Bundesstelle für Seeunfalluntersuchung
Federal Bureau of Maritime Casualty Investigation
Federal Higher Authority subordinated to the Ministry
of Transport and Digital Infrastructure

Investigation Report 258/18

Very Serious Marine Casualty

Capsize of survey boat GEO PROFILER in the Wadden Sea off Büsum on 17 July 2018

2 May 2019

This investigation was conducted in conformity with the Law to improve safety of shipping by investigating marine casualties and other incidents (Maritime Safety Investigation Law – SUG). According to said Law, the sole objective of this investigation is to prevent future accidents. This investigation does not serve to ascertain fault, liability or claims (Article 9(2) SUG).

This report should not be used in court proceedings or proceedings of the Maritime Board. Reference is made to Article 34(4) SUG.

The German text shall prevail in the interpretation of this investigation report.

Issued by:
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1 SUMMARY

On 17 July 2018, the 7 m-long survey boat GEO PROFILER sailed into turbulent waters in the Wadden Sea off Büsum. This led to the boat capsizing through the transverse axis and stern at about 1940[1] when – according to the crew – a wave of some 2 m in height struck the stern. The cause of this was a sudden increase in wind force from 4 Bft to 7 Bft. Since the water had been receding for about 2.5 hours at this point, a steep sea quickly developed. One outboard engine failed to begin with. It was not possible to steer the boat in a controlled manner with only one engine and she broached, resulting in her taking on even more water. The second engine and on-board electronics then also failed. This made it impossible to send an emergency call and only one lifejacket and a lifebuoy could be donned. Rescue cruiser THEODOR STORM sighted and rescued the two crew members on Tertiussand at about 1300 on the following day during a major rescue operation involving several agencies. The crew members had drifted there shortly beforehand in a weakened state. The water temperature stood at 20°.

[1] Unless stated otherwise, all times shown in this report are Central European Summer Time (CEST) = UTC + 2 hours.

2 FACTUAL INFORMATION

2.1 Photograph of the ship

Figure 1: Photograph of the ship

2.2 Ship particulars

Name of ship:	GEO PROFILER
Type of ship:	Survey boat
Nationality/Flag:	Germany
Port of registry:	Wilhelmshaven
IMO number:	None
Call sign:	DB7063
Owner:	GEO Ingenieurservice
Year built:	2011
Shipyard/Yard number:	Coenen, Kleve, DE-CYBCKB70E511
Classification society:	None
Length overall:	7.00 m
Breadth overall:	2.50 m
Gross tonnage:	N/A
Displacement based upon inclining test with four people and full fuel tanks:	2.53 t
Mean draught:	0.68 m
Engine rating:	2 x 44 kW
Main engine:	Suzuki
(Service) Speed:	12 kts
Hull material:	Aluminium
Hull design:	No double bottom
Minimum safe manning:	N/A

2.3 Voyage particulars

Port of departure:	Büsum
Port of call:	Büsum
Type of voyage:	Merchant shipping/national
Cargo information:	N/A
Manning:	2
Draught at time of accident:	0.67 m
Pilot on board:	No
Canal helmsman:	No
Number of passengers:	None

2.4 Marine casualty or incident information

Type of marine casualty:	Very serious marine casualty: capsize
Date, time:	17/07/2018, 1940
Location:	Büsum, Wadden Sea, Tertiussand
Latitude/Longitude:	φ 54°08.557'N λ 008°33.225'E
Ship operation and voyage segment:	High seas
Human factors:	Yes
Consequences (for people, ship, cargo, environment, other):	No casualties or environmental damage; boat salvaged

Extract from Navigational Chart 1360,
Federal Maritime and Hydrographic Agency (BSH)

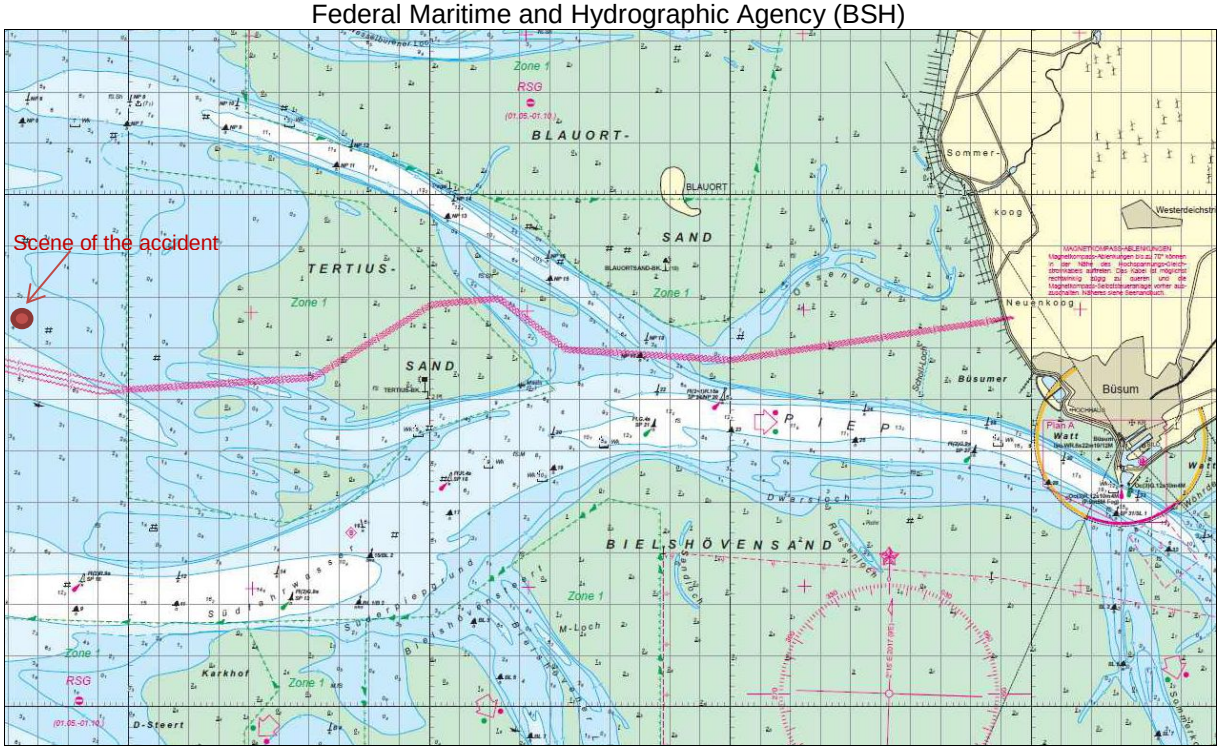


Figure 2: Navigational chart

2.5 Shore authority involvement and emergency response

Agencies involved:	Vessel Traffic Service Cuxhaven, Waterways and Shipping Office (WSA) Tönning, DGzRS, DLRG, fire service, DRK Water Rescue Service
Resources used:	Search operation coordinated by the HERMANN MARWEDE (on-scene commander), ANNELIESE KRAMER, KOMET, THEODOR STORM, HELGOLAND, PAUL NEISSE, SAR helicopter, hovercrafts
Actions taken:	THEODOR STORM rescued the crew at 1301 on 18 July 2018
Results achieved:	Buoy tender TRITON salvaged the GEO PROFILER on 23 July 2018 at 54°09.3'N 008°30.5'E; no casualties or environmental pollution

3 COURSE OF THE ACCIDENT AND INVESTIGATION

3.1 Course of the accident

At 1930 on 17 July 2018, the survey boat GEO PROFILER sailed into turbulent waters in the area of the Nordlink cable route (km 22) in the Wadden Sea off Büsum south-west of Tertiussand during a survey voyage for the offshore industry. The cause of this was a sudden increase in wind force from 4 Bft to 7 Bft, which followed a wind shift from approx. 320° to 270°. Since the water had been receding for about 2.5 hours at this point, a steep sea quickly developed. This led to the boat capsizing through the transverse axis and stern at about 1940 when – according to the crew – a wave of some 2 m in height struck the stern. One outboard engine failed to begin with. It was not possible to steer the boat in a controlled manner with only one engine and she broached, resulting in her taking on even more water. The second engine and on-board electronics then also failed, making it impossible to send an emergency call. Since the door on the aft edge of the superstructure was hooked open to improve ventilation due to high temperatures in the region of 30 °C, water also found its way into the cabin. It was not possible to close the door properly later on because of a floating line. The boat ultimately lost her buoyancy because only the fore section has a plane bulkhead. One person escaped into the water with an automatically inflatable lifejacket (275 N). The skipper was no longer able to reach his lifejacket. He had difficulty opening the aft door because the cabin was already under water. He did manage to reach a lifebuoy which helped him swim, however.

