ORBIS INTERNATIONAL

DESIGN AND DEVELOPMENT
OF THE MD-10 FLYING EYE HOSPITAL
MD-10 FLYING EYE HOSPITAL
WHY - WHAT - WHERE

orbis
WHY

• IMPEDES YOUR ABILITY TO GAIN AN EDUCATION.
• ABILITY TO FIND EMPLOYMENT
• LEAD YOU AND YOUR FAMILY TO A LIFE OF POVERTY.

• 285 million people worldwide are visually impaired. But they don’t need to be. That’s why Orbis works on the prevention and treatment of the causes of avoidable blindness
WHAT

• TRAINING

• Lack of adequate training for healthcare professionals is a problem around the world. Providing first-rate training is essential to solving this problem, and it's a primary component of our efforts.

• We focus on increasing the skills and knowledge of our partners, and we take a team approach. We don’t just train ophthalmologists, but the entire eye health team. A team approach ultimately affects the entire eye health system and transfers from one doctor or nurse to an entire team of eye care professionals. This improves the quality of patient care standards and clinical efficiency — leading to better quality patient outcomes.
WHAT

• ADVOCACY

• Orbis advocates for the elevation of eye care on local government agendas and works to increase public awareness of the importance of eye health. By creating strong actionable policy to support eye health we promote access to quality eye care and increase the accessibility to eye care services.

• We advocate to improve understanding of the social and economic burden of blindness and push for better access to quality eye care in the countries we work. Advocacy enables prevention and ultimately improves eye health in the community. Using evidence, effective partnerships and identifying champions to support our efforts, we look to a future where everyone has access to quality eye care.
WHAT

• RESEARCH

• Orbis supports research to develop strategy for evidence based interventions to plan the design and development of our programs. Research also supports advocacy efforts to impact access to eye care. Research is vital to planning and operating cost-effective and efficient eye care programs. Without accurate research on the extent of a problem, or what is already working, implementing quality eye care is very difficult. Orbis works in partnership to create meaningful research that informs global blindness prevention for adults and children where we work.
WHAT

• FLYING EYE HOSPITAL

• Orbis operates the Flying Eye Hospital (FEH), a fully equipped mobile teaching hospital. On the outside, the plane is like most other aircraft. Inside, it's like no other - it hosts an ophthalmic hospital and teaching facility right on board.
WHERE

- 92 COUNTRIES TO DATE
- AFGHANISTAN
- ALBANIA
- ARMENIA
- BEHRAIN
- BANGLADESH
- BOLIVIA
- BOSNIA
- BOTSWANA
- BRAZIL
- BULGARIA
- BURKINA
- CAMBODIA
- CAMEROON
- CHILE
- CHINA
- COLUMBIA
- COSTA RICA
- CROATIA
- CUBA
- CYPRUS
- DOMINICA
- DOMINICAN
- ECUADOR
- EGYPT
- EL SAVADOR
- ETHIOPIA
- FRANCE
- GERMANY
- GHANA
- GREECE
- GRENADE
- GUATEMALA
- GUINEA
- GUYANA
- HAITI
- HONDURAS
- INDIA
- INDONESIA
- IRAQ
- IVORY COAST
- JAMAICA
- JORDAN
- KAZAKHSTAN
- KENYA
- KYRGYZSTAN
- LAOS
- LATVIA
- LIBIA
- LITHUANIA
- MALAWI
- MALAYSIA
- MALI
- MALTA
- MEXICO
- MONGOLIA
- MOROCCO
- MYANMAR
- NEPAL
- NICARAGUA
- NIGER
- NIGERIA
- PAKISTAN
- PANAMA
- PAPUA NEW GUINEA
- PARAGUAY
- PERU
- PHILIPPINES
- PUERTO RICO
- ROMANIA
- RUSSIA
- SAINT LUCIA
- SENEAL
- SERBIA
- SINGAPORE
- SOUTH AFRICA
- SPAIN
- SRI LANKA
- SUDAN
- SWAZILAND
- SYRIA
- TANZANIA
- THIALAND
- TRINIDAD
- TOBAGO
- TUNISIA
- TURKEY
- UGANDA
- UNITED ARAB EMIRATES
- UNITED KINGDON
- URAGUAY
- UZBEKISTAN
- VIETNAM
The latest FedEx sponsorship, announced in August 2011, is designed to enhance the signature "Delivering Sight Worldwide" initiative developed by FedEx and Orbis several years ago. At no cost to Orbis, FedEx has agreed to:

