

Customers Seeking Environmental Testing

Introduction

Customers seeking environmental testing at commercial test laboratories can expect to be asked a number of questions. They may think to themselves "Why is the lab asking me all these questions? They are supposed to be the experts." The kinds of questions asked by the lab vary, depending upon circumstances. We have identified three scenarios.

Three Scenarios

Scenario 1: A project manager visits the lab, carrying a description of a new widget for which he seeks, say, a vibration test.

Scenario 2: A project manager requests a laboratory's quotation so he can include testing as a line item in a proposal.

Scenario 3: A purchasing agent seeks a quotation because a purchase requisition has been submitted to him.

Scenario 1 elicits the most questions by the lab, and thus occupies more of this article than do Scenarios 2 and 3 (least).

Why do you need this test?

Usually the test lab's first consideration is understanding why the project manager has concluded that he needs a vibration test. The project manager usually explains this need during his first lab contact. Reasons may include:

1) His employer manufactures widgets for the government or a prime contractor, and testing is required under the CDRL (Contractual Deliverable Requirements List) and/or other aspects of the contract. The test may be: a. A "First Article" test. The first widget submitted under contract with the Government. b. A "Qualification Test". The widget is tested to determine if it is "qualified" for its intended use. c. An "Acceptance Test" (maybe a "Lot Acceptance Test"). A certain number of widgets from each production lot must be tested prior to shipment to the government [or to the prime contractor].

2) Same as above, except no government involvement. Many companies (especially commercial launch vehicle companies) have adopted testing policies and standards similar to those imposed by government agencies, in order to maintain a high quality standard and low failure rate. Their testing requirements are passed on to their vendors before a supplied "widget" is accepted.

3) The project manager's group is developing a new line of commercial widgets and wants to establish the new product's suitability for use in various dynamic environments. This often involves determining a failure threshold for the new widget, under various environmental conditions. Sometimes this will (or should) involve combining vibration with temperature or altitude.

4) Too often, such testing is required retroactively, after failures have been noted in the field. The

project manager wants to determine the cause or causes.

5) His group may want to perform reliability tests in order to predict failure rates. Now that his activity knows the widget is suitable for this application, how long can they expect it to last? How many out of 100 will fail after 10 hours, 100 hours, 1000 hours, etc.? What are the failure modes (that is, how does it fail)?

6) His group wants to identify any latent workmanship defects (bad solder joints, loose connections, poor welds, etc.) in their new series of widgets. He wants a periodic production sample screened for these defects to assure that high production quality standards are maintained. This is often called ESS or environmental stress screening.

7) His group has developed (or is developing) a new line of widgets at his company (or at a university research lab or government facility). Labs available to him don't have the right equipment or can't achieve the desired test levels.

8) The new widget will experience extreme test levels, beyond the usual test parameters, and he needs help simulating new and/or extreme environments.

9) The project may work for a company or an agency with in-house test capabilities. He has probably already approached his own lab. Whether to use his own lab or to "outsource" the test to a commercial laboratory usually depends on price, schedule, and capability.

Reasons 1) and 2) (above) are most common. These are usually pretty straightforward because testing requirements are usually clearly delineated by the customer's contract. He will probably bring a copy for review. Not too many questions need be asked.

Sequence of Events

At Wyle Labs, the sequence of events typically goes as follows:

- a) Customer contacts lab for test and is introduced to the Quotes department.
- b) Quotes representative (an engineer) discusses testing requirement briefly and assesses his lab's ability to respond. He can call upon other engineering staff specialists (within the lab) for conference/consultation if the request is unusual and/or technically challenging.
- c) Customer transmits (letter, FAX, e-mail, etc.) hard copy request for quote (RFQ). In routine cases this predates 1) and 2) above. [Rick - in d) below, don't you need to add equipment hours? A big shaker must cost more than a small shaker.]
- d) Quotes department processes the RFQ and determines prices for each test, based on expected level of effort. This includes the quantity and labor grade (engineer, technician, machinist, etc.) of man-hours estimated to perform the test as well as materials that will be required during testing. Pricing normally includes preparation of procedures, test fixtures, performance of test(s), and preparation of test reports.

Pricing is presented in the format requested by the customer; many contractual formats are available, including:

Time and Material Cost Plus Fixed Fee Firm Fixed Price

e) Engineering management reviews the Quotes representative's estimate to assure that (1) the most appropriate and efficient technical approaches have been considered, (2) that the quotation meets the customer requirements and (3) is price competitive.

f) The estimate is forwarded to the lab's contracts department where it is further reviewed for accuracy. A quotation letter, presenting pricing by line item, also an estimate of lead-time required prior to test, also estimated test time, is drafted.

g) The quotation letter is finalized, then forwarded to the customer via mail, e-mail, FAX, FedEx, etc.

h) If the pricing is acceptable to the customer, the customer issues a Purchase Order (PO). It is normally accepted by the Wyle contracts office. The work is assigned to a specific Wyle test engineer who will interface with the customer throughout the performance of the test program.

