INTERNATIONAL AIRCRAFT MATERIALS FIRE TEST WORKING GROUP MEETING

March 16-17, 2016

Hosted by Rescoll – Bordeaux, France

Agenda:

WEDNESDAY, MARCH 16, 2016

8:45-9:00 AM	Welcome/Logistics/Participant Introductions
9:00-9:15 AM	Welcome from Rescoll
9:15-9:35 AM	Magnesium Alloy Test, Development of Advisory Material – T.Marker (FAATC)
9:35-10:00 AM	Cargo Liner Test/Airflow Study - (FAATC)
10:00-10:15 AM	*Break*
10:15-10:25 AM	VFP Update – R. Ochs (FAATC)
10:25-10:35 AM	Inaccessible Area Fire Tests on Composite Structure – R.Ochs (FAATC)
10:35-10:45 AM	Intermediate Wire and Wire Sleeving Tests – R. Ochs (FAATC)
10:45-11:05 AM	Burnthrough – R. Ochs (FAATC)
11:05-11:25 AM	Radiant Panel Update/Round Robin Results – S. Rehn
11:25-11:45 AM	RTCA – Alan Thompson (Element Minneapolis) RTCA – Thomas Krause (Airbus)
11:45-11:55 AM	Evacuation Slide Test – T. Marker (FAATC)
11:55 AM-1:30 PM	*Lunch*
1:30-1:40 PM	OSU Round Robin – M. Burns (FAATC)
1:40-1:50 PM	Airflow Analysis – Theos Spanos (Boeing)
1:50-2:00 PM	HR2 – DOE - Matt Anglin (Boeing)
2:00-2:10 PM	Aircraft Materials Fire Test Handbook Changes Procedure – A. Horner
2:10-2:20 PM	*Break*
2:20-4:20 PM	Task Group Meetings Session I: Magnesium Alloy – T. Marker VFP Composite/Ducting/Wiring – R. Ochs OSU/HR2 – M. Burns Approved Material List – S. Campbell Flame Retardants/Material Change Similarity – (Boeing) RTCA – S. Rehn

THURSDAY, MARCH 17, 2016

9:00-9:15 AM	2016 Triennial Conference – A. Horner
9:15-9:30 AM	Material Change Similarity Status – (Boeing)

9:30-9:40 AM Policy Statement Task Group: Updates – Michael Jensen
9:40-9:50 AM *Break*
9:50-11:50 AM Task Group Meetings Session I:
Burnthrough – R. Ochs
OSU/HR2 – M. Burns
Policy Statement – M. Jensen
Radiant Panel – S. Rehn
Magnesium Alloy - T. Marker

11:50 AM-12:30 PM Task Group Reports
12:30-1:00 PM Additional Discussion/Closing

Materials Meeting Minutes:

WEDNESDAY, MARCH 16, 2016

The purpose of International Aircraft Materials Fire Test Working Group was reviewed.

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

Tim gave a brief review of magnesium alloy testing at FAATC. Surface Area-to-Volume Ratios of Seat Components results table was presented. We are now starting to focus on the use of magnesium alloy in other cabin areas. The results of thin magnesium samples using radiant panel were presented. 3"x3" and 3"x6" samples were tested and results compared to AZ-31 results. Tim discussed the details of the test results. Self-extinguishment was the most important factor to us during this test series. Jensen: moved sample in chamber not pilot light, correct? Tim: yes, correct. Jensen: 0.050 had higher weight loss than the 0.025 thickness? Tim: yes. Jensen: How did you physically measure the weight loss? Tim: Tested sample sits for an hour and put what is left on the scale again. HPBusch: Do you compare mag thin sheets with maybe carbon fiber plastics which we are allowed to use on the aircraft? I think this approach is a little bit too strong/severe. I cannot imagine that other allowed materials will perform in these tests. Tim: we can discuss this during the Task Group meeting. Q: have you done any foam block tests? Tim: the foam block was a research test to us. Everything we do now is in one of the test apparatuses. We are not trying to make an overly severe test. We are trying to see if these materials once lit will self-extinguish. Jensen: do you plan on testing an annodized magnesium in the same test method? Tim: we could. We haven't ruled out even testing in the VFP. It is very experimental at this point. We are trying to come up with a test method that is representative. Jensen: are you planning to go and test the cut off of SAV of 20? Tim: yes, we certainly could do that. HPBusch: the good performing alloy is creating an oxide skin during the test – is it possible to coat a lower performing alloy – what is the difference to the good performing WE alloy? Tim: I think Jeff felt that we should still establish that the uncoated alloy should still pass the test. I would imagine that it would probably be the same logic in the other tests as well. Lyon: what was the burner time? Tim: 4 minutes.

Cargo Liner Tests/Airflow Study – T. Marker for T. Salter (FAATC)

Impact of test cell on test results: Test Cell Air Velocity Study. This test series was described and the results were presented. Cargo Liner 10'x10' test cell results compared to full-scale test chamber results for cargo liner tests. Conclusions: size of test cell and air velocity around it can influence test results. Other conclusions were reviewed. Tim Salter has done some collaborative work with the University of Cincinnati recently. Photos of the University of Cincinnati lab and cargo liner test apparatus were shown. University of Cincinnati is doing the shrouded thermocouple tests that Tim Salter had done.
Instructional Video for NexGen Cargo Liner Oil Burner Test Method: Tim Salter has the draft of this video completed. A copy of it was available for viewing during the March 2016 meeting. He expects to have the final video ready by the June 2016 meeting. Story: was Tim able to verify that the lab with the low data had a huge room? Tim: No, they had a very low hood in the test chamber. We could not recreate that. Spencer: what about the seat cushion test? Does he have to do the same thing for that test? Tim: we have to be more specific of where you are measuring the horizontal and vertical. Spencer: I was thinking more in terms of the cell size. Tim: when he had the rig in the 10'x10' chamber, there wasn't enough size to pull the heat away. HPBusch: the main requirement is influence of flame penetration. Bashford: is he looking at having reference material for the seat cushion test as well. Tim: You may want to forward that question on to Tim Salter. Bennett: did he have any data to establish the temperature inside the test cells? Tim: Yes, I believe he does have that data. RSmith: have you thought about looking into the heat transfer as well (ie: temps of the walls)? Tim: we thought of that as well. He is trying to focus just on the air velocity for now. He could also have a max temperature that you can test at – like we have for the magnesium alloy tests. I was wondering if someone could do a heat analysis of that test cell. Tim: That is something you can suggest to him.

