INTERNATIONAL AIRCRAFT MATERIALS FIRE TEST WORKING GROUP MEETING

MARCH 5-6, 2003

Held at Trump Taj Mahal Casino-Hotel, Atlantic City, New Jersey, USA

WEDNESDAY, MARCH 5, 2003

Burnthrough Presentation and Discussion – T. Marker

Discussion of Burner Heat Flux Mapping for Proposed Insulation Burnthrough Test Standard: Purpose: to produce a burner flame profile to determine if the high heat flux areas are in the same location as the current location used during calibration. The measurement process was explained. The conclusions derived from the second mapping measurement process were reviewed. Several future considerations were discussed including standardization of calorimeter mounting block size/type and the standardization of initial temperature of calorimeter block and a revised data collection procedure.

Oil Burner Optical Flame Analysis – J. Brooks

John described the set up for his idea for a quicker burner calibration using an IR camera and processing software. A demo was presented.

Blanket Installation Testing Support of Advisory Circular – T. Marker

The results of the blanket installation testing using the modified frame test rig were presented. A number of conclusions were reviewed including a note that many possibilities exist with regard to blanket installation and attachment, however, it may be necessary to show compliance by testing the exact configuration.

Printed Wiring Boards – J. Peterson

Jim's discussion included an explanation of the items considered typical electronic equipment and the reasons for electronic redesign. Certification of PWBs required FAA 25.853, 12-second vertical Bunsen Burner test. All PWB parts must have certification data. The current PWB study at Boeing in Seattle was reviewed. The FAATC has conducted parallel tests to corroborate results. The plan is to develop a process for certification by similarity. The objective is to classify and test PWBs according to IPC 4101 "slash sheet" classifications. The current test plan matrix was presented and explained. The results to date were reviewed.

Radiant Heat Panel Discussions – P. Cahill

Videos of the materials tested at sea level were presented. The tests in the altitude chamber were conducted with the altitude chamber was pressurized to 8000 feet. Videos of these tests were also shown.

Flame Profile/Flame Propagation – P. Cahill

Pat discussed the determination of what she considers flame propagation versus burn length when conducting insulation materials tests at the FAATC.

Other Materials

Tests should be conducted on adhesives used in insulation material systems. This is a concern now.

Design of Experiments on Radiant Heat Panel Test – S. Morgan

Steve described the design of experiments used in the Boeing labs. The variables have been categorized as: equipment, samples, and process. The test results were categorized as minor or no affect, after burn, and burn length groups.

Fire in Inaccessible/Hidden Areas

Wiring in Hidden Areas – P. Cahill

The FAATC wire flammability program was described in detail including the types of wire that will be tested as part of this program. These tests will determine the best test for wiring. The tests that will be evaluated are: 60-degree flammability test, medium-scale vertical flammability, flammability tests in fuselage test article, and radiant panel tests.

Other Materials in Hidden Areas – R. Hill

There are a number of other materials in inaccessible areas that have recently been determined to be flammable. The aircraft certification office is currently investigating urethane foams (used on ducting) that have been determined to be flammable. Investigations are also underway to determine if the requirements will need to be changed for various materials in certain areas, because certain materials were not upgraded at the time when newer standards were set for materials in specific inaccessible areas (ie: elastomeric materials).

European Update on Fire in Hidden Areas Work – T. Klems

There are two projects ongoing: one at CEAT under the direction of DGAC in France, and a national project in Germany to determine a cable overheat in a hidden area. The CEAT/DGAC test program involves materials used in hidden areas in the cockpit and cabin. Anne Mansuet of CEAT has previously given presentations at Working Group meetings on results of the tests conducted at CEAT. The German national project will be presented in more detail at the summer 2003 Working Group meeting.

Contamination in Hidden Areas – R. Hill

A copy of the industry letter sent on this issue was made available during this meeting. It may be found at the end of these Minutes as well.

