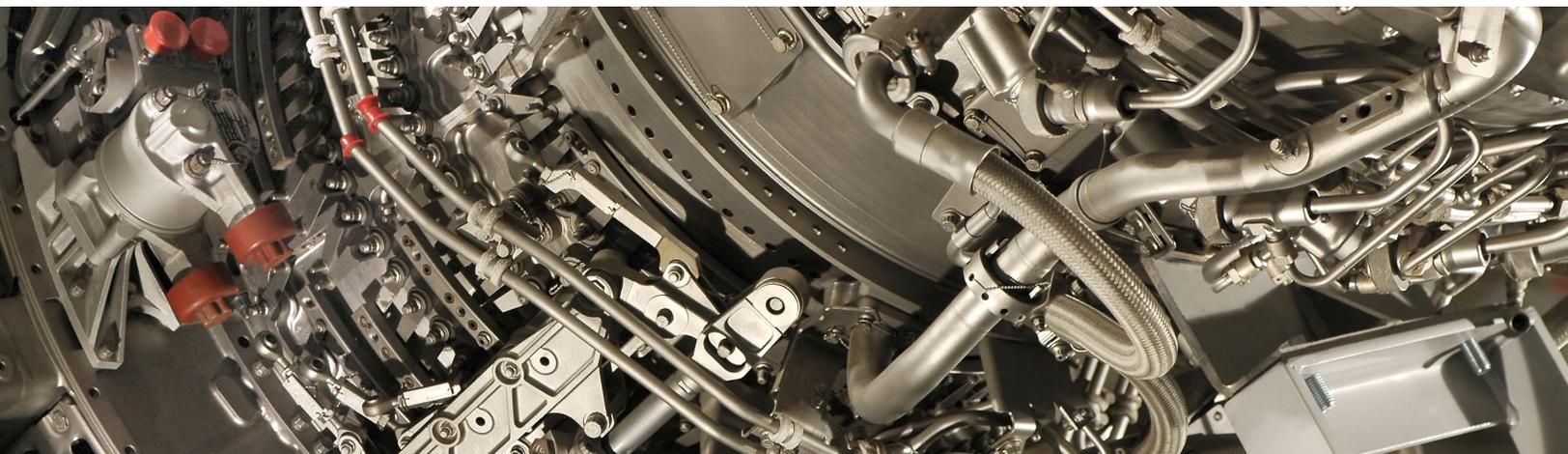


3 Ways Advanced Machining Builds a Competitive Edge in Aerospace

Solutions for suppliers seeking ways to meet new productivity challenges, including increasing demand and shorter lead times.



Aerospace and defense (A&D) suppliers are feeling the heat.

Over the next five years, **Original equipment manufacturers (OEMs) are expected to increase commercial aircraft production by 21%**. The ramp-up means suppliers face unprecedented challenges. They must find ways to satisfy demand for more components while OEMs place more pressure on them to decrease lead times and prices.

Industry 4.0 technologies, including the Internet of Things (IoT), automation and advanced machine-tool capabilities, such as 5-axis machining centers, could become more common on A&D shop floors as suppliers seek ways to keep pace with OEM demands.

These technologies can help the A&D suppliers respond to market needs faster without expanding their workforce. This white paper will explore some of these trends and the solutions that A&D suppliers need to remain competitive.

1. Enable Faster Throughput for Complex Designs

Modern aircraft designs are forcing suppliers to rethink their current production capabilities. Older machine tools may not be equipped to manage lighter-weight, heat-resistant materials, such as titanium. Modern machining centers that are purpose-built for aerospace applications can reduce set-up times, increase accuracy and improve throughput on less-conventional designs.

Titanium vs. Aluminum Considerations

Aluminum makes up about half of the aerospace materials market by volume. But titanium use is increasing as manufacturers seek ways to reduce weight for components in next-generation planes. Titanium is lighter than structural steels historically used and almost as strong. Aluminum and titanium present different challenges that manufacturers must take into consideration when selecting machine-tooling solutions. Aluminum requires more horsepower and high rpm while titanium requires high torque at low rpm.

