

Proposed Radiant Heat Panel Test

For the Evaluation of Aircraft Duct Material

“Status Report”

Presented to: International Aircraft Material Fire
Test Working Group

By: John Reinhardt, Aerospace Engineer

Date: June 26-27, 2007



Federal Aviation
Administration



Outline



What's New?

- ✓ Test Synopsis
- ✓ Explanation of Flame Propagation
- ✓ Report Due Date



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Test Synopsis



RADIANT HEAT PANEL TEST PROCEDURE (AS OF TODAY):

- Expose air ducting (or ducting joint) sample (21.59 cm by 27.94 cm) to 1.13 W/cm² (1 BTU/ft²/sec) radiant heat for 1 minute.
- After the 1 minute exposure, impinged the propane pilot flame on the sample for 15 seconds.
- After the 15 seconds impingement, remove pilot flame from the sample and allow the sample to self-extinguish its flames or extinguish them after 45 seconds.
- Determine flame propagation ($l < 5.08$ cm) and after flame time ($t < 45$ seconds)



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Flame Propagation

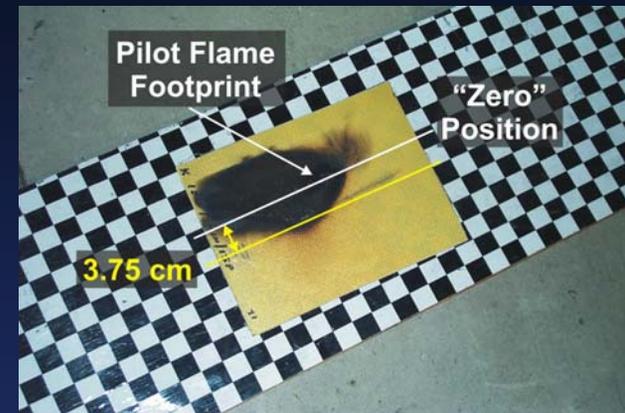


RADIANT HEAT PANEL ACCEPTANCE CRITERIA

- The test requires consideration of two parameters as pass/fail criteria: **flame propagation** and flame time after removal of the ignition source.

✓ Flame Propagation:

