within the 70-75F required range throughout the day as the unit heats up. It may need to be relocated outside the plumbing or the inlet to the MFC but too soon to tell.

VOLTAGE FLUCTUATION DATA (BOEING)

Boeing (Yaw) presented voltage fluctuation data gathered in their labs. It appears voltage fluctuation as small as 1.5 volts (AC) may have an impact on heat flux that will push the system out of range. Yaw expressed that they would next like to quantify how HF impacts data with the 2.5% voltage fluctuation requirement. They invited other labs to gather voltage/power data using their equipment. Currently Lufthansa offered to do so. Others interested please contact Yaw (above).

NBS ROUND ROBIN UPDATE

Zotefoams made contact with me offering to provide some materials for this round robin to continue. Once I hear more I will contact all the labs who have submitted their desire to participate. Stay tuned.

ANNOUNCEMENT

Heinz-Peter from Airbus announced his retirement! We as a group wish him the best in his future plans!

Radiant Panel – S. Rehn

Provided by Steve Rehn (FAATC), Task Group Lead

In the radiant panel task group meeting, we mainly talked about the changes we can make to the Handbook chapter and Advisory Circular (AC). It was brought up that we can't change the handbook because right now it is a direct copy of the rule. It was

decided that the handbook chapter needs to be rewritten to match the format of the other chapters before it can be changed. (This has since been completed and posted to the FAA Fire Safety website on 6/20/2017.)

Starting with the AC, we want to change the sample size of damping system materials to 12" x 4" instead of 12" long and the width sized to touch the back of the sliding platform and line up with the ignitor. The different sizing is not necessary and not the way testing is typically done. The alignment with the burner will not change.

We want to add in a design for a moveable laser to more easily mark and measure the farthest point of flame propagation. This will make measuring faster and more accurate. We may also add a design for an automatic timer and mechanism for the 15 second burn time of the ignitor. This would also make after-flame time measurements more accurate.

For the handbook, we agreed to remove the air-propane panel completely because it is not consistent and nobody uses it anymore. We also agreed to get rid of the voltage requirement on the electric panel because that can vary based on the individual setup and country the lab is based in. The wattage requirement will replace it.

We decided to get rid of all references to Kaowool M board and replace it with Superwool 607 board because it is safer to work with and more readily available. Then it was brought up that when testing certain materials that melt, Kaowool M or Superwool 607 board can actually absorb the melted material and act as a wick that will keep burning after the flame is lifted. Since the backer board is not supposed to interfere with the test, this is not acceptable. Another material called Fermacell does not have this problem so that would also be an acceptable backer board.

A more specific definition of flame propagation will also be added to the handbook to better describe what it is and how to measure it. A better definition has already been written for the workbook we were working on previously, so we will now add that to the handbook.

We want to add that you must take a 5 minute average for the heat flux measurement during calibration to make that more accurate and repeatable. Right now there is no averaging requirement at all and the raw data from the calorimeter does not stay very constant, so it is very difficult to get an accurate heat flux reading without averaging. We also want to reduce the ±5% on the heat flux reading for the calibration procedure. A 5% difference in the heat flux at the zero position can have a very large effect on test results and is much too large for this test to be repeatable. We would like to reduce it to 1% or less.

We also went over the test results for the air flow study we conducted with four test labs. We decided that we need to require that the radiant panel apparatus is not completely closed off around the drawer. It was never supposed to be like that to begin with (based on the ASTM Flooring material tester), but a few labs built their machines that way because it was never specified before. Our results showed that closing off the chamber completely can have an effect on test results in certain situations, and also causes the machine to go out of calibration for the 3 position check. Therefore in the handbook, we will likely set some minimum openings around the drawer, with either no maximum or a relatively large maximum, because as long as there are some openings for airflow, the sizes of the openings don't seem to effect test results much, if at all.

RTCA Task Group – S. Rehn

Provided by Steve Rehn (FAATC), Task Group Lead

In the RTCA presentation, it was shown that even if a flame doesn't escape an electronic box, flammable gases can still escape. The question is whether we need to worry about these flammable gases escaping the box if they don't ignite on their own. We decided it's probably not something we need to worry about based on how unlikely it would be that there would be an ignition source directly outside the box and the fact that no other material test standard considers this factor. We talked more about the testing we did to see what it takes for a flame to escape a vented box. We decided more testing is still needed in order to define the parameters for which a box would not need to be tested. We can try placing the line burner itself directly underneath the top of the box to see if we get the same results as burning a solid material. We can also try more hole pattern and size combinations so we know for sure what it takes to stop a flame from escaping a box.

