SE 218 CAST Safety Enhancement (SE)

DESIGN – OVERRUN AWARENESS AND ALERTING SYSTEMS

STUDY TOPIC
RE
RUNWAY EXCURSION

CICTT RISK AREAS
RE

SECTION I: SE OVERVIEW

SECTION I

Study Topic Overview Summary	CAST chartered the Runway Excursion (RE) Joint Safety Analysis and Implementation Team (JSAIT) in 2012 to review the findings and recommendations from 15 industry reports by 11 different organizations and authorities on the issue of RE. From those reports, the team identified 155 contributing factors and 274 recommendations that it eventually consolidated into 45 Standard Problem Statements (SPS) and 75 Intervention Strategies (IS). The RE JSAIT grouped, analyzed, and consolidated the ISs into 7 SEs for industry implementation and 1 research and development (R&D) SE. CAST approved the SEs the RE JSAIT recommended in June 2014.
SE Objective	CAST recommends manufacturers develop, and manufacturers and operators implement onboard technology to reduce or prevent landing overruns on new and existing aircraft designs, as applicable and feasible.
Primary Risks Mitigated	Runway Excursion (RE)

Action	Organization(s)	Strategy	Description	Due Date
Action 1	Aircraft Manufacturers	Procedures	Agree to make available onboard technology to reduce or prevent landing overruns on applicable new transport category aircraft programs.	12/31/2014
	Comments: CAST closed this action.			
Action 2	Aircraft Manufacturers	Procedures	Study the feasibility of providing onboard technology to reduce or prevent landing overruns on current production and out-of-production transport category aircraft programs.	09/30/2016
	Comments: CAST closed this action based on manufacturers reporting feasibility of adding runway overrun protection technology to out-of-production aircraft.			
Action 3	Air Carriers	Procedures	Develop implementation plan, as feasible, for onboard technology to reduce or prevent landing overruns on existing transport category aircraft programs.	06/30/2017
	Comments: CAST closed this action based on survey results from air carrier industry associations. CAST encourages air carriers that have not developed the implementation plan requested in this action to do so.			

See section II of this SE for detailed action descriptions.

References: The detailed analysis in the Runway Excursion Joint Safety Analysis and Implementation Team (RE JSAIT) Final Report (February 12, 2015) is available through CAST.

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SECTION II: DETAILED ACTION INFORMATION

Action 1: Agree to include technology to reduce or prevent landing overruns for new aircraft programs

Primary Implementer	**Aircraft Manufacturers**
Action Objective	Aircraft manufacturers should agree to make available onboard technology to reduce or prevent landing overruns on applicable new transport category aircraft (TCA) programs launched after June 1, 2015. Applicable new TCA programs include— • New type certificate programs, and • Major derivative, amended type certificate programs involving redesign of flightdeck avionics
Action Timeline	Flow Time: 6 months (for manufacturers to respond to Aerospace Industries Association (AIA)) Due Date: 12/31/2014
Timeline/Flow for Future Adopters	CAST recommends manufacturers include onboard overrun protection technology on new TCA programs. The implementation timeline is expected to coincide with TCA program timeline.
CAST Lead	AIA

#	Organization(s)	Detailed Steps
1a	AIA	Communicate with CAST-represented manufacturers that are currently producing or are expected to produce TCAs for use in U.S. part 121 operations, explaining the Runway Excursion Joint Safety Analysis and Implementation Team (RE JSAIT) analysis and the recommended action from industry reports regarding technologies to reduce or prevent landing overruns.
	Complete.	
1b	Aircraft Manufacturers	Review the CAST RE JSAIT study and recommendations, and respond to AIA by indicating intention to develop and make available onboard technology to reduce or prevent landing overruns into all applicable new transport category aircraft (TCA) programs launched after June 1, 2015.
	As of August 2015, a significant number of manufacturers have reported to AIA they meet the intent of this subaction.	
1c	AIA	Report results to JIMDAT and CAST.
	Reported to JIMDAT and CAST in August 2015.	

Notes

- Two systems that would satisfy the intent of this SE are already developed and have been approved on some aircraft platforms: the Airbus Runway Overrun Protection System (ROPS) and the Honeywell SmartLanding system.
- An additional system, the Boeing Runway Situation Awareness Tools (RSAT), is in development and is expected to enter service in 2015.

Note: See Section III for detailed costs and resources.

