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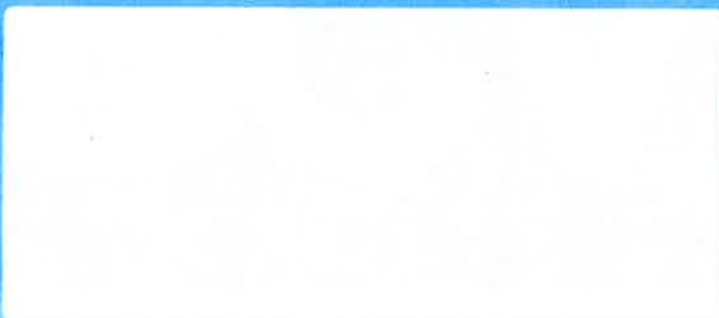
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Business jets converted to flying ICUs are the workhorses of aeromedical transport around the world

BY DAVID ESLER david.esler@comcast.net

When television viewers saw news coverage of American medical professionals infected with Ebola Hemorrhagic Fever arriving in the U.S. for treatment, it's doubtful many of them knew that the aircraft bringing them back from Africa were specially modified, commercially operated Gulfstream business jets.

Between August 2014 and March 2015, Phoenix Air of Cartersville, Georgia, flew more than 40 Ebola patient transfers between Sierra Leone, Guinea, and Liberia in West Africa to Europe and the U.S. The patients were carried aboard Gulfstream III air ambulances equipped with special isolation tents in their cabins designed to protect physicians, nurses and flight crewmembers from infection with the dreaded virus. The flights, transporting U.S. and European citizens associated with non-governmental organizations (NGOs) like Medecins Sans Frontieres, or Doctors Without Borders, were conducted under contract to the U.S. State Department.

Altogether, as the Ebola epidemic ran its course, Phoenix Air GIIIs transferred 12 infected patients and 33 who were exposed to the disease but hadn't yet developed symptoms. Of the infected, two died later in treatment in the U.S. One of them was Dr. Martin Salia, formerly of Sierra Leone and an American citizen who had

returned to his homeland to help fight the epidemic. Two notable survivors were Dr. Kent Brantly and registered nurse Nancy Writebol, also U.S. citizens who were representing the NGO Samaritan's Purse in Africa.

U.S. citizens were taken to hospitals the Centers for Disease Control and Prevention (CDC) had designated for Ebola treatment: Emory University Medical Center in Atlanta (also site of the CDC), the University of Nebraska Medical Center in Omaha and the National Institutes of Health in Bethesda, Maryland. The Europeans, employed by or volunteering with the United Nations, the World Health Organization (WHO), MSF/DWB and various governments, were likewise taken to hospitals designated for and equipped to treat Ebola in France, Germany, the Netherlands and Switzerland. The U.N., NGOs or foreign governments reimbursed the State Department for the European flights, which, as for those to the U.S., cost upward of \$250,000 for a round trip aboard the Phoenix Air Gulfstreams flying critical care units.

While the African Ebola epidemic represented an extreme case involving a very specialized form of international aeromedical transport, it stands as a demonstration of the capabilities of business jet-based airborne patient transfer. Air ambulance service is highly complex and

demanding, combining critical care medicine conducted by highly experienced physicians, flight nurses and other specialists with turbine-powered commercial aviation — and in the case of operators engaged in international activity, the additional requirement for training, capability and certification to conduct oceanic operations. The pilots and medical teams must be able to work in concert and be prepared for unexpected situations. Flexibility and resourcefulness are key, but in all situations, focus on the patient's welfare is paramount.

"For this work, you need resourceful crews and maintenance staff," Sam Cimone, president of Montreal-based Skyservice Air Ambulance Inc., which fields a trio of Learjet 45s on transoceanic patient transfer missions, told *BCA*. "The primary issue is safety. The pilots will keep the aircraft safe and the cabin crew will keep the patient safe."

Insurance for the Traveler and Cost-Containment for the Insurer

Getting deathly ill or badly injured in an accident is every globetrotting traveler's worst nightmare, especially in a country where modern medical care is scarce or, at worst, nonexistent.

“Most Americans who travel abroad do not realize that the medical care locally may be substandard as compared to health here,” Joe Cece, president and CEO of AeroCare Medical Transport System of Aurora, Illinois, pointed out. And when the unforeseen happens, it may be necessary to transport the stricken traveler back to the U.S. or to the nearest adequate treatment facility in an aircraft containing life-support equipment manned by medical professionals.

For a corporation, government entity or NGO that routinely sends workers abroad on its own aircraft or via airlines, it stands to reason that the security and health of employees should be a primary concern if productivity is to be assured. Customarily, companies cover their executives and employees with travel health insurance for this purpose, and many larger companies retain travel consultants to advise on dealing with illnesses or unforeseen mishaps.

“We are hired by travel health insurers, as there is no home coverage when traveling out of the country,” Cimone said. “The air ambulance is used as a cost-containment tool to get the patient back into the home health care system. [In Canada, that’s National Health.] The insurer calls us directly, often using a travel assistance company to book the flights. They can use us to move the patient to a higher level of care if necessary. They, like us in our aviation operations, are managing risk.”

Cece added, “Most insurance policies will pay for an evacuation if medically necessary. Some of these transfers can cost more than a quarter million dollars. They run from \$20,000 to \$300,000 depending on where in the world the patient is located” and the type of aircraft used.

