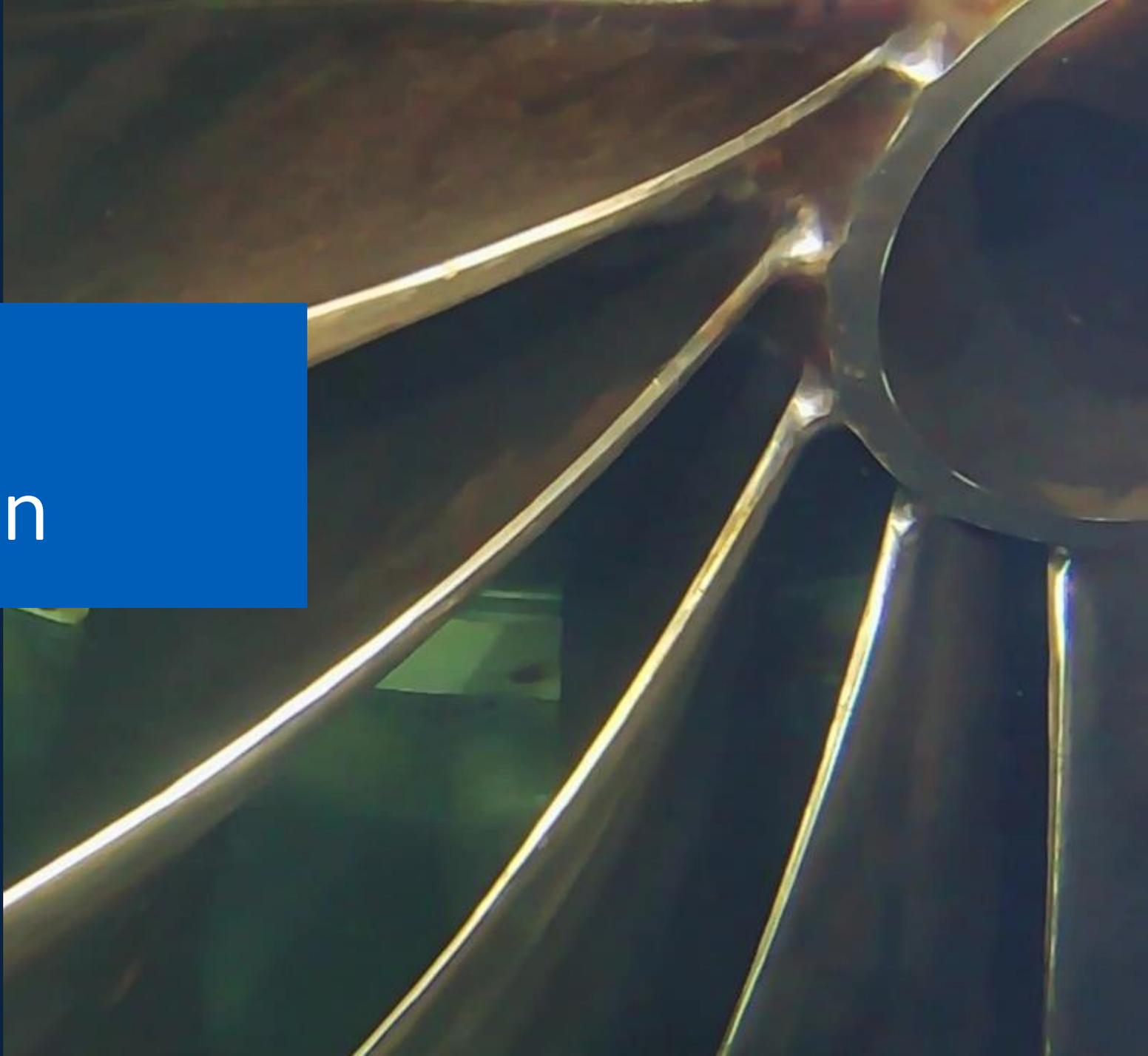




ROV Underwater Turbine Inspection

Product sheet

April 2021



ROV UNDERWATER TURBINE INSPECTION



Overview

GE's pioneering underwater inspection technology achieves results comparable to dry visual inspection without confined space work and dewatering. The remotely operated vehicle (ROV) deploys sensors to previously inaccessible areas. Experts review the information in real-time to ensure proper inspection of all critical surfaces. **Less risk, resources and outage time** are required for inspection.

Deployment and access

Light ROVs can be quickly deployed and operated by a single inspector. The solution is specifically designed to access hard to reach areas (e.g. inter blade area of Francis runner) and can inspect civil and hydromechanical equipment and structures. Our team can also find or design equipment for your specific challenges.



ROV UNDERWATER TURBINE INSPECTION



Report

The inspection report includes numbered pictures with identification, localization, and dimensions of defects. Additionally, experts can review inspection video and images remotely (live or recorded) optimizing resource allocation. Advanced analytics identify orientation (upstream/downstream) and blade numbering to facilitate defect localization. The user interface allows simultaneous viewing of multiple cameras and annotation by the inspector.

