SE 192 CAST Safety Enhancement (SE)
DESIGN – LOW AIRSPEED ALERTING

STUDY TOPIC
ASA
AIRPLANE STATE AWARENESS

CICTT RISK AREAS
LOC–I

SECTION I: SE OVERVIEW

SECTION I

Study Topic Overview Summary	CAST chartered the Airplane State Awareness (ASA) Joint Safety Analysis Team (JSAT) in August 2010 and the ASA Joint Safety Implementation Team (JSIT) in 2012 as a follow-on activity to the previous Loss of Control (LOC) JSAT in 2000. Historically, Loss of Control-Inflight (LOC–I) has been, and continues to be, one of the largest categories of commercial aviation fatal accidents. Loss of ASA is a subset of LOC–I accidents and incidents, defined as events in which the flightcrew lost awareness of the airplane's attitude or energy state. Between 2001 and 2010, half of all LOC–I accidents involved loss of ASA. The ASA JSIT recommended, and CAST adopted, 19 ASA SEs, 7 of which focus on airplane design. The ASA JSAT's study of 18 LOC accidents and incidents determined low energy state and stall, resulting from flightcrew loss of ASA, played a role in 8 events.
SE Objective	CAST recommends air carriers implement low airspeed alerting on existing transport category aircraft type designs as practical and feasible.
Primary Risks Mitigated	Loss of Control-Inflight (LOC–I)

Action	Organization(s)	Strategy	Description	Due Date
Action 1	Air Carriers	Design	Implement manufacturer service bulletins to install low airspeed alerting functionality in existing aircraft.	03/31/2015
	Comments: CAST closed this action.			
Action 2	Air Carriers	Design	Develop and implement service bulletins to install low airspeed alerting functionality in existing aircraft models with high rates of speed decay stall warnings.	12/31/2023

See section II of this SE for detailed action descriptions.

References: The detailed analysis in the ASA JSAT Final Report (June 5, 2015) and the ASA JSIT Final Report (December 31, 2014) is available through CAST.

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SECTION II: DETAILED ACTION INFORMATION

Action 1: Implement manufacturer service bulletins to install low airspeed alerting functionality

Primary Implementer	**Air Carriers**
Action Objective	Air carriers should implement existing and available manufacturer service bulletins to install low airspeed alerting functionality in their existing aircraft, as applicable.
Action Timeline	Flow Time: 19 months ○ 6 months for Aerospace Industries Association (AIA) to consult with manufacturers and communicate results to industry associations. ○ 1 month after receiving available service bulletins from the AIA for industry associations to communicate with their air carrier members. ○ 12 months from receiving list of available service bulletins from industry associations for air carriers to implement service bulletins. Due Date: 03/31/2015
Timeline/Flow for Future Adopters	TBD
CAST Lead	Airlines for America (A4A)

#	Organization(s)	Detailed Steps
1a	AIA	Consult with all CAST-represented manufacturers to determine what service bulletins are currently approved and available to install low airspeed alerting functionality in existing type designs, and communicate this information to air carrier industry associations.
	Complete.	
1b	Air Carrier Industry Assns.	Communicate with air carrier members, explaining the ASA analysis and the role of low energy state and stall in contributing to the accidents, and encourage them to install existing service bulletins from manufacturers that address this issue in their aircraft at their earliest convenience.
	Complete.	
1c	Air Carriers	Review the available service bulletins, determine applicability of the available bulletins to their specific fleets, and develop an implementation plan for prioritizing incorporation of these bulletins at their earliest convenience.
	Complete.	
1d	Air Carriers	Air carrier actions are complete when an air carrier has installed the available service bulletins in all applicable aircraft in its fleet.
	Complete.	
1e	Air Carrier Industry Assns.	Track implementation of member air carriers and report progress to JIMDAT and CAST.
	Reported to JIMDAT and CAST in March 2015.	

Notes

- Applicability: Air carriers that operate aircraft for which multisensory low airspeed alerting is available for incorporation via service bulletin. The ASA Joint Safety Implementation Team (JSIT) estimates at least 1,000 aircraft in the current U.S. fleet meet this criterion.

Note: See Section III for detailed costs and resources.

- Most in-production aircraft already incorporate some form of multisensory low airspeed alerting. The specific reduction in risk from this action assumes about 1,000 additional aircraft install the feature.

Note: See Section III for detailed costs and resources.

SECTION II: DETAILED ACTION INFORMATION

Action 2: Develop and implement new service bulletins to install low airspeed alerting technology

Primary Implementer	**Air Carriers**
Action Objective	Air carriers should collaborate with aircraft manufacturers and suppliers to develop service information that implements low airspeed alerting on existing aircraft models with high rates of speed decay stall warnings, as indicated by operational flight data, and then implement those service bulletins as they become available.
Action Timeline	Flow Time: 42 months ○ 6 months for JIMDAT to consult with manufacturers, suppliers, and air carriers to identify candidate aircraft and develop plans for service information. ○ 12 months from CAST approval of implementation plans for manufacturers to develop and certify service information. ○ 24 months from receiving service information for air carriers to implement service bulletins. Due Date: 12/31/2023
Timeline/Flow for Future Adopters	TBD when CAST closes this action.
CAST Lead	JIMDAT

#	Organization(s)	Detailed Steps
2a	JIMDAT	With support from the Issue Analysis Team (IAT) and MITRE Corporation, conduct a review of CAST loss of control metrics for stall warnings from speed decay and develop a list of candidate aircraft models for consideration.
2b	JIMDAT	Coordinate with affected manufacturers and air carrier operators of the candidate aircraft models to determine availability of aircraft performance data and systems to support implementation of low airspeed alerting similar in scope and complexity to such alerting systems that are already available for retrofit via service bulletins on existing aircraft.
2c	JIMDAT	Work with affected manufacturers, equipment suppliers, and air carrier operators of the candidate models to explore suitable plans for development of low-cost, technically feasible service information to retrofit implementation of low airspeed alerts on the candidate models.
2d	JIMDAT	Present those plans that prove feasible and acceptable to the affected aircraft manufacturers, suppliers, and air carriers to CAST for review and approval.
2e	Aircraft Manufacturers and Suppliers	Develop and certify suitable service information according to their agreed-upon and CAST-approved plans.

