International Aircraft Materials Fire Test Forum Meeting

Short Takes and Current Projects

Presented to: International Aircraft Materials Fire Test Forum, Montargis, France

By: Tim Marker, FAA Technical Center

Date: June 6-7, 2018

Federal Aviation Administration

New Name, Same Group

Old:

International Aircraft Materials
Fire Test Working Group (IAMFTWG)

New:

International Aircraft Materials
Fire Test Forum (IAMFTF)

New Name, Same Group

Why?

International Aircraft Materials Fire Test Working Group (IAMFTWG)

“Group” implies membership

New Name, Same Group

Annual Announcement will be made in the Federal Register:

ACTION: Notice of meeting.

SUMMARY: The Federal Aviation Administration (FAA) is announcing the…

Date and Location:

FOR FURTHER INFORMATION CONTACT:

SUPPLEMENTARY INFORMATION:

- **Agenda for the 2018 IAMFTF and IASFPF Meetings**
- **Attendance at the upcoming meetings**
- **Record of the Meeting**

Red Line Process for Updating Fire Test Handbook

Posted 4/10/18

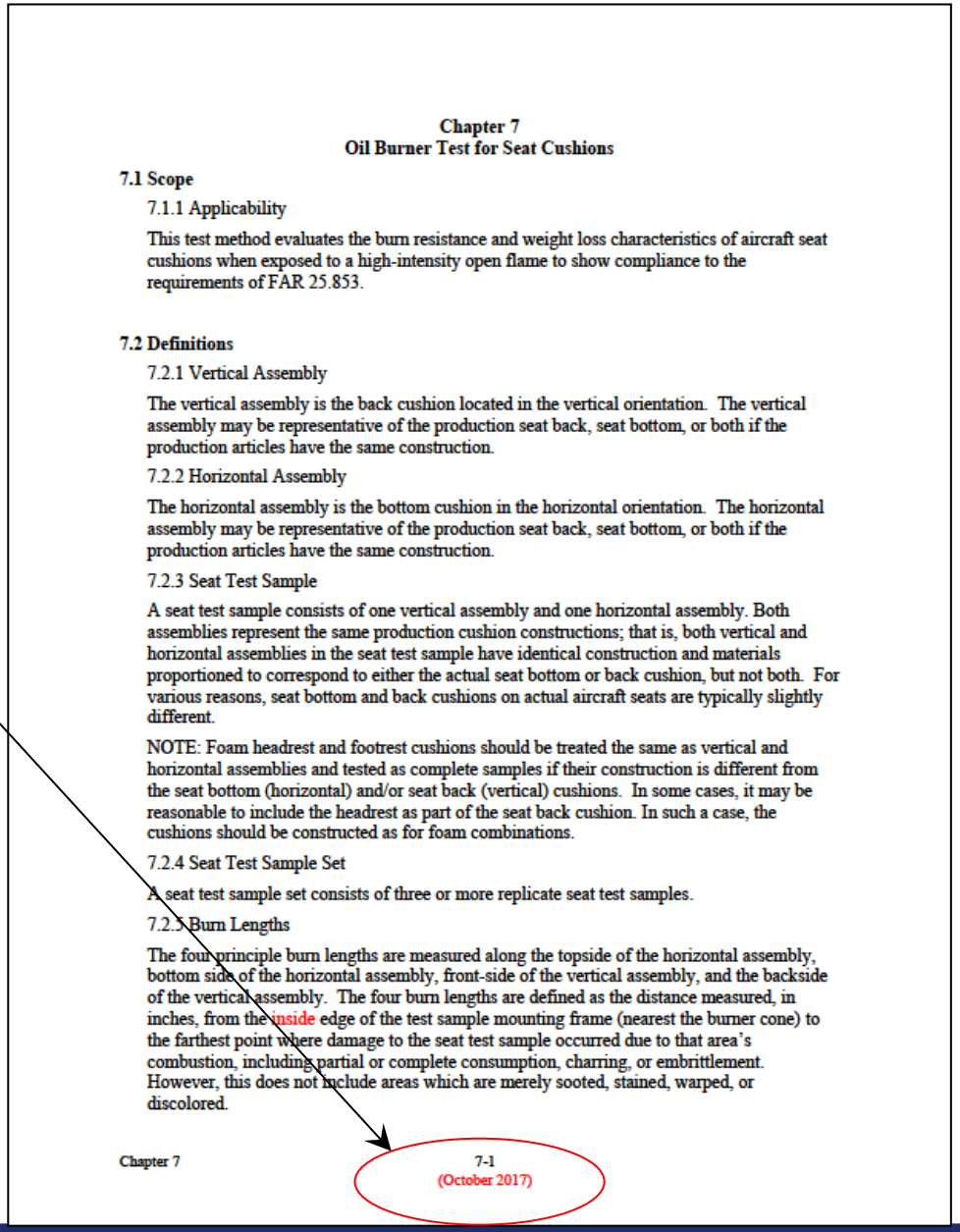
The Fire Test Handbook can be considered a living document, which can be edited and updated as new information becomes available. Some of these updates are simple corrections that are discovered with wording, terminology, or unit conversions. Other updates are procedural in nature, in which the execution of the test or the test arrangement or apparatus is improved.

Red Line Process for Updating Fire Test Handbook

(Cont'd)

In an effort to minimize confusion, a simple process has been developed to keep track of any edits or updates, while maximizing clarity of the test procedure. First, all Handbook chapters will now be tagged with a date at the footing of each page. The date will be given in month/year format, in red text. This will enable end users to determine if they have the latest version, by comparing their lab's version (printed in many cases) against what is available on the Fire Safety Branch's website. The FAA strongly encourages using the most recent version available

Date



Chapter 7
Oil Burner Test for Seat Cushions

7.1 Scope

7.1.1 Applicability

This test method evaluates the burn resistance and weight loss characteristics of aircraft seat cushions when exposed to a high-intensity open flame to show compliance to the requirements of FAR 25.853.

7.2 Definitions

7.2.1 Vertical Assembly

The vertical assembly is the back cushion located in the vertical orientation. The vertical assembly may be representative of the production seat back, seat bottom, or both if the production articles have the same construction.

7.2.2 Horizontal Assembly

The horizontal assembly is the bottom cushion in the horizontal orientation. The horizontal assembly may be representative of the production seat back, seat bottom, or both if the production articles have the same construction.

7.2.3 Seat Test Sample

A seat test sample consists of one vertical assembly and one horizontal assembly. Both assemblies represent the same production cushion constructions; that is, both vertical and horizontal assemblies in the seat test sample have identical construction and materials proportioned to correspond to either the actual seat bottom or back cushion, but not both. For various reasons, seat bottom and back cushions on actual aircraft seats are typically slightly different.

NOTE: Foam headrest and footrest cushions should be treated the same as vertical and horizontal assemblies and tested as complete samples if their construction is different from the seat bottom (horizontal) and/or seat back (vertical) cushions. In some cases, it may be reasonable to include the headrest as part of the seat back cushion. In such a case, the cushions should be constructed as for foam combinations.

7.2.4 Seat Test Sample Set

A seat test sample set consists of three or more replicate seat test samples.