Other than that we talked about an electrical component standard called ARINC 600 that we can research. It is a very widely used standard and defines how manufacturers build electronic components and housings, including ventilation designs. We also talked about the need to acquire more electronic boxes and components for testing and where we can get them. The draft test procedure for the RTCA DO-160 committee is due Spring 2018.

Approved Material List Task Group – S. Campbell

Provided by Scott Campbell (Zodiac Aerospace), Task Group Lead

Approved Material List (AML) Task Group Minutes 7 JUNE 2017

1. Discussed proposed listing specification topics.

a. Accepted laboratories: Agreed that labs should be regular participants in FAA round robin testing AND have on staff regulator designee(s) to witness. Potential problem: Will all countries (FAA, EASA, ANAC, TCCA, etc) accept the AML concept and will it be possible to utilize labs outside the USA to test materials if they meet the criteria above?

b. How will the AML be advertised and promoted?

c. Continued Compliance: Agreed data should be formally presented every three years, however, end users of the material should expect/request lot-to-lot (batch) test results from the manufacturer.

d. Manufacturer quality systems: Agreed should meet recognized criteria such as AS9100 or equivalent.

e. Inspection process: Need the FAA order to define a conformity inspection process similar to projects managed through TC/ STC processes.

f. Agreed for the need to develop database search tags to help end users find desired materials.

g. What happens when a material manufacturer discontinues listing for reasons other than the material does not continue to comply? Existing applications are OK, but new projects can't refer to the AML once a material is no longer listed.

2. The current PRI (Products Research Institute) listing model requires a group of expert volunteers staff the QPG (qualified products group). The QPG is responsible to review/approve

manufacturer test plans and reports and make recommendations for material listing. Question: Will regulators provide resources to staff this group? May encounter company hesitation to get non-material supplier flammability experts to volunteer time to this function.

3. Plan/Report/Data sheet template: Agreed to investigate the merits of creating a standard template to help ensure a level playing field.

4. PRI Questions answered:

a. Any discounts offered to material manufacturers listing multiple families of products? ANS- No.

b. Any cost associated with developing our database per our listing specification.

ANS- No, all fees are covered in the listing process.

c. Listing fees- the most prominent are:

1. $210 nonrefundable application fee

2. $520 Listing fee (upon approval) Doesn't include testing fees per the test plan

3. Annual Listing maintenance fee $780.

5. Action- Scott to get more in-depth information from Jeff (FAA) how the FAA would facilitate a proposed AML. Task Group to evaluate.

Any questions contact Scott Campbell: scott.campbell@zodiacaerospace.com
See high level draft listing specification below:

Approved Materials List

1.0 Scope: This specification provides the flammability qualification requirements for listing and maintaining materials on the FAA Approved Materials List. [list appropriate FAA Order, etc]

2.0 References:

a/ 14CFR 25.853(a), (d), (h) through Amendment 25-116.
b/ 14CFR 25.869(a),(4) through Amendment 15-116, 14CFR 1713(c) through Amendment 25-123.
c/ 14CFR 25.856(a) and (b) [material tests only]
d/ 14CFR 25 Appendix F, Part I, III, IV, V, VI, VII
e/ Flammability Testing of Interior Materials, PS-ANM-25.853-01-R2, Dated July 3, 2013.
f/ Aircraft Materials Fire Test Handbook, Final Report April 2000

3.0 Accepted Laboratories: Must be FAA / EASA accepted laboratories and have participated in the latest FAA heat release and smoke density round robins. [lab must have delegated witness per existing DER/CVE/etc]

5.0 Listing Entity: The approved Material Listing Agency shall manage data submittals, develop and maintain the flammability data database. Activities include qualifying new materials/ new material systems and managing the continued compliance of qualified materials / material systems. The company will organize and retain all data for potential FAA Audits. Ensure continued compliance company lot data is received every 3 years.

6.0 Material Manufacturer requirements: The material manufacturer must have a quality system that meet industry recognized criteria such as AS9100. The quality system must establish criteria for reporting non-conformances and major changes to a listed material that would require re-qualification. Test plans must define the basis of manufacturer's lot/ batch criteria.

