Description: Application of EZjet GT, Inc. d/b/a EZjet Airways (''EZjet'') requesting a foreign air carrier permit to engage in scheduled foreign air transportation of persons, property and mail between any point or points in Guyana and any point or points in the United States, and to the extent necessary EZjet further requests exemption authority to provide the services described above pending issuance of a foreign air carrier permit.

Renee V. Wright,

Program Manager, Docket Operations, Federal Register Liaison.

[FR Doc. 2012–24074 Filed 9–28–12; 8:45 am]

BILLING CODE 4910–9X–P

DEPARTMENT OF TRANSPORTATION

Office of the Secretary

Notice of Applications for Certificates of Public Convenience and Necessity and Foreign Air Carrier Permits Filed Under Subpart B (Formerly Subpart Q) During the Week Ending September 15, 2012

The following Applications for Certificates of Public Convenience and Necessity and Foreign Air Carrier Permits were filed under Subpart B (formerly Subpart Q) of the Department of Transportation's Procedural Regulations (See 14 CFR 301.201 et seq.). The due date for Answers, Conforming Applications, or Motions to Modify Scope are set forth below for each application. Following the Answer period DOT may process the application by expedited procedures. Such procedures may consist of the adoption of a show-cause order, a tentative order, or in appropriate cases a final order without further proceedings.

Docket Number: DOT–OST–2012–0153.

Date Filed: September 11, 2012.

Due Date for Answers, Conforming Applications, or Motion to Modify Scope: October 2, 2012.

Description

Application of LLC Nord Wind requesting a foreign air carrier permit and exemption authority to engage in on-demand charter transportation of passengers, property and mail between point(s) in the Russian Federation and point(s) in the United States, as well as other charters subject to pertinent national, bilateral and international laws and regulations.

Renee V. Wright,

Program Manager, Docket Operations, Federal Register Liaison.

[FR Doc. 2012–24075 Filed 9–28–12; 8:45 am]

BILLING CODE 4910–9X–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) to discuss transport airplane and engine (TAE) issues. It also withdraws the notice entitled, ''Aviation Rulemaking Advisory Committee Meeting on Transport Airplane and Engine Issues'', published on September 26, 2012.

DATES: The meeting is scheduled for Wednesday, October 17, 2012, starting at 9 a.m. Eastern Daylight Time. Arrangements for oral presentations must be made by October 10, 2012.

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 17, 2012.

This document also serves as withdrawal of the meeting notice entitled, ''Aviation Rulemaking Advisory Committee Meeting on Transport Airplane and Engine Issues'' (77 FR 59243), in FR Doc. 2012–23709, that published on September 26, 2012.

The agenda for the October 17, 2012 meeting is as follows:

- Opening Remarks, Review Agenda and Minutes.
- FAA Report.
- ARAC Executive Committee Report.
- Transport Canada Report.
- EASA Report.
- Flight Controls Working Group Report.
- Avionics Systems Harmonization Working Group Report.
- Aging Airplanes 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 10, 2012. 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 10, 2012. For persons participating by telephone, please contact Ralen Gao 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 10, 2012, to present oral statements at the meeting. Written statements may be presented to the ARAC 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 ARAC 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 27, 2012.

Brenda D. Courtney,

Acting Director, Office of Rulemaking.

[FR Doc. 2012–24203 Filed 9–28–12; 8:45 am]

BILLING CODE 4910–13–P

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

[AC 187–1F]

Schedule of Charges Outside the United States

AGENCY: Federal Aviation Administration (FAA), DOT.

Transport Airplane and Engine Issues Group Meeting

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

Agenda

DRESS: BUSINESS CASUAL

Wednesday, October 17, 2012 – ***Call in number:*** **(202-366-3920 code 5126#)**

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/ M. Kaszycki/M.Schooley
9:15	FAA Report	M. Schooley
9:45	EXCOM Report	C. Bolt
10:15	Transport Canada Report	O. Rusch
10:30	EASA Report	C Bolt for J. Hall
11:00	Flight Controls Working Group Report	B. Hance/D. Chatrenet
11:30	Lunch	
12:30	Avionics Systems Harmonization Working Group Report	C. Badie
1:00	Aging Airplanes Working Group Report	S. Chisholm/M. Yerger
1:30	Action Item Review / Any Other Business	C. Bolt

-- ADJOURN --

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

Meeting Minutes

Date: October 17, 2012
Time: 9:00 AM
Location: 1500 Wilson Blvd.
Arlington, VA

Call to Order /Administrative Reporting

Mr. Mike Kaszycki read the Procedures Statement at 9:06 AM.

Item	Wednesday May 16, 2012 Meeting Action Items	Status
1	Complete review and submit any comments to October 2011 minutes by end of May 2012.	Complete
2	TAEIG members to review Materials Flammability draft report and provide comments to Jim Davis by end of May 2012.	Complete
3	Materials Flammability working group to submit formal recommendations by end of June 2012.	Complete

Mr. Craig Bolt shared the agenda.

FAA Report

Ms. Mary Schooley presented this report. See Handout #1 for overview, Handout #2 for details of ongoing FAA Transport Airplanes Directorate (TAD) rulemakings)

Regarding the upcoming Flight Test Requirements tasking, Mr. Kaszycki stated that tasking arose because there have been some common issues that arose between FAA and EASA regarding a number of regulations. These are differences in regulations, in accepted methods of compliance, and in handling quality. FAA has also used special conditions for fly-by-wire. The FAA would like to take the lead and harmonize with EASA on the issues listed on Handout 1 page 8. This tasking will not so much look at software aspects, but more about performance and compliance standardization. EASA has agreed to participate on this working group.

Regarding policy statements, Mr. Kaszycki elaborated as follows: PS-ANM-25-03 Side Facing Seats arose because TAD had been providing exemptions for this for years. A rulemaking recently came about to provide standards for Side Facing Seats. This final policy added an implementation timeline.

As a matter of procedure, a policy can be promulgated more expediently than an advisory circular (AC), and can be used where there is time sensitivity. Otherwise, a policy and an AC are similar in their advisory intent, and both go through all relevant technical and legal reviews, with public comments solicited in the interest of government transparency. Typically, an AC is developed and published concurrently with new rules or amendments, whereas a policy may be the preferred method in the absence of new rulemakings.

Regarding Rulemaking Prioritization, Mr. Kaszycki stated that the FAA Reauthorization contains a section regarding ARC implementation, so the focus is currently on how to comply with this section. Internally, TAD is trying to streamline the use of issue papers, their effectiveness and prioritization. There is another initiative just getting started to modify and improve a tool, the Rulemaking Assessment Matrix, that looks at safety data quantitatively, rather than qualitatively.

EXCOM Report

Mr. Bolt presented this report. See Handout #3.

TAE will become a sub-committee to ARAC, and will operate with the same procedures as before, i.e. public meetings, working group reports. TAE will be the only sub-committee; all the other issue groups have been disbanded. However, the FAA reserves the right to create more subcommittees should the need arise. The major difference is, rather than submitting recommendations straight to the FAA, TAE will need to first present its recommendation to ARAC (formerly EXCOM), which will have to accept and approve before the recommendation can be submitted to the FAA.

Transport Canada Report

Mr. Oliver Rusch presented this report. See Handout #4.

TCCA is working on a full-suite of regulations for Canadian Aviation Regulation 521. The links provided are a current overview.

EASA Report

Mr. Bolt presented this report in place of Mr. Julian Hall. Please see Handout #5.

Mr. Kaszycki stated that, from the FAA's perspective, the focus is on harmonizing with ICAO or file a difference if need be, in order to support domestic operators and manufacturers.

Regarding CRD 2011-13, Fuel system low level indication, EASA is looking at airplane systems and procedures to detect low fuel, so the crew can timely detect and get to a safe place. The FAA is looking at this issue as well, and have consideration to extend its low-fuel indicator rule for ETOPS to part 25.

EASA has implemented new process where, while investigating aviation incidents, they must make inquiries from not only their own but foreign operators /manufacturers as well. The FAA will cooperate with this new process. It has begun to forward letters of investigative questions from EASA to domestic operators, and will maintain sufficient oversight to ensure that the responses submitted will be responsive to the questions.

Flight Controls Working Group (FCHWG) Report

Mr. Barry Hance presented this report. See Handout #6.

Mr. Kaszycki addressed the contents of meeting 5. In relation, the FAA provided the working group its survey that tended to show that people were using the rudder more than expected, sometimes incorrectly, and has the working group discussed this finding? Mr. Hance responded that one member constructed a survey and sent to the OEM in his community. His findings coincide with those of the FAA's survey. The working group recognize that while providing more pilot training may help, it will probably not resolve the problem altogether. In balance with the relative rareness of rudder events, the group is still considering what to recommend. Mr. Kaszycki commented that he would like more suggested solutions on this issue than pilot training, such as take a look at systems and other areas as well.

Avionics Systems Harmonization Working Group (ASHWG) Report

Mr. Loren Hayworth presented this report. See Handout #7.

Mr. Bolt clarified that the Recommendation was submitted to TAE a few weeks ago.

Mr. Phillipe de Gouettes asked and was confirmed that the corrections Airbus requested would be included in the Recommendation before submission to the FAA.

Mr. Bolt called for TAE to vote on whether to accept the Recommendation, with all necessary corrections, for presentation at the December ARAC meeting, and if approved, for submission to the FAA.

Recommendation was unanimously approved.

Mr. Bolt thanked Mr. Hayworth and all members of this working group for their hard work.

Aging Airplanes Working Group (AAWG) Report

Mr. Steven Chisholm presented this report. See Handout #8.

Note: sentence on page 2 of the handoutshould be “AAWG oversight role”.

Mr. Chisholm commented that the dates given on Page 9 may no longer be accurate. An NPA may unlikely be issued in November 2012, as it is not yet ready.

The difference between FAA and EASA Aging Airplane rules may lead to differences between implementation and compliance.

Mr. Kaszycki commented that the usefulness of STGs is questionable, so how does the working group intend to address this? Mr. Chisholm stated that the group needs further discussion to streamline and formalize guidance, which he will present at a later TAE meeting.

GAMA questioned what is the purpose of the action items listed in this report—is it merely a part of the working group’s continuous oversight work, or will there be recommended advisory materials. Mr. Chisholm stated that there are elements of both. There are many areas for theoretical exploration, as well as more practical implementations. Mr. Kaszycki stated that the primary role for this working group is that of support for WFD.

Action Item Review/ Any Other Business

Mr. Doug Kihm asked about schedule for the Specific Risks rulemaking. Mr. Kaszycki stated this rule is currently being delayed, primarily because certain parties are unable to agree on the cost /benefit estimates.

Item	October 17, 2012 Meeting Action Items	Status
1.	Ralen Gao to provide the list of 24 voting members in ARAC.	Awaiting availability of final list.
2.	Response whether AC-20-170, page 13 of FAA Report, was coordinated with EASA.	

Future TAEIG Meetings:

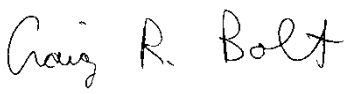
The meeting after this will be held on Wednesday, April 24, 2013, in Renton, WA. The meeting after that will be held on Wednesday, October 2, 2013 in Arlington, VA.

Public Notification

The *Federal Register* published a notice of this meeting on October 1, 2012.

Approval

I certify the minutes are accurate.



Craig R. Bolt
Assistant Chair, ARAC TAE

Craig Bolt
Mike Kaszycki
Mary Schooley
Doug Khim
Steve Chisholm
Ray Holanda
Edmond Boulay
Walter Derosier - GAMA
Oliver Rusch - TCCA
Phillipe de Gouettes
Bob Park – Boeing
Les McVey - GE
William Ertle
Loren Hayworth

FAA Rulemaking Status

Update to TAEIG

Presented to: TAEIG

By: Mike Kaszycki, Manager, Transport Standards Staff

Date: October 17, 2012

Federal Aviation Administration

October 2012 TAEIG Meeting

Topics:

- **Rulemaking project status**
- **Non-rulemaking project status**

October 2012 TAEIG Meeting

Rulemaking Project Status *(since May 2012)*

- **Final Rules (FR's)**
  - Part 25/26
    - None
  - Part 33/35
    - Vibration Test Technical Amendment §33.83(a) Amdt. 33-33
      - Published, effective July 5, 2012.
      - Correction published, effective September 20, 2012.
  - Part 121
    - None

October 2012 TAEIG Meeting

Rulemaking Project Status *(since May 2012)*

- **Notices of Proposed Rulemaking (NPRM's)**
  - Part 25/26
    - None
  - Part 33/35
    - None
  - Part 121
    - None

October 2012 TAEIG Meeting

Rulemaking Project Status *(since May 2012)*

Final Rules (FR's)

- **In OMB/OST**
  - 1 part 25 project
- **In Headquarters (HQ) for Coordination**
  - 1 part 25 project
- **In Directorate Coordination**
  - 1 part 25/33 project
  - 1 part 33/35 project
- **In Development:**
  - None

October 2012 TAEIG Meeting

Rulemaking Project Status *(since May 2012)*

Notices of Proposed Rulemaking (NPRMs)

- Open for Comment
  - None
- In OST/OMB
  - 1 part 25 project
- In Headquarters (HQ) for Coordination
  - 1 part 121 project
- In Directorate for Coordination
  - None

October 2012 TAEIG Meeting

Rulemaking Project Status *(since May 2012)*

Notices of Proposed Rulemaking (NPRMs)

- In Development
  - 7 part 25 projects
  - No part 33 projects
  - No part 121 projects

October 2012 TAEIG Meeting

Rulemaking Project Status *(since May 2012)*

New Draft Tasking

- Flight Test Requirements

  The FAA will propose a new task for ARAC to examine various flight test requirements in part 25, related to:

  - Fly-by-wire special conditions
  - Sidestick controller special conditions
  - Various performance and handling requirements
  - Handling qualities and PIO
  - Tail and cross winds

October 2012 TAEIG Meeting

Non-Rulemaking Project Status *(since May 2012)*

- **Final Advisory Circulars (AC's)**
  - Part 25
    - None
  - Part 33/35
    - None
  - Part 121
    - None

October 2012 TAEIG Meeting

Non-Rulemaking Project Status *(since May 2012)*

- **Draft Advisory Circulars (AC's)**
  - Part 25
    - None
  - Part 33 / 35
    - None
  - Part 121
    - None

October 2012 TAEIG Meeting

Non-Rulemaking Project Status *(since May 2012)*

- **Final Policy**
  - Part 25/26
    - PS-ANM-25-03

      Technical Criteria for Approving Side Facing Seats
      - Issued June 8, 2012

    - PS-ANM-25.851-01

      Flammability Testing of Interior Materials
      - Issued August 16, 2012

October 2012 TAEIG Meeting

Non-Rulemaking Project Status *(since May 2012)*

- **Final Policy**
  - Part 33/35
    - None
  - Part 121
    - None

October 2012 TAEIG Meeting

Non-Rulemaking Project Status *(since May 2012)*

- **Draft Policy Part 25/26**
  - In-Flight Aisle Policy
    - Comments Closed June 21, 2012
  - Application of AC 20-170 Integrated Modular Avionics Development, Verification, Integration, and Approval using RTCA/DO-297
    - Comments Closed August 13, 2012
  - Guidance for Hazard Classification of Runway Excursion
    - Comments Closed September 24, 2012

October 2012 TAEIG Meeting

Non-Rulemaking Project Status *(since May 2012)*

- **Draft Policy**
  - Part 33/35
    - None
  - Part 121
    - None

October 2012 TAEIG Meeting

Rulemaking Prioritization Working Group Update

- Developed prototype prioritization questionnaire and matrix
- Prototypes were tested with previously issued rules
- Questionnaire and matrix refined based on feedback
- Final Report to ARAC in November
- RPWG to present findings to ARAC in December

October 2012 TAEIG 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 Jones **Analyst:** Maria Delgado	Part 121 Activation of Ice Protection Systems	DONE	IPHWG	FR Issued Aug 2011	Collaboration
Team Lead: D. Stimson **Analyst:** Michael Menkin	Airworthiness Standards Flight Rules, Static Lateral-directional Stability, Speed Increase and Recovery Characteristics	DONE	FTHWG	FR issued Dec 2011	Reciprocal Information (Harmonization rule)
Team Lead: M. Wahi **Analyst:** Michael Menkin	Landing Gear Retracting Mechanisms, Pilot Compartment View	DONE	MSHWG	FR issued Jan 2012	Reciprocal Information (Harmonization rule)
Team Lead: Loran Haworth **Analyst:** Michael Menkin	Installed Systems and Equipment for Use by the Flight Crew - 25.1302 (Harmonization) - formerly listed as "Flight Crew Error/Flight Crew Performance Considerations in the Flight Deck Certification Process"	Final	HFHWG	FR with OST/OMB	Cooperation - EASA lead FAA Harmonizing with CS-25
Team Lead: Robert Hettman **Analyst:** Kenna Sinclair	Supercooled Large Droplet Icing Conditions (plus Exiting Icing Conditions, part 121)	Final	IPHWG	FR in development in FAA	Collaboration
Team Lead: Robert Hettman **Analyst:** Kenna Sinclair	Part 121 Exiting Icing Conditions	NPRM	IPHWG	NPRM in development	Collaboration
Team Lead: Jeff Gardlin **Analyst:** Kenna Sinclair	Chemical Oxygen Generator Systems	HPEP1 NPRM	Lav O2	NPRM 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, expect NPRM in late 2012. 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)

EXCOM Update For TAE

October 17, 2012

EXCOM Meeting – Aug 30, 2012

- **ARAC Restructure**
- **Rulemaking Prioritization WG Update**
  - **RPWG follow-on Tasking**
- **Proposed New Tasking**
  - **Establish Airman Testing Standards and Training Working Group**

ARAC Restructuring Update

- New ARAC Charter Issued – September 17, 2012
  - 24 Voting members of ARAC (ASD has been included)
  - EASA is a non-voting member, other authorities may request non-voting status
  - TAEIG becomes a sub-committee with WG's reporting to it
  - TAEIG recommendations submitted to FAA though ARAC (formerly EXCOM)

Rulemaking Prioritization Working Group (RPWG)

Update for TAE

October 17, 2012

RPWG Background

- April 19, 2011—RPWG tasked to provide advice and recommendations to the FAA about how to prioritize rulemaking projects.
- Task driven by DOT Future of Aviation Advisory Committee Recommendation #22.
- December 2011—ARAC deadline for completion of task.
- December 20, 2011 – ARAC Submits Recommendation Report to FAA.
- May 10, 2012 – Follow-on ARAC Task to Test Recommended Process
  - Review the RPWG Phase I Recommendation Report.
  - Test the methodology and the tools using a subset of completed rulemakings provided by the FAA.
  - Develop measurable scoring evaluation to evaluate projects against each other.
  - Evaluate the results of the test and refine the process and the tools accordingly.