VFP Update – R. Ochs (FAATC)

Rob reviewed the recent VFP testing conducted at the FAATC. T700/TC350 Ribbon Burner Test results were presented. FAATC lab will be testing thermoplastics in this apparatus. There are issues with melting and dripping with thermoplastics. Ribbon Burner – Summary: as purchased was a little too much flame. With modifications it was enough to evaluate it in the VFP. The ribbon burner manufacturer was given the information and will be manufacturing one for us to test in the FAATC lab. It should arrive in April 2016. Bashford: How did the new burner change the re-ignition? Ochs: You wouldn't need that with this burner. Richardson: will your group be looking at setting what you consider pass/fail criteria for materials? Ochs: Yes. I assume we will be discussing the pass/fail criteria in the Task Group. HPBusch: I see the same as with the magnesium test- to develop a robust test method, but we drive away from a realistic fire source. Where is the correlation of these fire sources to real fire sources? Ochs: The correlation is in the burn lengths. HPBusch: Then, the aim is different. This is a change in the philosophy. Maker: No, it's not. Same thing with the magnesium. We are looking at making it a self-extinguishment test. It is too hard to quantify some of the fire sources especially if it is a high energy electrical arc. Canari: This new burner is a way to screen the materials. Q: what is the 8-ply material? Is it about 1/10"? Ochs: Yes.

CFRP Flammability Test – R. Ochs (FAATC)

This is the intermediate scale work that the VFP was based on. It was based on an actual ELT incident. Rob described the tests that were conducted. Test Matrix: Foam Block Ignition Source was presented. The next steps were reviewed. We are working towards moving up to large scale CFRP Skin and Structure Tests. We built a new CFRP structure to simulate an actual CRFP structure. Rob reviewed the large scale test plan. HPBusch: the battery fire source – you heated up one cell only? After the fire runaway, the others will react? Ochs: Yes.

Intermediate Wire and Wire Sleeving Tests – R. Ochs (FAATC)

Rob reviewed the test apparatus, test configuration, and tests conducted. Test videos were shown. Summary: remove the film cover and remove the sidewall panel prior to testing, so they don't' contribute to the fire. Any thoughts? Jensen: I don't know that we see a lot of that particular configuration on an airplane. Ochs: My thought was that it might be in a hidden area of a galley. Kato: what is the real direction you are going to? Ochs: which wires can be excluded because they are considered small parts and go to VFP, but we need a baseline first.

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

Test results were reviewed. New Stator Testing Summary: new stator was found to provide similar results to the baseline configuration. There will be a Burnthough Task Group meeting on Thursday, March 17. Anglin: your eventual goal would be to put this new configuration into the AC? Ochs: it all depends on how it would be written. Bennett: have you had any problems with the spark plug connectors? Ochs: we haven't. Marker: you have to shield it.

Radiant Panel Update/Round Robin Results – S. Rehn

Round Robin: A Round Robin was initiated since the October 2015 Materials meeting. There are 23 responses so far. Steve reviewed some of the initial Round Robin results for the Round Robin materials. Analysis: a few of the labs took a very long time to heat up. Anything over an hour to heat up, consider looking into getting a new panel.
An airflow study was conducted. Steve discussed how the FAATC conducted the air flow study and presented the industry air flow results. We will discuss this in the Task Group meeting. HPBusch: we always find outliers with these materials and maybe these outliers are based on the material characteristics other than the geometry of the test apparatus.

RTCA – Alan Thompson (Element Minneapolis)

Alan reviewed the results of testing done using line burner for testing the small box at Element Minneapolis and showed a test video. The RTCA Working Group members were invited to spend a day at the Element Minneapolis lab in December. Alan discussed the Lessons Learned from this test series. Please contact Alan if you would like to participate in the RTCA Working Group. Ochs: Is your burner pre-mix or just methane? If you pre-mix, you might not have a problem with the methane going out. Thompson: that's a good idea and might be worth trying.

RTCA – Thomas Krause (Airbus)

Three step process: analysis of internal and external materials, test or not, compliance statement. Thomas also reviewed the 3-step process for the foam block test. Three videos were shown. Testing: Server Unit – test configuration and test results were reviewed.

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

Tim reviewed the tests Do conducted to determine the required power input to the furnace to produce the correct heat flux at various coil depths and the results of these tests. Recent activities: Evacuation Slide Task Group discussed positioning of furnace coils in their respective equipment. Do only had 2 other labs participate in the study. The results of the comparison tests between the labs were presented. Future work: particpants will send their furnaces to the FAATC to rerun the calibration tests of their furnaces. Do will visit the Task Group labs. Round Robin V will be conducted.

OSU Round Robin – M. Burns (FAATC)

30 labs from 7 countries participated in this Round Robin. This was an involved Round Robin with a lot of interaction with Mike. He expressed his appreciation to the labs that participated. OSU Airflow Measurement Test Plan was described/photos were shown. The Round Robin results were presented. A review of the problems encountered was given. Despite the problems, we are still on track to complete on time.

Airflow Analysis – Theo Spanos (Boeing)

Theo reviewed the initial results of this analysis. Some calibration data charts were discussed. Correlation data was shown. A definite conclusion has not been formed yet. We can discuss further in the Task Group.

HR2 – DOE – Matt Anglin (Boeing)

Matt provided background. The Plan was described. The data was reviewed.