7.2.5 Burn Lengths

The four principle burn lengths are measured along the topside of the horizontal assembly, bottom side of the horizontal assembly, front-side of the vertical assembly, and the backside of the vertical assembly. The four burn lengths are defined as the distance measured, in inches, from the inside edge of the test sample mounting frame (nearest the burner cone) to the farthest point where damage to the seat test sample occurred due to that area's combustion, including partial or complete consumption, charring, or embrittlement. However, this does not include areas which are merely sooted, stained, warped, or discolored.

Chapter 7 7-1 (October 2017)

Red Line Process for Updating Fire Test Handbook

(Cont'd)

Second, all changes to the chapter will be denoted in red text. In some cases, text strikethrough will also be used, to further indicate exactly what has been altered. Third, with the exception of minor corrections to spelling, wording, or incorrectly converted units, all changes must first be discussed during International Aircraft Materials Fire Test Forum (IAMFTF) meetings, which are held three times per year. A majority of the test method details and information are obtained through discussions that take place during these meetings. Industry experts most familiar with the test methods and equipment share their experiences with the public, including other industry experts, as well as the FAA and other regulatory authorities in attendance.

Revised Text

7.2.6 Percent Weight Loss

The percentage weight loss for a seat test sample is the pretest weight of the seat test sample less the posttest weight of the seat test sample expressed as the percentage of the pretest weight. All droppings falling from the seat test sample and test sample mounting frame are to be discarded prior to determining the posttest weight.

7.3 Apparatus

7.3.1 Test Sample Apparatus

The test sample apparatus ~~includes~~ the seat test sample mounting ~~frame~~ and drip pan. The arrangement ~~of~~ the test sample apparatus is shown in figures 7-1 and 7-2.

7.3.1.1 Test Sample Mounting Frame

Fabricate the sample mounting frame for the seat test sample from 1- by 1- by 0.125-inch steel angle and 1- by 0.125-inch steel flat stock as shown in figure 7-1. The dimensions listed for the test sample mounting frame are all inside measurements. The frame's upright section used for mounting the vertical assembly must be 33 ± 0.125 inches high and 18.125 ± 0.125 inches wide. The frame's bottom section used for mounting the horizontal assembly must be 18.125 ± 0.125 inches wide and 22.125 ± 0.125 inches long. The vertical and horizontal mounting surfaces should have two supporting braces made from 1- by 0.125 inch steel flat-stock. The centerlines of the flat stock braces are 6 ± 0.125 inches measured from the outer edges of the steel angle on the left and right sides of the frame. Four legs fabricated of 1- by 1- by 0.125-inch steel angle, and 12 ± 0.125 inches tall, are located below the four corners of the horizontal assembly mounting section of the frame. All connecting joints of the stand are welded and the flat stock components are butt-welded. The test sample mounting frame is used for mounting the seat test sample horizontal and vertical assemblies. The position of the test sample mounting frame relative to the burner cone during testing must be positioned as shown in figure 7-2.

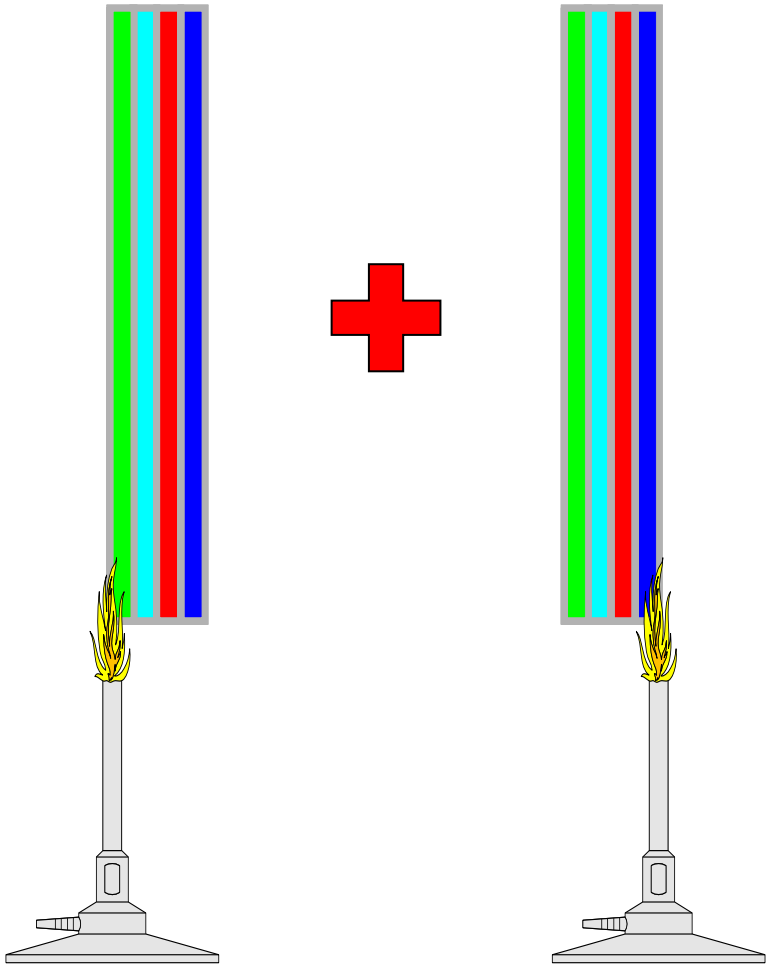
Red Line Process for Updating Fire Test Handbook

Lastly, all changes will remain in red text for a minimum period of 6 months, to allow sufficient time for review and discussion at IAMFTF meetings. Following the 6-month discussion period, if there are no objections, the change will be made permanent with all strikethrough removed, and red text changed to black.*

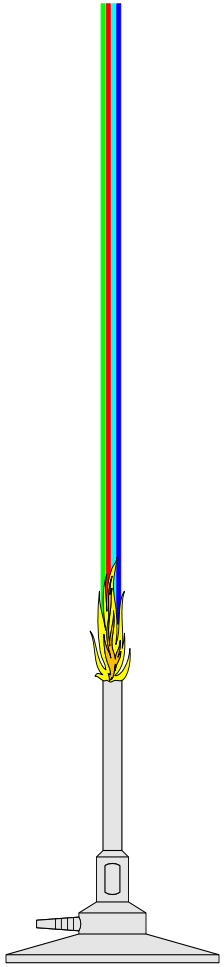
*Please note the previous version of the Handbook chapter will remain current until the revised chapter becomes permanent. This may require more than a 6-month period, to allow for additional experimentation and discussion. In addition, if the FAA determines that a specific apparatus or procedure specified in a current (or previous) version of the Handbook results in non-compliance with the original test methodology, the FAA will follow a formal process to require that a compliant procedure is followed.

Questions?

