



**Federal Aviation
Administration**

International Aircraft Materials Fire Test Forum Meeting

Development of New Flammability Test for Magnesium-Alloy Cabin Components

Presented to: International Aircraft Materials Fire Test
Forum, Atlantic City, NJ

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Oil Burner Flammability Test for Mag Seat Components

Significant Activities

Full-Scale Tests (2008-2010)

Lab-Scale Test Development (2010-2014)

Lab-Scale Test in Handbook (2014)

Interlab “Round Robin” Testing (2013-2015)

How are mag alloy seat components qualified using new test? (2014-present)

5 Primary Seat Components



How About Non-Primary Seat Components?

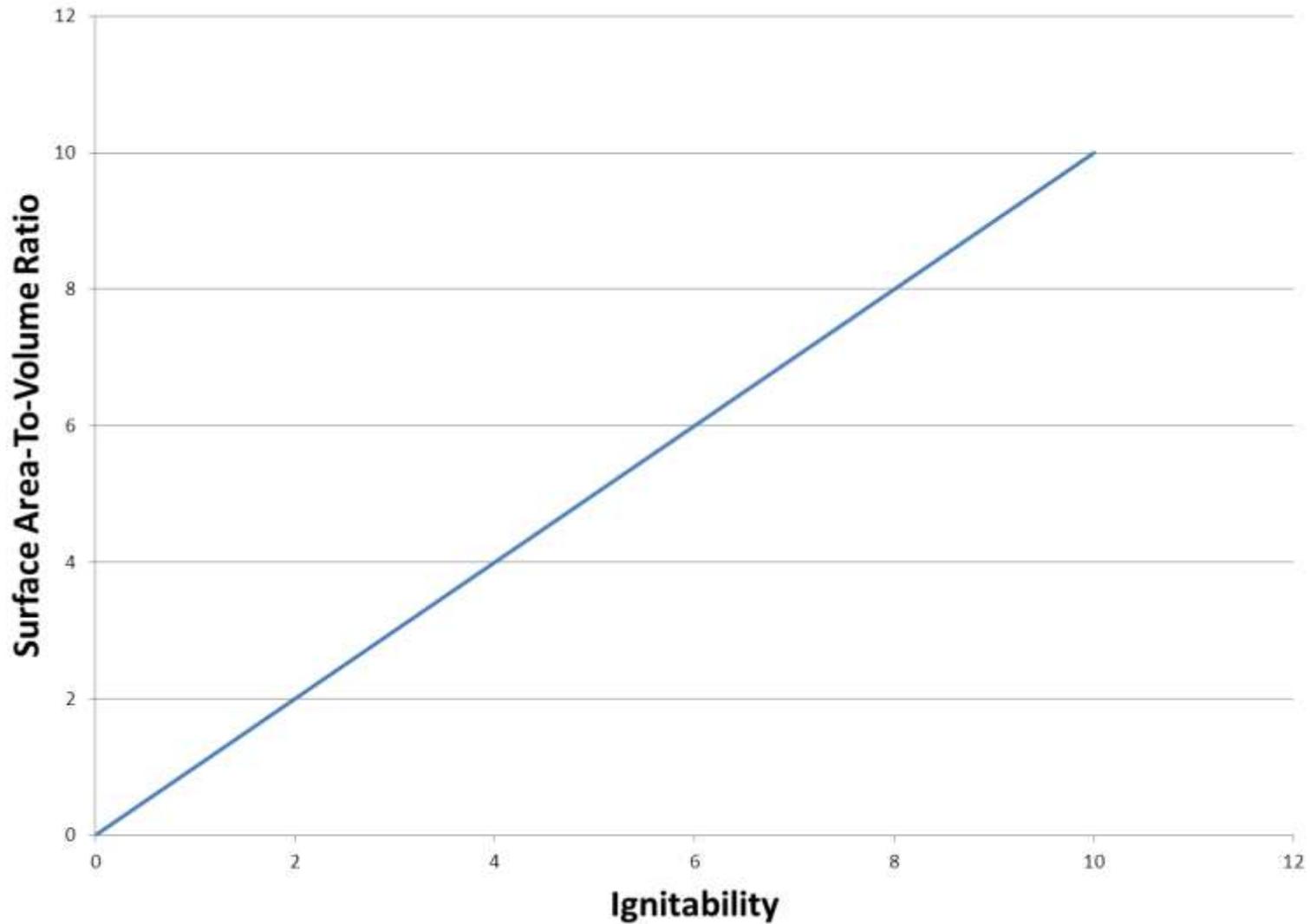


Non-Primary Seat Components

(tray tables, table arms, armrests, etc.)



