

S-44 edition 5

The IHO's New Standard For Hydrographic Surveys

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edition 5**



S-44 edition 5

The IHO's New Standard For Hydrographic Surveys

What is S-44?

The evolution of S-44

Who should use it and when should it be used?

What next?



What is S-44?



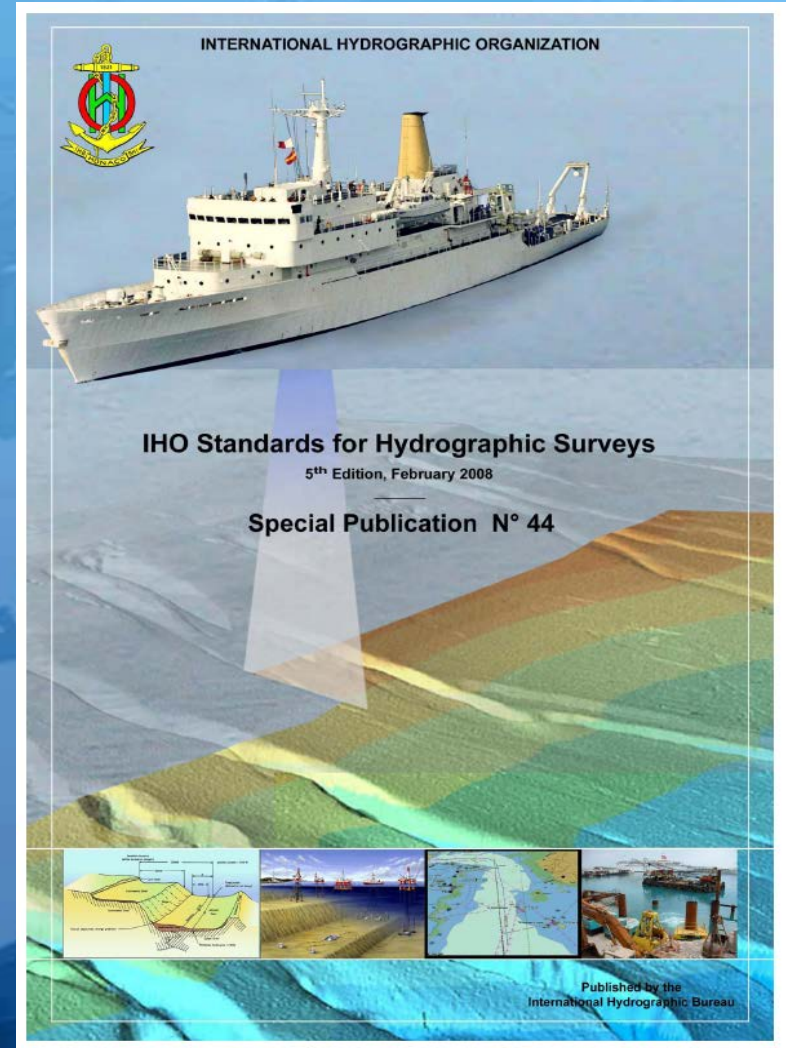
What is S-44?

S-44 is a Standard

S-44 is the International Hydrographic Organisation's standard for hydrographic surveys.

Hydrographic Surveys are classed (by the IHO) as

“those conducted for the purpose of compiling nautical charts generally used by ships.”



The evolution of S-44

S-44 is not new.

The IHO began looking at standards for hydrographic surveys during the VIIth International Hydrographic Conference back in 1957.

A working group was formed in 1962 comprising 4 members (2 from USA 1 from Finland and 1 from Brazil).

Two meetings held at the IXth IHC in 1968 during which the draft of the first edition of what would become S-44 was prepared.



The evolution of S-44

Edition 1 – Published in 1968

“Accuracy Standards Recommended for Hydrographic Surveys”

“The study confined itself to determining the density and precision of measurements necessary to portray the sea bottom and other features sufficiently accurately for navigational purposes.”



