SE 231 CAST Safety Enhancement (SE)
AIRCRAFT-BASED TECHNOLOGIES

STUDY TOPIC
ALM
APPROACH AND LANDING MISALIGNMENT

CICTT RISK AREAS
GCOL, RI

SECTION I

SECTION I: SE OVERVIEW

Study Topic Overview Summary	Throughout the National Airspace System (NAS), the risk for approach and landing misalignment (ALM) has been identified. This risk includes aircraft approaching or landing on a surface other than what they were cleared for. These other surfaces include the wrong runway, taxiway, or airport. While these events have typically been caught soon enough to prevent an adverse outcome, there have been high-profile events, including an event involving an approach to a taxiway on July 7, 2017, in San Francisco, California. This ultimately led CAST to charter the ALM Joint Safety Analysis and Implementation Team (JSAIT) to analyze misalignments and determine mitigations based on Aviation Safety Information Analysis and Sharing (ASIAS) data from sources such as Aviation Safety Action Program (ASAP) reports, Air Traffic Safety Action Program (ATSAP) reports, and Mandatory Occurrence Reports (MOR). CAST adopted four SEs as a result of the study, two of which are directed toward aircraft operators and original equipment manufacturers (OEM), while the remaining two are directed toward air traffic control (ATC). CAST also adopted one research and development (R&D) SE, which is directed toward aircraft operators and OEMs.
SE Objective	CAST recommends the industry develop and make available, on new transport category aircraft and major derivatives, enhanced aircraft design features as feasible, that increase flightcrew awareness of runway/taxiway/aerodrome ALMs. Applicable new aircraft programs include— •New type certificate programs and •Major derivative, amended type certificate programs involving redesign of flightdeck avionics.
Primary Risks Mitigated	Ground Collision (GCOL) and Runway Incursion (RI)

Action	Organization(s)	Strategy	Description	Due Date
Action 1	OEMs	Design	The OEMs should evaluate both their current production fleet and/or avionics suites and new type design aircraft, as well as incorporate these technologies as feasible.	5/31/2022
	Comments: CAST closed this action based on original equipment manufacturer (OEM) reports of technologies available and being developed.			
Action 2	Operators	Equipment	Aircraft operators should evaluate available technology against their fleets and decide what technology they will incorporate into their fleet.	11/30/2022
	Comments: CAST closed this based on OEMs developing the technology for air-carrier implementation.			
	See section II of this SE for detailed action descriptions.			

References: The detailed analysis in the ALM JSAIT Final Report is available through CAST.

TABLE OF CONTENTS

SECTION II: DETAILED ACTION INFORMATION

Action 1: Research available enhanced aircraft design features

Primary Implementer	**Aircraft Manufacturers**
Action Objective	Compile a portfolio of available commercial technology that increases flightcrew awareness of runway/taxiway/aerodrome approach and landing misalignments (ALM).
Action Timeline	Flow Time: 6 months Due Date: 5/31/2022
Timeline/Flow for Future Adopters	N/A
CAST Lead	Aerospace Industries Association (AIA)

#	Organization(s)	Detailed Steps
1a	Original Equipment Manufacturers (OEM)	Categorize and detail the currently available technologies related to— a. Situational awareness technologies i. Technologies providing additional situational awareness in the airport/approach environment, such as head-up displays (HUD), Synthetic Vision Systems (SVS), Enhanced Vision Systems (EVS), and Moving Maps that include a depiction of the whole airport rather than just the flightpath to the FMS-programmed runway. b. Advisory technologies i. Technologies providing advisories for the runway with which the flightcrew is aligned. c. Alerting technologies i. Technologies providing alerts when aligning to “not a runway” or “not a Flight Management Computer (FMC)–programmed runway.”
	Complete.	
1b	OEMs	Implement these currently available technologies on new type designs and future major derivatives programs, as feasible.
	Complete.	
1c	OEMs	Provide an upgrade path and cost to install these currently available technologies on in-production aircraft.
	Complete.	
1d	OEMs	Complete a feasibility study to make these future technologies available on currently out-of-production aircraft.
	Complete.	

