NRK INTERNATIONAL

TRENDS AND ISSUES IMPACTING METROLOGY & *SPATIALANALYZER*

Airbus – Reaching Higher

Airbus, the European aeronautics leader, causes ripples in the worldwide aeronautics industry any time they make a change. One of the changes they've made in their manufacturing process is using *SpatialAnalyzer (SA)*. Change is a constant as manufacturing sectors see the value in improving their technology.

Airbus is growing larger, especially in Asian markets, with major new airplanes like the A380 and A350. One of the reasons for the increase is the demand for efficiency in the passenger flight industry. In order to decrease the cost per person for flights, increasing the capacity of the plane means fewer trips and less fuel. *SpatialAnalyzer* is helping Airbus make sure the wings they build are aerodynamic and will deliver sufficient lift.

"In the past, planes used to be hand-built, piece by piece. Now there is a drive for lower cost, raised quantity and repeatability."

As more changes happen in the industry, the ripple effect continues. The increased use of composite materials has brought new material suppliers into the fold of portable metrology by raising the bar for precision and compatibility with other components being shipped in from all parts of the world.

Rick Cole, Sales Director for New River Kinematics (NRK), shared some reflections on the changing market. "The entire way Airbus manufactures has also changed – that includes processes, tolerances,

Assembly of Airbus A380 in Toulouse, France.

and material behavior. Due to *SA*'s measurement plan, it's particularly adapted to this automation, especially because of its ability to handle multiple portable instruments," Cole said.

One of the market adaptations that Airbus has made is working in a more competitive market. Gone are the days of technology sharing – things are more competitive and fierce.

Changes in materials and assembly have revolutionized the industry – as well as other large transportation production. In the past, planes used to be hand-built, piece by piece. Now there is a drive for lower cost, raised quantity and repeatability. The use of robots and automation allow for duplication more easily in the manufacturing process of planes, trains, and automobiles.

There are serious consequences if components are not aligned properly, especially if they are not aerodynamic enough to fly. This is a dangerous situation, particularly if it has a fuel payload that potentially could explode. The question is: How can you measure something to a hair's breadth, if that something is the size of a locomotive? Well, with *SpatialAnalyzer*, you can, in any language, anywhere in the world. ■

Worldwide Metrology Growth is no Mystery

Changes in the field of metrology have changed the way things are done all over the world. Rick Cole, New River Kinematics (NRK) Sales Director, added his perspective to the growth in emerging international markets.

"Basically, anything that needs speed or energy efficiency can benefit from more precision in the manufacturing process," Cole said. "Originally, the United States and Europe shipped products to emerging markets. But now, those markets can create the same products on their own soil. Using the latest technology, they dramatically increase the precision and versatility of their manufacturing capabilities," Cole said.

As a result, these emerging markets are becoming increasing consumers of portable metrology, with potentially explosive growth in the near future. "China, Russia, and India are the largest newly reinvigorated markets, and within all three markets transportation industries are going very rapidly: aircraft and aerospace production, automobile and truck production and mass transit such a subways, trains, and buses," Cole said. China, India and other emerging markets have more basic immediate needs – their priority is transportation, in order to continue growth. And the current direction is to create jobs and products by nationalizing the manufacturing of cars, trains and construction equipment.

He also identified energy and scientific research as other key fields.

Nicolas Tanala, International Business Development Manager for NRK, shared his perspective as well. In Europe, there's a huge interest in understanding and adopting portable metrology because it's not easy to verify quality without it. Larger pieces can't be taken to a stationary metrology device, so portability is a critical feature. "Portable metrology is used more often to replace bulky jigs and also more integrated into manufacturing to save time and money. This is what we call 'Metrology Guided Fabrication,'" said Tanala.

SpatialAnalyzer (SA), the industry-leading software for portable metrology in the USA, is extremely efficient in helping manage part assembly for clients all over the world.

Besides aerospace, portable metrology is invigorating other industries by adding precision to their large-scale projects. Even the scientific community is adopting portable measurement methods for particle accelerators, space shuttles and satellites. Accelerator rings, a highly specialized enterprise, is a growing field for portable metrology where *SA* is uniquely positioned to add great value.

Tanala said, because of the massive scale and highly sensitive experiments conducted on site at an accelerator ring, the need for accuracy and certainty is paramount. "When the client measures on this scale, there is a huge number of instrument stations. *SA* contains the USMN capability, which allows the user to assess the whole network uncertainty and therefore to get the very best measurement accuracy in such a complex configuration," he said.

> "The priority, for any business…is to make things simple, quick and accurate."

