INTERNATIONAL AIRCRAFT MATERIALS FIRE TEST WORKING GROUP MEETING

October 16-17, 2012

Hosted by E-A-R Thermal Systems, Aearo Technologies LLC, a 3M Company

TUESDAY, OCTOBER 16, 2012

Task Group Session on Revised Cargo Liner Test – Recap and Update on Recent Work – T. Salter

Tim gave a brief overview of the background work that was done on sonic burner settings that would recreate Park burner results. Cargo Sonic Burner Round Robin-FAATC is currently looking for additional labs to participate in this round robin. Alternative Air Supply Plumbing issues were described. Industry has suggested relocating the muffler. The current configuration will be investigated. FAATC is in the process of testing alternative plumbing supply configurations. Jensen: did you do any of the calibration with the calorimeter? Salter: Yes, it was within the range. For future, reference the sonic will not be using the slug cal. Busch: temp measured on backface of sample? Salter: we don't currently have an explanation for it; however, we are putting more focus on test results. Busch: one thermocouple to measure temp on backface? Salter: yes.

Development of Advisory Material for Cargo Liner – R. Hill/T. Salter

R. Hill: Cargo Liner AC- we are going to assign tasks to Task Group members to get the draft AC put together. The use of the sonic burner material will be included in the AC. This AC is how to comply with the present rule.
T. Salter: Cargo Liner Sample Testing: AC related testing is currently underway. Items tested so far: thickness comparison, pitch vs. overlap, overlap order, and clamp vs. pegged. Only initial tests have been performed at this point. All items require further testing. Thickness Comparison: thin liners substantiate thick liners if made out of the same materials. Result: thick liners show reduced measured temperatures compared to thin liners constructed of the same material. Conclusion: thin liners are suitable to substantiate thick liners constructed of the same material. Pitch vs. Overlap: Result: Joints using fastener pitch 6 inches or greater do not pass cargo liner test. Conclusion: greater overlap and smaller fastener pitch less likely to fail test. Overlap Order Comparison: Result: testing with short sample side o bottom increases likelihood of fire. Clamped vs. Pegged: Result: method of restraint does have an impact on test result. Material should be restrained using pegs/studs. Campbell: clamp vs. pegged – I don't know if I come to the same conclusion. We found in industry it we do a hundred sets of tests and drill holes for pegs, it takes a week or so longer. Salter: These are all preliminary tests that were conducted. These preliminary tests were done to present the results and get feedback from the Working Group. Danker: we used to slot the holes for the sample. Campbell: overlap vs. pitch: what was the result? Do we know what material this was? Salter: I believe it was a woven epoxy glass fiber liner.

Magnesium Alloy Test – T. Marker

Tim reviewed the evolution of the test configuration. Various shape samples have been tested in the process of trying to develop the test method. The hollow cylinder (vertical) and rectangular bars (horizontal) were compared through numerous tests in spring 2012. FAATC updated horizontal bar testing rig in 2012. The data indicated that the horizontal bar tests were more repeatable. Since Toulouse meeting: 284 tests completed, improvements made to the test apparatus, test parameters more well-defined, and internal "micro" round robin to determine repeatability and test robustness. This was conducted at the two FAATC test facilities. What should sample thickness be? .25-inch bar vs. .375-inch bar were compared.

Planned activities: what is the reason for the scatter date? Is it material-related or test-related? Ventilation?
Conduct additional tests on most appropriate thickness of bars. How many tests are enough?
Finalize parameters (i.e.: sample thickness, exposure time)
Influence of talc in pan vs. no talc: does talc affect test? Use of other material in place of talc. Jensen: have you done any testing with advanced composites so this test is applicable to other materials for future seats? Marker: no, this test is for the magnesium materials. It is definitely something we will take a look at in future. Busch: what about the size of the bar? Marker: 20" length. Busch: machining process is the same? Marker: no influence on the different finishing tested (beveling, etc.). It will probably be square edge, standard machined. Busch: is there a difference in how the different alloy materials perform? Marker: Yes, there are some materials that perform better than others. Danker: are these industry standard alloys are proprietary? Gwynne: These are industry standard.