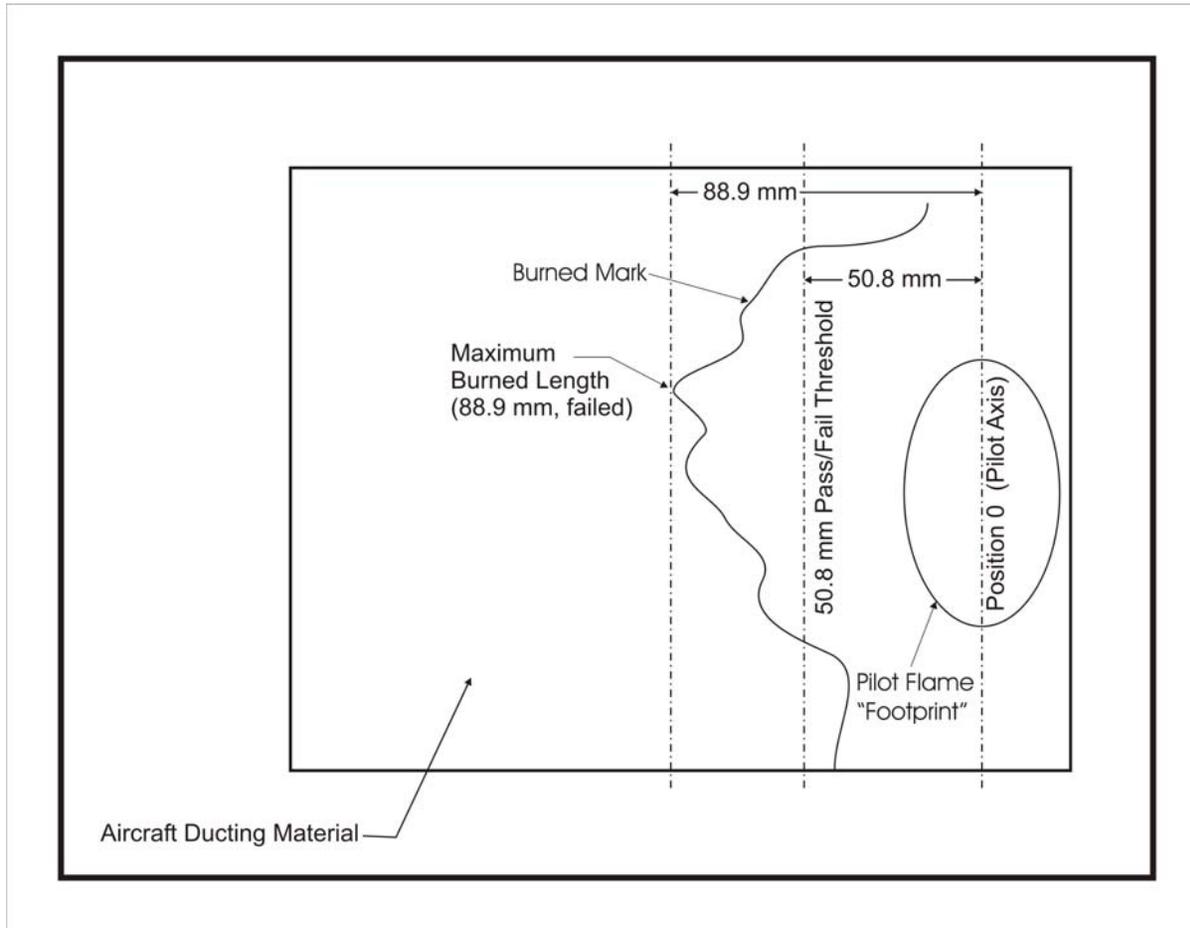
- Measure flame propagation by measuring the longest burn mark (not soot stain) on the sample.
- Start measuring from the “zero” position to the longest burn mark to the left of the pilot.



Flame Propagation



RADIANT HEAT PANEL MEASUREMENT EXAMPLE



Flame Propagation



RADIANT HEAT PANEL ACCEPTANCE CRITERIA

- No flame propagation (burn mark) shall exceed 5.08 cm to the left of the centerline of the pilot flame application
 - SPECIAL CONDITION ACCEPTANCE CRITERIA: Flame propagation ignored during the pilot impingement phase if material sample affects the free forward flow of the pilot flame and it is considered fireworthy (see explanation in next section)
- ✓ **After Flame Time:**
- Time < 45 seconds