The evolution of S-44

Edition 1

General Standards covering:

- Scale of Survey, Interval of sounding lines, Interval of plotted soundings, Sampling of bottom characteristics, Spacing of position fixes and Current observations and

Specific Standards covering:

- Horizontal control, Vertical control and Current measurements.



The evolution of S-44

Edition 1

The maximum acceptable error in a depth measurement depended on depth:

- 0.3m for depths between 0m and 20 m;
- 1.0m for depths between 20m and 100m; and
- 1% of depth for depths greater than 100m.



The evolution of S-44

Edition 2 – Published 1982

“IHO Standards for Hydrographic Surveys and Classification Criteria for Deep Sea Soundings”.

A WG representing 11 Member States.



The evolution of S-44

Edition 2

The increasing draft of ships and consequent need to improve the accuracy of depths between 20m and 30m was recognised in a change to the maximum error allowed:

- 0.3m for depths between 0m and 30 m;
- 1.0m for depths between 30m and 100m; and
- 1% of depth for depths greater than 100m.



The evolution of S-44

Edition 3 – Published 1987

**“IHO Standards for Hydrographic Surveys,
Classification Criteria for Deep Sea Soundings and
Procedures for Elimination of Doubtful Data”**



The evolution of S-44

Edition 3

The first mention of full seafloor coverage with the introduction of a reference to the use of a multi-beam, or side-scan or high definition sector-scanning sonar.



The evolution of S-44

Edition 3

The first mention of full seafloor coverage with the introduction of a reference to the use of a multi-beam, or side-scan or high definition sector-scanning sonar.

Full seafloor coverage was only suggested for recommended tracks and their adjacent areas to ensure the complete coverage of the track and its adjacent area.



The evolution of S-44

Edition 3

The continuing trend to increase the draft of vessels and now drilling rigs was recognised in a further tightening of the maximum errors allowed in depth measurement.

Now there were only 2 bands:

0.3m for depths from 0m to 30m;
1% of depth for depths greater than 30m.



The evolution of S-44

IMO Recognition

In 1989, the International Maritime Organization (IMO) adopted a resolution adding a footnote to its resolution on Ships' Routeing Measures which states that "The minimum standards to which hydrographic surveys are to be conducted, to verify the charted depths in the traffic lanes....are those defined in Special Publication No 44 of the IHO".



The evolution of S-44

Edition 4 – Published 1998

“Standards for Hydrographic Surveys”

Principal aim was to “To specify minimum standards for hydrographic surveys in order that hydrographic data collected according to these standards is sufficiently accurate and that the spatial uncertainty of data is adequately quantified to be safely used by mariners (commercial, military or recreational) as primary users of this information.”



The evolution of S-44

Edition 4

Four orders of survey to cover different areas:

- Special** – critical areas with minimum under keel clearance;
- 1** – harbours, harbour approaches, recommended tracks etc;
- 2** – coastal areas with depths to 200m not covered by Special and Order 1;
- 3** – all areas not covered by Special, Order 1 or 2 and water greater than 200m in depth.



The evolution of S-44

Edition 4

Took the idea of full seafloor coverage further by defining targets that should be detected for Special Order and Order 1 surveys.

Surveys did not have to detect all such targets but had to use equipment that was capable of detecting them!



The evolution of S-44

ORDER	Special	1	2	3
Examples of Typical Areas	Harbours, berthing areas, and associated critical channels with minimum underkeel clearances	Harbours, harbour approach channels, recommended tracks and some coastal areas with depths up to 100 m	Areas not described in Special Order and Order 1, or areas up to 200 m water depth	Offshore areas not described in Special Order, and Orders 1 and 2
Horizontal Accuracy (95% Confidence Level)	2 m	5 m + 5% of depth	20 m + 5% of depth	150 m + 5% of depth
Depth Accuracy for Reduced Depths (95% Confidence Level) (1)	a = 0.25 m b = 0.0075	a = 0.5 m b = 0.013	a = 1.0 m b = 0.023	Same as Order 2
100% Bottom Search	Compulsory (2)	Required in selected areas (2)	May be required in selected areas	Not applicable
System Detection Capability	Cubic features > 1 m	Cubic features > 2 m in depths up to 40 m; 10% of depth beyond 40 m (3)	Same as Order 1	Not applicable
Maximum Line Spacing (4)	Not applicable, as 100% search compulsory	3 x average depth or 25 m, whichever is greater	3-4 x average depth or 200 m, whichever is greater	4 x average depth



The evolution of S-44

Edition 5 – Published 2008

IHO Working group of 22 members from 15 Member States.

