

水下检查装置 Underwater inspectors



Hibbard Inshore亚大西洋纳瓦霍遥控潜水器准备好通过工作船进行部署，以进行水电大坝检查

Hibbard Inshore's Sub-Atlantic Navajo ROV ready for deployment from a work vessel to perform hydroelectric dam inspection

来自Hibbard Inshore公司的Dave Malak报道，该公司的遥控潜水器技术使得机器人能够对水力发电和海上可再生能源发电厂进行水下评估

Hibbard Inshore's ROV technology is enabling robots to carry out underwater assessments for hydropower and offshore renewable energy plants. The company's Dave Malak reports



Utilising robots to perform inspection of renewable energy plants' critical underwater assets might sound complex. But advances in Remotely Operated Vehicle (ROV) technology have allowed Hibbard Inshore to inspect underwater hydropower structures with less risk, while often reducing overall project costs.

Power generation plants take different forms and, increasingly, many of these power sources require a portion of their critical assets to be located underwater. This adds unique challenges to their operation and maintenance. Underwater assets at hydroelectric power plants can include the reservoir, dam structure, pressure piping, tunnels, gates, and/or valves that are necessary to transport and control the water required for generation. Offshore wind farms and tidal generation turbines, on the other hand, can have long transmission cables and be located in deep waters or high current areas. Today, it is widely accepted that the underwater inspection of critical assets should be a major component of a good preventive maintenance plan.

Until the mid-1980s, the options for inspection were to dewater the portion of the asset to be inspected, use commercial divers where safe and possible, or perform the inspection or survey with sensors towed from a boat. Dewatering presents a number of challenges including long downtimes, detrimental impacts on fisheries, and stressing of the structure. Draining the water removes the added structural support normally provided by the water pressure and allows materials to dry and contract.

利用机器人对可再生能源发电厂的重要水下资产进行检查听起来可能很复杂。但是，Hibbard Inshore公司先进的遥控潜水器 (ROV) 技术在降低项目总体成本的同时，还能够更加安全地检查水下水力发电设施。

发电厂采用各种形式且越来越多的能源设施要求发电厂的一部分重要资产设置在水下。这就给操作和维修工作带来了独特的挑战。水力发电厂的水下资产包括水库、大坝、压力管道、隧道、闸门和/或阀门等用于输送和控制发电所需水量的设备。另一方面，海上风电场和潮汐发电涡轮机可具有很长的输送电缆且位于深水水域或高海流区域。现在，人们已经普遍认为，一个好的预防性维修计划应将重要资产水下检查作为重要组成部分。

直到20世纪80年代中期，检查的选项是对资产待检查的部分进行脱水，在安全和可能的情况下使用商业潜水员或通过船舶拖曳的传感器进行检查或调查。脱水面临许多问题，包括停机时间长、对渔业资源产生不利影响以及给设施增加压力。排水会导致一般由水压提供的附加结构性支撑消失，使得材料变干、收缩，从而加快破裂和退化。利用先进的遥控潜水器技术，可减少需要脱水的检查项目。

由于能见度低，位于深水区，海流高，长距离准入受限或存在潜在的水下危害，之前的检查和维修工作难以实现。先进的遥控潜水器技术使得所述检查和维修工作能够在资产处于完全淹没状态时实现，对人身安全的危害小，且需要的发电中断时间短。由于采用现在的技术，流量减少时间或中断时间缩短，尽量减少了对珍贵渔业资源的环境影响，同时不会因排水而导致设施的压力过大。除了安全接触受限区域以及水下工作时间不限的优势外，相比由船舶拖曳的其它仪器，遥控潜水器还能够提高调查精确度，这是因为遥控潜水器能够更加靠近待调查的区域。

作为一个具有前瞻性的企业，Hibbard Inshore认识到检查和维修发电资产水下部分是一个独特的挑战，并希望能够利用遥控潜水器提供一个具有高成本效益的方案。自1984年，该公司已经将一系列遥控潜水器用于水下检查和施工中，并在世界范围内开展这些项目。

该遥控潜水器可空运，可根据项目需要进行尺寸调整，在海上时可利用更小的船舶。其活动的范围为距离单一接入点20km以上以及2,000m深的水域。他们可配有传感器（包括各种2D和3D声波定位仪）、摄像机、照明设备、超声波厚度计、导航系统以及调查用的跟踪系统。该遥控潜水器也可配有切割、提升、检索、疏浚、清除杂物、永久性封堵孔洞或阀门更换项目中临时性封堵压力管道等所需的工具。

检查的原因

水下检查和调查的原因如下：

- 主动识别水下资产的潜在问题，以延长其使用寿命
- 证明资产设施的建造符合规范且在试运行后是可保险的
- 识别可能降低产能的危害或材料，制定移除所述危害或材料的计划
- 确定海上资产的适当位置，确定电缆的线路
- 降低脱水对设施带来的风险
- 减少整体成本或检查所需的停机时间

This can expedite cracking and degradation. With the advances in ROV technology, fewer inspections have required dewatering.

These advances in ROV technology have allowed previously difficult inspection and maintenance work, due to low visibility, deep water, high currents, long distance confined entry, or potential underwater hazards, now to be completed in a fully flooded state with little risk to human life and minimal generating outage times. The shortened, reduced-flow time periods or outages required due to today's technology minimise the environmental impact on valuable fisheries, and undue stress is not placed on the structure by removing the water. In addition to safely accessing confined areas and the advantage of unlimited bottom time, ROVs can improve survey accuracy over that of instruments towed from a boat, as the ROV is able to swim in closer proximity to the area being surveyed.

As a forward-looking company, Hibbard Inshore recognises that inspecting and maintaining the underwater portions of power production assets is a unique challenge and aims to offer cost effective solutions for these issues using ROVs. The company has operated a fleet of ROVs for underwater inspection and construction since 1984 and has performed these projects worldwide.

The systems are shippable by air, can be scaled to fit project needs, and can utilise smaller vessels of opportunity in offshore situations. These ROVs can travel to distances greater than 20km from a single access point and to 2,000m of depth. They can be equipped with sensors, including multiple types of 2D and 3D sonar, as well as video cameras, lighting, ultrasonic thickness gauges, navigation and tracking systems for survey. They can also be equipped with tooling to perform cutting, lifting, retrieval, dredging, debris removal, the permanent plugging of holes or temporary plugging of pressure pipes for valve replacement projects.

Reasons for inspection

UNDERWATER INSPECTIONS AND SURVEYS ARE NECESSARY FOR THE FOLLOWING REASONS

- To identify potential issues with an underwater asset proactively in order to increase its lifespan
- As proof that an asset has been constructed properly and is insurable after commissioning
- To identify hazards or materials that may reduce productivity levels and to devise plans for their removal
- To determine the proper location for an offshore asset and to determine the route for cables
- To reduce risks to the structures caused by dewatering
- To reduce the overall cost or downtime related to inspection