Development of an Improved Fire Test Method and Criteria for Aircraft Electrical Wiring

UPDATE

Presented to: The International Aircraft Material Fire Testing Working Group

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Date: June 17-18, 2009

Location: Koeln, Germany

Federal Aviation Administration

Outline

- Additional Work Recommendation
- 30-Degree RHP Test Setup
- 30-Degree RHP Test Results
- Final Words

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Additional Work

Recommendation

– The National Fire Protection Association and ASTM International concluded and recommended, in their previous research studies, that the flammability of wires should be determined by bundling the wires, instead of testing a single wire. They indicated that different thermodynamics exist, when they burn as a group, because of the radiation that emanates from each of the wires in the bundle (heat energy to and from the wires) .

–In this past quarter, the FAA Technical Center decided to test the wires using bundles to study it and decide which specimen configuration to use.

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30-Degree RHP Test Setup

30-Degree Radiant Heat Panel Test for Electric Wire

– To be recommended as replacement test to Chapter 4 in the *Aircraft Materials Fire Test Handbook* and 14 CFR Part 25 Appendix F, part I (1v) and (3)

– **Sample Size:** 38.1cm long wire bundle (1.27 cm in diameter) mounted at 30 degrees from horizon.

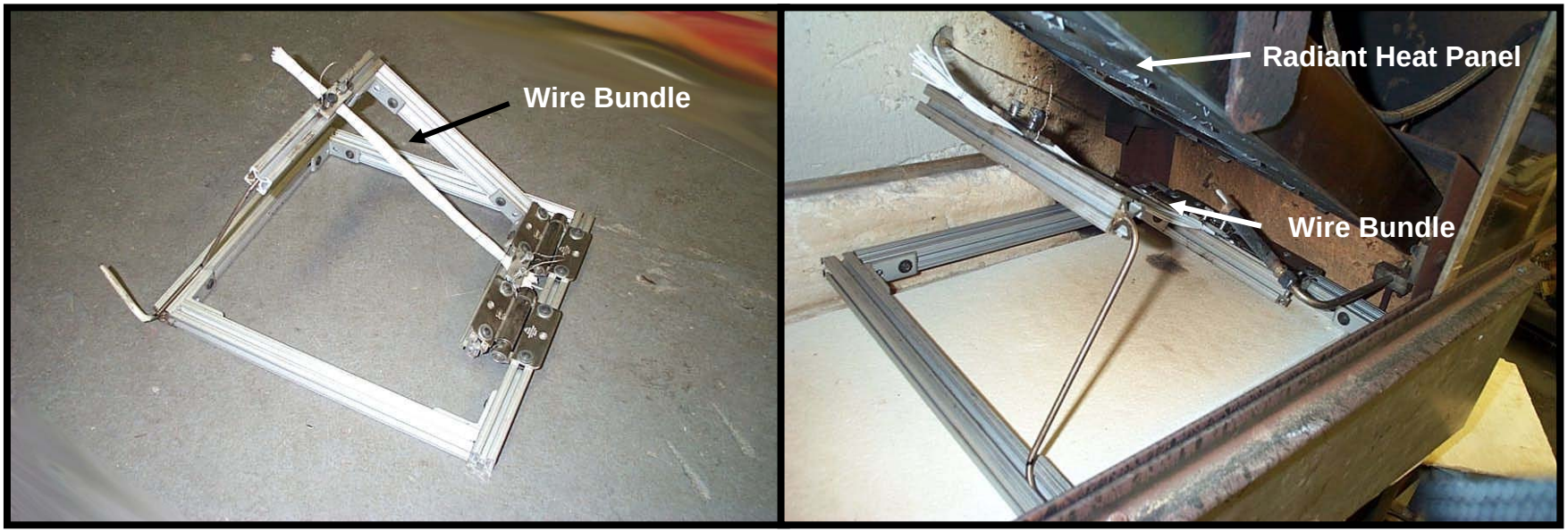
– **Heat Sources:** (1) Radiant Heat: 1.7W/cm^2, (2) Pilot Flame: Propane Flame (T>1093 C), perpendicular to wire sample

– **Heat Source Exposure:** (1) Radiant Heat: 1 minute, (2) Pilot Flame: 3 seconds

