

Surveying and charting the Surtsey area from 1964 to 2007

ÁRNI TH. VÉSTEINSSON

Icelandic Coast Guard, Hydrographic Department, Skógarhlíd 14, 105 Reykjavík, Iceland, arni@lhg.is

ABSTRACT

The history of hydrographic surveys in the area around Surtsey reveals considerable submarine erosion. The first survey was carried out in July 1964. Since then the Surtsey area has been resurveyed five times. The latest one, a multibeam survey, was carried out in July 2007 by the Hydrographic Department of the Icelandic Coast Guard (ICG). The 1967 survey was carried out after volcanic activity had stopped. The least depth on the Jólnir shoal at that time was 15 m. In 2007 it was 43 m. Depth had increased by 28 m in 30 years.

ERUPTION OFF THE SOUTH COAST

The November issue of Icelandic Notices to Mariners in 1963 is a rare one, if not unique, in the history of NMs worldwide. Notice No. 19 carried the information that a submarine volcanic eruption had started on 14 November SW near Geirfuglasker off the south coast of Iceland and that on 22 Novem-

ber an island had emerged from the sea 700–800 m in diameter and rising to 80 m above sea level (Fig. 1). Mariners were warned to keep clear of the area between $63^{\circ}17.8'N - 63^{\circ}18.2'N$ and $20^{\circ}36.1'W - 20^{\circ}36.9'W$, southwest of the Heimaey island.

In the early morning of 14 November 1963 at approx. 07:15, fishermen from the Heimaey island

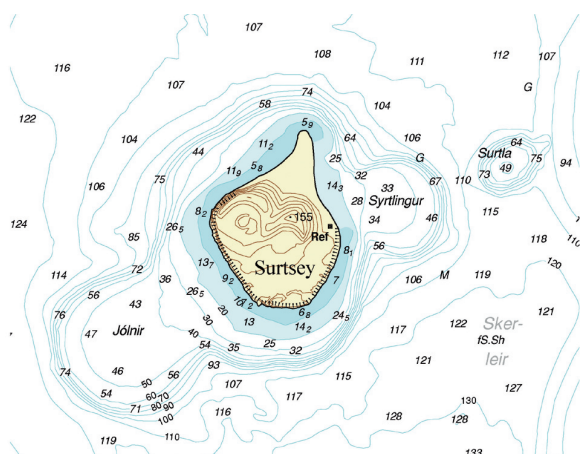


Figure 1. Surtsey as depicted on the latest edition (2002) of the chart Vestmannaeyjar, No. 321, scale 1:50,000.

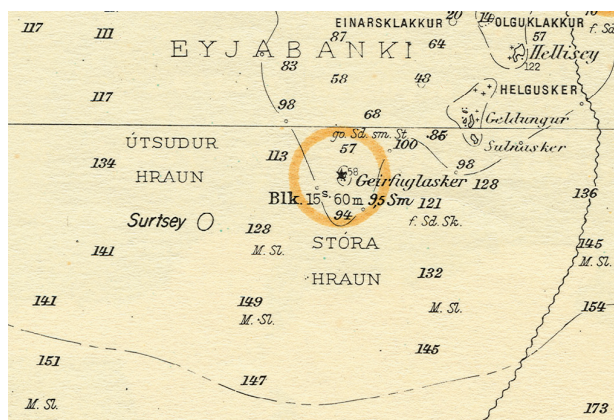


Figure 2. The Surtsey island was first shown on the Icelandic chart Dyrhólaey – Reykjavík, No. 31, scale 1:250,000, printed in January 1964

