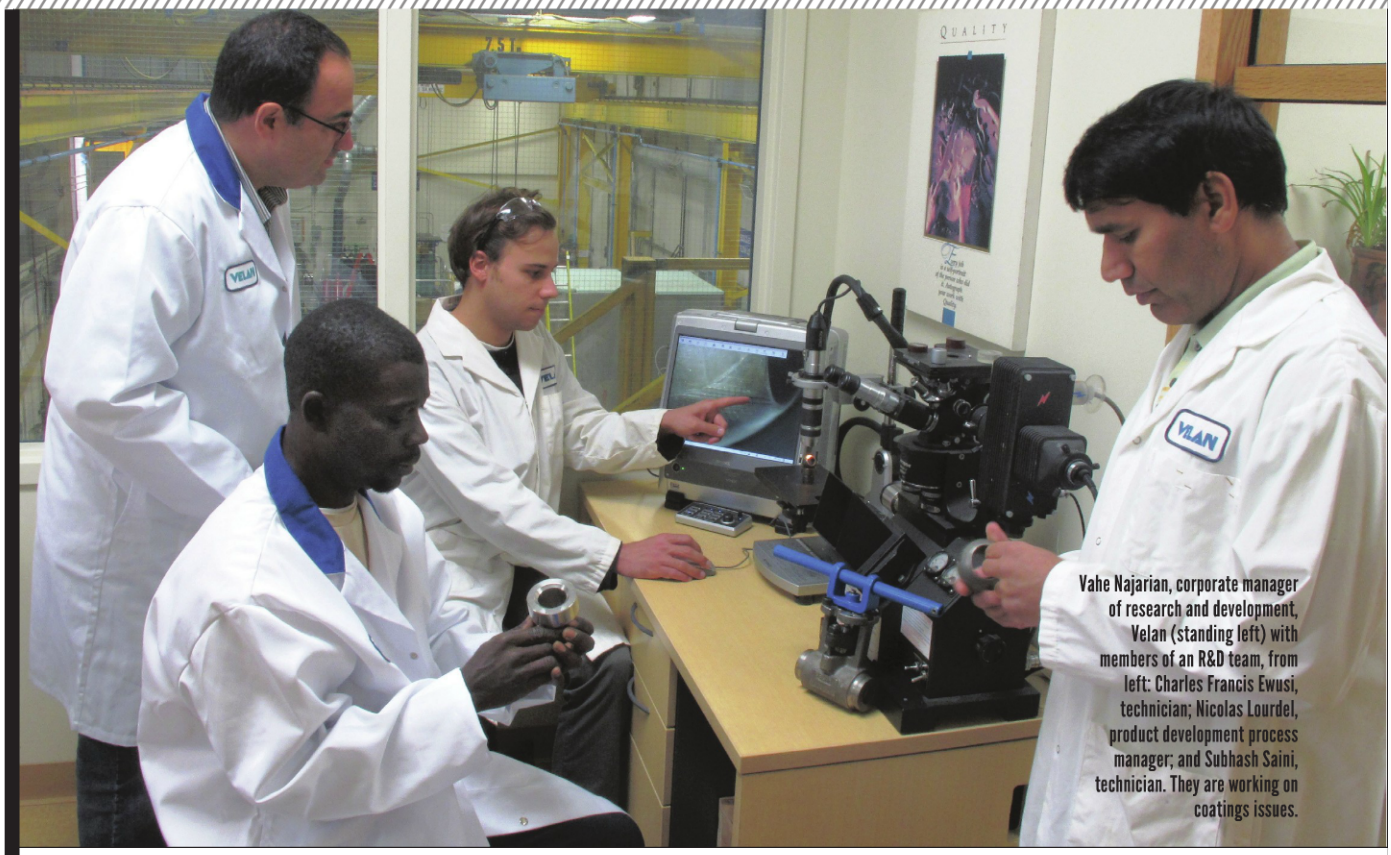

Vahe Najarian, corporate manager of research and development, Velan (standing left) with members of an R&D team, from left: Charles Francis Ewusi, technician; Nicolas Lourdel, product development process manager; and Subhash Saini, technician. They are working on coatings issues.

The Current State of R&D in the Valve Industry

BY KATE KUNKEL

As valve end-user industries become more complex and demanding, manufacturers and suppliers must develop and find better, more efficient products to do the work. For that reason, resources are increasingly allocated to the research and development (R&D) teams that can create the technologies needed.

VALVE Magazine spoke with a few of today's innovators to find out what is currently driving R&D in the valve and actuator industries and how their companies are responding.