Contamination/Aging Task Group – D. Slaton

Goal: obtain more/better feedback from industry in response to February 4, 2003, letter. Dan presented the airline survey form currently under development. Claude Lewis prepared a draft contamination categorization chart that was presented. Boeing has initiated discussions with domestic airlines to request onsite visits of their heavy maintenance facilities by Task Group representatives. Contamination/Aging Literature Search: attempt to separate contamination from aging through industry procedures and test data involving the effects of contamination and identify definitions of 'contamination', and determine test methods used to quantify contamination and systematic ways for applying levels of contamination. The goals of the aging search were explained. A summary of testing methodology to characterize polymer morphology degradation (based on PET) was outlined for the Working Group (list format). General Contamination Test Results: lab tests were conducted on in-service insulation blankets from a domestic airline. The microscopy and microprobe results of these lab tests were listed. The FTIR examination results were described. Aging Studies on Insulation Blanket Film: the various tests that have been initiated to date were discussed. Proposed Future Activities: Dan highlighted the Task Group's planned future activities.

Heat Flux Transducers – R. Johnson

Dick highlighted a letter recently sent to the FAATC by NIST concerning continuing the calibration work/research initiated several years ago. The importance of the handling and care of calorimeters was stressed. The procedure for cleaning the calorimeter was described as well as the proper storage of the calorimeter. Several examples of mis-used or mis-treated gauges were shown and discussed (corrosion, scratches, build-up, improper cleaning methods were present on these examples). All of these factors affect calibration of this equipment. Several photos of sections of unusable calorimeters were presented and discussed. Also, pay close attention to the condition of the calorimeter wires as well.

OSU Q/A Task Group Performance Evaluation Report 2002 – M. O'Bryant

There were 26 participants in the 2002 round robin. The results of the tests conducted on various panels were presented some variations in lab results were highlighted.

Handbook Test Method Updates/Reviews/Discussion – R. Hill

Chapters 1-4: J. Peterson – Jim received one question related to Bunsen burner tests on electrical wire that technically was not a Handbook question; it was related to failure of a test and why certain behavior resulted in failure of this test.

OSU (Heat Release Rate): H. Busch – No questions/comment were received.

NBS (Smoke Chamber): J. Rathbun – Received one question relating to gas sampling related to toxicity measurements.

Oil Burner Test For Seat Cushions: H. Nuesel – There were no comments from the Working Group members on this Chapter, however, Heiko presented a few points of concern at Lantal Textiles related to this Chapter. He outlined those points via viewgraphs. Possibly, more detail should be provided in the Handbook on the number of wires that should be used on certain materials. He discussed a number of concerns that had been discussed previously with Working Group members. He also stressed the request for approval by similarity of materials (weight of fabric plays a role in this).

Oil Burner Test for Cargo Liners: G. Danker – Should the oil burner be set up and calibrated in a more modern fashion as is done/researched in the burnthrough tests currently being conducted at the FAATC and through round robins. Another point to research is the interpretation of results (interpretation of backside flashover as far as pass/fail). George will work with Accufleet on some of these issues in the near future.

Ingo Weichert: Unable to attend this meeting, however, he told Dick Hill that he had not received any comments up to this point.

Dick proposed leaving this topic open for comment until the fall 2003 meeting at which the chairman of each of these chapter reviews will present their summaries of comments/concerns they have received and further discussion and determination of follow up activities resulting from these reviews will take place (ie: possibly some testing as follow up). It is also important that those conducting these tests be aware and up-to-date on the Advisory Circulars relating to these tests.

FAATC Fire Safety Branch Website announcement: Notification of this process will be posted to the Homepage of the website with a link to additional information and Chapter chairmen contact information.

What is the status of the blanket TSO? Dick will follow-up with the certification office and their response will be posted on the FAATC Fire Safety Branch website (www.fire.tc.faa.gov).

