# How to Use Test Data to Better Manage Your ATE Software and Hardware

**A Joint IntraStage and Industry Leader Case Study**

The Airbus 320 aircraft, which is one of the more widely used passenger aircraft on the planet, can cost up to $90 Million dollars to purchase by an airline. Most airlines that purchase such an aircraft also have additional repair and maintenance over the aircraft's lifetime which can cost up to 15% of the price or $14 Million. It is not surprising that there is a high cost of maintenance on such a mission critical vehicle where people's lives are at stake. In fact, can you imagine the scenario where the airline is not doing its proper and regular safety, reliability and performance data checks on its aircraft? Probably not, and if you did, you probably wouldn't be flying with that airline anytime soon.

As critical as it is to make sure there are regular data checks on flying aircraft, the same can be said of Automatic Test Equipment (ATE) that tests Electronic products that are delivered into mission critical industries such as Aerospace, Medical Device and Consumer. Without proper checking on the health of both the software and hardware on ATEs, there is a risk of tests not being performed effectively causing products to escape manufacturing with reliability and performance problems.

In this Case Study, we will talk about the experiences of a major USA based Aerospace Electronics manufacturer in the Pacific Northwest who understood the importance of managing their ATE's better through the use of Test Data. We will talk about some very specific examples of where they used and monitored their Test Data through the IntraStage software solution that helped them more cleverly reduce manufacturing operation costs and improve their overall engineering efficiencies.

## Using Test Data to help manage Test Equipment Calibration Failures

*It's 2 PM on a Friday, and the quality team sends out a high-priority email to the Test Engineering Manager. Quality has noticed that one of the Automated Test Equipment (ATEs) on the manufacturing floor is out of calibration. As a result, all the Test Data on every serialized product tested on that equipment since the last calibration date needs to be validated against new adjusted limits…and if the data cannot be validated quickly (or if any discrepancies occur), all of that product will have to be recalled.*

This was a scenario faced by our Aerospace Electronics manufacturer in the Pacific Northwest. With a low-volume, intensively tested, mission-critical (and expensive) product, the pressure was on the Test Engineering team to validate the data and either pull a trigger on a recall, or prove to Quality that the test results were valid.

"Prior to deploying IntraStage, we had to spend 240 man-hours (up to 6 calendar weeks) to validate the test data in such a situation" according to the Engineering Manager of the Test team. "While 240 hours is an expensive use of engineering time in our 6-sigma environment, the Engineers were also pulled off other projects in order to manually analyze spreadsheets and text files".

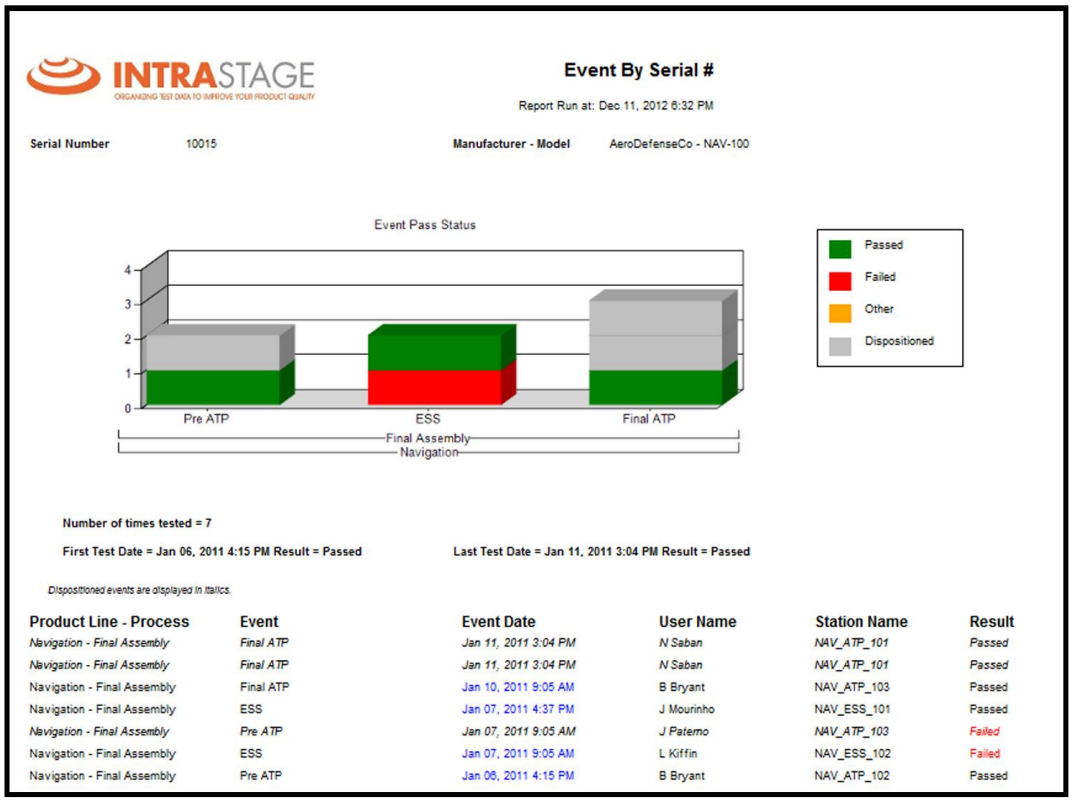
After the implementation of the IntraStage software solution, the Test team was able to take advantage of quickly isolating, analyzing and exporting the relevant Test Data from the centralized database and send the data to the quality team in the same afternoon. "Because of the ability for IntraStage to automatically collect, centralize and allow any of our Engineers to analyze the Test Data we avoided a large loss of 240 hours of engineering time and added an important benefit of not subjecting our customer to a product recall".

