

AVIATION WEEK

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INNOVATION

Leading the Way

More than technology innovation is needed to be competitive, says Raytheon CEO

GRAHAM WARWICK/WASHINGTON

Corporate culture is key to cultivating innovation, and to Raytheon Chairman and CEO William Swanson that means leading from the top. “If I don’t care about innovation, why would people do it? I have to make sure I am passionate about it,” he says.

As an engineer leading an engineering-driven company, Swanson could be expected to focus on technology innovation, but that is not sufficient to keep the company competitive, he says. “Most people think of innovation and technology. We need all business functions to understand it happens in all areas.”

Whether in the finance or information technology department, there is a need for new ideas. “There’s more to be had in innovation in your processes, and how you run your company, and that’s why it’s a focus for us,” Swanson says. “I became concerned that, because we are known for being a technical company, people would think innovation is all about the 40,000 engineers in Raytheon. That’s missing out on a large portion of our workforce.”

Swanson sees a place for both disruptive and sustaining innovation within Raytheon. “Innovation sometimes is incremental. From the bow and arrow to the guided missile is really an incremental evolution,” he says. But fostering disruptive innovation within a major prime contractor like Raytheon requires careful attention to the environment.

“You have to have the outliers in the company and it’s the responsibility of the CEO to make sure you have the environment that encourages that. But I’ve also learned as a CEO you don’t ask the same person to do both, or you will not get the disruptive innovation,” he says. “We’ll have a team look at a missile one



William Swanson
Raytheon Chairman and CEO

way, then have someone look at it from a directed-energy point of view. But those two are not in the same organization.

“It’s how we look at cyber: We have information operations and we have information assurance. I want the best sword in the world and I also want the best shield, but I don’t put them together,” he says. “I want the shield to think they’re good, then I want the sword to attack and if they get through then the shield team goes away, licks its wounds and fixes it next time. Then when the sword attacks and doesn’t get through, they go back and improve that.”

“You want an organization where that’s cultivated, but no one side suffers at the expense of the other,” he says. “I’ve watched organizations take

away resources from the incremental innovation teams to fund those that are disruptive. What you create are haves and have-nots, and that’s one way to destroy innovation. You need both.”

Raytheon has a disciplined process for deconstructing customer mission requirements and creating technology road maps to address them, but these have to allow for new ideas that pop up. “We have to plan entry points for both incremental and disruptive innovation, whether it’s in materials, processing or waveforms,” says Mark Russell, vice president of engineering, technology and mission assurance.

“We have to have processes with places along the way where the road maps can be interrupted,” Russell says. “Take quantum computing or quantum encryption; it could never happen or it could happen tomorrow. We have to be open to leaps in technology, and our process has to be able to take new ideas, reduce them to practice and deliver them to the customer.”

Swanson sees a “distinct advantage” in Raytheon’s broad-based portfolio of products and programs, which provides forward-fit and retrofit applications for both disruptive and incremental innovations. The active, electronically scanned array (AESA) is an example—a disruptive advance in airborne radar capability that is now being applied incrementally to the retrofit market.

Originally developed as its offering for the Joint Strike Fighter radar, Raytheon’s APG-79 AESA radar found a home in the F/A-18E/F and has been adapted for the F-15C and F-15E. Now the company is developing another derivative, called RACR, for the potentially huge F-16 AESA retrofit market, but still has 90% hardware and software commonality with the APG-79.

“When we invest in research and development, in hardware or software, we put hooks in so it can be reused,” says Russell. The company appoints system architects to ensure its designs are not point solutions. “A lot of large programs bring technical innovation. If we develop it properly, so it is not tied to a platform, then we can reuse that technology.”

Another example the company cites is Responder, a modular space sensor architecture designed to allow spacecraft to be configured more rapidly and cost-effectively. Using off-the-shelf optical telescope or radio-frequency (RF) antenna front ends and sensor and processor back ends, Responder is aimed at enabling missions from hyperspectral imaging to satellite communications at a fraction of the cost of traditional spacecraft.

Applying its design-for-reuse principle, Raytheon is building out its family of modules mission by mission, beginning with the Artemis hyperspectral sensor on the U.S. Air Force’s TacSat-3 experimental satellite and the Mini-RF synthetic-aperture radar on NASA’s Lunar Reconnaissance Orbiter and India’s Chandrayaan-1 lunar probe.

Responder’s “build-to-print, not build-to-spec” approach allows spacecraft costing less than \$100 million to be fielded in 24-36 months, depending on the payload, and Raytheon is hoping it will also enable innovation on the part of the customer. Potential missions include rapidly filling gaps in capability, maturing technology and requirements for larger spacecraft, and enabling technology insertion without driving up cost. “It’s an affordable path to try things out,” says Leslie Foster, space systems senior program manager.

Innovation mechanisms used by Raytheon include the IDEA program. “Submit any idea to solve any problem and we will consider providing seed money to see if the idea has merit,” says Russell. There is also an annual innovation challenge. “We put out four of five problems we can’t solve, a paragraph describing each problem. We get hundreds of white papers. We’ve had ideas so powerful the customer has followed with funding.”

Not all ideas will pan out. “One in four or five ideas will be a home run, and the culture has to be accepting of that,” says Swanson. “You have to allow for things to go wrong. If everything goes right, then you are not taking enough chances,” says Russell.

He cites an example from Raytheon’s radar development. “In the march from silicon to gallium arsenide to gallium nitride, as we pushed up the power densities and voltages to get more power out, there was a day when we were not sure we could make those materials work together,” Russell says. “But universities and small companies helped come up with the technology. Raytheon reduced it to practice, integrated it into radar systems and delivered it to the customer.”

In filling out its road maps, some of the technologies are original to Raytheon, some come from reuse, some from small business collaborators and some from teaming with universities. Raytheon may share rights to the intellectual property with commercial companies because their technology road maps overlap, even though their domains are different. “What we bring is knowledge of our domain. It’s not that we bring every technology organically developed by Raytheon; it’s that we have the right technology road map filled correctly to deliver a capability,” Russell says.

Both executives stress the importance of an inclusive corporate culture. “The best ideas may come from those who are hesitant to speak up. We have to create an environment where everyone is comfortable so we can get their ideas on the table and pick the best,” says Swanson. “If you do not have an inclusive culture, if you do not draw from the most diverse culture, you will not get the best ideas,” says Russell.

Innovation has to become part of a company’s DNA, says Swanson. “It has to be recognized, celebrated and cultivated. And you need to have that attitude from the top to the bottom.”