(A footnote here: Several aeromedical professionals consulted for this report pointed out that many Americans are unaware that when they depart the U.S., even into Canada or Mexico, their personal health care coverage, whether standard insurance or a health maintenance organization (HMO), usually no longer applies. Thus, for individuals or families engaged in personal international travel [or freelancers not covered

by full-time employers], it’s a good idea to look into travel insurance, which can be purchased either per trip or on an annual subscription basis, generally for reasonable prices. And when reading the policy before buying, make absolutely sure that the provider will guarantee transport back to the U.S. aboard a dedicated air ambulance if you’re too seriously ill or injured to survive the trip aboard a jetliner.)

A well-known medical resource that has assisted business aviation flight departments and charter/management operators in arranging air ambulance patient transfers all over the world is MedAire. Founded by former flight nurse Joan Garrett, MedAire celebrated its 30th anniversary in 2015. The company’s best-known service is providing real-time emergency medical advice to airliners and business aircraft in flight from its hospital-based call center in Phoenix. Its assistance to clients also ex-

Center. The diagnosis also ascertains what means of transport will be suitable, based on the patient’s condition.

Unless the affected traveler requires intensive-level care aboard a suitably equipped air ambulance, the Response Center may conclude the patient can return home on the company aircraft or aboard a commercial flight with a medical escort and portable support equipment dispatched to the location by MedAire. On the other hand, if Weaverling’s people determine that an air ambulance flight is necessary, additional information is sought as to what type of medical team to put on the aircraft, e.g., a doctor, respiratory therapist and registered nurse or just a physician and RN. “We have to determine if the problem is something that needs to be stabilized to get them home.

“Once that is determined, we arrange for them to come back to the U.S. or the closest center of medical excellence,”



Inside an AirMed Hawker 800A. The company’s medical staff numbers 42 physicians, nurses and respiratory therapists trained in flight physiology.

tends to health-related incidents on the ground in foreign countries and starts with a comprehensive medical evaluation of the patient.

“When our clients call into us with an employee sick or injured in a foreign country, our medical team speaks to the caller or a treating physician there, and we gather as much information as possible, which is very important, as it will determine if they are safe to fly,” explained Diann Weaverling, operations manager at MedAire’s Global Response

Weaverling continued. “For example, if you’re in Bali, we will get you to Singapore, which has excellent medical service.”

After the patient’s condition is determined, MedAire’s flight desk, “the team that has the relationships with the air ambulance providers,” takes over. “They will source the aircraft for us after we tell them when we need it, what type of aircraft it should be and the necessary medical team to fly aboard it,” Weaverling said. “We don’t use any companies that we haven’t vetted and credentialed. We

consider safety records, equipment and special needs that address the situation.”

From this point, the Response Center works directly with the flight desk throughout the operation to ensure the patient is safely transported to the designated medical facility of choice. “We are the direct contact with the client and the patient and the aircraft, a full service for the duration of the mission,” Weaverling said.

A Well-Utilized Process

Aeromedical transport is “a well-utilized process here and we’ve done a lot of them,” Weaverling said. “You have to have consent from the patient to talk to the hospital — a release of medical information — and that can take a while. Sometimes the support system isn’t so good where they are, and so you have to move quickly. We keep the air ambulance operators up to date on the situation constantly.”

Asked what, in her memory, was MedAire’s most interesting mission involving air ambulance transfers, Weaverling responded, “One that stands out was in Africa, a flight crewmember who got sick. But not only was it a serious medical condition, there also was lots of political unrest in the country. We had to get him out darn quick. We had security issues, a serious medical condition, maintenance on runways and availability of aircraft. We have to consider security as well as medicine and what is going on in real time in that country. Location can make something pretty interesting.”

Weaverling had some advice for companies with employees or families with relatives in distress while abroad. “The earlier you call, the better off you are, as maybe you can avoid an emergency transport,” she said. “We can definitely help with that. Don’t wait until you need an ambulance — call ASAP to get assistance. The earlier, the better, as it’s to everyone’s advantage to get as much information as possible as soon as possible. There are some places in the world where airports close or there are no night operations, and that has to be accommodated.”

To vet an air ambulance service for quality, equipment and especially safety, three internationally known aeromedical accreditation services may be a good place to start. These are the Commission on Accreditation of Medical Transport Systems (CAMTS) and National Accreditation Alliance of Medical Transport Applications (NAAMTA) in the U.S. and the European Aeromedical

Institute (EURAMI) based in Germany.

CAMTS (<http://www.camts.org>), which accredits all forms of medical transport — surface, marine and air-borne — lists 176 U.S. fixed- and rotary-wing air ambulance services in its database, nine of them foreign operators. EURAMI, whose mission is to assure high-quality medical transfers “throughout Europe and the world,” lists 40 rotary- and fixed-wing air ambulance services in its portfolio. On its website (<http://www.eurami.org>), EURAMI states that “Accreditation is an effective means of validating quality.” NAAMTA, the youngest of the three, hopes to create “measurable industry standards” and lists nine accredited members in the U.S., one in Puerto Rico and one in South Africa on its website (<http://www.naamta.com>).

All three focus on patient care and safety of operations, and a perusal of CAMTS fixed-wing accreditation stan-

plus longer range — Phoenix Air is an anomaly in the industry. It may be the only aeromed operator fielding such aircraft in the U.S. But the aircraft types of choice, even for international missions, tend to be entry-level to midsize business jets.

No Appetite for Large Aircraft

According to Skyservice’s Cimone, the reason for the smaller types rests with the insurance industry, which “doesn’t have an appetite to pay for larger aircraft. This fits their need and pricing model. So, the smaller Learns are the asset of choice.” The Canadian company began operations 27 years ago with a Cessna Citation 500 and in the early 1990s upgraded to a Learjet 35, adding four more of them through the decade.