Geo Ingenieurservice North-West in Wilhelmshaven was unable to reach the crew at its accommodation in Büsum on the morning of 18 July 2018. The two individuals and their boat were then reported missing at the DGzRS[2] control centre in Bremen, where it was established that the GEO PROFILER had not transmitted any AIS signals since 1930 on 17 July 2018. The last position was west of Tertiussand and a search was started. A total of three rescue cruisers, one rescue boat, one waterway police (WSP) boat, one BSH survey vessel and a German Navy SAR helicopter searched the Wadden Sea. About 100 fire fighters from Büsum, Meldorf and Friedrichskoog searched the shoreline. The DRK Water Rescue Service[3] and the DLRG[4] were also deployed. In addition, hovercrafts from Sankt Peter-Ording and Büsum were used for areas that were difficult to reach or shallow. At about 1300, the THEODOR STORM sighted and rescued the two crew members on Tertiussand, which they had swam to shortly beforehand. Suffering from exhaustion and hypothermia, they were then transferred to an ambulance in Büsum and taken to the Westküstenklinikum hospital in Heide.

[2] DGzRS: German Maritime Search and Rescue Association.
[3] DRK: German Red Cross.
[4] DLRG: Deutsche Lebens-Rettungs-Gesellschaft e.v. [German Life Saving Association].

On the afternoon of 23 July 2018, the buoy tender TRITON sighted the GEO PROFILER capsized with her bow visible on the surface at the position 54°09.3' N 008°30.5' E and salvaged her.

Figure 3: Salvaging the GEO PROFILER

3.2 Investigation

On 25 July 2018, the BSU surveyed and took measurements of the GEO PROFILER on the grounds of the Büsum buoy store for the investigation. The GEO PROFILER's last recorded AIS data and the weather reports of Germany's National Meteorological Service (DWD) analysed were used to reconstruct the course of the accident. The survey voyages were carried out south-west of Tertiussand. The last AIS signal was received at 1942. It was no longer possible for the crew to establish watertight integrity on the GEO PROFILER at this point due to the strong wind and waves. Twisted and disordered lines/cables are visible on the aft deck, making it impossible to lock the door in good time.[5] This caused the boat to take on water until she finally capsized stern first.

[5] Term for entangled lines (disorderly ropes)

