Delivery Services can be obtained online at the Advisory Committee's Web site at *www.state.gov/p/io/ipp/c25478.htm.* If you have any questions regarding the Advisory Committee or the application process, please contact Helen Grove, *GroveHA@state.gov.*

Deadline: All applications for membership should be submitted to Mr. Robert Downes, the Designated Federal Officer, by Monday, September 30, close of business. Applications can be sent to Mr. Downes at *DownesRR@state.gov,* with a copy to Ms. Grove, *GroveHA@state.gov.*

For further information, please contact Ms. Helen Grove of the Office of Global Systems (IO/GS), Bureau of International Organization Affairs, U.S. Department of State, at (202) 647–1044 or by email at *GroveHA@state.gov.*

Dated: September 10, 2013.

Robert Downes,

Designated Federal Officer, Department of State.

[FR Doc. 2013–22815 Filed 9–18–13; 8:45 am]

BILLING CODE 4710–19–P

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, October 2, 2013, starting at 9:00 a.m. Eastern Daylight Time. The public must make arrangements by September 27, 2013, to present oral statements at the meeting.

ADDRESSES: The Boeing Company, 1200 Wilson Boulevard, Room 234, Arlington, Virginia 22209.

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 email 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. 2), notice is given of an ARAC meeting to be held October 2, 2013.

The agenda for the meeting is as follows:

- Opening Remarks, Review Agenda and Minutes
- FAA Report
- ARAC Report
- Transport Canada Report
- EASA Report
- Flight Controls Working Group Report
- Airworthiness Assurance Working Group Report
- Engine Harmonization Working Group Report
- Flight Test Harmonization Working Group Report
- Any Other Business
- Action Items Review

Attendance is open to the public, but will be limited to the availability of meeting room space. Please confirm your attendance with the person listed in the **FOR FURTHER INFORMATION CONTACT** section no later than September 27, 2013. Please provide the following information: Full legal name, country of citizenship, and name of your industry association, or applicable affiliation. If you are attending as a public citizen, please indicate so.

The FAA will arrange for teleconference service for individuals wishing to join in by teleconference if we receive notice by September 27, 2013. For persons participating by telephone, please contact the person listed in **FOR FURTHER INFORMATION CONTACT** by email or phone for the teleconference call-in number and passcode. Anyone calling from outside the Arlington, VA, metropolitan area will be responsible for paying long-distance charges.

The public must make arrangements by September 27, 2013, to present oral statements at the meeting. Written statements may be presented to the Subcommittee at any time by providing 25 copies to the person listed in the **FOR FURTHER INFORMATION CONTACT** section or by providing copies at the meeting. 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. Sign and oral interpretation, as well as a listening device, can be made available if requested 10 calendar days before the meeting.

Issued in Washington, DC on September 13, 2013.

Lirio Liu,

Designated Federal Officer.

[FR Doc. 2013–22749 Filed 9–18–13; 8:45 am]

BILLING CODE 4910–13–P

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

91st Meeting: RTCA Special Committee 159, Global Positioning Systems (GPS)

AGENCY: Federal Aviation Administration (FAA), U.S. Department of Transportation (DOT).

ACTION: Meeting Notice of RTCA Special Committee 159, RTCA Special Committee 159, Global Positioning Systems (GPS).

SUMMARY: The FAA is issuing this notice to advise the public of the ninety-first meeting of the RTCA Special Committee 159, Global Positioning Systems (GPS)

DATES: The meeting will be held October 7–11, 2013 from 9:00 a.m.–5:00 p.m.

ADDRESSES: The meeting will be held at RTCA, Inc., 1150 18th Street NW., Suite 910, Washington, DC 20036.

FOR FURTHER INFORMATION CONTACT: The RTCA Secretariat, 1150 18th Street NW., Suite 910, Washington, DC 20036, or by telephone at (202) 330–0652/(202) 833–9339, fax at (202) 833–9434, or Web site at *http://www.rtca.org.*

SUPPLEMENTARY INFORMATION: Pursuant to section 10(a)(2) of the Federal Advisory Committee Act (Pub. L. 92–463, 5 U.S.C., App.), notice is hereby given for a meeting of Special Committee 159. The agenda will include the following:

Working Group Sessions

October 7

- Working Group 2C, GPS/Inertial, ARINC & A4A Rooms

October 8

- Working Group 2, GPS/WAAS, McIntosh-NBAA Room and Colson Board Room

October 9

- Working Group 2, GPS/WAAS, ARINC & A4A Rooms, Afternoon, 1:00 p.m.–5:00 p.m., Working Group 4, GPS/Precision Landing Guidance

October 10

- 9:00 a.m.–3:00 p.m., Working Group 4, GPS/GPS/Precision Landing Guidance MacIntosh-NBAA Room and Colson Board Room recent and upcoming Commission and UNESCO activities. The Commission will accept brief oral comments during a portion of this conference call. The public comment period will be limited to approximately 10 minutes in total, with two minutes allowed per speaker. For more information or to arrange to participate in the conference call, individuals must make arrangements with the Executive Director of the National Commission by October 15.

The National Commission, Washington, DC 20037 may be contacted via email *DCUNESCO@state.gov* or Telephone (202) 663–0026; Fax (202) 663–0035. The Web site can be accessed at: *http://www.state.gov/p/io/unesco/.*

Dated: September 24, 2013.

Allison Wright,

Executive Director, U.S. National Commission for UNESCO, Department of State.

[FR Doc. 2013–24111 Filed 10–1–13; 8:45 am]

BILLING CODE 4710–19–P

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 rescheduled public meeting.

SUMMARY: This notice announces the rescheduling of a public meeting of the FAA's Aviation Rulemaking Advisory Committee (ARAC) Transport Airplane and Engine (TAE) Subcommittee to discuss TAE issues. A number of issues have arisen that may affect the Committee's ability to have an effective meeting on October 2, 2013, including uncertainty regarding Federal Government shutdown and travel.

DATES: The October 2 meeting is rescheduled to Wednesday, November 13, 2013, starting at 9:00 a.m. Eastern Standard Time. The public must make arrangements by October 30, 2013, to present oral statements at the meeting.

ADDRESSES: The Boeing Company, 1200 Wilson Boulevard, Room 234, Arlington, Virginia 22209.

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 email 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. 2), notice is given of an ARAC meeting to be held November 13, 2013.

The agenda for the meeting is as follows:

- Opening Remarks, Review Agenda and Minutes
- FAA Report
- ARAC Report
- Transport Canada Report
- EASA Report
- Flight Controls Working Group Report
- Airworthiness Assurance Working Group Report
- Engine Harmonization Working Group Report
- Flight Test Harmonization Working Group Report
- Any Other Business
- Action Items Review

Attendance is open to the public, but will be limited to the availability of meeting room space. Please confirm your attendance with the person listed in the **FOR FURTHER INFORMATION CONTACT** section no later than October 30, 2013. Please provide the following information: Full legal name, country of citizenship, and name of your industry association, or applicable affiliation. If you are attending as a public citizen, please indicate so.

The FAA will arrange for teleconference service for individuals wishing to join in by teleconference if we receive notice by October 30, 2013. For persons participating by telephone, please contact the person listed in **FOR FURTHER INFORMATION CONTACT** by email or phone for the teleconference call-in number and passcode. Anyone calling from outside the Arlington, VA, metropolitan area will be responsible for paying long-distance charges.

The public must make arrangements by October 30, 2013, to present oral statements at the meeting. Written statements may be presented to the Subcommittee at any time by providing 25 copies to the person listed in the **FOR FURTHER INFORMATION CONTACT** section or by providing copies at the meeting. 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. Sign and oral interpretation, as well as a listening device, can be made available if requested 10 calendar days before the meeting.

Issued in Washington, DC, on September 26, 2013.

Lirio Liu,

Designated Federal Officer.

[FR Doc. 2013–23940 Filed 10–1–13; 8:45 am]

BILLING CODE 4910–13–P

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

[Summary Notice No. PE–2013–47]

Petition for Exemption; Summary of Petition Received

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Notice of petition for exemption received.

SUMMARY: This notice contains a summary of a petition seeking relief from specified requirements of Title 14, Code of Federal Regulations (14 CFR). The purpose of this notice is to improve the public's awareness of, and participation in, this aspect of the FAA's regulatory activities. Neither publication of this notice nor the inclusion or omission of information in the summary is intended to affect the legal status of the petition or its final disposition.

DATES: Comments on this petition must identify the petition docket number involved and must be received on or before October 22, 2013.

ADDRESSES: You may send comments identified by docket number FAA–2013–0800 using any of the following methods:

- *Government-wide rulemaking Web site:* Go to *http://www.regulations.gov* and follow the instructions for sending your comments digitally.
- *Mail:* Send comments to the Docket Management Facility; U.S. Department of Transportation, 1200 New Jersey Avenue SE., West Building Ground Floor, Room W12–140, Washington, DC 20590.
- *Fax:* Fax comments to the Docket Management Facility at 202–493–2251.
- *Hand Delivery:* Bring comments to the Docket Management Facility in Room W12–140 of the West Building Ground Floor at 1200 New Jersey Avenue SE., Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.

Privacy: We will post all comments we receive, without change, to *http://www.regulations.gov,* including any personal information you provide. Using the search function of our docket Web site, anyone can find and read the comments received into any of our dockets, including the name of the individual sending the comment (or

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

Meeting Minutes

Date: November 13, 2013
Time: 9:00 AM
Location: **Boeing**
1200 Wilson Blvd., Room 639
Arlington, Va. 22209

Call to Order /Administrative Reporting

Mr. Craig Bolt, Assistant Chair of TAE opened the meeting at 9:04 a.m. Mr. Mike Kaszycki, the designated FAA official, read the opening statement. Mr. Bolt then discussed action items from the last meeting.

Item	Wednesday October 17, 2012 Meeting Action Items	Status
1.	Craig Bolt to send out ARAC bylaws.	CLOSED
2.	John Piccola to provide answer to question of whether ARAC will coordinate on “inaccessible areas” from the Materials Flammability recommendation, before the NPRM is issued.	CLOSED
3.	Craig Bolt to send Robert Part the RPWG Model.	CLOSED

FAA Report

Ms. Mary Schooley presented this report (see Handout 2a).

Re the new part 33 tasking on Engine Endurance Testing Requirements, Mr. Bolt clarified that this tasking has not yet published due to government shutdown delay. No working group has been established but the process will begin as soon as the tasking is published at the Federal Register.

Re part 121 draft policy on lightning, the intention is this policy will serve as interim guidance until a new rulemaking on the issue come to effect. Re rulemaking prioritization tool, Mr. Kihm asked how it affected the FAA internal rulemaking priority and whether this list would be made public. The response is this tool has resulted in some surprising shifts in priority and is a government internal list that would not be publicized.

Mr. Kaszycki stated, re lithium ion battery, the FAA is deliberating how to address this issue, currently more as separate issues, i.e. limitation upon carriage and cargo, fire protection in airplanes, etc., but will eventually coalesce into a more uniform initiative.

Mr. Stift stated re magnesium content in iPad casing, the flammability of tablet batteries, and questioned whether the FAA is considering conducting tests re this issue. Mr. Kascyzcki stated there is a lot of testing, with the greatest concern is with permanently-attached and rechargeable batteries but none he has heard re magnesium content. He will pass this issue forward.

See Handout 2b for the current TAE rulemaking list.

ARAC Report

Mr. Bolt presented this report (see Handout 3a and 3b).

Re list of potential rulemakings on Handout 3a Page 3 and 4: this is a sample of upcoming rulemaking. Ms. Schooley will inquire in more detail about these two tables.

Transport Canada Report

No formal report or presentation for this meeting.

EASA Report

Mr. Bolt presented the report (see Handout 4a and 4b).

Re "Use of similarity analysis when showing compliance to SLD icing specifications" on Handout4a Page 3 caused some confusion, as Mr. Les McVey was on the committee and was not aware of this tasking.

Flight Controls Harmonization Working Group (FCHWG) Report

Mr. Barry Hance presented this report (see Handout 5a).

Re dissenting opinions, Mr. Kaszycki stated that this rulemaking was a test to address issues re rudder control reversal conditions. The FAA has already concluded that training is not the only solution, therefore disagrees with Boeing's position that no rulemaking is necessary.

Mr. Kaszycki also stated he was expecting a list of criteria for design mitigation that would address the rudder reversal issues. Mr. Hance stated the report contains such criteria, at the same time, some design mitigations have technical issues that make it difficult to implement and therefore may not be suitable to become required standards.

The subcommittee discussed whether to approve the FCHWG Report (see Handout 5b). If this report is approved by TAE today, it will be forwarded for approval by ARAC at its December 15 meeting. Mr. Bolt proposes giving TAE 2 weeks to review, then vote by email to determine whether to submit this to ARAC.

Airworthiness Assurance Working Group (AAWG) Report

Mr. Mark Yerger presented this report (see Handout 6).

Mr. Kaszycki asked for more details re “AI 4.13.3 Rotable Structural Components” on Current AAWG Action Items. There exist structural assemblies that may not have serial numbers or incomplete serial numbers, or numbers that are not uniquely identifying. When components are not traceable and identifiable, it becomes difficult to repair them nor know their history, installation cycle, etc.

Engine Harmonization Working Group –New Tasking

Mr. McVey presented this report (see Handout 7).

There was a discussion on the poundage requirement for different categories of birds, and how they affect different types of engine.

Flight Test Harmonization Working Group—New Tasking

Mr. Bob Park presented this report (see Handout 8).

Mr. Grenier supports extending the timeline for completing the action items. This means an extension for deliverables in mid-January/February. As mid-January approaches, the Working Group will provide status updates to TAE. Mr. Bolt stated if FTHWG can provide deliverables sometime in mid-to-late January, then TAE would have the time to review and present the report to ARAC’s March 2014 meeting.

Action Item Review/ Any Other Business

Item	November 13, 2013 Meeting Action Items	Status
1.	Mr. Bolt to send May 2013 minutes to TAE.	
2.	Mr. Kaszycki to research further into magnesium content in iPads and other tablets.	
3.		

<u>Future Transport Airplane and Engine Subcommittee Meetings</u>:

The next meeting will via teleconference, on Wednesday, February 12, 2014, 11:00 AM EST.
The next in-person meeting will be held in Washington, D.C., in Wednesday, October 22, 2014.

<u>Public Notification</u>

The *Federal Register* published a notice of this meeting on September 19, 2013. A notice of meeting rescheduling was published on October 2, 2013.

<u>Approval</u>

I certify the minutes are accurate.

Craig R. Bolt

Craig R. Bolt
Assistant Chair, ARAC

Name	Organization	Contact Information
Rolf Grenier	Airbus	
Ray Holanda	NADA	rahol@att.net
John Stift	ALPA	John.Stift@alpa.org
Bob Park	Boeing	
Doug Kihm	Boeing	Douglas.j.kihm@boeing.com
Mike Kaszycki	FAA	Mike.kaszycki@faa.com
Craig Bolt	Pratt & Whitney	Craig.bolt@pw.wtc.com
Mary Schooley	FAA	Mary.schooley@faa.com
Les McVey	GE	Leslie.mcvey@ge.com
Barry Hance	Boeing	
Mark Yerger		

Transport Airplane and Engine ARAC Sub-Committee Meeting

Agenda

Boeing Office
1200 Wilson Blvd., Room 234
Arlington, Va. 22209

November 13, 2013
All Times are Eastern Standard Time

DRESS: BUSINESS CASUAL

Wednesday, Nov 13, 2013 – *Call in number: 202-493-4180* and enter passcode **3806** when prompted.

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	C. Bolt/ J. Piccola or M. Kascycki
9:15	FAA Report	J. Piccola or M. Kascycki
9:45	ARAC Report	C. Bolt
10:15	Transport Canada Report	O. Rusch
10:30	EASA Report	J. Hall
10:45	Flight Controls Working Group Report	B. Hance/D. Chatrenet
11:30	Lunch	
12:30	Airworthiness Assurance Working Group Report	S. Chisholm/M. Yerger
1:00	Engine Harmonization WG Report	Chris Demers/Les McVey
1:30	Flight Test Harmonization WG Report	Bob Park/Christine Thibaudat
2:00	Action Item Review / Any Other Business	C. Bolt

-- ADJOURN --

FAA Rulemaking Status

Update to TAE

Presented to: TAE

By: Mike Kaszycki, Manager,

Transport Standards Staff

Date: November 13, 2013

November 2013 TAE Meeting

Topics:

- Rulemaking project status
- Non-rulemaking project status

November 2013 TAE Meeting

Rulemaking Project Status *(since May 2013)*

- **Part 25/26 related Final Rules**
  - *None*
- **Part 33/35 related Final Rules**
  - *Critical Parts for Airplane Propellers (Correction to rule issued 1/8/13)*
    - Correction issued 7/9/13, effective 7/26/13.
- **Part 121 related Final Rules**
  - *None*

November 2013 TAE Meeting

Rulemaking Project Status *(since May 2013)*

- **Part 25/26 Notices of Proposed Rulemaking**
  - *Harmonization of Airworthiness Standards: Gust and Maneuver Load Requirements*
    - Published for comment May 26, 2013
    - Comment period closed August 26, 2013

November 2013 TAE Meeting

Rulemaking Project Status *(since May 2013)*

- **Part 33/35 Notices of Proposed Rulemaking**
  - None

- **Part 121 Notices of Proposed Rulemaking**
  - None

November 2013 TAE Meeting

Rulemaking Project Status *(since May 2013)*

Final Rules (FR)

- **FRs in OMB/OST:**
  - None
- **FRs in Headquarters (HQ) for coordination:**
  - 1 part 25/33 project
- **FRs in directorate coordination:**
  - 1 part 25 project
- **FRs in development:**
  - 2 part 25 projects

November 2013 TAE Meeting

Rulemaking Project Status *(since May 2013)*

Notices of Proposed Rulemaking (NPRMs)

- **Open for Comment:**
  - None
- **In OST/OMB:**
  - None
- **In HQ for Coordination:**
  - 1 part 25 project
  - 1 part 121 project
- **In Directorate for Coordination:**
  - None

November 2013 TAE Meeting

Rulemaking Project Status *(since May 2013)*

<u>Notices of Proposed Rulemaking (NPRMs) in Development</u>

- 4 part 25 projects
- No part 33 projects
- No part 121 projects related to part 25

November 2013 TAE Meeting

New ARAC Tasking *(since May 2013)*

New Tasking (part 25)

- None

New Tasking (part 33)

- Engine Endurance Testing Requirements

Other Tasking of Interest to TAE

- Maintenance Control by Reliability Methods

November 2013 TAE Meeting

Non-Rulemaking Project Status *(since May 2013)*

- **Part 25 Final Advisory Circulars (AC's):**
  - None

- **Part 33/35 Final Advisory Circulars (AC's):**
  - AC 33.2C, General Type Certification Guidelines for Turbine Engines
    - Issued 6/25/13

- **Part 121 Final Advisory Circulars (AC's):**
  - None

November 2013 TAE Meeting

Non-Rulemaking Project Status *(since May 2013)*

- **Part 25 Draft Advisory Circulars (AC's):**
  - AC 25.341–X, *Dynamic Gust Loads*
    - Published for comment May 26, 2013
    - Comment period closed August 26, 2013
  - AC 25.362–X, *Engine Failure Loads*
    - Published for comment May 26, 2013
    - Comment period closed August 26, 2013
  - AC 25.415–X, *Ground Gust Conditions*
    - Published for comment May 26, 2013
    - Comment period closed August 26, 2013

November 2013 TAE Meeting

Non-Rulemaking Project Status *(since May 2013)*

- **Part 25 / 26 Final Policy:**
  - Guidance for Screening Engine Rotor Lock in Transport Category Airplanes During Aircraft Certification (PS-ANM-25-02)
    - Issued 6/28/13
  - Flammability Testing of Interior Materials (PS-ANM-25.853-01-R2)
    - Issued 7/3/13

November 2013 TAE Meeting

Non-Rulemaking Project Status *(since May 2013)*

- **Part 33 / 35 Final Policy:**
  - Turbofan, Turbojet and Turboprop Engine Rotor Lock (33.89)
    - Issued 6/28/13
- **Part 121 Final Policy:**
  - None

November 2013 TAE Meeting

Non-Rulemaking Project Status *(since May 2013)*

- **Part 25 / 26 Draft Policy:**
  - None
- **Part 33 / 35 Draft Policy:**
  - None
- **Part 121 Draft Policy:**
  - None

November 2013 TAE Meeting

Rulemaking Prioritization Tool

- **FAA Implementation**
- **ARAC Feedback**
- **Next Steps**

November 2013 TAE Meeting

Questions?