SAV Ratio Vs. Ignitability



Surface Area-to-Volume (SAV) Ratios of Seat Components Used in Full-Scale Tests

Part Description	Surface Area (in ²)	Volume (in ³)	SAV ratio
Test sample	70.750	7.500	9.43
Leg assembly	193.474	24.661	7.85
Front leg	77.315	7.583	10.20
Center spreader	237.049	18.225	13.01
Wall spreader	175.869	13.446	13.08
Aisle spreader	291.297	19.266	15.12
Backrest Frame	581.000	36.250	16.03
Crosstube	579.616	34.704	16.70
Baggage Bar	373.357	10.073	37.07

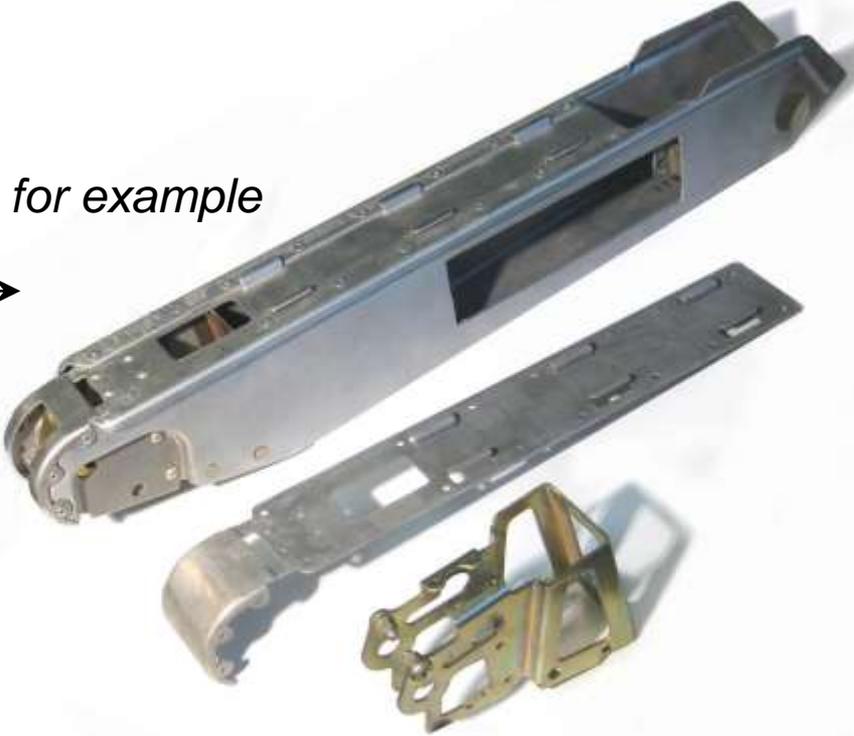
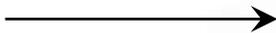


