International Aircraft Materials Fire Test Forum

Virtual Meeting

June 8-11, 2020

MONDAY, JUNE 8, 2020 (webinar)

Opening Remarks, Short Takes – Tim Marker (FAATC)

Tim provided an overview of this week's virtual meeting schedule. The purpose of International Aircraft Materials Fire Test Forum was reviewed: interactive format, group relies heavily on the expertise, contributions, and participation of industry to help fuel this meeting.

Development of New Flammability Test for Magnesium-Alloy Cabin Components – T. Marker (FAATC)

Objective: develop a flammability test for magnesium alloy components located in inaccessible areas of cabin that is representative, repeatable and reproducible.

Tim reviewed the Interlab Study and test results compiled by the FAATC. Preheating of samples may produce more consistent results. Tim reviewed some of the March 2020 Task Group discussion points on the Interlab Study and the Test Method. The FAATC plans to look into several of the test method discussion points when we return to the FAATC labs. Tim highlighted the discussion items for today's Magnesium Alloy Flammability Task Group Session. C. Mills: Are we looking to increase the magnesium percentage content to 10% or higher? J. Davis: An aircraft part is considered "magnesium" if it has more than 10% magnesium. M. Jensen: I think they are talking about the Policy Statement limit.

Cargo Liner, Seat Cushion Air Shrouds, Insulation Burnthrough Update – T. Salter (FAATC)

Sonic Burner Cargo Liner Test - Cargo Air Shroud: Phase 1 completed, several labs participated and provided beneficial data. Tim showed photos and described the Cargo Air Shroud. Shroud: new shroud design concepts were reviewed. Phase 2 of Cargo Air Shroud Interlab Study planned. We are seeking more Interlab Study participants. Please contact Tim Salter if you are interested. No modifications needed for test rig to participate in this Interlab Study.

Sonic Burner Seat Cushion Test - Air Shroud Update – T. Salter (FAATC)

Next Step: adapt shroud concept to seat cushion flammability test method to reduce influence of air currents. In the FAATC test lab, the shroud made these tests more repeatable. The shroud does not interfere with sample mounting. No frame modifications required. Proven FAATC results. Interlab Study planned: 3 sample foam types with 3 of each foam type provided to each participating lab, same dress covers for all samples.

Insulation Burnthrough – T. Salter (FAATC)

The heat flux measurement was slightly higher than measured previously in Phase 1 using the same blanket sample materials. This would indicate the burner flame is more severe for Phase 3 compared to Phase 1 and Phase 2. Test Phase 1 (stator with igniters) configuration with new insulation material to establish baseline data. Compare test results to Phase 3 (igniterless stator) burner configuration. Adjust burner settings to achieve equivalent results to Phase 1 burner configuration. Interlab Study with another lab to confirm test data and updated burner settings using new blanket materials. Purpose is to update sonic burner settings in Chapter 24 of the *Aircraft Materials Fire Test Handbook*. Phase 4 Interlab Study possible. Question: What new material will be used for the insulation base test? Salter: it is still the standard insulation glass material

just not the same manufacturer as previous. The same material that is used on most commercial manufacturer aircraft.

Powerplant Test Update – T. Salter (FAATC)

The propane burner has been removed from the Powerplant Advisory Circular (AC) documentation. No formal Task Group for powerpalnt testing this meeting. Questions in Burner Task Group if needed.

Insulation Burnthrough Video: It is in final draft 99% completed. It will be posted to FAA Fire Safety website as soon as possible. Updates for Task Group members. Sonic Burner instructional video will be available at: https://www.fire.tc.faa.gov/Handbook.

C. Mills: There are air currents on the aircraft perhaps these currents are more uniform than in the labs. Salter: I would like to discuss this more in the Task Group. Marker: Tim Salter has tried to make a more consistent environment in the labs.

Marker: Our FAATC team has been working on writing reports and analyzing data while working from home. We are available and encourage anyone to reach out to us via email or phone if you have questions or want to discuss anything.

MONDAY, JUNE 8, 2020 (Zoom meeting 1)

Task Group Report for Magnesium Alloy Flammability Test – Tim Marker (FAATC)

Topic: Interlab Study. The results of the interlab study were displayed during the webinar. The FAATC emphasized that the key to moving forward with a repeatable and reproducible flammability test for magnesium alloy components used in inaccessible areas is the need for consistent test samples. Some of the samples distributed to the labs for this study were machined using an Electrical Discharge Machining (EDM) process. The resulting samples were very inconsistent, and likely impacted the test results. The EDM process was complicated by the fact that the raw materials sent to the machining facility were already cut into 3- by 6-inch coupons of only 0.125 inches thickness. This likely caused difficulties for the machining facility, as it was challenging to hold such a thin coupon in place for machining. More favorable machining results would likely occur if a larger block of raw material was offered to start the process. The other observation was that varying amounts of oxidation were present on the surface of the EDM samples, which may also have impacted the test results. In contrast, the test samples supplied by Boeing were very consistent in terms of thickness, surface finish, flatness, etc.

Test Sample Discussion. **J. Davis**: Did we ever find out the way Boeing was slicing samples? **T. Marker**: Ken Young, can you weigh in on how Boeing did those samples? **Matt Anglin**: those were rolled. **Ken Young**: alloy 1 from Boeing was rolled to thickness. The other two alloys we were trying to get machined down. I will get them to the FAATC when they're ready.
T. Marker: should we start to consider doing a second interlab study? Response: yes. **T. Marker**: we learned a lot from that first interlab study. Initial Interlab Study results were reviewed. **J. Davis**: I wonder if a layer of oxidation will insulate sample and cause some variability. Should we sand or abrade samples before we conduct the test? This might absorb more heat than a shiny surface. It could introduce a new variable instead of eliminating a variable. **T. Marker**: it probably would be better if the FAATC lab completed any surface preparation before sending the samples out, and instruct participating labs not to alter the surface before testing.

Sample Holder Discussion. **T. Marker**: we had a little bit of a clearance issue in the sample holder, as the sample wants to expand while heated, so it will warp upwards or downwards, creating a bow. I think we talked about making some additional sample holders that are slightly wider to allow for the sample expansion. **M. Jensen**: I like the idea to give some expansion option. For the next interlab study: I think we need to look at some of the variables from the first interlab study before we start the next interlab study. We should try to address what the issues are before we start the next interlab study. **T. Marker**: There has to be a way to come up with some consistent samples. I plan to reach out to Ken Young and Matt Anglin at Boeing to get their thoughts. **M. Anglin**: Ken and I will talk to you later about those samples if you want. **T. Marker**: yes, Thanks Matt.