7.0 Data Submittals: TBD [listing company responsible for raw material usage]

8.0 Data Fields: The following data is required for product listing:

- ? Material category (Types- define types)
- ❑ Application number
- ❑ Company name
- ❑ Company address
- ❑ Material name
- ❑ Material description
- ❑ Thickness (ranges)
- ❑ Color (ranges)
- ❑ Density/weight/mass
- ❑ Listing date
- ❑ Test data expiration date
- ❑ Material Part Number

9.0 Listing Process

a/ Material supplier generates flammability test plan Provision a requirement as part of the test plan to include company data for a minimum of 3 batches/ lots (Ley-define batches) to establish material consistency. Group to define (if needed) a sample format/ data sheet format.
b/ Submits test plan to Listing Entity

c/ Submit material to approved laboratory. Initial recommendation would be a minimum of 5 specimens to test with 100% passing of each test specimen. For HRR/SD, looking to impose the candidate material meets an average 55/55, 180Ds margin with no samples failing 65/65, 200. [Under discussion- make provisions that if one sample fails, an additional 5 can be tested meeting original criteria- much like the radiant heat insulation test-avg all 10].
d/ Require some form of inspection- certs, etc? Need to define the process. This process will also have to be FAA released. Include provisions for deviation [size-]. Include proposed size deviations in test plan [eg, injection molded plastics].
e/ Test per FAA test methods.
f/ Test Witnessing- Propose an existing delegated witness (DER, ODA UM, EASA CVE)
g/ Need to define acceptable methods for retest if a material fails. [see paragraph c above]
h/ List product in database.
10.0 Continued Compliance
a/ Specification needs to define periodic intervals to submit continued compliance data. [every 3 years]
b/ Need to define procedures for materials that may fail retest/lot/batch testing. [NCR process established] [When to report continued compliance failures?] [AS9100 vs. including in the spec provisions of AS9100 for disclosure.]
c/ End users of an approved material should still expect to get Q/A lot/batch certificates/ data sheets with each order as specified on the purchase order- same process many already use. (Responsibility of end user)
11.0 Use of data to support similarity- Reference Policy Statement PS-ANM-25.853-01-R2, Dated July 3, 2013
Add criteria (Ley/Ralph) for what triggers requalification of a product (many suppliers develop major/minor product changes that determine if a new part number/ product number designation is needed). Examples of major/minor changes- Products listed must have data sheets that control flammability.
Do we want to add types or classes to scope for which this process is approved. For example:
Type 1- Materials/ material systems not post processed with decorative coverings (laminates, paints, veneer, etc.) [e.g., plastics, rub strips, seals, curtains, upholstery, hook & loop, placards, films, single sided tapes, carpet, cargo liners, insulation, bare panels, etc] Team discussed the use of data base tags to help end users find desired materials.
Type 2- [for this draft- not authorized]. More complex material systems with decorative coverings (Decorative laminates, paint, veneer, etc)
1/ What's the consequence of a failure? Define process for notification, etc. Batch lots received by end users that continue to meet could still be used?

Policy Statement/Flammability Standards Task Group – M. Jensen

Provided by Michael Jensen (Boeing), Task Group Lead

Minutes for Flammability Standardization Task Group International Aircraft Materials Fire Test Working Group Meeting Cologne, Germany June 8, 2017

The Flammability Standardization Task Group met on June 8th at the International Aircraft Materials Fire test Working Group meeting to discuss some of the FAA and EASA comments to the industry proposals that have been submitted to the regulators. These comments are attached. The following are some of the items that were discussed in the meeting.

PS3 – Thickness ranges. To address the concern that the multiple sliding ranges would prove to confusing, the team agreed to go with 40% for all thicknesses rather than the three different percentages.
PS3 – The industry proposal deleted the note about thickness of smoke samples over 1.75" because it was confusing and implied there was no need to test samples of 1.75". Three options were put forth to address smoke samples that were too thick to fit in the holder with the backing plate:
1. Test the panel with the same core, except at 1.5 inches thick.
2. Cut the panel through the core and remove enough core to allow panel to fit in holder and put the back skins back on the panel (placed there, no bonding).
3. Remove the sample holder backing plate and allow the sample to stick out the back of the holder.

