

## Interview with **Raj Aggarwal** **Vice President, Global Technology** **Rockwell Collins**



Rockwell Collins is a leading provider of communications and aviation electronics solutions to aerospace and defense companies. Dr. Aggarwal is Vice President, Global Technology and Special Projects, at Rockwell Collins. During his 30 years of Research & Development management experience, he has launched numerous initiatives specifically adapted to the company culture and business environment to achieve technology innovation and induced company growth. He is a former Vice President, Advanced Technology Center at Rockwell Collins; Senior Director, Strategic Planning and Technology at Computing Devices International; Director of Research and Technology at Alliant Techsystems, Inc., and a Director of advanced programs for Honeywell, Inc. Dr. Aggarwal received his Ph.D. in electrical engineering from Purdue University. He

is currently a member of a number of university advisory boards, the National Defense Industrial Association (NDIA) Science and Engineering Technology Committee and National Research Council Board on Army Science & Technology. Raj can be reached at [rkaggarw@rockwellcollins.com](mailto:rkaggarw@rockwellcollins.com)

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**Raj:** I would like to focus on three topics. First, technology enabled growth; second, our 10X program to cause outside the box thinking; third, collaboration from the outside to build organic growth in the company through open innovation.

**Doug:** Technology enabled growth is a terrific theme with which to begin.

**Raj:** Having been in research and development for a long time, I have come to realize that many companies are very good at fundamental research but it never has quite the expected impact on the bottom line. I realized that the organizational models are one reason for this. One model is the stand-alone R&D facility focused on Nobel Prize winners, patents and people who are recognized on the outside. Bell Labs was the premier example of this. Another alternative is to make advanced technology an adjunct of the product R&D and engineering organizations, and totally coupled to the business units.

I joined Rockwell Collins about nine years ago as the Vice President of the Advanced Technology Center. In discussions with the management, we decided to focus on technology-enabled growth. We agreed to run Advanced Technology as connected to the business units but not dictated by them. This required that we plan right, execute right, and transition the technology right in order to create the right innovations, which would solve customer problems and then eventually help the business units create sales in the organization.

**Doug:** What framework did you put in place to realize this intention?

Raj: We started with a **technology panel based planning** process that involved business units and the Advanced Technology Center. We formalized the inclusion of outside participation so that we would have a good, independent feel for technology and customer needs. We made extensive usage of the Technology Readiness Level, which is an established definition in the Department of Defense. It classifies technology starting from just a gleam in somebody's eyes, through being proven and reliable in the field. The business units love the near-term and mid-term projects; however, the long-term projects are always questionable. They know what will happen in the next two years, but five years out, they are not so sure. We intended to move away from projects based on the personal biases of any individual. Our technology panel planning does not require the businesses to be in agreement with everything.

Secondly, we put a scorecard in place. Advanced Technology had this notion that we are R&D; we are the innovators, so we cannot be measured. The innovation cannot be forecasted. I never bought into that. The scorecard measures business impact, operational excellence, innovation, external collaboration, and personal excellence.

The heart of the scorecard is what I call the **sales growth leverage**. How do you know the degree of impact we are making? At the end of the day, business units are the ones who say whether technology made or didn't make a difference. We defined sales growth leverage by how much money we spent over the last five years, including this year on advanced technology. Then the business units provide the strategic plan for the next five years and tell us which technologies will have made a difference for them. There is no debate. It is their call. The ratio of the two defines the sales growth leverage.

We have been very successful using the with sales growth leverage metric to measure the impact of innovation. Over a five-year period, we improved our sales growth leverage by more than a factor of three. It went from 12 to 1 to about 37 to 1. With 200 people in the advanced technology center, we created almost forty percent of all of the patents in the created in the company. People could argue about the accuracy of SGL but nobody would argue with the trend. We were investing in the right places and we were delivering in the right time frame.

Doug: On what criteria does a project get located in your Advanced Technology Center versus being located in a particular business?

Raj: Fundamentally, the business units generally respond to a specific customer need within a two year time period. The businesses are developing against the customer contract or against a proposal for a customer contract. The mission of Advanced Technology, as our CEO, Mr. Clay Jones likes to say, is to take the organization where it otherwise wouldn't go. We are creating some things that go not only beyond the time horizon of the businesses, but go beyond their expertise to actually evaluate and fully understand the business implications at the outset.

