

## NCWG Letter 01/2020 Consolidated Response Form regarding Swept Wrecks

Actions in blue

Comments and explanations in green

Extracts from S-4 in black with:

- Proposed additional words in red
- Proposed deletions ~~crossed through~~.

### ACTION 5\5

5/5 6.7 NL to re-draft proposed S-4 wording for swept wrecks based upon the comments received.

### Introduction / Background

The most reliable survey method for wrecks is sweeping by wire drag but as technology improves there are other methods to measure a reliable least depth for wrecks and obstructions.

### Extract from NCWG4 report:

12.1 INF1 Wreck symbolisation (NL)

Docs: NCWG4-12.1 INF1Wreck symbolisation

*A good discussion was had by members regarding whether or not it was considered acceptable to show wrecks as swept based upon findings from high quality multi-beam surveys. Whilst some members felt that this was ok there were concerns from some members and also the DQWG regarding the consistency and standard of accuracy between different nations. Finland informed the meeting that they already classified certain underwater features as swept based upon multi beam survey data only. UK will give feedback later on their policy regarding this issue.*

*ACTION 4\14 - Netherlands to draft wording for S-4 regarding swept wrecks and also consider impact on S-57. (NE)*

### Background

In the surveying of wrecks we have to deal with the following issues:

- Least depths of swept wrecks (with symbol K27) have a higher reliability than wrecks surveyed by soundings. Especially in the past with SBES this was a common rule and well-defendable.
- With new MBES techniques (like Water Column Imaging (WCI) it should be possible to obtain a least depth of an obstruction with high reliability.
- If the WCI-method gives a reliable result (equal to sweeping) it will be a much more efficient method. However: in charting the “swept” symbol K27 cannot be used, due to the description in S4, which only refers to “*swept by wire drag or determined by a diver*”

As a result of this a draft wording was produced by the Netherlands and this resulted in various comments. During NCWG5 the Chairman provided an overview of the responses received from members to the proposal for further guidance on Swept wrecks. The responses from members were circulated by NCWG Letter 5 before the meeting and this was also displayed during the meeting. There was an even number of members supporting the proposal and not supporting it. France and Germany explained how they class wrecks as swept when they have been surveyed or examined by two independent methods. This resulted in a new action for the Netherlands to re-draft proposed S-4 wording for swept wrecks based upon the comments received. Main issue was here not to describe new methods of survey, but mention the reliability of the new methods used. In this proposal the

methods “swept” and “investigated by diver” are maintained keeping in mind that certain surveys may be very old and do not match the current standards anymore.

For ENC's there are some attributes dealing with the accuracy/confidence in the wreck sounding:

QUASOU for the quality of measurement

TECSOU for the sounding technique. This attribute should have an extra value for water column imaging. However, as S57 is frozen this should be done in S100.



### Justification and Impacts

The impact for S4 is that these changes cannot have the status of clarification, but must be included in a new version of S4.

### Action required of NCWG

The NCWG is invited to agree with the text concept in S4. Also to define an action for S100 WG to include an attribute within TECSOU to describe the WCI method.

## B-415 SWEPT DEPTHS AND AREAS; AREAS INVESTIGATED FOR DEEP DRAUGHT VESSELS

 Swept depths must be shown by the symbol , for example:

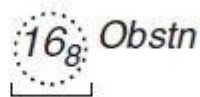
The use of the symbol must be confined to areas swept by wire drag or investigated by diver. ~~Newer technologies also include survey techniques with an equal high reliability. Areas investigated by techniques, which are considered to not fully guarantee the least depth sonar, laser or multibeam echo sounder~~ must not be described as ‘swept’ on charts.

Suggest amend B-422.3 as follows:

**B-422.3** A wreck which has been wire swept, or has had its least depth determined by a diver. ~~Newer technologies also include equally reliable survey techniques which really confirms the depth. This must be shown by sounding numerals showing the measured depth to which it has been swept~~, surrounded by a danger line, with the abbreviation ‘Wk’; the swept depths symbol K2 must be inserted under the danger line, for example:



Suggest amend example under B-422.9 as follows:



# K2, K42

(wire swept, or least depth determined by a diver. **Newer technologies also include equally reliable survey techniques which really confirms the depth.**)

No.	Question	Yes	No
1a	<b>Action 14:</b> Do you agree with the proposed wording for B-415 Swept Depths?	ZA, NL, BR, PK	AU, JP, FR, GR, SE, DE, EE, US, CA, UK
1b	Do you agree with the proposed wording for B-422.3 Swept wrecks	ZA, NL, PK	AU, JP, FR, GR, SE, DE, EE, US, CA, UK

## Further comments:

### Australia

The AHO believes that wire dragging is not always conducted to determine the least depth over an area or object. Sometimes (time constrains or lack of other means) it is used to 'declare' a safe clearance depth (there may be more water but not less than charted). The 'safe clearance' depth in this case is not 'estimated' (K30) it is physically determined. Neither in INT1 nor in S-4 the use of the symbol K2 or the term wire dragging has been explicitly connected to a way of representing the 'least depth' over an object (not consistently at least).

