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A training facility houses aircraft simulator cockpits underpinned by Moog motion control systems that prepare flight crews for a wide array of flying conditions.

Global Service Becomes Part of Maintenance Plan

Flying a plane requires a special feel. Helping pilots learn this feel is the mission of the flight simulation industry. According to Aviation Safety magazine, perhaps "the most significant factor" in helping pilots fly safely "is the high-quality simulator training airline pilots receive from their first flight and continuing regularly throughout their career."

THE MOTION control systems that make up a full-flight simulator replicate the conditions and forces that pilots routinely encounter in flight. The motion control system includes a motion base with actuators as well as control loading and associated software that work seamlessly with the instrumentation, seats and sophisticated visuals in the cabin. The motion base, which includes everything below the simulator's cockpit, can typically support payloads of up to 16,000 kg.

Keeping these full-flight simulators running requires engineering know-how, logistics expertise and creative solutions for maintenance and repair. Full-flight simulators commonly strive to achieve 99.5 percent availability or uptime. The continued growth in the number of commercial airframes, and the growing shortage of pilots, drives most commercial flight centres to operate civil flight simulators up to 20 hours per day. One flight simulator manufacturer – which our company, Moog, works with – operates a large customer service area with wall-size monitors tracking the status of simulators. Any simulators that are out of operation are highlighted, identifying details for the maintenance crews working on the simulators. When a simulator is not available for training and requires maintenance, it can cost between US$600 and US$1,500 per hour in lost revenue for the simulator operator. Compounding this impact is the logistical nightmare that results from flight crews arriving for periodic flight certification, only to find there is no simulator on which to train.

No maintenance professional wants to see his or her simulator unavailable for training because they can't quickly access a spare part to bring their system back online. And although this article highlights flight simulation, the pressure to keep equipment of all kinds running to meet customer demand is similarly critical whether it is a wind turbine, paper mill or power plant. A company, which has a long history of developing high-performance motion control systems for flight simulation, wind energy, manufacturing and power generation, understands that its flight simulation customers must have parts globally available for quick and easy access in response to planned and unplanned repairs.

The logistics behind making repairs

Moog's response was to keep a strategic inventory of emergency parts in regional hubs located in Asia, Europe, and the United States, so parts can easily and rapidly reach our customers where their simulators operate. For the last year and a half, we have had a partnership in place with UPS Supply Chain Solutions (UPS-SCS) for warehousing and logistics support. Our partnership has been about much more than shipping freight. For instance, UPS-SCS consultants examined our parts-fulfilment network and shipping lanes, resulting in a recommendation for optimizing the location of our regional stock locations. Once we established the global warehouses, we trained our 24/7 support team to use UPS-SCS's customer-facing software, thereby responding to customer requests for rapid dispatch of critical spares anywhere in the world. Our support team can now handle queries whenever a customer logs a maintenance issue from anywhere in the world. Moog engineers not only have the ability to quickly analyze the root cause of a simulator's failure, but also can dispatch parts around the clock.

KEEPING FULL-FLIGHT SIMULATORS RUNNING REQUIRES ENGINEERING KNOW-HOW, LOGISTICS EXPERTISE AND CREATIVE SOLUTIONS FOR MAINTENANCE AND REPAIR.

Part of the analysis process that we went through to set up our response to maintenance issues involved giving UPS-SCS data on the simulator locations, which established maintenance trends (e.g., type and quantity of parts, geographic locations requesting the most parts, etc.) for our simulator business. With this, UPS-SCS and Moog were able to identify where the best places were for warehousing spare parts. For example, one location was in The Netherlands, another was in the Midwest

Moog technicians seated in front of a motion system address field-service requests for flight simulators.

United States, and a third was in Singapore from where we could rapidly reach Asian customers.

With a logistics partner thinking about our maintenance solution, we were also able to strategize about different approaches to shipping, such as choosing warehousing locations in duty-free zones, thereby minimizing taxes our customers would incur. Additional cash-flow benefits for our global maintenance programme have resulted from UPS-SCS providing fiscal representation in Europe allowing VAT to be deferred.

Moog has always been the best source of repair for the technology we manufacture, but helping our customers keep their simulators running has become as much about the speed of repair as the quality of the workmanship. And by analyzing the parts of our process that were slowing down our delivery, we have been able to expedite help for our customers facing a critical maintenance issue. Our approach is twofold. Part one is putting in place technologies that help Moog and its customers get much better at diagnosing problems. And the second piece is quickly and safely dispatching parts where they are needed.

As for the technology, deterministic diagnostics is employed. This gives maintenance technicians and simulator owners a much clearer picture of what is behind a fault indicator. Moog has integrated schematics, the physical location of components, along with troubleshooting directions based on detected faults, and supplied this on a disk located on the motion control cabinet door. Maintenance technicians can load this disk onto their computer as needed. Motion base users receive a new disk if there are modifications to the cabinet after installation by Moog personnel. Moog monitors the supply chain to determine when to notify industry that an item will cease production due to the lack of critical components. And we offer recommendations for available replacement components.

With regard to dispatching parts, UPS-SCS looked at how best to set up central stock locations and forward stock locations for us. In China, for instance, there are a plethora of customs requirements, which can take a shipper up to a week or more to clear documentation. With a forward stocking location in Shanghai and a third-party customs clearinghouse, we have been able to pre-clear goods to make delivery that much faster for our simulator customers in China. While it is not necessary for every equipment manufacturer to have a forward stock location, we have found being pre-cleared for customs speeds up the process of getting a critical part to a customer whose simulator is down.

An evolving partnership

Even with all the work and processes we have put in place with UPS-SCS, maintenance is never a static business. As our customers' needs and locations change; it is critical to stay flexible within whatever construct we build for ourselves. Here is an example of that kind of thinking from our wind energy business: Moog supplies its wind turbine customers a battery back-up system to power the pitch systems that adjust the angle and inclination of a turbine's blades. These are critical components that maximize the efficiency of a turbine's output and protect a multi-million dollar turbine from possible wind damage. A battery back-up system's charge will degrade while sitting on a warehouse shelf for extended periods. To be responsive to our wind turbine customers' need for a critical part at a moment's notice, we are weighing the merits of supplying warehouses with battery trays and instructing UPS-SCS on how to charge the items prior to shipment.

Whether a customer wants to keep a spare part on his or her own shelf or rely on Moog to stock the part at a regional stock location, getting our customer's machines up and running quickly and safely is our parts-and-service goal. ■