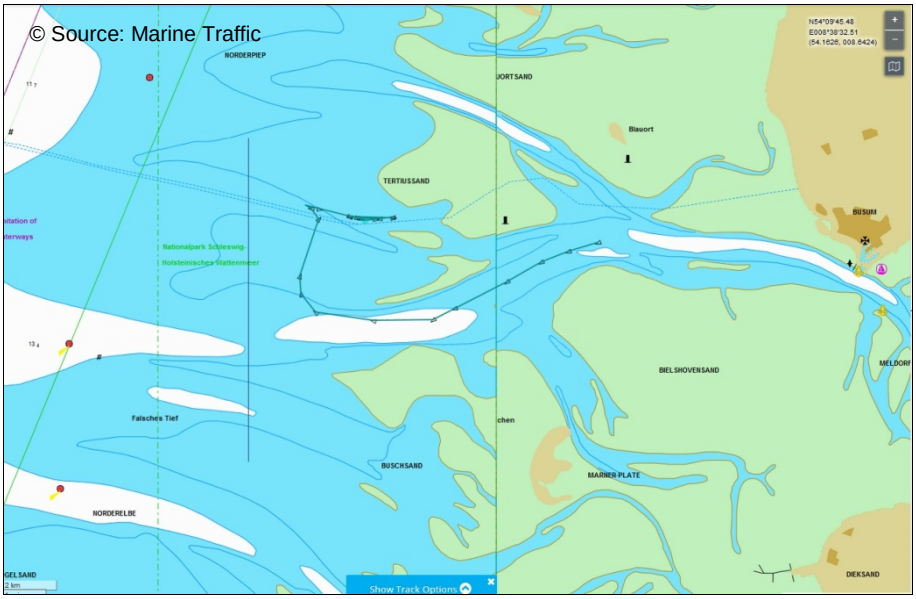


Figure 4: AIS track – Büsum

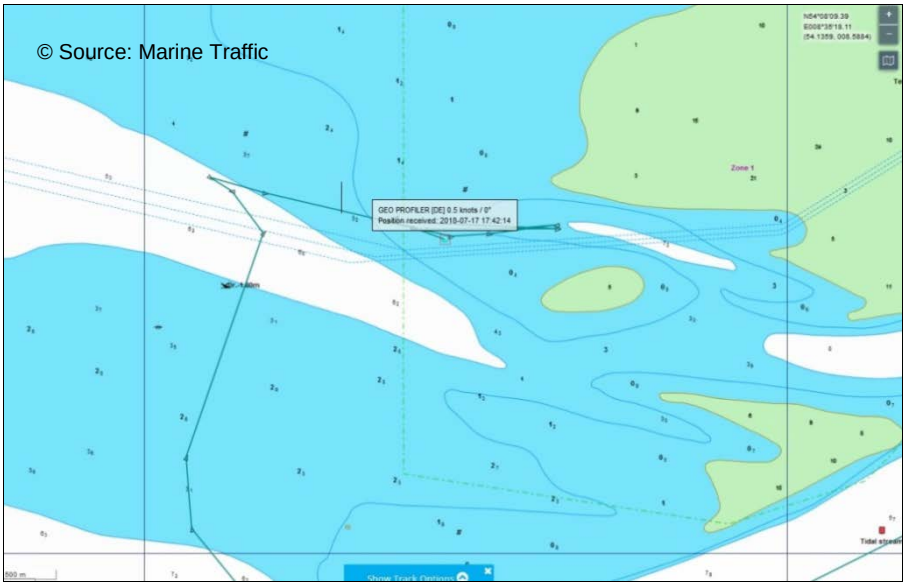


Figure 5: AIS track – Tertiussand

BSU's survey of the GEO PROFILER

Figure 6: Aft deck

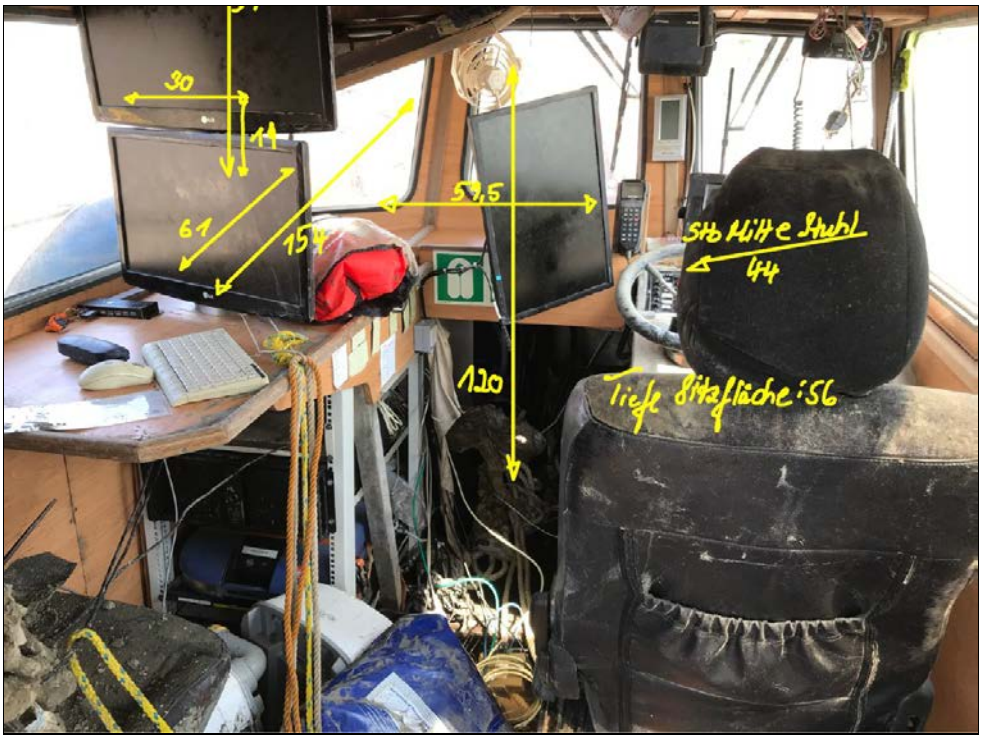


Figure 7: Inside the superstructure

Figure 8: Side view on a trailer

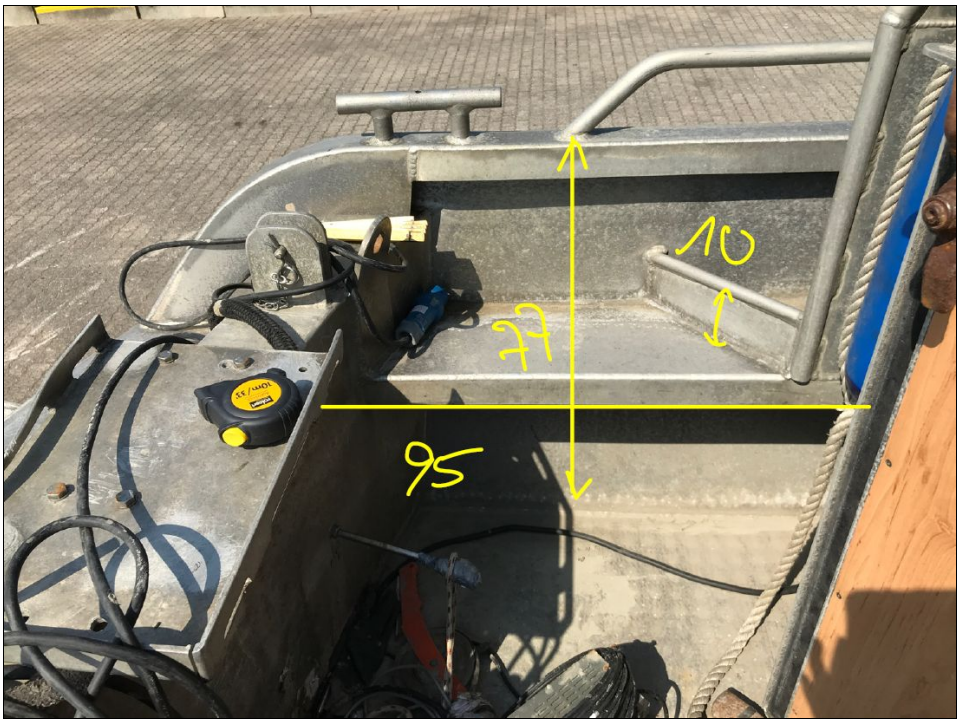


Figure 9: Bulwark

The GEO Group is in possession of a documented risk assessment, which lists the personal protective equipment, including safety shoes, helmet, survival suit, safety harnesses with energy absorbers, inflatable lifejackets and rules for general behaviour on the fleet's own boats or ships.

The skipper holds a *Sportbootführerschein See (SBF See)* [international certificate for operators of pleasure craft on the waterways navigable by seagoing ships], a certificate of competency in accordance with the STCW for ratings forming part of the navigational watch, a certificate of competency for basic safety training, as well as a certificate of fitness for sea service. His colleague holds the certificate of fitness for sea service.

WSA Stralsund has issued a so-called *Ausweis über das Kleinfahrzeugkennzeichen* [small vessel marking permit] for the boat, which is valid for inland waterways. With regard to seagoing vessels, the Ship Safety Division (BG Verkehr) only issues safety certificates for vessels greater than 8 m in length. Accordingly, the Ship Safety Division (BG Verkehr) was of the opinion that a safety and minimum safe manning certificate were not needed for the GEO PROFILER. In addition, the DNV-GL classification society issued a survey certificate for the boat with regard to environmental protection and technical condition with regard to the water protection/zero discharge strategy.

The GEO PROFILER was designed by Miechel van Vossen and built by Coenen Yachts & Boats. Her hull was delivered to the GEO Group weighing 1100 kg. The shipyard specifies a payload of 700 kg. A partial declaration of conformity and a stability calculation exist for the hull. According to the designer, a maximum engine output of 275 hp would be possible. Two boats of the same type with an engine output of 2 x 60 hp were delivered to the GEO Group. The interior fittings were dealt with by a company called Ralf Sprenger from Schmedshagen and the boat was fitted out by Sportboot- und Industrie-Motoren Olaf Lingrön from Barth. The multi-beam echo sounder at the bow of the GEO PROFILER was installed in Wilhelmshaven. There was also IT equipment for analysing the measurement data.

DWD report (extracts)

Forecast: The shipping forecast published in the morning at 0400 CEST predicted changing wind directions of force 2-4 Bft for the afternoon and evening in the area of the German Bight with the swell rising to 0.5 m. This was increased to a west wind of force 4 Bft in the update at 0800 CEST. The coastal weather forecast issued at 0630 CEST also only predicted a wind increase to 4 Bft, with 0.5 m swell near Heligoland. The shipping forecast at 1400 CEST continued to refer to only a temporary wind increase to 4 Bft with a significant sea of 1 m. Squalls were only expected early on and only in the northwest of the German Bight. Only the coastal weather report update at 1230 CEST contained an indication that the wind was expected to increase rapidly to and then remain at 4-5 Bft into the night.

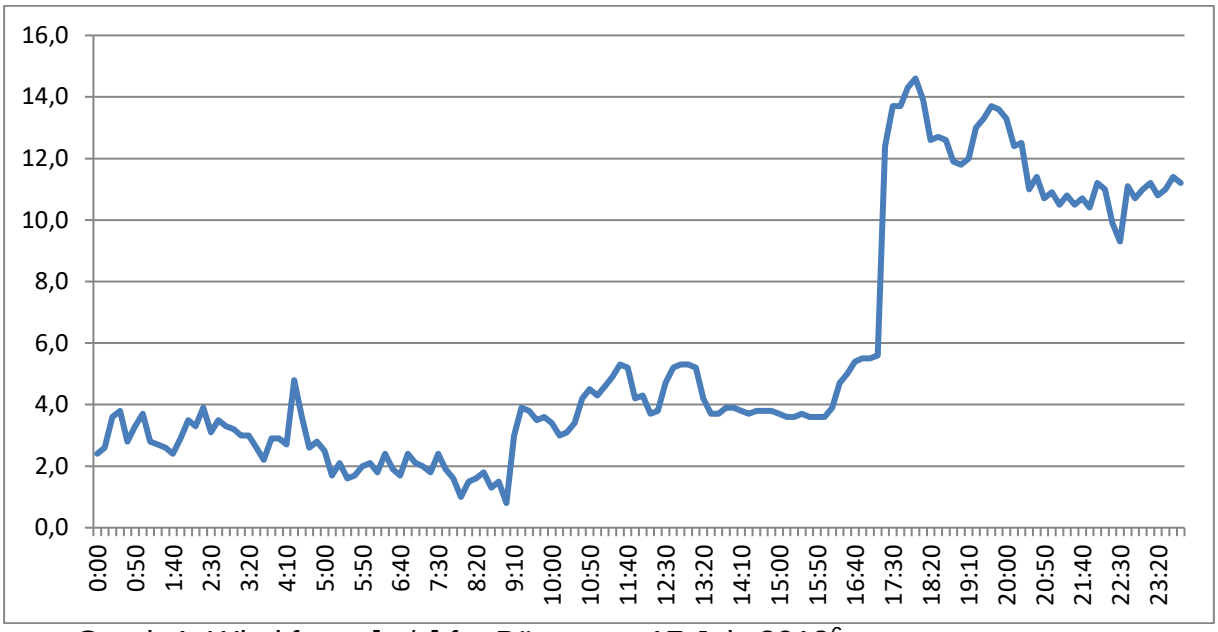
Gusts (at a height of 10 m above the water surface): Gusts reaching speeds of up to 28 kts (6-7 Bft) were recorded from 1700 to 2300 in an area between the Jade Bight and Büsum on the day of the accident.