Update to Chapter 1, Bunsen Burner Location



Greater Than ¼ inch



Less Than or = ¼ inch

Update to Chapter 1, Bunsen Burner Location

At the conclusion of the previous IAMFTF meeting:

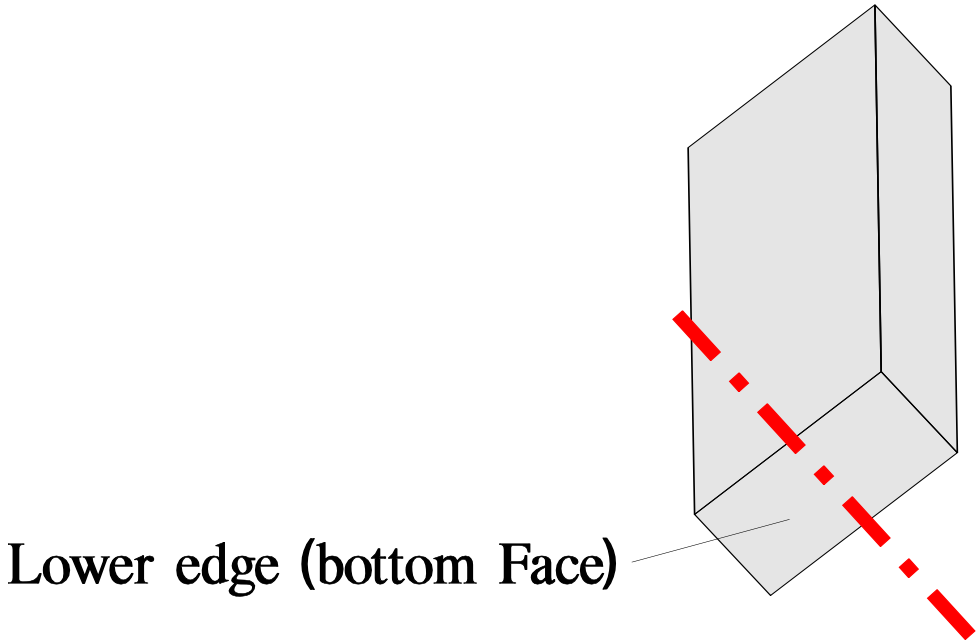
"Updated ¼- inch criteria would create additional testing"

From the Handbook, prior to update: "Position the burner so that the flame impinges on the midpoint of the lower edge of the front face of the test specimen. This flame position should be used for all specimen thicknesses."

From the Handbook supplement for 1.6.2.4 "Appendix F, FAR 25.853, Part I describes this test and specifies that the flame be placed "along the centerline of the lower edge."
The "centerline of the lower edge" is the line from the front face to the back face of the specimen. For thicker specimens, this is ambiguous since exactly "where" along the "centerline of the lower edge" is not specified.

Update to Chapter 1, Bunsen Burner Location

“Centerline of lower edge”



Handbook Chapter 1, Supplement to 1.6.2.4

"Historically, test practices regarding burner flame placement have not been uniform or consistent within either the FAA or aircraft manufacturers. The most common placement used in the past was specified in the original issue of this handbook, viz.: For specimens that are 3/4 inch (19 mm) thick or less, place the burner barrel centerline under the center of the bottom surface of the specimen. For specimens thicker than 3/4 inch (19 mm), center the burner barrel under the bottom surface of the specimen 3/8 inch (10 mm) in from the surface exposed to the airplane interior, test each surface separately unless the surfaces are of the same materials and construction."

Handbook Chapter 1, Supplement to 1.6.2.4

"Another placement that has been less commonly used is that specified here, viz., directly under the middle of the lower edge of the face of the specimen that is exposed to the airplane interior. For specimens thinner than the burner barrel thickness (3/8 inch; 10 mm), test results are relatively insensitive to exactly where "along the centerline of the lower edge" the burner flame is placed. For samples of greater thickness, however, burn lengths are typically an inch or so longer if the burner barrel centerline is placed under or near the specimen face, and flame times are sometimes a little longer than if the flame is placed per the original handbook, Report DOT/FAA/CT-89/15, September 1990."

Handbook Chapter 1, Supplement to 1.6.2.4

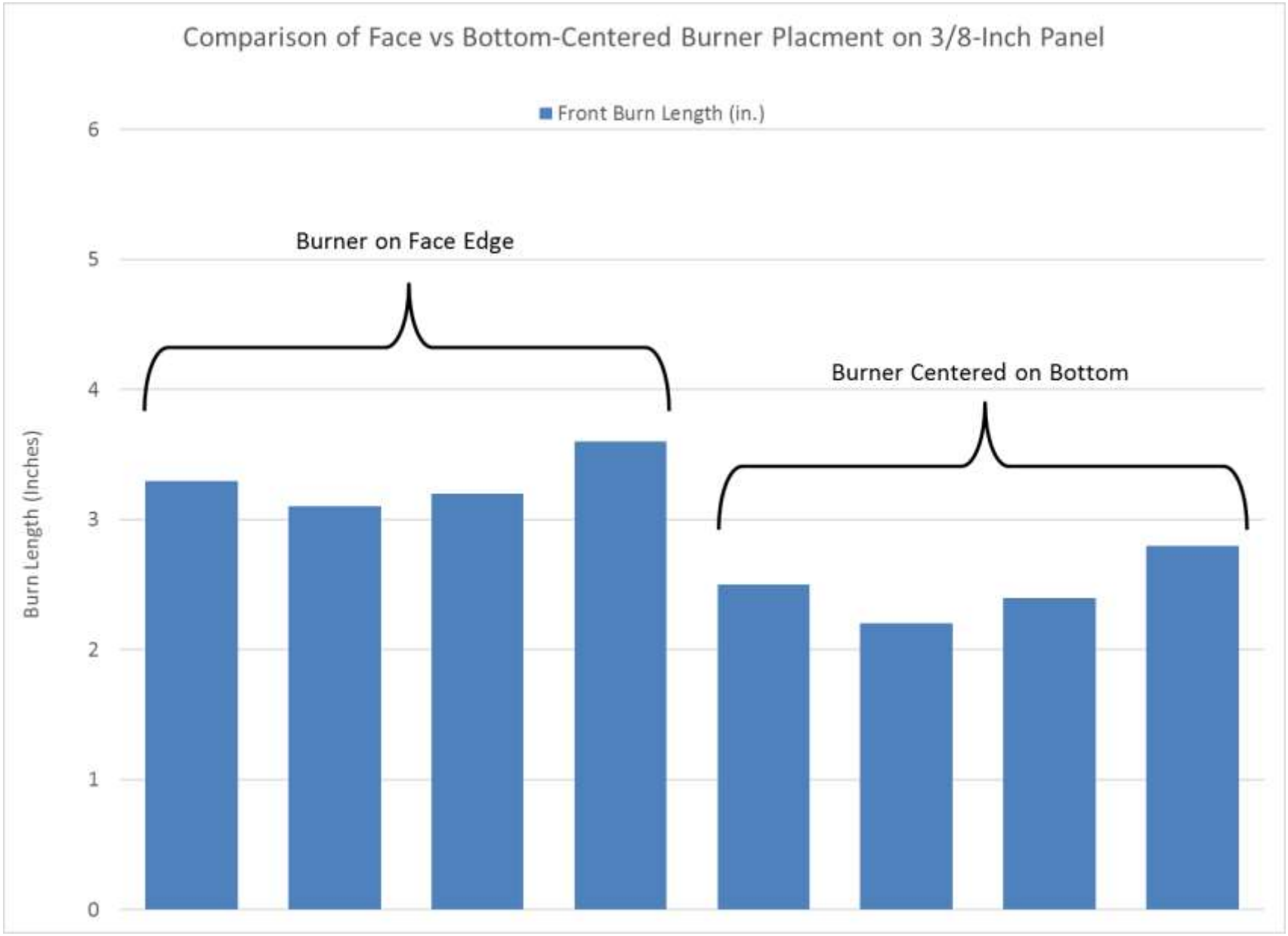
"Materials used in contemporary (especially post heat release) designs produce burn lengths and flame times that are considerably less than the acceptance criteria for certification (6 inches and 15 seconds), regardless of where the flame is placed. Although where the burner flame is applied is not of important pass/fail significance in this test, placing it directly under the specimen face generally represents a worst-case situation."