SECTION II: DETAILED ACTION INFORMATION

Action 2: Study the feasibility of technology to reduce or prevent landing overruns on existing aircraft

Primary Implementer	**Aircraft Manufacturers**
Action Objective	Aircraft manufacturers and avionics suppliers should study the feasibility of providing onboard technology to reduce or prevent landing overruns on current production and out-of-production transport category aircraft (TCA) programs.
Action Timeline	Flow Time: 24 months (extended to 27 months) o 6 months for Aerospace Industries Association (AIA) to send communication to manufacturers. o 18 months for manufacturers to perform feasibility studies and respond with results. Due Date: 09/30/2016
Timeline/Flow for Future Adopters	TBD
CAST Lead	AIA

#	Organization(s)	Detailed Steps
2a	AIA	Communicate with CAST-represented manufacturers that are currently producing TCAs for use in U.S. part 121 operations, explaining the Runway Excursion Joint Safety Analysis and Implementation Team (RE JSAIT) analysis and encouraging them to study the feasibility of implementing onboard technology to reduce or prevent landing overruns on current production, in development, and out-of-production aircraft programs.
	Complete.	
2b	Aircraft Manufacturers	In conjunction with avionics suppliers, conduct model-by-model feasibility studies on the implementation of onboard technology to reduce or prevent landing overruns on current production, in-development, and out-of-production aircraft , as noted in the Feasibility Study Guidelines below, and report results to AIA.
	As of October 2016, a significant number of manufacturers have reported to AIA the feasibility of adding runway overrun protection technology to out-of-production aircraft.	
2c	AIA	Track progress of feasibility studies and report results to JIMDAT and CAST.
	Reported to JIMDAT and CAST in October 2016.	

Notes

- Timelines for development, certification, and installation of systems are not included as these would vary based on the particular system and aircraft.
- Two systems that would satisfy the intent of this SE are already developed and have been approved on some aircraft platforms: the Airbus Runway Overrun Protection System (ROPS) and the Honeywell SmartLanding system.
- An additional system, the Boeing Runway Situation Awareness Tools (RSAT), is in development and is expected to enter service in 2015.

Feasibility Study Guidelines

Each manufacturer should consider the following elements in their study:

1. Existing production change and service bulletin information. If the feature has already been incorporated in the production line of an existing type design, the manufacturer need only

Note: See Section III for detailed costs and resources.

consider development of a service bulletin for retrofit. If a retrofit service bulletin also exists for a given model, no further study of the feature on that model is necessary. The manufacturer should identify existing service bulletin information in its response to CAST.

2. Market analysis. This analysis should include an estimate, based on the manufacturer's marketing projection, of the following as applicable for each model:
   a) The year in which the change could be implemented in production,
   b) The number of aircraft projected to be produced between implementation and the year 2025,
   c) The year in which a retrofit package could be offered, and
   d) Air carrier customer interest and operational requirements.
3. Rough Order of Magnitude cost estimates. Cost estimates should be given from initial development to entry into service, broken out by aircraft type, and should include at least the following:
   a) An estimate, in hours, of the engineering, pilot, and administrative labor required to develop design changes that would introduce these features into the production line and as a retrofit package into delivered aircraft. This estimate should include supplier labor hours and well as hours estimated for certification, both by the manufacturer and the regulatory authorities.
   b) An estimate, in hours, of the pilot-in-the-loop simulator hours required to develop and certify the change.
   c) An estimate, in hours, of flight test time required to develop and certify the system.
   d) An estimate, in dollars, of hardware or parts required per aircraft to support the change.
4. Technical feasibility assessment. This assessment should cover installation of the technologies on the production line as well as development of service bulletins to be made available for retrofitting the technology to delivered aircraft.
5. Certification risks. Any certification barriers, such as insufficient guidance for means of compliance, inconsistency with current FAA certification policy, or impact on other certified systems or Airplane Flight Manual procedures should be identified.
6. Impact to operators. An estimate, in hours, of additional flightcrew training time for new systems and of aircraft downtime to install service bulletins for retrofit scenarios. If the change can be implemented in parallel to other maintenance activities, only the incremental time or cost of the installation need be considered.

Note: See Section III for detailed costs and resources.

SECTION II: DETAILED ACTION INFORMATION

Action 3: Develop implementation plan for onboard technology to reduce or prevent landing overruns

Primary Implementer	**Air Carriers**
Action Objective	Air carriers should develop an implementation plan, as feasible, for onboard technology to reduce or prevent landing overruns on existing transport category aircraft (TCA) programs.
Action Timeline	Flow Time: 36 months (for air carriers to complete feasibility assessments) Due Date: 06/30/2017
Timeline/Flow for Future Adopters	TBD
CAST Lead	Airlines for America (A4A)