Burnthrough/NexGen Burner Comparative Testing – R. Ochs

Rob gave a quick review of his Toulouse presentation. Relocated sonic choke: Recent PIV Measurements: for each new stator and FRH tested on the burnthrough rig, PIV measurements were taken. PIV is Particle Image Velocimetry. J. Davis: Flame retention head – how do you keep the nozzle in the center? Ochs: we put three screws through the draft tube and tweaked them until it was centered. Nixon: Will PIV give droplet size? Ochs: It can, but there are better ways to get droplet size. PIV will give us a rough idea of droplet size. Lewis: Did you run multiple nozzles? Ochs: we could not get two identical nozzles to run multiple nozzles. The spray nozzles tested compare reasonably well with the baseline Monarch nozzle. Some are within 1 standard deviation, the rest within 2 standard deviations of baseline. Next Steps: continue nozzle evaluation, define settings for FRH F-22 that are equivalent to current NexGen settings, develop optimal burner settings: FRH, nozzle, cone. Establish a baseline for all burnthrough labs.

Development of a Lab Scale Fire Test Method for Composite Structure – R. Ochs

This test will be representative of the threat. Lab-scale test method development: the foam fire source was characterized by measuring the heat flux gradient along an insulated board for the duration of the foam burning event. Rob reviewed the recent modifications to the test apparatus and noted the change to smaller sample size. A video of a recent test was shown. This test procedure was followed for all of the materials tested. Summary of Recent Testing: fairly good repeatability was found for most sample sets. More tests need to be performed. A few tests were done on the effect of drafts on heat flux (5-minute tests). Next Steps: Furnace comparison, calibration, mapping of furnace with HFG on a traverse. Photos of Version 2.0 of the test apparatus were shown. Slaton: heat and pilot flame – could you make the pilot flame larger and remove the heater and get similar results? Ochs: any larger flame will give you a larger heat flux will also give you a larger footprint. Suggestion: look at currently used materials. Ochs: If anyone wants to supply materials or advice, please let me know.

OSU/HR2 – M. Burns

2012 Round Robin Results: 36 participating OSUs. Issues/problems found: thermopile wiring (9 incorrectly wired), air leaks. The confusion in wiring the thermocouples seems to happen in the lower plenum area. We also found that there wasn't much attention put on the bead size inspection. Mike presented a diagram indicating the correct thermocouple bead construction. Air leaks: these were found in this round robin or past inspections of facilities: orifice meter must be inspected and the lower plenum, manometer crack, lower plenum seals, main body (second stage plate perimeter, holding chamber outer door seal, globar insulators. Data analysis: quantify a lab's overall performance in a particular round robin; assist labs in better understanding range of data being they

are producing. Heat Release Round Robin Summary: low mv Rise/PHRR trend observed in data, high/low cal. Factor seems to correlate with mV rise. Labs should investigate the issues including air leaks.
Chapter HR Updates: Chapter HR: Mike reviewed the outline for Chapter HR. Updates were made based on the Task Group discussion and input from the June 2012 meeting in Toulouse. Mike reviewed the changes/updates to Chapter HR Supplement. Next: complete Chapter HR, Supplement, and Appendix. Continue to develop Round Robin Ranking System (analyzing tool).

Radiant Panel for Insulation – P. Cahill

Review of Sample Substrate Boards (previously presented during the June 2012 meeting in Toulouse. Further details are available in the presentation from the Toulouse meeting that can be found at www.fire.tc.faa.gov. Round Robin preliminary results: If there is anyone here who has a radiant panel and did not receive samples or was not initially participating in this round robin, please let me know, so I can send you round robin samples. This is the first time we looked at double-sided tapes in a round robin. Pat has received the results from 15 of the 26 participating labs. The preliminary results presented are from these 15 labs. Data from the remaining labs will be included in these results once it is received. The finalized data results will be presented at the March 2013 Materials WG meeting.

Wiring Test – P. Cahill

Develop an improved and simplified test method and procedure for aircraft wiring. Pat reviewed the types of wires that were tested. Conclusions were reviewed.

Slide Evacuation Test Method: Round Robin 2 – P. Cahill (for D. Do)

Pat reviewed the round robin 2 lab results Do has analyzed. A discussion or potential meeting will be held in early 2013 with the participating labs. This meeting may take place at the FAATC as early as January 2013.

Seat Cushion Test Method Update – T. Salter

Continue work with seat burner settings, standardize leather seat cushion restraints. Current Seat Burner Settings were presented. Leather Cushion Restraints: industry asked that a standardized method of restraining leather seats to the burn rig be developed. Some work had previously been done on this. Items to consider: number of restraints, spacing of restraints, type of restraint (safety wire, hook and loop, etc.). Goal: no favoring one part of the cushion (even spacing), multiple wires securely restrain cushions. Tim described the restraint methods that are part of the test program. Round Robin Update: initial results were presented. Future Items: Complete Round Robin: Gather and analyze data from all labs and refine burner settings as needed. Finalize leather seat restraints: input needed from industry.