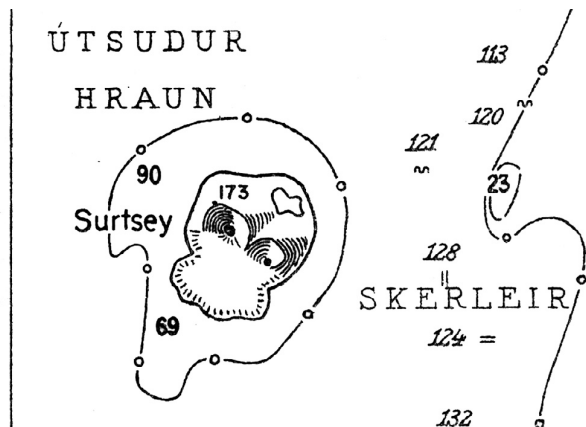


Figure 3. Part of the 1964 NM block for chart No. 33 – scale 1:100,000

saw black smoke not far from where they were fishing. The eruption site was a place of rich fishing grounds with depths of 120–130 m. At daybreak they saw that the sea was muddy and bubbling. This was the first sight of the Surtsey volcanic eruption.

FIRST NAUTICAL CHART SHOWING SURTSEY

The Surtsey island was first shown on an Icelandic nautical chart printed early 1964 (Fig. 2.), only some two months after the eruption started.

Hydrographic surveys, in Table 1, around Surtsey island have been carried out five times by the Icelandic Hydrographic Service (IHS).¹ A further survey was made in 1967 by the United Kingdom Hydrographic Office (UKHO). The surveys are:

Survey No.	Sheet scale	Date
SV-055	1:40,000	1964, July, August
SV-060	1:10,000	1967, July
SV-089	1:15,000	1973, July
SV-146	1:10,000	1985, June, July
SV-172d	1:10,000	2000, July
SV-216	Multibeam survey	2007, July

FIRST HYDROGRAPHIC SURVEY

After the first survey was carried out in July and August 1964 a Notice to Mariners was issued, including chart inserts (Fig. 3) for the different scale charts covering the area, showing the new island.

The 1964 survey (Fig. 4) was the first echo sounder survey of the area SW of the Heimaey island. The existing lead line survey dated back to 1901. The scale of the survey sheet is 1:40,000, giving survey line spacing of approx. 400 m (not very detailed depth information).

¹ Icelandic Coast Guard – Hydrographic Department from 2005

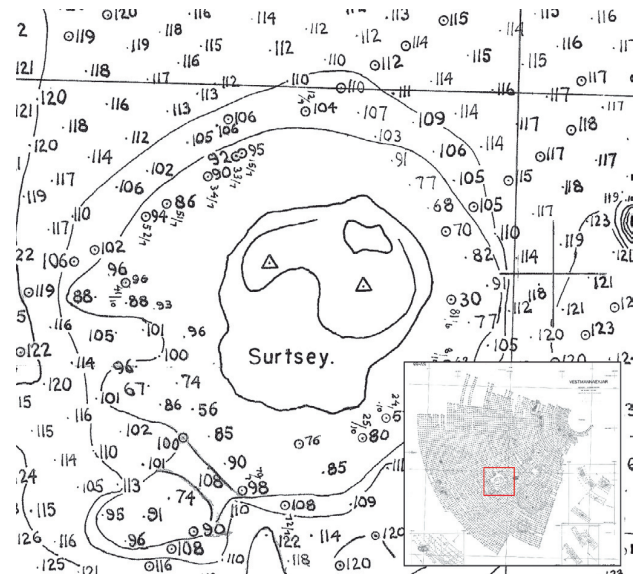


Figure 4. The 1964 survey showing depths around Surtsey.

NEW NAUTICAL CHART

Early in 1966 the chart Vestmannaeyjar – Selvogsbanki, No. 33, scale 1:100,000, was updated and printed showing the current status (Fig. 5) in the area around Surtsey island. Volcanic activity was ongoing close SW of Surtsey island where the small island Jólnir existed for a while. The chart bears a note: *GOS (Vol)*, “gos” meaning a volcanic eruption. Chart No. 33 is the first and only Icelandic chart (to date) to carry a note of this kind.

In October 1966 a new Icelandic chart (Fig. 6) Selvogur – Vestmannaeyjar, part of the Coastal Chart series at scale 1:100,000, was published. Volcanic activity at Jólnir had ceased. The small island had been washed away leaving a shoal of uncertain depth shown in blue bounded by a black line.

