The Role Of Small Part Innovation

Janaki Weiden, Global Marketing Manager for the Saint-Gobain Performance Plastics' Bearings & Tolerance Rings Group

Research & Development (R&D) is critical to the creation of effective and innovative technologies in all industries. And it starts with the pieces. Terms like "innovative" and "well-engineered" shouldn't be limited to referring only to iPads and airplanes. Small components – such as bearings and tolerance rings – are integral to successful product development and should be recognized for – and held to – high standards for performance and durability. Ensuring that these "unsung heroes" perform under adverse conditions and contribute to the overall product benefits, such as sustainability, durability, noise reduction, cost cutting or enhanced performance, requires R&D investment.

According to the 2010 Global Innovation 1000 study conducted by global management consulting firm Booz & Company, the top 1,000 R&D spenders cut their investment by 3.5 percent in 2009 to $503 billion. The dip marks the first time in the 13 years of the annual study that this group of companies reduced spending on R&D activities.

Since then, many manufacturers have gingerly increased R&D investment – though rates vary between industries and regions. Despite the gradual efforts to rebound, companies must continue to improve product performance, sustainability and longevity in order to remain competitive. By partnering with solution providers that invest heavily in the R&D of the engineered components they supply, these manufacturers can share the workload in achieving a better product.

Small Parts: Big Innovation

In a broad sense, bearings are used to maintain separation and reduce friction between two moving parts. While a seemingly tiny part that is often overlooked, the technology behind bearings has advanced to reduce friction and noise through special finishes and enhance sustainability by eliminating heavy metals – all thanks to R&D.

At its most basic level, a bearing provides the interface between a rounded shaft and the housing in which it rotates. Though they are often constructed from steel and aluminum, bearings are increasingly designed according to the application and can include various coatings for weather-proofing, heat protection and wear-resistance. Over time, R&D has enabled the incorporation of polytetraflouroethylene (PTFE) compounds which feature the lowest coefficient of friction of all solid materials. For example, the addition of proprietary PTFE compounds results in smoother movements and higher wear resistance. The properties are essential in bearings used in a wide range of products, including those in the appliance, automotive, bicycle and solar industries.

Let's look more closely at the applications of bearings in solar applications, for example, in the construction of the parabolic troughs found in Concentrated Solar Power (CSP) plants. Here, it's fair to say that bearings have a significant impact on CSP plant productivity. Parabolic trough collectors represent the most advanced technology for collecting and converting sunlight into electricity. Bearings are applied at the pivot points of tracking systems on parabolic troughs. The troughs track the sun over the course of the day to collect light which is later transferred to heat, then to electricity. Friction at the pivot points can impair the accuracy and efficiency of the parabolic troughs.

In search of a way to reduce friction levels in the motion of parabolic troughs, the R&D investment of Saint-Gobain [1] led to the launch of its SOLGLIDE T and SOLGLIDE M families of bearings. These bearings are designed with a unique fluropolymer to be non-corrosive, self-lubricating and 100 percent weather-proof. Able to withstand extreme temperatures, the bearings are extremely durable and provide 50 percent less friction than comparable models thanks to the addition of proprietary polytetrafluoroethylene (PTFE) based compounds. Over time, this reduction in the level of friction helps to maintain the accuracy of the troughs in tracking the sun, optimizing energy output. The added durability also reduces maintenance for an overall more efficient CSP operation.

Tolerance rings provide another example of small components that significantly affect larger devices. Again, at a basic level, a tolerance ring is essentially a flexible shim that fastens two cylindrical parts. However, with a strong dose of R&D, tolerance rings made from high-quality steel that are radially sprung become engineered fasteners that not only optimize the join between mating components, but reduce friction and noise to enhance product quality in a way that is noticeable to end-users and consumers.

Consider noise reduction in appliances. From refrigerators to vacuums, low output electric motors drive the appliances that we use every day. These low output, or fractional horsepower, motors (FHPs) are capable of creating excessive noise, vibration and harshness (NVH), eroding consumer satisfaction and quality of life. R&D allowed a component as small as a tolerance ring to significantly reduce noise and vibration in a household appliance – a major consumer demand.