Draft - Transport Airplane Directorate Rulemaking Projects

ANALYST/ TEAM LEADER	Project Title	Rule Stage	ARAC WG	Current Status	Harmonization Working Method: Former number system replaced with descriptors to broaden applicability and include add'l authorities (TCCA, etc)
Team Lead: Robert Hettman **Analyst:** Maria Delgado	Supercooled Large Droplet Icing Conditions (plus Exiting Icing Conditions, part 121)	Final	IPHWG	FR in development	Collaboration
Team Lead: Robert Hettman **Analyst:** Maria Delgado	Part 121 Exiting Icing Conditions	NPRM	IPHWG	NPRM in development	Collaboration
Team Lead: Jeff Gardlin **Analyst:** Jan Thor	Chemical Oxygen Generator Systems	HPEP2 FD	Lav O2	FR in development	Reciprocal Information
Team Lead: Linh Le **Analyst:** Maria Delgado	System Safety Assessments (formerly known as "Airplane-Level Safety Assessment - Specific Risk Analysis")	NPRM	ASAWG	NPRM in development. Incorporates the following projects from past inventory lists (now removed): 1) Revised General Function and Installation Requirements for Equipment and Systems on Transport Category Airplanes 2) Interaction of Systems and Structures 3) Flight Control Systems (25.671, 25.672)	Collaboration
Team Lead: Todd Martin **Analyst:** Maria Delgado	Harmonization of Airworthiness Standards - Miscellaneous Loads Requirements	NPRM	LDHWG / GSHWG	Harmonization rule. NPRM out for comment March 1, 2013). Incorporates a number of previously separate projects (now removed from inventory list): 1) Structural Integrity of Fuel Tanks 2) Fuel Tank Access Doors 3) Operations Test 4) 25.261 Casting Factors 5) Proof of structure (25.307)	Reciprocal Information (Harmonization rule)
Team Lead: Todd Martin **Analyst:** Theresa White	Harmonization of Airworthiness Standards - Gust and Maneuver Loads	NPRM	LDHWG / GSHWG	Harmonization rule, expect NPRM in spring 2013. Incorporates a number of previously separate projects (now removed from inventory list): 1) Revised Checked Pitching Maneuver 2) Continuous Turbulence Loads 3) Engine Failure Loads	Reciprocal Information (Harmonization rule)

Draft - Transport Airplane Directorate Rulemaking Projects

ANALYST/ TEAM LEADER	Project Title	Rule Stage	ARAC WG	Current Status	Harmonization Working Method: Former number system replaced with descriptors to broaden applicability and include add'l authorities (TCCA, etc)
Team Lead: Joe Jacobsen **Analyst:** Maria Delgado	Low Airspeed Alerting	RAP	ASHWG	Rulemaking plan in work for parts 25 and 121. ARAC ASHWG recommendations received for Phase II and under review.	Reciprocal Information
Team Lead: Jeff Gardlin **Analyst:** Jan Thor	Part 25 Revised Appendix F Flammability	RAP	MFHWG	Rulemaking plan in development, expect NPRM to publish in FY14	Collaboration
Team Lead: Massoud Sadeghi **Analyst:** Theresa White	Fuel tank lightning protection	NPRM	N/A (ARC)	NPRM in development, expect to publish for comment in FY15	Reciprocal Information
Team Lead: Mike Dostert **Analyst:** Theresa White	Fuel Vent System Fire Protection	NPRM	None	NPRM in development, expect to publish for comment in mid FY14	Reciprocal Information
Team Lead: S. Happenny **Analyst:** Theresa White	Main Deck Class B & F Cargo Compartments	NPRM	CSHWG	NPRM in development, expect to publish for comment in early FY14	Reciprocal Information (Harmonization rule)
Team Lead: Steve Happenny **Analyst:** Maria Delgado	Pressurization and Humidity	AFR	MSHWG	Rulemaking to begin in FY15	Cooperation - EASA lead FAA Harmonizing with CS-25
Team Lead: S. Clark **Analyst:** Michael Menkin	Turbine Auxiliary Power Unit (APU) Installations and New Appendix K	AFR	PPIHWG	Rulemaking to begin in FY16	Reciprocal Information (Harmonization rule)
Team Lead: Mike Dostert **Analyst:** Jan Thor	Engine Restart Envelope	AFR	None	Rulemaking to begin in FY14.	Reciprocal Information
Team Lead: Doug Bryant **Analyst:** TBD	Engine Fail Indication	AFR	None	Rulemaking to begin in FY15	Reciprocal Information
Team Lead: Mike Collins **Analyst:** TBD	Fuel Filter Bypass Contamination Standards	AFR	None	Rulemaking to begin in FY15	Reciprocal Information
Team Lead: TBD **Analyst:** TBD	Flight Deck Certification Streamlining	AFR	None	Rulemaking scope under review, TBD	Reciprocal Information
Team Lead: Doug Bryant **Analyst:** Michael Menkin	Reverse Thrust and Propeller Pitch Settings Below the Flight Regime	AFR	PPIHWG	Rulemaking to begin in FY14.	Reciprocal Information (Harmonization rule)
Team Lead: Robert Jones **Analyst:** TBD	Rudder Reversal Load Condition	AFR	FCHWG	Rulemaking to begin in FY14, pending recommendations from FCHWG.	Collaboration
Team Lead: Joe Jacobsen **Analyst:** TBD	Flight Testing Streamlining and Update - Relief from Specified Requirement to Flight Test & FBW	AFR	None	Rulemaking to begin in FY15, pending recommendations from FTHWG (new tasking in FY 13)	Reciprocal Information
Team Lead: TBD **Analyst:** TBD	Battery Requirements (including lithium batteries)	AFR	None	Rulemaking to begin in FY 14.	TBD

Draft - Transport Airplane Directorate Rulemaking Projects

ANALYST/ TEAM LEADER	Project Title	Rule Stage	ARAC WG	Current Status	Harmonization Working Method: Former number system replaced with descriptors to broaden applicability and include add'l authorities (TCCA, etc)
Team Lead: Mike Dostert **Analyst:** Jan Thor	Design Requirements for Minimizing Airplane Hazards Associated with an Uncontained Engine Failure	DOM	PPIHWG	On rulemaking inventory. No scheduled start date yet. Currently on "do by other means" list.	Reciprocal Information
Team Lead: Todd Martin **Analyst:** TBD	Damage tolerance and fatigue -- harmonize 25.571. GSHWG	DOM	GSHWG	Placed on "do by other means" list. Use of the ARAC rec as the basis for an ESF is voluntary on the part of the applicant.	Reciprocal Information (Harmonization rule)
Team Lead: Todd Martin **Analyst:** TBD	Pressurized compartment loads above 45K -- harmonize. GSHWG Task 13	DOM	GSHWG	Officially placed on "do by other means" list. WG couldn't reach consensus on implementation altitude, so nothing has been done to address this issue. To address would require rulemaking.	Reciprocal Information
Team Lead: Mike Dostert **Analyst:** TBD	Crashworthy Fuel Systems	CRD	TBD	New Tasking for ARAC in FY13, begin RM in FY 15. Addresses requirements for protection of fuel tanks during crash landing.	TBD
Team Lead: Greg Schneider **Analyst:** TBD	Composite Structures	CRD	TBD	New Tasking for ARAC in FY13, begin RM in FY 15. Generalize and add airframe requirements to account for non-metallic structure	TBD
Team Lead: Jeff Gardlin **Analyst:** TBD	Revised Ditching Standards	CRD	TBD	New Tasking for ARAC in FY14, begin RM in FY15 or FY16. Establish criterion for sink rate.	TBD
Team Lead: TBD **Analyst:** TBD	Thrust Reversing Systems, 25.933	DOM	PPIHWG	Rulemaking to begin in FY 17 or later.	Reciprocal Information
Team Lead: TBD **Analyst:** TBD	Low Fuel Warning	In Waiting	PPIHWG	Rulemaking moved down to later year, TBD, after determining it was no longer a harmonization project	Reciprocal Information
Misc Harmonization Projects					
J. Kirk Baker LA ACO	Takeoff Warning System	In Waiting	ASHWG	NPRM drafted, have draft AC 25.703-24, dated April, 2000	Reciprocal Information (Harmonization rule)
J. Claar	Stowage Compartments	In Waiting	EEIG	No draft NPRM prepared	Reciprocal Information (Harmonization rule)
J. Claar	Passenger Information Signs	In Waiting	EEIG	NPRM drafted	Reciprocal Information (Harmonization rule)
J. Claar	Emergency Egress Assist Means and Escape Routes	In Waiting	EEIG	No draft NPRM prepared	Reciprocal Information (Harmonization rule)
J. Claar	Emergency Egress Markings	In Waiting	EEIG	No draft NPRM prepared	Reciprocal Information (Harmonization rule)

Draft - Transport Airplane Directorate Rulemaking Projects

ANALYST/ TEAM LEADER	Project Title	Rule Stage	ARAC WG	Current Status	Harmonization Working Method: Former number system replaced with descriptors to broaden applicability and include add'l authorities (TCCA, etc)
M. McRae	Water Ingestion	In Waiting	PPIHWG	No draft NPRM prepared, HWG report indicates that the JAA ACJ 25.1091(d)(2) is to be adopted	Reciprocal Information (Harmonization rule)
J. Kirk Baker	Direction Indicator	In Waiting	ASHWG	No draft NPRM prepared, but have Final Report of AVHWG, revised 8/21/00	Reciprocal Information (Harmonization rule)
J. Kirk Baker	Instruments Using Power Supply	In Waiting	ASHWG	NPRM drafted	Reciprocal Information (Harmonization rule)
J. Kirk Baker	Cockpit Instrument Systems	In Waiting	ASHWG	NPRM drafted, have draft AC 25.1333(b)-X, dated June, 2001	Reciprocal Information (Harmonization rule)
Ken Frey Seattle ACO	Pressurization and Low Pressure Pneumatic Systems	In Waiting	MSHWG	NPRM drafted	Reciprocal Information (Harmonization rule)
R. Hettman	Oxygen Systems	In Waiting	MSHWG	No draft NPRM prepared (ARAC WG drafted an NPRM)	Reciprocal Information (Harmonization rule)

Draft - Transport Airplane Directorate Rulemaking Projects

ANALYST/ TEAM LEADER	Project Title	Rule Stage	ARAC WG	Current Status	Harmonization Working Method: Former number system replaced with descriptors to broaden applicability and include add'l authorities (TCCA, etc)
Other RM / AC Items					
Team Lead: Jeff Gardlin **Analyst:** Jan Thor	Emergency Evacuation Certification AC	DONE	EEIG	AC published	TBD
Team Lead: Todd Martin **Analyst:** Q	Fire Protection of Structure (25.865)	AC	LDHWG	The rule (25.865) is acceptable as-is, and no changes will be made. The advisory material submitted by the ARAC working group is not sufficient to address the problem. The FAA will continue to develop advisory material in-house. This project is unscheduled.	TBD
Team Lead: Mike Dostert **Analyst:** Q	FAST TRACK HARMONIZATION PROJECT: AC 20-135X, Engine Case Burnthrough, (25.903(d)(1))	AC	PPIHWG	ON HOLD	TBD
Team Lead: TBD **Analyst:** Q	Ice Protection HWG Task 4. Propeller deicing and induction system ice protection AC 25.1093	AC	IPHWG	Plan is to incorporate draft ACJ25.1093(b)(1) material into Propulsion Mega AC.	TBD
Team Lead: TBD **Analyst:** Q	Wheel Well Fire Detection	In Waiting		ON HOLD	TBD
Team Lead: Jason Claar **Analyst:** Q	Emergency Exit Access (Type III exits)	In Waiting	EEIG	ON HOLD	TBD
Team Lead: Mike Dostert **Analyst:** Q	PPIHWG Task 8: Negative acceleration, ATTCS	DOM	PPIHWG	Placed on "do by other means" list. 4 special conditions in past 4 years.	TBD
Team Lead: TBD **Analyst: Q**	Fire protection of engine cowling, 25.1193(e). PPIHWG	DOM	PPIHWG	Placed on "do by other means" list. Use of the ARAC rec as basis for an Exemption is voluntary on the part of the applicant.	TBD
Team Lead: Steve Hapenny **Analyst:** TBD	Cargo compartment fire extinguishing or suppression systems	DOM	MSHWG	Placed on "do by other means" list.	TBD
Team Lead: Todd Martin **Analyst:** TBD	Ground Handling Conditions	In Waiting	LDHWG	ON HOLD	TBD

ARAC Update For TAE

November 13, 2013

ARAC Meetings – June 20, 2013 and Sept 19, 2013

- **Airman Testing Standards WG Report Approved as ARAC Recommendation - Sept 19**

- **Maintenance Control by Reliability Methods Tasking Approved and WG Established**

- **Proposed Engine Endurance Tasking Reviewed**

- **FAA Progressing on Implementation of Rulemaking Prioritization Recommendations**
  - **PREP (Pre-Rulemaking Prioritization) Worksheets Established**

ARAC Meetings – June 20, 2013 and Sept 19, 2013

THE FAA POTENTIAL RULEMAKING
PROJECTS FOR FUTURE CONSIDERATION
FY15 & Beyond
(Possible ARAC Taskings)

Project Title	Project Description
Part 145 Repair Stations update	**Develop a performance based repair station rule that will quickly develop standards for new technology, leverage industry participation for more efficient standard development, address the changing world of air carrier contract maintenance, and harmonize with other aviation safety agencies.**
Part 145 Repair Stations update	**(Alternative) Establish a prioritized list of subjects to be updated, piecemeal, over time through a long-term regulation modernization effort.**
Crashworthy Fuel Systems	**Would require self sealing fittings in engine to wing attachments, considerations for fuel lines located within the fuselage contour, and closing of the spar valve whenever the engine is switched off or the fire handle is pulled. Would also require revisions to §§ 25.561, 25.721, 25.963(d), and 25.994 that require all fuel tanks (including body tanks) be designed for fuel pressures arising from emergency landing conditions and improve the existing requirements for protection of fuel tanks in a wheels-up landing and in conditions in which the landing gear or nacelles break away.**
Composite Structure	**Generalize and add airframe requirements to account for nonmetallic structure:** **1. Structural integrity of fuel tanks** **2. Bonded structure** **3. Flammability and toxicity** **4. Crashworthiness** **5. Damage tolerance** **6. APU compartment** **7. Large damage capability (GSHWG)** **8. Initial flaw size (GSHWG)**

ARAC Meetings – June 20, 2013 and Sept 19, 2013

Revised Ditching Standards	**Establishing criterion for sink rate to be considered during ditching certification. In response to RE&D results from A320 accident.**
Turbine Auxiliary Power Unit (APU) Installations and New Appendix K	**Harmonization with EASA, Delegated rule. This rule change is needed to clarify how the Part 25 rules are to be applied to APU Installations. The only advantages in completing the rulemaking is to improve visibility for new applicant/authority personnel, reduce the number of ESF'S we need to process. There are already ARAC Recommendations and EASA rulemaking upon which to base this rulemaking. With prohibition on appendices in 14 CFR, we need to determine how to package details of rule (e.g., IBR, Detailed reg).**
Update flutter requirements	**Update 25.629 and related rules after ARAC**
Direction Indicator	**Harmonization with EASA, Delegated Rule No draft NPRM prepared, but have Final Report of AVHWG**
Oxygen Systems	**Harmonization with EASA, Delegated Rule No draft NPRM prepared**
Parts 27/29 Updates	**Parts 27 and 29 rule changes intended to address safety enhancements, including areas intended to improve occupant survivability (e.g. birdstrike rules, crashworthiness seats, crashworthiness fuel tanks, etc.)**
Part 27/29 regulatory philosophy revamp.	**This rulemaking is intended to determine if the existing 7,000 lb maximum weight limit is still the right weight value and to determine if other rotorcraft characteristics (besides, or possibly in addition to weight) may be more meaningful parameters to distinguish between normal (Part 27) and transport category (Part 29) rotorcraft target safety levels. We will also invite comments to determine if the current philosophy is appropriate for future rotorcraft airworthiness standards and target safety levels.**
Rototrcraft Displays 27/29.1322	**Update 27/29.1322 regulation pertaining to Warnings, cautions and advisories. Update rule to address glass cockpit displays (similar to 25.1322)**
Bird Ingestion §33.76	**This NPRM will propose a revision to the §33.76 requirements for large flocking bird testing with emphasis on core ingestion requirements and mid-sized engines.**
Engine Endurance Test §33.87	**This NPRM will propose an alternate endurance test to that currently required by § 33.87. This alternate endurance test will allow an engine to be tested in the configuration representative of its type design. The test conditions will cover the basic elements currently in 33.87, including the ratings, operating limitations and engine configuration and will be validated with engine data.**

