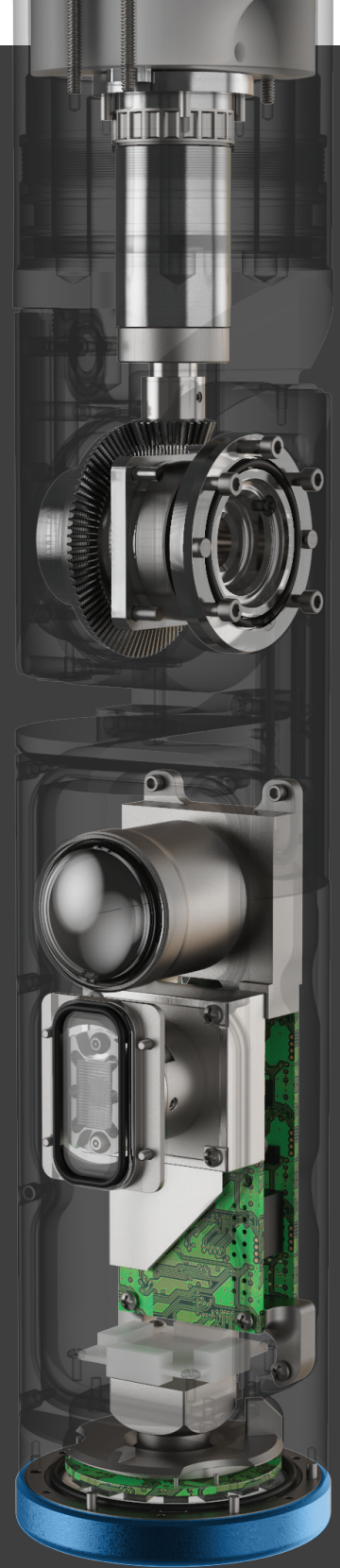


CASE STUDY

# GeoSight: Rugged LIDAR Scanner for Mining

Laser mapping of dangerous  
and inaccessible cavities in  
underground mining operations.



## The Challenge:

Design a 2.5 inch diameter watertight camera and LIDAR scanner to view and record the surfaces of a stope, ore-pass, crown pillar or cave-in while travelling 100m down a borehole.

## The Solution:

Design a Dual-Actuator with a custom pass-through torque-increasing Gearbox. Incorporate wear resistance materials with replaceable parts and use Gorilla® Glass for the camera viewing ports



## Impact on Client:

Successful deployment of their underground bore hole 3D mapping system with a 360 x 300 degree field of view.

## IP67 Protection

Ensure the product design provides adequate protection from water, dust, rock debris, impacts, pressure, hot temperatures, and severe abrasion.

## Supplier Selection

The Design 1st manufacturing set-up team helped GeoSight select a reliable volume-production partner to ensure tolerance and reliability.

## Rapid Turnaround

After creating the solution in CAD, Design 1st built the first working prototype in 8 weeks to test the design and function in real-world conditions.

# Mighty Package, Minimal Footprint

Multi-sensor array including LIDAR, wide angle video, & presence sensors to avoid falling into cavities & stopes

Custom Gorilla® Glass optical covers with technical coatings

Vision camera & high brightness spotlight



Custom connector and quick disconnect for easy transport

Tiny - 2.5" diameter for use in minimal diameter boreholes

Custom Abrasion Resistance & Avoidance System

Custom & Sealed - Continuous rotational joint with control, video & data feedthrough.