RPWG Follow-on Tasking Activity

- **12 Rules Selected to Test Process:**

	ORG	Title	FAA SME	RPWG
1	ATO	Modification of the New York, New York Class B Air Space Area and Establishment of the New York Class B Air Space Hudson River and East River Exclusion Special Flight Rules Area	David Maddox	**Bill Edmunds** Rob Hackman
2	ATO	Part 93 Special Rules Area in the Vicinity of Luke AFB, AZ	David Maddox	**Rob Hackman** Walt Desrosiers
3	AST	Human Space Flight Requirements for Crew and Space Flight Participants	John Howell Shirely McBride	**Craig Bolt** John Conley
4	AST	Lightning Criteria for Expendable Launch Vehicles	Karen Shelton-Mur Shirley McBride	**Bill Edmunds** Sarah MacLeod
5	AFS	Extended Operations (ETOPS) of Multi-Engine Airplanes (Final Rule Immediately Adopted)	Kim Barnette	**Mike Doellefeld** Sara Knife Rosemary Dillard
6	AFS	Clarification of Parachute Packing Authorization	Kim Barnette	**Charlie Holley** Dan Rauscher
7	AEE	Noise Limitations for Aircraft Operations in the Vicinity of Grand Canyon National Park	Sandy Lui	**Dave York** Rosemary Dillard
8	AIR	Lightning Protection Requirements	Chip Bulger	**Tom Peters** Rob Hackman
9	AIR	Fatigue Tolerance Evaluation of Metallic Structure	Sharon Miles	**David York** Charlie Holley
10	AIR	Rotor Overspeed Requirements	Tim Mouzakis	**Craig Bolt** Sarah MacLeod Walt Desrosiers
11	AIR	Harmonization of Airworthiness Standards Flight Rules	Don Stimson	**Mike Doellefeld** Doug Carr
12	AIR	Part 121 Activation of Ice Protection Systems	Robert Jones	**Dan Rauscher** Tom Peters
13	AEE	Stage 4 Aircraft Noise Standards	Sandy Lui	**Doug Carr** Paul McGraw John Conley
14	AIR	Damage Tolerance and Fatigue Evaluation for Composite Structures	Sharon Miles	**Sarah Knife** Paul McGraw

RPWG Follow-on Tasking Activity

- **July 31/August 1 Working Group Meeting:**
  - WG reviewed results of 12 test cases with SME's.
    - Approximately 40 comments received on Rulemaking Assessment. Questionnaire (RAQ), Rulemaking Assessment Matrix (RAM) and overall process.
  - Established two task groups to address comments from test cases.
    - RAQ team (Bill Edmunds) met August 23.
    - RAM team (Mike Doellefeld) met August 23.
  - Established next steps to complete task.

RPWG Follow-on Tasking Activity

- **Next Steps:**
  - RAQ and RAM task groups update process based on test case feedback
    - Status: Complete
  - Integrate Task Group's work - Complete
  - RPWG develop and finalize the recommendation report – *Work on from October thru mid- November.*
  - Submit report to ARAC – *End November.*
  - RPWG will present and request report approval at Dec 6th EXCOM.

Backup

RPWG Recommendation Report Highlights

- The RPWG developed a methodology that evaluates rulemaking projects in a consistent manner. The tools provided will allow the FAA to prioritize rulemaking projects across lines of business. The methodology is described in the RPWG's Rulemaking Prioritization Evaluation Tools (R-PETs), which consist of the:

- *Rulemaking Evaluation Process (REP)*—a flowchart that depicts the rulemaking process from identification of a problem/issue to the beginning of the "official" rulemaking process.
- *Rulemaking Assessment Questionnaire (RAQ)*—a three-part tool that ensures the (1) problem/issue is clearly defined, (2) factual data are gathered, so (3) appropriate "weighing" and "scoring" of the problem/issue and the potential solution can take place:
  - Part A is used by a subject matter expert (SME) to identify and summarize a problem or issue. It may also be used to outline a petition for rulemaking to evaluate whether the information required by 14 Code of Federal Regulation part 11 (14 CFR part 11) has been provided.
  - Part B is used by the Office of Primary Responsibility (OPR) to validate the problem/issue, to reject it as a rulemaking project or to authenticate and/or collect the basic factual data needed to complete the Rulemaking Assessment Matrix (RAM). The RAM's "score" helps prioritize the OPR's own "wish list" as well as the FAA's internal Rulemaking Council prioritization of projects across lines of business.
  - Part C is used by the Office of Rulemaking (ARM) or ARAC to validate the RAM and to ensure the factual data are capable of supporting a rulemaking project. This validation is then used by the OPR to prioritize its "wish list" so the top projects may be submitted to the FAA's internal Rulemaking Council for consideration.
- *Rulemaking Assessment Matrix (RAM)*—the tool that uses the results of the RAQ to "weight" and "score" the problem/issue and potential solution within eleven attributes: Safety; Environment, Capacity, Access, International, Cost/Impact, Benefit, Technology, Legislative mandate, Social Impacts and Security Effects.

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: Todd Martin **Analyst:** Maria Delgado	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)
Team Lead: Joe Jacobsen **Analyst:** Maria Delgado	Low Airspeed Alerting	RAP	ASHWG	Rulemaking plan in work for part 25. Part 121/26 requirements pending ASHWG recommendations.	Reciprocal Information
Team Lead: Massoud Sadeghi **Analyst:** Theresa White	Fuel tank lightning protection	RAP	N/A (ARC)	Rulemaking plan in work	Reciprocal Information
Team Lead: Mike Dostert **Analyst:** Theresa White	Fuel Vent System Fire Protection	AFR	None	Rulemaking plan in work	Reciprocal Information
Team Lead: S. Happenny **Analyst:** TBD	Main Deck Class B & F Cargo Compartments	AFR	CSHWG	Rulemaking plan in work	Reciprocal Information (Harmonization rule)
Team Lead: Mike McRae **Analyst:** TBD	Low Fuel Warning	AFR	PPIHWG	Rulemaking to begin in FY13.	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 McRae **Analyst:** TBD	Part 25 Revised Appendix F Flammability	AFR	MFHWG	Rulemaking to begin in FY14, pending MFHWG recommendations.	Collaboration
Team Lead: Mike Dostert **Analyst:** Jan Thor	Engine Restart Envelope	AFR	None	Rulemaking to begin in FY14.	Reciprocal Information
Team Lead: Mike McRae **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: Joe Jacobsen **Analyst:** TBD	Flight Deck Certification Streamlining	AFR	None	Rulemaking to begin in FY14.	Reciprocal Information
Team Lead: M. McRae **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: Mike McRae **Analyst:** TBD	Thrust Reversing Systems, 25.933	DOM	PPIHWG	Rulemaking to begin in FY 17 or later.	Reciprocal Information
Team Lead: Robert Jones **Analyst:** TBD	Rudder Reversal Load Condition	AFR	FCHWG	Rulemaking to begin in FY14, pending recommendations from FCHWG.	Collaboration

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:** 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
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
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)
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: M. McRae **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: Wahi **Analyst:** Q	Wheel Well Fire Detection	In Waiting		ON HOLD	TBD
Team Lead: Claar **Analyst:** Q	Emergency Exit Access (Type III exits)	In Waiting	EEIG	ON HOLD	TBD
Team Lead: 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: M. McRae **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: S. 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

MPS-750
(04/2009)

TCCA Report

TAEIG October 17th 2012





Canadian Aviation Regulation 521

- **Background**
  - **CAR521 provides the requirements to design or modify aeronautical products in Canada and for foreign products to be used in Canada.**
  - **CAR 521 serves the same purpose as FAR 21 and IR 21.**
- **Rulemaking**
  - **An NPA to address miscellaneous issues with CAR521 was consulted at CARAC (Canadian Aviation Regulation Advisory Council) in November of 2010.**
  - **Comments were received and are now being addressed through development of new NPA text**
- **CAR 521 Guidance is available at:**
  - http://www.tc.gc.ca/eng/civilaviation/opssvs/managementservices-referencecentre-documents-si-500-1254.htm
  - http://www.tc.gc.ca/eng/civilaviation/opssvs/managementservices-referencecentre-acs-500-menu-127.htm

EUROPEAN AVIATION SAFETY AGENCY
AGENCE EUROPÉENNE DE LA SÉCURITÉ AÉRIENNE
EUROPÄISCHE AGENTUR FÜR FLUGSICHERHEIT

EASA UPDATE

TAEIG Meeting DC October 17th 2012

Julian Hall

Your safety is our mission.

easa.europa.eu

Initial Airworthiness (R4.1) Deliverables

- Opinions/Decisions
  - Decision 2012/009 Review and transposition of existing FAA TSO for parts and appliances into EASA ETSO, 5 July 2012
  - Decision 2012/008 Halon update of CS's to comply to EU Regulations, 13 July 2012
  - Decision 2012/001 Cabin safety –air quality, 15 January 2012

Initial Airworthiness (R4.1) Deliverables

- Decision 2011/014 A-NPA Management of flight operations with known forecast volcanic cloud contamination, 12 December 2011
- Decision 2011/010 AMC and GM for Part 21, 1 December 2011
- Opinion 2011/007 Operational Suitability Data, 13 December 2011

Initial Airworthiness (R4.1) Deliverables

- Comment response documents -CRDs
  - CRD 2011-14 Halon update of CSs in order to comply with EC Regulations
  - CRD 2011-13 Fuel system low level indication/fuel exhaustion 15 February 2012
  - CRD 2011-12 Update of EASA ETSO, 3 May 2012
  - CRD 2011-11 CS-type specific data for cabin crew, 10 July 2012
  - CRD 2011-10 CS-MMEL for complex motor-powered aircraft, 10 July 2012
  - CRD 2010-04 Damage Tolerance & Fatigue, 5 July 2012

Initial Airworthiness (R4.1) Deliverables

- Notice of proposed amendments- NPAs
  - NPA 2012-11 Software considerations for airborne systems and equipment, 22 August 2012
  - NPA 2012-09 CS-MMEL for other than complex motor-powered aircraft, 05 July 2012

Continuing Airworthiness (R4.2) Deliverables

- Opinions/Decisions
  - Decision 2012/004 amending the Annexes I, II, IV, V, VI, VII and VIII to Decision No 2003/19 ,19 April 2012
  - Decision 2011/008 Appendix 1 Aircraft type ratings for Part-66 Maintenance licence, 24 November 2011
  - Decision 2011/011 Control of Contracted Maintenance personnel, 1 December 2011

Continuing Airworthiness (R4.2) Deliverables

- Notice of proposed amendments NPA's
  - NPA 2012-03 Control of Suppliers of components and material used in maintenance, 12 April 2012
  - NPA 2012-04 Critical Tasks, 12 June 2012
  - NPA 2012-05 Certification Specification Flight Crew, 6 July 2012
  - NPA 2012-08 Maintenance Check Flights, 30 July 2012

Continuing Airworthiness (R4.2) Deliverables

- Comment response documents-CRDs
- CRD-2 2010-10 Alignment of 2042/2003 with Regulation 216/2008 and with Annex 6, 03 April 2012
- CRD 2011-19 GM related to aircraft Continuing Airworthiness monitoring, 19 July 2012

Flight Controls Harmonization Working Group Status

Rudder Reversal/Sensitivity Issue

October 17, 2012

Barry Hance (Boeing)
Dominique Chatrenet (Airbus)

Flight Controls Harmonization Working Group Tasking Overview

Issue Background (from ARAC Tasking)

- "On November 12, 2001, an Airbus A300–600 crashed at Belle Harbor 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.' ''
- Two additional A300/A310 events, one A319 event, and a de Havilland event were also noted.
- An FAA sponsored pilot survey report reached a (disputed) conclusion that "many experienced pilots misused or may misuse the rudder after wake vortex encounters."
- Other FAA sponsored studies have tried to establish a possible correlation between potential excessive use of rudder and rudder control characteristics

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

Flight Controls Harmonization Working Group Members

Name	Organization	Expertise
Greg Anderson	Cessna	Flight Dynamics
Dominique Chatrenet (co-chair)	Airbus	Flight Controls
Marco Coccolin	Embraer	Flight Controls
Bill deGroh	ALPA	Flight Operations
Barry Hance (co-chair)	Boeing	Flight Controls
Robert Jones (sponsor)	FAA	Flight Controls
Stephanie Lalonde	TCCA	Hydromechanical
Tony Linsdell	Bombardier	Structures/Loads
Didier Poisson	EASA	Flight Operations
Nadine Polano	EASA	Flight Controls
Gerard Menard	Dassault	Structures/Loads
Luiz Jether de Holandino Vasconcelos	ANAC	Flight Operations

Flight Controls Harmonization Working Group
Additional Attendees

- Philippe Eichel (Dassault Flight Controls)
- Kyle Ford (Boeing Loads)
- Laurent LaPierre (Airbus Flight Test)
- Brian Lee (FTHWG representative)
- Todd Martin (FAA Structures)
- George Zografos (EASA Structures)

Flight Controls Harmonization Working Group
Work Plan

- Work Plan released 13 Jan 2012
- Multi-disciplinary tasking
  - FTHWG rep
  - Formed Loads sub-group
- March 2013 goal to complete Phase 1
- September 2013 goal to complete Phase 2
  - 6 month extension from prior schedule

Flight Controls Harmonization Working Group
Progress to Date

- Meeting 1 (Seattle) 29 Nov – 1 Dec 2011
  - Introduction, review tasking, ARAC guidelines
- Meeting 2 (Toulouse) 14 Feb – 17 Feb 2012
  - Level set on regs, OEM rudder architecture review, review service events, prelim OEM results for rudder doublet
- Meeting 3 (Montreal) 18 Apr – 20 Apr 2012
  - Analysis of available rudder studies (felt to be of little use for the task), final OEM results for rudder doublet, Loads Task Group & FTHWG report out

Flight Controls Harmonization Working Group
Progress to Date

- Meeting 4 (Bordeaux) 18 Jun – 21 Jun 2012
  - Analyze Subpart D & F applicability to tasking
  - Review CS25.1302 (Human Factors) with EASA expert
  - Review wake vortex flight test results
- Meeting 5 (DC) 11 Sep – 14 Sep 2012
  - Review Boeing proposal to improve pilot training
  - ALPA definition of appropriate/inappropriate rudder usage
  - Extension of load analysis from single doublet to multiple doublets
  - First cut at rudder system sensitivity analysis results

Flight Controls Harmonization Working Group
Meeting Schedule

- Scheduled meetings
  - Cologne, Germany in December, 2012
  - TBD in March, 2013

- Tentatively 2 more meetings prior to September 2013 deadline

Flight Controls Harmonization Working Group Challenges

- Cross-disciplinary nature of tasking
- How to address inappropriate pilot action with regulations (current regulation is found adequate for normal rudder usage)
- Concerns with regulatory precedents
- Impact on manual (unpowered) rudder control

Flight Controls Harmonization Working Group
Next Steps

- Subpart B
  - FCHWG needs significant support from FTHWG
  - Starting to make progress - FTHWG is engaged
  - Defining rudder sensitivity Handling Quality criteria is felt to be a challenging task that will require significant time
- Subpart C
  - Rudder doublet fin load analyses complete
  - Loads analysis following multiple doublets on-going
  - Drafting response to tasking from Loads standpoint
  - No consensus on changes to load standards
- Subparts D & F
  - No consensus that short pedal travels incite overcontrol
  - Tasking precludes any design-prescriptive rulemaking
  - These subparts may not be appropriate for rule changes

Flight Controls Harmonization Working Group
Conclusions

- Team is working together well
- The working group has the right skills
- Consensus may be difficult
- No help needed at this time
- Overall progress slower than desired
- September 2013 is the planned completion date

Contents

1 Background

The FAA established the Aviation Rulemaking and Advisory Committee (ARAC) to provide advice and recommendations to the FAA administrator on the FAA's rulemaking activities with respect to aviation-related issues.

In addition, EASA received recommendations from accident investigation boards to investigate the need for improved low airspeed awareness on the flight deck.

With respect to low airspeed alerting, the FAA and EASA previously revised regulations in the area of flight guidance (autopilot/autothrottle) and performance and handling qualities in icing conditions to improve transport airplane standards for low airspeed protection. Performance and Handling Qualities in Icing Conditions (Amendment 14 CFR Part 25-121, issued Oct 9, 2007 and CS 25 Amendment 3 for EASA, effective Sept 19, 2007) address handling and low speed protection requirements in icing conditions. In addition:

- In June 2007 the FAA revised Advisory Circular AC 25-11A which includes guidance for low airspeed *awareness*. For EASA this revision was introduced in CS-25 amendment 11, AMC 25-11.
- In November 2010 the FAA published the revised rule 25.1322 for flightcrew alerting, for EASA, this revision was introduced in CS-25 amendment 11.
- Information from AC 25.1329-1B (and the associated AMC) provides information which may be helpful in determining how to address low airspeed conditions. These were released in 2006.