We believe that, using the symbol K2 as a way of expressing the least depth over an object has been determined and very accurately measured can be misleading.


I think the discussion should be about how to communicate that, a charted depth over an object is the least depth and it has been measured to a very high level of accuracy. For certain it would indicated that there is no more water than charted!

At the moment there's no symbol to communicate both things. Mariners should refer to the ZOC and use 'seafloor coverage' and 'depth accuracy'. For example, it is expected that a wreck charted in an A1 area has been accurately positioned and it least depth measured. In this case wouldn't be necessary modifying the default symbology (K26).


On the other hand, if a wreck sits in a ZOC B area but it has been thoroughly investigated (by means different than wire drag or divers) and its least depth accurately determined, it could make sense to highlight this to mariners. The intention would be to inform mariners the horizontal and vertical accuracy of the wreck is A1 equivalent (in ENC's, POSACC and SOUACC could be used to be even more specific).

Based on all this, the AHO propose changes to the following sections. Please note the introduction of a new symbol **K4** (??):

**B-415 SWEEPED DEPTHS AND AREAS; AREAS INVESTIGATED FOR DEEP DRAUGHT VESSELS**

Swept depths must be shown by the symbol  K2, for example:



The use of the symbol  must be confined to areas swept by wire drag or investigated by diver.

Please note that, historically, these surveying techniques have been used to determine both, safe clearance and least depths.


For ~~swept~~ depths over wrecks and obstructions, see B-422.

**B-422.3 A wreck which has been wire swept**, or has had its ~~least~~ depth determined by a diver, must be shown by sounding numerals showing the depth to which it has been swept, surrounded by a danger line, with the abbreviation 'Wk'; the swept depths symbol K2 must be inserted under the danger line, for example:



**B-422.4 A wreck over which the least depth that is known has been found by ~~sounding only~~ a method different than B422.3**, must be shown as in B-422.3 but without the swept symbol, for example:

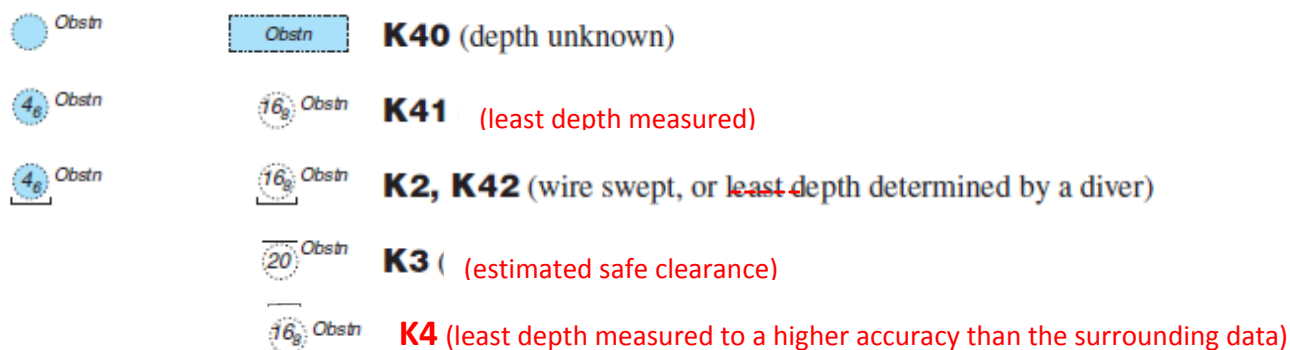


If a wreck sits in an area depicted as CATZOC A2 or worse but the object has been accurately measured to ZOC A1 standards, on paper charts, this can be highlighted by using the symbol  above the wreck one. For example:



In ENC's, producers can use the attributes POSACC and SOUACC as required.

**B-422.9** Retain text. Only amendment is to update the content of the figure below.



**Canada**

Like our colleagues in France, US and Germany, we don't see the purpose of updating this specification with more details. Seems that it will make it more complex and not necessary.

### **Estonia**

We don't have any swept wrecks, but according to proposed wording we shall have a large amount of them. We believe that CATZOC and ZOC answer the mariners question how certain it is that the charted depth over a wreck is a least depth and it is measured with a very high level accuracy.