The title and principal aim remain unaltered from edition 4.



The evolution of S-44

Edition 5

An evolutionary rather than a step change.

S-44 is a minimum standard and to move wholesale to encompass the capabilities of the latest equipment was considered unnecessary.

Also, the purpose of S-44 is to provide surveys that are suitable for use in navigational products and these have not changed markedly in their construction or use since edition 4 was published.



The evolution of S-44

Edition 5

Removal of section on Classification Criteria for Deep Sea Soundings. Introduced at Edition 2 in 1982 it was considered no longer relevant with modern systems.



The evolution of S-44

Edition 5

Edition 5 is, as far as is possible, independent of technique.

Those items that relate to 'how to survey' have been removed or an annex where they await placement in a more suitable publication – M-13 The IHO's Manual on Hydrography.



The evolution of S-44

Edition 5

Division of Order 1 into Order 1a and 1b.

Order 1a is essentially the same as the old Order 1.

Order 1b retains the same vertical and horizontal accuracies but removes the need to detect small objects.



The evolution of S-44

Edition 5

Order 1a retains the same vertical and horizontal accuracies as the old Order 1.

Like the old Order 1, Order 1a requires the surveyor to use equipment that is capable of detecting all targets of the specified size. It does however go further and requires the surveyor to operate the equipment in such a way that there is a high probability of all such targets being located.



The evolution of S-44

Edition 5

Order 1b intended for areas where under-keel clearance is not considered a problem to those vessels expected to transit the area.

Can be used where a general depiction of the bathymetry is adequate for the likely usage. Maximum line spacing limits the size of those objects that are likely to remain undetected.



The evolution of S-44

Edition 5

It is now explicit that it is not only the echo sounder that must be capable of meeting the requirement of the standard. The entire system must be e.g. the echo sounder, positioning system, motion sensor, processing methods/procedures, personnel etc when used in combination all contribute to (or detract from) the ability of the overall system.



The evolution of S-44

Edition 5

Although not of material benefit, the terminology was changed to bring it into line with current thinking.
Notably;

Error was replaced with uncertainty

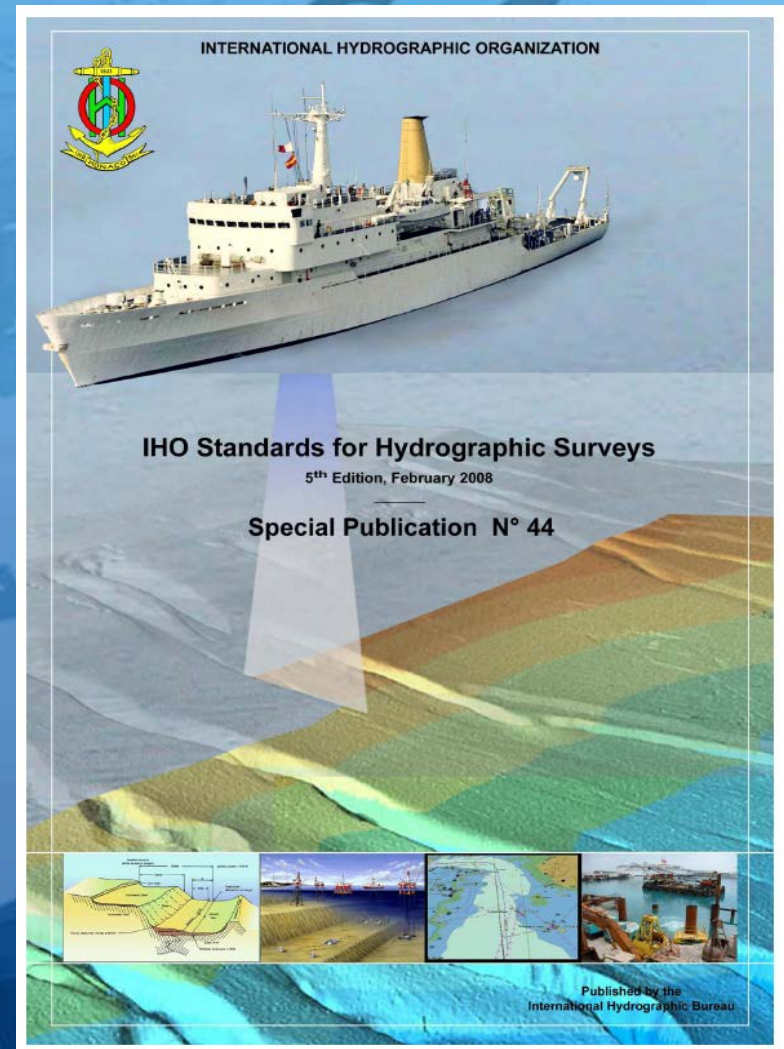
Sound Velocity was replaced by Sound Speed.