THURSDAY, MARCH 6, 2003

Alternative Cleaning Technologies Interior Fabric/Upholstery Phase IV – Commercial Laundry – L. Berry

Lana reviewed the project overview with the group reminding them that the initial reason for this test program was the phase out of perchlorethelyne. She also reviewed Phases I-III of this test program explaining what types of materials/cleaning processes were evaluated during each of these phases. A brief overview of the results of Phases I-III was presented. Six vendors participated in Phase IV – Commercial Laundering. She

reviewed results of the following evaluations of Phase IV: colorfastness to light, colorfastness to cleaning and appearance retention, stain removal after 10 commercial launderings, dimensional stability after 10 commercial launderings, and fire blocked cushion after 10 commercial launderings. The conclusions of this phase were explained. Phase V will be evaluation of dry cleaning methods including: liquid carbon dioxide, Ecosolv – isoparaffin solvent, and Rynex – ethylene glycol ether solvent. If you would like more detailed information, please contact Lana Berry directly at 425-234-3942, or via email at lana.berry@boeing.com.

Seat Cushion Round Robin – P. Cahill

Five labs participated in this round robin (FAATC and 4 outside labs). All materials used in this round robin were received with certificates of conformance/compliance. The oil burner seat testing results some significant percentages of weight loss per cushion to be considered. The following questions arose after seeing these weight loss percentages: test method, material, and quality control. Pat was asked to include the types of materials that made up the test sets in the round robin information posted to the FAATC Fire Safety Branch website. All of these test sets were put into the conditioning chambers at each of the participating labs prior to testing.

Laboratory & Full-Scale Testing of Non Traditional Lightweight Aircraft Seats – T. Marker

Problem: next generation aircraft seats that utilize lighter materials in their construction are unfairly restricted by the FAR-mandated 10% weight loss criteria.

The participating seat manufacturers were asked to supply 18 seat backs and 18 seat bottom cushions, and six would be randomly selected for testing at FAATC.

The full-scale test apparatus was presented and described via diagram including seat identification and thermocouple location.

The FAATC needs to have more companies involved in this test program. To date, only one seat manufacturer has sent samples for the full-scale test program.

Tim reviewed the baseline test highlights. Photographs of the baseline test results were presented. The test data was briefly discussed. A test video was shown to the group.

Burnthrough Task Group Report – T. Marker

Revised Burner Heat Flux Mapping Procedure
At the previous meeting in Ottawa, the group had agreed to streamline the mapping process by taking all of the heat flux measurements without shutting the burner off. This was envisioned to expedite the process, and eliminate the need to allow the burner and equipment to completely cool off between measurements. In order to do this, it was necessary for a special mapping board to be developed and tested by the FAATC first. After successful development, the FAATC agreed to manufacture these boards for all of the other labs. However, during the development phase it became apparent that this revised mapping procedure was not a viable solution.

Difficulties arose with the amount of holes in close proximity on the mapping board, causing it to crack and fail. It was also very difficult for the operator to move the heat flux transducer and mounting block to the various positions on the mapping board without risking injury. As a result, this development was temporarily postponed.

At the recent meeting, a more realistic mapping procedure was conceived. During this latest process, the entire 24-inch by 48-inch mapping board would be moved in 1-inch increments, eliminating the need to pull the heat flux transducer out and re-insert for each measurement. The new method also called for shorter measuring intervals, to expedite the process and eliminate the possibility of soot accumulating on the transducer face.

The revised mapping process is as follows:
Insert heat flux transducer into sub-board, and mount sub-board onto back of 24- by 48-inch mapping board. Begin at position 1. Start burner up, allow it to warm for 2 minutes, then swing into place. Allow 1-minute soak time, and then take 10 seconds of data (once per second). Next, slide entire mapping board over 1 inch, then take 10 seconds of data (no pre-soak). Slide over 1 more inch, and take 10 seconds of data. Repeat until position 7 is measured, then slide entire mapping board back to position 1, and take a final measurement (8 measurements total). Burner can be shut off. Compare the results of position 1 (initial) with position 1 (final). If these two measurements are nearly identical, it can be assumed that no soot accumulation occurred, and the data is accurate. Following this, drop the sub-board down 1 inch into the second hole on the mapping board, and repeat the process. Lastly, drop the sub-board down 1 more inch, and complete the measurements. This will amount to 24 measurements total, 3 rows of 8 measurements (figure 1).

