

INTERNATIONAL AIRCRAFT MATERIALS FIRE TEST WORKING GROUP MEETING

Hosted by Lantal Textiles, AG, Solothurn, Switzerland

June 25-26, 2014

Agenda:

WEDNESDAY, JUNE 25, 2014

8:30-9:00 AM Lantal Welcome & Logistics/Introductions
9:00-9:25 AM Seat Cushion Flammability Round Robin Update – T. Salter (FAATC)
9:25-9:35 AM Seat Cushion Leather Restraints – T. Salter (FAATC)
9:35-10:00 AM Magnesium Alloy Test – T. Marker (FAATC)
10:00-10:15 AM Break
10:15-11:00 AM VRP Composite Structure/Wiring/Ducting – R. Ochs (FAATC)
11:00-11:10 AM Vertical Flame Propagation Tolerance Study – M. Anglin (Boeing)
11:10-11:25 AM OSU Round Robin Update – Y. Agyei (Boeing)
11:25-11:35 AM HR2 Update – M. Spencer (Marlin Engineering)
11:35-11:50 PM Radiant Panel Update – M. Spencer (Marlin Engineering)
11:50-12:00 PM Heat Flux Calibration – M. Spencer (Marlin Engineering)
12:00-12:05 PM Radiant Panel AC – R. Smith (Boeing)
12:05-12:10 PM OSU Negative Heat Flux Values – R. Hill (FAATC)
12:10-12:15 PM RTCA (FAATC)
12:15-1:45 PM Lunch (on your own)
1:45-1:55 PM Evacuation Slide Test (FAATC)
1:55-2:20 PM Cargo Liner Advisory Circular Testing – T. Salter (FAATC)
2:20-2:35 PM Cargo Sonic Burner Comparison Results – D. Slaton (Boeing)
2:35-2:45 PM Flame Retardants (FAATC)
2:45-2:55 PM Approach for New Task Group – Material Change Similarity – D. Slaton
2:55-4:00 PM Task Group Meetings I:
Magnesium Alloy – T. Marker
VRP Composite/Ducting/Wiring – R. Ochs
OSU & HR2 – M. Spencer
Seats: Round Robin/AC – T. Salter & D.Hill
Material List – S. Campbell

4:00 PM Adjourn Meeting

THURSDAY, JUNE 26, 2014

9:00-10:00 AM Task Group Meetings II
Magnesium Alloy – T. Marker
VRP Composite/Ducting/Wiring – R. Ochs
Radiant Panel – Martin Spencer
Cargo AC – T. Salter
Policy Statement update – S. Campbell/M. Jensen
Flame Retardants – D. Hill

10:00-10:15 AM Break
10:15-11:30 AM Task Group Meetings III
RTCA – T. Marker & D. Hill
Cargo or Seat Tests – T. Salter
Heat Flux Calibration – M.Spencer
Continuation of other TG from previous, if needed

11:30-12:15 PM Task Group Reports
12:15-12:30 PM Additional Discussion/Closing

Meeting Minutes:

WEDNESDAY, JUNE 25, 2014

Seat Cushion Oil Burner Round Robin Update – T. Salter (FAATC)

Tim Salter provided background and reviewed initial test results using the flame retention head with the NexGen burner. The final results of the 2013 Round Robin were presented. Seven (7) labs participated in this Round Robin. The seat cushion materials included in this Round Robin were reviewed. In conclusion, we will be using the flame retention head and static plate set-up. Jensen: was there any investigation as to why Lab C was lower than everybody else? Salter: it may have been because of their ventilation hood. We are going to look further into it, because we just received all of the test data within a week of this meeting. We asked all of the participating labs to send photos of their lab set ups. Jensen: Has the FAATC done anything with pneumatic cushion oil burner testing? Salter: we are going to be getting into that. Slaton: air temps, pressures, tolerances, etc., it seems like these should be looked into as well. Salter: We asked the labs to provide their fuel flow, etc. Jeng: Do you have the specifications/sizes of the stator and parts? Salter: We will be contacting the manufacturer for tolerances.

