ransport Airplane and Engine ARAC Sub-Committee Meeting Agenda

FAA - TAD First Floor Conference Room
1601 Lind Ave SW, Renton, WA 98057

November 4, 2015
All Times are Pacific Standard Time

DRESS: BUSINESS CASUAL

Wednesday November 4, 2015 – *Call in number:*

Dial In Access: (USA Only)	888-924-3230
Dial In Access: (Direct Dial)	609-916-1975
Dial In Access (Alternate USA Only)	888-335-6670
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passcode: 311471

9:00	Call to Order, Reading of the Procedures Statement, Review of Agenda, Meeting Logistics, Review of Action Items, Review of Minutes from previous meeting, Calendar	Ali Bahrami/ Victor Wicklund
9:15	FAA Report	Mary Schooley
9:45	ARAC Report	Ali Bahrami
10:15	Transport Canada Report	M Provencher
	EASA Report - Cancelled	
10:45	Engine Harmonization WG Report – Engine Endurance Testing	Peter Thompson
11:15	Airworthiness Assurance Working Group Report	S Chisholm/M. Yerger
11:45	Flight Test Harmonization WG Report	Bob Park/Christine Thibaudat
12:15	Lunch	All
1:30	Metallic and Composite Structures WG Report	Michael Gruber
2:00	Materials Flammability WG Report	Jim Davis
2:30	Crashworthiness and Ditching WG Report	Kevin Davis
3:00	Action Item Review / Any Other Business	A. Bahrami

-- ADJOURN --

4910-13

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

Aviation Rulemaking Advisory Committee Meeting on Transport Airplane and Engine Issues

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Notice of public meeting.

SUMMARY: This notice announces a public meeting of the FAA's Aviation Rulemaking Advisory Committee (ARAC) Transport Airplane and Engine (TAE) Subcommittee to discuss TAE issues.

DATES: The meeting is scheduled for Wednesday, November 04, 2015, starting at 9:00 am Pacific Standard Time. Arrange for oral presentations by October 16, 2015.

ADDRESSES: FAA-Northwest Mountain Region Office, conference room 122, 1601 Lind Ave. SW, Renton, WA 98057.

FOR FURTHER INFORMATION CONTACT: Ralen Gao, Office of Rulemaking, ARM-209, FAA, 800 Independence Avenue, SW, Washington, DC 20591, Telephone (202) 267-3168, Fax (202) 267-5075, or e-mail at ralen.gao@faa.gov.

SUPPLEMENTARY INFORMATION: Pursuant to section 10(a)(2) of the Federal Advisory Committee Act (Pub. L. 92-463; 5 U.S.C. app. III), notice is given of an ARAC meeting to be held November 4, 2015.

The agenda for the meeting is as follows:

- Opening Remarks, Review Agenda and Minutes
- FAA Report
- ARAC Report
- Transport Canada Report
- EASA Report
- Engine HWG Report
- Airworthiness Assurance HWG Report
- Flight Test HWG Report
- Materials Flammability WG Report
- Metallic and Composite Structures WG Report
- Crashworthiness and Ditching WG Report
- Any Other Business
- Action Item Review

Participation is open to the public, but will be limited to the availability of teleconference lines.

To participate, please contact the person listed in FOR FURTHER INFORMATION by email or phone for the teleconference call-in number and passcode. Please provide the following information: Full legal name, country of citizenship, and name of your industry association, or applicable affiliation. If you are participating as a public citizen, please indicate so. Participants are responsible for any telephone, data usage or other similar expenses related to this meeting.

The public must make arrangements by October 16, 2015, to present oral or written statements at the meeting. Written statements may be presented to the Subcommittee by

providing a copy to the person listed in the FOR FURTHER INFORMATION CONTACT section. Copies of the documents to be presented to the Subcommittee may be made available by contacting the person listed in the FOR FURTHER INFORMATION CONTACT section.

If you need assistance or require a reasonable accommodation for the meeting or meeting documents, please contact the person listed in the FOR FURTHER INFORMATION CONTACT section.

Issued in Washington, DC on October 2, 2015.

Lirio Liu,
Designated Federal Officer,
Aviation Rulemaking Advisory Committee.
[FR Doc. 2015-25608 Filed: 10/7/2015 08:45 am; Publication Date: 10/8/2015]

Aviation Rulemaking Advisory Committee (ARAC)
Transport Airplane and Engine (TAE) Subcommittee

Meeting Minutes

Date: November 4, 2015, 2015
Time: 09:00 a.m. (PST)
Location: 1601 Lind Ave SW, Renton, WA 98057

Public Notification
The *Federal Register* published a notice of this meeting on October 8, 2015.

Call to Order /Administrative Reporting
Mr. Victor Wicklund, the FAA TAE Subcommittee Lead, opened the meeting at 9:07 a.m.

Following the reading of the Opening Statement, Mr. Ali Bahrami, the TAE Subcommittee Chair, shared the agenda (Handout #1). Ms. Mary Schooley, FAA member, gave an overview of the agenda. It was announced that Mr. John Piccola started a new position and Mr. Wicklund is the new FAA TAE Subcommittee Lead. Mr. Bahrami acknowledged there is no reason to review the action items from the June 2015 meeting because there were none. Mr. Bahrami motioned to the TAE members to approve the minutes and the TAE members approved the minutes, with a minor correction.

Item	June 2015 Meeting Action Items	Status
1	N/A	

FAA Update (See Handout #2)
Ms. Schooley presented this update.

The update covered rulemaking projects status, Advisory Circular (AC) and policy status, upcoming ARAC tasking notices, and future rulemaking proposals. Ms. Schooley clarified the fire protection rule expects to publish in March 2016.

Mr. Doug Kihm, a TAE member, asked why the inflight engine restart rulemaking was not originally tasked through the TAE subcommittee. Mr. Wicklund clarified that the focus of the rule is surrounding rotor lock and is currently addressed through issue papers. Mr. Mark Beauregard, a TAE member, asked for clarification as to when the FAA expects to publish the systems safety assessment NPRM. Ms. Schooley confirmed that the FAA now expects to publish the NPRM for comments by December 2016.

Mr. Beauregard asked when to expect the bird ingestion rule to publish and Ms. Schooley confirmed there is no estimate at this time. Mr. Beauregard asked the FAA to find out how it will address this issue in the meantime. The FAA took the action to look into it and respond back to the TAE subcommittee.

Mr. Kihm asked about the status of the extended-range twin-engine operational performance standards (ETOPS) AC. Mr. Wicklund confirmed that the FAA expects to publish the AC for comment in the first quarter of 2016. Mr. Kihm further asked why the FAA decided to draft the AC without the help of the TAE subcommittee. Mr. Wicklund reminded the TAE subcommittee that the ETOPS rulemaking was finalized and published in 2007 along with a draft AC. The FAA is incorporating the lessons learned from the draft AC. For example, the work with applicants on new type certificates (TC's) and amended TC's though issue papers. Mr. Kihm said the issue with the already published draft is that it doesn't factor in recommendations from the TAE subcommittee. Mr. Kihm voiced concern over the amount of comments the FAA will receive and Mr. Wicklund acknowledged. Mr. Steve Chisolm seconded the concern over the expected amount of significant comments to the ETOPS AC.

Ms. Schooley informed the TAE members that the FAA will be asking the Avionics Systems Harmonization Working Group (ASHWG) to clarify whether their phase 2 recommendations cover low energy situations in which the airplane is both slow and close to the ground. The clarification request will be discussed during the ARAC December 2015 public meeting and the ASHWG can address the question after approval.

Mr. Kihm asked what is the process for reviewing taskings? Mr. Bahrami clarified he will discuss this topic during the ARAC update.

In addition to the request for clarification for the ASHWG, Ms. Schooley announced the TAE subcommittee should expect two new taskings in 2016. The new taskings will address flutter and crashworthy fuel systems.

Mr. Chisolm asked if there is any more information about protection from debris impacts? What does it involve? Does it match the European Aviation Safety Agency (EASA) conversations about wheel and tire debris? Mr. Wicklund confirmed the FAA is harmonizing with EASA's rulemaking on the subject.

ARAC Update (N/A)

Mr. Kihm was acknowledged for presenting the TAE subcommittee update during the ARAC meeting in September 2015. One issue discussed during the ARAC September 2015 meeting was the tasking due date, specifically referencing the cargo task. The issue was when there is an end date in a tasking notice, is it due to the TAE subcommittee or the ARAC? The answer for

tasking notices starting in 2013 is the end date signifies the recommendation report is due to the FAA.

When the FAA drafts a tasking notice, the FAA should allow time for the recommendation report to get approved through both the TAE subcommittee and the ARAC. Keeping this in mind, a question was asked if the working group chairs should apply for extensions now based on this new information. Mr. Bahrami agreed that the working group chairs should apply for the extension if the working groups need extra time. In addition he asked the working group chairs if they have any concerns. Most of the working group chair's agreed that they struggle to keep the working group engaged, participating, and being prepared to meetings. Mr. Bahrami then asked how he could help. Mr. Kihm suggested that the TAE subcommittee should accommodate the TAE schedule in line with the ARAC schedule. Mr. Bahrami agreed to have further conversations with the Office of Rulemaking (ARM) regarding expectations and the perception that the ARAC is a long process. There was discussion surrounding the upcoming rotorcraft crashworthiness tasking that is being submitted to the ARAC. This is not a TAE subcommittee task, but it received lots of scrutiny from the ARAC members. Mr. Bahrami explained the background of this task; based on NTSB recommendations to update regulations like fuel tank protection and that many new models don't take into account these outdated regulations. There was discussion and agreement that the cost/benefit information is crucial. The ARAC revised the task and split it into two phases; phase 1 is to make an assessment on the existing rules. Phase 2 is to determine if there is a subset of rules to elevate safety and the cost/benefit information.

Mr. Bahrami informed the TAE members about the discussion he and Ms. Schooley had with the ARM. He said the ARM emphasized transparency within the TAE subcommittee, to keep the ARM included and the official ARAC mailbox email address on all official TAE business. There is a change to how taskings get approved; first the FAA will develop the task, it is approved by the FAA's Rulemaking Management Council, submitted to the ARAC for approval and once approved, it will be submitted to the TAE subcommittee. In the past, the tasking would be reviewed by the TAE members prior to being submitted to the FAA's Rulemaking Management Council and the ARAC. This process is inconsistent with procedure and is not in line with the Federal Advisory Committee Act (FACA). Mr. Bahrami said this is another issue he will further discuss with the ARM.

Another change being implemented is establishing a five year term limit with the option to renew for the TAE Chair. Mr. Bahrami explained that he views his role as the TAE Chair as representing the TAE members. He will do his best to work and facilitate issues with the ARM and the ARAC on behalf of the TAE. Mr. Bahrami expressed desire for the members to inform him of any areas of improvement. Mr. Kihm suggested the use of project management tools to see the big picture of the FAA, the ARAC, and the TAE subcommittee.

Mr. Beauregard brought up that the EASA develops a four year plan of future rulemakings and shares it and the FAA only develops a plan for the next fiscal year. He asked that the FAA explain its process. Ms. Schooley will report back to the TAE subcommittee.

A discussion occurred regarding unmanned aircraft system (UAS) and how it is a priority for the FAA. The TAE members voiced concern with the message the FAA is sending to industry when it says the rulemaking pipeline is full, especially because of UAS projects.

Mr. Bahrami discussed the upcoming calendar of events. He would like to make it align with the ARAC calendar so that the TAE subcommittee can better align its products. Mr. Kihm suggested the calendar be made available online through either the website or a sharepoint site.

Transport Canada Update (N/A)

Mr. Michel Provencher, the TCCA representative, reported there is no update at this time.

EASA Update (Handout #3)

Mr. Thomas Mickler was not available to present, but provided the update to the TAE subcommittee. Mr. Bahrami presented the update to the TAE members. All specific questions regarding the presentation should be sent to Ms. Schooley and she will consolidate and send to Mr. Mickler There was some discussion about the slides.

- SLD. There are some differences between the EASA and FAA versions of this rulemaking package.
- Runway excursion. If already an NPA, we are aware of them.
- Aging structures.
- Slide number 7, checking dates for NPA published and extended.
- Not addressed bird ingestion.
- Cybersecurity. Coordination with ARAC and EASA.
- Ditching parameters, related to crashworthiness. Slide 25. FAA should ask EASA.

Engine Harmonization Working Group (EHWG) Update – Engine Endurance Testing (Handout #4)

Mr. Peter Thompson, the working group chair, presented this update.

This working group has bi-weekly teleconferences, and meets face-to-face at least quarterly. The next meeting will be in December 2015 held at Williams International. Mr. Thompson reported that the working group is on schedule, but it's a challenging schedule. The hurdle the working group faces is the data gathering and analysis. Mr. Thompson reported the biggest challenge with the working group is engaging the members to continue to stay involved. Mr. Thompson met with the FAA to report on the progress and the FAA is pleased with the progress.

Airworthiness Assurance Working Group (AAWG) Update (See Handout #5)
Mr. Steve Chisholm, the working group chair, presented this update.

Mr. Chisholm announced that Mr. Mark Yerger accepted a new job and will no long co-lead this working group. The next task is to ask another operator to agree to co-chair. What is the future of this working group? The tasking of providing recommendations to implement the widespread fatigue damage (WFD) rule will expire in January 2017. Mr. Chisholm said this working group accepted tasks from other TAE working groups, it continues to be a valuable group, and that the TAE should continue tasking the AAWG. Mr. Bahrami agreed, but said we need to tighten control of this working group and will work with the FAA to decide the path forward, which includes taskings and determining how it fits into the ARAC activities.

Flight Test Harmonization Working Group (FTHWG) Update (See Handout #6)
Mr. Brian Lee, the working group chair, presented this update.

The working group has been meeting by teleconference and face-to-face. They have been discussing the following topics; envelope protection, stability, longitudinal and lateral, FBW aspects, flight in icing, steep approach and landing.

Mr. Lee reported that the National Civil Aviation Agency of Brazil (ANAC) should be more active in participation. Some topics are contentious and they expect dissenting positions. He also expressed that attendance and participation of all members is crucial to completing the tasking. He requested support from the AAWG for the low energy alert requirement, Stability Task Group.

The following discussions took place surrounding the following topics:

- Envelope protection. The working group is trying to harmonize all issues papers. The major issue is if you protect the envelope, can the pilot override it? Is there a minimum maneuver capability?
- Sidestick. This topic has been discussed at one meeting. The working group is waiting for consensus data from the original equipment manufacturer (OEM's)
- Out of trim, means of compliance details. Actively discussing proposals.
- Wet runway stopping performance. This topic has been discussed at one meeting and will be further discussed at future meetings.
- Runway excursion hazard. The working group has no clear consensus yet.

Mr. Lee voiced concern about recommendation reports just siting and rulemaking not starting right away. Mr. Bahrami insists that interim reports are important because it is a formal way to close the issue. Mr. Bahrami will discuss the notion that interim reports provide a close out of

issues with the FAA. He will also discuss with the FAA what will happen with remaining tasks that are not completed in the given timeframe.

Transport Airplane Metallic and Composite Structures Working Group Update (See Handout #7)

Mr. Mike Gruber, the working group chair, presented this update.

In the presentation, slide 3 lists the original 10 tasks with two additional tasks. Tasks 11 and 12 were developed by the working group members. Mr. Kihm believes task 11 is similar to task 6 and task 12 is similar to task 7. He suggested that instead of separate tasks, they might be subtasks. Mr. Gruber said the two additional tasks are a little different. This does beg the question of scope creep.

Mr. Gruber asked the TAE members to approve the work plan. Mr. Bahrami asked the TAE members to review for approval with a week deadline. Mr. Bahrami asked the TAE members to provide work plans examples, so that he can benchmark and create a standard work plan. Mr. Gruber said the working group started with a four month delay so they will most likely ask for an extension.

Materials Flammability Working Group Recommendation Report (See Handout #8)

Mr. Jim Davis, the working group chair, presented the recommendation report.

Mr. Davis said the working group researched inflight regime and post-crash regime. They forecasted performance standards for the future. They looked at the cost impact. He gathered most of the original working group members back together to work this continuation of tasking. Page 11 in the recommendation report is a recap. Page 13 discussed the framework for cost and benefit. Cost impact by area can be found on page 16. Page 17 discussed the qualitative information. The FAA did additional testing at the Technical Center to determine if the 15 inches to the floor matters and the FAA found it does matter. The recommendation report shows where costs could increase and decrease. Mr. Kihm asked about the assumptions of how the rule would apply to cost, with new TC, if applied to not a new TC, the cost would be greater. The FAA Technical Center is still developing the vertical flame testing with pass/fail criteria. The TAE subcommittee should agree to submit the recommendation report with a caveat of taking into account that the FAA Technical Center is still developing and to not start the rule without those results. Mr. Davis agreed and strongly believes the advisory material should publish at same time of the rule. Mr. Wicklund confirmed that is consistent with the FAA's rulemaking process. Mr. Bahrami said this continuation of tasking was created because of the cost/benefit information. He then asked if the working group felt comfortable that the recommendation report addressed the task. Mr. Bahrami expressed concern with the recommendation report because some results are not clear. Mr. Davis said the area with the biggest question was

significant items with inaccessible area standards. The line in the sand could be now either major or minor cost. Time and other constraints did not allow the working group to nail down the dollars for accuracy and the working group would like that documented. Mr. Kihm asked how to define the inaccessible areas and how to show compliance? If everything requires a test, this is not cost effective. The FAA needs to be clear in the preamble. Mr. Bahrami asked about timeline for this rule. Ms. Schooley said the FAA placed it on hold until this recommendation report is approved by the ARAC and submitted to the FAA. Mr. Kihm asked if we took out certain aspects, would it end the opportunity of proposing the rule? Mr. Gardlin explained there are a lot of aspects to this rule. The FAA will use this recommendation report to reassess the proposal and determine the next steps. Mr. Bahrami asked about the issue of test methodology; what is the understanding of the timing and how to progress? He anticipates that these are the type of questions the ARAC will ask. Mr. Gardlin mentioned the bar for new test methods. Boeing and Airbus have prototypes and the FAA is working with them to find out where the bar should be drawn. By the time the FAA publishes the NPRM for comment, there should be defined protocol for testing with cost/benefits.

The TAE subcommittee approved the recommendation report and will submit it to the ARAC for the December 2015 meeting. Mr. Bahrami acknowledged the tough job the working group had and they produced a good recommendation report on a complicated and complex issue. He asked that Mr. Davis please convey this to all the working group members. He asked Mr. Davis to develop a letter to ensure the preamble and the advisory material address the application of change product rule modified, clear up definition of pass/fail, define inaccessible area standards, and to develop test methods. This letter will be included in the submission to the ARAC.

Mr. Bahrami wants to keep the working group intact for another six months so that the FAA can easily ask the working group questions, which is phase 4 of the ARAC process. Mr. Davis said it is already included as task 6. Mr. Bahrami suggests this be part of each ARAC tasking notice.

The recommendation report is due to the ARM-20 Council Coordinator by December 1, 2015. Mr. Bahrami motioned the TAE members for approval of the recommendation report. The TAE members approved it.

Crashworthiness and Ditching Working Group Update (See Handout #9)

Mr. Kevin Davis, the working group chair, presented the update.

He informed the TAE members the next step is to develop the work plan and submit it to the TAE subcommittee for concurrence. In the work plan, they will include a time line for document submittal. The kick off meeting is December 8 and 9, 2015 in Everett, WA.

A question rose surrounding resolution and documentation of foreign delegate's participation on working groups. Ms. Schooley confirmed they checked with both the FAA's international lawyers (AGC-7) and Mr. Jim Crotty, the ARM-200 manager, about foreign delegates participation and agreed this information should be documented.

Action Item Review

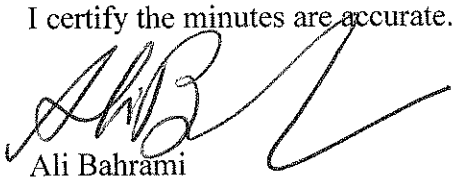
Item	November 4, 2015 Meeting Action Items	Status
1.	Ms. Schooley will report to the TAE subcommittee on how the FAA will currently address the bird ingestion issue while the FAA works on the rulemaking.	
2	Mr. Bahrami will have further conversations with the ARM surrounding timing and expectations, transparency, effectiveness of the TAE subcommittee.	
3	Mr. Beauregard asked that the FAA explain its process for prioritizing rulemakings for upcoming years.	
4	Create online sharepoint site or website for the TAE subcommittee.	
5	EASA Report – Any questions should be sent directly to Ms. Schooley who will collect the questions and send to Mr. Mickler.	
6	Airworthiness Assurance Working Group - Decide the path forward, including taskings and how it fits into the TAE activity.	
7	Flight Test Harmonization Working Group –The TAE members will discuss with the FAA what will happen if the FTHWG does not complete all of the assigned tasks. Also, what does the tasking statement say on interim reports?	
8	Metallic and Composite Structure Working Group – Mr. Bahrami asked the TAE members to review and approve the work plan, with a one week deadline.	
9	Mr. Bahrami asked the TAE members to provide examples of work plan and to create a standard work plan.	
10	Crashworthiness and Ditching Working Group - Develop work plan and submit to the TAE subcommittee for concurrence.	
11	Crashworthiness and Ditching Working Group - Resolution and documentation of foreign delegates participation on working groups.	
12	Material Flammability Working Group - The recommendation report is due to the ARM-20 Council Coordinator by December 1, 2015. This includes a letter from Mr. Jim Davis. Mr. Davis is to draft the letter for the TAE members to review and approve, prior to submitting the report to the ARAC.	

Any Other Business

None.

Future Transport Airplane and Engine Subcommittee Meetings:
The next subcommittee meeting will be held on June 22, 2016 in Arlington, VA.

Approval
I certify the minutes are accurate.



Ali Bahrami
TAE Subcommittee Chair, ARAC

MEETING ATTENDEES

NAME	ORGANIZATION
Ali Bahrami	AIA
Victor Wicklund	FAA AIR
Mary Schooley	FAA AIR
Katie Haley	FAA ARM
Doug Kihm	Boeing
Michel Provencher	Transport Canada
Tom Peters	Embraer
Rolf Grenier	Airbus
Jim Davis	Accufleet
Michael Gruber	Boeing
Mark Beauregard	AIAC
Walt Sippel	FAA AIR
Jeff Gardlin	FAA AIR
Suzanne Masterson	FAA AIR
Carlos Guzman	Boeing
Peter Thompson	GE
Steve Chisholm	Boeing
Brian Lee	
Mike Gruber	Boeing
Kevin Davis	Boeing

FAA Rulemaking Status Update

Transport Airplane and Engines (TAE) Subcommittee to ARAC

Presented to: TAE

By: Victor Wicklund, Acting Manager,
Transport Standards Staff

Date: November 4, 2015

Federal Aviation Administration

November 2015 TAE Meeting

Topics:

- Rulemaking Project Status
- AC and Policy Status
- Upcoming ARAC Taskings
- Rulemaking Proposals for FY16 / 17

November 2015 TAE Meeting

Rulemaking Project Status (since June 2015)

Part 25/26/33/35/121 Final Rules Published

– None

Part 25/26/33/35/121 NPRMs Published

– None

November 2015 TAE Meeting

Rulemaking Project Status (since June 2015)

Part 25 Final Rules

- **In Headquarters Coordination**
  - *Fire Ext and Class B & F Cargo Compartments* (CHWG)
  - *Fuel Vent Fire Protection* (non-ARAC)
- **In Directorate Coordination**
  - *Fuel Tank and System Lightning Protection* (FSLP ARC)

November 2015 TAE Meeting

Rulemaking Project Status (since June 2015)

Part 25 NPRMs In Directorate Coordination

- *System Safety Assessments* (ASAHWG)
- *Flammability Requirements for Transport Airplanes* (MFHWG)

Canceled Part 121 Related NPRM

- *Part 121 / 129 Exiting Icing* (IPHWG)

November 2015 TAE Meeting

Rulemaking Project Status (since June 2015)

NPRMs in Development

- **Part 25**
  - *Yaw Maneuver Conditions 25.353* (FCHWG)
  - *Inflight Engine Restart 25.903* (non-ARAC)
- **Part 33/35**
  - *Bird Ingestion 33.76* (EHWG)
- **Part 121 Related**
  - *Low Airspeed Alerting* (ASHWG)

November 2015 TAE Meeting

Advisory Circular Status (since June 2015)

Final Part 25 / 121 Advisory Circulars (ACs)

- None

Final Part 33 / 35 AC

- *AC 20-18B, Qualification Testing of Turbojet and Turbofan Engine Thrust Reversers*
  - Issued on July 7, 2015

Canceled 33/35 ACs

- *AC 33-3, Turbine and Compressor Rotors Type Certification Substantiation Procedures*
- *AC 33-1B, Turbine Engine Foreign Object Ingestion and Rotor Blade Containment Type Certification Procedures*
  - Both were canceled on June 30, 2015

November 2015 TAE Meeting

Policy Status (since June 2015)

Final Part 25 / 33 / 35 / 121 Policy

- None

Draft Part 25 Policies

- *PS-ANM-25-20, High-Energy Wide-Area Blunt Impact for Composite Structures* (25.571, 25.1529, and Appendix H to part 25)
  - Comment period closes November 13, 2015

Draft Part 33 / 35 / 121 Policy

- None

November 2015 TAE Meeting

Proposed ARAC Taskings

Proposed Taskings for FY16

- Low Airspeed / Energy Clarification (ASHWG)
- *Flutter 25.629*
- *Crashworthy Fuel Systems* (§§ 25.561, 25.721, 25.963(d), and 25.994)

November 2015 TAE Meeting

Future Rulemaking Proposals

Start in FY16

– *Protection from Debris Impact*

Start in FY17 and Beyond

– *Propeller Pitch Beta Lockout* (25.1155)
– *Design Roll Maneuver* (25.349)
– *Cabin Safety Harmonization Miscellaneous Requirements*

November 2015 TAE Meeting

Questions?

