



# Intelligent Borescope for smarter, faster engine inspections

Waygate Technologies and Rolls-Royce are working together to transform the engine inspection process.

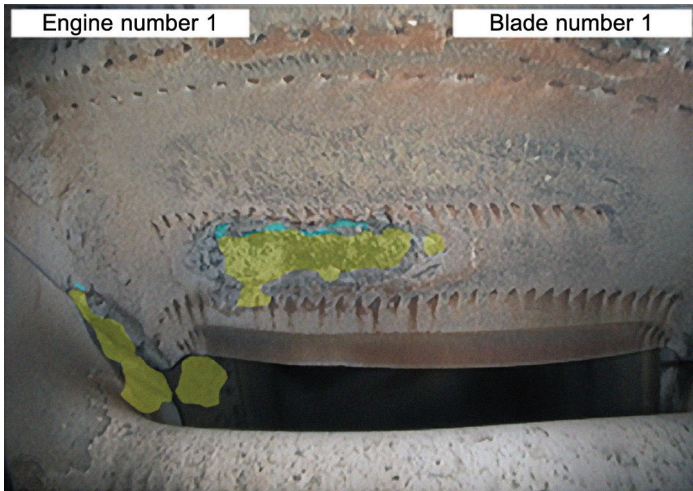
The Intelligent Borescope provides consistent and fast data collection by integrating artificial intelligence (AI) apps and leveraging Rhinestahl's FutureDriveNG+ electronic turning tool with Waygate Technologies' Everest Mentor Visual IQ VideoProbe™ with Real3D™ Measurement and Menu Directed Inspection technology.

## Benefits:

- Reduce aircraft engine inspection time up to 75%
- Reduce data processing time by nearly 95%
- Save millions in inspection costs over time — and keep your aircraft in the air

## Challenge

An average aircraft flies 20,000 times in its lifetime. That's the equivalent of 60 million miles—or 2,400 times around the globe. Many of these aircraft are powered by Rolls-Royce engines and, although designed to operate with minimal need for visual inspections, they sometimes must undergo unscheduled maintenance checks. These can be caused by naturally occurring events such as a bird strike or a heavy landing, or they can result from onboard health monitoring systems that indicate a need to check various systems or components.



One way of getting a look inside the engine is with a borescope. First, however, the engine must be completely shut down and then cooled. Staging, tooling, and activation of safety systems are all necessary before anyone is permitted to start working on the engine, so six or more hours easily can pass before work can begin. Add in the actual inspection time, and a routine borescope inspection can take an aircraft out of service for 12 hours. That's 12 hours the aircraft is on the ground and not in the air.

Rolls-Royce wanted a way to leverage AI to generate the required inspection dataset in a much more efficient manner—one that enables automated data collection, analyses, and reporting while helping inspectors make more informed decisions, faster. The creation of an intelligent engine inspection system would reduce overall inspection time and help minimise the risk of human error that can impact inspection outcomes.



## Solution

Working together, Waygate Technologies and Rolls-Royce created a system to improve the overall quality and efficiency of on-wing inspections. This one-of-a-kind Intelligent Borescope solution enables a level of semi-automated data analyses previously never seen in aviation.

The Intelligent Borescope uses Waygate Technologies' Everest Mentor Visual IQ VideoProbe™ with Real3D™ Measurement—the only 3D Phase Measurement software of its kind—along with enhanced probe optics and custom AI technology to not just semi-automate data capture but utilise it to support Rolls-Royce's IntelligentEngine vision.

The borescope tip is enabled with a scanner that generates 3D color images. As it moves through the engine, the borescope captured images are analyzed by an AI app installed on the borescope handset. The AI app maps the blade the same way a face is mapped, looking for irregularities or inconsistencies. Never before has facial recognition AI been used in this way in aerospace inspections.

Menu Directed Inspection (MDI) technology enables captured data to also include information that enables it to be processed and reviewed in an efficient and user-friendly format.

Embedded AI apps enable the operator to review, edit and report the data without using any additional equipment. It is all processed on board the Waygate Technologies' Everest Mentor Visual IQ VideoProbe™. No need to transport or carry additional IT equipment to the engine. A process that previously took 90 minutes... now takes just 5.

Once all data is processed and reported, users can simply push a button to send the data directly to the Rolls-Royce Inspection Insight platform, providing tremendous efficiency by removing this burden from the inspector.