## Using Test Data to Understanding ATE Aging


Whenever you get on a bathroom weight scale, do you ever get the feeling that it actually maybe wrong because it's not working properly? Without constant calibration of the weight scale, you in fact maybe getting bad results…making you seem heavier (or lighter) than you really are. This is the same case with your ATE equipment, without constant monitoring it may, in fact, be giving you bad results.

There are three sources of defects or failures when a product is tested on an ATE. The first source comes from the actual product being tested, the Operator and the other comes from the ATE itself. One industry wide practice to eliminate sources of ATE defects is to perform some sort of Gage R&R study on the ATE (there are a great many resources on the web for readers interested in knowing more about Gage R&R). Although Gage R&R is a widely accepted technique not many companies actually perform this critical evaluation and hence are not aware of the accuracy or aging of their Test Systems. This can lead to lower yields and operational inefficiencies in their manufacturing environment which actually have nothing to do with the product being tested.

An alternative technique to Gage R&R is to actually look at historical Test Data to understand ATE aging. The Engineering Manager described how they implemented this technique in their manufacturing environment "Upon in-depth analysis of the Test Data, we found that the First Pass Yield was much lower than their Roll Throughput yield". By examining a Retest Report such as in Figure 2 the Test Engineering manager was able to isolate several instances where the line operators had repeatedly retested certain serialized products.



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**Event By Serial #**

Report Run at: Dec 11, 2012 6:32 PM

**Serial Number** 10015 **Manufacturer - Model** AeroDefenseCo - NAV-100

Event Pass Status



**Number of times tested = 7**

**First Test Date = Jan 06, 2011 4:15 PM Result = Passed** **Last Test Date = Jan 11, 2011 3:04 PM Result = Passed**

*Dispositioned events are displayed in Italics.*

| Product Line - Process | Event | Event Date | User Name | Station Name | Result |
|---|---|---|---|---|---|
| *Navigation - Final Assembly* | *Final ATP* | *Jan 11, 2011 3:04 PM* | *N Saban* | *NAV_ATP_101* | *Passed* |
| *Navigation - Final Assembly* | *Final ATP* | *Jan 11, 2011 3:04 PM* | *N Saban* | *NAV_ATP_101* | *Passed* |
| Navigation - Final Assembly | Final ATP | Jan 10, 2011 9:05 AM | B Bryant | NAV_ATP_103 | Passed |
| Navigation - Final Assembly | ESS | Jan 07, 2011 4:37 PM | J Mourinho | NAV_ESS_101 | Passed |
| *Navigation - Final Assembly* | *Pre ATP* | *Jan 07, 2011 9:05 AM* | *J Paterno* | *NAV_ATP_103* | *Failed* |
| Navigation - Final Assembly | ESS | Jan 07, 2011 9:05 AM | L Kiffin | NAV_ESS_102 | Failed |
| Navigation - Final Assembly | Pre ATP | Jan 06, 2011 4:15 PM | B Bryant | NAV_ATP_102 | Passed |

Figure 1: An example IntraStage report showing multiple tests on a single serialized part

"One of my first assumptions was that the Operators were repeatedly reworking the failing components in order to avoid scrap and waste". Concerned that a repeatedly reworked component should not be released to a customer, the Manager exported a series of Retest Reports and spoke to the operators to understand the sequence of events that produced the repeated retests.

Surprisingly, the operators had not been reworking the components. "The operators, with the experience that the ATE systems were aging, knew that retesting a failed product could produce a potential passing result. Considering that each testing event took anywhere from twenty minutes to several hours, a large amount of operator time was being wasted on repeated and extraneous labor".

By correlating the Retest Reports with the labor figures for each retest, the Test Engineering manager was able to accurately report the amount of labor wasted in a single year was $200,000. By presenting this data to executive management, the company decided to initiate a new ATE program, realizing that the initial cost and implementation expenses were well worth the long-term savings in labor.