TEAMWORK

One point stressed by everyone interviewed for this article was the importance of a team approach to R&D. While engineers continue to be the forces behind new innovations, companies increasingly realize that other people within the company are needed to pinpoint what's needed and to assure that the results meet customer demands. They are also seeking to connect their company experts with academia and think tanks outside the company.

Luc Vernes, corporate director of product innovation and technology, Velan, who heads up many research efforts for that company, has structured most projects around the concept of working in teams. Good R&D is about fostering creativity, he explains, which is much more effective when a group is working together. The individual people that make up the research group have "specific strengths and areas of knowledge. The challenge is to bring them into a room and allow them to speak candidly to solve the problem," he says. This team of experts does not need to

Executive Summary

SUBJECT: The increasingly difficult conditions that today's valves face create an ever-broader need for new technologies and for the research and development that will create those technologies.

KEY CONCEPTS:

- New issues in R&D
- What companies are doing
- Where R&D is headed

TAKE-AWAY: The key may be in forming the right kinds of teams to tackle the tough issues.

consist of great quantities of people: "You just need a few really smart people and you need to use their combined talents intelligently," he says.

Engineers are a backbone of the teams while marketing and sales personnel and people from the manufacturing plants are critical limbs. The engineers bring technical know-how to the table; however, to be truly effective, "we have to know what the customers want and need. The sales staff are the people on the ground, interacting with the users," Vernes says. The manufacturing plant people are the realists—they know what will work on the floor so they need to be committed, and they need to be included "right from the beginning," he adds.

Velan also works in teams with academic experts and government institutions on research. The company partners with the National Research Council of Canada, a governmental body that supports technological development, as well as universities, including the University of Montreal.

These outside research specialists "are accustomed to future thinking," he says. By working with them on a team, "we can conduct common research to come up with solutions for the entire industry."

He adds that Velan works with its own supplier partners and end users as well.

"An example of this is working with Hydro Quebec and Pratt and Whitney, Canada. We are partnering on common research for solutions to wear issues due to friction and corrosion," he says.

Eric van Gemeren, vice president, research and development at Flowserve, pointed out that the current economic landscape has affected the internal dynamics and pressures for valve manufacturers' R&D departments, which has encouraged looking to outside sources of expertise.

"The larger macro economic conditions are forcing some manufacturers—especially those that don't have diverse markets—to make trade-offs between investing internally or externally in strategic technologies," he noted.

"That means we must get smarter and make more firm bets in terms of where we are going to go with R&D," he adds.

The 26,900-square-foot (2,500-square-meter) flow lab in the Emerson Innovation Center

As a result, many firms are carefully assessing how many people they have coming into the company's R&D program versus how much the company should invest in third-party research.

"It's important to note that the entire R&D field for our industry doesn't happen just within our companies. We collaborate with third parties for materials, coatings technology, etc., and those require routine annual financial commitments," he says.

This situation isn't about to change anytime soon, he points out.

"In order to continue to be on the cutting edge of technology, we must continue to partner with third-party vendors, even in challenging market conditions, because if we don't, those third-party experts can always share their technology with competitors," he adds.

DRIVERS FOR RESEARCH

Dale Friemoth, vice president of technology and business development for Crane Fluid Handling, says Crane looks to what's happening with end users for direction for its research.

"We have a product technology roadmap that takes its cues from the market," Friemoth explains. The company begins with the questions: "What does industry need? What are the problems?"

It then figures out what products are required to meet industry drivers, "and then we figure out what technology is needed to make the products," he says.

Friemoth says that this market-driven approach is taken across all fluid handling developments at the company, from ideation through launch of new products through follow-up to assess success.

"It's the same process across the company and around the world, but it is driven at the local level and operated locally" so that its closer to customer requirements, he says.

The idea that the direction for research in the valve industry must be driven by customers and the market is nothing new, according to those that have been in the industry a long time.

Ted Grabau, vice president for global technology, Emerson, is about to celebrate 36 years in the field. Grabau says he's seen many new challenges pop up for the valve industry in that time and that these challenges have kept him and his R&D colleagues on their toes. His toes are planted firmly in the company's Innovation Center in Marshalltown, IA, but like some other valve companies today, Emerson has such centers in several locations around the world.

Grabau pointed out that one of the greatest challenges for all valve industry companies today is escalating customer specifications, and that those increased specification levels source from a number of issues.

"Safety and environmental and economic risks are causing customers to become more conservative in how they specify control valves," Grabau points out.

Meeting industry standards is just the tip of the iceberg of what customers expect these days, he says. Many large customers have their own, special requirements for shut-off, materials of construction, the processing of those materials and where those materials can originate, he says.