In addition in manufacturing, "Emerging markets are starting to widely use portable metrology for large scale measurement. *SA* can help them to set up the best practices and avoid wasting money in heavy and expensive jigs. The priority, for any business, but particularly for emerging markets, is to make things simple, quick and accurate," Tanala said.

As this industry grows, more projects will adopt portable metrology as the method that ensures the pieces of their project fit. For example, Frank Gehry's Walt Disney Concert Hall in Los Angeles used precision portable metrology. Gehry's unique architectural style features wraparound stainless steel panels that create an illusion of random placement, but precision was needed to create metal panels that wrap the exterior of the building. When the pieces arrived on the construction site, they were ready to be snapped in place. So, there are possibilities for art and architecture, and countless new frontiers for portable metrology as well, all over the world. ■

Building Support Across the World

SpatialAnalyzer customers, around the world, have a complete training and support network to help them with all of their educational needs related to *SpatialAnalyzer (SA)*. Customers work with New River Kinematics (NRK), the makers of *SA*, and can access local field support, too. That means they have immediate contact for their needs, as well as someone to do a site visit to explore and provide solutions for any potential issue.

International customers can rely on the NRK-trained resellers in their country to provide field support in their native language and customized solutions. For additional *SA* needs, a great training tool is NRK's 24/7 support at support@kinematics.com. Customers sharing their challenges with "*SA* support" experience a quick response from qualified application engineers that not only are well-versed in the use of *SpatialAnalyzer* but often can quickly understand each customer's unique application. Like NRK training tools, *SA* support is intended to make learning and applying *SA* successful no matter what the measurement challenge.

NRK is making a concerted effort to provide training on many levels. Because people learn differently and technology is playing an increasingly important role, NRK is premiering a video series that explores important topics specifically related to the measurement industry and *SA*. These short videos explore topics such as "Who is NRK?" "*SA*, A Short Overview" and "How to use *SA* with Specific Instruments (i.e. Faro, API, Hexagon)." Videos and other interactive web-based tools enable customers to choose the amount of time they want to devote. Plus, training tools are available when the student has time to learn.

These videos, training tutorials and detailed descriptions are all included in the new *SA* RoadMap. The RoadMap is updated as *SA* is updated so it continuously parallels *SA*. This makes keeping up with all of the new additions added to *SA* easy for experienced and novice users alike. And of course, NRK is available to support users with a strong foundation and easy accessibility to get the job done, whatever that may be.

As the *SA* user base expands, NRK continues to offer training classes to fit the needs of their clients.

Although *SA* is easy to use, there are a variety of customized applications and add-ons that can enhance even the most complex of projects. NRK can always help clients maximize the use of *SA* with additional training. An *SA* class can even be customized to address a customer's specific situation, and include both consulting and application. New International users are trained by *SA* resellers, NRK trainers and independent contractors in their region. This makes it possible for international customers to have training in their native language. *SA* international resellers also provide updated *SA* translations of software and training materials in addition to local telephone support.

In the end, having a solid foundation of knowledge and continually adding to it makes a difference to the bottom line. And NRK is there to provide assistance with *SA* every step of the way, no matter what language the *SA* user speaks. ■

It All Started When... Two Engineers Decided to Write Software

In 1994, Joe Calkins and Bob Salerno were working on a robotics project together and discovered that the data provided by the measurement software wasn't useful. Since all of the instruments they were using came with their own individual software, data collating became a chore. So they requested better measurement software, only to find none existed. Salerno and Calkins founded New River Kinematics (NRK), then created a software package that eventually became known as *SpatialAnalyzer (SA)*.

From that idea came a solution that's been adopted across the world, in a variety of industries. Two reasons *SA* has been a success is that there was a need for better graphical measurement software and that NRK has a unique development philosophy. "We try to write things into our software that benefit everyone. There are lots of uses," said Calkins.

"We're mechanical engineers who know how to write programs, not the other way around," said Calkins. Actually, Calkins and Salerno are PhDs in mechanical engineering, so that's even more unusual. "We're PhDs but not entirely theoretical. We know that sometimes theories don't work on the factory floor, and I think that's one of the things that makes us different," Salerno said. "We apply what we know about engineering to the real world by using it for practical problem-solving."

NRK's goal is to keep the software development process customer driven. "Often, customers do not truly know what they want until they see an initial draft of their particular application. By proceeding forward with development in small steps, we're able to craft our products to best meet customer expectations," Calkins said.

NRK has a cohesive development team approach, which has the advantage of keeping the team small and also precise. "Instead of throwing an army of programmers at a software task, we use a small team with extensive knowledge. In addition, our staff has an engineering background, which means we understand the actual engineering challenges our clients face," Salerno said.

