

Engineered Materials Arresting System—A Pilot's

By **F/O Steve Jangelis (Delta)**, ALPA's Airport and Ground Environment Group Chairman

On Jan. 19, 2010, a regional jet airliner departing Charleston's Runway 23 was involved in a high-speed rejected takeoff. The airplane overran the runway end but was safely brought to a stop by an Engineered Materials Arresting System (EMAS), a bed of crushable concrete installed at the runway's end. The EMAS bed stopped the airplane from descending down a long, steep drop-off and prevented a potential catastrophe. The two pilots, the flight attendant, and their 31 passengers were not injured, and the airplane suffered only minor damage. This was an unfortunate event, but once again EMAS effectively proved its value as a runway safety device.

To help mitigate the potentially severe consequences of a runway overrun, the FAA approves the use of EMAS (see FAA Advisory Circular 150/5220-22A), an arresting system composed of frangible, aerated concrete blocks designed for safely stopping transport-category airplanes without significant damage or injuries to occupants in the event of a runway overrun. EMAS beds are installed beyond the end of a runway, typically for runways without adequate RSAs. The arrestor beds are designed to safely slow and stop an overrunning airplane by exerting uniform deceleration forces on its landing gear, without causing structural failure, as the collapsible EMAS material crushes beneath the airplane's tires. The system operates independently of runway friction conditions or airplane braking action and works well in all weather conditions.

EMAS is installed on 55 runway ends worldwide. Of those installations, 51 can be found at 35 airports in the

U.S., where many more sites are under consideration.

EMAS is not currently installed at any of Canada's major airports. However, as a result of the Transportation Safety Board of Canada's (TSBC) investigation into the Air France runway overrun accident that occurred in Toronto on Aug. 2, 2005, and destroyed an Airbus A340 but miraculously involved no loss of life, the TSBC released Recommendation A07-06 to Transport Canada: "The Department of Transport requires all Code 4 runways to have a 300-meter runway end safety area (RESA) or a means of stopping aircraft that provides an equivalent level of safety." In response to this recommendation, Transport Canada recently submitted a notice of proposed amendment that is intended to harmonize the airport requirements for a RESA with the international standards in ICAO Annex 14, Volume 1, Aerodrome Standards and Recommended Practices.

Some Canadian airports have indicated to Transport Canada that they



are already considering installing an EMAS on a voluntary basis. Transport Canada is developing an advisory circular to provide guidance on how the EMAS should be installed and maintained.

Since 1996, there have been seven uses of EMAS beds worldwide, all of which have been in the U.S., undoubtedly saving numerous lives and preventing serious injuries and airplane damage. Successful arrestments have involved a wide variety of airplane types ranging from small jets and

Materials Arresting Primer



LEFT: A CRJ stops in the EMAS bed's "crushable concrete" at Charleston, W.Va., with only minor damage after a rejected takeoff above V1. ABOVE: Entering an EMAS bed, steer straight ahead.

turboprops to widebody freighters. The most recent event occurred on Oct. 1, 2010, at Teterboro, N.J., when a landing Gulfstream IV departed the end of the runway and was successfully brought to a stop without injury to its crew or occupants, or significant damage to the airplane.

With the implementation of this technology, ALPA has spearheaded efforts to standardize the depiction of EMAS beds on airport diagrams to help pilots determine whether the runway they are using is equipped with the

system. Jeppesen is contemplating publishing a basic EMAS tutorial so that pilots may gain a better understanding of its proper use and benefits. While this information may seem like the latest addition to an ever-increasing amount of material you are responsible for knowing, reviewing it while at groundspeed zero and noting it during your takeoff or approach briefing may prove extremely beneficial in the unfortunate event of an airplane overrun.

For specific operational guidance regarding procedures to follow when

engaging an EMAS bed, refer to your company policy pertaining to the particular circumstances at hand. Because the arresting system is passive, it requires no specific pilot actions to engage it. However, if you determine that the airplane will exit the runway end and enter the EMAS bed during takeoff or landing, consider the following practices to ensure that the airplane engages the EMAS according to design entry parameters and thereby derives the maximum benefit the system provides:

- Continue deceleration—regardless of airplane speed upon exiting the runway, continue to follow rejected takeoff procedures or, if landing, braking procedures outlined in the flight manual.
- Maintain runway centerline—continue straight ahead into the EMAS bed to maximize its stopping capability. The quality of deceleration will be best within its confines.
- Once stopped, do not attempt to taxi



MAIN PHOTO: EMAS installation at Boston's Logan International Airport. BELOW: Workers install the EMAS squares.



or otherwise move the airplane.

An arrestment event by itself would not generally necessitate emergency ground egress. However, because offloading passengers and crew via an air stair truck after such an event may be impractical, you may need to use slides or internal aircraft stairs. If an

emergency egress is required, follow published airplane emergency ground egress procedures.

During the FAA's evaluation of EMAS, extensive testing demonstrated that the material did not adversely affect evacuation or the ability of firefighting and rescue vehicles to respond. Wherever the surface of an EMAS bed has been breached, the loose material will crush under foot. However, wherever its surface remains undisturbed, walking on the bed will not exert enough pressure to crush the material, so it's safe to walk on the EMAS surface. Continuous steps are built into the sides and back of the bed to provide easy access for emergency response vehicles and to enable

passengers to safely exit the bed.

I hope you never have to use an EMAS bed. However, if you are aware of its location, design principles, characteristics, and expected effects, you'll know what to do if you're running out of runway and find yourself quickly approaching an EMAS installation. 🌀

Steve Jangelis is the chairman of ALPA's Airport and Ground Environment (AGE) Group and oversees ALPA's Airport Safety Liaison (ASL) program. To report any unsafe airport condition relating to runways, taxiways, lighting, or signage, send an e-mail to asl@alpa.org or call ALPA's Engineering and Air Safety Department during business hours at 1-800-424-2470.