Military fighter jets, including the F-22 Raptor, require high-precision/high-quality products from gear manufacturers (courtesy of Airman 1st Class Amanda Grabiec).

Several programs involving the Joint Strike Fighter, including an alternate engine and reliable replacement warhead, could potentially be cut under Defense Secretary Robert M. Gates' 2010 defense budget (courtesy of Senior Airman Julianne Showalter).

High-Tech Risks and Rewards

AEROSPACE/DEFENSE CONTRACTS OFFER UNIQUE CHALLENGES FOR GEAR MANUFACTURERS

Matthew Jaster, Associate Editor

There's always pressure on gear companies to deliver high-quality products to customers, but the pressure increases slightly when Uncle Sam is involved and the United States' global interests are at stake. Decorated generals might drop by the manufacturing floor for an update, contracts may be more stringent and delivery/quality expectations are heightened.

Aerospace/defense gears aren't exactly your run-of-the-mill, garden variety type of equipment. For these applications, companies seek high-precision, high-quality and highly-inspected gears that are placed in vehicles or equipment that costs millions. What sort of preparation and expertise separates those working on a $45,000 automobile from those working on an $80 million fighter jet?

In order to land contracts in these industries, a gear manufacturer must have complete manufacturing and design capabilities in-house and an experienced workforce in place to meet the demands of these fields. Despite all the added pressure, aerospace/defense contracts can be extremely profitable for gear manufacturers that have the right systems and processes in place to handle the workload.

"Primary contractors are very demanding in the aerospace and military industries," says Tony Werschky, sales and marketing representative at Tifco Gage & Gear and Delta Research. "A traditional automotive company needs to have a 'come to Jesus' [moment] when they determine whether they have the ability to conduct business profitably in this industry and whether they can handle the stress, competition and responsibility that it encompasses."

For 25 years Delta and Tifco have been supporting the military through primary and secondary contractors,

continued

amounting to approximately 51 percent of business.

"We have built steering systems for the Navy since the '70s," Werschky says. "Since then, we've also provided all kinds of products from fuel metering units to parts on the Tomahawk Cruise Missile and complete gearboxes that go on satellites into space to precision optical parts."

"We also machine the transmission and engine adaptor housings for the Expeditionary Fighting Vehicle—an amphibious tank," Werschky says.

Werschky says the defense business is good if you can get it, but it is tremendously different than servicing other industries. "There is more accountability, more process control and little to no room to deviate from the part requirements."

Reputation is a huge factor in determining future business for companies seeking aerospace/defense work.

"Developing new customers takes time, but once you're in the system and accepted, these companies get into the habit of using you," Werschky says. "Margins can be higher if quality is attained without significant rework or overextended processes."

Werschky says that quality and delivery are more important than price for many aerospace and defense customers.

"They may not come out and say it—they don't have the time and resources to develop a new supplier every time a product change comes along. Additionally, some aerospace/military contractors are still buried by demands from the Iraq and Afghanistan wars and are looking for suppliers who may be able to help them with capacity issues," Werschky says.

Delta and Tifco's business comes primarily from the aerospace/defense and automotive markets, though Werschky notes that the automotive business is only a fraction of what it has been in the past.

"With Tifco's heritage being a master gear and gage producer, our teams produce their aerospace gears to gage quality tolerances. We continue to review alternate industries like wind, mining, medical and off-highway projects," Werschky says. "Although we are involved in these industries, we maintain a focus in automotive, military and aerospace based on market direction, current and future industry demands and risk-to-reward relationships."

Arrow Gear has provided gearing products for Armored Personnel Carriers (APCs), Landing Craft Air Cushion (LCAC) Hovercrafts, guidance systems for a tank gunner, missiles, military drones, as well as fighter jets including the F-18, F-22 and Joint Strike Fighter (JSF).

As commercial work was moving offshore in the 1980s, many gear companies were looking to other industries for new business. Arrow's President, Joe Arvin, had a background in the aerospace industry when he first joined Arrow and was already helping to steer the company in that direction. At the time, the specialized work involved in aerospace projects remained a viable sector for the company, thanks to its established gear expertise.

The aerospace industry accounts for roughly 65 percent of Arrow's business today. In addition to supplying various parts and services for military equipment, Arrow Gear has been an innovator in new technology and gear advancements for aerospace applications.

"Most aerospace companies are divesting themselves of gear design engineering—it's not a core competency—and we have taken up the slack," Arvin says.

As an example, Arvin explains that Arrow performed the gear design and prototype development for the power-take-off and the accessory drive bevel gears for the jet engine on the JSF as well as the lift-fan gears used on the STOVL version. Utilizing advanced computer aided technology, Arrow's engineers produced a design that accurately predicted how the contact pattern of the gears would move under full load — achieving optimal results on the first attempt.

