

## Notes

## Loch Ness Survey 2002

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During October 2002 the British Broadcasting Company (BBC) contracted Kongsberg Simrad to conduct an acoustic survey of Loch Ness, Scotland. The purpose of the survey was to provide a true baseline map of the loch floor and walls, a background against which other scientific data could be compared and put into context.

Drawing from their in-house equipment pool, Kongsberg Simrad mobilised an array of multi-beam echo sounders, motion compensation and GPS navigation systems. They also contracted an ROV team to provide live video from the loch floor.

A Loch Ness production team has been assembled by the BBC, the team included the award winning camera crew from the highly acclaimed 'Blue Planet' television series and the special effects team that created 'Walking

with Dinosaurs'. In conjunction with the resident scientific expert group, the Loch Ness Project, the BBC will evaluate all the available evidence, and carry out a 'ground-truthing' exercise against the background dataset of the Kongsberg Simrad survey. This will attempt to establish the facts surrounding legends of underwater cavern systems and passages leading to the open sea.

This paper looks at the primary instruments used to gather the data and the initial results from the preliminary post processing performed on the data. The primary sensor deployed to gather the mass of soundings required to form an accurate bathymetric map was the Kongsberg Simrad EM 3000 multi beam echo sounder (Figure 2). The Simrad EM 3000 is a multibeam echo sounder, using separate multi element transducers for transmission and



Figure 1: MV Deepscan looking out across Loch Ness

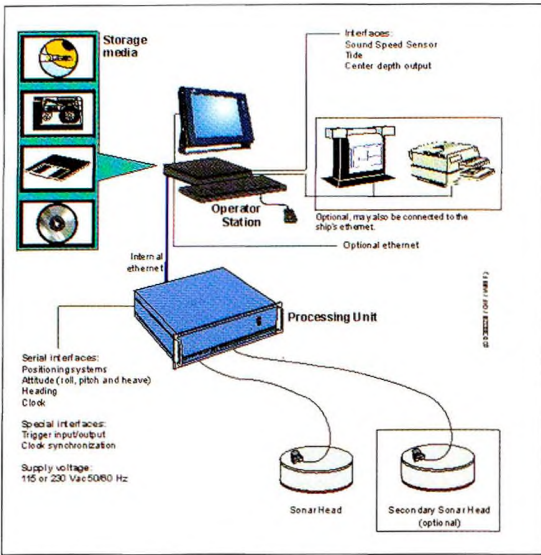


Figure 2: Kongsberg Simrad EM 3000 multi beam echo sounder

reception. During transmission, the signal is steered electronically to stabilise the sounding profile for vessel pitch motions. This is a necessary function to be able to detect objects on the seafloor reliably. During reception, beam forming is applied to the 64 hydrophone signals to form 127 (single transducer system) or 254 (dual transducer system) acoustic beams. Within each of these 1.5 degree beams, a phase comparison technique is applied to derive the precise angle for the centre line of each beam with a typical accuracy of 0.03-0.05 degrees. The system is used by several hydrographic institutions for hydrographic mapping to IHO-S44 requirements for special order surveys (Harbours, Canals, Critical passages). Typical uncertainty of individual soundings is 5 cm RMS.

To correctly position the gathered data an accurate and responsive positioning and attitude system is also required. The Kongsberg Seatex Seapath 200 was sup-

plied to provide this functionality (Figure 3). The third generation Seapath 200 provides highly accurate, real time heading, attitude and position information by blending the best characteristics of sensor based inertial navigation and GPS continuous update technologies. High rate motion data obtained from the system's IMU and precise position data from two fixed baseline GPS carrier phase receivers are integrated in a Kalman Filter that has been refined to ensure maximum fidelity and reliability. Seapath has four programmable data input/output communication ports and can accept DGPS correction signals to provide position also. Accurate to 0.3 degrees RMS for pitch and roll and 5cm heave or 5 per cent, whichever is highest, Seapath 200 is the most widely used and accepted instrument of its kind in use today.

The outcome of the survey was a highly detailed terrain map of the underwater portion of Loch Ness, using state-of-art hydrographic survey equipment, never before used on a project such as this (Figure 4).

