SE 127 CAST Safety Enhancement (SE)
FIRE MANAGEMENT

STUDY TOPIC
RR-CARGO
REMAINING RISK – CARGO FIRES

CICTT RISK AREAS
F–NI

SECTION I

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 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.

CAST adopted SE 126 (R&D) and SE 127 as recommended by the RR JSIT. SE 127 recommends developing standards and implementing fire containment covers (FCC) and/or fire-resistant containers (FRC) to contain Class A fires. As of 2018, FCCs are being manufactured and used in the industry. The standard for FRCs is still being developed; however, some operators have already developed their own FRCs ahead of the industry standard and associated FAA technical standard order (TSO).

SE Objective

CAST recommends regulators determine existing fire suppression and containment capabilities and revise standards to reduce accidents and incidents from cargo fires and manufacturers develop new fire systems for operator implementation.

Primary Risks Mitigated

Fire/Smoke (Non-Impact) (F–NI)

Action	Organization(s)	Strategy	Description	Due Date
Action 1	FAA Technical Center	Feasibility Study	Survey and report capabilities of available fire suppression and containment systems for container and palletized cargo fires.	06/30/2009
	Comments: CAST closed this action.			
Action 2	FAA AIR	Standards	Task an SAE International (SAE) industry standards committee to develop/revise standards for FCCs to suppress Class A fires within palletized and netted unit load devices (ULD) carried in Class B, E, or F cargo areas.	08/31/2014
	Comments: CAST closed this action based on publication of TSO–C203, Fire Containment Covers (FCC), on July 1, 2014.			
Action 3	Container Manufacturers	Design, Equipment	Develop standardized fire suppression and/or containment systems in accordance with the standards developed in Action 2.	08/31/2016
	Comments: CAST closed this action based on report of FCCs in production.			
Action 4	Cargo Air Carriers	Equipment	Implement use of the new fire suppression and/or containment systems developed under Action 3.	08/31/2018
	Comments: CAST closed this action based on report of FCCs being used for cargo.			
Action 5	JIMDAT	Monitoring	Monitor ongoing activity and development of new fire-resistant container ULDs.	08/31/2017
	Comments: CAST closed this action. JIMDAT continues to monitor.			

SECTION I: SE OVERVIEW

Action	Organization(s)	Strategy	Description	Due Date
Action 6	SAE	Standards	Task an SAE industry standards committee to develop/revise standards for fire-resistant container ULDs capable of internally containing a Class A fire for such duration as necessary to ensure continued safe flight and landing after detection of the fire.	06/30/2021
	Comments: CAST closed this action based on the publication of TSO C90e.			
Action 7	SAE	Standards	Task an SAE industry standards committee to develop/revise standards for fire-resistant container ULDs capable of suppressing a fire through an internal fire suppression system installed inside the container ULD.	Withdrawn
	Action withdrawn. ULD technologies are still emerging. SAE has not committed to developing a standard.			
Action 8	Container Manufacturers, Cargo Air Carriers	Design, Equipment	Develop and begin implementing new fire-resistant containers per TSO standards developed in either Action 6 or Action 7.	12/31/2021
	Comments: CAST closed this action based on underway air carrier implementation of Class A fire-resistant containers.			

See section II of this SE for detailed action descriptions.

References: The detailed analysis in the RR JSAT/JSIT Final Report is available through CAST.

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SECTION II: DETAILED ACTION INFORMATION

Action 1: Survey and report capabilities of available fire suppression/containment systems for cargo fires

Primary Implementer	**FAA Technical Center**
Action Objective	The FAA Technical Center should survey and report capabilities of available fire suppression and containment systems for container and palletized cargo fires.
Action Timeline	Flow Time: 6 months Due Date: 06/30/2009
Timeline/Flow for Future Adopters	N/A
CAST Lead	FAA Technical Center

#	Organization(s)	Detailed Steps
1a	FAA Technical Center	Conduct a survey of available fire suppression systems for container and cargo compartment fires (for example, fire-suppressing blankets and/or FedEx and UPS cargo fire suppression systems currently in development).
	Complete.	
1b	FAA Technical Center	Determine whether existing technology is sufficient and feasible, or if there is a need for further development.
	Complete.	
1c	FAA Technical Center	Report feasibility findings based on results of cost-benefits study of various cargo fire protection/suppression systems and technologies.
	Complete.	

Notes

Note: See section III for detailed costs and resources.

