INTERNATIONAL AIRCRAFT MATERIALS FIRE TEST WORKING GROUP MEETING

JULY 11-12, 2006

Hosted by C&D Zodiac, Westin Southcoast Plaza, Costa Mesa, California, USA

TUESDAY, JULY 11, 2006

Discussion of Burnthrough Test Method – T. Marker

Tim started his presentation by reviewing the work done concerning differences between flanged and socket burners and the modifications/adjustments made to the socket burner to get it to perform like the flanged burner. None of these made any significant differences in the test results. Some photos of the attempted modifications to the socket burner were shown. The test results using the socket burner and flanged burner were shown. Tim reviewed the planned activities as of the last Materials WG meeting in March 2006.

Round Robin 8 – T. Marker

Prior to the Round Robin, Tim discussed the test parameters for the round robin tests as a means to establish a unified methodology for this round robin. The material information, test sequence, configuration checklist for this round robin, and set-up measurements of the stator, nozzle, igniter wires, attachments (clamps), etc., prepared for the test labs involved prior to the round robin were presented. The following Round Robin 8 results were presented and discussed: Initial Temperature Calibration, Heat Flux Calibrations, Material A, Material B, Material C. Summary of Round Robin 8: burner adjustments resulted in good interlab correlation of temperature and heat flux. Burner adjustments also resulted in good interlab correlation of burnthrough times and time to reach 2.0 Btu ft2 sec on backface. Measurement of backface heat flux needs to be investigated. Small amount of scatter (standard deviation) still exists with most labs. The development of a calibration device for backface calorimeters is now being considered.

Testing of Pre-ox PAN Calibration Materials – T. Marker

Consistency of test data using “off-the-shelf” materials. Purpose-built materials supplied by TexTech – 362R: Stock material, used in previous round robin (8 oz .per square yard fabric using Zoltex fiber to simulate the performance of the roll produced in November 2005. A slightly heavier weight fabric was then produced by TexTech (Material 8579R). The percent standard deviation dropped with this material. Material 8580 was also produced – a lower density/high weight fabric using Zoltex fiber. This one also had a lower percent standard deviation than material 362R, but Material 8579 has the lowest percent standard deviation of the three materials. Dave Erb of TexTech explained the development of the calibration materials Tim Marker discussed.

Composition: 100% Zoltex PAN. Dave presented a video showing the manufacture of these materials. He presented the burnthrough time vs. the areal weight of the material. Style 8579R Burnthrough vs. Density was presented, also.

Information Available for use in Proposing Methods of Compliance with 25.856(b) – R. Hill

Lower Lobe cargo doors: lower lobe cargo doors leading into class C cargo compartments and having a complete liner on the door meeting the requirements of the 'ceiling' portion of appendix F, Part III, do not require modification to the insulation inside the door.

The wing box itself does not require improved insulation (assuming it is insulated). Note that the insulation on outer skin in the fuselage above the wing box does require improved burnthrough protection (lower half only).

If less than 12" of the door is in the lower half, no modification to the insulation is required. If 12" or more, and insulation is mechanically fastened, add barrier material to insulation, but no test for attachment required. If the insulation is not mechanically fastened.

Methods of Attachment:

Fasteners (not already covered in AC 25.856-2).

Installation (attachment) tests- the attachment test is primarily to ensure the continuity of the barrier rather than fire resistance of the material system.

Airplane geometry:
Window line-some allowance may be possible if the halfway point intersects the passenger windows. That is, adding insulation between closely space windows will not contribute to burnthrough protection in some cases. However, the variation in airplane design is too great to generalize this.

Burnthrough Test Method for Aircraft Thermal/Acoustic Insulation: Alternative Burner Apparatus – R. Ochs

Phase I: Proof of concept (originally presented to Materials WG March 2006)
Eliminate dependence on electric motor/replacement for electric motor, test sonic nozzle (choke), created pressurized fuel delivery system, drawing of proposed replacement test apparatus, photos of proposed replacement test apparatus, initial burnthrough times (material burnthrough comparison).

