Introduction

Verification is the process used to verify that your product meets its requirements. This is also traditionally called test engineering. The verification is independent of the actual design and implementation of product. In fact, at many companies and organizations, there are systems engineers, or test engineers, or verification engineers, that are creating verification plans in parallel with the design engineers actually designing the product.

There are also times when the verification engineers find an issue with the wording of a requirement that makes it untestable. In this case, the team has to meet to decide on new wording of the requirement. This is why the verification plan is due at the same time as the final requirement updates.

In these courses, verification consists of verification plans, verification process and evidence, and verification analysis.

Reference/Recommended Reading:

1. *NASA Systems Engineering Handbook*, Section 5.3

Applicable definitions from *NASA Systems Engineering Handbook:*

Verification

Verification is a formal process, using the method of test, analysis, inspection or demonstration, to confirm that a system and its associated hardware and software components satisfy all specified requirements. The Verification program is performed once regardless of how many flight units may be generated (as long as the design doesn't change).

Qualification

Qualification activities are performed to ensure that the flight unit design will meet functional and performance requirements in anticipated environmental conditions. A subset of the verification program is performed at the extremes of the environmental envelope and will ensure the design will operate properly with the expected margins. Qualification is performed once regardless of how many flight units may be generated (as long as the design doesn't change).

We will just use the term **Verification** for both of these activities.

Verification Plans

Verification plans are a formal set of testing procedures that will provide the evidence needed to show that the requirement has been met, or not met.

The verification plan shall include the parameter to be tested, which must be the parameter described in the wording of the requirement. It must also include the procedure used. This can include demonstration, inspection, or test[1]. It also includes the required equipment to produce the evidence. The evidence may be data (test), an image(inspection), or a movie(demonstration), etc.

Many times, the student and the program do not have access to the required equipment for an ideal test. This is common. In these cases, the student is to research and describe the ideal plan in addition to an alternate, non-ideal plan that is realizable. This should include a rationale for having to use a non-ideal plan.

Verification Process

Once the plan is complete and the product is designed and implemented, the verification process can begin. If you start the process before implementation is completed, you must be confident that later additions to the design will not cause the requirement being tested to fail after the verification.

The result of the verification process is the evidence. If the evidence is in the form of data, it shall include data with the units described in the requirement. For example, if you have an accuracy requirement in units of ±%, you cannot just show the measured value, you must calculate and include the % difference. See ***Appendix F – MixedSignalErrors.pdf***

Verification Analysis

Once the verification process is complete, you must analyze the evidence and indicate, in your engineering judgment, if the requirement is met or not. However, this can be an iterative process.

Any verification discrepancies are identified and reviewed to determine if it is due to a nonconforming product or the result of poor verification procedure or conditions. If possible, this analysis is performed while the test/analysis configuration is still intact. This allows a quick turnaround if the data indicates that a correction to the verification plan needs to be made and the test performed again.

If you completed the verification process, you really have four possibilities:

1. The evidence shows that the requirement was not met.
2. The evidence shows that the requirement was met but the process was not ideal so the results may not be accurate or complete.
3. The evidence shows that the requirement was not met but the process was not ideal so the results may not be accurate or complete.
4. The evidence shows that the requirement was met.

Cases 2 and 3 are the reasons engineering analysis and judgement is important when trying to determine if the requirement was met or not.

The other possibilities are:

5. The verification process was not completed.
6. The requirement was not approved so could not be verified.

All of these, need to be documented in the requirements and verification document.