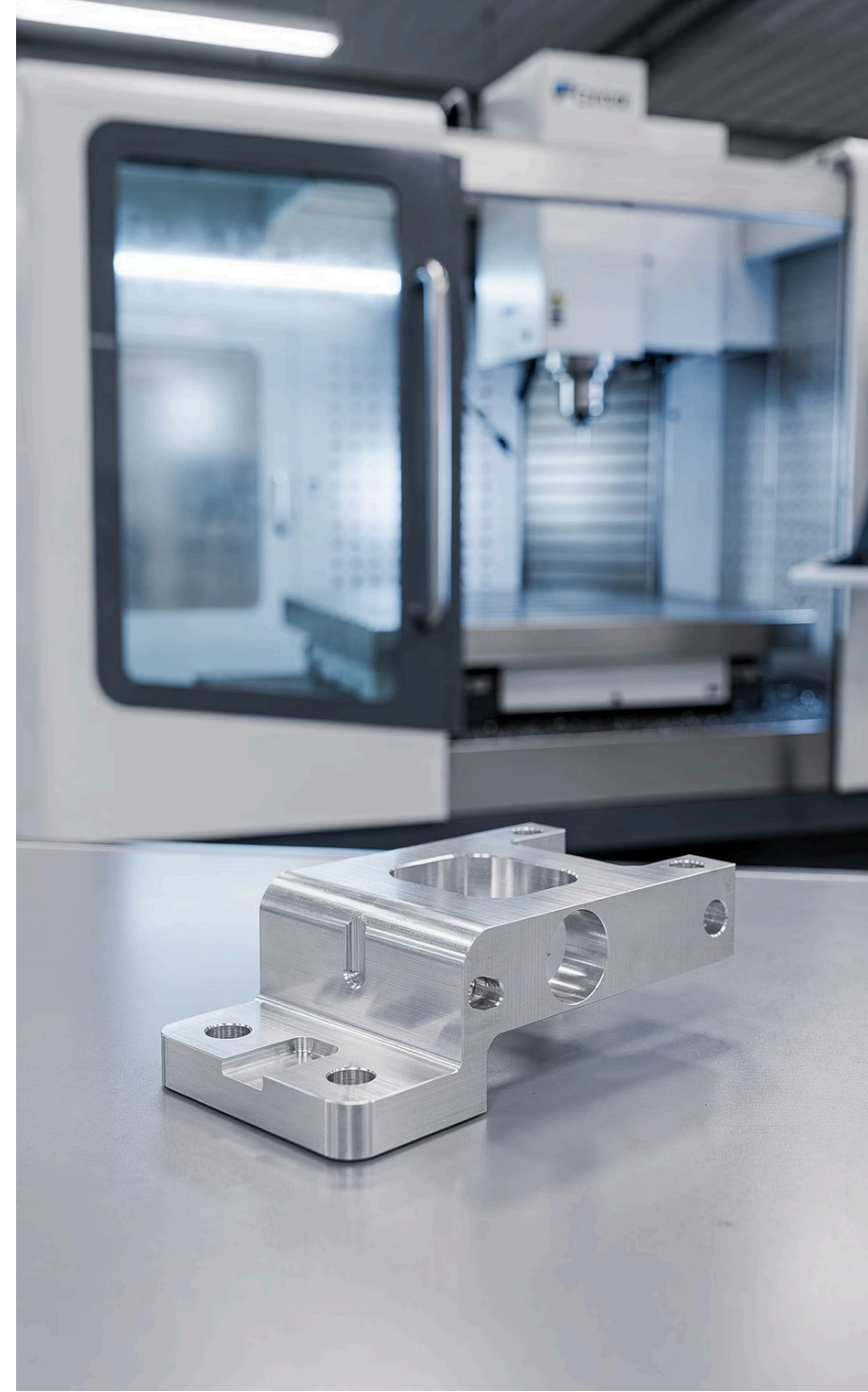




Re-Engineering a Multi-Part Bracket into a Precision Single-Piece Solution

An existing GSE client came to us with a part problem involving a bracket that was already in production. The original design consisted of a three-piece bracket bolted together with two rod clamps. While functional, this multi-piece assembly created unnecessary complexity and introduced several risks into the customer's final product build. GSE was asked to develop a more reliable, manufacturable solution that would improve assembly performance without driving up cost.