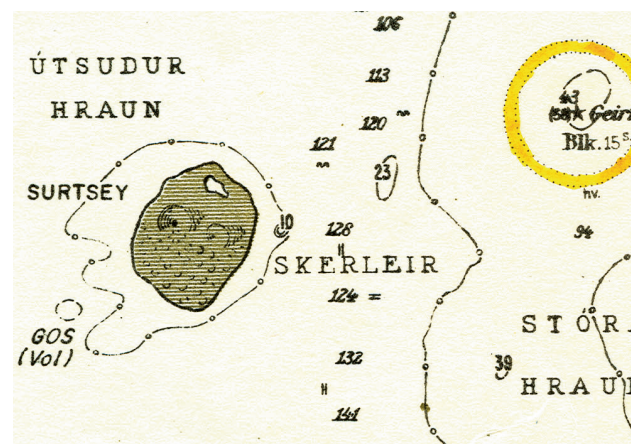


Figure 5. Volcanic activity close southwest of Surtsey as shown on the chart Vestmannaeyjar – Selvogsbanki, No. 33, in 1966.

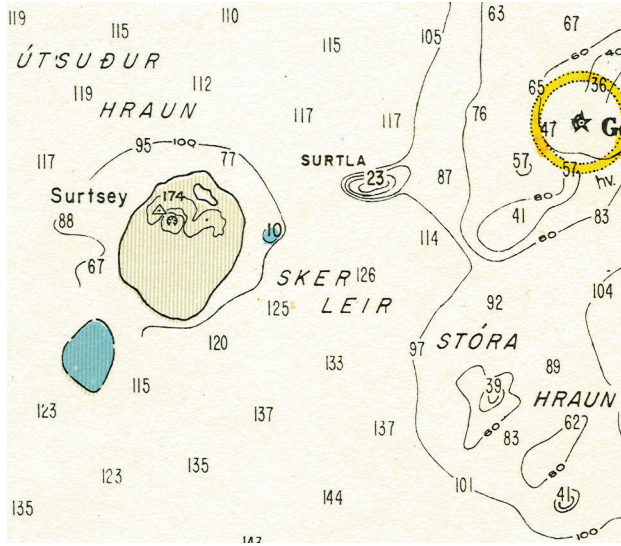


Figure 6. A cut-out from the first edition of the new chart Selvogur - Vestmannaeyjar, No. 16, published in October 1966.

FIRST SURVEY AFTER ERUPTION ENDED

The Surtsey volcanic eruption came to an end in June 1967. The area was surveyed (Fig. 7) the following month by the UKHO. The 1967 survey had a varying line spacing of 40–200 m because the survey was planned in this circular star radiating manner. This gave a good picture of the configuration of the seafloor around the island.

LATER HYDROGRAPHIC SURVEYS

The 1973 survey (Fig. 8) was again carried out in July which is high summer in Iceland and the most likely time of the year to give a favourable weather and sea state for hydrographic surveying. The density of depth data collected was considerably less than in the 1967 survey but gives very valuable information on submarine erosion around Surtsey island between 1967 and 1973. Least depth on the

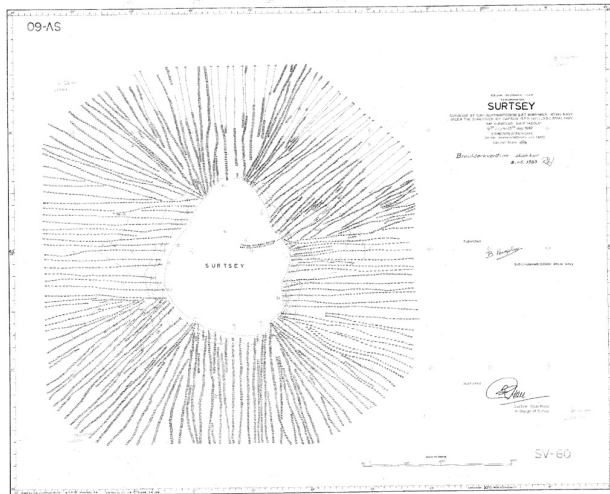


Figure 7. The 1967 survey was carried out by the crew of HMS Hecla, a UKHO survey vessel.