Rulemaking status

Tasks affecting Large Aeroplanes CS-25 - Part-26/CS-26

and Turbine Engines CS-E

CT7.1 – Regulations and Certification policy

Your safety is our mission.

Summary

- On-going rulemaking tasks affecting:
  - CS-25 and/or Part-26/CS-26
  - CS-E
- Future rulemaking tasks affecting
  - CS-25 and/or Part-26/CS-26
  - CS-E

On-going rulemaking tasks affecting CS-25 and/or Part-26/CS-26

On-going RMTs

- Task RMT.0572– Use of similarity analysis when showing compliance to SLD icing specifications
- **TOR** published 28 Jan 2013
- Amend CS 25.1420 and several AMCs (25.1420 and others) to allow showing compliance to SLD related specifications using a comparative analysis of similarities to previously certified aeroplanes with safe in-service experience in icing conditions
- **NPA 2015-07** – consultation 12 Jun–14 Oct 2015
- Comments review on going
- **Decision** mid 2016

On-going RMTs

- Task RMT.0570 – Reduction of runway excursions
  - **NPA 2013-09** published 10 May 2013
  - New CS-25 and Part-26/CS-26 provisions requiring the installation of a runway overrun awareness and avoidance system on new designs and production a/c
  - Comments reviewed and meetings with industry- **standard needed to support any new rule**
  - **New NPA** with more objective based requirements (mid 2016)
  - Technical standards development (EUROCAE)
  - **Opinion / Decision** in 2017

On-going RMTs

- Task RMT.0225 Ageing Aircraft
  - New **CS-25** standards + **AMC 20-20** revision + new **Part-26/CS-26** requirements
  - Mitigation of safety risks associated with ‘ageing aircraft’ issues, ie catastrophic events due to fatigue and corrosion
  - **NPA 2013-07** consultation ended 23 Oct. 2013
    - 700 comments, very controversial
  - 2 review group meetings in 2014 (Feb, Sept)
  - **CRD** to be issued Dec 2015 (with reaction period)
  - **Decision CS-25** 01Q2016
  - **Opinion** (Part-26, Part-21); **Draft Decision** (CS-26, AMC 20, AMC to Part-M): 01Q2016
  - **Implementing rules and Decision** (CS-26, AMC 20, AMC to Part-M): 2017

On-going RMTs

- Task RMT.0049 Specific risk and standardised criteria for conducting aeroplane-level safety assessments of critical systems
  - **NPA 2014-02** published **27 Jan 2014**
  - Define a standardised criterion for conducting aeroplane-level safety assessment of specific risks that encompasses all critical aeroplane systems, based on the results of the ARAC ASAWG
  - Amend AMC 25.1309 to take into account the latest updates of industry documents, such as ED79A/ARP4754A
  - Update CS 25.671 on safety assessment of flight control systems, based on the results of the ARAC FCHWG
  - **Consultation** extended until **end June 2014**

On-going RMTs

- Task RMT.0049 (cont'd)
  - Comments under review
  - Cooperation planned with FAA for harmonisation purpose
  - **Task in standby at EASA: FAA NPRM delayed and awaited**

On-going RMTs

- Task RMT.0252 (MDM.056) Instructions for continuing airworthiness (ICAs)
  - Started in **Sept 2009** with publication of the **ToR**
  - **ToR Issue 4** dated **15 May 2013**
  - Objective: establish clear requirements and responsibilities for all parties involved in the production of ICAs, their approval and their implementation.
  - It will affect Part-21, Part-M, CS's, related AMCs/GMs
  - Schedule delayed (resources issue)
  - **2 NPAs being drafted:** 1 for 2016, 1 for 2017

On-going RMTs

- Task RMT.0069 Seat crashworthiness improvement on Large Aeroplanes - Dynamic testing 16g
  - Improve protection of occupants in survivable impact accidents - passenger and cabin crew seats meeting the improved standard for dynamic testing and occupant protection per CS 25.562
  - **NPA 2013-20** published **10/10/2013**
  - **Part-26/CS-26** rule for newly manufactured large aeroplanes used in CAT
  - **Opinion/Decision** to be issued end 2015

On-going RMTs

- Task RMT.0560 Halon: update of Part-26 to comply with ICAO standards
  - Various CSs already amended to comply with ICAO Annex 8 and Regulation 744/2010 (= no mention of halon in Book 1)
  - Annex 6 mandates “forward fit” on newly produced aircraft (based on existing TCs) of alternatives to halon in lavatory and hand-held fire extinguishers
  - **NPA 2014-26** published on **18/11/2014**
  - No mandatory retrofit envisaged …. but this is prescribed by Regulation (EU) 744/2010
  - Comments review complete
  - **Opinion/Draft Decision** 01Q2016
  - **Rule/Decision** in 2017

On-going RMTs

- Task RMT.0264 Executive interiors accommodation
  - **ToR** published **29 Feb 2012**
  - Establish Executive Interior design specifications that will amend and/or complement **CS-25** by introducing new provisions and associated AMC/GM for executive interiors, taking into account the compensating factors offered by such interiors and their utilisation
  - Industry-led Working Group, monitoring by EASA
  - NPA drafted by the WG - but contentious issues identified by EASA experts
  - **NPA** publication Dec 2015

On-going RMTs

- Task RMT.0384 Open rotor engine and installation
  - **ToR** published **14 Mar 2011**
  - Define safety objectives based on the unique nature of the open rotor configuration. New provisions for **CS-25** and CS-E should ensure that the safety levels of Open Rotor engine installations are consistent with those of the existing turbofan fleet.
  - Industry-led working group, monitoring by EASA
  - NPA drafted by the WG
  - Schedule delayed (resources issue)
  - **NPA** publication Nov 2015

On-going RMTs

- Task RMT.0249 Recorders installation and maintenance thereof - certification aspects
  - **ToR** published **18/09/2014**
  - Affects **CS-25**, and also CS-23, -27, -29
  - Improve the availability and quality of data recorded by flight recorders in order to better support safety accident investigation authorities.
  - Introduce specs for installation of deployable recorders.
  - 9 specific objectives – 6 safety recommendations
  - **2 NPAs:** 1 NPA estimated 02Q2016, 1 NPA in 2017

On-going RMTs

- Task RMT.0071 Additional airworthiness specifications for operations: Thermal/acoustic insulation material
  - **ToR** published **18/09/2014**
  - Objective: reduce the safety risks due to flame penetration and propagation by introducing retroactive specifications based on CS 25.856(a) and (b) (CS-25 amdt 6), applicable to already type-certified large aeroplanes
  - **NPA 2015-15** published 01/10/2015**,** consultation open until 08/01/2016

On-going RMTs

- Task RMT.0673 Regular update of CS-25
  - **NPA 2015-11** published 13/08/2015
    - Introduce the content of the Certification Memorandum on ‘Respecting Brake Energy Qualification Limits’
    - Various other clarifications, references updates, typographic corrections
  - Comments under review
  - **Decision** in 2016

On-going RMTs

- Task RMT.0647 Loss of control or loss of flight path during go-around or climb
  - Mitigate the safety risk concerning large aeroplanes, of loss of control of the flight path, or loss of control of the aircraft during go-around phases, or climb phases executed from a low-speed configuration and close to the ground
  - 3 safety recommendations linked (ASAGA study by BEA)
  - Envisage specifications for new designs (**CS-25**) and current designs (production cut-in with **Part-26/CS-26** rule)
  - **TOR** published **06 July 2015**
  - KOM of the Working Group end Nov 2015 (FAA is represented)
  - **NPA** publication estimated end 2016

On-going rulemaking tasks affecting CS-E/CS-P/CS-APU

Active Propulsion Related Tasks

Task No.	Title	Status			
		ToR	NPA	CRD	Dec.
RMT.0384 (MDM. 092)	Engine Open Rotor	√	2015 Q4	2016	2016
E.015	CS-E Regular Update	√	2016 Q1	2016 Q3	2016 Q3
MDM.089	Volcanic Ash (TCH Information) CS-P/CS-APU update	√	√	√	TBD

On-going RMTs

- Task RMT.0384 Open rotor engine and installation
  - **ToR** published **14 Mar 2011**
  - Define safety objectives based on the unique nature of the open rotor configuration. New provisions for CS-E should ensure that the safety levels of Open Rotor engine installations are consistent with those of the existing turbofan fleet.
  - Industry-led working group, monitoring by EASA
  - NPA drafted by the WG
  - **NPA** publication Nov 2015

Future rulemaking tasks affecting CS-25 and/or Part-26/CS-26

Future RMTs

- Task RMT.0648 Aircraft Cyber-security
  - Mitigate the impact on safety stemming from cyber security risks due to acts of unlawful interference with on-board electronic networks and systems
  - For **CS-25** aircraft, and consideration of CS-29/CS-23/CS-27 aircraft
  - **ToR** to be issued by **Dec 2015**
  - **NPA** envisaged for publication **03Q2016**

Future RMTs

- Task RMT.0118 Analysis of on-ground wings contamination effect on Take-off performance degradation
  - Demonstrate that prior to take-off, the a/c aerodynamic surfaces cannot accumulate **undetectable hazardous quantities of ice contamination**, or provide adequate means of detection
    - small or clear ice contamination that is difficult to detect by visual observation
    - cold soaked fuel ice contamination
  - When the aircraft has been de-iced by application of **de-icing and/or anti-icing fluid**, demonstrate that there is no hazardous effect on aircraft performance and manoeuvrability or controllability
  - **CS-25** provisions & consider retroactive requirements (**Part-26/CS-26**) for sensitive a/c at least
  - **ToR** to be issued by end 2015

Future RMTs

- Task RMT.0586 Tyre pressure monitoring system
  - Objective: Improve the regulations to ensure that large aeroplanes tyres inflation pressures remain within the pressure specifications defined by the aircraft manufacturer
    - operator's responsibility to ensure regular tyre pressure checks
    - aircraft manufacturer obligation to define the tyre pressure checks procedures and intervals in the Instructions for Continuing Airworthiness (ICA)
    - Installation of a tyre pressure monitoring system
  - **ToR + Group Composition** 03Q2016

Future RMTs

- Task RMT.0453 Ditching parameters without engine power
- Objective: Amend CS-25 to require a demonstration that the ditching parameters can be attained by pilots without the use of exceptional skill, including power-on and power-off ditching cases.
- NTSB SR from the A320 US Airways Hudson River ditching
- **ToR + Group Composition** 04Q2016

Future RMTs

- Task RMT.0397 Unintended or inappropriate rudder usage – rudder reversals
- Objective: Protect the aeroplane against the risk of unintended or inappropriate rudder usage.
- Consider the ARAC group recommendations
- New CS-25 standards
- Suitability of a rule for existing Types to be reviewed (not recommended by the ARAC group)
- **ToR** 01Q2017

Future rulemaking tasks affecting CS-E/CS-P/CS-APU

Future Propulsion RM Tasks

Task No.	Title	Status			
		ToR	NPA	CRD	Dec.
RMT.0671	Engine bird ingestion	2015 Q4	2016	2016	2016
RMT.0180	CS-E Engine Testing, Endurance / IMI / ETOPS	2016 Q1	2017	2018	2018
RMT.0686	HP Rotor integrity and loss-of -load (due to shaft failure)	2016	TBD	TBD	TBD
RMT.0384	Engine Bird Ingestion for Open Rotor Engines (included in RMT.0384)	ToR Issue 2 Q1 2016	TBD	TBD	TBD

RMT.0180 (E.005) Engine Testing (Endurance /IMI /ETOPS) – Pre-development

Objective and Scope:

- To review the existing § 33.87 / CS-E 740, to assess its suitability for current and future engines, and consider an alternate endurance test and associated methods of compliance.
- Introduce a formal reliability test for turbine engines, to reflect FAR-33 IMI test.

Harmonisation Objective:

- To harmonise Endurance and IMI testing required for compliance with CS-E and FAR-33.
- Without additional changes to align related rules, minor differences will remain.

Agency Involvement and timeline:

- Initially via ARAC.
- ToR planned for Q2 2016

Future Propulsion Related Tasks

Task No.	Title	Status			
		ToR	NPA	CRD	Dec.
RMT.0178 (E.008)	Safety Analysis for piston engines	2017	2018	2018	2019
RMT.0503	CS-APU Regular updates	As needed			
RMT.0684	CS-P Regular Updates	As needed			

EASA
European Aviation Safety Agency

The End

Your safety is our mission.

EASA is an agency of the European Union

ARAC Working Group Status 150 Hour Endurance Test (14CFR33.87)

Summary For TAE November, 2015

Peter Thompson – Working Group Chair

Team Membership

- Airbus
- Boeing
- EASA
- FAA
- GE Aviation
- HEICO
- Honeywell
- Pratt & Whitney
- Pratt & Whitney Canada
- Rolls-Royce Derby
- Rolls-Royce Indianapolis
- SNECMA
- Transport Canada
- Williams International

Meeting Rhythm

- Bi-weekly telecons
- Quarterly face-to-face meetings
  - ✓ 3 mtgs in 2014
  - ✓ 4 mtgs in 2015
  - ➢ One more planned for 2014
  - ➢ 2016 mtgs scheduled

Working Group Schedule

- WG received an extension of 18 months (to mid 2017) to complete its efforts, with following schedule:
  - Gather necessary supporting data from OEMs to support the Alternate Test – 1Q16
  - Draft report for internal OEM & FAA review – 2Q16
  - Incorporate feedback – 3Q16
  - Submit report to TAE – 4Q16
  - Incorporate feedback – 1Q17
  - Submit report to ARAC - 2Q17

Working Group Summary

- Consensus reached that current 14 CFR 33.87 rule is outdated relative to modern high bypass ratio, high pressure ratio engines
  - Significant modifications, that take the engine away from type design, are required just to run the prescribed test
  - Modern high bypass ratio, high pressure ratio engines do not reach triple red line conditions in service and rarely, if ever, reach double red lines
  - Low bypass, low pressure ratio, hydro mechanical control engines are more able to reach triple red-line conditions at SL and don't require extensive modifications like high bypass engines
- New test is required which will meet the intent of an accelerated endurance run on a type design engine configuration
  - Team is evaluating a cyclic test which includes same EGT R/L demonstrations, a revised demonstration of R/L speed capability and more LCF content than today's test, and retains the oil & fuel pressure/temperature, bleed, starts etc. of today's test
    - The test is more severe than typical field operation
- Details of proposed test planned to be available end Nov '15

Key Points

- For HP modules with variable geometry compressors, the critical factor that makes it difficult to run the current endurance test is the effect on cooling circuit efficiency due to non type design HPC variable system schedules
  - EGT is no longer a good proxy for assessing relative HPT component metal temperature
  - Changes in type design needed to run the endurance test result in unrepresentative metal temperatures
- Need to develop a rule strategy that will satisfy **original intent**, be a severe test that provides a significant challenge, to the engine, and
  - Enables the engine to run in type design configuration , and
  - Be appropriate for today's high pressure ratio engines, associated airplane designs and operation
  - Exposes, more effectively, the type of failure modes which may occur during the early entry into service period
- Engine service life now vastly in excess of duration of this test and "wear out" modes not necessarily represented

Working Activities

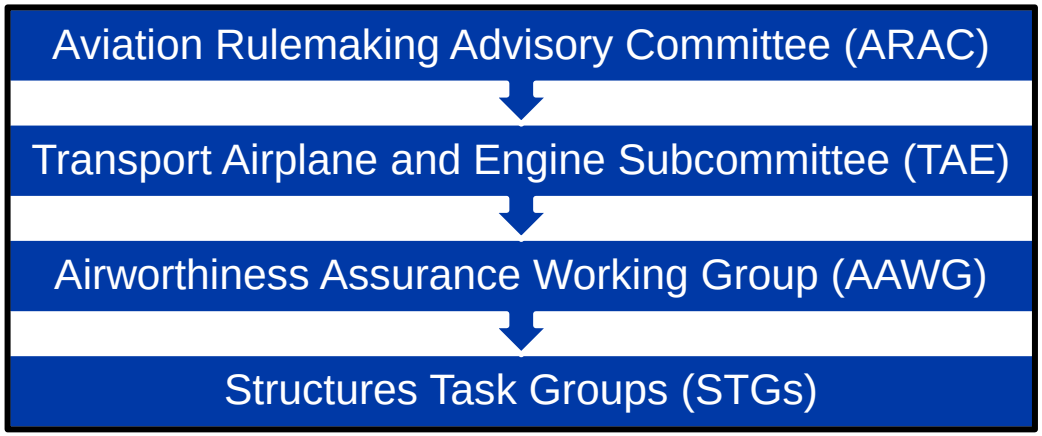
- The working group evaluated numerous minor modifications and variations to the basic content and profile of today's test - all potentially required significant modifications to the test engine if concurrent red lines or extended running at red line core speed were required
- Consensus reached to evaluate more detailed changes based on a modified service type cycle with some (TBD) running at limiting (red line) conditions – maintain **original intent** of rule and appropriate level of severity. Plan would be to include (TBD) varying times at Take Off & Max Con thrust settings
- Evaluate if other part 33 rules introduced or significantly modified post 14CFR33.87 may provide data to support the effort
- Evaluate harmonization efforts with EASA's regulations (CS-E 740) as appropriate

Reference

AAWG Report
Transport Airplane and Engine Subcommittee (TAE)
October 2015

Steve Chisholm / Mark Yerger
AAWG Co-Chairs

AAWG Update



No AAWG Meeting since March, 2015 (Melbourne, FL)

- 33 Attendees
- 4 regulatory authorities
- 5 manufacturers
- 12 operators

Next f2f Meeting: early 2016

Virtual meetings/coordination 4Q 2015

AAWG Assignment
from ARAC WG on Metallic and Composite ARAC WG

ARAC Working Group requested AAWG support…

- The ARAC Working Group is made up largely of individuals with composite experience and thus requested the Airworthiness Assurance Working Group (AAWG) assist in the evaluation and recommendation on two material independent tasks:

  1. Appropriateness of adding **Large Damage Capability** (LDC) back in the regulation

  2. Establishing an industry approach for assessing the **Damage Tolerance of Rotorburst**

Schedule:

- Draft proposal by end of year
- Proposal by March 2016

LDC Sub-Team

ARAC Working Group Request:

- Provide ARAC WG advice and recommendations related to the 2003 General Structures Harmonization Working Group (GSHWG) recommendation to incorporating some level of fail safety back into FAR/JAR § 25.571

  – *Specifically address whether it is appropriate to add a requirement for showing structural capability in the presence of damage, so that even if the structure fails partially, there will still be enough structure remaining to be safe.*

Rotorburst Sub-Team

ARAC Working Group Request:

- The FAA recognized different interpretations exist on their rotorburst policy statement PS-ANM100-1993-00041, Compliance with § 25.571(e) Discrete Source Damage (Uncontained Engine Failure), and added the issue to the items being assessed by the ARAC WG assessing 25.571.
  - Recent challenges have arisen with use of common industry practice
  - *ARAC is requesting AAWG to propose clarification / revision that is less open to interpretation*

Thank You

- Airworthiness Assurance Working Group
  - Steven Chisholm — Boeing — Co-Chair
  - Mark Yerger — FedEx — Co-Chair

Working Group: Flight Test Harmonization WG
FAA DFO: Joe Jacobsen
Date: October 5, 2015

- **Upcoming approvals needed by TAE (especially if they require TAE vote to approve)**

  None

- **Major accomplishments / milestones achieved**

  Productive meeting on September 21-25, 2015 in Cologne, covering wet runway accountability and runway excursion hazard classification

  Next meeting is scheduled for December 7-11, 2015, covering flight envelope protection and stall in ground effect

- **Points of concern among the team members**

  Huge variability on the subject of runway excursion hazard classification and reluctance by some to harmonize.

- **delays in the team meeting any deadlines**

  None yet, but we need to conclude some topics to stay on schedule.

- **Concerns you have from the FAA point of view with the direction the team is taking.**

  Reluctance to harmonize on runway excursion hazard classification is a concern. Some are taking a liberal interpretation of the guidance (justifying design by other means) and some are making design changes to meet the guidance. This subject will continue to be contentious unless we come to some harmonization agreements.

- **Anything else you think may be of interest to John Piccola and Mary/James, or something we should be aware of**

  Wet runway topic was tasked as “non-TALPA”. However, discussions during the Sept 21-25, 2015 meeting indicate that the introduction of wet runway landing performance accountability could be made consistent with the direction of TALPA (general consensus on this). This will require an explanation in our FTHWG report.

Report to ARAC Transport Airplanes and Engines Subcommittee

ARAC-Transport Airplane Performance and Handling Characteristics—Phase 2 Status

Flight Test Harmonization Working Group

Christine Thibaudat – European Co-chair
Robert Park – US Co-chair
November 4, 2015

FTHWG - Agenda

- Summary of Tasking
- Tasking Schedule
- Meeting Schedule
- FTHWG-35 Attendees
- Status of Tasking
- Help Needed

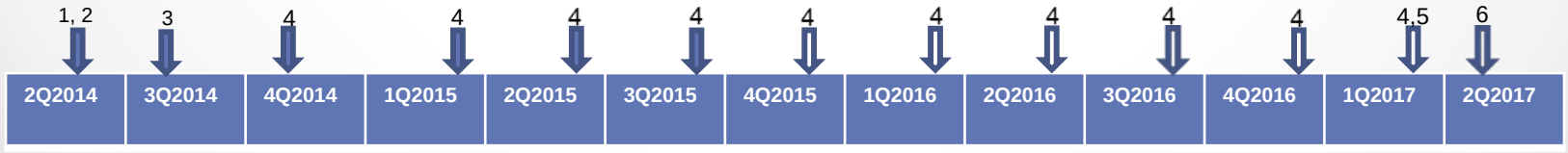
FTHWG - Summary of Tasking

- The FAA assigned the Aviation Rulemaking Advisory Committee (ARAC) a new Phase 2 task to provide recommendations regarding new or updated standards in the highest priority topic areas for airplane performance and handling characteristics
- There are twelve topics that fit under the three following topic areas:
  - Fly-by-Wire Controls
  - Takeoff and Landing Performance
  - Handling Characteristics

FTHWG – Tasking Schedule

#	Major Tasks/Deliverables	Date	Status	Metric	Comments
1	ARAC Tasking Published in Federal Register	April 11, 2014	Competed	Completed	Completed.
2	Tasking called for use of existing ARAC Working Group (WG) Chair and members	April 11, 2014	Completed	Completed	Completed
3	WG Plan accepted by TAE	June 6, 2014	Completed	Completed	Work plan contained in Phase 1 report – more details presented to TAE
4	*Face to Face WG Meetings	10/2014; 3/2015; 6/2015; 9/2015 12/2015; 3/2016; 6/2016; 9/2016; 12/2016; 3/2017	Completed Scheduled	40% 60%	SEA, TLS, SAV, CGN MLB, CGN, YUL, CGN, TBD, TLS
5	Planned Date to submit Final Report to TAE	March 11, 2017	Not Started		
6	Final Report Due to FAA	April 11, 2017	Not Started		Due Date

*Frequent between-meeting Telecons are not shown below



FTHWG Meeting Schedule/Venue/Topics 1/2

Meeting	Venue	Topics	Dates
*FTHWG-33	Airbus/Toulouse	T1 (Envelope Limiting) T2 (Adaptation for flight in icing) T6 (Lateral / directional / longitudinal stability)	9-10 March 2015 11 March 2015 12-13 March 2015
FTHWG-34	Gulfstream/Savannah	T6 (Lateral / directional / longitudinal stability) T13 (Out of trim characteristics) T7 (Side stick controls)	15-16 June 2015 17 June 2015 18-19 June 2015
FTHWG-35	EASA/Cologne	T9 (Wet runway stopping performance) T10 (Runway excursion hazard classification)	21-23 Sept. 2015 24-25 Sept. 2015
FTHWG-36	Embraer/Melbourne FL	T1 (Envelope limiting) T2 (Flight in icing) T11 (Stall speed in ground effect)	7-8 Dec. 2015 9 Dec. 2015 10-11 Dec. 2015

Completed Meetings

*Phase 2 kickoff meeting was FTHWG-32 in Seattle Oct. 20-24, 2014 (same topics as FTHWG-33)

FTHWG Meeting Schedule/Venue/Topics 2/2

Meeting	Venue	Topics	Dates
FTHWG-37	EASA/Cologne	T16 (HQ Compliance Finding) T9 (Wet runway stopping performance)	7-9 March 2016 10-11 March 2016
FTHWG-38	Bombardier/Montreal	T16 (HQ Compliance Finding) T9 (Wet runway stopping performance)	13-14 June 2016 15-17 June 2016
FTHWG-39	Dassault/Istres	T14 (Tailwind / Crosswind) T11 (Stall speed in ground effect) T15 (PIO/APC)	19-20 Sept. 2016 21 Sept. 2016 22-23 Sept. 2016
FTHWG-40	FAA/TBD	T10 (Runway excursion hazard classification) T16 (HQ Compliance Finding)	5-6 Dec. 2016 7-9 Dec. 2016
FTHWG-41	Airbus/Toulouse	T15 (PIO/APC) T14 (Tailwind / Crosswind)	6-8 March 2017 9 March 2017

FTHWG-35 Attendees

Organization / Attendees	Organization / Attendees
Airbus • Christine Thibaudat (Co-chair) • Laurent Capra / Dominique Chatrenet / Robert Lignee / Philippe Genissel / Olivier Nicolas	**EASA** • John Matthews / Massimo Barocco • Emilie Marchais
ALPA • Ron Wilson	**Embraer** • Murilo Pinto Ribeiro
American Airlines • Ernie Tangren	**FAA** • Joe Jacobsen / Paul Giesman • Bob Stoney / Linh Le
Boeing • Bob Park (Co-chair) • Brian Lee / Matthew Muehlhausen	**Gulfstream** • Barry McCarthy / Darren Gould
Dassault Aviation • Christian Camihort / Alain Cabasson	**TCCA** • John Wiseman
Delta Airlines • David Anvid	**Textron** • Kurt Laurie / Bill Dolejsi • JW Robertson (WebEx)
Note: SMEs vary with meeting topics Did not attend: ANAC, Bombardier, JCAB, CAAI	

FTHWG – Status of Tasking 1/2

Topic Schedule Dates	Issues	Status
Stability 6/2014 – 12/2015	Details of compliance Need ASHWG support (Low energy alert requirement)	Nominal agreement on regulations and important elements of guidance
Steep Approach Landing 10/2014-12/2015	Glideslope tolerance angle	More Telecons scheduled to work final issues
Envelope Protection 6/2014 -12/2015	Ability to override; Availability; Min Maneuver Capability	New regulatory structure in discussion. Tightly linked to Icing topic
Flight In Icing 6/2014 – 12/2015	Approach speed margin relaxation for protected airplanes and subsequent robustness demos	Initial regulatory structure and compliance guidance proposed

FTHWG – Status of Tasking 2/2

Topic Schedule Dates	Issues	Status
Sidestick Controls 6/2015 – 6/2016	Selection of particular force levels is the theme, but other aspects need to be considered further	Proposals have been made; waiting on consensus data from OEM's
Out of Trim 6/2015 – 12/2015	Means of compliance details and system details	Initial positions discussed; No clear consensus yet
Wet Runway Stopping Performance 9/2015 – 12/2016	Part 25 wet landing rule; Slippery runway TOA info; Wet runway testing standard	Initial positions discussed; Mixed operational and airworthiness issues
Runway Excursion Hazard Analysis 9/2015 - 12/2016	FAA Policy not harmonized; Late design changes to comply; Need data to understand fleet risk	Initial positions discussed; No clear consensus yet

FTHWG – Help Needed

Risk of overrunning final due date on some topics:

- Need all FTHWG organizations to ensure attendance at all meetings and relevant Telecons
- Need all FTHWG organizations to complete action items on schedule

Metallic and Composite Structures WG Report to TAE

Chair – Mike Gruber

November 4, 2015

Agenda

- Summary of Tasking
- Schedule
- Team Members
- Status of Tasking
- Help Needed

Summary of Tasking

Increased use of composite and hybrid structures has driven concerns whether the damage-tolerance and fatigue airworthiness standards and advisory material are adequate.