Notes

SECTION II: DETAILED ACTION INFORMATION

Action 2: Identify air carrier implementation of the technologies identified in Action 1

Primary Implementer	**Aircraft Operators**
Action Objective	Share the results of the Approach and Landing Misalignment (ALM) Joint Safety Analysis and Implementation Team (JSAIT) study with air carriers. Air carriers should recommend new design features where necessary.
Action Timeline	Flow Time: 12 months Due Date: 11/30/2022
Timeline/Flow for Future Adopters	N/A
CAST Lead	Airlines for America (A4A)

#	Organization(s)	Detailed Steps
2a	Air Carrier Industry Association(s)	Communicate with aircraft operators and provide results of the ALM JSAIT study. Operators should mitigate the risk by installing currently available ALM technologies, which include— a. Situational awareness technologies i. Technologies providing additional situational awareness in the airport/approach environment, such as HUD, SVS, EVS, and Moving Maps. b. Advisory technologies i. Technologies providing advisories for the runway with which the flightcrew is aligned. c. Alerting technologies i. Technologies providing alerts when aligning to “not a runway” or “not a Flight Management Computer (FMC)–programmed runway.”
	Complete.	
2b	Air Carriers	Report to CAST that aircraft operators have performed their fleet assessments and made their implementation decisions.
	Complete.	

Notes

SECTION III: SUPPLEMENTAL INFORMATION

Source Study	Approach and Landing Misalignment (ALM) Joint Safety Analysis and Implementation Team (JSAIT)
Related Initiatives	SE 200, Airplane State Awareness—Virtual Day-VMC Displays SE 218, Runway Excursion—Overrun Awareness and Alerting Systems
Examples of currently available technologies that meet the intent of this SE	• Situational Awareness o Enhanced Vision Systems (EVS) or Enhanced Flight Vision Systems (EFVS), Synthetic Vision Systems (SVS), head-up displays (HUD), and Moving Maps associated with EVS and SVS o Collins Aerospace Pro Line Fusion/Surface Management System (adds a visual overlay highlighting the target runway on the airport chart display) • Advisory o Honeywell Runway Awareness and Advisory System (RAAS) (advisory callout and navigation display text of runway being approached) • Alerting o Honeywell SmartRunway/SmartLanding (short runway or taxiway alignment) o Airbus Runway Overrun Prevention (ROP) (only if runway is too short) o Airbus SURF–A (only if runway is occupied) o Collins Aerospace Pro Line Fusion/Surface Management System (runway is too short, aligning to land on a surface that is not a runway)

Total Cost	**$125,000**	*Note: For labor, 1 Full Time Equivalent (FTE) = $250,000*
Action 1	$50,000	0.2 FTE *[add 0.1 FTE for each aircraft manufacturer over one]*
Action 2	TBD/$75,000	0.3 FTE *[add 0.3 FTE for each air carrier over one]*

	Organization	Resources Needed
Direct Resource Overview—Government		• N/A

	Organization	Resources Needed
Direct Resource Overview—Industry	AIA	• Action 1: 0.1 FTE
	Aircraft Manufacturers	• Action 1: 0.1 FTE, per manufacturer
	Air Carriers	• Action 2: 0.3 FTE, per air carrier • Action 2: $50,000 per aircraft for advisory and alerting technologies • Action 2: $100,000 per aircraft for situational awareness technologies

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
European Organisation for Civil Aviation Equipment (EUROCAE) Working Group 101	This working group is investigating similar technologies as the ALM JSAIT and, looking to mandate such technologies for air carriers operating in Europe.

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
0.3	12/01/2022	Action 2 completed and closed.
0.2	04/07/2022	Action 1 completed and closed.
0.1	03/24/2022	Administrative change to correct Strategy field in Action 2 in Section 1.
Original	12/02/2021	*Start date based on CAST adoption.*