



Delivering Nearly 11x Better Assembly Accuracy

Our client engaged GS Enterprises to investigate and create a solution to a production problem they had been managing for years — inconsistent assembly quality on a critical component requiring four-decimal-place parallelism tolerance. Their manual process was introducing variation they couldn't control, and every failure carried a steep price: the assembly was installed deep inside a larger final assembly, meaning defects weren't discovered until hours of labor had already been invested. With no path to rework and mounting scrap costs, the process was no longer sustainable.



The Challenge

At the time, the assembly was being built entirely by hand. Because of the nature of the product, once an assembly was identified as faulty, it could not be reworked. That made the issue especially costly, since the assembly was installed into a larger final assembly that required many labor hours before final testing could determine a pass or fail condition.

If the larger assembly failed, the internal sub-assembly had to be broken down and replaced, driving significant waste in labor, material, and production time. Although this process had been used for years, it was no longer sustainable.

Our Assessment

We started by breaking down the full assembly procedure to identify where variability was entering the process — reviewing work instructions, analyzing components, considering technician feedback, and building a strong set of project requirements. During that review, we found more than 20 variations of the sub-assembly that needed to be accommodated. Any solution also had to be highly repeatable across multiple assembly locations and technicians.

Manual Assembly

Built entirely by hand with no mechanism to control parallelism tolerance

No Rework Possible

Once a faulty assembly was identified, it could not be corrected

Cascading Labor Cost

Failed final units required full disassembly and replacement of the internal assembly

20+ Variations

Any solution had to accommodate more than 20 sub-assembly variations across multiple locations and technicians



Proof of Concept & The Solution

The proof-of-concept results were clear — our new approach improved final product parallelism accuracy by nearly 11 times compared with the customer's existing manual assembly process.

To reduce risk and control costs, we first moved into a proof-of-concept phase. We machined and fabricated representative parts using conventional methods to simulate the final product and validate the concept before committing to full production tooling. This gave us a practical, cost-effective way to test the process and collect meaningful data.

With proof of concept validated, we moved into full implementation.



Process Breakdown — Reviewed work instructions, analyzed components, and gathered technician feedback to identify where variability was entering the process



Requirements & Scope — Documented 20+ sub-assembly variations; defined repeatability requirements across multiple locations and technicians



Proof of Concept — Machined and fabricated representative parts using conventional methods to validate the approach and collect data before full production tooling



Fixture Design & Fabrication — Designed and fabricated more than twenty assembly fixtures for high-volume products, delivered with updated work instructions requiring little to no additional training

The Results

~11x

Improvement in Assembly & Performance Accuracy

20+

Assembly Variations Supported

\$10,000s

Scrap Cost Reduced Per Month

20+

Assembly Fixtures Fabricated

What We Delivered

- Nearly 11x improvement in assembly accuracy over the previous manual method
- Standardized, repeatable results across multiple technicians and assembly locations
- Support for 20+ assembly variations within a single solution
- Minimal additional training required — fixtures were intuitive and delivered with updated work instructions
- Scrap reduced by tens of thousands of dollars per month

Business Impact

This project did more than improve a tolerance condition. We replaced an outdated, failure-prone manual process with a scalable and repeatable assembly method. By addressing the root causes of variation and creating fixtures that made precision easier to achieve, we helped the customer improve product quality, reduce waste, and create a more sustainable production process.

The Outcome

By combining process evaluation, proof-of-concept validation, and practical fixture design, we turned a long-standing assembly problem into a repeatable, high-precision manufacturing solution. The result was better quality, less waste, and a more efficient path to consistent production.

The fixtures delivered improved tolerance capability while requiring minimal to no additional training for production personnel. Updated work instructions were also provided as part of the final tooling package — ensuring a smooth transition and lasting results.