Speeding-up Material Removal Rates

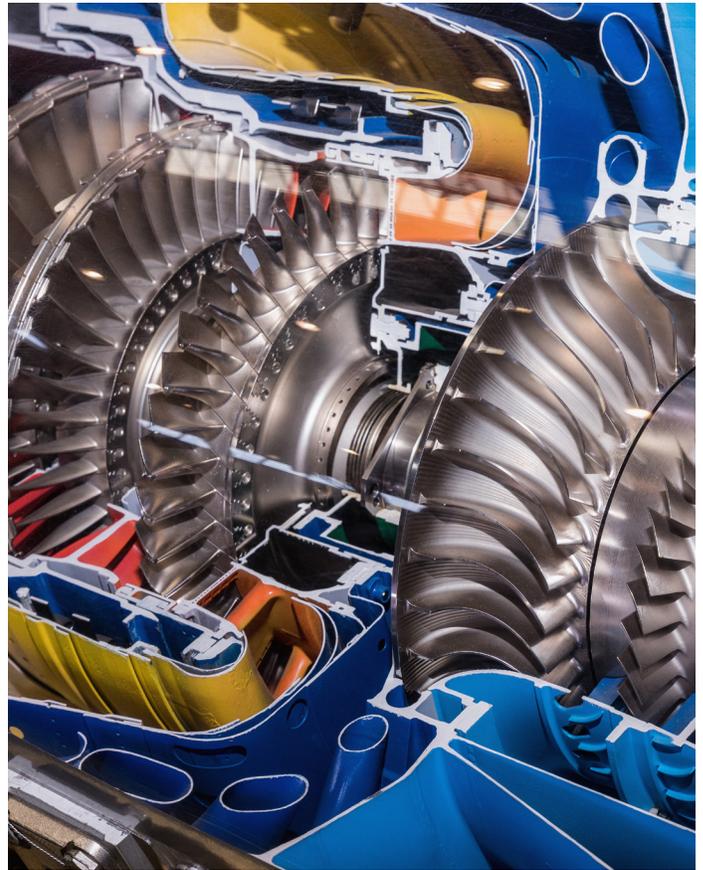
Suppliers need access to a variety of machine tools that can perform fast removal rates on a wide range of materials, including aluminum, stainless steel and titanium. Several key advancements in machine tooling are helping A&D suppliers address different material requirements. Some of the key technologies developed to increase productivity for titanium machining include:

Autonomic spindles that protect the spindle from excessive forces damaging the bearings. This can reduce unplanned downtime related to machine damage—which, in turn, optimizes productivity.

High-pressure, high-flow coolant systems deliver large volumes of coolant directly to the cutting zone for faster chip evacuation, increased production, and tool life.

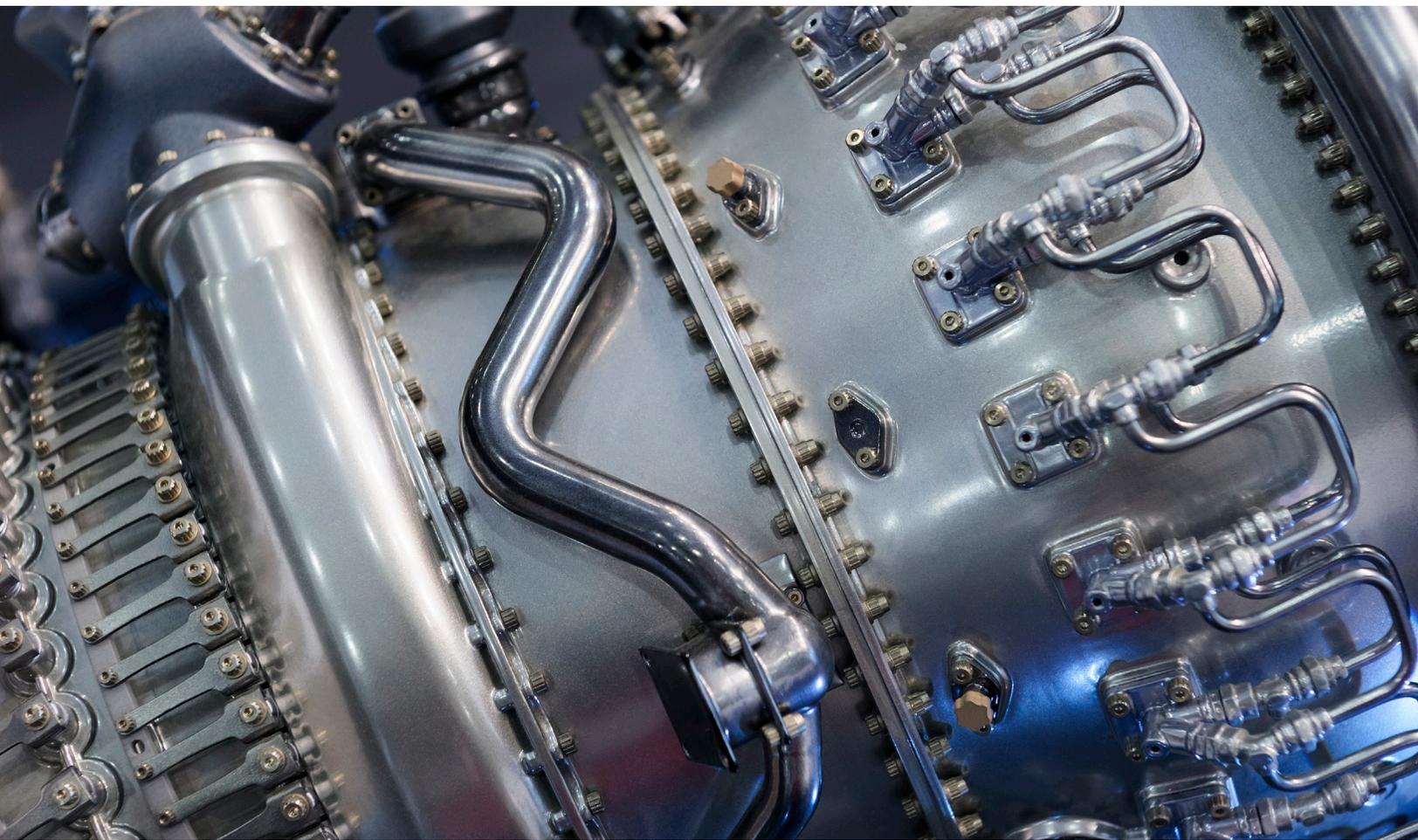
Vibration damping systems that adjust frictional forces based on low-frequency vibration sensing, avoiding chatter and cutter damage from structure resonance in real time. Vibration damping enhances depth of cuts, which results in higher removal rates.