– **Acceptance Criteria:**

- **Flame Extinguishing Time:** <30 seconds
- **Burn Length:** <7.6 cm

30-Degree RHP Test Setup



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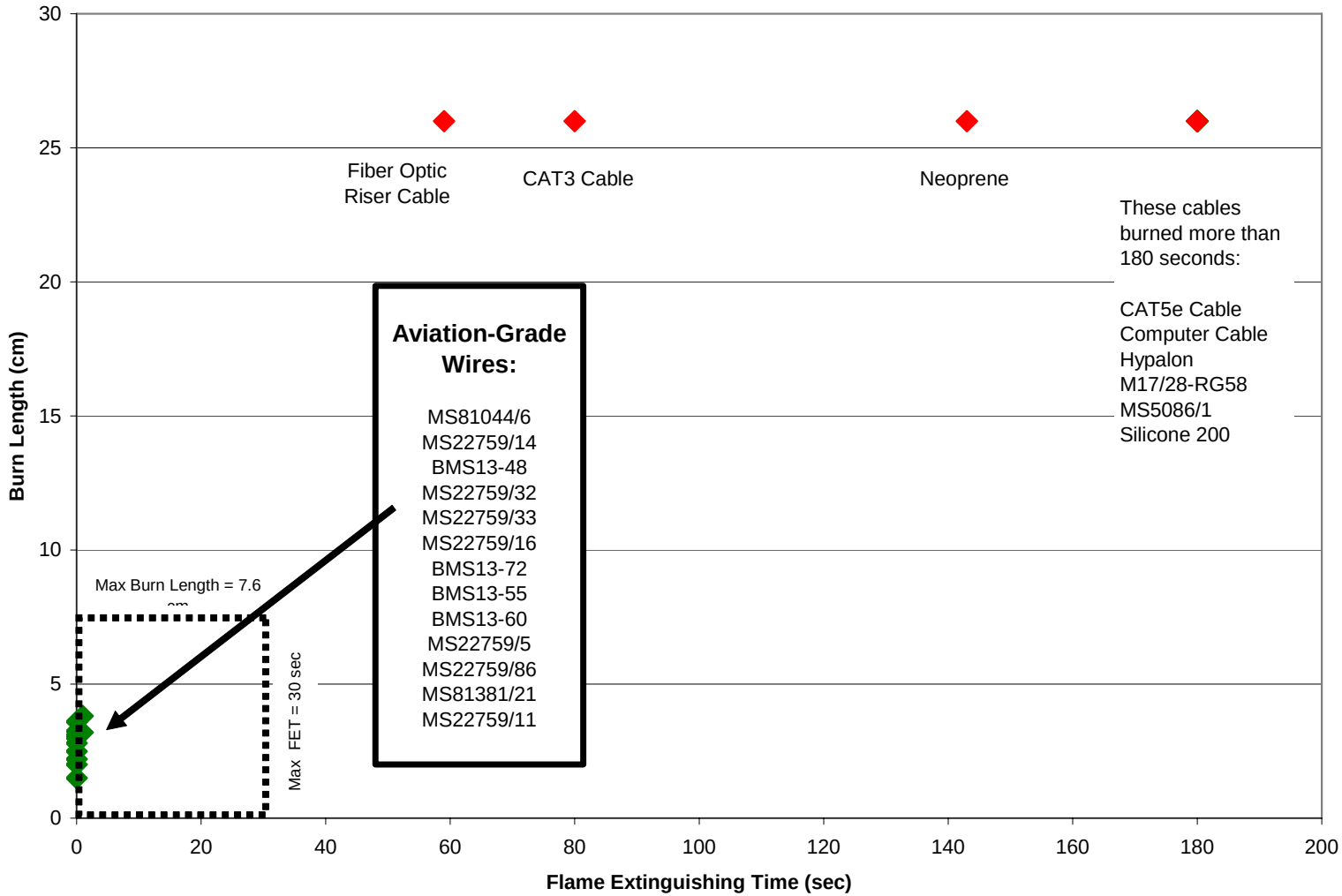
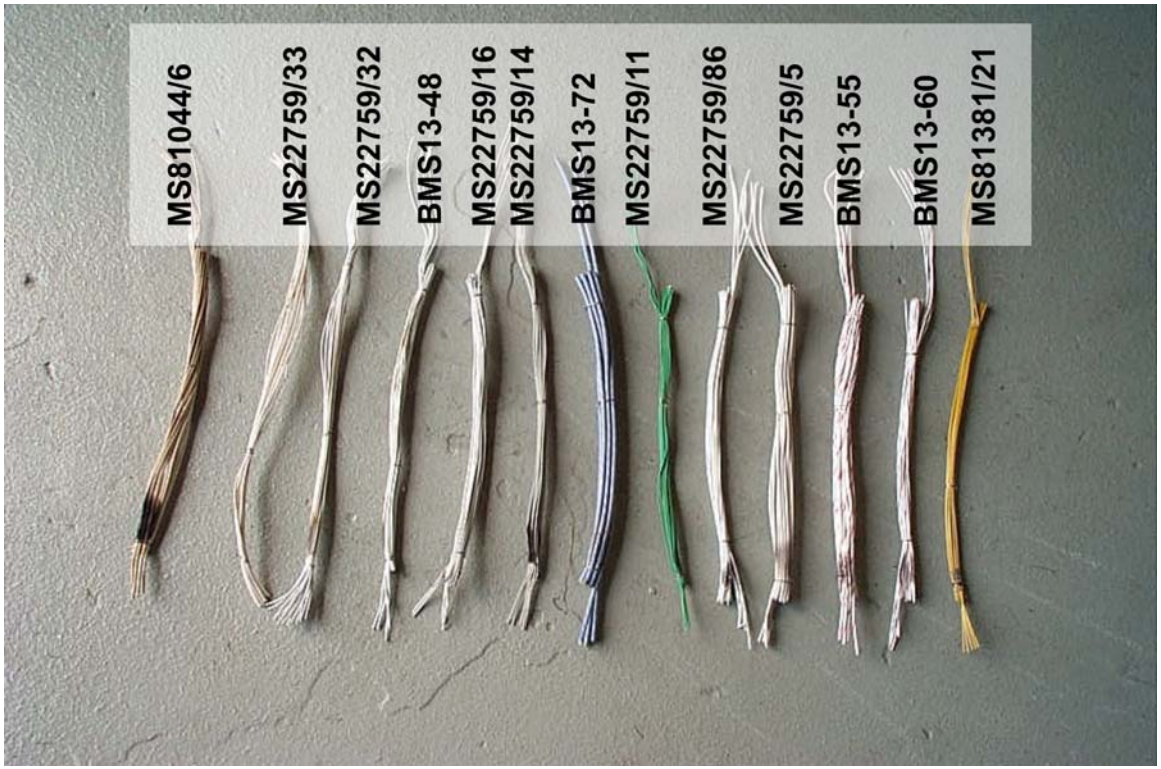
30-Degree RHP Test Results