Significant sea state: There was only a very low swell of 1-2 dm from the north until the onset of the west wind at 1700. The wind sea increased rapidly to heights of between 0.80 m and 1 m from 1700 to 2300. The swell remained low but turned and then also approached from the west. Since the wind model upon which the sea state analysis is based shows slightly lower wind speeds locally as compared to observations, the significant swell height may have risen locally to up to 1 m by 2000 and 1.5 m by 2300 given the wind speeds recorded. Furthermore, the current moved in the opposite direction to the developing wind sea over an extended area after high tide between 1559 (Heligoland) and 1808 (Husum), thus continuing to facilitate the occurrence of shorter, steeper and higher waves. Together with the analysed wave periods of a few seconds, there is a high probability that single waves of up to 2 m and 3 m occurred in the periods before 2000 and up to 2300 (and beyond) respectively.

Weather and visibility: In the area considered, no significant weather occurred between Büsum, Husum and Heligoland. Visibility in the area was more than 10 km. A thunderstorm started to develop south of Wilhelmshaven shortly before 1700. However, it did not affect North Sea water areas and had dissipated by 2000. Only associated high clouds reached the accident area. The remaining clouds at medium height swung eastward subsequently and covered the coastal sections considered but had no further effect on the weather. This cloud system explains the gusts observed in the south-east.

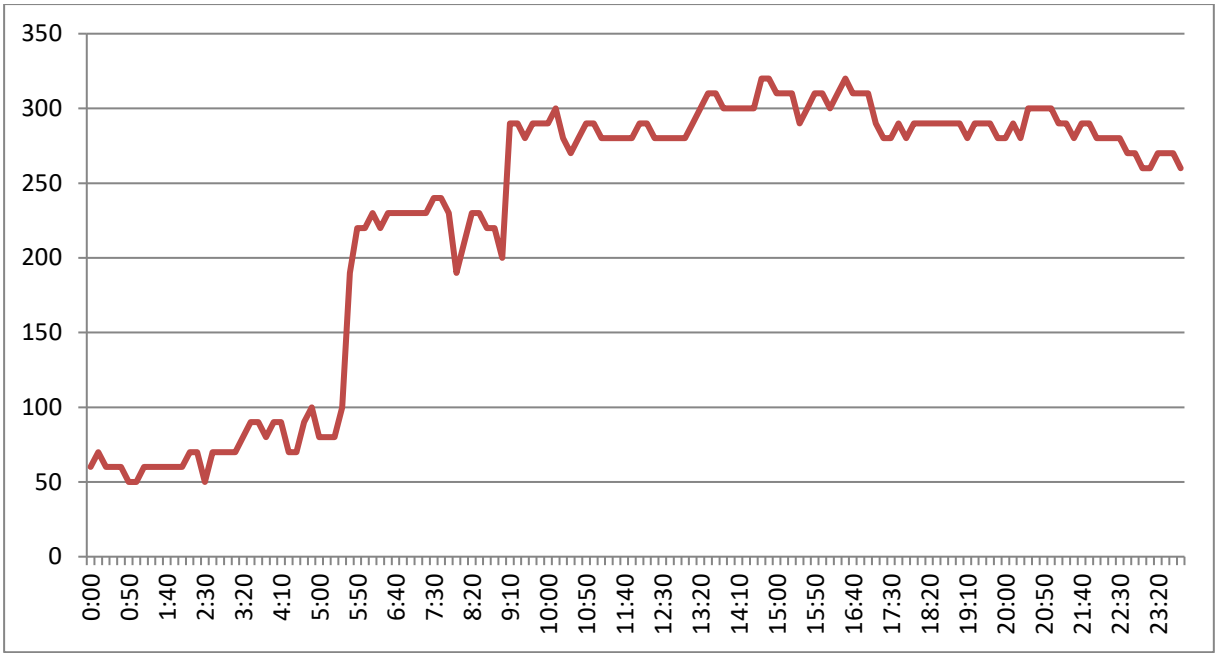
Temperature: The water temperatures ranged between 18 °C at Heligoland and 20 °C in the Elbe and Weser estuaries. Maximum air temperatures at a height of 2 m above the water surface reached about 23 °C on Heligoland and about 28 °C on the coast during the day and dropped to about 1 °C below the water temperature that evening.

GEO Ingenieurservice analysis of the DWD forecasts delivered for Büsum



Graph 1: Wind force [m/s] for Büsum on 17 July 2018[6]

High tide was at 1650 at the scene of the accident (reference: Blauort). The receding water ran in the opposite direction to the wind. Wave heights of up to 3 m are probable due to interference.



Graph 2: Wind direction [°] for Büsum on 17 July 2018

[6] The BSU produced both graphs using data the DWD had delivered to the company.

4 ANALYSIS

4.1 Weight

Due to the lack of stability calculation documents for the GEO PROFILER when fitted out, the GEO Group decided to arrange for an inclining test to be carried out on the identical GEO HAMBURG in Lubmin on 16 October 2018 in the presence of the BSU by Takel-Ing. UG from Neuenkirchen.

The BSU had already determined the GEO PROFILER's payload on the basis of available invoices. The following weights were determined:

- 2 108 kg engines 216 kg
- 2 gel batteries for supply 40 kg
- 2 lead batteries for starting 40 kg
- 2 seats 40 kg
- 2 battery chargers 10 kg
- 2 100 l tanks (full) 200 kg
- 2 kW Honda generator 21 kg
- Interior fittings 130 kg
- Multi-beam echo sounder with frame 100 kg
- IT surveying 50 kg
- Life-saving appliances 50 kg

This means a total weight of 897 kg with fittings and equipment plus the crew of 160 kg. The manufacturer specifies the light weight of the bare hull as 1100 kg and a possible total load of 700 kg (see Annex). This means that the boat would have been too heavy by about 200 kg. The inclining test (load case 1) on the GEO HAMBURG revealed (with a displacement of 2.36 t) 560 kg too much in relation to the declaration of conformity, exhibiting a total load of 1.8 t.

4.2 Certificates

Section 3 of the *Schiffssicherheitsgesetz (SchSG)* [German Ship Safety Act] indicates that the operator is responsible for the safe operation of a ship. The GEO PROFILER was used as a workboat for surveying exclusively in near-coastal waters for the offshore industry. Accordingly, she is a commercially used vessel in all respects regardless of size and ought to be classified in the same way as comparable vessels. In principle, commercially used vessels must have certificates for ship safety, minimum safe manning and the competency of those working on board.

The Ship Safety Division (BG Verkehr) is responsible for issuing certificates for ship safety and minimum safe manning in Germany. A minimum safe manning certificate could not be issued to the GEO PROFILER, however. The Ship Safety Division (BG Verkehr) does not have a legal basis for this because according to section 8(1) of the

Schiffsbesetzungsverordnung (SchBesV) [German Ordinance on Safe Manning], ships of less than 8 m in length do not require such a certificate.

The same applies to the ship safety certificate. International regulations do not apply because of the GEO PROFILER's size and the fact that she does not operate internationally. According to national regulations, the ship should be classified as a workboat within the meaning of Annex 1a to the *Schiffssicherheitsverordnung (SchSV)* [German Ship Safety Ordinance] (part 6, chapter 1, point 1.2.7). Part 6, chapter 1, point 2.1.12 of the Annex referred to states that a workboat is *an open or partially covered vessel intended for [...] work and similar purposes to a limited extent and for short distances near the coast [...]*. Part 6, chapter 1, point 2.1.13 of the Annex referred to defines *a distance not exceeding 5 nm from the coastline at medium high tide* as being near the coast. The safety requirements for cargo ships laid down in part 6, chapter 1, point 1.2.7 of Annex 1a to the SchSV do not apply for workboats of less than 8 m in length, however. This means that there are no national rules governing the safety requirements for commercially used vessels of this size.