And Skyservice developed an ex-



AirMed neonatal intensive care flight nurse tends a newborn in an isolette aboard one of the operator’s Hawker 800As.

dards reveals a collection of best practices resembling an aviation safety management system (SMS) like that found in the International Standard for Business Aircraft Operations (IS-BAO) program familiar to most av managers.

The workhorses of the worldwide fixed-wing air ambulance fleet tend to be smaller turboprop and turboprop-powered business aircraft. While one might assume large cabin aircraft would predominate — offering more space for liters, life-support equipment, personnel

expertise for operating these smaller jets on patient transfers all over the world, including, on at least one assignment, from Montreal to Australia and back with lots of tech stops. All aircraft were bought with about 12,000 hr. total time and were operated in dedicated ambulance configuration up to 2011, when the company again upgraded, this time to Learjet 45s. When the Model 35s were retired, their average total time was 25,000 hr., with the highest logging 29,316 hr. and 15,589 cycles. That



Phoenix Air Gulfstream III outfitted to handle up to five patients simultaneously.

aircraft, SN004, registration C-GIRE, now rests in the Canadian Aviation and Space Museum in Ottawa.

"In 2009," Cimone said, "we began a reevaluation of the market to determine growth and where the insurance business was headed. While the Lear 35 had served us well, it was determined not to be able to meet the requirements of an international asset in terms of new avionics like ADS-B, FANS, and so forth. It would be hard to get STCs for installations, and the technology might not work as well in a 30-year-old asset." Ultimately, the company decided on the Lear 45XR, which flies about the same range as the old 35 (about 1,600 nm, IFR) but is a more modern platform.

Skyservice bought the first one in 2011, added a second soon afterward and was expecting to put a third on line last month. "All are used, of course, as the aircraft is out of production," Cimone said. "When we're in the market for one, we look for low time, no APU to save weight, and airframes between serial numbers 100 and 200 that will accommodate the avionics upgrades we need. We tend to stick with the Honeywell versions, which make up the bulk of the fleet. There is a Service Bulletin to increase the takeoff weight of the 45, but they all came to us that way. So, max takeoff weight with the SB applied is 21,500 lb."

The 45XRs can carry dual litters installed along with a loading system by Lifeport Products. "We then remove the original cabinetry and install custom medical cabinetry in-house," Cimone

said. The aircraft door is 30-in. wide, and loading of the 24-in.-wide stretcher is done at an angle. Weight limitation varies and has to do more with girth than actual weight of the patient, "thus we can easily take on close to 400-lb. adults. Our airplanes are 100% dedicated to air ambulance, but I can tap into other airplanes available in the market that we lease — for example, one of Phoenix Air's Gulfstream IIIs. We have invested in state-of-the-art medical equipment including Hamilton T1 ICU ventilators and Istat blood gas analyzers. Also, for the comfort of the patients, we are equipped with Roho pressure-relief equipment to avoid pressure sores. And we stock incubators for neonatal patients. All this equipment is portable. When we go to a destination to pick up a patient, we are fully equipped to meet the requirements of the mission."

Cece's AeroCare also started with a Citation 500, operated it for three years, moved into Learjet 24s and 25s, and progressed to its current fleet of one King Air 200, two Lear 36s, a Lear 31 and, for most of its international trips, a Lear 55.

"These are dedicated air ambulances with full ICU capability for transporting the most critical patients," Cece said. "We've modified the interiors with rubber flooring, a stretcher system containing oxygen service, and medical air for operating ventilators and suction. We typically carry a flight nurse and flight paramedic and can still accommodate two passengers." Portable equipment can be brought aboard, as well,

like cardiac monitors, ventilators and advanced airway equipment.

"It is a cost-driven business, hence the use of smaller aircraft," Cece continued. "For example, the Lear 36 was never intended to be flown internationally, but we have flown it from the Chicago area to Singapore, Tokyo, Taipei, Dubai, South Africa and Australia . . . These required tech stops and crew changes. For Chicago-Tokyo, 10 hr. in the air, we would go first to Seattle for fuel, then to Anchorage for a crew swap with the crew staged there via airline, then to Petropavlovsk, and then on to Manila and Tokyo. The range of the Lear 36 is 2,800 nm, or 6 hr. endurance with reserves. For some of our customers, this will be the only time they will fly on a private jet."

From its base at Birmingham, Alabama, AirMed International fields two Hawker 800As for long-range international flights, two Beechjet 400s and a Learjet 35. It also manages and operates a Citation Bravo exclusively for University Hospital in Birmingham. All are dedicated air ambulances. As if the company were not busy enough, AirMed manages 18 Beech King Airs for EagleMed, an operator out of Wichita that is also owned by AirMed's Air Medical Group Holdings.

"We average 150 hr. a month on the Hawkers alone and have visited over 150 countries with them," said Denise Treadwell, AirMed's executive vice president and chief operating officer. "The average leg on an international trip is 1,800 nm and 4 hr. duration. The Beechjets average 900 hr. a year, while the Hawkers, flying longer legs and internationally, average 3,100 hr. annually."