Survey Time: 2 days, 166 Lines of EM 3000 and EM 2000 data, 2.26 GB Processed data, 54.3 Millions soundings.

During this survey the team from The Loch Ness

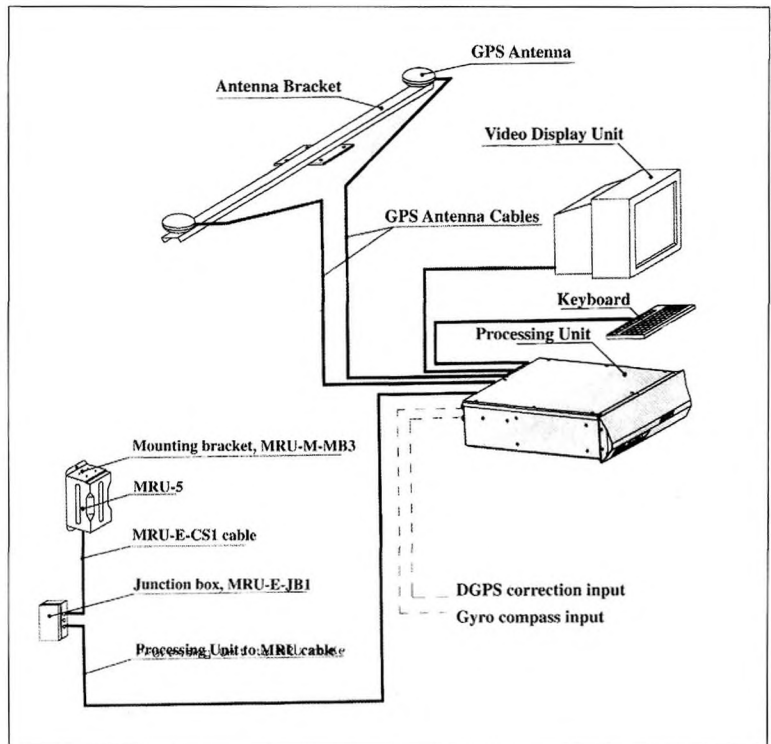
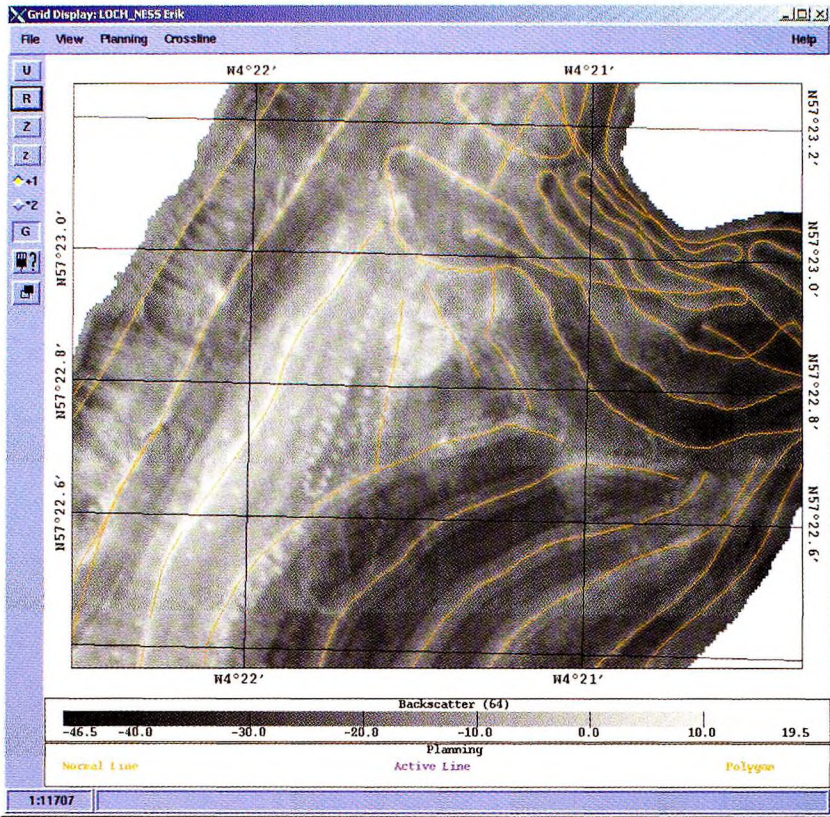
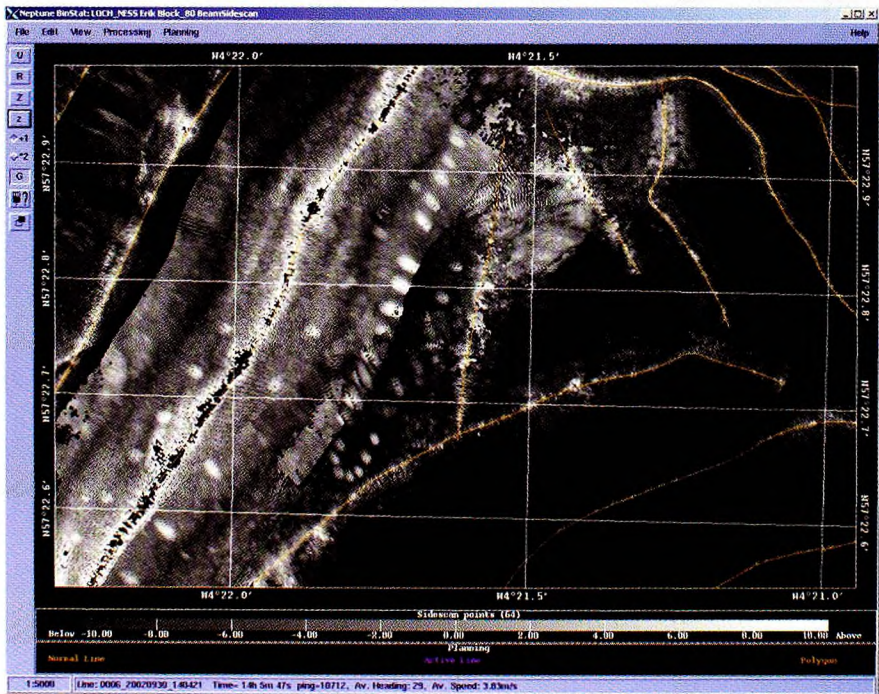


