INTERNATIONAL AIRCRAFT MATERIALS FIRE TEST WORKING GROUP MEETING

Hosted by AkroFire, Kansas City, Missouri, USA

June 7-8, 2016

AGENDA:

Monday, June 6 (Afternoon) Flammability Standardization Task Group Meeting

TUESDAY, JUNE 7, 2016

8:45-9:00 AM	Welcome/Logistics/Participant Introductions
9:00-9:15 AM	Welcome from AkroFire
9:15-9:40 AM	Magnesium Alloy Test, Development of Advisory Material – T.Marker (FAATC)
9:40-10:05 AM	Cargo Liner Test/Airflow Study – T. Salter (FAATC)
10:05-10:20 AM	*Break*
10:20-10:25 AM	VFP Update – R. Ochs (FAATC)
10:25-10:45 AM	Inaccessible Area Fire Tests on Composite Structure – R.Ochs (FAATC)
10:45-10:50 AM	Burnthrough – R. Ochs (FAATC)
10:50-11:10 AM	Radiant Panel Update – S. Rehn
11:10-11:25 AM	Evacuation Slide Test – T. Marker (FAATC)
11:25-11:50 AM	Flammability of Materials in a Low-Concentration Hydrogen Environment – S. Rehn
11:50 AM-1:30 PM	*Lunch*
1:30-1:40 PM	HR2 update – M. Burns (FAATC)
1:40-1:50 PM	OSU Round Robin Final Presentation – Theodoros Spanos (Boeing)
1:50-2:00 PM	OSU Guidance Document Development – Martin Spencer (Marlin Engineering)
2:00-2:10 PM	Material Change Similarity Status – D. Slaton (Boeing)
2:10-2:20 PM	Policy Statement/Flammability Standardization Task Group Update – M. Jensen (Boeing)
2:30-2:45 PM	*Break*
2:45-4:30 PM	Task Group Meetings Session I:

Magnesium Alloy – T. Marker
VFP Composite/Ducting/Wiring – R. Ochs
OSU/HR2 – M. Burns
Approved Material List – S. Campbell
Flame Retardants/Material Change Similarity – D. Slaton
RTCA – S. Rehn
Cargo – T. Salter

WEDNESDAY, JUNE 8, 2016

9:00-9:15 AM	Fire Safety Website/2016 Triennial Conference – R. Hill (FAATC)
9:15-9:30 AM	Transport of Lithium Batteries – R. Hill (FAATC)
9:30-9:45 AM	Smoke, Fire, Fume Events Study – R. Hill (FAATC)
9:45-10:00 AM	*Break*
10:00-11:50 AM	Task Group Meetings Session II: Burnthrough – R. Ochs OSU/HR2 – M. Burns Policy Statement/Flammability Standardization TG – M. Jensen Radiant Panel – S. Rehn Magnesium Alloy - T. Marker Seat – T. Salter
12:00-12:45 PM	Task Group Reports
12:45-1:00 PM	Additional Discussion / Next Meeting / Closing

Wednesday, June 8 (Afternoon) Flammability Standardization Task Group Meeting
The Flammability Standardization task group will be meeting from 1:00 to 5:00 PM on Monday at the Marriott Country Club Plaza Hotel and again on Wednesday afternoon from about 1:00 to 4:00 PM at the IAMFTWG meeting location at the museum.

MEETING MINUTES:

TUESDAY, JUNE 7, 2016

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

Tim reviewed decision outcomes from 2009-2010 timeframe full-scale tests. The Task Group will discuss accessible components like bin hardware, etc., during its meeting this afternoon. Results of tests using 3x6-inch sample size were presented (graph available in the presentation). There was good separation between good and poor alloys. Neither EL21 or EL43 samples burned completely (100% weight loss). Testing of thin mag samples in VFP Apparatus: we conducted 10 tests with 6x6-inch sample size. We ran 0.025-inch thick and 0.050-inch thick samples. A bar graph of the results was shown. HP Busch: have you investigated the influence of the backer board in the radiant panel tests because there are different densities and there might be an influence on the ignition time? Marker: No, we haven't, but I felt more confident with the tests run in the radiant panel than the VFP. We tried a number of things when we were setting up the sample in the VFP to see if it we could prevent it from warping during the test. The Use of magnesium alloy in cabin areas: the calculation method for testing of thinner bar samples using oil burner. A graph of the results was presented. Tim reviewed some of the discussion items for the afternoon Task Group meeting. A video of one of the VFP tests was shown. Gwynne: the magnesium sheet is constrained not free-floating, correct, so it is going to want to bow out? Marker: Yes.

Sonic Burner Cargo Liner Testing for Test Cell Airflow Study – T. Salter (FAATC)

Areas covered in this presentation:

Sonic Burner Cargo Test Cell Airflow Study
Proposed Changes to handbook Chapter 8
Cargo Liner Sonic Burner Instruction Video

Test Cell Airflow Study: all sonic burners are configured identically – capable of producing repeatable results within the same test lab. All test cells are unique in design – the test environment can affect the test – unique test cell design leads to unique test results. Possible solution: require all test labs to be constructed identical – highly unlikely acceptance by industry. This is why we have started looking at the test cell environment: small test cells and large test cells and the various issues associated with each type of test cell. Initial tests run at FAATC sonic burner cargo liner test cell: 10'x10'x10' cell, approximately 1,000 cubic feet. Exhaust airflow rate kept to a minimum to avoid influencing TC readings (1000-1200 CFM). Small cell size combined with low exhaust airflow rate resulted in considerably higher temperatures throughout test compared to labs in the past Round Robin study. A photo of FAATC test lab was shown. The results of the FAATC test cell airflow study were shown. The FAATC test apparatus was moved to the full-scale facility. We considered it an 'infinite' space since its approximately 455,000 cubic feet in size. The air velocity was approximately 0 ft/min around test sample. Heat and combustion byproducts were allowed to dissipate without the use of exhaust fan. A photo of the full-scale test cell where these tests were conducted was shown. The small test cell results were shown compared to the full-scale test cell results. The only difference was the size of the test cell. Question: where was the temperature taken? Salter: The thermocouple is located 4 inches above the ceiling sample as per the test method. We then moved the test apparatus back to the cargo liner test cell and made some modifications and increased the airflow to the test cell. The results were shown. Observation: increasing the exhaust airflow in the test cell reduced test result temperatures. 7 labs are participating in the Test Cell Airflow Study Round Robin that is currently underway. Three labs have returned data at this time.

Handbook Chapter 8 Update:

Current Handbook Chapter 8 (cargo liner test method) includes Park oil burner and sonic burner for use in cargo liner oil burner test method. We are proposing an updated version of Chapter 8. Park burner and test method would be in main Chapter only. Sonic burner information would be in the Supplement. Other information from original supplement would now be in the main Chapter. We will discuss this new format more in the Task Group meeting.

Handbook Chapter 7 Update (Seat Cushion oil burner test method): we have proposed to update Chapter 7 to include the sonic burner for seat cushion testing and would appear in the Supplement as Tim described for Chapter 8. Both Chapters would have the same layout.

Cargo Liner Sonic Burner Video: we recently completed this video and it will be shown during the Cargo Liner Task Group meeting so we can obtain industry feedback. Now is your chance to provide feedback before the video is finalized and released on the FAA Fire Safety website.