For example, some customers specify countries that cannot be a source; others have special welding requirements just for them, and still others have special non-destructive evaluation methods beyond code standards or dynamic performance criteria.

"All of these are real challenges to the research and development department as well as manufacturing operations," he says.

Grabau gave an example of the kind of unique customer requirements that come into play today and the benefits resulting tests can have. In this case, the customer wanted to know the consequences to the product's performance that might result if an explosion happened close to the product's location, exposing the valve to the blast.

A mechanical engineer figured out a way to simulate a blast impulse to satisfy that question. As a result, the company has a new measurement.

Members of Velan's Engineering Department conduct a test for an international architectural engineering firm of an automated valve to be used for turbine bypass isolation, a difficult power plant application.

By developing the simulation, "we now have that capability in our tool kit to use it [the simulation test] again," he says.

Van Gemeren pointed to another way in which end users have an impact on the way valve manufacturers conduct research and development in today's economic climate.

"Customers look to valve suppliers and original equipment manufacturers to provide significant reductions in total cost of ownership," he says.

Because of this, "they are more interested now in exploring possible new approaches and new technologies they perhaps would not have considered years ago. New sources of supply, new material selections and new non-traditional valve designs are given more consideration, even when the only real difference may be less expense upfront," he adds.

This trend puts pressure on R&D departments to be highly nimble and have relationships with customers that are intimate enough "to understand their truly critical requirements," van Gemeren notes.

"That means we must understand what can change versus what they must have to run safely and efficiently. We must know what to trade off for what they can and cannot live without."

One challenge in meeting changing customer needs is determining if what a customer initially believes it needs might not really be the case. That scenario happens more frequently today, and when it does, R&D must determine how quickly it can come up with an alternative technology that will address the real need.

Nabil Tarfa, vice president of materials and processes at Velan offers an example.

"Sometimes you face a situation where you are given a description of the service condition of a component and you comply and do everything possible to meet the requirements," he says. Then a failure occurs "and you realize that the valves are actually being misused," or they were incorrectly chosen in the first place.

This is not something the customer does deliberately, but usually is caused by misunderstanding the true challenges the valve faces in the field. For example, end users may believe they need a valve that operates at a certain temperature, only to discover the valve

faces higher temperatures when in place.

"In that instance, we might initially have chosen completely different materials or we would have used different seats or coatings," he says.

But those kinds of realities are part of the R&D process, especially when an application is new, he says.

NEW APPS AND THEIR CHALLENGES

Those new applications add to the importance of R&D. One example in the power industry is the newer ultra-super-critical power plants, which are believed to be the plant of the future.

As Tarfa points out, these plants are so new that how high temperatures will get has not been pinpointed.

"We have seen temperatures of 1,400°F (760°C) and possibly higher," he says. At those temperatures, packings and gasket materials, bolting material, body pressure boundary materials all must be considered by valve and actuator companies, Tarfa says.

One particularly robust area of R&D that is making it possible for components to survive these extremely high temperatures is coatings, R&D experts say.

Matthew Yao, staff engineer in the materials science department at Kennametal Canada, says his company has pledged significant resources to coatings for reasons that go way beyond temperatures.

"There are so many different environments" valves face today, Yao explains—acidic, corrosive, high pressure—that add to high-temperature challenges. There are also times when simply adding materials to a valve or the seats could introduce a problem with the base material, he added

"A welding overlay can actually break away or other coatings can meld right into the valve," he says.

Yao is currently working on new alloys for the ultra-super-critical power generation.

"The existing materials commercially available won't work because the temperature and pressure are too high," he says. Steel was previously used in most power-generating applications to make the valve components, then stellite was applied.

R&D engineers work directly with customers to understand critical application requirements.

However, with the higher levels of challenges, "you need the base material to survive," he explains. The base material has to be a nickel-based alloy, but he is working now on developing exotic, advanced materials for the coating.

Another example of a more challenging application in the power industry is combined cycle plants. Because these plants turn on and off frequently, they present a new level of demand.

"In the past the power plant situation was stable from the valve manufacturers' perspective," Tarfa says. But combined cycle plants, "must ramp up and ramp down in a very short period of time to be cost-effective. That is abusive to every piece of equipment in the plant; valves historically were not designed for such performance," he says.

One problem discovered early on occurred in pressure seal valves.

"The seals had metal gaskets that quickly failed," Tarfa says, so graphite became the substitute.

But those seals were but one problem in these plants.

With this constant up and down, "bolting material becomes a challenge, body pressure, boundary materials—all these must be studied and tested," he says.

