

Title: International Transportation of Patients during the 2014-2016 Ebola Outbreak

Activities: Transport healthcare personnel; Transport or evacuate patients

Stakeholders: National and subnational health authorities; National and regional militaries; Private sector courier and transportation services

Phases: Detection; Early response; Intervention; Post-intervention and recovery

Years: 2014-2016

Countries: Guinea; Liberia; Sierra Leone

Agent: Ebola

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During the 2014-2016 Ebola virus disease (EVD) outbreak in West Africa, foreign healthcare workers who contracted EVD in West Africa requested to be transported back to their home countries for medical care.¹ Phoenix Air, a private airline company, was largely responsible for transporting these patients. In collaboration with the U.S. Centers for Disease Control and Prevention (CDC) and the U.S. Department of Defense (DoD), Phoenix Air designed an Airborne Biological Containment System (ABCS) that was used to successfully transport 41 EVD patients back to the United States and Europe during the outbreak.²

The ABCS, however, was not originally developed with EVD patients in mind. Its development began in the aftermath of the 2003 severe acute respiratory syndrome (SARS) outbreak and subsequent avian flu outbreak. These outbreaks brought to global attention the need for a safe mechanism for the transport of highly infectious patients, wishing to be repatriated to their home countries or in need of transport to a particular clinical facility. Consequently, in 2007, the CDC, DoD, and Phoenix Air began designing the ABCS specifically for the international transportation of highly infectious patients with airborne diseases such as SARS and avian flu.³

¹ Jeremy Hsu. SARS Outbreak Isolators Helped “Ebola Air” Fly Infected Patients. Scientific American. September 18, 2014. <https://www.scientificamerican.com/article/sars-outbreak-isolators-helped-ebola-air-fly-infected-patients/> Accessed August 22, 2019.

² Contagious Disease Transport. <https://phoenixair.com/air-ambulance/contagious-disease-transport/> Phoenix Air Group, Inc.

³ Jeremy Hsu. SARS Outbreak Isolators Helped “Ebola Air” Fly Infected Patients.

The ABCS accommodates a single patient and is made up of a metal support system draped internally with a plastic liner that forms a tent-like isolation pod. The system is 5'2" by 5'11" by 12'. Within the metal frame, there are two chambers. The smaller chamber at the unit's entrance is reserved for healthcare providers (one doctor and two nurses) to don and doff personal protective equipment (PPE). Behind this chamber is the larger patient isolation chamber. Inside are a stretcher, patient monitoring equipment, and a disposable toilet for the safe disposal of infectious waste. A negative-pressure environment is maintained inside the unit to prevent air from leaking out, and the front and back sides of the unit each have an air filtration system that filters the air down to virus-sized particles. The entire unit is placed in a Gulfstream G-III aircraft. After each flight, the plastic liner and all equipment inside it is disinfected for 24 hours and then incinerated.⁴

Three ABCS units were finished in late 2011 and certified by the U.S. Federal Aviation Administration (FAA).⁵ The units were put in storage due to a lack of federal funds as well as the absence of a major infectious disease outbreak at the time.⁶ The ABCS remained in storage until late July 2014, when the U.S. State Department's Chief of Emergency Medicine called Phoenix Airlines to inquire if the containment units were suitable for the transportation of EVD patients. Two American healthcare workers had contracted EVD and requested to be transported back to the United States to receive medical care.⁷ U.S. CDC and Phoenix Air medical personnel thoroughly assessed the ABCS and determined that it would protect against EVD in addition to the airborne diseases it was originally designed for.⁸ Phoenix Air signed a six month contract worth \$4.9 million with the State Department.⁹

On August 2, 2014,¹⁰ Phoenix Air retrieved the first patient from Liberia and flew him to Atlanta, Georgia to be treated at Emory University Hospital.¹¹ The second patient's flight from Liberia was right after, and she was also flown to Atlanta to be treated at Emory University Hospital. Serving as "proof-of-concept" flights, these first two missions went well. There was a pressurization issue on the first flight that forced it to turn back before it reached Liberia;

⁴ Cameron McWhirter and Betsy McKay. Special Planes are Lifeline for Ebola Patients. Wall Street Journal. Updated March 13, 2015. <https://www.wsj.com/articles/special-planes-are-lifeline-for-ebola-patients-1426276096> Accessed August 22, 2019.