### **France**

France is not in favour of extending the methods of depth measurement / confirmation behind symbol K2 or K27. It should remain an independent and 'physical' method, like the use of a wire sweep or divers. The proposed wording seems too "permissive" and subject to interpretation by each HO (what is "survey techniques with an equal high reliability" ? MBES ? WCI ?) with a high risk of loss of meaning for mariners. The current wording is precise and should remain so.

### **Japan**

Depth determined by wire sweep or by a diver is a safe clearance depth, but does not necessarily represent the actual least depth. The depth is not shallower than charted, but it may be deeper. We interpret the symbol K2 as a symbol to convey the safe clearance depth to mariners.

Therefore, we would like to suggest that the term "the least depth" be changed to " the safe clearance depth".

### **Germany**

The confirmation by two independent methods is not mentioned. It is not necessary to use "newer technologies". See also comments by France.

### **Greece**

Greece concurs with the French and US position as it has been formulated in the letter 04/2019. The expansion of these symbols has the risk to confuse the navigator.

### **Netherlands**

This subject was on the agenda in NCWG-4 and NCWG-5 and was discussed during these meetings. I realize that not all members attended the meetings and the draft text produced requires some explanation:

In NCWG-4 there was a short discussion if new symbolisation will be needed for surveys of wrecks with a high reliability. At that time the choice was made *not to add new symbolisation*, but change the description/wording related to this symbol.

As a result action 4/14 was defined to change the wording related to the swept wrecks symbol. The proposed wording was made and after various feed-back was given this subject was discussed again in NCWG-5 and resulted in action 5.

Main concern in NCWG5 was that the draft description was too much related to certain techniques and not to reliability in general. As a result of that this new draft text was produced.

## Sweden

Sweden suggests as an alternative solution, in correspondence with S-44 Ed.6 Draft: that the definition of the Swept symbol K2 is renamed to “Mechanically swept”. “Mechanical sweep” is mentioned in S-44 Ed.5 and Ed.6 Draft, and such sweep does not have to be made using a wire, but can as well be made using a solid bar (with or without sensors attached), a pipe and similar items from a stable platform, but fills the same purpose with the same confidence level for feature detection, and better vertical uncertainty than a wire sweep.

Additionally, that for any other methods for determining a minimum depth over features (or areas) the “safe clearance (K3)” symbol is to be considered, and that any known or estimated uncertainty then is subtracted from the measured depth, to certify that the likelihood of a depth shallower than stated is greatly reduced.

In the Draft S-44 Ed.6 that has been sent to the HSSC and is intended to be sent out for acceptance by the member states later this year, by voting, is written:

“3.2.1 Depth Measurement Depths are to be understood as reduced depths within a well-defined vertical reference frame. The depth of a feature is expressed as the minimum depth of that feature.

In waters with very high turbidity, e.g. estuaries, this minimum depth may be determined on the basis of sediment concentrations in the water.

Under exceptional circumstances, for safety of navigation purposes, the use of a high precision method (e.g. mechanical sweep) that the hydrographic office or other responsible authority deems able to confirm the safe depth in an area, or over a feature / wreck, can be used to certify a safe depth. In this case, the uncertainty of the vertical measurement will define the survey order to be quoted.”

This new wording above (last paragraph) of surveys, that has the aim to certify a navigable depth in an area, or over a feature / wreck, opens up a bit more for each HO to determine what they consider to be a safe method of such determination. The earlier wording in the present S-44 Ed.5 is:

### “3.5 Feature detection

...

It should be noted that even when surveying with a suitable system 100% detection of features can never be guaranteed. If there is concern that features may exist within an area that may not be detected by the Survey System being used, consideration should be given to the use of an alternative system (e.g. a mechanical sweep) to increase the confidence in the minimum safe clearance depth across the area.

...

Note 2 to the Table 1: For safety of navigation purposes, the use of an accurately specified mechanical sweep to guarantee a minimum safe clearance depth throughout an area may be considered sufficient for Special Order and Order 1a surveys.”

The present wording in S-4 is not open to alternate survey methods, such as determining the least depth over a feature / wreck by the use of water column data, or to certify a minimum depth within an examined area using mechanical bar-sweeping. In the present wording (Ed.5) the mechanical sweep or other examinations was an addition to a regular survey for determining a minimum depth over a feature. To determine a minimum safe depth in an area, without a regular survey, only mechanical sweep was mentioned in the “Note 2” to the Table 1. The use of diver examinations, even that he in clear waters might see where the

shallow points are on the wreck, is not a guarantee that an accurate depth is assigned to a feature as there might be unknown errors on the divers depth gauges due to barometric pressure and water density. Water column data can be an excellent way of determining the shallowest point of a known feature or wreck, but not suitable for indication if features exists in an area (feature search).

