

ENGINEERED ARRESTING SYSTEMS CORPORATION

EMASMAX™ Aircraft Arresting Systems for Runway Overrun Protection"

ICAO - Global Runway Safety Symposium
Montreal, 24 May 2011



- **Overruns and RESAs**
- **What is EMASMAX®**
- **EMAS Installations and Arrestments**



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The Overrun Problem

- Over the last 15 years, there have been an annual average of +30 overruns worldwide involving commercial aircraft
 - In 90% of overruns, the aircraft exits the runway at <70 Knots
 - Approximately 50% are <40 Knots
 - 25% are classified as “major” incidents (significant aircraft damage and/or injuries/fatalities)
 - 10% result in fatalities (over 1000 fatalities since 1995)
- In the last 10 years, runway excursions have accounted for 29% of all aircraft accidents and over 50% of commercial aviation fatalities*

*Source: Flight Safety Foundation

- Excursions account for 83% of all fatal runway safety accidents*

*Source: Flight Safety Foundation



Kingston, Jamaica - Dec 2009



Brussels, Belgium – May 2008

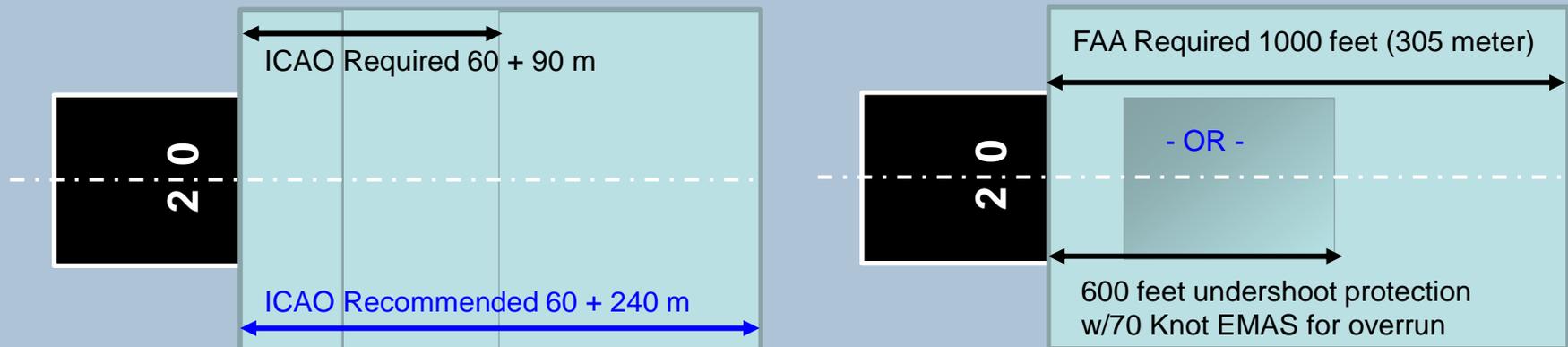
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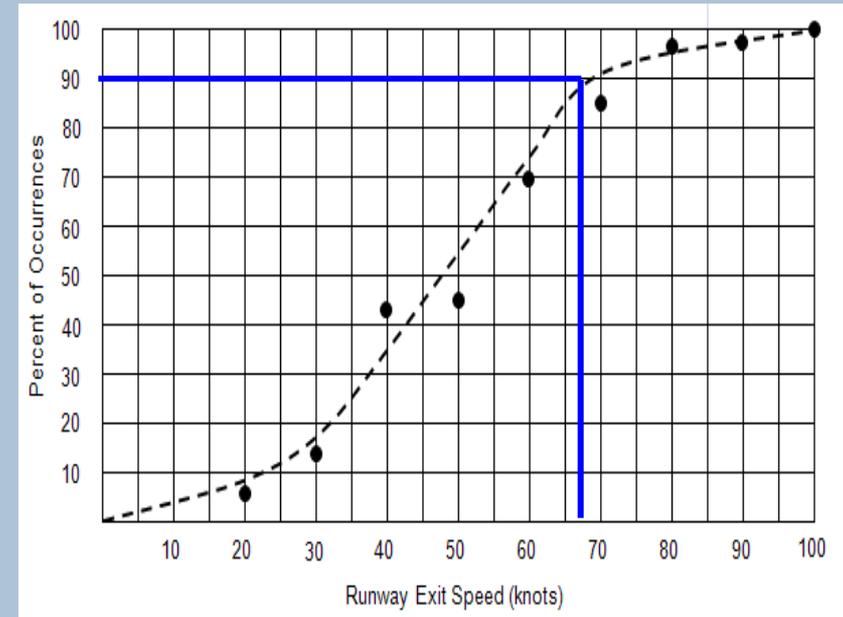
Runway End Safety Areas (RESA)

- **Definition:** A defined, prepared surface beyond the runway end suitable for reducing the risk of aircraft damage or injury to the passengers and crew in the event of an undershoot, overrun, or excursion from the runway.
- Provides a safety margin for aircraft that overshoot the runway surface.