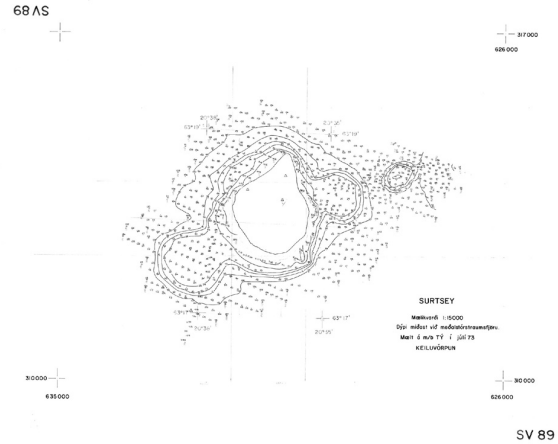


Figure 8. The 1973 survey. Least depth on the Jólnir shoal had increased from 13 m in 1967 to 28 m in 1973.

Jólnir shoal had by then increased by 15 m to a striking 28 m.

The next time Icelandic hydrographic surveyors paid the island a visit (Fig. 9) was in 1985. The elements had shaped the island and its surroundings for almost 20 years. It became evident, when the soundings were plotted on the survey sheet and compared to previous survey of 1973 that the submarine erosion had continued as expected. Least depth on the Jólnir shoal had increased to 37 m.

Fifteen years passed but in July 2000 surveyors came to the island once again. The survey (Fig. 10) was planned in a circular manner similar to the 1967 survey. Least depth on the Jólnir shoal had now increased by 5 m to 42 m.

FIRST MULTIBEAM SURVEY

The latest survey (Fig. 11) was carried out in July 2007. It was the first multibeam echo sounder survey around Surtsey island (seafloor coverage

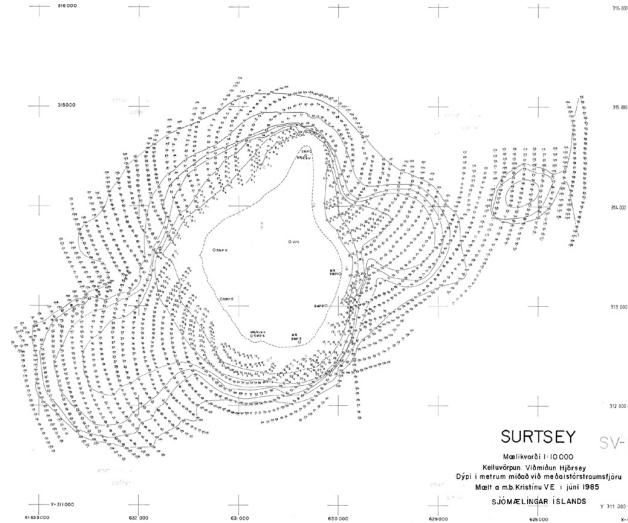


Figure 9. The 1985 survey of the Surtsey area.

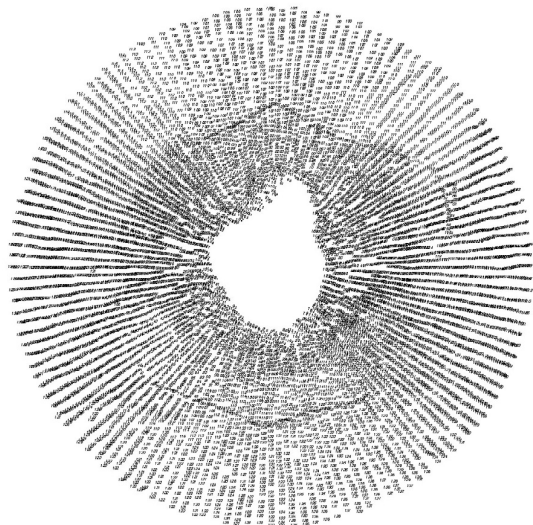


Figure 10. The July 2000 survey has a certain technical beauty, because of its circular shape.