Restraining Leather Cushions for the Seat Oil Burner Test – T. Salter (FAATC)

Tim Salter reviewed Chapter/Section 7.3.5 from the *Aircraft Materials Fire Test Handbook* information on restraint of leather seat cushions for testing. Various restraint materials were tested: including Ethel Dawson's idea to use a pre-bent 1/8" stainless steel rod. Tim reviewed the dimensions and locations for the pre-bent stainless steel rod. These rods are not bolted to the seat frame. A 'mini Round Robin' was performed to test the effectiveness of the new configuration. The final results of tests conducted at the FAATC and Accufleet were presented. The 1/8" SS rod is strong, reusable, and moves with the seat cushion as it shrinks from exposure to the flame, so it keeps the seat cushion clamped to the flame as the test progresses. We will be going with the 1/8" SS rods for these tests going forward.

Development of a New Magnesium Alloy Test Method – T. Marker (FAATC)

Tim Marker reviewed the activities in this project since the March 2014 Materials WG meeting. The results of Round Robins I & II were reviewed. The test method will be included in the current *Aircraft Materials Fire Test Handbook*. We worked on refining the burner flame for increased repeatability when using ignitorless stator: adjusted movement of tray away from burner cone slowly, stainless steel burner cone cover, ceramic cone guard, revised sample holder, ceramic cone guard & revised sample holder.

Other potential uses of magnesium in aircraft: bracketing, struts, ducting, food table carts, etc. Consider: how these parts would be certified. Surface area to volume ratio comparison was done. Jensen: Have you looked at other potential requirements other than weight loss since it seems to be giving you a huge variation? Marker: No, we haven't. There has been talk of getting rid of the weight loss, since it isn't giving us much. Two FAA reports on the magnesium alloy work are now available on the FAA Fire Safety website.

Development of a Flame Propagation Test Apparatus for Inaccessible Area Materials – R. Ochs (FAATC)

Objective: design, construct, and evaluate a new flame propagation test method; deliver new test method to FAA Transport Directorate for use in certification of novel design airplanes, and attempt to test other inaccessible area materials on same apparatus. Rob presented a schematic of the Vertical Flame Propagation (VFP) test apparatus. It has a coil furnace similar to the NBS chamber. There are two VFP apparatus labs at the FAATC, one at Airbus, and one at Boeing at this time. A comparative test series was conducted. Rob reviewed all of the comparative test series results: FAA Bldg. 203 and Bldg 277 labs, Boeing lab, and Airbus lab. A viewing window for observation of test in event of video failure has been created. Zimmerman: Did you look at air exchange in the room itself? Ochs: We have not quantified it. We don't know if it makes a huge difference. Jensen: concern about re-ignition system: I recommend that it not be used for all tests. I'm not sure this is a way to go. Ochs: typically it is a one minute test. Ochs: I think this is something that is going to be learned as we go along.

Wire Testing:

This is a follow on to the work the "Development of an Improved Fire Test Method and Criteria for Aircraft Electrical Wiring" by John Reinhardt. Rob showed a video of wire testing in the VFP. Rob showed videos of two different wires being tested in the apparatus. Microscale data: heat release capacity and heat of combustion. Comparison of data from VFP vs. MCC (data collected by John Reinhardt on these same materials using microscale calorimeter). Rob also reviewed data from VFP vs. intermediate scale and radiant panel tests that John Reinhardt has conducted on these same materials. Summary: Wire test method is feasible in the VFP. VFP test results correlate very well with MCC data. Comparative tests will be conducted in the coming months. Gardlin: The intent is to move to a more realistic way of testing wire materials. Glamoclija: This procedure will be put in the Workbook to replace Appendix F? Ochs: Yes. Glamoclija: Co-ax cables, in-flight entertainment wiring that pass today may not pass on this apparatus. All of those that are not general purpose wires/cables. Ochs: Hopefully, we can get samples of all of those to test. Glamoclija: We propose only gauge 20 from each type. Ochs: I think we can cite that. Jensen: We currently have a problem with the very small wires in the IFE boxes. We have a difficult time getting the wires – some are 1" pieces. Hill: We are talking about using this in a new framework, and there would be an AC in place. You have to look at the whole package.