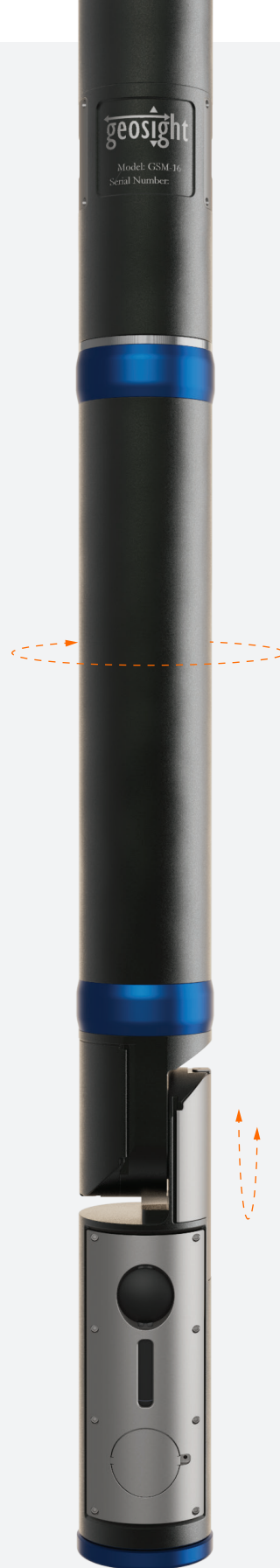
Custom & Sealed - Electrical feedthrough 90 degree gearbox, with control and video feedthrough

# Design

Bowmanville-based company GeoSight is known for having the toughest 3D mapping scanner in the mining industry. Since 2011, GeoSight has been helping scan for dangerous cavities in global mining operations across six continents.

In 2017, GeoSight began working on a new remote-operated 3D scanner that would allow a 360-degree view of underground mining conditions. The device would be placed in three-inch bore holes of up to 330m long. Customer demand was high for this device and GeoSight's goal was to accelerate its development, reducing project churn and delivering a reliable product to customers by 2020.

GeoSight chose Design 1st as a partner based on previous geotechnical probe experience and a multi-disciplined senior engineering and product management team. During concept design, Design 1st took GeoSight's initial thinking and quickly identified risk areas. Design 1st was able to deliver several mechanical design concepts with a high probability of meeting the functions and delivering the reliability and robustness for the conditions of use.



**“We were fortunate Design 1st had experience in outdoor products and Geotechnical probes. It meant a quick learning curve to understand this specific use situation and environment. They were up to speed on the key mechanical challenges in a few hours of discussion, and identified plausible low-risk solutions quickly to guide the choice of engineering direction to focus on.”**

- John Lupton, Managing Director at GeoSight



# Engineering

Working with GeoSight's existing product design team, Design 1st identified how to best integrate the mechanical, operational, and production options and risks into a solution capable of a fast turn, low-volume production run.

The scanner's limited space required a creative approach to the high-risk gearbox design. It would need to fit in a 2.5 inch diameter cylinder, allowing wires to pass through to other parts of the 3D scanner while still being 100% watertight. Standard 'off-the-shelf' gearboxes would not fit this design envelope, so a fully custom gearbox design was required, which allowed cables to pass through the rotating camera elbow.

One of the toughest operational risks was maintaining a high abrasion resistance from rocks while minimizing scanner weight. To mitigate this risk, Design 1st worked with GeoSight to choose the right balance of material, surface coating and geometry while balancing production costs, weight, and in-use operation reliability. The end result was a one-pass design with a custom gearbox ready for prototyping and testing.

# Prototype & Test

Working with GeoSight, Design 1st began prototyping a working unit to test function, robustness and tolerance for the high volume manufacturing process. This step included testing a variety of industrial surface coatings including PVD, PVO and several aluminum alloy coating options. The goal was to minimize the impact of abrasion over time and maintain GeoSight's competitive position as the 'toughest scanner' in the mining industry.

