COMFORT ZONE

A flexible CAN control box that functions as an intelligent test and simulation module is helping to make the testing of seat electronics more efficient

BY OLIVER FELS AND ARNE BREHMER

CANister is user configurable, which enables flexible use in production or in development for driving outputs and testing

Boeing and Airbus are forecasting a need for 32,000 to 38,000 new aircraft in the next 20 years due to high demand for mobility. For the lucrative long-distance market in particular, the manufacturers are forecasting around 8,500 new aircraft. Large, established and premium airlines have long recognized that they can survive only if they can offer their paying customers a flight experience that goes well beyond that of just transportation and focuses on the flight passenger – by means of exceptionally good comfort and service.

To improve the profitability of long-distance flights, airlines such as Lufthansa and American Airlines began to modify their class weighting toward more business class and premium class offerings. Introduction of the Economy Plus class – which is positioned between economy and business – also enables a comfort upgrade in the lower price segments.

Along with onboard multimedia offerings and services, passenger seats continue to assume greater significance. Often the functionality, space and layout of the seats are important decision-making criteria in choosing an airline. This has led to a high level of customization and many types of business and first class seats. Each airline insists on its own custom seat configuration and unique seat layout. To remain competitive, airlines need to update their cabin layouts and seat configurations at continually shorter time intervals and must increase their functionality and sophistication. An entire cabin configuration is completely updated every eight years on average, substantial upgrades are performed every four years, and sometimes the seats are replaced every one to two years. Seat manufacturers and suppliers benefit from the high demand, but they must also be able to handle the large range and variability of products. These challenges cannot be overcome without efficient methods and tools in development and integration tests.

TEST BENCHES FOR ACTUATOR CONTROL

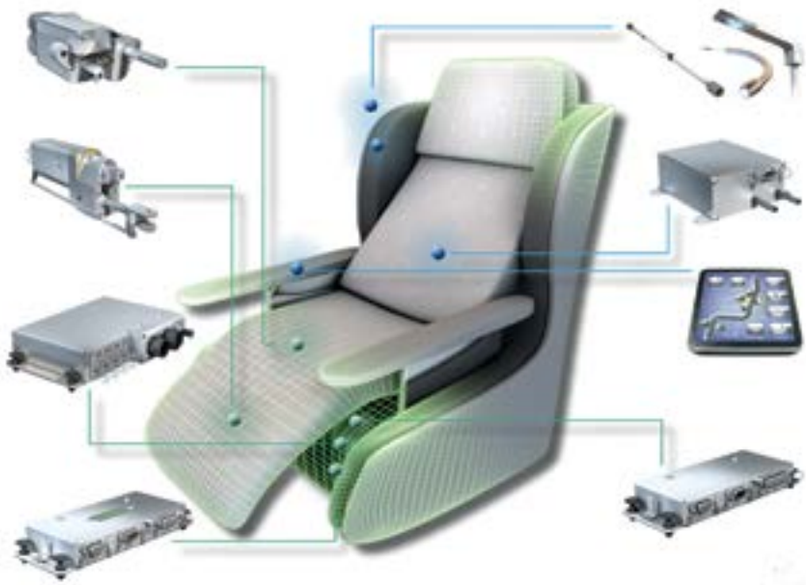
The company Dornier Technologie Systems – which has headquarters in Uhldingen-Mühlhofen, Germany, on Lake Constance – is a leading supplier of components and modules for passenger seats with very high comfort standards. The company develops and produces seat actuators, cabin lighting applications, pneumatic comfort functions, user control panels for passengers, and modules for power supply. The individual components are integrated into an overall system to fulfill specific requirements for a premium class seat for an airline and the specific seat manufacturer. Not only do the seats need to fulfill the test requirements of DO-160G (Environmental Conditions and Test Procedures for Airborne Equipment) and DO-178B (Software Considerations in Airborne Systems and Equipment Certification), they must also take other constraints such as low weight, quick and easy maintenance, low noise operation and flexible configuration into consideration.

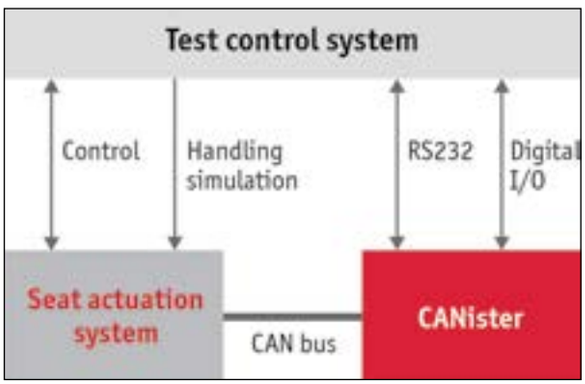
Because airlines place high value on brand recognition, there are many custom seat specifications. At Dornier, they result in an enormous number of variants in testing.