SAV ratio solid ≤ 20

SAV ratio hollow ≤ 40

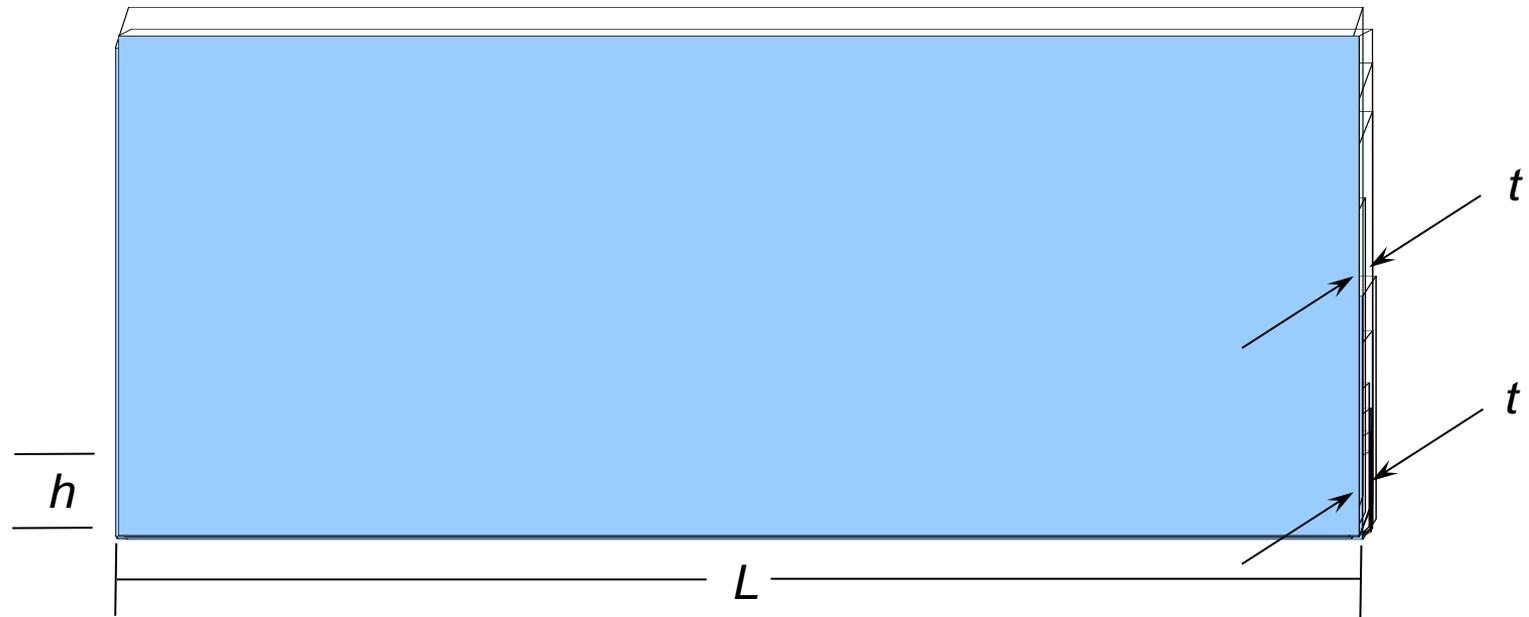
What options can be explored if a component exceeds SAV ratio?