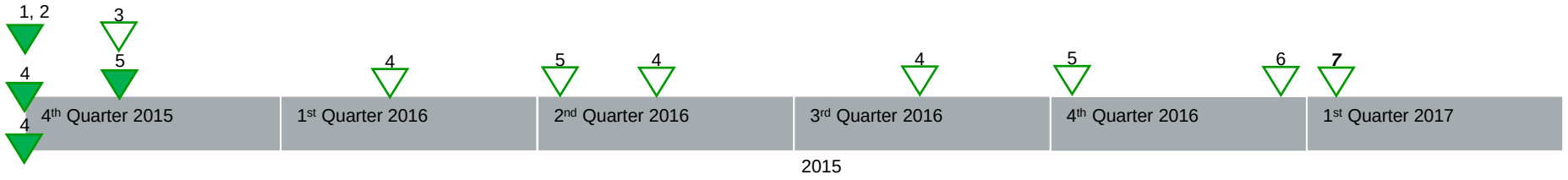
Task - Provide recommendations regarding revision of the damage-tolerance and fatigue requirements & associated guidance material

Working group reviewed standards and advisory material and agreed to address and provide recommendations on the following:

1. Threat Assessment
2. Emerging material technology
3. Inspection Thresholds
4. Large damage capability - **being worked by AAWG**
5. Aging, WFD & LOV *(including ultimate strength & full-scale fatigue test evidence)*
6. Testing (related to composite and hybrid materials *including WFD test demonstration)*
7. Repairs (bonding / bolting)
8. Modifications
9. EASA aging aircraft rulemaking and harmonization
10. Rotorburst – **being worked by AAWG**
11. Disposition of cracking during full-scale fatigue testing
12. Accidental damage inspections included in the ALS conflicts w/ MSG-3 program

Schedule

#	Major Tasks/Deliverables	Date	Status	Comments
1	ARAC Tasking Published in Federal Register	1/26/15	Complete	
2	ARAC Working Group (WG) Chair and member selected & notified	5/5/15	Complete	
3	WG Plan accepted by TAE	11/4/15		Submitted 7/20/15
4	Face to Face WG Meetings	6/16/15 9/14/15 2/24/16 5/24/16 7/22/16	Complete Complete	Kick-off meeting Everett, Wa . Montreal Canada Renton, Wa. (leverage AAWG mtg) Florida (leverage AAWG mtg draft rotor-b & LDC) Washington
5	Report Status to TAE	11/4/15 April 2016 Oct 2016	Complete	
6	Planned Date to submit Final Report to TAE	12/2016		
7	Final Report Due to FAA	1/2017		Due date



Team Members

Working group voting members

1.	Michael Gruber	(Boeing) – Chairperson
2.	Chantal Fualdes	(Airbus)
3.	Salamon Haravan	(Bombardier)
4.	Benoit Morlet	(Dassault Aviation)
5.	Antonio Fernando Barbosa	(Embraer)
6.	Kevin Jones	(Gulfstream)
7.	Toshiyasu Fukuoka	(Mitsubishi Aircraft)
8.	David Nelson	(Textron Aviation)
9.	Phil Ashwell	(British Airways)
10.	Doug Jury	(Delta Air Lines)
11.	Mark Boudreau	(FedEx)
12.	Eric Chesmar	(United Airlines)

Status of Tasking

- 2 face-to-face meetings
- 12 Sub-teams formed
- Strategies being developed for the 12 issues
- 2 Issues being worked by AAWG (LDC & Rotorburst)

Help Needed

- No help needed at this time

  WG started 4 months late but aggressively working to the 24 month window stated in the tasking

ARAC TAEIG

Materials Flammability Working Group Continuation of Task Report

October 7, 2015

Revision History

Revision	Description	Date
Original	Original	2/20/2015
1.0	Pre-Denver meeting	9/1/2015
2.0	First full content draft	9/28/2015
3.0	Draft with corrections and comments for WEBEX discussion	9/30/2015
3.1	Draft with corrections AFTER FINAL WEBEX 1	10/01/2015
3.2	Draft After Final WEBEX 2	10/5/2015
4.0	FINAL - review before issue	10/7/2015

Table of Contents

1.0 Executive Summary

In 2010, the FAA proposed a new organization and structure for aircraft flammability regulations. The Materials Flammability Working Group was charged by TAEIG within ARAC to review and evaluate the proposed new structure. The MFWG found many positives to the proposed new structure, but was concerned about the cost of implementation and change. In January, 2015, TAEIG, acting on request of the FAA, initiated a continuation of the MFWG. The main task was to quantitatively evaluate the proposed changes for cost impacts, for both increasing and decreasing costs.

The working group was able to quantify many, but not all, cost increases and decreases. Due to the incomplete nature of our estimates, we cannot say as a group what we expect the net effect of the proposed regulatory changes to be. Our work was all done looking at dollar costs of regulatory compliance. We did not attempt to look at social costs, or "dollarize" social results from regulatory change.

We have made and stated assumptions for each area of proposed changes, and provided our estimates of the impact. These estimates are quantitative wherever possible. Some are qualitative, where the group could not adequately assess either the proposed change, or the methods that would be required to meet the new regulation.

The proposed change with the greatest potential to increase costs is the new inclusion of the inaccessible areas regulations. The proposed changes with the most potential to reduce costs are the elimination of smoke testing, and the broader and simpler handling of exceptions to certification testing (small parts, listed parts, use of industry tests, etc.).

Details of the cost impact for each area of the aircraft follow in Section 6. Additionally, many of the members of the MFWG have volunteered to make quantitative but **confidential** information available to the FAA if requested.

2.0 ARAC Background

The Aviation Rulemaking Advisory Committee (A R A C) was formed in 1991 to provide information, assistance and advice to the FAA to support rulemaking. ARAC is made up of representatives from stakeholders in aviation. The FAA has sole responsibility to task ARAC with work to be done.

When ARAC is given a task by the FAA, they meet and decide whether or not the task is one they can accept. If the task is accepted, it is published in the Federal Register and ARAC forms a working group to develop the information and recommendations requested by the FAA.

The FAA proposed, and ARAC accepted in 2010, the formation of the Materials Flammability Working Group (MFWG), to review restructuring of flammability regulations.

In 2014, the FAA proposed the continuation of the MFWG to look at the cost impact of the potential changes. The task was accepted, and published in the Federal Register in January, 2015.

3. Tasking

The Materials Flammability Working Group is tasked to:

3.1. Review the Materials Flammability Working Group Recommendation Report dated July 9, 2012 and submitted in August 2012, along with subsequent research results to be provided to the Materials Flammability Working Group by the FAA.

3.2. Provide quantitative cost data for each recommendation, if applicable, along with assumptions and rationale for the cost data. The FAA will provide key assumptions to assist with cost estimation.

3.3. Provide quantitative economic benefit data for each recommendation, if applicable.

3.4. Provide service data regarding incidents (precursors) or accidents related to materials flammability that would be mitigated in the future by implementation of each recommendation.

3.5. Develop a report containing recommendations on the findings and results of the tasks explained above.

3.5.1. The recommendation report should document both majority and dissenting positions on the findings and the rationale for each position.

3.5.2. Any disagreements should be documented, including the rationale for position and the reasons for the disagreements.

3.6. The Materials Flammability Working Group may be reinstated to assist the ARAC, through the TAE Subcommittee, by responding to the FAA's questions or concerns after the recommendation report has been submitted.

4.0 Working Group Members

Member	Company
Becky Wulliman	Johns Manville
Blaklee Bohannan	American Airlines
Cheryl Hurst	American Airlines
Cheryl Miner	FAA
Chris Schofield	Transport Canada
Dan Slaton	Boeing
David Baker	Schneller
David E Lucas	Textron
Ed Nixon	Gulfstream
Enzo Canari	EASA
Gicela Zambon Guarnieri	Embraer
Francisco Rezende	Embraer
Gilberto Niitsu	Embraer
Ingo Weichert	Airbus
Jean-Claude Lerminiaux	Dassault
Jean-Francois Petit	Airbus
Jeff Gardlin	FAA
Jeff Smith	Gulfstream
Jim Davis	AccuFleet
Matt Marks	SABIC
Matthew Anglin	Boeing
Monique le-Roux	Zodiac Aerospace
Panade Sattayatam	Zodiac Aerospace
Perry Riggenbach	Schneller
Peter Busch	Airbus
Phuong Ta	UTC
Raki Islam	Zodiac Aerospace
Ralph Buoniconti	SABIC
Richard Hill	FAA
Rick Anderson	Schneller
Robert Trimble	Zodiac Aerospace
Scott Campbell	Zodiac Aerospace
Serge Le-Neve	DGA
Sonja Reents	Airbus
Steve Reich	BEAerospace
Thomas Krause	Airbus
Thomas Livengood	BEAerospace

5.0 Meeting Schedule

DATE	LOCATION
January 26-27, 2015	Phoenix
February 23, 2015	Huntington Beach
June 1-2, 2015	Bremen
September 1-2	Denver

The group met at sites in both North America and Europe. There were also numerous online conferences, conference calls, and websites upon which the group shared and exchanged ideas.

6.0 Working Group Recommendation Report

6.1. REVIEW OF ORIGINAL TASKING REPORT

FROM THE ORIGINAL REPORT (per 3.1 above): The flammability regulations governing transport type aircraft have primarily been developed on a reactive basis. As accidents and incidents have occurred, their causes have been investigated, and regulations have been put in place to avoid a recurrence of the prior failure, and to mitigate post accident hazards. The current regulations are a patchwork of changes that have evolved over time when new issues have arisen. Flammability requirements have become increasingly complicated, sometimes conflicting, and occasionally incomplete or obsolete for dealing with current aircraft. The FAA and the aviation industry have been struggling with the increasing cost and complexity of demonstrating compliance with the current flammability regulations.

To address this issue, the FAA proposed a new approach for flammability regulations. This new approach is an attempt to move from a reactive set of regulations to a proactive safety framework. The FAA proposal is to completely rewrite and update the existing flammability regulations. The current regulations are found in different paragraphs of 14 CFR part 25. The new structure consolidates flammability regulations from various places in the CFR, and puts them into § 25.853 and the associated appendix F. This effort applies only to flammability requirements within the typically pressurized portion of the aircraft; the separate requirements for specialized areas (e.g. wing tanks, engines, etc.) are not contemplated in this proposed revision. The new FAA approach to fire safety regulation is threat-based. It attempts to base the flammability performance for different parts of the aircraft upon realistic threats that could occur in-flight or in a post-crash environment.

The proposal is to design a coherent structure for flammability regulations. The result should be an organized framework into which the current flammability requirements can be placed. This structure should also accommodate future materials and systems, providing a logical place for any new requirements, and a clear statement of what performance will be expected in each area of the aircraft. This organized basis for regulating the flammability of aircraft components is designed to avoid future incidents and accidents, and effectively mitigate the hazards of a post crash fire. The new approach orients the regulations to proactively avoid or mitigate the effects of future in-flight incidents and accidents, rather than reactively adding regulations after incidents and accidents have occurred.

The proposed approach is a new regulatory philosophy which divides the threat based safety requirements into two operational regimes: in-flight and post-crash. The in-flight regime includes all normal operational phases for the aircraft, including taxi, takeoff, cruise and landing. The objective is to ensure that fire threats do not present a direct hazard to the occupants and allow the safe flight, landing and potential evacuation of the aircraft. The post crash regime assumes a post-incident environment where at least some of the occupants have survived. The objective is to sustain survivable conditions long enough to evacuate the aircraft.

Each condition is detailed below, with the applicable test. Tests marked with an asterisk (*) are not yet fully defined.

6.1.1. **For the in-flight regime**, the aircraft is divided into the appropriate zones:

6.1.1.1. Accessible areas within the cabin. The TSA controls materials carried on by the occupants. All components/materials are tested using a range of test methods to ensure the necessary level of fire resistant performance. The probability of ignition and flame propagation in the cabin is low. The occupied cabin also allows for active detection and suppression. Since the large panels and seats in the cabin must meet stringent post crash fire requirements (panels: Heat Release for 20+ passenger aircraft, and 60 second BB for 19 and less passenger aircraft; seats: Oil Burner), they are highly fire resistant. Tests: BB (Bunsen Burner)

6.1.1.2. Areas that are non-accessible. There are a large number of potential ignition sources and the size of the ignition source varies. Tests: BB, IRP (Insulation Radiant Panel), VFP * (Vertical Flame Propagation)

6.1.1.3. Waste containment receptacles. The likelihood of an ignition source is high due to illegal smoking and the disposal of flaming or near flaming materials on the commercial aircraft (or legal smoking if permitted). Tests: BB, FC (Fire Containment)

6.1.1.4. Cargo compartments. The likelihood of ignition sources is high and the size of the fire can be large due to the less controlled nature of cargo. Likelihood of detection is good due to detection systems. Ability to mitigate varies depending on the classification of the cargo compartment and the fire suppression systems. With respect to a fire threat, there is minimal proximity to occupants, but higher proximity to flight critical systems, though aircraft design considerations enforce extensive critical system separation. Tests: BB, COB (Cargo Oil Burner)

6.1.2. In the post crash regime, the threat is a large fuel-fed pool fire. The objective is to provide adequate evacuation time. This requires:

6.1.2.1. Protection for escape equipment. This brings in to the actual regulations the testing currently done to support TSO approval for evacuation slides. By setting a threat based standard for this type of equipment, expectations are set for any future evacuation aids. Tests: Slide Radiant Panel (SRP)

6.1.2.2. Limiting flame penetration into the passenger cabin. For aircraft with 20 or more passengers, protection will be provided which keeps the pool fire outside the cabin for a period of time. This protection is proposed regardless of the method used to provide it, so that methods other than the currently-mandated insulation will be held to a consistent performance level. Tests: BT (Burn Through)

6.1.2.3. Limiting flame spread within the cabin due to the involvement of cabin materials. The large exposed interior panels and seating systems must not become heavily involved in the fire until evacuation has been achieved. Tests: BB, HR (Heat Release), ST (Smoke Test: while considered in the original report, it is assumed in this report that the smoke test will be eliminated), SOB (Seat Cushion Oil Burner), MOB (Magnesium Oil Burner)

On August 27, 2010 [75 FR 52807], the FAA proposed the initial task, for ARAC to consider the merits and make recommendations for improvement of the approach outlined above.

The Materials Flammability Working Group completed the task, and the ARAC submitted the recommendations to the FAA in August 2012. The Materials Flammability Working Group believed the proposed threat-based organization for the flammability regulations was logical, practical and a more effective framework for regulation going forward than the current published regulations. The Materials Flammability Working Group believed the resulting regulation draft, along with appropriate advisory material, would ultimately be simpler and more easily understood and enforced. In order to evaluate whether to proceed with rulemaking to implement the recommendations, the FAA proposed this continuation tasking. The MFWG is to provide cost and benefit data associated with implementation of the proposed new regulatory structure.

6.2. FRAMEWORK FOR COST AND BENEFIT ANALYSIS

These changes, while providing a more logical structure for safety regulations, will affect costs to the industry. The working group has attempted to determine the cost/benefit impacts from each area, as specified in the Tasking 3.2 and 3.3 Ultimately, these two tasks are combined, with discussion detailing new costs and cost increases, and cost decreases. In development of the impact, we considered the following structure:

6.2.1 Development Costs
New Test Equipment (Development)
New Material/Specification Development / Revision of Current Specs due to new requirements.

6.2.2. Non-recurring Costs
New Test Equipment (Purchase and Production Approved)
New Design Development
New Methods of Compliance
Regeneration of Existing Flammability Certification Data (Existing materials/designs)
New Certification Data (New materials/designs)

6.2.3. Recurring Costs
Material/part cost.
Weight increases – airline operational cost
Customer Introduction Certification Requirements
Maintaining Separate Requirements, Documentation, and Test Data for In-Production Airplanes vs. New Certification Basis Airplanes
Testing Reliability
Unclear Initial Requirements and Guidance Materials Could be Costly

6.2.4. Cost Decreases (Benefits):
Simplified test methods and requirements
Simplified compliance activities/reports, reduced documentation
Reduced Testing
Hierarchy testing
Robust AC Guidance
Approved Materials list
Use of Industry Test Data

6.3. FAA NOTES ON IMPLEMENTATION OF THE CHANGES

As discussed in 3.2, the FAA has provided certain assumptions to the ARAC that industry can use in estimating cost increases and reductions:

6.3.1. The proposed NPRM generally tracks the ARAC report with the additions noted below. That is, the applicable requirement will be determined by the expected fire threat (not material type, or description)

6.3.2. The smoke emissions test is no longer a requirement

6.3.3. Items near (~15") the floor are not subject to heat release; items that extend to the floor and above the 'near' dimension would be subject to heat release if large enough. Seats, including pod shrouds require further consideration, which may reduce that height.

6.3.4. Pass/fail methodology (80% of test articles must pass, not average values) will be consistent across test methods

6.3.5. The materials that nominally pass the current standards will continue to pass the improved version of those standards (specifically oil burner, heat release, Bunsen burner). That is, the current methods could continue to be used if that is more economically viable than using the improved method. Data from the prior method could be used to show compliance, even if the new method was used to generate new data.

6.3.6. All seats and berths would be covered by the oil burner test for cushions (e.g., no exclusion for flight crew seats)

6.3.7. Special conditions for large surfaces on seats would go away because the rule would directly cover them

6.3.8. Materials/parts/etc. currently only requiring horizontal testing will be substantiated by analysis, or as a class of 'not significant' part. Data from the horizontal test can be used to support this; that test data could be from engineering tests.

6.3.9. There is a hierarchy of tests. Parts meeting a stringent test will not require (additional) testing with a less stringent test

6.3.10. New tests (vertical flame propagation) will exist for wiring, ducting and composite fuselage structure with the severity based on the 4”X4”X9” foam block; at this time, those are the only parts/components that would be subject to requirements for ‘extensively used materials’ in inaccessible areas (composite structure is already addressed by special condition, so this is a replacement). The back faces of sidewalls, floors, ceilings, cargo liners would not require a vertical flame propagation test if common aircraft materials/construction

6.3.11. An ‘approved’ wire list such as in AC 43-13 will continue to exist

6.3.12. Vertical Bunsen burner tests would only measure burn length (but still require that materials self-extinguish, including drips/puddles)

6.3.13. Many parts currently requiring 12 second Bunsen burner tests, could be substantiated with UL-94 V-0, or through analysis with some supporting data

6.3.14. Burnthrough requirements would remain as is, including MOC's. But would account for other methods so no ELOS would be needed.

6.3.15. Seat cushion requirements would remain as is with additional guidance to simplify things like headrests, footrests and thin cushions

6.3.16. Flammability requirements currently applicable to cargo compartment liners will continue to apply. Cargo compartment liner special requirements currently now levied on Class E compartments would continue to apply and be codified in the regulations.

6.3.17. All test method details are in advisory materials, i.e., not in appendix F.

6.3.18. Fabric on a seat that has been successfully tested to the oil burner does not require additional testing, even if it is used elsewhere on the seat (the ‘surface’ of a panel.)

6.3.19. Parts that do not require testing can be summarized by process and internal (company) documentation, and would not require item-by-item formal certification reports.

6.4. COST IMPACT BY AREA

Sections 6.1.1 and 6.1.2 show the types of testing required in each area of the aircraft to assure the required level of safety. Each area of the aircraft has testing requirements in order to assure the in-flight and post-crash safety levels are maintained. We studied each area of the aircraft, considering how the proposed changes would affect the costs of showing potential future compliance. We considered both in-flight and post-crash scenarios for each area of the aircraft when estimating the impact on cost.

An important area of cost reduction comes when the compliance documentation requirements are reduced, and when compliance testing is reduced. A concept very important to the overall cost reduction is how exceptions from regulatory compliance testing are handled. Section 6.6 discusses exception handling. Broadly, terms used in this document refer to:

- Class 1 items - items (typically very small) that do not need to be tested because their flammability performance is not expected to affect safety. Importantly, the documentation for these parts is very limited.
- Class 2 items - still typically quite small, the flammability performance of these items has a low impact on safety and can be documented using industry tests, as opposed to regulatory tests.
- Class 3 items - items for which there is no substitute due to the performance demands of the application.

Items may be allocated to Class 1-2-3 if they meet specific dimensional criteria or via lists provided in advisory material.

6.4.1. Accessible Areas (Excluding Seats) - In flight and Post-Crash

The Interiors (less seats) team evaluated the proposed rule changes and assumptions as described in 6.3, relative to the accessible areas of the aircraft for aircraft cabin capacities of less than 19 passengers as well as those with capacities of 19 and over. The review covered both the In Flight & Post Crash conditions.

Our overall analysis determined a net cost reduction to the industry, assumed to be at a point in time when all operated aircraft are compliant to the new requirements. This analysis is simpler than trying to estimate the cost one newly type certificated airplane at a time since most industry data is difficult to separate by airplane model. While cost reductions will begin to be seen as aircraft programs begin to use the new rules, the cost reductions will ramp up over time to eventually reach the levels estimated here. We did not try to model or forecast what the rate of change would be. We did not estimate the potential cost impact from the possibility that the proposed changes might be allowed for existing aircraft programs.

Table 6.4.1.1 below summarizes the overall cost trends. The subsequent paragraphs will discuss the assumptions from 6.3 which were determined to provide either a cost reduction or cost increase in relation to how compliance is found today. Items & assumptions which were found to have a neutral impact on cost will not be included in this discussion.