However, as a result of several recent loss-of-control accidents and incidents, the FAA and EASA have identified a need for additional low airspeed safeguards, in addition to the regulatory actions that have already been taken. Under the Transport Airplane and Engine Issues Group (TAEIG), the Avionics Systems Harmonization Working Group (ASHWG) was assigned to provide information that will be used to develop standards and guidance material for low airspeed *alerting* systems (LAS), which may complement existing stall warning requirements. The ASHWG activity was broken into two tasks:

The first task included a report from the ASHWG that addressed ten (10) technical questions relative to new aircraft designs (for support of possible Part 25 standards). This report was approved by the TAEIG in April, 2011.

The second task, which is addressed in this report, provides the ASHWG answers to the following low speed alerting technical questions relative to existing aircraft designs (Phase 2 task—part 25/121/129 retrofit standards), including a recommendation as to whether retrofit standards should be the same as standards for new designs.

1. How timely is the airplane in alerting the crew of flight below the intended operating speed?
2. How timely relative to stall warning?
3. Is alerting instantly recognizable, clear, and unambiguous to the flightcrew?
4. How are nuisance alerts minimized?
5. Does the alerting operate under all operating conditions, configurations, and phases of flight, including icing conditions?

6. Does the alerting operate during manual and autoflight?
7. 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?
8. Is coordination necessary with other harmonization working groups (e.g., Human Factors, Flight Test)? (If yes, coordinate and report on that coordination.)
9. If improvements are needed for low speed alerting in the existing fleet, should the FAA and EASA adopt a design approval holder (part 26) requirement to mandate development of design changes, or would an operational rule be sufficient?

Note that the terms "low airspeed" and "low energy" are both used in this report. A low airspeed alert is intended to provide awareness to the flight crew that the aircraft's airspeed is reaching a point where the energy level of the aircraft is being compromised.

1.1 Definitions, Acronyms, and Abbreviations

The following is a list of key definitions useful for this report

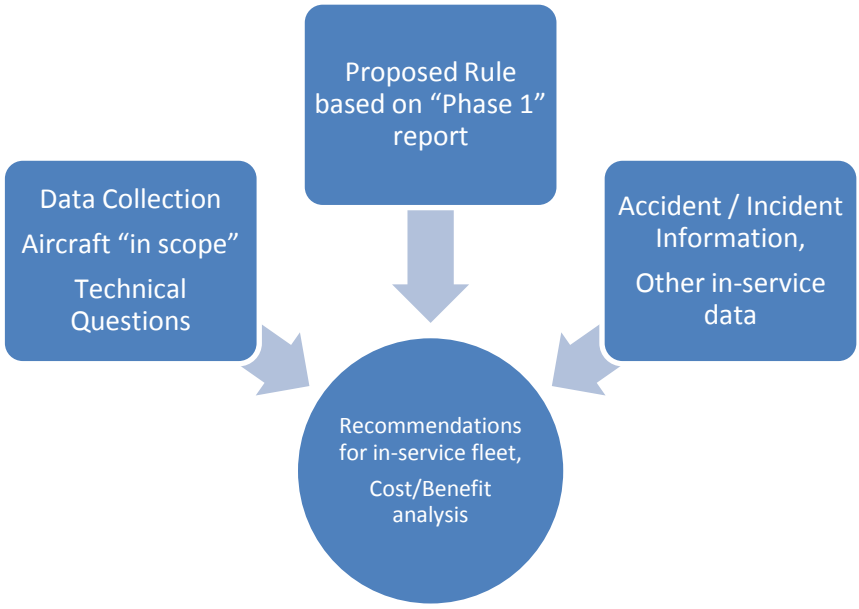
- Alphafloor –Angle of Attack threshold at which point automated speed protection will engage
- Low Airspeed Alert – Alert which provides awareness to the flight crew that the aircraft's airspeed is reaching a point where the airspeed decrease exceeds a pre-determined threshold. Within the context of this document this alert may have one or more attention getting elements (e.g. visual, aural or tactile).
- Low Energy Alert – An alert which provides awareness to the flight crew when the angle of attack exceeds a pre-determined low energy threshold.

The following is a list of key acronyms and abbreviations for this report

- AC / AMC – Advisory Circular/Acceptable Means of Compliance
- AoA – Angle of Attack
- ARAC – Aviation Rulemaking Advisory Committee
- ASHWG – Avionics Systems Harmonization Working Group
- EASA – European Aviation Safety Agency
- EICAS – Engine Instrument and Crew Alerting System
- FAA – Federal Aviation Administration
- FBW – Fly-by-Wire
- JSIT – Joint Safety Implementation Team
- LAS – Low Airspeed Alerting System
- TAEIG - Transport Airplane and Engine Issues Group
- TAWS – Terrain Awareness and Warning System

2 Process Followed

In order to perform this task, the ASHWG prepared a work plan, and presented a summary of that plan to the TAEIG.



Following approval of the work plan, the ASHWG collected information from a number of aircraft manufacturers to identify how existing designs provided low airspeed awareness and alert functionality. The ASHWG coordinated with the FAA and EASA to gain an understanding of the possible airworthiness requirements planned for new aircraft designs, and coordinated with findings from relevant accident information to understand the potential role that a low airspeed alerting function may have played in reducing loss of control. Specifically, the group was presented with a briefing on loss of control events, including a summary of six events occurring from 1999 – 2009, where failure to maintain proper airspeed resulted in a loss of control. Detailed analyses of these events are still pending, however three key factors from these events were discussed in creating the findings for this report: Distractions occurring in the flight deck; the effectiveness of the alerting in these aircraft; and lack of flight crew system knowledge resulting from current systems training.

As a result of this data collection and group discussion, the ASHWG were able to generate this report.

3 Scope

Aircraft "in scope" for this report include Part 25 certificated aircraft operating Part 121, Part 135, or international equivalent, manufactured in North America, South America, and Europe. These represent a global Air Transport fleet of approximately 24,000, which is approximately 85% of the total current Air Transport fleet of 28,000.

The overall level of flight deck capability was categorized into major groups as follows:

1. Aircraft with no low airspeed alert before stick shaker, no Primary Flight Display (i.e. glass display), and minimal alerting capability (i.e. no crew alerting "system" or no centralized or integrated alerting (EICAS)). This represents approximately 21 % of the "in scope" fleet.
2. Aircraft with no low airspeed alert before stick shaker, but have a Primary Flight Display & centralized alert capability (but no low airspeed alert indication). This represents approximately 15% of the "in scope" fleet.
3. Aircraft that have a Primary flight display with visual low airspeed alert indication only. This represents approximately 10% of the "in scope" fleet.
4. Aircraft that have a primary flight display with both visual and aural low airspeed alert indications. This represents approximately 45% of the "in scope" fleet. Only Boeing and Airbus aircraft are found in this category.

NOTE: Approximately 8-9 % of the in-scope fleet is not accounted for in this analysis, because manufacturer data was not available.

Appendix A includes a copy of the survey used to help generate this information, and Appendix B includes the survey results.

4 Key Findings and Recommendations

All of the aircraft in this analysis were certified prior to the update to AC/AMC 25.1322-1, as well as AC/AMC 25.1329-1B.

As stated in the original work plan for this task, the ASHWG is still expecting to receive a thorough analysis of relevant transport category accidents and incidents that identifies whether low airspeed alerting systems would have influenced the event sequence if installed. While a detailed report is still pending, a debrief on a representative selection of six low airspeed/low energy events (accidents and incidents over a 20 year period) were presented to and reviewed by the ASHWG.

Those six events reviewed included other contributing factors in addition to the lack of a low airspeed alert (e.g. flight crew distraction). Therefore, the need to impose a rule on existing aircraft to incorporate a practical means to implement a low airspeed alert can only be substantiated once the following has occurred:

- Sufficient detail quantifying the potential effectiveness of a low airspeed alert is provided (future JSIT report pending).
- A suitable economic assessment (cost-benefit analysis) is performed in order to deem the alerting "practical" for existing aircraft.

Additional data may help determine whether a low airspeed alert could have operational benefit (for example, Flight Operations Quality Assessment data – a complete list is identified in section 5.7). The ASHWG formally requests that data, and proposes to reconvene and review that data, and update any recommendations if applicable.

If a low airspeed alert is deemed to be required in the future, the ASHWG recommends using the information from this report to develop any rules and associated advisory material. This should take an integrated approach to incorporate design, pilot training, and flight crew procedures. From a design perspective, the ASHWG acknowledges that there are multiple means to improve low airspeed awareness.

Any associated rulemaking which is drafted should be reviewed by the ASHWG, to ensure that it is aligned with the findings in this report, and to facilitate FAA/EASA harmonization.

5 Technical Questions

The tasking statement specifically requested answers to the technical questions as stated in section 1. Technical questions 5.1 through 5.6 were based on the data from those aircraft which have implemented a low airspeed alert function. As noted in section 3, this is a subset (~45%) of the existing aircraft in service.

Note that the terms "low airspeed" and "low energy" are both used in this report. At least one manufacturer uses the term "low energy alert" instead of a "low airspeed alert." For example, Fly-by-wire (FBW) Airbus aircraft are fitted with a low energy alert to protect the flight path angle and alert the pilot when entering in a low energy situation. Both types of alerts are intended to provide awareness to the flight crew that the aircraft's airspeed is reaching a point where the energy level of the aircraft is being compromised.

NOTE: An "amber band" typically refers to an amber overlay on the airspeed tape, providing awareness of low airspeed relative to stick shaker. AC/AMC 25-11A provides additional information.

Boeing Example of Low Airspeed Alert

This is presented by an AIRSPEED LOW amber caution level EICAS message on the center forward display. It includes a caution aural tone (four pulses in 1 second), an amber Master Caution light in front of each pilot, and the box around the current airspeed changes to amber.

The Boeing low airspeed alert is set when the airspeed decreases to 30 percent into the lower amber band. It is reset when airspeed increases above the amber band. The alert is primarily a function of airspeed, airplane configuration, and minimum maneuver speed.

Airbus Example of Low Energy Alert

This is presented by a "SPEED-SPEED-SPEED" aural repetitive alert when the angle of attack exceeds an alpha low energy threshold, which is a function of aircraft configuration, deceleration rate and flight path angle. This angle of attack corresponds to the state where it is impossible for the aircraft to recover a long term positive flight path by lift increase only. This alert draws the crew's attention to the speed scale and indicates the need to adjust thrust. If the pilot does not adjust adequately the throttle, and the angle of attack continues to increase, then the alphafloor function triggers and sets automatically TOGA thrust.

The Airbus low energy alert "SPEED-SPEED-SPEED" (in compliance with a dedicated EASA & FAA Special Condition):

- Is available at low altitude (below 2500ft) during high lift configurations, and is reset when at least one engine thrust lever is at TOGA, when alphafloor is active, or the angle of attack has reduced below the alert threshold

This Low Energy Alert complements the following two levels of protections:

- Regardless of altitude, for low Mach number the alphafloor function applies TOGA thrust through A/THR automatic wake-up, when the angle of attack exceeds the alphafloor threshold.

- Airbus Fly-by-Wire (FBW) aircraft present a set of non overrideable high incidence protection layers limiting the Angle of Attack to a maximum achievable value (alphamax). At high altitude, there is no dedicated low speed/ energy alert needed because large altitude loss due to stall cannot occur on those aircraft in normal law.

5.1 How timely is the airplane in alerting the crew of flight below the intended operating speed?

For existing designs that incorporate low airspeed alerting, the alerting is relative to stall warning information or to other implemented protections. The alerting does not incorporate logic for deceleration below an intended operating speed, although that is the effect observed by the flight crew on the airspeed indication.

Boeing: The Boeing low airspeed alert implementation is not intended to alert for a deviation from the intended operating speed. It is intended to alert approaching stall warning.

Airbus: The Airbus low energy alert implementation is not intended to alert for a deviation from the intended operating speed. It is intended to protect flight path angle close to the ground to alert the pilot of a low energy situation, where recovering to a long term positive flight path angle by lift increase only becomes impossible. In this case thrust needs to be adjusted by the pilot to restore an adequate level of energy.

5.2 How timely relative to stall warning (alphafloor)?

In the Boeing example: The timeliness of the alert was established during development, and checks were conducted during simulator and flight test to ensure that no spurious activation of the alert occurred over a variety of flight conditions and airplane configurations. Evaluations were also performed to ensure that the alert reset properly.

In the Airbus example: The timeliness of the alert was established during development, and checks were conducted during simulator and flight test to ensure that no spurious activation of the low energy alert occurred over a variety of conditions including deceleration in descent, approach and landing.

Evaluations were performed to ensure that the alert disappeared as soon as the engine thrust was set sufficient to maintain an adequate energy level. The alert was tested in wings level and in turn at different slat/flap configurations, different acceleration rates, and with & without airbrakes. Operational scenarios (for example approach, cruise, and climb) were evaluated to validate minimal nuisance alerts and subjectively validate acceptable alerting prior to stick shaker. One of the worst-case scenarios for evaluating nuisance alerting was during go-around, with one engine inoperative.

The setting of the low energy alert aims at providing enough time to the pilot to manually recover an adequate level of energy through thrust adjustment, before engagement of any protection mechanism if applicable, for low deceleration rates. The approach cases were considered the most significant, so a one second response time was considered to evaluate the effectiveness of a timely thrust increase before stick shaker was activated.

For nominal deceleration rates (1-2 kts per second), the low airspeed alert is intended to provide the pilot sufficient time to increase thrust and minimize the possibility of decelerating to stick shaker activation.

The table below shows examples of alert timing for various rates of airspeed decay – 1 kt/sec and 3 kt/sec - as demonstrated during stall warning evaluations.

Boeing Example	**Airbus Example**
Approach: Flap 30, 141kts, 3 deg glideslope. With throttles at idle, achieved an approximate 1kt/sec deceleration rate. - 11 sec from 141kt approach speed to 130kt top of amber band - 5 sec from 130kt top of amber band to 125kt low speed alert (30% in the amber band) - 9 sec from 125kt alert point to 116kt stick shaker.	Approach & Landing: Full configuration. Low Weight, Idle thrust 1 kt/s deceleration rate is achieved for a Flight Path angle around -2 deg. Trying to maintain level flight increases the deceleration rate to about 1.5 kt/s. Timing from Low Energy Alert to Alphafloor: • -1 kt/s : 5.5s • -1.5 kt/s : 4s
Cruise – FL360, 0.83M/276kt. With throttles at idle, achieved an approximate 1kt/sec deceleration rate. - 18 sec from 276kt cruise speed to 258kt top of amber band - 14 sec from 258kt top of amber band to 244kt low speed alert (30% in the amber band) - 29 sec from 244kt alert point to 215kt stick shaker. Enroute Climb – 12,000-16000 ft, 300 kts. Varied climb rate & throttle reduction to achieve 1kt/sec and 3kt/sec deceleration rates. Timing for 1kt/sec deceleration rate – - 75 sec from 300kt climb speed to 225kt top of amber band - 10 sec from 225kt top of amber band to 215kt low speed alert (30% in the amber band) - 20 sec from 215kt alert point to 195kt stick shaker. Timing for 3kt/sec deceleration rate – - 25 sec from 300kt climb speed to 225kt top of amber band - 3 sec from 225kt top of amber band to 215kt low speed alert (30% in the amber band) - 7 sec from 215kt alert point to 195kt stick shaker.	Cruise and En-route Climb No low speed alert is needed in cruise or en-route climb, because presence of fully integrated airbus high incidence protection in Normal Law**.** Low energy alert is needed only in approach and landing conditions because these are the flight phases where low energy situation is more likely to occur (Engine near to idle) and occurring near the ground can lead to Controlled Flight Into Terrain. In cruise or en-route climb, low energy situation is less likely to occur (Engine thrust far from Idle) and thanks to high Angle of Attack protection in normal law, will eventually lead to loss of altitude, not to stall

5.3 Is alerting instantly recognizable, clear, and unambiguous to the flightcrew?

Low airspeed alerts which provide two senses of attention-getting characteristics are considered to be instantly recognizable. The specific content of the alert makes it clear and unambiguous.

- Airbus Example: "SPEED SPEED SPEED" aural voices with a visual indication on the display (amber/red band directly on the speed tape, no written messages). No other visual attention-getting means is provided.
- Boeing Example: Caution aural alert (4 beeps), an amber master caution light, and an "AIRSPEED LOW" caution EICAS message. In this case the crew reverts to the airspeed tape where the amber band is presented and the box around the current airspeed is changed to amber.

Alerts which provide a visual only sense may not be instantly recognizable (noticed) under all operating conditions. For example, the flight crew may be looking outside, and may not see the alert. Again, a visual – only alerting design represents a small subset of the population.

5.4 How are nuisance alerts minimized?

For existing designs that employ a low airspeed alert, input filtering and large margins from normal operating speeds are used as techniques to minimize nuisance alerts. Some designs filter airspeed inputs while other designs filter Angle of Attack (AOA). Both designs also reduce the likelihood of a low airspeed alert in conditions where there are large and sudden fluctuations in airspeed or AOA (for example while in turbulence).

In a few systems, nuisance alerts are minimized by other conditions including a fixed number excursion below a pre-determined low airspeed value, and may take into account failure of a suitable speed protection mechanism (e.g. autopilot/autothrottle).

For example, in the Boeing implementation, a reset of the low airspeed alert (from on to off) typically occurs after the aircraft has recovered to a point when the actual airspeed rises by a fixed value (e.g. 5 kts) above the top of the amber low speed band.

5.5 Does the alerting operate under all operating conditions, configurations, and phases of flight, including icing conditions?

For existing designs that provide an alert, they are provided under most (but not all) operating conditions.

Keep "by lift increase only"

For example, in current designs there are phases of flight where low airspeed alerting is not provided:

- Airbus does not provide a low energy alert when above 2500 ft. No low speed alert is needed in cruise or en-route climb, because of the presence of a fully integrated airbus high incidence protection**.** Low energy alert is needed only in approach and landing conditions because these are the flight phases where low energy situation is more likely to occur (Engine near to idle) and occurring near the ground can lead to Controlled Flight Into Terrain. In cruise or en-route climb,

low energy situation is less likely to occur (Engine thrust far from Idle) and thanks to high Angle of Attack protection in normal law, will eventually lead to loss of altitude, not to stall.