Future Work: complete the Test Cell Airflow Study RR; update Handbook Chapter 7 and 8; finalize sonic burner seat cushion video; and create sonic burner maintenance and/or troubleshooting checklist. Jensen: was the regulation for the sonic burner test based on testing in the small test chamber? Hill: No, when the oil burner test method was developed it was done out in the main test area not in a test chamber. It was developed out in the 455,000 cubic foot test lab. Question: did you get any humidity data for any of your studies? Salter: I did not, but I can look into it. Comment: I think that is going to be a factor. Salter: Yes, I do, too. We will be looking into humidity. S. Campbell: do you think it would be worthwhile to measure your incoming temperature? Salter: yes, I do plan to do that – temperature, how it comes into cell, and how it flows around sample will be investigated. Salter: the idea is to reduce the disparities between the labs. That's just a reference point.

Vertical Flame Propagation Test– R. Ochs (FAATC)

There is an increased use of carbon fiber composites in aerospace applications. New designs of commercial transport airplanes include primary and secondary structure constructed of carbon fiber composites. Objective: design, construct, and evaluate a new flame propagation test method. This is why the vertical flame propagation test apparatus was designed. The VFP components were described. Photos of the ribbon burner in operation were shown. Three different ribbon burners were ordered in February 2016. The production facility is backed up, so we (FAATC) are still awaiting delivery of these ribbon burners. New lab (at FAATC) acquired by FAA Fire Safety and VFP is currently being set up in this lab. Once modifications are made to lab, we will begin testing. VFP 3.0 is currently being built at FAATC with refined design, smaller footprint, controlled air inlet, double-door system to keep backside smoke out of lab, larger viewing windows, and improved sample frame. We will discuss the new design further in the Task Group meeting – now is the time for industry input on improvements from the previous design. Question: how many of the ribbon burners have you tested? Ochs: we have tested three with various modifications.

Inaccessible Areas Fire Tests on Composite Structure – R. Ochs. (FAATC)

We ran two different fire sources in a similar configuration: foam block source and a 5 D-cell lithium battery source (similar to the configuration that is in ELTs that are installed in some aircraft). Rob reviewed the test results for flat panel tests; simulated structure and panel tests; simulated primary lithium battery powered electronic locator transmitter (ELT) failure adjacent to CFRP panel; and exterior surface cooling tests. Observations from both series of tests were discussed. Video of an ELT fire source test (at 4x play speed) was shown. The results of the ELT fire source tests were presented. Main takeaways: foam block fire source and ELT fire source are fundamentally different. All inaccessible aircraft areas are different: some may be so tight as to restrict airflow and inhibit flame propagation, others may be just large enough to allow even a small fire to propagate. Ultimate goal is to ensure that for the most severe configurations where full length flame propagation is found the propagation will be inhibited or eliminated. Rob showed photos of the simulated CFRP panel built at FAATC. FAATC is starting to plan the baseline test for this panel. Test configuration guidance or suggestions welcome and encouraged. Question: Did you vary the type of D-cell that you used for the tests?

Ochs: they are different than the D-cells typically used in the ELTs. Ochs: I figured these were the worst, but no we did not vary the manufacturers.

NexGen Burner for Insulation Burnthrough – R. Ochs (FAATC)

Rob reviewed the variety of materials and set up used using new stator (65 psig) and the results of these tests. We can discuss this further in the Task Group meeting. FAATC has acquired a 3D printer and will use it to make stators to test and determine feasibility of replacing CNC machined stators.

Radiant Panel Update – S. Rehn

We have most of the test results back from the Round Robin. Round Robin: Materials sent out to 28 labs (including FAA). 24 labs have responded so far. Round Robin results for the various materials were reviewed. Air Flow Study: the new Handbook has a larger drawer length compared to the current Handbook. This was done to allow less air to flow into the chamber during testing. Larger drawer really isn't necessary as it turns out. Steve reviewed the results of the airflow study testing conducted so far. Future work: continue conducting tests with 3 different air gap levels: fully open, partially open, fully closed. Three (3) anemometers will be placed in the chimney for more accurate air velocity measurements. Steve showed Boeing's proposal for thermocouple array for the future tests. A Boeing statistician determined that a total of 60 samples will be needed (20 for each air gap level).

Development of a New Test Method for Evacuation Slide Materials – T. Marker for D. Do (FAATC)

Dung Do has visited two labs since the March 2016 Materials meeting to ensure they are set up properly. Purpose-built calibration tools were used to set up the apparatus. A diagram showing how one of the tools is used and its purpose was shown. Calibrations and tests were conducted at each of these two labs. One calibration test and two slide material tests were conducted at each of the labs. Lab A was using the same furnace as the FAATC lab. Lab B was not using the correct furnace type. The calibration and test procedure were reviewed. Future Work: Assist labs in obtaining the correct furnace and ensure correct apparatus arrangement, calibration, and test execution. Round Robin 5 will be conducted using new test method.

Flammability of Materials in a Low-Concentration Hydrogen Environment – S. Rehn

This work was conducted by Steve Rehn and Steve Summer at the FAATC. The background for these tests was provided. What we are trying to determine: can hydrogen concentrations below the LFL contribute to a fire? A photo of the test set up was shown. Videos of three different concentrations were shown side by side. Conclusion: Hydrogen concentration below the LFL can have a significant impact on material fires. As hydrogen concentration increases, materials can't self extinguish. Question: what was the motivation for this work? Hill: there are proposals to put fuel cells on board aircraft. Some of the applications being proposed are within the cabin such as putting a fuel cell within the galley area to provide power to the galley eliminating the need to run wiring to the galley area.

Heat Release Rate Updates – M. Burns (FAATC)

2016 HRR Round Robin is completed: 30 labs participated. The compiled test data will be available on the FAA Fire Safety website in the near future.

HR2: Calibration Yusuf Mansour (Boeing) and Mike have been working on a DOE. Mike described the current calibration method. The HR2 Proposed Step Method was described – two changes. The proposed ramp down method was described. Mike has been working with Marlin Engineering to develop an R&D Software Program that has flexibility built into it to adjust a number of parameters.
Chapter HR Updates: The Hardware changes were reviewed. The system airflow (MFC Requirements) were reviewed. Millboard specification. The software package arrived at the FAATC last week, and Mike will begin testing with it soon.
Future Work: HR2: install new equipment (MFCs); conduct calibration testing (step/ramp). Question: do you foresee that we will be able to modify current HR2 equipment to the HR2? Burns: It would be quite a challenge. There's been a lot that has been changed/modified.

Final Results from 2016 Industry OSU Round Robin – T. Spanos (Boeing)

Theodorous reviewed the final results from the 2016 OSU Round Robin: 31 labs participated. Conclusion: observation that significant variability still exists among the machines; perhaps due to manufacturing and operational differences.

Comparison of Heat Release Measurement Methods – R. Hill (FAATC)

Thermopile (TP) vs. Oxygen Depletion (OD) – Rich Lyon compiled a list of factors for each of these as part of a Tech Note. Dick gave a comparative discussion of these factors. The thermopile became a standard because it had a lot less problems and could be used by the aviation industry the way it is used for certification.