Aircraft Materials Fire Test Handbook: Updates Procedure – A. Horner

A copy of April's presentation is available at http://www.fire.tc.faa.gov/materials.asp, with the other presentations from this meeting.

8th Triennial International Aircraft Fire and Cabin Safety Research Conference – A. Horner

Tropicana Atlantic City, New Jersey, USA
October 24-27, 2016
Registration: open at www.fire.tc.faa.gov
Registration Fee: free
No International Aircraft Materials Fire Test Working Group will be held in fall 2016. The conference will take its place.

Material Change Similarity Status – T. Marker/Matt Anglin for R. Lyon/D. Slaton

Tim gave brief summary of highlights of this work. Matt briefly discussed the process the group has worked through. It will be discussed with Jeff Gardlin.

Flammability Standardization Task Group Update – Michael Jensen (Boeing)

This Task Group was restarted to work on an update to the previous Policy Statement issued by the FAA Transport Airplane Directorate. We are working on some holes and inconsistencies found when folks started using the Policy Statement. We are also working on some additions to the original Policy Statement. We have until approximately the Triennial Conference date this year to give our updates to Jeff Gardlin and Enzo Canari for review.

Task Group Reports

Magnesium Alloy Task Group – T. Marker

Task Group Report for Magnesium Alloy Flammability Test (provided by Tim Marker)

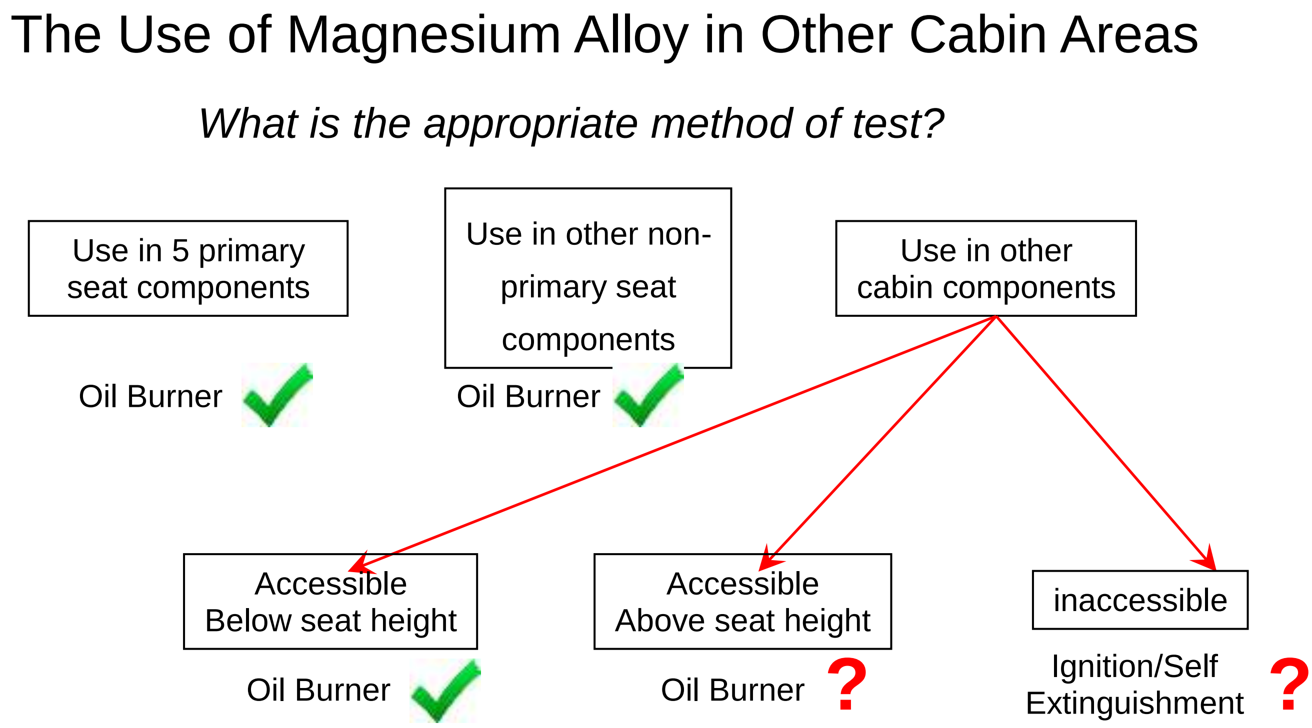
The Task Group participants reviewed the proposed methods of flammability testing of magnesium components in the various aircraft cabin applications. These were presented by the FAA during the main meeting:
1. Primary Seat Components. The FAA had previously conducted full-scale testing on aircraft seats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

2. Non-Primary Seat Components. Industry had previously inquired about the potential use of magnesium alloys in other (non-primary) seat components, for example tray table arms or other frame members. The FAA and the European Aviation Safety Authority (EASA) indicated that although these non-primary components were not represented during the full-scale demonstrations at the FAATC, they would not prevent magnesium alloy use in them if additional requirements were met. The FAA had previously proposed using the surface area-to-volume (SAV) ratio of the seat components as a means of determining the suitability of using the new oil burner flammability test for qualification. At the previous International Aircraft Materials Fire Test Working Group (IAMFTWG) meeting in Atlantic City, participants had discussed a proposed maximum SAV ratio of 20 for solid seat components, and 40 for hollow components. These maximum ratios were based on the components that were tested during the full-scale demonstrations at the FAATC. The Task Group participants agreed the 20 and 40 maximum SAV ratios were appropriate.

3. Other non-Seat Components. There is still considerable interest in the use of magnesium alloy in other cabin components, based on feedback provided by members

of the task group. The FAA determined this area of potential use should be separated into three (previously two) main categories:
a. those components that are accessible during flight, but located at a height <u>less than</u> the seatback height (approximately 60 inches),
b. those components that are accessible during flight, but located at a height <u>greater than</u> the seatback height (approximately 60 inches),
c. those components that are inaccessible.