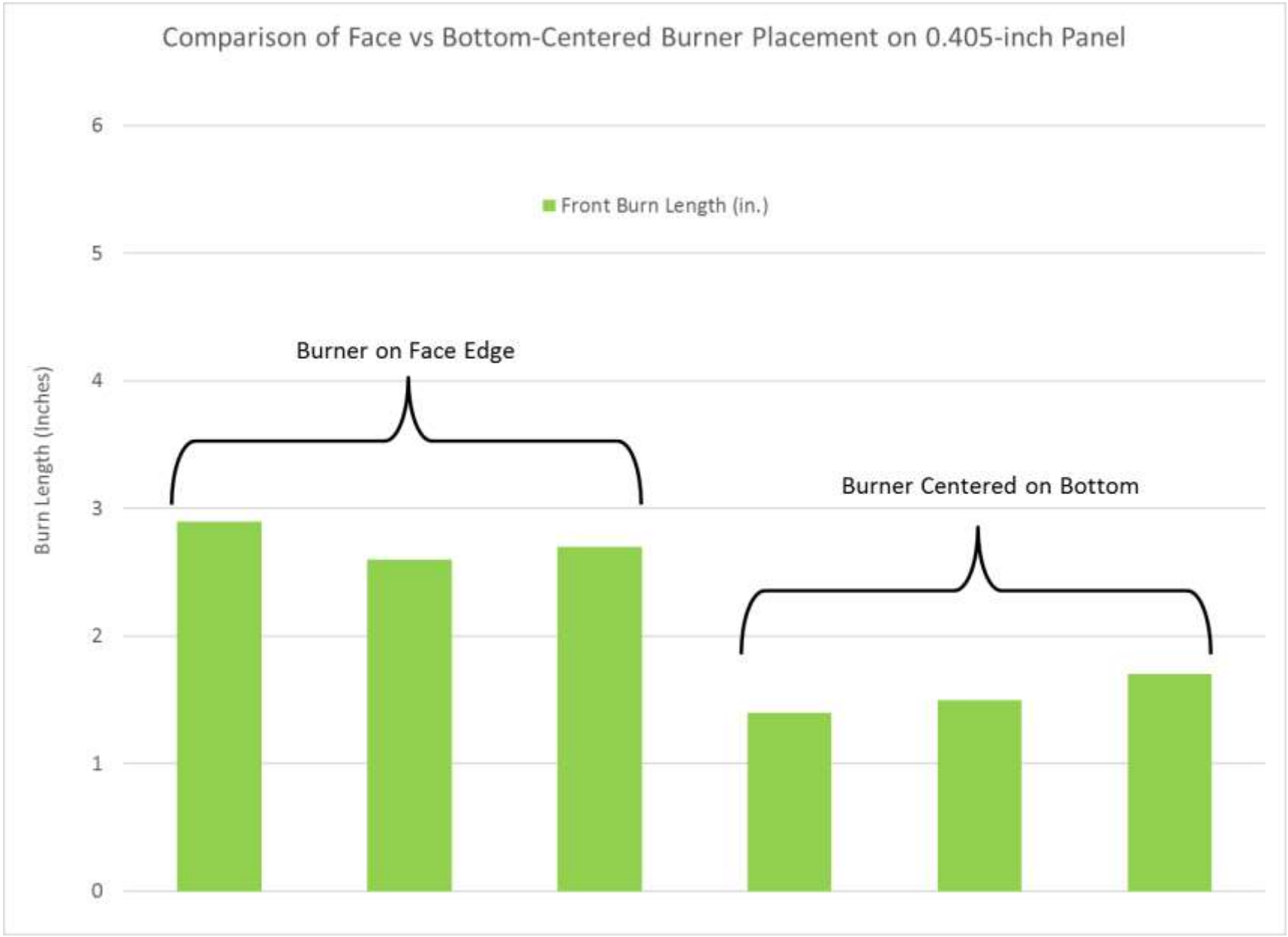
"The FAA should accept data for certification using the flame placement described in the original portion of this handbook, or using the flame placed under the exposed face of the test specimen. However, the FAA and aircraft manufacturers have agreed that in the future, the preferred placement of the burner flame is under the middle of the lower edge of the face of the specimen."

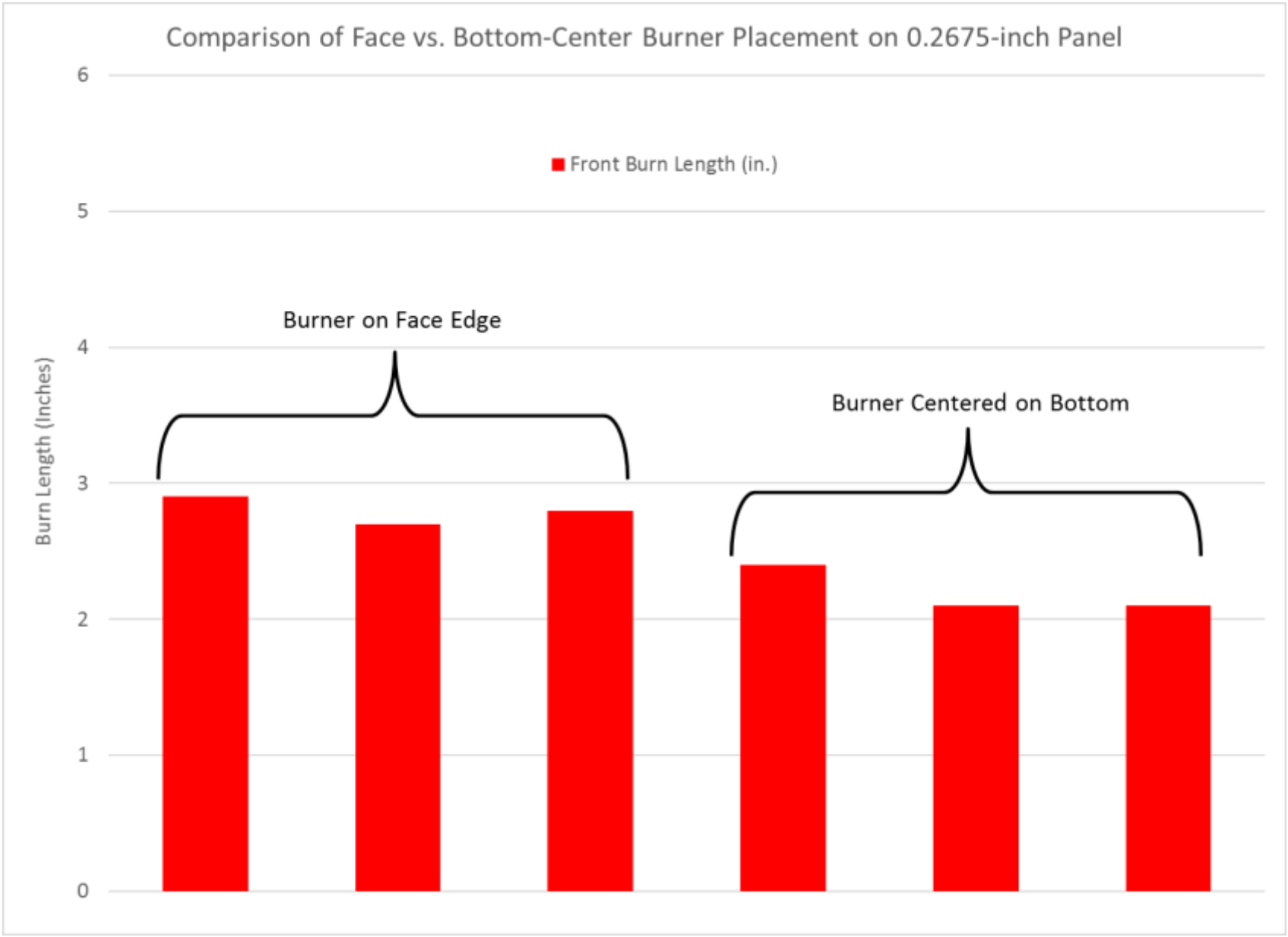
Update to Chapter 1, Bunsen Burner Location