Phase II: Construction and Calibration of Multiple Burners

Phase III:

Latest Adjustments and Modifications to Alternative Burner:

Tried several different nozzles
Installed in-line muffler to reduce high frequency noise
Installed in-line water-cooled aftercooler to maintain a constant-temperature airflow
Tried positioning the stator at several different locations, found maximum heat flux at 4.0" back from nozzle tip
Adjustments successful in achieving burner calibration
Now, with a calibrated burner, we can compare burnthrough results with burners of other types that are also in calibration
On to RR8

Round Robin 8:

Alternative burner apparatus participated as an informal participant. Rob altered the round robin 8 calibration checklist to the alternative burner.
Round Robin 8 Calibrations (alternative burner) – temperature and heat flux calibrations – in calibration.
Rob reviewed the results with the materials involved in the round robin. He showed comparison with performance of other burners involved in Round Robin 8 for all materials.

Phase II: Construction and Calibration of Multiple Burners
Objectives:

1. Construct and calibrate ten (10) identical burners
2. Use calibration materials (yet to be determined) in order to closely match the performance of each new burner with the performance of the FAA standard
3. Loan or distribute these burners

Design: FAATC has obtained parts for these 10 burners to be built in their lab

Current Status: The design has been finalized. These burners are currently being constructed.

Design and 'mapping' of stators: It has recently been discovered that modifying the H215 stators can provide higher heat fluxes and better burner performance. By mapping these stators we can produce our own stators that will not need modification.

Phase III: Design and Construction of a Fully Independent Burner
Objectives:

To design a burner:

1. Capable of simulating the performance of the FAA standard
2. That closely replicates the behavior of a post-crash pool fire and it's effect on an aircraft fuselage

3. That is independent of the previous designs and parts that are discontinued or hard to obtain
4. That is capable of a higher level of precision, as well as tighter tolerances for repeatability and reproducibility

Question: when will the prototype burners be available? Rob: FAA management has instructed us to have them ready in the fall 2006.
R. Hill: the FAATC is not supplying a cone, a lab will have to have an air supply capable of putting out numbers as the FAATC does, a lab will need a water air cooler, a lab also needs a pressurized fuel vessel as well.
Peter Busch: Have you done any heat flux mapping? Rob: No, not yet.
Dan Slaton: Have you thought about how you will integrate Phase III with the Task Group, is there a schedule? Rob: We have a milestone of the end of this year. Dick: We are open to any collaboration and comments during this time. Dan Slaton: It might be worthwhile to work with a focused Task Group on Phase III. Dick: You can discuss that in the Task Group meeting on July 12.
Jim Peterson: A good understanding of what equivalence is must be determined and produced by the FAA.

ICCAIA – Industry Cabin Safety Group – Hector Alcorta

Industry Burnthrough Development and Implementation

ICCAIA is International Coordinating Council of Aerospace Industries Associations – created in 1993.

Industry Cabin Safety Group Formation: Recommended by FAA Transport Airplane Directorate Management in November 2005

This group's focus is cabin safety in general. Industry and FAA need to develop a detailed plan and schedule to show that the new Burnthrough requirements are production ready and allow adequate time for industry to evaluate and certify Burnthrough compliant designs and materials.

Team Goal: Find a solution that is economically viable, reliable, repeatable and available, and equipment and process definition that can be accepted by the Aircraft Certification Offices.

Identify a commercially available industrial burner that:
Is readily available to all participants
Is economical
Is designed for the amount of expected flame output
Is developed by specialists in burner technologies
Has repeatable performance based on SQC tools (3 sigma)

By taking the necessary time required for successful R&D.

Ingredients for Successful Burner Development:
Commercially (worldwide) available equipment with performance based on process and not specific equipment type or manufacturer
Utilization of industry experts on burners/ignition
Means to transfer FAA burner performance into new burner solutions
Validated (Statistical Quality Control (SQC) methodologies process for burner performance within +/- 5 percent
Round robin results on common material. Round robin testing also validated to SQC methodologies
Documentation of equipment and procedures has to be acceptable to all

Burner Equipment Approach:
Improve calibration
Support FAATC research

Current Status:
Industry is working rapidly toward translating the current burner performance to a proposed new one to match FAATC burner requirement.

Once reliable test equipment is defined, industry will go through the steps of round robin testing using statistical process tools and industry experts for burners, etc.