Runway End Safety Areas (RESA)

- FAA statistics show that for 90% of the overruns, the aircraft exits the runway at 70 Knots or less
 - Approximately 50% are at 50 Knots or less
- The FAA-required 1,000 foot (305 m) long Runway Safety Area is designed to provide space for 70 Knot braking
 - Good Weather and Surface Conditions
 - Good Aircraft Braking
- Vast majority of overruns are in poor weather conditions
- Clear weather overruns are typically due to aircraft malfunction



Source: FAA report "Soft Ground Arresting Systems for Airports" (DOT/FAA/CT-93/80)

RESA Performance – not always guaranteed

Medellin, Columbia (June 2006)

- ICAO Recommended RESA
 - 240 m beyond 60 m runway strip
- B747-200 Cargo Aircraft
 - Aborted Takeoff
 - Exits Runway at ~ 45 Knots
- Aircraft Destroyed



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EMASMAX[®] - An Alternative to RESA

JZH EMASMAX[®] - R/W 02



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What is EMASMAX[®]

- A bed of cellular cement blocks encased in an environmental cover that is placed at the end of a runway to decelerate an overrunning aircraft in an emergency
- Passive system that will reliably and predictably crush under the weight of an aircraft, providing gentle, consistent deceleration



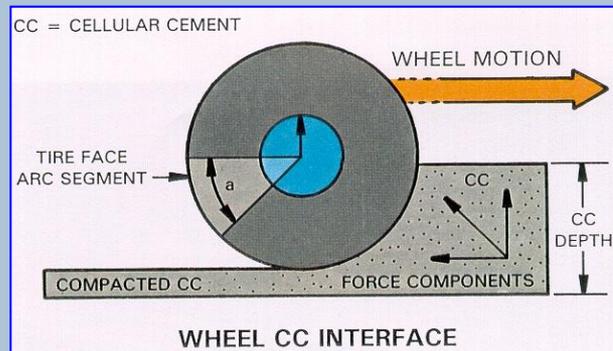
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Theory of Operation

- Tire/material interface provides resistive loads to decelerate the aircraft
- Loads are placed on the aircraft landing gear and support structure
- ESCO's FAA-Approved computer model is used to determine final arrestor bed configuration



EMAS Design

- Each EMAS is custom designed based on:
 - The aircraft that operate on the runway
 - The length and width of the runway
 - The elevation of the runway
 - The length of available RESA
 - The slope of the RESA

- Performance is predicted based on:
 - All critical aircraft (more than 500 annual operations)
 - Aircraft at field-adjusted MTOW
 - Aircraft at field-adjusted 80% MLW



Jiuzhai-Huanglong (JZH), China 1st installation outside of US



EMAS Installations



Juizhai Huanglong Airport (PRC)



Madrid Barajas International Airport (Spain)



JFK International Airport



Boston Logan International Airport



Chicago O'Hare International Airport



Winston-Salem, NC

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Charleston (CRW) Airport Arrestment

19 Jan. 2010: US Air Express, Flight 2495, CRJ-200 regional jet with 34 pax & crew



No injuries

**Runway reopened
within 5 hours**

**Aircraft returned to
service (3 days)**



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Teterboro Arrestment – October 2010

Teterboro, NJ Airport
Runway 06 Departure



Prior to EMAS - Overrun
February 2005



Arrestment
October 2010



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Other EMAS Successes



May 1999 – New York JFK 4R
SAAB 340 @ 70+ Knots



May 2003 – New York JFK 4R
MD11 @ 30+ Knots



January 2005– New York JFK 4R
B747-200F @ 70 Knots



July 2005 – Greenville SC GMU 01
Falcon 900 @ 30+ Knots



July 2008 – Chicago ORD 22
A321 @ 35 Knots

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Toronto International Airport Accident, Aug 2005



- TSB Final Accident Report
12 Dec 2007

“The Board believes that all such runways could benefit from a RESA built in accordance with the ICAO Annex 14 recommended practice or the FAA’s runway safety area (RSA) standard



The Board believes that there exists a requirement for an alternate means of compliance, such as the use of an engineered material arresting system to provide a level of safety that is equivalent to a 300 m RESA”.

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Belgian AAIU, Final Report on Kalitta 747 Overrun, May 2008



- Section 1.10: Aerodrome Information, RESA: “Computation showed that N704CK, if it had not deviated to the right would have stopped before the first ditch, in the case runway 20 was equipped with an EMAS RESA.” *Note: RWY exit speed approx 72 knots*
- Safety Recommendations: “We recommend to extend the RESA of Runway 20 of EBBR to the length recommended by ICAO (240m plus 60m), either thru physical extension, or by the use of the EMAS system ...and evaluate the need to apply this recommendation to other runways and Belgian airports”.

**EMAS Installation
Yeager Airport
Charleston, WV**

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