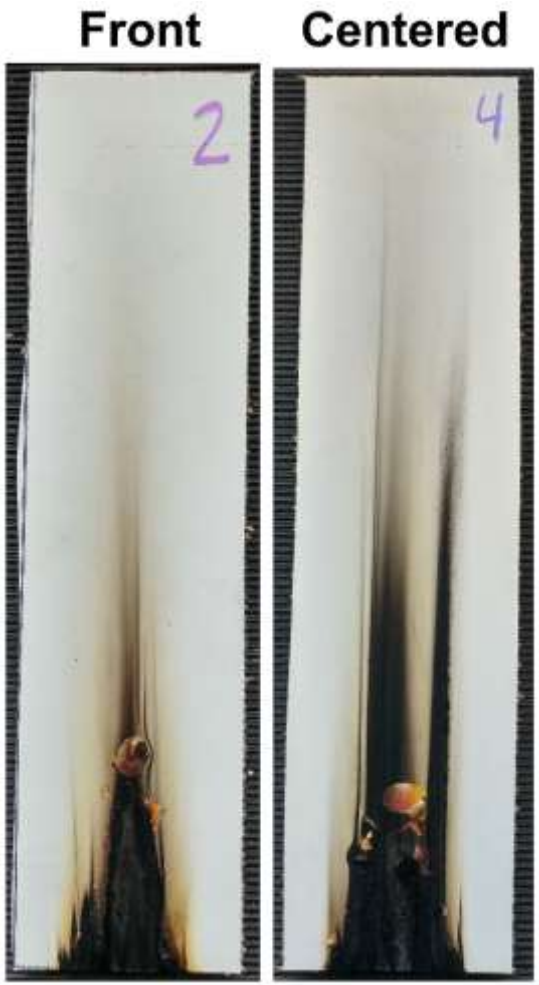
Webex meeting arranged to discuss issues:

- Compromise was suggested from ¼-inch to 3/8-inch thickness
- Flipping samples to reduce costs
- Testing thick foams and carpet


Comparison of Face vs Bottom-Centered Burner Placment on 3/8-Inch Panel
Front Burn Length (in.)
Burn Length (Inches)
6
5
4
3
2
1
0
Burner on Face Edge
Burner Centered on Bottom


Comparison of Face vs Bottom-Centered Burner Placement on 0.405-inch Panel
Front Burn Length (in.)
Burn Length (Inches)
6
5
4
3
2
1
0
Burner on Face Edge
Burner Centered on Bottom


Comparison of Face vs. Bottom-Center Burner Placement on 0.2675-inch Panel
Front Burn Length (in.)
Burn Length (Inches)
6
5
4
3
2
1
0
Burner on Face Edge
Burner Centered on Bottom



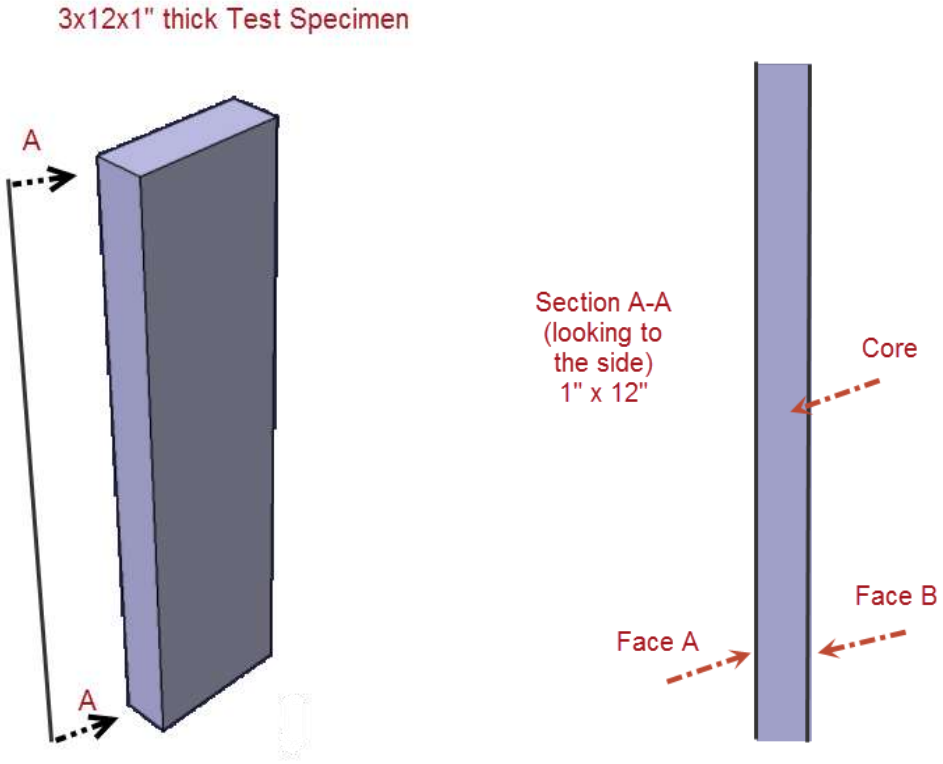
0.375-inch

0.405-inch

0.2675-inch

Update to Chapter 1, Bunsen Burner Location

Another topic generated from this discussion is how to minimize sample costs for thicker panel constructions that are proposed to be tested on both faces. The figure below represents a thicker panel with faces A and B.



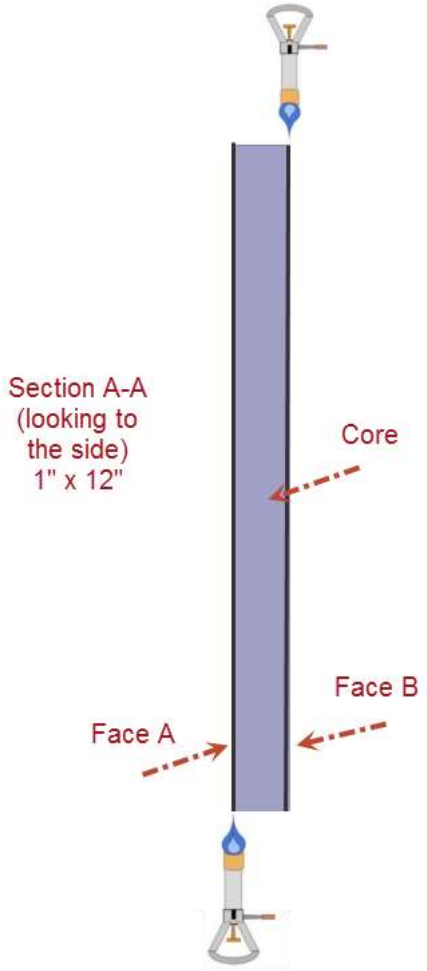
Update to Chapter 1, Bunsen Burner Location

One proposal is to formally allow samples to be flipped and tested as shown in the figure on the right. As testing one face will typically have flame wrap around the bottom edge and damage the opposite face, maximum limits such as 3" of burn damage (typical burn length damage) to the non-tested face could be considered before allowing the opposite non-tested face to be tested (assumes a full 12" long specimen).

