

FLIGHT TRAINING SIMULATOR DAQ SYSTEM

G Systems' solution included a full upgrade and modernization of a system for the leader in flight training and simulation resulting in improved longevity, reduced size, and creation of a new and efficient means to generate reports.

CHALLENGE

A worldwide leader in flight training with over 50 locations around the world had a unique problem to solve and sought G Systems' expertise to find the solution. With dozens of flight simulators, each one unique for specific business aircraft flight training, the company must meet the simulation and training requirements for type ratings for both new and experienced pilot training. These simulators must mimic the look and feel of the aircraft they are representing,

right down to the intricacies of cockpit layout, controls, noises, vibrations and more. This is necessary to provide the most realistic and effective training.

Since the 1970s, the Federal Aviation Administration (FAA) has gradually expanded the permitted use of flight

SOLUTION

G Systems worked with the flight simulation company to provide the requested upgrade and modernization of the test equipment. All the hardware and software was replaced and integrated into a nice portable

roll around case in contrast to the much larger roll around desk the company was using. Brand new, state-of-theart hardware was utilized along with LabVIEW software and a modern laptop that served as the measurement controller. All the tests had a common software interface and seamlessly integrated with one another, creating a cohesive look and feel for all the tests.

G Systems' solution fit into a rugged self-contained case that could be transported and rolled around like modern luggage. The data acquisition (DAQ) hardware

simulation for training. Over the years, simulation training has become more and more accepted and approved with strict regulations by the FAA. As such, every Part 61 & 142 flight training center in the United States, must create reports for easy access to present to the FAA when requested. This data covers many different facets, all related to how well the flight simulators replicate their aircraft counterpart and conform to regulations.

> The company was in need of an upgrade to the way they were taking measurements and collecting data that would make the process more seamless and efficient, along with a means to more easily produce reports per FAA specifications.

consisted of two USB connected devices, and was tucked away under the shelf where the laptop sits. A USB-6211 Multifunction I/O device was used for most of the signal measurements while a USB-4431 Sound and Vibration device was

used for low-noise microphone measurements. Electrical isolation was placed between the simulators and the DAQs for safety and equipment protection. DIN mount analog input isolators were leveraged to protect the inputs of the USB-6211 analog devices. Two different connectors were paralleled to the analog inputs to successfully interface and service both the AST and NLX style of simulators – the two models used by the company.

The equipment now contains a self-test feature that delays the need for yearly calibration of the electronic modules



SOLUTION continued

inside the case. Normally, these modules must be removed every year and sent to a calibration facility. With the upgrade, this test can be done as needed without any disassembly.



Some of the previous solutions were written in an earlier version of LabVIEW and this allowed G Systems to more effectively understand which data would be necessary in their new software architecture. The parts of the software unavailable in LabVIEW were reproduced by the team and added to the final deliverable.

Since many of the measurement parameters were stored in a configuration file that was only accessible by someone with administrative permissions on each laptop, a configuration editor was added to make changes to the file more readily. This aided in development of the test by allowing easy measurement variations while comparing those to the older results.

Finally, G Systems used NI's DIAdem software to produce the reports that are submitted to the FAA. Using the DIAdem software allowed the team to adjust all the necessary labels, data fields, and graphs to ensure the new reports emulated the originals preferred by the FAA. These reports were sent wirelessly via FTP to the archive location on the company network to be stored indefinitely.

RESULTS

G Systems successfully upgraded and modernized the company's system by upgrading key technology and replacing obsolete hardware to improve longevity. The system was improved by reducing the size, utilizing a common software package, and creating an efficient means to produce detailed reports.

G Systems performed several tests on the simulators, mainly related to the motion generated by the six actuator legs supporting the machine. The following measurements were calculated:

- **Mechanical Frequency Response** override and drive the actuator legs on the simulators with a low frequency sine wave. This results in the simulator bouncing up and down rhythmically with the sine waves. The feedback from the simulator, which is reporting the extensions of the legs, is measured and compared to the control sine wave.
- **Inertial Leg Balance** override and drive the actuator legs with a low frequency sine wave and compare the feedback signal to the control sine wave looking at the phase of the movement.
- Turn Around check all legs motion recorded on a single graph.
- **Transport Delay** measures the integrity of the pitch, roll and yaw of the simulator.
- **Buffet** measure of vibrations exhibited by the simulator while performing various portions of a flight including engine full throttle, braking, cruising, and more.
- **Sound** measure of sounds the pilot hears during the operation of the simulator. A microphone is placed next to where the pilot's right ear would be located and a third-octave analysis is performed over 40Hz to 20kHz.
- **Diagnostic Mechanical Recording** diagnostic routine that could record and playback the feedback from the six legs to help them diagnose intermittent problems with simulators. (This was not in the original scope of the project but was easy to implement and proved to be a useful tool.)

The client was extremely pleased with the work G Systems performed. After the completion of this project, G Systems aligned with the client a half dozen more times for additional projects ranging from making cable assemblies, to creating new replacement circuit boards, to adding accelerometers to help streamline the maintenance for the older simulators still in operation.



Do you have an older system that needs to be upgraded? Do you want to have your system proactively designed with obsolescence in mind?

Let the our team of experts modernize your system and extend its lifespan. Contact G Systems today to learn more and get started on your next upgrade!

