The benefits of large aircraft medical conversions that can evacuate high numbers of casualties long distances are clear. If such full-size air ambulances can be ready within six hours of calling on a passenger-configured Boeing without technical modification, or if they can be custom-built with highly advanced medical levels, the advantages are endless. Femke van Iperen looks at some of the options available as demand for large medevac aircraft grows.

In 1998, there was a catastrophic nightclub fire in Gothenburg, Sweden. As a chaotic picture unfolded, with ambulances, buses, taxis and helicopters feverishly evacuating hundreds of wounded to overflowing hospitals close-by, it slowly became clear that the need for a national transport system to handle large-scale medevac situations had become essential. Sadly, 63 young people died. Sweden had had a military evacuation system of converted medical aircraft in place since the Cold War, but the tragic event highlighted for the first time a national need for a quick mass emergency medical evacuation capability in peace time.

The brief

The Swedish government began to investigate and set up the Swedish National Air Medevac (SNAM) in 1999 and Håkan Österhed, then at the Swedish Civil Aviation Administration (SCAA), initiated a study to examine the possibilities of mass medevac transport. Following the findings of the study, a three-year project was funded, which started in 2001 with the goal to establish the SNAM system. The brief: to design a lightweight aircraft reconfiguration system with sophisticated levels of care that was capable of meeting regulatory transport requirements and without the need for technical aircraft modification. Two real-life simulation studies – a hotel fire in Sweden and a large jet conversions

Mass evacuation in the face of changing global medical needs
an Italian earthquake – helped determine details about patient transport requirements and system capabilities. Following this, the SAS (Scandinavian Airlines) AMAT (Advanced Medical Air Transport System) was born, which can be used in aircraft ranging from a King Air 200 to an Airbus A380. SAS Technical Services, together with Micus AB, had developed a flexible medical air transport system that was capable of providing an intensive care service while flying patients out of an emergency area. The light-weight micus™ Mobile Intensive Care Unit (MICU) was selected as the key integral component and a Stretcher Interface Module (SIM) allowed it to be mounted on the aircraft by using the seat tracks.

Challenges
Identifying commercially available aviation resources was one of the many challenges, along with avoiding the need to have expensive medical crews permanently on standby and still ensuring the quickest response time. "But the greatest challenge", says Österhed, "was to have an advanced care system which was fully certified for use in an aircraft. An aircraft has a sensitive environment; there are vibrations and aircraft and equipment emissions to consider. We also had to ensure the arrangement could be integrated into the larger national health and response system with a fast response time, and rapid support of the local embassy office in case of international disaster. That took a lot of work."

In service
The SAS AMAT system proved so successful that it became the air-ambulance solution for Sweden. SNAM became the launch customer. Today in Sweden, within six hours a Boeing 737-800 aircraft, converted into a flying hospital, is ready for take-off to fly at a maximum speed of 823 km/hr, and then return back to commercial configuration. A typical SNAM set up includes a medical crew of 19 to handle six intensive care patients, six to 18 stretcher patients and 23 seated patients or relatives. It can also be used by international governments and organisations. SAS stores and maintains the equipment at its hangars at Stockholm Arlanda Airport, and instantly makes one of its 737s available for transformation, whilst a contract with local healthcare ensures the provision of medical crews. "After the system is activated, everyone is grouped together at a command and control centre at Stockholm airport," adds Mr Österhed, who as manager of marketing and sales is now responsible for the marketing of the SAS AMAT system. The system’s first real-life mission, as a non-finalised project, was prompted by the 2004 Boxing Day Tsunami disaster. More than 120 stretcher patients and 100 walking wounded and relatives were evacuated in several flights on two reconfigured MD80s. Part of the system was more recently used to evacuate people from Lebanon following hostilities. It was later used in November 2008 on a European Union mission after the terror attacks that struck Mumbai in India.
Last September, a full SNAM reconfiguration exercise took place at Stockholm Arlanda airport’s hangar, and the medevac plane was ready for take-off within six hours.

Procedure: after removal of seats, the aircraft cabin is thoroughly cleaned; the rails in particular need to be cleaned to be ready for the stretchers. Before the stretchers are mounted a ‘template’ is used to precisely identify their placement, followed by electrical wiring and functionality checks.

Other systems
Although the SNAM system remains unique for its combination of high level medical care without requirement for aircraft adaptation, there are other organisations that convert large passenger aircraft (defined here as a passenger-configured capacity of 50-plus) for medical purposes. Those globally in use serve a variety of operations: private use on VIP or head-of-state aircraft; government and military ventures; and commercial air ambulance operations, explains Horst Heinicke, vice-president of international marketing for US customised air-ambulance equipment producer Spectrum Aeromed.

Private use
Medical conversions of VIP or head-of-state aircraft, such as Boeing 747s, Boeing business jets (BBJs), 727s, and Airbus A319/320 or A340s, are mostly for private use, explains Heinicke. High-end intensive care medical units are taken onboard for long-range operations, for example flights from the Middle East to Europe or the US, where executives travel with personal physicians to specialised clinics for treatment.