OSU Guidance Document Development – M. Spencer (Marlin Engineering)

During the Task Group meeting in March 2016 in Bordeaux, we discussed developing an OSU Guidance Document because it is easier to create an industry guidance document than to revise the Fire Test Handbook. A joint meeting was held to evaluate the list of items to be included in the Document. The list was broken down into three distinct areas and responsibilities assigned. Martin reviewed the top level of the list. Next steps: follow up meetings and plans to create a draft document and forward it to Mike Burns to review. Industry suggestions welcome. Marker: why can't you just update the Handbook Chapter? Burns: we weren't sure where this is going to go when it's all done.

Material Change Similarity Task Group Status – D. Slaton (Boeing)

Dan has been working with Dr. Rich Lyon (FAATC) to create a draft AC Guidance Proposal Using the Microscale Combustion Calorimeter to share with the Task Group for input. Dan briefly reviewed some areas of the draft AC. Next steps: review draft

AC, provide inputs; industry to identify certain data available to validate the process; final draft AC to FAA – October 2016; and FAA to propose new AC 2017 (concurrent with NPRM). HPBusch: are you able to demonstrate process changes to measure differences in the HR2 heat release characteristics; is it also possible in the microscale calorimeter? Slaton: certainly there are temperature changes we can imagine. It is something we need to bring up.

FAA Policy Statement – Clarifications and Additions for Future Advisory Circular – M. Jensen (Boeing)

There have been a lot of questions of interpretation since the Policy Statement (PS ANM 25.8153-01-R2) release. Revision 1 and 2 of the Policy clarified a number of those issues. Michael reviewed this group's Working Plan. We are trying to complete this work by the October 2016 Triennial Fire and Cabin Safety conference. The current clarifications and additions being requested by industry were shown. Zodiac Aersopace (Pom Sattayatam) hosts a Sharepoint for this Task Group. If you would like access to this Sharepoint, contact Pom (panade.sattayatam@zodiacaerospace.com). Contact the team leaders to get on their team. Spencer: has there been any consideration about wiring MOCs? Jensen: I'd like to do that, too. We could add that to this.

WEDNESDAY, JUNE 8, 2016

8TH Triennial International Aircraft Fire and Cabin Safety Conference

The conference will be held October 24-27, 2016, at the Tropicana Hotel
In Atlantic City, NJ, USA.
Register at: http://www.fire.tc.faa.gov/2016/Conference/conference.asp

The draft conference schedule will be available at the above URL within a month or two. Topic areas: Materials, Systems Fire Protection, Crash Dynamics, Cabin Safety, Fire Research, Batteries, and Magnesium use in aircraft.

The conference will replace the fall 2016 Materials and Systems Working Group meetings. No Working Group meetings will be held in fall 2016 due to the conference. Some Task Groups may meet during the conference week. Check with your Task Group Leader.

Fire Safety Website – R. Hill (FAATC)

Dick provided a brief tutorial on the use of the FAA Fire Safety website.

ICAO Lithium Battery Shipping Update – R. Hill (FAATC)

Addendum 3 and 4 have been published by ICAO. It was done through the ICAO Dangerous Goods Panel (DGP). Packing instruction 965, Section IA.1: Lithium ion cells must be offered for transport at a state of charge not exceeding 30 percent of their rated capacity. This is for bulk loaded lithium ion batteries, not batteries shipped installed in equipment. Packing Instruction 965, Section II: packages and overpacks of lithium ion batteries prepared in accordance with the provisions of Section II must be

offered to the operator separately from cargo which is not subject to these Instructions and must not be loaded into a unit load device before being offered to the operator. Not more than one package prepared in accordance with this section may be placed into an overpack. The ICAO Air Navigation Council voted (on February 22, 2016) for a temporary ban on the shipment of lithium ion batteries on passenger aircraft. This ban took effect on April 1, 2016. This ban does not apply to lithium ion batteries packed with or contained with equipment. ICAO tasked SAE to form a committee to develop battery packaging standards. This committee is currently working on this issue.

Smoke, Fire, Fume Events Study – R. Hill (FAATC)

RGW Cherry and Associates Limited was tasked with creating a large Excel Database using three sources on U.S. tail number aircraft from 2002-2011. We are in the process of having this study updated through 2014. Each record of smoke, fumes, or fire occurrences from the three sources was analyzed and input into the Excel Database. Dick reviewed the occurrences that were categorized at "Significant Events". A brief review of some of the findings in this study was given. The report and Excel Database are being finalized and are to be released in the fall. Question: is there any mention of materials in the database? Can you sort by any instance of materials being involved? Hill: in looking at the data from the SDRs, it's not that clear. There may be words in there about the insulation burnt, but that's about it. There is not a field in the database that specifies 'thermal acoustic insulation burning', but you can pull up the write ups of the incidents to get more detail.

Task Group Summaries

Magnesium Alloy Flammability Test Task Group – Tim Marker

Task Group Report provided by Tim Marker (tim.marker@faa.gov).

For the benefit of those not able to attend the meeting, below is a summary of the presentation given on the development of new flammability tests for magnesium alloy components located in aircraft cabins:

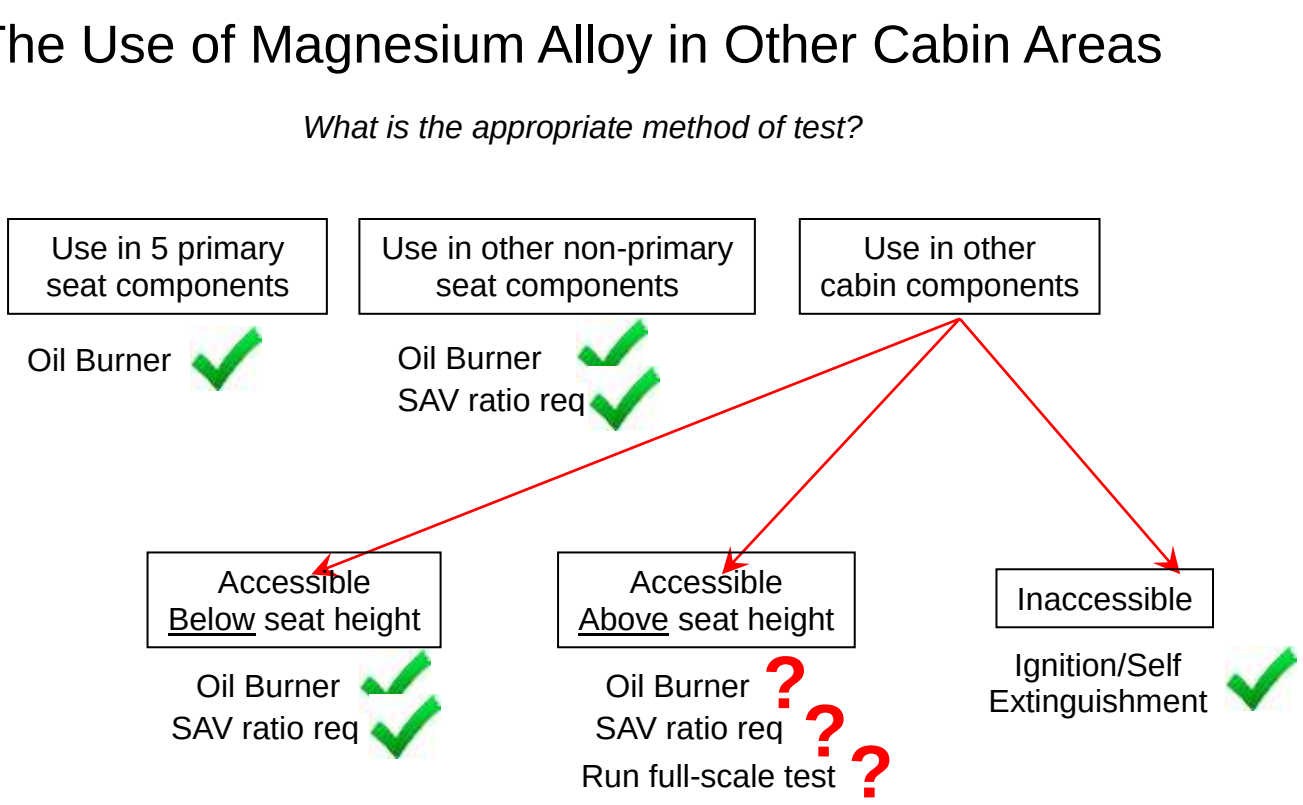
1. Primary Seat Components. The FAA had previously conducted full-scale testing on aircraft seats constructed of magnesium alloy at the FAA Technical Center (FAATC). The results indicated no significant increase in hazard level if certain types of magnesium were used in the construction of 5 primary components (legs, spreaders, cross tubes, seat back frames, and lower baggage bar frames). The FAA has indicated it would be acceptable for certain types of magnesium alloy to be used in these areas if the material meets the requirements of the new flammability standard described in Chapter 25 of the Aircraft Materials Fire Test Handbook. Applicants would still be required to apply for Special Conditions in order to complete the certification of the material for use on a commercial aircraft.