6.4.1.1. General Interiors (less seats) cost summary

Assumption #	Assumption	Flight Scenario	Development Cost	Non-recurring Cost	Recurring Cost	Weight Impact	Comments
2	The smoke emissions test is no longer a requirement	In-flight	N/A	N/A	N/A	N/A	
		Postcrash	=	↓	↓	=	
3	Items near (~15") the floor are not subject to heat release; items that extend to the floor and above the 'near' dimension would be subject to heat release if large enough. Seats, including pod shrouds require further consideration, which may reduce that height.	In-flight	N/A	N/A	N/A	N/A	
		Postcrash	=	↓	↓	=	
4	Pass/fail methodology will be consistent across test methods	In-flight	↑	↑	↑	=	These cost impacts may not materialize since Assumption 5 allows current test methods to be used in the future.
		Postcrash	↑	↑	↑	=	These cost impacts may not materialize since Assumption 5 allows current test methods to be used in the future.
5	The materials that nominally pass the current standards will continue to pass the improved version of those standards (specifically oil burner, heat release, Bunsen burner). That is, the current methods could continue to be used if that is more economically viable than using the improved method. Data from the prior method could be used to show compliance, even if the new method was used to generate new data	In-flight	=	↓	↓	=	If FAATC test development projects to improve test repeatability result in equivalent test methods (same pass/fail critieria), there could be some cost savings. Not considered to be large.
		Postcrash	=	↓	↓	=	If FAATC test development projects to improve test repeatability result in equivalent test methods (same pass/fail critieria), there could be some cost savings.
6	All seats and berths would be covered by the oil burner test for cushions (e.g., no exclusion for flight crew seats)	In-flight	N/A	N/A	N/A	N/A	
		Postcrash	=	↑	↑	=	Costs could be minimized: see assumptions below.
8	Materials/parts/etc. currently only requiring horizontal testing will be substantiated by analysis, or as a class of 'not significant' part. Data from the horizontal test can be used to support this; that test data could be from engineering tests.	In-flight	=	↑	↓	=	The cost impacts are assumed to be small, but some level of initial process development is needed to potentially gain small recurring costs.
		Postcrash	N/A	N/A	N/A	N/A	
12	Vertical Bunsen burner tests would only measure burn length (but still require that materials self-extinguish, including drips/puddles)	In-flight	=	=	↓	=	
		Postcrash	=	=	↓	=	Applicable to airplanes less than 19 PAX
13	Many parts currently requiring 12 second Bunsen burner tests, could be substantiated with UL-94 V-0, or through analysis with some supporting data.	In-flight	=	↓	↓	=	Cost benefits are moderate, but until the specific process is defined by guidance, it is not clear on the cost benefit from changing from the current formal compliance processes of testing/similarity to a process that allows analysis with supporting engineering data.
		Postcrash	N/A	N/A	N/A	N/A	
19	Parts that do not require testing can be summarized by process and internal (company) documentation, and would not require item-by-item formal certification reports.	In-flight	=	↓	↓	=	These cost benefits are believed to be significant.
		Postcrash	N/A	N/A	N/A	N/A	

6.4.1.2. In-Flight Threat

General Remarks

For the in-flight fire threat, the group generally agreed that there can be substantial differences in the cost impacts relative to the cabin size. Therefore, for assumptions where cabin size affects the cost impact comments will separately address cabins with 19 or less passengers & those with 20 passengers or greater.

Some Working Group members have prepared specific quantitative cost benefit assessments that are proprietary, but can be shared directly with the regulators.

Assumption 6.3.4- Pass/fail methodology will be consistent across test methods. While difficult to determine the cost impact purely on revising the pass/fail criteria to the proposed 80% pass standard, the team identified the greatest cost increases associated with this change to be the number of samples needed to be fabricated (e.g. 5 samples instead of the 3 that are currently the standard) to ensure the greatest success to meet schedule. Impacts to the different cabin sizes are noted below:

Commercial Seat Testing (20 or more PAX); Some test regimes this could lead to the industry exercising the business decision to fabricate more (at least two additional) samples to protect schedule in complying with an 80% pass rate.

Large Commercial (20 or more PAX); generally, the number of Bunsen burner samples would not be affected given high success rates passing burn length. This would generally result in an insignificant cost increase."

Biz Jet (19 or less PAX); With regard to the Bunsen burner testing required for 19 or less PAX in lieu of 20 or more PAX heat release test requirement and it impact on testing of custom dress coverings such exotic woods, fine leathers, which amounts to, on average, 50 Bunsen burner tests per shipset/delivery, and like previously stated for Commercial Seat Testing, the Biz Jet industry would also exercise the business decision to fabricate more (at least two additional) samples to protect schedule in complying with an 80% pass rate for both Bunsen burner and Oil Burn testing. Impact to Bunsen burner testing will be mitigated by relaxing the after flame requirements resulting in substantial cost savings to the Biz Jet fleet. However the Oil burner (Seat testing) would remain negatively impacted resulting in cost increases to the Biz Jet fleet.

Assumption 6.3.5- The materials that nominally pass the current standards will continue to pass the improved version of those standards (specifically oil burner, heat release, Bunsen burner). That is, the current methods could continue to be used if that is more economically viable than using the improved method. Data from the prior method could be used to show compliance

The team interprets this to mean that the new test methods will be equivalent to the ones currently used. This means that the rule change will not purposely render obsolete commonly used materials today that pass the current standards and that use of materials acceptable by the current standards will still be accepted under those test methods.

Generally, this will result in a neutral/ cost reduction relative to the administrative work required to document compliance under the new regulation.

Assumption 6.3.8- Materials/parts/etc. currently only requiring horizontal testing will be substantiated by analysis, or as a class of 'not significant' part. Data from the horizontal test can be used to support this; that test data could be from engineering tests.

This change results in neutral/minimal cost reduction relative to administrative work required to document compliance under the new regulation. It provides more flexibility to use analysis for class 3 parts. The cost/benefit is neutral where previously tested data is applicable, but cost reductions will be realized when new data may be generated by an engineering test or other analyses may be used to substantiate various unique applications. Since the details of how a "flammability analysis" would be performed have not been documented, this assumption could be a minimal cost increase or decrease depending on the complexity of the Showing of Compliance.

Assumption 6.3.12- Vertical Bunsen burner tests would only measure burn length (but still require that materials self-extinguish, including drips/puddles)

This change results in a cost reduction. The elimination of the after flame time Bunsen Burner requirement reduces risk to programs and increases material selection. Type Certificate (TC) and Supplemental Type Certificate (STC) programs for aircraft with more than 19 passengers record several failures per year due to after flame time only (even with compliant burn lengths with plenty of margin). Costs for typical (10-20 per year) and non-typical instances (1-2 per year) are shown in Table 6.4.1.6. Smaller business jet configurations can experience 50+ such typical occurrences due to usage of more exotic materials (also with very conservative burn lengths).

Assumption 6.3.13- Many parts currently requiring 12 second Bunsen burner tests, could be substantiated with UL-94 V-0, or through analysis with some supporting data.

This change generally results in a cost reduction. Allowing for the use of engineering data for class 2 parts reduces time and administrative costs vs. testing per an FAA project, conformity, and witness. UL94 V0, V1, V2 compliant materials such as PCBs can also substantially reduce costs of the materials used by the industry. See Table 6.4.1.7.

Assumption 6.3.19- Parts that do not require testing can be summarized by process and internal (company) documentation, and would not require item-by-item formal certification reports.

This will result in a substantial cost reduction relative to administrative time spent preparing & FAA approval/review of insignificant items that have been determined not to require testing. Most group members estimate that not requiring class 1 parts to be shown in test plans/reports reduces technical research and administrative document costs by up to 40-50%. An analysis by one facility of a component manufacturer noted that 2240 hours could have been saved in 2014 (56 test plans with an average of 40 hours per plan researching and documenting class 1 parts). This varies with the complexity of the system/assembly being evaluated. Significant Time is saved in reviewing the drawings for class 1 parts without considering quantities, spacing, material and manufacturer and then documenting in a report. Global drawings such as placard drawings won't require tracing

every placard back to its installation substrate. Thousands of electrical small parts can be reduced to a drawing review only. Test plan reviewers will also be able save significantly by not being required to verify quantities, material, spacing, manufacturer, etc- again just a drawing review will be acceptable.

6.4.1.3. Post Crash Threat

For the post crash fire threat, there were differences in the cost impacts relative to the cabin size. Therefore, comments below are separated into cabins with 19 or less passengers & those with 20 or more passengers.

6.4.1.3.1. **Cabins with less than 20 passengers**:

Assumption 6.3.4- Pass/fail methodology will be consistent across test methods

The increased cost analysis presented by the seat group is would also be representative of cost increases for seat-oil burner samples to substantiate mattresses, ottoman and other misc. applicable cushions that are applicable to airplanes with 19 or less passengers.

Assumption 6.3.5 The materials that nominally pass the current standards will continue to pass the improved version of those standards (specifically oil burner, heat release, Bunsen burner). That is, the current methods could continue to be used if that is more economically viable than using the improved method. Data from the prior method could be used to show compliance

Generally this could result in a cost reduction, but until the modified test methods are validated to be equivalent with less variability, it is difficult to predict the cost benefits. Since the current test methods will continue to be acceptable, this is at least cost neutral at this time. Refer to the comment in the In-flight section.

Assumption 6.3.6- All seats and berths would be covered by the oil burner test for cushions (e.g., no exclusion for flight crew seats, lavs and crew rest)

As this is not currently a compliance requirement, addition of this regulation would result in a cost increase. The team assumed that this would require seat oil burner testing for components (mattresses, misc non seat applications). Additionally costs associated with redesigning existing/new components will accrue additional costs for engineering, planning, materials and production. These costs could be substantially reduced if the foam/foam-fire block system for these type of components may be tested to the seat oil-burner test and the dress cover tested separately to a 12-second vertical Bunsen burner test.

Assumption 6.3.9- There is a hierarchy of tests. Parts meeting a stringent test will not require (additional) testing with a less stringent test

This should result in either no change, or a cost reduction. As mentioned above in 6.3.6, costs could be substantially reduced if any foam/foam-fire block system for components may be tested to the seat oil-burner test, and the dress cover tested separately to a 12-second vertical Bunsen burner test.

Assumption 6.3.12- Vertical Bunsen burner tests would only measure burn length (but still require that materials self-extinguish, including drips/puddles)

Results in substantial cost reduction. Refer to the comments in the In-Flight section.

6.4.1.3.2. Cabin with 20 or more passengers:

Assumption 6.3.2- The smoke emissions test is no longer a requirement

This regulatory change results in the largest cost reduction as it eliminates an entire test regimen. The team surveyed the major manufacturers, OEM's, and test houses to obtain an estimated annual cost to the industry of meeting the current smoke density requirements. This study returned an annual $42.8M current industry fleet-wide cost expenditure due to this testing for thousands of aircraft, the details of which can be found in Table 6.4.1.4. This dollar amount will have to be scaled by the FAA as part of the cost/benefit calculations so it can be compared to other costs that are determined for implementation of a single aircraft model/program. The data also includes quality assurance and non-regulatory testing for completeness, although this is cost is not specifically certification costs and is managed by the industry in various ways that may or may not change in the future. Data collected generally represents tests run in 2014 and may represent a peak year for testing due to several new aircraft models being introduced into service. However, with more airplanes being produced and many airlines continually upgrading their fleets it is believed the numbers are generally representative. As a note, the industry is in support of implementing the cost benefits of this revised regulation into production programs. The administrative costs of implementing only portions or paragraphs of the new regulation into production programs needs to be streamlined by the regulators to capture these industry cost benefits promptly.

Assumption 6.3.3 – Items near (~15") the floor are not subject to heat release; items that extend to the floor and above the 'near' dimension would be subject to heat release if large enough. Seats, including pod shrouds require further consideration, which may reduce that height.

This regulatory change will result in a substantial cost reduction as it eliminates 2 testing requirements, Heat Release & Smoke Density(if assumption 12 is not included in the new regulation). Additional benefits from this change may result in the use of alternative materials assuming they are tested and analyzed by the end-user for use in their specific applications. Reference Figure 6.4.1.5 for member research. A SABIC Report is available to regulators under separate cover.

Assumption 6.3.4 - - Pass/fail methodology will be consistent across test methods

Generally results in a cost increase. While difficult to determine the cost impact purely on revising the pass/fail criteria to the proposed 80% pass standard, the team identified the greatest cost increases associated with this change to be the number of samples needed to be fabricated to ensure the greatest success to meet schedule. The increased cost analysis presented by the seat group is representative of cost increases for seat-oil burner samples to substantiate mattresses, ottoman and other misc. applicable cushions. The increase in the number of Heat Release test specimens would cost approximately $28 x number of test sets (10,050 sets per regulatory smoke test analysis per year)= $281K based on industry retail data for a ½" thick honeycomb panel with a decorative laminate. This value is reduced to approximately $14 per number of sets if the smoke requirement is eliminated as proposed [$140.5]. This stated, more studies would need to be conducted to determine how an HRR 80% pass criteria would impact constructions currently being used that may have passed by simple average and ensuring that the number of failed samples do not exceed the number of passing samples.

Assumption 6.3.6- All seats and berths would be covered by the oil burner test for cushions (e.g., no exclusion for flight crew seats).

As this is not currently a compliance requirement, addition of this regulation for large airplanes with 20 and over passengers would result in a cost increase. Refer to the comments in the Cabins with less than 19 passengers section for Post Crash- the cost increase would be applicable to all part 25 airplanes.

Assumption 6.3.9- There is a hierarchy of tests. Parts meeting a stringent test will not require (additional) testing with a less stringent test

This change results in a cost reduction due to the elimination of the less severe testing. In Flight fire requirements would be substantiated by higher requirements for Post Crash substantiation, reducing the administrative time to document & FAA compliance finding activities of multiple tests against the same material construction. Most commonly, constructions substantiated by heat release testing can reduce the number of Bunsen burner tests, but would be difficult to remunerate since multiple methods of compliance (MOCs) such as the FAA Policy Statement already significantly reduce Bunsen burner testing.

6.4.1.4. Summary of Cost Reduction Eliminating the Smoke Test (below)

Costs Per Test

	Rate / Hr	Time (hrs)	Cost ($)
Planning	$65.00	0.25	$16.25
Material*			$835.89
Manufacturing*	$55.00	1	$55.00
Inspection	$100.00	0.25	$25.00
Operator Time	$560.00	0.5	$280.00
UM Witness	$120.00	0.5	$60.00
Data Sheets	$80.00	0.25	$20.00
Test Report	$120.00	0.25	$30.00
UM Approval	$120.00	0.25	$30.00
	Total	3.25	$1,352.14

QTY Tests Per Year

	Lab Type	Size	Qty / Yr
Lab K	Lab	M	300
Lab J	Com	L	846
Lab H	Lab	L	812
Lab Z	Com	L	817
Lab D	Lab	S	150
European Lab 1	Lab	L	600
European Lab 2	Lab	M	250
European Lab 3	Lab	M	350
Lab S	Mtl	M	300
Est. Small Lab (5)	Misc	S	375
Est Medium Lab (5)	Misc	M	1500
Est Large Lab (5)	Misc	L	3750
		Total Qty	10050
		Avg Qty of Tests	419
		Total Hours	32663
		Total Costs	$13,589,024

QTY of FAA Test Labs Considered		
24		
(Number Estimated = 15)		
Qty/Year for Estimated Labs		
S = 75	M = 300	L = 750

QTY Tests Per Year - TC (Certification)			
	Lab Type	**Size**	**Qty / Yr**
Boeing	OEM	L	600
		Total Qty	600
		Total Hours	1000
		Total Costs	$811,285

QTY Tests Per Year - Quality Assurance Tests			
	Lab Type	**Size**	**Qty / Yr**
Lab H	Lab	M	2438
Lab S	Mtl	L	4000
		Total Qty	6438
		Avg Qty of Tests	3219
		Total Hours	8048
		Total Costs	$28,439,801

Total Yearly Costs			
		Total Hrs	**41710**
		Total Cost	**$42,840,109.37**

Hours per Test less UM Activities
2.5
Cost per Test less UM acitivities
$1,262

QTY of Matl Qual Labs
7

6.4.1.5. Group Member Research Supporting Assumption 6.3.3: Items near (~15") the floor are not subject to heat release; items that extend to the floor and above the 'near' dimension would be subject to heat release if large enough. Seats, including pod shrouds require further consideration, which may reduce that height. (below)

- A major aftermarket parts supplier estimated a 50-75% cost savings (material and processing) for high volume parts such as air grilles, rub strips, small shrouds, etc.
- The highest volume items in the cabin located below the 15" line are lower sidewall panels and decompression air grilles.
- A rough estimate of aftermarket pricing on these items is approximately $100. (OEM pricing for the same items tends to run 8-10X this cost).
- There are approximately 50 such parts per aircraft in large commercial aircraft and 30 such parts per aircraft in smaller commuter aircraft.
- Typical damage and replacement occurs at a rate of 20% per aircraft every 3-5 years.

- To cover these replacement requirements, a large airline such as American Airlines will inventory 200-300 parts per fleet type.
- Therefore, the potential cost savings per airline fleet type per category would be $12.K.
- Similar savings could be realized by OEM installers.

6.4.1.6. Assumption 6.3.12: Cost Impacts of After Flame Time Failures per Test Construction

Typical Scenario: Failures during TC/ STC projects industry wide(10-20 per commercial transport/ 50+ per Business Jet projects per year). Each event costs:

Customer Coordination	3-4 hours
Test Plan Change (Flammability Engineer)	2 hours
Test Plan Approval (DER/UM/FAA)	1 hour
Request for Conformity (QA)	1 hour
Sample inspections (QA/ FAA)	2 hours
Test and Witness (Technician and Engineer)	2 hours
Engineering Change (Design Engineer)	4 hours
Planning Change (Planner)	1 hours
Procurement Activity (Supply Chain)	4 hours
Expedite Fees	$500
Manufacturing to make new parts	2-20 hours
Rework/ Replace failed materials/ parts	2-20 hours

Non-Typical Scenario: Failures that delay revenue service per year (1-2)

Although not a common occurrence, when a certification requirement can not be met and it occurs very late in the design approval process, a delay to the aircraft delivery to the operator can add up to schedule disruption, cancelled trips, and lost revenue. Lost revenue per trip cancelled ranges from $3K for smaller commuter aircraft such as an Embraer E190 to $87K for a wide body international aircraft like the Boeing B777-300 resulting from delayed return to service by operator after STC.

6.4.1.7. Assumption 6.3.13: Class 2 Parts Cost Reduction

Eliminating the following processes generates a typical 50%-90% reduction in the hours required. (based on a stand alone basis needing to test one construction at a time). Both options (cert and non-cert tests) require material, manufacturing, verification of material build

up, a test and a data sheet. Schedule delays represent perhaps the largest hourly contributor for a test plan containing multiple class 2 parts. Also, this assumption allows materials to be tested immediately and only once- no pre-burns before cert testing needed.

FAA plan approval	1-2 hours
Request for Conformity (RFC)	1 hour
Inspection time & Forms	2 hours
Witness time & Forms	1 hour
Schedule delays waiting for plan approval, RFC, Inspections	Days to weeks
UL94 V0- Data saves conducting separate test	.5 hour + sample costs

6.4.2. Seating -In flight and Post Crash

Overview:

The seating group assessed the impact of the ARAC report and FAA assumptions on five types of seats: pilot/copilot, attendant, premium class, business class and economy class. The data presented is from five specific case studies. The proposed changes have an expected cost reduction for attendant, premium class and business class seating, but have and expected cost increase for pilot/copilot and economy class seating. Major drivers for cost savings are elimination of smoke emissions testing and hierarchy of tests which will eliminate many vertical tests, as well as program disruptions that result when vertical tests occasionally fail. Pass/fail methodology consistency across all tests methods may have negative cost impact due to delivery schedules and material costs for most seating types. In order to eliminate this negative cost effect, allowance to continue to use current compliance methodologies must be ensured through guidance. Removal of the heat release special conditions has a substantial initial negative cost impact to economy class seating due to numerous traditional seat components no longer being exempt. Developing an industry standard will offset this negative cost impact long term (it is recommended that guidance be issued to allow the TSO holder to find compliance to heat release under the new rule. This will result in efficiencies that will offset the negative impact).

During this cost assessment, the seating group had uncertainty on the effect of tiling and spacing, seat TSO alignment, usage of engineering analysis and usage of existing data. Since seats are numerous on aircraft and spaced together, small part exemption may not apply. The seating group assumed that tiling assessment is NOT required between seat places, since there is space between seats, and tray tables are not tiled. When calculating the size/area of small components on seats, dimensions are only additive if they have the same cross section of materials. The seat TSOs will need to be updated and AC developed for engineering analysis and existing data usage. Size criteria will also need to be finalized.

In the following sections the seating group assessed both non-recurring and recurring cost. Non-recurring cost are those incurred during the initial certification of a seat design. Recurring cost are those incurred as follow-on certification of same seat design for the same seat model. Recurring cost include different color leathers, different color plastics, etc. The costs assessed were only certification costs and did not include cost of continuous production such as lot testing.

Savings evaluated were from direct cost and not indirect cost. Saving from potential simplification with the elimination of HRSC and compliance found at the TSO level that may result from the new rule and associated guidance were not evaluated.

Implementation in current production models: The ARAC team would clearly like to implement cost savings efforts into current production programs as soon as possible, not only since there are cost savings but also since maintaining two separate certification processes results in additional costs associated with managing, training, and auditing two processes at the same time.

6.4.2.1. Impact to Seating per FAA Assumptions

The elimination of smoke emissions has a positive impact across all seating systems except pilot/co-pilot seating. Pilot and Copilot seating are currently exempt from the existing smoke requirements. In the case studies provided, a specific attendant seat project can eliminate 5 smoke tests, Business Class and Premium Class seating can eliminate 25 smoke tests each and Economy Class seating can eliminate 3 smoke tests. These totals will likely vary depending on the specific seat design but could vary significantly.

The exemption of items near the floor from heat release testing impacts Business Class and Economy Class seating. If items 15 inches from the floor are exempt from heat release testing, both seating systems will have some cost savings. If there is no exemption from the floor, Economy Class seating will have a substantial cost increase. This cost increase is due to composite seat pans with varying ply combinations and other designs under the seat that would now require heat release testing.

The elimination of heat release special conditions for seats has a negative impact to Attendant, Business Class and Economy Class seating. This will require testing of components that are currently considered traditional and currently exempt from heat release testing. Attendant seating is negatively impacted since attendant seats are currently considered traditional and exempt from heat release testing, but will require 6 additional heat release tests with this new regulation in the specific case study presented. Business Class seating is impacted due to composite backrest requiring 8 additional heat release tests in the specific case study presented. Economy Class seating is negatively impacted due to composite backrests, tray tables, end bays, armrest closeouts and video shrouds requiring 10 additional heat release tests. There may be simplification in the compliance report process with the simplified heat release criteria (as compared to the HRSC requirements) that could further reduce the cost impact of seat certification.

The new regulation requiring all seat cushions to be oil burner compliant only negatively impacts Pilot/Copilot seating. These cushions have been exempt and will require 1 oil burner test in the specific case study presented.

The hierarchy of testing has a positive impact across all seating systems. The elimination of redundant vertical Bunsen burner tests due to the heat release hierarchy eliminates 150 tests across all five seat types, in the specific case study presented.

The elimination of horizontal Bunsen burner testing has a positive impact due to reduction in complexity of showing compliance. The seating group could not assign a cost due to confusion on how to use engineering data and analysis since the applicable guidance is unknown at this time. The seating group felt that development costs and non-recurring costs would increase, but recurring cost would decrease provided the analysis method can be quick, simple and easily explained in the future AC.

The pass/fail methodology being consistent across all test methods has a negative impact across all seating systems. The biggest driver of this impact is the assumption that industry will choose to increase cushion test samples due to delivery schedules; i.e. companies will choose to build/test 5 cushion test article sets instead for 3 cushion test article sets which is currently the norm. This cost driver may be eliminated by holding costly materials (leather) in reserve for possible failures. Another opinion to this assumption is that there is a neutral impact initially since the current test methods and existing data can be utilized for showing compliance.

The vertical Bunsen burner test only measuring burn length has a positive impact across all seating systems. The seating group could not assign a cost because testing would still be conducted to measure burn length and failure recovery costs are difficult to determine. All seating suppliers have experience costs associated with materials failing to self-extinguish in the allot time. These costs include schedule impacts, material costs, testing cost and rework costs.

The 12 second Bunsen burner test may be substantiated by UL-94 V0,V1, and V2 has a positive impact for Premium Class seating. 25 tests may be eliminated for Premium Class seating. Although no cost assessment was done for the other types of seats, there is potential to have some positive impact once the details of utilizing UL-94 V0, V1,and V2 data is developed.

The new wire test has no impact on seating systems since the wires in the cabin will be exempt from the new wire VFP test method requirement.

6.4.2.2. Pilot and Co-Pilot Seating

For pilot and copilot seating, the overall ARAC report and FAA assumptions have an overall negative impact to non-recurring and recurring costs. The most positive impact is due to hierarchy of tests. The most negative impact is due to all cushions being oil burner compliant. Pilot/Copilot cushions are currently exempt. Material costs do not increase since pilot/copilot seats are currently constructed of materials that are compliant.

All other FAA assumptions have minimal impact. The elimination of smoke emission and new heat release rules have no impact on pilot/copilot seating since these seats are installed in areas that are exempt.

Pilot/Co-pilot Seats has the following overall impact summary per seat place for the specific case study presented:

Non-Recurring: Cost increase $520

Recurring: Cost increase $7120

6.4.2.3. Attendant Seating

For attendant seating, the overall ARAC report and FAA assumptions have an overall positive impact to non-recurring and recurring costs. The most positive impact is due to hierarchy of tests. This allows the elimination of vertical Bunsen burner tests when materials have been tested in a cushion oil burner test or heat release test. The cost savings from elimination of smoke emission testing is offset by the removal of the heat release special conditions for seats. Attendant seats are currently considered traditional, and thus; are not required to meet heat release special conditions.