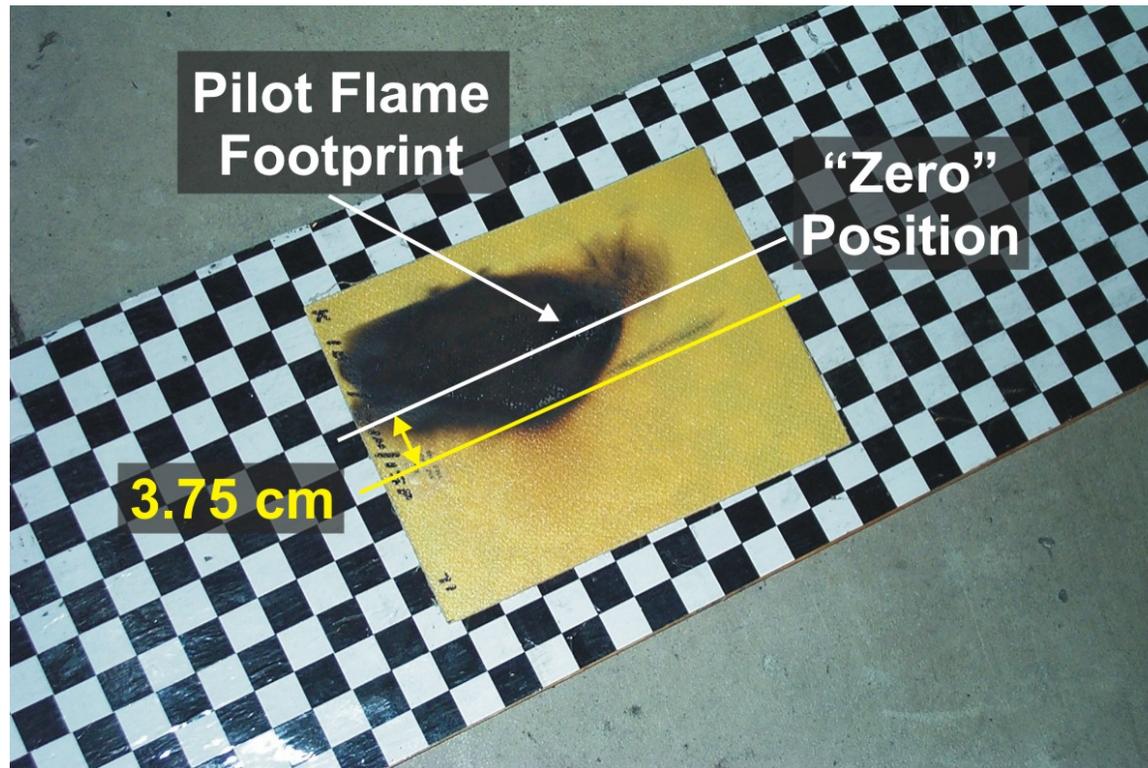
Flame Propagation



Example of a Material that Passed the RHP Test ($L < 5.08$ cm)



Flame Propagation



Example of a Material that Passed the RHP Test ($L < 5.08$ cm)