Let me give you an example of a successful technology that we invented and transferred to the business units - synthetic vision. Pilots can fly at night quite safely. When there is inclement weather, however, the whole flight operations cannot cope. Synthetic vision utilizes navigation and the onboard databases to create a virtual reality in the cockpit. The pilot can land the airplane without even being able to see the outside. With collaboration from NASA and the Air Force, we developed that technology and now we have transferred that technology into the business units.

Doug: If you would speak to how you bring the businesses along in advance of the actual transition of the technology to the businesses?

Raj: Advanced Technology works hard for a successful business transition. However, "what can I do if the business units didn't go where I wanted to take them?" We said that is

not acceptable because at the end of the day sales growth leverage cannot happen if technology doesn't enable additional sales. So, we have to insure that we are bringing the businesses along.

First, we paint a vision of what is possible. "If we could do this, what would it make possible?" They can see the potential. Take synthetic vision, for example. At this level, most of the businesses understand it. They understand that inclement weather is a problem. If I had a virtual reality then it should be possible to land in more adverse conditions than is possible today. They may not buy into the magnitude of the impact or the schedule of when that would happen. They may remain skeptical as to whether all of the vision that you're planning will actually play out the way we are predicting, however, they do sort of buy in.

The second is bringing the external credibility. We independently talk to our external customers. When our business unit people go to Boeing or Airbus or our defense side goes to the defense customers, we speak with their advanced technology groups.

The third piece, which is always attractive to them, is that we can mature the technology without costing the company much money. In one advanced technology, tactical targeting, we have received almost seventy-million dollars from customers over the years to develop that technology. Rockwell must have something unique to offer because the customers are funding us, not a competitor.

Doug: When you are getting to the readiness stage to begin to have it play out in commercial or in government contracts and products, what do you do to facilitate the actual transition into the business organization?

Raj: I decided that we were not going to grow the Advanced Technology Center inside. We would grow our sales growth leverage. That required the business unit engineering to provide its engineers to work on that project. We started coupling them in the middle phases. The business units have generally been supportive of near and mid-term projects.

Doug: Rockwell Collins' business model is driven by major contracts. Some people reading this might be tempted to say, "What Raj is saying doesn't apply to us because we don't have the major contract business model. We're an industrial company or we're a consumer company."

Raj: Remember, we start by creating the business vision of a technology. I don't think that most places do that. Most of the engineers shy away from it. They think that somebody else is going to do it. I spent a lot of time changing that culture at ATC. I used to joke about whom you want creating the vision - the marketers or us. And, should we have the marketer understand technology or should we understand the business needs? Which one is easier? So, our creating a business vision is important.

The paradigm shift was this; yes, we are scientists and engineers, and yes, we are in the Advanced Technology Center, but our mission is to increase the technology-enabled sales in the company. We want to create growth in the company which is technology enabled. One can argue about the magnitude of it, but they shouldn't argue about it happening.

Doug: Shall we move to your second topic, stimulating disruptive thinking?

Raj: Rockwell Collins CEO, Mr. Clay Jones and I had much discussion about how to cause outside of the box thinking. How do you do disruptive things in the company? How do you take major swings? How do you hit homeruns? We tried some different techniques and eventually settled on what we named 10X (Ten X). The concept was very simple. If

anybody in the company has an idea that they believe can improve anything that we do by a factor of ten, not ten percent, but a factor ten, then we'll fund them fifty thousand dollars to prove their idea. So, spend that money on simulation or buying some parts and putting some demos together - whatever. Fifty thousand dollars is yours. Your boss and management are not in the middle of it.

We launched 10X in the Advanced Technology Center with a half-million dollars. We wanted to test the demand. In the first year 10X was only open to Advanced Technology Center personnel, and we got forty-six ideas and funded eight. We briefed Clay Jones and the rest of our leadership. His comment was that we have strong value in the idea itself, because now we have energized the organization. The second year we opened it up to US engineering and we got seventy plus ideas and increased the funding to one million. In the third year, that number increased to one hundred and eighty worldwide. Now 10X has become part of our fabric by which we talk about disruptive thinking.

The 10X program is creating a disruptive, outside of the box thinking and not just incremental progress, giving us the ability to hit some home runs.

