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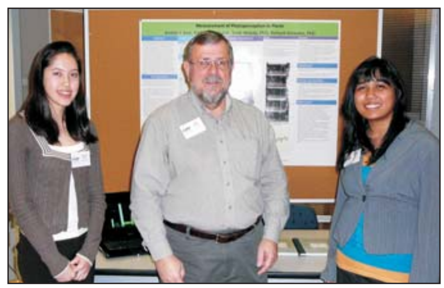
Getting the Process Right: MIL, Space and ISO Standards

Gary Breed
Editorial Director



This issue's featured tutorial article explains where to find key MIL, space and Hi-Rel standards. With attention focused on this topic, it's a good time for some reminders why these standards are important; why they are a lot more than simply the rules for a supplier/customer game.

Key standards for military, space and other high-reliability products emphasize adherence to well-defined processes and procedures. Similarly, the ISO 9000-series of standards establishes appropriate processes to ensure consistent, high quality business operations. These standards address the methods used in manufacturing, measurement, documentation, and other business functions. Ideally, the guidance (and enforcement) of these standards will ensure that products are built, tested and delivered in a manner that will result in consistent performance for products manufactured at different times, along with accurate records that confirm compliance, and provide a means of examining "what and when" in the event that problems arise later on.

When I was much younger, my first reaction to such firm rules was predictable, "Hey, I know how to do this. Why bother with all the extra paperwork?" I discovered the answer to this question the first time a failure occurred and another question—"Why?"—needed an answer. Without a defined methodology and a formal system of record-keeping, we can only guess what happened. Of course, there are many situations where a minimal approach is acceptable: non-critical work, some very low cost (disposable) manufacturing, and products with little or no effect on health and safety. But, when a product is expected to perform at a very high level, with high reliability over time and under severe conditions, we need exact answers when performance declines, or something fails to operate.

There is another benefit to strong standards—they ensure that the buyer has done all the necessary work to define the required performance of the products they will put into service. When the highest performance and reliability are the objectives, both the buyer and seller need to have a 100% certain understanding on performance definition, and the criteria that will ensure that the required performance has been achieved.

When I started writing this column, I did not expect to make a connection between these performance and quality standards and the student projects in the regional Capital Science and Engineering Fair, where I recently served on the judging team. Surprisingly, one of those projects made that connection quite clear.

In this month's photo, I'm pictured with Amber Kazi and Kathleen Ralph, whose project was the top entry in the team category. Although their project was done under the guidance of University of Wisconsin professors, it was not simply "cheap labor" involvement in a university research program. The actual work of this project was studying plant growth under varying light conditions, comparing responses of normal plants and a common mutant version—but its true purpose was more than biological research.

Kazi and Ralph were testing this experiment as a possible teaching tool at the high school level. They were expected to develop the entire project—grow the test plants and identify enough mutant plants to establish a comparison group, figure out how to control the light exposure, decide what response data to measure, make all the measurements, and analyze the data.

This is classic instruction in the *scientific method,* the keystone of experimental science. Which brings us back to process standards, since that is a perfect description of the four rules of the scientific method. They are worth a review:

1. *Identify the Problem*—Scientific inquiry begins with thoughtful observation of a particular phenomenon that we would like to understand.

2. *Formulate a Hypothesis*—To explain the phenomena, we must suggest a possible causal connection, or a mathematical relation.

3. *Make a Prediction*—Use the hypothesis to predict other phenomena, or to predict a quantitative result of new observations.

4. *Test the Hypothesis*—Perform experiments that confirm (or disprove) the prediction, then have independent experimenters verify the results in their own properly performed experiments.

We enjoy the wonder and speculation of Steps 1 and 2, but Steps 3 and 4 are the downfall of much scientific work. Designing a good experiment, doing it properly, then having others repeat it involves a lot of work. We often attempt to take shortcuts, which may lead to erroneous, unconfirmed results. But even small errors can create big problems, so we always need to follow the correct process.

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