- Sponsor two Flying Eye Hospital medical programs per year for the next five years. The medical programs will be provided entirely free-of-charge to both host countries and patients.
- Provide employee volunteer support during Orbis medical programs and help increase public awareness about avoidable blindness.
- Continue the unique fellowship program — the FedEx Fellows — in which Orbis will award 10 medical training fellowships to ophthalmologists around the world over the next five years.
- Deliver medical supplies to Orbis programs all over the world.
- Manage the cost and completion of routine and critical maintenance procedures, including the annual safety checks for the Orbis Flying Eye Hospital to ensure its airworthiness, and provide spare aircraft components as needed.
- Provide volunteer FedEx pilots to move the Flying Eye Hospital to its program destinations, and train all Orbis volunteer pilots.
- In addition to the above support, FedEx donated the MD-10 airframe that is being converted to serve as the next generation Flying Eye Hospital.
• United Airlines is the Founding Airline Sponsor of Orbis, having donated the first Orbis Flying Eye Hospital, a DC-8, which was launched in 1982. Until 2001, when it retired its fleet of DC-10 aircraft, United held the lead role in maintaining the current Orbis Flying Eye Hospital — with United employees treating the plane as though it was part of their own fleet.

• United's support of Orbis continues in a variety of ways, such as providing volunteer pilots and an annual travel credit. Over the years, more than 300 United pilots and maintenance crew members have donated their time and expertise to Orbis.
CORPORATE PARTNERS

- **Engineering Review** - Review of the engineering drawings and specifications of the Hospital modules as it relates to medical gas system, design, connection and function.

- **Equipment Operation and Maintenance Manuals** - Service operation manual to include all related equipment, specifications, drawings, manuals, and trouble shooting documents. The service operation manual will include an equipment checklist for each dedicated service that should be performed by either the flight engineer or Alliance Medical Gas Corporation.

- **Safety** - Create and maintain an aircraft specific medical gas safety manual. This manual will be dedicated to the safe operation of the medical gas components specific to the MD-10 Flying Eye Hospital.

- **Service Related Parts** - Facilitate the acquisition of any and all parts, service items, and equipment specific items that relate to the piped medical gas system. This will include open discussions with the manufacturers to allow for an in kind donation by the manufacturers.

- **Inspection - Verification** - Perform the initial module inspection, verification, and purity testing in Victorville, CA. for the MD-10 Flying Eye Hospital, perform multiple remote field verifications to include off load, set up, connections, start up, verification and purity.

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- **Integration** - Integrate our team into the MD-10 Flying Eye Hospital project team via email, teleconference, or physical team meeting.

- **Training** - Coordinate the training as directed in the service operation manual and medical gas safety manual to adequately instruct the flight engineers on protocol, service and operation.

- **Evaluations** - Perform a comprehensive code and standards review based on the MD-10 Flying Eye Hospital utilization certificate as CARGO. It is understood that the Flying Eye Hospital WILL NOT function as designed until the aircraft is secure on the apron and set up for procedures.

