

## SECTION I: SE OVERVIEW

**Study Topic Overview Summary** CAST chartered the Remaining Risk (RR) Joint Safety Analysis Team (JSAT) and Joint Safety Implementation Team (JSIT) in 2003 to study and mitigate risks outside of the largest aviation fatality risks outside of what CAST had studied between 1997 and 2002. The RR JSAT/JSIT identified several risk areas and mitigations related to cargo; cargo fires continue to pose a significant risk. In 2006, CAST adopted two SEs regarding cargo fires—SE 126 (R&D) and SE 127—as recommended by the RR JSIT.

CAST adopted SE 126 (R&D) and SE 127 as recommended by the RR JSIT. SE 126 recommended R&D to mitigate risks of hazardous materials fires that would otherwise overwhelm containment systems designed for Class A fires. CAST adopted four additional SEs (223 through 226) as a result of the research in 2016.

**SE Objective** CAST recommends 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.

**Primary Risks Mitigated** Fire/Smoke (Non-Impact) (F–NI)

Action	Organization(s)	Strategy	Description (see section II for details)	Due Date
Action 1	Aircraft Manufacturers	Equipment	Implement the installation of a single full-face flightcrew smoke mask/oxygen system with state-of-the art communications technologies.	12/31/2018
<i>Comments: CAST closed this action based on CAST-represented manufacturers reporting they offer single full-face crew smoke/oxygen mask with integrated communications on all current in-production airplanes.</i>				
Action 2	Air Carriers	Equipment	Implement a means to maintain pilots' view of necessary flight information in dense continuous smoke conditions on the flightdeck.	TBD
Action 3	Air Carriers	Feasibility Study	Study the feasibility of implementing aircraft systems that use Controller Pilot Data Link Communications (CPDLC) to upload emergency route information.	TBD

*See section II of this SE for detailed action descriptions.*

**References:** The detailed analysis in the RR JSAT/JSIT Final Report and SE 126, Mitigations for Hazardous Material Fires, is available through CAST.

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Implement Controller Pilot Data Link Communications (CPDLC)

## SECTION III: SUPPLEMENTAL INFORMATION

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This section contains the following additional information that may be of interest to implementers:

- Source Study
- Related Initiatives
- Total Cost / Resource Overview

## SECTION IV: REVISION LOG

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This section provides a history of revisions to this SE.

**SECTION II: DETAILED ACTION INFORMATION****Action 1: Implement smoke mask/oxygen system with communications***Primary Implementer***Aircraft Manufacturers***Action Objective*

Aircraft manufacturers should implement in new type designs and existing in-production type designs, as feasible, the installation of a single full-face flightcrew smoke mask/oxygen system with state-of-the-art communications technologies that accommodate glasses at each critical flightdeck position.

Flow Time: 24 months

- 6 months for Aerospace Industries Association (AIA) to contact manufacturers.
- 18 months for manufacturers to respond.

*Action Timeline*

Due Date: 12/31/2018

- 6/30/2017 for AIA to contact manufacturers.
- 12/31/2018 for manufacturer response.

*Timeline/Flow for Future Adopters*

N/A

*CAST Lead*

AIA

#	Organization(s)	Detailed Steps
1a	AIA	<p>Communicate 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:</p> <p>a. Single full-face flightcrew smoke mask/oxygen systems that can accommodate eyeglasses and are equipped with state-of-the art communications technologies, installed at each critical flightdeck position.</p>
Complete.		
1b	Aircraft Manufacturers	<p>Respond with intentions regarding installation of these systems in new and existing production or in-development type designs, as feasible.</p> <p>CAST-represented manufacturers reported they offer single full-face crew smoke/oxygen mask with integrated communications on all current in-production airplanes</p>
1c	AIA	<p>Track implementation and report to CAST and JIMDAT.</p> <p>Reported to JIMDAT and CAST in December 2018.</p>

*Notes*

Note: See section III for detailed costs and resources.

