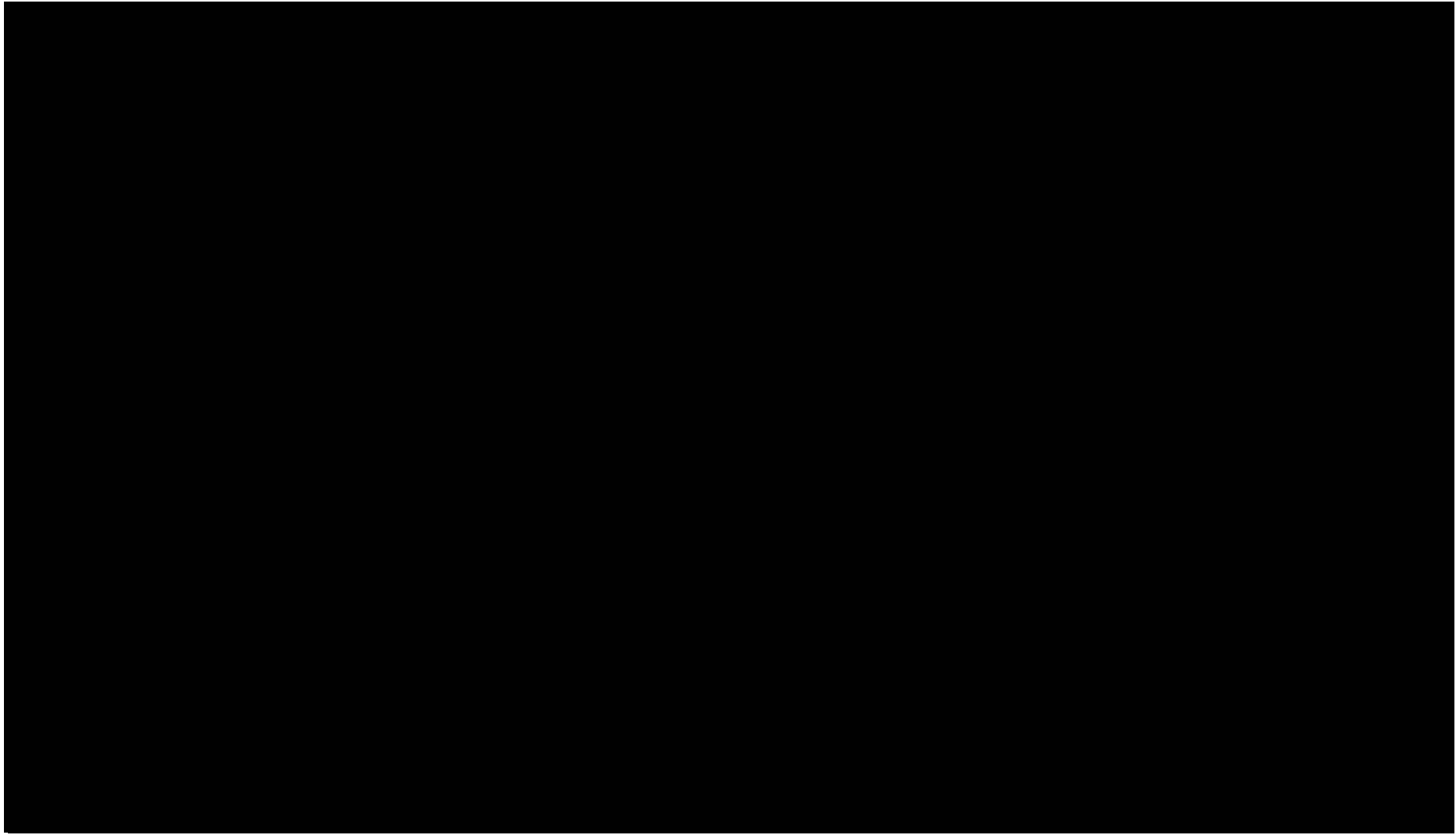




Runway Excursion Mitigation and EMAS





Runway Excursions: Overruns – A Big Problem

- 40 per year (typically overruns for jet aircraft) for the past 16 years
- 34% of all turbojet aircraft accidents
- 24% of all turboprop aircraft accidents



