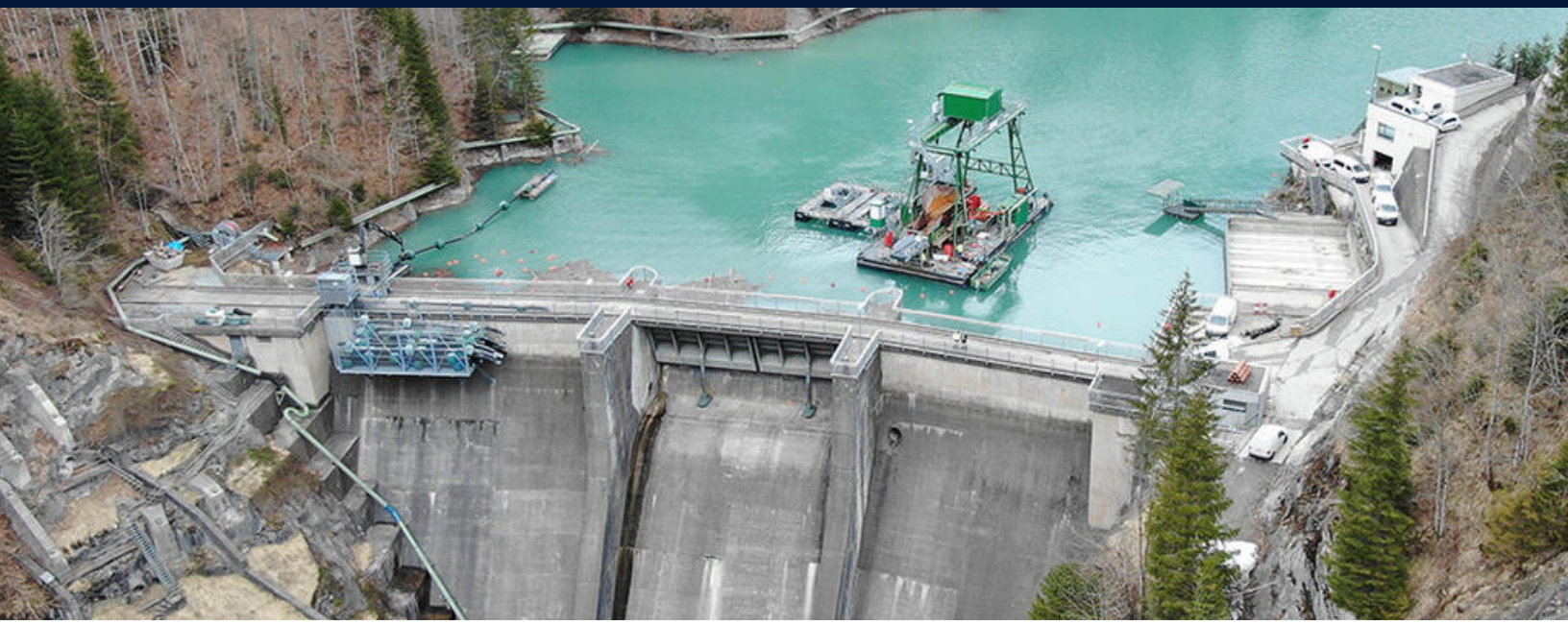
# Kongsberg solutions for dams

KONGSBERG



Dams play a vital role in our societies and daily lives. They serve multiple purposes, such as storing water for homes, industries, and farms. They also help with controlling floods, preserving fish habitats, and generating renewable hydroelectric power.

## Kongsberg provides benefits to dam owners and operators

In the United States, approximately three percent of dams provide hydroelectric power to households and businesses. Dams contribute 8-12 percent to the nation's power needs.

Globally, the International Convention on Large Dams recognizes around 58,700 large dams. The USA's National Inventory of Dams lists over 91,000 dams. However, there are more than two million dams in the USA that are not public. Clearly, there is a growing need for these structures, especially as populations expand into arid and flood-prone regions.

Over the past two decades, the number of high-hazard-potential dams has doubled due to urban development encroaching on rural dam sites. Dams are vital for our economy and well-being, but they are also susceptible to damage and failure. It is the responsibility of dam owners and operators to inspect and maintain these crucial assets.

Inspecting and maintaining dams is a challenge, particularly because the submerged portions are hard to examine. Draining the dam for inspection defeats its purpose. But underwater dam inspections require specialized tools to collect comprehensive, cost-effective data.

Moreover, changing weather patterns, from droughts to atmospheric rivers, present additional challenges. Silt management and avoiding dead-pool conditions in river systems are major concerns.

