



Advisory Circular

Subject: Engineered Materials Arresting Systems for Aircraft Overruns

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| Issuing Office: | Civil Aviation, Standards | Document No.: | AC 300-007 |
| File Classification No.: | Z 5000-34 | Issue No.: | 03 |
| RDIMS No.: | 12866734-V2 | Effective Date: | 2017-04-24 |

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1.0 INTRODUCTION

- (1) This Advisory Circular (AC) is provided for information and guidance purposes. It describes an example of an acceptable means, but not the only means, of demonstrating compliance with regulations and standards. This AC on its own does not change, create, amend or permit deviations from regulatory requirements, nor does it establish minimum standards.

1.1 Purpose

- (1) The purpose of this document is to provide guidance for the design and installation of Engineered Materials Arresting Systems (EMAS) as an alternative to a runway end safety area (RESA).

1.2 Applicability

- (1) This document applies to airport operators.

1.3 Description of Changes

- (1) Issue No. 03 of this AC contains the following principal revisions:
- (a) Hyperlinks to NPA 2016-007 updated in Sections 2.1 and 3.1 (5);
 - (b) References to standards given in TP 312 5th Edition – *Aerodrome Standards and Recommended Practices* added to document;
 - (c) Revisions to Section 2.3 Definitions and Abbreviations;
 - (d) Updates to hyperlinks in Section 5.0;
 - (e) Changes of an editorial nature.

2.0 REFERENCES AND REQUIREMENTS

2.1 Reference Documents

- (1) It is intended that the following reference materials be used in conjunction with this document:
- (a) *Aeronautics Act* (R.S., 1985, c. A-2);
 - (b) Part III, Subpart 02 of the *Canadian Aviation Regulations* (CARs) — *Airports*;
 - (c) Transport Canada Publication (TP) 312 5th Edition – [Aerodrome Standards and Recommended Practices](#);
 - (d) TP 312 4th Edition – [Aerodrome Standards and Recommended Practices](#);
 - (e) Notice of Proposed Amendment (NPA) [2016-007](#) – *Runway End Safety Areas (RESA)*;
 - (f) International Civil Aviation Organization (ICAO) Annex 14 to the Convention on International Civil Aviation, Aerodromes, Volume 1 — *Aerodrome Design and Operations* (Seventh Edition, July 2016);
 - (g) Federal Aviation Administration (FAA) Advisory Circular (AC) [150/5220-22B Engineered Materials Arresting Systems \(EMAS\) for Aircraft Overruns](#).

2.2 Cancelled Documents

- (1) Not applicable.

- (2) By default, it is understood that the publication of a new issue of a document automatically renders any earlier issues of the same document null and void.

2.3 Definitions and Abbreviations

- (1) The following **definitions** are used in this document:
- (a) **Critical aircraft:** The aircraft operating at the airport, identified as having the most demanding operational requirements with respect to the determination of the Engineered Materials Arresting System (EMAS) characteristics;
 - (b) **Engineered materials:** High energy absorbing materials of selected strength, which will reliably and predictably crush under the weight of an aircraft;
 - (c) **Overrun:** When an aircraft passes beyond the end of the runway during an aborted takeoff or while landing;
 - (d) **Runway End Safety Area:** An area symmetrical to the extended runway centreline, intended to reduce the severity of damage to an aeroplane undershooting or overrunning the runway;
 - (e) **Runway Safety Area:** Runway Safety Area as per FAA definition (at the runway end includes both the runway strip and the RESA as per TC definitions); and
 - (f) **Undershoot** means when an aircraft touches down prior to runway threshold.
- (2) The following **abbreviations** are used in this document:
- (a) **EMAS:** Engineered Materials Arresting System;
 - (b) **FAA:** Federal Aviation Administration;
 - (c) **ICAO:** International Civil Aviation Organization;
 - (d) **NPA:** Notice of Proposed Amendment;
 - (e) **OLS:** Obstacle Limitation Surface;
 - (f) **RESA:** Runway End Safety Area;
 - (g) **RSA:** Runway Safety Area; (as per FAA definition);
 - (h) **TCCA:** Transport Canada Civil Aviation; and
 - (i) **TP:** Transport Canada Publication.

3.0 BACKGROUND

3.1 Runway End Safety Area

- (1) The objective of a RESA is to have an area free of objects other than frangible visual aids required to be there by function, so as to reduce the severity of damage to an aircraft overrunning or undershooting the runway, and to facilitate the movement of rescue and fire fighting vehicles.
- (2) TP 312 4th Edition -*Aerodrome Standards and Recommended Practices* recommends that a RESA be provided at each end of a runway strip where the code number is 3 or 4 and that it extend from the end of a runway strip for as great a distance as practicable, but at least 90 metres. The runway strip ends 60 metres from the runway end. The RESA begins at the end of the runway strip which results in the RESA ending 150 metres from the runway end.
- (3) For runways certified to TP 312 5th Edition, standards with respect to RESA are given in Section 3.2 *Runway End Safety Areas*.