SECTION II: DETAILED ACTION INFORMATION

Action 2: Develop/revise standards for FCCs to suppress Class A fires in ULDs

Primary Implementer	**FAA Aircraft Certification Service (AIR)**
Action Objective	Based on demonstrated feasibility of various fire suppression/protection technologies, as determined in Action 1, Step 3, FAA AIR should task an SAE International (SAE) industry standards committee to develop and/or revise standards for fire containment covers (FCC) to suppress Class A fires within palletized and netted unit load devices (ULD) carried in Class B, E, or F cargo areas. These standards could become the basis for a revised or new technical standard order (TSO) for FCCs. (Class C cargo areas are already required to have detection and suppression on passenger aircraft).
Action Timeline	Flow Time: 18 months Due Date: 08/31/2014
Timeline/Flow for Future Adopters	N/A
CAST Lead	FAA AIR

#	Organization(s)	Detailed Steps
2a	FAA AIR	Based on Step 3 of Action 1, determine if any proposed methods of cargo fire protection/suppression are feasible.
	Complete.	
2b	FAA AIR	Based on the determination in the first step of this action, task an SAE International industry standards committee to develop and/or revise standards for FCCs that suppress Class A fires within palletized and netted ULDs.
	Complete.	
2c	SAE Standards Committee	Report out on standards developed.
	Complete.	
2d	FAA AIR	Determine if the standards should be incorporated into a TSO, and publish revised or new TSO, if applicable.
	TSO–C203, Fire Containment Covers (FCC), published July 1, 2014.	

Notes

Note: See section III for detailed costs and resources.

SECTION II: DETAILED ACTION INFORMATION

Action 3: Develop standardized fire suppression/containment systems

Primary Implementer	**Container Manufacturers**
Action Objective	Container manufacturers should develop standardized fire suppression and/or containment systems in accordance with the standards developed in Action 2.
Action Timeline	Flow Time: 24 months Due Date: 08/31/2016
Timeline/Flow for Future Adopters	TBD
CAST Lead	Aerospace Industries Association (AIA)

#	Organization(s)	Detailed Steps
3a	Container Manufacturers	Develop standardized fire suppression and/or containment systems in accordance with the standards developed in Action 2.
	Closed based on report of fire containment covers in production.	

Notes

Note: See section III for detailed costs and resources.

SECTION II: DETAILED ACTION INFORMATION

Action 4: Implement use of new fire suppression/containment systems to mitigate operational risks

Primary Implementer	**Cargo Air Carriers**
Action Objective	Cargo air carriers/operators should implement use of the new fire suppression and/or containment systems developed under Action 3 as applicable to mitigate operational risks.
Action Timeline	Flow Time: 24 months Due Date: 08/31/2018
Timeline/Flow for Future Adopters	TBD
CAST Lead	Airlines for America (A4A)

#	Organization(s)	Detailed Steps
4a	CAST	Encourage cargo air carriers to use the fire containment and/or suppression systems developed under Action 3.
	Complete.	
4b	Cargo Air Carriers	Perform a risk assessment and incorporate the new fire suppression and/or containment systems developed under Action 3 as necessary to mitigate identified risk.
	Closed based on report of fire containment covers being used for cargo.	

Notes

Note: See section III for detailed costs and resources.

SECTION II: DETAILED ACTION INFORMATION

Action 5: Monitor development of FRC ULDs

Primary Implementer	**JIMDAT**
Action Objective	Through JIMDAT, CAST should monitor ongoing activity and development of new fire-resistant container (FRC) unit load devices (ULD) capable of either— 1. Internally containing a Class A fire long enough to ensure continued safe flight and landing after detection, or 2. Suppressing a fire through an internal fire suppression system installed inside the container ULD. At the end of the monitoring period, CAST should determine whether to proceed with Action 6 and/or Action 7. Activities to monitor include— • SAE International (SAE) discussion and decision to pursue development of standards for FRC ULDs in 2013 meetings; • FAA Technical Center Fire Lab full-scale testing of FRC ULDs currently underway by UPS and other cargo carriers; • FAA Aviation Safety (AVS) Research, Engineering, and Development (RE&D) planning for support of the FAA Technical Center fire lab activity; and • Other industry development efforts.
Action Timeline	Flow Time: 54 months Due Date: 08/31/2017
Timeline/Flow for Future Adopters	TBD
CAST Lead	JIMDAT

#	Organization(s)	Detailed Steps
5a	JIMDAT	Identify a focal point for monitoring and reporting activity.
	Complete.	
5b	JIMDAT	Monitor work by SAE, UPS, FedEx, and the FAA Technical Center and provide bimonthly update to JIMDAT.
	Complete.	
5c	JIMDAT	Report out on ongoing activities at regular CAST meetings.
	Complete.	
5d	JIMDAT	Coordinate with FAA AVS RE&D program manager, FAA Technical Center, and FAA technical specialists in cargo fire safety in the FAA Aircraft Certification Service (AIR) Transport Standards Branch staff to define potential for FAA funding of Technical Center Fire Lab testing of FRC ULDs and submit RE&D requirements through FAA RE&D process.
	Complete.	
5e	JIMDAT	Summarize status at the end of the monitoring period and make a recommendation to CAST.
	Complete. JIMDAT continues to monitor.	