## Using Test Data to Optimize Limits in your ATE Software

In New Product Introduction (NPI), test limits are originally determined from R&D specifications. Some limits that are critical to the performance of the product also have to be approved by the end customer. As the product moves from NPI to initial mature manufacturing these limits may never be adjusted because the limits have been approved and proven over multiple NPI runs. But the hidden cost of this

lack of adjustment can be very high. It is like tuning up your car once at the manufacturing plant and never doing it again. Eventually the car over time gets to a certain average performance specification but this only happens after lots of interaction with the environment.

Using Test Data to understand trends and yields in manufacturing over a longer time period can more accurately allow you to set limits that give you optimal yields without sacrificing quality. Read on to understand how our Aerospace Manufacturer in the Pacific Northwest accomplished savings on scrap and rework by tuning test limits in mature manufacturing.

The Test Engineering group noticed that their CP and CPK for one of their measurements was very close to failing grade (under 1.33) as shown in Figure 2. Upon analysis of the Trend of that measurement it was visually found that the measurement was very close to the upper limit, and at times going over that limit. As a result, First pass Yield was about 50%. With a unit cost of 10's of thousands of dollars, this yield was costing the organization money in scrap, rework and retest.

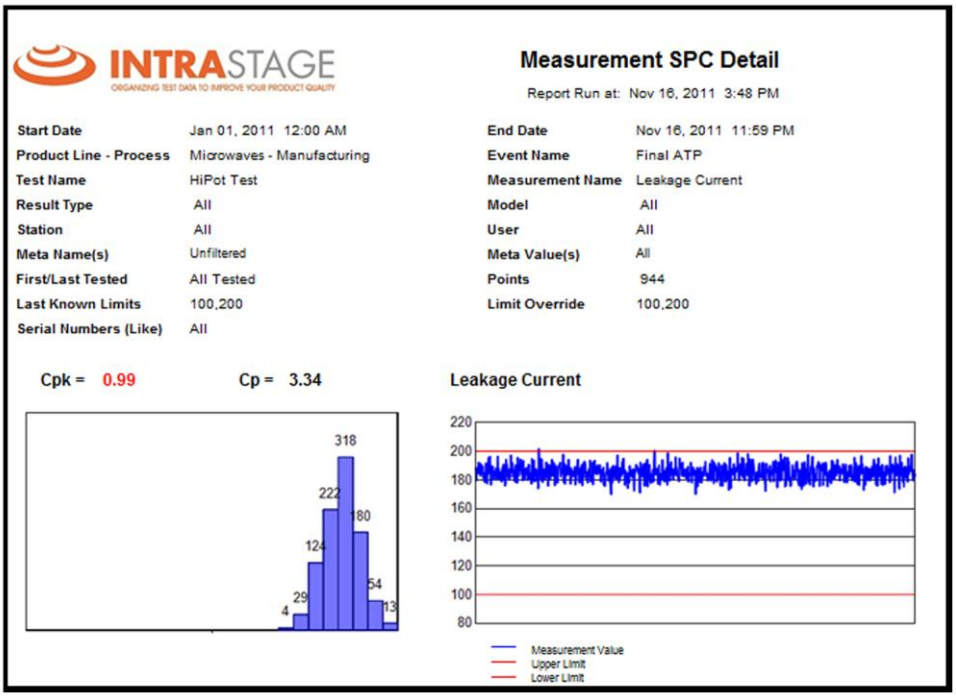


Figure 2: An IntraStage report showing a measurement that is very close to its upper limit.

As it turns out, the limits on this measurement were set during NPI and from the initial R&D specifications. "When we approached the customer about the restrictions on the limits, the customer was actually fine to make the limits looser because the specification did not need to be that tight". By being able to show this trend and data to their customer in a Web-based reporting tool, the IntraStage customer was able to get clearance from their client to push the manufacturing limit for that measurement back to the customer-specified limit, increasing yield significantly.

## Ongoing Improvements

"Having rapid and accurate visibility into our Test Data has improved our manufacturing operations in a number of different ways" says the Engineering Test Manager. "Moving forward, being able to distribute this data to more functional teams within the company is our next goal. By everybody having access to the data to make decisions, this will improve overall collaboration and reduce times to fix problems". Stay tuned to the next chapter in this Aerospace Manufacturer's quest to better manage their Test Equipment…

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***About IntraStage***

*IntraStage is a Quality Management Software provider for companies who design and manufacture electronic products. We provide SPC, Yield, CP, CPK, and test data analytical tools by automating the retrieval, storage, mining and reporting of R&D, Manufacturing, Supplier and Field test data. Our clients choose us because we seamlessly integrate test data from different sources, lower their product design, manufacture and return costs by finding quality trends more quickly and accurately. Fortune 1000 companies rely on our business intelligence to keep them competitive when product quality and customer satisfaction are key differentiators.*

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