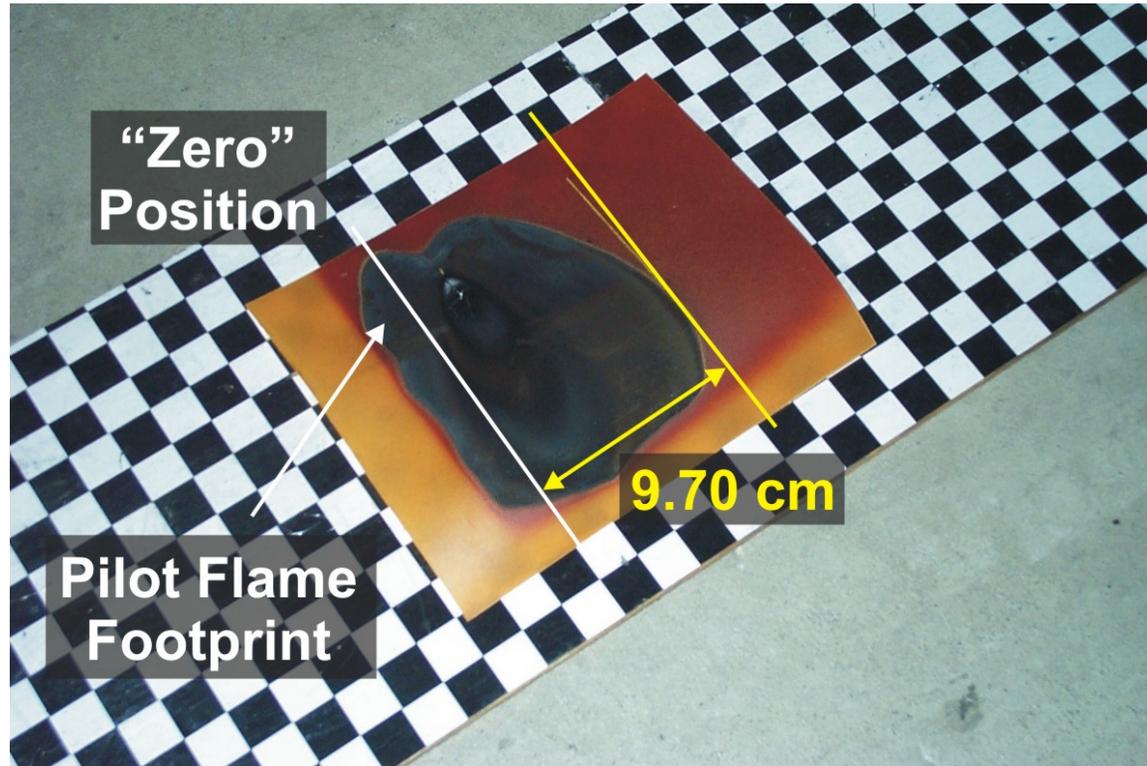
Flame Propagation



Example of a Material that Failed the RHP Test ($L > 5.08$ cm)



Flame Propagation



Example of a Material that Failed the RHP Test ($L > 5.08$ cm)