4.3 Certificates of competency

Regulation II/3(3) of the STCW[7] Convention states that every officer in charge of a navigational watch on a seagoing ship of less than 500 gross tonnage engaged on near-coastal voyages must hold an appropriate certificate of proficiency. As the authority responsible for issuing certificates of competency, the BSH is of the opinion that in accordance with the *Seeleute-Befähigungsverordnung (See-BV)* [German Ordinance on the Competence of Seafarers], skippers of such boats require either

a) a valid certificate of proficiency for masters (NK 500) in accordance with section 29(2)(2) See-BV or

b) a valid certificate of proficiency in accordance with section 3(2) of the *Schiffsoffizier-Ausbildungsverordnung* [German Ordinance on the Training and Qualification of Ships' Officers] in conjunction with section 64(2) See-BV for masters (GT 500) on national voyages or

c) a valid foreign certificate of proficiency with a valid endorsement of recognition in accordance with section 20 or 21 See-BV or

d) a valid German certificate of proficiency that is more advanced or a recognised foreign certificate of proficiency.

The definition of near-coastal voyage is different here to that for ship safety, however. Section 2(3)(16) See-BV states that near-coastal voyage means *international voyage during which ports in the European part of the Kingdom of the Netherlands, the Kingdom of Denmark (with the exception of the Faroe Islands and Greenland) and ports of the Republic of Poland are called at*. The GEO PROFILER does not undertake such voyages but only sails on national voyages in near-coastal areas.

[7] STCW Convention: International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 7 June 1978 (BGBl. [Federal Law Gazette] II 1982, p. 297ff and BGBl. II 2013, p. 934ff).

Accordingly, the BSU believes that section 29(2) See-BV cannot apply here, as national voyages are addressed in paragraph 3.

On the other hand, a certificate of proficiency for the skipper of a small vessel (NSF) operating on national voyages pursuant to section 29(3) See-BV does not satisfy requirements because the term small vessel within the meaning of the See-BV only applies to merchant ships of less than 24 m in length if they are used as supervisory or inspection vessels, pilot tenders or as so-called 'Börteboote' [transfer boats used in the Heligoland area] (see legal definition in section 2(3)(21) See-BV).

Information on this certificate of proficiency can be found in part 2 of the See-BV (on qualifications for deck service) under section 29 (on certificates of proficiency and competency) in paragraph 3 and section 30 (on requirements for the acquisition of qualifications) in paragraph 7 in conjunction with Annex 3 of the See-BV. However, nobody in Germany holds only the NSF certificate of proficiency. This makes sense because it can only be applied for in conjunction with a more advanced certificate of proficiency and there has been no training to qualify students for the NSF alone, thus far. 118 seamen hold it in addition to a nautical certificate of proficiency (NWO, NEO, NK, NWO 500, NK 500, OFFZ-NF, KPT-NF, BGW, BG, BKW, BK or BKü).

In the view of the BSU, direct application of the STCW Convention is not possible, either, as the GEO PROFILER is not a seagoing vessel within the meaning of the Convention because she only operates in sheltered waters (see Art. III in conjunction with Art. II g of the STCW Convention). Both legal and systematic reasoning support this view. The requirements for a certificate of proficiency under regulation II/3 of the STCW Code (section29(1) point 3 (master on ships up to 500 GT)) are excessive for a vessel with a length of 7 m, such as the GEO PROFILER, especially in comparison to yachts and traditional vessels. For example, traditional vessels with a length of up to 55 m may carry more than 100 passengers and be manned in accordance with the *Sportseeschifferscheinverordnung (SportSeeSchV)* [German Offshore Cruising Licences Ordinance]. In addition, the management of the GEO Group asserts that it has a serious problem manning its smaller commercial vessels, such as the GEO PROFILER, with professional seamen because the periods of service necessary to maintain certificates of proficiency are not officially recognised during permanent deployment. A new regulation would be urgently necessary here so that these boats can be manned by professional seamen.

Pleasure craft certificates are not relevant, either, as the GEO PROFILER is used for commercial rather than recreational purposes. Accordingly, this case uncovers a regulatory gap with regard to nautical certificates of competency.[8]

However, a certificate of competency would have been required for the crew of the GEO PROFILER under section 13(4a) of the *Schiffssicherheitsverordnung (SchSV)* [Ship Safety Ordinance] (VHF voice radio).

[8] In the opinion of the Ship Safety Division (BG Verkehr) responsible for ship safety in a comparable case (RIGI), there is no need for regulation for commercial vessels of less than 8 m in length, meaning a commercial qualification would not be necessary to operate such vessels, either.

4.4 Shipyard's declaration of conformity

The shipyard issued a declaration of conformity for recreational craft in accordance with module A of Directive 94/25/EC. The declaration refers to the bare hull, which is built according to designer van Vossen's drawings. This defines a maximum wind force of 6 Bft up to and including a wave height of 2 m for near-coastal waters and certifies floatation and sufficient stability during flooding. Only module Aa requires extensive stability documents from a notified body, e.g. a classification society.

The designer supplied a design drawing and the following stability curve for the bare hull:

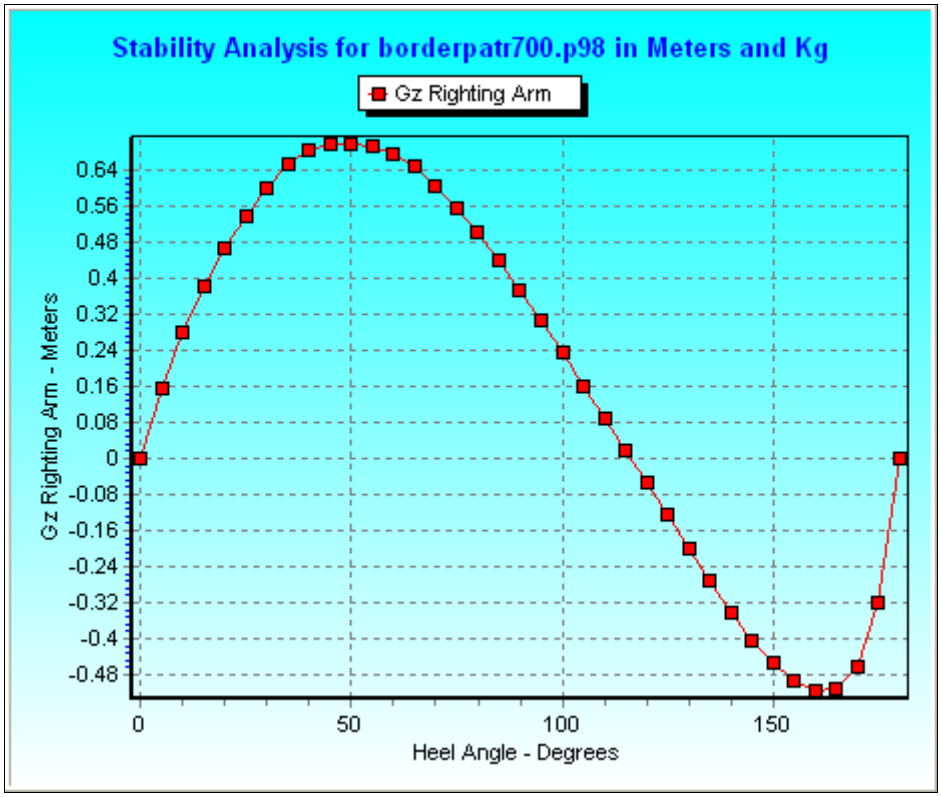


Figure 10: Stability curve for the bare hull

The range of stability is 115°. It is reasonable to assume that the structure was taken into account in the closed state, otherwise this relatively high value would not have been achieved.