Attendant Seats has the following overall impact summary per seat place:

Non-Recurring: Cost savings $3532

Recurring: Cost savings $2518

6.4.2.4. Premium Class Seats (front of the aircraft)

For Premium Seats, the overall ARAC report and FAA assumptions have an overall positive impact to non-recurring and recurring costs. The most positive impact is due to elimination of smoke emissions tests and hierarchy of tests. Using UL-94 V0, V1, or V2 compliant materials in lieu of FAA 12 second Bunsen burner testing is also a cost savings. Although, the removal of heat release special condition has no measurable direct impact, it has the potential to lower the cost of compliance due to simplification of the seat analysis and the ability to assign the requirement to the TSO holder. Pass/fail methodology consistency across all test methods has no impact since Premium Class seats have more recovery time. The seat group did not identify any negative impacts to Premium Class seats.

Premium Seats has the following overall impact summary per seat place for the specific case study presented:

Non-Recurring: Cost savings $78150

Recurring: Cost savings $78150

NOTE: The presented case study is for an average Premium Class program where both similarity and testing are used to find compliance. Premium Seat design are very unique. It is expected that variation in the cost savings can be very different than the specific case study presented.

6.4.2.5. Business Class Seats with Composite Surrounding Shell (middle of the aircraft)

For Business Class Seats, the overall ARAC report and FAA assumptions have an overall positive impact to non-recurring and recurring costs. The most positive impact is due to elimination of smoke emissions and hierarchy of testing. The most negative impact is due to elimination of heat release special conditions for seats. Pass/fail methodology consistency across all test methods also has a negative impact since multiple cushion combinations are required and recovery times are limited.

Business Class Seats has the following overall impact summary per seat place for the specific case study presented:

Non-Recurring: Cost savings $13185

Recurring: Cost savings $4485

6.4.2.6. Economy Class Seats (back of the aircraft)

For Economy Class seats, the overall ARAC report and FAA assumptions have an overall negative impact to non-recurring and recurring costs. The most positive impact is due to the elimination of smoke emissions tests and hierarchy of testing. The most negative impact is due to the elimination of heat release special conditions for seats and converting to the standard “large exposed surface area” criteria. Economy Class seats are constructed of traditional components that are currently exempt for heat release testing. Composite backs/seats structure, video shrouds, and tray tables are some components that are currently exempt that would now require heat release testing. These components will have design development costs as well as non-recurring and recurring cost impacts. Pass/fail methodology consistency across all test methods also has a negative impact since multiple cushion combinations are required and recovery times are limited.

Economy Seats has the following overall impact summary per seat place for the specific case study presented:

Non-Recurring: Cost increase $25085

Recurring: Cost increase $10260

6.4.2.7. OEM Seat Cost Assessment

The FAA provided a list of assumptions to the ARAC on January 28th, 2015, which included the following:

> ***“Special conditions for large surfaces on seats would go away because the rule would directly cover them.”***

As an OEM (Seat Installer), the following assumptions were used to develop the cost assessment for covering large surfaces on seats within the regulation:

- Elimination of the SC will require new materials and designs be developed and these development costs will be borne by the seat suppliers. The impact on Non-recurring and recurring costs on the OEMs should not be significant relative to the installation certification.
- Seat manufacturers will likely have non-recurring and recurring cost impacts and may have weight impacts.
- The Seat TSO shall be aligned to cover the new regulation requirements so that a TSO approved seat fully meets the new regulation requirements.
- FAA and EASA regulations shall be harmonized.
- The standard heat release requirements create unique aspects for seats (per seat place, spacing, tiling, etc…) and well developed Advisory Circular guidance is required so that seat suppliers are consistent with substantiation reports and regulatory groups are consistent in approving the seat to the TSO.

Based on the above assumptions and using the current level of effort of certifying seats under the special conditions, the following OEM assessment is defined:

Non-recurring Cost:
Development and deployment of training and new processes will be required and coordinated with the seat suppliers. The level of effort is considered moderately low relative to the overall certification of a new TC, but it will take effort and resources to develop the processes, coordinate with the suppliers, and develop/coordinate any new MoC's and guidance.

Recurring Cost:
Currently the OEM reviews and approves the Special Condition substantiation for seats. For the new regulation, it is assumed the TSO is updated to align with the new regulation language, and thus the seat supplier will have responsibility for substantiation to get TSO approval. The recurring costs for OEMs associated with new customer introductions of a new type certification airplane program should be reduced assuming there is alignment with TSO and harmonization with EASA regulations. The OEM will simply validate the TSO article is approved and only review and approve suppliers' substantiation reports if there are areas not covered by TSO. The cost reduction saved per customer introduction compared to the level of effort the OEM does today under the special conditions can be provided separately by the OEMs.

OEM Cost Assessment	Development Cost	Non-recurring Cost	Recurring Cost	Weight Impact
FAA Assumption: Special conditions for large surfaces on seats would go away because the rule would directly cover them.	**N / A**			**N / A**

6.4.3. Inaccessible areas, In-flight:

Summary:

The Inaccessible Area Team has completed the tasks as outlined in the ARAC re-tasking notice. The team has concluded that the cost impact associated with the in-flight inaccessible area new regulation is high. Type certification of an all new aircraft model to the proposed new amendment level would be substantially more costly than it would be compared to using the flammability regulations that exist today. A majority of the costs are the result of the following:

-New testing and new material development and certification activities due to the more stringent test requirements for air ducting and electrical wiring/sleeving.
-New compliance activities due to the new regulatory coverage for the inaccessible areas where there was not regulatory coverage before. This includes new compliance test plans and reports, new conformed and officially witnessed tests, and new compliance documentation.

6.4.3.1. Inaccessible Area Background:

There are two types of fire threats: in-flight fires and post-crash fires. Addressing the in-flight fire threat is accident prevention, whereas addressing the post-crash fire threat is accident mitigation.

In-flight fires have historically only been a direct hazard to the airplane when they begin in an area that is not accessible to a person with a hand-held fire extinguisher. These areas either tend to be behind interior panels (such as behind sidewalls, floor panels or ceilings), or in cargo compartments. The principal risk with such fires is that they could grow and propagate, affecting critical systems and directly affecting occupant survivability. Consequently, the parts and materials of most concern are those that are most extensively used and could potentially be a path for fire propagation. FAA research has determined that materials that self-extinguish and do not propagate a fire under stringent but realistic conditions provide an acceptable level of safety. In-flight fires occurring in areas that are readily accessible to a person with a hand-held fire extinguisher are still a concern, but are much less likely to evolve into a threat to the airplane

Thermal/acoustic insulation covers a majority of the inaccessible area surfaces of a typical aircraft. Enhanced flammability regulations were adopted in the early 2000's, and the FAA estimated that roughly half the potentially catastrophic in-flight fires would be mitigated over a 20 year period due to these enhanced regulations. In order to more completely address the risk due to in-flight fire, the FAA has stated that the remainder of extensively used materials in inaccessible areas would need to be able to withstand the same in-flight fire threat as thermal/acoustic insulation. In particular, the materials of primary concern are electrical wiring, ducting, and composite fuselage structure. Each of these could be "extensively used" in the meaning intended here depending on their specific usage, and could permit a fire to propagate inside the airplane depending on the materials and configurations used. Since the areas in question are not accessible, and there is no effective

way to actively fight a fire involving these materials, the flame propagation resistance of these materials is paramount in overall in-flight fire safety

Except for thermal/acoustic insulation, the historical requirements for other inaccessible area materials were not threat-based, yet provide a relative fire performance. FAA research has shown that the traditional Bunsen burner test methods do not represent a realistic fire threat, as they were intended to show relative flammability performance of materials and provide a minimum performance standard to be judged against. In some cases the Bunsen burner tests may not discriminate between well performing and poor performing materials from a flame propagation standpoint, although the vast majority of materials currently used perform well. As established at the new proposed amendment, the same level of flame propagation performance will exist for the extensively used materials in inaccessible areas covered by this new regulation, using the threat developed for thermal/acoustic insulation as a reference

The FAA has previously addressed the issue of nonmetallic fuselage structure with respect to in-flight fire safety through the use of special conditions. The intent of the special conditions was to ensure that the use of nonmetallic or flammable metal structure did not reduce the level of in-flight fire safety that would have been provided with a traditional metallic fuselage. This new proposed regulation would now provide coverage for composite fuselage structure, eliminating the need for special conditions, and creates a new lab-scale test method – the Vertical Flame Propagation Test (VFP) to test extensively used composite fuselage structure, extensively used air ducting, and extensively used electrical wire and sleeving

The backsides of many existing interior features (e.g., galleys, sidewalls, ceilings) could have fallen into the category of “extensively used” and could have technically been subject to the vertical flame propagation test requirement. However, based on the performance of these materials, both in service and in testing, and given the other flammability requirements they are subjected to, there is no reason to require tests for the portion of these parts in inaccessible areas.

6.4.3.2. Inaccessible Areas Sub-Group Activities

The main objectives of the original 2010 proposed revision and consolidation were to establish threat based flammability performance requirements that will

- **Provide simpler regulations.**
- **Simplify compliance demonstrations.**
- **Maintain or improve aircraft safety in fire related incidents.**

6.4.3.2.1. **Providing simpler regulations:**

At this time it is not clear if the new regulations will be simpler. The existing regulations are well known and have been used for many years, and the inaccessible area regulations are new. The new inaccessible area regulations create a new system of classification that did not exist before – Class 1, Class 2, Class 3, and Extensively Used. Depending on the final regulation language and accompanying guidance material, it's possible the regulation will be easier to understand.

In order to better understand the meaning and impact of the new classification system based on assumptions provided, the sub-group created a table that lists the material type, size, and test requirement. The draft table is found in 6.6.2. The definitions are still in work, particularly the definition of extensively used. At this point the sub-group is not able to determine if the regulation will be simpler than the existing regulation to understand and use. See Exhibit 6.4.3.xx for example of air ducting and how the various classes are used.

6.4.3.2.2. Simplify compliance demonstrations:

The sub-group, and the full ARAC, has spent a significant amount of time discussing that compliance demonstrations (showing compliance to the regulations) accounts for a majority of the cost of compliance. This is the most important aspect of the new regulations.

Class 1 parts - The ARAC has discussed at length the simplification of compliance demonstrations for Class 1 parts. If this was simplified, or eliminated on the basis of the size criteria only, this would reduce the cost impact of the new regulation to industry.

Class 2 parts – The new regulation will allow for the use of industry specifications and test data to show that a material is self-extinguishing under specific test methods, in addition to the currently mandated FAA test methods. The regulation will also eliminate the need for these tests to be certification tests for this class of part. It will depend on how the final FAA guidance on compliance showing for Class 2 parts states industry data must be documented in reports, but these provisions have the potential to reduce the cost impact of the new regulation to industry. For example, if a simple reference to a UL listing is acceptable for a material, this could be simple to use.

Class 3 parts – The use of analysis has the potential to simplify compliance. Similar to Class 2 parts, the final FAA guidance will determine if this reduces the cost impact of the new regulation to industry.

Extensively Used parts – At this time the definition of extensively used parts is still being developed, and therefore it cannot be determined if this is a simplification. The FAATC will be performing large-scale tests in the near future to help determine the definition of Extensive Used electrical wiring/sleeving. The assumptions provided by the FAA on this class of parts are that it will only be applicable to composite fuselage structure, air ducting, and electrical wiring/sleeving. This has the potential to be simple provided the size criteria is easily followed and understood. The FAATC sent out a draft of future

advisory material for industry to provide comments to, and industry provided comments to the advisory material draft that would simplify the compliance if the inputs are accepted. Without clear guidance, and simple methods of compliance that limit testing to the bulk materials, compliance to this classification of parts could become very complicated and costly. In addition, there is substantial potential cost impact to showing compliance to the new regulations for all parts in the inaccessible areas. This is discussed later in the report. One potential recommendation for simplification of the inaccessible area regulations is to focus on the larger surface area parts and not have to show compliance for smaller parts or materials. This is discussed further in the recommendations section.

For extensively used electrical wiring and sleeving, there will also be a new Advisory Circular similar to the existing AC 43.13-1B with approved wire and sleeving types that will pre-approve these materials and will not require additional testing or compliance showings.

6.4.3.2.3. Maintain or Improve Aircraft Safety in Fire Related Incidents

The regulation as understood maintains or increases the level of safety in inaccessible areas. The FAA has stated that the level of safety will be maintained for extensively used composite fuselage structure, and level of safety will be increased for extensively used air ducting and electrical wiring/sleeving. The in-flight fire performance of existing certified composite fuselage structure will be kept at its current level. Materials and designs that are currently certified and in service on production aircraft will continue to be compliant. In practice what this means is that the pass/fail criteria of the future Vertical Flame Propagation (VFP) test that is in development by the FAATC and will be mandated for these materials will be set such that existing extensively used composite fuselage structure materials and designs when tested in this new test will pass the new test. Existing designs will be able to be used on future all new aircraft.

For extensively used air ducting, the FAA has stated that the level of safety will be increased by setting the pass/fail criteria in the new VFP test such that some existing certified materials and designs that are extensively used on production aircraft will no longer be certifiable and compliant. These materials and designs will not be allowed on future all-new TC aircraft, only on current aircraft models and derivatives. The same applies to extensively used electrical wiring and sleeving used on this wiring. For electrical wiring and sleeving, the FAA has stated that the level of safety will be increased by setting the pass/fail criteria in the new VFP test such that some existing certified materials and designs that are extensively used on production aircraft will no longer be certifiable and compliant. These materials and designs will not be allowed on future all-new TC aircraft, only on current aircraft models and derivatives.

The ARAC team has been told by the FAA that the primary intent of the new regulation is for it to be applied to all-new TC aircraft, and not derivatives of current products. The cost/benefit analysis is being looked at with this guidance in mind, and not accounting for any cost impact to future derivative aircraft. If this regulation was applied to a future derivative aircraft per Changed Product Rule, the cost impact could be very large.

6.4.3.2.4. Cost increases of proposed regulation changes

Cost data for inaccessible area regulation will be provided by the sub-team. For this report, cost impact is being provided in general terms due to the sensitivity and proprietary nature of cost data. Detailed cost information can be provided directly to the FAA in the future by individual ARAC sub-team members, but can't be shared with other sub-team members.

The latest assumptions provided by the FAA that are relevant to the inaccessible area regulations to assist with the cost assessment are found in section 6.3.

The cost impact of the new inaccessible area regulation has been calculated based on the following methodology adopted by the ARAC. R&D and non-recurring costs, one-time costs for certification, recurring costs for each airplane, weight increase for each airplane are assessed for the aircraft parts and materials that are extensively used in the inaccessible areas and subject to the new VFP test method.

In addition to the above costs for extensively used composite fuselage structure, air ducting, and electrical wiring and sleeving, there are substantial additional costs associated with the provision in the new regulation language that adds regulations where they do not currently exist. For areas such as those below the passenger floor and outside of the cargo compartments, there currently are no flammability regulations for parts that are not thermal/acoustic insulation, air ducts, or electrical wiring. All of these parts would now be subject to the inaccessible area regulations. Costs for showing compliance for the thousands of parts that fall into this category are discussed below. In addition, there is an increase in certification costs due to conformity inspection, formal certification test witnessing and associated costs, certification planning, and creation and processing of certification paperwork and forms.

Below are the items that were analyzed that impacted the costs by the inaccessible area sub-team members:

Air Ducting	• New duct materials required due to increased level of fire safety • In addition to flammability, new Air Ducting materials will need to meet mechanical systems/equipment performance test criteria (e.g.- Temperature; Humidity; Fluid Susceptibility; Fungus Resistance; Salt Spray; etc.). • New part standards / flexible air hoses required due to increa level of safety • Recurring cost increase per airplane due to more expensive parts and materials • Weight increase per airplane due to new parts and materials • New certification processes and documentation required due to new regulation and new test method • VFP baseline testing of all currently used air ducting materials on the final version of the VFP test method to

	determine if certifiable or not per new regulation • VFP official certification testing of final chosen parts and materials for new TC aircraft
	For air ducting, the sub-team concluded that the cost impact of this portion of the regulation was high. Using the future VFP test it is assumed some current materials will not be compliant in the future. This test method is currently in the R&D phase and the pass/fail criteria have not yet been established.
Electrical Wiring and Sleeving	• New sleeving materials required due to increased level of fire safety • In addition to flammability, new Wire Insulation and sleeving materials will need to meet electrical systems/equipment performance test criteria (e.g.- Aging Stability; Life-Cycle environment; Dielectric Strength; Volume Resistivity; Corrosion; Low-Temperature Flexibility; Thermal Shock; Water Absorption; Fluid Resistance; Fungus Resistance; etc.). • Recurring cost increase per airplane due to more expensive parts and materials • New certification processes and documentation required due to new regulation and new test method • VFP baseline testing of all currently used electrical wiring and sleeving materials on the final version of the VFP test method to determine if certifiable or not per new regulation • VFP official certification testing of final chosen electrical wiring and sleeving materials for new TC aircraft
	For electrical wiring and sleeving, the sub-team concluded that the cost impact of this portion of the regulation was moderate, but has the potential to be high depending on the sleeving impact. Using the future VFP test it is unknown if some current sleeving materials will not be compliant in the future. This test method is currently in the R&D phase and the pass/fail criteria have not yet been established.
Composite Fuselage Structure	• New certification processes and documentation required due to new regulation and new test method • VFP baseline testing of all currently used composite fuselage structure materials on the final version of the VFP test method to determine if certifiable or not per new regulation • VFP official certification testing of final chosen parts and materials for new TC aircraft • New bench-top scale VFP test method instead of larger-

scale foam block tests

For composite fuselage structure, the sub-team concluded that the cost impact of this portion of the regulation was low, but has the potential to be higher if the assumptions regarding the future pass/fail criteria of the future VFP test turn out to not be correct. This test method is currently in the R&D phase and the pass/fail criteria have not been established.

New area covered by the regulation (Below Passenger Floor) Impact

- New certification documents required to be generated by the new areas covered by the new regulations (X new documents / test plans / test report)
- New certification deliverables and certification paperwork required to be generated (X test plans/reports)
- New certification tests, and conformity inspections, and official witnessing required.

The sub-team concluded that the cost impact of this portion of the regulation was very high.

.

The elimination of the horizontal Bunsen burner test method has the potential to increase the cost of compliance, and cause some materials to no longer be viable or certifiable, depending on the final details of the new regulation. The latest assumptions provided by the FAA for these parts indicates that existing horizontal test data or new horizontal test data will be allowed for compliance for these parts. Depending on the final details of future guidance for these parts, the cost could be minimal. If new materials need to be developed if existing materials are no longer viable due to this provision, this could add substantial cost to industry for the regulation.

6.4.3.2.5. Cost decreases of proposed regulation changes

Areas of the new inaccessible area regulation that may limit the cost impact of the new regulation are as follows:

There is potential for the definition of Class 1 parts along with the guidance for these parts to not be required to be part of a detailed showing of compliance could limit the cost impact to industry for areas where the regulations currently exist. The creation of a Class 1 electrical wiring part class will also reduce the cost impact to industry of the new regulation by eliminating the testing and compliance showing for small lengths of electrical wire and sleeving.

The use of industry standards, UL listings, and other such listings or data or knowledge for Class 2 parts could be a cost reduction to industry for areas where the regulations currently exist.

The development and implementation of a new bench-top scale test method for certifying composite fuselage structure could benefit industry by eliminating the need to perform non-standard larger-scale foam block tests to certify all-new composite fuselage structure designs. This benefit would mainly be for all-new designs since existing designs would not require new testing.

The new allowance to use analysis in the flammability compliance process has the potential to benefit industry, depending on what the future guidance material says regarding the requirements for showing compliance using analysis.

6.4.3.2.6. Additional recommendations

- In order to assist industry in implementing the new regulations as seamlessly as possible, it is recommended that existing Designees and Authorized Representatives be delegated for compliance findings and test witnessing required by the new regulation upon release of the final regulation. This would minimize the non-recurring costs on implementation, as well as minimize schedule risk for a new future airplane program.

- In the ARAC in-person meeting held in Bremen, Germany in June, 2015, there was a lengthy and valuable discussion regarding the continued use of existing certification test data and the optional use of the proposed updated flammability test methods. One of the assumptions used by industry for the cost/benefit analysis is that the revised test methods will be equivalent and therefore optional to the existing test methods. This ground rule removes from the cost impact the need for industry to purchase, install, and implement the use of the test equipment and associated procedures. This eliminates tens of millions of dollars of cost impact from the assessment. In order to document the details of the agreement reached in the Bremen meeting, the test data usage file should be a record in the final report so it's clear to all in industry in the future.

- As part of the VFP test method development process, the FAATC provided draft guidance materials on the test method, procedure, and applicability to industry for comment. Industry provided comments to the draft guidance materials for clarity and simplification. These comments should be considered recommendations as part of the ARAC report. Clear guidance materials that simplify and streamline the implementation and testing are critical to success of the new test method, and limit the cost of implementation to industry.

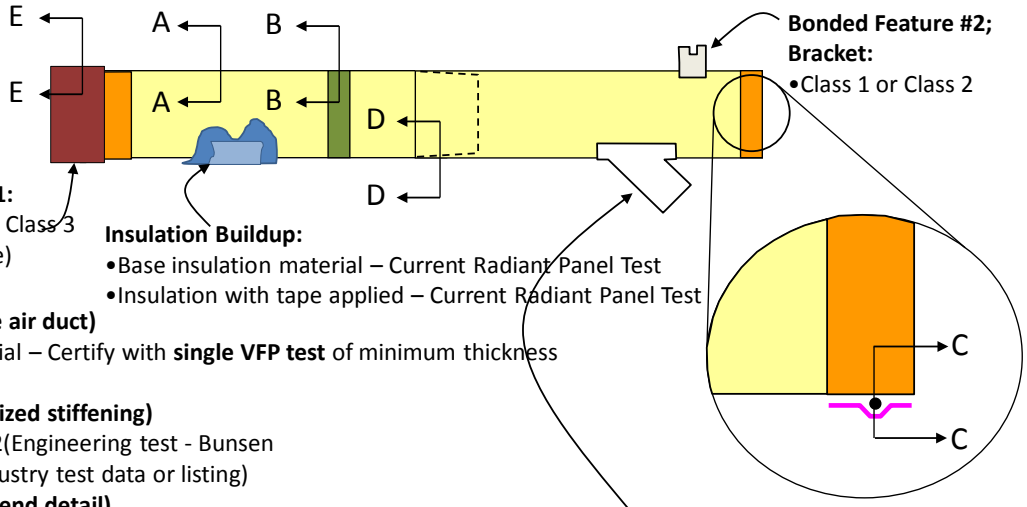
- Also provided to the ARAC in the Bremen meeting were a list of suggested updates to the FAA Final Policy PS-ANM-25.853-01-R2 that could simplify and streamline the testing and compliance process. These proposals should be considered recommendations as part of the ARAC report.

- The original tasking (75 FR 52807, Aug. 27, 2010) stated that the “approach could include new requirements pertaining to inaccessible areas of the airplane, where in-flight fire is the greatest risk, by expanding the requirements to include air ducts and electrical wiring systems, as well as other high volume materials”, and as stated here in this report will incur a very high cost to the industry for changes required for these large area components. It is proposed here that there would be no safety benefit, but an additional magnitude of cost, for also including “small parts”/non-extensively used materials in this new regulation. As with the existing Thermal/Acoustic Insulation regulation, the intent is to prevent flame propagation over large surfaces and limit the spread and intensity of an in-flight fire. As a reference, AC 25.856-1 (Thermal/Acoustic Insulation Flame Propagation Test Method Details) allows for the exclusion of material that is “not so extensive a part of the insulation system that it could have an effect on flame propagation”. Additionally, the EWIS final rule publication (72 FR 63382) states that “it is not necessary to test small parts such as clamps and grommets because they would not contribute significantly to the propagation of a fire”. Including coverage for non-extensively used materials (Class 1, Class 2, Class 3 Parts) under a new regulation would incur additional very costly initial an recurring costs that could be avoided altogether by simply keeping the new regulation to addressing only large volume (extensively used) materials such as air ducts, electrical wiring and composites fuselage structure, and Thermal/Acoustic Insulation as currently implemented and applied, without requiring accounting and documentation of non-extensively used parts in the inaccessible areas.

- “Systems approach” to show compliance for “Air Ducting with Thermal/Acoustic Insulation (T/AI)”: A duct that is insulated with T/AI that will protect the duct material from exposure for the duration of the fire threat (i.e.- T/AI that does not shrink away or fall away during fire exposure) would not be a fire safety hazard. Advisory material should provide means of compliance methods for testing these design configurations (i.e.- “duct + insulation” combination) for duct materials that may not pass a VRP “material” test, yet would provide acceptable fire protection when insulated with appropriate T/AI design. Ability to show compliance using a “system approach” could reduce the costs associated with a new rule.

6.4.3.2.7. AIR DUCT EXAMPLE

ARAC Inaccessible Area Air Duct New Size Criteria Assessment:



Bonded Feature #1:
•**Sleeve:** Class 2 or Class 3 (Depending on size)

Insulation Buildup:
•Base insulation material – Current Radiant Panel Test
•Insulation with tape applied – Current Radiant Panel Test

Bonded Feature #2; Bracket:
•Class 1 or Class 2

Section A-A (base air duct)
•Base duct material – Certify with **single VFP test** of minimum thickness

Section B-B (localized stiffening)
•Class 1 or Class 2(Engineering test - Bunsen burner test or industry test data or listing)

Section C-C (duct end detail)
•Class 1 or Class 2 (Engineering test - Bunsen burner test or industry test data or listing)

Section D-D (two ducts bonded together)
•Class 1 or Class 2 (Engineering test - Bunsen burner test or industry test data or listing)

Section E-E (bonded sleeve)
•Class 1 or Class 2 (Engineering test - Bunsen burner test or industry test data or listing)

Bonded Feature #3: Duct branch
•Class 1 or Class 2 (Depending on size)

Result:
•One VFP test on base minimum thickness air duct material, all the rest potentially non-cert tests/data/listing or no test.
•Insulation – Current radiant panel test.