Who should use it and when should it be used?

S-44 is the International Hydrographic Organisation's standard for hydrographic surveys.

If conducting a survey for use in navigational charting S-44 should be used. Indeed, for governments, this is a requirement of the SOLAS convention as modified in 1989.



Who should use it and when should it be used?

S-44 is not mandatory for non government organisations (e.g. Port Authorities) even if conducting surveys primarily for use in navigational products. However, using it will ensure that the surveys are adequate for their intended purpose.



Who should use it and when should it be used?

S-44 is a standard. It is NOT a specification.

It is designed to be used by those organisations who are specifying surveys, not by the surveyors themselves.

A specification needs to be written based around S-44 that can be used by the surveyors to enable them to meet the standard such as the Land Information New Zealand (LINZ) specification (Hyspec) based on S-44 edition 4.



What next?

S-44 edition 5 is finished and published so there is no more work on that.

There is however work that is being done related to edition 5:



What next?

Firstly, the new standard needs to be written.



What next?

Firstly, the new standard needs to be written.

UKHO and MCA are planning to write such a specification over the next 12 – 18 months so it is ready in time for the next round of CHP contracts.



What next?

Secondly, there needs to be a better way of informing the mariner of the quality of the survey that the chart is based upon.



What next?

The traditional Source Data diagram on paper charts or the CATZOCs of ENC's both go some way towards this.

However, both are less than perfect and the IHO has set up a new working group, the Data Quality Working Group (DQWG), to devise a better method and to link this to the survey standard.



What next?

The DQWG has only just started but is currently thinking about using a new concept - Depth Confidence contours and areas. The Depth Confidence value will be in metres and indicates how close to the charted seabed a ship can get and remain safe.



What next?

The Depth Confidence is not Under-keel clearance as this is ship specific. It simply relates to how well the charted seabed matches reality taking account of sounding uncertainty and object detection. Mariners should add the Depth Confidence to their specific under keel clearance to get the safe passage depth for a given area.



What next?

For a modern survey done to S-44 order 1a the Depth Confidence will be in the order of 2m since order 1a surveys only require the surveyor to locate objects that are larger than 2m cubed. Any number of 1.9 metre objects may be missed and yet the survey will still have met the Order 1a standard.

If surveyors consider that 2m is too loose they may need to state the Depth Confidence that the survey they have completed has.



What next?

HOs too will perhaps have to state the confidence they have in the depths shown on their charts. For modern surveys they can take the values supplied by the surveyor although for existing surveys Confidence values may need to be calculated. This is a new departure and for old lead line surveys the Depth Confidence value may be very large – not for the soundings themselves but for the depths in the gaps between them. If there is no confidence that the sparse soundings represent the entire seabed accurately, the Depth Confidence may equal the actual water depth!



What next?

The DQWG is looking for input from all sources to ensure that what is being proposed meets the Surveyors, the HOs' and the Mariners needs.



What next?

Thank You