In May this year, Spectrum Aeromed joined with Dubai-based aircraft conversion programme Project Phoenix to develop a large plane medevac system (Waypoint Nine, August/
September 2009, Spectrum to develop medical CRJ200. It followed global market interest for the reconfigured VIP Bombardier CRJ200 airliner in the role of air ambulance. The Project Phoenix team of specialists have been converting airliners for VIP/executive use since 2007, the CRJ200 particularly, but thanks to the new partnership the aircraft model will be kitted out as a custom-built, permanent medical evacuation transport facility. Spectrum Aeromed will provide the medical interior and a range of medical equipment.

Government and military

“To be able to evacuate larger numbers of patients without delay – following natural catastrophes, political or military crises, or large traffic accidents – government and military operation services generally incorporate a mix of high-end ICUs and stretchers (10-50 patients),” says Heinicke. The German Air Force owns a system that comes the closest to the SNAM arrangement – a converted Airbus A310 with medevac units. Civilian A310s were transformed into multi-role transport aircraft (MRT) by Airbus Deutschland GmbH and Lufthansa Technik AG, and to convert an MRT into medevac the German military operator needs up to three days from a passenger version and about five days from cargo configuration, said a spokesperson for the German Air Force.

The A310 is stationed at the military section of Cologne/Bonn Airport, with one permanently on standby, and is used to transport up to 25 medical crew, 38 patients on stretchers and six in intensive care units. It flies globally to take German soldiers in need of medical care to safety and regularly travels to those on duty in Afghanistan from the German airbase in southern Uzbekistan near the Afghanistan border. Though the service is for military use, it is also used to evacuate civilians on request of the German Government; for example after the 2004 Boxing Day Tsunami disaster, and in Dresden in 2002 when more than 30,000 people were evacuated after continuous heavy rains devastated areas all over Europe including Germany.

Commercial air ambulances

Commercial air ambulance operations, explains Heinicke, often on larger aircraft such as the Bombardier CRJ200 and the transport/passenger Antonov AN-74, include a mix of multiple ICUs and stretchers (three to six patients). “This model is particularly attractive in the case of a known patient pool and during peak seasons in holiday destinations in Turkey, Spain, Canary Islands in summer or winter skiing areas”, he says, and
The benefits

Besides the more obvious advantages of flexible use of an aircraft fleet, enabled by non-permanent adaptations without modification of the plane, the general benefits of large plane medevac conversions are extensive. "Regarding the destinations, there are almost no limitations", says Heinicke. "Commercial air ambulance operators can collect patients from different locations on one turn-around, with the advantage that though the cost per flight is slightly higher (higher aircraft operating and crew costs), the cost per patient is definitely lower, which gives operators and customers (mostly medical insurance companies) a large advantage in a competitive and cost-sensitive market."

There is also the advantage of type and quantity of equipment the larger planes can carry. "Onboard all of the aircraft there are stretchers with comfort pads for long-range transports; oxygen supplies with therapeutic oxygen (3,000 to 12,000 l, depending on mission duration) and power converters to support medical equipment. ICU medical equipment such as ventilators, monitors, defibrillators, pacemakers, infusion pumps and incubators for neonatal transport are also often included, together with telemedical devices to send patient data to a ground station to receive a third opinion during complications onboard." Thanks to medical technicians who have been performing regular checks since 2005 to replenish equipment when needed, the medical standard of the SNAM design is also notably highly advanced. The self-sustaining micus™, which has oxygen and an internal electric supply for a minimum of two hours, includes a patient ventilator, defibrillator with vital-signs monitor, multi-channel infusion pump and dual-suction pumps. It also has a detachable carbon-fibre stretcher allowing for computerised tomography (CT) scanning while the patient is still on life support. Less critical patients can be transported on litter stacking systems, which can be expanded with advanced life support capability. A highly specialised and specially trained SAS team, who have yearly drills with a full cabin reconfiguration, put it all together.

Medical organisation

Still, permanently ready equipment is only part of the solution. The University Hospital in the town of Umeå in Northern Sweden trains and co-ordinates SNAM medical crews and is responsible for the medical equipment and medications. The medical crew, highly experienced in air ambulance operations, are summoned from a pool of medical personnel trained in aviation medicine, and consists of flight doctors (anaesthesiologists and a trauma surgeon), flight nurses (specially trained in anaesthesiology and intensive care), and a medical technician. They will all pass through a three-level, specially designed educational programme and there are yearly refresher courses including a full-scale emergency exercise carried out jointly with the cabin reconfiguration drill.

The future

Since the grim 1998 nightclub accident, Sweden has come far in long-distance mass rescue operations. Thanks to the success of the Mumbai mission, the Swedish government ordered a second ship set for the Boeing 737 NG. Sweden is scheduled to have two operational ship sets in place imminently. "We are currently in discussion with seven different nations and we are targeting the system to head-of-state aircraft", says Österhed. "The recently launched corporate BBJ C Boeing, a multi-role convertible 737 BBJ aircraft, also has a quick reconfiguration to medevac."

The aeroplane, which reconfigures from all-passenger to all-cargo in less than eight hours, is available to prospective customers for disaster-relief or to carry patients requiring medical evacuation. As for the future of the VIP Bombardier CRJ200 ambulance project, the two companies have agreed to review future conversion of other larger airliner types such as the Airbus A320 series and Boeing 737. As the world is changing, so are the demands on patient safety and the development of medevac planes is far from standing still.

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