THE FAA POTENTIAL RULEMAKING
PROJECTS FOR FUTURE CONSIDERATION
FY15 & Beyond
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EUROPEAN AVIATION SAFETY AGENCY
AGENCE EUROPÉENNE DE LA SÉCURITÉ AÉRIENNE
EUROPÄISCHE AGENTUR FÜR FLUGSICHERHEIT

Initial Airworthiness
2013 RMP

Peter Corbeel
Initial Airworthiness Manager
Rulemaking Directorate

13 September 2013

2013 RMP

- Delivered:
  - 7 TORs
  - 7 NPAs
  - 5 CRDs
  - 3 Decisions/Opinions
- To be delivered:
  - 2 TORs
  - 5 NPAs
  - 3 CRDs
  - 4 Opinions/Decisions

Already delivered

TOR

- RMT.0278 and RMT.0536 (MDM.078), Importing of aircraft from other regulatory system, and Part 21 Subpart H review, 01/02/13
- RMT.0572, Use of similarity analysis when showing compliance to SLD icing specifications, 04/02/13
- RMT.0075 (26.008), Fuel tank flammability reduction of already certificated large aeroplanes, 22/04/13
- RMT.0252 (MDM.056), Instructions for continued airworthiness, 15/05/13
- RMT.0560 Halon, Update of part 26 to comply with ICAO standards, 15/05/13
- RMT.0262 RMT.0550 (MDM.060) Embodiment of Safety Management System (SMS) and Level of Involvement (LOI) requirements into Regulation 748/2012, 27/08/13

Already delivered

NPA

- 25.028, Protection from debris impacts, NPA2013-02, 18/01/13
- RMT.0134, Rotorcraft AMC revision (Group 1) NPA 2013-04, 14/03/13, (Group 2) NPA 2013-18, 11/09/13
- RMT.0003 (LSA.001) Regular update of CS-LSA, NPA 2013-05, 15/04/13
- RMT.0225 (MDM.028(a)), Ageing aircraft structures, NPA 2013-07, 23/04/13
- RMT.0047 (25.027), RMT.0569 and RMT.0570, Reduction of Runway Excursions, NPA 2013-09, 10/05/13
- RMT.0108(21.039), CS-SIMD, NPA 2013-09, 10/05/13

Already delivered

CRD

- RMT.0462, Recognition of ED-12C/DO-178C in EASA AMC 20-115 (Software Considerations for Airborne Systems and Equipment Certification), CRD 2012-07, 13/03/13
- RMT.0460, Guidance Material for the development of a safety risk assessment for flight operations with known or forecast volcanic cloud contamination, CRD 2012-07, 17/04/13
- RMT.0110 (21.039(k)), Additional airworthiness requirements for operations (Part-26), CRD 2012-13, 27/05/13
- RMT.0081, Certification Specifications for Gas balloons and Tethered gas balloons, CRD 2012-24, 04/07/13
- RMT.0001 (20.002), Airworthiness and Operational Approval of Electronic Flight Bags, CRD 2012-02, 31/07/13

Already delivered

Decisions/Opinions

- RMT.0081 (31.003&31.004), CS for Gas balloons and Tethered gas balloons, Decision 2013/011/R, 04/07/13
- RMT.0003 (LSA.001), Regular update of CS-LSA, Decision 2013/15/R, 30/07/13
- MDM.003 (a), Flight testing, Opinion 07/2013, 22/08/13

To be delivered

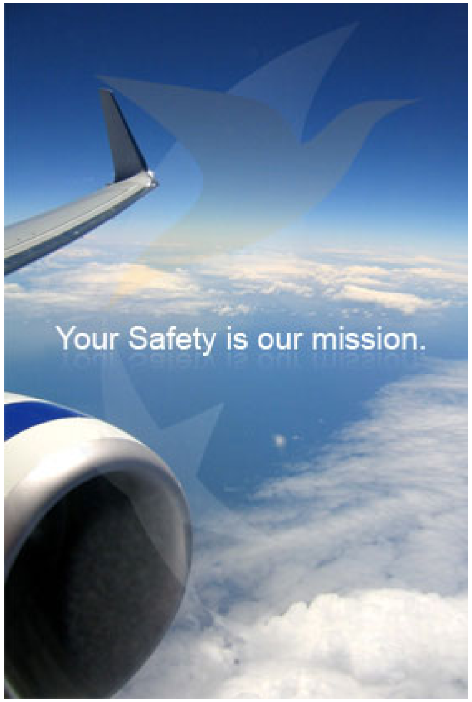
- RMT.0498, Reorganisation Part-23/CS-23, TOR, Q4
- RMT.0123, Helicopter tailrotor failures, TOR, Q4
- RMT.0069 (26.002), Seat crashworthiness improvement on Large Aeroplanes – Dynamic testing 16g, NPA, Q4
- RMT.0550, Embodiment of Safety Management System (SMS) and Level of Involvement (LOI) requirements into Regulation 748/2012, NPA, Q4
- RMT.0039, Incorporation of standard special conditions in CS-23 and harmonisation with FAR-23, NPA, Q4

To be delivered

- RMT.0075 (26.008), Fuel tank flammability reduction of already certificated large aeroplanes, NPA, Q4
- RMT.0047 (25.027), Reduction of runway excursions (CS-25), CRD & Decision, Q4
- RMT.0569, Reduction of runway excursions (retrofit Part-26), CRD & Opinion, Q4
- RMT.0048, Protection From Debris Impacts Fire, Decision, Q4
- RMT.xxx (21.039(k)), Part-26, Opinion, Q4

Thank you for your attention

Questions?



EASA Rulemaking Update (Continuing Airworthiness)

Juan Anton
Continuing Airworthiness Manager
Rulemaking Directorate
EASA

- **Task MDM.047 “Alignment of EC2042/2003 to EU218/2008”**
  - Opinion 06/2012 published on 27 November 2012 and discussed in EASA Committee in July 2013.
- **Task M.027 “Guidance for Aircraft Continuing Airworthiness Monitoring (ACAM)”**
  - Opinion 02/2013 published on 22 March 2013
  - Decision 2013/005/R published on 21 March 2013
  - An additional Decision will be published when the change to the rule is adopted.
- **Task MDM.020 “Critical tasks”**
  - CRD/Opinion published on 10 June 2013.

Task 66.027 “Avionic licence for general aviation and licence for sailplanes, balloons, airships and ELA1 aeroplanes”

- NPA 2012-15 published for comments on 04 October 2012.
- Workshop performed on 06 November 2012 explaining its content.
- Review Group meeting for the L licence on 14/15 May 2013.
- Review Group meeting for B2L licence on 28/29 May 2013.
- CRD/Opinion will be issued together (expected before the end of 2013).

Part-M General Aviation:

- NPA 2012-17 published for comments on 29 October 2012.
- Workshop performed on 06 November 2012 explaining its content.
- Covers proposals related to:
  - Maintenance Programmes
  - Airworthiness Reviews
- 2 meetings of the Review Group took place in March and April 2013 (including initial discussions for Phase II).
- CDR/Opinion (Phase I) will be issued together (expected September 2013)

Task MDM.056 (ICAs):

- Task started at the end of 2009.
- A working group of 24 members had 3 meetings during 2010. However, the CMT meeting (December 2010) showed parallel activities with FAA and TCCA.
- EASA, FAA and TCCA decided in a meeting held in April 2011 the following:
  - The scope of the task was too large.
  - To split the task in subjects of common interest to the 3 authorities, which should be harmonised, and other subjects, which will be dealt separately by each authority.
- Coordination with FAA, TCCA in order to identify issues of common interest and harmonize approaches.
- Status report issued last October 2012 (published on the EASA website together with the ToR of the task)
- Certain sub-tasks are defined in this report.

Task MDM.056 (ICAs):

- New ToR published on 15 May 2013
  - Subtask 1: Definition and identification of ICAs
    - Meetings to start in July 2013
    - NPA 2016/Q1, Opinion 2017/Q2
  - Subtask 2: Availability of ICAs
    - Meetings to start in July 2013
    - NPA 2015/Q3, Opinion 2016/Q3
  - Subtask 3: MRB Scheduling information
    - Agency task
    - NPA 2015/Q2, Opinion 2016/Q2
  - Subtask 4: Acceptance/approval of ICAs by other than the authority
    - NPA 2016/Q3, Opinion 2018/Q1
  - Subtask 5: Certification Maintenance Requirements
    - NPA 2015/Q3, Opinion 2016/Q3

Task M.014 "Contracting of continuing airworthiness management activities"

- NPA2010-09 published in July 2010
- Highly controversial task (total support from Industry, significant rejection from certain NAAs).
- Review Group after NPA agreed to continue with the task and presented a report to the management of EASA.
- EASA decided, in view of the divergent comments to the NPA, that it was needed more debate on the subject:
  - A letter and a questionnaire was sent on 14 March 2012 to stakeholders and NAAs in order to obtain feedback on the subject.
  - A workshop was performed on 28 June 2012 in order to discuss the issue and the feedback received.
- Based on the result of the actions above the Agency is preparing a final outcome for the task.
- CRD/Opinion will be published together (expected before end 2013)

Task MDM.038 “Guidance on TBO limits”

- Covers all type of components installed on non-powered and piston engine aircraft other than complex motor-powered aircraft, when not used for Commercial Air Transport.

- Very detailed guidance on the inspection procedure to extend the TBO of a piston engine.

- CRD/Decision will be published together (expected September 2013).

Task 145.023 “AMC/GM adapted to the grant of foreign Part-145 approvals”

- NPA published on 11 July 2013.

Task 145.017 "Control of suppliers for components, parts and appliances"

- Clarify the requirements and produce guidance on how to evaluate component suppliers.
- Evaluate the possibility to use industry standards and accreditation programmes in order to reduce the auditing burden when a supplier is used by many maintenance organisations.
- CRD/Opinion will be published together (expected September 2013).

Task MDM.097 "Maintenance check flights" (previous task M.009 + Operational issues)

- CRD expected before end 2013.

Task MDM.076 “Technical records”

- 6 meetings already took place.
- NPA expected 2014/Q1.

- The objective is to clarify the following:
  - Inconsistency in the use of terms such as “Life Limited Parts” and “Service Life Limited Parts”
  - Which components require EASA Form 1 and which documents are equivalent.
  - Whether “Back to birth traceability” is needed.
  - Guidance on the use of electronic signature, the acceptability of scanned record copies and the use of new technology such as RFID (Radio Frequency Identification).
  - Harmonisation with FAA requirements.
  - Address Safety Recommendation UNKG-2007-091 (to keep maintenance and overhaul records until the aircraft or component has been destroyed or permanently removed from service).

Task 145.024 “Functions and responsibilities of B1 and B2 support staff”

- 5 meetings already took place
- NPA expected 1Q2014.

- The objective is to clarify the following:
  - How the organisation evaluates the complexity of each task and assign it to personnel authorised to “sign-off” or to non-authorised personnel under supervision.
  - Who can be authorised to “sign-off”, under which qualification and under which authorisation process.
  - What is the role of the “sign-off” personnel and the “B1 and B2 support staff”.
  - How are recorded the actions taken by “sign-off personnel” and “B1 and B2 support staff”.

Task MDM.048 “CS for standard changes and repairs”

- Linked to the changes introduced in Regulation EU748/2012 for Standard Changes and Repairs

- NPA expected before the end of 2013.

Task MDM.055 “SMS embodiment and alignment with AR/OR requirements”

- NPA 2013-01 published on 21 January 2013.
- Comment period finished 22 May 2013.
- Covers Part-M and Part-145

NOTE: Another NPA has to be issued for Part-147 organisations.

Task MDM.078 “Importing of aircraft from other regulatory systems”

- First meeting will take place last week of May 2013.
- NPA expected 2015/Q2.

Task M.029 “CAMO and Part-145 responsibilities”

- First meeting expected in September 2013
- NPA expected 2015/Q1.

Task MDM.082 “New training/teaching technologies”

- Meetings already started.
- NPA expected 2014/Q4.

Task RMT.0521 “Review of the airworthiness review process”

- Meetings to start after summer 2013.

Flight Controls Harmonization Working Group Final Report

Rudder Reversal/Sensitivity Issue

November 13, 2013

Barry Hance (Boeing Co-chair)
Dominique Chatrenet (Airbus Co-chair)

Flight Controls Harmonization Working Group
Tasking Overview

- Consider whether changes to part 25 are necessary to address rudder pedal sensitivity and rudder reversals. Two phases, new aircraft and existing aircraft

- Tasking driven by NTSB recommendation from AA587 accident
  - Two additional A300/A310 events, one A319 event, and a de Havilland event were also noted in tasking

- FCHWG to consider the following areas:
  - Loads
  - Maneuverability
  - System design
  - Control sensitivity
  - Warning

Flight Controls Harmonization Working Group Results

- New Aircraft
  - Subpart B investigation did not identify any effective, performance-based standards
  - Subparts D and F standards were considered to be design prescriptive
  - FAA proposed new Subpart C rule – two dissenting opinions

- Existing Aircraft
  - Loads analyses show that existing designs can withstand one pedal doublet to full overyaw in normal flight conditions
  - Multiple doublets are sustainable at lower pedal amplitudes
  - No additional rudder reversal service events were identified
  - Consensus that no unsafe conditions identified for the models studied
  - FAA reserves right to request similar data for models not studied by the group
  - Unsafe conditions will be addressed via AD as needed

- All Aircraft
  - Consensus to recommend improvements to Flight Crew training

Flight Controls Harmonization Working Group
25.353 *Rudder Control Reversal Conditions*

- FAA proposal
  - Imposes two tuned rudder doublets as ultimate load condition
  - Supported by FAA, EASA, TCCA, ANAC, and ALPA

- OEM dissenting opinion; variation on the FAA proposal
  - Imposes a single tuned rudder doublet as ultimate load
  - Mitigates some impacts of 2 doublet rule while setting a minimum standard
  - Supported by Airbus, Bombardier, Cessna, Dassault, and Embraer

- Both camps agreed on a ~common AC
  - Details the requirements to take credit for systems that reduce structural loads
  - Exonerates applicants from 25.302 compliance

- Boeing dissenting opinion; no rulemaking required
  - Rudder reversals are very rare; No Boeing events in over 300 million flight hours
  - Not feasible to prevent pilots from exceeding structural limits for all possible instances of excessive and inappropriate maneuvering
  - Enhanced pilot training is the most effective mitigation for these events

FAA Aviation Rulemaking Advisory Committee

Flight Controls Harmonization Working Group

Rudder Pedal Sensitivity/Rudder Reversal Recommendation Report
November 7, 2013

Table of Contents

List of Abbreviations

AA	American Airlines
AC	Advisory Circular, Air Canada
AD	Airworthiness Directive
AFM	Airplane Flight Manual
AFS	Flight Standards Service
ALPA	Air Line Pilots Association
ANAC	Agência Nacional de Aviação Civil
APC	Airplane Pilot Couple
ARAC	Aviation Rulemaking Advisory Committee
CFR	Code of Federal Regulations
CG	Center of Gravity
CS	Certification Specification
DAH	Design Approval Holder
EASA	European Aviation Safety Agency
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulation
FBW	Fly By Wire
FCHWG	Flight Controls Harmonization Working Group
FDR	Flight Data Recorder
FH	Flight Hours
FTHWG	Flight Test Harmonization Working Group
FR	Federal Register
GNSS	Global Navigation Satellite System
HQ	Handling Qualities
NASA	National Aeronautics and Space Administration
NTSB	National Transportation Safety Board
Ny	Yaw Axis Acceleration
OEM	Original Equipment Manufacturer
PIO	Pilot Induced Oscillation
PR	Potential Reversals
SAFO	Safety Alert For Operators
SR	Safety Recommendation
TAEIG	Transport Airplane and Engine Issues Group
TBC	The Boeing Company
TCCA	Transport Canada Civil Aviation
TSB	Transportation Safety Board of Canada
VA	Design Maneuvering Speed
VC	Design Cruising Speed
VD	Design Dive Speed
VFR	Visual Flight Rules
VMC	Minimum Control Speed (with critical engine inoperative)
YD	Yaw Damper

Executive Summary

The FAA tasked the ARAC - http://www.regulations.gov/#!documentDetail;D=FAA-2011-0314-0001 - to consider the need to add a new flight maneuver load condition to 14 CFR part 25, subpart C, that will ensure airplane structural capability in the presence of rudder reversals and associated buildup of sideslip angles through a defined flight envelope, or to consider if other standards may more appropriately address this concern, such as certain pedal characteristics that discourage pilots from making pedal reversals. The ARAC was tasked to recommend a performance-based requirement that allows manufacturers the flexibility to design airplanes to meet their needs while ensuring airplane safety. The ARAC was also tasked to recommend methods of compliance, such as background simulation or piloted simulation.

The FCHWG makes three recommendations.

1) Enhanced Flight Crew Training Recommendation.
2) Proposed new regulation 25.353, which would apply to new transport airplanes.
3) For existing transport airplanes, the FCHWG believes that retrofit should be considered on a case by case basis and that if any potentially unsafe conditions are found that they should be addressed using airworthiness directives. (Note: Several airplanes were reviewed as part of the FCHWG deliberations. None were found to have an unsafe condition.)

There are dissenting opinions with regard to Recommendation 2. These dissenting opinions are outlined in "Recommendations" and "Consensus and Dissenting Opinions."

Background

Service experience and recent investigation show that regardless of training, pilots make inadvertent and erroneous rudder inputs. Some actual cases have resulted in pedal reversals. Accident and incident data show some airplanes that have experienced such reversals have surpassed the airplane's structural limit load and sometimes ultimate load. The FAA finds it is necessary to revise the rules to ensure that airplanes are designed such that pilots will not (1) inappropriately make pedal reversals and/or (2) be capable of overloading the fin under foreseen conditions.