- Boeing inhibits the alert after takeoff until the flaps are moved out of the takeoff flap position. For other than initial takeoff conditions, the low speed alert is set when airspeed decreases 30% into the amber band, i.e., 30% below minimum maneuvering speed. On takeoff, before flap retraction is started, the amber band is not displayed because the V2 speed bug (takeoff safety speed) is the key speed reference, not the amber band. The flaps are retracted once acceleration begins and the amber band is then displayed as the key minimum reference speed.

On certain fly-by-wire aircraft, load factor is used as a parameter to set the alert.

Low Airspeed Alerts account for the effects of normal Weight and CG variations.

One manufacturer ensures that the Low Airspeed Alerting function operates when the wing anti-ice is operating. On other aircraft, alert parameters are adjusted during icing conditions. For example, stick shaker AOA is decreased, effectively increasing all of the low airspeed indications that set a low airspeed alert (to trip the alert sooner in icing).

There are also certain non-normal system conditions (e.g. air data failure, alpha data failure) where the alert will not operate.

5.6 Does the alerting operate during manual and autoflight?

Yes. Low airspeed alerts operate the same under both manual and autoflight operation.

5.7 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?

1. Aircraft which have a history of low airspeed awareness issues should be clearly identified. Findings should include any relevant accident/incident information, and the reasons why low airspeed was a contributor to those events. Detailed information about the effectiveness of a low airspeed alert (if provided) should be clearly identified.

   Beyond accident/incident information, other operational data/information should be collected and analyzed (by aircraft type) for low airspeed conditions that did not result in a reportable incident/accident. This is considered precursor information to a potential future low airspeed event (accident or incident). Other sources of operational or safety information includes data from:

   - Line Operations Safety Audit (LOSA),
   - Flight Operations Quality Assurance (FOQA),
   - Aviation Safety Action Program (ASAP),
   - Aviation Safety Reporting System (ASRS)

This information would help strengthen the need for improved low airspeed alerting but may not be feasible to quantify in an economic assessment such as a cost-benefit analysis (see below). A risk with that data collection is that the data is mainly U.S. based.

2. A comprehensive solution to address low-airspeed alerting in existing fleets should be considered, based on the recommendations contained within section 5.10 of this report.

This includes one or more technical solutions which may be the most practical to incorporate in existing aircraft types. These solutions can also be used in support of a future cost-benefit analysis. With respect to low airspeed alerting, several "functional solutions" are described in Appendix C. The range of changes which might be necessary to implement low airspeed alerting is quite variable, which means that the cost by aircraft type is also variable. This report provides representative examples of a federated and an integrated functional solution.

This also includes any required procedures and training which would help a pilot better manage the aircraft energy state when presented with a low airspeed alert.

3. If a low airspeed alert is deemed mandatory, a cost-benefit analysis must be performed in order to establish whether a requirement to implement low airspeed alerting would be economically feasible for existing fleets.

This cost-benefit analysis should be done on a "per type" basis. Aircraft variability will play a key role in understanding the feasibility of implementing a low-airspeed alert vs. the expected effectiveness of a low-speed alert. The focus should be on those aircraft with known concerns of low-airspeed control, as opposed to a broad analysis, in order to support a specific aircraft safety finding (e.g. Airworthiness Directive or voluntary implementation) if applicable.

Costs should consider the following:

- The proposed rule and advisory information for existing aircraft
- The proposed technical solution
- A cost estimate to develop and certify the proposed technical solution (non-recurring per aircraft type)
- A cost estimate to retrofit the proposed technical solution (recurring per aircraft type)
- Other implementation costs such as training

Benefits should consider the following:

- Current accident/incident rate by aircraft type, and whether those accidents/incidents were a result of low airspeed loss of control
- Expected effectiveness – percent reduction in those accidents/incidents if a low airspeed alert is implemented
- Average cost per accident/incident

Expected longevity of the aircraft type being analyzed must be taken into account. For example, there may be plans to make a specific aircraft type obsolete (retire) as a result of future airspace requirements.

5.8 Is coordination necessary with other harmonization working groups (e.g. Human Factors, Flight Test)? (If yes, coordinate and report on that coordination)

Coordination with other harmonization working groups has already occurred, through direct participation of ASHWG from Human Factors and Flight Test working group members.

An aviation rulemaking committee (208ARC) addressing stall and loss of control avoidance and recovery training should address the pilot training aspects. An advisory circular (AC 120-xxx) has been developed by this committee which will provide training procedures for stall and stick pusher recovery. The preventions identified in this AC should be updated to include low airspeed alerting awareness and recovery procedures.

In addition, the coordination is required with the Airplane State Awareness Joint Safety Implementation Team (JSIT), who will be generating the feasibility of retrofit, through a cost-benefit analysis. Reports from JSIT will help provide the detailed data required to substantiate the effectiveness of low-airspeed alerting into existing aircraft. The report is also expected to provide information on other means of mitigation that could help reduce loss of control, for those aircraft which were examined (those with specifically known loss of control accidents/incidents).

The ASHWG will work with an FAA economist to complete any required cost-benefit analysis.

5.9 If improvements are needed for low speed alerting in the existing fleet, should the FAA/EASA adopt a design approval holder (part 26) requirement to mandate development of design changes, or would an operational rule be sufficient?

If a broad requirement is applied across all of the existing fleet, a requirement in an appropriate operational rule (e.g part 121) would be sufficient. The operational rule would have to be specific to low airspeed alerting, regardless of the existing aircraft systems on board, and would be based on the information provided in this report.

A low airspeed alert may be required for specific aircraft with a history of low airspeed events. In addition, safety findings may include a recommendation to implement interventions including an appropriate low-airspeed alert. Either instance may necessitate an airworthiness directive (AD) to incorporate a low airspeed alert, based on the information provided in this report.

5.10 In responding, the working group 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). The ARAC working group should provide information that could lead to standards for low speed alerting that can be satisfied with practical design approaches

If rulemaking is deemed necessary, the ASHWG recommends rulemaking and guidance material that existing fleets may be able to utilize based on the information already contained within AC 25.1329-1B and AC 25.1322-1. This does not directly reference AC 25.1329-1B (and EASA Amendment CS-25/4) but instead incorporates the appropriate wording from this AC. AC 25.1329-1B was written for flight guidance systems for forward fit applications.

The following design information should be included:

Low Airspeed Alerting should be developed in accordance with AC 25.1322-1. A low airspeed alert should be considered as a caution level alert which precedes a warning condition (such as a stall warning), to provide immediate flight crew awareness and subsequent flight crew response.

Caution alerts should be developed in accordance with AC/AMC 25.1322-1, Paragraph 6.d:

> d. Caution Alerts.
>
> (1) The alert elements used for caution are typically identical to those used for warnings, as both require immediate flightcrew awareness.
>
> (2) Some caution alerts are related to conditions that are precursors to potential time-critical warning conditions. In these cases, the alerting system elements associated with the caution should be consistent with the elements for related time-critical warnings (described in paragraph 6b of this AC). For example, reactive windshear warnings, ground-proximity warnings, and caution alerts can develop into time-critical warning alerts.

Two senses for attention getting should be provided. The low airspeed alert should be sufficiently specific to direct the attention of the flight crew as to the energy state of the airplane.

Under conditions where multiple alerts are occurring, or during certain failure conditions, the flight crew's workload may be significantly challenged, and any one specific alert may be missed.

Certain failure conditions may reduce the confidence of the flight crew to believe that one or more alerts are valid. For example, if the airspeed information presented to the flight crew were unreliable, the crew may not believe that the logic to set the low airspeed alert is working correctly.

Note that these considerations are not necessarily specific to low airspeed alerting - that is, alerts from legacy aircraft designs which are not in compliance with the recently updated 14 CFR/CS §25.1322, and specifically those where a suitable attention-getting means is necessary, may exhibit similar behaviors.

It is also important to note that none of the aircraft for which low airspeed "incidents" were evaluated by the JSAT had a low airspeed alerting function which would be in compliance.

Prioritization of low airspeed alerts should be developed in accordance with AC/AMC 25.1322-1, paragraph 8.a:

> a. Rules and General Guidelines.
>
> (1) All flight deck alerts must be prioritized into warning, caution, and advisory categories (§ 25.1322(b)).
>
> (2) To meet their intended function(s), alerts must be prioritized based upon urgency of flightcrew awareness and urgency of flightcrew response (§ 25.1301(a)). Normally, this means time-critical warnings are first, other warnings are second, cautions are third, and advisories are last (§ 25.1322(b)).
>
> (3) Depending on the phase of flight, there may be a need to re-categorize certain alerts from a lower urgency level to a higher urgency level. Furthermore, prioritization within alert categories may be necessary. For example, when near threatening terrain, time-critical aural warnings must be prioritized before other warnings within the warning-alert category
>
> (25.1322(c)(1)). AC 25-23, Airworthiness Criteria for the Installation Approval of a Terrain Awareness and Warning System (TAWS) for Part 25 Airplanes, also identifies situations where prioritization within alert categories is necessary.
>
> (4) The prioritization scheme within each alert category, as well as the rationale, should be documented and evaluated, by following the guidance in paragraph 13, *Showing Compliance for Approval of a Flightcrew-Alerting System*, of this AC.
>
> (5) Documentation should include the results of analyses and tests that show that any delayed or inhibited alerts do not adversely impact safety.

The intended function of the low airspeed alert should be documented, and the alert design should be incorporated according to its intended function.

A low airspeed alert may still be needed for systems that provide a speed protection function. Factors which should be considered include the reliability of the speed protection, the availability of the speed protection function in other than normal flight control laws and in particular flight phases, and speed protection failure conditions where a low airspeed alert may still be needed. Alternatively, aircraft fitted with a high incidence protection system that can demonstrate the loss of AOA protection is improbable (remote) may constitute an Equivalent Level of Safety (Ref 14 CFR §25.1309(b)(2); CS 25.1309(b)(3)).

Standard stall warning and high-speed alerts are not always timely enough for the flight crew to intervene to prevent unacceptable speed excursions. Low Airspeed Alerting should be shown to be

appropriate and timely to ensure flightcrew awareness and enable the pilot to keep the airplane within an acceptable margin from the low speed range of the normal flight envelope.

Data regarding crew recognition and response from the Human Engineering Compendium by Boff/Lincoln may be helpful to develop a more "complete" timeline, from condition to expected recovery.

For practical reasons, on existing airplanes where integration of new alerts into the flight deck would be very challenging, incorporating low airspeed alerts into existing designs should consider the guidance contained in AC/AMC 25.1322-1, paragraph 14:

> 14. Integrating Flightcrew-Alerting System Elements into the Existing Fleet.
>
> a. General.
>
> (1) This material provides recommendations to applicants on how to retrofit existing airplanes so they comply with § 25.1322 without major modifications to the current flightcrew alerting system.
>
> (2) System upgrades to existing airplanes should be compatible with the original airplane's flightcrew-alerting philosophy. The existing alerting system might not be able to facilitate the integration of additional systems and associated alerts due to limitations in the system inputs, incompatible technologies between the airplane and the system being added, or economic considerations.
>
> (a) We discourage incorporating a new additional master visual function into the flightcrew-alerting system. If it is not feasible to include additional systems and associated alerts in the existing master visual function, an additional master visual function may be installed, provided that it does not delay the flightcrew's response time for recognizing and responding to an alert.
>
> (b) Where possible, new alerts should be integrated into the existing flightcrew alerting system. If these alerts cannot be integrated, individual annunciators or an additional alerting display system may be added.
>
> (c) Not all alerts associated with failure flags need to be integrated into the central alerting system. However, for those alerts requiring immediate flightcrew awareness, the alert needs to meet the attention-getting requirements of § 25.1322(c)(2) as well as the other requirements in § 25.1322. Thus, a master visual or master aural alert may not be initiated, but an attention-getting aural or tactile indication must still accompany an attention-getting visual failure flag to meet the attention-getting requirement of § 25.1322(a)(1), which requires attention-getting cues through at least two different senses for warning and caution alerts.
>
> b. Visual Alerts. Following the guidance in paragraphs 5 and 6 of this AC, determine whether or not the added system features will require activation of an airplane master visual alert.

c. Aural Alerts.

(1) Using the guidance in this AC, determine if an added system will require activating an aural alert.

(2) The new aural alert should be integrated into the existing aural alerting system and functions. If this is not possible, a separate aural alerting system may be installed, provided that a prioritization scheme between existing aural alerts and the new aural alerts is developed so that each alert is recognized and can be acted upon in the time frame appropriate for the alerting situation. This may require a demonstration of any likely combination of simultaneous alerts.

After the new and existing alerts have been merged, follow the guidance in this AC for determining how to prioritize the alerts.

d. Tactile Alerts.

(1) Using the guidance in this AC, determine if an added system will require activating a tactile alert.

(2) If possible, incorporate the new tactile alert into the existing aural alerting system. If this is not possible, a separate tactile alerting system may be installed, provided that the following elements are included:

(a) A prioritization scheme between existing tactile alerts and the new tactile alerts should be developed so that each alert is recognized and can be acted upon in the time frame appropriate for the alerting situation. After the new and existing alerts have been merged, follow the guidance in this AC for determining how to prioritize the alerts.

(b) A means to ensure that an individual alert can be understood and acted upon. This may require a demonstration of any likely combination of simultaneous alerts.

In addition to design, appropriate procedures and training for proper flight crew reaction in response to the alert should be provided.

Flight crew procedures should be designed to facilitate corrective action from the low airspeed condition, and may consider:

- The need to continue flying the airplane
- The recognition of the low airspeed condition
- An assessment of the aircraft's energy state, and other conditions which may be a factor in determining appropriate corrective action
- Roles and responsibilities between flight crew members
- The corrective action necessary to avoid a stall condition, and recover to safe flight

In addition to the need for pilots to receive training in stall recovery, airspeed management training should provide pilots the knowledge and skills to avoid undesired aircraft states that result from low airspeed, and be able to respond correctly and consistently to low airspeed alerts. Training should include crew procedures and appropriate CRM measures for avoidance, recognition, and recovery of low speed events.

Appendix A – Aircraft Survey

The following survey was administered to aircraft manufacturers, and the attached data in Appendix B was collected through the survey to identify where and how low airspeed alerting has been implemented in existing fleets.

Survey - Low Airspeed Indications, Alerting & Protection/Limiting

As a result of several recent accidents and incidents, the FAA has identified a possible need for additional low airspeed safeguards and tasked the Aviation Rulemaking Advisory Committee (ARAC) to answer technical questions on this subject. The ARAC assigned this task to the Avionics Systems Harmonization Working Group (ASHWG). To accomplish this task, the ASHWG is collecting information on the low airspeed indications, alerting and protection/limit functions available on current commercial airplanes. The ASHWG will provide information to help develop recommendations on whether there should be regulatory requirements and guidance material for retrofit of low airspeed alerting on existing aircraft.

Any rulemaking that the FAA might undertake based on the ARAC recommendations would be subject to a cost-benefit analysis. Detailed information for the FAA tasking to ARAC can be found at 76 FR 11844. The survey requests information on low airspeed flight deck indications, alerting and protection/limiting functions as well as technical information on input parameters to these functions. The following are brief definitions of terms to help in understanding the survey.

- “Indications” for low airspeed conditions - information presented full time on a display or indicator.

- “Alerting” for low airspeed conditions - additional information presented to the flight crew (visual and/or aural) only under specific predefined conditions.

- “Protection/limiting” for low airspeed or approach to stall conditions - functions that automatically provide assistance to the flight crew (e.g., throttle advance, increase in stick forces), but only under specific predefined conditions.

The ASHWG strictly adheres to ethical standards, public law, and federal policies for safeguarding the confidentiality of all participants in this survey. Completion of this survey is voluntary and all responses to the survey that are released will not contain survey participant information.

The survey should take approximately 20-30 minutes to complete per airplane model. Please complete the survey within 30 days of receipt. It is recommended that you review the attached survey file and gather all the necessary information before completing the online survey.

Thank you for participating in this survey.