Item No.	Material ID	Number of Wires/Cables in Bundle	Flame Extinguishing Time, FET (sec)	Burn Length, BL (cm)	Conductors Exposed?	Pass/Fail Criteria	Matched ISF Test?	Comments
1	MS22759/11	25	0	1.5	Yes	Passed	Yes	
2	MS81381/21	25	0	2.0	No	Passed	Yes	
3	MS22759/86	25	0	2.2	No	Passed	Yes	
4	MS22759/5	20	0	2.5	No	Passed	Yes	Light stain on the insulation
5	BMS13-60	25	0	2.8	No	Passed	Yes	
6	BMS13-55	25	0	3.0	No	Passed	Yes	
7	BMS13-72	10	0	3.0	No	Passed	Yes	But, shield exposed
8	MS22759/16	25	0	3.0	No	Passed	Yes	
9	MS22759/33	25	0	3.1	Yes	Passed	Yes	
10	MS22759/32	25	0	3.2	Yes	Passed	Yes	
11	BMS13-48	25	0	3.6	Yes	Passed	Yes	
12	MS22759/14	25	1	3.2	Yes	Passed	Yes	
13	MS81044/6	25	1	3.8	No	Passed	Yes	
14	Fiber Optic Riser Cable	5	59	26.0	Yes	Failed	Yes	
15	CAT3 Cable	6	80	26.0	Yes	Failed	Yes	
16	Neoprene	12	143	26.0	Yes	Failed	Yes	
17	CAT5e Cable	6	180	26.0	Yes	Failed	Yes	Exceeded 180 seconds
18	Computer Cable	4	180	26.0	Yes	Failed	Yes	Exceeded 180 seconds
19	Hypalon	8	180	26.0	Yes	Failed	Yes	Exceeded 180 seconds
20	M17/28-RG58	5	180	26.0	Yes	Failed	Yes	Exceeded 180 seconds
21	MS5086/1	25	180	26.0	Yes	Failed	Yes	Exceeded 180 seconds
22	Silicone 200	16	180	26.0	Yes	Failed	Yes	Exceeded 180 seconds