The new wording in S-44 Ed.6 Draft “the use of a high precision method that the hydrographic office or other responsible authority deems able to confirm the safe depth in an area, or over a feature / wreck, can be used to certify a safe depth.” Opens the possibility to perform any special survey and the best possible solution to present those in the charts would be to use the K3 symbol within a similar area as described in B-415.1

It is our opinion that S-4 should not unnecessary mention specific technologies, but refer to uncertainties and the objectives of the symbolization. If there is a need to assign a minimum quality for depth determination, an appropriate order should be assigned for the vertical determination of the depth. One of the main issues is that the use of symbology is reflected in the names of the symbols used. For this reason SMA proposes the following changes to the S-4 that corresponds to the survey standards in S-44 Ed.6 draft:

**B-415 MECHANICALLY SWEPT DEPTHS AND AREAS; AREAS INVESTIGATED FOR DEEP DRAUGHT VESSELS** The changed name corresponds to the S-44, and the intention for the use of the symbol.


Mechanically Swept depths must be shown by the symbol K2, eg:

The use of the symbol must be confined to areas mechanically swept by wire drag or investigated by diver. Areas investigated by sonar, laser or multibeam echo sounder other methods must not be described as ‘swept’ on charts using this symbol. For mechanically swept depths over wrecks and obstructions, see B-422. Again, not specific technology pointed out, and harmonizing with the S-44 Ed.5 and Ed.6 draft.




## B-415 **MECHANICALLY** SWEEPED DEPTHS AND AREAS; AREAS INVESTIGATED FOR DEEP DRAUGHT VESSELS

The changed name corresponds to the S-44, and the intention for the use of the symbol.

**Mechanically** Swept depths must be shown by the symbol  K2, eg:



The use of the symbol  must be confined to areas **mechanically** swept ~~by wire drag or investigated by diver~~. Areas investigated by ~~sonar, laser or multibeam echo sounder~~ other methods must not be described as ~~'swept'~~ on charts using this symbol.

For **mechanically** swept depths over wrecks and obstructions, see B-422.

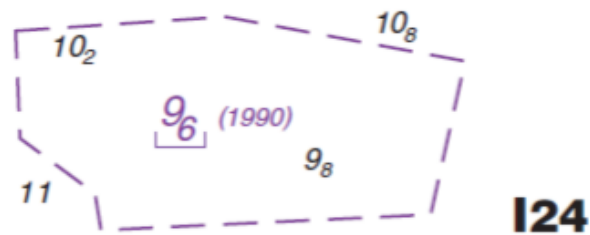
Again, not specific technology pointed out, and harmonizing with the S-44 Ed.5 and Ed.6 draft.

**B-415.1 Mechanically Swept Areas.** Extensive areas ~~swept by wire drag~~ **mechanically swept**, must be delimited by magenta dashed lines enclosing large magenta soundings with the **mechanically** swept symbol (K2) beneath them. **If the depth is a guaranteed minimum depth within the area, the symbol K3 can be used with the depth as an absolute value, that might be the surveyed depth with the measurement uncertainty (and possibly extra margin) subtracted from it. The date year of the investigation should be indicated within brackets:**


Harmonizing with the S-44 Ed.5 and Ed-6 draft. Full date is not described in the example below and the use of year (as in the example) is suggested to be mentioned instead. The main difference between the use of the symbols K2 and K3 is that the later will only be used if the depth is guaranteed by the responsible authority or not, and that any depth together with the K2 symbol still has an uncertainty assigned to it, whilst a depth with the K3 must be an absolute value, that might be the found depth with the measurement uncertainty (and possibly extra margin) subtracted from it.

*Consider also the possibility to enhance the annotation so that "S-44 survey order" can be added as an example behind the year (1990, order 1a) or (1990, special order), when possible to fit within the given space.*





B-422.3 A wreck which has been **mechanically wire** swept, ~~or has had its least depth determined by a diver~~, must be shown by sounding numerals showing the depth to which it has been swept, surrounded by a danger line, with the abbreviation 'Wk'; the **swept-depths** symbol

 K2 must be inserted under the danger line. **If the depth is a guaranteed minimum depth over the wreck, the symbol K3 can be used with the depth as an absolute value, that might be the surveyed depth with the measurement uncertainty (and possibly extra margin) subtracted from it.** for example:



B-422.4 A wreck over which the least depth that is known has been found by sounding only, must be

shown as in B-422.3 but without the **swept-symbol**  **symbol K2**, for example:



B-422.9 Submerged obstructions

...