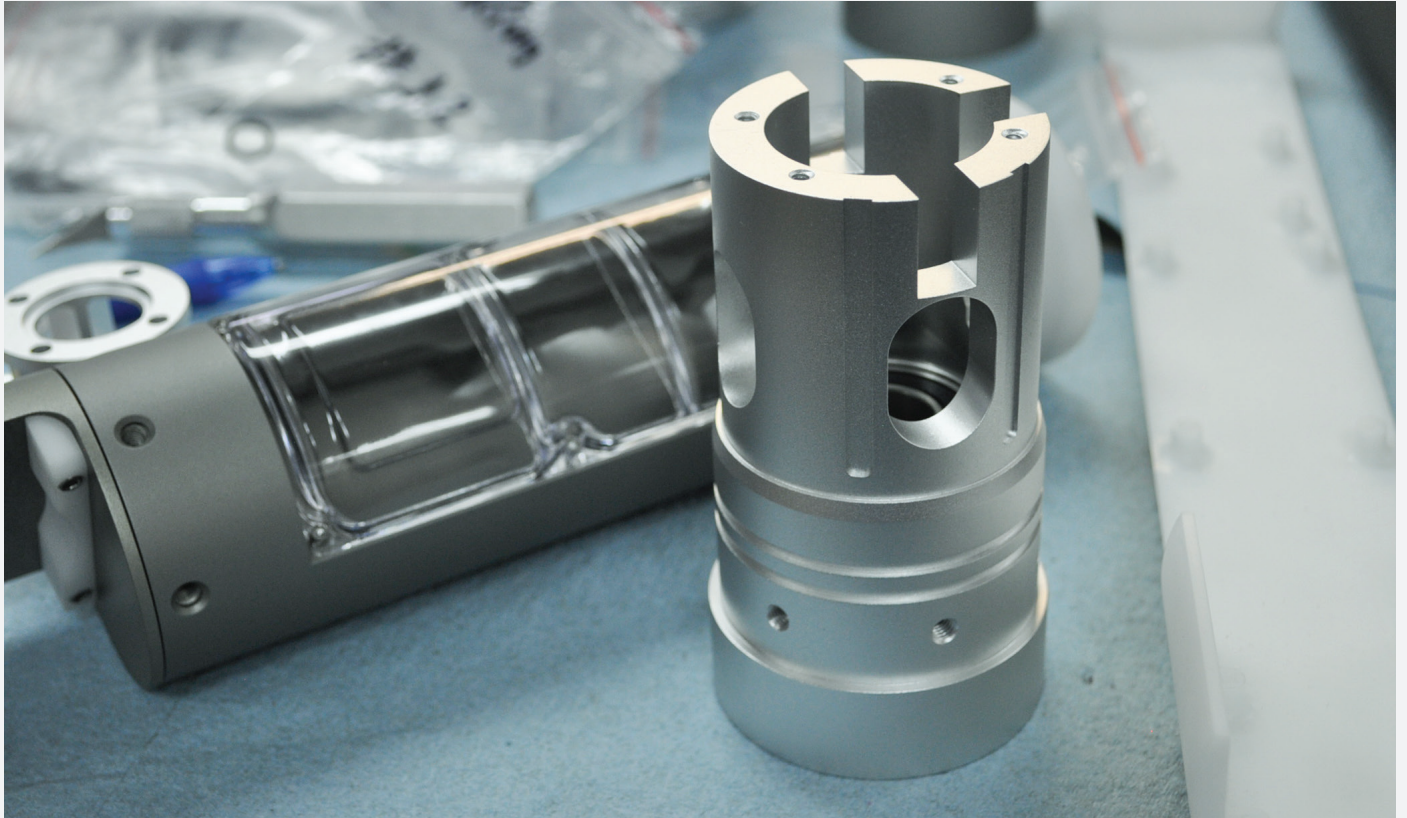
The in-field prototype testing confirmed the abrasion resistance of the materials and coating.

A second round of validation included drop, extreme temperature testing and tough abrasion experiments using a variety of surface coatings.

**“Wear and abrasion-resistant surface coatings are critical to GeoSights’ success.”**

- Shawn Romkey, Sales Manager at GeoSight

The result was a production release manufacturable design that both the development groups and end-users were happy with.