The Challenge

The customer's existing bolted assembly left room for several problems in final product assembly. Bolts could loosen over time, creating reliability concerns, and because secondary machining was performed after assembly, the main 3 pieces had to be serialized and kept together as a matched set. This added handling complexity and reduced interchangeability.

During the requirements phase, one possible solution discussed was casting the aluminum bracket and then performing post-machining operations. However, the annual production volumes did not justify the cost and lead time associated with a casting approach.

Our Assessment

We evaluated the design with a focus on reducing part count, improving repeatability, and eliminating the weaknesses created by the original assembled configuration. The goal was to create a solution that would maintain precision while simplifying both manufacturing and final assembly. From the outset, it was clear that the best long-term answer was not to optimize the existing three-piece assembly, but to re-engineer it entirely into a single solid component.

Loosening Fasteners

Bolts could loosen over time, creating reliability and performance concerns in the final product

Matched-Set Dependency

Serialized components had to be kept together, reducing interchangeability and adding handling complexity

Post-Assembly Machining

Secondary machining after assembly meant parts could not be swapped or replaced independently

Casting Not Viable

Production volumes did not justify the cost and lead time of a casting-based approach



Proof of Concept & The Solution

By rethinking the design instead of forcing improvements into an inefficient assembly, GSE delivered a simpler, stronger, and more manufacturable solution.

We redesigned the original three-piece bracket as a one-piece solid part. Before moving into production, we used 3D printing to prototype the new design and verify that the bracket would integrate into the final product without any clearance or fitment issues.

Once the design was approved, we moved into production using a high-speed five-axis milling operation. Each bracket was machined from a billet of aircraft-grade aluminum, resulting in a highly precise finished component.

1

Design Evaluation

Assessed the three-piece assembly to identify weaknesses — focused on reducing part count, improving repeatability, and eliminating matched-set dependency

2

Re-Engineering

Redesigned the bracket as a single solid component, eliminating fasteners, serialization, and post-assembly machining requirements

3

3D Prototype Validation

Used 3D printing to validate fit and clearance in the final product before committing to production tooling

4

Five-Axis Machining

Produced the final bracket from a 24-pound billet of aircraft-grade aluminum using high-speed five-axis milling for precision and repeatability

The Results

1 Piece

Re-engineered from a 3-piece bolted assembly

24 lbs

Aircraft-grade aluminum billet per bracket

100%

Interchangeable — no matched sets required

AS9100 FAI

Supplied with every part to reduce incoming inspection

What We Delivered

- Re-engineered a three-piece bracket into a single solid, precision-machined component
- Eliminated risks associated with loosened fasteners and matched-set assemblies
- Validated fit and clearance through 3D-printed prototyping before production
- Produced the final part using high-speed five-axis machining from aircraft-grade aluminum
- Achieved a fully interchangeable, high-precision component
- Reduced time to market compared to a casting-based approach
- Supplied AS9100 First Article Inspection (FAI) documentation to reduce customer incoming inspection labor

Business Impact

This project did more than solve a part issue. It simplified the product architecture, reduced assembly risk, improved interchangeability, and removed unnecessary inspection burden from the customer's team. By choosing a proven development path — redesign, prototype validation, and five-axis machining — GSE helped the customer avoid an expensive manufacturing approach while still achieving a high-precision, production-ready result.

The Outcome

By rethinking the design instead of forcing improvements into an inefficient assembly, GSE delivered a simpler, stronger, and more manufacturable solution. The result was a precision-machined bracket that improved reliability, supported faster production, and reduced overall burden on the customer's assembly and inspection processes.

The new single-piece design eliminated the need for serialized matched sets, removed fastener reliability risks, and enabled any bracket to be used in any final product assembly — without sacrificing tolerance or end-use performance. AS9100 FAI documentation were delivered as part of the final package, ensuring a smooth transition and lasting results.