See figure below that was presented during main meeting:



The FAA suggested that accessible, non-seat components located at or below 60 inches in height could also be substantiated using the maximum allowable SAV ratios that were proposed for non-primary seat components. A good example of this would be galley cart frames. The Task Group participants concurred with this logic. That left 2 remaining areas; the accessible area above 60 inches, and inaccessible areas. The FAA indicated the accessible areas above 60 inches would need further analysis, and could possibly require full-scale testing to complete the analysis. In terms of the inaccessible area, the FAA had previously stated that the test for magnesium alloy components located in this area should be either an electrical arcing test or ignition and self-extinguishment test representative of the threat in the hidden areas. Prior to the last meeting, the FAA had conducted testing using electrical arcs, but with limited success. Following these tests, the FAA began testing thin samples in the vertical Bunsen burner, and then more recently in the radiant panel apparatus. The FAA described the logic behind the switch to the radiant panel apparatus, in which the sample is forced to ignite, and then must demonstrate the ability to self-extinguish. The FAA reviewed the test results it had obtained thus far using the radiant panel apparatus (shown during main meeting), which were very promising. The results using a 3- by 6-inch sample size appeared to be scaled appropriately for the radiant panel, resulting in well-performing alloys self-extinguishing on a consistent basis. This configuration was also capable of distinguishing differences between 2 well-performing alloys tested, which had not been done previously. The tests included a measurement of the sample weight loss and time required for the sample to start burning. The FAA summarized by stating that the test arrangement (4 minute exposure) forced the magnesium alloy sample to ignite, and then measured the sample's ability to self-extinguish. The FAA felt the most important aspect of the test was to ensure that a component fabricated from magnesium alloy possessed the ability to self-extinguish, if located in a hidden area.

Additional Discussion. Based on the review summarized above, Task Group participants formulated questions and made suggestions to the Task Group leader. The initial discussion
focused on the use of the radiant panel apparatus as the proposed test method for inaccessible area components constructed of magnesium alloy. Commenters suggested the use of the new vertical flame propagation (VFP) test currently under final development as a potentially more applicable test. One commenter also suggested that since the VFP would be the test for other hidden area materials such as composite structure, ducting, and wiring insulation, it made sense to at least experiment with this apparatus for the magnesium samples as well. The FAA indicated it could begin experimentation using this apparatus in the very near future. However the FAA also cautioned that one limiting factor in the experimentation was the availability of thin magnesium alloy test samples. During the main meeting, the FAA had described the multitude of approaches undertaken to machine its own thin samples, due to lack of commercial availability. These approaches were very time consuming and caused delays in the actual testing. Additionally, the FAA has been forced to purchase costly samples, since certain alloys are simply not readily available, as the processes to manufacture thin sheet have not yet been refined.

The next area of discussion focused on the FAA's oil burner testing of thinner test samples. At the previous meeting in Atlantic City, one participant questioned the proposed SAV ratio of 20 for solid components, and gave an example of a particular seat component application in which the SAV ratio would be exceeded (the actual SAV ratio was approximately 23 for the component in question). The FAA had agreed to conduct a few oil burner tests on reduced thickness samples. During discussions with industry prior to the meeting, the FAA suggested a methodology for determining the appropriate thickness of a component in which the SAV ratio exceeds the proposed criteria of 20. Considering the standard bar sample for a moment, the SAV ratio is calculated as follows:

Surface Area = (2 x t x l) + (2 x w x l) + (2 x w x t)
= (2 x 0.25 x 20) + (2 x 1.5 x 20) + (2 x 1.5 x 0.25)
= 70.75 in^2

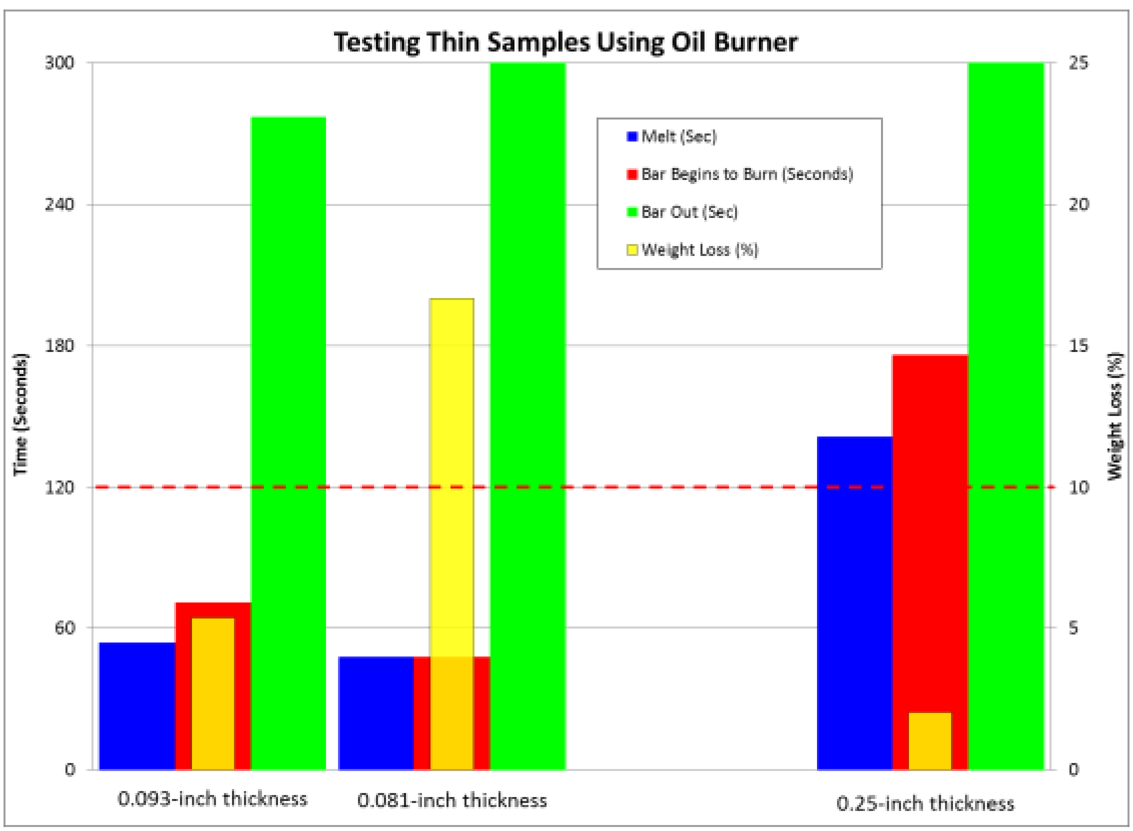
Volume = (t x w x l) = (0.25 x 1.5 x 20) = 7.5 in^3