Flame Propagation – Special Criteria



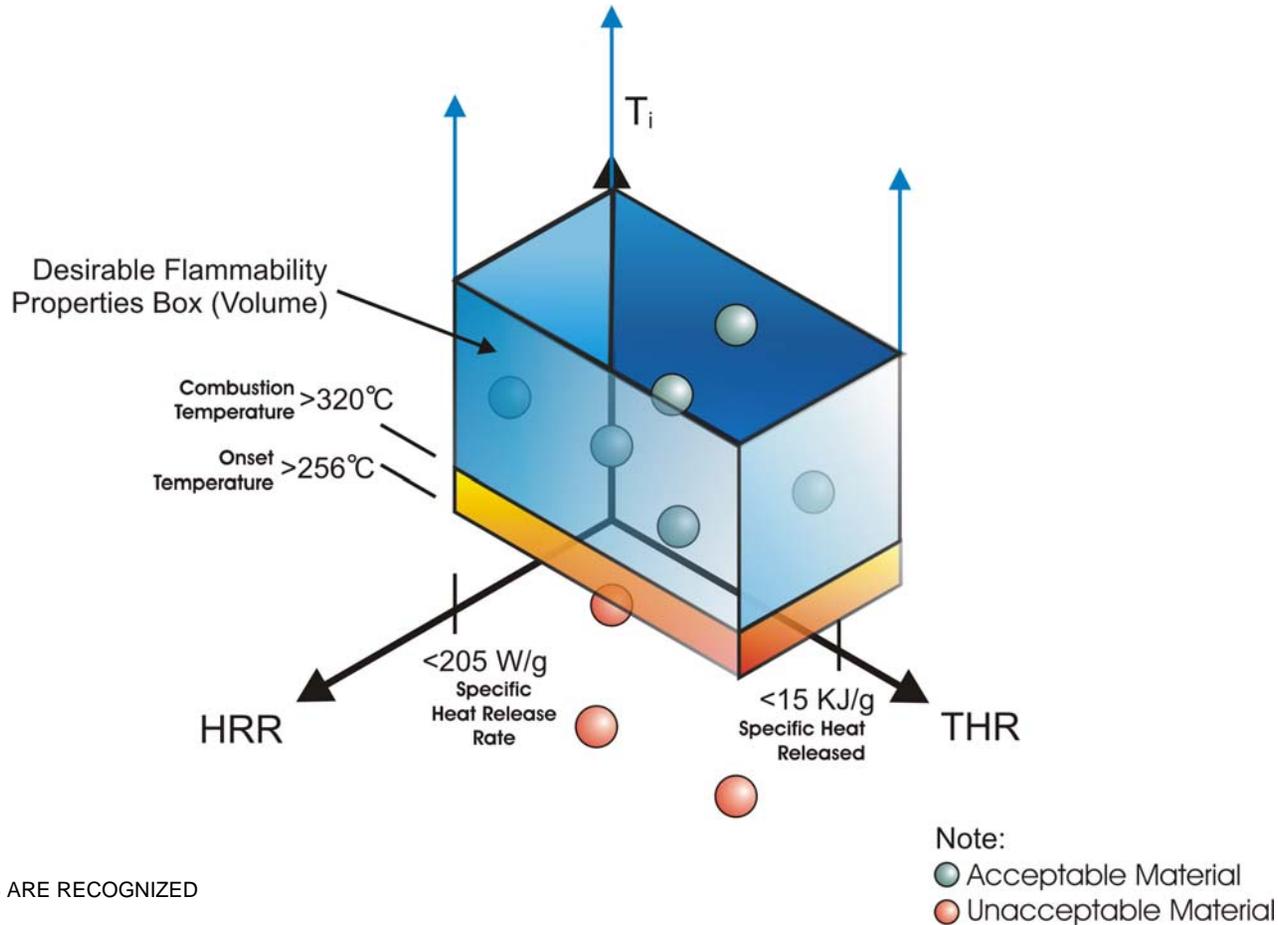
SPECIAL CONDITION ACCEPTANCE CRITERIA APPLICATION

- ✓ Normally in the radiant heat panel test, the longest flame propagation length is found after the pilot flame has been removed from the sample and the sample continues to burn on its own until it self-extinguishes or the fire is extinguished by the test evaluation staff.
- ✓ But sometimes, the physical configuration (like reinforcement ribs) of the sample affects the pilot flame impingement free forward flow. In this case, the longer flame propagation length may occur during the pilot flame impingement (refer to the material AV example).
- ✓ In this special condition case, If the sample flames retract back after the pilot flame is lifted and they do not exceed the 5.08 cm threshold afterwards, the propagation observed during the pilot impingement shall be ignored if the material is fireworthy.
- ✓ For this special condition criteria, a material is considered fireworthy if its combustion temperature is higher than 320 degC, has a total heat release less than 15 kJ/g, and has a heat release rate of less than 205 W/g (determined with ASTM D 7309-07).

Flame Propagation – Special Criteria



ASTM D 7309-07 FLAMMABILITY CHARACTERISTICS TO MEET AIR DUCTING RHP TEST*



* SOME EXCEPTIONS ARE RECOGNIZED

Flame Propagation – Special Criteria Example



Example of a Material that Requires the Usage of the Special Condition Acceptance Criteria – Sample AV

Flame Propagation – Special Criteria Example



Sample AV passes RHP test when ribs are parallel to pilot flame ($BL < 5.08$ cm)



Flame Propagation – Special Criteria Example



Sample AV flames exceed 5.08 cm during the pilot flame application when ribs were perpendicular to pilot flame, but retracted after the pilot was removed.



Flame Propagation – Special Criteria Example



FACTS

- ✓ When the pilot flame was impinged on the sample, having its ribs perpendicular to the pilot, the flames travel along the rib promoting combustion past the 5.08 cm threshold.
- ✓ The pilot flame temperature was much higher (963 degC) than the combustion temperature of the materials used to fabricate the sample AV composite (skin = 680 degC, ribs = 622 degC, primer = 323 degC).
- ✓ When the pilot flame was lifted from the sample, the flames burning on the sample retracted behind the 5.08 cm boundary line because of the material's fireworthy properties.
- ✓ The fire propagation after the pilot impingement was less than 5.08 cm.

Flame Propagation – Special Criteria Example

SAMPLE AV FLAMMABILITY PROPERTIES (ASTM D 7309-07 DATA)