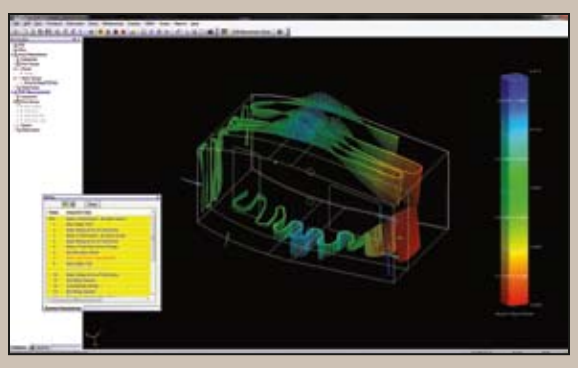
> "We apply what we know about engineering to the real world..."

"We wrote the code so that we can change a part without changing the whole thing, and we think that the right people are better than more people," Calkins said.

During the last *SA* user's conference, the founders' intimate knowledge of the product was clear as they handled questions from the audience. No detail is too small for them to know its function, origin and adaptability. NRK has engineers who understand the customer's challenges actually writing the software.

Will Austin works in customer relations for NRK. "We're a very collaborative company, and we are responsive pretty much around the clock. We have to be because our clients are in Japan, France, or anywhere, and their workday is different than ours," he said.

The result of this development cycle and round the clock service is success for NRK and their customers. New River Kinematics has produced *SpatialAnalyzer*, which has changed the industry of portable metrology. The product and the company are a unique combination of success for their clients: a universal software solution and a responsive company to back it up.



In the founders' pursuit of a solution to their own problem, they found solutions for lots of people. And, in an industry that always needs good problem solvers, the opportunity for worldwide growth is limitless. ■

Case Study: *SA* in the UK

Join us for a case study in how *SpatialAnalyzer (SA)* has improved results for a customer. Sometimes, a real world situation brings home just how much a technology can positively impact a business. As you surely know, application is everything!

In December 2008, 4G Metrology, based in Ireland, teamed up with Babcock Marine as an *SA* customer and provided extensive introductory training to their personnel in early 2009. *SA* is currently being used at the facility in Scotland to run both Leica 1201 and Sokkia Net 05 total stations as well as handle all of the post-processing and data analysis of critical dimensional measurements. Duo-Touch® II rugged tablet PCs are used to run *SA* and the instruments via a Bluetooth connection.

Babcock's Marine division is the major support partner to the Royal Navy.

Alan Robertson, the Tech Lead for Babcock's Marine Division Design Services gave a history of how Babcock got to where they are today. "Our predecessor to *SpatialAnalyzer* metrology software was SMX Insight. Like a lot of advanced users back in the late 1990s and early 2000s, there wasn't much we couldn't do with it using a laser tracker. However, as soon as we started using *SpatialAnalyzer* in 2003, we quickly realized its potential – to broaden the type and increase the quality of service we could offer to our customers," Robertson said.

Due to this change in software, Babcock became able to support a whole range of new instruments. The other major change was an increased control and analysis of measurements that was far more powerful.

SA's "Relationship Fitting soon became our new 'Best-Fit' friend and a whole new world was opened up. We no longer required fixed points in order to tie-in to a component," Robertson said. And he added jokingly "It's what we had been 'weighting' for." It's good to know engineers have a sense of humor about such serious matters.

Back to the case study: Measuring direct to the model is a great advantage. Robertson said that in the past, a set of pre-determined "hard points" would be selected and these points would need to be measured and then compared to the model. Often this was difficult as lines of sight were often obscured by scaffolding or equipment. "Now we can pick and choose what to measure on-site which allows a much more flexible approach. After a unit or block is complete, we use

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SpatialAnalyzer: A Problem Solver from Day One

From the beginning, *SpatialAnalyzer (SA)* was architected from the ground up to be a metrology solution. Bob Salerno and Joe Calkins, the creators of the software, both have PhDs in mechanical engineering, and that's why they understand what users need and how their instruments are used.

"When measuring a physical property like angle, distance or length, those observations get turned into coordinates. That's the real nugget of what we do, turn observations into coordinates," Salerno said.

In Salerno's role as a mechanical engineer and co-founder of New River Kinematics (NRK), he gets a lot of calls from clients in the aerospace and shipbuilding industries for problem solving.

"One of the reasons people call with a production crisis is that they are doing something like trying to get a part to fit, and can't find the reason why it's not working. Many times the problem is simply the result of transferring data from one measurement environment to another," Salerno said.