The FAATC will draft a detailed specification for the mapping device, including board type, thickness, and density, as well as all other pertinent information. It will be the responsibility of the individual labs to purchase the materials and construct the device. Time permitting, the FAA Technical Center will also run additional heat flux mapping trials in the opposite direction, to determine any discrepancies.

Point of Contact: Tim Marker (609) 485-6469

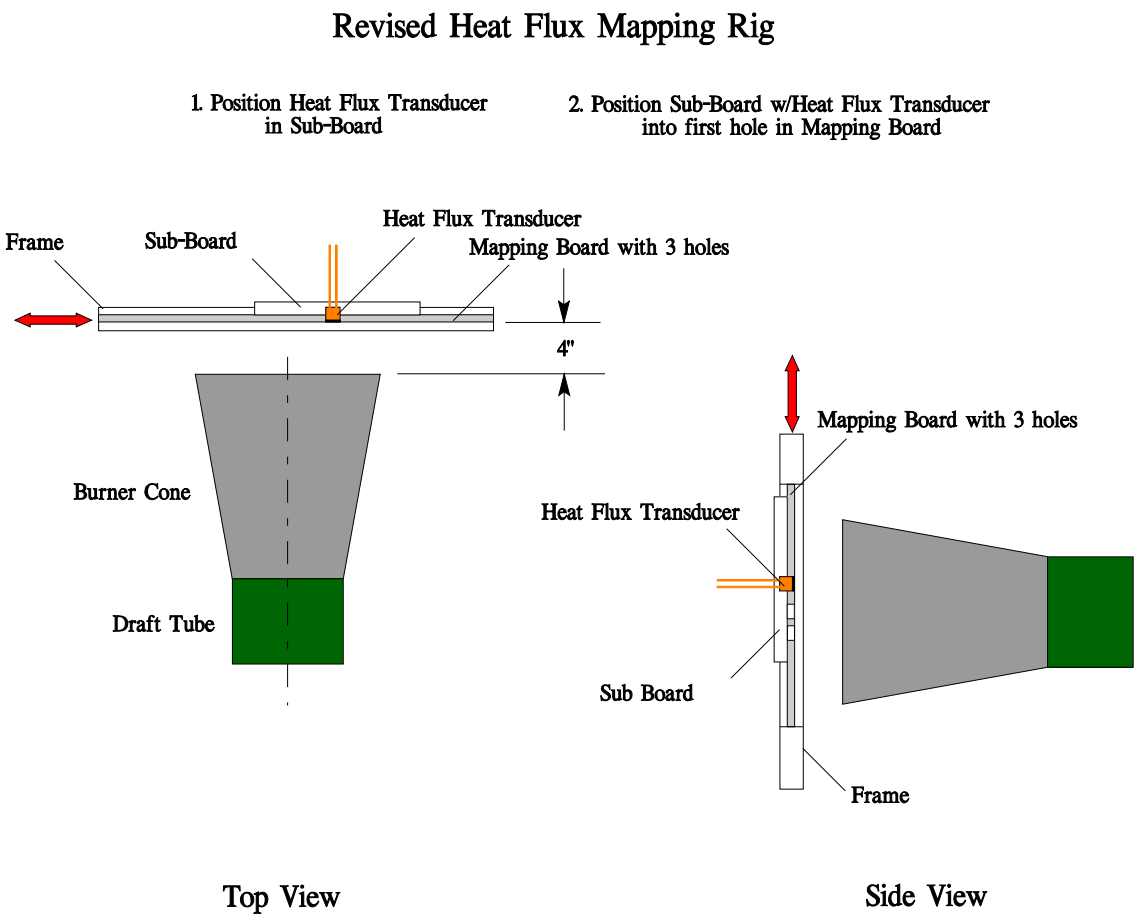

Figure 1. Revised Heat Flux Mapping Rig

Lastly, just to be double sure, let's make certain we're all using the same reference point for the mapping orientation. The chart shown in figure 2 is viewed looking INTO the burner. For example, if you are positioned directly in front of the cone, looking into the mouth of it, with flames bouncing off your chest, position #1 is on the top left. If you are situated behind the burner, sipping a margurita, where the switch box is located, then position #1 is on the upper right. You may also notice that the distance between each hole is back to the original 1-inch spacing.