Developments in aluminum machining are also helping A&D suppliers increase productivity. This includes greater spindle power to improve processing speeds, improvements to acceleration and cutting feed rates, and large-capacity automatic tool changers that are capable of holding more than



100 tools and automatic pallet changer—which can reduce changeover and set-up times significantly.

In both aluminum and titanium, 5-axis capability is a key advantage by providing an efficient way to produce typical, complex, A&D part geometries. In addition, large-capacity tool changers and pallet changing automation can allow for unattended machining, which means less operator labor cost per part. These system features reduce machine downtime between parts and part handling between set-ups, which also lowers labor costs. The ability to reduce handling time, including moving parts from machine to machine or resetting them on new fixtures, also helps increase throughput and shrink production lead times to enable faster deliveries.



How ATEP Slashes Titanium Machining Costs

Arconic Titanium & Engineered Products (ATEP) in Laval, Quebec, Canada, needed titanium-machining solutions to meet customer demands to lower costs and shrink delivery times. ATEP specializes in assembly and precision machining of various titanium aircraft components, including wing attachments, seat tracks and doorframes. Standard machine platforms couldn't provide the rigidity, flexibility or control the company needed to meet its customer requirements. The company decided to install several Makino T-Series 5-axis horizontal titanium machining centers. Research engineers from ATEP determined the machines could help the company perform certain production processes three times faster than previous methods. It eventually led to a **60% reduction in cycle times and 30% reduction of tool costs.**

The company also has realized benefits related to quality improvements. ATEP is a fully integrated supplier of titanium and other specialty metals products. ATEP is receiving additional business from customers who are asking the company to correct quality issues from other suppliers, according to a company executive.

2. Maximize Productivity to Avoid Costly Delays

Many A&D suppliers are struggling to meet demand. For instance, in November 2018 Boeing reported **decreases in 737 deliveries due to supplier delays**. The lead time in A&D manufacturing is already longer compared to other industries, which means suppliers can't afford machine failures or any other issues that could result in downtime. Suppliers may need to place a greater emphasis on predictive maintenance and automation to maximize productivity.

Why Reliability Matters

On-time delivery issues are urgent enough that Boeing and Airbus are working with suppliers to ensure they're equipped to meet expectations. In addition, unplanned downtime costs manufacturers about **\$50 billion annually**, and equipment failure is the cause of downtime **42% of the time**.