100%) and it revealed details of underwater landscape never seen before.

The sea floor image of the Surtsey area (Fig. 12) was created using the CARIS HIPS Multibeam Professional software (a suite of bathymetry processing tools). ICG Hydrographic Department uses CARIS HIPS for processing hydrographic survey data.

The resolution of the image ranges from 2 m to 10 m in four depth zones (0–30 m, 2 m, 30–60 m,

3 m, 60–95 m, 5 m and 95 m+, 10 m). The reason for this is the fact that as depth increases the maximum possible resolution decreases. To get the most out of the sea floor image, in terms of feature detection on shallower areas around Surtsey island, this method of variable image resolution was used.

Vertical exaggeration is tenfold (10). This large vertical exaggeration creates wavelike “artefacts” most apparent on smooth surfaces e.g. like the Jólnir shoal. These artificial waves are very regular and can be differentiated rather easily from natural features. Erosion on the Jólnir shoal seemed to be slowing down as the least depth was 43 m, an increase of only 1 m the past 7 years.

ACKNOWLEDGEMENTS

The author would like to thank Kjartan Thors and Sveinn P. Jakobsson for their constructive comments on the final draft of the paper and the colleagues at Hydrographic Department of the Icelandic Coast Guard for their contribution to the paper.

References

- Icelandic Coast Guard – Hydrographic Department 2007. Multibeam survey.
- Icelandic Hydrographic Service 1964. Survey Sheet SV-55, Scale 1:40,000.

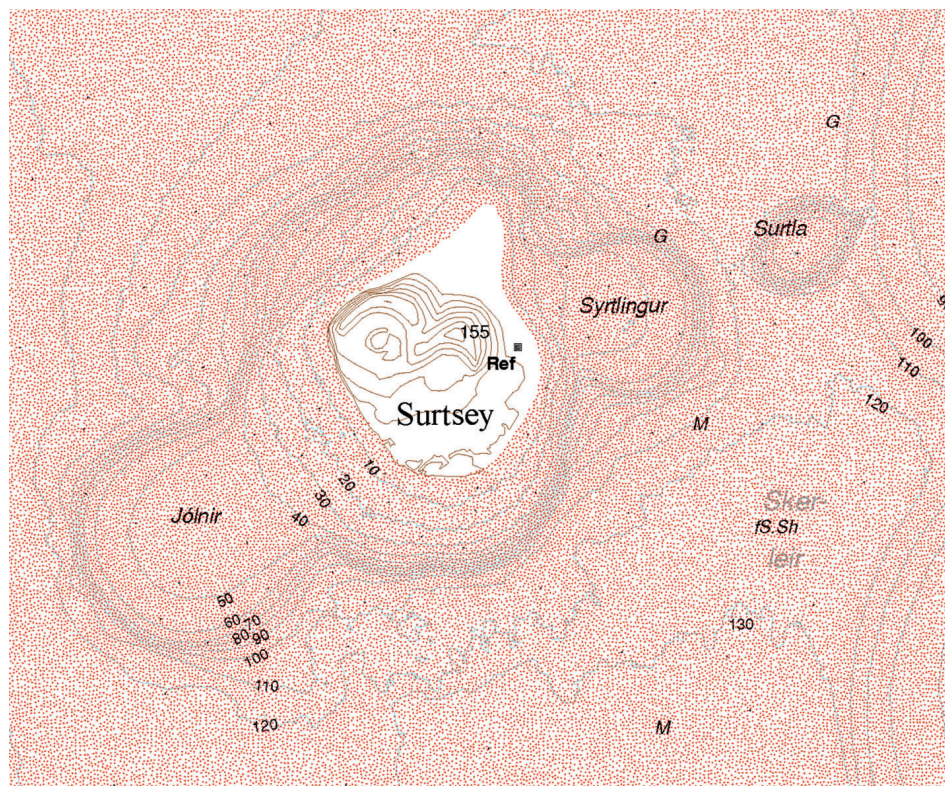


Figure 11. The 2007 multi-beam data set reduced to 20 m sounding spacing.

