National Instruments / MIKE SANTORI

Pursuing the Holy Grail
of DESIGN AND TEST INTEGRATION

National Instruments applies off-the-shelf technology to serve test, control, data-acquisition, and even design applications.

MIKE SANTORI, business and technology fellow at National Instruments, has been with the company for 22 years and has seen it evolve from a GPIB (general-purpose-interface-bus)-focused company to one providing graphical-system-design technology to scientists and engineers worldwide.

What is your role at NI?
I work at the engineering/marketing boundary for developing product strategy. My role involves combining available technologies, customer input, and a heavy dose of vision into determining what we are trying to enable engineers and scientists to do.

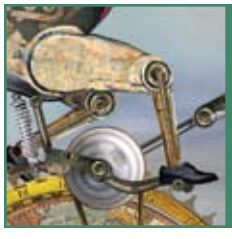
Given your title and role, let me ask a tough question: Is NI an engineering-driven company or a marketing-driven company?
That's an easy question. The answer is yes. We have a heavy technology and engineering focus, and we think part of our success is in recognizing standard off-the-shelf technology that can be used by a lot of different people for a lot of different applications. And 16% of our $740 million in revenue last year went back into R&D.

Now, having said that, we are absolutely cognizant of and focused on the market and, more specifically, on customer-driven requirements. We would not be successful with LabView if we didn't listen to our customers. If you are so busy chasing new customers that you don't make your existing customers successful, it doesn't work.

What is the role of innovation at NI?
Innovation is a key part of our personality. Keeping our focus on being innovative has been challenging as the company has gotten bigger, because innovation can tend to be associated with individual heroes. That's fine if you have five employees, but, with 4800, we have to address what innovation means to individuals at any given level of the company.

How do you do that?
We have formal training programs where we help the leaders of the company understand the role that vision plays in helping us be innovative. The leadership component is making innovation a part of our culture while also meeting customer and market needs.

How do you foster innovation throughout the company?
We offer internal research grants and establish challenge programs. And we encourage our engineers to spend 10% of their time looking outside the domain in which they specialize. We also encourage them to speak up with ideas. Sometimes, innovation is just making sure people know it's OK to innovate. Engineers are inventors, and we have to let engineers be engineers. Of course, we do need to establish a balance between getting projects done on time and exercising creativity.



We've developed more embeddable products so customers can deploy the systems more quickly without major re-engineering.

Who are the better innovators—entry-level engineers or those with more experience?
It's difficult to say who's better because there are many facets to innovation. Entry-level people come in here wired to innovate because, in college, they were always learning new things and were exposed to the latest new ideas and technologies. We just need to help them become productive engineers in a company that has a business to run. The challenge often comes at the more senior levels, where we have to balance innovation with the business need to get products out on time and with high quality. A key leadership concept at NI is the balance between innovation and continuous improvement. The senior managers have to maintain that balance. The leadership classes are important here.

I think of NI as a test company. Is that an accurate perception?
Lots of people think of us as a test company, a lot think of us as a data-acquisition company, and a lot think of us as a software company. Part of the challenge in categorizing NI is [that] our approach to products and systems is very horizontal. A key component of our business is using off-the-shelf technologies—software and hardware—to let an engi-

neer or a scientist get his job done better, faster, and cheaper. Our roots are in the test-and-measurement business; we've been there for 30 years. But, with the continued evolution of LabView and modular products in many form factors like PXI and CompactRIO, the ability to apply those [products] is not limited to test.

Can you describe some nontest applications that NI serves?

Any engineer or scientist trying to do a measurement-, I/O-, control-, or analysis-related task is likely to grab an NI product. First off, a lot of test systems require a control system. We have customers doing stress testing where LabView runs the tests and also controls the temperature chamber. We have customers who use LabView Real-Time to control a dynamometer for engine or transmission testing. Rather than using a separate dedicated controller, they can use the same tools and technology for both testing and control. There are also many applications that you'd call pure control systems built with LabView—machine control, laser positioning systems, biomedical instrumentation. These are systems that are not the typical PC-based test systems you probably associate with NI. They are embedded systems, which is an area where we are seeing a lot of growth.

So, NI is a test company, a data-acquisition company, and a controls company. Is that all?

Over the last few years, we've begun to talk about ourselves as a design company. As I said, NI products are now used by engineers and scientists to implement systems embedded in the product that they are trying to develop. Historically, these customers would use NI products to prototype a new idea because it's so easy to get something up and running quickly. When it was working, however, they turned the design over to a different team that reimplemented the LabView application in C and built custom hardware. This is an expensive process. With increasing time-to-market challenges, customers are looking for ways to cut the development time. We've developed more embeddable products so customers can deploy the systems more quickly without major re-engineering. We now talk about graphical system design, which is about applying our graphical software development tools and modular hardware to much more than just test applications.

So, what's the ongoing role of test at NI?

Our intent is to be a test company for a long time. But the nature of test is changing. It's no longer OK to view test as a separate function from design. It's the same scenario I just described, where time to market shrinks, while product functionality keeps growing. Sometimes, our products can be used in the actual design, and testing is kind of automatically included because you can use the same platform for design and test. In other cases, like cell phone or chip design, you can't really use our products directly in the target product. But you can use our modular software/hardware approach to get much better integration of test with your design process. Design/test integration has been a bit of a Holy Grail in the industry for years. We think design/test integration is a lot more doable now than ever before.

Why is achieving the Holy Grail of design and test integration more doable now?

It's fundamentally due to the adoption of modular software and hardware. Test equipment is now much more granular. The functions are broken down in pieces as opposed to conglomerated into somebody's definition of what a piece of measurement hardware should be. Modularity provides a much greater opportunity to implement design tools at a much lower level. Also, the high software content of today's test systems provides more capabilities to connect to the design-software tools used today.

Could you provide an example?

Look at way people test automotive electronics. Literally, what they've been doing is using a tool to develop a model that can simulate, for example, the automotive electronics necessary to generate a crankshaft-position signal. Then, they want to take that model and run it in real time to test their prototype hardware, such as an engine-control unit. This approach is called hardware-in-the-loop testing. But you cannot take a traditional instrument hooked up over GPIB cable and hope to run a piece of software fast enough to make an automotive ECU think it's hooked up to a real car. There is no way. But with tools like LabView and modular hardware—especially modular hardware with FPGAs—it's totally possible because the components have been designed to run in real time. We see a similar test approach being used for so-called protocol-aware ATE, where the testing of a chip requires much more dynamic behavior than possible with traditional vector-based ATE systems. We generally talk about emulation-based testing, where the test system must be much more dynamic and exercise the device in real-world rather than static scenarios.

And that's a big change?

Yes. Testing of complex devices necessarily gets more complex. Customers can't simply use the old test-system architectures and expect to easily adapt and move forward. Innovative approaches like emulation-based testing will increasingly become the norm. And innovative approaches to embedded-systems development, approaches that let you seamlessly move from design to prototype to deployed system, will also become the norm. To adapt these types of approaches to both test and design, you need an approach that is very modular and puts a lot of functionality into the software.

How will NI change the future of engineering?

You see NI focusing a lot on academia. We believe that engineers need to be trained for a world where they'll face the challenges I've mentioned. They need to be trained how to design and how to test and how to fit it all together in a multidisciplinary way. The field of engineering itself is changing. All those events are changing the face of NI, and, I think, at the same time, NI is changing the face of engineering. *—Rick Nelson*

On EDN.com:

Santori addresses the role of NI's suppliers, the challenges NI engineers face, and the potential obsolescence of classical engineering. Go to **edn.com/innovate0824.**