6.4.4. Waste Compartments - In flight

There were few recommendations for waste compartment testing from the original ARAC committee. The prime focus was on updating the advisory material for modern forms of combustible materials (i.e. removal of cigarette packages). The assumptions for waste container testing are that the method of testing, and the pass fail criteria are not changing. Waste container testing is conducted only when new container configurations are required. In this light, there would be no significant change in cost due to the new regulations.

6.4.5. Cargo Compartments - In Flight

6.4.5.1. Overview

The primary assumption affecting the cargo liner testing requirements is 6.3.16 (restated and clarified):

Flammability requirements currently applicable to cargo compartment liners will continue to apply. Cargo compartment liner special requirements currently now levied on Class E compartments would continue to apply and be codified in the regulations.

Considering that the FAA and EASA rules for Cargo/Baggage Compartments are not yet harmonized at the current amendment levels, an additional key assumption was applied by the Cargo ARAC MFWG as a base-line in order to proceed with the cost benefit analysis:

> Assume that the FAA's harmonization to EASA [Ref. 7 and 8] under FAA's NPRM "new classification rule" [Ref. 5] will occur prior to our ARAC new rule. We will assume an FAA-EASA harmonized rule, with the understanding that more harmonization between FAA and EASA needs to be done for what concerns the acceptable means of compliance with the rule.

The cost-benefits analysis provided in this report is contingent upon the application of this additional sub-committee assumption.

The EASA rule and the FAA NPRM impose size restrictions on Class B compartments, and add a new Class F. Under our ARAC assumptions, the cost/benefits incurred by the industry under the EASA CS rule and a FAA Final Rule (impending NPRM) would have already occurred, therefore our ARAC evaluation does not account for those costs/benefits.

It must be noted that the scope of this tasking effort for cargo compartments is limited to material testing required by 14 CFR 25.853 and 25.855, and as specified in Appendix F.

The “Systems” design requirements addressed in Ref. 5, 7 and 8 are not accounted for in this assessment.

At a high-level, the cost-benefits analysis developed by the Cargo Compartment sub-committee is summarized in the following stop-light chart:

Cargo Compartment: Cost-Benefit Summary

Costs/Impact \ Cargo Class	Class B	Class C	Class E	Class F
Development Cost	=	=	= ↓	=
Non-recurring cost	=	=	= ↓	=
Recurring	=	=	=	=
Weight Impact	=	=	=	=
Impact of Complicance Process	=	=	=	=

Note: More details are found in Table 1 and 2.

<u>Results Summary</u>: Based on the assumptions provided by the FAA and the assumptions developed by the Cargo sub-committee during the ARAC MFWG’s January-to-September 2015 continuation of task, there would be no significant cost impact or cost benefit by implementing the recommendations submitted in the ARAC 2012 report for the Cargo/Baggage Compartment area. It is also noted that there is significant development of advisory material defining methods of compliance so that the regulation is harmonized with the EASA AMC.

References:

1) FAA, Notice: Federal Register 75 FR 52807, Aviation Rulemaking Advisory Committee; Transport Airplane and Engine Issues—New Task (Aug 27, 2010)
2) ARAC TAEIG, Materials Flammability Working Group Report (July 9, 2012)
3) FAA, Notice: Federal Register 80 FR 2772, Notice of a continuation of task assignment for the Aviation Rulemaking Advisory Committee (ARAC); (Jan 20, 2015)
4) section 6.3 - assumptions
5) FAA, NPRM: Federal Register 79 FR 38266, Harmonization of Airworthiness Standards—Fire Extinguishers and Class B and F Cargo Compartments, (July 7-14)
6) Cargo AC suggested language rev A 2014-7-9 (“FAA AC Draft Proposal on Installation of Cargo Liners for Flame Penetration Protection”, IFCTG)
7) EASA Regulation: 25.855 and 25.857 from CS-25 Amendment 17
8) EASA Regulation: AMC to CS 25.855 and 25.857 from CS-25 Amendment 17

6.4.5.2. Background

In August 2010, the FAA assigned the Aviation Rulemaking Advisory Committee a new task to review and submit recommendations in response to the Federal Aviation Administration's approach to update, reorganize and improve the level of safety of requirements for flammability of materials [Ref. 1]. As part of this task, the flammability regulations covering Cargo/Baggage Compartment were evaluated by a Cargo sub-committee within the ARAC MFWG, and that sub-committee's recommendations were included in the ARAC MFWG's final report [Ref. 2].

As summarized in the 2012 ARAC Report [Ref 2], "The scope of this tasking effort for cargo is (as defined in the charter) limited to material testing required by 14 CFR 25.853, and 25.855 plus as specified in Appendix F. The proposal is to move all material testing as currently defined in 25.855 (c and d) to 25.853. All 'system' aspects would be retained in 14 CFR 25.855."

The FAA released an NPRM in 2014 [Ref 5], providing background, "ARAC established the Cargo Standards Harmonization Working Group (CSHWG), assigning it the task of developing new or revised requirements for Class B cargo compartments of transport category airplanes. ARAC also established the Mechanical Systems Harmonization Working Group (MSHWG), assigning it the task of developing new or revised requirements for a built-in fire extinguishing system for existing or new cargo compartment classifications." The NPRM also provided the background that "EASA incorporated the ARAC working groups' recommendations into the CS–25 requirements via Amendments 4 and 8, on December 27, 2007, and December 18, 2009, respectively. The FAA agrees with ARAC's recommendations to harmonize U.S. airworthiness standards for cargo compartments and associated fire extinguishers with corresponding EASA regulations and proposes to amend part 25 accordingly."

Noting the above, the Cargo sub-committee cost-benefits analysis focuses only on the materials testing aspects of the cargo compartment (liners, etc) addressed in Ref. 2, 5 and 6, but the "Systems" design requirements addressed in Ref. 5, 7 and 8 are not included in this assessment. Our sub-committee did not have access to, not did we review the CSHWG or MSHWG reports.

In order to develop a Cost-Benefits analysis a baseline set of assumptions was required. The FAA provided a basic set of assumptions for MFWG in making its cost estimates [Ref 4]. The assumptions applicable to Cargo are as follows: [Note: only those directly related to Cargo are listed below, see Ref 4 for the complete assumptions list. [Ref. 4]:

Assumption 1: The NPRM generally tracks the ARAC report with the additions noted below. That is, the applicable requirement will be determined by the expected fire threat (not material type, or description)

Assumption 4: Pass/fail methodology will be consistent across test methods

Assumption 5: The materials that nominally pass the current standards will continue to pass the improved version of those standards (specifically oil burner, heat release, Bunsen burner). That is, the current methods could continue to be used if that is more economically viable than using the improved method. Data from the prior method could be used to show compliance, even if the new method was used to generate new data.

Assumption 8: Materials/parts/etc. currently only requiring horizontal testing will be substantiated by analysis, or as a class of 'not significant' part. Data from the horizontal test can be used to support this; that test data could be from engineering tests.

Assumption 9: There is a hierarchy of tests. Parts meeting a stringent test will not require (additional) testing with a less stringent test

Assumption 12: Vertical Bunsen burner tests would only measure burn length (but still require that materials self-extinguish, including drips/puddles)

Assumption 13: Many parts currently requiring 12 second Bunsen burner tests, could be substantiated with UL-94 V-0, V1, or V2, or through analysis with some supporting data

Assumption 16: Flammability requirements currently applicable to cargo compartment liners will continue to apply. Cargo compartment liner special requirements currently now levied on Class E compartments would continue to apply and be codified in the regulations.

Assumption 17: All test method details are in advisory materials, i.e., not in appendix F.

Assumption 19: Parts that do not require testing can be summarized by process and internal (company) documentation, and would not require item-by-item formal certification reports.

In addition to the FAA's set of assumptions, the Cargo subcommittee established an additional key assumption as a baseline assumption for Cargo Compartment cost/benefits analysis:

1. Assume that the FAA's harmonization to EASA (Ref. 7 and 8) under FAA's NPRM 79 FR 38266 "new classification rule" (Ref. 5) will occur prior to our ARAC new rule; we will assume an FAA-EASA harmonized rule.
    a. Understanding that more harmonization between FAA and EASA needs to be done, and
    b. Under this scenario, we assume that this NPRM will have its own cost/benefits analysis separate from (and prior to) the ARAC "new rule", therefore we do not consider its affect in our C/B analysis.

The EASA rule and the FAA NPRM impose size restrictions on Class B compartments, and add a new Class F. Under our ARAC assumptions, the cost/benefits incurred by the industry under the EASA CS rule and a FAA Final Rule (impending NPRM) would have already occurred, therefore our ARAC evaluation does not account for those costs/benefits.

The question on level of harmonization of (or differences between) the FAA NPRM and EASA CS-25 and AMC 25 was discussed by this ARAC Cargo sub-committee. As stated in

Ref 5, “Adopting these proposals would eliminate regulatory differences between the airworthiness standards of the U.S. and the European Aviation Safety Agency (EASA), without affecting current industry design practices. These proposed changes would ensure an acceptable level of safety for these types of cargo compartments by standardizing certain requirements, concepts, and procedures.” A review of these documents [Ref. 5, 6, 7 and 8] by the sub-committee indicates that the FAA and EASA regulations would be harmonized, pending an FAA Final Rule incorporating the NPRM details, and the release of advisory guidance material noted in the NPRM. Therefore, the assumptions of a “harmonized rule” is a reasonable baseline assumption for the cargo sub-committee, but with the stipulation that any cost-benefit analysis presented by this ARAC is contingent upon these assumptions becoming a reality.

Additional points made during the Cargo sub-committee meetings and webex discussions:

1. If Cargo liner remains typical materials/designs used today, then current liner material is acceptable (ie- no backside ignition requirement added.) Assumption here is that the current liner materials shown to be acceptable would continue to show acceptable performance.
2. To simplify the assessment, we evaluated by Class (ie- B, C, E, F).
3. A noted issue is that it is impractical to design Class E to meet Class C requirements (liner, joints, suppression, etc) and also meet all system protection requirements (ie- decompression vents, suppression agent retention, etc.). This is also an issue for Class B compartments and new Class F.
4. Need definition of “critical systems” and linking to Continued Safe Flight & Landing.
5. Need guidance on “critical system protection” and extent of “critical” / “essential” system protection for Class C vs. Cl. E vs. Cl F.
6. Some companies have developed various methods of compliance (accepted by EASA and FAA) to special conditions for Class E systems protection on specific aircraft models. Industry needs guidance on how to apply the new rule outside special conditions issue papers and to allow various methods of compliance besides the oil burner test due to design features of a class E compartment.

6.4.5.3. ARAC “2012 Final Report”

6.4.5.3.1. ARAC Final Report “Recommendations”

See ARAC 2012 Final Report for the complete list of recommendations based on the current FAA approach at that time. As recommended, there are 25.855, 25.857, and 25.1309 complexities, therefore, a comprehensive ‘systems’ cargo task needs to be developed, and a similar ARAC working team be formed.

The cargo recommendations from the ARAC 2012 report are provided below in an abridged format; see the 2012 report for complete list and supporting rationale details. It should be noted that these are the initial 2012 ARAC recommendations, but have been modified by more recent assumptions and clarifications as noted elsewhere in this subcommittee report section.

1. No change to the oil burner test performance parameter requirements specified in Appendix F for cargo ceiling and sidewall liners in Class C and Class B/F (when applicable).
2. No change to the 45 degree Bunsen burner test performance parameters for floor (or equivalent) for all compartment Classes. No change to the 45 degree Bunsen burner test performance parameters for liners of Class E compartments that are not required to protect critical or essential systems.

   Hierarchical acceptability of sidewall or ceiling oil burner resistant passing results is considered acceptable as substitute for 45 degree Bunsen burner test.

3. Include oil burner resistant liner requirements to protect critical systems that can be impacted by cargo fire in Class E or Class B/F compartments.
4. Include Oil Burner resistant materials for sidewall to cargo floor/liner interface transition to prevent fires from migrating from under floor space when no cargo floor is present (this is unique to certain manufacturer designs).
5. Appendix F recommend to be updated to include the 2 GPH cargo ‘sonic’ burner (in development by the FAA-TC sponsored working group) as the prime test method while retaining the current (as originally defined, but commercially no longer available) ‘Park’ and other burners as optional.
6. Eliminate redundant Bunsen burner tests currently specified for components within the cargo compartment and/or part of the liner system.
7. Recommend formation of AC cargo team through the FTWG to create AC materials for cargo testing. Relocate advisory information from the current Fire Test Handbook into the new AC relating to Methods of Compliance, standardized testing for common joints and in-service repair of liners.

6.4.5.3.2. ARAC Final Report “Appendix F Language”

This cost benefits analysis is also based upon the Appendix F language noted in the ARAC Final Report. *Excerpt from 2012 ARAC report for cargo is as follows:*

Appendix F, <u>Part I: Requirements for in-flight fire threats</u>

(a) **Cargo**:

(1) Except as provided in section (2), materials (that represent parts, components or assemblies) forming a cargo compartment shall be tested as specified below:

(i) <u>Class C or equivalent</u>

Ceiling and sidewall liner panels of each cargo or baggage compartment classified as C or equivalent, including any design features such as joints, lamp assemblies, etc., that may alter the continuity of the liner, shall be

tested per the FAA Fire Test Methods Reference , original revision, Chapter xx, “Cargo liner testing”.

Cargo floor panels (including materials serving the purpose of a liner at or below cargo floor level) shall be tested per the FAA Fire Test Methods Reference , original revision, Chapter xx, “45 degree Bunsen burner”.

(ii) Classes B and E

Class B, and E cargo liners (ceilings, sidewalls and floors) shall be tested per the FAA Fire Test Methods Reference , original revision, Chapter xx, “45 degree Bunsen burner”.

Areas of the liners including design features used to protect critical/essential systems of Class B or E compartment required to maintain safe flight and landing of the airplane per the FAA Fire Test Methods Reference , original revision, Chapter xx, “Cargo liner testing”.

(iii) Class F

Unless there are other means of containing the fire and protecting critical systems and structure, a Class F compartment must have a liner tested per the FAA Fire Test Methods Reference , original revision, Chapter xx, “Cargo liner testing”.

(2) Exceptions alternatives and specific requirements:

i. Components (examples: cargo restraint, cargo conveyance, moisture control, floor panels not part of liner and other similar miscellaneous components) within the confines of a cargo compartment require no flammability testing.

ii. Components, parts and assemblies that have been shown by an analysis to be acceptable to the administrator in regard to fire penetration for parts that are essential for the safety of the aircraft/occupants or for the functionality of the aircraft that cannot reasonably be constructed of a less flammable material without compromising their integrity and functionality. (Examples include cargo door surrounds, system ventilation penetration, emergency decompression vents,).

iii. Materials serving as an air or fire stop between a Class C cargo volume and other areas must meet the requirements (cargo oil burner resistance test) or be shown to maintain safe flight and landing for aircraft and occupants.

6.4.5.4. FAA Suggested AC Language for Cargo [25.855(c)]

- Noted during the FAA IAMFT-WG meeting in Bremen, the Cargo AC "suggested AC language" [Ref. 6] was forwarded to TAD. This suggested language is not to be assumed to be what final released AC will contain. It is expected that this AC will reduce compliance costs for Class C cargo compartment liners that require oil burner testing.
- Discussions regarding the suggested AC language:
    - The FAA "suggested AC language" from IFCTG addresses only materials testing, in that it only "provides guidance for the test method to determine flame penetration resistance of cargo liner materials and installations in transport category airplanes. This guidance applies to airplanes required to comply with § 25.855 and part III of Appendix F to 14 CFR part 25."
    - The FAA NPRM [Ref. 5] does include references to Airworthiness Directives (AD) and AC's that are acceptable and notes that "advisory material will provide guidance on acceptable means of compliance with this proposal."
    - Additional guidance needs to be developed for the Class E requirements beyond just the cargo liner test method. Question remains, will FAA AC include "critical systems" list? [as EASA CS 25.855(c)(2)).

6.4.5.5. Cost-Benefits analysis (our baseline ARAC categories).

Details of the cost-benefits analysis criteria are contained in the main report text. The analysis shown in attached spreadsheets was developed based on the following:

- Development Costs
- Non-recurring Costs
- Recurring Costs
- Weight Impact
- Assumptions
- Impact of Compliance Process

6.4.5.6. CONCLUSION:

Based on the assumptions provided by the FAA and the assumptions developed by the Cargo sub-committee during the ARAC MFWG's January-to-September 2015 continuation of task, there would be no significant cost impact by implementing the recommendations submitted in the ARAC 2012 report for the Cargo/Baggage Compartment area. There is assumed to be some minimal cost benefit to OEM and regulatory groups by eliminating the need to issue and address Special Conditions and/or Means of Compliance Issue Papers/CRIs related to flammability of materials used in the construction of cargo compartments.

6.4.5.7. CARGO Compartments, Cost-Benefits analysis

"Cost-Benefit, Summary: CARGO Compartments"					
Airplane Area Costs/Impact /Category 1/ 2/ 3/	**Class B**	**Class C**	**Class E**	**Class F**	**NOTES/COMMENTS: 3/**
Development Cost	=	=	= ↓	=	Development Costs: - New Test Equipment (Development) - New Material/Specification Development / Revision of Current Specs due to new requirements. *[Note: Potentially a small cost reduction since the effort by OEM and regulators to define a Special Condition/Issue Paper/CRI.]*
Non-recurring cost	=	=	= ↓	=	Non-recurring Costs: - New Test Equipment (Purchase and Production Approved) - New Design Development - New Methods of Compliance - Regeneration of Existing Flammability Certification Data (Existing materials/designs) - New Certification Data (New materials/designs) *[Note: Potentially a small cost reduction since the effort by OEM and regulators to define a Special Condition/Issue Paper/CRI.]*
Recurring	=	=	=	=	Recurring Costs - Material/part cost. - Weight increases – airline operational cost - Customer Introduction Certification Requirements - Maintaining Separate Requirements, Documentation, and Test Data for In-Production Airplanes vs. New Certification Basis Airplanes - Testing Reliability - Unclear Initial Requirements and

					Guidance Materials Could be Costly
Weight Impact	=	=	=	=	Weight increases – airline operational cost
Assumptions 1/ 2/ 3/					
Impact of Compliance Process	=	=	=	=	
1/ "Assumptions" provided by FAA					
2/ Additional assumptions presumed for cost-benefit analysis that were developed by each area sub-committee are noted in this table, the attached area sub-committee sheets, and the sub-committee report sections.					
3/ Cost-Benefit values stated in this chart are contingent upon the noted assumptions. See attached area sub-committee sheets and the sub-committee report sections for details of these additional assumptions unique to the area.					

6.4.5.8. Cargo Compartments: Comparison of Requirements (EASA CS/AMC and FAA NPRM) by Compartment Classification

Cargo compartment Class	**EASA CS25 855 & 857 Amdt 17**	**Assumptions new FAA rule: *"Cargo compartment liner special requirements currently now levied on Class E compartments would continue to apply and be codified in the regulations."***	**Consequences**	**FAA Cargo NPRM "current reg"(79 FR 38266, FAA NPRM) *(5)***	**Cost Impact**	**Notes**

B	VBB, HBB, 45°	No Change	No Change	VBB, HBB, 45°	**=**	ARAC 2012 required "critical systems" to have oil burner, but with FAA-EASA harmonized rule assumption Cl B requires 45-degree BB
C	OB, VBB, HBB, 45°	No change	No change	OB, VBB, HBB, 45°	**=**	
E	OB, VBB, HBB, 45° + protection of critical systems for CSFL**	Same as before for lining (see assumption). Protection of essential systems will be added in the rule (App F part III for all liners, and liners/features necessary to protect critical systems).	No change	OB, VBB, HBB, 45° OB/Appx F, Part III is only required for protection of critical systems, and not required throughout the cargo area	**=** (2) (3)	Additional AC guidance required for MOC, Class E
F*	OB, VBB, HBB, 45° + protection of critical systems for CSFL** EASA AMC: "Class F cargo compartment was introduced as a practicable and safe alternative to the previous	Not in FAA rulebook yet but Jeff confirmed FAA would harmonize with EASA. What do we assume the test requirements are?	Class F is a new class of cargo compartment. Certification work would only be done if such compartment is installed.	Need AC guidance. Assumption: harmonization between FAA and EASA is completed, and is harmonized.	**=** (4)	For our cost-benefit analysis we expect fully harmonized rules.

	practice of providing large Class B cargo compartments"					

***EASA only**

****Continued Safe Flight & Landing**

(2) Similar cost for OEMs currently showing compliance to Issue Papers requiring Class E protection of critical systems. Assumes all the available methods of compliance allowed today will be allowed in the future and defined in a new AC. Issue Papers/SpecCond currently in place to cover protection of critical systems.

(3) NEW ASSUMPTION: Increased cost (over today's 25.855 regulation) for OEMs designing an initial Class E compartment. Assumption is that FAA would impose Special Conditions on the new applicant for that initial certification project, After the initial certification project there would be "=" no impact going forward .

(4) Assumption: FAA Cargo NPRM will have its own cost/benefits analysis separate from (and prior to) the ARAC "new rule", therefore we do not consider its affect in our C/B analysis..

(5) FAA Cargo NPRM "current reg" (79 FR 38266, FAA NPRM: this header title reflects our assumption that the FAA's harmonization to EASA under FAA's NPRM 79 FR 38266 (7/7/14) "new classification rule" will occur prior to our ARAC new rule; we will assume an FAA-EASA harmonized rule as the "current regulation" for this cost-benefit analysis.

Additional Notes:

Liners: Multiple elements (cutouts with fixtures installed): "features" are definitely covered; "liner integrity" is required to ensure performance of the fire suppression system. Class F specific requirements would not be relying on this so much therefore seams/features/joints not fully a Class C requirement.

Class F system tests for suppression containment would potentially be required but dependent on how showing compliance. (Ref. to NPRM that there are a few methods to achieve the Class F intent based on past

Class B & F changes do not affect Class C usage. Class E is different, incorporates requirements that can be used when no passengers. Class F I flexible, depends on approach/MOC that is being proposed by applicant (so individual, case-by-case), so yes it does need guidance. So our assumption of "NPRM already made rule" is good approach. Class E is basically how we currently to Class E; Class B and Class F are the changed rules.

45 °Λ will not protect against fire, so that's where needs to apply; rest of the liner is to contain smoke. For "protection of critical systems", Appdx F, Part III is needed in these areas; AC needed to better define MOC and details. "Other MOC" could be fire-hardened wire, conduit.

6.4.6. Escape slides - Post Crash

The original ARAC report recommended consolidation of current TSO procedures into the CFR. No issues were raised, so no change in the compliance effort is expected. The new flammability structure should have a cost neutral effect.

6.4.7. Flame penetration into cabin - Post Crash

ARAC Assessment - Burnthrough 25.856(b)

Overview:

The FAA provided an assumption that burnthrough requirements would remain the same in the future regulation, and would account for other methods so that ELOS would not be required.

When using thermal acoustic insulation designs to meet the requirements, there would be no significant cost impact and no significant cost benefit. Further reductions in the cost of compliance may be gained from revising AC 25.856-2A with lessons learned and other changes to simplify and standardize testing and compliance showing.

When a composite fuselage provides the burnthrough protection there will be non-recurring cost savings. The cost savings will be different for an applicant that has previously generated data under ELOS project which is assumed to be acceptable to use to show compliance to the future regulation. For an applicant that has not yet certified a composite fuselage, there should still be cost savings compared to certification through an ELOS, assuming a simplified test method is defined. Specific cost information can be obtained from the OEMs.

Discussion on FAA Assumption:

The FAA provided a list of assumptions to the ARAC on January 28th, 2015. Related to fuselage burnthrough (e.g. flame penetration) requirements in 14CFR25.856(b), the FAA provided the following assumption:

> ***"Burnthrough requirements would remain as is, including MOC, but would account for other methods so no ELOS would be needed."***

The assumption implies that current test requirements for thermal acoustic insulation installed in aluminum airplanes would remain the same as described in Part VII of Appendix F and Fire Test Handbook Chapter 24. In addition, AC25.856-2A and FAA approved Methods of Compliance would be acceptable under the new regulation.

The assumption also implies that the new regulation would allow for effective certification of other methods that provide flame penetration resistance besides thermal acoustic insulation installed in the lower half of the fuselage without the use of a

ELOS/special condition. This change is being made to provide certification coverage without requiring an ELOS/special condition for composite fuselage structure that is inherently flame penetration resistant.

Impact Assessment:

The information below is provided to describe aspects of proposed regulation to assess the benefit/impacts of this future regulation. The information is separated into two parts; 1) thermal/acoustic insulation (current requirements), and 2) other methods that provide burnthrough resistance (e.g. composite fuselage).

1) Burnthrough Protection using Thermal Acoustic Insulation installed in Aluminum Fuselage Structure:

a. Current requirements remain unchanged.
b. Current designs utilizing thermal/acoustic insulation materials would remain compliant and no new development costs would be required.
c. The improved test method (e.g. Sonic Burner) is already accounted for in AC 25.856-2A.
d. The testing hierarchy is not applicable for burnthrough requirements.
e. For an initial certification project, there would be no change in the non-recurring cost of certification (e.g. same level of design review, same level of data generation, reuse of existing data as applicable and same level of effort to mange Certification Plans/Test Plans/Test Reports.
f. The preamble shall clearly describe that all current approved Methods of Compliance for the current 25.856(b) amendment level will be acceptable under the new regulation/amendment level. This will allow for efficient implementation without an increase in cost.