SAV ratio = 70.75/7.5 = 9.43

The FAA suggested taking the elevated SAV ratio of 23, and back-calculating for the thickness as follows:

Surface Area = 2(t x l) + 2 (w x l) + 2 (w x t)
Volume = t x w x l
SAV = [2(t x l) + 2 (w x l) + 2 (w x t)] / [t x w x l] = 23
If w = 1.5 and l = 20,
[(2t x 20) + 60 + 3t] / 30t = 23
(40t + 60 + 3t) / 30t = 23
(43t + 60) / 30t = 23
43t + 60 = 690t
647t = 60 or **t = .09274 inches**

Based on this calculation, the FAA machined a standard bar sample of EL43 down to a thickness of 0.093 inches, and ran the sample in the oil burner. The FAA had also done a similar exercise for a SAV ratio of 26 (sample thickness of 0.081 inches). The results below were shown during the main meeting:



As expected, both of the machined samples melted and began to burn much more quickly than a standard thickness sample. Based on these results, both machined samples would fail the current requirement for the time to begin burning (sample cannot begin to burn in less than 2 minutes). Surprisingly however was that the weight loss of the 0.093-inch thick sample was only approximately 5% (current requirement for a standard sample is 10% maximum weight loss). After discussing the results during the Task group session, one participant suggested a revised pass/fail criteria for components exceeding the SAV ratio. Considering the current "time until burn" requirement of not less than 2 minutes, the participant suggested the following:

Revised "time until burn" = (revised sample thickness / standard sample thickness) x 2 minutes
Based on the example above:

Revised time until burn = (0.093/0.250) x 2 minutes = 44.6 seconds

Using this logic, the 0.093-inch thick sample could not begin to burn in under 44.6 seconds. During the actual test, the sample did not begin to burn until 71 seconds, so it would meet the revised criteria. Similarly for the 0.081-inch this sample:

Revised time until burn = (0.081/0.250) x 2 minutes = 38.9 seconds

Applying this logic, the 0.081-inch thick sample could not begin to burn in under 38.9 seconds. During the actual test, the sample did not begin to burn until 48 seconds, so it too would meet the revised criteria.

The FAA cautioned that although promising, the above logic and methodology are only one possible way forward for allowing an exception for the very small number of instances where the SAV ratio is exceeded. The participants and the FAA agreed to conduct additional testing, since the results discussed were based on one data point each. Magnesium Elektron volunteered to provide machined samples for additional oil burner testing at the FAATC.

The final area of discussion pertained to the discussion paper that was previously co-written by EASA and the FAA. In addition to a background on the topic of magnesium alloy use in aircraft cabin components, the paper included an explanation of SAV ratios and how they could be applied to the various applications, and the proposed methodologies for substantiating magnesium alloy use via the oil burner. The FAA and EASA agreed to update the discussion paper to also include a summary of the proposed testing methodologies described above, including recent testing conducted using the radiant panel apparatus. Once the paper is updated, the FAA plans to recirculate it to key Task Group participants for comment. The FAA would like to present the refined discussion paper to its sponsor for comment prior to the next IAMFTWG meeting.

<u>VFP Composite/Ducting/Wiring</u> – R. Ochs

The Task Group discussed advantages of ribbon burner and future iterations. By the June meeting we should have decided on which ribbon burner we are going to use. We are going to do a comparison of propane vs. methane for the pilot burner for burn length.

We are going to do a worst case thermoplastics study with this new burner to see if it will clog the holes in the ribbon burner. We will try to set up a VFP Workshop at the Tech Center for Task Group members.

Burnthrough – R. Ochs

We reconvened this group and discussed the new stator vs. old stator, heat flux with new configuration, and there is interest in a Round Robin with the new vs. old stator.

Approved Material List Task Group – S. Campbell

Approved Material List Task Group (provided by Scott Campbell)

The task group discussed our scope, history, objectives and progress to date. Our goal is to provide a robust process and platform for material manufacturers to be able to list materials as "FAA/EASA/ETC" approved for use in a suitable application without the need to perform additional certification testing or provide regulator approved substantiation test data. Current focus is fleshing out a process specification that the FAA could model for a subsequent AC. Major topics will include how to list, continued compliance, QA requirements and mitigation for subsequent failures. Task group members volunteered to work specification topics raised during the meeting. The group is planning April and May WEBEX meetings to go over our progress before the next meeting in Kansas City. We are looking at the PRI model for hosting and administering the database allowing the FAA and a group of other appointed experts to review test plans and data to ensure compliance to the specification before listing.

Phase I is still concentrating on materials that can be evaluated for use that don't require post processing such as paint or decor. Examples include curtains, floor carpet, upholstery, thermoplastics, insulation systems, cargo liners, etc. Could also be materials that could be evaluated in a worse-case Bunsen burner test defined by the FAA Policy Statement. Examples would include hook & loop tapes, single sided tapes, double sided adhesive films, adhesives, placards, rubstrips and other components with pressure sensitive adhesive tape backing, etc.

Contact Scott Campbell [scott.campbell@zodiacaerospace.com] for questions or interest to support the group.

