Safety Enhancement SE 226
Cargo – Hazardous Material Fires – Enhanced Protection of Occupants and Aircraft

Safety Enhancement Action:	Air carriers provide additional training and equip their fleets (as feasible) with systems to enhance the protection of occupants and aircraft and increase the flightcrew's ability to continue safe flight and landing in response to an onboard fire involving hazardous materials, including lithium batteries.
Implementers: (Select all that apply)	☐ Air Carrier ☐ Industry Association ☐ Commercial Aviation Safety Team (CAST) ☐ Joint Implementation Measurement and Data Analysis Team (JIMDAT) ☐ Research Organization ☐ Labor Organization ☐ Manufacturer ☐ Regulator ☐ Other (specify) _____
Statement of Work:	To improve the outcome of accidents and incidents due to cargo fires involving hazardous materials, including lithium batteries, and to enhance the protection of occupants and aircraft, air carriers should implement the following, as feasible: 1. Installation of crew smoke mask/oxygen systems employing a single full face mask that can accommodate glasses and is equipped with state-of-the art communications technologies 2. Installation of systems to maintain pilots' view of necessary flight information and, where possible, visual references outside the aircraft in dense continuous smoke conditions. 3. Installation of a system to upload emergency route information to aircraft using Controller Pilot Data Link Communications (CPDLC).
Total Financial Resources:	**Total: $29.5M** **(not including smoke training)** Output 1: N/A (no cost) Output 2: $29.2M (to equip 785 airplanes) Output 3: $0.3M
Relation to Current Aviation Community Initiatives:	• Industry development of oxygen mask vision system in process. • CPDLC systems are already being deployed in U.S. fleets in expectation of Next Generation Air Transportation System (NextGen) changes to airspace procedures.

Performance Goal Indicators:	Risk Reduction: • Standalone effectiveness 19.4% by 2026 against fatality risk. Implementation: • Assumes 70% implementation in the fleet of full face smoke masks by 2026. • Assumes 100% use of systems to maintain view of the instruments by 2026. • Assumes 100% implementation of CPDLC emergency routing by 2026.
Key Milestones:	

	Flow time (months)	Start Date	End Date
Output 1	24	1/1/2017	12/31/2018
Output 2	36	1/1/2017	12/31/2019
Output 3	Per ATO rollout	TBD	TBD

Potential Obstacles:	
Detailed Implementation Plan Notes:	A CAST study of three accidents associated with hazardous material fires determined that the presence of smoke, fire, and/or heat exceeded the capabilities of aircraft systems. The study determined that several design features incorporating existing technology, working separately or in conjunction with one another, could have significantly improved the ability of the flightcrew to maintain control of the aircraft for continued safe flight and landing.
CICTT Code:	F–NI

Output 1:	
Description:	Aircraft manufacturers implement in new type designs and existing in-production type designs, as feasible, the installation of a single full-face crew smoke mask/oxygen system with state-of-the art communications technologies that accommodate glasses at each critical flightdeck position.
Lead Organization:	Aerospace Industries Association (AIA)
Supporting Organizations:	Aircraft manufacturers
Other Affected Organizations:	**Organization** / **How affected** Air carriers — Training requirements for full-face oxygen/smoke masks FAA Flight Standards Service (AFS) — Approval of revised air carrier training for full-face oxygen/smoke masks FAA Aircraft Certification Service (AIR) — Design approvals as necessary
Implementers: (Select all that apply)	☐ Air Carrier ☐ Industry Association ☐ Commercial Aviation Safety Team (CAST) ☐ Joint Implementation Measurement and Data Analysis Team (JIMDAT) ☐ Research Organization ☐ Labor Organization ☒ Manufacturer ☐ Regulator ☐ Other (specify) _____
Actions:	1. AIA communicates with CAST-represented manufacturers, explaining the analysis undertaken by the CAST Hazardous Material Fires study, and recommending they implement the following features in new type designs and as a forward-fit (production cut-in) feature on existing in-production or in-development type designs: a. Single full-face crew smoke mask/oxygen systems that can accommodate eyeglasses and are equipped with state-of-the art communications technologies, installed at each critical flightdeck position. 2. Aircraft manufacturers respond with their intentions regarding installation of these systems in new and existing production or in-development type designs, as feasible. 3. AIA tracks implementation and reports to CAST and JIMDAT.
Financial Resources:	No cost.
Itemized Resources:	• For new airplanes, no additional cost as masks are already part of design. • For retrofit, original equipment manufacturer (OEM) engineering costs to develop and certify service bulletins for installation (TBD by OEMs).

Output Notes:	1. Most in-production aircraft already have these features available and installed. 2. Several air carriers have full-face oxygen masks on their aircraft or have initiatives to install.
Timeline:	24 months for manufacturers. • 6 months for AIA to contact manufacturers. • 18 months for manufacturers to respond.
Target Completion Date:	Output 1a: 6/30/2017 for AIA to contact manufacturers. Output 1b: 12/31/2018 for manufacturer response.