Vertical Flame Propagation (VFP) – Boeing Update – M. Anglin (Boeing)

The comparative tests were conducted in March 2014 on the VFP provided by the FAATC. Matt discussed the Experimental Design, flamelet length, electrical power to heater, exhaust flow rate, time between tests. Conclusion: flamelet length has significant effect on burn length, time door was open had minimal effect on burn length for material tested. The basis to establish pass/fail criteria should be based on intermediate scale results. Matt reviewed the next steps. Jensen: How did you test the duct in the vertical? Angling: notch out of the top so you have half of the duct, so you actually test in the apparatus. It was fairly straightforward and simple. You have air around it. Some hoses and materials are not possible to make flat.

2013/2014 OSU Round Robin Update – Y. Agyei (Boeing)

Purpose: Pinpoint major sources of variability in OSU Heat Release testing. Yaw reviewed the trends observed: possible correlation between interspace pressure and calibration constant. Next steps: gather all round robin data; determine change in thermopile voltage for a unit with an airflow split ratio of 3:1.

80% Criterion on Sidewall Panels – D. Slaton (Boeing)

Peak Heat Release example; Total Heat Release example.

Heat Release Rate Updates – M. Spencer (Marlin Engineering) for Mike Burns

OSU: protruding pressure taps (beyond the pipe inner wall) vs. surface pressure taps (flush with inner wall) may have an influence on pressure readings and could have an influence on total airflow. Mike will send out a request to the labs for them to determine what their orifice plate looks like.

HR2: Heat Release Test Method

Martin explained that the Supplemental Material will be moved to the Test Method. He reviewed the updates/changes.

Radiant Panel Updates – M. Spencer (Marlin Engineering) for Mike Burns

Martin reviewed the planned outline for Chapter RPI of the Workbook. Mike is looking for participants for the 2014 Radiant Panel Round Robin. He plans to send test samples out by mid-July 2014.

Heat Flux Gauge Calibration Update – Chapter HF Draft of Workbook – M. Spencer for M. Burns

Recommendations for Insulation Radiant Panel AC – R. Smith (Boeing)

Randy reviewed the examples of harmonizing acceptable means of compliance used by Boeing.

OSU Negative Heat Release Values – R. Hill (FAATC)

What was the problem that caused negative heat release values: the upper pilot flames started going out. The material started extinguishing the upper pilots. You cannot subtract negative heat release (negative numbers cannot be subtracted from your total). You have to watch the test. You have to re-ignite the pilots immediately. Campbell: there are some materials where the sample sucks up a lot of the heat. Member: we have some materials which extinguish all pilot flames. It is untestable with this test. Hill: You need an alternate means of compliance. You have to convince the authority that the material meets the requirement by using another test.

RTCA – R. Hill (FAATC)

We will be able to set something up coordinated with the RTCA. Steve Rehn will be working as a contractor for FAA Fire Safety and will be working on this project.

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

Comparison testing: current test method vs. recommended test method. 4 labs participated in comparison testing.

Test Results for Proposed Cargo Liner Advisory Circular Material – T. Salter (FAATC)

Items Tested: backside burning, fastener pitch, NexGen burner calibration, and exhaust flow. Campbell: Is there a recommended number of cycles for thermocouples? Salter: That is why we have this check. We factored that in with this check. From my experience, they tend to level off around 1600F.

Boeing Cargo Liner Sonic Burner Update – D. Slaton (Boeing)

Dan presented the results of the Boeing Sonic Burner vs. industry round robin lab comparison. Observations & Discussion: Round Robin Results: significant variations in experimental results across labs; further analysis of existing data; additional data collection; equivalent performance

validation (Park vs. Sonic). Conclusion: inter-lab matching of round robin results; validation of sonic burner as comparable test method to Park oil burner; continued development work required. Jensen: cargo liner spacing fastening pitch AC testing, were you using the sonic or Park? Salter: Sonic. Flame Retardants – R. Hill (FAATC)

Rich Lyon at FAATC is waiting to hear from industry members regarding how he can help with this Task Group. Rich met with Dan Slaton to discuss this topic.