Doug: I deeply appreciate the elegant simplicity of the 10X idea.

Raj: Thank you. One of the intents was to stir up the creativity so inherent in people and around the areas in which their passions lay. If I were to tell Cely to create something, but Cely has no passion for it, then there is no chance that she's going to do outside of the box thinking. People do outside of the box thinking where they are passionate. So yes, we are very happy with what has happened.

Doug: Shall we move to the third area, open innovation?

Raj: We launched our Open Innovation initiative with the question "How do we collaborate smartly so that we can take the ideas and come up with innovative solutions for our customers' problems faster and cheaper than do our competitors?" We have been at this for about two years. Nan Mattai, Senior Vice President of Engineering & Technology at Rockwell Collins, has been a big proponent of this initiative. **Open innovation says connect and develop** instead of invent and develop. That's a huge culture change - going from 'not invented here' to 'invented anywhere.' The key piece of this puzzle is focus, because it is like watching the ocean out there. Then, secondly, how do you collaborate speedily? Then, eventually, how do you create growth in the company.

We decided that we wanted open innovation to become part of the fabric of Rockwell Collins, as well. We have formed a Technology Area Council to facilitate a global scan of technologies that are of relevance to Rockwell Collins. Many technical advances are being made in related markets such as automotive, wireless communication and consumer electronics that apply to our products. We want to be aware of them.

Another piece we have added to the process of global technology scan is what we call the Technology Readiness Level greater than three. TRL greater than three implies that the idea has been proven somehow - it is not just a gleam in somebody's eye. At level three, depending upon the technology, we can make the impact on the company within three to five years. We wanted to stay in that window - outside of the first two years because then it is really just procurement, but within five, because otherwise it becomes a long-term thing.

A good example of this is around cognitive radio. Every frequency in the electromagnetic spectrum is now assigned. People want spectrum for different uses that are coming up, but it's not available. However, at any given time almost ninety percent of the spectrum is not in use. The cognitive radio technology scans frequencies, finds

out which ones are not being used, and jumps in and out of those frequencies. That technology is known as cognitive radio because it has some intelligence. We knew that this technology was coming and that it was important, but we thought it was still a few years away. Then we discovered a very small company in Florida that had developed a spectrally adaptive radio for a public utility problem, which is not in Rockwell Collins sphere of interest. Not only have they developed it, they are manufacturing it, and they got it certified. Through this open innovation process, we signed up with this company. Within three months and making only a modest investment, we were able to demonstrate cognitive radio capability in the military domain. We were the first ones in the whole industry to show that. It took us a very, very short time with very little investment, which is the power of this open innovation.

At Rockwell Collins, we have Engineer of the Year and Inventor of the Year recognition programs. Now we have added the open innovator of the year. We are taking steps to continue this culture shift. My own belief and passion is that when we look back five years from now, this initiative will dwarf everything else that we have done. There is so much potential. The Internet technology is allowing us to tap into the millions of brains that are out there to solve problems. A company should be able to say, "My employees are in the millions. I don't pay them every month. We pay them when something useful comes out." Another unique thing about open innovation is that it is not about outsourcing. It is about in-sourcing. It is about the in-sourcing of the ideas and the intellectual property that has been generated elsewhere. I think the future prosperity of corporations will come through this global collaboration.

Doug: Your passions have been ringing throughout the entire conversation. Is there anything else that you are passionate about to which you haven't yet spoken?

Raj: I've always believed that the inventors, the innovators have a larger obligation; that they should be able to impact the economy of the state and the economy of the country. That it is not limited to just your own self-interests. I do believe that the thing the U.S. has going for it is our ability to innovate; our ability to set up the right systems and devise incentives to innovate. More can be done to collaborate between universities, industries, and the federally funded organizations. I do participate in some of them. I would like to see some organization evolve and take on this larger obligation of bringing innovation into the country to make a difference for everyone.

### **Velcro Points**

1. The purpose of an advanced technology organization is technology-enabled growth. The measure is sales growth leverage.
2. It is preferable to have scientists conversant in business value than having marketing able to evaluate advanced science.
3. Encourage out of the box thinking by investing and supporting disruptive benefits.
4. Use open innovation to actively manage your access to technology in different markets and the look ahead needs of your customers.

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