Notes

Note: See section III for detailed costs and resources.

SECTION II: DETAILED ACTION INFORMATION

Action 6: Develop FRC ULD standards to internally contain Class A fires

Primary Implementer	**SAE International (SAE)**
Action Objective	Based on the outcome of Action 5, FAA Aircraft Certification Service (AIR) should task an SAE industry standards committee to develop and/or revise standards for fire-resistant container (FRC) unit load devices (ULD) capable of internally containing a Class A fire for such duration as necessary to ensure continued safe flight and landing after detection of the fire. Such standards should include detection and alerting criteria, a minimum demonstrated containment time and a standardized flammability test that shows the product can meet the required containment time. These standards could become the basis for a revised or new technical standard order (TSO) for container ULDs.
Action Timeline	Flow Time: 49 months Due Date: 06/30/2021
Timeline/Flow for Future Adopters	TBD
CAST Lead	FAA AIR

#	Organization(s)	Detailed Steps
6a	FAA AIR	Send formal tasking to SAE.
	Complete.	
6b	SAE	Accept FAA tasking and assign to appropriate subcommittee.
	Complete.	
6c	SAE Subcommittee	Develop standards for fire-resistant container ULDs capable of detecting and alerting a fire and containing a Class A fire long enough to ensure continued safe flight and landing. These standards would include standardized flammability testing criteria.
	Complete.	
6d	SAE	Approve standards and send to FAA AIR.
	Complete.	
6e	FAA AIR	Develop and publish TSO.
	Closed based on the publication of TSO C90e, Unit Load Devices.	

Notes

Note: See section III for detailed costs and resources.

SECTION II: DETAILED ACTION INFORMATION

Action 7 [WITHDRAWN]

Primary Implementer	**SAE International (SAE)**
Action Objective	Based on the outcome of Action 5, the FAA Aircraft Certification Service (AIR) should task an SAE industry standards committee to develop and/or revise standards for fire-resistant container (FRC) united load devices (ULD) capable of suppressing a fire through an internal fire suppression system installed inside the container ULD. Such standards should include detection and alerting criteria, a minimum demonstrated suppression time and a standardized flammability test that shows the product can meet the required suppression time. These standards could become the basis for a revised or new technical standard order (TSO) for container ULDs.
Action Timeline	Flow Time: N/A Due Date: N/A
Timeline/Flow for Future Adopters	Action withdrawn. ULD technologies are still emerging. SAE has not committed to developing a standard.
CAST Lead	FAA AIR

#	Organization(s)	Detailed Steps
7a	FAA AIR	Send formal tasking to SAE.
7b	SAE	Accept FAA tasking and assign to appropriate subcommittee.
7c	SAE Subcommittee	Develop standards for FRC ULDs capable of detecting and alerting a fire and suppressing the fire through an internal fire suppression system installed inside the container ULD. These standards would include standardized flammability testing criteria.
7d	SAE	Approve standards and send to FAA AIR.
7e	FAA AIR	Develop and publish TSO.

Notes: CAST will decide if it should pursue this action contingent upon the results of Action 5.

Note: See section III for detailed costs and resources.

SECTION II: DETAILED ACTION INFORMATION

Action 8: Develop and use new FRCs

Primary Implementer	**Container Manufacturers, Cargo Air Carriers**
Action Objective	Manufacturers of container unit load devices (ULD) should develop new fire-resistant containers (FRC) based on technical standard order (TSO) standards developed in either Action 6 or Action 7, and cargo air carriers begin implementing their use in operations.
Action Timeline	Flow Time: Product available for use within 24 months of TSO publication. Due Date: 12/31/2021
Timeline/Flow for Future Adopters	TBD
CAST Lead	National Air Carrier Association (NACA)

#	Organization(s)	Detailed Steps
8a	CAST	Through NACA and Aerospace Industries Association (AIA), encourage manufacturers of FRC ULDs to develop new containers in accordance with the revised TSO in Action 6 and/or Action 7.
	Complete.	
8b	Container Manufacturers	Develop and produce new FRC ULDs in accordance with the revised TSO from Action 6 and/or Action 7.
	Complete.	
8c	CAST	Through NACA, the Regional Airline Association (RAA), and Airlines for America (A4A), encourage cargo air carriers to use the new FRC ULDs.
	Complete.	
8d	Cargo Air Carriers	Perform a risk assessment and incorporate the new FRC ULDs as necessary to mitigate identified risk.
	Complete based on underway air carrier implementation of Class A fire-resistant containers.	