The team thought that option 2 was the best choice. This would be put into the industry proposal.
PS9 – Plastic Color Similarity – To address the concern that the proposal wording could imply that a thicker sample could be used to certify a thinner sample, the proposal will be updated to state the thickness would be the same between the two parts or use the guidelines of PS3.
PS9 – A definition of integrally colored will be added to the proposal. "The color of the plastic or elastomer is homogeneous through the thickness of the part."
PS13 – Synthetic Leather – To address the concern over potential failures, the team discussed adding margins to the proposal of 5 or 5.5" burn length maximum and 9 seconds after flame time.
PS21 – Bonding Details – Under Table 1 of the proposal, it was decided to add a note to part C that stated "…except for items bonded to metal listed in section A above must be tested per Options 3 or 4."
PS21 – The following was discussed.
How do we handle a 2 ply composite doubler?
Is there a percentage of surface area of the items being bonded that would distinguish between the usage of Table 1 and table 2?
No conclusions were reached on these points.
A meeting was scheduled in the afternoon to discuss the proposals with the regulators.

item	AAs position	Comments
1	OK (but no hierarchy of testing)	
3	OK (but language needs improvement)	1) the format of the notes need to be consistent (* vs. Numbers). 2) Note on smoke density was deleted. Why? 3) Option #2 text needs improvement. Can't we agree on a single percentage (e.g. 40%)
9	Needs further discussion	1) No data on time after flame and drips. 2) Additonal testing on materials from different manufacturers is

		needed. 3) Testing a thicker part cannot cover a thinner part.
10	OK	1) Test data in support of the MOC should be referenced.
13	Needs further discussion	1) Margins with respect to the maximum burn length and the extinguishing time should be introduced (ref. figure 9) to compensate variability between the results obtained testing different colours. 2) Data on drips should be included.
14	ok	
15	Data doesn't seem to support it. Some fail.	
19	rejected: no justification provided in support of the proposed MOC	
21	Needs further discussion	1) Therminology and text are quite unclear. The expression "Secondary bonding" is not of immediate understanding. The text in table 1 should mention explicitly placards. 2) I would be ok with a change to option #1 as long as we have a single thickness value or a clear decision tree. What if the glue fails at 0.06" thickness? Should we allow retesitng at higher thickness? 3) Floor covering not installed by means of tape (peel-and-stick) should be substantiated with option 4 or option 3, adapted as per comment 5) below. Do we have any data? 4) Paint systems are not installed through bonding process. Item 21 applicability should be based on use of adhesive. 5) Bonded items of similar size : only option 4 . We may consider option 3 if adapted to foresee testing with a worst case substrate using the test

		standard applicable to the actual substrate (not always 12 s VBB). However, no data is available. 6) Table 2 creates confusion and should be deleted.
23 & 24	OK	1) In item 24 in option 1, point 2) the sentence stops in the middle compared to the current wording (…compliance data used for similarity analysis… missing) 2) In item 24, the General Note 2 was added and no reference to this note is found elsewhere in item 24. Does this constitute an alleviation? What are multi ditch and pot panels ?
26	Needs further discussion	1) The report should be revised to include examples and figures.
27	Needs further discussion	1) We need a justification (test data) for the 0.25" limit. 2) Definition of double layer may not apply to paint, powder coating, primers, etc.
101	Data doesn't seem to support it for all combination of materials.	1) It contraddicts existing explicit guidance in AC 25-17A. 2) Maybe we could consider it for Part I but for Part IV and V we need more data.
107	The report needs to be revised.	The proposal is unclear. We could expand the applicability of certain PS items to 45 degrees BBT but we need a clear proposal backed by support data.
115	OK as long as crushed panel that are compared are obtained from the same initial thickness.	
118	Needs further discussion	1) We should isolate a definition of color and explain what "different color" actually means from a manufacturing process point of view. The idea is that the delta in the process between different

		colors does not affect performance in the BBT. 2) Margins with respect to the maximum burn length and the extinguishing time should be introduced to compensate variability between the results obtained testing different colours. 3) Data on drips should be included.
119	Needs further discussion	1) ok for part I but the data should be presented in a clearer manner. 2) No data for HRR so every single pattern should be tested. Is this the intention of the group?

VFP Task Group – R. Ochs, PhD

Main focus is VFP 3.0 and getting commercially produced units out to the labs that need them. We should see them in our lab or their final destination lab by the fall 2017 Materials Working Group meeting. Now that we have a good ribbon burner, we will do burn testing on propane vs. methane. Rob will work on acquiring some materials (ducting materials, aerospace carbon fiber materials). We would like to get the specs for the ribbon burner from Martin Spencer.