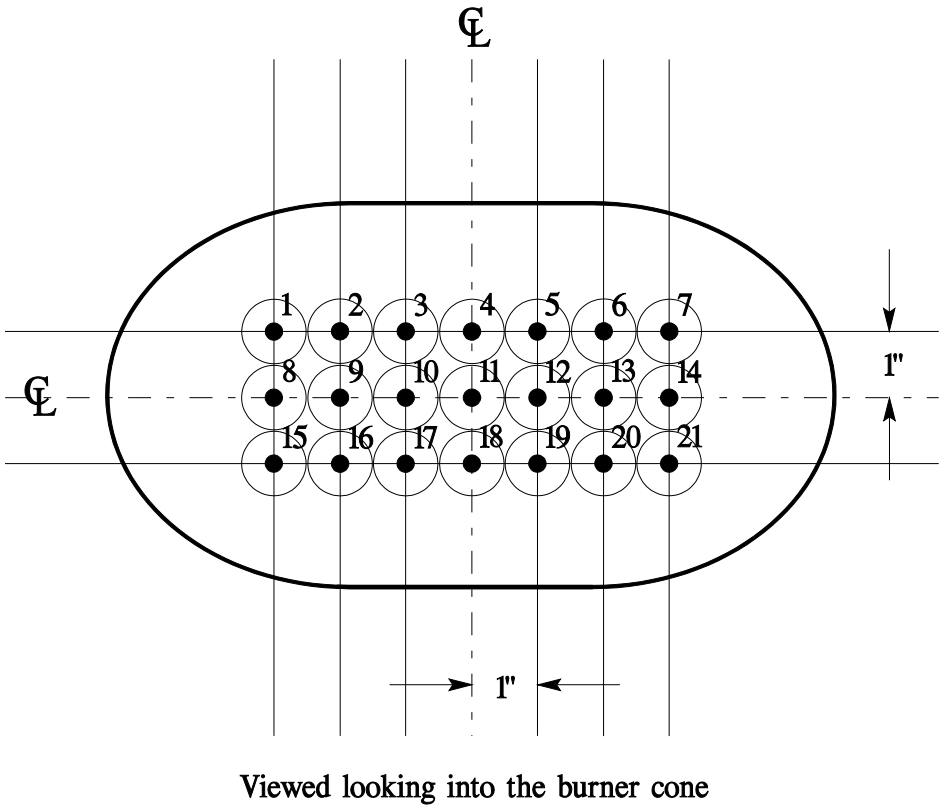

Figure 2. Heat Flux Transducer Positions for Mapping Burner Flame

Development of IR-Type Mapping Apparatus
Because of the uncertainty surrounding the accuracy of the heat flux transducer used to map the burner flame profile, an alternate mapping methodology was presented during the general meeting session. The alternate procedure employs an infrared (IR) camera to capture a picture of the flame profile. This picture is filtered using a layer of dot-printed Nextel ceramic paper in front of the camera. Although the device only has the capability to develop a temperature map of the burner flame, it is possible that these temperatures could be converted into heat flux. International Aero has completed development of a prototype testing apparatus that utilizes an IR camera, and will ship the device to the FAA following successful trials. If possible, this device could also be shipped to the other participating labs in the group, so that all labs have the opportunity to map their burner flame profile using this technology. It is anticipated that mapping results could be compared (heat flux transducer method vs. IR camera method) and discussed at the next meeting.

Point of contact: John Brooks, International Aero (360) 757-2376

Standardization of Stator Position
Additional testing by the Boeing Company has confirmed the findings of previous FAA testing with regard to the position of the internal H215 stator. The findings indicate that slight differences in the location of the stator can have a dramatic effect on the calibration (temperature and heat flux) profiles, and likely the actual test results. Boeing initially constructed a simple device that could be inserted into the end of the burner to measure the stator position/angle. The device was shipped to the FAA Technical Center in 7/02, during which time the FAA's

position/angle was indicated on the device, and shipped back to Boeing for comparison. Boeing used that information to adjust their stator position identical to the FAA's, and ran several tests to confirm the new location. Test results indicated heat flux and temperature profiles nearly identical to the FAA's. Following the initial comparison, Boeing developed more sophisticated tools, which allow for a more precise measurement of the stator angle.