2. Non-Primary Seat Components. Industry had previously inquired about the potential use of magnesium alloys in other (non-primary) seat components, for example tray table arms or other frame members. The FAA and the European Aviation Safety Authority (EASA) indicated that although these non-primary components were not represented

during the full-scale demonstrations at the FAATC, they would not prevent magnesium alloy use in them if additional requirements were met. The FAA had previously proposed using the surface area-to-volume (SAV) ratio of the seat components as a means of determining the suitability of using the new oil burner flammability test for qualification. At the previous International Aircraft Materials Fire Test Working Group (IAMFTWG) meeting in Atlantic City, participants had discussed a proposed maximum SAV ratio of 20 for solid seat components, and 40 for hollow components. These maximum ratios were based on the components that were tested during the full-scale demonstrations at the FAATC. The Task Group participants agreed the 20 and 40 maximum SAV ratios were appropriate.

3. Other non-Seat Components. There is still considerable interest in the use of magnesium alloy in other cabin components, based on feedback provided by members of the task group. The FAA determined this area of potential use should be separated into three main categories:
a. those components that are accessible during flight, but located at a height less than the seatback height (approximately 60 inches),
b. those components that are accessible during flight, but located at a height greater than the seatback height (approximately 60 inches),
c. those components that are inaccessible.

See figure below representing the proposed "blueprint" that was presented during main meeting:



The FAA suggested that accessible, non-seat components located at or below 60 inches in height could also be substantiated using the maximum allowable SAV ratios

that were proposed for non-primary seat components. A good example of this would be galley cart frames. The Task Group participants concurred with this logic. That left 2 remaining areas; the accessible area above 60 inches, and inaccessible areas. The FAA indicated the accessible areas above 60 inches would need further analysis, and could possibly require full-scale testing to determine the appropriate test for magnesium alloy components located in these areas. In terms of the inaccessible area, the FAA had previously stated that the test for magnesium alloy components should be either an electrical arcing test or ignition and self-extinguishment test representative of the threat in the hidden areas. The FAA began testing thin samples in the radiant panel apparatus with reasonable success. At the previous meeting, Task Group participants suggested the FAA also carry out tests using the Vertical Flame Propagation (VFP) test, since it had been identified as the test method for other materials located in inaccessible areas, including electrical wiring, ducting, and composite structure. The FAA conducted 10 tests using the VFP apparatus, but the testing was difficult due to the propensity of the vertical sample to distort towards the heat source. This situation was difficult to control, and highlighted the drawbacks with this test configuration. Previous testing in the radiant panel apparatus did not result in excessive warpage of the sample, since they are situated horizontally on top of a backer board. Since the radiant panel test results were promising, the FAA stated they would continue development of a flammability test based on this apparatus.

A Task Group meeting was conducted to discuss additional details. Topics discussed included:

1. Ability to certify a particular type of magnesium alloy once, requiring no additional testing. The FAA made it clear that this approach will not be allowed. Several participants used the example of aircraft wiring, which does not have to be continuously tested, if it meets a certain MIL spec. The FAA clarified that a MIL spec is very specific, and the only instance where additional flammability testing is not necessary. In all other cases of aircraft cabin materials, flammability qualification testing is initially conducted in accordance with a certification plan, and follow-on testing is also conducted as per a quality control program. The FAA (with confirmation from Magnesium Elektron) indicated that not all magnesium alloys systems are equivalent. Magnesium alloys are classified based on their primary alloying elements, for example AZ31 indicates a magnesium alloy with approximately 3% aluminum and 1% zinc. However, these quantities are not exact, so two different manufacturers can produce the same classification of alloy, but they may not perform similarly during flammability tests. That is why it will be necessary to conduct flammability tests based on the exact alloy configuration that will be used in the aircraft component.

2. Full-scale testing to determine risk of using magnesium alloy components in areas above seat back height. The FAA discussed full-scale testing conducted previously, in which the focus was on the 5 primary seat components. In order to determine any additional hazards associated with magnesium alloy use above seat back height (e.g., stowage bin hardware), additional full-scale testing would be recommended. After an in-depth discussion with Task Group participants on this subject, it was agreed that this activity would be postponed for the time being, since other, higher priority areas still require investigation.

3. What is the meaning of the term “inaccessible area”. During the discussion, the FAATC indicated it had received from EASA a clear definition of accessible/inaccessible developed by the ARAC Group for the revision of 25.853:

Accessible areas are the areas of the aircraft where in-flight fires:

- may be visible or detected by passengers or crew, and
- may be reached without the use of tools and extinguished by the crew .

Accessible areas are occupiable by passengers and crew, or immediately adjacent to areas that are occupiable. Compartments that have separately-defined flammability requirements are excluded (examples: Class B and Class F cargo compartments, waste containers, etc.).

A non-accessible area is any area not addressed by the definition of accessible, and is defined as any area where in-flight fires may not be visible or detected, and cannot be reached and extinguished by the crew. This zone is located between the fuselage skin and the passenger cabin “living space”, such as the area behind sidewall panels, ceiling panels, and below cabin floor, and monument surfaces that are exposed/opened to the areas defined above. Compartments that have separately-defined flammability requirements are excluded (examples: cargo compartments; fire zones; waste containers).