Arvin said, to his knowledge Arrow Gear produces more jet engine gears and bevel gears for helicopters, than any other non-captive gear manufacturer in the world.

Arvin agrees that the work done in the aerospace/defense field is far different than other areas and the challenges are extremely specific; this has required Arrow to triple their engineering and quality overhead.

"There are many more quality and documentation requirements. In some instances, the paperwork required to ship the parts actually weighs more than the gears."

Arvin notes that there is more pressure on delivery of a complicated part that can take up to 120 different operations for a lot size of one or 20 gears.

"If it is a military DX rating, someone from the military will be in your factory making sure you're running their part," Arvin says.

Precipart Corporation, founded in 1979 in Farmingdale, NY, has worked in the aerospace/defense industry for more than 20 years. These industries have contributed to approximately 25 percent of the company's business.

Don Weinzimer, vice president of special projects, says the company is always looking for new opportunities throughout the aerospace and defense markets. Through its engineering and manufacturing expertise, Precipart has designed and produced components and motion control devices that have been incorporated on commercial and military aircraft, the Hubble Telescope and the Mars Rover.

"Contracts in this field typically are more sensitive to economic turns up or down. These contracts require special process controls, specify tighter requirements overall and mandate adherence to the National Aerospace and Defense Contractors Accreditation Program (NADCAP) performance standards for suppliers."

While the aerospace/defense industries present many manufacturing challenges, it's equally demanding for these organizations to seek new business opportunities.

"The question we continued to ask ourselves is how do you become more diversified as an organization when 85 percent of your business involves aerospace and defense?" asks Adam Nelson, general manager at Nelson Engineering.

"It's a matter of finding other industries that need the same type of high-quality products, focusing on areas such as industrial gearboxes, the automotive aftermarket and maintenance/repair and overhaul."

Nelson says the precision and machining knowhow needed to satisfy these fields can be utilized for other areas of the gear industry.

"Customers always value experience and the knowledge you bring to the table," Nelson says. "This positions us to satisfy other markets that expect the same high-quality and high-precision products."

Nelson Engineering recently brought in 10 outside sales representatives to aggressively seek business in industrial gearboxes with wind generation a key focal point.

"The benefits of working in aerospace and defense are that the work you do ends up creating robust systems and processes, and this allows you to really stand behind the products that are being manufactured," Nelson says.

Products at Nelson Engineering include gearboxes in nuclear missile silos, high-end gear products for the Multifunction Utility/Logistics and Equipment (MULE) vehicles for the U.S. Army and work involving the next generation of catapults for aircraft carriers (the device used to assist military jets in launching from ships).

Nelson adds that the pressure that comes with manufacturing highly critical components is not much different than other types of components.

"The interesting thing about working in aerospace and defense is that you're not the only one holding the part. It might go through 12 different companies before you reach the finished product. It's as much about program management as everything else," Nelson says.