Another challenge in the industry is the changing technological environment. "Instrumentation is always changing," Salerno said. "10 years ago, laser trackers dominated, but now scanners are more common, and laser radar is finding more use." It can be a challenge to find solutions for all types of instrumentation.

Each of these instruments brings a different set of strengths and weaknesses, but the software they use can be universal with *SpatialAnalyzer,* which was designed with these industry shifts in mind.

"We know that it's critical that our users understand the uncertainty associated with every coordinate. Tolerances are getting tighter, more than ever before. Our clients say 'We need to know where this edge is, plus or minus 0.004 inches.' If you want to know that, you need a measurement system that not only provides the edge location, but does so with acceptable uncertainty," Salerno said.

For engineers in manufacturing, this can mean less rework and less waste. That's one of NRK's motivations, and also being able to create more compatibility in the industry. That means that *SA* runs on arms, trackers and scanners, and that operators can be cross-trained to work *SA* with any instrument. The data is compatible and so are the operators.

The benefits of cross-training are often overlooked. "Having an operator know more than one instrument increases their creativity for whole systems. A tracker guy can bring his tracker tricks that he's known for years, to using an arm. He might be able to innovate in a way that someone who was trained only on an arm might not think of it," Salerno said. Some users have never had instrument-specific software, so they use *SA* and pick it up right away, and become flexible workers.

What is rapidly making *SpatialAnalyzer* the de facto worldwide industry standard is that it's an interface that can be used on any instrument. The user doesn't need to know the software of each brand and type of equipment; they can just jump between equipment. "This streamlines data collection and creates universal solutions on the production floor," Calkins said.

In the metrology industry, the GD&T standards are often designed with the assumption of perfect conditions. But in real life, as engineers are all too aware, conditions are never perfect. So the right tools make all the difference. That's one of reasons *SA* has become the industry standard for engineering in large volume projects.

New River Kinematics is now a company that solves problems for major international corporations. Their clients include Boeing, Northrop Grumman, Airbus, and contractors for aerospace, shipbuilding and particle accelerators across the country and throughout the world. A wide selection of features allows for customized solutions from basic measurement to completely automated production processes. In an industry that relies on precision data, this small start-up company continues to set the standard higher and tighter.

NRK, who is headquartered in Williamsburg, Virginia, has employees based in different locations throughout the U.S. and in Europe. In addition, NRK has representatives in most other parts of the world through their extensive sales and support reseller network. NRK's staff includes developers, application engineers, trainers, sales and operations personnel. The collaborative teamwork that happens at the offices often includes problem-solving sessions for clients. The custom engineering consulting is unusual, but standard for NRK.

"We help our clients solve their problems – it's part of the relationship we've built," said Salerno.

Part of the company's philosophy is to serve the clients by meeting or exceeding their needs. One of the ways they do that is to create customized solutions. Often these solutions go on to become part of the software package of *SpatialAnalyzer.* "Basically, our clients call us and tell us what kind of challenge they are facing. And we find a way to make our software work for them. There's so much we can do to help our clients in this way," Salerno said. ■

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'relationships' to 'best fit' the built unit to the model," he said. "This allows for comparisons with other units so we can best assemble them to the overall design. Used correctly, this software can bring big savings in time and costs by minimizing rework."

In terms of the best uses of *SA*, there are a number of industries who use it. But there continue to be new areas for it to be applied to. Robertson said he sees *SA*'s USMN interface (Unified Spatial Metrology Network) as a very valuable function. "The ability to determine at the click of a button the uncertainties associated with a group of measurements is of great importance in large-scale projects which require high accuracy."

His opinion is that future growth in control networks is likely due to being able to quite simply determine a "composite" set of measurements. "The composite set with associated uncertainties for a set of points measured from multiple stations is paramount moreover in the aerospace and ship-building industries."

In conclusion, this case study proves that: "The introduction of robotic total stations controlled by *SA* has revolutionized the DC processes within Babcock Marine. Using *SA* to set out control networks (using the USMN function) means quick, accurate and reliable set ups. The time taken to measure our units and blocks for the aircraft carrier build is greatly reduced, and using *SA* allows the results to be immediately available on site."

Sometimes the benefits go both ways. "In addition to their utilization of *SA*, the team at Babcock Marine has provided ideas for improvements and new features in the total station interface," said Tom Fitzmaurice, of *SA* reseller 4G. *SpatialAnalyzer*'s future relies on the inherent flexibility of the product, along with great partners like Babcock Marine and reseller 4G. ■

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