On November 12, 2001, an Airbus A300-600 operated as American Airlines Flight 587 crashed at Belle Harbor, New York, on climb-out resulting in 265 deaths and an airplane hull loss. The National Transportation Safety Board (NTSB) found "that the probable cause of this accident was the in-flight separation of the vertical stabilizer as a result of the loads beyond ultimate design that were created by the first officer's unnecessary and excessive rudder pedal inputs. Contributing to these rudder pedal inputs were characteristics of the Airbus A300-600 rudder system design and elements of the American Airlines Advanced Aircraft Maneuvering Program."

In two additional events, commonly known as the Miami Flight 903 event and the Interflug event (both included in the AA587 report), A300-600/A310 fins were loaded past the certification ultimate load level due to pilot commanded pedal reversals. Both airplanes survived these events due to having strength in excess of that required by the current standards.

In January 2008, an Airbus 319 operated as Air Canada Flight 190, encountered a wake vortex. The pilot responded with several pedal reversals. Analysis has shown that this caused a fin load exceeding limit load. The pilot eventually stabilized the airplane and safely landed. The Transportation Safety Board (TSB) of Canada investigated this event with the NTSB providing an accredited representative and advisors.

In May 2005, a de Havilland DHC-8-100 (Dash 8) experienced an upset during which the pilot commanded a pedal reversal during climb-out, when the airplane entered an aerodynamic stall. There were no injuries and the airplane was not damaged. The FCHWG loads subgroup determined that the loads occurring during this event were less than limit and was therefore only considered as evidence that pedal reversals may occur in service. Attachment F identifies the official reports for these events.

The current yaw maneuver standard addresses large pedal displacements at airspeeds up to the design dive airspeed (V_D). This ensures safe structural airplane characteristics throughout the flight envelope from single full pedal inputs and releases. However, the standard does not address the loads imposed by pedal reversals. Additionally, other certification standards require that controls operate with ease, smoothness, and positiveness appropriate to their function. However, these standards do not address specific control system parameters such as inceptor travel, breakout force or force gradient.

The FAA is addressing, in part, this condition for new designs by requiring under § 25.601 that applicants for new type certificates show that their design is capable of continued safe flight and landing after experiencing rudder pedal reversals. For fly-by-wire architectures, the applicants have been able to show compliance with this requirement by appropriate rudder control laws. These control laws have been incorporated through software and therefore add no weight or maintenance cost to the airplanes. However, depending on the design, such control laws might only be capable of a limited number of pedal reversals prior to exceeding airframe ultimate loads, any new regulation may need to consider this situation.

Historical Information

1. Systems Design Review

The combined group reviewed data of several airplane configurations to determine if some airplane designs were less sensitive to rudder pedal reversals. By reviewing several configurations we found that in addition to fly-by-wire airplanes, manually, or hydromechanically controlled airplanes with yaw dampers whose commands cannot be nulled by the pilot (unswampable) are much more tolerant to rudder pedal reversals than airplanes whose yaw dampers can be nulled by the pilots. The unswampable nature results in lower loads. This shows that FBW, hydromechanical, and manually controlled airplanes with yaw dampers can mitigate high loads due to large pedal inputs.

Our activity also showed that there are several airplanes currently in service that contain this beneficial design feature.

Conclusion:
Fly-by-wire as well as manual and hydro mechanical systems appropriately configured with unswampable yaw dampers can significantly lower fin loads resulting from pedal reversals relative to airplanes with swampable yaw dampers. This activity also showed that this type of design has been used on certain airplane models for many years, and is not new technology. However, requiring such a configuration on new airplanes is considered design prescriptive and is therefore one option, but not the only option, a manufacturer might use to address rudder pedal reversals.

2. Loads Task Group Activity

The loads task group (sub-group formed mainly by load specialists amongst FCHWG members) reviewed in-service events involving rudder reversals. The group used these events to inform the development of a static strength condition that would be used to evaluate the current fleet of commercial airplanes. Since the evaluation of the aircraft structure for all possible rudder commands is not feasible, one idealized condition was developed. This condition was considered to provide a reasonable level of safety based on the understanding from the fleet history data. The development of the static strength evaluation focused on five major areas: the number of doublet cycles, the factor of safety, failure scenarios, flight envelope, and static strength evaluation criteria.

Based on the in-service events, the loads task group designed a single-doublet rudder pedal reversal condition in which the rudder pedals are reversed at maximum sideslip based on the peak overswing sideslip. The idealized condition is as described below (Note this condition is different from the proposed 25.353 design load condition described under Recommendation).

Maneuver Definition
One complete doublet is applied consisting of an initial rapid application of maximum pedal force from 25.351(a). As the sideslip develops, the rudder pedals are rapidly reversed (maximum 25.351(a) pedal force applied to the opposite pedal) either at maximum overswing or so as to achieve the allowable reversed rudder deflection coincident with the peak overswing sideslip, yielding the highest vertical stabilizer loads. As the sideslip develops in the opposite direction, the rudder pedals are rapidly returned to neutral either at maximum overswing or so as to achieve zero rudder deflection coincident with the peak overswing sideslip, again yielding the highest vertical stabilizer loads.

Factor of Safety

There are four known notable rudder reversal events in commercial aviation history, two of which occurred as a result of a wake encounter, and the commercial airplane fleet has more than a combined 500 million flight hours. Assuming an equal probability across all airplanes in the commercial fleet, the probability of a rudder reversal that reaches or exceeds design limit loading is approximately 10^{-8} per airplane flight hour. For this reason, it was determined that use of an ultimate load condition (factor of safety = 1.00) was deemed appropriate. This probability is based on historical data; very accurate GNSS navigational accuracy that produces highly repeatable flight paths, and any changes in air traffic control, specifically vertical separation minimums, may change the probability of a wake encounter.

Failure Scenarios

Due to the low probability of a high load rudder doublet event, failure scenarios were not addressed in combination with the rudder pedal reversal condition. For example, fly-by-wire aircraft analyzed this maneuver in normal control law mode.

Yaw Damper

Since the conditions evaluated for the Loads study were typical operational flight conditions, if the yaw damper were typically on as per AFM procedures, the Loads calculations generally assumed yaw damper on in these calculations.

Flight Envelope Determination

Since this event is rare, it was deemed acceptable that this condition be evaluated using nominal and realistic flight conditions and parameters (in particular aerodynamic configurations not used frequently as airbrakes extended can be omitted). The analyses did not use the worst possible aircraft payload combined with the worst possible flight envelope condition, but instead the analysis used a representative fatigue mission condition.

Static Strength Evaluation Criteria

The evaluation of this load condition used the vertical stabilizer side-of-body bending moment, which is the primary design load for the vertical stabilizer structure.

The vertical stabilizer side-of-body bending moment was compared as a percentage to the design bending moment level, at ultimate load, produced by the current FAR regulations. Manufacturer imposed design requirements were removed from this comparison so that the loads could be presented as a percentage of level of safety provided by the current regulations.

In summary, the rudder pedal reversal static ultimate strength condition was analyzed for one full rudder pedal doublet with the pedal reversal initiated at or just before the maximum sideslip overswing, a nominal flight condition, and with all systems in normal mode.

Results

Each OEM evaluated a representative set of airplanes by running the time history loads analysis to the criteria defined above. The aircraft analyzed were categorized by size and general arrangement to provide a similar basis of comparison. The vertical stabilizer side of body bending moment for the pedal doublet was compared as a ratio to the ultimate static strength design load level as defined by the FAR design criteria. This ratio is presented in the second column of Table 1. Comments are provided to distinguish between the different rudder system designs.

Aircraft Type	Doublet/Ultimate	Comments
Small/Medium Business Jet	0.40 up to 1.0 (approx)	Approx value based on estimated yaw damper effect. Lower value powered rudder. Higher value manual rudder 300 lb pilot effort
Medium/Large Business Jet	0.34 up to 0.75	Powered rudder, rudder FBW produces lower value
Fuselage-Mounted Engine Regional Jet	0.42 up to 0.79	Lower value based on rudder FBW laws, upper value no FBW
Wing-Mounted Engine Regional Jet	up to 0.80	Open loop rudder FBW
Single Aisle Passenger Jet	0.61 up to 0.73	No Rudder FBW
Widebody Passenger Jet	0.50 up to 0.81	Lower value based on rudder FBW laws, upper value no FBW

Table 1. Single pedal doublet results by commercial transport category (rudder pedal reversal *initiated at* peak overswing sideslip). All results in Table 1 are generally with yaw damper on.

The work of Table 1 was repeated, but this time with the pedal reversal coincident with the peak overswing sideslip. Results are presented in Table 2 and show the sensitivity to timing of the rudder pedal reversal input. It should be noted that for most aircraft types there was no more than 2% difference.

Aircraft Type	Doublet/Ultimate	Change vs Table 1
Small/Med Biz Jet	0.41 up to 1.0 approx	Upper value unchanged
Med/Large Biz Jet	0.38 up to 0.75	Upper value increased by <2%
Eng/fuse mount Regional Jet	0.41 up to 0.81	Upper value increased by <2%
Eng/Wing mount Regional Jet	up to 0.92	Upper value increased by 15%
Single Aisle Passenger	0.62 up to 0.75	Upper value increased by <2%
Widebody Passenger	0.51 up to 0.83	Upper value increased by <2%

Table 2. Single pedal doublet results by commercial transport category (rudder pedal reversal *coincident with* peak overswing sideslip).

The results from Tables 1 and 2 show that the ultimate load single pedal doublet condition defined herein does not generate higher airframe loading than the current FAR design ultimate load level. With the exception of the Small/Medium Business Jet with a manual rudder system, the airframe loading of the current commercial fleet is approximately 20 percent below the current FAR design ultimate load level. The data also shows that, for aircraft with either advanced fly-by-wire systems or high authority yaw dampers, the pedal doublet load is less severe.

<u>Effect of Multiple Doublets on Vertical Tail Side of Body Bending Moment</u>

To understand the effect of multiple doublets, beyond the single full-stroke doublet, and to what extent the single full-stroke doublet envelopes multiple lower amplitude doublets, a side study was undertaken. This study sought to determine, at the same flight condition as the single full-stroke doublet, how much the single full-stroke doublet rudder pedal input would need to be reduced for 2, 3, 4, and 5 doublets in order to not exceed the loads of the single full-stroke doublet.

The critical (i.e., largest vertical tail side of body bending moment) single full-stroke doublet (rudder pedal reversal initiated at peak overswing sideslip) was used as the baseline condition. That same condition was run for multiple doublets with reduced rudder pedal input so that the multiple doublet load was equivalent to that of the single full-stroke doublet load.

Results are shown in Figure 1 for the four aircraft noted (representing 3 OEMs). The average of the results is shown by the solid line, while the dashed lines show the envelope of the minimum/maximum result values.

Figure 1 shows that for the airplanes studied, reducing the rudder pedal input to approximately 60% (±5%) of the full-stroke doublet input would allow 3 doublets to not exceed the load of the single full-stroke doublet. Furthermore, due to the asymptotic nature of the curve, that same level of pedal input would allow 4, 5, and potentially more doublets to be performed without exceeding the load of a single full-stroke doublet. For example, for a rudder control system in which the full stroke rudder pedal travel is 4 inches, reducing the rudder pedal travel to 2.4 inches (60%) would allow 3 doublets that would not exceed the load of the single full-stroke doublet.

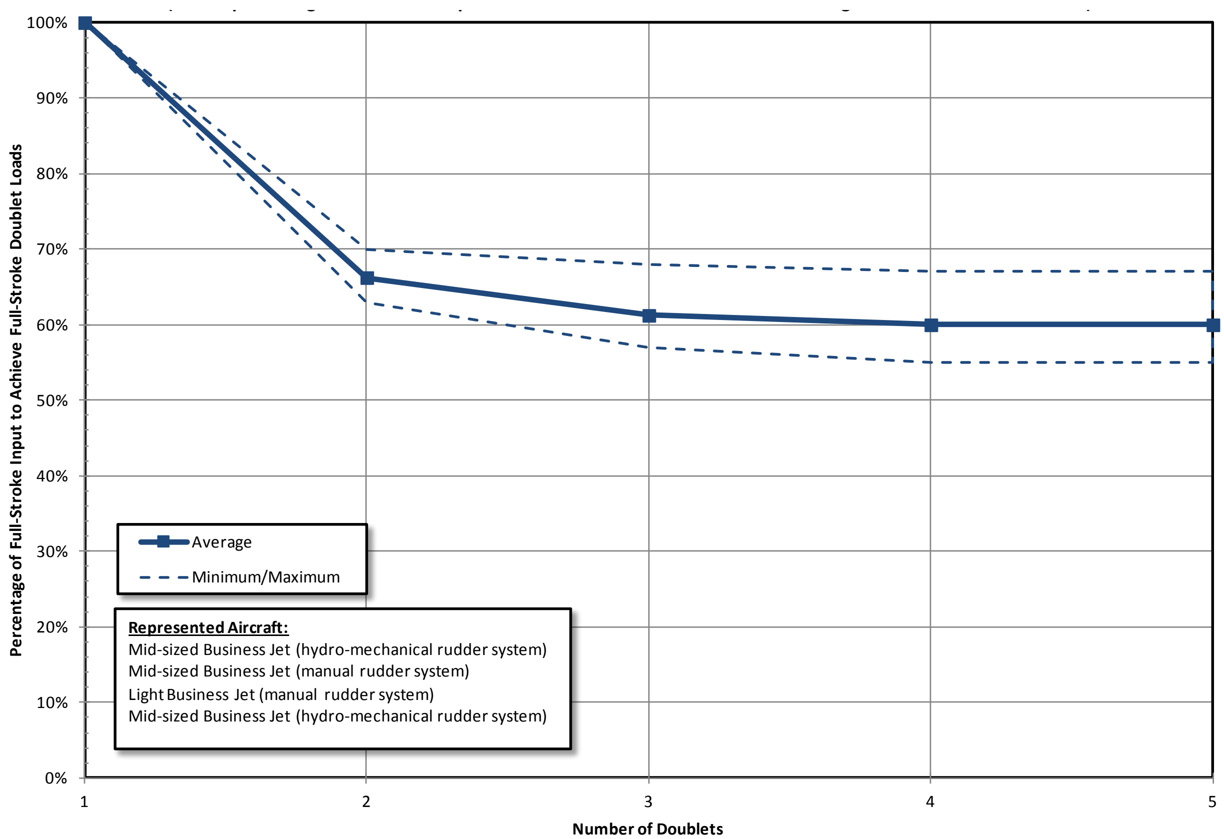


Figure 1. Percentage of full pedal stroke input to get for several doublets the one full stroke doublet load.

Conclusions

The most significant fleet history events were used to guide the creation of a reasonable static strength condition to represent severe vertical stabilizer loading. This condition represents a single full-stroke rudder pedal doublet, but also provides some coverage for lower-amplitude multiple doublets. The resulting static strength condition was analyzed for the current fleet of commercial airplanes and the airframe loading did not exceed the design ultimate loads defined in the current FAR regulations. The analysis shows that current requirements provide adequate structural protection against a single pedal reversal in the most likely flight conditions. The analysis also shows that after three doublets, fin loads did not increase, indeed even after two doublets there is little further increase, if rudder pedal displacement is limited to 60% of full travel.

Research Information

FAA sponsored studies had been conducted prior to the ARAC tasking to understand parameters that affect the way pilots use the rudder. (See the tasking statement for details). These studies included a survey[1] of transport pilots from all over the world and several real time piloted simulation studies.

The survey found that some experienced pilots unexpectedly used the rudder after wake vortex encounters. The survey also found:

1. Pilots use the rudder more than previously thought and often in ways inconsistent with the intended function recommended by the design approval holders (DAHs).
2. Pilots make erroneous pedal inputs, and some erroneous pedal inputs include rudder reversals.
3. After years of training, many pilots are not aware that they should not make pedal reversals, even below design maneuvering speed (V_A). Note: Over the past 4 years, training and Airplane Flight Manual (AFM) changes have directed the pilot not to make cyclic control inputs even below V_A. The Air Canada event occurred despite this effort.
4. Pilots in airplane upset situations (e.g., wake vortex encounters) may revert to prior training and make excessive pedal inputs that they may then counter with pedal reversals.

ARAC/FCHWG reviewed the simulator studies, which suggested that short pedal throws are more prone to pedal reversals. These simulator studies provide insight into the level of difficulty to try to assess a control that is not designed to be used very often, and almost never at higher speeds. All of the piloted studies had to provide somewhat artificial circumstances to ensure the pilots would interact with the pedals, which led to issues of how realistic the scenarios were. The capability of the simulators used was also called into question. Additionally, the data methods and statistical significance of the results were questioned. Ultimately, the FCHWG did not find that the FAA/NASA sponsored simulator studies directly addressed the tasking of the group (i.e., none of the reports were adequate to directly address any single tasking question). Additional information regarding FCHWG's assessments of these studies is contained in Attachment D.

The aircraft response of AC190 and AA587 was recomputed assuming the pilots did not use rudder pedal inputs for recovery, instead using normal roll control inputs from the largely roll-upset induced by the wake encounters. In both cases, the severity of the aircraft response would have been substantially reduced (in sideslip as well as bank angle) if the pilot would not have made rudder pedal inputs, but rather apply only roll commands in response to the roll upset.

[1] Peterson, Sarah L., et al, "An International Survey of Transport Airplane Pilots' Experiences and Perspectives of Lateral/Directional Control Events and Rudder Issues in Transport Airplanes (Rudder Survey)," DOT/FAA/AM-10/14, October 2010.

Recommendation

Summary

The FCHWG makes three recommendations.

1) Enhanced Flight Crew Training Recommendation.
2) Proposed new regulation 25.353, which would apply to new transport airplanes.
3) For existing transport airplanes, the FCHWG believes that retrofit should be considered on a case by case basis and that if any potentially unsafe conditions are found that they should be addressed using airworthiness directives. (Note: FCHWG reviewed several airplanes as part of the FCHWG deliberations. None were found to have an unsafe condition.)

NOTE: For recommendation 2, there are dissenting opinions, which are discussed later in this report.

Recommendation 1 - Enhanced Flight Crew Training:

FCHWG recommends that appropriate Civil Aviation Authorities and other training organizations consider enhanced flight crew training regarding appropriate rudder use. Details of the enhanced training outline are contained in Attachment A.

