



# Maski

## Underwater Robot for Dam Inspections

To ensure their long-term safety and service life, Hydro-Québec dams must be regularly inspected to assess their general condition and to diagnose anomalies. Since some dam walls are at depths of over 200 m, it is difficult, if not impossible, for a diver to thoroughly inspect them safely. The solution is Maski, a remotely operated vehicle (ROV).

### *Inspecting safely*

The underwater robot can be used to inspect submerged structures when depth, turbidity or strong currents make it too risky for humans. Maski is a key member of the diver team, making inspections safer and quicker, and thus helping to reduce generating unit down time.

Operated from a mobile control console, Maski is equipped with a positioning system for pinpointing its location and that of anomalies observed. The ROV's location is constantly tracked based on an optimal estimate combining measurements from multiple sensors: acoustic transponder, bathymetric sensor, Doppler velocity logger, inertial sensor and compass.

The control console has six monitors, one for each of the four cameras and two to graphically display data from the navigation software. The system can be used to digitize images and incorporate them into an inspection report. Visual observations can be measured and annotated. The ROV can be operated under conditions of high turbidity using a 3D graphical navigation interface and can produce a complete 3D profile of its environment using a multibeam sonar system.



Boom truck hauling the mobile unit

### **Autonomy, stability and flexibility**

The control console, ROV and tether fit into a trailer that is easily hauled by a truck, preferably one with a crane for lowering the ROV into the water. The entire system can be powered from a single 600 V outlet.

Maski's motors are arranged to allow it to move along its three axes and to rotate. Such flexibility of movement makes piloting the ROV quite straightforward. Operator-assisted navigation modes allow stable ROV movement even through turbulent water. In addition, the automatic navigation mode allows the ROV to follow predefined inspection paths or to return to precise locations visited during prior inspections.

### **Key advantages**

There are many advantages to using Maski as a tool to complement work by divers:

- > Greater worker safety by reducing risks associated with diving operations
- > Rapid, detailed inspections
- > Detection and documentation of anomalies
- > Clearer representation of work required
- > Extended service life of dams and control structures

The industrial version of Maski has been in service since 2006. Hydro-Québec, which manages some 600 dams and control structures, estimates that annual savings from using the underwater ROV amount to over \$2 million.

### **Specifications**

Maximum depth: <b>270 m</b>
Length of tether: <b>400 m</b>
Four color cameras
Seven <b>1.5 hp</b> thrusters
Independent movement on three axes plus rotation
Dimensions: <b>122 cm</b> long, <b>84 cm</b> wide, <b>88 cm</b> high
Weight: <b>210 kg</b>

### **For information:**

#### **Research**

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#### **Commercialization**

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