Brussels, Belgium – May 2008



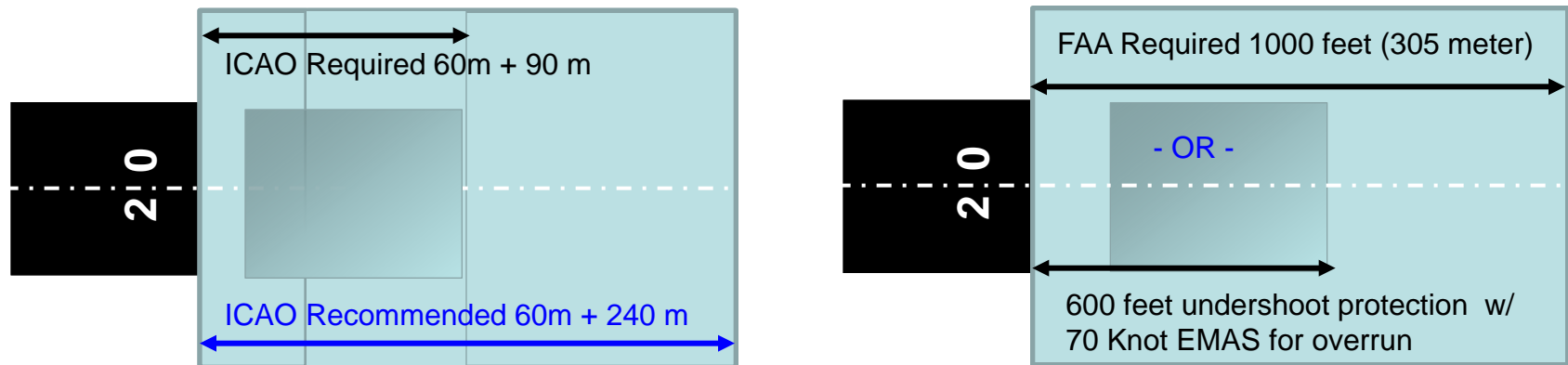
Kingston, Jamaica - Dec 2009

- Over 50% of commercial aviation fatalities
- Excursions account for 83% of all fatal runway safety accidents

Source: Flight Safety Foundation

Runway End Safety Areas (RESA)

- Provides a safety margin for aircraft that overshoot the runway surface
- Dimensions dictated by International Civil Aviation Organization (ICAO) and State Civil Aviation Authorities



EMAS in lieu of RESA allowed with Annex 14 Update

JZH EMASMAX® - R/W 02



EMASMAX® - An Alternative to RESA

What is EMASMAX[®]?

- Bed of cellular cement blocks
- Placed at the end of a runway to decelerate an overrunning aircraft
- Tire/material interface provides resistive loads to decelerate the aircraft
- Reliably and predictably crushes under the weight of an aircraft
- The system is FAA-certified
- FAA-Approved computer model is used to determine final arrestor bed configuration



EMAS Installation List (January 2013)