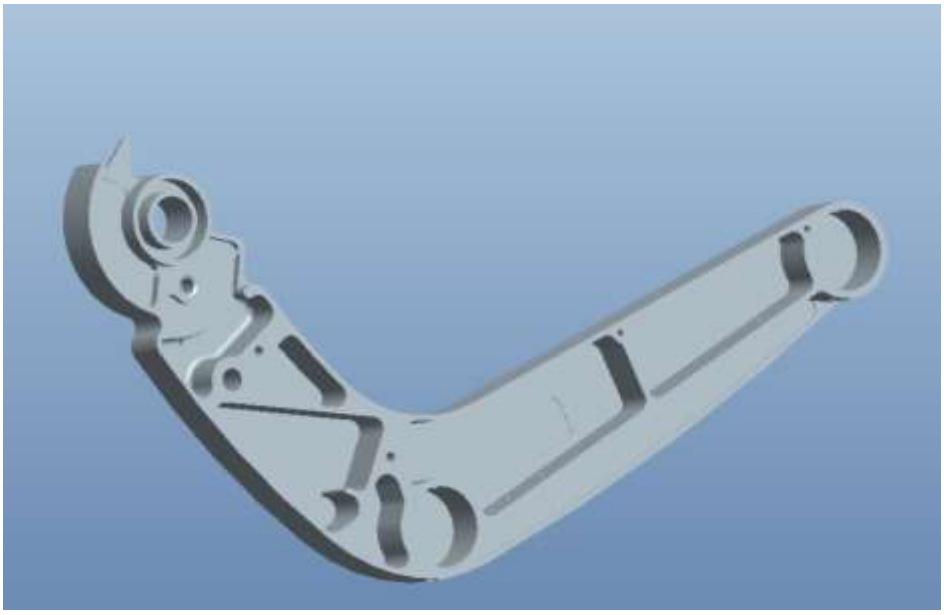
4. Discussion of the appropriate test for inaccessible area. The FAATC reviewed the flammability test results on thin magnesium alloy samples tested using the radiant panel apparatus, and more recently the VFP apparatus. As described during the general meeting, the VFP test results were not favorable due to the distortion of the thin sample during the heating process. The FAATC recommended further testing with the radiant panel apparatus, since initial results were very promising. During radiant panel testing using a 3- by 6-inch sample, the sample was forced to ignite, and then demonstrate the ability to self-extinguish. The preliminary results indicated well-performing alloys self-extinguished on a consistent basis. This configuration was also capable of distinguishing differences between 2 well-performing alloys tested, which had not been done previously. The tests included a measurement of the sample weight loss and time required for the sample to start burning. The FAA felt the most important aspect of the test was to ensure that a component fabricated from magnesium alloy possessed the ability to self-extinguish, if located in a hidden area.

5. Lack of current research projects involving magnesium alloys submitted to airworthiness authorities. 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. Magnesium Elektron (Bruce Gwynne) indicated that several projects were in the works, and would likely be proposed in the near future (note: Due to the proprietary nature of these projects, the details could not be disclosed). Other Task Group participants indicated they would be submitting proposals for inaccessible area applications, once the test details are finalized. This highlighted the importance of the FAATC’s development of the inaccessible area test using the radiant panel. Magnesium Elektron

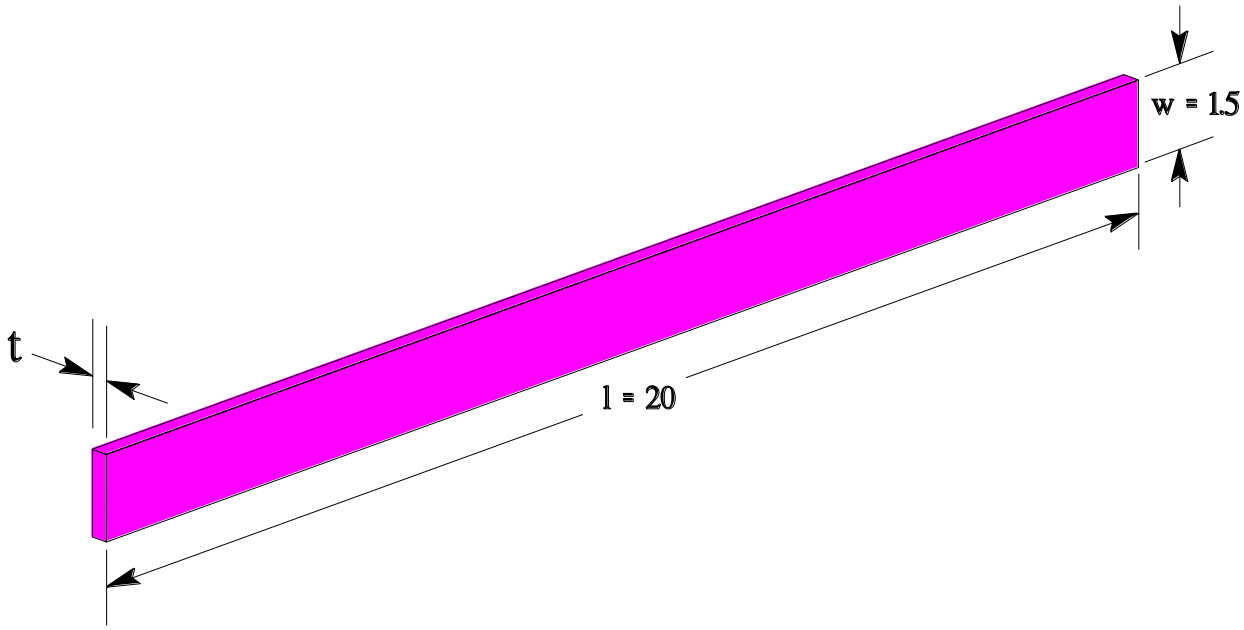
also indicated they would likely be submitting a proposal for non-primary seat components if the acceptance criteria can be developed for components with SAV ratios exceeding the limits (20 for solid, 40 for hollow).

6. Development of acceptance criteria for non-primary seat components with SAV ratios exceeding the proposed limits of 20 for solid and 40 for hollow. The FAATC has been conducting oil burner tests and working towards an acceptance criteria based on the ratio of the thickness of the high SAV ratio component to that of the standard 0.250-inch thick component. The logic is as follows:

a. determine SAV ratio of actual non-primary seat component to be qualified



b. plug in the SAV ratio from above, and back calculate to obtain the thickness t for a standard length and width bar sample according to equation below (w and l remain at 1.5 and 20, respectively).