Weight Measurement and Surface Preparation Discussion. **J. Davis**: we had lots of discussions about what is the remaining mag and what is the slag (oxidized magnesium), to make sure you are only weighing the metal afterwards. This may be one of the things we want to have a discussion on so we all do this the same way. **T. Marker**: that is a good point. We did this when we were working on the seat mag test using the oil burner. Oxidized vs. remaining metal needs to be differentiated. **Question**: what was the difference between the Batch 1 and Batch 3 samples? **T. Marker**: The Batch 1and Batch 2 materials were both Elktron 43 alloy, which were sliced using the EDM process. Batch 3 materials were supplied by Boeing, and labeled as "alloy1". In looking at the results, the Batch 3 samples exhibited more burning. **M. Jensen**: the inconsistency in the Luxfer coupons indicates the surface finish was playing a role. I think a method to verify the surface roughness would be good. There is a profilometer that will tell what the surface roughness is. **T. Marker**: I will check Chapter 26 for any information on surface roughness. **J. Gardlin**: if the part itself is going to be relatively rough, you don't want to make a super smooth sample. This has to be considered. **T. Marker**: Agree. The test sample must mimic the in-service component, especially if we determine the surface roughness is a factor. Maybe we can artificially create some type of degrees of roughness to see if this impacts the test. **M. Jensen**: I think if you ran a variety of cutters, you might be able to affect the surface roughness. Most components have detailed drawings for machining metal parts, which includes surface finishing details. **K. Young**: I don't know if machining (magnesium alloy) is an option anymore (in the Boeing facilities) because of the flammability of the parts (chips) during the machining process. S. Campbell: is there going to be a study to look at surface roughness as a factor? T. Marker: I think it could be added.

T. Marker: So the major takeaways are as follows:
1) FAATC will contact Ken Young/Matt Anglin of Boeing to discuss procurement of rolled samples. If this is not possible, FAATC will explore the possibility of obtaining larger mass of magnesium alloy for subsequent EDM machining
2) FAATC will reach out to Laboratory E, which produced test results that differed greatly from the results of the other participating labs, to try to determine the cause. 3) FAATC will go through interlab study data again, to see what parameters are impacting the results. 4) some of the variability was due to the materials themselves, so it may be worthwhile to do an Interlab 1A study when consistent samples are obtained 5) Video or photographic coverage of test. J. Davis recommended we have everyone video future tests, as this could help us determine any outliers. T. Marker concurs with this point. 6) Temperature measurement of sample. FAATC plans to conduct testing to determine the impact of sample temperature on test results. This will be done by mounting a thermocouple to the back of the test sample, and tracking temperature from pre-heat conditions to test conditions. T. Marker: our testers did a series where they slide the sample into the test position to pre-heat the sample for 1 minute, prior to applying the pilot burner. So the sample had one minute of preheating, causing higher weight loss, but results were more consistent (this was due to a miscommunication in our lab), but this is why I think we may want to look into some type of preheating. 7)

FAATC will investigate the test robustness, by varying the range of heat flux in the apparatus from the low end to the high end, to determine the impact on test results. 8) Weight Loss measurement. There was agreement among participants that the measurement of the sample following the test and the calculation of the weight loss needs to be clarified. The time at which the remnants are weighed seems to have an impact on the measurement, as the burned samples continue to oxidize following the test.

MONDAY, JUNE 8, 2020 (Zoom meeting 2)

Task Group Report for Oil Burner Tests – Tim Salter (FAATC)

Cargo/Seat Air Shroud

Initial task group discussion focused on the developments with the cargo liner and seat cushion air shroud. One member expressed concerns that the shroud would cause an increase in sample burning due to heat being reradiated back from the shroud walls. This could especially be more of a concern in smaller test labs with less ventilation airflow. This could be a situation for the cargo liner or seat test when utilizing the shroud. FAA Fire Safety has performed a number or tests in lab and a cargo liner interlab study also to ensure the test results are not made to be more severe or increase the likelihood of sample failure. The FAA would not add the shroud into the test method if it influences the test results in any way by making it more conservative or difficult to pass. The shroud is designed to improve test result repeatability and interlab correlation by minimizing the influence of air currents around the sample. We would not put the shroud in the test method if it would make the test more difficult to pass. We have performed tests at the Technical Center lab and have initial test results comparing the data with and without the shroud for the seat test. There was no significant change in weight loss or burn length severity. We did see more repeatable test results using the shroud. There has been no recent since these initial tests as the supply of seat cushion test samples had been depleted. The new stock of samples arrived just before the teleworking began do to the COVID situation. We aren't able to perform testing within the lab until we are allowed to return to the Technical Center. I will reach out to the labs interested in participating in a shroud interlab study for the seat test method. The FAA will supply the seat test samples, shroud assemble, and test instructions. The shroud will be designed in a manner that will allow for mounting on the seat test rig without making modifications to the frame sample frame.
M. Anglin: Are these going to be an optional addition to the Handbook? Are they going to be mandatory?
T. Salter: I don't have a definitive answer for that right now. One of the things that was my concern was we always try to keep these tests equivalent for each lab (fuel coming out of burner defined, parameters defined, etc.). During Phase 1 of the cargo liner interlab study, some labs experienced situations where the shroud was interfering with the support structure for the cargo sample frame. Three participating labs had to make minor modifications to the shroud for proper fitment on the test frame. This was not foreseen in our initial lab tests. Only after Phase 1 of the study did it become apparent. General design parameters of the new shroud could allow for minor modifications (if needed) to the shroud without reducing its effectiveness to improve test repeatability or make the test more conservative.
T. Marker: If we can show conclusively that these shrouds work and make interlab test results agree with one another, then I think it is something we would put into the Handbook. Tim Salter is currently trying to make the shroud work with everyone's different lab arrangement. The shroud could be added to the Handbook if it can be shown the shroud is cutting down on the influence of air currents.
J. Gardlin: If we collectively decide that it is an improvement to the test method, then we could add it to the Handbook, but previous test arrangements would be accepted and not invalidated. For us to mandate the shroud, it would require some type of Policy Statement. I don't see this as being any different than any other improvements added to the test method.
T. Salter: We are looking for any input from test labs regarding shroud design parameters. The shroud design should not influence test results if it is added to the Fire Test Handbook. A Phase 2 of the cargo shroud interlab study is being planned. Fire Safety can provide samples and a shroud fixture to those interested in

participating. We will be running tests in our lab to develop an updated shroud design upon returning from telework.
J. Davis: For the cargo liner test – the sample liner temperature thermocouple only measures at a very specific point. A slight air current could easily influence the temperature reading. The shroud seems to do a god job of addressing this. I think it does make the temperature criteria more consistent.