Like this component for example



Discussion of SAV Ratio for Seat Components

Produce constant volume test sample



Test sample volume = volume of standard test sample specified in Chapter 25

Test sample length = length of standard test sample specified in Chapter 25

Test sample thickness = thickness of thinnest component cross section

Test sample height = variable, to maintain constant volume

Discussion of SAV Ratio for Seat Components

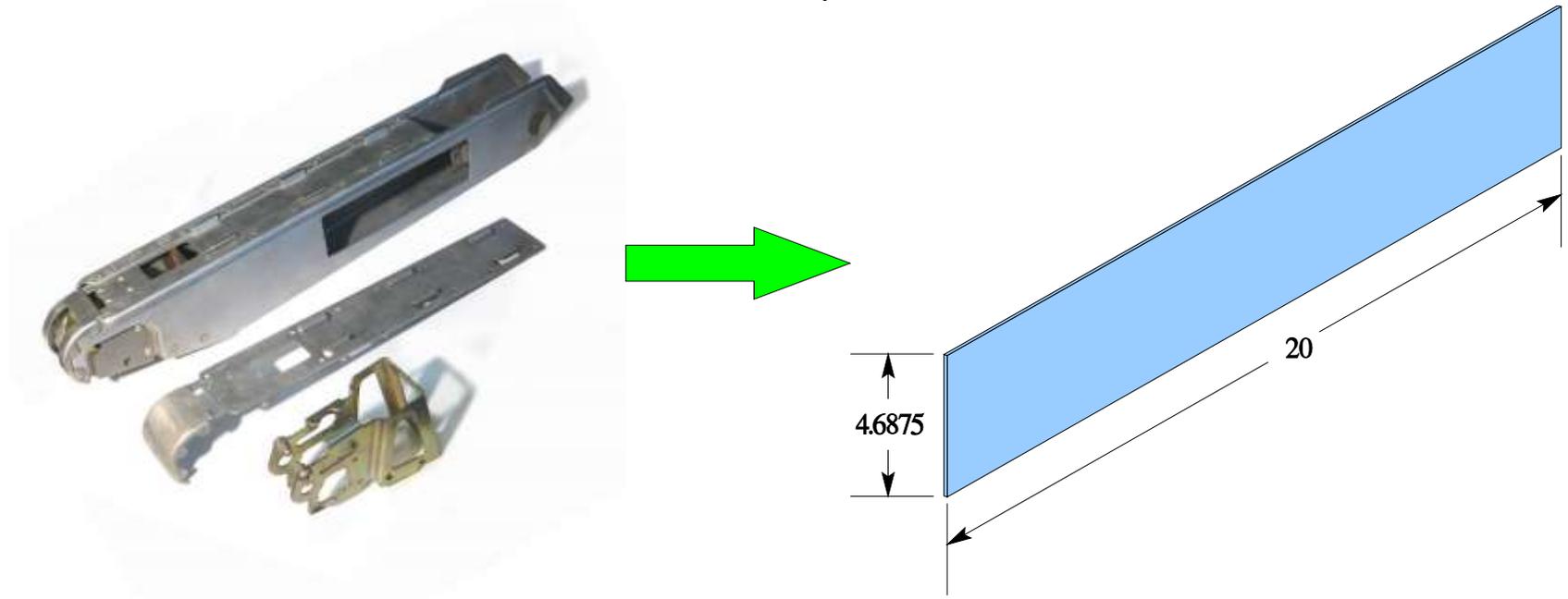
Example of constant volume test sample

Assume thickness of seat component is 0.080 inch

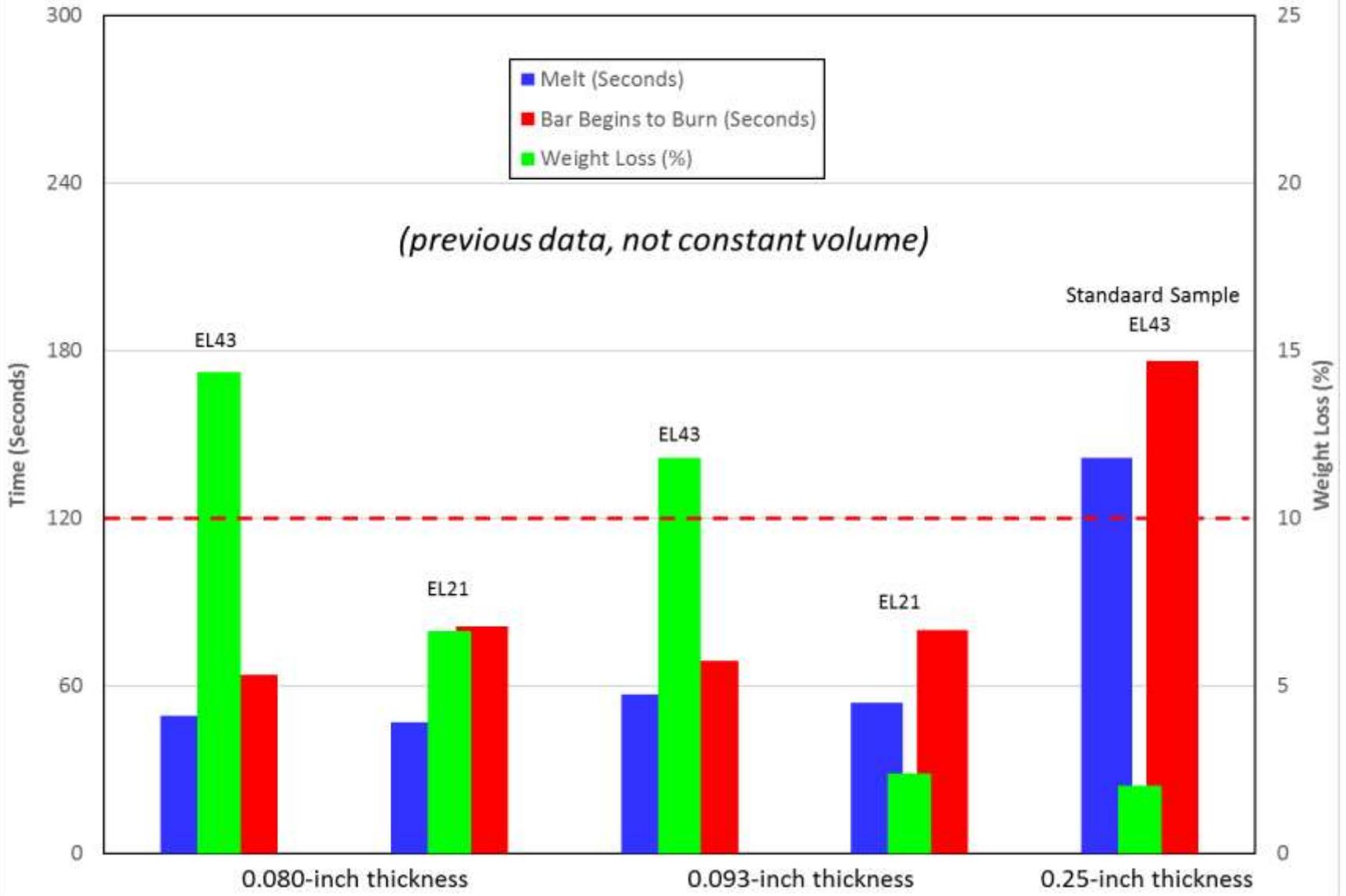
Volume standard sample = Length x Height x thickness = 20 x 1.5 x 0.25 = 7.5 in³