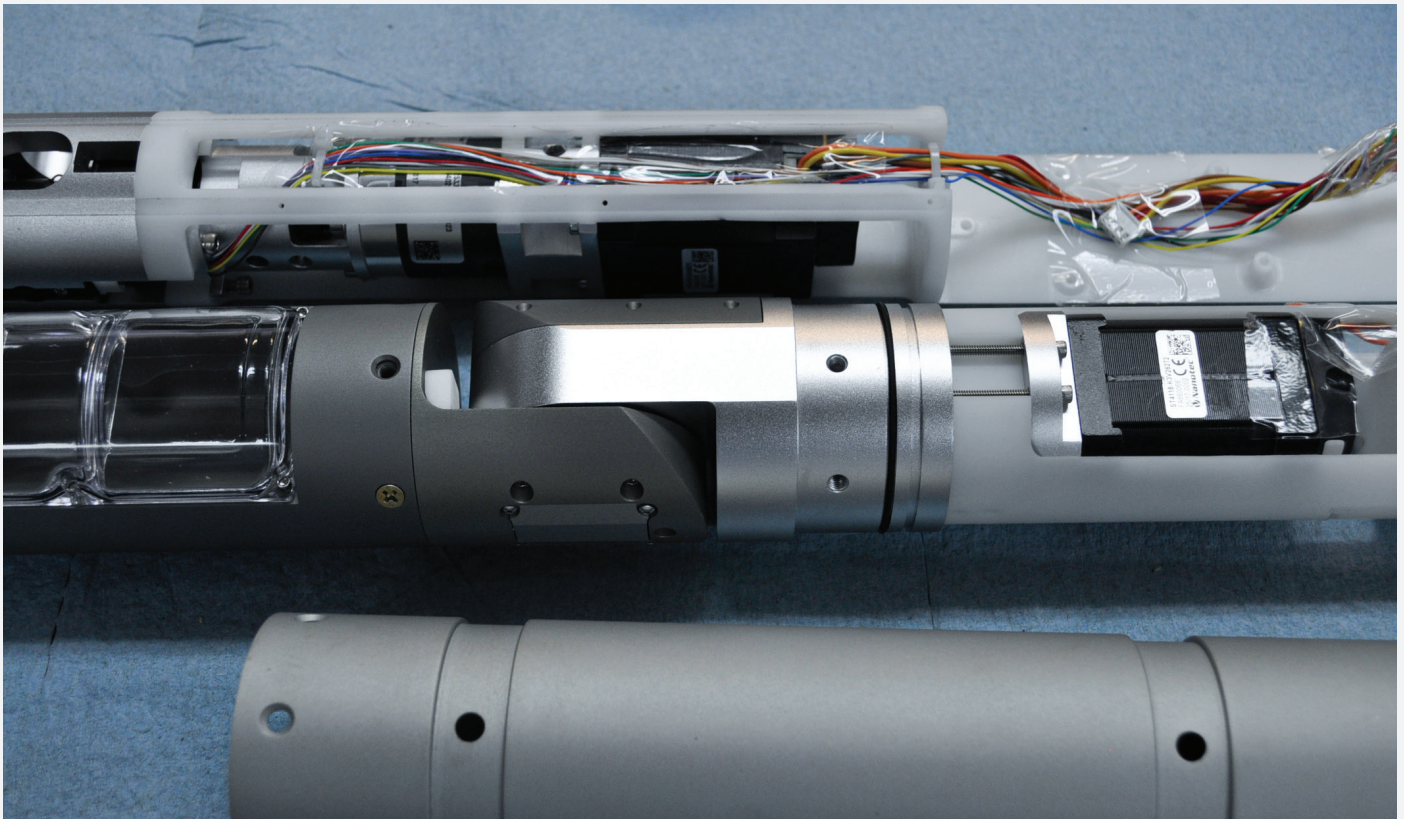
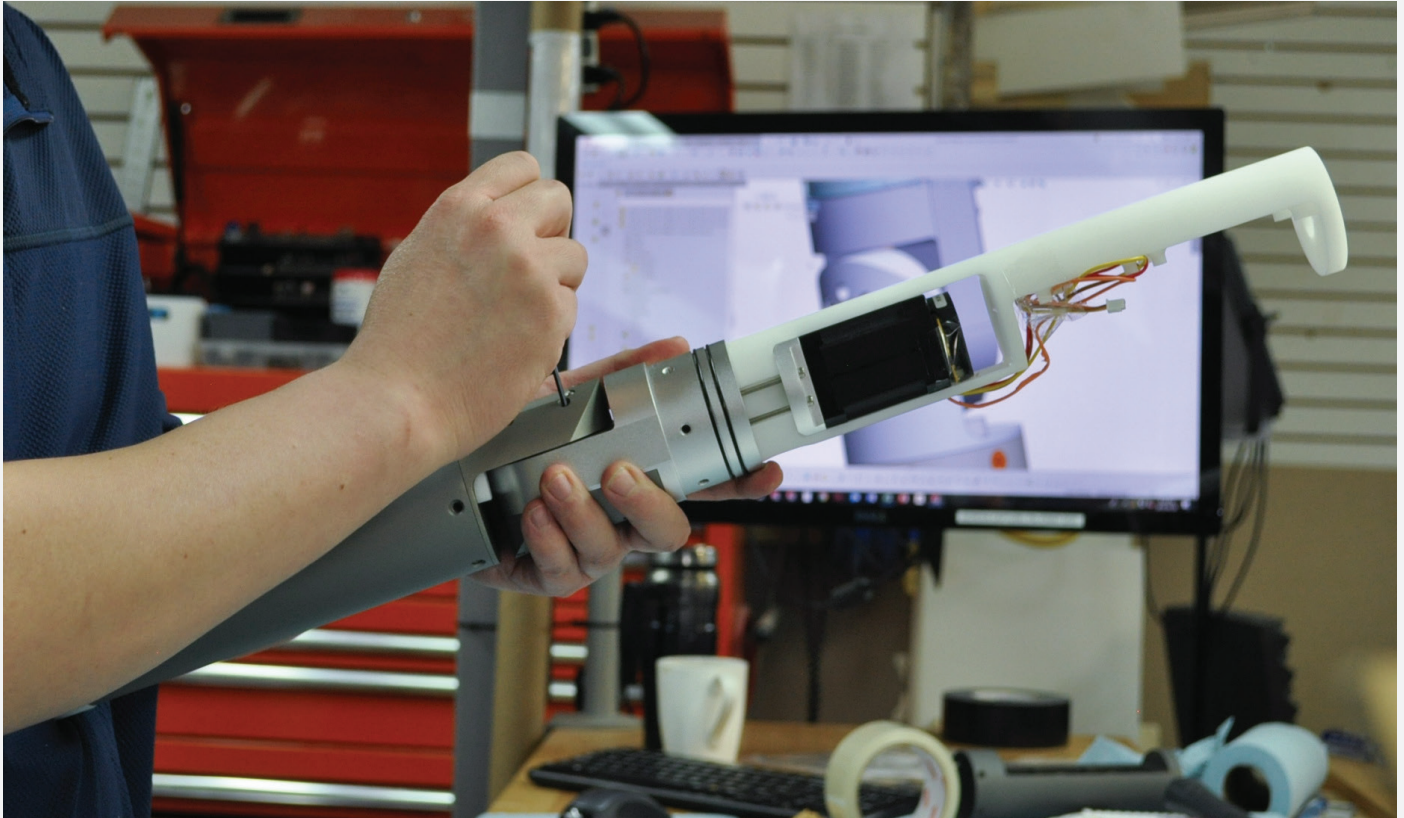




# Manufacturing Support

GeoSight engaged Design 1st to coordinate a low-volume production run in the summer of 2020. This activity involves working with Design 1st's global supply chain network to find the right mix of suppliers and manufacturers to produce high-tolerance, repeatable production, as well as a stringent quality assurance process to maintain product operation consistency in this extreme environment.

During the manufacturing support process, Design 1st also helped GeoSight build a 'product file' that includes the full release-controlled documentation blueprints to manufacture the device and maintain quality. The result is a volume production process that GeoSight can ramp up as orders from customers come in.



# Are you looking for help on your next rugged, challenging product design?

We can be up to speed on your product design challenges in a few hours.

We will provide feasible options in a few days and then work with your team to finalize the best solution to test.

Get in touch, we have a senior team of skilled professionals to help.

**1.877.235.1004**  
**info@design1st.com**  
**Design1st.com**



See other rugged outdoor instrumentation we have worked on.