

Fasteners of the Future

Larry Joseph Bogatz, Chief Design Engineer & CEO
B&B Hardware, Inc.
www.sealtightfastener.com

Here's a little historical trivia to provide some perspective on the growth of screw-type fasteners. The original invention of the screw is accredited to the Greek mathematician **Archytas** of Tarentum in 383 B.C. These original screws were used mainly in oil and wine presses and were primarily comprised of wood. In 1513, a German clock maker created the first metal screw out of brass wire and used a file to cut the threads. Striking and flattening one end of the wire, he made the screw head and used a file to cut a slot in the head for ease of assembly.

Fasteners were very simple back then. There were very few critical applications that would warrant advanced fastener technology. It wasn't until the introduction of steam engines during the Industrial Revolution that self-sealing fasteners were introduced for the first time. Then in the early 1950s, **Iaia** of **Abscoa Industries**, and in the early 1960s **Morse** of **Apm Hexseal**, added their self-sealing fastener designs to the marketplace. These products fulfilled a need in their time. However, through no fault of their own, technology did a leap-frog beyond the capabilities for which these products were created.

Just as Archytas could not have anticipated the need for metal screws, neither could they have anticipated a time when their products would be outdated and ineffective. After all, these designs were introduced in an era predating the creation of microwave ovens, personal computers, VCRs and fax machines.

Foreseeing that the world would not remain so simple, on May 27, 1968, the **Naval Ordnance Systems Command** approved the Military Standard for self-sealing fasteners. This standard became known as the **MS3212 & MS3213 Series**. But the groove design was not specified in the Military Standard drawings because the groove dimensions are proprietary of the companies that patented and produce the self-sealing fasteners. Unfortunately, this allowed for inclusion of some outdated self-sealing fastener designs that are unable to meet today's advanced technological requirements.

The Importance of Groove Design

The most important factor in designing a self-sealing fastener is the groove design. The best groove design is one that properly calculates the compression of its mating O-ring and assures that the O-ring will

be completely contained within the groove. This is a delicate balance because too much compression causes O-ring failure (known as compression set) while too little compression prevents the O-ring from maintaining a positive seal line between the two surfaces (resulting in product leakage).

The Space Shuttle Challenger disaster exemplifies the importance of a proper O-ring groove design, where the O-ring failure was due to improper compression of the O-ring. Therefore, since a self-sealing fastener is only as good as its groove design, and this is not specified in the Mil Spec, many unknowing fastener buyers have purchased self-sealing fasteners certified to **MS3212** and **MS3213** specs that won't even seal. At the time these specifications were created, there was no way to know that a self-sealing fastener failure could be a life or death matter, but technology has advanced to the stage where this is a very real concern.

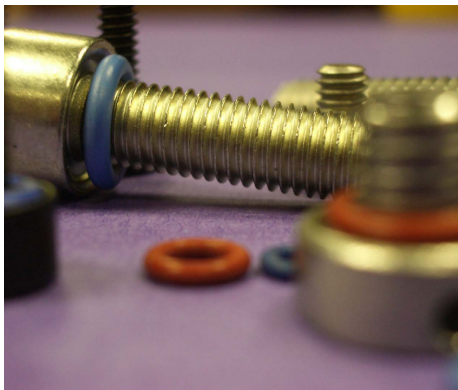
Even Higher Importance in the Future

The emerging technologies in sky cars and space travel will lead the fastener industry to greater sophistication. As this new technology unfolds, the need for completely reliable self-sealing fasteners providing 100% pressurization of products with a zero failure tolerance is paramount. It's obvious that 20th century self-sealing fastener designs cannot meet the requirements of 21st century product applications. It is clear where the fastener industry is headed, and the 2006 report of well known forecasting experts, **The Freedonia Group** state this plainly: "The demand for application specific standard fasteners will grow at a faster pace than other standard fastener types, as more original equipment manufacturers (OEMs) replace commodity items with specialized designs. Sales of aerospace grade fasteners will be bolstered by renewed strength in aircraft production. Innovations in fastener design include new generations of self-locking fasteners, sealing fasteners, and fasteners fabricated from advanced alloys." Innovative, proprietary fastener designs will be the new standard in the future fastener industry. New lightweight, high strength-to-weight ratio materials like titanium and aluminum alloys will be a primary design element in these new fasteners.

This Freedonia Group report refers specifically to my own particular area of expertise in sealing fasteners. This market transcends all seven categories of the industrial fastener industry. Sealing fasteners will soon represent over US\$1 billion in annual fastener revenue. Without a doubt, sealing fasteners will be a vital part of the transition from present to future technologies.

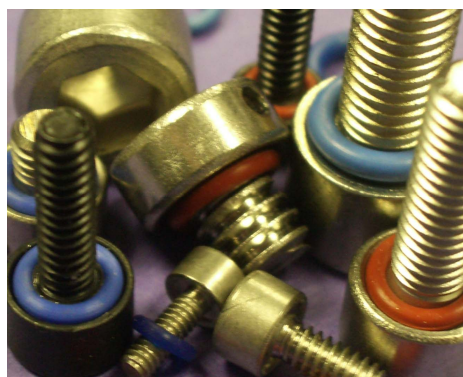
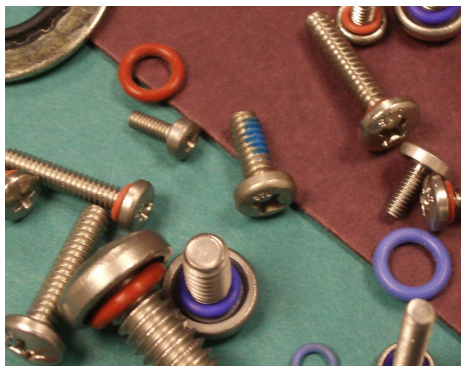
Sealtight® Technology from **B&B Hardware, Inc.**, Santa Barbara, CA, USA, has multiple self-sealing fastener patents that will meet the technological demands of the future and is the only company holding current patents on self-sealing fastener technology.