The initial plan was to have Boeing mass produce these tools, in order to supply each lab with the proper equipment to measure the stator angle. Due to constraints, however, this effort has been suspended. Boeing has provided the FAATC with the CAD drawings of the tools so that they may construct their own. In the interim, Boeing has also agreed to loan the tools to the FAA Tech Center, to enable FAATC personnel the opportunity to visit the individual labs and investigate the burner set-up with the necessary tools.

Point of Contact: Steve Morgan, Boeing (425) 266-9949

Proper Alignment of the Fuel Rail System
During the heat flux mapping discussion, a point was made with regard to the alignment of the fuel rail, and hence the fuel nozzle. It was intimated that the fuel rail could be slightly misaligned, thereby directing the flame slightly off center (figure 3).

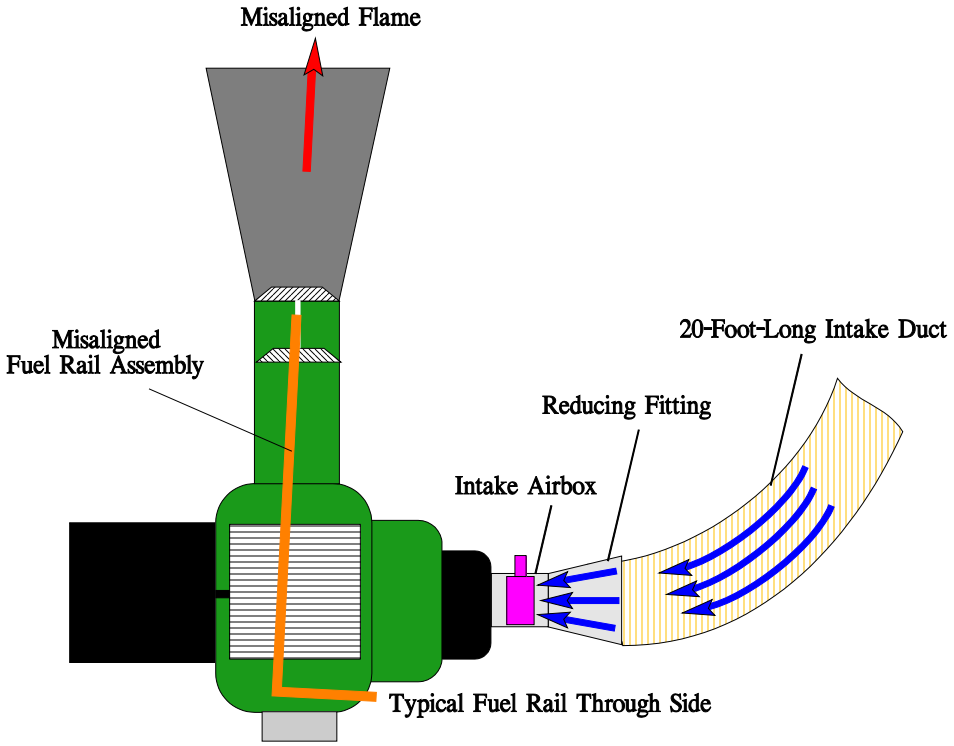

Figure 3. Typical Fuel Rail Installation Allowing Possible Misalignment

Several labs had indicated difficulties adjusting this segment of the burner apparatus. One suggestion was to simply bore a hole in the back plate to allow the passage of a totally straight fuel rail, eliminating the possibility of misalignment (figure 4).

