

SpatialAnalyzer Provides Total Solutions for Portable Metrology

Bob Salerno has been in the metrology industry for the past 20 years, and he’s a problem solver. In his role as a mechanical engineer and co-founder of New River Kinematics, he gets a lot of calls from clients in the aerospace and shipbuilding industries for problem solving.

As the industry innovated rapidly, certain issues bubbled to the surface. “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 it’s 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. “Ten 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 weakness, but the software they use can be universal with *SpatialAnalyzer*, a software product created by Salerno and his partner Joe Calkins.

The SA software package was designed with these industry shifts in mind. From the beginning, SA was architected from the ground up to be a metrology solution. Salerno and Calkins both have Ph.D.s in mechanical engineering, and that’s why they understand what the user needs 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.

“We know 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.

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Engineers Who Write Software, Not Software Engineers

One of the reasons for the success of NRK is their development philosophy. “We try to write things into our software that benefit everyone. There are lots of uses,” said Joe Calkins, co-founder. They also don’t wait until mid-year to release new versions of software. “Once you have your license key, you can download the latest enhancements to the software each week or month, or whenever you choose,” said Joe. If there’s a need to send the *SpatialAnalyzer* data to a non-subscriber, a “Viewer” or Read-Only version is available for download.

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.

“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,” Joe said.

So NRK has a cohesive development team approach, which has the advantage of keeping the team small and 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,” Calkins said.

Having worked most of his career in IT, Director of Training, Gary Garrison, finds the company philosophy about software refreshing. “It’s so important to get software out in a timely manner. Sometimes, if it takes six months, it might be obsolete or the requestor might have moved on to another project. It absolutely helps our clients to provide them with solutions as soon as possible.”

Will Austin used to work for Newport News Shipbuilding in the Metrology Department, but now pursues his love of metrology as the customer relations contact for NRK. “We’re a

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SpatialAnalyzer software provides universal solutions in measurement planning.

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NRK, founded out of need, now serves global market with industry leading software.

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SA training is based on individual needs, not group, for maximum comprehension.

CODING

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SpatialAnalyzer paired with GD&T code to empower engineers.

Sounds Like A Plan: Measurement Planning in SA

Bob Salerno, mechanical engineer and co-founder of New River Kinematics, talks about the advantages of measurement planning (MP), a module of the software program called *SpatialAnalyzer*.

“Measurement planning is almost like a scripting environment for any repetitive analysis you have and the measurement of data that you do over and over again,” he said. “The idea is that it gets you away from the tedium of doing the same thing over and over again. Likewise, this offers managers the assurance that a measurement or analysis was performed the same way each time.”

Many engineers have experienced the process of part verification on their factory floors, and know it can be time consuming. “A lot of times

people have exported data to Excel for calculation, special statistics, or some treatment of the data.

Measurement planning provides the operator with a place to do that within *SA*—the MP module can coordinate automatically, gathering data or it can provide a guide-through for the data gathering process. The operator can then use MP for analysis and reporting operations, too,” said Salerno.

SpatialAnalyzer has other advantages as well. One of the most important quality control processes is finding out if a part is out of tolerance or not. Challenges in this process can be varied, but often time is one of the most important concerns. Exporting operations can take days if data needs to be sent to another place for results, such as an analysis group. And another delay can occur when manufacturing is held up while waiting for data analysis to return. The part sits on the factory floor or assembly line while data analysis is occurring.

These challenges are being minimized with measurement planning in *SA*. “The operator can measure and say it’s good to go. Now, the case is reduced to a minute or so,” Salerno said. There’s also less room for error. “Sometimes, in

a measurement system, a mistake could occur and with the old system, the data would go off for analysis, and they’d find out something’s wrong. But, due to uncertainty about where the mistake is located, either in the part or in an error of the measurement system, they’d re-measure it, and send it back to be analyzed,” Salerno said.

There are pitfalls in the process that can be eliminated with *SA*’s closed loop feedback. “Before they move the instruments, an engineer can see what point is out, and there’s a visual presentation of that point out of tolerance. Therefore, the operator can know what’s causing that,” Salerno said. This empowers the operator to resolve the problem quicker.