Smarter Approaches to Efficiency

Manufacturers are implementing automation and Industry 4.0 technologies to gain visibility into machine performance issues before they lead to major repairs or failures. In the A&D sector, Industry 4.0 is bringing predictive insights to operators and technicians in several ways, including:

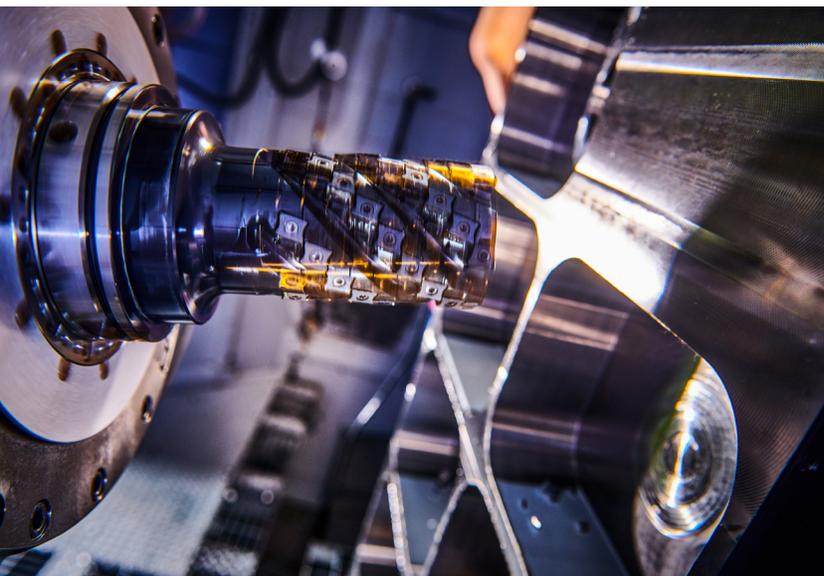
The ability to access charts that display alarm events, so operators and technicians can observe trends and implement corrective measures.

Access to spindle and axis monitoring technologies that record and display axis forces, loads and speeds. This data can then be used to fine-tune processes for faster cutting speeds and greater depths of cut. In addition, manufacturers can monitor critical tool data for multiple machines from one centralized location. Operators can use this data to make adjustments for enhanced tool performance and lifespan.

Camera monitoring capabilities that capture an internal view of a machine's work zone, making it easier to solve processing errors before they impact part quality. Technicians also can receive email and text notifications of alarms, including images of the work zone. This helps service staff immediately address maintenance issues before they become costly problems.

According to Deloitte, manufacturers that implement predictive maintenance technologies typically experience operations and **MRO material cost savings of 5% to 10%**, reduced inventory carrying costs, equipment uptime and availability increases of 10% to 20%, **reduced maintenance planning time of 20% to 50% and overall maintenance cost reductions of 5% to 10%**.

A&D suppliers also are realizing enhanced performance through automated machining solutions, such as pallet-stacking systems. The Makino Machining Complex (MMC2) is an automated material handling system that links Makino horizontal machining centers, pallet loaders and operators. The system provides a constant flow of parts to the machining centers, so it can operate for extended periods unattended, including overnight and on weekends. The ability to automate manual processes reduces the need for time-consuming manual tasks and increases flexibility to meet OEM demands.



Automation Enables JIT Delivery for Universal Machining

Universal Machining Industries Inc. (UMII) needed a solution to keep pace with growth and remain competitive with suppliers in low-cost labor countries. The Muenster, Texas, manufacturer of machinery derives **70% of its business from the aerospace industry**.

UMII transitioned from primarily stand-alone vertical machining centers to horizontal machining centers in automated cells. This includes the purchase of a 60-pallet Makino Machining Complex (MMC2) and five Makino a61 horizontal machining centers.

The automated system allows operators to manage five machines simultaneously. Its fourth-axis table, tombstone fixtures and rigid cutting capabilities along axis extremities have helped operators fixture more parts per face. Parts now require fewer setups and are produced with higher quality and consistency.

Key benefits cited by the company include:

Utilization rates of more than 90% from its a61 machines.

30% increase in part production in automated cells.

20% improvement in cycle times.