Height of new sample = Volume ÷ (Length x thickness)

$$= 7.5 \div (20 \times 0.080) = 4.6875 \text{ inches}$$



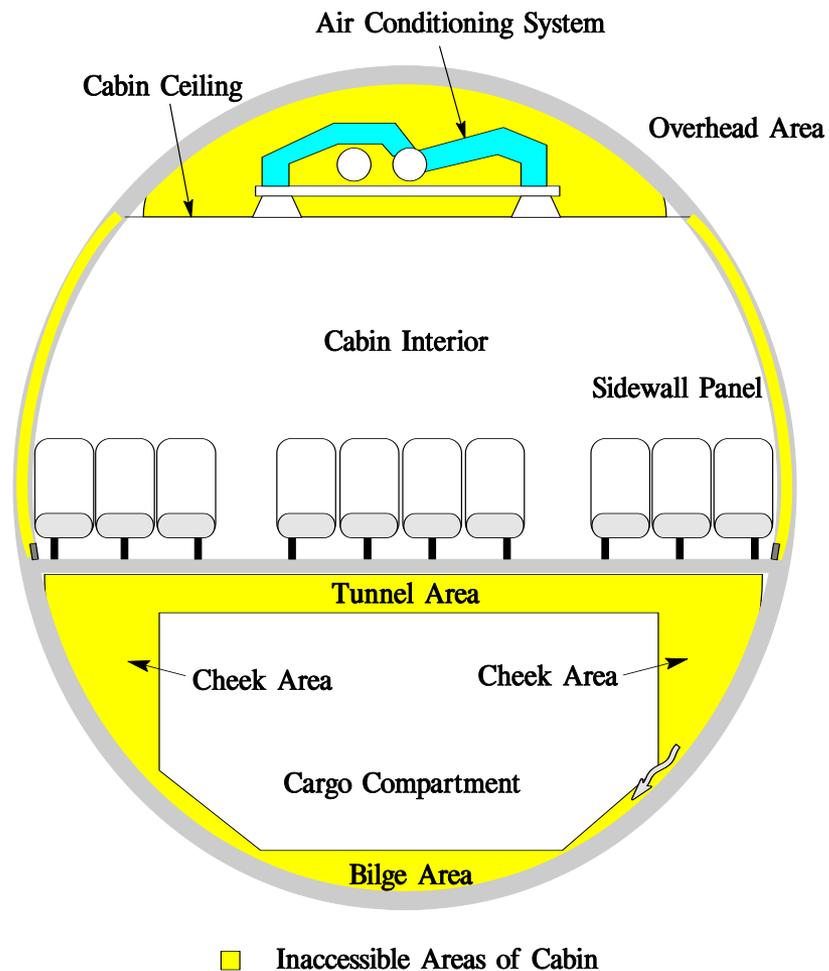
Testing Thin Samples Using Sonic Burner



Questions?



Development of Flammability Test for Magnesium Components Used in Inaccessible Areas



Current Test Parameters

- *Radiant Panel Apparatus*
- *3- by 6-inch sample size, 0.025-inch thickness*
- *2-minute pilot ignition*
- *4-minute exposure to radiant heat*
- *Maximum weight loss of 30% (proposed)*

...Test Method inserted as Chapter 26 in current Fire Test Handbook!