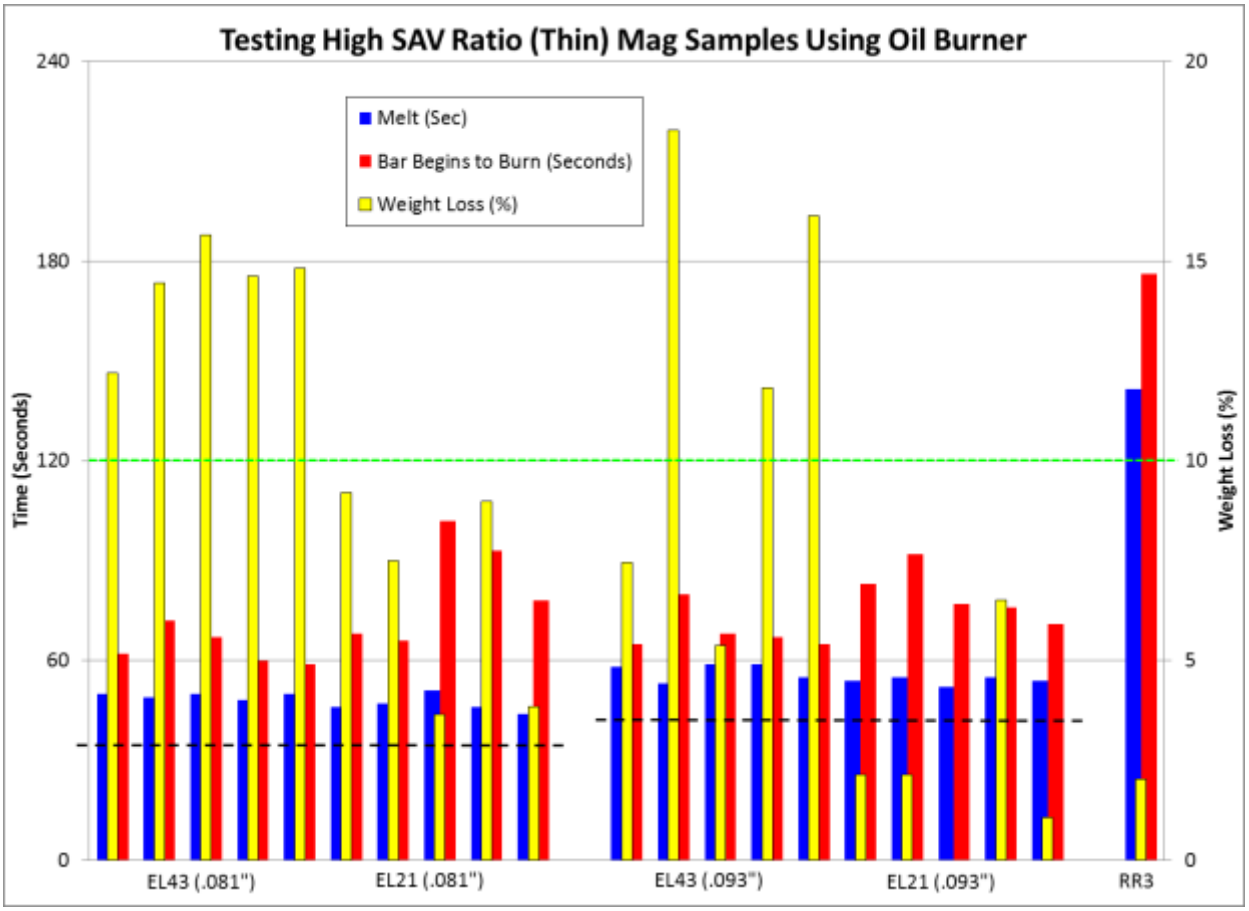


Surface Area = 2(t x w) + 2(t x l) + 2(w x l)
Volume = t x w x l
SAV ratio = (2tw + 2tl + 2wl) / twl = 2/l + 2/w + 2/t
2/t = SAV ratio - 2/l – 2/w
t = 2 / (SAV ratio – 2/l – 2/w)

c. calculate the revised allowable time before burning starts by using the following ratio:

Revised Allowable Time to Burn = t / 0.250 x 120 seconds

The FAATC carried out 20 tests using this logic, with the results summarized in the chart below.



The chart displays the results for 2 test cases (SAV ratios of 23 and 26), using 2 different alloys (EL43 and EL21). In all cases, the samples would pass the proposed test criteria for the time to burn, however some would fail for exceeding the 10% weight loss criteria, which would not change.

In summary, the proposed blueprint of testing methodologies for magnesium alloy components was well-received by the Task Group participants. The FAATC and industry agreed to continue to perfect and update these concepts in the coming months. The FAATC plans to have a Task Group meeting during the upcoming triennial conference in Atlantic City. Details on the meeting time and location will be forthcoming.

Task Group Meeting Attendees: Tim Marker (FAATC – Task Group leader)Jim Davis (Accufleet), Enzo Canari (EASA), Heinz-Peter Busch (Airbus), Bruce Gwynne (Magnesium Elektron), Michael Jensen (Boeing), Jeff Jones (Dassault Falcon Jet), David Lucas (Textron Aviation), Brad Shelton (Dassault Falcon Jet), and Jeff Smith (Gulfstream). Contact Tim at: tim.marker@faa.gov

Burnthrough Task Group – R. Ochs (Robert.ochs@faa.gov)

We haven't done a lot of work since Bordeaux. We discussed starting a Round Robin – possibly 6 participating labs. Brook One will provide some material. Rob described the tests that will be part of the Round Robin.

VFP Task Group – R. Ochs (Robert.ochs@faa.gov)

VFP 3 design was discussed during the Task Group meeting. Martin Spencer will visit the FAA Fire Safety VFP lab to offer some tips while he is in the area.

Heat Release Rate Task Group – M. Burns (mike.burns@faa.gov)

Heat Release Rate Task Group Minutes (Kansas City, MO USA – June 2016)

Heat Release Rate Task Group notes provided by Mike Burns.

- OSU Guidance Document:

  This document is being assembled in order to address standardization issues related to the OSU heat release rate test method that may not be clearly identified in the current Fire Test Handbook. This effort is being chaired by Yaw Agyei, Yonas Behboud (Boeing) and Martin Spencer (Marlin Engineering). During the meeting, Martin presented a draft outline of the document. Currently it is not exactly certain where this document will end up but there was mention that possibly it could be included in the Fire Test Handbook Supplemental section. Stay tuned.
  Action Item:
  - All labs (new and old) are requested to provide feedback on what they would like to see in this document. It can include things like lab design, test equipment or material related issues or any other thing you can think of that would help standardize procedures and equipment.

  Example:
  Recommended list of 'Standard' materials labs can use to assess equipment performance? If so, what?
  Contact:
  yaw.s.agyei@boeing.com
  yonas.behboud2@boeing.com
  mspencer@marlinengineer.com

- HRR Round Robin Data

  Thank you to all participating labs! Theodoros Spanos (Boeing SC) presented the final report of compiled test data resulting from the round robin. Thank you Theo! I presented my take on the results of the round robin during the break-out portion of the meeting. I have included this data in a bulk email sent to all labs.
  Airflow Split:

We talked about the results and the wide variability in total airflow and airflow split ratio. The working groups initial desire was to require replacement of all orifice meters with mass flow meters and control valves (for all labs) to achieve the target flow of 85 cfm and 75% / 25% airflow split. Dick Hill (FAA) was in attendance and assisted the group by pointing out challenges that may be faced going forward with this ideology. Everyone wants action but no general agreement on how to proceed was found. In the end it was decided to possibly form a small group of labs who would like to purchase and install this equipment in their lab on a research basis. Once data is gathered it can then be presented to the task group to see if there is much improvement in test results.
As a result of the variability in data from the round robin there was additional discussion on the possibility of having an independent audit entity (such as Exova) inspect all labs and test equipment. There was not much support concerning this approach.
Action Items:

- Labs are requested to have internal discussions on willingness to participate in a focus group. This group will need to purchase & install the needed airflow control (and measure) test equipment followed by testing.