Bunsen Burner Test – R. Hill

The Bunsen Burner Task Group completed its work a few meetings ago. This Task Group looked at the 12-second Bunsen burner test only. There were no comments or discussion on after flame time or flaming drips by Task Group members.

Contamination of Thermal Acoustic Insulation Study – C. Lewis (TCCA) R. Hill

RGW Cherry (under contract) will be collecting contamination on thermal/acoustic insulation from various areas on the following type aircraft: two wide body aircraft (long haul), two narrow body aircraft (short haul), and one short haul turboprop.

WEDNESDAY, OCTOBER 17, 2012

Task Group Reports

Magnesium Alloy TG – T.Marker

Discussed what might be the possible source of the variability in the tests conducted (not all materials in a batch burn). Magnesium-Elektron does not see it as a material issue. However, FAATC does not see it as a test issue, since it's tested in the same lab by the same technician each time. There has been an offer to analyze the samples to see if there's any variation in the samples. There was discussion on what the test method would look like. We are targeting spring 2013 for the test method to be submitted in a report to FAA Transport Airplane Directorate for review. Jeff Gardlin was asked to speak to how industry would go about using magnesium alloys in seat components. We are thinking of holding a status meeting some time before the end of the year either via telecom or a small meeting at the FAATC.

Test: Method Development for Composite Structure TG – R. Ochs

We are currently using the NBS furnace. Rob will share the NIST report on the furnace with the Task Group. We discussed the frame width. The material burns all the way to the edge of the sample to the frame, so we will investigate if the frame has an effect on the test. We will also work on defining burn length. We will hold a mid-term telecom progress report sometime in January 2013. IF anyone else would like to be included, please contact Rob Ochs.

Burnthrough/NexGen Burner TG – R. Ochs

Survey on burnthrough times: FAATC will send out materials to the 5 or 6 labs that will be participating. NexGen Burner: we discussed directionality of the flame. We will attempt additional measurements with the PIV at the FAATC. We also discussed the current Advisory Circular. We can update the Appendix in the current AC for the NexGen burner. We discussed the tolerances for the test rig.

Cargo Liner TG – T. Salter

We discussed the length of the burner for the cargo liner test vs. the seat test. It creates an issue with height in the cargo liner test configuration. We are going to work on better describing how the burner should be set up.

Seat Cushion Test TG – T. Salter

We discussed how the plumbing should enter and exit the burner. This impacts stators. The issue of the igniter wires was also discussed. It was suggested that the igniter wires run parallel to the fuel rod and be wrapped. The sonic draft tube has a larger diameter than the Park draft tube, and this was not previously expressed in the previous write-up. Leather seats: this was a subject of great debate. WE focused our discussion on the type of restraints, number of restraints, and where they should be placed in order to simulate how the seat is restrained on an actual aircraft. Vertical burn test was also discussed (use of vertical Bunsen burner prior to testing on seat burner – can this be done).

HR2/OSU TG – M. Burns

The future HR2 and current OSU machines were discussed. Current OSU: the ranking system – middle labs 10-18 range and try to pick out parameters for specific measurements that labs can use as a baseline. WE discussed the materials to be used for future round robins. Mike is looking for materials for future round robins, please contact him if you can provide materials. HR2: we discussed the supplement section videos and photos (sample prep, etc.). WE made one change to the specimen holder – top attaching flange – we decided to wrap the flange all the way around the holding plate. We came to terms on general tolerances. Slaton: do you see identifying a new AC? Burns: I have to talk to Jeff and see how we can implement this new guidance material.

Thermal Acoustic Insulation TG – P. Cahill

Two additional labs have been added as participants in the current Round Robin. The flame propagation measurement is still an issue. Airbus will send a laser beam to FAATC to use. We discussed damping systems and the use of composite materials in damping systems – how will these new damping systems be tested? Update to the Handbook:

Aircraft Wiring TG – P. Cahill

Pat provided the TG with the background on the development/decision on using the NBS furnace in the bench scale test set-up for aircraft wiring. Pat will give the TG members updates as she works on the set-up for this wiring test. One of the big problems we have is that the Task Group members change every time we have a meeting, and this makes it difficult to keep the TG work cohesive.

AC for Cargo Liners – R. Hill

WE discussed the format of the AC and made assignments. The FAATC will work on background and generalization of the test method, write up the use of the sonic burner. Kendall Kreig will chair a group that will collect means of compliance for the burner test for material certification. Akro Fireguard will collect means of compliance for repairs. Our plan is to have drafts of the components of the AC for discussion at the next Materials WG meeting.