Wire Insulation Task Group – R. Ochs, PhD

We are looking at the small wires in inaccessible areas that are not tested because they are not a flammability risk. These may mainly be in the aftermarket. We will try to get some photos of examples of these types of items – if anyone has any, please send them to Rob.
. . .end of Task Group Reports

Characterization of OSU Airflow Using Particle Velocimetry – R. Ochs, PhD (FAATC)

Rob described how the PIV functions and how it was used to characterize OSU airflow. Rob reviewed the observations for both cold OSU and hot OSU. We also looked at turbulence intensity. Summary: we would like to do the hot OSU measurements again. We will do the cold OSU measurements in the Plexiglas OSU that Martin Spencer built. We are open to suggestions for other possible measurements. Question: is this being done more to understand for HR2 or for quality assurance? Ochs: this is just for research.

FAA Aircraft Certification and Regulation Reorganization – J.Gardlin

Jeff Gardlin provided this location for additional information:
http://www.faa.gov/about/office_org/headquarters_offices/avs/offices/air/transformation/

Comparison Study: Teclu Burner vs. 2- and 6- Gallon Oil Burner – HP Busch (Airbus)

Small Scale Burnthrough Test Set-up. Motivation: to offer industry a robust, simple and small test tool for material investigation with the certification methods of CS/FAR 25.855 App F, Part III, and CS/FAR 25.856, App F, Part VII. Peter presented the results of the study conducted in the Airbus lab. Peter discussed the proposed modified Teclu burner test rig. Conclusion: The Teclu test set up in the configuration presented herein, shows equivalent results to the 2 gallon oil burner test acc. to CS/FAR 25.855c. The comparability to the 6 gallon burner for fuselage burnthrough is limited in this configuration only to metallic materials. Danker: Teclu? HP Busch: Teclu was a French engineer. Danker: if I want to get a Teclu burner, where do I get that? HP Busch: it is commercially available. The commercially available head is 25mm. It will need to be modified.

Fire, Smoke or Fumes Occurrences on Transport Airplanes – R. Hill (FAATC)

FSF Database is now available on the FAA Fire Safety website (fire.tc.faa.gov). There is a report that explains how to use the database. The database can be downloaded – it takes a while to download. The initial study included a 10-year span 2002-2011 of smoke, fire, or fumes events (14,533 occurrences) on U.S. aircraft. 38% of these were considered significant events. We now have 12 years of data (2002-2013). In the future, it will be expanded to include 2014. Dick demonstrated use of the database (Excel).

Status of SAE G-27 Lithium Battery Packaging Standard Development – R. Hill (FAATC)

The International Aircraft Systems Fire Protection Working Group has done quite a bit of work related to this topic. This SAE G-27 committee is working on developing a standard for the packaging to safely ship lithium batteries. This presentation is currently available on the FAA Fire Safety website on the Systems page with the presentations from the May 10-11, 2017, Systems Working Group meeting held at EASA in Cologne, Germany.

Protection Against Hydrogen Fire Update – R. Hill (FAATC)

Fuel Cells – Energy Supply ARC: the group has decided to focus on PEM and SOFC fuel cells. The document is nearing completion with the final report to be submitted to FAA in July 2017. Dick highlighted the reports related to this topic (DOT/FAA/TC-TT14/36) and flammability of materials in a low-level hydrogen environment (see proceedings from 2016 Fire & Cabin Safety Research Conference on FAA Fire Safety website). Steve Summer at the FAATC will be conducting these tests.

EASA Materials-related Rulemaking Activity – Enzo Canari (EASA)

Update on CS-25 Amendment 19 was reviewed. This was released on May 12, 2017.

EASA Acceptance of SAE ARP 6199A: EASA found SAE ARP 6199 revision A is an acceptable MOC to the seat HR/SE special conditions. EASA acceptance of SAE ARP 6199 rev. A can be formally recorded in project-specific or generic MOC CRIs. Another option is to introduce a reference to the ARP in Specifications issued by the TC holders

(e.g. Airbus Seat Frame Specification). Campbell: does the FAA have a similar presentation of acceptance? Gardlin: It was discussed at the Seat committee meeting.

Next Meeting:

Confirmation of the specific meeting location and dates will be sent to those on the Materials Email Distribution List. Tentatively: Atlantic City, New Jersey, USA, October 30-31, 2017. Systems Working Group meeting will immediately follow on November 1-2, 2017.