What about conditioning? Does testing Face A impact the testing of Face B without conditioning in between tests? Experience suggests no impact and agreed no extra conditioning required. Substrates such as metal that may get warm may be allowed to cool a few minutes in the conditioning chamber.

What about contamination to the non-test side? Verify the test surface is clean (wipe with a clean dry cloth).

What about test sample conformity? Should not be an issue if allowed in the handbook.



Update to Chapter 1, Bunsen Burner Location

What about thick cushion foams tested at 0.5” thick and thick business jet floor carpets (around .375” thick)?

The FAA report cited in the handbook confirms the worst-case for thick foams is in the center of the centerline (see figure to the right).

Floor carpets: Industry practice has always been to test in the center (see figure to the right). Agreed to continue to test floor carpets in the middle.

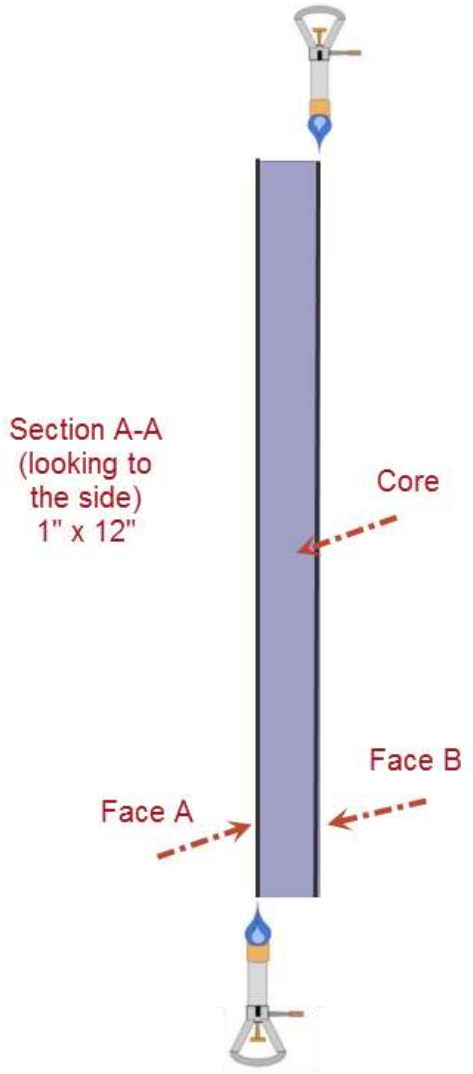
What about other thick homogenous constructions?

Proposal: Test per the handbook. Materials such as thick rubstrips are typically homogenous and should be tested on the face. Agreed.

Update to Chapter 1, Bunsen Burner Location

Other Question- What about a thick panel where one face must meet a 60-second vertical test and the other side is only required to meet a lessor test (as defined in the Policy Statement PS1).

Not recommended to create test constructions where both faces must be tested and are required to meet different requirements. Such panel faces may need to be part of separate test constructions. Proper application of the policy statement (items 10 and 21) will help avoid such situations.



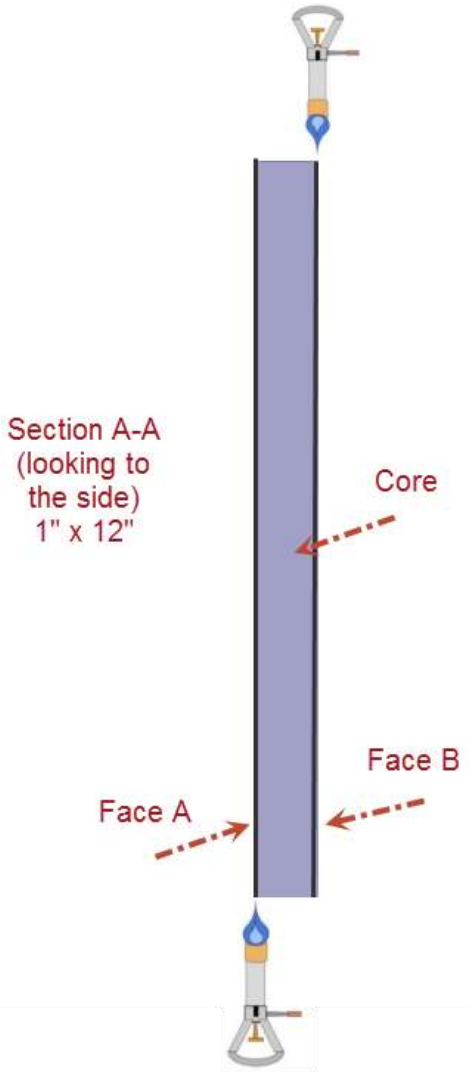
Vertical Bunsen Burner Testing

•Next Question- What about thick homogenous materials.

•Proposed answer- Test one face.

•Next Question- Thick Asymmetrical constructions?

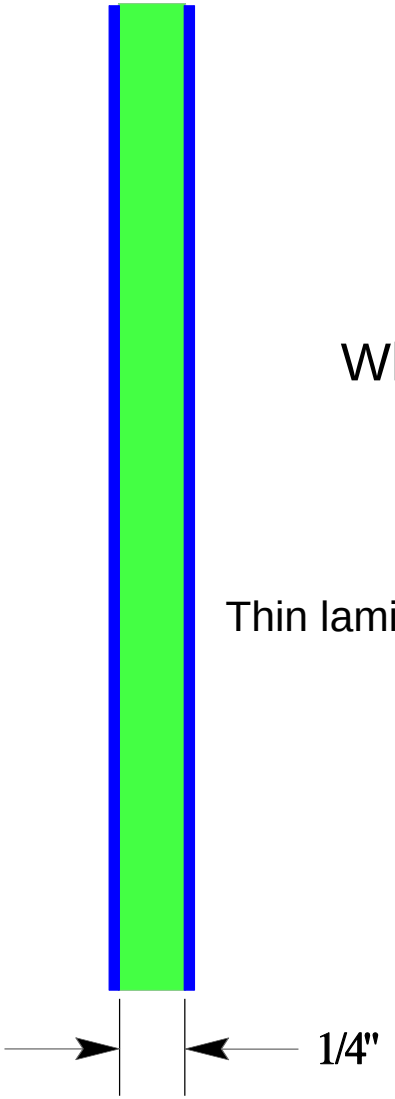
•Proposed answer: Just follow the handbook and incorporate the Policy Statement item PS10 as needed for reduced testing.



