

Up in the Air

Volatile Aerospace Market Keeps Gear Manufacturers Guessing

Matthew Jaster, Senior Editor

The highly competitive aerospace/defense market is chock-full of holes in 2013. The budget—particularly in defense spending—has been a hot topic. Programs are being cut, research and development is being pulled back and blue/red states are debating national security issues. Some analysts want to see reductions in aerospace/defense spending across the board. Others—such as the 45 states involved in the F-35 Joint Strike Fighter Program—refuse to get caught up in a political chess match when high-paying jobs are at stake.

According to www.deloitte.com, despite the notion that it costs too much to develop and produce a new commercial airline in today's market, the commercial aircraft segment is expected to reach record revenues in 2013 after posting its best production year in 2012. Global defense contracts, however, are expected to decline for the third straight year. Trimming the 'budget fat' is becoming the norm for many involved in these high risk, high reward aerospace/defense projects. In a recent *New York Times* article by David E. Sanger and Thom Shanker, the authors suggested that military officials should abandon the phrase "do more with less" and start to assess what it would mean to "just do less."



Arrow Gear, Delta Research and Precipart Corporation continue to find success in the aerospace/defense sector despite these various question marks. This is accomplished for a number of reasons including an emphasis on machine tool technology, customer service and quality control. They've managed to maintain a significant market presence in aerospace while branching out to the other industries. It also helps to have the Boy Scout mantra "Be Prepared" in your back pocket, as aerospace/defense plans frequently change.

Tried and True Technology

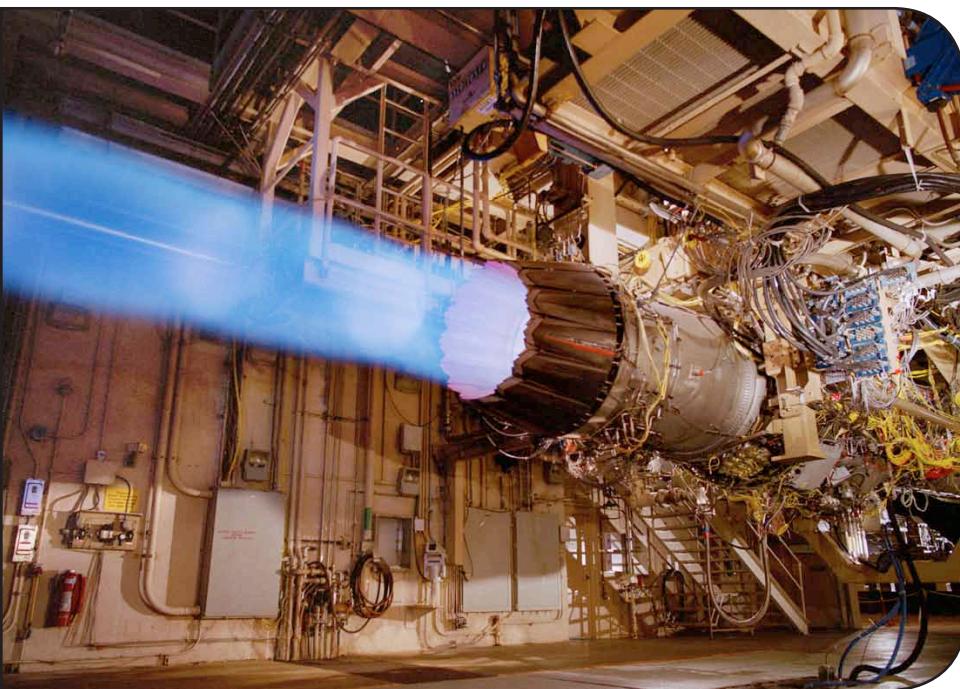
If there's a formula to aerospace/defense work it would surely start with new technology. A company eager to gain work in this highly critical field needs both the machines and the skilled manpower to succeed. This means consistently upgrading machine tool equipment to handle multiple operations and getting equipment shipped ahead of schedule. For the time being, the United States is very good at this.

"The United States remains the leader in many advanced technologies, and low volume, high quality products are still a U.S. specialty," says Joseph L. Arvin, president and COO at Arrow Gear, located in Downers Grove, Illinois. "We have largely lost high volume, low quality products. I have con-

cerns about the United States retaining its role as the top producer of high quality products as China's industrial sector becomes more advanced. There has been a lot of talk about reshoring and jobs coming back, but until we see a reversal of our trade deficit of manufactured products (\$436 billion in 2012), the United States runs the risk of further decline and deindustrialization, not to mention the negative impact on our overall economy."

For Arrow Gear to remain at the leading edge of the gear industry, Arvin believes they must continue to improve on both technology and new machine tools.