Shroud for Seat Cushion Tests

T. Salter: The shroud did make an improvement in repeatability for the seat cushion test. There was no noticable increase in weight loss or burn length with the shroud. This test data is available in previous meeting PPTs. We do not have the same amount of time invested in testing the shroud with the seat cushion test. There is still more testing and an interlab study to conduct. We want to be sure the shroud does not make for a more conservative test before adding it to the test method.

Insulation Burnthrough

T. Salter: We have been working to update the Sonic burner in the Handbook to the igniterless type stator configuration. This eliminates the igniters and igniter wires inside the original Sonic burner design and can influence the fame patter. The igniterless design has proven to be more repeatable. The most recent phase of the burner interlab study used a configuration that produced a hotter flame than previous burners. We plan to rework the burner setting to keep the flame temperatures where they originally were previously. Once these new settings are established, we can conduct tests in our lab using the new thermal blanket sample material recently acquired. We were unable to include blanket materials in the previous interlab study as the material supply had been depleted. There are plans for performing another interlab study with the new materials. The purpose is to ensure the updated burner configuration will produce equivalent test results to the igniter-type burner introduced in the AC documentation. The new igniterless burner will go in the Fire Test Handbook.
B. Gustavesen: You had mentioned performing a Phase for the interlab study. Are you still planning this for future?
T. Salter: Yes. We will let everyone know more about this, but we have some work to do at FAATC lab before we are able to proceed with it. We need to establish new baseline data using the new sample materials.

Thermocouple Research

T. Salter: While teleworking, I have been doing some research on new types of thermocouples and pricing. We are trying to find a compromise between longevity, stability, and reliability with the thermocouples without significantly impacting the price of them. We are trying to figure out the best thermocouples to use for the oil burner test methods. We are going to test various thermocouples in the lab.
M. Kelly: do you have an idea of about how much the external sheath expands by? It would be good to get together to work on this and not duplicate the research. Maybe we can get a thermocouple expert involved.
T. Salter: I would really like to have a conversation with someone who is familiar with the inner workings of thermocouples if you can arrange that. That would be great.
M. Kelly: I will work on setting that up.

Insulation Burnthrough Instructional Video

T. Salter: Cargo, Seat, Radiant Panel and Sonic burner videos are available on the FAA Fire Safety website. We have been trying to develop as many of these videos as we can because we have received a lot of positive feedback on them. We are thinking about developing more instructional videos in the future. The new insulation burnthrough video is essentially completed and can be posted to our website once we return from teleworking.

T. Marker: The videos Tim Salter mentioned are on the FAA Fire Safety website in the Handbook section. https://www.fire.tc.faa/Handbook.

TUESDAY, JUNE 9, 2020 (webinar)

Vertical Flame Propagation (VFP) Test Update – R. Whedbee (FAATC)

Review of what VFP test is and its objective. Objective: Proposed new test method for non-metallic, extensively used materials located in inaccessible areas i.e.: composite skin, structure, and sub-components, wires (insulation/jackets/sleeving), duct materials, and others (TBD).

Where we left off in October 2019: varying diameters of ducts and their results (flat vs. round and varying thicknesses) – these results were presented during October 2019 Triennial Conference in Atlantic City (https://www.fire.tc.faa.gov/2019Conference/conference.asp). Tina and I had experienced varying heat output per watt supply voltage and inconsistent heat flux values in our testing.

Where are we? Interlab Study (5 labs) of Heat Flux Gauges (HFG) was conducted. Goals: determine the variability among HFGs, use this deviation to evaluate HFG reliability. Rick reviewed the HFG Comparison results. Question: How many measurements were taken in each case? Whedbee: one 20–minute per gauge Question: Is each part an average of measurements or a single measurement? Whedbee: An average. Conclusions: 1) most gauges varied 0.03-0.1 w/cm^2, one gauge varied 0.11-0.17 w/cm^2. 2) will HFG be reliable going forward? Determine effect on burn length of these variances, visit HFG manufacturer to discuss calibrations. This led us to a Baseline Materials Assessment test series. Rick described the experiment set up. Effect on Burn Length was investigated and recorded. Conclusion: relationship between heat flux variation and the effect on burn length. Three (3) ranges shown. Max heat flux variation < of this material.

In March 2020, the Task Group discussed and agreed upon a heat flux calibration tolerance of +/- 0.05 w/cm^2. The Task Group also agreed to install a thermocouple to monitor inlet air and establish new air flow measurement using hood adapters. Still need to open a dialog with HFG manufacturers to discuss calibrations. Start Interlab Composite Testing. Simultaneously continue ducting materials & wires. Tina and I have been writing Test Plans while we have been on 100% mandatory telework status.

Interlab Study (Round Robin I) Pre-test Procedure, Test Procedure, and Post-Test Sheet reviewed.

RTCA Development of a New Flammability Test for Electronic Boxes – S. Rehn (FAATC)

This is primarily the same presentation I gave in Mobile in March 2020 due to our mandatory 100% telework since March 18. Since the October 2019 Task Group meeting: ventilation limit testing conducted, test standards contradictions. I have been working on a report on this work while on telework status. Steve described the new test method including Ventilation Limit Testing: test maximum ventilation that will not allow flames to pass through. Goal is to determine future enclosure designs that would not need to be tested. Create worst case scenario fire inside box and see if flames penetrate through vent holes. Videos of the Ventilation Limit Tests were shown and described. Highest open area percentage that "passed" this test was 1.43%. Is this too severe of a test? In March, Task Group discussed creating a more realistic worst-case scenario. This got too complex and would essentially be making a new test method to test an enclosure only instead of the electronic equipment as installed. More practical solution is to add guidance wording. Steve discussed the Test Standard Contradictions in RTCA DO-160G, RTCA DO-313, and also in a few Advisory Circulars (ACs). FAATC conducted some12-second Vertical Bunsen burner (VBB) Box Testing of 3D Printed box out of Ultem™ 9085 with removable lid. Video of these tests shown. Photos of boxes after tests were shown, and the results were described.

Results of 12-second Vertical Bunsen Burner (VBB) Testing conducted previously on box made out of metal were presented. We did this to get a better definition of what is a ventilated box. We need to get all of these standards documents to agree with each other. Steve discussed telecon test pass/fail criteria. Steve ran a few of these tests in the lab (video shown). We are going to try 7 thermocouples spaced 1 inch apart, placed above equipment being tested. This will be the first testing I do when I return to the lab. Conclusion: ventilation limit testing – almost anything will fail with enough fuel inside, no further testing planned. Need to reconcile ACs and RTCA documents.