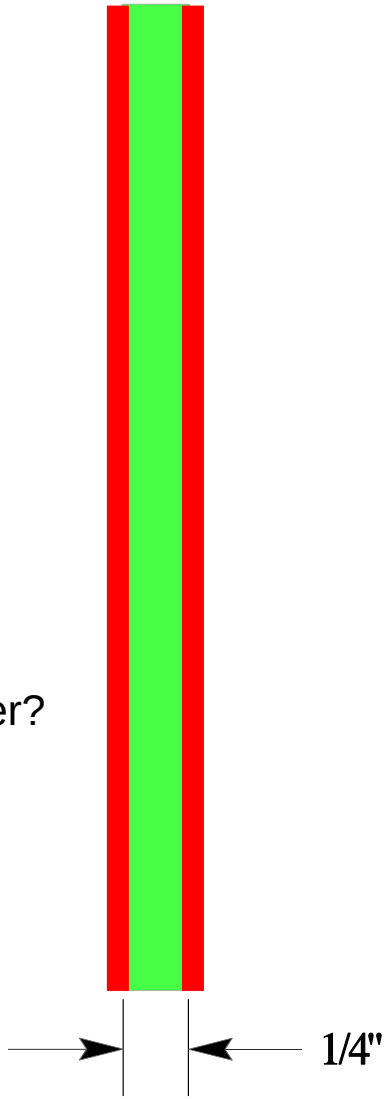
Questions?

What does ¼-inch requirement include?

Thin laminate/paint?



Thick veneer?



HR2 Review

…From previous meeting minutes…

HR2 Prototype Heater Development. Tech Center presented a prototype heater to the group. There was lengthy discussion covering many pros & cons of changing the heater type. Some issues included uniformity criteria, durability & longevity of the heater and difficulties maintaining a clean glass surface (of the heater) over long periods of testing. The Tech Center will install the new heater and begin to gather data for future discussions.

HR2 Placeholder Document. Discussions concerning the frequency of calibration for corner heat flux and Methane gas calibration. It was agreed to the following:

	Old	New
•Corner HF	Monthly	Daily (When testing)
•Methane Calibration	Monthly	Weekly (When Testing)

Prototype Heat Flux Calibrator. Preliminary equipment and calibration data was presented for discussion. A complete review of the calibration placeholder document was conducted and all group members agreed that it is sufficient with the exception of one item. A desire to use stronger wording on the swapping of positions of heat flux gauges needs to be incorporated. This is with respect to reproducibility of the calibration process.

HR2 Review

Action Items:

FAA Tech Center

- Distribute voltage-monitoring draft test plan to task group members for comment ✓
- TRL5 activity – Update software to determine Time interval stability criteria on HR2 ✓
- Begin testing new prototype radiant heater on HR2 ✓
- Update HR2 placeholder document as needed.
- Continue initial testing of prototype HFG calibration apparatus ✓
- Update Heat Flux Calibration placeholder document as needed.

Boeing Team

- Build upon OSU guidance document ✓
- Develop voltage-monitoring round robin draft test plan (OSU) and submit to Tech Center for distribution to task group members (based on previous OSU RR participation). ✓
- Develop TRL5 test plan – Update software to determine Time interval stability criteria on OSU ✓

HR2 Update

Prototype Radiant Heater

The original design of the apparatus called for several horizontally-oriented glowbars that produced a relatively uniform heat flux against the test samples.

Although this arrangement was fairly repeatable, it was concluded that the positioning of the glowbars obstructed the flow of air through the combustion chamber section. This disruption of air likely contributes to erratic test results.

In an effort to minimize air flow disruption and turbulence, a flat-plate radiant heater was experimented with. The smooth-faced heater used a carefully wound heating coil imbedded in ceramic, all of which was concealed behind a glass face.

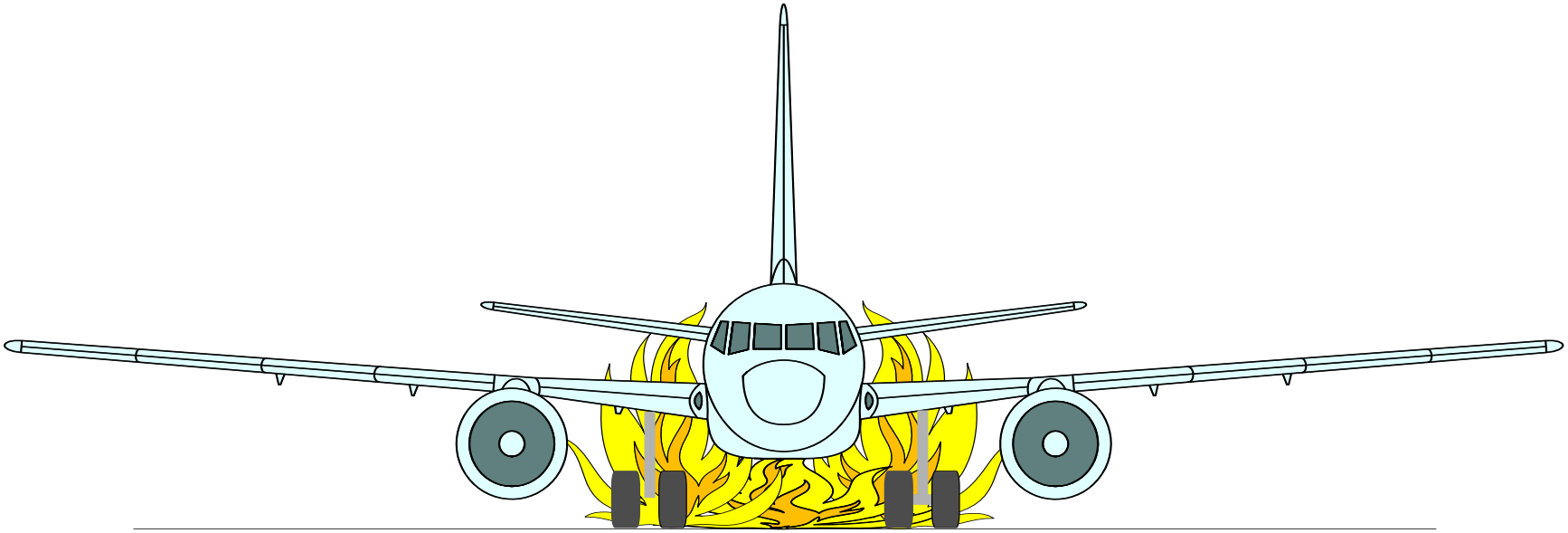
Experiments indicated the power requirement to the heating coil was significantly reduced, while maintaining the required 3.5 Watts/cm^2 heat flux against the sample. However, stack temperatures were also impacted.