5 Actions taken

Risk assessment

The GEO Group's HSEQ[9] manager investigated the accident within the framework of the quality management system, which is certified according to the ISO 9001:2015, ISO 14001:2015 and BS OHSAS 18001:2007[10] standards:

- internal and external crisis management;
- accident meeting with the clients, management and staff of the GEO Group;
- internal review for the staff on site with presentation of measures;
- accident meeting as part of the external safety audit (08/2018);
- documentation in GEO's internal accident report with improvement measures.

One immediate measure is that the skipper must notify his project manager of the boat's departure and arrival and the inflatable liferaft must be stored outside at sea.

The equipment of each lifejacket with a personal locator beacon (PLB) for activities on the water and the installation of an emergency position-indicating radio beacon for the GEO PROFILER, GEO EXPLORER and GEOID are in the pipeline. Existing liferafts are being replaced by small containers permanently installed outside.

The procedural instructions aim to improve the following:

- actual implementation of existing risk assessments;
- work must be discontinued immediately in the event of unsafe conditions;
- such assessments as *"nothing will happen..."* must be avoided;
- documented risk assessment, including risks and area experience, when preparing for every project;
- smaller boats may only be used in near-coastal waters in Navigation Area C;
- boat's maximum payload must be observed;
- establish watertight integrity in good time by closing the door;
- finish the survey and start the return voyage in good time by obtaining weather forecasts before departure and observing developments in the weather;

[9] HSEQ: Health, safety, environment and quality (at company level).
[10] Implementation of a health, safety, environment and quality management system.

- timely familiarisation and use of the safety appliances provided, such as PLBs, VHF radio and distress flares;
- implementation of (safety) training.

Stability report for the GEO HAMBURG with inclining test

The GEO Group had an inclining test carried out on the identical GEO HAMBURG in Lubmin Marina on 16 October 2018 in the presence of the BSU and requested an expert opinion from Takel-Ing. UG. As a result of the GEO PROFILER capsizing, the owner commissioned this expert opinion to investigate how the stability of the boat should be assessed in general, whether she complies with CE regulations in her current condition and what can be done to increase safety during operation. The findings are summarised below.

The GEO HAMBURG is a small-series aluminium boat. She can be transported on a trailer and was sold by the shipyard as a bare shell. Final outfitting was the responsibility of the owner. She is currently equipped with two outboard engines (Suzuki, four stroke, 60 hp). The boat is CE certified (category C – coastal waters in moderate weather conditions, gusts up to 7 Bft). She is covered and has a closed wheelhouse. The cockpit behind the wheelhouse is self-draining with rubber valves on the scuppers to prevent the ingress of seawater. The hull is not divided inside by watertight bulkheads and there is no watertight double bottom. The doors and hatches are weatherproof but not watertight when closed, i.e. rain and swell water is averted but the boat would probably fill up slowly if she capsized despite closure. The boat is currently used for surveying. Permanently installed computers and screens, an external power generator (at the stern) and a multi-beam echo sounder (at the bow) are on board the boat. An aluminium holder for the multi-beam scanner was welded to the stem.

Dimensions:

Length overall	7.10 m
Length of the waterline	6.10 m
Breadth overall	2.45 m (without rubbing strake)
Draught DWL	0.40 m
Depth at L/2 above base	1.13 m
above BEK 0.86 m	

Light ship data according to inclining test:

Light ship weight	2.15 t
Weight centre of gravity lcg	2.74 m
vcg	1.26 m
tcg	-0.02 m

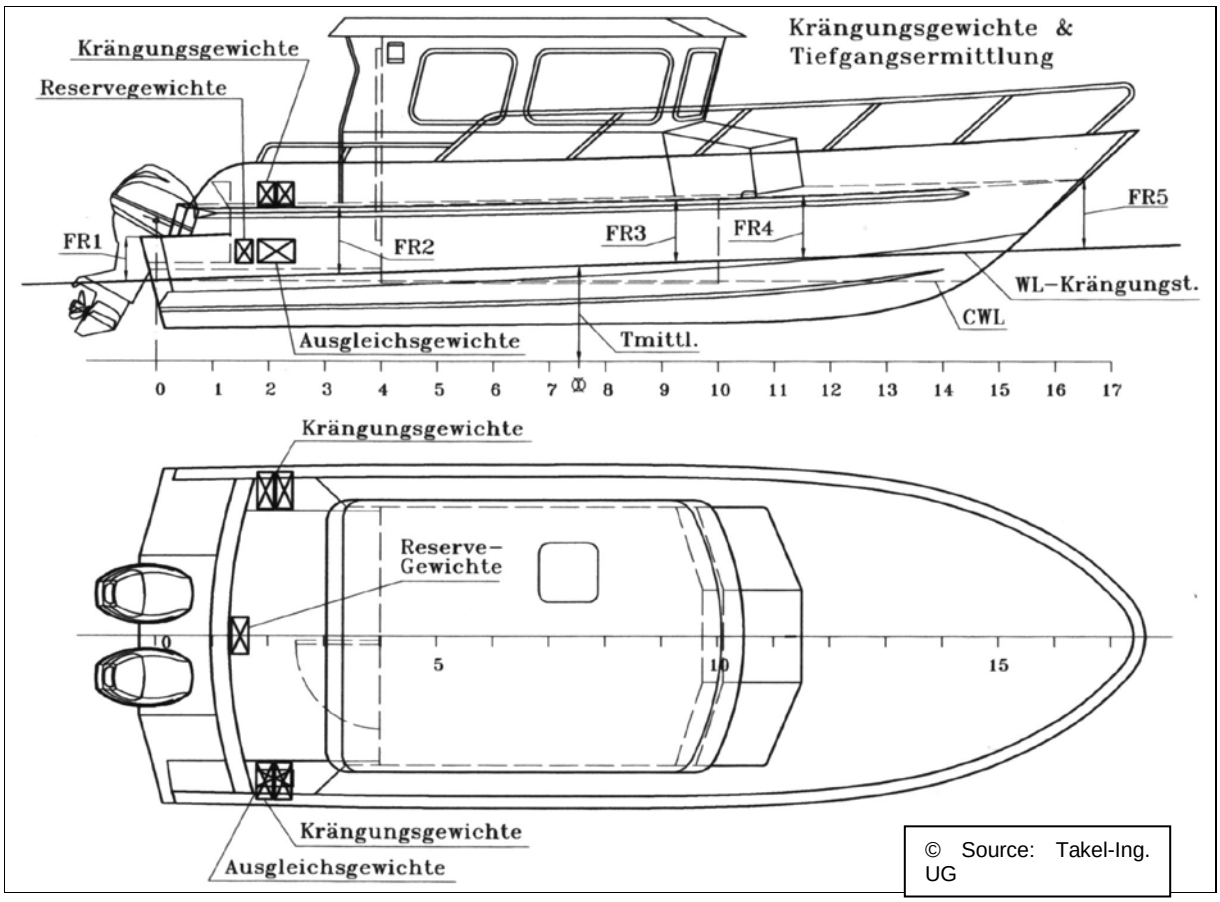


Figure 11: Inclining test

The inclining test delivered a light ship weight of 2.15 t for the boat ready for use with her current equipment (bridge equipment, survey computer, multi-beam echo sounder, generator, fenders and lines, two 60 hp outboard engines but without people, effects and diesel on board). The initial stability GM was determined as 0.89 m. This value is within the normal range for smaller boats and confirms the safe feeling one has upon entering one. The light ship data are required as input variables in the load case calculations.

Three load cases were calculated:

Load case 1: (IS Code) two people in the wheelhouse,
tanks 50% full

Load case 2: (IS Code) two people in the cockpit, flooded cockpit,
tanks 50% full

Load case 3: (CE) four people standing on one side of the boat,
tanks 100% full

In load cases 1 and 2, the criteria of the IS Code (generally applicable stability criteria for international shipping) were used to achieve a comparable image of the boat's stability. These criteria do not have to be met, but the check provides a good qualitative classification. The change in stability when the aft cockpit is filled with

water, e.g. when a wave floods it, was investigated in load case 2. A check as to whether the boat complies with the CE requirements of ISO 12217-1 for category C in her current level of equipment was made in load case 3. Irrespective of load case, the heeling moment caused by static lateral wind pressure was checked, revealing that at 7 Bft (15 m/s) the static heel angle due to wind pressure is only 6°. (No dynamic influences such as swell or gusts are taken into account here.)