1) Select your airplane model:

- ☐Airbus A300-600 or A310 All
- ☐Airbus A318/319/320/321/330/340/380 All
- ☐ATR ATR42 All
- ☐ATR ATR72 All
- ☐BaE J31 All
- ☐BaE J41 All
- ☐Boeing 717 All
- ☐Boeing 727 All
- ☐Boeing 737 -300, -400, -500 Conv
- ☐Boeing 737 -300, -400, -500 EADI F/S
- ☐Boeing 737 -300, -400, -500 EADI Spd Tape
- ☐Boeing 737 -600, -700, -800, -900
- ☐Boeing 747 -200
- ☐Boeing 747 -400
- ☐Boeing 757 -200 EADI F/S
- ☐Boeing 757 -200, -300 EADI Spd Tape
- ☐Boeing 767 -200, -300 EADI F/S
- ☐Boeing 767 -200, -300 EADI Spd Tape
- ☐Boeing 767 -400
- ☐Boeing 777 All
- ☐Boeing DC9 All
- ☐Boeing MD 80 All
- ☐Boeing MD 90 All
- ☐Boeing MD10 All
- ☐Boeing MD11 All
- ☐Bombardier CRJ -100, -200, -400, -440
- ☐Bombardier CRJ -700, -701, -702
- ☐Bombardier CRJ -705, -900
- ☐Bombardier DHC8 -100, -200, -300
- ☐Bombardier DHC8 -400
- ☐Embraer 120 All
- ☐Embraer 135 All
- ☐Embraer 140 All
- ☐Embraer 145 All
- ☐Embraer 170 All
- ☐Embraer 175 All

- ☐Embraer 190 All
- ☐Saab 340 All

Section 1 - General System Capabilities

2) 1-1. What general system capabilities does the airplane have to support new flight deck indications and alerting? (Check all that apply)

- ☐Primary Flight Display (with speed tape)
- ☐Alert message system (visual message list)
- ☐Master caution/warning light
- ☐Aural tone and/or voice capability
- ☐Enhanced Ground Proximity Warning System
- ☐Angle of attack data
- ☐Flap data
- ☐Anti-ice active data
- ☐Other (please specify)

If you selected other, please specify

_____

Section 2 - INDICATIONS for Low Airspeed Awareness

3) 2-1.What low airspeed awareness indications or cues (other than alerts) are presented on the airspeed indicator or airspeed tape? (Check all that apply)

[Reference AC 25-11A Appendix 1, Paragraph 2.3 provides information for low airspeed awareness]

- ☐Colored bands
- ☐Trend vectors
- ☐Speed bugs
- ☐Other (please specify)

If you selected other, please specify

_____

4) 2-2. What other indications exist that support low airspeed awareness, although it may not be the primary function? (Check all that apply)

- ☐Pitch limit indicator
- ☐Angle of attack indicator
- ☐Other (please specify)

If you selected other, please specify

_____

Section 3 - ALERTING Functionality for Low Airspeed Conditions (prior to stall warning)

5) 3-1. What additional visual indications are presented to the flight crew for a low airspeed alert, prior to stall warning? (Check all that apply)

[CFR 14 Part 25.1322, Paragraph (c) (2) provides requirements for alerting indications]

- ☐Discrete indicator (lamp)
- ☐Master caution light
- ☐Indicator on Crew Alerting display
- ☐Indicator on Primary Flight Display
- ☐Change in display of current airspeed (i.e., flash, color change, etc)
- ☐Change in display of angle of attack or angle of attack threshold (i.e., flash, color change, etc)
- ☐Other (please specify)

If you selected other, please specify

_____

6) 3-2. What aural indications are presented to the flight crew for a low airspeed alert, prior to stall warning? (Check all that apply, and specify in Comments)

[CFR 14 Part 25.1322, Paragraph (c) (2) provides requirements for alerting indications]

- ☐Voice (please specify)
- ☐Tone (please specify)
- ☐Other (please specify)

Additional comments

_____

7) 3-3. What input parameters are used in the logic for the low airspeed alert? (Check all that apply)

- ☐Airspeed
- ☐Airspeed rate of change
- ☐Angle of attack
- ☐Barometric altitude
- ☐Radio altitude
- ☐Minimum maneuver speed
- ☐Stick shaker speed
- ☐Manual or automatic flight state
- ☐Thrust/power parameters
- ☐Time
- ☐Other (please specify)

If you selected other, please specify

_____

8) 3-4. Is the low airspeed alert adjusted for the following conditions/configurations? (Check all that apply)

- ☐Flaps setting
- ☐Speedbrake extension

- Weight
- CG
- Load factor/g-loading
- Icing conditions
- Other (please specify)

If you selected other, please specify

_____

9) 3-5. What trip point is used to activate the low airspeed alert? (Check all that apply)

- X kts or X% in the low speed amber band
- X% above stall speed
- X degrees angle of attack
- Low airspeed alert is same as stall warning
- Other (please specify)

If you selected other, please specify

_____

10) 3-6. How do you minimize nuisance alerts? (Check all that apply)

- Hysteresis (e.g. delay in reset)
- Filtering
- Large margins from normal operating speed
- Special combinations of input parameters
- Manual inhibit
- Automatic inhibit
- Other (please specify)

If you selected other, please specify

_____

11) 3-7. What circumstances or conditions are used to inhibit the low airspeed alert? (Check all that apply)

- Baro Altitude
- Radio Altitude
- Priorities with other alerts
- Phase of flight (e.g., takeoff, approach)
- Non-normal configurations
- Other (please specify)

If you selected other, please specify

_____

12) 3-8. Is there a design requirement or goal for a minimum time margin between the low airspeed alert activation and stall warning activation? (assuming these are two independent points)

- Yes (please specify below)
- No

Additional comments

_____

13) 3-9. Can you provide a description or illustration or logic diagram or equation that describes how the low airspeed alert is activated?

- Yes (If so, email to the point of contact identified in the introduction)
- No

14) 3-10. How did you determine that the Low Airspeed Alert is timely (i.e., provides the pilot sufficient time to avoid stall warning, or some other identified point)? (Check all that apply)

- Analysis
- In-service history
- Flight test
- Flight simulator or lab testing
- Other (please specify)

If you selected other, please specify

_____

15) 3-11. Is the alerting functionality you have described above implemented on all airplanes or only some through a customer option, STC or later add-on?

- All
- Some through option, STC or later add-on

16) 3-12. If you selected some through option, STC or later add-on, please specify the number of airplanes modified versus the number in the fleet:

Number of airplanes modified _____

Number airplanes in the fleet _____

Section 4 - PROTECTION/LIMITING functionality (automated assistance) for low airspeed or approach to stall conditions?

17) 4-1. What protection/limiting functionality is available to automatically assist the pilot for low airspeed conditions, prior to stall warning? (Check all that apply)

- Autothrottle "wakeup"/automatic thrust activation
- Stick pusher
- Automatic pitch control
- Increased column/stick forces
- Angle of attack protection
- Auto-slat extension
- Angle of attack limit

- Other (please specify)

If you selected other, please specify

_____

18) 4-2. What protection/limiting functionality is available to automatically assist the pilot for approach to stall conditions, at/after stall warning? (Check all that apply)

- Stick pusher
- Automatic pitch control
- Increased column/stick forces
- Angle of attack protection
- Auto-slat extension
- Angle of attack limit
- Other (please specify)

If you selected other, please specify

_____

Appendix B – Survey Results

Appendix B contains the data which was collected through the survey questions in Appendix A, to identify where and how low airspeed alerting has been implemented in existing fleets.

		1-1. What general system capabilites does the airplane have to support new flight deck indications and alerting?									
Model Capabilties (Reference survey question in parentheses)	Airplane model (number in fleet at the time of data collection)	Primary Flight Display (with speedtape)	Alert message system (visual message list)	Master caution/warning light	Aural tone and/or voice capability	Enhanced Ground Proximity Warning System	Angle of attack data	Flap data	Anti-ice active data	Other	OtherText
Round dial No SW cptr	Boeing DC9 All (433)	No	No	Yes	Yes	Yes	Yes	Yes	No	No	EGPWS is available as an STC.
	Boeing 727 All (826)	No	No	No	Yes	Yes	Yes	Yes	No	No	
	Boeing 747-200 (202)	No	No	No	Yes	Yes	Yes	Yes	No	No	
Round dial Have SW cptr to support	Embraer 120 All (126)	No	No	Yes	Yes	**No**	Yes	Yes	Yes	No	
	Boeing 737 -300, -400, -500 Conv (1550)	No	No	Yes	Yes	Yes	Yes	Yes	No	No	EGPWS is available as an STC
	Boeing MD 80 All (1016)	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	
	Boeing MD 90 All (108)	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	
	Saab 340 All (197)	No	No	Yes	Yes	Yes	**No**	**No**	No	No	
Have EFIS & alert capability. (1-1)	Boeing 737 -300, -400, -500 EADI F/S (190)	No	**No**	Yes	Yes	Yes	Yes	Yes	No	No	
	Boeing 757-200 EADI F/S (971)	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	
	Boeing 767-200, -300 EADI F/S (880)	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	
	Boeing 737 -300, -400, -500 EADI Spd Tape (58)	Yes	**No**	Yes	Yes	Yes	Yes	Yes	No	No	
	Boeing 757-200, -300 EADI Spd Tape (37 -300 only)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	
	Boeing 767 -200, -300 EADI Spd Tape (46)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	
	Bombardier CRJ-100, -200, -400, -440 (718)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
	Bombardier CRJ -700, -701, -702 (215)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Ice Detector detected ice
	Bombardier CRJ -705, -900 (105 -900)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
PFD with visual low airspeed alert indication only. (3-1)	Embraer 135 All (137)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	
	Embraer 140 All (74)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	
	Embraer 145 All (503)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	
	Embraer 170 All (76)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	
	Embraer 175 All (54)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	
	Embraer 190 All (51)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	
	Boeing 717 All (155)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	
	Boeing MD10/11 All (257)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	
	Airbus A300-600 or A310 All (A300-158; A310-70)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	
Visual & aural low airspeed alert indication. (3-1, 3-2)	Boeing 737 -600, -700, -800, -900 (3908)	Yes	**No**	Yes	Yes	Yes	Yes	Yes	Yes	No	
	Boeing 747-400 (675)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	
	Boeing 767-400 (38)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**No**	No	
	Boeing 777 All (981)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	
	Airbus A318/319/320/321/330/340/380 All (767) (318-321--724; 330-380--43)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	

		2-1.What low airspeed awareness indications or cues (other than alerts) are presented on the airspeed indicator or airspeed tape?				
Model Capabilties (Reference survey question in parentheses)	**Airplane model (number in fleet at the time of data collection)**	**Colored bands**	**Trend vectors**	**Speed bugs**	**Other**	**OtherText**
Round dial No SW cptr	Boeing DC9 All (433)	No	No	No	No	
	Boeing 727 All (826)	No	No	No	No	
	Boeing 747-200 (202)	No	No	No	No	
Round dial Have SW cptr to support	Embraer 120 All (126)	No	No	No	Yes	Fast/Slow indicator
	Boeing 737 -300, -400, -500 Conv (1550)	No	No	No	No	
	Boeing MD 80 All (1016)	No	No	No	No	
	Boeing MD 90 All (108)	No	No	No	No	
	Saab 340 All (197)	No	No	Yes	No	
Have EFIS & alert capability. (1-1)	Boeing 737 -300, -400, -500 EADI F/S (190)	No	No	No	Yes	Fast/Slow Indicator
	Boeing 757-200 EADI F/S (971)	No	No	No	Yes	
	Boeing 767-200, -300 EADI F/S (880)	No	No	No	Yes	
	Boeing 737 -300, -400, -500 EADI Spd Tape (58)	Yes	Yes	Yes	No	
	Boeing 757-200, -300 EADI Spd Tape (37 -300 only)	Yes	Yes	Yes	No	
	Boeing 767 -200, -300 EADI Spd Tape (46)	Yes	Yes	Yes	No	
	Bombardier CRJ-100, -200, -400, -440 (718)	Yes	Yes	Yes	No	
	Bombardier CRJ -700, -701, -702 (215)	Yes	Yes	Yes	No	
	Bombardier CRJ -705, -900 (105 -900)	Yes	Yes	Yes	No	
PFD with visual low airspeed alert indication only. (3-1)	Embraer 135 All (137)	Yes	Yes	No	No	When airspeed trend vector touches the red band, airspeed rolling digits become amber.
	Embraer 140 All (74)	Yes	Yes	No	No	
	Embraer 145 All (503)	Yes	Yes	No	No	
	Embraer 170 All (76)	Yes	Yes	No	No	
	Embraer 175 All (54)	Yes	Yes	No	No	
	Embraer 190 All (51)	Yes	Yes	No	No	
	Boeing 717 All (155)	Yes	Yes	Yes	No	
	Boeing MD10/11 All (257)	Yes	Yes	Yes	No	
	Airbus A300-600 or A310 All (A300-158; A310-70)	Yes	Yes	Yes	No	
Visual & aural low airspeed alert indication. (3-1, 3-2)	Boeing 737 -600, -700, -800, -900 (3908)	Yes	Yes	Yes	No	
	Boeing 747-400 (675)	Yes	Yes	Yes	No	
	Boeing 767-400 (38)	Yes	Yes	Yes	No	
	Boeing 777 All (981)	Yes	Yes	Yes	No	
	Airbus A318/319/320/321/330/340/380 All (767) (318-321--724; 330-380--43)	Yes	Yes	Yes	No	

		2-2. What other indications exist that support low airspeed awareness, although it may not be the primary function?			
Model Capabilties (Reference survey question in parentheses)	**Airplane model (number in fleet at the time of data collection)**	**Pitch limit indicator**	**Angle of attack indicator**	**Other**	**OtherText**
Round dial No SW cptr	Boeing DC9 All (433)	No	No	No	
	Boeing 727 All (826)	No	No	No	
	Boeing 747-200 (202)	No	No	No	
Round dial Have SW cptr to support	Embraer 120 All (126)	No	No	No	
	Boeing 737 -300, -400, -500 Conv (1550)	No	No	No	
	Boeing MD 80 All (1016)	Yes	No	No	
	Boeing MD 90 All (108)	Yes	No	No	
	Saab 340 All (197)	No	No	No	
Have EFIS & alert capability. (1-1)	Boeing 737 -300, -400, -500 EADI F/S (190)	No	No	No	
	Boeing 757-200 EADI F/S (971)	Yes	No	No	
	Boeing 767-200, -300 EADI F/S (880)	Yes	No	No	
	Boeing 737 -300, -400, -500 EADI Spd Tape (58)	Yes	No	No	
	Boeing 757-200, -300 EADI Spd Tape (37 -300 only)	Yes	No	No	
	Boeing 767 -200, -300 EADI Spd Tape (46)	Yes	No	No	
	Bombardier CRJ-100, -200, -400, -440 (718)	No	No	No	
	Bombardier CRJ -700, -701, -702 (215)	No	No	No	
	Bombardier CRJ -705, -900 (105 -900)	No	No	No	
PFD with visual low airspeed alert indication only. (3-1)	Embraer 135 All (137)	Yes	No	No	
	Embraer 140 All (74)	Yes	No	No	
	Embraer 145 All (503)	Yes	No	No	
	Embraer 170 All (76)	Yes	No	No	
	Embraer 175 All (54)	Yes	No	No	
	Embraer 190 All (51)	Yes	No	No	
	Boeing 717 All (155)	Yes	No	No	
	Boeing MD10/11 All (257)	Yes	No	No	
	Airbus A300-600 or A310 All (A300-158; A310-70)	No	No	No	
Visual & aural low airspeed alert indication. (3-1, 3-2)	Boeing 737 -600, -700, -800, -900 (3908)	Yes	Yes	Yes	The Angle of attack indicator is an available option; the "other" is the pilot-selectable flight path vector
	Boeing 747-400 (675)	Yes	No	Yes	There is a pilot-selectable flight path vector
	Boeing 767-400 (38)	Yes	Yes	Yes	Pilot-selectable flight path vector
	Boeing 777 All (981)	Yes	Yes	Yes	The Angle of attack indicator is an available option; the "other" is the pilot-selectable flight path vector
	Airbus A318/319/320/321/330/340/380 All (767) (318-321--724; 330-380--43)	Yes	No	No	

		3-1. What additional visual indications are presented to the flight crew for a low airspeed alert, prior to stall warning?							
Model Capabilties (Reference survey question in parentheses)	**Airplane model (number in fleet at the time of data collection)**	**Discrete indicator (lamp)**	**Master caution light**	**Indicator on Crew Alerting display**	**Indicator on Primary Flight Display**	**Change in display of current airspeed (i.e., flash, color change, etc)**	**Change in display of AOA, or AOA threshold (i.e., flash, color change, etc)**	**Other**	**Other Text**
Round dial No SW cptr	Boeing DC9 All (433)	No	No	No	No	No	No	No	
	Boeing 727 All (826)	No	No	No	No	No	No	No	
	Boeing 747-200 (202)	No	No	No	No	No	No	No	
Round dial Have SW cptr to support	Embraer 120 All (126)	No	No	No	No	No	No	Yes	Dedicated equipment to indicate fast/slow airspeed
	Boeing 737 -300, -400, -500 Conv (1550)	No	No	No	No	No	No	No	
	Boeing MD 80 All (1016)	No	No	No	No	No	No	No	
	Boeing MD 90 All (108)	No	No	No	No	No	No	No	
	Saab 340 All (197)	No	No	No	No	No	No	No	
Have EFIS & alert capability. (1-1)	Boeing 737 -300, -400, -500 EADI F/S (190)	No	No	No	Yes	No	No	No	10 kts below target speed
	Boeing 757-200 EADI F/S (971)	No	No	No	Yes	No	No	No	
	Boeing 767-200, -300 EADI F/S (880)	No	No	No	Yes	No	No	No	
	Boeing 737 -300, -400, -500 EADI Spd Tape (58)	No	No	No	No	No	No	No	
	Boeing 757-200, -300 EADI Spd Tape (37 -300 only)	No	No	No	No	No	No	No	
	Boeing 767 -200, -300 EADI Spd Tape (46)	No	No	No	No	No	No	No	
	Bombardier CRJ-100, -200, -400, -440 (718)	No	No	No	No	No	No	Yes	Engine Cont Ignition light and message
	Bombardier CRJ -700, -701, -702 (215)	No	No	No	No	No	No	Yes	
	Bombardier CRJ -705, -900 (105 -900)	No	No	No	No	No	No	Yes	
PFD with visual low airspeed alert indication only. (3-1)	Embraer 135 All (137)	No	No	No	Yes	Yes	No	No	
	Embraer 140 All (74)	No	No	No	Yes	Yes	No	No	
	Embraer 145 All (503)	No	No	No	Yes	Yes	No	No	
	Embraer 170 All (76)	No	No	No	Yes	Yes	No	No	
	Embraer 175 All (54)	No	No	No	Yes	Yes	No	No	
	Embraer 190 All (51)	No	No	No	Yes	Yes	No	No	
	Boeing 717 All (155)	No	No	No	Yes	Yes	No	No	
	Boeing MD10/11 All (257)	No	No	No	Yes	Yes	No	No	
	Airbus A300-600 or A310 All (A300-158; A310-70)	No	Yes	No	Yes	No	No	Yes	3 alerts considered : 1) dynamic red speedtape on PFD, 2) AP disconnect at VLS-10 associated to master caution flashing 3) alphafloor :autoset of TOGA Thrust by autoconnection of ATHR "THRUST LATCH" set on FMA(PFD)
Visual & aural low airspeed alert indication. (3-1, 3-2)	Boeing 737 -600, -700, -800, -900 (3908)	No	No	No	Yes	Yes	No	No	
	Boeing 747-400 (675)	No	Yes	Yes	Yes	Yes	No	No	
	Boeing 767-400 (38)	No	Yes	Yes	Yes	Yes	No	No	
	Boeing 777 All (981)	No	Yes	Yes	Yes	Yes	No	No	
	Airbus A318/319/320/321/330/340/380 All (767) (318-321--724; 330-380--43)	No	Yes	Yes	Yes	No	Yes	No	three alerts considered : 1) dynamic amber & red speedtape on PFD, 2) alfa floor amber flashing on ECAM & PFD, 3) AP disconnect at alphaprot + 1°

