

CASE STUDY

WHEN STANDARD MANUFACTURING PROCESSES WON'T CUT IT: ENGINEERING CUSTOM SOLUTIONS FOR SPACE-CRITICAL COMPONENTS

ABOUT THE COMPANY

In the aerospace industry, component failure isn't just about cost overruns or schedule delays — it's about mission success in the unforgiving environment of space. When a leading aerospace company needed precision converted parts for space applications, their existing supplier struggled to meet the demanding profile tolerance requirements.

With hundreds of these critical components needed and tight delivery schedules, they turned to Modus Advanced for a solution.

This aerospace company designs and manufactures equipment for space applications, where every component must perform flawlessly in the harsh environment of space.

The converted parts in question serve a critical function — protecting sensitive equipment while maintaining precise positioning across multiple mounting points throughout the structure.



CHALLENGE

MANUFACTURING BOTTLENECK

The customer faced a significant manufacturing bottleneck with their converted parts. The parts required extremely tight profile tolerances — a specification driven by the complex tolerance stack-up requirements inherent in space application assembly.

SPACE ENVIRONMENT REQUIREMENTS

These converted parts would need to perform reliably in the harsh environment of space, where material integrity and dimensional precision are paramount. Critical considerations included:

- Dimensional variance could compromise system performance
- Assembly issues with mating components could jeopardize mission-critical systems
- Material integrity must be maintained throughout specialized processing
- Precision requirements for proper function in space environments

SUPPLIER LIMITATIONS

The existing supplier had been struggling to consistently achieve these tolerances using conventional manufacturing approaches. Key challenges included:

- Production schedules at stake
- Need for hundreds of components per application
- Requirement for precision results within aggressive timelines

TECHNICAL COMPLEXITY

The technical challenge was compounded by the material properties — the rubber-like converted part material would deform during cutting. This created multiple issues:

- Nearly impossible to maintain required profile tolerance using standard waterjet cutting
- Traditional fixturing methods inadequate for space application precision
- Standard cutting parameters insufficient for dimensional requirements



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SOLUTION PROCESS

INITIAL ASSESSMENT

When Modus Advanced was approached with this challenge, our engineering team immediately recognized that conventional waterjet cutting processes wouldn't suffice. Rather than declining the project or accepting substandard results, we committed to developing a custom manufacturing approach specifically tailored to these unique requirements.

PROCESS VARIABLE ANALYSIS

Our engineers began with a systematic analysis of the cutting process variables. The primary issue was material movement and deformation during cutting, which was throwing the profile tolerance out of specification. Standard waterjet setups presented limitations:

- Abrasive cutting approach insufficient for precision requirements
- Water-only cutting failed to deliver needed accuracy
- Neither conventional approach met tolerance specifications

INNOVATIVE HYBRID DEVELOPMENT


Through extensive testing and process refinement, we developed an innovative hybrid approach.

Key breakthroughs included:

- Using an abrasive nozzle while reducing air suction that destabilized the water stream
- Plugging the abrasive feed port to achieve consistent, stable water stream
- Dramatically improved edge quality and dimensional accuracy with existing equipment

CUSTOM FIXTURING SOLUTIONS

The fixturing challenge required equally creative solutions. The rubber material's tendency to flex and move during cutting was addressed through a multi-layered approach:

- Custom fixturing system using double-sided adhesive tape
 - Parts secured to wooden backing board for enhanced rigidity
 - Maintained dimensional stability throughout the cutting process
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LEAD-IN/LEAD-OUT OPTIMIZATION

Even with improved fixturing and water stream stability, we discovered that the cutting entry and exit points were creating dimensional issues that threatened tolerance compliance. As the waterjet completed cuts and parts became fully separated from the source material, the water stream would pull parts along with it, creating indentations and dimensional variance at critical tolerance zones.

Lead-in and lead-out strategies proved critical to final part quality. Our optimization process included:

- Experimentation with various approach angles and exit strategies
- Development of perpendicular lead-in technique
- Minimized material distortion at critical tolerance zones
- Refined adhesive bonding techniques to prevent water stream pull-through



RESULTS

TOLERANCE ACHIEVEMENT

The innovative manufacturing approach successfully delivered parts meeting the demanding profile tolerance requirements. Our custom waterjet process eliminated the dimensional variance issues that had plagued the previous supplier, enabling consistent production of space-qualified components.

SCHEDULE COMPLIANCE

The customer was able to maintain their production schedule with all parts delivered on time for assembly. The converted parts successfully passed all required quality inspections, demonstrating that our manufacturing approach maintained material integrity throughout the process.

EXCEPTIONAL CUSTOMER SERVICE

The innovative manufacturing approach successfully delivered parts meeting the demanding profile tolerance requirements. Our custom waterjet process eliminated the dimensional variance issues that had plagued the previous supplier, enabling consistent production of space-qualified components.

LONG-TERM PARTNERSHIP

The success of this project established a strong foundation for ongoing partnership, with the customer continuing to rely on Modus Advanced for critical space application components. This collaboration demonstrates how engineering expertise and creative problem-solving can overcome seemingly impossible manufacturing challenges in aerospace applications.

PARTNER WITH MODUS ADVANCED

At Modus Advanced, we specialize in solving complex manufacturing challenges for aerospace and defense applications. Our engineering team develops custom processes and innovative solutions to meet the most demanding specifications.

When standard approaches won't work, we engineer new ones.

OUR CAPABILITIES

- Waterjet cutting with custom process development
- Precision fixturing for challenging materials
- Space-qualified component manufacturing
- Custom process development for critical applications

OUR CERTIFICATIONS

- AS9100 certified for aerospace applications
- ISO 9001 quality management systems
- ITAR compliant for defense applications

Contact us to discuss your critical component manufacturing needs.

