

# AEROSPACE & DEFENSE **REVIEW**

**CNC  
MACHINING**  
EDITION



STEVEN MCCLURE,  
CEO

# **PACON MFG, INC.**

**MACHINING  
REINVENTED - PRECISION  
MACHINING 4.0®**

\$15



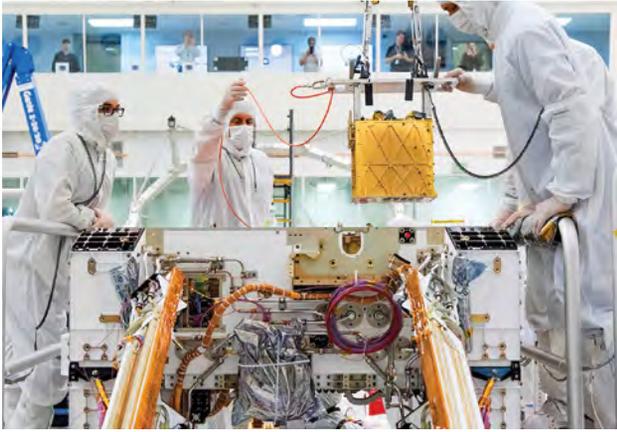
# PACON MFG, INC.

## MACHINING REINVENTED –PRECISION MACHINING 4.0®

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By Jonathan Allred

**I**n February 2021, NASA's Mars 2020 Perseverance Rover made its landing inside Mars' Jezero Crater. With seven instruments and thousands of machine components, it is the most advanced robotic piece ever sent to Mars that will investigate Martian geology, atmosphere, environmental conditions, and potential biosignatures. Precision machining specialists PACON Mfg, Inc. is among the few companies involved in delivering machine components critical to supporting the mission. PACON provided more than 50 mission-critical components for the Perseverance Rover, including parts for the Mars Oxygen In-Situ Resource Utilization Experiment (MOXIE), designed to explore the possibility of producing oxygen from carbon dioxide in the planet's atmosphere.



*NASA's Jet Propulsion Laboratory (JPL) installs the MOXIE unit housed by components machined by PACON*



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Headquartered in Livermore, CA, PACON has a proven track record of more than 50 years in manufacturing and supplying mission-critical machined components with the tightest tolerance demands for space, defense, robotics, semiconductor, and life sciences industries. It is a one-stop-shop for all CNC machining requirements, offering 5-Axis milling, mill-turn, light assembly, and sub-tier management of other specialized requirements, including prototyping, Design for Manufacture (DFM) support, lean Just in Time (JIT) production, and cost reduction. "As a recognized leader in advanced manufacturing, we specialize in machining complex geometry and close-tolerance components for mission-critical applications, leveraging best-

in-class precision CNC machines," says Steven McClure, CEO, PACON.

## **The Precision Machining 4.0 Novelty**

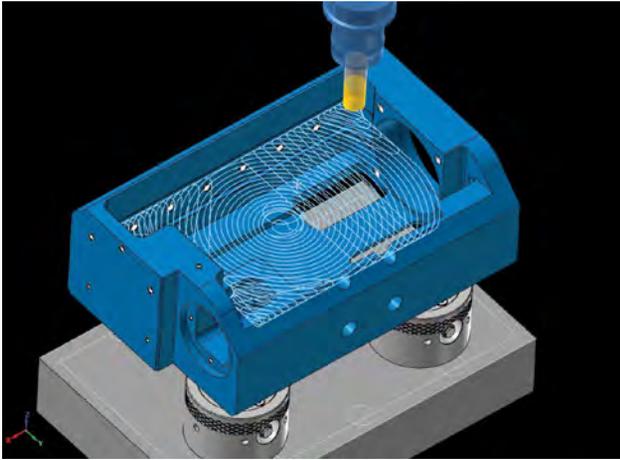
Prototyping and production of close-tolerance components essential to mission-critical applications demand repeatability which can only be unlocked through process automation. Traditional CNC machining of precision components typically involves complex machine set-ups, several manual tasks and other human interventions. As companies in industries like aerospace and defense integrate various components to supply the final product, they require objective evidence or a "paper trail" that the delivered components were built to the exact quality standards and from the exact material specified. This documentation package provides an essential record for repeatable outcomes on future builds and an exact record of what was built in the event a mission fails to achieve its objectives.