   <u>OVERALL COST IMPACT :</u> No significant cost impact, no significant cost benefit. Further reductions in the cost of compliance may be gained from updates to current AC 25.856-2A with lessons learned and other updates to simplify and standardize testing and compliance showing. Detailed review of proposed changes to the AC would need to be reviewed by OEMs before determining if there is cost reduction in testing and the showing of compliance.

2) Burnthrough Protection using Composite Fuselage Structure:

a. Assume this will only be applicable to airplanes that carry 20 and more passengers.
b. As described by the FAA in ARAC meetings, any prior ELOS/special condition certification work would be valid and applicable under the new regulation. Composite fuselage designs similar to current certified designs could be certified under the new regulation using the existing data. It is important to describe this implementation information in the preamble to enable efficient use of existing data to substantiate a new Type Certification.
c. The FAA also described that a simple burnthrough test would be appropriate to confirm burnthrough resistance of a new design and materials. Conceptually this would be similar to the current insulation test rig except a representative composite skin would be attached to the frame. It is

recommended that the test method and test details be defined in a new AC. AC Guidance is required to ensure no cost impact greater than incurred under the ELOS/Special Conditions.

OVERALL COST IMPACT:

a. Scenario #1 - Using similar composite fuselage design/material:

There are non-recurring cost benefits:

i. The initial type design certification when comparing to the cost incurred during certification under the Postcrash Equivalent Level of Safety Issue Paper (e.g. 787, A350), since similarity analysis can be used without performing costly burnthrough tests. This scenario assumes current ELOS data is applicable. Need to ensure efficient usage of existing data and minimize coordination of an approved MoC with local ACO.
ii. There will be less administrative cost to OEMs and FAA since writing and coordinating Issue Papers will not be required.
iii. Minimal to no development costs, since similar designs/materials as prior certification are being used.
iv. No new development costs.
v. No change in recurring costs.
vi. No weight impacts.

b. Scenario#2 – New composite design and material requiring new certification data (assumes new testing will be required):
   i. *Best Case:* Non-recurring cost benefit if simplified test method and test details are clearly defined, and smoke/toxicity testing is not required.
   ii. *Worse Case:* Likely cost neutral (Development, and Non-recurring costs) when compared with prior Type Certification programs. This assumes the same kinds of tests used for prior Postcrash ELOS projects will be required.

Note about recurring costs: In general, the certification activity for this regulation requirement is primarily a one-time certification effort on the initial airplane design. Once certified, the type design does not generally change in a way that would require substantial re-certification unless there is an ATC (amended type certification). This is especially true for composite fuselage structure since the certified airframe structural design does not change. Certification of thermal acoustic insulation is also a substantial effort on the initial design and becomes very reduced for any follow-on localized design changes. This is different than many of the other flammability certification requirements for cabin interiors that have significant certification efforts for all customer introduction programs due to new cabin interiors.

Proposed Regulation Section	Development Cost	Non-recurring Cost	Recurring Cost	Weight Impact	Assumptions	Impact of Compliance Process
THERMAL/ACOUSTIC INSULATION: Part 2. Post-crash Fire 1.Fuselage Burnthrough	=	=	=	=	1. Preamble clearly states that existing MoCs are approved for new certification. 2. The improved test method (e.g. Sonic Burner) is already accounted for in AC 25.856-2A. 3. Heirarchy is not applicable.	Some reductions in the cost of compliance may be gained from updates to current AC 25.856-2A with lessons learned and other updates to simplify and standardize testing and compliance showing.
COMPOSITE FUSELAGE SCENARIO #1: Similar Design, Prior Cert Part 2. Post-crash Fire 1.Fuselage Burnthrough	↓	↓	=	=	1. Preamble clearly allows efficient usage of existing ELOS data and automatic approval of current MoC with local ACO. 2. New AC defines simplified composite fuselage test methods and test details.	Compliance documentation is done at the airplane level and not at a detailed part level.
COMPOSITE FUSELAGE SCENARIO #2: New Cert *BEST CASE*. Part 2. Post-crash Fire 1.Fuselage Burnthrough	↓	↓	=	=	1. Baseline effort compared to 787 or A350 Post Crash ELOS/Special Condition effort. 2. New AC defines simplified composite fuselage test methods and test details. Assumes that that no smoke/tox assessment is included in the compliance activity.	Compliance documentation is done at the airplane level and not at a detailed part level.
COMPOSITE FUSELAGE SCENARIO #2: New Cert *WORST CASE*. Part 2. Post-crash Fire 1.Fuselage Burnthrough	=	=	=	=	1. Baseline effort comparable to 787 or A350 Post Crash ELOS/Special Condition effort.	

6.4.8. Limiting Flame Spread in the Cabin - Post Crash

Post Crash cabin effects are covered in 6.4.1 and 6.4.2 above.

6.5. Member Observations on cost impact

The proposed revamp of the flammability regulations consolidates current flammability regulations and adds new requirements. The following topics provide some member concerns about topics that are important aspects to consider regarding implementation of the new requirements.

6.5.1. New regulation requirements:

New requirements are being proposed for the inaccessible areas. These requirements will define new test requirements and additional compliance throughout the inaccessible areas. Certain aspects of these new requirements are provided below:

6.5.1.1. **Cost/Benefit & Safety Analysis:**

The overall cost/benefit/safety analysis of the new inaccessible requirements should be done on the merits of the new requirements and not combined with benefits proposed in other areas of the flammability regulation. E.g. increasing the cost impact for new hidden requirements must be justified by a safety benefit in the hidden area, and not justified by cost benefits/reductions in other areas (accessible, seats, hierarchy, etc…). For the new requirements that will ultimately increase the cost of certification for those areas (e.g.

hidden areas), the safety benefit should be commensurate to the cost increases. The FAA should consider which systems (ducting, wiring, etc…) provide a safety benefit and only apply the new requirements specifically rather than wholesale to the entire inaccessible areas. The ARAC OEM members are providing a general assessment that there is limited benefit (based on no incident data) for the new hidden area requirements. If no safety benefit can be shown, there is no justification for cost increases wholesale across the inaccessible area. Also it is important to consider the historical perspective of past regulations that provide improvement in the hidden area [25.856(a), etc…] as well as OEM requirements that Boeing and Airbus currently have for these hidden areas which provide a higher level of safety and is already providing a "benefit" to the level of safety.

6.5.1.2. Applicability:

With the FAA proposing new requirements for the inaccessible areas in addition to changes to existing requirements, not all existing designs will comply with these new inaccessible requirements. The new inaccessible area requirements and new vertical flame propagation test method being proposed for "extensively used materials" (extensively used system?) will apply to extensively used composite fuselage structure, air ducting, and electrical wiring and sleeving, while insulation will retain the current flame propagation requirements per 14 CFR 25.856(a). For all other materials/designs that that are not "extensively used," basic flammability requirements will be defined where no requirements exist today. These requirements will mandate a range of compliance activities including testing (Bunsen burner) and compliance reports using newly defined size and application criteria. These new requirements will result in the use of new materials and design architectures in order to comply with the new regulations.

Applying these new requirements to areas of a significant product level change for which the materials and design architectures area being carried over from the base product would be extremely costly and impractical. The Flam ARAC economic study determined it would be extremely costly to implement due to the cost of development, redesign, certification and compliance for a significant product level change for which the materials and design architectures area being carried over from the base product. The only time the new requirements would be cost effective would be for changes determined to be substantial, thus requiring a new type certificate according to 14 CFR 21.19. As such the subparagraph format of the updated requirements will clearly enable the appropriate applicability of the revised regulation. The intent of the Flam ARAC is to apply the revised regulation to changes determined to be substantial. The NPRM should include this information and should also make clear that the existing cert basis is adequate for all changes not determined to be substantial.

6.5.1.3. In-service incident and accident data:

The FAA Tasking Notice asked for industry to "Provide service data regarding incidents (precursors) or accidents related to materials flammability that would be mitigated in the

future by implementation of each recommendation." ARAC OEM members have reviewed their COSP (Continued Operational Safety Process) databases and have determined there is no data that is not already provided to the FAA. In general, ARAC OEMs do not know of specific incident data that can be identified that indicates new requirements are necessary to provide an additional safety level. The FAA is requested to identify those incidents/accidents that support that improved flame propagation resistance on ducting, wiring and composite structure will increase airplane safety.

6.5.2. Optional Test Methods:

Ensure that optional test methods will not be misinterpreted as required under the new regulations. It is assumed that the new and modified test methods will be defined in a document similar to the current Aircraft Materials Fire Test Handbook and this will be referenced in the new Appendix F to FAR25.853. The regulation shall define that "other means approved by the administrator" be included, and that AC Guidance is defined that is similar to the current Policy Statement Number ANM-01-01; FAA Policy on Use of the "Aircraft Materials Fire Test Handbook."

6.5.3. Modifications of current requirements and the impact on safety:

Assessing the overall impact on safety was not part of the ARAC Tasking. Many group members agree with the FAA that the proposed simplification and streamlined changes to the current regulation requirements will maintain the level of safety. ARAC recommends that the FAA acknowledge this industry level concurrence in the NPRM which supports the regulation changes of the current requirements. Many group members agree that changes to the existing requirements provide cost reductions (eliminate smoke, hierarchy, engineering test, UL, analysis, small part size/compliance simplification, etc…), and do not reduce safety. The ARAC also recommends implementation of specific sections of the ARAC proposed MOC on current production airplane programs is acceptable once the ARAC report is released, to capture cost reductions without needing to wait until a new future certification basis airplane project. In addition, the ARAC suggests that the FAA consider ways to implement these cost reductions via another approach so that industry may implement these into current production programs as soon as possible.

6.5.4. ARAC Assumptions are Critical to Cost Assessment:

This ARAC report has developed a cost assessment of the assumptions provided by the FAA. During the development of the costs assessment many assumptions were made and documented within this report. It is critical to the ARAC cost assessment that these assumptions be understood, and that any changes to the assumptions will make this cost assessment inaccurate. Several assumptions need well defined AC Guidance in order for standardized and consistent implementation based on the intent of the assumptions provided to the ARAC. It is acknowledged by the ARAC members that there are substantial efforts needed to develop and document the final AC Guidance, but it is important the development of the AC Guidance not create scope creep beyond the intent of the assumptions provided by the FAA and the other assumptions documented by the ARAC.

6.6. Exceptions And Alternate Means of Showing Compliance

6.6.1. The Accessible areas group defined Class1-2-3 with the following structure:

From CAR: Part 1 Requirements for In-Flight Fire Threats

(a) Resistance to small ignition sources in accessible areas.

(1)Except as provided in Table 6.6.1.1 below, components, parts and assemblies located in accessible areas shall meet the test requirements specified in the FAA Fire Test Methods per formal FAA established procedures.

6.6.1.1. Exceptions and Alternatives.

Part / Material Class	Interior Accessible Parts (excluding electrical wire and sleeving)	Requirement	Electrical Wiring and Sleeving Part Class Definitions	Requirement
Class 1	Less than 2”x2”x2”, 3x3x0.5” or exposed surface area 12 square inches and less than .06” thick.	No Test / No Showing, since these parts are negligible to the in-flight threat. Test plan and report preamble statement to acknowledge these parts were evaluated per engineering review. (spacing and tiling not measured/documented)	Electrical wiring or bundle installed in any part of the aircraft which are 24 inch or shorter and wire gauge 10 (AWG 10 or smaller) or smaller. In case of ribbon cable, Class 1 include ribbon cable of 24 conductor or less with wire gauge 20 or smaller.	No Test / No Showing, since these parts are negligible to the in-flight threat. [Ref. Fed Reg 72FR63382: Small parts covered under EWIS do not require testing]
Class 2 (boundary for formal compliance)	Surface area of parts/ material up to 144 sq. in. limit.	Non-Cert[1] test to characterize the part/material configuration. Data included as part of the showing of compliance documentation.	Electrical wire or bundle installed in any part of the aircraft which is XX inch or shorter and wire gauge 10 (AWG 10 or smaller)	Existing 60 degree test (Non Cert), SAE equivalent 60 degree wire test, or UL 1581 (VW-1) flammability testing.

		(Previously tested certification data can be used to show compliance) [Acceptable test methods include the Existing 60-second, 12-second, UL94 V0 and other industry equivalent VBB tests as allowed by the FAA. See Table 2 for aircraft legacy materials that have been qualified using industry flammability test methods]	or smaller. (awaiting final FAA determination)	
Class 3	Special Applications (Materials & Parts that are essential for special functions and/or the safety of the aircraft, or its occupants or the functionality of the aircraft *and* cannot reasonably be constructed of a less flammable material without compromising their integrity and functionality (e.g. lighting lenses and windows, transparent panels needed to enhance cabin safety, curtains of	Analysis- Minimum of a compliance statement, but also may include test data & rationale. Table 3 lists materials/ applications that could be shown compliant with a horizontal Bunsen burner test.		

	galleys and class dividers, pressure & closeout seals, crew safety & emergency equipment, etc.). (Crew safety equipment would include flashlights, bull-horn, crash axe, 1st aid kit, etc)			

[1] Non-Cert test- A non-cert test is an engineering/ QA test which does not require FAA conformity inspections and witness delegations.

6.6.1.2. Industry Flammability Test Methods Assumed as Acceptable "Non-Certification" Test Methods for Class 2 Parts

Table 6.6.1.3 contains examples of Industry specifications (SAE, military, ASTM) that are proposed as acceptable industry standard test methods for use during Class 2 small parts evaluations. Industry standards for materials and parts require testing for qualification and subsequent QA acceptance testing for many properties. When flammability testing is also included in that specification, it should be considered to be a standard baseline test. Flammability testing conducted according to recognized industry test methods provides data showing an acceptable flammability performance for that material or part when used for "non-cert" Class 2 compliance documentations. The flammability test methods listed below are published and controlled by organizations recognized by the aerospace industry. The methods below are applicable to the material specifications requiring the test.

6.6.1.3. TABLE OF TESTS

Industry Flammability Test Method	Referencing Document	Requirement ("referencing document" requirement)	Notes
ASTM D 2671	AMS-DTL-23053	Flammability: "Flammability shall be determined in accordance with the appropriate flammability procedure in ASTM D 2671. The procedure shall be as specified in the applicable specification sheet."	
ASTM D2671	MIL-PRF-46846, Class 1	Self-Extinguishing (test per ASTM D2671)	
ASTM D635	MIL-PRF-46846, Class 2	Self-Extinguishing (test per ASTM D635)	
ASTM D876			
MIL-STD-2223	AS5382	3.6.1 Flammability: "When specified on the applicable specification sheet and when tested in accordance with 5.6.1, the cable shall conform to the requirements of the applicable specification sheet." 5.6.1 Flammability: "Flammability testing shall be performed in accordance with MIL-STD-2223 Method 1006 Procedure A."	
ASTM D3032			Test Method A (vertical 5 inch flame test); Test Method B (inclined 3 inch flame

			test)
ASTM D3801			Burner per ASTM D5025; Calibrate per ASTM D5207
UL 94	IPC-4101	3.10.1.1- Flammability, "When specimens are tested in accordance with Table 3-1 and UL94 flammability requirements, the rating shall be as indicated in the applicable specification sheet and Table 3-9."	Many other industry materials specifications reference UL94.
ASTM D5025, ASTM D5207	UL 94		Burner per ASTM D5025; Calibrate per ASTM D5207
UL 1581		Referenced by industry specifications.	Wire flammability
ASTM D5025, ASTM D5207	UL 1581	Contains various wire tests.	Burner per ASTM D5025; Calibrate per ASTM D5207
ASTM F777			Wire flammability; Superseded by ASTM D3032

References:

ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position

ASTM D876 - Standard Test Methods for Nonrigid Vinyl Chloride Polymer Tubing Used for Electrical Insulation

ASTM D2671 - Standard Test Method for Heat-Shrinkable Tubing for Electrical Use

ASTM D3032 - Standard Test Methods for Hookup Wire Insulation

ASTM D3801 - Standard Test Method for Measuring the Comparative Burning Characteristics of Solid Plastics in a Vertical Position

ASTM D5025 - Specification for Laboratory Burner Used for Small-Scale Burning Tests on Plastic Materials

ASTM D5207 - Practice for Confirmation of 20–mm (50–W) and 125–mm (500–W) Test Flames for Small-Scale Burning Tests on Plastic Materials

ASTM F777 - Standard Test Method for Resistance of Electrical Wire Insulation Materials to Flame at 60 Degrees

AMS-DTL-23053, Insulation Sleeving, Electrical, Heat Shrinkable, General Specification For

AS5382, Aerospace Cable, Fiber Optic

IPC-4101, Specification for Base Materials for Rigid and Multilayer Printed boards

MIL-PRF-46846, PERFORMANCE SPECIFICATION, RUBBER, SYNTHETIC, HEAT – SHRINKABLE

MIL-STD-2223 Test Methods for Insulated Electrical Wire

UL 94 Test for Flammability of Plastic Materials for Parts in Devices and Appliances

UL 1581, Reference Standard for Electrical Wires, Cables, and Flexible Cords

6.6.1.4. Materials and applications where data from a Horizontal BB Test can demonstrate compliance.

Materials	Applications
Elastomeric	Seals, etc. (parts constructed in whole or in part of elastomeric materials)
Webbing (Nylon, Polyester, etc)	Seat belts, shoulder harnesses, cargo and baggage Tie down equipment including containers, bins, pallets, etc.
Acrylic	Structural windows
Air Bag material	Air Bags
	Edge lighted instrument assemblies consisting of two or more instruments in a common housing.

A task group member proposed a 2nd option recommending to eliminate current class 1 parts by stating in the rule/AC that "All non-metallic parts larger than 2"x2"x2", 3X3X0.5" or exposed surface area greater than 12 square inches and less than 0.06" thick, must meet the requirements shown in Table 1." Table 1 would then be modified to renumber the classes. The benefit would be that everything in Table 1 would require a finding of compliance as noted and the table is not mixed with parts requiring compliance with parts not intended to find compliance. Additional language for wire & sleeving small parts would also be required. Inaccessible small parts would require similar language. Also, all metallic parts/materials would not require testing or showing of compliance, except magnesium.

6.6.2. Inaccessible Area Definitions and tests.

Part / Material Class	**Part Class Definitions**: **Air Ducts, Composite Fuselage Structure, Other High Volume Materials**	**Requirement**	**Part Class Definitions:** **Electrical Wiring and Sleeving**	**Requirement**
Class 1	Less than 2" X 2" X 2" or 8 cubic inches (or equivalent multiple same parts when added together) No spacing requirement. See additional below for parts list and guidance.	No Test / No Showing, since these parts are negligible to the in-flight threat.	Electrical wiring or bundle installed in any part of the aircraft which are 24 inch or shorter and wire gauge 10 (AWG 10 or smaller) or smaller. In case of ribbon cable, Class 1 includes ribbon cable of 24 conductors or less with wire gauge 20 or smaller.	No Test / No Showing, since these parts are negligible to the in-flight threat. **[Ref. Fed Reg 72FR63382: Small parts covered under EWIS do not require testing]**
Class 2	Exposed surface area 200 square inches or less, and not meeting Class 1 definition.	Part/material self extinguishing in vertical test (Non Cert).	Electrical wire or bundle installed in any part of the aircraft which is XX inch or shorter and wire gauge 10 (AWG 10 or smaller) or smaller, and not meeting Class 1 definition. (awaiting final FAA determination)	Existing 60 degree test (Non Cert), SAE equivalent 60 degree wire test, or **UL 1581 (VW-1)** flammability testing.
Class 3	Exposed surface area greater than 200 square inches and less than extensively used.	Analysis* or Appendix F 12 Second Vertical Flammability Test (Cert	Electrical wire or bundle installed in any part of the aircraft which is greater than XX inch wire gauge 10 (AWG 10 or smaller) or smaller	Analysis or Existing 60 degree test (Cert Test).

		Test). *Horizontal test data acceptable. *Analysis showing essential for safety or functionality of airplane may apply.	and less than extensively used. (Definition still in work)	
Extensively Used (Applies to Air Ducting and Composite Fuselage Structure Only – See FAA Assumptions)	Extensively used over significant area of the fuselage length and width – Both X% of circumference and Y% of length. (Definition still in work) (may have to be a specific size due to flex duct test performed at FAATC) Could be parts that run up the size wall longer than 2'. (This size to be used for cost impact)	New VFP Test	Any new electrical wiring which are proposed to be qualified for aerospace/aircraft usage and application as a hook wire (extensively used as aircraft wire in). (Definition still in work) FAATC to perform foam block test on simulation of back side of galley wall to determine that this configuration does not fall into the definition of extensively used as assumed up to this point.	New VFP Test

Table 6.6.3 contains examples of Industry specifications (SAE, military, ASTM) that are proposed as acceptable industry standard test methods for use during Class 2 small parts evaluations. Industry standards for materials and parts require testing for qualification and subsequent QA acceptance testing for many properties. When flammability testing is also included in that specification, it should be considered to be a standard baseline test. Flammability testing conducted according to recognized industry test methods provides data showing an acceptable flammability performance for that material or part when used for "non-cert" Class 2 compliance documentations. The flammability test methods listed below are published and controlled by organizations recognized by the aerospace industry.

6.6.3. Industry Flammability Test Methods Proposed as Acceptable "Non-Certification" Test Methods for Class 2 Parts

Industry Flammability Test Method	Referencing Document	Requirement ("referencing document" requirement)	Notes
ASTM D 2671	AMS-DTL-23053	Flammability: "Flammability shall be determined in accordance with the appropriate flammability procedure in ASTM D 2671. The procedure shall be as specified in the applicable specification sheet."	
ASTM D2671	MIL-PRF-46846, Class 1	Self-Extinguishing (test per ASTM D2671)	
ASTM D635	MIL-PRF-46846, Class 2	Self-Extinguishing (test per ASTM D635)	
ASTM D876			
MIL-STD-2223	AS5382	3.6.1 Flammability: "When specified on the applicable specification sheet and when tested in accordance with 5.6.1, the cable shall conform to the requirements of the applicable specification sheet." 5.6.1 Flammability: "Flammability testing shall be performed in accordance with MIL-STD-2223 Method 1006 Procedure A."	
ASTM D3032			Test Method A (vertical 5 inch flame test); Test Method B (inclined 3 inch flame

			test)
ASTM D3801			Burner per ASTM D5025; Calibrate per ASTM D5207
UL 94	IPC-4101	3.10.1.1- Flammability, “When specimens are tested in accordance with Table 3-1 and UL94 flammability requirements, the rating shall be as indicated in the applicable specification sheet and Table 3-9.”	Many other industry materials specifications reference UL94.
ASTM D5025, ASTM D5207	UL 94		Burner per ASTM D5025; Calibrate per ASTM D5207
UL 1581		Referenced by industry specifications.	Wire flammability
ASTM D5025, ASTM D5207	UL 1581	Contains various wire tests.	Burner per ASTM D5025; Calibrate per ASTM D5207
ASTM F777			Wire flammability; Superseded by ASTM D3032

References:

1. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position
2. ASTM D876 - Standard Test Methods for Non-rigid Vinyl Chloride Polymer Tubing Used for Electrical Insulation
3. ASTM D2671 - Standard Test Method for Heat-Shrinkable Tubing for Electrical Use
4. ASTM D3032 - Standard Test Methods for Hookup Wire Insulation
5. ASTM D3801 - Standard Test Method for Measuring the Comparative Burning Characteristics of Solid Plastics in a Vertical Position
6. ASTM D5025 - Specification for Laboratory Burner Used for Small-Scale Burning Tests on Plastic Materials
7. ASTM D5207 - Practice for Confirmation of 20–mm (50–W) and 125–mm (500–W) Test Flames for Small-Scale Burning Tests on Plastic Materials
8. ASTM F777 - Standard Test Method for Resistance of Electrical Wire Insulation Materials to Flame at 60 Degrees
9. AMS-DTL-23053, Insulation Sleeving, Electrical, Heat Shrinkable, General Specification For
10. AS5382, Aerospace Cable, Fiber Optic
11. IPC-4101, Specification for Base Materials for Rigid and Multilayer Printed boards

12. MIL-PRF-46846, PERFORMANCE SPECIFICATION, RUBBER, SYNTHETIC, HEAT – SHRINKABLE
13. MIL-STD-2223 Test Methods for Insulated Electrical Wire
14. UL 94 Test for Flammability of Plastic Materials for Parts in Devices and Appliances
15. UL 1581, Reference Standard for Electrical Wires, Cables, and Flexible Cords

7. In-Service data as requested by task 3.4

In-service incident and accident data: In 3.4, we were asked to "Provide service data regarding incidents (precursors) or accidents related to materials flammability that would be mitigated in the future by implementation of each recommendation." ARAC OEM members have reviewed their COSP (Continued Operational Safety Process) databases and have determined there is no data that is not already provided to the FAA. Similarly, Airlines report major issues through the Service Difficulty reporting process to the FAA.

8. Exhibits

8.1. Test Methods and Data Use Assumptions

The following options are all acceptable for the generation of new test data or the use of existing test data in support of compliance activity associated with the new amendment level regulations.

Heat Release (These three options all allowed).

(1) **New HR2 data** at new amendment level = **new** test method with **new** pass/fail criteria (80% pass).
(2) **New OSU data** at new amendment level = **current** test method with **current** pass/fail criteria (max averages).
(3) **Use existing OSU test data the current way (max averages).**

All data generated before date of new rule continue to be valid.