Gulfstreams With Cargo Doors

Not only is Phoenix Air operating ICU-equipped Gulfstream IIIs as air ambulances, the three aircraft also are unique for the type in that they feature large cargo doors on the right sides of their fuselages. "Only a handful of these were made off the books by Gulfstream for use by foreign governments for intelligence and military applications and our three are the only ones still in existence," explained Dent Thompson, vice president and COO. The cargo doors are especially useful when loading large specialized medical-support equipment — or overlarge patients — into the aircraft. The trio of IIIs has been retrofitted with hush kits, bringing

PHOENIX AIR



Protection from Contagion

Phoenix Air's Aeromedical Biological Containment System (ABCS) erected beside one of the operator's Gulfstream III air ambulances. Note the "exoskeleton" fabricated from aluminum stock and the disposable isolation tent for patients suffering from dangerous communicable diseases that it supports. The system breaks down for storage and is designed to be assembled in the Gulfstream's cabin and secured in the seat tracks.

The tent, which is pressurized below ambient cabin pressure as a safety feature, is divided into an anteroom for physicians and attendants and a patient chamber. To treat the patient, the medical team member enters the anteroom, dresses in personal protection equipment (PPE, or "bunny suits"), then enters the patient chamber. Exiting back into the anteroom, the med pro removes the PPE, places it into a burn bag and returns to the cabin.

The metal boxes on each end of the tent contain redundant HEPA filters to clean air as it enters and exits the ABCS; the filters are CDC Level 4 and scrub the anteroom and chamber air down to virus-size particles. When the aircraft is decontaminated after the patient transfer, the filters are incinerated along with the ABCS tent and any patient fluids it contains.

To the right of the ABCS is a standard Gulfstream rear cargo door modified with pressurization system outflow valves moved from the factory-installed location in the cockpit to the aft cabin so that pressurized air flows from the front of the cabin to the rear en masse, exiting through the relocated outflow valves with any germs that may have escaped the ABCS. Thus, no cabin air is recirculated. The modification and the ABCS are covered by an STC owned by Phoenix Air.

During Ebola transfers, medical teams consisted of a physician and two flight nurses. Augmented crews of three pilots flew the trips. **BCA**

their Rolls-Royce Spey engines to Stage 3 noise standards.

The Gulfstreams are set up in two configurations, one a single-patient VIP arrangement where opposite the passenger door is a Spectrum 2800 litter that locks into the seat tracks. "We use that system on the Lear's, too," Thompson said. "It is what the U.S. Air Force uses on their medevac aircraft. These self-contained patient-support systems can cost up to \$75,000. They are custom built for the Gulfstream with a wider stretcher to accommodate super-size people or normal ones swollen by drugs."

The medical crew is accommodated in seats aft of the litter. "We retain some seating for family members and have preserved the galley for use on long missions," Thompson continued. "This aircraft is for transfer of very-high-asset patients, so it is equipped with a very-high-asset interior."

The other configuration was designed for mass casualty movement, equipped with five stretchers plus seating for the medical crew. "The typical scenario," Thompson said, "is a cruise ship in port, and a number of passengers go on a day trip. There is an accident, and they are severely injured in a place where the local hospital would be overwhelmed. So we get hired by the cruise line, because they are responsible for their passengers even when they are off the ship. We bring the injured passengers back to the U.S., often to the closest well-equipped hospital in Florida where many of the cruise lines are headquartered. No one has an airplane that can carry more than two patients, and we have one that can carry up to five. They are flying ICUs with all the equipment for that function."

With a full house of patients, oxygen use can be high. "Normally," Thompson explained, "the litter is equipped with a 3,500-liter bottle built into it, but with five patients in critical condition, we would exceed that very quickly, so we have gone into the luggage area and installed four 'H' tanks in a rack feeding a common manifold." The O₂ lines are plumbed behind the sidewalls of the cabin with outlets every 5 ft. Phoenix Air's factory-level maintenance department engineers perform the conversions in-house. Flexibility is designed into the GIII interiors so that the operator can convert back and forth among the three aircraft depending on mission requirements.

Phoenix Air is a highly diversified company, with air ambulance service representing only 15% of its revenues. The company was launched in 1979, adding the aeromedical transport component to

its operational portfolio in 1995 when it was seeking additional markets to exploit. Based at Cartersville-Bartow County Airport (KVPC) just north of Atlanta, about 70% of its work is contracting for the U.S., Canadian and other governments, NATO and the U.S. Africa Command for which it provides airlift.

The remaining 15% of its activity involves air cargo, specializing in the transportation of dangerous goods, one of the few operators licensed and equipped to carry high explosives by air. The company performs several types of special missions for the military with Learjets and Gulfstreams, including electronic warfare testing and decoy work. It also operates a civil flight training school.

In addition to the three Gulfstream III air ambulances, Phoenix Air operates an additional five conventional IIIs (i.e., no cargo doors) and three GII/IIBs exclusively for government work, including monitoring missile launches from the U.S. West Coast and the Pacific Missile Range out of Hawaii and other locations; six Gulfstream I turboprops; and 15 Learjet 35s and 36s for electronic warfare testing (some of them distinguished by camouflage paint schemes and interesting-looking devices mounted under their wings). An additional five Learjet 35s and 36s are operated as dedicated air ambulances.

"When we were considering moving into medical transfer," Thompson related, "we hired a consultant to educate us on the industry and look for a segment of the market we could move into. Eventually, we developed our own business model of marketing only to the travel industry and other operators." Phoenix Air had to undergo "a tremendous amount of legal research" in order to position itself within FAA and European regulatory frameworks.

Developing a Unique Niche

"So we've developed our own unique niche," Thompson said. "The other part of that is the unusual airplanes we operate. We fly about 160 to 180 trips a year all over the world on air ambulance patient transfers. There is hardly a place that we don't go."