Heat Release Rate Task Group – M. Burns

Heat Release Rate Task Group Minutes – Bordeaux, France March 2016 (provided by Mike Burns)

OSU Guidance document

There was discussion concerning a new document that will be put together to address all issues that may not currently be covered in the FAA Fire Test Handbook. This document will be a guide for all labs to use relative to all aspects of the OSU. Yaw Agyei (Boeing) and Martin Spencer (Marlin Engineering) have agreed to chair this project. Some information that will be included is as follows:

- Recommended method to set Heat Flux (Center & Corner)

- Construction of orifice meter (pick up ports and how far they should penetrate in from inner wall)
- Piping (length of tubing between orifice meter and OSU and quantity of bends)
- Nominal operating parameters
- Etc.

We are not exactly sure where this document will be placed as of yet, possibly in the supplemental section of Chapter 5. It may also include any recommendations for equipment changes as a result of the 2016 Airflow split round robin data.

OSU finalized round robin data and analysis

Once the round robin has been completed in the next few weeks or so, data will be compiled and a final report will be presented to the group at the June Materials meeting.

Software development for HR2 calibration

The goal of this software change is to try to reduce variability from calibration to calibration based on DOE data. Currently the variability is low (about 6%) but perhaps we can make it even better (<2%). A two pronged approach will be looked at to accomplish this. The first idea is to try to make some slight changes to the current method. The second idea is to change from a step change in flow to a ramp down in flow over a certain amount of time. Our goal here is to try to have very repeatable calibrations and reduce the calibration time significantly.

For the Step procedure the first thing to look at is to incorporate a new 20 second moving average of the thermopile signal. This will replace taking the average value of the final 10 seconds of data during each of the 3-minute step changes. In other words, we will take the average of the last 20 seconds of data instead of 10 seconds.

Secondly, I would like replace the 3-minute preheat time (4 L/min flow at the beginning of calibration) with having the software monitor the mV values until a certain mV level is achieved (threshold). After this threshold limit is achieved the normal calibration step process can proceed. The goal here is that every machine will always start calibration at the same mV level each time, I think this will help.

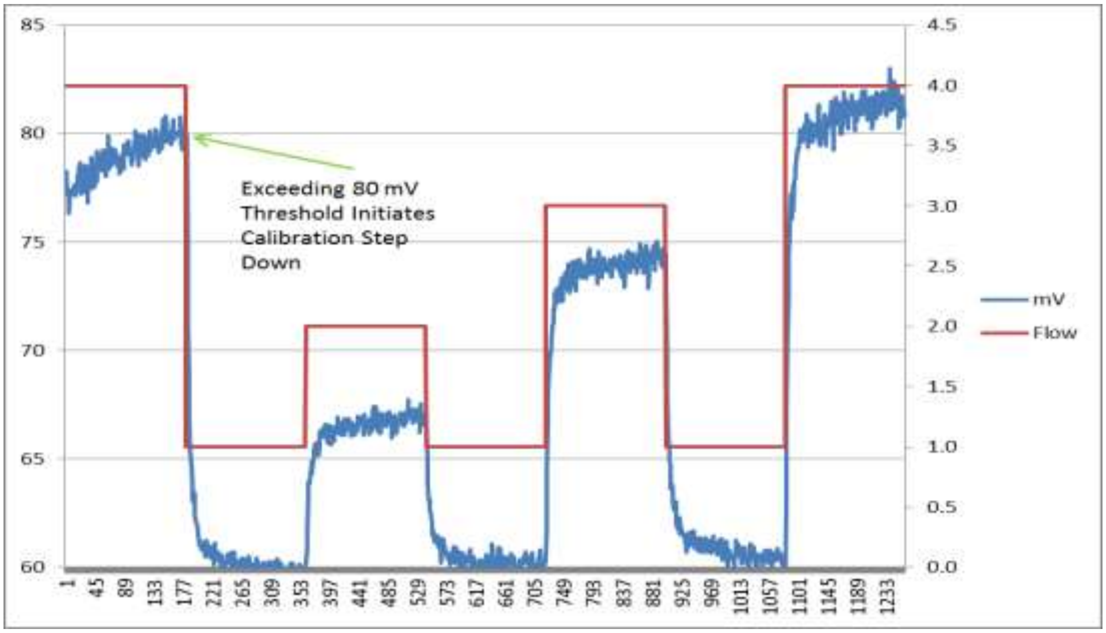
For the Ramp down procedure everything would be the same as far as the beginning of the calibration goes but instead of step changing flows drastically (1-2, 1-3, 1-4), it will be subtle changes in flow (ramp) over a certain time frame. I'm not sure what flow rate change or time will work just yet. Marlin Engineering has agreed to work with the Tech Center to incorporate some flexibility in this software change. Once all data is collected a slope will be generated then converted to a calibration factor by multiplying by a constant.

“Step” Method: Changes to the current calibration method

Note: Now it is required to have a sample holder (with millboard) installed during the calibration process. There should be a “comment” to alert the operator before beginning calibration.

- Replace the current 180 second preheat time (once the calibration “START” button is pressed) with a minimum millivolt threshold limit that must be achieved prior to starting the calibration step process. This will be based on a 20 second moving average replacing the 10 average at the end of each step

- Ability to adjust this threshold limit (Default = 80 mV)
- Ability to turn threshold limit "ON / OFF" which would allow operator to manually initiate the calibration step sequence using a "START" button (Default = "ON")
- All other calibration steps remain the same (4 – 1 – 2 – 1 – 3 – 1 – 4 SLPM) except now using the last 20 second moving average value at the end of each 3-minute step.

