

MODE S TEST EQUIPMENT

Pulse test equipment to raise your blood pressure

BY GARY PICOU

Mode S (for Mode Select, by the way) transponders have been lurking in the background for more than a dozen years. Their ability to transfer data from the air to the ground, and vice versa, has long offered some exciting potential. In the 21st century, we MAY see this potential realized, with safety enhancing datalink capability such as traffic advisory and weather uplink.

Finally, we can sell Mode S transponders to our customers with the sure and certain knowledge that they will benefit from the device. We know that the FAA will benefit from the increased capabilities in Mode S that provides for better air traffic control. We won't mention the fact that the discrete address provided by Mode S will make collecting fees for using the airspace easier than swiping a card at Wal-Mart.

Back to the subject. If we install Mode S, we necessarily must test and maintain it. You can't function test this system on the ramp, like Loran or GPS. You need to fully exercise the functions. Since this is a transponder system, you will need to exercise the system every two years. This requires test equipment.

Mode S test equipment is among the priciest stuff around. The market is so

very specialized that the sales volume is very low. Even with three manufacturers competing for your test equipment dollar, there is no easy way to reduce this cost. Consider this, if every avionics shop in the world bought TWO, that would be fewer sets than the Series X headsets that Bose sells in one day at Oshkosh.

There are three manufacturers of Mode S test sets, IFR Systems of Wichita, Kan., Tel-Instruments Corp. of Carlstadt, N.J., and the JcAIR division of Goodrich, in New Century (near Olathe), Kan. These manufacturers make bench and/or portable test sets for civil aviation.

IFR Systems

IFR makes two Mode S test systems, the ATC-601 for ramp, and the bench-only ATC-1400A. Many of us have used the ATC1200Y3, and the 1400 is the logical progression. The digital LED readouts replace the tiny analog meter for power, PRF etc., but most of the familiar controls are still there. The ATC-1400A also requires a Mode S adapter, the S-1403DL/MLD.

This adapter is required for the new datalink and ADS-B capability for Mode S. The S-1403DL Mode S Accessory Unit (which is replacement for the S-1403C) supports the new

Mode S datalink and ADS-B. The "DL" is backward compatible with the "C" model, current ATE programs implemented on the S-1403C will operate with the S-1403DL without program changes. The optional MLD function is available for testing Mode S transponders with MLD requirements.

MLD stands for Multi-Level Diversity. This has nothing to do with workplace ethnicity, but instead is related to the top and bottom antenna signals. While this isn't a discussion about Mode S theory, we'll just mention that it is vital to a Mode S system installation to process the signals arriving from the top and bottom antennas properly.



IFR's ATC-601

A more practical solution for the small, flight line shops is to use the ATC601 (\$12,600) as their bench and ramp tester. Although the 1400A is a very capable unit, the bench repair of this sophisticated Mode S system is falling to the larger shops and avionics manufacturers. Even with the automation, the return to service test time for the Mode S can take longer than to troubleshoot and repair the high voltage to replace the cavity in an AT-50A! We have better things to do around the shop.

The ATC-601 is completely automatic. This means that the technician who is doing the 91.413 testing doesn't have to be trained in the esoteric Mode S theory, and know exactly what the UF means. All he has to know is if it passes, you must accept.

The automation also means that these tests will run much faster at the machine speed, instead of human digital manual speed. Plus, there is no chance of missing a step, or making a mistake in the interpretation.

This spring (in fact as you are reading this), IFR will offer a memory expansion hardware modification. This development will support a staged software development of the ATC-601 to support enhanced surveillance. Any ATC-601 can be modified by return to either the Wichita or Chandlers Ford (UK) service centers.

Barry Beasley, product development manager for IFR Systems, said, "The advantages to our customers are, no need to buy a new test set. No need to re-train on a new test set. And this will be the most comprehensive decode and display of Mode S data on any test set currently available."

IFR says that the battery should last for two hours. A backlit 6-line LCD display provides the readout, and the information can be sent to an RS232

print port for posterity.

The ATC-601 tips the scales at 30 pounds.

Unlike the ubiquitous ATC-600A, the 601 does NOT include a DME test capability. Therefore, you'll have to hang on to the 600A for a few more years if you want to service the dwindling DME market.

JcAIR

The JcAIR subsidiary of Goodrich makes the ultimate of Mode S bench testers. This is also pricey, at \$43,495. Still, if you have depot level repairs to do, this may be a cost effective option. Test parameters can be stored and retrieved from a disc, and the color LCD touch screen display provides a straightforward "digital" input

through the index finger.

Called the SD X2000, this is a fully programmable RF signal generator that provides complete test capability for all commercial and military L-band pulse equipment. That includes not only Mode-S transponder, but ATCRBS, DME, TACAN, and the military IFF system. Since the system software is a more open architecture, the system can be updated from the disc drive when necessary, saving down time and the always risky test equipment shipping process.

