Safety Enhancement SE 133R3.1 Icing – Turboprop Aircraft Ice Detection Systems	
Safety Enhancement Action:	Adapt and implement automatic ice detection and alerting systems on turboprop aircraft, as outlined in the SE 133 outputs, that have non-evaporative ice protection systems and non-powered flight controls and are in part 121 service if feasible. If not feasible, implement procedures in flight to identify signs of large drop conditions conducive to ice accumulation aft of the airframe areas protected by de-icing or anti-icing systems, and to exit the conditions as soon as possible.
Implementers: (Select all that apply)	☒ Air Carrier ☐ Industry Association ☐ CAST ☐ JIMDAT ☐ Research Organization ☐ Labor Organization ☒ Manufacturer ☐ Regulator ☐ Other (specify) _____
Statement of Work:	To prevent fatal accidents caused by in-flight icing encounters, for all turboprop aircraft with non-evaporative ice protection systems and non-powered flight controls used in Part 121 operations, manufacturers of such airplanes should: 1. Adopt and implement automatic ice detection and alerting systems in **all new type designs,** and 2. Conduct a study to determine the feasibility of installing automatic ice detection and alerting systems on **current existing type designs.** a. For current existing type designs where installation of such systems is determined to be feasible, manufacturers should develop and operators should implement appropriate design and procedure modifications to meet the intent of the safety enhancement. b. For current existing type designs where installation of such systems is determined to be not feasible, operators should implement procedures in flight to identify signs of large drop conditions conducive to ice accumulation aft of the airframe areas protected by de-icing or anti-icing systems, and exit the conditions as soon as possible.
Total Financial Resources:	**Total SE: $2.75M** Output 1: $1.75M Output 2: $0.05M Output 3: $0.8M Output 4: [Withdrawn] Output 5: $0.15M

<table>
<tr><td>Relation to Current Aviation Community Initiatives:</td><td>

ARAC Ice Protection Harmonization Working Group
ARAC Flight Test Harmonization Working Group
Airworthiness Directives
NTSB Safety Recommendations
FAA rulemaking activity for new icing regulations based on ARAC recommendations and CAST SE 39:

14 CFR Part 25 performance and handling characteristics for certification in icing conditions
14 CFR Part 25 requirements for activation of ice protection
14 CFR Part 121 requirements for activation of ice protection
14 CFR Part 25 Appendix O –supercooled large drop (SLD), mixed phased, and glaciated icing conditions
14 CFR Part 121 requirements for exiting icing conditions

Industry research and development of ice detection probe technology capable of detecting 14 CFR Part 121 Appendix O icing conditions
Safety Alert for Operators (SAFO) 06016
SAFO 10006

</td></tr>
<tr><td>Performance Goal Indicators:</td><td>SE 133 Stand Alone Fatality Risk Reduction:

2020 – (2.73)
100% – (5.46)

Differential beyond original 46 SE CAST plan:

2020 – (0.4)
100% – (0.8)

</td></tr>
<tr><td>Key Milestones:</td><td>
<table>
<tr><th></th><th>Flow time (mo)</th><th>Start Date</th><th>Target Completion Date</th></tr>
<tr><td>Output 1:</td><td>8</td><td>2/4/2010</td><td>10/31/2010</td></tr>
<tr><td>Output 2:</td><td>12</td><td>2/4/2010</td><td>2/28/2011</td></tr>
<tr><td>Output 3:</td><td>12</td><td>N/A</td><td>10/1/2015</td></tr>
<tr><td>Output 4:</td><td>Withdrawn</td><td>N/A</td><td>N/A</td></tr>
<tr><td>Output 5a:</td><td>6</td><td>4/7/2016</td><td>10/31/2016</td></tr>
<tr><td>Output 5b:</td><td>12</td><td>10/31/2016</td><td>10/31/2017</td></tr>
<tr><td>Completion:</td><td>92</td><td>2/4/2010</td><td>10/31/2017</td></tr>
</table>
</td></tr>
<tr><td>Potential Obstacles:</td><td></td></tr>
</table>