Assortment of self-sealing fasteners incorporating Sealtight® Technology.



Close-up of socket head cap self-sealing fastener utilizing Sealtight® Technology.

Pan head self-sealing fasteners featuring Sealtight® Technology.



Socket head cap self-sealing fasteners with Sealtight® Technology.

The Critical Will Become Commonplace

Imagine how these rapid changes are going to affect the fastener industry and create new opportunities for those who are ready to embrace it. What does this tell us about the future of fasteners? It tells us that critical applications will become commonplace.

In the very near future, you may well be walking down the corridors of the newly completed moon base. A temporary base will be established by 2018, and NASA has projected the completion of a small city on the moon in the year 2024. NASA is currently developing the Orion space capsule (approximately two and a half times larger than the Apollo Capsule) to rendezvous with the space station replacing the Space Shuttle by 2010. The Orion is expected to be NASA's primary mode of transportation to the moon. In anticipation of the future lunar base, NASA has implemented the Innovative Partnerships Program (IPP) to create a multi-terrain loader to be used for the construction of lunar bases, lunar surface development and mining from the solar system's largest known deposit of titanium.

Completion of the first intergalactic spaceport with scheduled commercial flights into space is expected in 2010, and Hilton's first orbiting hotel is anticipated in 2012. It won't be long before the people who purchased lunar property will be able to stake their claim in person. However, the moon is only one focus. There are many advancements in technology taking place right here on Earth, and it won't be long before the world depicted in *The Jetsons'* cartoons will be a part of our everyday reality.

This rapidly emerging technology was predicted by Henry Ford in 1940 when he said, "Mark my word: A combination airplane and motorcar is coming. You may smile. But it will come..." As a precursor to flying cars, many of the personal aircraft manufacturers are producing Very Light Jets (VLJs). Very Light Jets are aircraft with a maximum take-off weight of 10,000 lb., and are priced below standard business jets. Cessna Aircraft indicates its intention by naming its new line of VLJ aircraft with car names like Mustang, Caravan and Grand Caravan.

The Government Accountability Office (GAO) states, "The role of VLJs in the National Airspace System (NAS) is uncertain; however, VLJs are expected to be a game changer for transportation and the advent of commercial regulations would heighten that potential."

NASA offers a US\$2 million cash prize for the winner of the Personal Air Vehicles (PAVs) flight competition. This air vehicle will operate similar to a car and will transport people to within a few miles of their home in a fraction of the time.

Terrafugia, Inc. and Moller International take it one step further with their "flying cars". Terrafugia's

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vehicle is named the Transition. The Transition is deemed a road-worthy vehicle for long-distance highway travel when its wings are folded and takes off like a standard aircraft when its wings are extended. Moller International's vehicle is named the Skycar. The Skycar it is not designed for long distance highway travel. However, it doesn't require space for take-off or landing because it hovers like a Harrier Jet prior to forward propulsion.

Bruce Holmes, Manager of the General Aviation Office at the **NASA Langley Research Center**, stated, "Once we have the infrastructure, then Moller's Skycar has a place to grow. Such a system is on the way. Various organizations including NASA, the **FAA**, the **Department of Transportation**, individual states and aviation industry groups are currently developing a small aircraft transportation system."

Conclusion

As we move forward towards the commercialization of space, sky cars and higher technology products, specialized fasteners will become the new standard. Many of these applications will require self-sealing fasteners that are completely reliable providing 100% pressurization with a zero failure tolerance that at this time is only offered by Sealtight Technology.

We are embarking upon a new world where much of our population will commute via sky cars, space travel will become commonplace and our technology in electronics, medical, marine and other industrial applications will become more sophisticated. In this new environment the front-end savings of low-cost fasteners will be more than negated by the loss of products and lives on the back end.

The safety provided by effective fastener designs will be the most important factor. Applications that are more advanced than the fastener used to hold it together is a recipe for failure. Ever-changing applications will require ever-changing designs to meet this need. It's time for the fastener industry to move into the twenty-first century because fastener designs of the twentieth century will no longer make the grade.

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Personal Air Vehicle (PAV).



Terrafugia's Transition flying car.



Moller International Skycar.

More On The Author...

Larry J. Bogatz is the Chief Design Engineer and CEO of Sealtight® Technology (**B&B Hardware, Inc.**). He has designed thousands of different fastener products, and he is the only holder of multiple current patents for specialty self-sealing fasteners. His designs have been used in the Mars Rovers, the Alvin & Jason submersibles, **Medtronic's** insulin injectors, various **NASA** projects and numerous other military and commercial applications. He has more than

20 years experience in the fastener industry. As a professional mechanical engineer and a veteran of the **Navy Seabees**, he has extensive hands-on real-world experience. In addition, he has authored a book, numerous articles and has appeared on ABC Television and numerous talk shows.

larry@sealtightfastener.com