Output 2:	
Description:	Air carriers should implement in existing type designs a means to maintain pilots' view of necessary flight information and, where possible, visual references outside the aircraft in dense continuous smoke conditions on the flightdeck, in new type designs. Air carriers and manufacturers of this equipment should also study the feasibility of implementing such systems in existing in-production and out-of-production airplane designs.
Lead Organization:	National Air Carrier Association (NACA)
Supporting Organizations:	Airlines for America (A4A) Aircraft Industries Association (AIA) Aircraft manufacturers Air carriers
Other Affected Organizations:	**Organization**: FAA Flight Standards Service (AFS) **How affected**: Approval of revised air carrier training for full-face oxygen/smoke masks
Implementers: (Select all that apply)	☒ Air Carrier ☐ Industry Association ☐ Commercial Aviation Safety Team (CAST) ☐ Joint Implementation Measurement and Data Analysis Team (JIMDAT) ☐ Research Organization ☐ Labor Organization ☒ Manufacturer ☐ Regulator ☐ Other (specify)
Actions:	1. Air carrier industry associations communicate with their air carrier members and encourage them to implement, as feasible, systems that maintain the pilots' view of necessary flight information and, where possible, visual references outside the aircraft in dense continuous smoke conditions on the flightdeck. 2. Air carriers review available system options and implement in their existing aircraft, as feasible. 3. AIA communicate with CAST-represented manufacturers that are currently producing transport category airplanes for use in Title 14, Code of Federal Regulations (14 CFR) part 121 operations, encouraging them to study the feasibility of developing and implementing systems that maintain the pilots' view of necessary flight information and, where possible, visual references outside the aircraft in dense continuous smoke conditions on the flightdeck. 4. CAST-represented aircraft manufacturers, in conjunction with appropriate suppliers, respond with their intent to include such system in future type designs. Manufacturers should also conduct, for all existing type designs, a model-by-model feasibility study on the implementation of the recommended systems on current production, in-development, and out-of-production aircraft. 5. Manufacturers respond to AIA and JIMDAT with the results of their studies and any intended follow-on implementation plans.

	6. AIA and air carrier industry associations track progress of feasibility studies and report results to JIMDAT and CAST.
Financial Resources:	$28.5M to equip 785 airplanes; $0.7M for training
Itemized Resources:	• $13K per unit. • $260 per unit to install. • $500 maintenance per unit per year. • 2 units per aircraft. • $75 per pilot for training. $36,260 per airplane, including 10 years of maintenance costs.
Output Notes:	Systems have been developed by third-party suppliers that will maintain pilots' view of necessary flight information and, where possible, visual references outside the aircraft in dense continuous smoke conditions on the flightdeck. One example is the Emergency Vision Assurance System (EVAS). Other systems include critical instrument vision systems or heads-up display information projected within smoke goggles.
Timeline:	Year / Implementation Value / Action 1 2 — 40% of aircraft manufacturers — Aircraft manufacturers respond to CAST regarding the feasibility of implementing Output 3. 3 — 80% of aircraft manufacturers
Target Completion Date:	12/31/2019

Output 3	
Description:	Controller Pilot Data Link Communications (CPDLC) that can upload emergency route information to the aircraft.
Lead Organization:	National Air Carrier Association (NACA)
Supporting Organizations:	Air carriers Airlines for America (A4A) Federal Aviation Administration (FAA) Air Traffic Organization (ATO) FAA Flight Standards Service (AFS)
Other Affected Organizations:	
Implementers: (Select all that apply)	☒ Air Carrier ☐ Industry Association ☐ Commercial Aviation Safety Team (CAST) ☐ Joint Implementation Measurement and Data Analysis Team (JIMDAT) ☐ Research Organization ☐ Labor Organization ☐ Manufacturer ☒ Regulator ☐ Other (specify)
Actions:	1. Air carrier industry associations communicate with their air carrier members, encouraging them to study the feasibility of implementing systems for current and anticipated aircraft in their fleet that use CPDLC to upload emergency route information to the aircraft. 2. Air carriers, in conjunction with FAA ATO and FAA AFS, study the feasibility of implementing systems for current and anticipated aircraft in their fleet that use CPDLC to upload emergency route information to the aircraft. 3. Air carrier industry associations track progress and report to CAST and JIMDAT.
Financial Resources:	$250K
Itemized Resources:	• No cost for operators with equipped aircraft. • 1 air traffic control (ATC) Full Time Equivalent (FTE) for emergency route programming.
Output Notes:	1. CPDLC network is being installed in the domestic airspace. 2. Because installing CPDLC for the sole purpose of uploading emergency route information may be cost prohibitive, only aircraft already equipped will be able to use CPDLC for this purpose. 3. ATC will have to implement CPDLC into their procedures.
Timeline:	TBD

Target Completion Date:	TBD

Reference Material	
Supporting CAST Intervention Strategies	IS1532: Manufacturers should develop, operators should implement, and regulators should require systems to maintain pilots' view of flight instruments and out the windshield in dense continuous smoke conditions. IS850: To reduce the risk of flight crew incapacitation or visual impairment, the crew smoke mask/oxygen system should effectively block smoke and fumes, be one-piece, accommodate glasses and be integral with the oxygen mask. IS1526: MANUFACTURERS/REGULATORS/OPERATORS – DESIGN – should develop and implement the latest oxygen mask-cockpit communications technology. IS1521: ATC and operators should implement and utilize a system to upload emergency route information to aircraft using Controller Pilot Data Link Communications (CPDLC). IS1599: Manufacturers should develop and regulators should require Cockpit Smoke Vision Systems to maintain pilots' view of flight instruments and out the windshield in dense continuous smoke conditions. IS1508: Manufacturers and operators should review smoke and fume removal checklists to ensure the procedures do not direct crews to take actions that would exacerbate a fire event. IS1531: Manufacturers should develop and regulators should require the accessibility and physical ability to perform tasks involving available aircraft emergency equipment, specifically walk around oxygen, from the pilot's seated position.