- **Terms** - Partnership with ORBIS International for a term of ten years or longer. It is our pleasure and honor to offer this service to ORBIS international to continue its mission.
DESIGN / DEVELOPMENT

- Orbis 1- Donated by United Airlines, a DC-8 in 1982, utilized as a research and surgery center till 2001. Aircraft is currently in a museum in China on display.
- Orbis 2- Donated by United Airlines, a DC-10 in 2001 maintained and flown under the direction of United Airline pilots till 2009. United Airlines also trained the current full time pilots of the Flying Eye Hospital as well as the volunteer pilots to Orbis International. The current MD-10 utilizes a platform construction method which no longer conforms to the FAA after 2016. The utilization of the current Orbis 2 Flying Eye Hospital is not only for the surgery center but also for the immense training and exam space that the airframe has over the DC-8 platform. Once construction of Orbis 3 is complete by year end 2014 the current aircraft will be utilized as an educational tool as well as a way to gain support from corporate partners and the public at open venue air shows around the globe. In addition it will still maintain its FAA rating and maintenance to be used as a Flying Eye Hospital on an as need basis due to FAA required system checks and testing of the MD-10 Aircraft.
MODULE DESIGN

• The current MD-10 utilizes a module system design, the basis for the design are pre manufactured cargo platforms that can slide in and out of the aircraft bay and lock in place one in location, this system has been used in cargo aircraft for over ten years and is approved by the FAA for engineered cargo platforms.

• The pre manufactured cargo platforms are load tested and designed specifically for the MD-10 aircraft, the size, location and materials had to be FAA approved.

• The design was based on the need to remove the modules on a given time frame to support the FAA required A Check and C Check during the lifespan of the aircraft. Each module has interconnected wiring, plumbing, HVAC, sanitary drain, chilled water and return and piped medical gas systems.

• Based on need and type of space the MD-10 aircraft has 9 modules in the upper deck and 3 modules in the lower hold.
UTILITY MODULE

• This module is located immediately behind the smoke barrier which delineates the cargo space from the crew, operations areas.

• Contains the access hole from the upper deck to the lower cargo hold, as well as all the required piping, wiring, water, medical gas and data lines from the lower hold area, all these connections must be removed and capped as the plane is under way and the access door to the lower cargo hold is sealed.
The Audio Visual Module serves the function of data storage as well as to offer the 50 seat class room located in the front of the aircraft to see all the procedures and examinations to educate doctors and staff from the destination facilities. Each procedure is discussed while in process from the surgeon, anesthesiologist, and hosted by a narrator located in the class room portion of the classroom, this information is also sent world wide streaming to other educational facilities. Orbis International serves as a continued educational facility to over 325,000 doctors, staff and biomed technicians. Completing over 23.3 Million procedures since 1982.
LASER/ EXAM MODULE

• The next two modules contain the Laser/ Exam area of the Flying Eye Hospital.
• The primary purpose of this module is to perform examinations of patients both before and after surgery. With two Laser/ Examination stations. Unlike the OR for performing surgical procedures the Laser Room is not required to be a sterile environment. By using lasers there is no open living tissue, which results in no possibility of infection. Much of the equipment is fitted with a second eye piece as well as a camera to record and to utilize in the class room during live procedures.
OPERATING ROOM

- The Operating Room also contains two modules due to the required space. This module has a single bed location and is placed in the most stable area of the aircraft, central between the wing span. There are 5 cameras places in the room to generate large close up shots of each procedure as well as wide over all shots of the operating theatre. The floor and the ceiling has been reinforced to support heavy equipment as well as used as a tie down point for securing equipment and supplied during flight.
- The Operating Module also contains a fire rated closet for the Oxygen Concentrator which operates off of a Medical Air Compressor that is part of the axillary equipment modules.
The Sub-Sterile Module has been designed to be a complete isolated area where nurses can sterilize instruments for surgery and also, where the scrub sink is located for the medical staff to wash their hands prior to entering the operating theatre. Scrub sinks provide water that is potable, filtered through a 12 step process involving charcoal, UV light and a chemical compound filter.
RECOVERY MODULE

• The Recovery Module consists of two modules located at the very aft of the aircraft, the far aft module also contains a storage location for Oxygen E Cylinders and additional medical supplies.