Material Change Similarity – D. Slaton (Boeing)

Rich Lyon is thinking at the analysis level testing. The first thing this TG would have to do is discuss what the goals of the TG are and the boundaries of the TG. Dan reviewed the some of the discussion points for this TG. Please let Dan know if you are interested in participating.

THURSDAY, JUNE 26, 2014

Task Group Reports

Magnesium Alloy Task Group – T. Marker

Tim Marker provided the following highlights from this Task Group meeting:

Task Group Report for Magnesium Alloy Flammability Test

There are currently 3 parameters that are measured during the magnesium flammability test:

1. The amount of time until the sample first ignites following exposure to the burner flames (cannot be less than 2 minutes)
2. The time when the sample self-extinguishes (cannot be greater than 7 minutes from start of test)
3. The calculated weight loss (maximum 10%)

In reviewing the most recent 93 tests that were run at the FAATC, it appears the time until extinguishment measurement fluctuates highly. There was a consensus amongst the Task Group that this measurement does not provide useful data. The Task Group felt that the weight loss measurement was still the most accurate means of determining what degree a sample burned during the test. Furthermore, it is difficult to determine when a sample self-extinguishes, since there is a high degree of interpretation on the part of the tester.

The Task Group also discussed how powder coated samples should be tested. The members agreed that the basic magnesium alloy must first pass the flammability test on its own. It must also be demonstrated that by powder coating or anodizing a seat component, this process does not make the material more flammable. Magnesium Elektron agreed to provide some powder-coated samples for the FAATC to test. One Task Group member also inquired as to how a composite ceramic/magnesium compound should be tested. The Group agreed that if it contains more than 10% magnesium by weight, it must be tested as any other magnesium alloy (i.e., with the new flammability test).

The Task Group discussed what other locations in the aircraft cabin that magnesium alloy could be used, and more specifically, how would magnesium components be certified. Surface Area-to-Volume (SAV) ratio still seems to be a reasonable way to approach this problem. Most Task members agreed that SAV was easy to obtain for complex-shaped parts, since a majority of design programs currently have this capability. The Task Group also discussed what constitutes “sheet”. What defines it? Can it simply be defined by thickness?

After a good discussion, the Task Group members came to a consensus on how they felt magnesium alloy components could be tested. If the component would be located in the accessible area, the SAV ratio should be calculated first. If this SAV ratio is less than (TBD), then the new oil burner flammability test would apply. No agreement could be reached for components with a SAV ratio greater than (TBD). Furthermore, if the part or component would not be accessible (i.e., hidden), then

further criteria would apply, for example resistance to a small electrical arc. The FAATC agreed to begin experimentation with thin sheet provided by Magnesium Elektron, to determine susceptibility to ignition from electrical arcs. The Task Group agreed this would be a good starting point for evaluating the efficacy of using small, thin magnesium alloy components in the cabin.

VFP Composites Task Group – R. Ochs

We discussed the drawings for the test apparatus. We are still working through the apparatus development. We will release the drawings soon. We talked about the comparison that Boeing did and will extend their DOE to Airbus and hone in on a few more parameters. We talked about ducts and flat vs. round ducts and how to test in the rig. We talked about how to apply this test to all wires and cables not just the standard wires. The Task Group will work on this. We talked about the application of this test. We talked about wire support brackets and how those would be tested in this apparatus. Correlation of foam block test to actual threat was discussed. We also have the microscale data we can use for screening and correlate back to the threat. We hope to get the manufacturers to participate in this group. Task Group members will contact them.

Seat AC Round Robin – T. Salter

We discussed the ranges that were used for the air and the fuel temperatures and will look into it a bit more and expand those ranges. Gary Palmer sent some samples for testing, so we will do a small study to see if those ranges can be expanded. The Accufleet lab will also participate in this study. We may need to recommend cleaning the nozzles or checking them periodically. We talked about how much is too much burning. We need to spend some more time testing that. We discussed the subject of when drawings would be available showing how the burners would be used for these tests. The FAATC is currently working on the drawings for these. We discussed the size of the test chamber and the airflow within the test chamber.