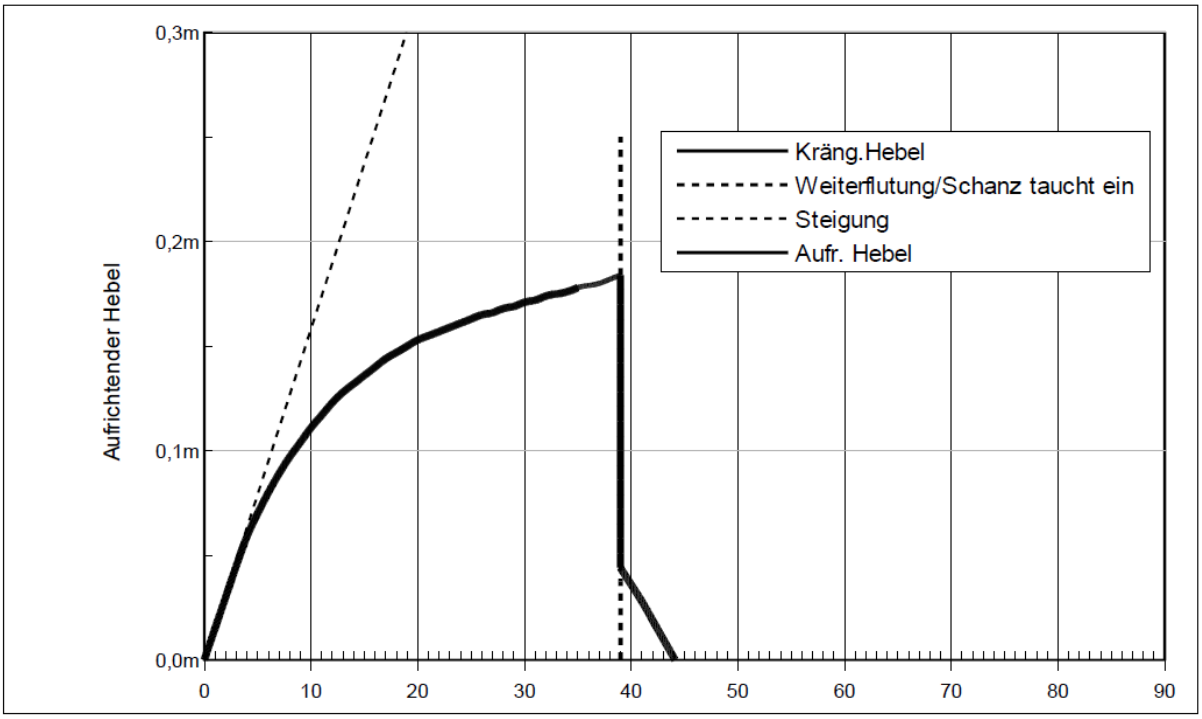


Figure 12: Load case 1 stability curve

Although initial stability is good, the maximum righting lever arm is too low (for the criteria of the IS Code, which do not have to be met here). The lever arm curve clearly demonstrates that the righting lever arm continues to rise up to a heel of 39°. However, stability is lost from the moment the bulwark is immersed and the deck floods. A 'remaining' lever arm still exists but it is too small to right the ship. In practise, this means that the boat will capsize and probably founder as soon as the bulwark is immersed. Accordingly, it should basically be regarded as an open (uncovered) boat.

The mean draught stood at 0.67 m with a displacement of 2.36 t. The freeboard was 0.46 m (0.2 m was required).

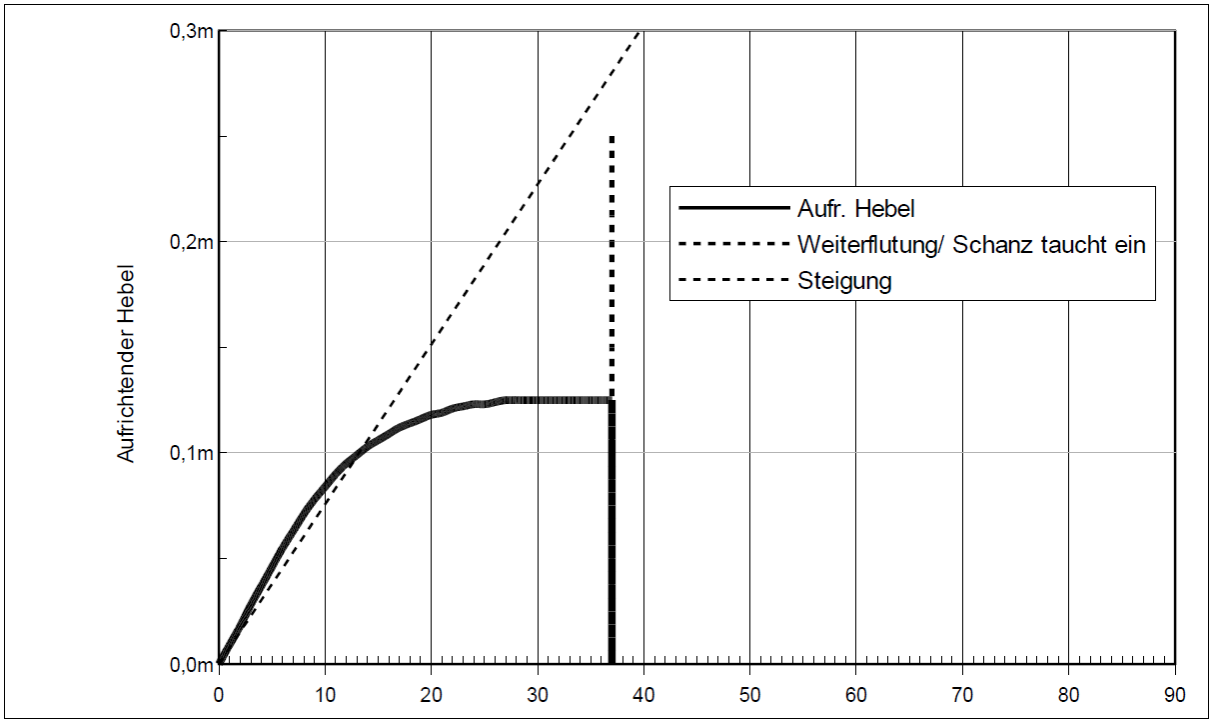


Figure 13: Load case 2 stability curve

The effect of a flooded cockpit on stability is considered in this load case. Stability deteriorates considerably due to the additional weight of the water and especially its free surface. The bulwark immerses at a heel of 37°, which then leads to capsizing. In practise, this means that the opportunity to drain the (slowly self-draining) cockpit through a cautious sailing style remains despite reduced stability if the cockpit floods but the wheelhouse remains dry to begin with.

The mean draught stood at 0.71 m with a displacement of 2.87 t. The freeboard was 0.42 m (0.2 m was required).