In FHP motors, press fit and adhesive solutions are the most commonly found bearing mounts and present different challenges. While press fits literally press the mating components together to create friction, adhesive solutions use unstable solvents to achieve the same join. Press fits rely on rigidity to fasten the bearing, while adhesive solutions depend on unstable chemical bonds, both of which can result in noise and vibration.

Through rigorous application testing, Saint-Gobain's researchers worked to optimize its RENCOL tolerance rings for FHP motor applications. Because they lack rigidity but provide a firm hold, the tolerance rings affect both transmissibility and structure modification – two of the major ways to reduce noise and vibration. The spring-like qualities of the ring, and the ability to perfect the thickness of material and geometry, allow manufacturers to alter the stiffness of the bearing mount to realize

their optimum transmissibility ratio (ratios greater than one lead to amplification while ratios less than one conclude in effective isolation).

Fine-tuning in this way enables manufacturers to decrease the ratio of vibration output to input in the system. And only through this rigorous application testing were researchers able to overcome this major challenge with an everyday household item - improving product quality for the consumer and helping the manufacturer build brand equity.

Two Heads are better than One

Partnering with component providers that offer extensive R&D capabilities can help manufacturers develop a better product faster and with greater efficiency. This is crucial for companies across industries that aim to reduce costs and gain the competitive edge. And the testing doesn't stop once the component becomes available on the market. Additional R&D work is required for the supplier to take an existing solution that meets 99 percent of a customer's needs and turn it into an exact fit. Collaborative application testing involving the parts supplier and the product manufacturer can produce an even more perfectly engineered piece to the puzzle. Through continuous collaboration, a strong partner can develop new solutions to new problems and applications for even further product benefits.

Saint-Gobain utilized this approach in working with Cane Creek Cycling Components (Fletcher, NC, US) to achieve the world's lightest headset – a component that connects a bicycle's forks to its frame. Headsets provide a rotatable interface between the bicycle fork and the frame. Bearings, most commonly rolling element bearings, are applied between these two moving parts to decrease friction, increase performance and reduce the energy output of the cyclist. However, traditional bearings were too heavy for the ultra-lightweight bicycle desired by Cane Creek and its loyal cyclist fans.

Leveraging its global resources, Saint-Gobain's team worked closely with Cane Creek to develop the NORGLIDE X2 bearing, a new version of its existing NORGLIDE bearing, which is less than one-fourth of the weight of alternatives on the market. The companies worked closely to create the X2 material at the Willich, Germany, R&D facility belonging to Saint-Gobain before measuring the appropriate quantities of the X2 material for the application and finalizing the bearing design with the business unit's team in Wayne, New Jersey. The step-by-step R&D collaboration resulted in Cane Creek's first generation of AER family of superlight headsets – each approximately half the average weight of comparable products on the market. The most recent generation of the AER headsets utilizes NORGLIDE T bearings which offer greater rigidity.

Getting the Right Support

In short, a good R&D partner must possess the ability to test and trouble-shoot challenges at various stages of component development alongside the product manufacturer through to implementation. This helps manufacturers get over hurdles and get on with business.

Manufacturers looking for not just a supplier but an R&D partner should make sure that candidates offer the following:

- Global Projects/Analytics (The ability to connect projects across multiple facilities and apply previously learned concepts to new applications).
- Product Development.
- Technology Transfer.
- Manufacturing Support.
- Application-Driven Customer Support.
- Extensive Capabilities in:
    - Materials Formulation.
    - Design Control.
    - Solutions Testing.

Additional capabilities may include structural analysis and mapping of material microstructures and their components as well as chemistry characterizations to better understand materials and modeling for applications. With these tools, suppliers can minimize time spent on physical testing and potential material waste.