"This technology will not only speed up inspection times, but also transform many aspects of our business through the capture and analysis of high-quality standardized data from all of our engines, which can be exploited to maximize the efficiency of our entire fleet and improve future design."

—Adriano Pulisciano  
Imaging and Computer Vision Specialist, Rolls-Royce

## Results

With this high level of innovation and partnership, Rolls-Royce was able to boost data collection, optimize its inspections, and set itself up for a future of speed, innovation, safety, and success.

Harnessing Real3D Measurement, MDI and AI-enabled automation, this new Intelligent Borescope has massively increased data collection while reducing aircraft engine inspection time by 75% and the time to process this data by nearly 95%.

The Intelligent Borescope is an industry-first AI application-enabled borescope that can capture and process image data in around 30 minutes for certain inspections. But this is just the start. With new apps and innovation to come, Waygate Technologies and Rolls-Royce will continue to invest to transform in-situ inspection.

## Artificial Intelligent analytics

Artificial intelligence (AI) and computer vision have been combined to create bespoke apps designed to significantly improve the time taken to undertake certain in-situ visual inspections.

These apps are designed to be fully integrated into the Waygate Technologies' Everest Mentor Visual IQ system. No additional laptop or companion device is needed – all the necessary computational power is fully provided by the onboard processor within the handset.

## Rhinestahl's FutureDriveNG+ electronic turning tool

The Intelligent Borescope is digitally connected to the electronic Rhinestahl FutureDriveNG+ turning tool. This positions the blade to enable reliable and repeatable capture of each and every aerofoil in the stage. After each blade is successfully positioned, the tool sends a signal to the borescope to capture the image automatically. For more information, visit <https://www.rhinestahl.com/>



"At Waygate Technologies, we are proud to be driving the future of inspection by delivering data, insights, and advanced analytics through connected assets such as the Mentor Visual IQ. With innovative technology and industry partnerships, we can better create value-add technology to accelerate, scale, and unlock new outcomes."

**Mike Domke**  
Executive General Manager, Waygate Technologies

# Specifications

## VideoProbe handset kit

Part number	RR-MVIQHANDSET-KIT
Included standard accessories	Work Station Shipping/Storage Case with Integrated insertion tube storage reel, battery charger and power word, optical tip case, 16 GB USB thumb drive, user manual, accessory pouch, 1 battery, Magic Arm, 3D measurement block and DHMI-DP cable (5m)
Shipping box dimensions	57.2 x 56.3 x 41.2 cm (22.52 x 22.16 x 16.22")
System weight in case	43.2 lbs
User interface	Menu-driven and soft button operation; menu navigation using either touchscreen or joystick
Ergonomic design	Unitized hand-held design with interchangeable QuickChange probes
Illumination	White LED
Measurement	Real3D stereo and phased measurement with point cloud visualization, Projected Plane and Area Depth Profile measurement types
Articulation	360° All-Way® tip articulation, menu access, and navigation
Internal memory	32 GB
Zoom	5X continuous digital zoom
Battery	2-hr Li ion battery pack, charge while attached or detached from handset
Display	6.5" XGA LCD, daylight readable with touchscreen
I/o ports	(2) USB 3.0 "A" port, (1) USB 3.0 client micro 'B' port
Video output	DisplayPort digital video output
Still image formats	Bitmap (.BMP) and JPEG (JPG)
Video format	MPEG4 AVC/H.264 (.MP4 file)
IP rating	IP65 (assembled), IP55 (disassembled)
Military standard compliance	MIL-STD-810G 501.5, 502.5, 506.5, 507.5, 509.5, 510.5, 511.5, 514.6, 516.6, 521.3 MIL-STD-461G electromagnetic compatibility with RE102, and RS103 – above deck
Agency compliance	Group 1 Class A; EN61326-1, IEC CB Scheme, UL/EN/CSA-C22.2 61010-1, IEC 62133, UN/DOT TI-T8, EU RoHS 2, EU RED Directive, ISTA 2G

## Probe & optical tip kits

Diameter	Part number	Description
6.1mm	RR-HD6130PROBE-KIT	Interchangeable probe with rigidizer, grippers and 6 OTAs: side, forward view and 3DPH measurement
4.0mm	RR-SD4030PROBE-KIT	Interchangeable probe with guide tube, probe holder and 4 OTAs: side, forward view and stereo measurement

## Rolls-Royce Analytics

Part number	Description
MVIQ-ADRRRBEMAT	Blade elongation analytic
MVIQ-ADRRRERO	Blade erosion analytic