• The Recovery Module is utilized as a location where patients are prepped prior to surgery as well as recover after the procedure. The room is equipped with three bed locations in addition to monitors to record vital signs and two crash carts in case of emergencies. The location is also used as a training area for local nursing staff.
BIOMED MODULE

- Located in the lower level of the aircraft are three additional modules the first being the Biomed Module, included in this module is a series of work stations to repair equipment, test and service electronics and store replacement parts. Additionally the Biomed Module contains a secondary Medical Gas Master Alarm, Medical Air and Vacuum Patient Terminals as well as the Main Alarm Panel for the aircraft axillary systems.
STORAGE MODULE

• Adjacent to the Biomed Module in the lower cargo hold is a Storage Module, this module is to be utilized for the sole purpose of supplies for the Biomed Team. Due to the locations served there is limited supply of key components and thus need to be on site for immediate use.

• Through the relationship with Fedex as well as United Airlines supplies and personnel can be brought to site very rapidly. In addition vendor partners have agreed to offer a 24 hour contact in the case of immediate need of service parts, technical assistance and documentation.
The last item in the lower forward cargo hold is the Utility Skid, though a module based item, this one piece is the life blood of the entire Flying Eye Hospital care system. ALL axillary components feed into this module and then forwarded through out the aircraft.

Chilled Water, Medical Air, Vacuum, Potable Water, Electrical Power, Medical Gas Master Alarms, Air Makeup/Filtering all connect to this module.

Due to the climate and harsh conditions that can be found in different countries, each system must be disconnected at the conclusion of each day and the forward lower cargo door must be shut for a period of time. Thus each system must be started up and tested each and every day. Hoses, wiring and ducts are brought into the aircraft and the axillary equipment capped and sealed.
AXILLARY EQUIPMENT

• Axillary equipment for the Orbis International MD-10 Flying Eye Hospital has more than doubles from the current DC-10 aircraft.

• In order to meet current standards and loads needed the following items are located in the rear lower cargo hold and are removed from the aircraft upon arrival at its mission location, each piece of equipment has a location from the aircraft to facility needs of exhaust, intake air, water, drain and fuel locations.

• Medical Gas Skid- Contains one duplex Medical Air Compressor, Dual Desiccant Dryers and Receiver. Duplex Medical Vacuum Pump, this equipment also has a Master Alarm cable that connects to the Utility Skid, Connection to the Utility Skid is made via a stainless steel encased hose.

• Chiller- Two Chillers are now required from the previous one due to chilled water needs. Fed to the Utility Skid with Rubber Hoses and twist lock ends.

• Generator- Two Generators each run with Jet A Fuel located at very specific locations to not induce vapor in the air.

• Transformer- Two transformers to feed electricity to the aircraft.

• Portable Ground Unit- Supply constant electrical current to be utilized for engine startup, In most cases the mission airport will have this item, but not all.

• Cabling/ Circuit Module- Utilized to be fed from the Transformer Skid to supply specific power to different pieces of equipment in the Flying Eye Hospital.
AXILLARY EQUIPMENT
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MD-10 AIRCRAFT LAYOUT
DESIGN CRITERIA

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  – Flight Electronics and Updated Flight Deck.
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  – Upgrade the Piped Medical Gas System.
MEDICAL GAS SYSTEM

- The piped medical gas system consists of a Med Gas Module that is remote of the aircraft containing a Medical Air Compressor and Medical Vacuum Pump. The current DC-10 does not have a suction system piped into the aircraft, this was a critical request from the staff that this be included.
- The connection to the Interface Module within the aircraft is via a stainless steel braided hose for each, along with the interconnected hose is a cable containing the required Medical Gas Source Alarm. This connection serves all the source equipment and is alarmed at the Biomed Module and the Operating Room.
- The Oxygen is made via a concentrator located in a Fire Rated closet on the Operating Room Module, this is derived from pressurized Medical Air at 80 PSIG and then regulated down to 50 PSIG at the outlet of the concentrator.
- The Operating Room Module contains a Zone Valve Box that serves the Operating Room Module containing Oxygen, Medical Air and Vacuum, as well as a Zone Valve Box that serves the Recovery Room containing Oxygen and Vacuum.
MEDICAL GAS SYSTEM