Steps Beyond Burner Development (Part 1):
Materials
Part 2: Design and Manufacturing

Summary:

Translate the current performance of proposed new test equipment that is consistent in meeting the same FAATC burner output requirements
Document test equipment and perform round robin testing that establishes a means to develop and certify Burnthrough compliant designs and materials
Need a collective common approach and support to adequately provide a timely and quality solution that needs overall industry needs and is acceptable to regulatory authorities

Radiant Panel Activities– R. Hill

We are constructing a new Electric Radiant Panel Test Apparatus specifically for Thermal Acoustical Insulation.
The Air Propane Radiant Panel Test Apparatus is officially being retired.
The Electric Radiant Panel Test Apparatus currently in use will be used for other future R&D Flammability testing (i.e.: wiring, ducting, etc.).
Polymer Technologies Inc. of Newark, DE, has shown to be compliant.

Completed evaluation of various configurations (size and thickness) of hook and loop sample other than those proposed in the AC.
FAATC is currently working with a new manufacturer of Radiant Panel Test Chambers.
Various densities of fiberglass, both belt and fluffy sides have been retested.
There are no Round Robins planned at this time.
The data from Round Robin 8 demonstrated that participating labs are conducting their tests in a repeatable fashion.
None of the participating labs have brought any problems to our attention.
If the Working Group is interested in participating in another Round Robin, please contact Pat Cahill so one can be arranged.

Seat Round Robin – R. Hill

Review of Aircraft Seats Worldwide Round Robin Testing

Currently, 8 labs in the U.S. have oil burners set up for seat testing:

Boeing Seattle
Accufleet
Starr Aircraft Products
Custom Products
Flame Out
Skandia
Govmark Labs
Chestnut Ridge

Dick explained the process for involvement of labs outside the U.S. and how it will be coordinated with foreign aviation authorities.

Review of Aircraft Seats – photo of test samples

Testing is complete in the U.S.
Testing is complete at Bodycote Ortech Inc. in Canada
Plans are still evolving for testing outside North America

Aircraft Electrical Wiring – R. Hill

A list of types of aircraft wire that were tested in the radiant panel and other tests was presented. It is also available on the FAATC Fire Safety website.

All small gauges were evaluated at the heat flux and flame application time is specified for thermal acoustical insulation.
Preheat and longer flame application times were evaluated.
No repeatability was found for the Riser cable, which passed the 60-degree flammability test, but was major flame spreader during intermediate scale testing.
Difficult to work with small gauge wire. FAATC has ordered larger gauge wire.

Both bundled and side-by-side testing will be performed at various flame application and preheat times.

Proposed Radiant Heat Panel Test for the Evaluation of Aircraft Duct Material Status Report – R. Hill

Last Quarter Test Results were listed and will also be available on FAATC Fire Safety website

Microscale Calorimeter Test Results were presented

Status of Proposed Radiant Panel Test for Aircraft Ducts was explained.

Summary

11th Annual OSU and Smoke Round Robin – Mike O'Bryant

The Smoke Density results were presented for the following panels:

5596 Panel
5524 Panel

Statistically significant factors based on 3 years of data.

Recommendations:

Develop a new panel optimized to have a good peak time to heat flux correlation.
Use an IR imager to characterize heat loss of OSUs.
Visit other labs, especially the outliers to gain understanding. Bring the IR imager.
Develop a finite element analysis model of the OSU to better understand significant variables.
Extend calibration equilibration time from 2 minutes to 3 minutes per step.
Re-establish OSU QA Task Group.

OSU Round Robin Status/Plans – R. Hill

FAATC will send the round robin materials to the labs that will be participating and a letter will be sent to the U.S. labs through the ACOs. A questionnaire will be sent as well. The round robin participation of foreign labs will be coordinated through their aviation authorities.

Contamination and Aging Task Group Update – Dan Slaton

The Risk Matrix created by Ray Cherry was presented and explained.

See "Presentations" from this meeting for supplements to Contamination Presentation and Contamination Task Group work.

Obtain contamination survey information
Summarize survey information
Down select 'contamination' types and test
Collecting precursor event data

Information and activities required from other organizations:
- Obtaining MSG3 Zonal Analysis for specific airplanes
- Electrical equipment locations & risk of ignition potential
- Boeing spreadsheet displayed

Define Deliverables:
Risk Assessment and impact on overall airplane safety
Recommendations on contaminate types and test method
Recommendations for Contamination Mitigation
Recommendations for Material Selection
Future technology recommendations for hidden areas

WEDNESDAY, JULY 12, 2006

Task Group Reports

Burnthrough Task Group – T. Marker

Burnthrough Task Group Meeting Minutes 7/12/06
(Prepared by Tim Marker)

The FAATC described the planned activities in the coming months. As discussed in the general meeting, the FAATC had conducted 45 tests using 3 styles of PAN materials supplied by TexTech Industries. The purpose of the trials was to determine if one particular style of material performed better than the others in terms of test repeatability. The results conducted by the FAATC indicated that PAN style 8579 was superior, yielding only 4.6% standard deviation. By comparison, style 362R (used in socket burner round robin) yielded 8.7% standard deviation, and style 8580 yielded 6.0% standard deviation.

