

SECTION I: SE OVERVIEW

*Study Topic
Overview
Summary*

In 2009, CAST initiated a directed study of terrain awareness and warning system (TAWS) alerts and warnings because flightcrews reported receiving incorrect, nuisance, or overly conservative alerts and warnings. This study, a follow-on to address specific issues not focused on in earlier, broader studies, involved gathering data from multiple databases (1981 through 2008), identifying event reports of interest, and reviewing those reports to identify contributing factors.

The TAWS Joint Safety Analysis and Implementation Team (JSAIT) identified the top contributing factors to excessive TAWS alerts and determined there was a large occurrence of nuisance alerts, which could cause crew desensitization. The findings from this analysis indicated TAWS software upgrades available from manufacturers could significantly reduce the majority of undesired TAWS alerts issued when an airplane is not in imminent danger. The analysis also reemphasized the importance of CAST SE 120, which calls for air carriers to install Global Positioning Systems (GPS) and to maintain the TAWS equipment with the most current software updates. Based on these findings, JIMDAT developed two SEs to reduce TAWS alerts.

SE Objective The purpose of this SE is to reduce terrain alerts by providing area navigation (RNAV) visual or other procedures that resolve known TAWS alerts and terrain clearance issues.

Primary Risks Mitigated Controlled Flight Into or Toward Terrain (CFIT)

Action	Organization(s)	Strategy	Description	Due Date
Action 1	FAA ATO	Design	Develop criteria and tools used for evaluation of RNAV visual flight procedures and other procedures that reduce unnecessary terrain alerts, while maintaining adequate terrain clearance.	09/30/2011
<i>Comments: CAST closed this action.</i>				
Action 2	JIMDAT, FAA, Air Carriers	Research	Prioritize locations based on occurrence of TAWS alerts and investigate potential for RNAV visual or other procedures to mitigate issues.	02/04/2010
<i>Comments: CAST closed this action.</i>				
Action 3	Air Carriers	Procedures	Develop RNAV visual flight procedures at prioritized locations identified for RNAV visual mitigation.	12/31/2014
<i>Comments: CAST closed this action.</i>				
Action 4	Air Carriers, Air Carrier Industry Assns., FAA ATO/AFS	Procedures	Evaluate airports with TAWS event histories aligning with specific terrain to identify specific hotspot areas within the highest TAWS warning airports.	08/03/2017
<i>Comments: CAST closed this action based on TAWS warnings having decreased at all airports being monitored.</i>				

See section II of this SE for detailed action descriptions.

References: The detailed analysis in the TAWS Joint Safety Analysis and Implementation Team (JSAIT) Final Report (December 3, 2009) is available through CAST.



TABLE OF CONTENTS

SECTION II: DETAILED ACTION INFORMATION

PAGE 3

SE 185 consists of four actions, which this section lays out in detail.

- **Action 1 (FAA ATO, FAA AFS-400, JIMDAT).....PAGE 3**
Develop criteria and tools to evaluate procedures to reduce unnecessary terrain alerts
- **Action 2 (JIMDAT, FAA, Air Carriers).....PAGE 4**
Prioritize locations of TAWS alerts and investigate potential procedures to mitigate issues
- **Action 3 (Air Carriers, A4A, FAA AFS-470)PAGE 5**
Develop RNAV visual flight procedures at prioritized locations
- **Action 4 (Air Carriers, Air Carrier Industry Assns., FAA ATO, FAA AFS)PAGE 6**
Evaluate airports to identify specific hotspot areas within the highest TAWS warning airports

SECTION III: SUPPLEMENTAL INFORMATION

PAGE 8

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

PAGE 9

This section provides a history of revisions to this SE.



SECTION II: DETAILED ACTION INFORMATION

Action 1: Develop criteria and tools to evaluate procedures to reduce unnecessary terrain alerts

Primary
Implementer

FAA Air Traffic Organization (ATO)

Action Objective

FAA ATO should develop criteria and tools used for evaluation of RNAV visual flight procedures and other procedures that reduce unnecessary TAWS alerts, while maintaining adequate terrain clearance.