- We will reconvene to see how industry wants to move forward.

- HR2

Pros/Cons of using Oxygen Depletion:

A portion of Theo's presentation included a reference to Dr. Rich Lyon's (FAA) recently published Tech Note comparing Thermopile (TP) and Oxygen Depletion (OD) methods for measuring heat release rate. Following Theo's presentation, Dick Hill spoke on the history of these two approaches and the pros/cons for each. This led to a much more detailed discussion during the break-out session.
Similar to the airflow split, industry was tasked with forming a small group of labs who would agree to purchase and install the necessary oxygen measuring equipment and gather some data to be presented before the task group.
Action Item:

- Labs are requested to have internal discussion on participating in a focus group willing to purchase & install oxygen depletion measuring equipment.

- We will reconvene to see how industry wants to move forward.

Acceptable HR2 variability

There was some discussion concerning what should be considered acceptable repeatability/reproducibility criteria for the HR2 (DOE).
Action Item:

- Industry needs to define goals for acceptable HR2 variability.

Airflow % Relative Humidity (% RH):

There was discussion concerning % RH of the airflow through the HR2 (and OSU) and its impact on test data. The Tech Center will investigate collecting data from a saturated air stream and a very dry air stream to compare differences in heat release values and other parameters.
Action Item:

- FAA Tech center will make modifications to the air supply piping to include a method to saturate the air supply to the HR2 while measuring %RH, followed by testing.

- Additional testing will include a repeat of tests using dry air (or much dryer air).

- NBS Round Robin & Test Plan

  An NBS mailing list was distributed to working group members for contact information/email verification. The group discussed including the following items in the test plan:

  1. Having a 'voluntary' option for labs to include toxicity test data
     a. Include what method was used
  2. Provide a checklist for labs to follow
  3. 5 test coupons will be provided (all 5 must be tested)
  4. What style furnace is used (wire coil or rigid coil tube)
  5. Heat flux gauge type (air or water cooled), manufacturer and range (calibration factor)
  6. Boeing / Airbus / FAA acceptance?

  Action Items:
  - FAA Tech center will generate test plan and data sheet.
  - Heinz-Peter Busch (Airbus) is looking into providing test materials for Round Robin.

RTCA Task Group – A. Thompson (Element) (alan.thompson@element.com)

RTCA Task Group notes provided by Alan Thompson.

1- The group decided to move forward with the line burner as opposed to the foam block method. The primary reason is that the line burner is less invasive and more appropriate when testing smaller or compact electronic enclosures.
2- A draft document (new method in section 26 of RTCA) is due Spring of 2018 in order to be present in the FRAC RTCA DO160 rev. H which will be released in Spring of 2019. This leaves 5 meetings of the FAA working Group to accomplish this task. This is doable.
3- We reviewed the scaleable line burner rationale and are satisfied that it and the equation used is appropriate
4- The FAA Tech Center will purchase a line burner to assist with additional testing. More testing is needed to satisfy the "start small and grow" concept if the line burner extinguishes due to lack of O2.

5- We decided best way to move forward was to put together a draft procedure and circulate. We can use this to keep us on track and focus on the areas that need work. I hope to have this to you by the end of June.
6- Our immediate focus is on pass/fail. We agreed to use flame exiting the box for 12 seconds and not exceed a height of 1.5 inches (following the Bunsen burner 12 second test method) as a good start. More work is needed to decide if the SLIIM (ignition module of flammable PCB material located above the box) is needed as well.
7- Other focus will be on guidance: where to place burner, how many burns in each box, what happens if burner goes out, etc.
8- Thomas Krause (Airbus) will be experimenting from the perspective of the box design. His goal is to offer guidance based on geometry and construction and will present findings at the Triennial Conference in October Atlantic City. This work will tie in nicely with our development of the procedure.
9- We decided it would be good for this group to meet in Atlantic City during the conference. For those of you interested in this, please let me know if a particular day/time works best for you. I know many of us do not plan on attending all week and have particular presentations that we want to see. I will do my best to accommodate.

Cargo Liner Task Group – S. Salter (timothy.salter@faa.gov)

Cargo Liner Task Group notes provided by Tim Salter.

The majority of the time for this task group was spent viewing the recently completed cargo liner test method instructional video using the sonic oil burner. Attendees were asked to view the video and ask questions and/or provide feedback so any necessary changes could be made before releasing the final copy of the video for public viewing on the Fires Safety website. The video is intended to be a visual aid to accompany the newly revised Chapter 8 of the Handbook. Suggestions included revising the air velocity measurement method in the test chamber, as well as additional information regarding the patch adhesion test. Additionally, the group discussed the issue of the orientation of the 1/16-inch thermocouple located 4 inches above the ceiling liner panel during sampling test. The thermocouple tip location is specified, but no other information is provided regarding a standardized method of mounting the instrumentation. All test labs should have this thermocouple mounted using standardized method to reduce any disparities in data results among labs. It was only recently discovered through testing that the orientation/mounting method other of the thermocouple can influence test sample temperature readings.

Seat Cushion Task Group – T. Salter (timothy.salter@faa.gov)

Seat Cushion Task Group notes provided by Tim Salter.

In the weeks leading up to the meeting, it was decided that the sonic burner should be included in Chapter 7 of the Handbook for use in the seat cushion oil burner test method. The new Chapter 7 will follow the same format as the revised Chapter 8 of the Handbook (cargo liner oil burner test method). The group asked that the new Chapter 7

be sent out for a 2-week review period to those interested so feedback may be provided before updating the chapter and allowing the use of the sonic oil burner.
Other items touched upon included a schedule or maintenance schedule for the sonic burner, pictures and descriptions of what to look for regarding a good or bad flame emitted from the burner, requiring fuel and air temperatures to be recorded during testing, and a possible round robin using the sonic burner to conduct an test cell airflow study similar to the one currently underway for the sonic burner cargo liner test airflow study. Anyone interested in participating in the round robin should email Tim Salter directly to be added to the list of labs that have a sonic burner for the seat cushion test method.

Radiant Panel Task Group – S. Rehn (steven.rehn@faa.gov)

The calibration method was discussed. We've seen as much as a 10% difference from one calibration method compared to another. Steve will survey the Round Robin participants to see what calibration method they used for the RR tests to see if that contributed to the varying results. We also discussed the gaps in the drawer. We are looking at placing hot wire anemometers to get a better idea of how the airflows around the chamber and how the gaps around the drawer will affect it.

Approved Material List Task Group – S. Campbell
(scott.campbell@zodiacaerospace.com)

The group has met a few times in the past few months and has a lot going on. We talked a lot about continued compliance. We will be putting together a matrix for how products will be qualified. Contact Scott Campbell for additional details.

Flammability Standardization Policy Statement Task Group – M. Jensen
(Michael.e.jensen@boeing.com)

The Task Group Minutes below were provided by Michael Jensen.

Paint thickness allow thick test data to cover thinner – If we go forward, additional testing needed:

2 coatings (Sherwin Williams, Mapaero) Spies Hecker?

HR/SM/VB - 5 individual specimens with 2 different thicknesses of paint/primer

Substrate – Aluminum – 0.8 mm (approx.)

