

## Introduction

There is no need to invent a test method to demonstrate that your aerospace component or system will comply with the demanding stresses of flight. A team of people have already been doing that and composing testing standards since the 1940's. Environmental testing in the aerospace industry is an industry all its own. When you work with an experienced aerospace component supplier, consider the environmental requirements you are imposing, what value they add, how you are measuring success, and how they impact your project constraints.

many unique applications. The efficiency is due to the extensive list of detailed processes contained within them. The standards contain the information needed (that can be tailored) to successfully write environmental test procedures that laboratories across the world can execute.



## Define Success

The process of imparting environmental test requirements begins by including the test requirements in a technical specification flowed down to the manufacturer. It is as simple as identifying the environments the product will need to survive in service and then calling out the paragraphs and categories for each applicable test contained in RTCA/DO-160 or MIL-STD-810.

The supplier will then be obliged to claim compliance of the design to these requirements via actual test, analysis, or similarity. There is usually a cost and lead time associated with any of these compliance methods. This is where it becomes apparent that only the tests that need to be run should be completed. Actual tests will require a test procedure to be approved and signed off internally at



## “Standard” not “Specification”

RTCA/DO-160 and MIL-STD-810 are two revision controlled documents maintained by the Radio Technical Commission for Avionics and the United States Military, respectively. They exist to generate confidence in environmental worthiness and overall robustness of component and system design. The documents can be used to efficiently write tailored requirements for

the manufacturer and with the customer. This is an opportunity to customize the test method, ensure the most value, and impart rigor into the test practices before the test takes place. The procedure can also contain terms and conditions - such as the right for a customer to witness testing, how to handle failures and hardware returns, and some general program information.

Whenever a test is required, pass/fail criteria must be defined as the standards documents are intended for many devices with many failure modes. This is commonly referred to as an acceptance test. Analysis requires a form of calculation or simulation to show that a model or concept representative of the final device is compliant to the prescribed stresses the manufactured hardware will be subjected to. In practice this requires an immense attention to detail that can only be completed by experienced engineers. Every material, material condition, fit, dimension, tolerance, and joining method must be outlined and discussed prior to acceptance. Also discussed would be the method of analysis and the sources of data. Similarity requires previous testing on an objectively similar device that satisfies the requirements of the new specification. A comparison of the bill of materials or parts, materials, and process list would be required for similarity.

There is an element of subject matter expertise required when determining the effectivity of analysis or the similarity between two products and tests. Therefore the most robust option is usually to complete a test, especially if you're partnered with a supplier that has standard

work associated with completing the tests. It can be quick and cost effective since RTCA/DO-160 and MIL-STD-810 allow the use of common language and process from part number to part number. The output of actual test, analysis, or similarity will be a report containing photos and data evidence of test results that can be reviewed and archived for future use (Similarity on another part number, for example).



## Robustness vs Reliability

MIL-STD-810 and RTCA/DO-160 don't require a specific sample size of items to undergo testing. In many cases for aerospace, the test articles are prohibitively expensive or too complicated to make more than several. So in order to add value and demonstrate meaningful compliance, many of the test methods simulate a lifetime or great deal of exposure by subjecting the test article to increased stress levels for reasonable short periods of time in order to make designs available to support the program schedule. Of course the stress cannot be so great as to create unrealistic failures.

Even when a device satisfies the requirements of a test, one can't make any statistical inferences about the population with a sample size of 1. This means one cannot make any guesses about the mean or standard deviation. However, a one piece qualification test quantifies that the design meets the functional requirement (pass/fail). Reliability testing in aerospace refers to the amount of time a device or group of devices can survive an environment without diverging from its intended functionality and causing a performance non-compliance. The calculations, methods, and criteria for understanding and executing a reliability test program are not covered by RTCA/DO-160 or MIL-STD-810, as it is a different topic.

## **Program Management**

Someone responsible for completing the testing on the manufacturers end should always be present from the earliest design reviews. The program schedule's critical path follows the procedure composition, hardware availability, test equipment / lab availability, and then time to complete the test and interpret the results. A program kick off with a test engineer and project manager will allow all the stakeholders to understand complexities, compliances, and non-compliances of the design under consideration. The test engineer can address test readiness and identify standard work (tests) vs. unique tests that may require additional time to complete and potentially drive test costs.

## **Summary**

G.W. Lisk has been a supplier to the

aerospace industry for decades and with that comes experience navigating the intricacies of RTCA/DO-160 and MIL-STD-810 testing needs. We have extensive internal test capabilities and partner with various certified test labs for a full breadth of testing capabilities. Please visit [www.gwlisk.com](http://www.gwlisk.com) for more information or contact our customer support at [sales@gwlisk.com](mailto:sales@gwlisk.com) for more information.