~~swept, or least depth determined by a diver~~ ) **(wire-mechanically**

B-432.1 b. (4th bullet point) • dredged area (see B-414) or **mechanically** swept area (see B-415) limits.

B-439.1 (1st bullet point)

• in black when associated with depths (except mechanically swept-areas and declared DW routes) or with permanent physical obstructions. If no other limit is specified, the general limit should be used:

#### MAGENTA

Mechanically swept area see B-415.1

The main difference between the use of the symbols K2 and K3 will only be if the depth is guaranteed by the responsible authority or not, and that any depth together with the K2 symbol still has an uncertainty in the measurement, whilst a depth with the K3 must be an absolute, that might be the found depth with the measurement uncertainty subtracted from its value (for some instances a safe estimated value, Eg. B-422.5).

#### UK

UK do not agree with the exact wording proposed by NL but do acknowledge the need to adjust the definition of the swept symbols K2, K27 and K42 to allow for modern best survey practice as well as past techniques and future techniques not yet developed. To this end UK recommend that the definition should be system independent and focus on the fact that the depth has been found to the highest reliability and with least uncertainty. This aligns with the ethos of the S-44 survey standards in regard of being independent of technology.

UK believe that the mariner should not need to be concerned with the method employed to obtain a depth, they just need to be able to understand the level of uncertainty. UK also consider that depths on wrecks "swept" using appropriate MBES water column data analysis can be at least as reliable (if not more so) than wire sweeping (as proven during our trials of the technologies 10 years ago) and it would be useful to be able to inform the mariner of this reliability but the method used to obtain the depth is not important to the mariner, just that the depth is very reliable.


As it is unlikely that a new symbol would be introduced to S-4, the best solution is to change the definitions of the current symbols. UK also recommend that this subject should be considered and discussed as part of S-101 to ensure it is correct in the future standard.

For wrecks and obstructions, it would seem sensible to have 3 levels of uncertainty:

1. Lowest confidence, highest uncertainty. Depth not reliable or estimated. Currently covered by symbols K3 & K30

 **K3, K30**


2. Moderate confidence, average uncertainty. Reasonably reliable. Currently covered by symbols K26 & K41

 **K26**


3. Highest confidence, lowest uncertainty. Most reliable. Depth measured using best currently available methods. Currently covered by symbols K2, K27, K42

In response to the proposal by NL, UK instead recommend using the following text for S4:

## B-415 SWEPT DEPTHS AND AREAS; AREAS INVESTIGATED FOR DEEP DRAUGHT VESSELS

Swept depths must be shown by the symbol K2, for example:



The use of the symbol  must be confined to areas investigated using the most reliable currently available survey techniques, resulting in a depth with the least uncertainty. While a depth can never be guaranteed, the use of this symbol should be reserved for investigations that leave little doubt that the minimum depth has been determined. Examples include properly controlled mechanical/wire sweeping & collection and analysis of sonar water column data.

**B-422.3 A wreck which has been wire swept, by investigation using the most reliable currently available survey techniques, resulting in a depth with the least uncertainty and leaving little doubt that the minimum depth has been determined. This** must be shown by sounding numerals showing the measured depth surrounded by a danger line, with the abbreviation ‘Wk’; the swept depths symbol K2 must be inserted under the danger line, for example:



B-422.9



**K2, K42** (Highest confidence, lowest uncertainty, most reliable depth, measured using best currently available methods)

## US (NOAA)

### Concern about clutter

In a previous age when depths were determined by lead line, the technique and symbolization of wire drag (and diver determined) depths provided an added assurance that a minimum depth had been obtained with a high level of confidence compared to other charted depths, which were obtained by lead line or later by single-beam or even multi-beam sonar. These first two methods may have missed the obstruction altogether and “ordinary” multi-beam may not have adequately revealed masts or other thin components of a wreck extending toward the surface.

In this environment, the prevalence of swept depths and the associated extra “weight” of the larger basket symbol remains small. In a new age when ever greater accuracy and precision of depths are being obtained – including water column imaging, essentially an advanced form of multi-beam sonar – the number of depths collected with “survey techniques with an equal high reliability” is likely to increase significantly. This could potentially flip the ratio of charted swept depth symbols to ordinary sounding symbols significantly increasing the amount of clutter, especially in high-traffic areas where advanced techniques are most likely to be used.

### Concern about diminishing ability to understand the symbol’s meaning

The US agrees with France that that K2 and related “basket” symbols are meant to indicate a physical method of depth determination. Broadening the description to include other unspecified, non-physical techniques would reduce mariners’ ability to know exactly what any given use of the symbol was meant to show.