Volunteers? –

Powder Coat – Color Similarity (HR and Smoke)

Additions to existing data – Test additional HR on a few (5) colors based on the existing data to give a wide variety HR values and colors (Blue, Black, red, white, grey) 5 specimens each (rather than 3) with highly controlled and recorded thickness. 0.6 or 0.8 mm aluminum. (at least two mfrs?). No smoke due to existing data low values.

Zodiac, Alkmaar

Fabrics – Color Similarity (Blend Similarity) (12 sec Vert) (60 sec?) (Leather)

Margins of 6" max (Note, ~3% max dye content)

Test data required:

Upholsteries

Wool/Nylon blends – Blue, Red, Grey, Beige/Brown for a single blend type

All Wool – Blue, Red, Grey, Beige/Brown

Carpets

Wool – Blue, Red, Grey, Beige/Brown

Nylon – Blue, Red, Grey, Beige/Brown

Draperies

Polyester - – Blue, Red, Grey, Beige/Brown

Wool - – Blue, Red, Grey, Beige/Brown

Suppliers – Lantal, Mohawk, Botany Mills, Kalogridis (Douglas, Lakawana, Townsend)

Email Heiko Thermoplastics report

Ask Jim Davis for Leather data

PS21 option 1 Adhesive plaque thickness

¼" to 1/16" (~0.060) plaque thickness (Look at a lower limit)

Add verbiage about shrinking not allowed. I.e., films cannot be tested.

Testing 3 thicknesses (1/4, 1/8, 1/16)

Number of adhesives – 4 different Epoxy adhesives, 2 Urethanes,

Klaus may have 1/8" data (Zodiac)

Exclude film adhesives (pressure sensitive, spray and elastomer based) from option 1 or any that melt quickly from flame.

Reinforced PS adhesives, a single ply is allowed (i.e., carpet tapes with cloth reinforcement)

Use of UL 94 V0 for 12 second Vertical Burn

AC20168 -authorizes use of DO-313, UL approval allows for conformity. Still have to run FAA test.

For thermoplastics and thermosets

Look at 5V UL test for 60 (possible)

Test Data Needed:

Data of known UL 94 V0 that could be tested to 12-sec VB (FAA Test). Sabic has some polycarbonate data. Do black box suppliers have circuit (PC) data for 12 sec.

Bonded Metal same as Imbedded Metal Details

Can we use data from original report?

Test data for bonded metal and substrate alone.

Minimum thickness of .01” to match existing PS.

Inorganic Finished metals do not require HR/SM (no data required)

Thinner metal for Thicker on HR/SM (Bonded and alone)

Klaus has some data that can be used.

Check with Zodiac Galleys

Test Data to generate:

3 thickness of metal with DTL musing PSA or Thermoplastic adhesive – Test HR and Sm

Testing mechanically attached materials separately VB

Compare to current PS 21 options

Limit materials to non-melting materials (polyester, nylon Velcro, etc, must test together?)

Collect any data on materials tested together versus alone.

Address this does not cover materials cured together such as non-metallic panels

PS21 Clarification on Options 1 and 2

Option 1 - adhesive test is always 12 sec regardless of detail requirements

Option 2 – Adhesive test (bonded between two nonmetallic) must meet the bonded detail requirement (not the substrate)

Additive Manufacturing – Guidance on certification testing – Chuck Wilson has some data

Data needed:

Testing of a variety of plastics in multiple orientations (talk to Stratasys)

Multiple thicknesses

Fill ratios (Packing) or Resin Density

Ultem (9085, 1010)

FR Nylon

Polycarbonate

ABS

PEEK/PEKK

Test of different technologies (SLS, Stereolithography, Fused Deposition modeling)

45 Degree BB

Itemize MOCs form Policy Statement and put forward to determine which of these will require data.

Wiring Similarity and test guidance

Color similarity

AC43-13 additions of new slash numbers – If military material or AS spec requires FAA Flammability criteria, then okay to use with no further test.

Small gage certifies larger gage

Twisted pair – Same as above for color similarity. Test of jacket is okay without regard to size of internal wires.

Testing of sleeving, shrink tubing, wraps (self-adhesive silicone and similar), spiral wrap

Use of UL approval for commercial wiring (what would be equivalent rating?)

Clarify ribbon cable testing

How to test short lengths of wire (less than spec requirement of ~15 inches). Did Pat Cahill come up with something.

Small parts for wiring?

Speak with Chris B.

Inner passenger window

The dust cover (Boeing term) for inner most window is defined a s a window and is required to meet 2.5 In/Min test (F3). Limit to windows over a single structural window and not multiple windows. ~~Less than 2 sq ft?~~

Bonded Carpet to Flooring Guidance

Certification of multiple layers (Floor, plastic sheet, tape, carpet/hard floor covering)

Limited to floor applications only

Remember structural floor panels require 60 second by themselves. Provide a definition of structural flooring (requested by Enzo) (Provide examples)

Address use of hook and loop – most likely with option 3. For typically hard, rigid flooring (Look at AC 25-17A guidance)

Use similar options to PS21

1. Each detail tested separately
2. Adhesive tested between non-metallics, others individually.
3. Tested to 2 ply laminate
4. As installed

Bonding two same sized parts together

Allow PS 21 options for all bonding, including 60 second VB applications (Not OSU/SM).

The 4 PS 21 options should be okay with limitations on the substrates, i.e., For options 1 or 2, limit to items that are not thin, materials that don't melt or shrink away, no Hook and loop, these would be only option 3 or 4.

For bunsen burner testing only

Need data on 2 ply laminate or cargo liner and compare to use on panel, etc.

Add OSU HR to burn test hierarchy

Allow HR to satisfy VB test requirement

Issue with EASA not using AC as method to show equivalent method of compliance.

Potentially limit to laminates, metals and panels.

Material Change Similarity Task Group – D. Slaton (Daniel.b.slaton@boeing.com)

The Task Group notes below were provided by Dan Slaton.

The task group is developing a draft AC to utilize the MCC (Microscale Combustion Calorimeter) for assessing the flammability performance of materials changes. Dan Slaton provided a status of a draft AC developed in collaboration with Rich Lyon and Natalia Safronava of the FAA Tech Ctr. The draft AC defines material change scenarios that can be assessed to determine if it can be considered a minor change for flammability. The task group will review the draft AC and provide comments on the approach and test method. Industry participates are asked to volunteer to provide data that supports this proposal by comparing MCC results of the material change. Also looking for volunteers to write up case-studies that can be published in the AC to provide context and guidance on how to use the new process.

Update on Foam Block Equivalent (FaBLE) – T. Krause (Airbus)

Airbus is working on a line burner to replace the foam block. Thomas showed a photo of what the VFP Task Group came up with last year. Thomas reviewed the results. A video of FaBLE was shown.

Next Meeting:

The spring 2017 meeting will be hosted by Airbus North America Engineering at the Holiday Inn Downtown in Mobile, Alabama, USA, on March 1-2, 2017.

There will be no fall 2016 Materials Working Group meeting because of the International Aircraft Fire and Cabin Safety Research Conference, October 24-27, 2016, Tropicana Hotel, Atlantic City). Some Task Groups may meet during that week.

October 24-27, 2016 Task Group Meetings:

Contact April Horner (april.ctr.horner@faa.gov) if you would like to schedule a Task Group meeting that week.