"In 2010, we expanded our manufacturing capabilities to accommodate larger gears. This investment of over \$4 million led to the addition of 65 new employees and allowed us to secure new work on two different military helicopter projects. Currently, we are in the process of purchasing additional new machine tools and inspection equipment to en-



Commercial aerospace forecasts look up but global defense contracts will most likely decline in 2013 (photo courtesy of U.S. Department of Defense).

hance our productivity. This is critical to remain competitive because our foreign counterparts, particularly in China, are equipped with the latest technology."

The Delta family of companies (Delta Gear, Delta Research and Delta Inspection), located in Livonia, Michigan, continue to invest in leading technology and capital equipment for aerospace applications. The organization has invested in Reishauer 260s for production gear grinding and a Niles 800 that grinds internal and external gears (a machine will be used for prototype internal ring gear grinding for new jet engine projects). The six different grinding arms on Delta's two Kapp VUS machines also work on the Niles 800. Additionally, Delta has Gleason GP 300 shapers for internal and external gears and splines. "They have electronic lead guides and a tilting column which allows us to produce back-tapered splines and exotic type gear and spline profiles. We will also be able to 'shuttle shape' extremely long splines," says Tony Werschky, sales/partner at Delta. "We also have a new Koepfer 300 CNC hobber. This machine has built-in automation for ease of use for low-volume automation, which is great for aerospace. It also has special software for producing special lead-in on gear/spline profiles, which is used in circumstances when assemblies continuously engage and disengage in operation."

New machine technology doesn't add up to much more than shiny new toys if you don't have the business to take advantage of the highly specialized work found in aerospace/defense applications. "The key to developing long-lasting relationships with large OEMs and primary contractors is by solving their problems, consistently meeting their needs and through all this, providing consistent communication that always gives them a level of security where they know they are being taken care of," Werschky says. "We have a high degree of expertise in the demanding re-

Delta recently moved into a new building in Michigan to streamline the production process and increase throughput.



Aerospace gearing has helped companies like Delta improve work in other areas such as the automotive prototype industry.

quirements of aerospace gearing," adds Arvin. "Foremost among our core strengths is our gear design and development capabilities. Using state-of-the-art technology, we use computer models to predict the contact pattern location of the gear teeth under load before actual fabrication. This approach, which replaces the conventional trial and error method, saves our customers a great deal of time and expense. I noticed 20 years ago that most major aerospace corporations were divesting themselves of the actual gear tooth design. For the past several years, Arrow has acquired this complete capability and currently we do not rely on any outside services for support. Within the last three years we have completed 24 new developments, which include jet engine PTOs, transfer boxes, and accessory drives. For helicopters: main drive bevels, intermediate, nose, and tail gears."

John P. Walter, president and CEO at Precipart Corporation says the company provides custom-designed actuators, motion control components and precision mechanical assemblies for several aerospace companies. "We have increased our workforce throughout the organization in both our manufacturing and office areas by approximately 33 percent. We have also added machinery in critical areas to stay ahead of projected demand increases. This new machinery is allowing us to hold tighter tolerances while increasing throughput."

Machine tool technology, according to Arvin, is progressing and evolving at a brisk rate. It's no coincidence that aerospace gear manufacturers are beginning to reap the benefits from machine tools that handle multiple manufacturing functions.

"As these technologies change, the result is faster, more accurate and efficient machining operations. We are currently investing in multi-

purpose machining centers that will perform multiple operations," Arvin says.

"We recently purchased a Mori Seiki NL2000 T2Y2, which is a 4-axis lathe with twin chucks, live tooling and bar-feeding capabilities," Werschky says. "This machine can handle multiple operations in one setup, which allows for better throughput on low-volume production."

The Benefits Beyond Aerospace/Defense

It's hardly a trade secret that a state-of-the-art facility and a strong engineering team must be in place in order to keep up with the high demands of aerospace/defense work. While it takes a major investment and plenty of man hours to get there, the benefits can actually be greater *outside* the market segment.

"Since our facility is optimized for aerospace work, this is beneficial in our work with non-aerospace customers in that we are able to provide extremely high precision products," Arvin says. "Arrow supplies gears for a very wide variety of customer applications that are quite demanding from a quality perspective, such as oil rigs, mining, off-road equipment, machine tools, auto racing (on and off road) and ships, etc. We do work with more than 500 customers over any two year period."

Delta's aerospace work has spilled over to other applications, particularly in the automotive prototype industry. "Our high-precision gears are no longer only needed in the aerospace industry; automotive gear engineers are pushing the envelope with new gear profile modifications, which can only be met with the latest gear grinding machines," Werschky says. "We have met these engineers' needs by working collaboratively with them to show them what these machines can do in production, which helps them to develop long-term solutions for their company's production automotive gearbox designs."