HR2 Update

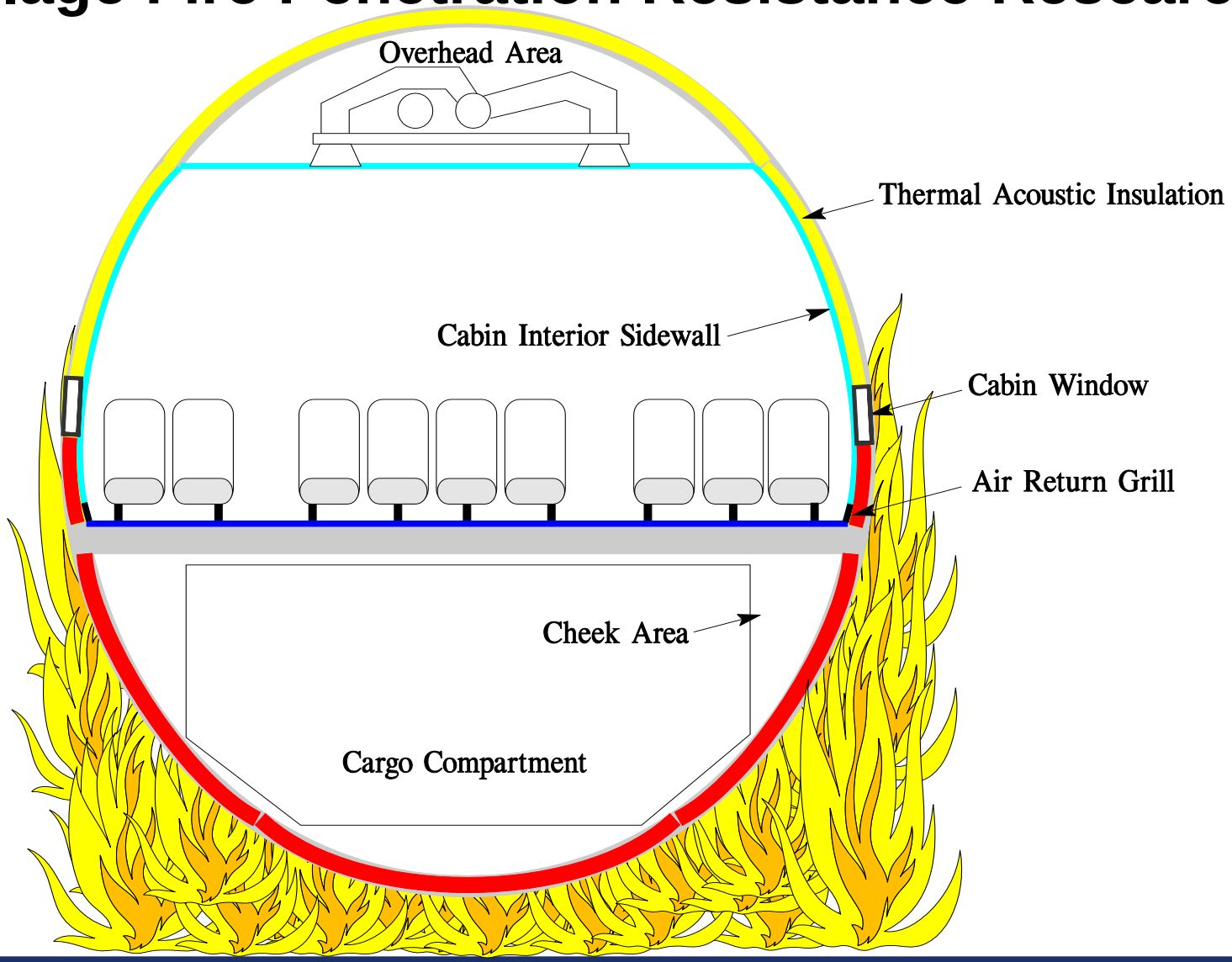
Pilot Flame Alignment

Additional testing on the HR2 apparatus also revealed the impact of misaligned lower pilot ignition flames. Although the pilot ignition is a small flame, a misalignment of less than 0.25 inches was found to significantly influence the peak and total heat release rates. Additional guidance on pilot ignition positioning will be implemented based on these findings.

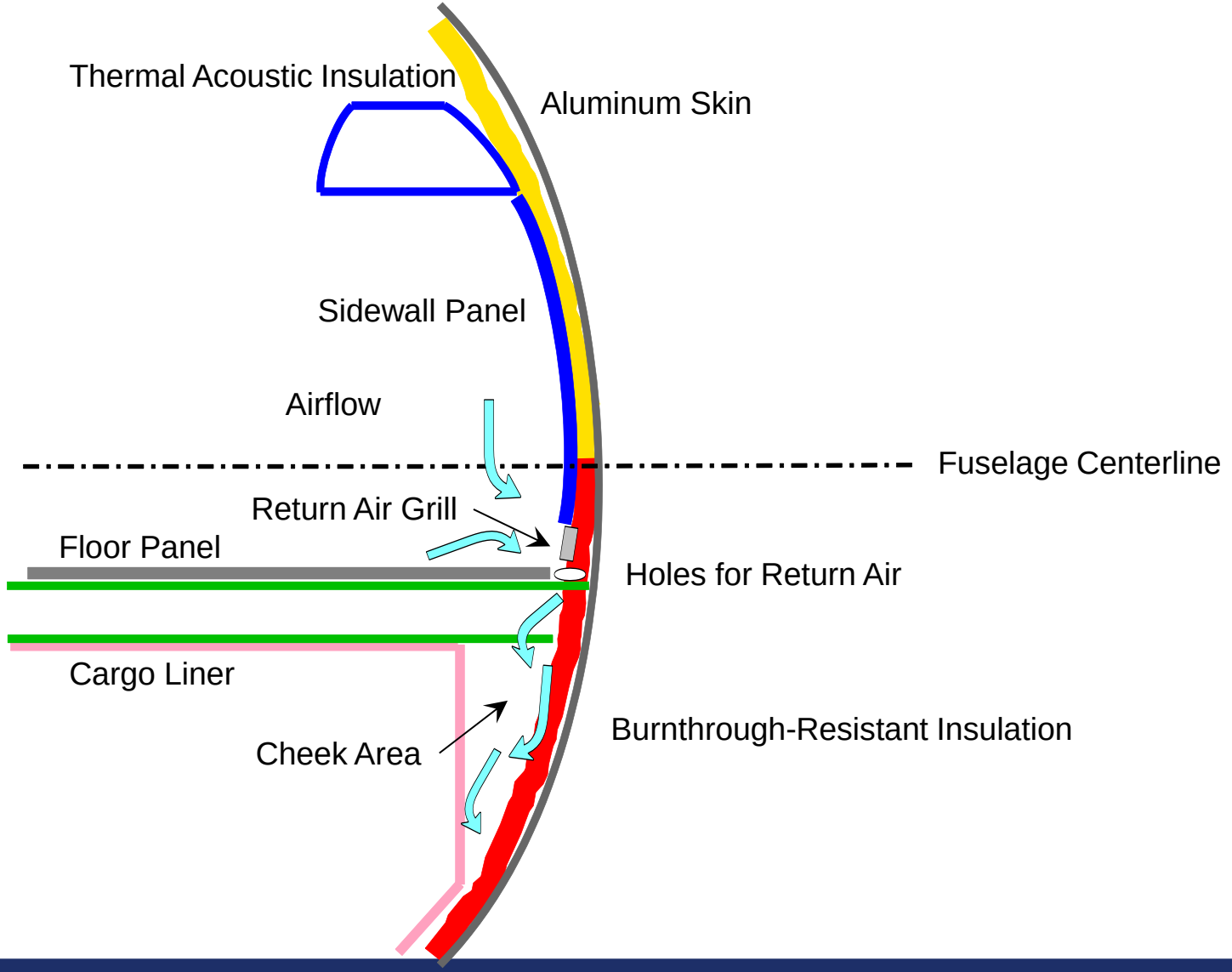
Fuselage Fire Penetration “Burnthrough” Resistance Research



Fuselage Fire Penetration Resistance Research



Fuselage Fire Penetration Resistance Research



Fuselage Fire Penetration Resistance Research

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Fuselage Fire Penetration Resistance Research

Questions?