TUESDAY, JUNE 9, 2020 (Zoom meeting 1)

Task Group Report for VFP – Tina Emami, Rick Whedbee (FAATC)

A discussion was had on the frequency of calibrating the VFP heater with a heat flux gauge. This will need to be further discussed. As of now and for the round robin the radiant heater calibration would need to be frequent (one calibration per set of 10 samples). Usual testing frequency could be reduced to twice daily.

Room temperature measurements – This was discussed as an important parameter in the VFP, more important than the back wall thermocouple reading. It was discussed that as of now, FAATC is measuring room temperature using an external data acquisition system, with a thermocouple within a radius of the VFP. It will be planned that this temperature should be taken centered underneath the air intake grate.

- It was asked that since the room temperature is so important, should the room thermocouple be changed with the back wall thermocouple or should we keep both for the test? We decided to both keep the back wall thermocouple temperature reading as well as adding a room temperature reading. For the VFP test, the heater should be pre-heated before testing for at least an hour. Although the back wall thermocouple temperature reading isn't a specification to be met, it can help with preheating times.

Heat Flux Gauge Manufacturer – It was discussed as to what type of heat flux gauge type to use and per what manufacturer. FAATC is using Vatell Gardon Gauges for the VFP now. This can be further looked into.

It was asked if the voltage of the heater will need to be monitored now because of the heat flux gauge addition. As of now, no it will not need to be monitored. The manufacturers of the VFP have mentioned that they will be including in the design of the heater to keep the heat output uniform.

FAATC will edit the round robin data sheet to input the room temperature measurement.

TUESDAY, JUNE 9, 2020 (Zoom meeting 2)

Task Group Report for RTCA – Steve Rehn (FAATC)

Task group participants discussed the testing that was shown in the IAMFTF webinar earlier in the day. The discussion focused mainly on the details of the testing, such as the reason a lighter was used to ignite the gases coming from the vent holes of the enclosures being tested. This was because the testing was meant to represent a worst-case scenario where the lighter simulates a capacitor or lithium battery exploding that would ignite the gases coming out of the box. The purpose of the testing was to find the maximum amount of ventilation where no flames could penetrate, but flames were able to with almost any small amount of ventilation.

Also discussed were the tests on a sealed box made from a thermoplastic material that passes the 12-second vertical Bunsen burner test. As per AC 25-17A, it is allowable to use a sealed enclosure constructed from a 12-second VBB compliant material and be exempt from testing its internal components. The 12-second VBB

test only determines if a material can self-extinguish, not if it can act as a fire barrier to contain a fire. The material could melt away and still pass the 12-second VBB test, thus making it unable to contain a fire of potentially flammable untested materials.

There are plans by the FAA of using thermocouples above the electronic enclosure being tested to measure the temperature as the pass-fail criteria. There were many questions about what temperature would be used as the cutoff for pass or fail. As of now, it is not known what temperature will be used. The plan is to take measurements from many different scenarios that have previously been tested, such as no flames coming from the enclosure, small flames for a short time, large flames for a long time, etc. and hopefully an appropriate cutoff point can be found in order to get an objective measure of pass or fail. This cutoff point could either be a peak temperature or a temperature threshold for a certain period of time.

The main objective requested by the task group members was more guidance material to reduce and simplify future testing. Specifically if an enclosure is used in several configurations of internal components, if the configuration with the highest internal fuel load can pass the test, then the other configurations do not have to be tested. One problem mentioned was that the suppliers typically don't perform the certification testing so that might need to change in order for them to say, "this enclosure passed with X amount of circuit boards and Y amount of lithium batteries so anything less will automatically pass." Another suggestion was if all the circuit boards in an enclosure are UL94-V0 certified and there are no other threats like capacitors or batteries, then it should automatically pass. The UL94-V0 test is more severe than the 12-second vertical Bunsen burner test that circuit boards currently need to pass.

TUESDAY, JUNE 9, 2020 (Zoom meeting 3)

Task Group Report for Radiant Panel Testing – Steve Rehn (FAATC)

During the radiant panel task group meeting, the state of current testing was discussed. An update on a study comparing three different insulation backing boards using a foam test sample that melts was given. Two out of the three labs involved finished their testing while the third lab has been unable to test because they originally had to purchase a new radiant panel apparatus and now are forced to work from home. The results of this testing will be used to update the handbook to better define the insulation backing boards used under the sample being tested.

The task group also discussed the radiant panel aging study, which will be used to develop guidance on when to replace a used electric panel. The FAATC and several other labs have seen discrepancies in test results as a panel ages, which can be fixed by replacing the panel. The FAATC has seven panels, some old and new, and can measure several parameters such as power, resistance, surface emissivity, temperature, heat flux, and material test results in order to define a criteria of when to replace a panel. A "borderline" material is needed that can show a difference between an old and new panel in order for testing to begin, so the FAA made a request to any company that can supply such a material.

Another question that was raised was about the heat shield that goes on the back of the drawer in order to block heat from the panel when loading the test sample. In the Fire Test Handbook, it stated to use 0.25 inch or 13 mm thick refractory board as the heat shield, which are not equivalent. The 0.25 inch measurement was a misprint, since the original rule stated to use a 0.5 inch thick board. This was corrected in the latest Handbook update, but a couple labs may have 0.25 inch thick heat shields now.

Recently, there have been several problems with new electric radiant panels manufactured by PMI. There have been issues with the black paint on the surface chipping off after minimal use. This was a known issue that the FAATC was told had been fixed, but it possibly has not been. It was also brought up that new panels have warped on their own and shorted out after about two months of use. This is completely unacceptable if this is happening and the FAATC will contact PMI to try to fix this problem.

WEDNESDAY, JUNE 10, 2020 (webinar)

Heat Release Rate Updates – M. Burns (FAATC)

Background:

OSU Voltage Round Robin (March 2019 – Boeing)

Implemented globar voltage and current monitoring (April 2019)

Summary of airflow effect on material heat release results using OSU Calorimeter (T. Spanos – Boeing)

HR2 Nominal Operating Parameters Range (Y. Agyei – Boeing)

Current work (June 2020)

Investigation into mass flow controller replacement with sonic choke – in progress

TRL 6

Globars

R&D Heater: zone heater developed to eliminate globars and to provide a more uniform and safer heater assembly. First prototype used two heating zones. FAA tests showed more efficient heating (less current) but not enough zonal adjustment. Three zone heater. Mike showed photos of heater. Status of heater: complete with identical resistive heaters in all three zones controlled by three Watlow controllers. This will be shipped to FAATC for R&D testing when able to do so. This is R&D work.

HR2 Sonic Choke (R&D Work):

Mike provided background and description of the sonic choke. This is currently R&D work. Installation drawing of sonic choke was shown and described. Photo showing sonic choke installation was shown and described. HR2 Sonic Choke Theoretical Data (can be found in Yaw Agyei's March 2020 IAMFTF presentation on Fire Safety website). Mike reviewed some of the items to be considered for sonic choke.

