

THE TOP 5 THINGS TO CONSIDER WHEN AUDITING A MILITARY TEST LAB





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This paper goes into some detail on a few of the items that must be considered when looking at a laboratory. This is not an in depth look at each item but are items to consider when auditing a test lab for MIL testing. While MIL-STD-461 is called out in this paper, other standards would equally be important for consideration. Limiting this paper to one standard simplifies the discussion.

Regardless of the limitations of standards called out in this paper, check that the laboratory is accredited and that the standard or standards that apply to your product are included in their Scope of Accreditation. If the use of an accredited laboratory is required by your contract, and the laboratory isn't accredited, you will need to look at a different laboratory. If they are accredited, and the Scope of Accreditation includes the appropriate standards, do your audit.

1 Is the Laboratory Truly Capable of Performing Your Needed Tests?

What are the standards to which your product must be tested? Which version of the standards? When you test the product it must be to the correct version. And the test report from the laboratory must call out the correct version. The latest version is not always the right answer. Keep in mind that the version needed may not be the latest and greatest.

Why is it important for you to know which version of a standard or other document applies?

Contracts written by procurement agencies may not call out the latest version of a standard. They may take the requirements section of a previous contract and copy it into the new one, even though standards may have changed in the intervening years. Does the contract call out, for example, MIL-STD-461F instead of the more recent MIL-STD-461G? As noted below, there are important differences between the two versions. Which one do you need to audit the lab against? Don't just assume that the latest version applies. Check your contract, make sure you know which version applies, and audit the laboratory to ensure that they know and can test to the applicable version. Also, to what version or versions of the standard is the laboratory accredited? If the version called out is not one to which the laboratory is accredited, you may have further problems.

MIL-STD-461G (and at least F, E and D before it), uses undated references to external documents. This means that the laboratory must use the latest versions in order to claim or show compliance with the standard. The laboratory does not have the flexibility or authority to use an earlier edition if it exists. Sometimes the differences are minor, other times they are not. And, changes to those documents may occur out of sync with the new version of the standard you have applying directly to your product. Does the lab have the correct (latest) version? Are they using it? How do they know if what they are using is the latest version? You need to check. Their accreditation documentation, especially their Scope of Accreditation, is a good place to start your search.

2

Versions of Standards

We called this out above. Let's take a quick look at a few of the differences.

MIL-STD-461G calls out a number of tests to which you must test your product. Do you know which

ones apply to your product? Not all do, or not all have the same limits depending on the product and its end user.

What does the contract for your product call out? Is it MIL-STD-461G? How about MIL-STD-461F? Does the contract call out the latest version? What difference does it make?

A quick look at the differences in tests called out in the two versions is instructive.

MIL-STD-461F calls for testing to the method and levels in CS106. CS106 is conducted susceptibility, transients on power leads. This test method and levels applies to power input leads on surface ships and submarines that obtain power from the platform's primary power source that are not part of the EUT. MIL-STD-461G does not call out CS106. It was deleted in the new version of the standard. Does your contract call out MIL-STD 461F? If it does, and CS106 applies to your product, can the lab perform the test? Do they still have the equipment and expertise? This can be important.

MIL-STD-461G added a pair of conducted susceptibility tests that might apply to your product. CS117 (conducted susceptibility, lightning induced transients, cables and power leads) and CS118 (personnel borne electrostatic discharge).

CS117 is applicable to all safety-critical equipment interconnecting cables, including complete power cables, and individual high side power leads. Article 5.15.1 of MIL-STD-461G details more applicability for this test. This test is very important if your product is to be used where lightning may occur.

CS118 is applicable to electrical, electronic, and electromechanical subsystems and equipment that have a man-machine interface. It is not applicable to ordnance items. ESD may not be of critical importance in the mind of the user if they are located

in an area where high humidity levels are common, but what about areas, such as Washington, DC or Denver, CO in the winter? These areas (and many more) may have very low humidity levels and ESD is a serious concern. If CS118 in MIL-STD-461G applies to your product, take it seriously. Make sure the lab does, as well. A good question to ask the laboratory deals with how they handle the test when the laboratory conditions are not within the tolerances called out in the standard. For example, if the humidity in the lab is too high or too low, what do they do? Same for barometric pressure. How do they determine it? Corrected to sea level (like you get in weather reports) or actual pressure? Is their barometer calibrated?

Are either of these tests applicable to your product? If so, does the lab have the capability to perform the tests to the levels required in MIL-STD-461G? Remember, these were new as of MIL-STD-461G. Is the lab accredited to MIL-STD-461F or MIL-STD-461G? Or both? These new tests can be critical to the long term success of your product, so make sure that the lab can perform these tests correctly and well.