#	Organization(s)	Detailed Steps
3a	Air Carrier Industry Assns.	Communicate with air carrier members, explaining the Runway Excursion Joint Safety Analysis and Implementation Team (RE JSAIT) analysis and the potential benefits of onboard technologies that reduce or prevent landing overruns.
	Complete.	
3b	Air Carriers	Study the feasibility of incorporating these technologies into their specific fleet (both existing aircraft and new purchases) and operations. Studies should take into account current and potential future availability of systems from manufacturers, with consideration of results from Action 1 and Action 2.
	Complete.	
3c	Air Carriers	Develop implementation plan for systems based on results of the feasibility assessments, where applicable, and report whether or not they intend to incorporate systems in their fleet to air carrier industry associations.
	As of August 2017, a significant number of air carriers have reported to their respective industry associations they meet the intent of this subaction.	
3d	Air Carrier Industry Assns.	Track implementation and report progress to JIMDAT and CAST.
	Reported to JIMDAT and CAST in August 2017.	

Notes

- Timeline for implementation of systems is not included as this will vary depending on results of assessments.
- Two systems that would satisfy the intent of this SE are already developed and have been approved on some aircraft platforms: the Airbus Runway Overrun Protection System (ROPS) and the Honeywell SmartLanding system.
- An additional system, the Boeing Runway Situation Awareness Tools (RSAT), is in development and is expected to enter service in 2015.
- Although not specifically assessed for its capacity to mitigate RE risk, Rockwell Collins offers enhanced head-up display (HUD) energy management cues to aid in maintaining a stabilized approach to landing and Surface Management System for operators that have already incorporated HUD in the flightdeck.

Note: See Section III for detailed costs and resources.

SECTION III: SUPPLEMENTAL INFORMATION

Source Study	Runway Excursion Joint Safety Analysis and Implementation Team (RE JSAIT) Final Report (February 12, 2015)
Related Initiatives	CAST SE 216, Air Carrier Operations and Training – Flightcrew Landing Training

Total Cost	**$8,300,000**	*Note: For labor, 1 Full Time Equivalent (FTE) = $250,000*	
Action 1	$25,000	0.1 FTE	Plus cost of installation on new aircraft designs.
Action 2	$1,200,000	4.6 FTE	Plus cost to develop service bulletins.
Action 3	$7,100,000	28.3 FTE	Plus cost to install service bulletins, as determined by the results of each air carrier's cost-benefit assessment of available technologies.[1]

Notes
- Does not include cost of equipage, which will vary based on system options chosen and other factors.
- Costs do not include training at operators on use of the system; this cost is presumed to be introduced during initial and recurrent training for stable approaches (see CAST SE 216).

	Organization	Resources Needed
Direct Resource Overview – Government	JIMDAT	• Action 2: 0.5 FTE for communication, tracking, and consultation. • Action 3: 0.5 FTE for communication, tracking, and consultation.

	Organization	Resources Needed
Direct Resource Overview – Industry	AIA	• Action 1: 0.02 FTE for communication and tracking. • Action 2: 0.1 FTE for communication, tracking, and consultation.
	Air Carriers	• Action 3: 27.5 FTE (0.5 FTE per air carrier to assess available or potentially available systems for their fleet). *Note: Cost-benefit analyses by operators to assess system effectiveness are assumed to be part of normal process in assessing aircraft and equipment purchases.*
	Air Carrier Industry Assns.	• Action 3: 0.3 FTE for communication, tracking, and consultation. *Note: 55 air carriers are represented by three CAST-member air carrier industry associations:* o *Airlines for America (A4A),* o *Regional Airline Association (RAA), and* o *National Air Carrier Association (NACA).*

[1] JIMDAT has developed a cost assessment methodology that allows operators to account for variations in their specific fleet demographics and expected remaining service life to aid them in cost-benefit analysis. This assessment methodology will be made available through air carrier industry associations to their members.

	Organization	Resources Needed
	Aircraft Manufacturers	• Action 1: 0.08 FTE for review and communication (0.02 per manufacturer). • Action 2: 4.0 FTE (1.0 FTE per aircraft manufacturer to perform feasibility studies, including support for suppliers and sub-contractors for potential development). *Note: Study costs for Action 2 assume aircraft manufacturers will consult with avionics suppliers. Manufacturers may also elect to subcontract with other manufacturers to use systems they have already developed.*

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
FAA AIR	Certification staff resources required for normal review and approval of design changes as part of duties performed.

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
1.1	03/22/2019	Administrative edits to Action 3.
1.0	09/17/2018	New SE format. Content reorganized and terminology updated. No substantive changes.
0.3	08/03/2017	Action 3 closed.
0.2	10/06/2016	Action 2 closed.
0.1	08/04/2016	Action 1 closed. Action 2 due date extended from 06/30/2016 to 09/30/2016.
Original	06/05/2014	CAST adopted SE 218.