Aircraft Materials Fire Test Handbook

Chapter 12	Powerplant Fire Penetration Test
Chapter 13	Test for Electrical Connectors used in Firewalls
Chapter 14	Test for Electrical Wire used in Designated Fire Zones
Chapter 15	Two Gallon per hour Oil Burner Certification Testing for Repaired Cargo Compartment Liners
Chapter 18	Recommended Procedure for the 4-Ply Horizontal Flammability Test for Aircraft Blankets Lab Test Form - Bunsen Burner Test
Chapter 19	Smoke test for Insulated Aircraft Wire
Chapter 20	Dry Arc Tracking Test Procedure
Chapter 21	Dry Arc-Propagation Resistance
Chapter 22	Cotton Swab Test for Thermal Acoustic Insulation Blankets
Chapter 23	June Update Test Method To Determine the Flammability and Flame Propagation Characteristics of Thermal/Acoustic Insulation Materials Advisory Circular on Thermal/Acoustic Insulation Flame Propagation Test Method Details Radiant Panel Procedures Training Video: View Online Download
Chapter 24	September Update Test Method To Determine the Burnthrough Resistance of Thermal/Acoustic Insulation Materials Advisory Circular on Installation of Thermal/Acoustic Insulation for Burnthrough Protection
Chapter 25	Oil Burner Flammability Test for Magnesium Alloy Seat Structure
<u>Chapter 26</u>	New Test Method to Determine the Flammability and Flame Propagation Characteristics of Magnesium Alloy
Appendix A	FAA Regulations

Interlab Study

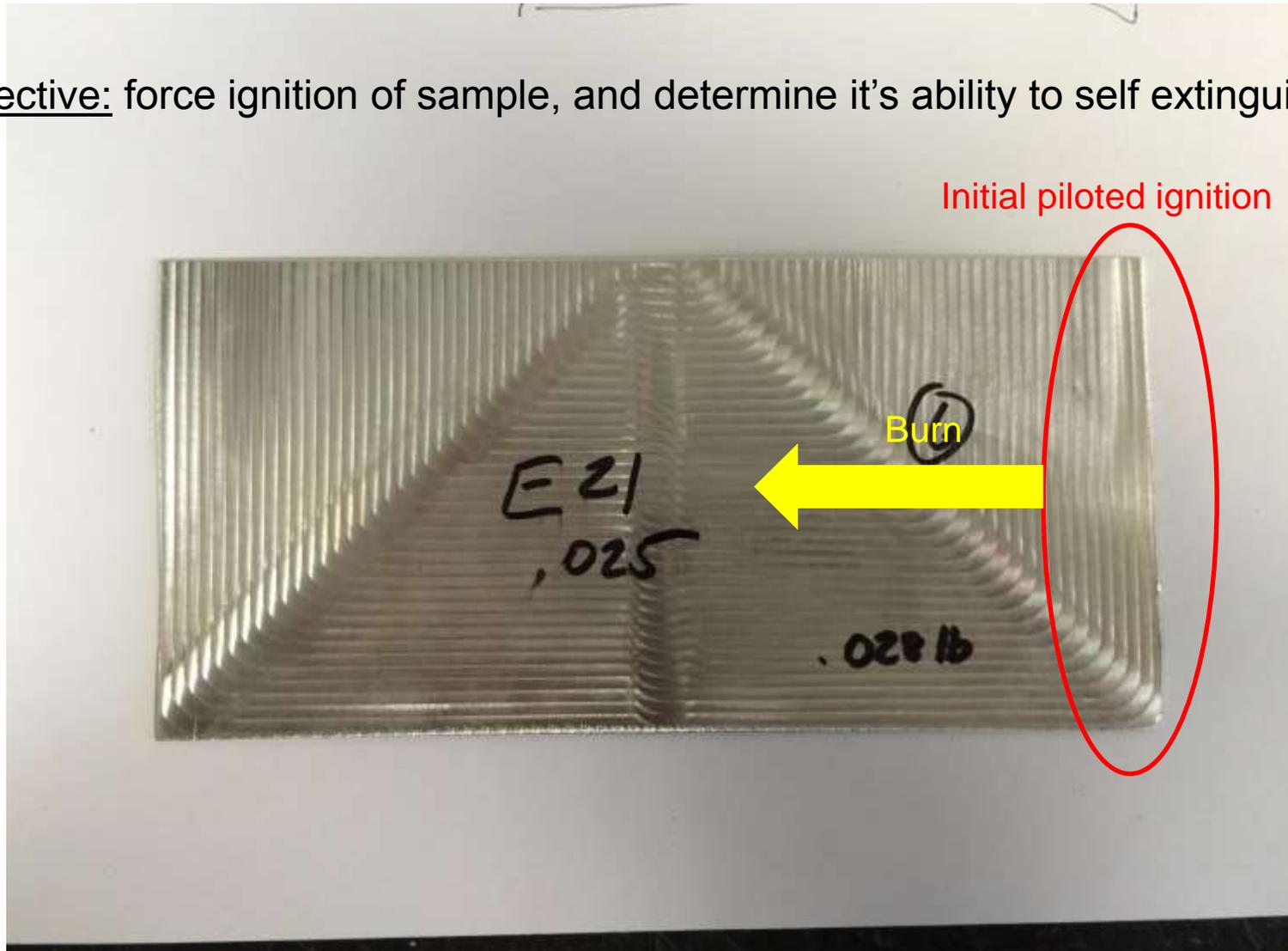
Prepare identical samples for participating laboratories, to determine lab-to-lab reproducibility:

- *6 laboratories (FAA, Accufleet, Boeing, CEAT, Airbus, Govmark)*
- *3 types magnesium alloy (EL43, EL21, ZE41)*
- *20 samples of each (60 tests) per lab*
- *Test results compiled by FAA*
- *Purchase order for samples initiated; samples currently being produced*
- *Samples manufactured to 0.125-inch thickness, will then need to be milled down to 0.025-inch thickness by FAA for testing*

*Refine test parameters and pass/fail criteria based on results of interlab study

3- by 6-inch Thin Magnesium Sample

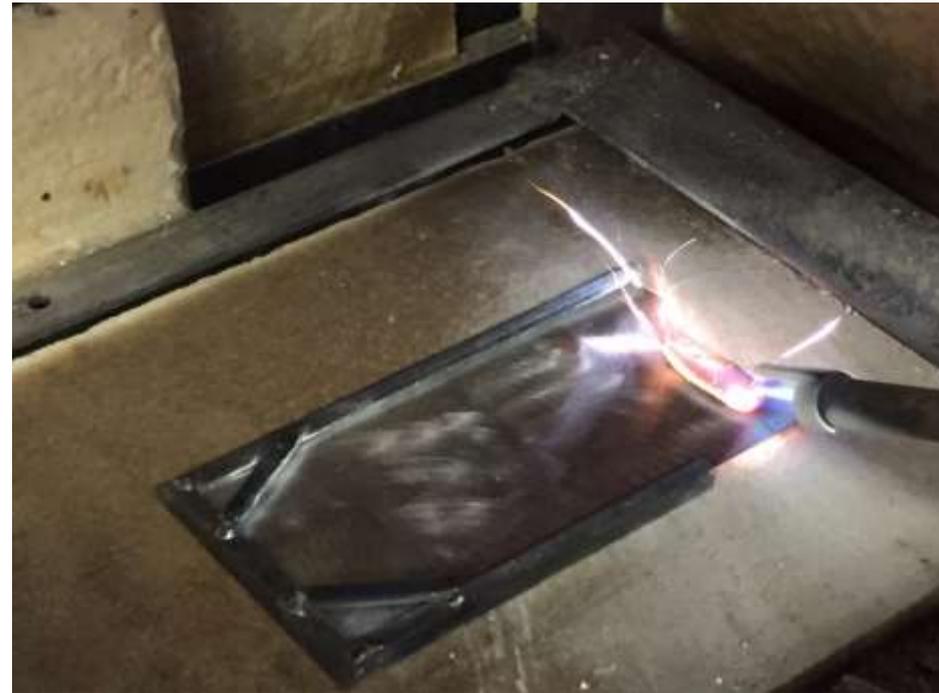
Objective: force ignition of sample, and determine it's ability to self extinguish