"For air ambulance missions," Thompson recounted, "just in the last six months we've gone to Japan twice, the Dominican Republic, Italy, France twice, Austria, UAE, Kuwait, Saudi Arabia, Belgium, Qatar, Guantanamo Bay in Cuba, Sweden, Greece, Gibraltar, Germany and the U.K."

Some destinations, though, are "very bad places," he says, requiring considerable vetting before a flight is launched. "We have flown into Beirut when it was under fire," he continued, "and the Central African Republic where the LRSA rebel group has been slaughtering people and thousands of refugees are living in a huge cleared area next to the airport. Hundreds of them would be pressed up against the fence 50 ft. from the airplane. And we flew into Tripoli when there was unrest there. We don't hang around in those places; we land, shut down one engine, grab the patient, don't refuel and depart in 10 min."

Phoenix Air dispatchers access various intelligence resources "to know what we're getting into." The company also has to obtain clearance from its insurer for missions into potentially haz-

ardous locations. "We often call embassies of other countries in the hot areas to get information," Thompson said. "Is the airport in town or outside of town? If the latter, your risk is lower. Part of my job is risk assessment. We begin to do some intelligence gathering for places where we expect we'll be asked to fly even before we get an assignment."



A patient is moved onto an AirMed Hawker 800A. Note the flight crew member (right) assisting the medical team.

ardous locations. "We often call embassies of other countries in the hot areas to get information," Thompson said. "Is the airport in town or outside of town? If the latter, your risk is lower. Part of my job is risk assessment. We begin to do some intelligence gathering for places where we expect we'll be asked to fly even before we get an assignment."

Phoenix Air does not solicit to the public. "We provide airlift for the travel insurance industry and other air ambulance operators that don't have the right size aircraft or lack experience in a particular country or region," Thompson said. "The other operators can put

their medical people onto our aircraft for these missions that we fly for them. In the Gulfstreams, we have to put one of our own people on board to operate the aircraft systems, but the contractors can also put their own doctors and nurses on board, as they are representing the patient and family."

Phoenix Air employs two emergency medicine board-certified physicians permanently as medical directors and eight more on contract trained to meet its standards, and up to 14 nurses trained either as flight EMTs or paramedics, four full time and the remainder contractors. Fleet-wide, the company retains 65 full-time pilots on staff. According to Thompson, the average Gulfstream pilot has "north" of 10,000 hr. total time and is over 45 years old. Fleet average experience for pilots is between

8,000 and 10,000 flight hours. A number of pilots are dual-rated as A&P mechanics, "as we go to a lot of places where you just don't want to break down."

"We are a career company," he continued, noting that his brother, Mark Thompson, Phoenix Air founder and president (and part-time NASCAR driver), is also a pilot who "quit counting at 28,000 hr. and still flies. Our chief pilot has 25,000 hr." All have flown FAR Part 135 their entire careers, and most are civilian trained and came up in general aviation. "We can deploy them and mechanics for up to a month in places like Africa, and

The 'Ebola Business'

Phoenix Air has a history of adapting business aircraft to unusual applications to service government contracts.

In 2005, the Centers for Disease Control and Prevention (CDC) released a solicitation for a five-year contract for international airlift to support treatment of infectious diseases. Phoenix Air, which is based close by the CDC in Cartersville, Georgia, already had an ongoing airlift contract with the Department of State. It bid for the new contract and won. Two years later, as swine flu and avian flu ravaged China and other Asian countries, the CDC sent a number of medical professionals to China to assist the government in dealing with the epidemics.

"Some of the physicians were concerned that if they caught the diseases they would not be able to return home via airline or private air, as these diseases were spread by airborne contagion and could endanger crewmembers and other passengers," recalled Dent Thompson, vice president and chief operating officer at Phoenix Air. "So the CDC management called us to their headquarters in Atlanta and described the problem, and we set up a working group of scientists with them, the DOD [Department of Defense] Chemical and Biological Warfare Group and our maintenance engineering group."

Phoenix Air then spent two and a half years developing an airtight tent that could be set up in the cabin of a Gulfstream III with its own environment to contain a contagious patient for any known disease. "We called it the Aeromedical Biological Containment System, or ABCS, and it was subsequently certified by the FAA, DOD and U.S. Health and Human Services, the parent of CDC," Thompson said. "We hold the STC, and we built 10 of the exoskeletons that supported the plastic tents."

The ABCS was never used during the swine and avian flu outbreaks, as by the time the system was developed, those diseases had run their course. "So we warehoused them," Thompson said. "But every time afterward when I had contact with a government agency, I reminded them we had these things."

"For the Sochi Olympics, the State Department had us transport President [Barack] Obama's delegation to the opening and closing ceremonies, as he and [Russian President



Vladimir] Putin were not getting along, and Obama elected not to go," Thompson continued. "So we were working closely with the State Department, and in July 2014, I got a call from the chief of emergency medicine at State, Dr. William Walters, and he cited the ABCS system and asked if it worked. I said we've never had to use it, and he informed me that there were two U.S. citizens about to die from Ebola in Monrovia, Liberia."

They were Dr. Kent Brantly, a physician, and nurse Nancy Writebol, who had been over there working for Samaritan's Purse, a non-governmental organization (NGO). "We had to get them back to the U.S. for specialized medicine, and Dr. Walters asked if we could do the transfer," Thompson recounted. "This was on a Friday afternoon, and the following Tuesday, Dr. Walters showed up here with the top physicians at CDC, DOD, NIH [National Institutes of Health] and State tasked with dealing with Ebola. We called in our own Phoenix Air doctors, and we spent the whole day discussing the system, and at the end of the day, they were satisfied the ABCS would work while protecting the med teams and pilots."