PACON addresses the need for predictable process outcomes by combining the principles of lean manufacturing with Industry 4.0 technologies to achieve Precision Machining 4.0®. With automation at both the software and hardware levels, PACON reduces unintended process variations before, during and after machining. PACON's systems and processes are built around precision which for PACON includes process repeatability, maintaining traceability and providing objective evidence for the manufactured components. The company is able to handle engineering changes and maintain objective evidence, enabling them to provide a complete snapshot of changes on a component. This helps clients identify what and when a change was made and how that change rippled through the product development. "Our clients often are required to deliver comprehensive drawing packages to government agencies or other defense primes and want their document package, especially their mechanical drawings to match the system they deliver," says McClure, "With our methodology, we've found drawing issues for several clients on parts that had been made years prior by other shops."

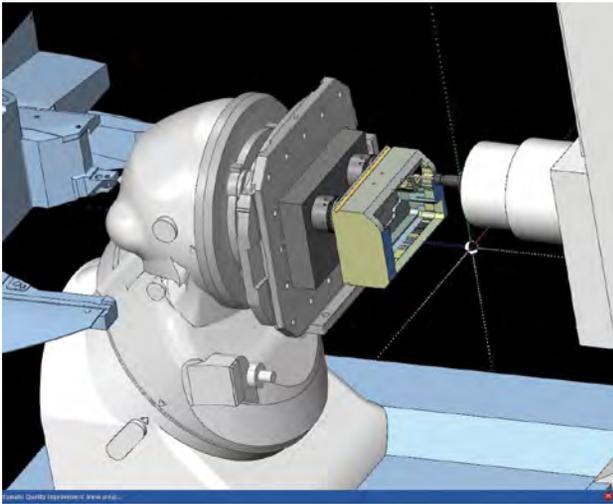
## **Digital-to-Physical Manufacturing Powered by Automation**

PACON's Precision Machining 4.0® starts in the digital domain, where clients' digital CAD files are put through the entire manufacturing process in a software environment prior to manufacturing. The company reviews the clients' SolidWorks or wireframe CAD files through a DFM lens. This enables them to point out design discrepancies in the clients' drawings that would normally only occur during machining. "Close enough is not good enough for our clients. We manufacture components that meet clients' requirements to the T," asserts McClure. By leveraging CNC simulation, PACON can proactively identify and eliminate any chances of machining errors, systematic defects, or mishaps such as machine-workpiece collisions. This allows PACON to solve problems before they arise, ultimately leading to

accelerated prototyping and seamless production of components that translate to improved time to market for clients.



*Precision Machining 4.0® begins with the client's CAD. PACON's CNC programs are created from the client's SolidWorks or wireframe CAD file, and Design-For-Manufacturing (DFM) & cost reduction options are exchanged*



*NASA's Jet Propulsion Laboratory (JPL) installs the MOXIE unit housed by components machined by PACON*

PACON's innovative 5-axis CNC machining includes the automatic transmission of tool data direct to the machine cell controller, eliminating the need for manual data entry. PACON uses CNC tool pre-setters to automate tool measurement and eliminate human variations such as toolholder clamping force, or any other difference that can lead to inconsistent machining in the cell. In addition, the tool pre-setter transmits data to both the cell controller as well as to RFID tags embedded in each holder. This ensures that tool parameters in the given automatic tool changer (ATC) slot match the values in the cell controller