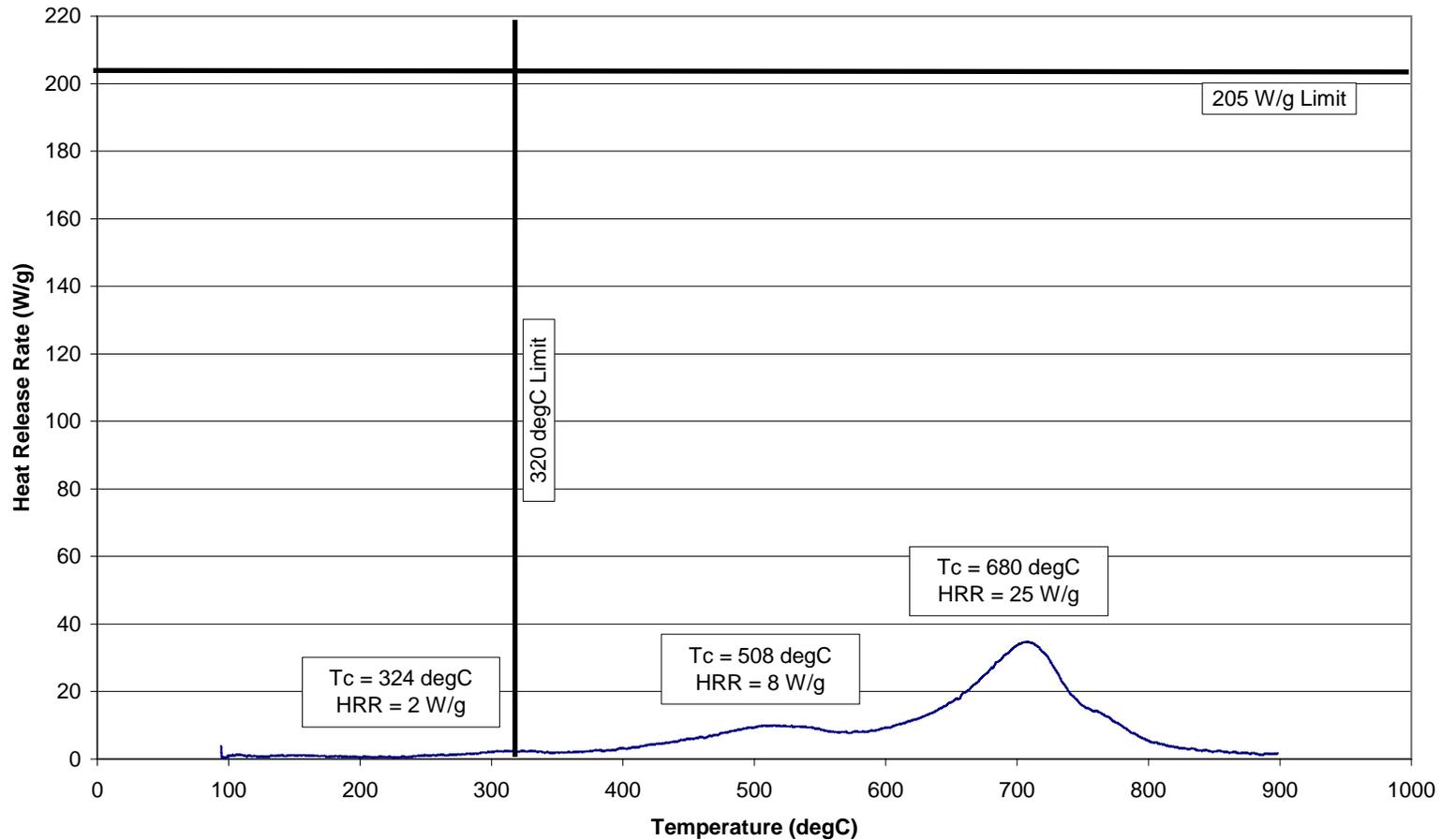
FLAMMABILITY PROPERTIES	SAMPLE AV			DESIRABLE PROPERTIES TO MEET THE RHP TEST
	Skin	Ribs	Primer	
Combustion Temperature (degC)	680	622	323	> 320
Total Heat Released (kJ/g)	5	8	0.1	< 15
Heat Release Rate (W/g)	25	145	1	< 205