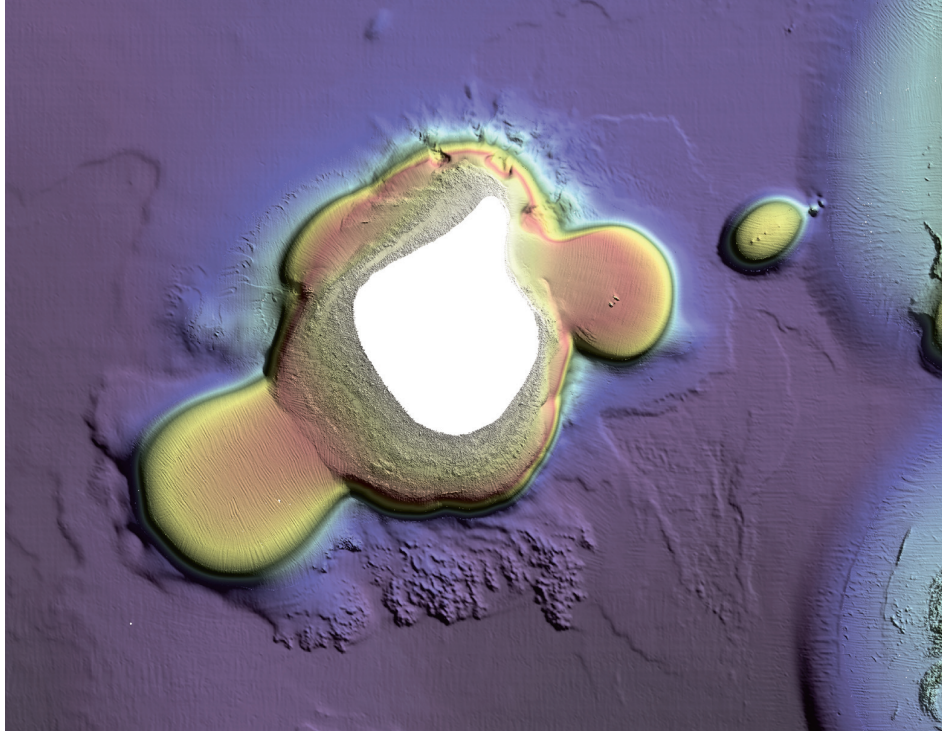


Figure 12. Sea floor image created using the 2007 multi-beam survey full data set.

Icelandic Hydrographic Service 1973. Survey Sheet SV-89, Scale 1:15,000.
 Icelandic Hydrographic Service 1985. Survey Sheet SV-146, Scale 1:10,000.
 Icelandic Hydrographic Service 2000. Survey Sheet SV-172d, Scale 1:10,000.
 Icelandic Hydrographic Service 1964. Nautical Chart No. 31, Dyrhólaey – Reykjavík, scale 1:250,000.
 Icelandic Hydrographic Service 1966. Nautical Chart No. 33, Vestmannaeyjar – Selvogsbanki, scale 1:100,000.
 Icelandic Hydrographic Service 1966. Nautical Chart No. 16, Selvogur – Vestmannaeyjar, No. 16, scale 1:100,000.

Icelandic Hydrographic Service 2002. Nautical Chart, No. 321, Vestmannaeyjar, scale 1:50,000.
 Icelandic Lighthouse Authorities 1963. Notices to Mariners, No. 10–11, November 1963, NM No. 19.
 Icelandic Lighthouse Authorities 1964. Notices to Mariners, No. 8, August 1964, NM No. 13.
 Icelandic Lighthouse Authorities 1966. Notices to Mariners, No. 1–2, February 1966, NM No. 1.
 Icelandic Lighthouse Authorities 1966. Notices to Mariners, No. 10, October 1966, NM No. 15.
 United Kingdom Hydrographic Service 1967. Survey Sheet SV-60, Scale 1:10,000.