Customer may be uncertain

The situation in which the customer project manager's group is developing a new line of commercial widgets (reason 3 above) and wants to establish the new product's suitability for use in various dynamic environments, can be tricky. Considerable "hand holding" may be required. Often the customer knows he has a vibration problem and wants a test to determine a solution, but he isn't certain about the best technical approach. Here the "sine or random?", "how many g's?" type questions that can be asked of an experienced customer would be futile. When the Quotes Department representative question "Do you have a particular test requirement, such as a specification or a procedure on which you want us to quote?" elicits a "No" answer, he normally introduces the customer to the appropriate test department manager or a test engineer, where customer needs are assessed further. Here typical questions include:

1) What is the intent of the test? Usually it is to solve a problem that is anticipated or has already developed. For example, a new adhesive or laminate material may be proposed for a composite structure to be installed in an aircraft or launch vehicle and the customer is concerned about delamination caused by launch or flight vibration. In this case, Wyle would recommend he choose the worst case environment anticipated, (worst possible location and the most severe in-service environment). Then Wyle would show the customer an existing test specification followed by others who are supplying components for that particular area of that particular vehicle. Wyle would suggest developing a test procedure using an existing specification as a reference. We may suggest considering other environments, such as acceleration during take-off, shock during landing or stage separation, airborne acoustic noise, temperature and altitude. Specifications exist for each of these environments aboard many aircraft and launch vehicles. This general approach is followed no matter what the widget's end use and/or in-service environment may be.

2) If specifications do not exist for the customer's application, more questions must be asked. Example

#1: the customer may simply want to know how much vibration his widget will withstand before it fails. Establishing this failure threshold can be accomplished by subjecting widgets to the most applicable "in-service" vibration environment, then slowly increasing the intensity until a failure is observed.

Example #2: a widget to be mounted on a piece of rotating machinery may be subjected to repeated cycles of sinusoidal vibration through the min/max RPM of the machine, until failure. Example #3: a widget that will be attached to a rocket engine may be subjected to severe random vibration over the frequency range expected.

3) Every customer application should be addressed independently. Sometimes the in-service environment cannot be anticipated, but data is still desired. A simple resonance search may provide the customer with all he really wants to know about the dynamic response of his widget.

4) In some circumstances the lab may offer to assist the customer in measuring the service environment, so that future tests can be realistic.

5) Test cost must be kept in mind. Testing should accomplish its intent with minimum cost to the customer.

Scenario 2

The project manager is working on a proposal to secure a large contract to produce widgets, and knows testing will be required. He wants commercial lab pricing to include as a line item in his proposal, so that the contract, if awarded, covers testing.

Here the lab's response must be fair and be consistent. The lab is assured that estimated charges will be covered if the customer wins the contract. The lab should price as competitively as possible, to keep the customer's overall proposal competitive. It is tempting to try to "cover the lab" by building in a margin for unforeseen variables. But if the customer adds to the lab's margin to cover his unforeseen variables, then burdens his pricing with another margin, he becomes less competitive and may lose the contract. That test does not come to the lab.

Another issue is consistency. The lab may be asked to provide this same pricing to vendors competing for the same contract. The lab has an obligation to provide consistent pricing to each vendor for the same effort. The lab's quotation department should "flag" RFQ's that appear similar or identical.

Scenario 3

A purchasing agent wants a test because a purchase requisition has been submitted to him. Often the agent is unfamiliar with the requirements in detail. He will have (or can be asked to obtain) the following information, which is needed by the Quotes department for all three scenarios. Readers might use this as a checklist when seeking environmental test quotations:

General Questions

1. Is testing imminent (customer has contract and/or has test specimens ready for test) or is the customer quoting a future program and so needs test pricing as part of his proposal package? What is the timeline for testing?

2. Does a complete test procedure or specification exist for this test? Note: When a procedure exists, it is important to provide it all. If only excerpts are sent and referenced, details may be missed and later may impact cost. If only a portion can be transmitted, make sure it includes all details necessary, including test tolerances and references to other documents.
3. Does the customer want the lab to prepare a test plan and/or procedure? Is this preparation to be quoted as a line item deliverable or amortized within the total test cost? Description of specimen(s) including:
4. Type and quantity of specimens that the customer will provide.
5. Drawings of test specimens if available If drawings are not available, then the customer must at least provide
6. Specimen size (basic dimensions, geometric envelope), cg location and weight
7. Interface information (how many mounting points, where located, type of fasteners)
8. If a test procedure is not available, then document
- 8a. Test levels and axes
- 8b. Test durations
- 8c. Is a fixture available (adaptation required, or directly compatible with Wyle equipment)?
9. Is this a requote? If so, reference previous quote number.
10. Has this test been performed before (when, where, results). If at Wyle, reference previous Test Report number.
11. Who is point of contact for pricing information? Whom to contact with technical questions?
12. When is quotation due?

Questions are Essential

Yes, it is fair to assume the test laboratory has experts on its staff. But they are not clairvoyant. Customers should allocate time to clearly present the testing requirements as well as the intent of the test. Questions should flow in both directions. With clear communication up front, testing disappointments (and disasters) can be avoided.