

# Next Generation Fire Test Burner for Powerplant Fire Testing Applications

International Aircraft Systems Fire  
Protection Working Group  
Cologne, Germany  
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**Federal Aviation  
Administration**

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<http://www.fire.tc.faa.gov>



# Background

- **Currently specified oil burners are no longer commercially available**
- **Industry is utilizing legacy oil and propane burners**
- **Propane burner has been shown to be less severe than an engine flammable fluid flame**
- **New Technology Sonic Burner developed and approved for use in interior and fuselage testing.**
  - Sonic Burner provides numerous advantages to legacy burners
- **FAA Tech Center Fire Safety Branch has been tasked by Transport Standards Branch (TSB) to develop burner performance standards for the next-generation fire test burner for powerplant fire testing**
  - New burner should be much easier to calibrate, provide more consistent results, and be readily available for industry use.

# Current Status - Testing

- **Previous round robin consisted of aluminum, PAN and copper slug calorimeter**
- **Searching for additional non-metallic materials to test in a round robin with objectives of**
  - Utilizing results to ensure proper settings of sonic burner
  - Ensure consistency of testing within lab using sonic burner
  - Ensure repeatability across burners at various labs

# Materials Previously Evaluated

- **10-ply carbon composite**
- **Carbon Fiber – 1-ply, 2-ply & 3-ply**
- **Fiberglass – 1-ply, 2-ply & 3-ply**
- **Garolite**
- **¼” Honeycomb Panel**
- **Fiberglass cargo liner**

*All shown to not be suitable for round-robin testing*



# Materials Previously Evaluated -Resonate Testing

	TEMP (min Avg)	BTU/Hr	Burnthrough TIME	Vibration applied @	Summary	Comment
Panel 1	2025	4696	00:27:16	20:20	Wednesday Afternoon.	Vibration applied in the expectation of generating expedited Burnthrough- No significant impact observed.
Panel 2	2010	4606	00:25:18	20:20	Wednesday Afternoon.	
Panel 3	2011	4641	00:26:30	00:00	Thursday Morning	Vibration 4G applied from start. NO IMPACT- Vibration discontinued.
					Applied vibration has no impact?	
Panel 4	2116	5234	0:24:45	No Vibe	Thursday Afternoon	Excess Flame temp and BTU/hr applied. NO IMPACT.
					Increased BTU does not significantly affect burnthrough time	
Panel 5	2035	4720	0:20:00		Bolt installed in center of panel	1 week later returned with new approach. Stopped test- Bolt making no impact
Panel 6	2019	4839	0:22:34		Bolt installed in center of panel with a 5kg load	Pull through eventually achieved!

**Test 4 Flame artificially high, no significant impact.**

**Test 6 Pull Through load, no significant impact.**

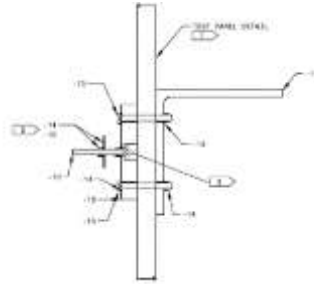


# Current Work – Composite Panel Design and Initial Setup Concept (Spirit Aerosystems)

A small metal fitting will be mechanically fastened to the composite panel to introduce load on the panel and generate a failure in a time frame of greater than 5 minutes, but less than 15 minutes. The metal fitting will be covered by a hard insulation to minimize damage to the metal fitting during the test and reduce the chance of backside ignition prior to catastrophic panel failure. The panels will contain an even number of gr/ep plies, and for those that have a core, the core will be positioned within the center of the plies so that the panel construction is symmetric. Core materials utilized include a .25" Aramid (Kevlar) Paper Core or a .60" Fiberglass Phenolic Honeycomb Core and the total number of gr/ep plies will be either 4, 8, or 12 plies.



•Flame Side Shown



•Fitting Section View

•(graphics from Spirit AeroSystems)