- The MD-10 Flying Eye Hospital has an Area Alarm Panel downstream of the Recovery Room Zone Valve Box located in the Recovery Module nurses station.
- The Interface Module contains a Main Valve for both Medical Air and Vacuum. In addition, the Oxygen Concentrator due to it is within the structure has a Main/Source Valve in the fire-rated closet. The Medical Gas Module also has a set of Source Valves for the Med Air Compressor and Vacuum Pump system.
- Piping for the Medical Gas System is installed via stainless steel tubing ½” for Oxygen and Medical Air and ¾” for Medical Vacuum. Flexible hoses are utilized for ceiling outlets through the module ceiling and into outlet ceiling boxes. The stainless steel tubing is supported via an aluminum rack located inside the utility chase. ALL utility conduits, data, medical gas, drain, condensate, emergency and normal power are supplied through this location.
- The Oxygen system additionally has 6 reconfigured Oxygen Cylinders with Rosata Connections that will act as a storage vessel for the Oxygen piped medical gas system.
MEDICAL GAS SYSTEM

• The Oxygen System and Concentrator also has a high pressure vent system though a collaboration with the FAA, McDonald-Douglas, Fedex and Alliance Medical Gas. This process took well over one year of engineering, design and construction. The final design is to create a window plug (remove a single window on the port side of the aircraft) and install a vent location with a check valve redundant and to run stainless steel tubing across the upper structure of the aircraft frame utilizing very specific fasteners, then convert to a braided stainless steel hose and connect to out vent above the Oxygen closet while connecting to the Oxygen Concentrator High Pressure Relief as well as the tank blow off disks.

• This was the most challenging engineering aspect of the design, the current DC-10 has a very antiquated medical gas system, they utilize high pressure cylinders that have to be located and brought to sight as required, this has hampered the current use of the DC-10. This was one of the most requested changes in the design of the new Flying Eye Hospital.
MODULE INSTALLATION

- Each module upon installation must meet very specific requirements for dimensions, there is only 3 ½” of space allowed to the outside of the modules to clear the cargo door.

- **HVAC/ Chilled Water/ Ducts** from the top of the modules must be removed prior to entering the cargo door and then re-installed once the module is in place. In addition wiring and medical gases that go from one module to another must be disconnected, capped and protected until they can be re-connected. The clearance once inside the aircraft is on 24” from the top of the module to the structure of the aircraft.

- As the modules are moved into place the interconnected utility chase must be connected and tested for function, pressure and leakage. This test is conducted for 24 hours before the next module can be installed. Most connections are made up of a union or flexible connector, there is NO room for movement, the modules were built as if they were in the aircraft cargo hold.
Alliance Medical Gas Corp.

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In Kind Donations

• Orbis International would not be able to continue to conduct such important work in the curing of blindness without corporate and individual partners, Alliance Medical Gas Corp is going to match all INDIVIDUAL donations made from the NEHES Fall Meeting that are made with the donation cards available or calling on the Orbis International donation line and telling them you are giving from the NEHES Fall Meeting.

• Corporate donations are certainly appreciated and greatly enhance the goals of curing more individuals. Corporate donations can be monetary or by means of supplies, equipment, and staff.

• I would ask that you take a moment to look into the Orbis International history and all the great things this organization is doing around the world, we are proud to be affiliated with such an organization and look forward to a long lasting relationship with them.
THANK YOU

• A special thank you to the Orbis International MD-10 Flying Eye Hospital Team

Bruce Johnson- Director of Flight Operations
Charles Thompson- MD-10 Project Manager
Noelle Whitestone- MD-10 Engineering Mgr.
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