It also means that the issue may be prevented from happening again. Mistakes are trapped where they happen, either during fabrication or data acquisition and analysis, and then fixed. These time-saving advantages are why *SpatialAnalyzer* is a software solution that’s changing the industry. Portable metrology continues to grow in function and *SA* provides universal solutions that save time, money and energy in the long run. ■



It All Started When... The History and Philosophy of NRK

In 1994, two graduate students from Virginia Tech were working on a project for a local nuclear plant involving steam generator changeout. Joe Calkins and Bob Salerno discovered that the data provided by the measurement software wasn’t useful. All of the instruments came with their own individual software, which made collating data a chore. So they requested better measurement software, only to find none existed. Therefore, they created one. A software package that eventually became known as *SpatialAnalyzer*.

One of the unique things about the company is the foundation of Joe and Bob’s experience. “We’re mechanical engineers who know how to write programs, not the other way around,” said Joe. Actually, they’re Ph.D.s in mechanical engineering, so that’s even more unusual. “We’re Ph.D.s 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 founders Bob Salerno and Joe Calkins

In 1996, they premiered their first version of their *SpatialAnalyzer* software at the CMSC conference in Williamsburg, Virginia, to the amazement of the industry. “We surprised them with the product—we had graphical measurement software that raised the bar,” Calkins said.

New River Kinematics, the company that started with two students looking to solve a specific problem, is now a company that solves problems

for major international corporations. Their clients include Boeing, Northrop Grumman, Airbus, and contractors for aerospace, ship building and particle accelerators across the country and throughout the world. A choice of modules 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.

What is rapidly making *SpatialAnalyzer* the de facto 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 easily jump between equipment. “This streamlines data collection and creates universal solutions on the production floor,” Joe said.

“We help our clients solve their problems—it’s part of the relationship we’ve built,” said Bob. ■

Training: **Make it Easier to Make Your Job Easier**



Installing great software can be exciting because there’s always the promise of making your job easier. But, until you know how to use it, you can’t get there.

Portable metrology software *SpatialAnalyzer*, also known as *SA*, comes with extensive training. But you don’t have to read a heavy manual, load a disk or download a tutorial. You get a real person. Gary Garrison is the director of training at New River Kinematics, the manufacturer of *SA*. He’ll tell you that *SpatialAnalyzer* is different from old measurement technology.

Gary says “math is a universal language,” which is helpful because NRK has clients all over the world.

One of the key concepts that Garrison believes is that portable metrology offers certain advantages, such as the ability to know if you have the right part before it’s removed from the production process. The old way of taking a part sample to linger in the coordinate metrology machine (CMM) queue is not the most efficient way to know if you can get the green light. It’s also hard to determine where the problem occurred down the line. Time is money and taking a long time to know that a piece trending out of tolerance with the spec can be costly. “Go to the source and investigate,” Garrison said.

When training people on portable metrology software, Garrison says the challenge is that there is so much that can be done. “It’s a comprehensive package, with lots of tools for specific tasks. It can be overwhelming ... but once you master a few fundamental concepts it’s easy to use.” Garrison starts training with questions, to find out what each person does in a day’s work. It’s important to know what their daily work schedule is like to find out the best way to help them maximize their time and complete their tasks. NRK’s training is adapted to each customer’s needs instead of assuming each customer wants to walk through a rote syllabus.

By training people on standard software,

there’s educational leverage. Rather than the old method of one person per piece, like “Kevin the tracker master” and “Phil the arm guru,” they can each work any measurement device that is running *SA*, which is universally understood once you know the concepts.

One of the major differences about *SA* is the traceability factor. “A lot of people make assumptions with their data, and that can lead to trouble. *SA* records the root measurement data from the instrument. Analysis can be changed or modified without re-measurement,” Garrison said.

Engineers know the variety of issues that can come with recollecting data, from the wasted time and energy, to the delays on the production floor,

but *SpatialAnalyzer* makes it easier to avoid those pitfalls.

“*SA* stores the data that the instrument reports separately from the assumptions that are made during measurement. That way, if the assumptions are subsequently changed, the expense of re-collecting measurements can be avoided,” Garrison said.

In the end, it’s better to have a real person to talk to about whatever issue you are having with your software. And the best situation is to talk to one of the people who helped develop it, someone who understands what you do every day. So, make a new friend, call the NRK engineers, and get started making your job easier. ■

“SA stores the data that the instrument reports separately...”

Convergence: SA Users meet in Virginia

From April 7th through the 9th, more than 100 users of New River Kinematics’ *SpatialAnalyzer* came together to discuss the ways they use the product, as well as ask questions and make suggestions.