Current Test Method Discussion – R. Hill

We have been doing a lot of work over the past few years looking into new regulation, and we need to be sure to keep track on problems or issues industry may have with the current regulations/rules/test methods. Let's make sure we are not missing any issues/problems we have with current test methods since they may be around in some part for several years as the new regulations are phased in. Does anyone have anything they w9ould like to bring up related to the current test methods? Winn: we still do not see any ACOs at these meetings. Hill: I am sure it's travel funding. We are in the process of planning an ACO Workshop to be held at the FAATC in April 2013. There will probably be about two people from each ACO attending, and we will go over each test method. This will be open to ACOs only to educate them on the current test methods. Jensen: I have been working with some new suppliers recently and there lack of knowledge of how to run simple vertical and horizontal Bunsen burner tests is astounding. It would be good to have videos on how to run these simple tests as part of the Handbook. Campbell: It could be a hyperlink in the Handbook. Hill: we have limited resources and limited people at the FAATC to put these types of things together. If we could enlist Working Group members to assist us with putting these videos together, it would expedite the process. Let's discuss this at the next Working Group meeting possibly in the individual Task Group meetings. If you think we should have workshops for DERs or others, then you should talk to Jeff Gardlin about this. What about inviting ODAs in for a workshop? Hill: That's going to have to be discussed and decided by the Authorities. We (FAATC) can do these types of workshops if they are

needed and requested by the regulating Authorities (FAA or foreign Authorities). Kreig: calibration methods remain an issue for OSU and maybe oil burner. Hill: I think we have it pretty well underway with the oil burner. Anything anyone else wants to bring up on the current test methods?

Deca BDE Discussion – R. Hill

Deca BDE is a fire retardant additive added to a lot of materials that has been found to be carcinogenic. Various environmental authorities around the world have been looking to ban this agent from use. In Europe, it has been banned from use but there are currently some exemptions. In the U.S.: there has been a production ban. U.S. EPA then put out a rule that banned its use under the thinking that since it's banned from production, it's not being used in materials. However, it is still in some currently used materials in aviation and other industries. There has been a major debate in the fire community as to whether these fire retardants and additives actually do anything in a real fire. Are they just helpful in getting the materials to pass a fire test only? We would like to open up a time slot here for a discussion on this subject now. Does anyone from one of the airframe manufacturers to discuss this subject now? Nixon: can we use the Policy Memo to minimize the testing? Campbell: we'll go over that during the "Use of Policy Statement – Flammability Testing of Interior Materials" discussion this afternoon. Jensen: Boeing does have an issue with this. It's in adhesives, plastics, films, etc. It's hard to compare adhesives to plastics. We have identified a lot of the materials that have this additive in them. Renninger: the three main manufacturers in the U.S. will stop manufacturing it by the end of 2013. It will be difficult to get it into the U.S. from Asia due to restrictions. I think the industry suppliers are waiting on the EPA to issue something. It is a very complex situation because of the types of materials it is added to. Slaton: It is a very complex issue. Are there ways to evaluate on a material level – MCC may be a way to do this – to say these materials are similar enough. Engineering drawings are costly to revise to call out the substitute material. IF there is a way to evaluate these change in materials at a material level, this would go a long way in easing the transition we all have to go through. Hill: Is there anything we can do within this Working Group to look at how you transition from Deca BDE to other fire retardants or is it being done elsewhere or we just let it go? Is it worthwhile getting a Task Group together with a representative from each airframe manufacturer within the Materials Working Group since there is a lot of technical expertise within this group and it may be beneficial to work together as a group like the FSTG group. Bishop: I think it would be beneficial to identify all the materials that have Deca BDE in them. Renninger: the only problem I see is that it is already too late. Campbell: if we have a list of materials with Deca BDE, we might be able to develop a bench-scale test to test the various types of materials and see if we can eliminate testing similar materials or something along those lines. Nixon: there are many industries affected by this other than aerospace. Member: there are a lot of new products out there that can be used for fire retardant, but testing will need to be done to see how these new agents affect other aspects such as humidity, etc. It will not be a quick process. Hill: I'm hearing a lot of confusion, there are some fire retardant replacements for some applications, there is concern about recertifying after the new agents are added to the materials. I would like the airframe manufacturers (especially) to go back and think about if it is worthwhile having a Task Group within this Working Group. Would this Task Group be beneficial. We will discuss it at the next meeting. Danker: I would like to see a presentation on these materials. I think this is a subject we should be knowledgeable about. Hill: We will offer the opportunity to give a presentation or two on this towards the end of the spring 2013 meeting.

Final Discussion/Next Meeting:

The next meeting will be hosted by Boeing in Renton, Washington, USA, March 6-7, 2013.