

Cost-Effective Assessment of System Reliability Using Data from Subsystem/Assembly Level Testing

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The paper describes a simple method developed to use and combine subsystem or assembly level accelerated test results with the system level test results to estimate achieved overall system reliability.

The need for an improved method of assessing system reliability is based on the recognition that one of the major constraints of most programs is the length of time allowed for reliability assurance testing of the completed/assembled system. The time schedules for product delivery usually do not allow adequate test duration for system reliability assessment or demonstration with a desirable degree of confidence. Also, the complexity of failure isolation and diagnosis at the system level, along with the implementation of corrective action can be an additional cause of undesirable delays and schedule slips. With the assembly level accelerated testing and reliability assessment, a special attention can be devoted to those assemblies identified to need additional test time and the reliability and quality improvement.

To reduce the test duration, test acceleration is usually applied. In addition to the limited available system test time, there is the issue of appropriate test acceleration for a system. This issue can become very important in case of complex systems. Different subsystems or assemblies usually have different critical failure modes and different failure mechanisms. The proper type of test acceleration applied is the one that is related to the specific failure mechanism, i. e. thermal, electrical, dynamic, etc. Adequate test acceleration can be determined with more accuracy for assemblies of smaller size to minimize over-stress or under-stress of individual components or groups of components.

The method of combining the assembly, subsystem, and system level test results allows assessment of the system reliability with considerable cost and time saving.