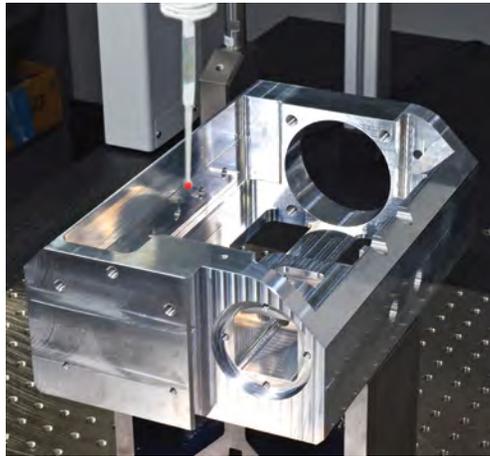
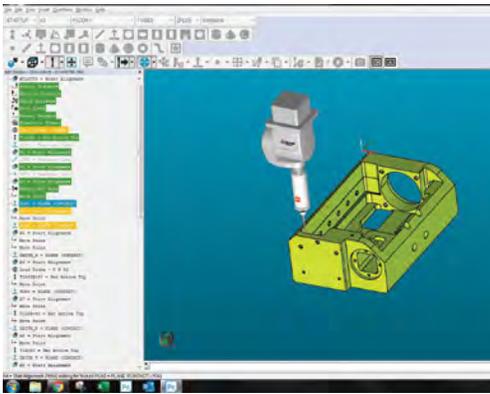
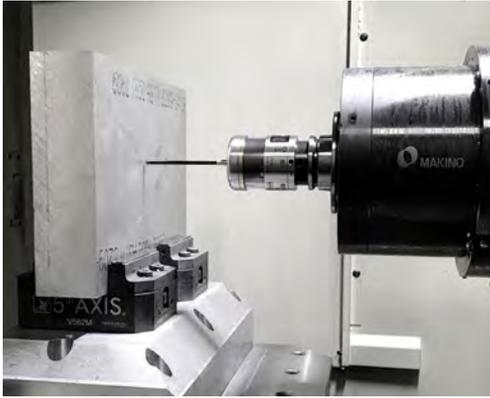
tool library. The RFID tags also help predict whether tools can last through unattended machining cycles, as the cutting time or data related to tool life is recorded on the tool itself and in the cell controller.



*PACON's Precision Machining 4.0® process eliminates process variations wherever possible, including automated tool parameter measurement and embedded RFID tracking*

Having standardized the fixturing and tooling—using about 70-percent common tools and the rest, specialized ones—PACON can minimize machine setup times allowing concurrent production and prototyping in their 5-Axis cell. PACON sequences work queue priorities using KANBAN and level loading that enables the cell-controller to release the job to an available machine, creating an instant production line change. This optimization of facilities for maximum 5-Axis milling efficiency and capability to manufacture components in an asynchronous, single piece flow enables PACON to operate 24/7 with unattended second and third shifts. With the lean manufacturing capability to produce one piece as efficiently as a hundred, the company can quickly provide parts for clients who need them urgently. PACON's machining efficiency for repeatable and reliable production or prototyping translates into cost-effectiveness and flexible and scalable delivery options.

Another aspect that makes PACON's Precision Machining 4.0® 5-Axis machining ideal for mission-critical components is in-process, autonomous inspections that prevent machine downtime, minimize yield loss, and ensure the inherent quality of components. The company's multiple process point inspections utilize laser and optical tool fault detection, in-machine probing, and post-machining first article inspection. For tool fault detection, each tool, before and after its use, undergoes laser and optical checks. The tool images taken during optical fault detection undergo comparative analysis that can easily highlight the wear and tear of the tool after usage.



## Unparalleled Machining Expertise

As a progression from its humble beginnings in the 1970s machining microwave components, PACON today has established itself as a leader in the advanced manufacturing of mission-critical components for the world's most innovative OEMs and defense primes. From machining microwave and RF components used in radar, electronic warfare, satellite communications, and other precision applications across the space and defense industry, the company has expanded its footprint to other sectors. PACON has assisted in world-changing innovations in life science, semiconductor, space exploration, and defense industries in the past five decades. For the semiconductor industry, PACON manufactures precision motion components responsible for moving and position wafers in and out of different chambers. When the global supply chain froze, OEMs were unable to supervise the quality of their offshore suppliers. PACON responded when others could not, more than doubling its output of precision motion components, and pulling-in shipments without missing a beat. As trade frictions drive new on-shoring demands, especially for precision machined components, PACON's Precision Machining 4.0® processes and its 60 pallet 5-Axis cell have proven essential.

