



From Proof of Concept to Manufacturable Design

Driving Innovation with Intelligent Lidar

About the Customer

As a global leader in high-performance lidar solutions, Benchmark's customer is the preferred provider of intelligent, next generation lidar for vehicle autonomy, advanced driver-assistance systems (ADAS), and robotic vision applications.

The customer wanted a "one-partner solution" from engineering and design development, through New Product Introduction (NPI) and eventually high-volume manufacturing — all capabilities Benchmark offers in its global network of facilities. Benchmark was brought on as the customer's strategic partner to help rapidly scale manufacturing to meet volume production needs, while also ensuring the highest quality and reliability of their products to meet the stringent requirements of the automotive industry. Benchmark also provided engineering support in electro-optical design, design for excellence (DFX), and test development.

The Challenge

Through many years of experience, Benchmark's customer developed industry-leading expertise in

the development of intelligent lidar systems for autonomous vehicles. The company was now ready to ramp up volume production by turning a proof of concept into an easily manufacturable design. They selected Benchmark for two principle reasons:

1. Benchmark is a manufacturing partner with top-of-the-line quality and reliability systems.
2. Benchmark offers proven experience with opto-electrical design and engineering.

The first challenge the partnership would tackle involved improving the customer's proof of concept that needed to be smaller, cost-effective, and manufacturable at volume to be competitive in the automotive lidar market. This next iteration of the design aimed to improve size, manufacturability, reliability, and cost. The partnership could then meet the production targets for the high-volume automotive lidar market. Benchmark's engineering team blended in well with the customer's team, becoming a natural extension. Additionally, there were some failure analyses and troubleshooting requirements that arose with the development of critical subsystems within the lidar unit, and Benchmark was approached to lend our expertise.

The customer opted to work with Benchmark's design engineering team in Rochester and Winona, Minnesota to leverage the geographic proximity to their own engineering team. While qualification units were built at these same sites, production at volume will take place in Benchmark's Ayutthaya, Thailand location. Not only are both sites well versed in optical applications, but working with Benchmark for design and manufacturing allows for parallel supply chain development, process consistency, and an overall smooth transition into manufacturing.

The Solution

The first task Benchmark and the customer aimed to solve was turning the lidar system proof of concept into a manufacturable design. To meet the required optical module cost and rapid manufacturing cycles, Benchmark leveraged its experience to reduce the size of the optics, apply design for manufacturing (DFM) principles, and ruggedize the lidar solutions through hermetic sealing processes. A few specific solutions and capabilities Benchmark offered included:

- Collaborating with the customer from the design stages to final manufacturing for its complex laser scanner – a component critical to the safe function of autonomous vehicles and advanced driver assistance systems.
- Designing plastic injection-molded components where possible to reduce size and cost.
- Redesigning the optical path to shrink the mechanical form factor. This included designing power injection molding (PIM) parts for lower size and weight, designing hermetically sealed enclosures, and redesigning electronics to fit the new smaller footprint.
- Consulting with the customer to provide advice on how to troubleshoot any challenges that arose regarding its critical subsystem components (including performing failure analysis and recommending critical changes).

Overall, Benchmark provided complete product realization support on the following requirements of the project:

- Optical redesign
- Electrical and mechanical engineering support
- Hermetic enclosure design
- Assembly process development and automation
- Design verification and manufacturing test development

The partnership has proven successful, as the customer and Benchmark now move to volume production with a redesigned product optimized for manufacturability, cost, and quality.

Results

The customer has successfully leveraged Benchmark's manufacturing excellence and design and engineering expertise to meet market demands for the company's industry-leading lidar technology. Production will begin shortly with systems architected to scale rapidly in parallel with the customer's growth.

Together, the engineering partnership was able to achieve a 60% form factor reduction and 80% cost reduction in volume manufacturing. The customer has also won significant business from Tier 1 automotive suppliers based on its new lidar design. The partnership is now in the stage of transferring to high volume, automotive-certified production in Benchmark Ayutthaya.

About Benchmark:

Benchmark provides comprehensive solutions across the entire product lifecycle, leading through its innovative technology and engineering design services, leveraging its optimized global supply chain, and delivering world-class manufacturing services. The industries we serve include commercial aerospace, defense, advanced computing, next-generation communications, complex industrials, medical technologies, and semiconductor capital equipment.

Benchmark

56 S. Rockford Drive | Tempe, AZ 85288, USA

623.300.7000 | www.bench.com

© 2023 Benchmark Electronics, Inc. All rights reserved. Benchmark and Benchmark Electronics are registered trademarks of Benchmark Electronics, Inc. Benchmark-SATCOM-09052023



Benchmark