While training and AFM changes implemented in the wake of AA587 have been beneficial, FCHWG learned anecdotally of events (even in the presence of the changes to crew training from AA587) where some flight crews:

- Appeared to misunderstand the structural protections afforded by maneuvering speed,
- Appeared to be unaware that those structural partial protections are only inherently provided in the pitch axis,
- Appeared to be unaware of the magnitude of loads which can be generated by the rudder, especially in the presence of sideslip,
- Appeared to misunderstand the mechanism by which the rudder generates roll, and the effect of wing sweep on the (delayed) roll response to a rudder input,
- Appeared to generally misunderstand, or were apparently not aware of, what the manufacturer considers appropriate and inappropriate rudder use,
- Appeared to not fully understand the purpose of, or presence of, control system features like rudder-limiting, auto turn coordination, and how their functioning changes with airspeed and/or configuration.

Furthermore, in the re-creation of AA587 and AC190, but *without* the use of the rudder pedals, the upset was substantially reduced versus when the flight crews used the pedals in the accident events themselves. Meaning the crews' use of the rudder, in a flight condition where rudder use was not necessary, greatly exacerbated the magnitude of the upset leading to vertical tail limit-load exceedance.

For these reasons, the FCHWG recommends that FAA Flight Standards and industry groups that focus on pilot training review Attachment A, and as appropriate implement it as part of approved flight crew training programs. This training will benefit not only pilots that operate new transport airplanes, but also the existing transport fleet. FCHWG's training recommendation should be covered in Type Rating and Recurrent training, and is broken down in to a general academic module, as well as a module dedicated to the specific aircraft design, and a simulator demonstration (if the simulator can be used as a demonstrative tool, given its limitations, without negative transfer of training).

Recommendation 2 - Proposed new regulation 25.353, which would apply to new transport airplanes.

The FCHWG recommends that a new rule be adopted (25.353), together with a corresponding advisory circular (AC). These are shown in Attachment B (the rule) and Attachment C (the AC). The majority believe that a rule change is needed, but they are not in agreement on what it should require. One FCHWG member believes that no change to the subpart C maneuver loads requirements is necessary. See further discussion under Consensus and Dissenting Opinions below.

The proposed new rule, 14 CFR Part 25.353, includes a yaw maneuver condition that would be required in addition to the current yaw maneuver condition specified in 25.351. The rule would add a design ultimate load requirement that would consist of either a single pedal doublet maneuver, or a two pedal doublet maneuver. Five members are in favor of the single doublet condition, and five are in favor of the two doublet condition. This maneuver would be defined as either a full displacement input, followed by one reversal and return to neutral (single doublet condition); or a full displacement input, followed by three reversals and return to neutral (two doublet condition).

All 14 CFR Part 25.353 conditions, whether (a)-(c) (Version 1) or (a)-(d) plus return to neutral (e) (Version 2), would be considered ultimate load conditions with a safety factor of 1.0. The applicant would not need to consider failure conditions in combination with these ultimate loading conditions. The applicant must consider all approved airplane configurations and flight conditions (weights, cg, speeds up to V_C, altitude, etc.) in accordance with Sec. 25.321. These conditions are to be considered with the landing gear retracted and speed brakes (or spoilers when used as speed brakes) retracted. Flaps (or flaperons or any other aerodynamic devices when used as flaps) and slats extended configurations are also to be considered if they are used in en route conditions. For rudder reversals, the sudden displacement of rudder pedal occurs when the overswing sideslip angle is achieved, not before.

During the proposed condition, system effects should be taken into account. If the airplane is fly-by-wire, it should be evaluated in normal law. Systems which are used to show compliance must meet conditions outlined in the AC.

Recommendation 3 - For existing transport airplanes, the FCHWG believes that retrofit should be considered on a case by case basis and that if any potentially unsafe conditions are found that they should be addressed using airworthiness directives. (Note: Several airplanes were reviewed as part of the FCHWG deliberations. None were found to have an unsafe condition.)

The FCHWG believes that a review of the existing fleet is important to ensure fleet safety. We conducted an evaluation during the proceedings of the FCHWG, covering a representative spectrum of the Part 25 aircraft designs currently in service. This evaluation did not reveal any additional *relevant* rudder reversal service events beyond what was noted in the tasking (though in the survey, several pilots self-reported reversals). Further, the loads analysis demonstrated that the models studied have adequate protection from a single, full pedal stroke doublet. The FCHWG recommends that no further retrofit evaluation is needed for the models evaluated by the group.

Models that were not considered by the group may need to be considered for evaluation for acceptability. The FAA proposes criteria of service history, current structural capability and architecture as a means to determine whether airplanes are safe enough without modification. In particular the comparison of yaw system architecture and lateral dynamic behavior of the concerned airplane with a previously evaluated model could be sufficient to demonstrate its robustness to "doublets". If loads analysis is required, it will not impose any criteria more severe than was used during the Loads subgroup study mentioned under "Historical Information." Note, this effort would also support NTSB Safety Recommendation (SR) A-04-057. If the need arises for retrofit action in the future, the best approach would be to issue airworthiness directives as required on a case-by-case basis.

<u>Questions Raised in the Tasking Statement</u>

The FCHWG was asked to answer the following questions as it developed its recommendations.

Questions:

For New Transport Airplanes:

1. Define what is meant by pilot misuse/use of rudder and rudder pedal sensitivity, and determine the appropriate flight envelope that should be considered.

   Answer:

   <u>Pilot misuse/use of rudder:</u>

   After extensive discussion there was general consensus as to what is meant by pilot misuse of rudder. There was one dissenting opinion from ALPA which is contained below.

   The FCHWG views pilot rudder/pedal usage as falling into one of three categories:

1. Appropriate: Pilot rudder/pedal usage (or non-use) consistent with the manufacturer's recommendations, including failure cases, considering system architecture and functions, and verified to lead to structural loads covered by regulations (possibly including Special Conditions).
2. Inappropriate: Pilot rudder/pedal usage (or non-use) inconsistent with the manufacturer's recommendations, considering system architecture and functions. Inappropriate rudder/pedal usage can be further subdivided:
    a. Inappropriate/intentional: Pilot rudder/pedal usage which is inconsistent with the manufacturer's recommendation, but made intentionally by the crew. This could be due to the crew reverting to prior training, misunderstanding of the rudder function, improper failure diagnosis, overreaction, etc.
    b. Inappropriate/inadvertent: Pilot rudder/pedal usage which is inconsistent with the manufacturer's recommendation, but made inadvertently/accidentally (rudder inputs due to seat ingress/egress, stretching/reaching, etc.).

It is the opinion of the FCHWG, at least based on the available accident record, that the current regulations (Subparts B, C, D/F) provide adequate design requirements for appropriate pilot rudder/pedal usage (#1), even possibly including rudder reversals on the ground and at the low airspeeds of takeoff and landing. However, although rare, the accident record indicates that the regulations may not provide adequate design requirements for inappropriate pilot rudder/pedal usage, whether inappropriate-intentional (#2a) or inappropriate-inadvertent (#2b).

ALPA dissenting opinion

ALPA agrees that the regulations may not provide adequate design requirements for unexpected use of the rudder but has difficulty with use of the words "appropriate" and "inappropriate" in the statement above. ALPA is of the opinion that "appropriateness" of an action depends on the situation at hand. Use of the rudder control that is inappropriate in one scenario may be appropriate in another; i.e., should a situation arise in which the lateral control is ineffective then it may be appropriate to apply a small amount of rudder in the direction of desired roll as the only means remaining to facilitate an increase in roll rate. The appropriate use of the rudder control is determined by the pilot based on his perception of the current flight situation. This may result in an unexpected use of the rudder from the manufacturer's point of view. Therefore, unexpected use of the rudder should not result in an Airplane-Pilot Couple (APC) that may lead to multiple rudder reversals that have the potential to exceed the vertical fin ultimate load. Recommend the words "appropriate" and "inappropriate" be replaced with "expected" and "unexpected."

ALPA would consider misuse of the rudder to be pilot use of rudder in a manner that has a high likelihood of causing harm to the airplane.

Flight Envelope to be Considered:

For the FCHWG members recommending modification to existing 14 CFR Part 25 design standards – both proposed 25.353(a)-(c) and proposed 25.353(a)-(e) – a flight envelope for use in the proposed rule was agreed by all.

Airplane Response/Maneuverability and Rudder Pedal Sensitivity:

See discussion under 2b and 2d, below.

2. What types of part 25 standards can be developed to prevent unintended rudder usage or to ensure that unintended usage provides a level of safety commensurate with part 25? The working group should consider the following types of standards:
    a. Load
    b. Maneuverability
    c. System design
    d. Control sensitivity
    e. Warning

Answer:

The group determined that no standard can be developed to prevent unintended rudder usage. However, the group was able to develop a standard that accounts for inappropriate usage (a design load condition), described above. The referenced standards (a. thru e.) were considered.

In responding to this question, the FCHWG also considered NTSB SR A-04-056, "Modify 14 CFR part 25 to include a certification standard that will ensure safe handling qualities in the yaw axis throughout the flight envelope, including limits for rudder pedal sensitivity." FCHWG investigated Airplane Response/Maneuverability (2b) and Control Sensitivity (2d), including engagement of the Flight Test Harmonization Working Group (FTHWG) and analysis of 9 different airplanes' responses to a contrived rudder pedal input aimed at determining a pass/fail criteria for rudder pedal control sensitivity. However, given the time/resources available, the group was unable to reach any conclusions regarding what kinds of sensitivity parameters pilots were sensitive to, especially with regards to what would make them less prone to making rudder pedal reversals. (Additional details are contained in Attachment H.) Hence, this recommendation contains no changes to Subpart B.

Furthermore, after significant review of the existing Subpart D and F System requirements (2c), there was no logical place where system requirements, in isolation from the airplane, would aid reducing rudder reversals. Even when the airplane response to a rudder doublet (FTHWG, see above) was considered, the group was unable to reach any conclusions regarding systems parameters which would make pilots less prone to making rudder pedal reversals. Hence, this recommendation contains no changes to Subpart D or F.

For this reason, the recommendation for changes to 14 CFR Part 25 contained herein is a change to Subpart C (Loads, 2a), largely because of the FCHWG's inability to determine reasonable and effective changes to the other subparts of 14 CFR Part 25.

The group discussed the possibility of including in the rule the allowance to use deterrent systems, including warning systems, to mitigate the severity of the loading condition defined in 25.353 or deter the pilot from making subsequent doublets. However, the rule cannot anticipate the various solutions that manufacturers might propose. Therefore, references to deterrent systems including warning systems were not included in the final proposal. Deterrent systems like warning systems could be used only as part an Equivalent Level of Safety request of a compliance demonstration to 25.353.

3. What is the optimal regulatory approach for addressing rudder usage (to include unintended rudder usage)?

   Answer:

   A design loads condition, described above, was determined to be the optimal regulatory approach. We found systems solutions to be too design prescriptive and were not able to define a handling qualities maneuverability parameter that would address the tasking.

4. What standards, including details for compliance demonstration and guidance, are recommended for new type certification applications?

   Answer:

   A new loads condition and accompanying advisory material are proposed as shown in Attachments B (the rule) and C (the AC).

   However, as noted above, Attachments B and C have not been unanimously accepted by the FCHWG. The three positions are documented in Positions 1, 2, and 3 under "Consensus and Dissenting Opinions."

5. Are there any regulations or guidance material that might conflict with the proposed standard?

   Answer:

   No such conflicts have been identified.

6. Does current technology exist to support implementation of the proposed standard?

   Answer:

   Yes.

7. What are the effects and implications of proposed standards and guidance relative to commonly used system designs? For example, would the new standard cause adverse interaction with currently used fly-by-wire flight control systems, stability augmentation or auto-flight systems or with current operations?

   Answer:

   Insufficient work has been done to adequately answer this question. It would depend on the aircraft configuration and control system. While some current airplane designs would be able to meet the proposed criteria (either the single doublet or the two doublet design load condition) without any changes, loads analyses conducted by the OEMs as part of the FCHWG deliberations suggest that manual control systems and hydro-mechanical control systems whereby pilot commands can negate the yaw damper would have more difficulty complying with this rule. However, there are manual or hydro-mechanical control system designs where pilots cannot negate yaw damper. Therefore, designs currently are available that could be used to support future airplane compliance with this rule.

8. Do the proposed standards present any issues relating to specific flight phases or environmental conditions? If so, what are they, and how should they be addressed?

   Answer:

   The proposed standard does not present any issues to specific flight phases or environmental conditions.

9. What recommended guidance material is needed?

   Answer:

   An AC has been drafted. See Attachment C.

10. After reviewing airworthiness, safety, cost, benefit, and other relevant factors, including recent certification and fleet experience, are there any additional considerations that should be taken into account?

    Answer:

    Additional training procedures have been recommended. See Attachment A.

11. Is coordination necessary with other harmonization working groups (e.g., Human Factors, Flight Test)?

    Answer:

    The Flight Test Harmonization Working Group (FTHWG) was contacted to provide assistance in defining key parameters that predict rudder system sensitivity and propensity for reversals. A representative of the FTHWG attended all FCHWG meetings. The FTHWG representative, and the FTHWG as a whole, evaluated a stylized rudder command profile and were unable to identify sensitivity parameters that would be useful for rulemaking. The FTHWG did accept a task to examine the doublets issue further. However, the schedule for this review was too far in the future to acceptably support the FCHWG tasking.

For Existing Transport Airplanes:

The report will address the following questions, considering existing transport airplane designs, and provide the rationale for their responses. Any disagreements should be documented, including the rationale from each party and the reasons for the disagreement.

1. What factors should be considered to determine if retrofit should be required?

   Answer:

   For existing transport airplanes, the FCHWG believes that retrofit should be considered on a case by case basis and that if any potentially unsafe conditions are found that they should be addressed using airworthiness directives. (Note: Several airplanes were reviewed as part of the FCHWG deliberations. None were found to have an unsafe condition.)

As described earlier in this report, the loads task group reviewed in-service events involving rudder reversals. The most severe fleet history events were used to guide the creation of a reasonable static strength condition to represent severe vertical stabilizer loading. A single doublet executed in the most likely flight conditions was considered appropriate because airplanes that can safely withstand a single full pedal travel doublet, can also withstand multiple shorter stroke doublets. The FCHWG believes that this level of protection is an acceptable standard for the in-service fleet. The single doublet maneuver and the resulting loads were analyzed for many models in the current fleet of commercial airplanes. For the models evaluated, the airframe loading did not exceed the design ultimate loads defined in the current FAR regulations. This analysis shows that current requirements provide adequate structural protection against a single pedal reversal in the most likely flight conditions.

Based on these findings, together with service history and training improvements, the FCHWG concludes that no further airworthiness review is necessary on those airplanes evaluated by the FCHWG.

2. For airplanes that require retrofit per the criteria, what differences should be considered from the standards and guidance developed for new transport airplanes?

   Answer:

   If the authorities determine on a case by case basis that an airplane requires retrofit, the FCHWG proposed that the criteria include safety margin to a single full-stroke doublet, the fleet history relative to reversals and control system characteristics that have been shown to deter or inhibit doublets (for example alerts). In particular, the comparison of yaw system architecture and lateral dynamic behavior of the concerned airplane with an already evaluated model could be sufficient to demonstrate its robustness to "doublets." If any loads analysis was deemed required, it would not be more severe than employing the same criteria that were used to evaluate the airplanes in the OEM review of this report.

3. What are the effects and implications of proposed retrofit standards and guidance for current system designs. For example, would the new standard cause adverse interaction with currently used fly-by-wire flight control systems, stability augmentation or auto-flight systems or with current operations?

   Answer:

   None.

4. After reviewing airworthiness, safety, cost, benefit, and other relevant factors, including recent certification and fleet experience, are there any additional considerations that should be taken into account?

   Answer:

   Consideration should be given to exempt certain existing fleets from further evaluation for retrofit. Models evaluated by the FCHWG or models with small and declining fleet size may be exempted from the evaluation described in Recommendation 3.

5. If improvements are needed to ensure safe rudder usage, what is the recommended method to mandate retrofit? (Ad hoc airworthiness directives, part 26 rules, etc.) In responding, the ARAC should address the factors set forth in “FAA Policy Statement: Safety-A Shared Responsibility-New Direction for Addressing Airworthiness Issues for Transport Airplanes” (70 FR 40166, July 12, 2005), and the ability of industry to provide necessary retrofit equipment that might be required.

   Answer:

   The FCHWG determined that the best approach would be to issue airworthiness directives as required on a case-by-case basis.

Consensus and Dissenting Opinions

Recommendation 2 - Proposed new regulation 25.353, which would apply to new transport airplanes.

The FCHWG could not reach consensus regarding changes to 14 CFR Part 25 (proposed new 14 CFR 25.353 design loads condition).

The proposed rule (designated as 25.353) would add a design ultimate load requirement that would consist of either a single full-stroke pedal doublet maneuver, or a two full-stroke pedal doublet maneuver. Five members are in favor of the single doublet condition, and five are in favor of the two doublet condition. This maneuver would be defined as either a full displacement input, followed by one reversal and return to neutral (single doublet condition); or a full displacement input, followed by three reversals and return to neutral (two doublet condition).

One FCHWG member believes that no change to the Subpart C maneuver requirements is necessary.

Position 1: No new loads condition is necessary, the existing Part 25 rules and enhanced crew training are sufficient.

Supported by FCHWG member(s): Boeing

Justification:

In service event data show, though very rare, that transport airplanes have experienced in-flight rudder reversals that were the result of inappropriate control use by the pilot. The ARAC Flight Controls Harmonization Working Group (FCHWG) was tasked (FR Doc. 2011-7180) to examine all 14 CFR part 25 sub-parts and to recommend a performance-based requirement that allows manufacturers the flexibility to design airplanes to meet their needs while ensuring airplane safety during this inappropriate rudder usage. The FAA finds it is necessary to revise the rules to ensure that airplanes are designed such that pilots will not (1) inappropriately make pedal reversals and/or (2) be capable of overloading the airframe. The FAA proposed a new flight maneuver load condition to 14 CFR Part 25, subpart C that will increase structural tolerance in the presence of rudder reversals and the associated buildup of sideslip angles.

The ARAC tasking notes five inappropriate rudder reversal events in the commercial airplane fleet, three of which produced loads that exceeded the ultimate structural design level. These rudder reversals occurred as a pilot response to a wake upset, or as a pilot input to apply lateral control in a stall recovery. In both cases, these applications of rudder do not meet the intended control use as defined by the airplane designers, nor do they meet the standard airmanship norms for commercial transport airplanes. Furthermore, the working group has determined that there is insufficient evidence that rudder reversals to counteract an upset are a common piloting error. Based on these findings we, The Boeing Company (TBC), do not believe it is reasonable to mandate consideration of this pilot action in the airworthiness standards.