Advantage	ROV inspection reduces risk and cost of unit dewatering and platform installation. It eliminates confined space, work at height and diving operations.
Versatility	Turbine, trash racks, gates and penstocks can be inspected on most hydro turbines: vertical and horizontal Francis, Kaplan, propeller, bulb and pump turbines.
Innovation	Our patent pending compact inspection probes can be inserted between runner blades and record 360 degrees images in 4K, ultra high definition.
Detect, locate, quantify	Erosion, cavitation, corrosion, impact marks and foreign bodies.
Depth rating	305 meters (1000 ft.)
Battery life	Up to 8 hours. Continuous operation possible using a spare battery set.
Tether length	Standard 305m (1000 ft.). Up to 800 meters (2600 ft.).
Lighting	The cameras and dimmable lights are designed specifically for underwater use. If water turbidity is low, the image quality is comparable to a digital camera in daylight.
Diver support	Complex underwater tasks can require divers. A pre-dive ROV environment survey and current validation increase diver's safety and efficiency.
Accessories	Grabber, cutter, samplers, pressure washer, caviblaster, DVL, sonar, water quality and dissolved oxygen sensors can be added to meet your needs.

ROV UNDERWATER TURBINE INSPECTION – Q&A



Q1 What is the impact of water turbidity?

Water turbidity affects visibility. Clear water allows better and faster inspections. GE's solution has dimmable lighting configurations adapting to most situations. Water turbidity below 10 NTU is recommended, below 2NTU is ideal. If needed, GE can measure water turbidity from a sample and confirm inspection feasibility.

Q2 What is the support needed from the owner/operator?

Minimal support is required. Unit to be inspected must be stopped. A safe access to work area and 120V electrical power must be accessible. One operator helper is needed. It can be provided by GE if needed.

Q3 When is the best time of the year to perform ROV inspection?

Inspection is possible in all weather. GE recommends low flow season when water is typically clearer. Temperatures above 15°C (60°F) are preferable to ease operation.

Q4 What equipment is needed to launch/retrieve the ROV?

Our ROVs respectively weigh 4 and 26Kg (9 and 60 lbs).
The ROVs are launched using their tethers and a portable retrieval system.

Q5 What is the runner inspection duration?

The time is dependent on water clarity and level of detail required. In most circumstances, the runner inspection lasts 4 hours. GE recommends planning a 2-day outage to cover unforeseen and in-depth inspection should adverse conditions be identified.

Q6 How does the ROV access the runner?

The access can be adapted to unit configuration. Generally, the ROV is lowered in the tail race then navigates to the runner.

ROV UNDERWATER TURBINE INSPECTION – Q&A



Q7 What if the ROV get stuck between the turbine blades?

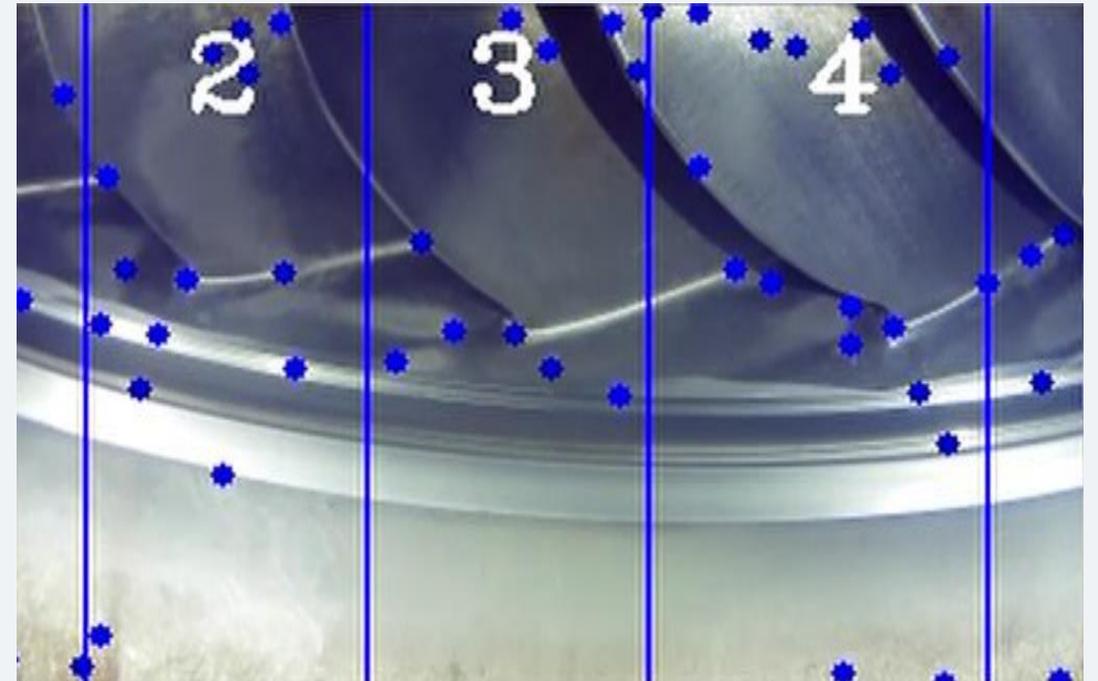
The GE inspection ROV is designed to remain under the runner while the compact inspection module is inserted between the runner blades. Should there be a problem, the ROV would sink in the draft tube and be retrieved by the operator pulling on the tether. Should the inspection ROV be stuck, the assistant ROV would retrieve it using its robotic arm.

Q8 Can you inspect the entire runner?

The ROV inspection uses the same protocol as dewatered inspection. A qualified engineer ensures all the critical surfaces are inspected and defects identified. Should an area require additional inspection, it is possible to vary camera distance, angle and lighting to gather more information about the defect.

Q6 How do you keep track of location underwater?

GE has adapted software developed in the aviation and wind industries to identify locations and facilitate reporting. See the example below.





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