The consistency of the test materials was the primary focus of the discussion. TexTech Industries, the suppliers of the calibration materials, detailed the different types of processes used to manufacture the materials, and described how the density and loft of the material was impacted by various manufacturing parameters. An important point in the discussion was that the materials used in the most recent round robin were not manufactured with a high degree of quality control, since these materials are typically used as welding blankets, in which minor imperfections do not necessarily impact the performance. The group discussed the importance of using a material that contained

minimal “voids” or “windows” as calibration materials, in order to reduce scatter and prevent premature burnthrough failure times. Other group participants felt that the size of the voids was not a factor in premature burnthough failure. Several participants suggested that small holes be placed in test blankets to determine what the minimum size of hole would be to allow flame passage.

The group agreed that additional testing on the calibration type of material would be helpful. TexTech Industries agreed to make another run of this material, producing enough for the FAATC to conduct 60 additional tests. Half of the tests would be run using the original FAA flanged burner, and the other half would be run using the newly developed pressurized air burner. By repeating this run of PAN style 8579, the group could also determine any batch-to-batch differences, which would be useful in determining the repeatability of the manufacturing process. In addition, the group felt it would be beneficial to have another material produced that would fail very close to the 240-second pass/fail criteria, so TexTech has agreed to produce an additional 60 tests of this heavier material. Again, half of the tests would be run using the FAA flanged burner, and the other half using the new air burner. One participant also suggested that if additional materials were to be available, other labs currently set up to conduct the burnthrough test could provide additional data. The FAATC agreed that this would not be a detriment to the proposed testing schedule at their facility, and would let the material supplier and the participant to work out the details.

During the upcoming trials of calibration materials, one domestic airframe manufacturer requested that the instantaneous heat flux levels be recorded during calibration of the burner, since they claim this is an indication of the stability of the burner. The FAATC has agreed to record these instantaneous levels, although they emphasize that the test method is designed to mimic a fuel fire, in which the heat flux is not a perfectly stable condition. The airframe manufacturer argued that their cargo liner test, which also uses an oil-fired burner, is much more stable because of the reduced fuel-to-air ratio. The FAATC indicated that the cargo liner test is intended to mimic a cargo compartment fire, in which cellulosic materials are burning much more cleanly, as opposed to the burnthrough test, in which a large pool of burning jet fuel is being simulated.

Other topics discussed during the meeting included the influence of the room size on the test results. One participant felt it would be interesting to note the area/size of each lab, including the height of the fume hood. The FAATC agreed to request this information in any upcoming round robins, to determine if there was a correlation between the room size and test results.

Contamination Task Group – D. Slaton

TG discussed deliverables, precursor data (getting this data to Ray Cherry for analysis) and where this work is leading.

Ray Cherry prepared a report that will be posted on the FAA Fire Safety Branch website.

Miscellaneous Task Group Discussion – R. Hill

TG discussed electronic devices, ducting work, and the interest in reforming the Ducting Task Group. Dick indicated that the FAA would evaluate reforming this Task Group.

FAATC Fire Safety Branch Website – R. Hill

Dick reviewed various sections of the Fire Safety Branch website (www.fire.tc.faa.gov) and where to find certain topics, reports, and information (such as 2007 Fire and Cabin Safety Research Conference).

Composite Materials – R. Hill

FAATC will be investigating the need for new test methods for composite materials that will be replacing non-combustible materials in the aircraft (i.e.: fuselage skins, all-composite fuselage airplanes, seat aluminum frame structure replaced with composite material) over the next few years. There may be a need for a test method for a replacement composite material where there was no flammability requirement for the replaced component in the past, because the original component was non-combustible.

Next Meeting

The next meeting will be hosted by Airbus in Bremen, Germany, on December 6-7, 2006. Please see www.fire.tc.faa.gov "Materials" page closer to the meeting date for additional information/meeting details/registration form.