Volunteer Crews

"We then had to ask for volunteer med crews and pilots to fly the mission, as they would be putting their lives on the line," Thompson continued. "We prepared the airplane and left

they receive bonuses for that." All flight planning is conducted in-house, including obtaining overflight and landing permits for international operations. Total employees at Phoenix Air number more than 200.

Skyservice Air Ambulance was founded in 1989 as a division of Skyservice Aviation Inc., claimed to be Canada's largest charter/management company. In 2012, it was separated from the "mother company" for liability reasons and continues as a self-contained entity, although it operates under Skyservice Aviation's Transport Canada 704 certificate (equivalent to U.S. FAR Part 135). Air Ambulance is

headquartered in Montreal with a satellite base at Toronto. It performs long-range medical patient transfers from Canada throughout North America and to Europe, the Middle East, Africa, Asia, Australia, Central and South America, and the Caribbean and also flies into Cuba to retrieve Canadian citizens sick or injured while vacationing or working on the island (see "Operating in Cuba," *BCA*, October 2011, page 62). And it's flown these missions in the Learjet 35s and 45s described earlier.

"We have flown close to 26,000 accident-free missions, visiting more than 180 countries and territories on these flights," Cimone said. "Our average leg

is 3 hr., and the average round trip is 6 hr. This represents more than 150,000 hr. of flying. We are logging 1,500 hr. a year each on the aircraft in our fleet."

Challenging Operations

There are two groups that can veto a Skyservice flight: the pilots and the med team in the cabin.

"We once had a situation on a flight from Johannesburg to Montreal where an aircraft was struck by lightning with a patient on board and couldn't proceed after the crew executed an emergency landing at Dakar, Senegal," Cimone said. "We often have to send our maintenance people

here two days later, Thursday, Aug. 1, 2014. The aircraft flew to Monrovia and picked up Dr. Brantly, who had one foot in the grave but managed to walk on the airplane, and brought him to Dobbins Air Force Base in Atlanta where he walked off the airplane to a ground ambulance that took him to Emory University Hospital. We immediately decontaminated the aircraft and flew back to Monrovia and picked up Ms. Writebol. Then the government issued us an emergency contract, and over night we were in the Ebola business big time."

At that point, Phoenix Air's maintenance and engineering department went into full production, modifying four of the company's Gulfstream IIIs for the ABCS and building five more exoskeletons that support the self-contained plastic tents. The system is designed so that when a transfer flight is completed, the tent is collapsed and incinerated.

(As reported in the main story, Phoenix Air ultimately operated more than 40 Ebola transfer flights between Africa and the U.S. and Europe between August 2014 and March 2015.) After a patient delivery at one of the designated Ebola treatment facilities, the aircraft would deadhead back to Cartersville, and a special team would remove the "hot" ABCS.

"The range of the GIII is basically 2,867 nm," Thompson said. "We had a regular route from Georgia to Bermuda with a sterile airplane, then to Dakar, Senegal, where the three-person crew would rest, then on to where the patients were in Sierra Leone, Guinea and Liberia.

"We would pick up a patient and fly to the Azores, refuel and then proceed to Dulles International Airport near Washington, D.C., officially entering the U.S. for clearance. We had arranged special procedures with ICE [Immigration and Customs Enforcement], the TSA, Homeland Security and the U.S. Public Health Service — maybe 25 federal agents in all — to clear the inbound flights there. From there, we would fly to one of the hospital locations. When the patient was offloaded, the airplane would come back 'dirty' to a reserved hangar at Cartersville where we would decontaminate it."

Today, Phoenix Air remains under contract to the State Department with at least two aircraft fully outfitted for Ebola on standby 24/7 to respond to an outbreak anywhere in the

world. The company has fabricated 40 tents that are stored in warehouses around the country. Its State Department/CDC transport contract covers other bad diseases, as well, including multiple drug-resistant tuberculosis and Extreme MDR-TB, polio, along with swine and avian flu.

"In addition, the State Department has contracted us to open an air ambulance base in Africa for non-Ebola missions," Thompson said. "It is in Accra, Ghana, and we have a Lear 36 permanently based there with pilots and a medical team to handle flights for basically all government employees in Central and West Africa for CDC, DOD, and so forth. They are taken usually to London and Frankfurt. The contract covers only U.S. government employees, not the public. Our feet are in two different worlds: one in the commercial world and the other in the government contracting world."

Another type of specialized medical transport in which Phoenix Air has pioneered is ECMO (extracorporeal membrane oxygenation) heart/lung machine-supported transfers. ECMOs are fairly large and heavy machines used in hospitals to keep patients alive during heart or lung failures. Some manufacturers have managed to downscale them so they can fit into a large corporate jet like the Gulfstream. Thompson claims that Phoenix Air is the only air ambulance operator capable of performing patient transports on ECMO machines.

Yet another device reflective of contemporary medical technology is the Berlin Heart Pump, made for children being transported to surgical facilities for heart transplants. Phoenix Air has worked closely with the Berlin medical instrument company to adapt the heart pump to the Gulfstream to enable air transport of children for this purpose, again, claiming to be the only operator so far performing this type of transfer.

"This year [2015] alone, we've flown four missions in which we've gone to Tokyo, picked up a child and flown that child to Eastern Canada for heart transplants," Thompson said. "Berlin sends a team on the aircraft to move the child onto the machine at the hospital and then to the aircraft. A cardiac surgeon flies with the child. We have specialized with medical technical companies that have developed life-support equipment especially for small jets." **BCA**

out to the location of an aircraft in a situation like this to release the aircraft."