3 Instrumentation Calibration Records

Check the laboratory's quality system for how test equipment is to be calibrated and labeled. Some labs require that the expiration date of the calibration be included on calibration stickers, others do not. Find out the lab's requirement and check some instruments to see if the lab's own requirements are being followed. If an instrument does not have a calibration sticker on it, find out why. It may be legitimate, such as a controller for a turntable or antenna mast, or it may not be legitimate and the lab either forgot or is hiding something. Find out. How are antenna calibrations (among others) tracked? How are the new antenna factors loaded into measurement software and how does the lab ensure that the new

factors were loaded correctly? The same goes for other items that require periodic calibration and loading of correction factors. A classic example is the insertion loss of antenna cables. Clearly a function of frequency and the loss file is unique to each cable. Are the cables labeled so the correct file is used for the correct cable?

This can take a significant part of the time of the audit. Don't just look at a few items of equipment and assume that they represent the laboratory as a whole. Randomly select a number of pieces of test equipment as you tour the laboratory and have the lab personnel show you the calibration records for them. An inability or unwillingness to show you the records is a red flag. If the laboratory is accredited their documentation should be in good shape in this area, but you need to check, anyway. The on-site assessor may have missed the instrument(s) you checked and their calibration documentation may not be in compliance with their own requirements. Check.

4 "Sanity" Checks

Does the laboratory perform periodic checks of their test systems to ensure that they are working properly and providing valid results? If so, how often? If not, why not? How are the results tracked to identify systems that have "gone out of spec"? Are the results reviewed to see if systems are moving towards an "out of spec" condition so that they can be taken out of service and repaired prior to failure? Does the laboratory have back-up equipment that is operational and in calibration so that they are able to continue to perform any tests that your product may require while the primary equipment is out for calibration and/or repair? Or are you able to take a schedule hit while their only example of a test system is down for repair or calibration? It's your call on this last question, but you need to be aware of it and its potential impact on your product schedule. The

presence, or absence, of sanity checks, the records of them and evidence of the use of them to make sure that the equipment is functioning properly is a good indication of the overall quality of a laboratory.

Again, check the lab's quality manual and see if this is included. If it is, are they following it?

5 How Does the Lab Make Sure That the Correct Version of a Document is Used?

Ask the laboratory personnel to show you how they check to make sure they are using the correct version of a test standard, and how they know that they are using the correct version of the laboratory's procedures, as called out in the quality manual. This is important and can tell you a great deal about the quality of the laboratory's results. Remember that earlier we said that contracts may not call out the latest version of a standard. We also mentioned that, for example MIL-STD-461, standards may use undated references. This would mean that even an older version of a standard, MIL-STD-461F for example, may still require the latest version of a document referenced in it. Is the lab using the latest version of a referenced document? As asked above, how do they (or you) know? Find out, this can be very important to you when dealing later with the contracting agency.

6 What Happens if the Computer Running a Test Fails and the Test Must Go On?

What did the title of this paper say? "The Top 5 Things..." Well, here's a bonus item for you.

Ask the lab to show you how they perform a test if the computer that normally runs the test fails. This may not apply to all tests, but an example where it might is radiated emissions. Normally a modern laboratory has a control computer that runs the test and

test equipment. It does the data reduction and prints out the results. Have the lab personnel demonstrate how they would perform the test by hand if the control computer failed. Not only how they would gather the data, but how they would reduce the data to provide a final set of numbers to compare against the limits and how they would manually present these results. Normally this isn't an issue, but what if the computer died and you need the results immediately, not a week or two later. This is also a good way to check the training of the laboratory personnel. Are they just button pushers, or do they really know their stuff? This will show you if they do know what they are doing and if the software is telling the truth.

Conclusion

This is just a short, and non-comprehensive, list of items to look at. Retlif is a great place to start when looking at labs for your MIL testing needs. They have the necessary equipment, understanding of the test standards and the necessary security clearances needed to handle your testing needs. Laboratories vary widely in their compliance with standards, and you must know the requirements in the standards at least as well as, if not better than, the laboratory you are considering using. They are your eyes and ears, but they must not be making the business decisions for you, as well. Retlif labs can meet your testing needs for MIL testing and help you understand the appropriate version or versions of the standards that apply to your product.

It is critical that you understand the standards to which your product will be tested when auditing a laboratory prior to selecting them. Retlif labs is staffed by excellent technicians and engineers. You must know the standards that apply to your product so that you can ensure that the correct version is being used. Retlif labs can help you in this area as they have been doing these tests for decades.

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