Automation also has helped the company focus on smaller batch production. The system's cell-control software allows operators to store program, fixture and tooling data for each part order into the cell's database and retrieve them when needed. **Smaller-batch production cut WIP inventory by 30%. The company also decreased raw-material inventory by 25%.**

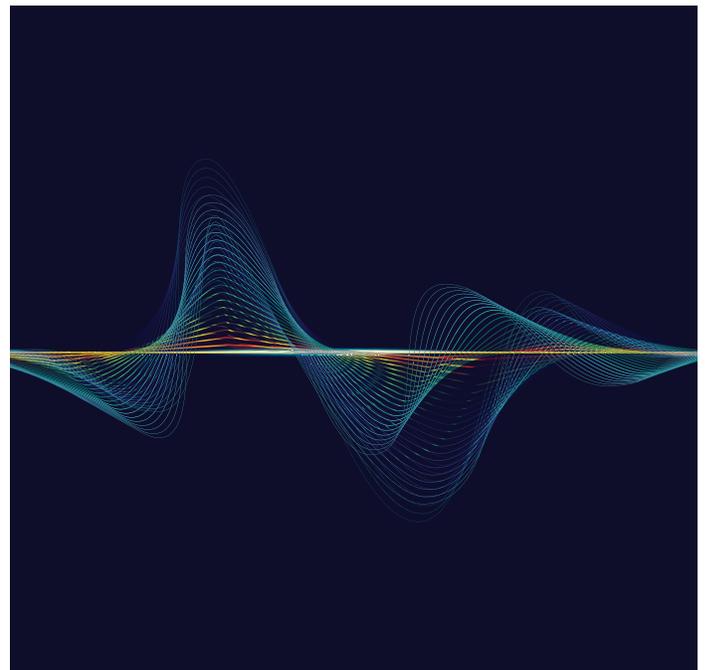
Overall, the investment has helped the company address customer demands for shorter lead-times and reduced part costs.

3. Bridging the Workforce Skills Gap

As machine tools become more technologically advanced, the A&D industry must confront another persistent challenge: the lack of skilled workers. In a recent industry workforce survey, 75% of respondents said they are concerned with the availability of key skills. "The need for talent will become even more critical in the next few years, as the baby boom generation moves beyond traditional retirement age – and the unavoidable loss at some point of their expertise and knowledge," according to Aviation Week's "2018 Workforce Report." Machines that are equipped with IoT, artificial intelligence (AI) and other smart capabilities can enhance productivity for existing employees and minimize the learning curve for new hires.

The Case for a Connected Workforce

Voice-assistant technology common in the consumer world, such as Alexa and Siri, are now making their way into modern machine tools. In fact, more than **80% of A&D industry executives say they expect their workforce to be directly impacted by an AI-based decision** within the next three years, according to an Accenture report. Voice-activated commands reduce manual interaction with the machine and helps operators translate and analyze big data. These digital assistants typically work through the use of headsets. Operators speak commands into the headsets, such as "turn the machine's lights on," "change tools," or "show set-up instructions." These voice-actuated capabilities simplify machine operation by reducing the time operators spend searching for information or performing manual tasks.



Minimizing the Learning Curve

AI also serves as a coach for operators who may not be familiar with various operating procedures, such as how to perform different maintenance tasks. For example, a worker can ask the voice assistant how to change a filter. In many cases, these intelligent machines are not replacing operators but helping the existing workforce perform their tasks more efficiently.

They're also allowing workers to move easily from one type of machine to another without a significant learning curve because they're not reliant on an unfamiliar machine interface. These intelligent machines may help A&D manufacturers identify and onboard skilled workers with greater ease because they require less training and experience than more traditional technology.

Looking Ahead: What's Next for A&D Machining

High-tech machining solutions are advancing at a rapid pace. The availability of new technologies comes at a critical point for the A&D industry. Suppliers must continue to improve productivity and reduce costs amid a constantly changing environment. In addition to OEM demands, the industry faces new competitive challenges, including potential price increases for materials. For instance, A&D manufacturers are still uncertain how U.S. tariffs on aluminum and steel imports could impact prices. The potential for higher material prices puts additional pressure on suppliers as they try to meet increasing demands for lower costs per part and delivery.

Suppliers need equipment that can reduce downtime, increase productivity and minimize labor costs. Manufacturers should consider machine-tool providers with a broad portfolio of equipment built specifically for the aerospace industry. The latest machining centers can perform high-precision tasks faster than ever. Vendors with experience in the aerospace industry can help A&D suppliers evaluate their needs and select a solution that is appropriate for specific applications. Makino is continuously updating its machines with the latest technologies, including automation and IoT capabilities, to help the industry produce accurate structural and turbo machinery parts faster with less variability and at the lowest cost.

For more information on how modern machining solutions can help your organization meet current future A&D industry needs, contact Makino with questions.

RESOURCES

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