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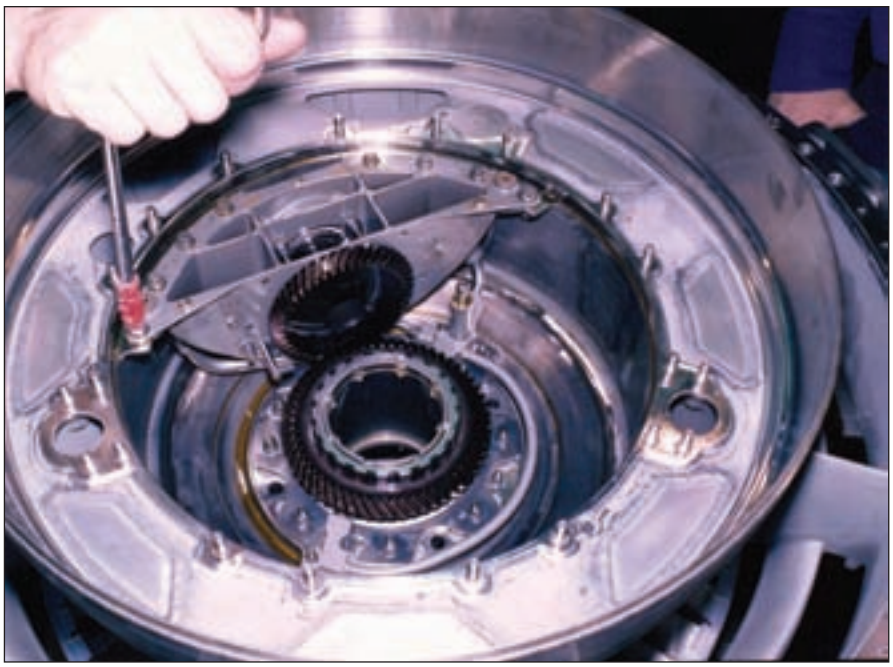
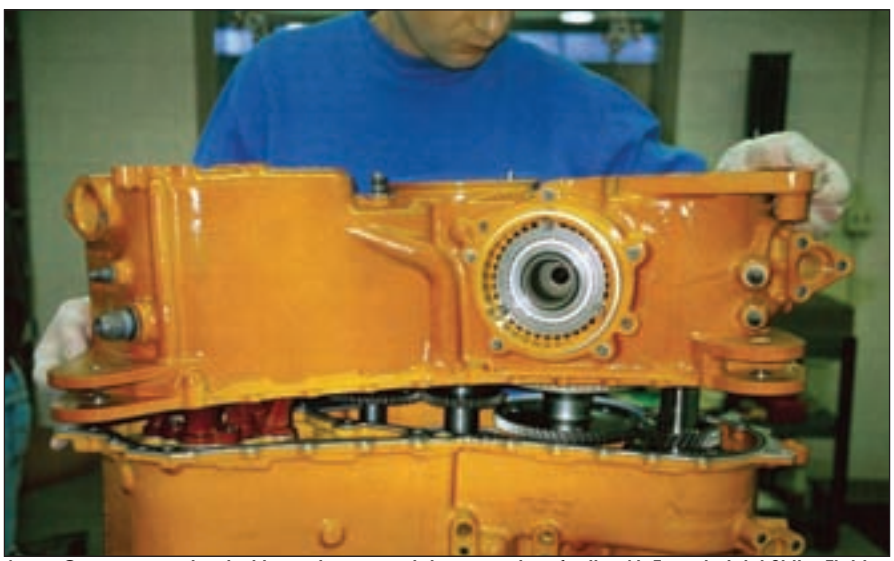


Arrow Gear provided components for the F-18 404 engine power takeoff shaft (courtesy of Arrow Gear).



Arrow Gear was contracted to work on a prototype gearbox for the Air Force's Joint Strike Fighter (courtesy of Arrow Gear).

Nelson Engineering has worked with the U.S. Army on components for the Multifunction Utility/Logistics and Equipment vehicles (courtesy of the U.S. Army).

as everything else," Nelson says.

And is there any added pressure when military organizations are keeping a close eye on your work?

"We're one of only a dozen or so companies with a DX-rated contract, meaning that the only one who can issue the purchase order is the President of the United States," Nelson says. "It has been made clear to us numerous times that if we make any hiccups, the government would get involved very quickly."

As it stands now, it's the manufacturers that are paying close attention to Washington. As *Gear Technology* went to press, Defense Secretary Robert M. Gates was pleading his case before Congress for the 2010 defense budget. Although base funding is projected at $534 billion, Gates announced billions of dollars in cutbacks to programs in all four military branches.

In his opening statement to the House Armed Services Committee on May 13, 2009, Secretary Gates expressed the principles of his budget plan.

"This budget aims to alter many programs, and many of the fundamental ways that the DOD runs its budgeting, acquisition and procurement processes," Gates said. "The responsibility of this department first and foremost is to fight and win wars—not just constantly prepare for them."

The rampant debate on how U.S. dollars should be spent on defense projects is making headlines due to Gates' plan to "remake" the U.S. military, shifting the focus to unconventional war items like mine-resistant vehicles, surveillance drones and medical helicopters while cutting back on fighter jets, bombers, tanks and aircraft carriers.

Gates wants to focus on "irregular" warfare issues instead of spending billions of dollars on expensive future weapon systems while the fighting in Iraq and Afghanistan continues.

"These recommendations are less about budget numbers than they are about how the U.S. military thinks about and prepares for the future. Fundamentally, the proposals are about how we think about the nature of warfare."

It remains to be seen what projects will be terminated and how the budget under the Obama Administration will affect future contracts. Nevertheless, gear manufacturers are keeping tabs on the outcome of this debate.

"We are concerned about these cutbacks as it would be a major loss of jobs," Arvin at Arrow Gear says.

Nelson adds, "The market will pick up in some areas and slow down in others. You have to be really prudent and yet at the same time, it's necessary to expand your reach to see what other

Delta Research and Tifco Gage and Gear machine the transmission and engine adaptor housings for the U.S. Marine Expeditionary Fighting Vehicles (courtesy of the EFV Program Office).

opportunities are out there."

Time will tell how manufacturers will cope with terminated contracts in industries that account for more than half of their business.

"We are ever vigilant as to how to evolve as a company in order to provide the products that are needed in the future," Werschky says. "What we have found is when you produce outstanding quality products, on-time and at a reasonable price, there will always be a place for you in this business."

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