Action Timeline

Flow Time: 25 months

Due Date: 09/30/2011

Timeline/Flow for
Future Adopters

N/A

CAST Lead

FAA ATO

SECTION II

Organization(s) Detailed Steps

1a

FAA ATO,
FAA AFS-400

Incorporate the ability to evaluate TAWS occurrence rates into procedure development tools.

Complete.

1b

JIMDAT

Work with ATO and FAA Flight Standards Service, Flight Technologies and Procedures Division (AFS-400) to describe the TAWS equipment and algorithms to be considered.

Complete.

Notes



SECTION II: DETAILED ACTION INFORMATION

Action 2: Prioritize locations of TAWS alerts and investigate potential procedures to mitigate issues

Primary
Implementer

JIMDAT, FAA, Air Carriers

Action Objective

JIMDAT, the FAA, and air carriers should prioritize locations based on occurrence of TAWS alerts and investigate potential for RNAV visual or other procedures to mitigate issues.

Action Timeline

Flow Time: 6 months

Due Date: 02/04/2010

Timeline/Flow for
Future Adopters

N/A

CAST Lead

JIMDAT

SECTION II

#	Organization(s)	Detailed Steps
2a	JIMDAT	Provide FAA ATO and FAA Flight Standards Service, Flight Technologies and Procedures Division (FAA AFS-400) a site prioritization list.
		Complete.
2b	FAA, Air Carriers	Identify potential RNAV visual flight procedures or other procedures to mitigate TAWS alerts at prioritized sites.
		Complete.

Notes



SECTION II: DETAILED ACTION INFORMATION

Action 3: Develop RNAV visual flight procedures at prioritized locations

Primary
Implementer

Air Carriers

Action Objective

Air carriers should develop RNAV visual flight procedures at prioritized locations identified for RNAV visual mitigation.

Action Timeline

Flow Time: 59 months

Due Date: 12/31/2014

Timeline/Flow for
Future Adopters

N/A

CAST Lead

FAA Flight Standards Service, Flight Technologies and Procedures Division, Performance Based Flight Systems Branch (AFS-470)

#	Organization(s)	Detailed Steps
3a	A4A	Identify a lead air carrier for each site identified for RNAV visual approach procedures mitigation.
		Complete.
3b	Lead Air Carrier	Start the approval process in accordance with FAA Notice 8900.28, Special Area Navigation (RNAV) Visual Flight Procedures, or later guidance.
		Complete.
3c	FAA AFS-470	Approve, as appropriate, the RNAV visual flight procedure.
		Complete.
3d	A4A	Advise other operators of the availability of the approved procedure.
		Complete.

Notes



SECTION II: DETAILED ACTION INFORMATION

Action 4: Evaluate airports to identify specific hotspot areas within the highest TAWS warning airports

Primary Implementer Air Carriers; Air Carrier Industry Associations; FAA Air Traffic Organization (ATO); FAA Flight Standards Service, Safety Standards (AFS)

Action Objective This action evaluates airports with TAWS event histories aligning with specific terrain. Air carriers should share the historical analysis of TAWS alerts among ASIAs carrier participants. The analysis should identify specific hotspot areas within the highest TAWS warning airports. For each of these airports, the arrival procedures that help mitigate or reduce TAWS alerts should be shared on a common public server. RNAV visual flight procedures should be initiated by a lead air carrier for those facilities not scheduled to update instrument approach procedures (IAP) within the next 15 months.
(Note: This action supersedes previously described Actions 1–3.)

Action Timeline Flow Time: Ongoing until all 14 CFR part 139 airports exhibit fewer than three TAWS warnings or a rate lower than .00005 for two consecutive data cycles. TAWS warnings have decreased at all airports being monitored under this SE.