Detailed Implementation Plan Notes:	For the purpose of this SE, the following definitions apply: "*Automatic ice detection and alerting systems*" are defined as systems that do the following: 1. Automatically detect the presence of icing conditions and either: a. Automatically activate the ice protection system, or b. Alert the crew to manually activate the ice protection system. 2. Determine whether the icing conditions exceed those for which the aircraft was certified, and if so, alert the crew to exit the conditions. 3. If feasible, also provide a measurement of the rate of ice accretion and provide this as advisory information for the flight crew. "*Conditions conducive to airframe icing*" are defined as conditions in which visible moisture is present at or below a static air temperature of 5° C or a total air temperature of 10° C. "*Large drop conditions conducive to ice accumulation aft of the airframe's protected area*" are defined as conditions containing a population of supercooled drops sufficiently larger than those provided in 14 CFR Part 25 Appendix C, which can cause ice accretions aft of the airframe areas protected by the aircraft's de-icing or anti-icing system. The accumulation mechanism aft of the protected surface may be by direct impingement and accretion or delayed freezing of large drops that impinge further forward. These conditions may be aircraft dependent as a consequence of airfoil geometry and limits of protected areas.
CICTT Code:	ICE, LOC–I

Output 1:		
Description:	For new turboprop type designs, manufacturers agree to adapt and implement automatic ice detection and alerting systems.	
Lead Organization:	Aircraft Industries Association (AIA)	
Human Resources:	Aircraft Manufacturers	
Implementers: (Select all that apply)	☐ Air Carrier ☒ Industry Association ☐ CAST ☐ JIMDAT ☐ Research Organization	☐ Labor Organization ☒ Manufacturer ☐ Regulator ☐ Other (specify) _____
Actions:	• AIA encourages manufacturers to adapt existing ice detection probe technology to provide measurement capability of icing conditions for turboprop aircraft that exceed the conditions for which the aircraft is certified. • Manufacturers of affected turboprop airplanes respond to AIA letter and agree to implement ice detection and alerting systems on new type designs.	
Financial Resources:	$1.75M	
Itemized Resources:	Total government and industry resources: $1.75M	
Output Notes:	None	
Time Line:	60 days after CAST “G” level approval for AIA to issue communication 180 days after receipt of the AIA communication for manufacturers of affected turboprop airplanes to respond	
Target Completion Date:	10/31/2010. Completed in October 2010.	

Output 2:		
Description:	FAA review of guidance material regarding certification of ice detection and alerting systems.	
Lead Organization:	FAA Aircraft Certification Service (AIR)	
Human Resources:		
Implementers: (Select all that apply)	☐ Air Carrier ☐ Industry Association ☐ CAST ☐ JIMDAT ☐ Research Organization	☐ Labor Organization ☐ Manufacturer ☒ Regulator ☐ Other (specify) _____
Actions:	• FAA review pertinent aircraft certification policy and guidance material, including AC 25.1419-1A "*Certification of Transport Category Airplanes for Flight in Icing Conditions*" and determine if revisions should be made to address certification of the ice detection and alerting systems proposed by this SE. • FAA develop a plan and initial schedule for making revisions to guidance material that is compatible with icing rulemaking activity recommended in SE 39, and share this information with CAST.	
Financial Resources:	0.2 FTE ($50,000). Note: 1 FTE = $250,000.	
Itemized Resources:	0.2 FTE for FAA to review guidance and develop revision plan. No incremental costs to perform revisions as this will be part of FAA rulemaking.	
Output Notes:	None.	
Time Line:	12 months	
Target Completion Date:	2/28/2011. Completed in February 2011.	

Output 3:		
Description:	For current turboprop production aircraft and existing type designs, conduct a study to determine the feasibility of installing automatic ice detection and alerting systems.	
Lead Organization:	Aircraft Industries Association (AIA)	
Human Resources:	Manufacturers JIMDAT	
Implementers: (Select all that apply)	☐ Air Carrier ☒ Industry Association ☐ CAST ☒ JIMDAT ☐ Research Organization	☐ Labor Organization ☒ Manufacturer ☐ Regulator ☐ Other (specify) _____
Actions:	• AIA send a letter to manufacturers of applicable turboprop airplanes requesting that they conduct feasibility studies to determine the cost-benefits to install automatic ice detection and alerting systems for each type of turboprop aircraft they manufacture, both current and post-production. • Manufacturers perform the requested studies. JIMDAT will provide manufacturers with estimation of fatality risk reduction benefits from the CAST fleet-wide assessment to ensure consistency across the processes. • Manufacturers will provide the results to AIA. • AIA refer the completed studies to CAST.	
Financial Resources:	$800,000	
Itemized Resources:	Total government/industry resources: $800,000 for feasibility cost study. Total costs to be determined by feasibility study.	
Output Notes:	Manufacturers determined installing automatic ice detection and alerting systems on existing type designs is not feasible. Output 5 added in SE-133R3 to mitigate risk through procedures.	
Time Line:	12 Months	
Target Completion Date:	Completed 2/4/2016.	