Delta has positioned itself for growth by investing not only in high-precision production equipment but also by investing in equipment to measure these tight-tolerance gears, shafts and assemblies. "You're only as good as what you can measure, and there's not much we can't measure," Werschky adds.

The Challenges of High Quality Components

The most significant challenges facing aerospace gear manufacturers today involve global competition, business incentives, raw materials, lower prices and shorter delivery times.

"Many foreign companies have lower overhead than we do here in the United States, coupled with the latest machine technology. All other foreign governments know how important manufacturing is to a nation's economy and in providing jobs for its people. High quality aerospace products are next on their agenda!" Arvin says. "Every major aerospace corporation has already flocked to China to make a quick few billion dollars to help China build their C919. I see this as very unfortunately short-sighted. In 10 to 15 years they will be laying off employees in their U.S. plants (our children and grandchildren) for today's big bonuses and golden para-

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chutes – all of this while saying, 'I am doing this for the sake of stockholders."

"We believe we are going to see more of the high-precision parts that were sourced to low-cost countries come back to U.S. suppliers as OEMs and primary contractors get a better understanding of what the overall cost impact can be. Having a U.S. supplier allows the OEM more control to quickly rectify a quality or delivery problem."

Werschky continues, "We now live in a world economy where your parts can be made anywhere around the globe. And all companies, both small and large, can do business wherever they want. To drill down on this question a little more, the Detroit Metropolitan area has the largest population of engineers in the world per capita. Detroit is still a hot-bed for the design of gears, gearboxes and transmission components and assemblies. The state of Michigan has recognized this and knows that it must continue to develop this competitive advantage if they want to stay the leader in the world economy. Fortunately, the Michigan State Legislature has taken multiple steps to move Michigan from being the 46th worst state to do business in to now being in the top 10 percent. Future enhancements are coming as well. This will help to give companies the incentive to come to Detroit to start their new business."

"Although we have an internal training program, finding the right mix of people who are ready, willing and capable of performing at such high levels of performance can be difficult," Werschky says. "That is why we are partnering with our local community college (Schoolcraft College – Livonia, Michigan) to develop a gear curriculum for students and prospects which will enhance their understanding of gears and give them a solid foundation of understanding of gears from which they can build upon."

At Precipart, Walter believes that the general economy is still having a negative effect on some of the company's commercial aircraft business. "The cost, quality and lead-time issues related to supply chain led us to bring some secondary operation capability in-house. This helps us control processes and keeps us highly competitive," Walter says.

"One of our challenges is the lead time required to get raw material for our aerospace gears," Arvin adds. "I have been told that South African mills that supply much of the aerospace grade steel are once again having a difficult time meeting the demand from China. As a result, we may need to wait for months to get forgings. Another challenge is the ongoing pressure for lower prices and shorter deliveries."

"I think the industry will become more regionalized – aircraft will be built in the countries where they will be purchased and used. China and India will be busy making aircraft for their own consumers and the U.S. will be in a similar position," Werschky says.

A Critical Calling

Not lost on any of the people involved in aerospace/defense projects is the high level of manufacturability needed to complete these complex components. The staffs at Arrow, Delta and Precipart take great pride in each unique job in this field.

"At Precipart, we are very aware that we play a crucial role in things bigger than ourselves. Our people take pride knowing that the components we make contribute to the safety and integrity of platforms carrying airline passengers, as well as military personnel," Walter says. "We are driven to work to the highest quality standards because we know the critical nature of these aerospace and defense applications."

"Producing the product we do is challenging, but I believe all of us here take great pride in the fact that our gears are used in some of the most advanced aircraft produced by our civilization. I can see the pride in their faces when I take customers and other visitors through our plant," Arvin says.

"We love a challenge," Werschky says. "When we finish a difficult program and send the parts or assemblies on their way, everyone knows they did their best and when the customer's contact is only to make more — that meant everything was right the first time around."

Steady As She Goes

Gear manufacturers will tell you that the last economic downturn left many unanswered questions. While things have picked up in 2013, most manufacturers are approaching 2013-2014 with cautious optimism. They're keeping an eye on Washington while defense spending and budget constraints get sorted out. Still, meeting customer demands in this field can be very rewarding. "From engineering the elaborate processes for manufacture to actually running the multi-million dollar machines that produce aerospace gears, we've built a world class reputation by consistently meeting our customers' needs and being honest and open," Werschky says. "This is what we feel keeps them coming back for more." **PTE**



A PECo ND300 inspects gear attributes at Precipart Corporation.