The FCHWG Loads Sub-Group assessed the current commercial fleet’s tolerance to inappropriate rudder inputs by analyzing a representative loads condition that was based on the four high load events from the fleet history data. A single rudder doublet, for the typical mission flight points, was generated to benchmark the current commercial airplane fleet’s structural capability. The results of the rudder doublet evaluation showed that aircraft designed to the current structural FAR requirements provide adequate structural protection against the inappropriate rudder doublet. We, TBC, do not believe that multiple rudder reversal cycles should be considered as this would indicate a potential PIO/APC event which would be in conflict with the existing CFR part 25, subpart B standards. In sum, the Loads Sub-Group’s data analysis reinforces that there is not a widespread commercial fleet safety concern. Additionally, a rudder reversal event is extremely rare (10^{-8} per flight hour, CS 25.302) and therefore does not warrant an increased level of structural tolerance.

It is not feasible to prevent pilots from exceeding structural limits for all possible instances of excessive and inappropriate maneuvering. Rather, industry relies on training and basic airmanship to minimize the potential for severe maneuvers. In 2004, the FAA and industry partnered to revise the Airplane Upset Recovery Training Aid to emphasize that multiple full deflection, alternating flight control inputs are not necessary to control transport-category airplanes and, in 2005, the corresponding safety alerts for operators (SAFO) was issued. Improvements to pilot training for wake vortex recovery to ensure appropriate in-flight control response familiarity should be pursued as recommended by the FCHWG. The working group strongly recommends that more comprehensive pilot training be required regarding pilot use of rudder on transport category airplanes. Such training should involve a general academic module followed by a module dedicated to the aircraft design specificities. A simulator module or some simulator evaluation conditions may be proposed as a demonstrative tool.

The FCHWG has reviewed the five rudder reversal events cited in the FAA ARAC tasking and found that (1) the pilot actions in all cases did not conform to the industry norms in airmanship, (2) rudder doublets are a misuse of the rudder control, (3) the current structural standards provide tolerance in the nominal flight conditions for a full rudder doublet, and (4) rudder doublets are an extremely rare misuse of the rudder controls. After consideration of the data analysis performed in support of the tasking and the conclusions reached by the FCHWG, The Boeing Company feels that there is insufficient evidence to suggest that the current 14 CFR part 25 certification standards require modification to further protect against inappropriate use of rudder control. Improving commercial airplane safety, in light of the extremely rare and inappropriate rudder use found in the fleet, must focus on minimizing the potential for severe maneuvers through pilot training for wake vortex recovery.

Position 2: Section 14 CFR Part 25.353 should be adopted as shown in Attachment B, Version 1. This is the single doublet condition.

Supported by FCHWG member(s): Airbus, Bombardier, Cessna, Dassault, Embraer

Justification:

The single full-stroke rudder control doublet of proposed draft 14 CFR 25.353(a)(b)(c) (Version 1 single-doublet) is a sufficient design standard to provide additional protection against rudder control reversals. There is no need for requirements beyond the single-doublet. This position is based on:

- Crew training, and regulatory changes to AFMs, as a result of AA587 have highlighted what structural protections are/aren't afforded at V_A, and that only single-axis/single-input are protected. Crews are cautioned that making multiple large and alternating inputs may cause structural damage even at and below V_A.
- One of the factors related to AA587 (the airline's upset recovery training which encouraged and trained crews to use rudder to effect recovery) has ceased, and is now in-line with OEM recommendations for rudder usage.
- Notwithstanding the above, FCHWG seeks to further bolster crew awareness and understanding of rudder usage with the FCHWG's Training Recommendation. This Training Recommendation requires initial and recurrent crew training (academic, type-specific, and simulator where appropriate) in the areas of: difficulty in using rudder for precise control of bank, the significant delay from rudder input to roll rate development, why using rudder for wake recovery is unnecessary, ineffectiveness in using rudder pedals to damp Dutch roll, and an appreciation of the magnitude of empennage loads resulting from rudder reversals. These factors were pertinent in the accidents/incidents stated in FCHWG's tasking.

Further,

- Based on available service history data it appears that significant rudder reversal events are very rare, on the order of 10^{-8}/FH. While single rudder control doublets cannot be completely ruled out in the future, through adequate crew training and awareness multiple large rudder control doublets would be even rarer. Therefore, the more severe regulatory action regarding multiple full-stroke rudder control doublets (proposed draft 14 CFR 25.353(a)-(e) of Version 2) is unnecessary.
- The AA587 accident consisted of one full rudder pedal reversal, followed by a full wheel reversal with maximum rudder pedal displaced, followed by an additional full rudder pedal reversal. The pilot inputs which led to the AA587 accident were unique to that event and it is very rare that this series of inputs would be repeated. The complete series of pilot inputs was too rare, and too chaotic, to serve as a new design standard.
- The single full-stroke doublet of proposed draft 14 CFR 25.353(a)(b)(c) (Version 1) criteria and associated conditions are much more severe (i.e., extreme CG, extreme design weight, reversing the rudder control at the maximum overswing sideslips, large pedal forces, etc.) than typical operational lateral criteria and conditions.
- Codifying the single full-stroke rudder control doublet of proposed draft 14 CFR 25.353(a)(b)(c) (Version 1) ensures that all future designs, which may contain features which would lower the severity of the existing 14 CFR 25.351 (such as overspeed protection to limit the severity of the rudder kick at V_D, other load alleviation functions, etc.), would remain robust against a conservative single full-stroke rudder control doublet.
- FCHWG work shows that the conservative single full-stroke rudder control doublet provides protection against multiple reduced (but nevertheless significant) amplitude doublets, such as those experienced by AC190, AA903, and Interflug.
- Overly severe requirements for more than the single full-stroke rudder control doublet could result in applicants pursuing design solutions such as further restrictions on rudder authority, or additional systems, which could have unintended detrimental operational consequences. Furthermore, if more than the single full-stroke rudder control doublet criteria were applied to the existing Transport Category fleet, some models could find the criteria difficult to meet without significant design changes and penalties. Overly severe vertical tail loads could also result in increased vertical tail structure and aircraft weight, leading to increased fuel burn and environmental impact.
- Evaluating response to a single doublet would provide valuable information to systems designers which may lead to inclusion of beneficial design features (i.e., functions to limit the single doublet loads, which would be beneficial to multiple doublet loads as well).

In summary,

- Significant rudder control reversal events appear to be very rare, on the order of 10^{-8}/FH.
- Only one accident, AA587, has a unique pedal and control wheel activity, with erroneous training procedures. It should not serve as a design standard.
- The conservative single full-stroke rudder control doublet covers all other known incidents of multiple rudder control reversals investigated.
- For some types of aircraft, overly severe criteria, including multiple full-stroke doublets, would lead to structural strengthening, a weight penalty, and/or system changes that could be detrimental to normal operations.
- Enhanced training (as recommended by FCHWG) is the single most effective countermeasure to inappropriate rudder control reversals.
- In conclusion, the conservative single full-stroke rudder control doublet is sufficiently severe.

<u>The Position 2 Group's Understanding of the Other Alternate Positions</u>

One alternate position of the FCHWG's Final Report seeks to implement FCHWG's Training Recommendation, but make no changes to 14 CFR Part 25. In part, that position is based on rudder reversals and the accidents stated in the tasking being primarily related to crew training, and that prevention of future events is adequately served only by enhanced crew training and awareness on the appropriate use of the rudder.

The proponents of the single full-stroke pedal doublet criteria strongly agree that enhanced crew training per the FCHWG's Training Recommendation is a vital and necessary part of *any* solution regarding rudder reversals. We believe adding a conservative single full-stroke doublet for future designs would be useful for the following reasons: single rudder control doublet cannot be completely ruled out in the future, advancement of flight control features may result in future designs having less inherent tolerance for rudder control doublets (such as overspeed protection lessening the 14 CFR 25.351 loads at V_D, other load alleviation functions, etc.) without including codification regarding rudder control reversals in 14 CFR Part 25. For the reasons stated above, the single full-stroke rudder control doublet criteria of proposed draft 14 CFR 25.353(a)(b)(c) (Version 1) ensures that future designs remain robust against a conservative single full-stroke rudder control doublet, as well as multiple rudder control doublets of reduced amplitude.

Another alternate position of the FCHWG's Final Report seeks to implement a *multiple* full-stroke rudder control doublet criteria (i.e., proposed draft 14 CFR 25.353 (c) (d) and (e) of Version 2) *in addition* to the single full-stroke rudder control doublet criteria of proposed draft 14 CFR 25.353(a)(b) (Version 1 first steps). In part, that position is based on fully containing the load growth of additional full-stroke rudder doublets within 14 CFR Part 25.

Of the events stated in the FCHWG tasking, only AA587 experienced multiple full-stroke rudder reversals. However, the pilot's actions were likely influenced by the airline's specific upset recovery training which encouraged and trained crews to use rudder to effect recovery, counter to OEM recommendations. Since that airline's training program has ceased and is now in-line with OEM recommendations, the proponents of the single full-stroke pedal doublet criteria believe that it is very rare that this series of inputs would be repeated, especially with implementation of FCHWG's Training Recommendation further stressing appropriate rudder use and the unique characteristics in attempting to use rudder for roll control. Therefore, it is not appropriate to use this case to set a design standard. While the other events stated in FCHWG's tasking experienced multiple rudder reversals, they were of reduced amplitude, for which the single full-stroke rudder control doublet provides protection.

Furthermore, the multiple full-stroke rudder control doublet criteria of proposed draft 14 CFR 25.353 (a)-(e) (Version 2) could drive applicants towards designs such as further restrictions (or elimination in some flight phases) of rudder authority which could have unintended detrimental operational consequences. For some aircraft types, this would not be a low-cost effort since structural and/or systems changes will likely be required.

As the proposed multiple full-stroke rudder control doublet criteria of proposed draft 14 CFR 25.353 (a)-(e) (Version 2) is both unnecessarily severe and could lead to undesirable design solutions, the single full-stroke rudder control doublet of proposed draft 14 CFR 25.353(a)(b)(c) (Version 1) affords reasonable protections against both a conservative single full-stroke rudder control doublet, as well as multiple rudder control doublets of reduced amplitude as have been seen in service.

The presence of the conservative single full-stroke rudder control doublet in the regulations could force a design change on future aircraft that contain unforeseen load alleviation or other systems which might tend to reduce safety margins relative to the existing regulations.

Moreover, FAA having accepted similar multiple doublet criteria as a means of compliance to the Yaw Oscillations Generic Issue Paper on previous programs is not a valid reason, in and of itself, to codify that criteria.

Position 3: Section 14 CFR 25.353 should be adopted as shown in Attachment B, Version 2. This is the two doublet condition.

Supported by FCHWG member(s): ALPA, ANAC, EASA, FAA, Transport Canada

Justification:

- While multiple rudder reversals appear to be a very low probability event, they have been seen in service and cannot be ruled out in the future. Without knowing the root causes of the multiple rudder reversals that have occurred in service, a design loads condition is the only practical solution available at this time to address this safety concern.
- The proposed design criteria, including paragraphs (a)-(e) (Version 2), provide a practical, relatively low-cost solution that will be achievable on future designs

without the need for significant strengthening of the vertical tail, or significant changes to system design. In fact, some current airplanes would be able to meet these criteria with no changes whatsoever.

- Designs tolerant to multiple doublets have been used since the 1980s to no detriment, both hydro-mechanical and fly-by-wire. In that sense, the proposed rule reflects the current state of the art. In case of changes in future designs that may include load alleviation features or other changes, the design criteria should be upgraded to ensure these designs do not have a lower level of safety.
- The proposed criteria would be responsive to NTSB Safety Recommendation(s) A-04-056, and if adopted on a new airplane, would provide more capability to withstand an event like the AA587 event. The justification for this is qualitative. First, if the two doublet conditions were imposed, the manufacturer could use a system to mitigate pedal reversals by limiting sideslip to safe levels. Second, the AA587 reversals did not occur at the Dutch roll frequency and may not have occurred at the maximum overswing yaw. The proposed load conditions are conducted such that the reversals occur at the maximum over-swing condition. Therefore, the proposed load conditions would provide more capability to withstand an event like the AA587 event.
- It is noted that the second doublet would be applied with the aircraft at a non-zero condition (at a non-zero sideslip, etc.). This condition would more likely represent a pilot reaction to an unexpected upset (such as a wake turbulence encounter) than a single doublet that begins at a zero state initial condition. Therefore, the proposed two-doublet design condition would provide more capability to better withstand a potential pilot response to an unexpected external condition such as a wake turbulence encounter.
- If only a single doublet were included in the proposed criteria, with a safety factor of 1.0, this would not materially increase the design load level from current design loads criteria. This is evident in the table in Attachment E. There would be little benefit to proceed with a rule change (single doublet only) that has such modest effects.
- The pedal force specified in 25.353 (Version 1 and 2) is reduced from the levels in 25.351 to 200 pounds, recognizing that it would be difficult for a pilot to maintain a high level of force (300 lb up to V_C) while performing rapid alternating inputs. This reduction in pedal force would reduce the loads for airplanes with manual control systems.
- An issue paper addressing multiple doublets has been applied on recent programs that have complied with few technical or cost issues.

In a final attempt to reach consensus, there was discussion on a compromise in which the proposed 14 CFR 25.353 would specify two reversals rather than one reversal (Version 1) or three reversals (Version 2). After discussion, it became clear that no one was in favor of this compromise.

Summation of Economic Impact Associated with Proposed Rule Changes

As noted in the various positions, there is disagreement about the relative cost of a rule change to add either the one doublet or the two doublet design load requirement. Therefore, the OEMs agreed to qualitatively evaluate recently certified designs against both options. The results are shown in Attachment E.

Fourteen airplane models were qualitatively evaluated by the six manufacturers represented on the group. These models were evaluated to determine whether they would meet the proposed single doublet or two doublet condition. If unable to meet either condition, the OEM determined the percentage by which the loads of the proposed condition would exceed the certification design loads of the airplane. Further, if unable to meet either condition, the OEM estimated the recurring costs, non-recurring costs, and increase in fuel burn and emissions. Due to resource constraints and lack of a supporting staff-economist, these estimates are only given in general terms - High, Medium, Low, Negligible, or None.

For each model, the certification date is provided by decade. If the airplane is a derivative, then the original certification date of the airplane is also provided.

In general, Attachment E shows that advanced flight control architectures (FBW) are able to meet the proposed criteria, whereas some hydro-mechanical and manual control architectures cannot. In some cases, OEMs assumed the yaw damper was not operational for their loads analysis of the single doublet and the two doublet conditions. (See line 17 of the table.) However, the yaw damper probably would be considered operational according to the final versions of the proposed rule and advisory material. If the yaw damper were “unswampable” and assumed to be operational in those cases, the loads (and the costs) would likely decrease. The use of an unswampable yaw damper (YD) may be able to reduce the load levels for the single doublet to a “low” or “no” economic impact. However, it might not adequately reduce the large loads of the two-doublet condition to a “low” economic impact. It would depend on the YD authority to reduce pilot commanded side slip angles to safe limits and the cost to redesign these items. Also the use of a high authority YD would need to consider the ramifications of failures and reliability.

Attachment A – FCHWG Training Recommendation

The FCHWG recommends that more comprehensive pilot training be required regarding pilot use of rudder on transport category airplanes. This training should be continuous throughout a pilot's career, and include knowledge (academic) and skill training at the appropriate level. This recommendation should be reviewed by FAA AFS-210 and by industry groups that have recently focused on pilot training.

(Note: AC120-109 – "Stall and Stick Pusher Training" addresses appropriate rudder use during the stall regime consistent with FCHWG's training recommendation. Furthermore, AC120-109 may serve as a useful template for FCHWG's enhanced crew training regarding appropriate rudder use in other regimes.)

The appropriate use of all flight controls should be covered in a general academic module during licensing training, while the airplane specific requirements should be covered in Type Rating and Recurrent training. Academic Training is appropriate at both the Licensing and Type Rating/Recurrent levels. Current regulations and training requirements are in place to ensure this training requirement, and this recommendation serves to add specifics to the issue of rudder usage training. This training must involve a general academic module followed by a module dedicated to the aircraft design specificities.

If the OEM specifies the use of rudder in operational normal and/or non-normal procedures, such maneuvers must be incorporated in the Type Rating Training. A simulator training module should be used if a simulator can be used as a demonstrative tool with the guaranty that its limitations will prevent any negative transfer of training.

The general academic module should contain the following topics:

- Inherent airplane characteristics regarding roll and yaw coupling;
- The effect of wing sweep on roll response due to a rudder input;
- The effect of pilot use of rudder in an attempt to establish a specific bank angle, with emphasis on the delayed response of roll rate to pedal input;
- The effect of pilot use of rudder in an attempt to establish a specific heading (bank angle control remaining under the control of the ailerons);
- The effect of rudder reversals on empennage forces (empennage loads if "loads" are explained to the pilot) to include a rough order of magnitude of such forces on their aircraft;
- Dutch roll and accepted Dutch roll damping strategies, including an explanation of reasons why a pilot cannot damp efficiently the Dutch roll with the rudder pedals;

- The general use of the rudder pedals
    - yaw control during takeoff and landing, in particular with crosswinds,
    - engine failure,
    - turn coordination if aircraft not equipped with automatic turn coordination function,
    - yaw control with abnormal situation as part of recommended procedures,
    - asymmetric surface configuration as part of recommended procedures;
- The effect and danger of using rudder pedal during upset, wake turbulence and stall or approach to stall recovery (using rudder pedal is not recommended unless specified by the respective OEM).

The aircraft specific academic module should contain the following topics:

- Explanation of the rudder control system to include rudder limiting as a function of speed (i.e., variable lever arm type, travel limit unit type), pedal characteristics as a function of speed, yaw damper effects, and an auto coordination system if installed.
- Include a listing of what rudder usage is assumed in the design of the specified aircraft design for normal and abnormal configurations.
- Training in the use rudder for bank control when the type aircraft has an emergency /abnormal procedure that specifies this use.