"There are many materials that work, but they don't seal well, so you have to find the right materials with the right amount of life," which requires extensive testing, he says.

OLD APPLICATIONS, NEW CHALLENGES

Van Gemeren said that it is increasingly difficult to advance the state-of-the-art when it comes to key valve performance factors.

"The low-hanging fruit in terms of materials sciences, mechanics and fluid dynamics has been plucked," he explains, which means "we must explore new, non-traditional technologies. We must engage in research to stay ahead," he stresses.

One example he gave was in the area of dealing with cavitation and noise suppression.

"For the longest time, competitors all used the same bag of tricks when it came to reducing cavitation and managing noise in control valves," he explains. "But they've very quickly drained that swamp in terms of easy, quick ways to do that. All competitors have access to the same technology and solutions, so for those who are committed to staying ahead, they must pursue less-understood technologies," he adds.

Another example van Gemeren gave is with the field of diagnostics and asset management.

"A healthy process that is sorting the wheat from the chaff in the valve manufacturer space is between those who really did have a robust diagnostics and management strategy and those who were just riding on coattails and launching 'me too' products," he says.

"Customers are getting a lot more sophisticated in their understanding and expectation of what kind of real-world solutions they are looking for, and are expecting their suppliers to keep up," says van Gemeren.

This include the number and complexity of failure modes and fault patterns their solutions should be able to recognize. It also includes the amount of advance warning that those patterns can provide end users before performance begins to degrade, he says.

"The primary goal is to be able to draw a clear connection between investment in these new technologies and the hard savings that the operator realized by having made them," he adds.

As a result, "customers have raised the bar for proof in the capabilities, which means that R&D must test solutions with much more rigidity and formality. We must have real empirical data and novel solutions that separate our solutions from others."

THEN THERE'S FUGITIVE EMISSIONS

Another R&D challenge today mentioned by all the interviewees was the need to address fugitive emissions.

"It's not just meeting the API 624 requirements, or even the draft API 641 for quarter-turn valves," offers Vahe Najarian, corporate manager of research and development at Velan. "It's the sheer amount and number of qualifications and regulations and safety concerns involved," he says. For example, 624 specifies the qualifications for every valve. But each size, class and type must be tested, which can be time consuming. Small valves take about one week each while large valves can take up to two weeks.

In other words, if there were 40 valves to qualify, it could take one and a half years to get through them all, he explains. "Then we will have to deal with API 641," he says.

There are also certain risks in the testing process itself. For example, one test involves methane gas, which carries its own set of safety concerns.

While Velan used to farm out such testing to independent

contractors,"it made better economic sense to build the capacity to do it in-house," said Najarian. To do so required meeting many regulations, including those that deal with what can be done in a lab located in a city, as well as meeting challenges in getting insurance.

Friemoth agrees that fugitive emissions have brought a new level of challenge into the R&D arena.

"The expanded consent decrees that were implemented with refineries a few years back and now with the chemical process industries are driving requirements well beyond even the standards. You can't just design and work to the standards; you have to exceed the expectations. You have to improve reliability of in-line sealing to give more cycle and physical life and to improve fugitive emission control," he says.

Many of the valve industry companies are working directly to help update standards or are working on standards committees in addition to developing products that exceed the standards, he says.

Beyond exceeding requirements, many end users also want product traceability. This traceability "has to be right from the foundry through the final assembly and testing—you need to have all of it within your control," he says.

SOUR CRUDES

Changes in the oil and gas industry bring another set of R&D challenges. Grabau points to the prevalence of sour crudes as an example.

"Globally the availability of sweet gas and crude has diminished and most new exploration is relatively sour," he said. The users want to be able to buy spot crudes and enjoy the lower feedstock price. As a result, new technologies and new materials are needed, and processes must be upgraded at the front end of refining.

One area that has been particularly affected is alloy valves. Grabau says just a few decades ago such valves used to be ordered in small numbers. Today, these valves, including those made from duplex and super-duplex materials for high strength and corrosion resistance, are common.

Grabau also said nickel alloys have their own set of challenges when it comes to casting because they have such low solubility for normal contaminants. Such alloy valves have to be ultra clean, the material must be virgin, and the products often must be degassed using argon oxygen. Every casting requires a new liner in the crucible and even in the ladle, he adds.

CONCLUSION

Tarfa says it is critical to build a bridge between engineering and production as a way of developing the very best technologies to handle the challenging, changing business of process control. "There is always a gap between what is designed on a piece of paper and what can be produced," he points out.

However, the innovators are working hard to close the gap using financial resources, creating corporate-wide cultures of innovation and by building teams of research and development specialists both from within and outside their own companies. VM

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