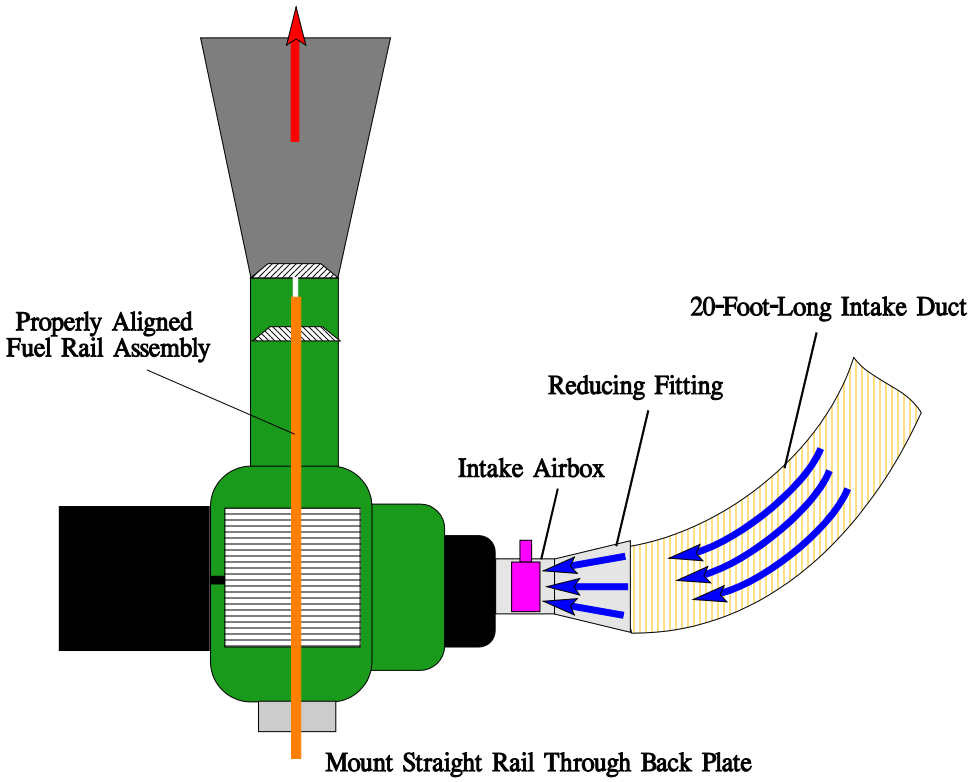

Figure 4. Fuel Rail Mounted Through Back Plate, Allowing Proper Alignment

This would also allow the possibility of making stator adjustments from the rear of the burner, since the stator is attached directly to the fuel rail assembly.

Point of Contact: Tom Tompkins, 3M (651) 736-3250

Development/Construction of Standardized Air Inlet Control Device/Air Filter (Left over from previous meeting in Ottawa)
Accufleet/Boeing have determined that the absence of intake ducting used to supply fresh air to the burner will significantly diminish the accuracy and life of the Omega air velocity meter. This is due to the combustion products being drawn back into the burner intake during testing, contaminating the air velocity meter blades, and possibly deteriorating the bearing surfaces prematurely. For this reason, an intake duct system was proposed (and standardized) prior to the 6/02 meeting, in which a 20-foot long, 4-inch flex duct was specified. Previous FAA tests have determined that different lengths of intake duct can impact the amount of air entering the burner, so it is critical that all labs strictly adhere to the intake duct specifications.

In addition, several labs raised concern over the usefulness of the present air damper mechanism, which is used to control the amount of air entering the burner. At the task group meeting in 10/02, many labs expressed an interest in removing this mechanism in favor of a more precision component that could be mounted on the inlet of the 20-foot intake duct. This arrangement would allow better control of the inlet airflow, which is a key element in interlab correlation. One suggestion was to utilize a gate-type hand valve, which can be purchased at home center supply outlets, or hardware stores. The FAA Technical Center has agreed to design and construct such a device, and produce enough for all participating labs. The device will also incorporate an

air filter to prevent ingestion of dust/soot. The group agreed to continue using the present air damper system until such time that a new device is designed, constructed, and shipped to their lab.