⁵ Robert Roos. Very few aircraft equipped to evacuate Ebola patients. CIDRAP News. September 16, 2014. <http://www.cidrap.umn.edu/news-perspective/2014/09/very-few-aircraft-equipped-evacuate-ebola-patients> Accessed August 23, 2019.

⁶ Josh Hicks. The whole world relies on this one U.S. company to fly Ebola patients. Washington Post. October 28, 2014. <https://www.washingtonpost.com/news/federal-eye/wp/2014/10/28/the-world-relies-on-this-one-company-to-fly-ebola-patients/> Accessed August 23, 2019.

⁷ Josh Hicks. The whole world relies on this one U.S. company to fly Ebola patients.

⁸ Robert Roos. Very few aircraft equipped to evacuate Ebola patients.

⁹ Jeremy Hsu. SARS Outbreak Isolators Helped "Ebola Air" Fly Infected Patients.

¹⁰ Josh Hicks. The whole world relies on this one U.S. company to fly Ebola patients.

¹¹ Robert Roos. Very few aircraft equipped to evacuate Ebola patients.

however, the delay ended up working in the patient's favor as it allowed him to take an experimental medicine that would not have been available had he left Liberia on time.¹² After transporting the two patients, Phoenix Air left the responsibility of coordinating future flights with the U.S. Department of State, which could better mitigate challenges associated with customs officials, foreign airspace, and determining treatment centers.¹³ Phoenix Air additionally began taking emergency calls for flights at all hours of the day.¹⁴

While all patients were transported safely, Phoenix Air faced logistical difficulties. Staffing was initially a problem as many medical personnel employed by Phoenix Air also worked in other medical facilities. They were advised by their employers not to participate in the transportation of EVD patients as they could not return to work for 21 days after the flight, so it was necessary to hire full time medical staff. Other problems did not have as easy of a fix. Fear surrounding EVD meant that many foreign countries did not allow Phoenix Air flights to stop to refuel. In addition, Phoenix Air flights were only allowed to land at five airports in the U.S. Flights were complicated by these restrictions, sometimes requiring an extra stop.¹⁵

It became clear that there needed to be a larger capacity for transporting EVD patients internationally. As such, after the 2014-2016 EVD outbreak, the State Department partnered with MRIGlobal to design the Containerized Biocontainment System (CBCS). This project was funded by a five million dollar grant from the Paul G. Allen Foundation.¹⁶ The CBCS can transport four patients at a time as opposed to the ABCS' one-patient maximum. It features a patient treatment area, an anteroom where medical staff don and doff PPE and store medical and cleaning supplies, and a medical staff room where staff can rest without wearing PPE. With a steel inner wall and aluminum outer wall, it is sturdier than the ABCS.¹⁷ The CBCS is flown in a B747-400 cargo aircraft.¹⁸

Please include case study summary text below this line.

During the 2014-2016 Ebola virus disease (EVD) outbreak in West Africa, a private airline called Phoenix Air used its Airborne Biological Containment System (ABCS), developed in collaboration with the CDC and DoD, to successfully transport 41 healthcare workers who contracted EVD in West Africa to their home countries for higher levels of medical care.

¹² Robert Roos. Very few aircraft equipped to evacuate Ebola patients.

¹³ Josh Hicks. The whole world relies on this one U.S. company to fly Ebola patients.

¹⁴ Cameron McWhirter and Betsy McKay. Special Planes are Lifeline for Ebola Patients.

¹⁵ Cameron McWhirter and Betsy McKay. Special Planes are Lifeline for Ebola Patients.

¹⁶ Heather Higginbottom. Testing a State-of-the-Art Medevac Unit for a Flight You Hope to Never Take. United States Department of State. November 28, 2016.

<http://2007-2017-blogs.state.gov/stories/2016/11/28/testing-state-art-medevac-unit-flight-you-hope-never-take.html>.

¹⁷ Introducing the Next Generation of Biocontainment: Containerized Bio-Containment System. MRI Global.

¹⁸ Contagious Disease Transport. <https://phoenixair.com/air-ambulance/contagious-disease-transport/> Phoenix Air Group, Inc.

However, with only three ABCS units available that could each only transport one patient at a time, it became clear that a higher capacity for patient transport was needed. The CDC consequently partnered with MRIGlobal to develop the Containerized Biocontainment System (CBCS), which can transport four highly infectious patients at a time.