Independent 1553 Validation Testing: What's it Worth?

**An experienced 1553 tester tells what
to consider in the decision to test in-house or out.**

by Leroy Earhart

Having just built up your 1553 remote terminal (R I) proto type, you are ready to characterize it. Whether the contract calls for passing the RT Validation Test Plan or just "meeting MIL-STD-1553," only comprehensive testing can properly assess the performance of your RE Should you do it yourself or hire outside help? The answer depends on your personnel, equipment and experience. If your company has 1553 projects year after year, you may want to develop your own facility. For other companies, however, hiring a service that specializes in 1553 validation testing could be more cost-effective and add credibility. If you are going to hire a testing service, here are points to consider.

A testing service should have specialists in the 1553 standard and Test Plan who have experience in testing 1553 RT designs. This is not to be underestimated. A specialist's knowledge is crucial because the intent of some tests does not always come across clearly. A specialist who has been involved in writing 1553 test plans finds it easier to read between the lines and perform the proper tests.

On the practical side, the specialist is familiar with components from many different manufacturers (protocol chips, transceivers, transformers, etc.). He is also aware of component problems that SEAFAC missed in its evaluation) The specialist should also be aware of interaction problems between components, circuit-board layout and LRU pine replaceable unit) design. He must

ported by hardware and software that have been field-tested successfully on many customers.

A testing service should complete testing in a reasonable amount of time, ten to 12 hours for one RT, for example. Additional time can be spent trouble-shooting if problems are found. Test personnel should be able to quickly determine whether a problem originates from the user (i.e. software or circuit board layout) or is inherent in components (transceiver or protocol chip, etc.). By solving problems early, you save time and money, enter production sooner and avoid redesigns.

Problems should be expected. The 1553 databus provides a lot of flexibility to accommodate different applications. As a result, protocol chips have been designed to provide a lot of capability and flexibility. This flexibility means that there are just that many more ways to miss something

in the design. Many designers also find clever ways to create problems through misuse. In the four and one half years we have tested, *not a single RT passed the Test Plan on the first try.*
Here is a glimpse at how our service operates. Testing is performed in three major areas: electrical, protocol and noise rejection. When problems are found, fixes, work-arounds or component replacements are suggested. Through previous testing, we've discovered numerous failures in some components (see table).
Software tools for fault isolation are available for trouble-shooting: modifying pass criteria can isolate problems such as a late response or a status bit that is repeatedly set (and causes multiple failures). This allows us to determine if a particular

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Common 1553 Remote Terminal Problem Areas

Component Problem Areas
Noise Rejection
Threshold Levels
Input ZCD Tolerance
Late Response
Setting of Terminal Flag Bit
Mode Command Implementation
Detection of Sync Error

Hardware Design Problem Areas
Input Impedance
Crosstalk (Output Isolation)
Output Noise
Output Amplitude
Ground Plane
Wrong Transceiver Chosen
Wrong Transformer Chosen

Software Design Problem Areas
Initialization of Protocol Chip
Use of Status Bits
Reset Remote Terminal Command
Bus Switching
Initiate Self-Test Command

test fails for more than one reason or if it is one of many tests affected by a single problem. Modifying pass criteria can also identify conditions that meet the equipment specification but fail the Test Plan. Off-line testing and fault isolation are necessary when failures are found. We isolate the problem so that the customer can reproduce it, fix it, then verify the solution.

Customers have told us they are spared weeks of preparing acceptable test procedures and documentation in addition to the time to become familiar with running all of the tests. We provide an Air Force approved test procedure for implementing the tests and obtaining repeatable results. A comprehensive test report is issued to document the results.

Component manufacturers can use a validation service to get more complete testing and assure their customers of a better product. Purchasing validation hardware and software is also a possibility for manufacturers or customers who eventually decide to set up their own facility. The testing service is also a resource for contractors to check out boxes they receive from their vendors. (The tendency to do less testing instead of more is quite prevalent.) Relying on the vendor to supply a compliant RT without a test report for verification may be unwise.

In addition to validation testing, we also provide other services. If the customer needs help following testing, he can rent test equipment for reworking a design. Pre-design consulting, where recommendations are given for components to use, or a complete design review, are available to prevent problems down the line.

Whether you are looking for a consultant, need to get involved in comprehensive testing on a limited basis or just want to observe a model before setting up your own test facility, an independent validation testing service can expose you to a proper test environment and glue quality results with minimum time and expense. ✈

Leroy Earhart is founder and president of Test Systems. He has more than 15 years experience in 1553 hardware and test equipment. is a member of the SAE task group that developed 1553 test plans and was a major contributor to the RT Validation Test Plan..