Notes

Note: See section III for detailed costs and resources.

SECTION III: SUPPLEMENTAL INFORMATION

Source Study	Remaining Risk (RR) Joint Safety Analysis Team (JSAT) and Joint Safety Implementation Team (JSIT) Final Report
Related Initiatives	• SAE standards development for FCCs. • International Organization for Standardization (ISO) work in the area of cargo fire safety. • Industry development and testing of FCCs and FRC ULDs. • Industry development and certification of aircraft-level fire suppression systems with Class E cargo areas. • Industry research in new fire suppression chemicals (for example, "Firebane"). • Industry and Government work in the area of mitigating the risk of hazardous material fires onboard aircraft. • Impact on non-part 121 or international applications: o ISO is an international body. o Harmonization of TSOs with FCAAs (EASA, TCCA, etc.).

Total Cost	**$610,000**	*Note: For labor, 1 Full Time Equivalent (FTE) = $250,000*
Action 1	$150,000	
Action 2	$150,000	
Action 3	$0	Cost of developing fire suppression/containment systems. Figure not available.
Action 4	$0	Figure not available.
Action 5	$10,000	
Action 6	$150,000	
Action 7	$150,000	Withdrawn.
Action 8	$0	To be determined.

	Organization	Resources Needed
Direct Resource Overview – Government	FAA AIR	• Action 2: $150,000 – Administration, meetings, and travel • Action 6: $150,000 – Administration costs, meetings, and travel. Additional resources for flammability testing costs at the FAA Tech Center – total test cost is unknown and dependent upon progress of testing and standards work. • Action 7 (withdrawn): $150,000 – Administration costs, meetings, and travel. Additional resources for flammability testing costs at the FAA Tech Center – total test cost is unknown and dependent upon progress of testing and standards work.
	FAA Technical Center	• Action 1: $50,000 – Administration costs, meetings, and travel. • Action 1: $100,000 – Possible testing for sufficiency.
	JIMDAT	• Action 5: $10,000 – Administration, meetings, and travel.

SECTION III: SUPPLEMENTAL INFORMATION

	Organization	Resources Needed
Direct Resource Overview – Industry	Cargo Air Carriers	• Action 4: Cost of buying, implementing, maintaining, and replacing FCCs in cargo operations. • Action 8: The costs of this action depend on the fire containment and/or suppression systems that are implemented but are generally the development costs of the new container ULDs and the differential costs between current container ULDs and new ULDs that would meet the standards of Action 6 and/or Action 7.

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
4.5	10/07/2021	Action 8 closed 10/07/2021.
4.4	08/05/2021	Action 6 closed 08/05/2021.
4.3	11/02/2020	Action 6 due date extended from 12/31/2020 to 06/30/2021.
4.2	12/05/2019	Action 6 due date extended from 12/31/2019 to 12/31/2020.
4.1	10/04/2018	Action 6 due date extended from 12/31/2018 to 12/31/2019. Action 8 due date extended from 12/31/2020 to 12/31/2021.
4.0	09/17/2018	New SE format. Content reorganized and terminology updated. No substantive changes.
3.4	06/01/2017	Action 5 closed 06/01/2017.
3.3	04/06/2017	Action 3 closed 02/04/2016. Action 4 closed 02/04/2016. Action 6 due date extended from 04/30/2017 to 12/31/2018. Action 7 withdrawn at August 2015 CAST meeting. Action 8 due date extended from 04/30/2019 to 12/31/2020.
3.2	08/06/2014	Action 5 due date extended from 08/31/2015 to 08/31/2017.
3.1	04/03/2014	Action 1 completed and closed 06/30/2009. Action 2 completed and closed 08/31/2014. Action 5 due date extended from 02/28/2014 to 08/31/2015. Action 6 due date extended to 04/30/2017.
3.0	03/07/2013	Revised Action 2 resources and steps. Action 2 due date extended from 06/30/2012 to 12/31/2013. Revised Action 3 resources. Revised Action 4 resources and timeline. Added Actions 5, 6, 7, and 8.
2.0	12/04/2008	Revised statement of work. Amended Actions 1, 2, 3, and 4.
1.0	06/06/2008	Amended statement of work. Amended Actions 1, 2, 3, and 4. Action 1 timeline extended from 90 days to 180 days.
Original	12/07/2006	CAST adopted SE 127.