**SECTION II: DETAILED ACTION INFORMATION****Action 2: Implement means to maintain pilots' view in smoke conditions**

<i>Primary Implementer</i>	<b>Air Carriers, Aircraft Manufacturers</b>	
<i>Action Objective</i>	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 aircraft designs.	
<i>Action Timeline</i>	Flow Time: TBD	
	Due Date: TBD	
<i>Timeline/Flow for Future Adopters</i>	TBD when CAST closes this action.	
<i>CAST Lead</i>	National Air Carrier Association (NACA)	
#	Organization(s)	Detailed Steps
2a	Air Carrier Industry Assns.	Communicate with 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.
2b	Air Carriers	Review available system options and implement in existing aircraft, as feasible.
2c	Aerospace Industries Association (AIA)	Communicate with CAST-represented manufacturers that are currently producing transport category aircraft 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.
2d	Aircraft Manufacturers	In conjunction with appropriate suppliers, respond with 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.
2e	Aircraft Manufacturers	Respond to AIA and JIMDAT with the results of their studies and any intended follow-on implementation plans.
2f	AIA, Air Carrier Industry Assns.	Track progress of feasibility studies and report results to JIMDAT and CAST.
<i>Notes</i>	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.	

Note: See section III for detailed costs and resources.



**SECTION II: DETAILED ACTION INFORMATION****Action 3: Implement Controller Pilot Data Link Communications (CPDLC)***Primary Implementer***Air Carriers***Action Objective*

Air carriers should study feasibility of implementing CPDLC that can upload emergency route information to the aircraft.

*Action Timeline*

Flow Time: Per FAA Air Traffic Organization (ATO) rollout

Due Date: TBD

*Timeline/Flow for Future Adopters*

TBD when CAST closes this action.

*CAST Lead*

National Air Carrier Association (NACA)

#	Organization(s)	Detailed Steps
3a	Air Carrier Industry Assns.	Communicate with 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.
3b	Air Carriers	In conjunction with FAA ATO and FAA Flight Standards Service, Safety Standards (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.
3c	Air Carrier Industry Assns.	Track progress and report to CAST and JIMDAT.

*Notes*

- CPDLC network is being installed in the domestic airspace.
- 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.
- Air traffic control (ATC) will have to implement CPDLC into its procedures.

**SECTION III: SUPPLEMENTAL INFORMATION**

<i>Source Study</i>	Cargo Hazardous Material Fires (SE 126) Working Group	
<i>Related Initiatives</i>	<ul style="list-style-type: none"> <li>Industry development of oxygen mask vision system in process.</li> <li>CPDLC systems are already being deployed in U.S. fleets in expectation of Next Generation Air Transportation System (NextGen) changes to airspace procedures.</li> </ul>	
<b>Total Cost</b>	<b>\$29,450,000</b>	Not including smoke training.
<u>Action 1</u>	N/A	No cost.
<u>Action 2</u>	\$29,200,000	Cost to equip 785 aircraft (see below), plus \$700,000 for training.
<u>Action 3</u>	\$250,000	
<i>Direct Resource Overview – Government</i>	Organization	Resources Needed
	FAA ATO	<ul style="list-style-type: none"> <li>Action 3: 1 ATC Full Time Equivalent (FTE) for emergency route programming.</li> </ul>
<i>Direct Resource Overview – Industry</i>	Organization	Resources Needed
	Air Carriers	<ul style="list-style-type: none"> <li>Action 2: <ul style="list-style-type: none"> <li>\$36,260 per aircraft, including 10 years of maintenance costs. <ul style="list-style-type: none"> <li>\$13,000 per unit.</li> <li>\$260 per unit to install.</li> <li>\$500 maintenance per unit per year.</li> <li>2 units per aircraft.</li> <li>\$75 per pilot for training.</li> </ul> </li> <li>\$700,000 for training.</li> </ul> </li> <li>Action 3: No cost for operators with equipped aircraft.</li> </ul>
	Aircraft Manufacturers	<ul style="list-style-type: none"> <li>Action 1: <ul style="list-style-type: none"> <li>For new aircraft, no additional cost as masks are already part of design.</li> <li>For retrofit, original equipment manufacturer (OEM) engineering costs to develop and certify service bulletins for installation (TBD by OEMs).</li> </ul> </li> </ul>
<i>Indirect Resource Overview</i>	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
1.5	10/07/2021	Action 2 administrative due date change from 5/30/2021 to TBD pending rewrite of action.
1.4	11/02/2020	Action 2 due date extended from 09/30/2020 to 05/30/2021.
1.3	07/01/2020	Action 2 due date extended from 04/30/2020 to 09/30/2020.
1.2	02/06/2020	Action 2 due date extended from 12/31/2019 to 04/30/2020.
1.1	12/06/2018	Action 1 closed.
1.0	09/17/2018	New SE format. Content reorganized and terminology updated. No substantive changes.
Original	12/01/2016	CAST adopted SE 226.