A threat-based approach to part 25 flammability regulations

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Current Transport Airplane Flammability Requirements

- Basic requirements contained in §§25.853, 25.855, 25.856 and 25.1713
- Test methods and detailed requirements contained in Appendix F
- Supported by Advisory Circulars and Aircraft Materials Fire Test Handbook
Current Flammability Requirements

- Apply to all interior materials, except:
- Small parts… that would not contribute *significantly to the propagation of a fire*…
- Certain locations in the airplane, unless a specified type of part
- The interior portion of exterior surfaces
Historical Evolution

• Requirement for evaluating flammability of materials dates to 1940’s
  – First only if smoking was allowed
  – Then irrespective of smoking
• Initially did refer to ‘threat’ i.e., ignition by a cigarette or matches
• Later requirements (into the 70’s) simply based on material, or use, but not driven by threat per se
Research Focus

• In 1958, FAA established the National Aviation Facilities Experimental Center
• One of its research programs investigated the threats posed by fires and ways to characterize them
• This program initially focused on materials and post-crash fire threats
• As the program matured, the focus on the threat(s) became more prominent
Threat-based research/regulation

• Research focus on two basic fire threats: in-flight and post-crash
• Characterization of those threats in a way that lends itself to standards
• Regulatory action based on the research, and safety benefit assessments specific to each action
Threat Characterization for Standards

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Current State

• Appendix F has grown and evolved over 40-plus years

• Each successive revision has focused more specifically on a particular safety issue
  – Beginning with radiant heat standard for escape slides
  – Continuing through radiant panel for inaccessible areas

• Many materials/parts are subject to multiple requirements
  – Because of different usage (carpet on a floor and a sidewall)
  – Because more than one requirement applies (both Bunsen burner and Heat Release apply to affected parts)
Current State cont.

- Appendix F has 7 parts
- Only part I establishes requirements based on type of material (as opposed to usage)
- Current approach, whether by usage or material, is to list applicable parts explicitly
- All requirements permit ‘other approved equivalent method’
Main Factors in Establishing Flammability Requirement

• **Nature of threat: principally**
  – Post Crash, or
  – In flight

• **Potential contribution of the item: principally**
  – Propagation, and/or
  – Intensity, and/or
  – Penetration

• **Relative ability to mitigate: principally**
  – Accessible, or
  – Inaccessible
Threat Hierarchy

- Accessible, or exposed materials subject to both in-flight and post crash threats
- Post crash is more intense threat
- In general, parts meeting post crash requirements are acceptable against in-flight threats
- In-flight threats most significant for materials in inaccessible regions, which are generally not subject to the post crash requirements
Several motivators for new rulemaking

- Enhanced safety
- Standardization
- Simplification
Existing Test methods and their applicability

- Bunsen burner: post-crash, in-flight, accessible and inaccessible materials—six possible tests/criteria
- Oil Burner (seats, cargo liners, insulation): used both for post-crash and in-flight threat representation, accessible and inaccessible materials—three test methods
Existing Test methods and their applicability

• OSU/NBS Chambers: Post-crash, in-flight accessible materials—two test methods
• Radiant Panel: in-flight, inaccessible materials (currently just insulation)—single test method at present
• Radiant furnace test for escape slides (only captured in TSO C69)—single test method
• Fire containment for receptacles—not captured in a rule per se
Representation of Current State

Post Crash Fire Safety
- OSU/NBS
- TSO C69
- Appendix F, part VII

In-Flight Fire Safety
- Bunsen Burner
- Radiant Panel
- Appendix F, part I
- Appendix F, part II
- Appendix F, part III
- Appendix F, part IV and V
- Appendix F, part VI

Accessible

Inaccessible
Current state has

- Lots of overlap
- Lots of test methods
- Challenges to determine applicable requirements
Example of Simplified Structure

- **Appendix F, Part I:**
  - In-flight fire protection requirements
- **Appendix F, Part II:**
  - Post crash fire protection requirements
Future Appendix F, part I

- IA Radiant Panel Requirements for Inaccessible areas
- IB Oil burner—cargo liner Requirements for cargo compartments
- IC Fire containment tests for all disposal receptacles
- ID Bunsen burner General Requirements Resistance to ignition;
Future Appendix F, part II

- IIA OSU/NBS—Large surface area parts
- IIB Oil burner—Cushions
- IIC Oil burner—Insulation in the lower half
- IID Radiant furnace—Escape slides
Current Appendix F, Part I would become…

- Things not covered elsewhere that could contribute to the propagation of a fire
- Possibly only 1 test method (for airplanes with >19 pax)
- Simplified method to qualify common things, such as adhesive used to bond two parts together (a ‘fabricated part’ is covered by one of the other tests)
Some Issues to Consider

- Airplanes with less than 20 passengers
  - Some standards currently don’t apply
  - Would one test method be sufficient in that case?
- Small parts: concept based on size might not be most appropriate
- Implementation: simplified rule might be attractive, but could also include some enhancements to safety, i.e., certain elements more onerous than currently
Status

• FAA beginning the rulemaking process
• ARAC tasking published in August
• First Working Group meeting is scheduled
• FAA will provide a proposal to ARAC, rather than request a proposal starting from scratch