		3-2. What aural indications are presented to the flight crew for a low airspeed alert, prior to stall warning?			
Model Capabilties (Reference survey question in parentheses)	**Airplane model (number in fleet at the time of data collection)**	**Vcice (please specify)**	**Tone (please specify)**	**Other (please specify)**	**CommentText**
Round dial No SW cptr	Boeing DC9 All (433)	No	No	No	
	Boeing 727 All (826)	No	No	No	
	Boeing 747-200 (202)	No	No	No	
Round dial Have SW cptr to support	Embraer 120 All (126)	No	No	Yes	The sound produced by stick shaker motor is loud enough to be perceived by pilots
	Boeing 737 -300, -400, -500 Conv (1550)	No	No	No	
	Boeing MD 80 All (1016)	No	No	No	
	Boeing MD 90 All (108)	No	No	No	
	Saab 340 All (197)	No	No	No	
Have EFIS & alert capability. (1-1)	Boeing 737 -300, -400, -500 EADI F/S (190)	No	No	No	
	Boeing 757-200 EADI F/S (971)	No	No	No	
	Boeing 767-200, -300 EADI F/S (880)	No	No	No	
	Boeing 737 -300, -400, -500 EADI Spd Tape (58)	No	No	No	
	Boeing 757-200, -300 EADI Spd Tape (37 -300 only)	No	No	No	
	Boeing 767 -200, -300 EADI Spd Tape (46)	No	No	No	
	Bombardier CRJ-100, -200, -400, -440 (718)	No	No	No	
	Bombardier CRJ -700, -701, -702 (215)	No	No	No	
	Bombardier CRJ -705, -900 (105 -900)	No	No	No	
PFD with visual low airspeed alert indication only. (3-1)	Embraer 135 All (137)	No	No	Yes	The sound produced by stick shaker motor is loud enough to be perceived by pilots
	Embraer 140 All (74)	No	No	Yes	
	Embraer 145 All (503)	No	No	Yes	
	Embraer 170 All (76)	No	No	Yes	
	Embraer 175 All (54)	No	No	Yes	
	Embraer 190 All (51)	No	No	Yes	
	Boeing 717 All (155)	No	No	No	
	Boeing MD10/11 All (257)	No	No	No	
	Airbus A300-600 or A310 All (A300-158; A310-70)	No	No	Yes	"cavalry charge" when AP disconnet & stickshaker
Visual & aural low airspeed alert indication. (3-1, 3-2)	Boeing 737 -600, -700, -800, -900 (3908)	Yes	No	No	Service Bulletin available to enable vcice - "AIRSPEED LOW, AIRSPEED LOW"
	Boeing 747-400 (675)	No	Yes	No	Standard EICAS caution tone
	Boeing 767-400 (38)	No	Yes	No	
	Boeing 777 All (981)	No	Yes	No	
	Airbus A318/319/320/321/330/340/380 All (767) (318-321--724; 330-380--43)	Yes	No	No	"Speed-Speed-Speed" below 2500ft

		3-3. What input parameters are used in the logic for the low airspeed alert?											
Model Capabilties (Reference survey question in parentheses)	Airplane model (number in fleet at the time of data collection)	Airspeed	Airspeed rate of change	Angle of attack	Barometric altitude	Radio altitude	Minimum maneuver speed	Stick shaker speed	Manual or automatic flight state	Thrust or power parameters	Time	Other	Other Text
Round dial No SW cptr	Boeing DC9 All (433)	No	No	No	No	No	No	No	No	No	No	No	
	Boeing 727 All (826)	No	No	No	No	No	No	No	No	No	No	No	
	Boeing 747-200 (202)	No	No	No	No	No	No	No	No	No	No	No	
Round dial Have SW cptr to support	Embraer 120 All (126)	No	No	Yes	No	No	No	Yes	No	No	No	No	
	Boeing 737 -300, -400, -500 Conv (1550)	No	No	No	No	No	No	No	No	No	No	No	
	Boeing MD 80 All (1016)	No	No	No	No	No	No	No	No	No	No	No	
	Boeing MD 90 All (108)	No	No	No	No	No	No	No	No	No	No	No	
	Saab 340 All (197)	No	No	No	No	No	No	No	No	No	No	No	
Have EFIS & alert capability. (1-1)	Boeing 737 -300, -400, -500 EADI F/S (190)	Yes	No	No	No	No	No	No	No	No	No	No	
	Boeing 757-200 EADI F/S (971)	Yes	No	No	No	No	No	No	No	No	No	No	
	Boeing 767-200, -300 EADI F/S (880)	Yes	No	No	No	No	No	No	No	No	No	No	
	Boeing 737 -300, -400, -500 EADI Spd Tape (58)	No	No	No	No	No	No	No	No	No	No	No	
	Boeing 757-200, -300 EADI Spd Tape (37 -300 only)	No	No	No	No	No	No	No	No	No	No	No	
	Boeing 767 -200, -300 EADI Spd Tape (46)	No	No	No	No	No	No	No	No	No	No	No	
	Bombardier CRJ-100, -200, -400, -440 (718)	No	No	Yes	No	No	No	No	No	No	No	Yes	
	Bombardier CRJ -700, -701, -702 (215)	No	No	Yes	No	No	No	No	No	No	No	Yes	Mach & AoA rate
	Bombardier CRJ -705, -900 (105 -900)	No	No	Yes	No	No	No	No	No	No	No	Yes	
PFD with visual low airspeed alert indication only. (3-1)	Embraer 135 All (137)	No	No	Yes	No	No	No	Yes	No	No	No	No	
	Embraer 140 All (74)	No	No	Yes	No	No	No	Yes	No	No	No	No	
	Embraer 145 All (503)	No	No	Yes	No	No	No	Yes	No	No	No	No	
	Embraer 170 All (76)	Yes	Yes	Yes	No	No	No	Yes	No	Yes	No	No	
	Embraer 175 All (54)	Yes	Yes	Yes	No	No	No	Yes	No	Yes	No	No	
	Embraer 190 All (51)	Yes	Yes	Yes	No	No	No	Yes	No	Yes	No	No	
	Boeing 717 All (155)	Yes	No	No	No	No	Yes	Yes	No	No	No	No	
	Boeing MD10/11 All (257)	Yes	No	No	No	No	Yes	Yes	No	No	No	No	
	Airbus A300-600 or A310 All (A300-158; A310-70)	Yes	Yes	Yes	No	No	No	No	No	No	No	No	
Visual & aural low airspeed alert indication. (3-1, 3-2)	Boeing 737 -600, -700, -800, -900 (3908)	Yes	No	No	No	No	Yes	Yes	No	No	No	No	
	Boeing 747-400 (675)	Yes	No	No	No	No	Yes	Yes	No	No	No	No	
	Boeing 767-400 (38)	Yes	No	No	No	No	Yes	Yes	No	No	No	No	
	Boeing 777 All (981)	Yes	No	No	No	No	Yes	Yes	No	No	No	No	
	Airbus A318/319/320/321/330/340/380 All (767) (318-321--724; 330-380--43)	Yes	Yes	Yes	No	Yes	No	No	No	No	No	Yes	Mach (for alphaprot-alphamax)

		3-4. Is the low airspeed alert adjusted for the following conditions/configurations?							
Model Capabilties (Reference survey question in parentheses)	Airplane model (number in fleet at the time of data collection)	Flaps setting	Speedbrake extension	Weight	CG	Load factor/g-loading	Icing conditions	Other	OtherText
Round dial No SW cptr	Boeing DC9 All (433)	No	No	No	No	No	No	No	
	Boeing 727 All (826)	No	No	No	No	No	No	No	
	Boeing 747-200 (202)	No	No	No	No	No	No	No	
Round dial Have SW cptr to support	Embraer 120 All (126)	Yes	No	No	No	No	Yes	No	
	Boeing 737 -300, -400, -500 Conv (1550)	No	No	No	No	No	No	No	
	Boeing MD 80 All (1016)	No	No	No	No	No	No	No	
	Boeing MD 90 All (108)	No	No	No	No	No	No	No	
	Saab 340 All (197)	No	No	No	No	No	No	No	
Have EFIS & alert capability. (1-1)	Boeing 737 -300, -400, -500 EADI F/S (190)	No	No	No	No	No	No	No	
	Boeing 757-200 EADI F/S (971)	No	No	No	No	No	No	No	
	Boeing 767-200, -300 EADI F/S (880)	No	No	No	No	No	No	No	
	Boeing 737 -300, -400, -500 EADI Spd Tape (58)	No	No	No	No	No	No	No	
	Boeing 757-200, -300 EADI Spd Tape (37 -300 only)	No	No	No	No	No	No	No	
	Boeing 767 -200, -300 EADI Spd Tape (46)	No	No	No	No	No	No	No	
	Bombardier CRJ-100, -200, -400, -440 (718)	Yes	No	No	No	No	No	Yes	Mach
	Bombardier CRJ -700, -701, -702 (215)	Yes	No	No	No	No	No	Yes	
	Bombardier CRJ -705, -900 (105 -900)	Yes	No	No	No	No	No	Yes	
PFD with visual low airspeed alert indication only. (3-1)	Embraer 135 All (137)	Yes	No	No	No	No	Yes	No	
	Embraer 140 All (74)	Yes	No	No	No	No	Yes	No	
	Embraer 145 All (503)	Yes	No	No	No	No	Yes	No	
	Embraer 170 All (76)	Yes	No	No	No	No	Yes	No	
	Embraer 175 All (54)	Yes	No	No	No	No	Yes	No	
	Embraer 190 All (51)	Yes	No	No	No	No	Yes	No	
	Boeing 717 All (155)	Yes	No	Yes	Yes	Yes	No	No	
	Boeing MD10/11 All (257)	Yes	No	Yes	Yes	Yes	No	No	
	Airbus A300-600 or A310 All (A300-158; A310-70)	Yes	Yes	Yes	No	Yes	No	No	
Visual & aural low airspeed alert indication. (3-1, 3-2)	Boeing 737 -600, -700, -800, -900 (3908)	Yes	No	Yes	Yes	Yes	Yes	No	The adjustments are made to the amber band/barber pole, which directly affects alert trip point
	Boeing 747-400 (675)	Yes	No	Yes	Yes	Yes	Yes	No	
	Boeing 767-400 (38)	Yes	No	Yes	Yes	Yes	Yes	No	
	Boeing 777 All (981)	Yes	No	Yes	Yes	Yes	Yes	No	
	Airbus A318/319/320/321/330/340/380 All (767) (318-321--724; 330-380--43)	Yes	Yes	Yes	No	Yes	No	No	

		3-5. What trip point is used to activate the low airspeed alert?					
Model Capabilties (Reference survey question in parentheses)	**Airplane model (number in fleet at the time of data collection)**	**X kts or X% in the low speed amber band**	**X% above stall speed**	**X degrees angle of attack**	**Low airspeed alert is same as stall warning**	**Other**	**Other Text**
Round dial No SW cptr	Boeing DC9 All (433)	No	No	No	No	No	
	Boeing 727 All (826)	No	No	No	No	No	
	Boeing 747-200 (202)	No	No	No	No	No	
Round dial Have SW cptr to support	Embraer 120 All (126)	No	No	Yes	Yes	No	
	Boeing 737 -300, -400, -500 Conv (1550)	No	No	No	No	No	
	Boeing MD 80 All (1016)	No	No	No	No	No	
	Boeing MD 90 All (108)	No	No	No	No	No	
	Saab 340 All (197)	No	No	No	No	No	
Have EFIS & alert capability. (1-1)	Boeing 737 -300, -400, -500 EADI F/S (190)	No	No	No	No	Yes	Difference from target airspeed (10 kts.)
	Boeing 757-200 EADI F/S (971)	No	No	No	No	Yes	Difference from target airspeed
	Boeing 767-200, -300 EADI F/S (880)	No	No	No	No	Yes	Difference from target airspeed
	Boeing 737 -300, -400, -500 EADI Spd Tape (58)	No	No	No	No	No	
	Boeing 757-200, -300 EADI Spd Tape (37 -300 only)	No	No	No	No	No	
	Boeing 767 -200, -300 EADI Spd Tape (46)	No	No	No	No	No	
	Bombardier CRJ-100, -200, -400, -440 (718)	No	No	Yes	No	No	
	Bombardier CRJ -700, -701, -702 (215)	No	No	Yes	Yes	No	
	Bombardier CRJ -705, -900 (105 -900)	No	No	Yes	No	No	
PFD with visual low airspeed alert indication only. (3-1)	Embraer 135 All (137)	No	No	Yes	Yes	No	
	Embraer 140 All (74)	No	No	Yes	Yes	No	
	Embraer 145 All (503)	No	No	Yes	Yes	No	
	Embraer 170 All (76)	Yes	No	Yes	Yes	No	
	Embraer 175 All (54)	Yes	No	Yes	Yes	No	
	Embraer 190 All (51)	Yes	No	Yes	Yes	No	
	Boeing 717 All (155)	Yes	No	No	No	No	
	Boeing MD10/11 All (257)	Yes	No	No	No	No	
	Airbus A300-600 or A310 All (A300-158; A310-70)	Yes	Yes	Yes	No	No	
Visual & aural low airspeed alert indication. (3-1, 3-2)	Boeing 737 -600, -700, -800, -900 (3908)	Yes	No	No	No	No	30%
	Boeing 747-400 (675)	Yes	No	No	No	No	
	Boeing 767-400 (38)	Yes	No	No	No	No	
	Boeing 777 All (981)	Yes	No	No	No	No	
	Airbus A318/319/320/321/330/340/380 All (767) (318-321--724; 330-380--43)	No	No	Yes	No	No	

		3-6. How do you minimize nuisance alerts?							
Model Capabilties (Reference survey question in parentheses)	Airplane model (number in fleet at the time of data collection)	Hysteresis (e.g. delay in reset)	Filtering	Large margins from normal operating speed	Special combinations of input parameters	Manual inhibit	Automatic inhibit	Other	Other Text
Round dial No SW cptr	Boeing DC9 All (433)	No	No	No	No	No	No	No	
	Boeing 727 All (826)	No	No	No	No	No	No	No	
	Boeing 747-200 (202)	No	No	No	No	No	No	No	
Round dial Have SW cptr to support	Embraer 120 All (126)	No	No	Yes	No	No	No	No	
	Boeing 737 -300, -400, -500 Conv (1550)	No	No	No	No	No	No	No	
	Boeing MD 80 All (1016)	No	No	No	No	No	No	No	
	Boeing MD 90 All (108)	No	No	No	No	No	No	No	
	Saab 340 All (197)	No	No	No	No	No	No	No	
Have EFIS & alert capability. (1-1)	Boeing 737 -300, -400, -500 EADI F/S (190)	No	No	No	No	No	No	No	
	Boeing 757-200 EADI F/S (971)	No	No	No	No	No	No	No	
	Boeing 767-200, -300 EADI F/S (880)	No	No	No	No	No	No	No	
	Boeing 737 -300, -400, -500 EADI Spd Tape (58)	No	No	No	No	No	No	No	
	Boeing 757-200, -300 EADI Spd Tape (37 -300 only)	No	No	No	No	No	No	No	
	Boeing 767 -200, -300 EADI Spd Tape (46)	No	No	No	No	No	No	No	
	Bombardier CRJ-100, -200, -400, -440 (718)	No	Yes	Yes	No	No	No	No	
	Bombardier CRJ -700, -701, -702 (215)	No	Yes	Yes	No	No	No	No	
	Bombardier CRJ -705, -900 (105 -900)	No	Yes	Yes	No	No	No	No	
PFD with visual low airspeed alert indication only. (3-1)	Embraer 135 All (137)	No	Yes	Yes	No	No	No	No	
	Embraer 140 All (74)	No	Yes	Yes	No	No	No	No	
	Embraer 145 All (503)	No	Yes	Yes	No	No	No	No	
	Embraer 170 All (76)	Yes	Yes	Yes	No	No	No	No	
	Embraer 175 All (54)	Yes	Yes	Yes	No	No	No	No	
	Embraer 190 All (51)	Yes	Yes	Yes	No	No	No	No	
	Boeing 717 All (155)	No	No	No	No	No	No	No	
	Boeing MD10/11 All (257)	No	No	No	No	No	No	No	
	Airbus A300-600 or A310 All (A300-158; A310-70)	No	Yes	Yes	No	No	Yes	No	
Visual & aural low airspeed alert indication. (3-1, 3-2)	Boeing 737 -600, -700, -800, -900 (3908)	Yes	Yes	Yes	No	No	No	No	The alert is triggered when current airspeed has decreased so as to "use up" 30% of the minumum maneuver speed margin to stickshaker. The alert is removed when airspeed is greater than minimum maneuver speed.
	Boeing 747-400 (675)	Yes	Yes	Yes	No	No	No	No	
	Boeing 767-400 (38)	Yes	Yes	Yes	No	No	No	No	
	Boeing 777 All (981)	Yes	Yes	Yes	No	No	No	No	
	Airbus A318/319/320/321/330/340/380 All (767) (318-321--724; 330-380--43)	No	Yes	Yes	No	No	Yes	No	