In Dakar, the maintenance team had to evaluate the aircraft, repair some small damage, then release the flight to proceed. During the 16-hr. delay, the patient was admitted to a local hospital and care was ensured by Skyservice's medical personnel, who remained with the patient at the facility.

"We approach situations like this as a challenge and not a failure," Cimone said. "As long as we take care of our patients, the mission is a success. We keep it within an envelope of safety — the ability to evaluate, make a smart decision and minimize risk in our decision.

And cost does not drive the decision, safety does."

The company is IS-BAO registered and ARGUS Platinum certified and was the first air ambulance company in North America to be granted accreditation by EURAMI for long-range intercontinental fixed-wing transport with a medical endorsement for adult and pediatric critical care.

"We have an SMS for the operational part of the business and a similar one for the medical side, the same kind of risk assessment tool with a transportation perspective," Cimone claimed. "Aviation is very black and white. However, medicine is very gray — it is an art, a 'feel' you

develop. Not all [strains of] pneumonia [are] the same, for example, so we use the risk mitigation tool to see where they fall in the illness category. What is the risk exposure due to age, weight, and so forth? It is the 'art of critical air medicine.' We have to manage risk."

The medical professionals are contractual. "We want them to keep working in a medical environment so they are always exposed to updated training and intervention, which they bring back to us," Cimone explained. "We use around 50 of them. They are physicians, flight nurses and respiratory therapists. We maintain an extensive training program for them, and before we bring them

aboard, they have had to work in a high-acuity setting, that is, an ER or ICU.

“We train them in flight physiology, what altitude does to the patient and where it is a factor; preceptor training [mentoring] with experienced people for several weeks or months, depending on how many rotations they do with us; and ongoing training four times a year,” he explained. “We also evaluate our missions and pass on what we’ve learned in these recurrent training sessions and how they influence our best practices.”

The company is a medical-driven business, but equal emphasis is given to aviation. Skyservice maintains 14 pilots on its payroll. Minimum requirement for hire is 2,000 hr. total piloting time, and new hires start as FOs, upgrading to domestic captain with experience. From there, they can transfer into global operations, flying under an experienced international captain. Pilots are drawn from the military, bush flying, firefighting and cargo/passenger charter, most with prop backgrounds. Average retention is five years.

“It’s a very demanding job over time,” Cimone said. “It’s a small airplane with lots of time zones crossed.” Total employment in the company is 30 not including the contractors. “We staff a flight coordination center with a dedicated flight planner, but the pilots make the ultimate decisions whether to go.” The flight planner is a licensed dispatcher and has weather monitoring experience.

Joe Cece’s introduction to the patient transport business began in 1994 when he started a surface ambulance service. He ran it for year, then sold it and launched AeroCare.

“I came from a medical and aviation family — my father was a doctor and my mother an Eastern Air Lines flight attendant — a natural path to start this company,” he reminisced.

Because the new company didn’t own any aircraft or hold a Part 135 certificate, it partnered with R&M Aviation to provide the air transport component. “In 2004, we acquired R&M, merged the companies, and got a dba from the FAA to retain the certificate,” he explained. “As I grew the company, I learned how to market it to insurance providers and hospitals.”

AeroCare maintains bases in Aurora and Scottsdale, Arizona, and was scheduled to open a third in December in Fort Lauderdale, Florida. Currently, the company is exceeding \$20 million in annual revenue.

“Over the 24 years we’ve been in

business, we’ve flown more than 8,000 missions, representing more than 50,000 accident-free flight hours,” Cece said. “In 2014 alone, we flew 500 missions totaling 2,000 flight hours. Additional missions were flown outside of our territory with cooperating operators’ aircraft. In the history of the company, we’ve flown to more than 100 countries. We’re hired by hospitals, insurance companies, corporations, government entities and the general public. In an emergency, from the time of the call to launch, we can be in the air within 2 hr.

“Our Part 135 certificate allows us to operate throughout North America and abroad in Central America, South America, the Caribbean and Bermuda,” he continued. “Elsewhere, we outsource to other companies we have built relationships with like AirMed and Airser-

employs 18 full-time pilots and requires candidates to hold ATPs with 2,000 hr. minimum total time and at least 1,000 hr. PIC in type. Generally, line pilots have at least 5,000 hr. total time and typically are former military or have civilian with Part 135 backgrounds. “We have high retention because we hire people who are passionate about saving lives,” Cece claimed. AeroCare maintains a 24-hr. in-house communications center at Aurora staffed by Part 121-certificated flight dispatchers.

Aeromedical Circumnavigations

AirMed, the Hawker operator, dates from 1987 and in 2014 became a division of Air Medical Group Holdings (AMGH),



Skyservice’s Learjet 45 pauses for a tech stop at Anchorage, westbound to the Orient on a patient transfer.

VICES, with our own medical personnel on board. We flew the Indian minister of commerce from Mumbai to Houston for heart valve surgery on a GIV operated by a [cooperating charter provider] and the CEO of McDonald’s Corp. from Chicago to Sydney on their Global Express with our medical team on board. We frequently get calls from charter operators that are managing an aircraft and the owner has a relative who is sick. We can then put our medical people on that airplane for the transfer.”

