Development of a Lab-Scale Flame Propagation Test for Composite Fuselages

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Introduction

- **With the increased use of non-traditional materials for modern aerospace applications, fire test methods must be continually updated and re-evaluated in order to maintain a high level of passenger safety**
  - Application of fire tests to modern materials
  - Re-evaluation of pass/fail criteria
  - Introduction of new safety threats with new materials
  - Develop new standards or test methods to address these issues
- **Composite materials (carbon fiber-epoxy) are being used in places where aluminum was traditionally used**
  - Fuselage skin
  - Structural members – stringers and formers
  - Seat frames
  - Fuel tanks
- **There is a need to evaluate the fire properties of these materials to ensure there is not a decreased level of safety**

Composite Fuselage

- **There is a need to evaluate the fire properties of a composite fuselage**
  - Burnthrough
  - Toxicity
  - In-flight burnthrough
  - Flame propagation
- **This objective of this study is to determine whether a composite fuselage will pose a flame propagation hazard**
  - Identify potential scenarios where a threat may be present
  - Evaluate threat with full or intermediate scale test
  - Analyze results to determine if there is an increased risk
  - Use full/intermediate scale test results to develop a lab-scale test for future certification purposes

Evaluation of Flame Propagation Risk

- **An intermediate scale test was performed using the foam block fire source**
- **Different configurations of the fire source, thermal acoustic insulation, and composite panel were attempted**
- **Test results indicated that the material being evaluated did not present a flame propagation hazard**
- **Other composites or composites of varying thicknesses may pose a threat**

Development of Lab-Scale Test

- **Use the results from previous intermediate scale test as a baseline for a "pass"**
  - The intermediate scale test results were used to certify that specific material for use in aircraft
  - The intermediate scale test will not suffice for certification, however, as it is a large test and takes time and money to perform
  - Certification tests must be performed when varying the material (different epoxies, thicknesses, etc.)
  - The lab scale test must provide the same discretion as the intermediate scale test, but be more efficient to perform
- **Radiant Panel Test Apparatus**
  - The radiant panel test is very useful for evaluation flame propagation tendencies for materials
  - The test is more of a "surface" test, as radiant heat and the burner impingement are applied to the material surface
  - Material thickness and thermal conductivity play a large role in this test
  - Test parameters must be adjusted to account for composite materials of varying thicknesses (warm-up time, flame exposure time, radiant heat energy, etc.)
  - Task here is to determine if the radiant panel test will be useful for evaluating the flame propagation threat of composite materials

Status

- **Work is in the initial phase right now**
- **Initial work will involve tooling with the radiant panel and different composite material plaques to observe how the material behaves in this test**
  - Vary sample size, thicknesses
  - Vary radiant heat and flame exposure times
- **Gather samples of different composite materials for intermediate and lab scale tests**
- **Perform intermediate and lab scale tests, change test parameters such that the intermediate and lab scale results correlate**

Task Group

- **Would like to form a task group to get input from members**

Questions or Comments?

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