The simulator module should contain the following topics, and be taught only if the simulator has been appropriately qualified and the instructor has been trained and standardized in accordance with OEM recommendations:

- Acquaint pilots with the pedal characteristics required to achieve increasing rudder deflections, up to the maximum, as a function of different speeds.
- A demonstration to show why large pilot rudder pedal inputs are not recommended for establishing a specified bank angle or heading. This demonstration will illustrate the delayed response of roll rate to pedal input which may lead to PIO and unwanted rudder pedal reversals.
- If a particular airplane type has a manufacturer recommended emergency/abnormal procedure that calls for use of the rudder to control the airplane (e.g., jammed ailerons, or manual reversion) then practice in such use is necessary in order to equip the pilot with the knowledge and experience to use the rudder with care in these situations.

Attachment B – Proposed New Regulation 25.353

Section 25.353 Rudder control reversal conditions
(Version 1 – Single Doublet Condition)

The airplane must be designed for loads, considered as ultimate, resulting from the yaw maneuver conditions specified in paragraphs (a) through (c) of this section from the highest airspeed for which it is possible to achieve maximum rudder deflection at zero sideslip or V_{MC} , whichever is greater, to V_C. These conditions are to be considered with the landing gear retracted and speed brakes (or spoilers when used as speed brakes) retracted. Flaps (or flaperons or any other aerodynamic devices when used as flaps) and slats extended configurations are also to be considered if they are used in en route conditions. Unbalanced aerodynamic moments about the center of gravity must be reacted in a rational or conservative manner considering the airplane inertia forces. In computing the tail loads the yawing velocity may be assumed to be zero. A pilot force of 200 pounds is assumed to be applied for all conditions.

(a) With the airplane in unaccelerated flight at zero yaw, it is assumed that the cockpit rudder control is displaced as specified in Sec. 25.351(a) and (b).

(b) With the airplane yawed to the overswing sideslip angle, it is assumed that the cockpit rudder control is suddenly displaced in the opposite direction.

(c) With the airplane yawed to the opposite overswing sideslip angle, it is assumed that the cockpit rudder control is suddenly returned to neutral.

Section 25.353 Rudder control reversal conditions
(Version 2 – Two Doublet Condition)

The airplane must be designed for loads, considered as ultimate, resulting from the yaw maneuver conditions specified in paragraphs (a) through (e) of this section from the highest airspeed for which it is possible to achieve maximum rudder deflection at zero sideslip or V_{MC} , whichever is greater, to V_C. These conditions are to be considered with the landing gear retracted and speed brakes (or spoilers when used as speed brakes) retracted. Flaps (or flaperons or any other aerodynamic devices when used as flaps) and slats extended configurations are also to be considered if they are used in en route conditions. Unbalanced aerodynamic moments about the center of gravity must be reacted in a rational or conservative manner considering the airplane inertia forces. In computing the tail loads the yawing velocity may be assumed to be zero. A pilot force of 200 pounds is assumed to be applied for all conditions.

(a) With the airplane in unaccelerated flight at zero yaw, it is assumed that the cockpit rudder control is displaced as specified in Sec. 25.351(a) and (b).

(b) With the airplane yawed to the overswing sideslip angle, it is assumed that the cockpit rudder control is suddenly displaced in the opposite direction.

(c) With the airplane yawed to the opposite overswing sideslip angle, it is assumed that the cockpit rudder control is suddenly displaced in the opposite direction.

(d) With the airplane yawed to the subsequent overswing sideslip angle, it is assumed that the cockpit rudder control is suddenly displaced in the opposite direction.

(e) With the airplane yawed to the opposite overswing sideslip angle, it is assumed that the cockpit rudder control is suddenly returned to neutral.

Attachment C – Proposed New Advisory Material

AC 25.353-X “Rudder Control Reversal Design Load Conditions”

1. Purpose. This advisory circular (AC) describes acceptable means for showing compliance with the requirements of Title 14, Code of Federal Regulations (14 CFR) 25.353, Rudder control reversal conditions. Section 25.353 specifies structural design load conditions that apply to the airframe, and that occur as a result of multiple rudder pedal inputs.

2. Applicability.

a. The guidance provided in this document is directed to airplane and engine manufacturers, modifiers, foreign regulatory authorities, and Federal Aviation Administration (FAA) transport airplane type certification engineers and their designees.

b. The material in this AC is neither mandatory nor regulatory in nature and does not constitute a regulation. While these guidelines are not mandatory, they are derived from extensive FAA and industry experience in determining compliance with the relevant regulations. These means are issued, in the interest of standardization, for guidance purposes and to outline a method that has been found acceptable in showing compliance with the standards set forth in the rule. If, however, we become aware of circumstances that convince us that following this AC would not result in compliance with the applicable regulations, we will not be bound by the terms of this AC, and we may require additional substantiation or design changes as a basis for finding compliance.

c. The material in this AC does not change or create any additional regulatory requirements, nor does it authorize changes in, or permit deviations from, existing regulatory requirements.

d. Except in the explanations of what the regulations require, the term “must” is used in this AC only in the sense of ensuring applicability of this particular method of compliance when the acceptable method of compliance described in this AC is used.

3. Related 14 CFR Regulations.

a. Section 25.351, *Yaw maneuver conditions*.

b. Section 25.353, *Rudder control reversal conditions*.

4. Background.

a. Requirements. Sections 25.351, *Yaw maneuver conditions*, and 25.353, *Rudder control reversal conditions*, specify structural design load conditions that occur as a result of rudder pedal inputs. These conditions are intended to encompass all of the rudder maneuver loads expected to occur in service.

b. Section 25.351 – Yaw maneuver conditions. Section 25.351 was established when 14 CFR part 25 was adopted in 1965, and has been modified several times since then. The design load conditions specified in § 25.351 are considered limit load conditions, and a 1.5 factor of safety is applied to obtain ultimate loads.

c. Section 25.353 – Rudder control reversal conditions. Section 25.353 was established at Amendment 25-XX. The design load conditions specified in § 25.353 are more severe than those in § 25.351 and include rudder control reversals. These conditions are anticipated to occur very rarely, and so these are considered ultimate load conditions, and no additional safety factor is applied.

5. Application of the requirements.

a. General

(1) The airplane must be designed for the rudder control reversal load conditions specified in § 25.353. These are considered ultimate load conditions and, therefore, no additional factor of safety is applied. However, any permanent deformation resulting from these ultimate load conditions must not prevent continued safe flight and landing.

(2) Design loads must be determined as specified in § 25.321. The load conditions are considered from the maximum airspeed for which it is possible to achieve full rudder deflection at zero sideslip or V_{MC}, whichever is greater, to V_C. A pilot force of 200 pounds is assumed to be applied for all conditions. These conditions are to be considered with the landing gear retracted and speed brakes (or spoilers when used as speed brakes) retracted. Flaps (or flaperons or any other aerodynamic devices when used as flaps) and slats-extended configurations are also to be considered if they are used in en route conditions.

(3) System effects. System effects should be taken into account in the evaluation of this maneuver. For example, fly-by-wire aircraft should be analyzed assuming the airplane is in the normal control law mode. Any system function used to demonstrate compliance with these requirements should meet the following criteria:

(a) The system is typically operative during flight in accordance with the airplane flight manual procedures; and

(b) Appropriate crew procedures should be provided in the event of loss of function. If loss of system function would not be detected by the crew, the probability of loss of function (failure rate multiplied by maximum exposure period) should be less than 1/1000.

(4) Failure conditions. Due to the very low probability of a full rudder doublet event, failure scenarios do not need to be addressed in combination with the rudder control reversal conditions specified in § 25.353.

[The proposed rule (designated as 25.353) would add a design ultimate load requirement that would consist of either a single rudder doublet maneuver, or a two doublet maneuver. Five members are in favor of the single doublet condition, and five are in favor of the two

doublet condition. The single doublet condition is defined in the FCHWG report as Version 1, and the two doublet condition as Version 2. The following section b. would depend on what is included in the final rule. Differences are highlighted in blue.]

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b. Section 25.353(a) through (c) [Version 1 of proposed rule – single doublet condition]

(1) Conditions 25.353(a) through (c) are intended as a full displacement pedal input followed by a pedal reversal and return to neutral. Speed should be kept reasonably constant throughout the maneuver using pitch control.

(2) With the airplane in unaccelerated flight at zero yaw, it is assumed that the cockpit rudder control is suddenly displaced to achieve the resulting rudder deflection. In this context, "suddenly" means as fast as possible within human and system limitations. In the absence of a rational analysis, initial pedal displacement is achieved in no more than 0.2 seconds, and full rudder control reversal displacement is achieved in 0.4 seconds. Alternatively, the applicant may assume the rudder pedal is displaced instantaneously.

(3) The resulting rudder displacement should take into account additional displacement caused by sideslip build-up, and the effects of flexibility should be considered when relevant.

(4) As soon as the maximum overswing yaw angle is achieved, full opposite rudder pedal input is applied. The achieved rudder deflection may be limited by control laws, system architecture, or air loads, and may not be the same magnitude as the initial rudder deflection prior to the pedal reversal. For critically damped aircraft response, maximum overswing yaw angle may be assumed to occur when the sideslip angle is substantially stabilized.

(5) The airplane yaws to the opposite overswing yaw angle. As soon as this point is reached, the cockpit rudder control is suddenly returned to neutral.

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b. Section 25.353(a) through (e) [Version 2 of proposed rule – two doublet condition]

(1) Conditions 25.353(a) through (e) are intended as a full displacement pedal input followed by three pedal reversals and return to neutral. Speed should be kept reasonably constant throughout the maneuver using pitch control.

(2) With the airplane in unaccelerated flight at zero yaw, it is assumed that the cockpit rudder control is suddenly displaced to achieve the resulting rudder deflection. In this context, "suddenly" means as fast as possible within human and system limitations. In the absence of a rational analysis, initial pedal displacement is achieved in no more than 0.2 seconds, and full rudder control reversal displacement is achieved in 0.4 seconds. Alternatively, the applicant may assume the rudder pedal is displaced instantaneously.

(3) The resulting rudder displacement should take into account additional displacement caused by sideslip build-up, and the effects of flexibility should be considered when relevant.

(4) As soon as the maximum overswing yaw angle is achieved, full opposite rudder pedal input is applied. The achieved rudder deflection may be limited by control laws, system architecture, or air loads, and may not be the same magnitude as the initial rudder deflection prior to the pedal reversal. For critically damped aircraft response, maximum overswing yaw angle may be assumed to occur when the sideslip angle is substantially stabilized.

(5) Two additional reversals are performed as defined in (4). After the second reversal, as soon as the airplane yaws to the opposite overswing yaw angle, the cockpit rudder control is suddenly returned to neutral.

Attachment D – Summary Report Following FCHWG Review of FAA-Sponsored Studies

Summary report following the analysis of:

1) Hess, Ronald A., "Rudder Control Strategies and Force/Feel System Designs in Transport Aircraft," Journal of Guidance Control and Dynamics, Vol. 28, No. 6, Nov-Dec. 2005.
2) Stewart, Eric C., "A Piloted Simulator Evaluation of Transport Aircraft Rudder Pedal Force/feel Characteristics," NASA/TP-2008-215109, January 2008.

3a) Hoh, Roger H., et al, "Piloted Simulation Study to Develop Transport Aircraft Rudder Control System Requirements Phase 1: Simulator Motion System Requirements and Initial Results," DOT/FAA/AR-09/5, March 2009.

3b) Hoh, Roger H., et al, "Piloted Simulation Study to Develop Transport Aircraft Rudder Control System Requirements Phase 2: Develop criteria for rudder overcontrol," DOT/FAA/AR-10/17, November 2010.

Introduction: The FAA tasking statement for the Flight Control Harmonization Working Group regarding rudder pedal sensitivity/reversal referenced the 3 documents above. The research behind these documents was sponsored by the FAA and NASA. The purpose of these reports was to try to determine parameters that most significantly affect handling qualities (HQ) associated with rudder usage and to try to determine characteristics that might predict or prevent over control; particularly pedal reversals or doublets. To support responding to the tasking statement, all the above documents were reviewed by the FCHWG members. Each of them has been subject to a group analysis. The group found that for various reasons these studies were of limited value. The various comments and conclusions have been recorded in the minutes of the relevant meetings. They are summarized here:

1) Hess document:

Based on the notion that linearity in a control system is most predictable for a pilot, Hess developed an "index" by which to judge the linearity of a rudder control system. The linearity index included parameters such as force gradient, breakout force and available travel. The linearity index presented in this study, while perhaps having some merit on its own as a measure of linearity, was not found to correlate well with measured pilot opinion. The group found that breakout force, a factor in nonlinearity, is necessary for good centering of powered flight controls and for a grounding point for yaw damping and autopilot control. Using the linearity index might lead to a low breakout force that would result in a good linearity index rating but poor system performance. The applicability of the pure math model used in the analysis was a concern. But it was beyond the scope of our group to fully address. Ultimately, we felt that these studies might be useful for design consideration. But, this data was not useful for fulfilling the tasking.

2) Stewart Document:

Stewart identified critical variables in rudder control system design such as breakout force, max travel force and pedal travel. He generated two equations; one to predict good handling qualities relative to rudder usage and one to predict potential for pedal reversals. He used the NASA Langley simulator, and conducted numerous piloted simulations. The results of this study showed weak correlation between HQ and maximum pedal force and breakout force. The same weak correlation was shown for potential reversals (PR). But his data showed a strong correlation between HQ and PR with longer pedal travels. Based on the Stewart study the group could conclude that pedal travel was a potential predictor of handling qualities and PR. But again it did not provide a performance based method by which to assess the adequacy of airplane HQ or PR. Additionally, there were concerns with the test methodology. These include 1. The cab was fixed base so the effect of motion could not be determined, 2. The subjects were line pilots not formally trained in handling qualities assessments, and 3. The test scenarios included only low speed visual conditions (landing); there may be different results for the higher speed conditions that generated the FCHWG tasking. For these reasons we consider the data to have limited value to our tasking. The case of unusual use of rudder pedals at high speed, without a runway in sight is not addressed at all by this experiment. At the end, this study was deemed to not provide an effective discriminator to address the FCHWG tasking.

<u>3a) & 3b) Hoh documents:</u>
In these studies Hoh too tried to determine a key characteristic that would predict good HQ and low PR. Hoh conducted their study in the NASA Ames Vertical Motion Simulator. It was selected as it could provide a reasonable level of Ny. This study too included performing numerous piloted simulations. The results of the simulations were similar to Stewart in low altitude VFR scenario, that longer pedal throws predict better HQ and lower PR and that breakout and gradient forces were less critical. However, the statistical meaning of the results was a major concern. For example the standard deviation of one parameter was found to be roughly equal to the mean.

Hoh found the yaw damper tended to reduce fin loads and was therefore beneficial.

Unlike Hess and Stewart, Hoh used mostly flight test pilots (11) in the study including two OEM test pilots. The way the experiment was conducted was criticized by the two OEM pilots who participated in the exercise. The two OEM test pilots felt the Ny was too low and not representative of a real airplane. They felt that higher Ny might have resulted in less aggressive pedal usage. Subsequently, Hoh raised the level of Ny in a few simulator tests and concluded that it didn’t significantly change the HQ. Again the results showed value in longer pedal travel (again the statistical meaning of the results is highly questionable because the standard deviation was roughly equal to the mean value) and lower loads with yaw damper. However, he did not provide a flight test methodology to assess handling qualities that seemed adequate to address the tasking

<u>Conclusion:</u> The three studies provide insight into the level of difficulty to try to assess a control that is not designed to be used very often, and almost never at higher speeds. All the piloted studies had to provide somewhat artificial circumstances to ensure the pilots would interact with pedals. This led to issues of how realistic the scenarios were and the capability of the simulator and called into question the data produced. Ultimately, the FCHWG did not find in the above documents material directly relevant and useful to address the tasks given to the FCHWG.

Attachment E – Economic Impact Assessment for Proposed Rule Changes

Top-Level "Simplified" Economic Analysis of Proposed Doublet(s) Criteria

For a given airplane model or models that have been recently certified, evaluate the loads for the single doublet condition in ARAC Final Report Attachment B Version 1, 25.353(a)-(c), and also the two doublet condition in Version 2, 25.353(a)-(e).
For the single doublet and the two doublet condition, use a 200 pound pedal force at all speeds.
Compare the resulting doublet load levels to the design ultimate load levels for that airplane (vertical tail side of body bending moment).
Provide rough cost estimates. Results may include rough cost numbers or qualitative values such as low, medium and high.