		3-7. What circumstances or conditions are used to inhibit the low airspeed alert?						
Model Capabilties (Reference survey question in parentheses)	**Airplane model (number in fleet at the time of data collection)**	**Baro Altitude**	**Radio Altitude**	**Priorities with other alerts**	**Phase of flight (e.g., takeoff, approach)**	**Non-normal configurations**	**Other**	**Other Text**
Round dial No SW cptr	**Boeing DC9 All (433)**	No	No	No	No	No	No	
	Boeing 727 All (826)	No	No	No	No	No	No	
	Boeing 747-200 (202)	No	No	No	No	No	No	
Round dial Have SW cptr to support	**Embraer 120 All (126)**	No	No	No	No	No	Yes	Weight On Wheels equal to ground inhibits LAA
	Boeing 737 -300, -400, -500 Conv (1550)	No	No	No	No	No	No	
	Boeing MD 80 All (1016)	No	No	No	No	No	No	
	Boeing MD 90 All (108)	No	No	No	No	No	No	
	Saab 340 All (197)	No	No	No	No	No	No	
Have EFIS & alert capability. (1-1)	**Boeing 737 -300, -400, -500 EADI F/S (190)**	No	No	No	No	No	No	
	Boeing 757-200 EADI F/S (971)	No	No	No	No	No	No	
	Boeing 767-200, -300 EADI F/S (880)	No	No	No	No	No	No	
	Boeing 737 -300, -400, -500 EADI Spd Tape (58)	No	No	No	No	No	No	
	Boeing 757-200, -300 EADI Spd Tape (37 -300 only)	No	No	No	No	No	No	
	Boeing 767 -200, -300 EADI Spd Tape (46)	No	No	No	No	No	No	
	Bombardier CRJ-100, -200, -400, -440 (718)	No	No	No	No	No	No	
	Bombardier CRJ -700, -701, -702 (215)	No	No	No	No	No	No	
	Bombardier CRJ -705, -900 (105 -900)	No	No	No	No	No	No	
PFD with visual low airspeed alert indication only. (3-1)	**Embraer 135 All (137)**	No	No	No	No	No	Yes	Weight On Wheels equal to ground inhibits LAA
	Embraer 140 All (74)	No	No	No	No	No	Yes	
	Embraer 145 All (503)	No	No	No	No	No	Yes	
	Embraer 170 All (76)	No	No	No	No	No	Yes	
	Embraer 175 All (54)	No	No	No	No	No	Yes	
	Embraer 190 All (51)	No	No	No	No	No	Yes	
	Boeing 717 All (155)	No	No	No	No	No	No	
	Boeing MD10/11 All (257)	No	No	No	No	No	No	
	Airbus A300-600 or A310 All (A300-158; A310-70)	No	Yes	No	No	No	No	
Visual & aural low airspeed alert indication. (3-1, 3-2)	**Boeing 737 -600, -700, -800, -900 (3908)**	No	No	No	Yes	No	Yes	The low speed alert is inhibited until first flap retraction after takeoff. The logic detects that the flaps have changed after takeoff.
	Boeing 747-400 (675)	No	No	No	Yes	No	Yes	
	Boeing 767-400 (38)	No	No	No	Yes	No	Yes	
	Boeing 777 All (981)	No	No	No	Yes	No	Yes	
	Airbus A318/319/320/321/330/340/380 All (767) (318-321--724; 330-380--43)	No	Yes	No	No	No	Yes	slat/flap conf for "Speed-Speed-Speed" alert

		3-8. Is there a design requirement or goal for a minimum time margin between the low airspeed alert activation and stall warning activation?		3-9. Can you provide a description or illustration or logic diagram or equation that describes how the low airspeed alert is activated?
Model Capabilties (Reference survey question in parentheses)	Airplane model (number in fleet at the time of data collection)	Yes or No	CommentText	Yes or No
Round dial No SW cptr	Boeing DC9 All (433)			
	Boeing 727 All (826)			
	Boeing 747-200 (202)			
Round dial Have SW cptr to support	Embraer 120 All (126)	No		Yes
	Boeing 737 -300, -400, -500 Conv (1550)			
	Boeing MD 80 All (1016)			
	Boeing MD 90 All (108)			
	Saab 340 All (197)			
Have EFIS & alert capability. (1-1)	Boeing 737 -300, -400, -500 EADI F/S (190)	No		No
	Boeing 757-200 EADI F/S (971)	No		No
	Boeing 767-200, -300 EADI F/S (880)	No		No
	Boeing 737 -300, -400, -500 EADI Spd Tape (58)			
	Boeing 757-200, -300 EADI Spd Tape (37 -300 only)			
	Boeing 767 -200, -300 EADI Spd Tape (46)			
	Bombardier CRJ-100, -200, -400, -440 (718)	No		Yes
	Bombardier CRJ -700, -701, -702 (215)	No		Yes
	Bombardier CRJ -705, -900 (105 -900)	No		Yes
PFD with visual low airspeed alert indication only. (3-1)	Embraer 135 All (137)	No		Yes
	Embraer 140 All (74)	No	Low Speed alert is the same as Stall	Yes
	Embraer 145 All (503)	No	Low Speed alert is the same as Stall	Yes
	Embraer 170 All (76)	No	Low Speed alert is the same as Stall	Yes
	Embraer 175 All (54)	No	Low Speed alert is the same as Stall	Yes
	Embraer 190 All (51)	No	Low Speed alert is the same as Stall	Yes
	Boeing 717 All (155)	No		No
	Boeing MD10/11 All (257)	No		No
	Airbus A300-600 or A310 All (A300-158; A310-70)	No	Single time margin value cannot address all dynamic conditions	Yes
Visual & aural low airspeed alert indication. (3-1, 3-2)	Boeing 737 -600, -700, -800, -900 (3908)	No		Yes
	Boeing 747-400 (675)	No		Yes
	Boeing 767-400 (38)	No		Yes
	Boeing 777 All (981)	No		Yes
	Airbus A318/319/320/321/330/340/380 All (767) (318-321--724; 330-380--43)	No	single time margin value cannot address all dynamic conditions	Yes

		3-10. How did you determine that the Low Airspeed Alert is timely (i.e., provides the pilot sufficient time to avoid stall warning, some other identified point)?					
Model Capabilties (Reference survey question in parentheses)	**Airplane model (number in fleet at the time of data collection)**	**Analysis**	**In-service history**	**Flight test**	**Flight simulator or lab testing**	**Other**	**Other Text**
Round dial No SW cptr	Boeing DC9 All (433)	No	No	No	No	No	
	Boeing 727 All (826)	No	No	No	No	No	
	Boeing 747-200 (202)	No	No	No	No	No	
Round dial Have SW cptr to support	Embraer 120 All (126)	No	No	Yes	No	Yes	The values used for stick shaker activation follows the certification requirements (25.207) and are confirmed via flight test.
	Boeing 737 -300, -400, -500 Conv (1550)	No	No	No	No	No	
	Boeing MD 80 All (1016)	No	No	No	No	No	
	Boeing MD 90 All (108)	No	No	No	No	No	
	Saab 340 All (197)	No	No	No	No	No	
Have EFIS & alert capability. (1-1)	Boeing 737 -300, -400, -500 EADI F/S (190)	No	No	No	No	No	
	Boeing 757-200 EADI F/S (971)	No	No	No	No	No	
	Boeing 767-200, -300 EADI F/S (880)	No	No	No	No	No	
	Boeing 737 -300, -400, -500 EADI Spd Tape (58)	No	No	No	No	No	
	Boeing 757-200, -300 EADI Spd Tape (37 -300 only)	No	No	No	No	No	
	Boeing 767 -200, -300 EADI Spd Tape (46)	No	No	No	No	No	
	Bombardier CRJ-100, -200, -400, -440 (718)	No	No	No	No	Yes	Has not been verified
	Bombardier CRJ -700, -701, -702 (215)	No	No	No	No	Yes	
	Bombardier CRJ -705, -900 (105 -900)	No	No	No	No	Yes	
PFD with visual low airspeed alert indication only. (3-1)	Embraer 135 All (137)	No	No	Yes	No	Yes	The values used for stick shaker activation follows the certification requirements (25.207) and are confirmed via flight test.
	Embraer 140 All (74)	No	No	Yes	No	Yes	
	Embraer 145 All (503)	No	No	Yes	No	Yes	
	Embraer 170 All (76)	No	No	Yes	No	Yes	
	Embraer 175 All (54)	No	No	Yes	No	Yes	
	Embraer 190 All (51)	No	No	Yes	No	Yes	
	Boeing 717 All (155)	No	No	No	No	No	
	Boeing MD10/11 All (257)	No	No	No	No	No	
	Airbus A300-600 or A310 All (A300-158; A310-70)	Yes	Yes	Yes	Yes	No	
Visual & aural low airspeed alert indication. (3-1, 3-2)	Boeing 737 -600, -700, -800, -900 (3908)	Yes	Yes	Yes	Yes	No	
	Boeing 747-400 (675)	Yes	Yes	Yes	Yes	No	
	Boeing 767-400 (38)	Yes	Yes	Yes	Yes	No	
	Boeing 777 All (981)	Yes	Yes	Yes	Yes	No	
	Airbus A318/319/320/321/330/340/380 All (767) (318-321--724; 330-380--43)	Yes	Yes	Yes	Yes	No	

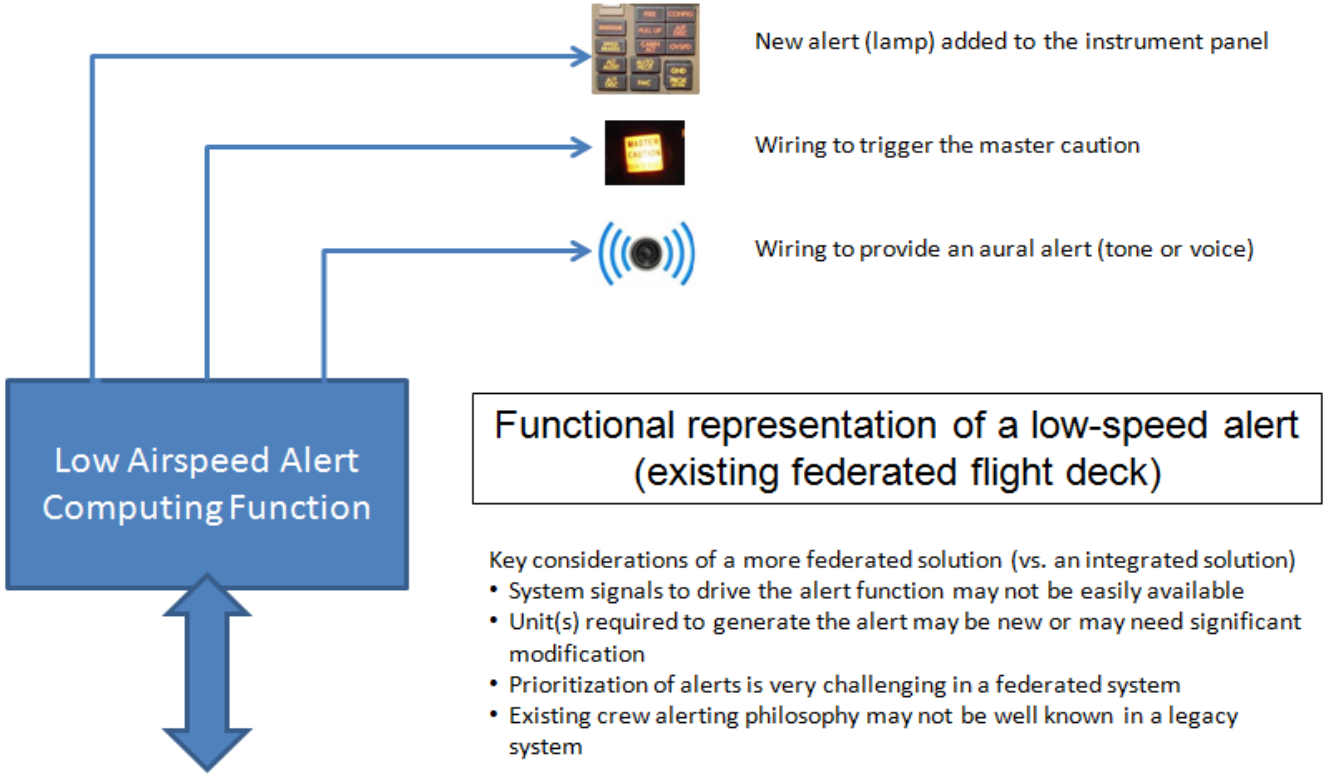
		3-11. Is the alerting functionality you have described above implemented on all airplanes or only some through a customer option, STC or later add-on?		3-12. If you selected some through option, STC or later add-on, please specify the number of airplanes modified versus the number in the fleet:	
Model Capabilties (Reference survey question in parentheses)	**Airplane model (number in fleet at the time of data collection)**	**All**	**Some through option, STC or later add-on**	**Number of airplanes modified**	**Number airplanes in the fleet**
Round dial No SW cptr	Boeing DC9 All (433)	No	No		
	Boeing 727 All (826)	No	No		
	Boeing 747-200 (202)	No	No		
Round dial Have SW cptr to support	Embraer 120 All (126)	Yes	No		
	Boeing 737 -300, -400, -500 Conv (1550)	No	No		
	Boeing MD 80 All (1016)	No	No		
	Boeing MD 90 All (108)	No	No		
	Saab 340 All (197)	No	No		
Have EFIS & alert capability. (1-1)	Boeing 737 -300, -400, -500 EADI F/S (190)	Yes	No		
	Boeing 757-200 EADI F/S (971)	Yes	No		
	Boeing 767-200, -300 EADI F/S (880)	Yes	No		
	Boeing 737 -300, -400, -500 EADI Spd Tape (58)	No	No		
	Boeing 757-200, -300 EADI Spd Tape (37 -300 only)	No	No		
	Boeing 767 -200, -300 EADI Spd Tape (46)	No	No		
	Bombardier CRJ-100, -200, -400, -440 (718)	Yes	No		
	Bombardier CRJ -700, -701, -702 (215)	Yes	No		
	Bombardier CRJ -705, -900 (105 -900)	Yes	No		
PFD with visual low airspeed alert indication only. (3-1)	Embraer 135 All (137)	Yes	No		
	Embraer 140 All (74)	Yes	No		
	Embraer 145 All (503)	Yes	No		
	Embraer 170 All (76)	Yes	No		
	Embraer 175 All (54)	Yes	No		
	Embraer 190 All (51)	Yes	No		
	Boeing 717 All (155)	Yes	No		
	Boeing MD10/11 All (257)	Yes	No		
	Airbus A300-600 or A310 All (A300-158; A310-70)	Yes	No		
Visual & aural low airspeed alert indication. (3-1, 3-2)	Boeing 737 -600, -700, -800, -900 (3908)	No	Yes	400	3700
	Boeing 747-400 (675)	No	Yes	350	680
	Boeing 767-400 (38)	Yes	No		
	Boeing 777 All (981)	Yes	No		
	Airbus A318/319/320/321/330/340/380 All (767) (318-321--724; 330-380--43)	Yes	No		