To fulfill specific functions, a business class seat is extended to include a number of additional electronic components such as: two to six linear and rotary actuators, power supply, digital control of lighting, pneumatic pump systems for massage functions, passenger control panel, controller for discrete control and seat interface, and maintenance interfaces.

In order to assure the required quality and reliability despite the large number of variants, Dornier uses tools such as Vector's CANister, which serves as a universal, handheld test device for development, final assembly and field use. As an intelligent CAN node, the device controls CAN-networked aircraft components such as control units, sensors and actuators, and it can simultaneously analyze response messages if the user desires. The mobile control box offers 16 user-assignable buttons and 20 user-assignable LEDs with which the engineer can make inputs and receive notifications. System reactions can be tested at the push of a button, for example actuating aircraft seats into the best possible position for shipping. Application cases range from a universal control panel to an intelligent tester or simulation module.

During development, CANister is also used to simulate passenger control units (PCUs). Since the PCUs are individually customized for the specific seat manufacturer and the end customer, they must frequently be procured as extra, separate devices





ABOVE: **Line-replaceable units of a seat actuating system**

ABOVE RIGHT: **Schematic for the use of CANister in automated test runs**

from a supplier. Dornier has reduced these procurement costs by simulating the PCU with CANister. In addition, tests and remaining bus simulations can be started earlier in development without needing to have the final versions of the PCUs on hand.

In final assembly, the finished and installed components are subjected to a final functional test to verify the functional integrity of each individual device before it leaves the company. CANister is used here to stimulate the devices with CAN messages in a semi-automated test procedure. In this procedure, CAN messages are sent periodically, and the responses of the CAN components are checked and visualized on the CANister device. In addition, individual components such as the pneumatic pumps for massage functions undergo a specific test.

CANister has proven its worth in the field based on its compact design. Here, Dornier uses it as a tester to check the functionality of the finished installation in the airplane. CANister's compact design and ease of reprogramming makes it relatively easy to change to different test scenarios and devices – and this offers savings when there is a need for different test revision levels and hardware that would otherwise have to be retrofitted with great effort.

BELOW: **CANister is used for functional testing during final assembly**

The seat actuator systems are used at different airplane seat manufacturers, which is why both high-speed CAN and low-speed CAN are needed on the physical bus level. Both applications are covered by a single CANister device, which saves on costs. The version used is equipped with one high-speed and one low-speed channel, and they may be used simultaneously.

It is also conceivable to use the CANister in automated test runs (see diagram, top right). The CANister will be connected to the test control system via an RS232 interface or digital inputs/outputs. Because the control box has many integrated inputs and outputs, it offers optimal communication and control options. In addition to its RS232 interface, the tester also has eight digital inputs and eight digital outputs, four analog inputs, and – depending on the variant – two Hall sensor inputs or two PWM outputs. This lets users connect conventional sensors and actuators without a bus interface.

CONVENIENT CONFIGURATION

Dornier uses the CANister Configurator to configure and program the CAN control box. In this Windows software, the engineer can easily define which individual actions the device should execute, and how it should react to events, for example by sending messages or turning LEDs or outputs on or off. Simple signal checks are possible with the Configurator, while special C programs are used for extensive evaluations of individual control unit messages and for sending the required responses. A function library makes the entire CANister functionality available to such individual programs and enables complex evaluations and test flows. In this process, Dornier is able to access existing models of the CANbus that were created in software development using the Vector analysis tool CANalyzer.

The Configurator is used to load finished configurations into CANister as a hex file. Requirements and constraints often change in development and testing, making program maintenance necessary. The combination of high-performance control box hardware with flexible configuration software can handle these situations ideally and enables quick reactions to them. A maximum of 16 different configurations may be stored in the device.

Airplane manufacturers must respond to increasing demands by airlines for customized cabin equipment with many different variants. For suppliers of passenger seats such as Dornier, this trend – which is expected to grow in upcoming years – means increased complexity in development and higher demands in testing. The described test layout with Vector's CANister implemented at Dornier is one of many applications in which CANister serves as a flexible tool for communicating with a network in development, production or in the field testing. ▮

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