Kongsberg offers innovative, economical solutions for dam inspection and monitoring. We facilitate speed, accuracy, and efficiency to enhance safety and reliability.

# Application

## Structural inspection

Divers can inspect the upstream face of a dam. But, in many cases, diver-based inspections can be unsafe or disrupt dam operations.

Sonar instruments, however, perform dam inspections without disruption. Sonar creates visual images of the reservoir dam face, aiding civil engineers in making informed decisions about the dam's condition. Engineers can then plan scheduled or emergency-corrective maintenance accordingly.

# Solutions

## 1171 High Resolution Sonar or M3 Sonar HF

Kongsberg's 1171 High Resolution Sonar is a powerful inspection tool. The image quality of single-beam scanning sonar is superior to multibeam data, particularly when looking for features, such as cracks, in the dam face.

With a narrow horizontal beam pattern and enhanced angular resolution, this sonar delivers exceptionally clear visuals that are essential for detecting structural anomalies. Equipped with tunable-frequency transducers, the 1171 High Resolution Sonar allows operators to adjust settings based on specific inspection requirements, ensuring optimal performance across various conditions. Additionally, the exposed transducer design eliminates acoustic lensing effects, providing consistent image quality regardless of water temperature.

Using high-resolution sonar for dam inspections ensures precise, reliable assessments, helping to detect structural issues early and support long-term safety and maintenance efforts.

Kongsberg's M3 Sonar HF is a high-frequency multibeam sonar with both imaging and profiling capabilities in one sonar head. This multibeam sonar is an exceptionally good option when speed is essential, but image quality is also important.

Using the M3 Sonar HF with SoundTiles mosaicking software provides automatically-mosaiced multibeam images. Using this sonar with HYPACK Hysweep provides 3D point-cloud data for inspections.

The M3 Sonar HF is available in several system configurations suitable for ROVs, manned, and unmanned vessels. This versatility gives civil engineers several options for safe data collection.

# Applications

## Intake debris monitoring
## Discharge scour monitoring
## Reservoir sedimentation monitoring

Many dams serve as debris filters for large watersheds, accumulating waterlogged debris that can reduce flow or block intake structures, affecting power generation. Intake debris monitoring keeps conditions safe – and keeps the power on.

In addition, when dams have emergency bypasses, water flow can cause significant scour downstream. Discharge scour monitoring illuminates the severity of the scouring.

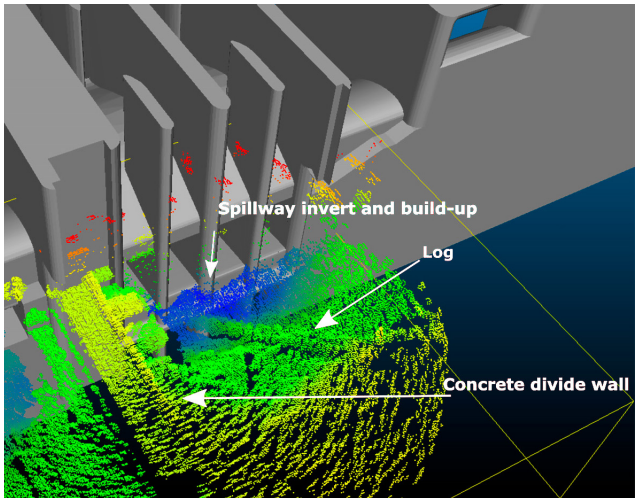
Siltation buildup in dam reservoirs is also a significant concern, as it can damage turbines and affect power generation. With increasing storm activity, deforestation, and wildfires, reservoir sedimentation monitoring is more important than ever.

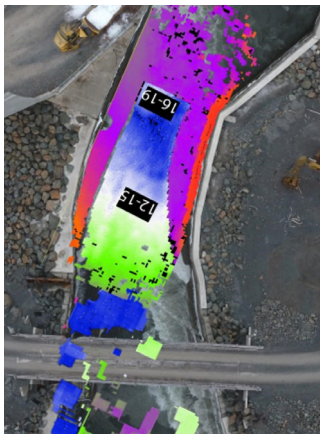
# Solution

## Dual Axis Sonar with K-Observer

Kongsberg's Dual Axis Sonar with K-Observer can be used for intake debris monitoring. This combo gives dam operators constant awareness of intake conditions, preventing blockages. The K-Observer software provides alarms when solid objects or silt threaten to block the intake at the trash racks or around the inlet.