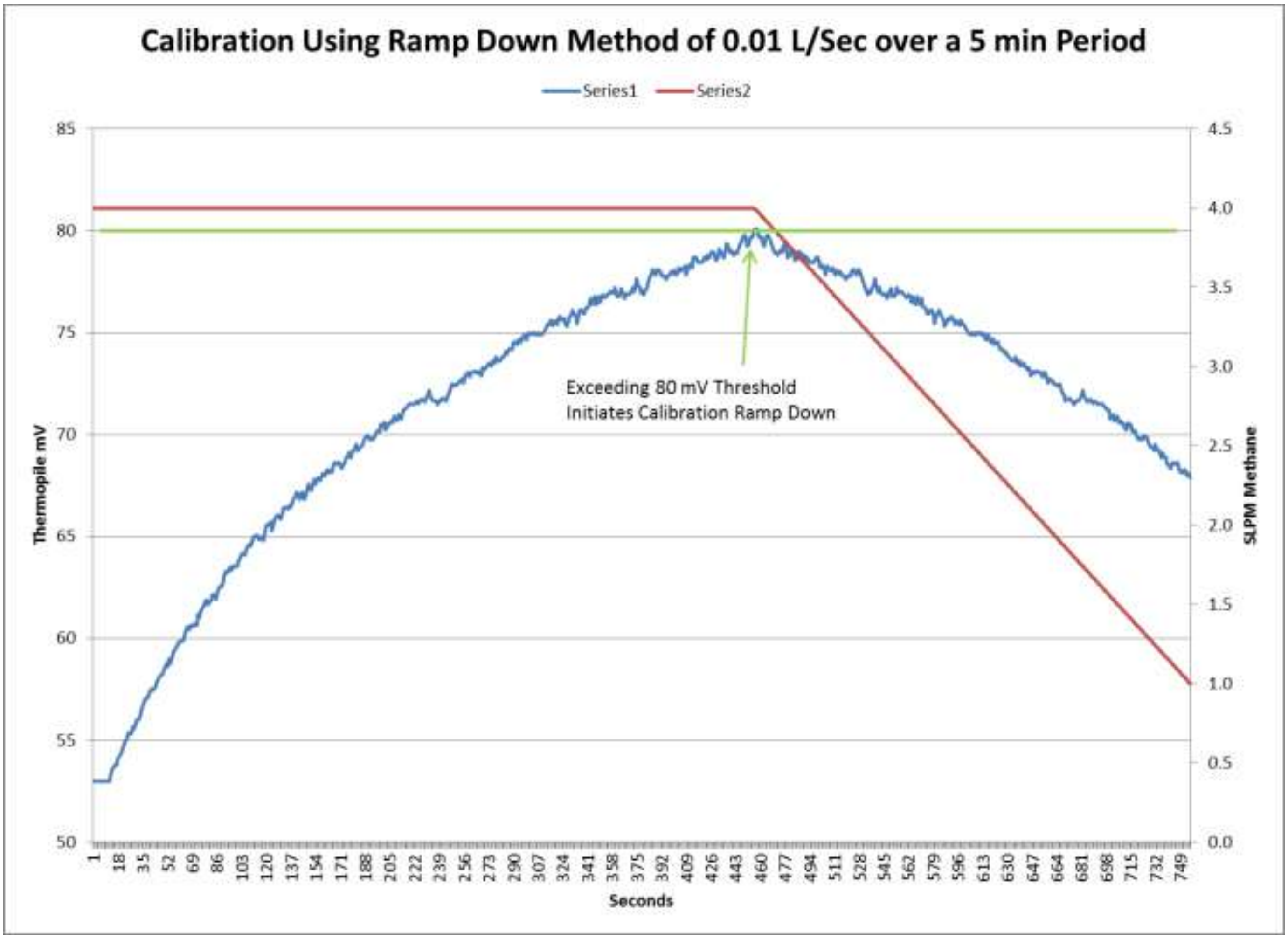


(Graphs are for demonstration purposes only)

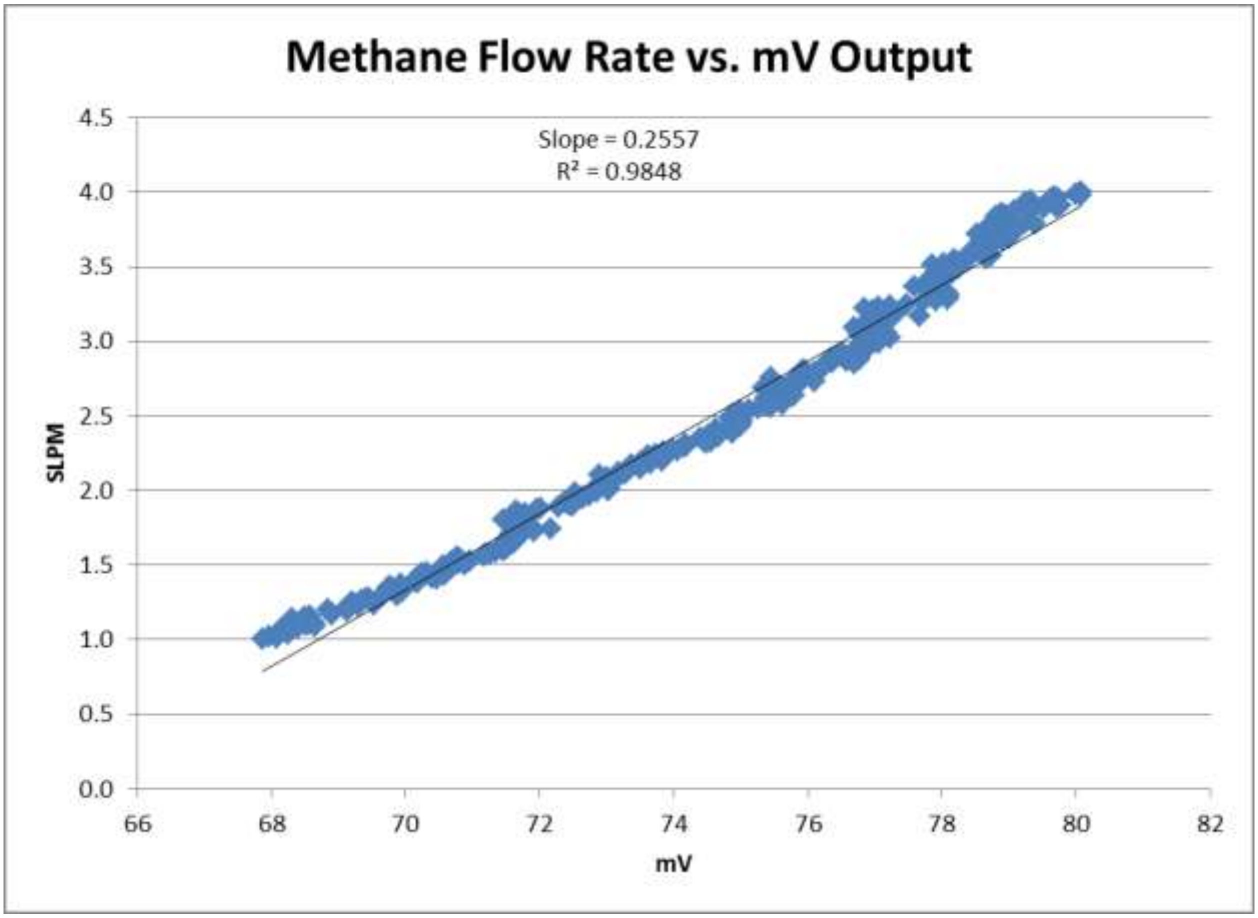
<u>"Ramp" Method: This is the new exploritory calibration method</u>