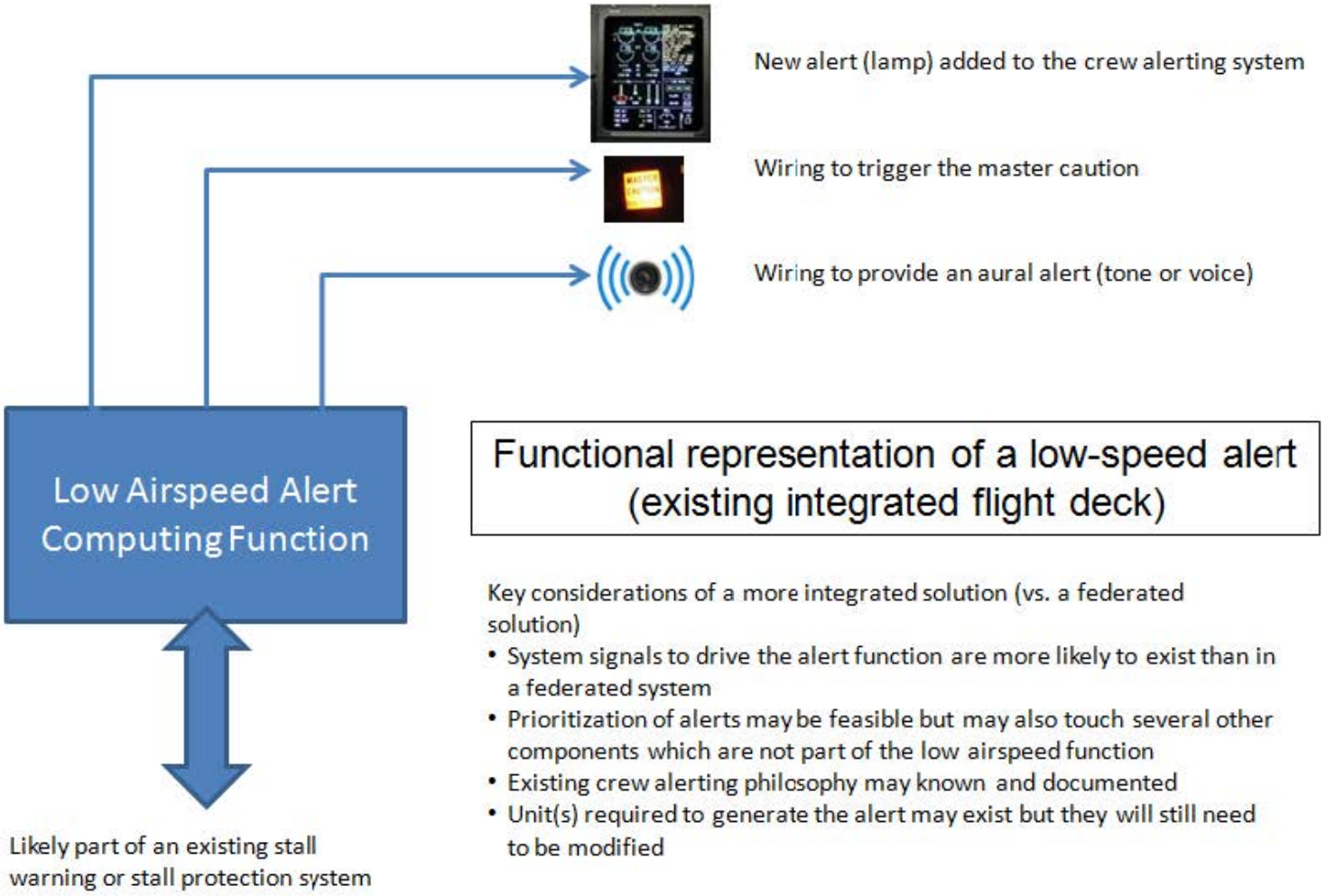
		4-1. What protection/limiting functionality is available to automatically assist the pilot for low airspeed conditions, prior to stall warning?								
Model Capabilties (Reference survey question in parentheses)	**Airplane model (number in fleet at the time of data collection)**	**Autothrottle "wakeup"/automatic thrust activation**	**Stick pusher**	**Automatic pitch control**	**Increased column/stick forces**	**Angle of attack protection**	**Auto-slat extension**	**Angle of attack limit**	**Other**	**Other Text**
Round dial No SW cptr	Boeing DC9 All (433)	No	No	No	No	No	No	No	No	
	Boeing 727 All (826)	No	No	No	No	No	No	No	No	
	Boeing 747-200 (202)	No	No	No	No	No	No	No	No	
Round dial Have SW cptr to support	Embraer 120 All (126)	No	No	No	No	No	No	No	Yes	Stick Shaker
	Boeing 737 -300, -400, -500 Conv (1550)	No	No	No	No	No	Yes	No	No	
	Boeing MD 80 All (1016)	No	No	No	No	No	Yes	No	No	
	Boeing MD 90 All (108)	No	No	No	No	No	Yes	No	No	
	Saab 340 All (197)	No	No	No	No	No	No	No	No	
Have EFIS & alert capability. (1-1)	Boeing 737 -300, -400, -500 EADI F/S (190)	No	No	No	No	No	Yes	No	No	
	Boeing 757-200 EADI F/S (971)	No	No	No	No	No	Yes	No	No	
	Boeing 767-200, -300 EADI F/S (880)	No	No	No	No	No	Yes	No	No	
	Boeing 737 -300, -400, -500 EADI Spd Tape (58)	No	No	No	No	No	Yes	No	No	
	Boeing 757-200, -300 EADI Spd Tape (37 -300 only)	No	No	No	No	No	Yes	No	No	
	Boeing 767 -200, -300 EADI Spd Tape (46)	No	No	No	No	No	Yes	No	No	
	Bombardier CRJ-100, -200, -400, -440 (718)	No	No	No	No	No	No	No	No	
	Bombardier CRJ -700, -701, -702 (215)	No	No	No	No	No	No	No	No	
	Bombardier CRJ -705, -900 (105 -900)	No	No	No	No	No	No	No	No	
PFD with visual low airspeed alert indication only. (3-1)	Embraer 135 All (137)	No	No	No	No	No	No	No	Yes	Stick Shaker
	Embraer 140 All (74)	No	No	No	No	No	No	No	Yes	
	Embraer 145 All (503)	No	No	No	No	No	No	No	Yes	
	Embraer 170 All (76)	No	No	No	No	No	No	Yes	No	
	Embraer 175 All (54)	No	No	No	No	No	No	Yes	No	
	Embraer 190 All (51)	No	No	No	No	No	No	Yes	No	
	Boeing 717 All (155)	Yes	No	No	No	No	No	No	No	
	Boeing MD10/11 All (257)	Yes	No	No	No	No	Yes	No	No	
	Airbus A300-600 or A310 All (A300-158; A310-70)	Yes	No	Yes	Yes	No	No	No	Yes	alphalock function : slat retraction inhibition (conf1 to conf0) with "blue" discrete lamp on frontdesk
Visual & aural low airspeed alert indication. (3-1, 3-2)	Boeing 737 -600, -700, -800, -900 (3908)	Yes	No	No	No	No	Yes	No	No	
	Boeing 747-400 (675)	Yes	No	No	No	No	No	No	No	
	Boeing 767-400 (38)	No	No	No	No	No	Yes	No	No	
	Boeing 777 All (981)	Yes	No	No	Yes	No	Yes	No	No	
	Airbus A318/319/320/321/330/340/380 All (767) (318-321--724; 330-380--43)	Yes	No	Yes	No	Yes	Yes	No	Yes	alphalock function : slat retraction inhibition to go from conf1 to conf clean

		4-2. What protection/limiting functionality is available to automatically assist the pilot for approach to stall conditions, at/after stall warning?							
Model Capabilties (Reference survey question in parentheses)	**Airplane model (number in fleet at the time of data collection)**	**Stick pusher**	**Automatic pitch control**	**Increased column/stick forces**	**Angle of attack protection**	**Auto-slat extension**	**Angle of attack limit**	**Other**	**Other Text**
Round dial No SW cptr	Boeing DC9 All (433)	No	No	No	No	No	No	No	
	Boeing 727 All (826)	No	No	No	No	No	No	No	
	Boeing 747-200 (202)	No	No	No	No	No	No	No	
Round dial Have SW cptr to support	Embraer 120 All (126)	Yes	No	No	No	No	No	No	
	Boeing 737 -300, -400, -500 Conv (1550)	No	No	No	No	No	No	No	
	Boeing MD 80 All (1016)	Yes	No	No	No	No	No	No	
	Boeing MD 90 All (108)	Yes	No	No	No	No	No	Yes	Pylon flap provides additional nose down capability at full column forward
	Saab 340 All (197)	Yes	No	No	No	No	No	No	
Have EFIS & alert capability. (1-1)	Boeing 737 -300, -400, -500 EADI F/S (190)	No	No	No	No	No	No	No	
	Boeing 757-200 EADI F/S (971)	No	No	Yes	No	No	No	No	
	Boeing 767-200, -300 EADI F/S (880)	No	No	Yes	No	No	No	No	
	Boeing 737 -300, -400, -500 EADI Spd Tape (58)	No	No	No	No	No	No	No	
	Boeing 757-200, -300 EADI Spd Tape (37 -300 only)	No	No	Yes	No	No	No	No	
	Boeing 767 -200, -300 EADI Spd Tape (46)	No	No	Yes	No	No	No	No	
	Bombardier CRJ-100, -200, -400, -440 (718)	Yes	No	No	No	No	No	Yes	AP disconnect at shaker/stall warning
	Bombardier CRJ -700, -701, -702 (215)	Yes	No	No	No	No	No	Yes	
	Bombardier CRJ -705, -900 (105 -900)	Yes	No	No	No	No	No	Yes	
PFD with visual low airspeed alert indication only. (3-1)	Embraer 135 All (137)	Yes	No	No	No	No	No	No	
	Embraer 140 All (74)	Yes	No	No	No	No	No	No	
	Embraer 145 All (503)	Yes	No	No	No	No	No	No	
	Embraer 170 All (76)	No	No	No	No	No	Yes	No	Pitch trim up inhibition
	Embraer 175 All (54)	No	No	No	No	No	Yes	No	
	Embraer 190 All (51)	No	No	No	No	No	Yes	No	
	Boeing 717 All (155)	Yes	No	No	No	No	No	No	
	Boeing MD10/11 All (257)	No	No	No	No	No	No	No	
	Airbus A300-600 or A310 All (A300-158; A310-70)	No	No	No	No	No	No	No	
Visual & aural low airspeed alert indication. (3-1, 3-2)	Boeing 737 -600, -700, -800, -900 (3908)	No	No	Yes	No	No	No	No	
	Boeing 747-400 (675)	No	No	No	No	No	No	No	
	Boeing 767-400 (38)	No	No	Yes	No	No	No	No	
	Boeing 777 All (981)	No	No	Yes	No	No	No	No	
	Airbus A318/319/320/321/330/340/380 All (767) (318-321--724; 330-380--43)	No	No	No	No	No	No	No	

Appendix C– Example Implementations

This appendix illustrates two possible functional implementations – one for a federated configuration and one for an integrated configuration. These are representative functional examples and will vary between aircraft types.





Functional representation of a low-speed alert (existing integrated flight deck)

Key considerations of a more integrated solution (vs. a federated solution)

- System signals to drive the alert function are more likely to exist than in a federated system
- Prioritization of alerts may be feasible but may also touch several other components which are not part of the low airspeed function
- Existing crew alerting philosophy may known and documented
- Unit(s) required to generate the alert may exist but they will still need to be modified

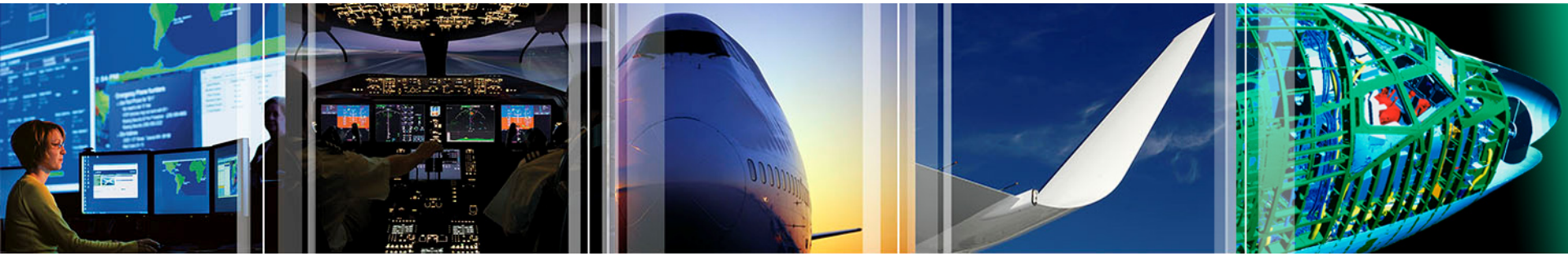
ASHWG – October 2012

- Phase 2 Task
  - Provide information that could lead to standards for low speed alerting that can be satisfied with practical design approaches in existing aircraft
  - This includes possible retrofit standards and guidance material for low speed alert systems
  - Report completed August 2012
    - Responses to 10 low airspeed speed alerting technical questions, relative to existing aircraft designs
    - Additional key findings and recommendations
  - Released to TAEIG September 2012 for approval
    - Request minor change (following page)

ASHWG – Minor Change Request

- Under §1.1, Definitions, Acronyms, and Abbreviations
  - Current text - “Alphafloor –Angle of Attack threshold at which point automated speed protection will engage”
  - Replace in the sentence “speed” by “low energy” to appropriately reflect the Airbus design
  - Proposed text - “Alphafloor –Angle of Attack threshold at which point automated low energy protection will engage”
- Under § 5.5, Does the alerting operate under all operating conditions, configurations, and phases of flight, including icing conditions?
  - Remove the editorial comment *Keep “by lift increase only”*
  - Should have been removed from the report

BCA Engineering



Airworthiness Assurance Working Group (AAWG) Report

17 October 2012

Steve Chisholm

Boeing Commercial Airplanes – Chief Structures Engineer – AAWG Co-Chair

AAWG Status

- The last AAWG meeting was February 28th and 29th
  - Primary issues addressed at that meeting related to implementation of FAA WFD rule and potential harmonization issues with EASA rulemaking
  - Richard Minter (EASA) provided the latest status on pending rulemaking for AASR and WFD
  - AAWG oversight rule was discussed
- Next meeting intended to coincide with an EASA meeting in early 2013

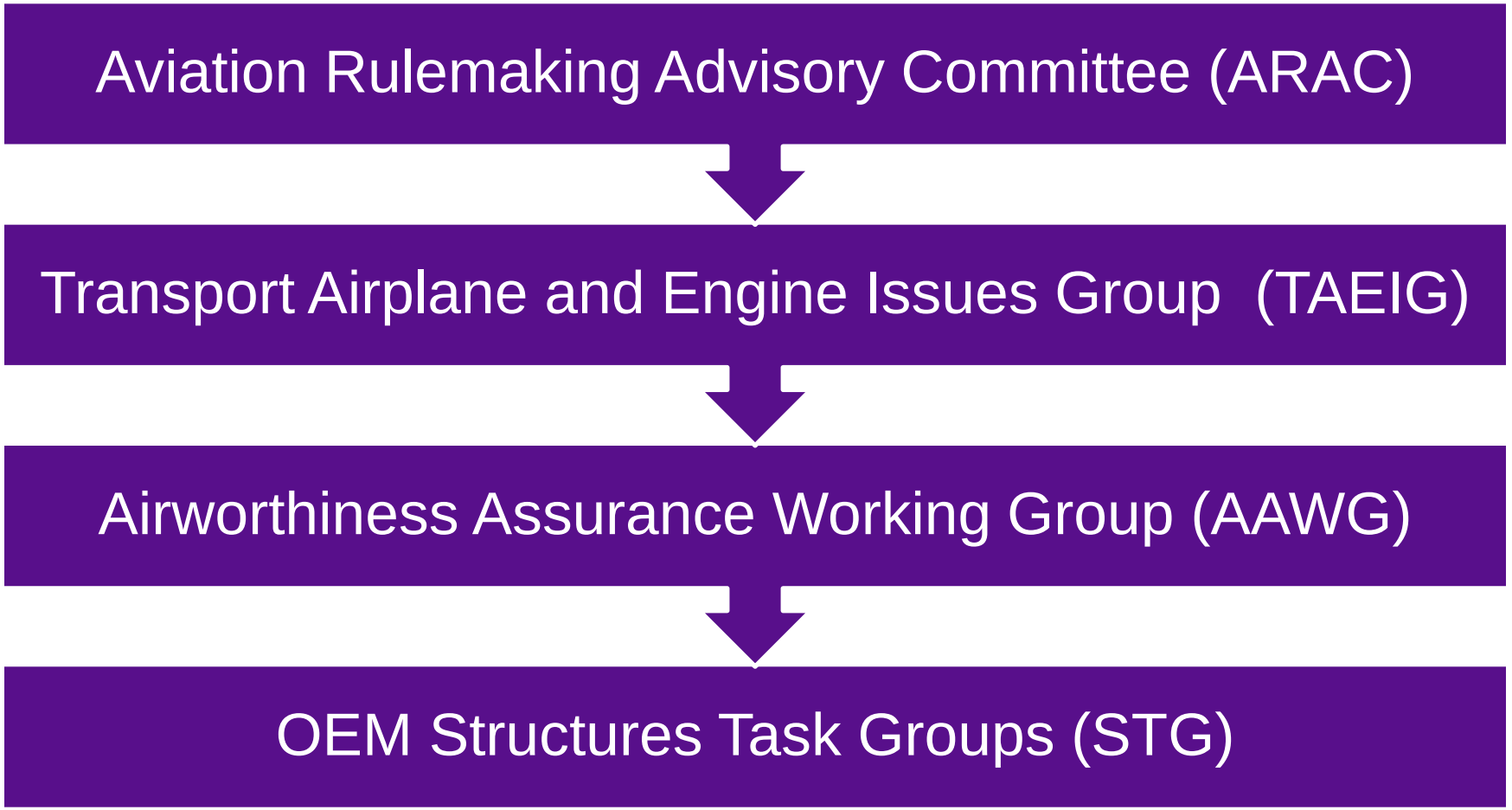
AAWG Members

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*

*observers

AAWG & STG Hierarchery



AAWG - Role

- AAWG Initially tasked in 1988 by the FAA to direct five Aging Aircraft Initiatives
- AAWG membership represents
  - All transport category manufactures
  - FAA
  - Multiple operators
- In the advisory material for both14CFR 26.21 & 26.43 the FAA suggested the use of STGs to support the development of compliance data necessary to support the associated operational rules
- The AAWG continues (under the umbrella of the initial tasking) to provide industry level oversight and guidance throughout the Part 26 compliance activities
  - STGs provide progress reports to the AAWG
  - AAWG provides a path for industry level resolution
  - AAWG reports overall status to the TAEIG on a regular basis
- AAWG is also reviewing on-going oversight of aging airplane initiatives for all airplane models

EASA Aging Airplane Rule Status

Non-Harmonized Concerns

EASA Aging Airplane Rule Status

- The following is based on recent communication from EASA and AAWG Presentations
- EASA's pending rule will encompass requirements of FAA's Widespread Fatigue Damage (WFD) & Aging Airplane Safety Rule (AASR, DT of repairs)
- There are potentially non-harmonized requirements

EASA differences will complicate airplane transfers between US and Europe

EASA Aging Airplane Rule Status

- **EASA's draft schedule:**
  - **EASA Internal consultation in October**
  - **NPA issue November**
  - **Workshop proposed for interested parties Jan/Feb 2013**

EASA rule has been pending since 2006

EASA Aging Airplane Rule Status

- **Anticipated EASA differences**
  - **WFD evaluation of all future repairs**
  - **WFD evaluation of all future design changes**
  - **Means for operational implementation**
  - **Requires additional information in Airworthiness Limitations Section (CPCP and SSID by reference)**
  - **Use of existing FAA approved data for EASA compliance is questionable**
  - **EASA WFD rule is not limited to aircraft w/gross weight of 75,000 lbs and above as in FAA rule**
  - **No exempted airplanes as in FAA rule (707/720 for Boeing)**

EASA rule may drive additional requirements for operators and OEMs

Tentative Agenda for Next AAWG

- WFD implementation OEM/STG report-out
- Open action items – primarily WFD related
- Plans/issues with next group for WFD implementation
- Future role of AAWG (beyond WFD)
  - STG guidance/oversight
  - STG “tasks” for non-aging airplanes
    - CPCP – industry standards
    - Modification in lieu of on-going inspections
    - Supplemental fatigue inspections
    - AASR implementation
    - On-going review/oversight of airplane model specific fleet findings and service actions
    - Maintenance program oversight