The Dual Axis Sonar with K-Observer can also monitor scour impact over time, providing historical records and alerts for operators. Alarm levels can be set based on scour depth so that operators can assess and modify dam operations accordingly.


Kongsberg's Dual Axis Sonar, coupled with K-Observer data processing, enables continuous reservoir sedimentation monitoring. The dam operators can detect siltation build-up over time and set alarms so that they can schedule maintenance dredging when required.

Operators can permanently mount the Dual Axis Sonar and program it to operate continually, generating a 3D point cloud with each scan. K-Observer monitors the change in bottom conditions scan-on-scan to provide a historical record.

# Application

## Reservoir bathymetric surveying

Large dam owners and operators need to monitor sediment buildup in the reservoir through periodic surveys.

# Solution

## Flexview, M3 Sonar PHS, or EM 2040P

Kongsberg's Flexview Multibeam Sonar, M3 Sonar PHS (Portable Hydrographic System), and EM 2040P system are all suitable for mapping dam reservoirs. These can be mounted on manned or unmanned survey vessels, in moon pools, or pole mounted on vessels of opportunity.

# Application

## Environmental monitoring of at-risk species

Since dams impound water and block the riverway, dams can impact local ecosystems. Environmental agencies need to monitor and report on at-risk species.

# Solution

## M3 Sonar or EK80

Biologists use Kongsberg's M3 Sonar and EK80 split-multibeam echosounders to study species behaviour and their response to dam construction and operation.

**Kongsberg's solutions empower dam owners and operators to safeguard these critical structures efficiently and economically.**

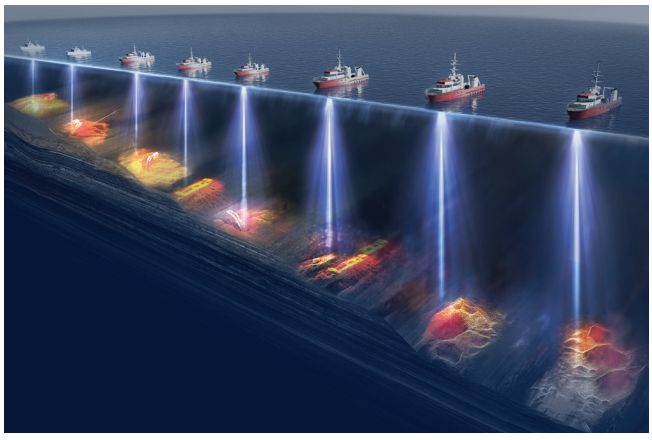
Kongsberg Discovery

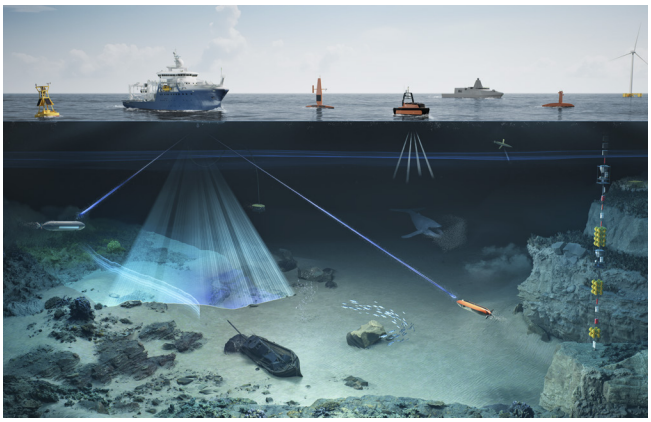
# Protecting people and planet

## From the deepest sea to outer space

Kongsberg Discovery serves the ocean space from the deepest sea to outer space. We develop technology to ensure sustainable management of marine resources, monitor climate change and critical infrastructure, and safeguard national security.

Our technology aims to sustainably manage marine resources, monitor climate change, secure infrastructure, protect national security, and address crucial global challenges. It is vital for offshore operations, fisheries, marine research, maritime activities, ocean energy production, infrastructure monitoring, and naval operations.





## Committed to protecting our planet

We recognize the global sustainability challenges and are committed to developing solutions and products that resolve operational issues while addressing environmental impacts on the ocean ecosystem.

The business has over 1,100 employees located in Horten, Trondheim, and Oslo in Norway, as well as operations in Alicante in Spain, Aberdeen in the UK, Lynnwood (Seattle), Houston, and New Orleans in the USA, Vancouver and Halifax in Canada, Kuala Lumpur in Malaysia, and Singapore. Kongsberg Discovery is part of KONGSBERG, a leading technology group based in Norway.

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