OSU and HR2 Task Group – M. Spencer

Martin Spencer and Randy Smith provided the following highlights from this Task Group meeting:

Following an initial discussion on the Orifice Assembly and the need to ensure that the pressure tappings are flush and not protruding into the airflow there was a great deal of follow on discussion regarding the airflow into the current OSU Chambers. The consensus was that it was felt that the ideal 1:3 ratio could be achieved fairly easily without too much cost to at least have all labs start with the same. The Technical Center cautioned the ‘fixing’ of the current system and stated that that is what the HR2 was meant to be doing. It was requested that Mike requests that all known labs send either images of their piping from the Orifice Assembly to the Chamber or a clear schematic showing bends and dimensions.

It was announced that two new HR2 units should be completed this summer and enter into a validation program, one will be at the FAA Technical Center and one at Herb Curry in Indiana. Several other labs indicated that they are considering purchasing an HR2 to assist with the evaluation/validation process. There was some concern noted about the increase in exhaust temperature since there is no cooling from an upper manifold anymore. It was also agreed that the current warp and fill test criteria for non-anisotropic materials should be kept in the new procedure.

Heat Flux Task Group – M. Spencer

Martin Spencer and Randy Smith provided the following highlights from this Task Group meeting:

It was agreed that once Mike has validated a new unit that is currently being built in accordance with his procedure that a round robin be set up between the FAA, Boeing, MEI and Vatel.

It was asked if the FAA would be able to provide a list of acceptable facilities that could perform the calibration to which the answer was no. Also on the question of who would be responsible for any annual validation of the calibration labs it was noted that the Technical Center would not be responsible. It was later announced that the local ACO would have this authority, just like they currently have for the test labs in their area.

Radiant Panel Task Group – M. Spencer

Martin Spencer and Randy Smith provided the following highlights from this Task Group meeting:

Even though the RP Chapter is for future rules, it was noted that the location of the radiant panel heater with respect to the unit may be different between labs since the original location of the 7.5” vertical dimension from the zero point was not clearly defined in the original rule. The labs in attendance agreed to check their machines and report back to Mike. It was pointed out however that all labs were able to meet the correct heat flux at the zero point but it may be the reason that the values at the position 1 and 2 were different. Task group members acknowledged that their current equipment does not match the new specifications in the placeholder Workbook, and if the equipment were modified to match, it could produce different result than before. Therefore, each lab might need to have two sets of equipment to test per the current rule and for the new rule.

Participants were requested to respond to Mike’s latest draft of the RP Chapter and provide either a gap analysis or comments by the end of July. It was suggested that Mike should try and organize a conference call in August sometime to go over the feedback collectively since it is a long time to the next meeting.

Randy Smith: Maybe we can refer to the radiant panel for the Workbook as RP2.

Material Change Similarity Task Group – D. Slaton

Dan Slaton provided the following highlights from this Task Group meeting:

Material Change Similarity Task Group:

- a. Dan Slaton presented general approach for the task group developed with input from Rich Lyon
- b. During the task group discussion it was agreed that the goal of the task group is to be able to assess a change in a material (generally a chemistry change) to confirm no appreciable effect so that the material does not have to be recertified. Had general discussion regarding minor/major changes. The goal is to define the testing and evaluation methods that would support a minor change.
- c. It was agreed that industry folks would identify some past examples where a material change was evaluated to have general discussion on the approach used at the next meeting. Suggested materials include insulation films/tapes, coatings/paints, thermoplastics and adhesives.
- d. A task group member proposed developing a decision tree/flow chart to outline the general process to evaluate the changed material.
- e. The process would benefit from a simple “screening” evaluation phase before additional configuration tests are defined.
- f. Had general discussion about the differences between supplier materials called out on the type design versus when a material is qualified to a specification.
- g. Some task group members (raw material supplier) described that in some cases the OEM forced a new product ID. Sometimes the OEM requires all the qualification testing to be done again.