•Cold Side Shown

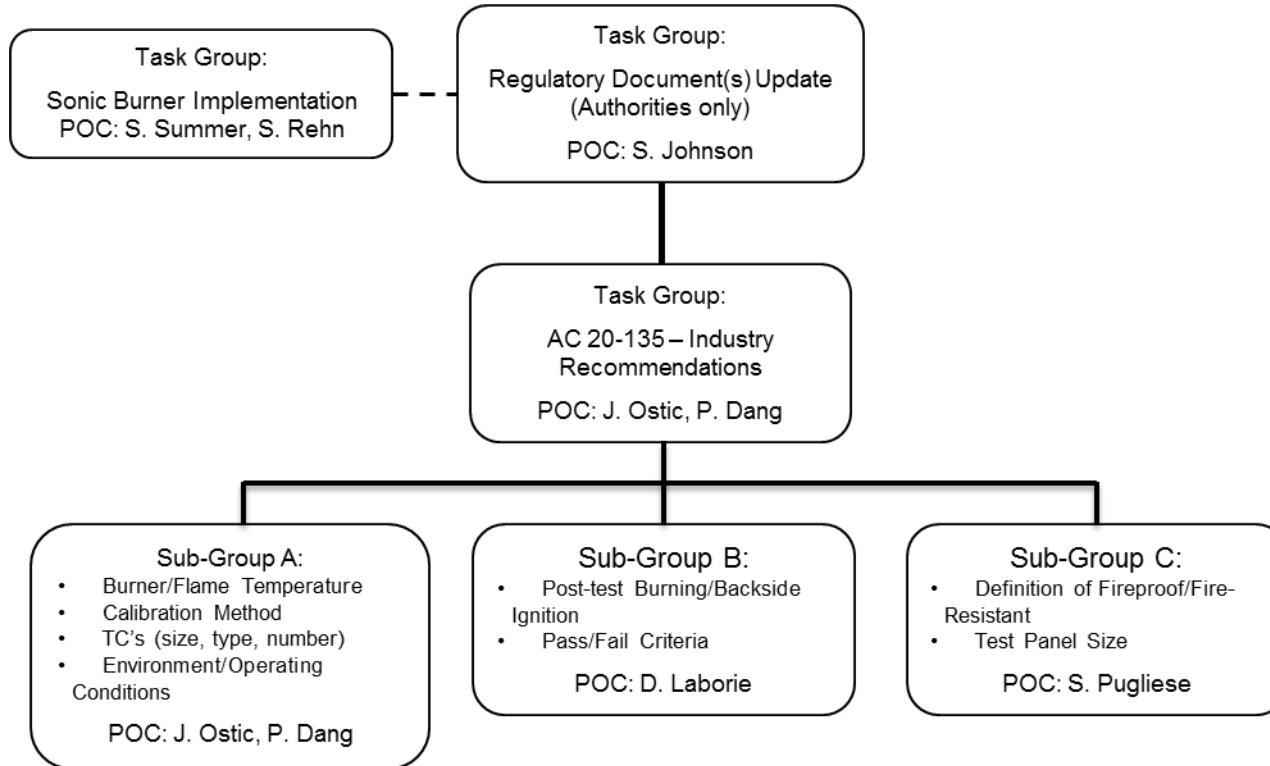
## •Important Note

•After testing a few of panels it was determined that removing the insulation from the center fitting and mounting to a smaller steel frame provided a better test setup to induce panel failure closer to the preferred timeframe.

# Current Work - Spirit Aero Material Evaluation

- Initial testing at NIAR showed promising results with burnthrough occurring between 3 – 5 minutes, depending on configuration.
- Testing ongoing at NIAR to refine weight loading and ensure repeatability
- Testing at NIAR, FAA and possibly 1 additional lab to ensure reproducibility to take place in coming months
- Following that a round-robin study is planned to evaluate legacy and sonic burner

# Task Group Status





# Current Work – T/C Round Robin

- **Initiated by Resonate Testing through the Task Group**
- **Objective is to investigate effect on temperature readings caused by:**
  - External sheath diameter and wire gauge
  - Exposed junction vs sheathed
  - Thermocouple age
- **In process of procuring thermocouples**
- **8 labs in agreement to participate**

# Current Work – T/C Round Robin

- **Four T/C types to be evaluated:**
  - 1/8” exposed junction
  - 1/16” exposed junction
  - 1/8” Grounded/Sheathed
  - 1/16” Grounded/Sheathed
- **Proposed testing to utilize four rakes, with a center control T/C in each**
- **Initial comparison testing of 5 measurements per rake**
- **Cycling test to consist of 20 measurements per rake**

Rake one:

1	2	3	4	5	6	7
1/8	1/8	1/8	1/8	1/8	1/8	1/8
exposed	exposed	exposed	exposed	exposed	exposed	exposed
			control			

Rake two:

1	2	3	4	5	6	7
1/16	1/16	1/16	1/8	1/16	1/16	1/8
exposed	exposed	exposed	exposed	exposed	exposed	exposed
			control			

Rake three:

1	2	3	4	5	6	7
1/8	1/8	1/8	1/8	1/8	1/8	1/8
sheathed	sheathed	sheathed	exposed	sheathed	sheathed	sheathed
			control			

Rake Four:

1	2	3	4	5	6	7
1/16	1/16	1/16	1/8	1/16	1/16	1/16
sheathed	sheathed	sheathed	exposed	sheathed	sheathed	sheathed
			control			

# Migration to SAE Committee

- **Current task group effort being moved to SAE Committee**
- **This will allow more formal engagement/collaboration amongst industry and authorities to develop guidance regarding the revision of regulatory documents and testing requirements**

# SAE Committee

- **Task Request to SAE:**
  - Develop standards for use in demonstrating compliance with the powerplant fire protection requirements. Develop updated methods for a new burner (sonic burner) as an optional replacement for existing fire test burners, which are no longer manufactured.

# SAE Committee

- **Committee to be formed as SAE A22 Fire Protection and Flammability Testing Committee**
- **Kickoff meeting to be held May 9 & 10<sup>th</sup> following the Systems Fire Protection WG**

# Questions?

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