T. Marker: When we have purchased sonic chokes for the sonic burner, we have never calibrated them because they come with a calibration sheet. Why did you do CEESI calibration? Burns: I did that for my own comfort. T. Marker: It does not sound like that is a necessary thing. I don't think it would really be a requirement if a test facility is going to purchase a choke. Question: What is the cost of the HR2 heater? Burns: No cost information provided by manufacturer yet.

Observed Interactive Effects on OSU Apparatus – Theo Spanos (Boeing)

Summary of airflow studies conducted in recent past: we presented this at the October 2019 Triennial Conference in Atlantic City (https://www.fire.tc.faa.gov/2019Conference/conference.asp). Theo reviewed the (2015) Airflow Studies briefly. Theo reviewed the observations during the airflow studies: multiple relationships were observed with high correlations – he provided more details on this. Boeing Everett and Charleston labs conducted these experiments. Boeing BR&T flammability conducted additional experiments recently. Theo reviewed the Experimental Design. Correlation of Variables (heat map) was presented. Calibration Constant – Boxplots and Effect Plots of the tests were presented. Peak Heat Release Boxplots and Effect Plots were presented. Peak Time Boxplots and Effect Plots were presented. Two Minute Total Boxplots and Effect Plots were presented.

Overall observed relationship matches prior discussions that the more air into the lower plenum, the higher the two minute total values except total flow rate over the ranges tested.

Summary/Discussion: Calibration Constant, Peak Heat Release, Peak Time, and 2-Minute Total Heat Release. In order to reduce industry variability, the largest lever we have is to control the airflow, which will be applicable to both OSU improvement and HR2 development.

Additional Statistical Observations will be presented during the Heat Release Task Group meeting today.

HR2 TRL 6 Status Update – Yaw Agyei (Boeing)

TRL 6 Objective: Conduct unit response and material test assessment to evaluate the reproducibility of Heat Release Rate (HR2) test methods: 4 units at 3 locations (2 units at FAATC, 1 at Airbus, and 1 at Boeing). Let us know if other labs are interested.

Status of TRL 6: FAATC Unit 1 assessment is complete. FAATC Unit 2: Mike Burns will be completing this as soon as he can go back into the lab. Airbus: unit 3 requires hardware and software upgrades. Boeing: unit 4 in capital procurement process.

TRL 6 Schedule: budget and execution heavily impacted by Covid-19. As soon as we have a new schedule, we will communicate that to the Task Group and present it at the next IAMFTF meeting.

TRL 6 Units Response Assessment: 1). Operating response limits set using Unit 1 – HR2 prototype 2). TRL 6 units assessment.

Production Unit Assessment (Proposal): new units for production/certification capability assessed using Process Capability Index (CpK) – this proposed by Katy Wrenn and Applied Math team at Boeing. Yaw reviewed this proposal.

Moussa: Labels for X and Y axis of slide 7, please. K. Wrenn: This is just a general slide of the distribution of data. Think of unit response on X axis. It applies to the parameters we set: baseline temp parameters, thermal stability temp, and calibration factor. Vargas: When do you expect to start building of production units, and how do we get the most current information for building new units? Burns: Chapter 4 is in the NPRM which is accessible through the Fire Safety website (www.fire.tc.faa.gov).

WEDNESDAY, JUNE 10, 2020 (Zoom meeting 1)

Task Group Report for Heat Release Testing – Mike Burns (FAATC)

R&D Heater Update:

There is FAATC R&D interest in trying to remove the globars from the air stream within the HR2 unit. Marlin Engineering developed a prototype design in collaboration with FAATC and Task Group team. The cost and design drawings are currently not available. The system employs a 3-zone heat control (upper, center and lower). Some areas of concern were discussed, including: burned products from certain materials/plastics/etc. that may affect the useful life of the heating elements; products on the quartz glass affecting transparency changes; longevity and durability of the heater and also 4-corner uniformity capability.

CE labeling for electrical parts used in the machine was discussed. Martin Spencer commented the plan is to use low voltage DC for this component, so we would not have the same issues we would have with higher voltage AC. Eventually the hope would be to publish a specification for the heater.

The target date for testing was initially scheduled after the TRL 6 testing is completed, however due to the current pandemic status delay of additional units, this priority may be moved up. **T. Marker**: are the globars the same for the HR2 and the OSU? Can this new heater be installed in mostly all currently-operating OSU's? **M. Burns**: the current globars operating in the HR2 units are the same as the OSU, however it's not that easy to retrofit all current OSU's due to different bolt patterns or dimensions of the rear globar pan. Potential labs

interested in installing this heater to assist in gathering data may want to reach out to manufacturers for additional assistance (there was never really a standardized specification on the rear globar pan dimensions of OSU's).

Martin Spencer commented one of the benefits of using these AC/DC power supplies is the ability to easily regulate power output (power control to the new heater elements). **S. Campbell**: how vulnerable is this new unit to 'panel popping' damage. **M. Spencer**: the heater is protected by a quartz glass barrier to prevent potential damage from such an event (This is the same glass that is used on windows and other high temperature fire test equipment). It is most likely too soon to speculate.

Sonic Choke R&D Project

This is an FAATC R&D project at this time to gather data. If we can control temperature and pressure precisely, then it may be a viable option in the future. FAATC provided initial sonic choke validation data by a third party (CEESI; cost of calibration $1785 US). **Burns/Marke**r confirmed that the company that provides the sonic choke provided calibration information as well. FAATC and Task group members didn't feel the need for spending the additional money for lab requirements to calibrate the choke annually (or even once). There will, however, be an annual disassembly and cleaning requirement procedure written up for review going forward.

Pressure regulation is extremely important with the sonic choke. It was agreed to require two inline pressure regulators for better control (Coarse and Fine control). A range specification for each will be called out.

The location of reference thermocouple: Currently this thermocouple is located in the lower plenum and measures air inlet temperature for the thermopile. With the use of the sonic choke this will need to be relocated to the sonic choke inlet. With this action, there will be no other penetrations in the lower plenum itself. Note: One item for manufacturers to consider is to install pressure taps to have the ability to monitor the lower plenum and interspace pressures periodically. **M. Burns** mentioned that there may be a difference of a few degrees between the lower plenum and the choke inlet but all participants felt this would not have a large impact in the operation of the thermopile.

M. Burns informed the participants that the current planned configuration of this sonic choke is to have it threaded directly into the lower plenum inlet port immediately downstream of the 'fine' control pressure regulator. The reference thermocouple will also be mounted in this same regulator along with an absolute pressure transducer. The absolute pressure transducer would have an annual calibration requirement (output to DAQ).