AeroCare’s nurses, paramedics and physicians receive extensive aeromedical and altitude physiological training. All are part-time employees on call and required to be at the airport within 1 hr. and be in the air within 2 hr. when summoned for a mission. The company

an umbrella corporation that owns several other medical transport companies, including rotary-wing operators AirEvac, REACH and Med-Trans, and a ground ambulance service called LifeGuard. AirMed operates from Birmingham, Alabama; Pensacola, Florida; and Rochester, Minnesota, the last in support of the Mayo Clinic. In its history, AirMed has flown more than 18,000 patient-transport missions, and the company’s FAA-approved OpSpec allows worldwide operations. AirMed is approved by the Department of Defense, CAMTS and EURAMI and late last year was awaiting FAA approval for a Level 4 SMS.

“We have circumnavigated the globe moving patients more than four times in one year [2015],” said Denise Treadwell.

“For one of those flights, we moved a patient from the U.S. to the UAE, then picked up another patient in South Africa, moved that patient to Australia, then flew to Guam to move a third patient back to Los Angeles. We positioned pilots and med teams ahead via commercial airlines for swaps. These aircraft [the Hawker 800As] are work-horses!”

The Hawkers are configured to accommodate two litters or can be set up for a pregnant woman and an isolette in the event the patient delivers in flight. “We’ve had to do that many times, as we perform quite a few neonatal trips for higher levels of care,” Treadwell said. “The baby would be in an isolette, and the mom would be in a patient care area.” AirMed claims to have operated the first jet equipped with liquid oxygen



SKYSERVICE

for the cabin service, and the Hawkers carry a total of 3,200 cu. liters of O₂ in multiple tanks for redundancy.

The operator has developed a proprietary STC for building the Hawker interiors that feature weight reduction through use of carbon fiber; the interiors have been installed by multiple completion centers. One of the Hawkers has been equipped with Aviation Partners winglets to facilitate ETOPS operations by extending single-engine range. Additionally, AirMed is upgrading the avionics of its aircraft to meet European regulations calling for dual FDRs and TCAS.

“And we will install ADS-B in the newer Hawker and ultimately replace the other one with a more modern aircraft that’s better equipped,” Treadwell said. “We like the Hawker because it has a standup cabin, a closed lav and

an APU, the last of which is very important in places where there is no ground power available, like the Pacific islands.” It’s important that power be maintained in the cabin to maintain temperature and operation of the medical equipment during tech stops, she added.

AirMed’s medical teams operate bedside to bedside, picking up patients at the treating facility and delivering them to the receiving facility on the other end of the flight. For international operations, aircraft are in transit for an average of four days. Circumnavigations take about eight days, occasionally with day-long layovers along the way.

“The majority of our operations are domestic and performed with the smaller aircraft, while the Hawkers are reserved for long-range international flights,” Treadwell said. “We manage utilization for the appropriate airframe for a given transport. For DOD contracts, we cover CONUS [continental U.S.] and U.S. Territories. We specialize in critical care transport, and medical escort business is typically not critical care, accounting for about 5% of our business.”

The company employs just over 100 people including 30 full-time pilots. It performs the majority of maintenance in-house with 12 A&Ps on staff. Five FAA-licensed dispatchers handle flight planning and international permit arrangements. The full-time medical support staff consists of 12 “communicators” who handle flight following, scheduling of ground ambulances and all incoming calls. Then there are five clinical coordinators, advance-practice nurses, who coordinate the entire transport by connecting with the treating facility, determining the treatment needs, how the patient will be moved and the timing, and then talking with the receiving facility to pass on when the transfer flight will depart and arrive at their location.

“The coordinators have to have an understanding of the facilities in the country where the flight will go and how the patient will be transferred from the treating facility to the aircraft,” Treadwell explained. “They are all former flight nurses.”

The medical crews that attend to the patient are a mix of full- and part-time employees. Specialty teams are made up of part-time physicians and full-time nurses; they staff neonatal intensive care units (NICUs) and pediatric intensive care units (PICUs) and come from University Hospital and Children’s Hospital in Birmingham. The full-time

medical staff is 42 physicians, nurses and respiratory therapists.

“We hire people with three to five years of critical care experience and then train them for the air transport function,” Treadwell said. “This includes altitude physiology, travel medicine, diversity training [i.e., what is accepted in different regions in the world in terms of attire, gender of med team members, local customs, etc.] and safety training on the aircraft including altitude chamber testing, emergency egress training and water survival.”

Pilots must be ATP-certificated and type-rated in the aircraft they will fly with a minimum of 2,500 hr. at hire. To fly as PIC, they must have accumulated 4,500 hr. Existing AirMed Hawker and Beechjet captains average, respectively, 7,000 and 4,500 hr. total time. The company’s high-time Hawker captain has logged 15,000 hr. total time.

The communications center is a control room in Birmingham where all the flight preparations take place. There, dispatchers handle all immigration requirements, make arrangements for overflight and landing permits, and TSA passenger screening for international arrivals.

“We work with travel assistance companies and are the preferred provider for some of those,” Treadwell said. “We also have an independent membership program that covers tailored agreements for corporations and individuals. If an enrolled member is hospitalized at least 150 mi. from home, either domestic or international, they can contact us to be returned. We try to use our own aircraft but also use affiliates’ if ours are not available.” Customers can enroll on the company’s website. An annual membership is priced at \$385 covering the person registered, a spouse and up to five dependents.

Meaningful Work

There are few occupations in life where one can make a meaningful difference like aeromedical transport, whether you’re a “stick” working in the front office, an attending physician, flight nurse or respiratory therapist keeping watch in the back, or a coordinator, dispatcher or maintenance tech working at home base. “It’s a rewarding business on a daily basis,” AeroCare’s Joe Cece said. “It’s an interesting combination of medical and aviation, very challenging, a lot of moving parts requiring coordination and lots of experience.” **BCA**