# EMAS	Airport	Location	Departure End of RWY(s)	Installation Date
2	JFK International	Jamaica, NY	4R, 22L	1996(2002)/2007
1	Minneapolis St. Paul	Minneapolis, MN	12R	1999(2008)
2	Little Rock	Little Rock, AR	4R, 22R	2000/2003
1	Rochester International	Rochester, NY	28	2001
1	Burbank	Burbank, CA	8	2002
1	Baton Rouge Metropolitan	Baton Rouge, LA	13	2002
2	Greater Binghamton	Binghamton, NY	16, 34	2002/2002(2011)
1	Greenville Downtown	Greenville, SC	1	2003
1	Barnstable Municipal	Hyannis, MA	24	2003
1	Roanoke Regional	Roanoke, VA	34	2004
2	Fort Lauderdale Intl.	Fort Lauderdale, FL	27R, 9L	2004
1	Dutchess County	Poughkeepsie, NY	6	2004
2	La Guardia	Flushing, NY	22, 13	2005
2	Boston Logan	Boston, MA	4L, 15R	2005/2006(2012)
1	Laredo International	Laredo, TX	17R	2006
2	Jiuzhai-Huanglong (JZH)	Sichuan Province, PRC	2, 20	2006
1	San Diego	San Diego, CA	27	2006
2	Teterboro	Teterboro, NJ	6, 19	2006/2011
4	Chicago-Midway	Chicago, IL	31C, 4R, 22L, 13C	2006/2007
1	Charleston Yeager	Charleston, WV	23	2007
1	Cordova	Cordova, AK	27	2007
2	Madrid-Barajas Intl.	Madrid, Spain	33L, 33R	2007
1	Manchester	Manchester, NH	6	2007
2	Wilkes-Barre/Scranton Intl.	Wilkes-Barre, PA	4, 22	2008
2	San Luis Obispo	San Luis Obispo, CA	11, 29	2008
2	Chicago-O'Hare Intl.	Chicago, IL	4R, 22L	2008
1	Newark International	Newark, NJ	29	2008
1	Charlotte Douglas Intl.	Charlotte, NC	36R	2008
2	St. Paul Downtown	St. Paul, MN	14, 32	2008
2	Worcester Regional	Worcester, MA	11, 29	2008/2009
1	Reading Regional	Reading, PA	13	2009
2	Kansas City Downtown	Kansas City, MO	19, 1	2009/2010
1	Smith Reynolds	Winston-Salem, NC	15	2010
1	New Castle County	Wilmington, DE	19	2010
1	Key West Intl.	Key West, FL	9	2010
1	Arcata-Eureka	Arcata, CA	32	2010
2	Telluride Regional	Telluride, CO	9, 27	2010
1	Taipei Songshan	Taipei, Taiwan	10	2011
1	Palm Beach International	West Palm Beach, FL	14	2011
2	Martin County/Witham Field	Stuart, FL	30, 12	2011
1	Republic Airport	Farmingdale, NY	14	2011
2	Cleveland Hopkins Int'l	Cleveland, OH	10, 28	2011
2	Lafayette Regional	Lafayette, LA	22L, 4R	2011, 2013
2	Groton-New London	Groton, CT	5, 23	2011
2	Augusta State	Augusta, ME	17, 35	2011
1	Elmira-Corning Regional	Horseheads, NY	6	2012
2	Kjevik Airport	Kristiansand, Norway	04, 22	2012
2	Trenton Mercer Airport	West Trenton, NJ	16, 34	2012
1	Coastal Carolina Regional	New Bern, NC	22	2012
75	Systems Installed			

Key West (EYW) International Airport Arrestment

3 Nov 2011: Cessna Citation 550 private jet with 5 passengers & crew



No injuries
Runway reopened within 2 hours

Photos Courtesy of Key West Int'l Airport

Teterboro Arrestment – October 2010

Teterboro, NJ Airport
Runway 06 Departure End

With EMAS - Arrestment
October 2010

Prior to EMAS - Overrun
February 2005



Above Photos Courtesy of Port Authority of NY & NJ

Charleston (CRW) Airport Arrestment

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



No injuries

Runway reopened just under 6 hours

Aircraft returned to service



EMAS Installation
Yeager Airport Departure End of Runway 23
Charleston, WV





Photo Courtesy of the Port Authority of New York and New Jersey





Toronto International Airport Accident



- 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”.



Chicago Midway Airport Accident



- NTSB Final Accident Report AAR-07-06
 - Findings Conclusion #23

“The absence of an Engineered Material Arresting System (EMAS) installation in the limited overrun area (RESA) for Runway 31C contributed to the severity of the accident; Even a nonstandard EMAS installation would have safely stopped the airplane before it left airport property.”

Final Thoughts

EMAS minimizes risk, saves aircraft and saves lives!

**ZODIAC
AEROSPACE**