The ability to develop customized approaches to achieving effective solutions is also a crucial characteristic of a potential R&D partner. Just because a process typically works one way doesn’t mean it cannot and should not be changed. The component should be tested both inside and outside the application under different variables to ensure it will remain effective even in the most challenging environments.

For example, when an automotive manufacturer requires a solution to enhance the fluidity of a steering system, the R&D partner should be able to adapt the application testing process to find the right solution.

In automotive steering systems, RENCOL tolerance rings can be applied within hollow steering designs to comply with European Union (EU) and Chinese anti-theft regulations which require steering locks to withstand forces of 100Nm applied through the steering wheel. Tolerance rings provide a cost-effective manufacturing solution that preserves the integrity of the steering system even in attempts of theft. The alternative of manually welding the shaft to the steering column can result in either a weak locking pin in the steering column breaking due to excessive force and the vehicle being stolen or the thief causing significant damage to the steering wheel without succeeding in stealing the vehicle. In light of this, tolerance rings are the preferred fastener for European automotive manufacturers.

What makes a RENCOL tolerance ring adaptable to a given application is its shape, size, number of radial protrusions and its thickness and hardness. These factors can be combined to provide the ideal interference fit. However, the parameters depend on the components used in the car’s steering shaft, and manufacturers should seek a solution customized for their operations. A column comprised of soft steel components calls for a tolerance ring tailor-designed for that material.

Chances that an automotive manufacturer will find a one-size-fits-all solution are slim. To get a precise match, the company may have to work with its supplier to conduct a series of application tests reflecting numerous scenarios. The testing process will likely differ between different types of vehicle manufacturers based in different regions. For the supplier to be a true R&D partner, the company must demonstrate enough flexibility to adjust the process again and again.

Such attention to detail is rigorous but necessary to produce the most effective components for a given application. But manufacturers from the automotive, appliance, bicycle and solar markets don't have to go it alone. By pairing with component suppliers that offer extensive R&D capabilities and support collaborative application testing, they can find or help create their own "unsung heroes" to enhance product performance and build brand equity.

Janaki Weiden, Global Marketing Manager

Janaki joined Saint-Gobain Performance Plastics in 2004 as Application Engineer in the organization before moving to Technical Sales Manager and Key Account Manager. He is an expert in sales and marketing and also all areas of bearing design. Janaki has a Masters Degree in Mechanical Engineering as well as a Master of Business Administration (MBA). In his current role as Global Marketing Manager, Janaki is involved in strategic planning and implementation of global marketing activities. Previously, Janaki held the position of the Global Market Manager Solar & Industrial, and handled market studies, marketing planning and implementation as well as technical product trainings and support on a global scale.

About Saint-Gobain Performance Plastics Bearings and Tolerance Rings SBU

Saint-Gobain is a global leader in the design, production and distribution of innovative, high performance materials for industry and employs around 195,000 people. With operations in over 64 countries, Saint-Gobain is the 60th largest employer and among the top 100 global industrial companies worldwide. Last year, Saint-Gobain achieved global sales of over €42 billion. Saint-Gobain is listed on the stock exchanges of Paris, London, Frankfurt, Zurich, Brussels and Amsterdam. Saint-Gobain's global strategy is focused around three core markets: Construction Products, Innovative Materials, and Building Distribution; and, the company is committed to play a leading role in developing energy efficient innovations for the housing and construction sectors, protecting the environment, and managing growth in a sustainable fashion.

With 15 sites and six R&D centers globally, the Bearings and Tolerance Rings Group, a division of Saint-Gobain Performance Plastics, provides 'engineer-to-engineer solutions-in-motion' to high volume international OEMs in the automotive, leisure, energy, industrial, and other markets. Backed by a heritage of product innovation, technology, advanced materials and market leadership, they are dedicated to working with customers using their extensive engineering expertise to deliver standard and custom solutions in NORGLIDE bearings, RENCOL tolerance rings, SOLGLIDE bearings, JOINSHIM rings, and NORSLIDE cable liners that meet the

most demanding applications. For further information, please visit: www.bearings.saint-gobain.com *[2].*

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