Tel-Instrument Electronics Corp.

We know and love 'em as TIC, the granddaddy of avionics test equipment

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Tel-Instruments' TR0-220



JcAIR's ST X2000

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manufacturers. Known for rugged designs with big knobs and buttons, their Mode S systems are no different. Although 10 pounds less than the IFR unit, both the TR-220 multi-function and the T-49C transponder test sets have large displays and knobs that us “mature” technicians will enjoy, especially on a cold day.

The T-49C (\$13,900) Test Set is for ATRBS MODE A & C and MODE S transponders as well as TCAS I/II systems. It is a battery powered ramp tester unit that receives and radiates signals to the aircraft equipment from the supplied antenna.

For MODE S and ATRBS, an antenna coupler unit is provided to measure transponder transmitter power, receiver frequency, receiver sensitivity, and diversity.

The T-49C allows simulation of TCAS intruder scenarios (ATCRBS and Mode S targets) as well as the transponder tests.

The T-49CA is available with dual antenna couplers for diversity testing, for \$600 more.

The TR-220 (\$18,900) is a Mode S test set, which also will test DME and provide intruder signals to test TCAS systems. Like the T-49, it is self-contained and battery operated. The test set can be operated over-the-air using a hand-held directional antenna or directly connected to the unit-for bench testing, or maybe to check the transponders onboard to verify the antenna system.

The TR-220 is capable of receiving and transmitting 1090 MHz squitter, both DF17 and DF18. The TR-220 can handle various squitter formats including airborne and surface position, velocity, aircraft category and identification, Mode S address, and latitude/longitude. ADS-B capability is available as an upgrade.

To quote Rod Coday of Tel-Instrument, “The TR-220 provides a complete, comprehensive ramp test of a Mode S transponder. The TR-220 provides test capability for modes A, C and S. The TR-220 determines the capability of the transponder (ATCRBS only, Mode S Level 1, etc.) and performs the appropriate tests. For Mode S, the TR-220 performs a test of each Mode S format. The TR-220 displays the various Mode S data received from the transponder including Mode S address (Hex and octal format), vertical status bit, air/ground bit, country code decoding, tail number decoding, diversity, and squitter period (surveillance and extended squitter). The TR-220 determines the transponder receiver sensitivity (MTL), power and frequency.”

This makes the TR220 look like a great partner for the ramp technician.

AEA Members . . .

If you have airplanes to work on, you’ll need some way to verify the Mode S operation. These are becoming increasingly popular as the services offer on the datalink will proliferate.

We can expect to see more Mode S in the future—can there be a better way to track and monitor aircraft for security reasons?

DF17 and extended squitter

A large part of the interest in Mode S installations and testing is related to new requirements and services available through the transponders. These are specific services, like Flight Information Services and Traffic Information (TIS) and depend on advanced transponders to fire off aircraft data both on request (and TCAS), and unsolicited in the form of squitter (ADS-B).

The purpose of extended squitter is to provide additional information regarding aircraft position; intention

and status in the air and on the ground on an unsolicited basis i.e. listen only.

To quote IFR’s Beasley again, “This will form an important part of the ADS-B (Automatic Dependent Surveillance Broadcast) system, which relies on each Mode S equipped platform basically transmitting ‘I am xxx aircraft and this is my position.’”

If you learn nothing else from this article, we want you to be very conscious about your choice of the Mode S test set. Look for ones that are capable of the enhanced capabilities. The motivation for Mode S in your customers aircraft is going to be ADS-B, FIS and TIS.

All of the manufacturers here offer this capability. But not all of the test boxes they make are so equipped. Be specific in your request for quotation, this is too expensive an investment to make a mistake. When your customers want to install equipment to take advantage of the new systems for traffic advisory and graphical weather, you’ll need this gear to not only support new installations, but to check it every two years thereafter.

In conclusion. . .

You are probably saying, “OK, tell me what Mode S test set to buy.” Sorry, we can’t do that. One, because all of these manufacturers are treasured members of your faithful AEA, who are all jumping up and down saying “Pick me, pick ME!”

Two, because there is no perfect answer for any case, or even the limited number of cases we could cover here. Your decision tree goes like this—What kind of customers will predominantly want my services in the future? Bench, routine ram tests? Installation verification?

And what is the skill level of the techs you have doing routine transponder tests? If you want a quick and profitable Appendix F Biennial, dragging the unit to an

ATC1400A/S1403DL is not appropriate, neither is a SDX2000. But they ARE perfect for a depot-level facility that will see more and more of these in the future.

If I were going to add one to a small shop to do routine tests, I'd see which supplier was the best service, like Edmo for IFR or Avionics International for Tel-Instrument. Negotiate, bargain. Technically, these are all really good products that will bring in years of revenue. q

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