Output 4:	***Output Withdrawn***	
Description:	For current turboprop production aircraft and existing type designs, manufacturers of applicable airplanes agree to adapt and implement ice detection and alerting system in the airplanes where such installations are determined to be feasible, in accordance with the results of the studies completed under Output 3.	
Lead Organization:	Airline Industries Association (AIA)	
Human Resources:	Manufacturers Air Carriers	
Implementers: (Select all that apply)	☒ Air Carrier ☒ Industry Association ☐ CAST ☐ JIMDAT ☐ Research Organization	☐ Labor Organization ☒ Manufacturer ☐ Regulator ☐ Other (specify) _____
Actions:	• AIA encourages manufacturers to implement automatic ice detection and alerting systems on airplanes where feasibility has been determined by the cost-benefit studies. • Manufacturers of affected turboprop airplanes agree to implement ice detection and alerting systems on current existing type designs, as feasible and in accordance with the results of Output 3.	
Financial Resources:	To be determined	
Itemized Resources:		
Output Notes:	***Output withdrawn – determined not feasible in Output 3.***	
Time Line:	60 days after completion of Output 3 for AIA to issue communication. 180 days for manufacturers of affected turboprop airplanes to respond to AIA letter.	
Target Completion Date:	***Withdrawn 2/4/2016.***	

Output 5:	
Description:	For current turboprop production aircraft and existing type designs where installations of ice detection and alerting systems are determined to be not feasible, in accordance with results of studies completed under Output 3, air carriers implement in-flight procedures to identify signs of icing conditions that exceed the certified flight envelope for the airplane, and to exit the conditions as soon as possible.
Lead Organization:	JIMDAT
Human Resources:	FAA Flight Standards Service (AFS) FAA Aircraft Certification Service (AIR) Regional Airline Association (RAA) Airlines for America (A4A) National Air Carriers Association (NACA) Aircraft manufacturers
Implementers: (Select all that apply)	☒ Air Carrier ☒ Industry Association ☐ CAST ☐ JIMDAT ☐ Research Organization ☐ Labor Organization ☐ Manufacturer ☐ Regulator ☐ Other (specify) _____
Actions:	• JIMDAT to seek recommendations from air carriers, labor associations, airplane manufacturers, FAA AIR, and FAA AFS, on procedures that can be used to determine presence of large drop conditions conducive to ice accumulation aft of the airframe areas protected by de-icing or anti-icing systems, including: o Existing air carrier icing operations procedures o FAA Icing Program research reports o Draft advisory circular material o Manufacturer recommendations and SOPs for operation in icing conditions • JIMDAT to collect material together into a proposed best practices document and seek stakeholder consensus on its recommendation • Upon approval, CAST to disseminate the best practice material to affected members for dissemination to their organizations. • Air carriers operating turboprop aircraft without ice detection and alerting systems installed should review the best practices for detecting and exiting icing conditions exceeding the certified flight envelope of the airplane, and revise their procedures as applicable.
Financial Resources:	Total resources: 0.6 FTE ($150,000) (0.35 FTE outside organization support, 0.25 FTE JIMDAT support)
Itemized Resources:	• 0.25 FTE for air carrier review of current policies/procedures (0.02 FTE per carrier for 12 carriers

	that operate turboprop airplanes) • 0.04 FTE for OEM review of current recommendations (0.02 per OEM for the 2 OEMs that produce turboprop airplanes) • 0.04 FTE for FAA to review draft guidance material (0.02 for AIR and 0.02 for AFS) • 0.02 FTE for labor organizations to review of material • 0.25 FTE for JIMDAT to review inputs and develop material
Output Notes:	None.
Time Line:	• Output 5a: 6 months for JIMDAT to collect inputs and develop and disseminate best practices • Output 5b: 12 months after dissemination of best practice material for air carriers to revise procedures as applicable
Target Completion Date:	• Output 5a: 10/31/2016 • Output 5b: 10/31/2017 • Output completed 2/2/2017. JIMDAT verified operational recommendations contained in draft guidance to support withdrawn SLD rulemaking is already in the AFM of affected fleets, satisfying the intent of this output.