

## CASE STUDY

### TOTAL TEST SOLUTIONS FOR AIRCRAFT BRAKE-BY-WIRE

When it comes to Aerospace and Avionics engineering there is literally no room for compromise. Product failure is not an option, so standards for both design and manufacturing are demanding and precise.



**FLEX 50**

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Test solutions play a key part in the manufacturing process by providing feedback to production and, vitally, ensuring that the product is entirely fit for purpose before use. When a new 'brake by wire' system was developed for commercial aircraft, choosing a test solutions supplier with a proven track record in delivering accurate, reliable systems was essential. Already enjoying a sound reputation in the Aerospace and Avionics industry, having provided test systems and applications for safety critical functions such as fuel measurement systems, ATE Solutions were entrusted with developing the tests.

As always with Avionics projects – and most others – both technical and commercial confidentiality are fundamental requirements. Essentially though, the product to be tested was a module comprising several printed circuit board (PCB) assemblies. Taking command signals from the pilot and various sensors around the aircraft, the unit sends control signals to the braking systems.

**ATE** A.T.E. SOLUTIONS

The first stage of the project was to define the test strategy and concepts, considering all the options and how they might work best together.



This was vital for several reasons. Firstly, it provided a high degree of test coverage, ensuring that the maximum number of potential manufacturing defects could be found. Secondly it helped avoid duplication of tests, which may have been an unnecessary expense. Thirdly it ensured defects could be found as early as possible in the manufacturing process. This minimises the rework cost, and also reduces potential risks to the long-term reliability of the product.

For each of the PCB assemblies, it was determined that automated optical inspection (AOI) during production would be followed by boundary scan test, in-circuit test (ICT) and a board-level functional test. The final assembly was then to be tested as a complete unit. There were to be individual test application fixtures and programmes for each PCB, all using a common single automated test (ATE) platform. ATE Solutions were tasked with providing all of the test solutions.

The second stage of the project was to define the test specifications. As ever with avionics projects the specifications were exacting. Combining ATE Solutions expertise in test solutions with the customer's design authority and manufacturing engineering input, detailed test specifications were produced for the test system and test application development. These were also to be used for the 'sign off' criteria during final acceptance testing, which again was very carefully defined.

From a technical perspective the project was quite straightforward. Drawing on knowledge and experience from many other aerospace, avionics and other high-reliability projects, it was possible to employ proven test techniques through boundary scan (JTAG), ICT and functional test in order to successfully meet the required test coverage and specifications.

Perhaps one of the more complex challenges was to understand the particular aircraft protocols used in communicating to and between the various board assemblies. This was particularly important in order to achieve a true functional test running at 'real life' speeds. In this case too, all functional testing was to be performed through the board connectors only, meaning full control of each board was required through its interfaces in order to exercise each functional 'block', as there was no direct access to each part of the circuit. Again, this required close cooperation between the customer's design engineers and ATE Solutions in order to understand the protocols and correctly implement them within the test system.

In addition to the challenge of producing multiple test solutions for a demanding project, timescales were also very tight. The design of the assemblies was completed closer to the planned manufacturing start date than had originally been expected, which put added pressure on the development of the test systems. Fortunately ATE Solutions were able to draw on their configurable, commercial 'off the shelf' (COTS) ATE architecture, called FLEX, which significantly reduced both system design and manufacturing lead times. This allowed the first system and application to be delivered on time, with identical repeat test systems following at the agreed intervals after.

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