- h. One member mentioned that most of the time when this issue comes up the material change is not usually better than the old material (from a flammability performance). It was suggested that this process could be used to implement material changes that do have improved flammability properties.

Approved Material List Task Group – S. Campbell

Scott Campbell provided the following from the Task Group discussion:

Sample Listing Specification for FAA approved Materials

Draft 1: 5/22/2014 6-3-2014

- 1.0 Scope: This specification provides the qualification and Continued Compliance requirements for placement on the FAA Approved Materials List. This draft will concentrate on simple monolithic materials.
- 2.0 References:
 - a/ 14CFR25.853(a), (d), (h) through Amendment 25-116.
 - b/ 14CFR25 Appendix F, Part I, IV, V.
 - c/ Flammability Testing of Interior Materials, PS-ANM-25.853-01-R2, Dated July 3, 2013.
- 3.0 Accepted Laboratories: TBD- Need to consider that Boeing, Airbus, FAA and EASA audit and accept/ approve laboratories. We can state the requirements to list a laboratory such as those that have been successfully audited by these entities or lock it down to a few mutually agreed upon labs.
- 4.0 Listing Entity: The data Listing 'company' shall create and manage the flam data database. The company will retain all data for FAA Audit. Additionally, responsible to coordinate all continued compliance activities. **Add quality system requirements. Provide continued compliance data every 3 years?**
- 5.0 Data Options: The data base shall be developed to facilitate the following data options:
 - a/ Data generated for the purpose of listing (typically a material supplier/ manufacturer).
[note- for multilayer constructions, do mfgs for each layer need to concur to be listed?]
 - b/ Data listed through Consignment for sale- many organizations may hold proprietary flammability data that they wish to offer for sale. Data should again come from accepted laboratories. (Could prove to be a bit tricky determining who "owns" the data...)
 - c/ Need the ability to create "public" and "private" listings.
- 6.0 Data Fields: Reference UL Yellow card- material, thickness, color and tests met at thickness.
- 7.0 Listing Process
 - a/ Submit material (FAA handbook sizes, require 3 results to be averaged?) to approved laboratory.
 - b/ Require some form of inspection- certs, etc? Need to define the process.
 - c/ Test per FAA test methods.
 - d/ Need to define acceptable methods for retest if a material fails.
 - e/ List product in database.
- 8.0 Continued Compliance
 - a/ Specification needs to define periodic intervals for retesting to confirm continued compliance.
 - b/ Need to define procedures for materials that may fail this retest.

9.0 Use of data to support similarity- Reference Policy Statement PS-ANM-25.853-01-R2, Dated July 3, 2013

Add criteria 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).

RTCA Task Group – R. Hill

The RTCA document is going to be updated with a new revision. There will probably be a window of 2-3 years to produce new data in the flammability section. Testing of components within the electronic boxes needs to be addressed. We are accepting proposals from electronic box manufacturers and component manufacturers. Is there a certain fire load that can be used, etc. We are in the process of collecting data and receiving proposals. We also discussed working with other groups that are tasked with working on lithium batteries so there is no duplicated work.

The foam block was a way of evaluating a hazard.

Keep in mind that we are going through an exercise to develop test methods for a new rule in the future. We have to assume that the 80% rule, if that is what is used, is made to simplify things. It will be used on new test methods that are more repeatable and reproducible. Be careful what you are changing on the current test apparatus (ie: OSU).

Policy Statement Task Group – M. Jensen

The Policy Statement now in use has some limitations and interpretations that have been missed. We met today to discuss what we might want to submit to the FAA for a future AC regarding vertical burn: carpeting, how do you tell what the thickness of plastic you test for an injection molded part is? We are gathering as much information as possible from industry. If you have any information for the augmentation to the Policy Statement, send it to me or Scott Campbell (Michael.e.jensen@boeing.com or scott.campbell@zodiac.com).

Next Meeting

The next meeting will be held in Atlantic City, New Jersey, at the Tropicana October 27-28, 2014. April will send hotel reservations information as soon as it is available.