Figure 3: Kongsberg Seatex Seapath 200



A



B

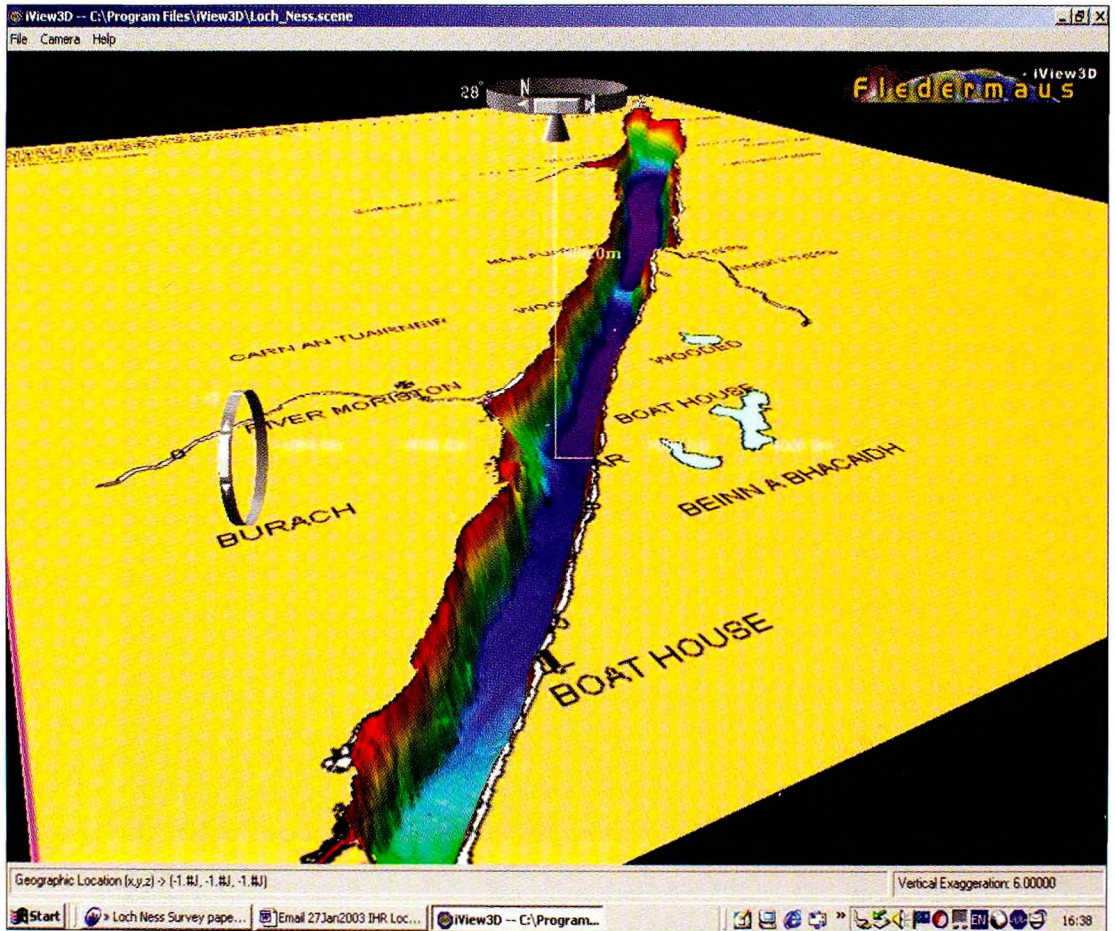
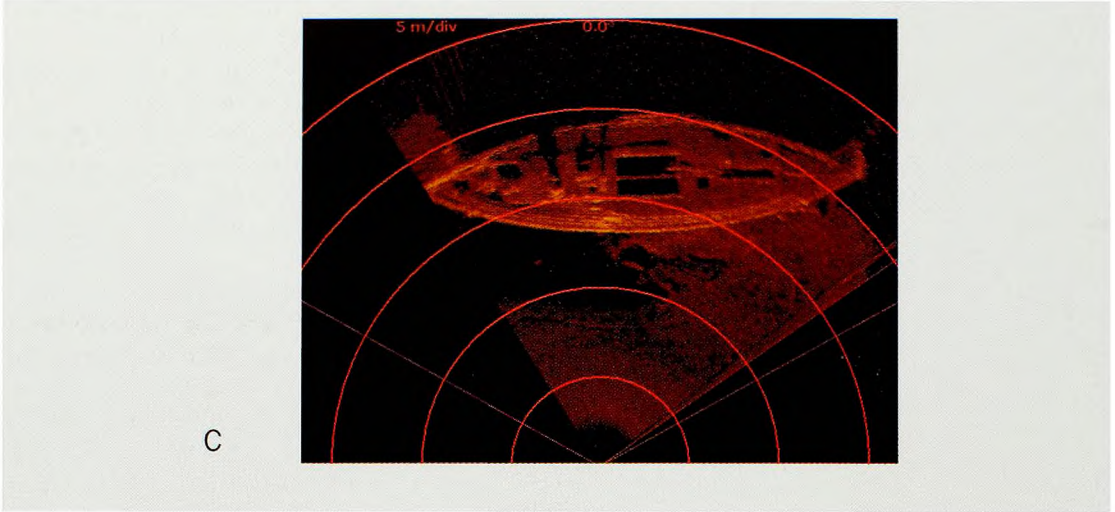


Figure 4: Loch Ness bathymetry visualised in Fledermaus. A, B, C: Objects found in northern part in the imagery data

Project directed Kongsberg Simrad Sonar equipment towards several targets deemed worthy of further investigation, and, in conjunction with MARINSPECT, the ROV inspection company, these 'objects of interest' were duly investigated by remote control.

Sonar images from the Kongsberg Simrad MS1000 High-Resolution scanning sonar (as shown in Figures A, B and C). As the ROV approaches, the 'target', becomes clearly identifiable as a vessel, but unknown type. Within 15m of the wreck, the details of hull planking, a hatch and deck fittings

start to become clear. From the sonar image, she is approximately 25m (75ft) in length.

The images presented are the initial results of the data processed so far, the data will undergo further processing and comparison against previous data sets gathered. The BBC now have a true baseline map of the loch floor and walls against which other scientific data may now be compared and put into context.

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