The discussion also included possible filtration requirements and if so what Micron size? Action item for FAATC is to contact the manufacturer for additional guidance.

It was agreed by task participants not to include the addition of a mass flow meter mounted downstream of the choke to validate/monitor flow.

Finally there were questions asked about where to locate the specification drawings to build an HR2 unit if desired. All information can be found on the FAATC's Fire Safety website in the interim final report on Handbook III:

https://www.fire.tc.faa.gov/pdf/TC17-55.pdf

- A4-1 Heat release rate apparatus
- APPENDIX L—HR2 TEST APPARATUS AND EQUIPMENT DETAILS

Task Group Report for Additional Statistical Data/Observations – T. Spanos and K. Wrenn (Boeing)

K. Wrenn provided more details on the statistical data presented during Theo's webinar presentation. Y. Agyei from Boeing confirmed that for each test configuration a calibration was conducted. **B. Johnson**: I see this as a sensitivity analysis. Maybe information from this can be used to adjust settings to make less sensitive. **M. Anglin**: it seems like there are some fairly easy ways to tweak the controls with this machine. **B. Johnson**: Other adjustments could be done with variations in the airflow. **M. Anglin**: It really makes us think about using the sonic choke (in OSU). **M. Burns** confirmed that OSU sonic choke data was briefly looked at many years ago at FAATC (I will look into finding this data). **T. Marker**: in terms of cost, the combination of sonic choke and the pressure regulator, what would be that cost in comparison to a mass flow controller (MFC) used in the HR2? **M. Burns**: the MFC we currently have is approximately $4,600 plus annual calibration costs. Pressure regulator and sonic choke: Choke ($850), regulator ($300), plus cost of transducer ($300). You would still have annual pressure transducer calibration costs. **B. Johnson**: it would make sense going forward to evaluate the sonic choke set up vs. MFC set up with their ability to regulate upstream conditions with an upset in airflow. **S. Campbell**: what could be the most effective way to control total airflow and airflow split? **Y. Agyei**: that is kind of what we did in the experiment Katy and Theo just presented. We did not use the orifice meter. **T. Marker**: I think we have two parallel topics here. I think these are related but separate by the HR2 or OSU machine. **M. Spencer**: One of the things that Mike and I discussed, was the inability to use a blower system if using a choke (requires much more upstream pressure). **Y. Agyei**: What is the noise level of the sonic choke? **M. Burns**: It is quiet and only ¼ of the total flow in the OSU. **T. Marker**: Trying a regulator and a sonic choke on each of the streams would provide excellent control of the split ratio. **M. Burns**: If used in the OSU, what comes into play on currently certified materials (example: If an OSU produces different results with the new choke configuration)? **Y. Agyei**: It would be a slightly different design. **M. Anglin**: A tweak to the Handbook possibly? **M. Burns**: My focus up to this point has been to develop and standardize the HR2 and not make adjustments to the current OSU. **T. Marker**: We have had the OSU for 30+ years and lived with its inconsistencies, and Mike's task has been to develop a machine on a similar platform with better control (HR2). **T. Marker**: FAATC Action: we will take an action to have an internal discussion on that. Mike, Tina, and I will discuss this further – what direction we want to go in terms of the OSU. **J. Gardlin**: I think that is a good idea. I think maybe it is a matter of who is leading which effort and what our role is. I think everyone recognizes that the OSUs out there are not going anywhere. I think just discussing how we deal with this approach is good. If there are ways to make the OSU better, no one wants to stand in the way of that.

Task Group Report on Technical Readiness Level (TRL) 6 – Yaw Agyei (Boeing)

Note: The time sort of ran short for additional discussion on this topic. **B. Johnson**: Does everyone understand why we would move towards CpK? (no additional questions were asked in reply). **Y. Agyei**: The more units we have for the TRL 6, the better. If your lab is going to be purchasing an HR2, let the Task Group know (contact Mike Burns). **M. Spencer**: would the manufacturers have to provide evidence that they meet the CpK requirements? **Y. Agyei**: it would not fall on the manufacturers. It would fall on the end user to qualify their unit in order to participate in the TRL6 testing activities.

WEDNESDAY, JUNE 10, 2020 (Zoom meeting 2)

Task Group for Waste Compartment Fire Containment – Scott Campbell (Safran)

Task Group Activities: (impacted by Covid-19)

1. Redline proposal on Chapter 10 (Fire Containment Test of Waste Stowage Compartments) of the FAA Fire Test Handbook is still pending (see proposals in the March Presentation located on the FAA meeting website).
2. Fleshing out similarity substantiation MOCs stalled.

The main topic discussed at this task group meeting was an increased interest how to certify touchless waste flaps. Several electronic touchless waste flap design and certification aspects were presented and included in the presentation (based on Safran, Airbus and EASA experience). Mechanical foot pedal based designs are potentially more straight forward.

Sent out to the task group the Excel file with the proposed similarity MOCs. Will propose a task group WEBEX meeting for July 29th 7:30AM PST to further discuss our actions.

THURSDAY, JUNE 11, 2020 (webinar)

Relationship between 3D Printed Materials and Flammability – S. Rehn (FAATC)

3D printing introduces all new variables in material construction. Steve reviewed the variables the test plan will focus on and reviewed the Test Plan. FAATC and Airbus have done testing on infill percentage. Steve described calculating the infill percentage. FAATC tested with Ultem™ (PES) and Ultem™ 9085 (PEI) materials. FAATC tested infill with solid outer layers: 0.10" thickness, 2 solid outer layers, is hollow infill, Ultem™ (PES) and Ultem™ (PEI). Results of tests conducted at FAATC were presented. Steve also reviewed data from infill only, 0.20" thickness Ultem™ 9085 tests. Steve noticed less burning with the 0.20" thickness material.

Additive Manufacturing Vertical Bunsen Burner (VBB) Advisory Circular (AC) – S. Rehn (FAATC)

Steve began writing an Advisory Circular for vertical Bunsen burner testing of 3D printed materials. We can discuss this further during the Task Group meeting later this morning.

Conclusion: Less infill percentage is more severe case than more infill; agrees with Airbus test results using Ultem™ 9085, thinner samples produce a more severe case than thicker samples. J. Davis: Thin, low infill systems, for burn length how much was real burning vs. melting. Rehn: Real burning not melting because we try to go by the Handbook. Marker: Do you see this moving towards any OSU based materials in the future or no? Rehn: I think Mike tried to do some OSU testing a while ago, and it created a big mess.