In life sciences, PACON manufactures precision motion components, optical housings, and automated 96-well plates components utilized in PCR equipment. During the COVID-19 pandemic, the company's manufacturing process was put to the test and successfully delivered components for more than 2,000 digital PCR systems necessary to automate the detection of the virus, accelerate diagnosis verification, and support Operation Warp Speed vaccine development.

The credit for PACON's success goes to its team that encompasses journeyman machinists, manufacturing engineers, and domain experts in the verticals they serve. With a belief in learning by doing, these experts have gained enormous



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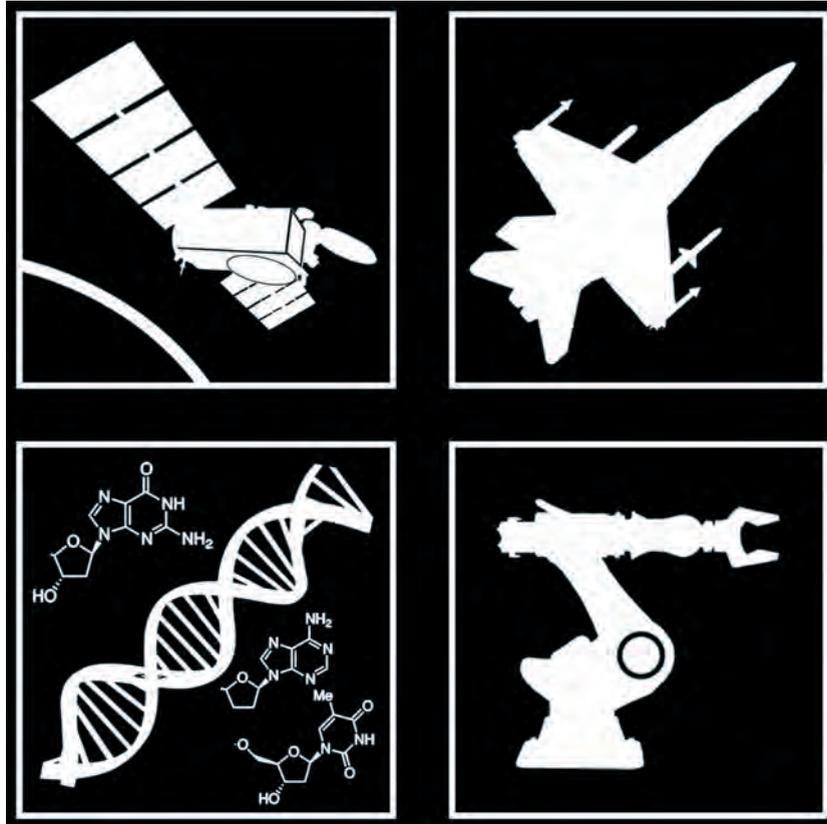
*PACON's Precision Machining 4.0® utilizes Industry 4.0 technologies to minimize and detect unwanted process variations: a) in-machine measurement probe detects workpiece dimensions and location, b) automated CMM measurements can be programmed direct from client's CAD files for maximum repeatability, and c) AS9102 inspection, critical dimension, or Statistical Process Control (SPC) can be supplied for each unit or lot shipment*

knowledge and expertise in precision CNC machining leveraging the principles of lean manufacturing. They continue to further refine and improve PACON's Precision Machining 4.0® process for the benefit of their customers. With the help of this team, PACON aims to continue delivering the highest total value through its services, precision components, and predictable outcomes around quality, consistency, and schedule. **AD**

# Precision Machining 4.0<sup>®</sup>

innovation essential for precision & quality

mission critical CNC machining



## PACON

- Microwave, optical & electronics chassis & housings
- Motion system & structural spacecraft components
- Cryo-cooling, heat transfer & heat sinks
- Manifolds & microfluidic system components

Let's connect. What's essential to your mission?

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[www.paconquality.com](http://www.paconquality.com)