	OEM ->>														
	Proposed Criteria ->>	**1-Doublet**	**2-Doublet**	**1-Doublet**	**2-Doublet**	**1-Doublet**	**2-Doublet**	**1-Doublet**	**2-Doublet**	**1-Doublet**	**2-Doublet**	**1-Doublet**	**2-Doublet**	**1-Doublet**	**2-Doublet**
Assumptions	Decade of Certification?	'10+		'00-'09		'90-'99		'90-'99		'10+		'00-'09		'10+	
	If a derivative model, what is the decade of the *original* Certification?	'90-'99		original TC		'90-'99		original TC		'70-'79		'90-'99		'90-'99	
	Would the design meet proposed one/two doublet criteria without any modifications?	No	No	No	No	No	No	Yes	No	Yes	No	Yes	No	Yes	No
	If unable to meet proposed criteria, what percentage does the one/two doublet condition loads exceed the design ultimate loads (VT tail side of body bending moment)?	29%	88%	3%	35%	20%	67%	---	27%	---	25%	---	22%	1%	10%
	Is the design maneuver-load critical (i.e., not gust-critical) under current FARs?	Yes	Yes	Yes	Yes			No	No					No	No
	Type of Flight Control System architecture?	Manual	Manual	Manual	Manual	Hyr-Mech	Hyr-Mech	Hyr-Mech	Hyr-Mech	Hyr-Mech	Hyr-Mech	Hyr-Mech	Hyr-Mech	Hyr-Mech	Hyr-Mech
	Was Yaw Damper function assumed operational in these loads calculations?	No	No	No	No	No	No	Yes	Yes	Yes	Yes	No	No	No	No
	Is the Yaw Damper unswampable?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No
	Assumed design solution for complying with doublet(s) criteria: (Note: other solutions may be possible, but were not fully vetted for this evaluation.)	Structural	Structural	Structural	Structural	Structural	Structural		Structural		Structural		Structural		Structural
Non-Recurring Costs to the Manufacturer		7 - High	7 - High	1 - Negl.	7 - High	5 - Med	7 - High	3 - Low	5 - Med	3 - Low	3 - Low	3 - Low	5 - Med	1 - Negl.	3 - Low
Recurring Costs to the Manufacturer		7 - High	7 - High	1 - Negl.	7 - High	5 - Med	7 - High	0 - None	5 - Med	0 - None	7 - High	3 - Low	5 - Med	1 - Negl.	5 - Med
Increase in Fuel Burn/Emissions?		5 - Med	7 - High	1 - Negl.	7 - High	3 - Low	5 - Med	0 - None	5 - Med	0 - None	3 - Low	0 - None	3 - Low	1 - Negl.	3 - Low
	GRAND TOTAL	**19.0**	**21.0**	**3.0**	**21.0**	**13.0**	**19.0**	**3.0**	**15.0**	**3.0**	**13.0**	**6.0**	**13.0**	**3.0**	**11.0**
	AVERAGE	**6.3**	**7.0**	**1.0**	**7.0**	**4.3**	**6.3**	**1.0**	**5.0**	**1.0**	**4.3**	**2.0**	**4.3**	**1.0**	**3.7**

	OEM ->>														
	Proposed Criteria ->>	**1-Doublet**	**2-Doublet**	**1-Doublet**	**2-Doublet**	**1-Doublet**	**2-Doublet**	**1-Doublet**	**2-Doublet**	**1-Doublet**	**2-Doublet**	**1-Doublet**	**2-Doublet**	**1-Doublet**	**2-Doublet**
Assumptions	Decade of Certification?	'80-'89		'00-'09		'10+		'00-'09		'10+		'00-'09		'00-'09	
	If a derivative model, what is the decade of the *original* Certification?	original TC		'00-'09		original TC		'80-'89		original TC		original TC		original TC	
	Would the design meet proposed one/two doublet criteria without any modifications?	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	If unable to meet proposed criteria, what percentage does the one/two doublet condition loads exceed the design ultimate loads (VT tail side of body bending moment)?	---	---	---	15%	---	1%	---	---	---	---	---	---	---	---
	Is the design maneuver-load critical (i.e., not gust-critical) under current FARs?	Yes	Yes	No	No					No	No	Yes	Yes	No	No
	Type of Flight Control System architecture?	Hyr-Mech	Hyr-Mech	FBW	FBW	FBW	FBW	FBW	FBW	FBW	FBW	FBW	FBW	FBW	FBW
	Was Yaw Damper function assumed operational in these loads calculations?	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Is the Yaw Damper unswampable?	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Assumed design solution for complying with doublet(s) criteria: (Note: other solutions may be possible, but were not fully vetted for this evaluation.)		Warning		System										
	Estimated years of production run:														
	Average production/units per year:														
	Average annual flight hours per unit:														
	Total Fleet Size (CALC'D):	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total Fleet Flighthours at End of Production Run (CALC'D):	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non-Recurring Costs to the Manufacturer		1 - Negl.	5 - Med	1 - Negl.	3 - Low	3 - Low	3 - Low	3 - Low	3 - Low	1 - Negl.	1 - Negl.	1 - Negl.	1 - Negl.	1 - Negl.	1 - Negl.
Recurring Costs to the Manufacturer		0 - None	1 - Negl.	1 - Negl.	1 - Negl.	0 - None	3 - Low	0 - None	0 - None	1 - Negl.	1 - Negl.	1 - Negl.	1 - Negl.	0 - None	0 - None
Increase in Fuel Burn/Emissions?		0 - None	0 - None	0 - None	0 - None	0 - None	0 - None	0 - None	0 - None	0 - None	0 - None	0 - None	0 - None	0 - None	0 - None
	GRAND TOTAL	**1.0**	**6.0**	**2.0**	**4.0**	**3.0**	**6.0**	**3.0**	**3.0**	**2.0**	**2.0**	**2.0**	**2.0**	**1.0**	**1.0**
	AVERAGE	**0.3**	**2.0**	**0.7**	**1.3**	**1.0**	**2.0**	**1.0**	**1.0**	**0.7**	**0.7**	**0.7**	**0.7**	**0.3**	**0.3**

Attachment F – Upset Events

Some of the events described in the tasking and in the Background section of this report are described in detail in the following investigation reports.

1. NTSB/AAR-0404 - In-Flight Separation of Vertical Stabilizer
   American Airlines Flight 587
   Airbus Industrie A300-605R, N15043
   Belle Harbor, New York
   November 12, 2001
   * Also includes information Miami Flight 903 and Interflug event

2. TSB A08W0007 - Encounter with Wake Turbulence
   Air Canada (Flight AC 190)
   Airbus A319-114 C-GBHZ
   Washington State, United States
   10 January 2008

3. TSB LP007/2008 - Engineering Report – FDR Analysis
   Air Canada (Flight AC 190) Airbus A319-100, C-GBHZ
   Washington State, United States
   Occurrence Date: 10-Jan-08

4. TSB A05A0059 - Stall and Loss of Control during Climb
   Provincial Airlines Limited
   De Havilland DHC-8-100 C-GZKH
   St. John's, Newfoundland and Labrador
   27 May 2005

Attachment G - Working Group Membership List

Original Working Group	Organization	Expertise
Greg Anderson	Cessna	Flight Dynamics
Dominique Chatrenet (co-chair)	Airbus	Flight Controls
Bill de Groh	ALPA	Flight Operations
Barry Hance (co-chair)	Boeing	Flight Controls
Robert Jones (sponsor)	FAA	Flight Controls
Stéphanie Lalonde	TCCA	Hydromechanical
Tony Linsdell	Bombardier	Structures/Loads
Didier Poisson	EASA	Flight Test
Nadine Polano	EASA	Flight Controls
Gerard Menard	Dassault	Structures/Loads
Marco Coccolin	Embraer	Structures/Loads
Luiz Jether de Holandino Vasconcelos	ANAC	Flight Test
Additional Support	**Organization**	**Expertise**
Philippe Eichel	Dassault	Flight Controls
Kyle Ford	Boeing	Structures/Loads
Jack Grabowski	TCCA	Structures/Loads
Laurent Lapierre	Airbus	Flight Test
Brian Lee	Boeing	Handling Qualities
Todd Martin	FAA	Structures/Loads
Muriel Pouzargue	Dassault	Structures/Loads
George Zografos	EASA	Structures/Loads

Attachment H – FTHWG Report on Rudder Control Sensitivity

Please view this document at the link below. Access to this link may not be publically available at this time. This document will soon be moved to an FAA site, and the link will be updated as needed to ensure it remains accessible.

Analysis_by_FTHWG_for_FCHWG_2013.pdf

TAE November 13, 2013

AAWG Report

AAWG Members

Manufacturers
Airbus
Boeing (Co-Chair)
Embraer
Lockheed-Martin
Bombardier
Regulators
FAA
TC
EASA
ANAC

Operators
AAL
ABX
ANA
BAB
CAL
DAL
FDX (Co-Chair)
JAL
LYC
UAL
UPS
USA
SWA
KLM*
DLH*

Growing industry representation

*observers

AAWG Report to TAE

- Last AAWG meeting April 22-23
- No meeting since last report to TAE
  - Monthly co-chair meetings to monitor progress on action items
- Next meeting scheduled for December 10-11 at Boeing office in Washington D.C.
  - Proposed agenda items:
    - STG reports outs
    - Status/review of open actions
      - Sub-team status report on Replaceable Structural Component (RSC) utilization -develop industry solutions necessary to obtain & establish utilization history for RSC when it can not be shown to be the same as the basic airframe.
      - Sub-team proposal for update to STG guidelines
      - Co-chairs recommendation for response to MPIG request on CPCP level one corrosion definition
      - AAWG input to 2003 General Structures Harmonization Working Group recommended changes to 14 CFR 25.571.
    - EASA NPA status
    - Future of AAWG

Current AAWG Action Items

- AI 4.13.1 - Question on undefined Damage Tolerance requirements beyond the Limit of Validity
  - Action Closed - Part of RSC Discussion in AI 4.13.3
- AI 4.13.2 - Is FCAS/FCBS required for new STC/FCBS?
  - Action Closed - Greg Schneider, FAA, does not intend to release a new rule at this time

Agenda Topics for the December 10-11 AAWG Meeting in Washington, DC

- AI 4.13.3 - Rotable Structural Components action
  - Boeing is leading an industry group to provide an RSC definition and a proposal for tracking utilization of applicable components
- AI 4.13.4 – Corrosion Prevention & Control Program (CPCP)
  - Boeing will present a level 1 corrosion definition at the December AAWG meeting
  - Additional discussion will take place to determine if AAWG should define level 2 and 3 corrosion
- AI 4.13.5 - Review and provide an update to the Structures Task Group Guidelines Document
  - Boeing is leading an industry team to update the guidelines
- AI 4.13.6 - Develop a proposal for future AAWG tasking and present to TAE
  - Meeting to be held on 11/13/2013
- AI 4.13.7 - FAA request for 25.571 review of 2003 recommendation
  - The FAA has received input from Airbus, Boeing, Bombardier, Japan Airlines, Lockheed & US Airways
- AI 9.11.14 – re-opened action on "Reconsideration of items listed in AC 25.571-1D
  - No further action is needed, close this action after discussion at the December AAWG meeting

Work will continue for the AAWG in the short to medium term with no incremental tasking

EHWG Status Update
Bird Ingestion Requirements Development Working Group

November, 2013

Co-Chairs: Chris Demers, Les McVey

BIRD EHWG ARAC Task

Objective is to evaluate whether the requirements for small and medium bird core ingestion and the large flocking bird requirements for Class “D” engines ($1.35m^2$-$2.5m^2$ inlet areas) should be revised. Identify any deficiencies in the current rule, and provide the FAA with recommendations for changes, as appropriate, by March 31, 2015.

Specific Tasks:

1) Evaluate the core ingestion element for small and medium birds, and consider the large flocking bird threat in this assessment.
2) Evaluate large flocking bird requirements for Class “D” engines.
3) Consider the NTSB’s two bird ingestion related safety recommendations from the USAir 1549 investigation.
4) Define an industry process for periodic update and review of engine bird ingestion data.

Work Schedule

1st Meeting June 18-19, 2013 at FAA Offices in Burlington, MA

Developed work plan & schedule, held preliminary discussions.

- Prioritized ARAC tasks :

  1 - Work core ingestion test adequacy

  2 - LFB ingestion applicability for the smaller inlet class

  3 – Future strike database update frequency and ownership

- Quarterly meetings at locations TBD, shared amongst member work locations.
  - Monthly webex/telcons to keep work on track, more often if needed.

- Work plan forwarded to TAE for approval after meeting.

Work Schedule

2nd Meeting Sept. 25-26, 2013 in Toulouse hosted by Airbus.

Progress was made on core ingestion elements of tasks, discussions centered around perceived deficiencies in the current rule & advisory material for core ingestion by comparing field events to certification demonstrations.

The WG considered what options for improvement are available to address various phases of flight, and whether a new certification test is necessary – or whether new certification design requirements or guidance would be adequate.

3rd Meeting scheduled Dec. 11-12, 2013 at FAA Offices in Burlington, MA

- Will continue work on core ingestion
- Begin to address Large Flocking Bird requirements into Medium thrust class engines under task 2

Continuing to hold monthly webex/telcon to address action items from meetings and keep work progressing.

Additional Info

(from May TAE mtg.)

ARAC TAE Engine Harmonization Working Group

Task: Engine Bird Ingestion Requirements

ARAC accepted a new task to review and assess the standards and advisory material for bird ingestion requirements.

An EHWG Subcommittee has been formed with members (15) selected from across industry

The Working Group will use the Aerospace Industries Association engine bird ingestion database which was recently updated in coordination with FAA and the EASA in response to the US Air Flight 1549 Hudson River accident in January 2009 and the related NTSB safety recommendations.

The final report will include a summary of the overall work scope, conclusions and rationale for all recommendations related to the tasks.

Required completion is no later than March 31, 2015.

ARAC TAE EHWG Engine Bird Ingestion

Working Group Members:

Alan Strom (FAA-ANE Standards) FAA Representative

Les McVey (GE Aviation) WG Co-Chair

Chris Demers (Pratt & Whitney) WG Co-Chair

Angus Abrams (EASA)

Amy Anderson (FAA-Airports)

John Barton (SNECMA)

Mark Beauregard (Pratt & Whitney Canada)

Walter Drew (Airbus Industries)

Tom Dwier (Cessna)

Ken Knopp (FAA)

Brian Lesko (Air Line Pilots Association)

Dr. Julian Reed (Rolls Royce)

Russ Repp (Honeywell)

Terry Tritz (Boeing)

DC Yuh (Transport Canada)

ARAC TAE EHWG Engine Bird Ingestion

Task 1

Evaluate the core ingestion element of small and medium bird requirements to determine if the intended safety objective of the current rule is adequate. Consider the threat from large flocking bird species in this assessment. Identify any deficiencies in the current rule, and provide the FAA with recommendations for changes as appropriate.

Task 3 - Related NTSB recommendations

A-10-65 (Part 2) During the bird-ingestion rulemaking database (BRDB) working group's reevaluation of the current engine bird-ingestion certification regulations, specifically reevaluate the 14 Code of Federal Regulations (CFR) 33.76(d) large flocking bird certification test standards to determine whether they should ……include a requirement for engine core ingestion.

A-10-64 Modify the 14 Code of Federal Regulations 33.76(c) small and medium flocking bird certification test standard to require that the test be conducted using the lowest expected fan speed, instead of 100-percent fan speed, for the minimum climb rate.

ARAC TAE EHWG Engine Bird Ingestion

Task 2

Evaluate large flocking bird requirements, to determine the need for new large flocking bird requirements, or advisory material, or both, for Class D engines (1.35m2–2.5m2 inlet areas). Identify any deficiencies of the current rule, and provide the FAA with recommendations for changes as appropriate.

Task 3 - Related NTSB recommendation

A-10-65 (Part 1) During the bird-ingestion rulemaking database (BRDB) working group's reevaluation of the current engine bird-ingestion certification regulations, specifically reevaluate the 14 Code of Federal Regulations (CFR) 33.76(d) large flocking bird certification test standards to determine whether they should apply to engines with an inlet area of less than 3,875 square inches (2.5m2)

Task 4

Define an industry led process for periodic update and review of engine bird ingestion data, such that industry and the authorities can maintain an awareness of the bird threat experienced in service.

Flight Test Harmonization Working Group Status

Transport Airplane Performance and Handling Characteristics—New Task

November 13, 2013

Bob Park and Christine Thibaudat

Topics

- Task Definition
- FTHWG Schedule
- Second Meeting Results
- Plan for Completing Recommendations
- Flight Test HWG Members

Task Definition

- The FAA tasked ARAC to consider several areas within the airplane performance and handling qualities requirements of the 14 CFR part 25 airworthiness standards and guidance for possible revision
- The task includes prioritizing the list of topic areas provided in this notice based on prioritization criteria established by the FTHWG
- The prioritization criteria should consider harmonization of regulatory requirements and associated guidance material for airworthiness certification of airplane designs
- Recommendations may result in subsequent ARAC taskings for standards recommendations in follow-on phases
- ARAC may also recommend additional topics in the general area of airplane performance and handling qualities that are not on the list provided in the notice
- The working group will provide a draft report to ARAC recommending focus areas and work plans to address those areas the FTHWG identified as high priorities for airworthiness standards development relative to new airplane designs

FTHWG Schedule

- ARAC tasking published in Federal Register on March 8
- Formal team selection started April 5
- First meeting (FTHWG-29) was held May 22-24 at the Boeing Longacres site
- Work plan was developed and was accepted by ARAC June 26
- Second meeting (FTHWG-30) was held September 10-12 at the Embraer site in Melbourne, Florida (details next slide)
- Next meeting scheduled in November has been cancelled
- Remaining work is being coordinated via email and using the FAA’s FTHWG SharePoint
- Task completion date is nominally December 8, 2013

Second Meeting Results

- Draft work plans were reviewed and modified for the fifteen high priority focus tasks identified during FTHWG-29
- Action items call for additional post-meeting work plan activity
- The FAA identified four of the high priority focus tasks which they no longer need work plans for (they are preparing NPRMs)
- An additional high priority focus task was identified – HQRM and Failure Assessment Methodology for Handling Qualities and Performance Classification (Action item to develop work plan)
- EASA requested an additional sub-task to define a new Part 25 wet runway landing distance rule (wet runway overrun topic)
- A sequencing activity resulted in a proposal that five subteams with appropriate SMEs would be required to accomplish the remaining 12 high priority tasks over a period of three years

Plan for Completing Recommendations

- There were thirty four action items identified during FTHWG-30
- Five of the action items were completed during the meeting
- Substantial progress has been made on many of the others
- However, the almost two week FAA furlough did cause delays which will affect the December 8 completion date
- Still required:
  - A proposed alternate sequencing plan is being evaluated
  - All action items to be completed including finalizing work plans
  - Any significantly changed work plans must be reviewed by WG
  - Working Group draft report to be written and reviewed by FTH members
- Considering furlough plus holiday schedules, expect WG report will be sent to ARAC TAE Subcommittee by mid-January 2014.

Flight Test HWG Members

Organization	Member(s)	Expertise
Airbus	Christine Thibaudat (co-chair) *Laurent Capra / Dominique Chatrenet (Alt)	Flight, Propulsion, Icing Certification HQ and Flight Control Laws / Flight Controls Executive Expert
ALPA	*Chad Balentine	Sr. Staff Engineer, Engineering & Operations
American Airlines	*Ernie Tangren	Performance Engineer
ANAC	*Diego Muniz Benedetti / Luiz Jether (Alt)	Performance and Flight Qualities
Boeing	Robert Park (co-chair) *Brian Lee	Aerodynamics ATF and Sr. AR Advisor Handling Qualities
Bombardier	*Hany Sadek Mike Hinson / Brent Storrer (Alt)	Senior Engineering Advisor Aero - Flight Sciences Engineer / Pilot
Cessna	*Kurt Laurie	Flight Test
Dassault Aviation	*Alain Boucher Christian Camihort / Philippe Eichel (Alt)	Navigation, Flight Guidance Systems Takeoff and Landing/ HQ – Flight controls specialist
EASA	*John Matthews Massimo Barocco	Flight Test Engineer Flight Test Pilot
Embraer	*Murilo Pinto Ribeiro	Performance and Handling Qualities
FAA	*Joe Jacobsen Don Stimson	Airplane Performance & HQ Specialists
Gulfstream	Barry McCarthy	Chief Engineer Technical Assurance
Honeywell	*Larry Gardner / Dean Wilkens (Alt)	Fly-by-Wire Flight Controls Specialists
Transport Canada	*John Wiseman	Flight Test

*Voting Member