Additive Manufacturing: Progress on Ultem™ 9085 – T. Krause (Airbus)

Thomas reviewed test results for a number of tests outlined by the Additive Manufacturing Task Group. Photos of some of the materials tested were shown and discussed. Results: variation of infill for different orientations graphs were discussed. We will discuss how we will move in during the Task Group meeting today. Thomas outlined the planned Next Steps. Maloney: Are there any plans or discussion by Airbus or the FAATC to test parts for methods of printing other than FDM? Rehn: FAATC – not as of now, because we only have an FDM printer.

Material Change Similarity – R. Lyon (FAATC)

Microscale Method to Determine Equivalent Flammability (Similarity) of Combustible Components: The important thing is understand where this number comes from. I am going to talk about what we are doing on the development of the standard with ASTM.

14 CFR 25 (FAA) Fire Tests being compared: FAA Rate of Heat Release, Radiant Panel, and Vertical Bunsen Burner tests. Rich explained the Burning Model of Solids and what they are going to look for in comparing these tests- (Burning temperature). Ignition Temperatures: MCC – Cone. We have published a paper on ignition temperatures. We did some measurements of surface temperatures in Cone Calorimeter and MCC. Results of these tests were presented. Fire Growth at Bench-Scale is 2-D: we are going to look at horizontal flame spread (radiant panel, horizontal Bunsen burner [HBB]) or vertical upward spread (in vertical Bunsen burner [VBB]) or in OSU, VFP. Equation for Fire Growth Capacity (FGC) was explained. Accurate FGC by

Correcting for Baseline Drift in the MCC: thermal expansion of the purge gas in the pyrolyzer during the test has effect of: increasing the terminal flow rate (Methods A and B). Diluting O_2 at the sensor (Method A).

At High Sensitivity Baseline Drift is Mainly Due to O_2 Sensor Fluctuations: Rich described two tests for same material (aircraft phenolic resin). He explained Correcting MCC Data for Baseline Drift. This Baseline Correction to D7309-19 is a Balloted Item in ASTM D20.30 Subcommittee on Thermal Properties of Plastics. FGC is Independent of Choice of Baseline.

Conclusions: ignition temperature and burning temperature of components identified in MCC. FGC combines flame spread and burning rate in a single parameter and is useful for comparing flammability of polymers at microscale. Microscale (FGC) criteria for equivalent bench (kg) scale flammability of certified and sub components has been demonstrated (Natallia will talk about this in today's Task Group meeting).

M. Miler: Are the individual case studies for particular aircraft interior materials (i.e.: dec-lam, thermoplastics) available to review somewhere? R. Lyon: Natallia Safronava (FAATC) is writing a report. It will be available on the FAA Fire Safety website when it is finalized. This information will also be in Natallia's Powerpoint presentation during today's Task Group meeting.

THURSDAY, JUNE 11, 2020 (Zoom meeting 1)

Task Group Report for Additive Manufacturing – Steve Rehn (FAATC), Thomas Krause (Airbus)

A very early draft of an advisory circular (AC) for guidance of how to test 3D printed materials has been started. It was sent to the task group members before the meeting to discuss. One question was whether we could add this guidance to the unreleased Bunsen burner AC 25.853-4X instead of making another AC. The group did not get an answer during this meeting. There was discussion on the infill percentage part of the guidance. It states that testing lower infill percentage can be used to substantiate higher infill percentages but testing has shown that the middle ranges (40% - 60%) of infill percentage can have longer after flame times than the lower ranges with Ultem 9085 material. However, this only happens when only the infill is tested, and not with any solid outer layers, which is not very realistic. A few new ideas to produce more data for infill percentage testing are to test thinner 0.02 or 0.04 inch thick Ultem 9085 samples or test very thick samples, 0.5 or 0.75 inch, with solid outer layers to determine whether the large number of infill layers will burn.

SABIC stated that they have non-3D printed Ultem 9085 samples that can be tested to compare to 3D printed samples. Wulfmeyer has volunteered to do thermogravimetric analysis to determine any material changes that may occur from the 3D printing process compared to conventional manufacturing processes.

For future work, the FAA and Airbus will continue testing different 3D printing parameters to continue to build on our data set. HondaJet has previously volunteered to do additional testing and they will likely repeat some of the testing that has already been done in order to get a third data set for comparison. The infill percentage data has been similar and had the same basic trends but did not line up perfectly so a third data set would be helpful.

Another idea was to try to calculate the surface area of materials with various infill patterns. UL research suggests a correlation between surface area and flammability test results. This calculation will be difficult with the complex printing patterns done by the 3D printer but it is something that can be attempted.

A comment by DGA regarding the Policy Statement #3 (Data from testing a thinner construction substantiates a thicker construction made of the same materials.) was discussed, as some laminates show increasing after flame time for higher thicknesses. It was found that for the thermoplastics currently discussed in the group, the simplification of the Policy Statement stays valid.

THURSDAY, JUNE 11, 2020 (Zoom meeting 2)

Task Group Report for Material Change Similarity - John Harris (Boeing) and Rich Lyon (FAATC)

The Material Change Similarity Task Group convened a virtual meeting within the International Aircraft Materials Fire Test Forum and recorded the 3rd highest attendance (88 participants), including all three of the licensed manufacturers of the FAA's microscale combustion calorimeter (MCC) due to the convenience of the on-line format. Discussions were limited to comments during the presentations because the Zoom meeting time had inadvertently expired.

Webinar: Rich Lyon (FAATC) presented a webinar on "Microscale Method to Determine Equivalent Flammability (Similarity) of Combustible Components," describing the physical basis, calculation and utility of the Fire Growth Capacity/FGC, which is a MCC parameter that combines burning rate and ignitability into a single metric to better discriminate between levels of performance in 14 CFR 25 bench scale tests.

Material Similarity Using MCC Method: John Harris opened the meeting with a review of the Task Group Goals and discussed key steps in the path forward. These include, in order of completion: 1) Publication of the FAA report documenting the physical basis, use and accuracy of the MCC baseline correction that will be the basis for; 2) A revision of the ASTM D7309-19 standard to address negative votes on the nomenclature of the proposed baseline correction; 3) A limited inter-laboratory study (ILS) within the Similarity Task Group of low heat release aircraft materials to confirm the precision and (lack of) bias of the new heat release rate calculation and baseline correction in ASTM D7309-19 so as to gain experience on the repeatability and reproducibility of the revised ASTM Standard; 4) Publication of the FAA report on the Fire Growth Capacity/FGC that establishes the physical basis and utility of the proposed metric for microscale determination of equivalent flammability (similarity) of substituted components of constructions; 5) Publication of a FAA report documenting the results of an FAA/aircraft industry study on the validity of the MCC Similarity Criterion:; 6) Drafting an Advisory Circular that is based on the MCC similarity metric (FGC) and similarity criterion, $\Delta FGC/FGC \leq \Delta X/X$, where X is a 14 CFR 25 test result for a certified construction containing the certified component. If sufficient test data exist or is generated, ΔX may be taken to be twice the standard deviation of X.