Note: Now it is required to have a sample holder (with millboard) installed during the calibration process. There should be a "comment" to alert the operator before beginning calibration.

- Replace the current 180 second preheat time (once the calibration "START" button is pressed) with a minimum millivolt threshold limit that must be achieved prior to starting the calibration ramp down process. This will be based on a 20 second moving average value.
- Ability to adjust this threshold limit (Default = 80 mV).
- Ability to turn threshold limit "ON / OFF" which would allow operator to manually initiate the calibration step sequence using a "START" button (Default = "ON")
- Ability to change START / STOP point of flowrate (Default: START = 4 L/min; STOP = 1 L/Min)
- Ability to change the ramp down time (Default = 300 seconds)



Calibration Using Ramp Down Method of 0.01 L/Sec over a 5 min Period
Series1
Series2
Exceeding 80 mV Threshold
Initiates Calibration Ramp Down
Thermopile mV
SLPM Methane
Seconds



EXAMPLE	Flow			Minutes		
	Start	Stop	Delta	5	10	15
	4	3	1	0.0033	0.0017	0.0011
	4	2	2	0.0067	0.0033	0.0022
	4	1	3	0.0100	0.0050	0.0033
				Rate Change (L/sec)		

- Generate a least squares fit (slope) of the flow rate vs mV readings of all data points (SLPM/mV)
- Multiply the Slope by constant 0.587914 to determine the Calibration Factor (kW/mV)
- Calibration Factor must be 0.085 +/- 0.01 (0.075 - 0.095) for a “PASS”

Chapter HR Updates

1. Tolerance changes:

- It was agreed in the task group to reduce tolerance criteria on 3 parameters as a result of DOE data as follows:

  - o Main Airflow from 20 +/- 5% (19 – 21 SCFM) to 20 +/- 2% (19.6 – 20.4 SCFM)
  - o Methane (Pilot) From +/- 13.3% (1.3 – 1.7 L/min) to +/- 2% (1.47 – 1.53 L/min)
  - o Air (Pilot) From +/- 20% (0.8 – 1.2 L/min) to +/- 5% (0.95 – 1.05 L/min)

2. Hardware Changes (inlet air from MFM to MFC / Mixing air from flow meter to MFC):

- It was agreed in the task group to replace the main air supply Mass Flow Meter (MFM) with a Mass Flow Controller (MFC). A MFC was also recommended to control the upper pilot air flow as well (replacing a flow meter).

3. Calibrate with Sample holder installed:

- It was agreed in the task group based on flow data that was presented to change the calibration procedure to require that a sample holder (including Millboard and drip pan) be in place to represent better actual air flow patterns that occur during testing.

  Testing will be conducted to see what stability/preheat time may be required as well as defining a Millboard specification (density/thickness).

<u>Policy Statement Task Group</u> – M. Jensen

We presented all of the current methods of compliance that we would like to clarify as well as new ones we would like to add. The group created a spreadsheet that highlights all of these items. A Sharepoint will be set up by Pom Sattayatam (panade.sattayatam@zodiacaerospace.com).

<u>Radiant Panel Task Group</u> – S. Rehn

We reviewed the Round Robin data and discussed the different variables that were causing the spread: air flowing through chamber. We decided to expand this study a little bit – a few labs will participate. We will test many samples of one material to get statistically better result.

<u>RTCA Task Group</u> – S. Rehn

We discussed the comparative test results from tests conducted by Alan Thompson and Thomas Krause. We need more data before we select the method we use. We will try to build a generic electronic box so we can vary the vent holes and run a lot more comparative tests. We will contact folks in the telecommunications industry, since that is what the line burner test was developed from.

Additional Meeting Discussion:

HPBusch: Horizontal Bunsen Burner Test: The Handbook says to test samples as installed in the aircraft but less than 3mm (sample thickness should be less than 3mm). Why less than 3mm? Marker: We will discuss this question with Jeff Gardlin and let the Working Group know.

Seat Test Method Tim Marker: A number of people have approached me about the Seat Test. When Tim Salter updated the cargo liner test Chapter, he incorporated the NexGen burner. The first 10-12 Chapters are covered under a Policy Memo, so we cannot add another Chapter, so that's why we had asked him to incorporate it in the existing cargo liner chapter. This is why we didn't give a Seat Test update during this meeting, and we haven't updated the Seat Test Chapter in the *Aircraft Materials Fire Test Handbook*.

Next Meeting

The next meeting will be hosted by AkroFire at The National World War I Museum and Memorial, June 7-8, 2016. AkroFire has arranged for a block of hotel rooms at a local hotel. Hotel reservation information and additional meeting details will be sent to all Working Group members in the near future.