Bunsen Burner (These three options all allowed):

(1) **New vertical Bunsen burner testing** at new amendment level = **new** test method with **new** pass/fail criteria (**burn length only, 80% pass**).

(2) **Use existing test data the current way (burn length, extinguish time, max averages).**

(3) **Use existing test data evaluated the new way (burn length only, 80% pass).**

All data generated before date of new rule continue to be valid.

8.2. Assumptions and Observations Concerning Policy Statement Updates

Policy Statement Updates and Questions in New Regulation :

PS3 – test only bottom of the range for HR since top and bottom was done for smoke reasons. One test instead of 2.

PS 4 PS 5 – not both sides of the range, just the bottom.

PS7 – with 80% pass, does the need for margin go away for new test data? Applicable to all margins.

PS9 – Use of Thin-for-thick and color at the same time. Thickness range and vary color or parts with multiple thicknesses to be allowed at the same time.

PS 10 – FASE / Hierarchy – If HR tested on the passenger cabin face then you don't need Bunsen burner testing on either face. Same would apply to oil burner testing – if tested from cargo compartment face then don't need any additional testing on either face.

PS14 – Painted metal should not require HR testing – no test required.

PS17 – should apply to more than edge trim, also to other metal details and any bonded metal on the surface of a panel.

PS19 – With the horizontal test going way, may have an impact for parts like widows, signs, light plates, seat belts, sealants, seals, etc. What about the TSOs for impacted horizontal parts or for parts that contain horizontal-only materials? New TSOs – at new rev levels – will be required that state the new requirements and how TSO holders show compliance. EASA harmonization will be necessary for all impacted TSOs.

PS20 – UL data is now acceptable. If a report says UL94 V-0 for circuit board materials and conformal coatings, you would be done. Solder mask is so insignificant to any test results that if the boards and conformal coatings are UL-94 then no further compliance required. Class 1 small parts (chips, etc) not needed to show compliance.

PS21 – No need to test bonded metal. Option 3 – change def of same / reassess. For Option 3, need clarification if an elastomeric part is the bonded detail then what is the correct test (horizontal).

PS22 – Softness of the definition makes the analysis harder. How to make this easier?

PS27 – The back side of a panel has little or no impact. Does the back really matter? Modify to state that back face may be either decorated/painted/bare for Bunsen burner or for HR. Similar to FASE but adds more flexibility. Maybe for a panel greater than 0.5", HR on exposed side is ok and don't care what is on the back.

General:

Can we test one or more panel constructions on the panel for HR and say they are representative of the panel and don't need Bunsen burner per the hierarchy guidance? A definition or allowance to define representative constructions would be beneficial. 1 to 3 tests per panel. This could have substantial benefit in showing of compliance.

Back face of cargo flooring no additional testing, similar to back of sidewall panels.

Even for parts that are within 15" of the floor, HR data is ok to use for hierarchy. Just because HR is not a requirement for these parts, if you have HR test data then you can use the hierarchy to not require Bunsen burner testing. Clean up Radiant Panel for Bunsen burner also to allow hierarchy for materials that pass RP that aren't in insulation applications to not have to test Bunsen burner.

Materials of construction language could be made clear such that if you tested the large panels, the rest is not significant and no safety threat and could be substantial cost savings and time savings in compliance documents for monuments like lavatories, galleys, etc. You want the major material/construction and spend significant time on the miniscule/ 1%. Take full advantage of hierarchy concept.

An AR/DER without seat oil burner on their authority ticket should be allowed to use hierarchy of seat oil burner test data for Bunsen burner data. Want to make sure the use of hierarchy in a compliance finding isn't limited to specific regulation paragraph authority of designee.

Cost impact of delegation and expansion of DERs/ARs to new regs. Cross reference table. Rule based authority mapping pre-done would be helpful for smoother transition.

Hierarchy tracking impacts not known at this time.

How to implement portions of the new regulation wording early into our current production? This could be a cost savings for some items now.

Within 15" of the passenger floor discussion. Individual unique cross sections not just part components. Where is the floor measured? Assume the top face of the passenger floor panel.

8.3. Seating Standard Costs

	$						
Material Cost (5 Samples)	175						
Cut/manufacturer	250						
Conformity	50						
Smoke Density testing	400						
report	100						
total	975						
Material Cost (5 Samples)	175						
Cut/manufacturer	250						
Conformity	50						
Heat Release testing	400						
report	100						
total	975						
Material / Manufacturer (Cushion Oil Burner kit - 5 horizontal and 5 vertical cushions)	6700		Material / Manufacturer (Cushion Oil Burner kit - 3 horizontal and 3 vertical cushions)	4020		Material / Manufacturer (Cushion Oil Burner kit - 2 horizontal and 2 vertical cushions)	2680
Conformity	200		Conformity	120		Conformity	80
Cushion Oil Burner Testing	670		**Cushion Oil Burner Testing**	402		**Cushion Oil Burner Testing**	268
Report	100		Report	60		Report	40
Total	7670		Total	4602		Total	3068
Material Cost (10 samples - fabric)	150						
cut/manufacture samples	100						
conformity	50						
Vertical Bunsen Burner testing	150						
report	100						
Total	550						
Material Cost (5 samples -plastic)	170						
cut/manufacture samples	250						
conformity	50						
Vertical Bunsen Burner testing	150						
report	100						
Total	720						
Material Cost (5 samples -Engineered Mat'l - such as Composite / laminat	2000						
cut/manufacture samples	250						
conformity	50						
Vertical Bunsen Burner testing	150						
report	100						
Total	2550						
Material Cost (5 samples -Engineered Mat'l - such as Composite / laminat	2000						
cut/manufacture samples	250						
conformity	50						
Heat Release testing	400						
report	100						
Total	2800						

8.4. Seats Cost Impact Worksheet

Negative number is cost impact due to new rule Positive number is cost saving due to new rule		Pilot Seat Certified 2012 - Phuong		Attendant Seat Certified 2015 - Phuong		Premium Class Seat Certified in 2014 -Thomas		Economy Seat Certified 2014 - Monique	
Assumptions	**New Rules**	**Non Recurring Cost**	**Recurring Cost**	**Non Recurring Cost**	**Recurring Cost**	**Non Recurring Cost**	**Recurring Cost**	**Non Recurring Cost**	**Recurring Cost**
	Smoke Emission no longer a requirement	0	0	5850	0	24375	24375	9750	2925
15" exemption from floor	Items near the floor are not subjected to heat release	0	0	0	0	4875	4875	975	975
	No heat release special conditions	0	0	-5850	0	0	0	-33850	-5850
	All seat cushion must be oil burner compliant	-4602	-4602	0	0	0	0	0	0
	Hierarchy of testing	7150	550	6600	550	30900	30900	11220	4870
	No horizontal testing	0	0	0	0	0	0	0	0
Extra cushion oil burner test samples	Pass/Fail methodology will be consistent across test methods	-3068	-3068	-3068	-3068	0	0	-15340	-15340
	Vertical bunsen burner would only measure burn length	0	0	0	0	0	0	0	0
UL-94, V0 are acceptable in place of 12 second vertical bunsen burner test, no size criteria per ARAC report.	12 Second bunsen burner test may be substantiated by UL-94, V0	0	0	0	0	18000	18000	2160	2160
Wires in the cabin will not need to meet new wire rule.	New Wiring test	0	0	0	0	0	0	0	0
	Total Cost Savings	-520	-7120	3532	-2518	78150	78150	-25085	-10260

Certification cost only; does not include cost of continuous production such as lot testing of leather.

Recurring cost means follow on certification of same seat design for the same seat model; does not consider on-going production quality cost.

8.5. Seat Cost Impact Without 15" Exemption

Negative number is cost impact due to new rule Positive number is cost saving due to new rule		Pilot Seat Certified 2012 - Phuong		Attendant Seat Certified 2015 -Phuong		Premium Class Seat Certified in 2014 -Thomas		Economy Seat Certified 2014 - Monique	
Assumptions	**New Rules**	**Non Recurring Cost**	**Recurring Cost**	**Non Recurring Cost**	**Recurring Cost**	**Non Recurring Cost**	**Recurring Cost**	**Non Recurring Cost**	**Recurring Cost**
	Smoke Emission no longer a requirement	0	0	5850	0	24375	24375	9750	2925
No 15" exemption from floor	Items near the floor are not subjected to heat release	0	0	0	0	0	0	-28000	0
	No heat release special conditions	0	0	-5850	0	0	0	-33850	-5850
	All seat cushion must be oil burner compliant	-4602	-4602	0	0	0	0	0	0
	Hierarchy of testing	7150	550	6600	550	30900	30900	11220	4870
	No horizontal testing	0	0	0	0	0	0	0	0
Extra cushion oil burner test samples	Pass/Fail methodology will be consistent across test methods	-3068	-3068	-3068	-3068		0	-15340	-15340
	Vertical bunsen burner would only measure burn length	0	0	0	0	0	0	0	0
UL-94, V0 are acceptable in place of 12 second vertical bunsen burner test, no size criteria per ARAC report.	12 Second bunsen burner test may be substantiated by UL-94, V0	0	0	0	0	18000	18000	2160	2160
Wires in the cabin will not need to meet new wire rule.	New Wiring test	0	0	0	0	0	0	0	0
	Total Cost Savings	-520	-7120	3532	-2518	73275	73275	-54060	-11235
Certification cost only; does not include cost of continuous production such as lot testing of leather.									
Recurring cost means follow on certification of same seat design for the same seat model; does not consider on-going production quality cost.									

Candidate Working Group Participants

#	Name	Company	Experience	Comments
1	**John van Doeselaar** Head of Structure Airworthiness 33 567 190247 John.Van-Doeselaar@airbus.com	Airbus	• Airbus Engineering Senior Expert Structure rulemaking • Certification Manager for the A350 program • Member of the industry/regulatory composites WG • Previously a member of the European Ageing Aircraft Group • Has been involved in multiple regulatory activities in the structures domain • Significant design and certification experience of composite and metal structures • Is the main Airbus focal point on the A350 special condition on crash survivability for CFRP fuselage and the A350	**Recommendation:** Team member
2	**Kevin R. Davis** Senior Engineer 425-717-0885 kevin.r.davis@boeing.com	Boeing	• Expertise in structural analysis and fuselage structure • Expertise in metal and composite test and analysis • AR and AR Advisor of the BCA Organization Designation Authorization • Can lead a team through complex problems with clean direction and communication • 15 years on the 787 program, responsible for the development and execution of much of the 787-8 fuselage structural test program • Responsible for developing and coordinating the certification plan and acceptable means of compliance with the FAA and EASA • Coordinated with foreign regulatory agencies and airlines in support of the Validation Type Certification of the Model 787 • Part of the leadership council for the CMH-17 Crashworthiness WG	**Recommendation:** **Leader (chair)** SME for crashworthiness
3	**Akif Bolukbasi** Senior Technical Fellow Structures and Crashworthiness 408-891-5111 Akif.O.Bolukbasi@boeing.com	Boeing Military – Vertical Lift	• Expert in aircraft crash survivability specifically in regards to seats, restraint systems, energy absorbing airframe structures, fuel systems and landing gear. • Expert in subsystems integration • Significant experience developing crashworthiness technologies for rotorcraft over many R&D projects. • Began career at Simula, Inc. a small company that specializes in crashworthiness technology • Responsible for the development of multi-body dynamics and structural analysis tools to support development of crashworthy subsystems for rotorcraft • Co-authored the U.S. Army Crash Survival Design Guide • Was an FAA Designated Engineering Representative for airframe landing gear and fuel systems for Part 27 and 29 rotorcraft	**Recommendation:** Team member

Candidate Working Group Participants

			• Serves as a Faculty Associate at the Arizona State University Aerospace and Mechanical Engineering Program where he teaches graduate and undergraduate classes in composite materials and aerospace structures.	
4	**Milenko Milekic** Principle Stress Engineer Specialist 514-855-8507 milenko.milekic@aero.bombardier.com	Bombardier	• Transport Canada Structural Designated Authority Delegate (Primary DAD) • Interacting with TCAA, EASA, and FAA authorities • Generating and approving Certification Compliance Plan for structure • Developed Certification Ground Test Program (Static & DADT) • Developed bird strike and windshield-cabin windows test requirements • Lead the team of 45 stress engineers responsible for developing the new Global business aircraft • FEM for complete aircraft and internal load generation	**Recommendation:** Team member
5	**Clóvis Augusto Eça Ferreira** Advanced Design Office	Embraer	• Ground experience on crash scenes, responsible for the designing, supervising, and submittal of repair for the aircraft. • Headed the team that developed the wing, engine pylon and nacelle of the E-Jet 190 • Was part of the KC-390 team responsible for the design principles and requirements that would ensure safer emergency landings. • Through these and other projects the study of crashworthiness regulations, accident reports and design solutions has been a key priority for Mr. Ferreira. He is currently dedicated to writing a handbook about the design for survivability, valid for new airplanes to be created by Embraer.	**Recommendation:** Team member
6	**Olena Zagoskina** Engineer Phone: 604-557-2716 ext. 3061 ozagoskina@Cascadeaerospace.com	Cascade Aerospace	• Strong knowledge of mechanical engineering principles, stress analysis, and fluid analysis • Q400 MMA Project 2012 – present • Prepared certification plans, reports, and general certification documents • Conducted structural analysis of auxiliary fuel tank structure including emergency landing conditions • Worked on uncontained engine failure safety analysis, discrete source damage for bird strike, and wheel rim release • Technical lead for lighting protection and ignition prevention • Completed preliminary certification report addressing nose gear separation • Provided input for fuel tank access panels safety assessment • FAM, Hercules C130 Modifications for Government of Mexico • CC130J – Small Modifications Project 2014	**Recommendation:** Team member

Candidate Working Group Participants

			• Q400 Multi Role (Airtanker) Project 2012-2013 • Completed damage tolerance analyses on modified aircraft main frames, certification reports and instructions for continued airworthiness • Hercules C-130 Fuselage and Systems Trainer 2011-2012	
7	**Matthias Waimer** 0711-6862-648 matthias.waimer@dlr.de www.DLR.de	German Aerospace Center (DLR)	• Started his career as a researcher at the Institute of Structures and Design of the DLR as a researcher focusing on crashworthiness of transport aircraft • Received his doctorate for developing a modelling technique for crash simulations of composite transport aircraft fuselages • Team leader for crash in the aeronautical research field since 2013 • Research concentrates on crash concepts for composite aircraft • Uses a wide array of modelling approaches • Performed several dynamic test campaigns on CFRP crash components and structural elements. • Involved in several industrial projects contributing to the development of the second generation composite transport aircraft fuselage	Primary representative: Matthias Waimer Secondary representatives: Marius Lützenburger, Nathalie Toso
8	**Toru Sakagawa** Deputy Head of Project Management Division toru_sakagawa@mitsubishiaircraft.com	Mitsubishi Aircraft Corporation	• Reason to participate Propose the industry's opinion to rulemaking, and to obtain the trend of crashworthiness and ditching requirements • Interest: Integration and harmonization of structure and propulsion system requirements and design philosophy • Expertise to bring: Transport airplane structure design and analysis philosophy, general requirement of propulsion system, structural test for metallic/composite/static/fatigue	**Recommendation:** Team member
9	**Vincent Jacques** 33147114439 Vincent.Jacques@dassault-aviation.com	Dassault Aviation	• Working for Dassault-Aviation for 8 years in the aero-structural technical division and has acquired significant experience in the structural vulnerability field. • Involved in the development and improvement of new methods and tools for vulnerability analyses • Lead several R&D programs for Dassault including Smart Aircraft in Emergency Situations (SMAES) dedicated to ditching. • Involved in the design and certification of the F7X and F5X	**Recommendation:** Team member
10	**Candace K. Kolander** Coordinator, Air Safety, Health and Security 206-434-0595	Association of Flight Attendants	• Coordinator, Air Safety, Health and Security at the AFA • Participated and currently participate in multiple policy and technical working groups related to enhancing aviation safety for all occupants of commercial transport airplanes.	**Recommendation:** Team member

Candidate Working Group Participants

	ckolander@afanet.org		• Member of the FAA Air Carrier Training Aviation Rulemaking Committee • Member of the ICAO Cabin Safety Group • Representative of the industry Master Minimum Equipment List Subcommittee • AFA Party coordinator during the January NTSB Investigation into the accident of US Airways flight 1549	
11	**Heidi R. Moore** NAVAIR Loads & Dynamics Technical Specialist CH-53K, MH-60S, MV/CV-22 NAVAIR Associate Fellow 301-342-2795 (office) heidi.r.moore@navy.mil	Naval Air Systems Command (NAVAIR) U.S. Department of Defense	• Airframe structural design and design for ditching experience • Expertise includes metallic and composite airframe structural response, high mass item retention, turnover structure, nose plowing, fuselage separation, ditching, post-crash accident assessment, accident sequence creation, casual determination, evaluation of structural damage, and determination/estimation of impact characteristics • Lead AIR Structural Engineer 4.3.3 since 1996, recognized as the expert in AIR 4.3.3 Structural Crashworthiness. • Designed crashworthy seats for various military rotorcraft • Frequently called upon to brief AIR 4.0 competencies and PEO(A) management on the crashworthiness certification process and to provide insight into the technical rationale for the NAVAIR structural criteria and the level of rigor imposed during qualification and substantiation of these systems • Often called to assist other nations militaries in crashworthiness • Due to her expertise with crashworthy seat systems, Ms. Moore was invited by AIR 4.6 management to participate in a one year rotation to AIR 4.6.7.2 acting as the lead Crashworthy Systems Engineer for Rotary Wing Aircraft	**Recommendation:** Team member
12	**Karen E. Jackson** NASA Langley Research Center 757-864-4147 Karen.E.Jackson-1@nasa.gov	NASA Langley Research Center	• 34 years of experience conducting aircraft crashworthiness research including full-scale crash tests, simulating structural impact using finite element codes, and developing energy absorbing structural concepts • Began her career at the US Army Aeromechanics Laboratory at NASA Ames Research Center, and then transferred to the Army Research Laboratory Vehicle Technology Directorate at NASA Langley Research Center. There she was assigned to the Impact Dynamics Research Facility. • Attained a Masters Degree in Engineering Science and Mechanics from Virginia Tech in 1984 • Her work and her interests slowly focused in two areas: scale model testing and the application of composite materials to aircraft	**Recommendation:** Team member

Candidate Working Group Participants

			crashworthiness • Served as leader of the Subsonic Rotary Crashworthiness Team which has worked to develop a composite energy-absorbing concept and to improve prediction of rotorcraft crashworthiness. The team has documented research in energy absorption concept development, multi-terrain impact simulation, human occupant injury prediction, probabilistic analysis, advanced photogrammetry test methods, and system-integrated finite element model development	
13	**Mr. Jack Caughron** Principal Engineer	Gulfstream Aerospace Corporation	• Principal Engineer in our Stress Analysis group with 30+ years of industry experience designing and certifying aircraft systems and structures, and has earned FAA delegations as an ODA Airworthiness Representative to find compliance with many of the applicable crashworthiness/ditching regulations. • Mr. Caughron has also participated in multiple Gulfstream accident and incident investigations to assess aircraft damage and failure modes. We believe Mr. Caughron's experience will serve this ARAC committee well.	**Recommendation:** Team member
14	**Gerardo Olivares Ph.D.** Director of Crash Dynamics and Computational Mechanics Laboratories	NIAR	• 15 years of international experience directing and managing engineering organizations, projects, and laboratory facilities for the aerospace and automotive industries. • Twenty years of experience in structural crashworthiness and injury biomechanics • Development and certification by analysis methods for aircraft interiors • Development and certification by analysis methods to evaluate the crashworthiness performance of composite and metallic aerospace structures • Crashworthy metallic and composite structural design: aerospace, automotive, buses and Light Rail Vehicles • Safety systems design for aerospace, automotive, buses and Light Rail Vehicles occupants • Ditching: Helicopter Flotation Devices Development • Airbag and advanced restraint systems design and development • High Velocity Impact Applications: Bird Strike, Ballistic Impact • Twenty years of experience in virtual product and system development for the aerospace and automotive industries • Software development multidisciplinary\multiphysics analysis. Component to system level virtual development and testing methods. Real	**Recommendation:** Team member

Candidate Working Group Participants

			time flight and driving simulators	
15	**Dan Hoverson**	Textron Aviation	• Senior Engineering Specialist, Interior Structures & Crashworthiness Group • Currently lead a team of crashworthiness engineers and flammability technicians responsible for structural, crashworthiness and flammability certification for all Textron Aviation aircraft interiors. • Have 23 years of experience with interior structures, crashworthiness, dynamic seats and flammability certification of business jets and turboprops. • In the past 23 years, worked on the interior crashworthiness of the following Cessna Models: 208 (Caravan), 510 (Mustang), 525 (CJ1), 525A (CJ2), 525B (CJ3), 525C (CJ4), 550 (Bravo), 560 (Ultra), 560XL(Excel), 680 (Sovereign), 680A (Latitude), and 750 (Citation X).	**Recommendation:** Team member
	João Maria Antunes Leite joao.maria@anac.gov.br	Agência Nacional de Aviação Civil (ANAC)		**Recommendation:** CAA Team member
	Wim Doeland 49 221 89990-4041 willem.doeland@easa.europa.eu	European Aviation Safety Agency (EASA)		**Recommendation:** CAA Team member
	Natasa Mudrinic 613-952-4367 Natasa.Murdrinic@tc.gc.ca	Transport Canada (TCCA)	• Senior engineer with aircraft structures expertise • Her participation as a voting member or observer on this working group will facilitate TCCA's long term rulemaking harmonization goals with the FAA, EASA, and the industry.	**Recommendation:** CAA Team member
	Zhang Zhuguo 86-21-22321448 Zhangzhuguo_hd@caac.gov.cn	Shanghai Aircraft Airworthiness Certification Center (SAACC) of Civil Aviation Administration of China (CAAC)	• Joined in SAACC after gaining the Master and Bachelor degree of Aircraft Design in Nanjing University of Aeronautics and Astronautics (NUAA) on April 2008 • In charge of the certification and validation of airframe and cabin safety areas about ARJ21-700, C919 and TA600 airplane certification, and have conducted or participated in almost all the validations activities of international airplane mentioned above • Responsible for §25.561, 25.562, 25.785, 25.787, 25.789, 25.801, 25.1411, 25.1415 during certification • Have taken part in the investigation to study the inability of opening doors for the accident occurred in 2010 • Have taken part in ditching testing of ARJ21-700 and related ditching research based on model testing	**Recommendation:** CAA Team member

Candidate Working Group Participants

			• Preparing fuselage crashworthiness research using the building block approach and have conducted several coupon tests and a fuselage section drop test • Willing to share Chinese crashworthiness and ditching research and my certification and accident investigation experience among the working group, and give my comments and recommendations	
	Ian Won 425-227-2145 ian.y.won@faa.gov	FAA, ANM-115 Office of Primary Responsibility		**FAA Team Member**
	Jeff Gardlin 425-227-2236 jeff.gardlin@faa.gov	FAA, ANM-115 Office of Primary Responsibility		**FAA Team Member**
	Joseph Pellettiere 937-822-1073 Joseph.Pellettiere@faa.gov	FAA, AIR-100 Chief Scientific & Technical Advisor (CSTA)— Crash Dynamics		**FAA Team Member**
	Larry Ilcewicz 425-917-6579 larry.ilcewicz@faa.gov	FAA, AIR-100 Chief Scientific & Technical Advisor (CSTA)— Composites		**FAA Team Member**

Crashworthiness and Ditching WG Report to TAE

Chair – Kevin Davis

November 4, 2015

Agenda

- Summary of Tasking
- Schedule
- Team Members
- Status of Tasking
- Help Needed

Summary of Tasking

- Provide recommendations regarding the incorporation of airframe-level crashworthiness and ditching standards into Title 14, Code of Federal Regulations (14 CFR) part 25 and development of associated advisory material.

Schedule

#	Major Tasks/Deliverables	Date	Status	Metric	Comments
1	ARAC Tasking Published in Federal Register	4 June ‘15	Comp.	Completed	Completed.
2	ARAC Working Group (WG) Chair and member selected & notified	October ‘15			
3	WG Plan accepted by TAE	March ‘16			Present to TAE
4	Face to Face WG Meetings	tbd			
5	Planned Date to submit Final Report to TAE	05/2017			
6	Final Report Due to FAA	06/2017			Due Date

Team Members

Working group voting members

Kevin Davis	(Boeing Commercial) – Chairperson
John van Doeselaar	(Airbus)
Akif Bolukbasi	(Boeing Military Vertical Airlift)
Milenko Milekic	(Bombardier)
Clóvis Augusto Eça Ferreira	(Embraer)
Olena Zagoskina	(Cascade Aerospace)
Matthias Waimer	(German Aerospace Center (DLR))
Toru Sakagawa	(Mitsubishi Aircraft Corporation)
Vincent Jacques	(Dassault Aviation)
Candace K. Kolander	(Association of Flight Attendants)
Heidi R. Moore	(Naval Air Systems Command)
Karen E. Jackson	(NASA)
Mr. Jack Caughron	(Gulfstream Aerospace Corporation)
Gerardo Olivares Ph.D.	(National Institute of Aviation Research)
Dan Hoverson	(Textron Aviation)

Status of Tasking

- Approved Chairperson (October)
- Approved list of voting members (October)
- Planning kick-off meeting

Help Needed

- No help needed at this time