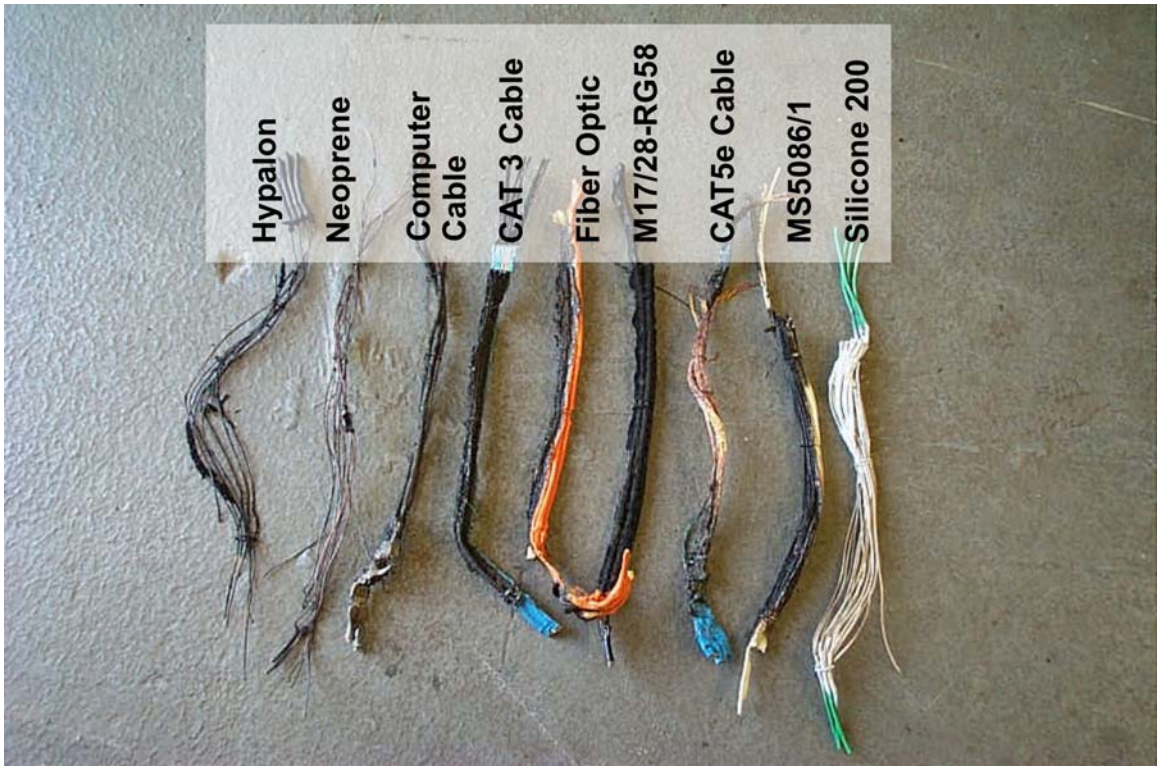
Note: Heat Flux: 1.7 W/cm^2, Wires at 7.62 cm from Panel, 1 min Exposure, 3 seconds Pilot

30-Degree RHP Test Results



Fireworthy Wire Bundles (Aviation-Grade)

30-Degree RHP Test Results



Non-Fireworthy Wire Bundles (Low Temperature Rating =< 105°C)

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Conclusions:

- ✓ Wire bundling did not affect the results of the aviation-grade wires (current), but it increased the flame extinguishing time and burn length of the low temperature rating wires.
- ✓ Wire bundle specimens amplified the results of the single-wire specimens due to additional fuel (material), and radiant/contact heat interaction between the bundled wires.
- ✓ A wire bundle, instead of a single wire, will be used in the final flammability test method.

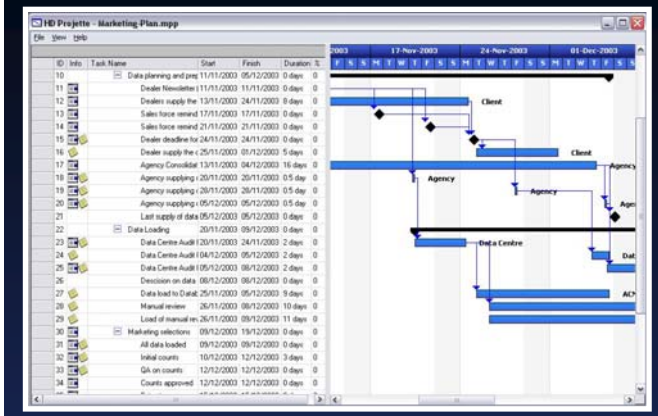
Final Words

Project Status:

Project Tasks % Completion = 98%

Cost Performance Index = 1.18

Schedule Performance Index = 0.97



Final Words

Questions?

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