“I thought it would be a great idea to get some of our users together, and our initial goal was about 50 of our customers,” said Paul Collins, COO of New River Kinematics. “So we were thrilled with the turnout.”

The 2008 conference, held in the world-class resort of Kingsmill on the James in Williamsburg, Virginia, was attended by users from around the world. Engineers from Ireland, France, Germany, Japan, Korea, and England were present.

Presentations included where *SpatialAnalyzer* is today and will be in the future. Breakout sessions for attendees covered GD&T, USMN, Measurement Planning and Instrument Interfaces.

Collins said the purpose of the conference was three-fold. “We wanted to listen to customers, have a forum for networking between users, and find out the many different ways that people are using *SA* and its applications.”

The first night kicked off the conference with a networking reception where *SA* users from several industries and various parts of the world came together.

The second full day of the conference concentrated on listening to users through formal and informal presentations of how they use *SA*. A question and answer session with NRK founders Joe Calkins and Bob Salerno yielded very specific answers about the software.

It wasn’t all business though; beer and barbeque, a Southern tradition, was followed by night golf on the Bray Course at Kingsmill, one of the top-rated resorts for golf in the country.

Calkins said, “We got great feedback for product enhancements, and I was glad to see all the people who made the effort to come. Customer feedback has made *SA* what it is today!” ■



SA Users’ Conference breakout session.



Quite a Pair: SA + GD&T

GD&T, or Geometric Dimensioning and Tolerancing, has become an industry standard as well as a different way of describing tolerance. Rather than the traditional reference frame, GD&T emulates the constraints of putting something together, based on the kinds of spatial relationships of the parts.

It's been proposed and circulated by different organizations, but in the United States, it was ASME, the American Society of Mechanical Engineers, that formalized the standards for GD&T. The code was revised in 1994 to clarify the standards even further. A similar international standard is put out by the International Standards Organization, or ISO.

These codes create the framework for how the industry implements them.

Dave Calkins, a mechanical engineer from New River Kinematics, explained that in GD&T, the relationships are the most important. "It's like how kinematics is the science of spatial relationships, and GD&T is a way of describing them," he said.

The industry leading software, *SpatialAnalyzer*, is created by New River Kinematics and Calkins explains how GD&T is integrated into that software. "It's an important feature of *SA* that it supports the engineer's ability to read and implement GD&T design from CAD drawings," he said.

The GD&T design gives the measurements relativity, and once those points are known, the data can be arranged. *SA* allows the technician to encode CAD with annotations indicating curvature, diameter or true position. "The piece needs to fit, so you are basically encoding the constraints. In *SA*, you go measure, then validate the code's pass or failure. The feature checks assign and validate measurements, and you can also generate reports."

Another feature of *SA* is that in addition to process flow, manual creation is allowed with imported CAD files that need to be annotated. So,

not only is it compatible with GD&T notations, it can also create them on files when necessary, making it easier to implement GD&T.

"SA stores the data that the instrument reports separately..."

With *SA*, engineers and mechanical technicians can more easily implement and integrate GD&T into their daily work, using the tools it provides, as well as work on their own customized annotations. GD&T has been around for the past 36 years, and it will continue to change the industry and the way that measurement is conveyed. ■

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SpatialAnalyzer

For engineers in manufacturing, this can mean less rework and less waste. That's one of NRK's motivations, as well as 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* on all of them. The data is compatible and so are the operators.

There's another benefit of cross training that's overlooked sometimes. "Having an operator know more than one instrument ups 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.

And, that is one of many reasons that *SA* is becoming the industry standard for engineering in large volume projects. ■

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Software

very collaborative company, and are responsive pretty much around the clock. We have to be because our clients are all over the world and their workday is different than ours," he said.

The shipyard got rid of confusing multiple software applications as it began to grow, and adopted *SpatialAnalyzer* as its measurement standard. "They embraced the technology, and now they can speak a common language, as they build a ship, work with another contractor or send information to a sister company," Austin said.

Time is important to the industry—an early delivery time can make a great impression. "There's nothing a shipyard can't do with *SA*. When we needed help thinking outside the box or had a challenge, we'd call Joe at NRK," Austin said. He's the one to solve issues for clients—he finds a way or makes one.

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. ■



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