Discussion during the talk identified the need for industry-wide standardization on MCC testing process and data reduction, and the ILS pilot study will provide a test run of the D7309 test method to allow for modifications made before the final ILS. **John Harris** (Boeing) explained the requirements for the ILS and the pilot study ILS and recommended doing a small scale ILS within the IAMFTF before opening it up to the ASTM D20.30 committee. John recommended getting a list of participants and materials because Boeing has noticed a difference in MCC results for formulations of supplier A and supplier B in an earlier study A discussion of the test materials indicated that phenolic materials have poor reproducibility due to non-homogeneity of the cure chemistry, so well-behaved phenolic resins are being solicited from the Task Group. John also indicated that his time at Boeing is under close scrutiny, but he should be able to at least have the planning meeting. **Rich Walters** (FAATC) suggested that polystyrene be included because it is the ASTM D7309 reference material but was not included in the previous ASTM D7309 ILS. Rich Walters also suggested we use the same set of materials as last time so there is a historical crossover for the inter-laboratory study. We can substitute the PS standard for HIPS or use the PS standard as the screening round material. Rich Walters also questioned the use of halogenated materials in the inter-laboratory study (other than the PVC used previously). It may be possible to substitute one of the other materials offered for the ILS, e.g., KYDEX, instead of PVC. One halogenated sample is plenty. Rich also suggested using a multi-component composite material to evaluate how bad the results can get where sampling location can alter the results significantly. **N. Wright** of SEKISU KYDEX volunteered to provide KYDEX PVC/acrylic alloy for the pilot ILS. **E. Pyun** of 3M volunteered to supply a 3M structural epoxy adhesive for the internal ILS. **Jeff Gardlin** (FAA) stated that he thought that what the Similarity Task Group has been doing is good in principle. **Rich Lyon** (FAA) said that outstanding reports revealed that reports 1), 3) and 4) above are about 99% complete and would have been published by now if not for the pandemic. **Scott Campbell** (Boeing) stated that when they (Boeing) fire test aircraft interior

constructions that have two or more layers in the OSU, changing one of these can result in synergistic/antagonistic effects in the burning behavior by changing the way it degrades during combustion, which changes the fire dynamics. John Harris stated that if you know the mass percent of combustibles in a thin composite, the heat release are repeatable to within about 8%. John Harris also mentioned that process variations often affect the fire test dynamics as much as the flammability of the combustible component. Rich Lyon commented that the antagonistic effect of process variations, which is not a component flammability issue, is accounted for by the inequality in the MCC similarity criterion, i.e., $\Delta FGC/FGC \leq \Delta X/X$. **Albert Moussa** (BlazeTech) questioned this approach, and Rich Lyon replied that the AC on Material Change Similarity would probably be interpreted narrowly until more data was available.

Small Scale Fire Test for Component Substitutions in Aircraft Materials – Natallia Safronava (FAATC)

Natallia Safronava (FAA) reviewed the Task Group Goal of develop guidance on determining equivalent flammability of components that must be substituted due to unavailability, environmental problems or cost, using the MCC Similarity Process. Natallia presented the results of a validation study to prove the concept of determining equivalent flammability of a component of a certified construction using a 10 mg sample in the MCC and a statistical acceptance criterion. Natallia reviewed the results of 12 industry case studies using the MCC Similarity Criterion that included phenolic resin systems, adhesives & potting compounds, decorative laminates, thermoplastics, paints/coatings, and insulation blankets. Natallia explained the step-by-step process for each Case Study, some of which included results from multiple laboratories. Case Studies were grouped by 14 CFR 25 fire test rather than by material type or use in the airplane. At the present time the FAA report is being written and no additional tests are planned. The validation study data is included at the end of the presentation which is posted on the FAA Fire Safety website.

THURSDAY, JUNE 11, 2020 (Zoom meeting 3)

Task Group Report for Disinfection Agents Impact on Interior Materials Flammability – Jim Davis (AccuFleet)

This is the first meeting of this group. The CV19 pandemic has caused a substantial change in the quantity and type of chemicals used in the cabin. This group is attempting to characterize the effects of these chemicals on aircraft fire safety.

Jim Davis gave an overview of the aviation industry status and response. An initial run-down of stakeholders and regulators includes OSHA for workers applying chemicals, EPA for effects on the passengers onboard, FDA and CDC for the effectiveness of killing viruses, and the aircraft regulators like FAA and EASA for the effect of chemicals on aircraft.

After the overview, there was discussion by the group members on how to effectively focus efforts to support safe aircraft (both from a disease and fire safety perspective). The group was surveyed, and a number of different entities were identified that are investigating the effects on aircraft. These include:

- SAE SEAT committee (focusing on the effects on seats, including flammability, structural integrity and appearance)
- Airlines For America (A4A)
- Aircraft Interiors Materials Hygiene Working Group (build materials that support safety)
- Individual Airline efforts

One objective is to eliminate duplicative efforts. Jeff Gardlin noted: It would be useful to try and compile the activities that are going on in various forums. There is some value in a little bit of duplication because there are so many unknowns. One of the things that is of interest is the use of the FAR UVC because it moves away from some of the issues that the chemicals have.

There were discussions about UVC, noting that: if a tray table is not open, it will not get hit with ultraviolet. Structurally, there is a concern about embrittlement of thermoplastics by UVC. The most attractive feature is that no residual chemical is left in the cabin when passengers board. It was noted that a good cleaning is needed to clean the surface **before** UVC, because UVC does not penetrate – it only affects the surface.

Tim Marker noted: for our purposes here, we are looking into what the impact these processes/chemicals have on the interior materials flammability not the efficacy of the products used. Jeff Gardlin: We need to keep in mind the distinction between cleaning and disinfecting. The means of delivery and the medium you are delivering are closely linked (wiped on, electrostatically applied, fogged, etc.).

Kevin Walsh noted: The SAE effort is specific to seats in the aircraft – sterilization or disinfection of the seats. Further, we are working with NIAR on a research program to take the major disinfecting agents and the major components of the seat for strength, flammability, and brittleness (from a head impact point of view).

While these groups will **NOT** be looking at the effectiveness of the chemicals for killing viruses, there is a need to keep an information channel open to the medical efforts. Aviation needs to be investigating those chemicals and methods proposed as most effective by the medical establishment.

Next Steps: Attendees of the Working Group will be surveyed to gather information on groups they know of that are working in this area (for liaison efforts), and those chemicals and methods that are currently being used or are planned.