Due Date: 08/03/2017

Timeline/Flow for Future Adopters N/A

CAST Lead Airlines for America (A4A)

#	Organization(s)	Detailed Steps
4a	Air Carriers, Air Carrier Industry Assns., FAA ATO, FAA AFS	Create a list of airports with a significant history of terrain related TAWS warnings from the FOQA and air carrier databases. Initially, this is expected to include all Title 14, Code of Federal Regulations (14 CFR) part 139 airports with TAWS events above a given threshold rate and number within the previous 12 months. <ul style="list-style-type: none"> For data reviewed covering the August 2013 to August 2014 period, 32 airports had a rate greater than 5 per 100,000 flights and at least 3 events over that 12-month period.
	Complete.	
4b	Air Carriers, Air Carrier Industry Assns., FAA ATO, FAA AFS	Perform a preliminary analysis of the airports for trends and potential terrain issues based on groupings or clusters of TAWS events close to terrain for each runway. This analysis should be conducted using current analysis tools or other three-dimensional analysis programs (available through Google Earth or other commercial or proprietary sources) of the current TAWS hotspots.
	Complete.	
4c	Air Carriers, Air Carrier Industry Assns., FAA ATO, FAA AFS	Inventory all recently developed or scheduled improvements at identified hotspot airports. This inventory should include all FAA ATO IAPs commissioned within the previous 6 months or proposed to be commissioned in the next 15 months and air carrier-implemented RNAV visual approach flight procedures over the same period. Timeframes may be adjusted for the review windows, as appropriate.
	Complete.	

Note: See Section III for detailed costs and resources.



SECTION II: DETAILED ACTION INFORMATION

4d	Air Carriers, Air Carrier Industry Assns., FAA ATO, FAA AFS	<p>Identify airports that are: 1) candidates for new procedures, 2) candidates for validating existing procedures, and 3) those showing no clear terrain-related history from the preliminary analysis. Air carrier associations will conduct detailed analysis of candidate airports for new improvements. When a detailed analysis shows an opportunity for RNAV visual operations, a lead air carrier will be identified for development based on the current proportion of operations and future schedule plans. Air carriers will identify any RNAV visual approaches already developed but not yet shared. Once an existing RNAV visual approach is identified or an air carrier has developed a new RNAV visual approach, the procedure will be posted on an A4A server for other 14 CFR part 121 air carriers and approved 14 CFR part 135 and approved 14 CFR part 91 operators to access (A4A, RAA, NACA).</p> <ul style="list-style-type: none"> ○ Validate that current hotspots are mitigated through existing or planned introduction of new procedures. Perform a detailed analysis of all 14 CFR part 139 airports identified as candidates for evaluation. Conduct any improvements necessary as a result of the detailed evaluation.
<i>Complete.</i>		

Notes

Action items should be considered flexible because this process is repeated biannually and as improvements in technology or methodology are identified.



SECTION III: SUPPLEMENTAL INFORMATION

Source Study TAWS Joint Safety Analysis and Implementation Team (JSAIT) Final Report (December 3, 2009)

Related Initiatives N/A

Total Cost \$450,000

[Action 1](#) TBD

[Action 2](#) \$200,000

[Action 3](#) \$250,000

[Action 4](#) 1 FTE Estimate of 1 full-time equivalent (FTE) shared across air carriers, air carrier industry associations, and FAA ATO/FAA AFS.

	Organization	Resources Needed
<i>Direct Resource Overview – Government</i>	FAA AFS	<ul style="list-style-type: none"> Action 4: Depends on hotspots and specific operations at each given airport.
	FAA ATO	<ul style="list-style-type: none"> Action 4: Depends on hotspots and specific operations at each given airport.
	Organization	Resources Needed
<i>Direct Resource Overview – Industry</i>	Air Carriers	<ul style="list-style-type: none"> Action 4: Depends on hotspots and specific operations at each given airport.
	Air Carrier Industry Assns.	<ul style="list-style-type: none"> Action 4: Depends on hotspots and specific operations at each given airport.
<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
2.0	09/17/2018	New SE format. Content reorganized and terminology updated. No substantive changes.
1.1	08/03/2017	Action 4 completed and closed 08/03/2017.
1.0	06/04/2015	Action 1 due date extended from 08/06/2010 to 09/30/2011. Action 3 due date extended from 02/04/2011 (end of Action 2) to 12/31/2014. Action 4 revised.
Original	08/06/2009	CAST adopted SE 185.