- (4) The International Civil Aviation Organization (ICAO) in its Annex 14 to the Convention on International Civil Aviation, Aerodromes, Volume 1 — *Aerodrome Design and Operation*, requires that a RESA be provided at each end of a runway strip where the code number is 3 or 4, and where the code number is 1 or 2 and the runway is an instrument one. ICAO requires that the RESA extends from the end of the runway strip to a distance of at least 90 metres. Furthermore, ICAO recommends that the RESA extend from the end of a runway strip to a distance of at least 240 metres where the code number is 3 or 4 and 120 metres where the code number is 1 or 2. The width of the RESA is to be at least twice the width of the associated runway and wherever practicable, be equal to the width of the graded portion of the associated runway strip.
- (5) The Notice of Proposed Amendment (NPA) [2016-007](#) proposes regulations that are consistent with the ICAO standards for the dimensions of the RESA and identify EMAS as an alternative to RESA. Similarly, TP 312 5th Edition standards also are consistent with the ICAO standards for the dimensions of the RESA and identify EMAS as an alternative to RESA.

3.2 Federal Aviation Administration - Runway Safety Area

- (1) The Federal Aviation Administration (FAA) requires that a RSA end 1000' (300 metres) from the runway end. This is the same distance from the end of the runway for the end of the RESA as recommended by ICAO for code 3 and 4 runways.

3.3 Engineered Materials Arresting System

- (1) An overrun accident at New York's JFK airport in 1984 was the catalyst for a FAA project that lead to the development of EMAS.
- (2) The use of various materials was explored as arresting systems and EMAS is considered to be an innovative solution allowing airport operators to meet the FAA's RSA requirements. An EMAS installation could reduce land disturbance and result in the gaining of runway footage.
- (3) An EMAS is comprised of high energy absorbing materials of selected strength, which will reliably and predictably crush under the weight of the aircraft utilized as its design reference. When an aircraft rolls into an EMAS arrestor bed, the tires of the aircraft sink into the bed and the aircraft is decelerated by having to roll through the material.
- (4) The objective of an EMAS is to bring an aircraft overrunning a runway to a stop. It also provides an acceptable level of safety for undershoots.
- (5) A typical EMAS bed is the width of the runway and for larger aircraft, 400' to 600' in length (120 meters to 180 meters). For airports in the United States, an EMAS bed would take up approximately half of the distance of the 1000' (300 meters) RSA. In the Canadian context, an EMAS bed would take up approximately the same distance as a RESA – for each of the current recommendation in TP 312 4th Edition, the standards given in TP 312 5th Edition and the proposed regulation.

4.0 SPECIFICATIONS

- (1) An EMAS should be designed to:
 - (a) stop the critical aircraft at a runway exit speed of 70 knots without imposing loads that exceed the aircraft's design limits causing major structural damage to the aircraft; and
 - (b) not protrude into an Obstacle Limitation Surface (OLS).
- (2) For runways certified to TP 312 5th Edition, a similar standard is given in Section 3.2.1.10.

- (3) The most recent version of FAA AC [150/5220-22 Engineered Materials Arresting Systems \(EMAS\) for Aircraft Overruns](#) provides standards for the planning, design, installation, and maintenance of EMAS that are acceptable to Transport Canada Civil Aviation (TCCA).

5.0 CONCLUSION

- (1) An airport operator wishing to install an EMAS should have the design proposal for the EMAS installation prepared by the manufacturer and submit the design proposal to the Regional TCCA office.
- (2) Currently there are two manufacturers of EMAS:
- (a) [Zodiac Aerospace](#); and
 - (b) [Runway Safe](#).

6.0 INFORMATION MANAGEMENT

- (1) Not applicable.

7.0 DOCUMENT HISTORY

- (1) AC 300-007 Issue 01, RDIMS 7688742 (E), 7834243 (F), dated 2012-10-31 - *Engineered Materials Arresting Systems for Aircraft Overruns*.
- (2) AC 300-007 Issue 02, RDIMS 8290135 (E), 8290167 (F), dated 2013-04-24 - *Engineered Materials Arresting Systems for Aircraft Overruns*.

8.0 CONTACT OFFICE

For more information, please contact:

<http://www.tc.gc.ca/eng/regions.htm>

Suggestions for amendment to this document are invited, and should be submitted via:

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