Flame Propagation – Special Criteria Example

MICROSCALE COMBUSTION CALORIMETER TEST 061407T4

Material: AV

ASTM D 7309-07 Data

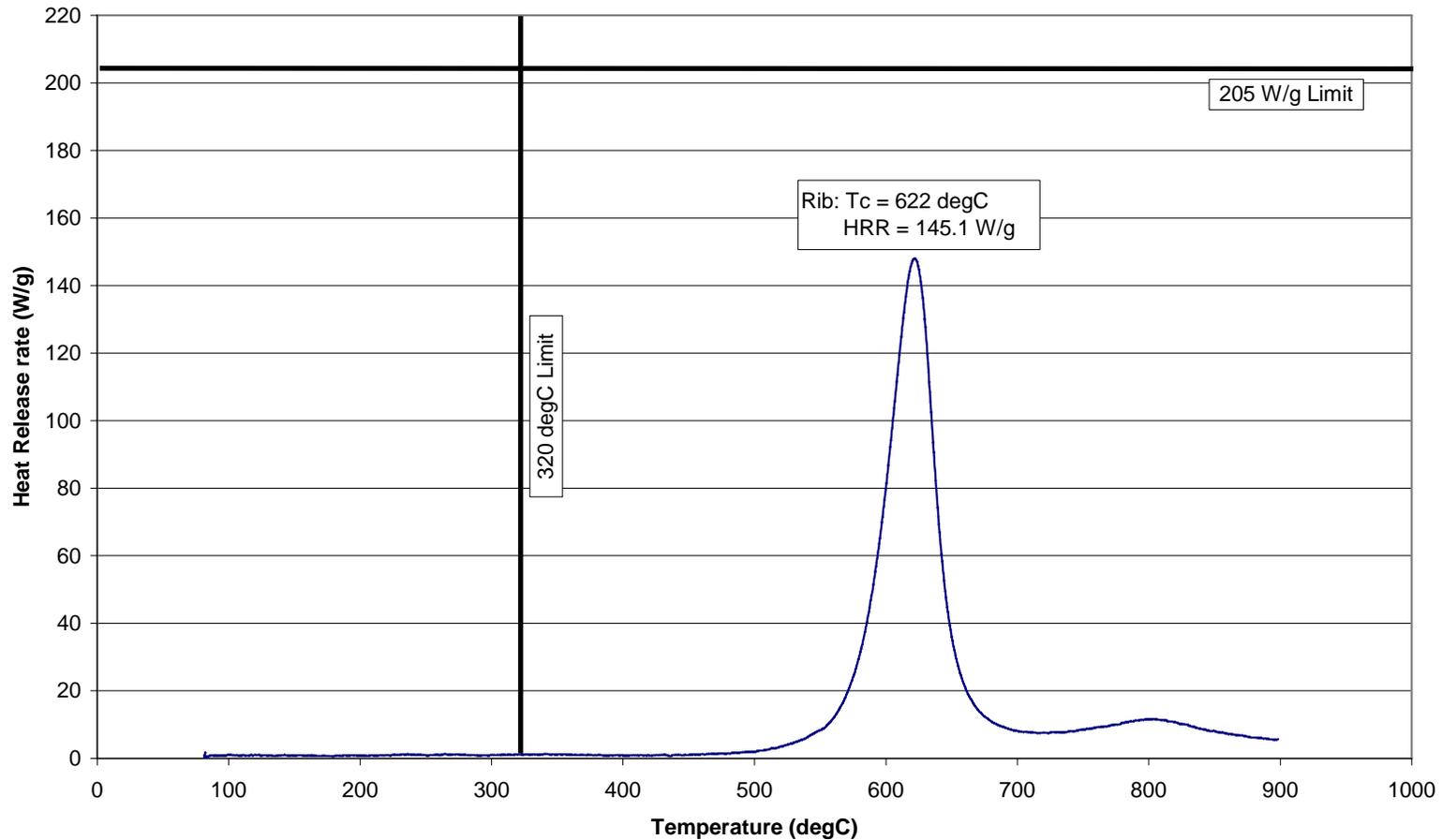


Flame Propagation – Special Criteria Example

MICROSCALE COMBUSTION CALORIMETER TEST 061407T3

Material: AV

ASTM D 7309-07 Data



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Report



Report Due

- Draft final report is due on September 2007
- It will be available for review by the task group members after it passes initial FAA internal review.





Questions?