Truncated Perimeter Sample Holder



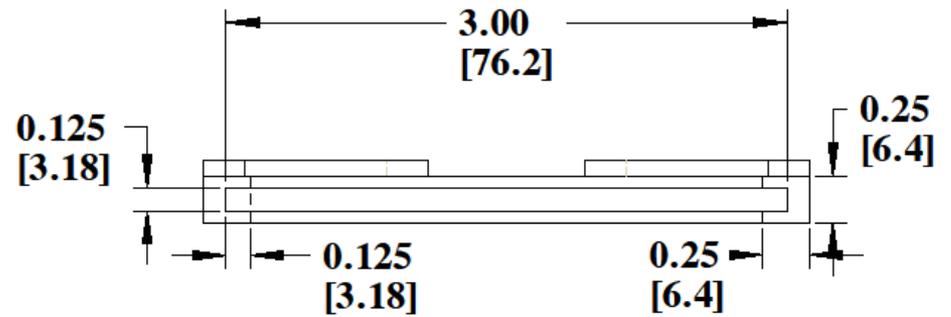
Truncated Perimeter Sample Holder



Truncated Perimeter Sample Holder

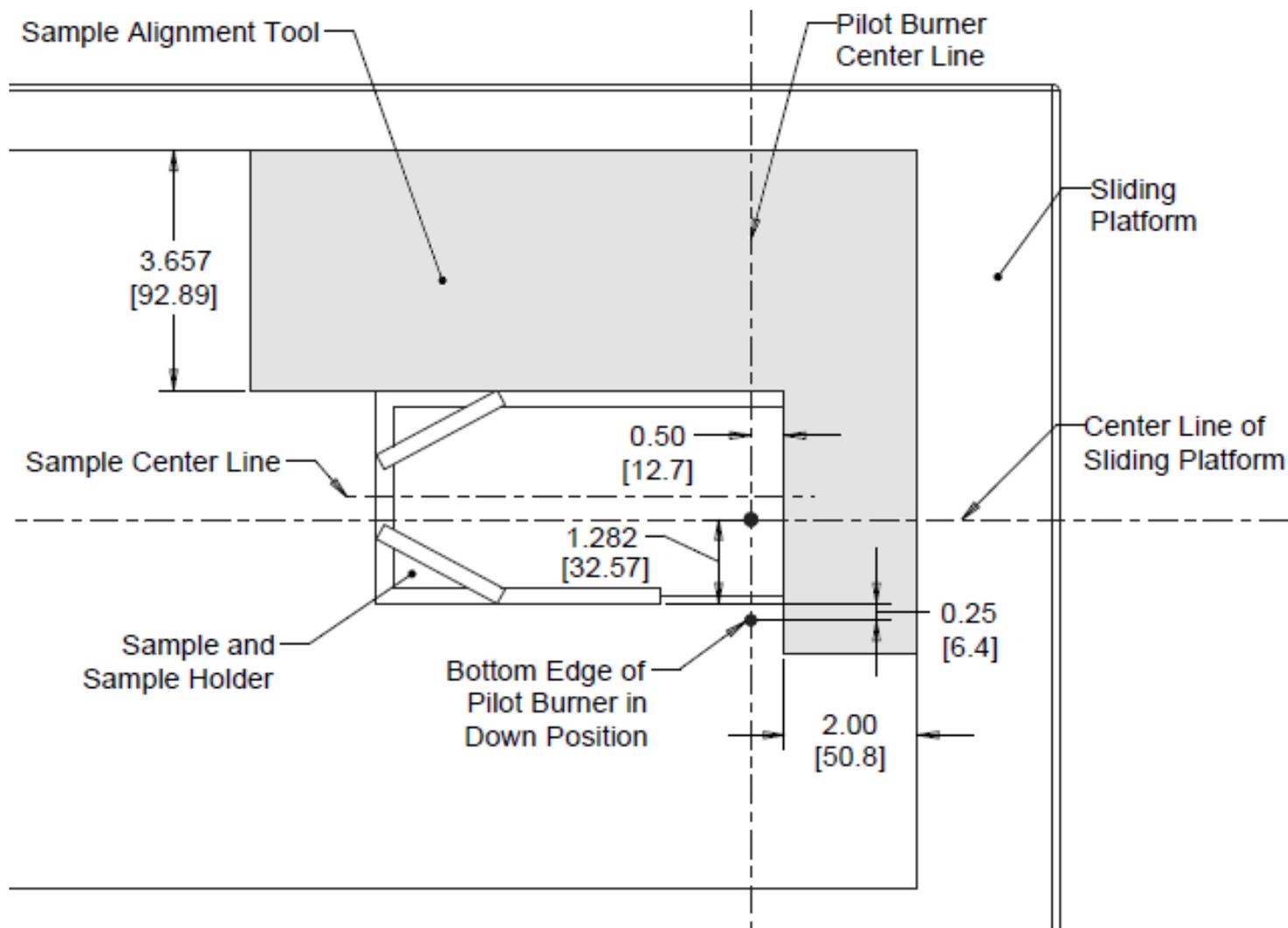


Drawings of Sample Holder



SCALE 1.750

Drawings of Sample Alignment Tool



Discussion Items for Task Group

Discuss proposed concept for testing seat components that exceed allowable SAV ratio:

- *Should there be a limit?*
- *Should the existing pass/fail criteria be altered?*

Discuss the key elements of the new flammability test for components located in inaccessible areas:

- *Should there be a limit on self extinguishment?*
- *Where are the samples?*

Discuss any other items related to the use of magnesium alloy in either seats or other cabin components

Questions?