Note: See Section III for detailed costs and resources.

2f	Air Carrier Industry Assns.	Communicate with air carrier members, explaining the ASA analysis and the role of low energy state and stall in contributing to the accidents, and encourage them to install the newly developed service bulletins from manufacturers that address this issue in their aircraft at their earliest convenience.
2g	Air Carriers	Review the service bulletins, determine applicability of the available bulletins to their specific fleets, and develop an implementation plan for prioritizing incorporation of these bulletins at their earliest convenience.
2h	Air Carriers	Air carrier actions are complete when all applicable aircraft in an air carrier's fleet have the available service bulletins installed.
2i	Air Carrier Industry Assns.	Track implementation of member carriers and report progress to JIMDAT and CAST.

Notes Most production aircraft already incorporate some form of multisensory low airspeed alerting. The systems to be developed in this action are envisioned to be low cost and similar in function and complexity to those systems already certified and available for retrofit by existing service bulletins.

Note: See Section III for detailed costs and resources.

SECTION III: SUPPLEMENTAL INFORMATION

Source Study	ASA Joint Safety Analysis Team (JSAT) Final Report (June 5, 2014) ASA Joint Safety Implementation Team (JSIT) Final Report (December 31, 2014)
Related Initiatives	• FAA Title 14, Code of Federal Regulations (14 CFR) § 25.1322, Amendment 25–131 • FAA Advisory Circular (AC) 25.1322–1, Flight Crew Alerting • FAA 14 CFR § 25.1322, Amendment 25–119 • FAA AC 25.1329–1B, Approval of Flight Guidance Systems

Total Cost	**$750,000**	*Note: For labor, 1 Full Time Equivalent (FTE) = $250,000*	
Action 1	$300,000	1.2 FTE	
Action 2	$450,000	1.8 FTE	Plus ~$300,000 per candidate model for design and certification work.[1]

	Organization	Resources Needed
Direct Resource Overview – Government	JIMDAT	• Action 2: 0.5 FTE; assumes four people working on average 1 week a month for 6 months to oversee the communication and work.

	Organization	Resources Needed
Direct Resource Overview – Industry	AIA	• Action 1: 0.1 FTE, for communication and consultation on available service bulletins.

	Air Carriers	• Action 1:
		  ○ 0.5 FTE; assumes 20 hours per carrier on average for 55 air carriers to review applicable and available service bulletins and incorporate them into aircraft maintenance plans.
		  ○ 0.5 FTE; assumes 1,000 aircraft will be modified @ 1 hour per installation; assumes installation will occur during normal maintenance; assumes no material or parts cost, software load only.
		• Action 2:
		  ○ 0.3 FTE; assumes 80 hours per carrier on average for 8 air carriers to review applicable models, determine availability of performance data, and develop implementation plans in coordination with JIMDAT.
		  ○ 0.5 FTE; assumes 20 hours per carrier on average for 55 air carriers to review applicable and available service bulletins and incorporate them into aircraft maintenance plans.

SECTION III

[1] Estimated costs of development and certification, per model: $100,000 to $500,000 (average $300,000 per model). Estimated installation costs, per airplane: dependent on final service information, but expected to be 8 hours or less, to be performed during normal scheduled maintenance

SECTION III: SUPPLEMENTAL INFORMATION

	Organization	Resources Needed
	Air Carrier Industry Assns.	• Action 1: 0.1 FTE, for communication and tracking implementation. • Action 2: 0.3 FTE, for communication and tracking implementation. *Note: 55 air carriers are represented by three CAST-member air carrier industry associations:* ○ *Airlines for America (A4A),* ○ *Regional Airline Association (RAA), and* ○ *National Air Carrier Association (NACA).*
	Aircraft Manufacturers	• Action 2: 0.3 FTE; assumes 80 hours per manufacturer/supplier for 8 companies to review applicable models, determine availability of performance data, and develop implementation plans in coordination with JIMDAT.

Indirect Resource Overview

The organizations identified in this section are not expected to incur direct costs associated with implementing this SE, but they may incur indirect costs within their normal line of work.

Organization	Description
N/A	N/A

SECTION IV: REVISION LOG

Major revisions (whole numbers) represent CAST-approved changes to SE language. Minor revisions (decimals) represent minor changes to target dates or completion notes that do not affect implementer actions.

Revision	Date	Description
2.1	6/1/2023	Action 2 due date extended from 06/30/2022 to 12/31/2023.
2.0	12/06/2018	Action 2 added to SE.
1.0	09/17/2018	New SE format. Content reorganized and terminology updated. No substantive changes. Action 1 closed at April 2015 CAST meeting.
Original	08/01/2013	CAST adopted SE 192.