Point of Contact: Time Marker, FAA (609) 485-6469

Standardization of Intake Velocity Measurement (Reminder from previous meeting)
Testing conducted at the FAA Technical Center has shown that the position of the burner (facing the calorimeter, facing the thermocouples, or facing the test rig) can have a slight effect on the intake air velocity readings. This is likely due to the rotation of the unit, causing differences in the bend radii of the intake hose*. For example, a reading of 2150 ft/min while the burner is in the warm-up position may result in a reading of 2100 ft/min when the burner is rotated into the test position. Recent round robin testing has confirmed the FAA's findings. For this reason, a standard methodology of measuring the intake air velocity follows:

1. Install Omega air velocity meter into intake airbox.
2. Install standardized length of intake duct onto airbox (see above).
3. Position burner either in the temperature measurement position, heat flux position, or test position, depending on which measurement will be taken.
4. Turn the blower motor ON, making certain that the fuel and ignitors are in the OFF position.
5. Adjust the damper position of the burner to 2150 ft/min intake velocity while monitoring the digital read-out. This may take some care, as the intake velocity will fluctuate somewhat during the adjustment.
6. After adjustment is complete, tighten the set-screw on the air inlet damper to prevent further movement
7. Rotate burner back to warm-up position, and resume with normal warm-up and testing.

*One method of eliminating this problem is to rigidly mount the burner unit, and have the calibration stands and test sample holder mounted on tracks that allow them to be slid in front of the burner. This method has proven successful in several labs already.

Radiant Heat Panel Task Group Report – P. Cahill

Another round robin will be conducted.

Materials In Inaccessible Areas Discussion – R. Hill

Group consensus is to utilize same test equipment if new tests are required instead of requiring labs to purchase additional/new equipment. Another consideration will be: if a material already meets a specific test requirement, will the reverse side of the material (the part of that material located in an inaccessible area ie: the back side of a cargo liner) be required to meet another test or will the existing test for that material be considered stringent enough? How will certain materials such as wires in inaccessible areas be tested (ie: one wire or a bundle of wire)? How about different gauges of wire vs. types of cables? All of these variables must be evaluated and considered.

Contamination Task Group Report- D. Slaton

Two parallel tasks: manufacturers will produce a list of significant contamination types, and contamination survey will be conducted once the proposed form is developed (Dan Slaton and Peter Short will send proposed form out to Task Group members for review/comments within the next month). Also, investigate the other components should be evaluated in the contamination/aging study.

Hidden Fire Task Group Report – R. Hill

Dick reviewed the approach to fires in hidden areas with the Task Group.

Contamination Letter (mailed February 4, 2003):

TO: Don Collier, Air Transport Association (ATA)
Paul Woodburn, International Air Transport Association (IATA)
Valerie van Passel, Association of European Airlines (AEA)

CC: James A. Bouey, Boeing
Jim Peterson, Boeing
Daniel B. Slaton, Boeing
Peter Short, British Airways
Brian Freeman, Delta Airlines
Marco Niederkleine, Lufthansa Technik
Theo Klems, Airbus
Richard Theisen, Northwest Airlines

DATE: February 4, 2003

SUBJECT: Support Data Collection for FAA Contamination/Aging Task Group

FROM: Richard Hill
Program Manager
Fire Safety Branch
Federal Aviation Administration (FAA) Technical Center

The United States Federal Aviation Administration (FAA) requests your participation in a new industry Task Group established at the October 29, 2002, meeting of the International Aircraft Materials Fire Test Working Group (IAMFTWG). This Task Group's charter is to address adverse effects on flammability properties of materials installed in inaccessible areas of transport aircraft due to contamination and/or aging. The effect of contamination on flammability has become an increasing concern.

The Task Group's first activity is to do a survey to identify, categorize, and quantify the kinds of contaminants that accumulate in inaccessible areas during airline operation. A variety of contaminants has been reported in the past, including corrosion inhibiting compounds, fluids, trash, lint, grease, etc. The Task Group will then initiate collection of in-service parts for testing and evaluation.

The next meeting of the IAFTWG will be held March 5-6, 2003,at the Trump Taj Mahal Casino in Atlantic City, New Jersey. This issue will be discussed, and the Task Group

will report on progress to date. Representatives of the ATA, IATA, and AEA are encouraged to attend.

Your support is appreciated.