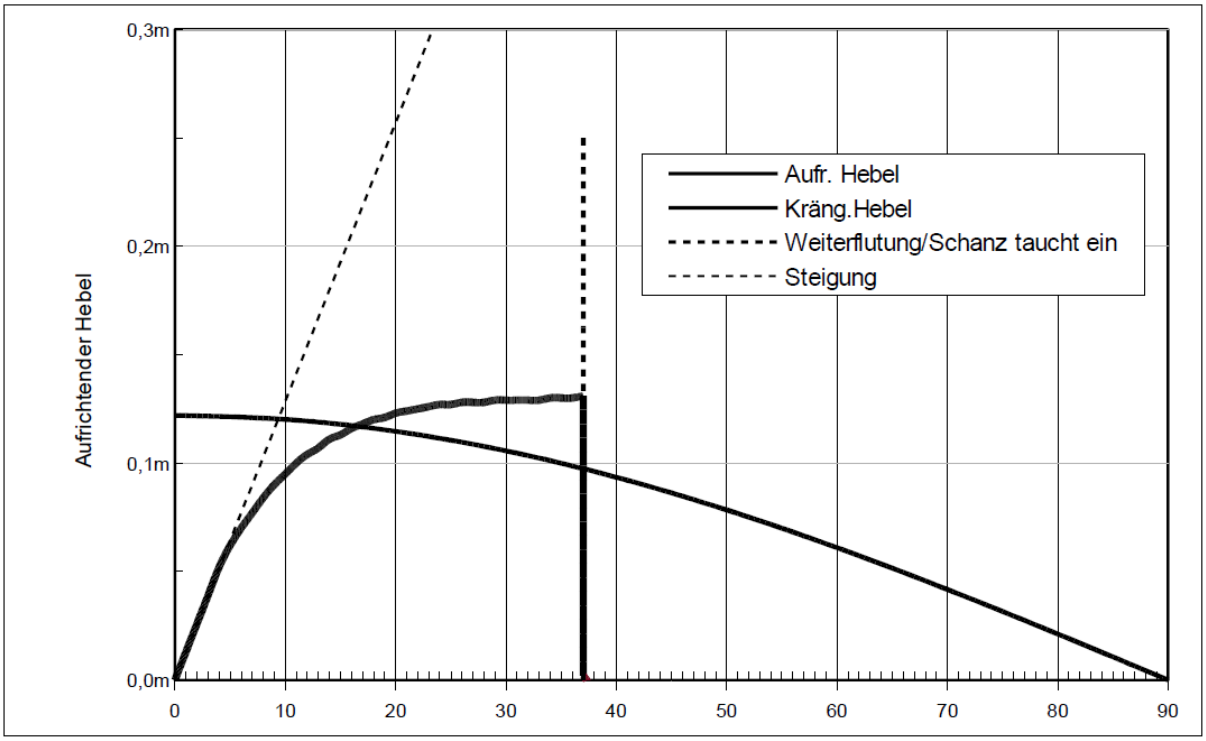


Figure 14: Load case 3 stability curve

CE criterion 6.2 (offset load, see table on following page) was checked in this load case. The boat meets the CE criteria for category C in her current state. The static heel angle (17°) is calculated from the intersection of the heeling and righting lever arm curves when four people (the permissible number of people) are standing on the side. The other relevant CE criteria are also shown here but do not refer exclusively to this offset load case.

The mean draught stood at 0.68 m with a displacement of 2.53 t. The freeboard was 0.39 m (0.293 m was required when heeling).

The following requirements were referred to:

ISO 12217-1 for Small Craft
Stability and buoyancy assessment and categorisation
Part 1: Non-sailing boats of hull length greater than or equal to 6 m

In particular, the points under sections 6.1 and 6.2 were reviewed.
The other sections are not relevant for this boat.

4.1 CE Table for Stability

Table H.1 — Summary of requirements

	Option number	1		2		3	4		5		6	
	Design category	A	B	C	D	B	C	D	C	D	C	D
Degree of decking or covering	any amount					yes	yes	yes			yes	yes
	partially decked								yes	yes		
	fully decked	yes	yes	yes	yes							
Downflooding openings comply (6.1.1)		yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Required downflooding height (using figures)	$h_{D(R)}$ >	0,5	0,4	0,353	0,3	0,4	0,3	0,25	0,5	0,4	0,6	0,4
	$h_{D(R)}$ to be >	$L_H/17$	$L_H/17$	$L_H/17$	$L_H/20$	$L_H/17$	$L_H/20$	$L_H/24$	$L_H/12$	—	$L_H/10$	—
	$h_{D(R)}$ need not be >	1,41	1,41	0,75	0,4	1,41	0,75	0,4	0,75	—	0,75	—
Downflooding height (by annex A)	$h_{D(R)}$ to be >	0,5	0,4	0,3	0,2	0,4	0,3	0,2	0,3	0,2	0,5	0,4
	$h_{D(R)}$ need not be >	1,41	1,41	0,75	0,4	1,41	0,75	0,4	0,75	0,4	0,75	—
Downflooding angle (6.1.3)	ϕ_D to be > $\phi_{D(R)}$ =	$\phi_D + 25$	$\phi_D + 15$	$\phi_D + 5$	ϕ_D	$\phi_D + 15$	$\phi_D + 5$	ϕ_D	—	—	—	—
	or = (whichever is greater)	30°	25°	20°	ϕ_D	25°	20°	ϕ_D	—	—	—	—
Offset load (6.2)	ϕ_D < $\phi_{D(R)}$ =	$10 + (24 - L_H)^3/600$										
	residual freeboard to be >	(not applicable)							$0{,}11\sqrt{L_H}$	$0{,}07\sqrt{L_H}$	$0{,}11\sqrt{L_H}$	$0{,}07\sqrt{L_H}$
Rolling in waves (6.3.2)	when v_W (m/s) =	28	21			21						
	$A_2 \geq A_1$ when ϕ_R =	$25 + 20/V_D$	$20 + 20/V_D$			$20 + 20/V_D$						
Resistance to waves (6.3.3)	If $\phi_{GZmax} \geq 30°$, RM_{30} to be ≥	25 kN·m	7 kN·m			7 kN·m						
	If $\phi_{GZmax} \geq 30°$, GZ_{30} to be ≥	0,20 m	0,20 m			0,20 m						
	If $\phi_{GZmax} < 30°$, RM_{max} to be ≥	$750/\phi_{GZmax}$ kN·m	$210/\phi_{GZmax}$ kN·m			$210/\phi_{GZmax}$ kN·m						
	If $\phi_{GZmax} < 30°$, GZ_{max} to be ≥	$6/\phi_{GZmax}$ m	$6/\phi_{GZmax}$ m			$6/\phi_{GZmax}$ m						
Heel due to wind (6.4) only if $A_{LV} > L_H B_H$	when v_W (m/s) =			17	13		17	13	17	13	17	13
	wind heel angle ϕ_W <			$\phi_{O(R)}/2$	$\phi_{O(R)}/2$		$\phi_{O(R)}/2$	$\phi_{O(R)}/2$	$\phi_{O(R)}/2$	$\phi_{O(R)}/2$	$\phi_{O(R)}/2$	$\phi_{O(R)}/2$
Level flotation test (6.5)	none required	yes	yes	yes	yes				yes	yes	yes	yes
	required					yes	yes	yes				

Notes on free surfaces:

The liquids contained in a completely filled tank cannot move and the effects on the ship are the same as if the contents of the tank were solid. The situation changes completely from the moment something is removed from a full tank and the stability of the ship is affected by the free surfaces. This effect is referred to as 'reduction of GM' or 'virtual increase in the vertical centre of gravity G' and calculated as follows:

Reduction of GM [m] = moment of inertia I [m⁴] x density of tank contents [t/m³] / Ship weight [t]

= Free surface moment [tm] / Ship weight [t]

The free surfaces were considered here. In this case they are only marginal for the tanks but those caused by the flooding of the cockpit are very high (see load case 2).

Conclusions and advice of the expert for the skipper:

1. *The boat satisfies the CE stability criteria of ISO 12217-1, category C, for which she was also built, with her current level of equipment. This standard states that a category C boat is designed to withstand a significant wave height of up to 2 m and a steady wind of 6 Bft and that such conditions may be encountered on unsheltered inland and near-coastal waters in moderate weather conditions.*

2. *Despite the covered design (with a weatherproof and closable wheelhouse), the boat should basically be regarded as an open boat and therefore used with appropriate caution. From the moment the bulwark immerses and water flows onto the deck in any noteworthy extent, stability is lost, possibly leading to the boat capsizing and ultimately foundering.*

3. *The doors and hatches are not watertight but only weatherproof (which is quite common and appropriate). This means that the boat will eventually flood after capsizing even if her doors and hatches are tightly closed.*

4. *If water reaches the deck or cockpit in any noteworthy extent but the boat is still floating upright and the bulwark is not immersed, it is possible to drain the cockpit and thus the deck through a cautious sailing style if the doors and hatches are closed and further flooding is thus prevented.*

5. *The wheelhouse door should therefore be closed whenever possible at sea.*

6. *To increase protection against further flooding, it may be advisable to use a washboard for the wheelhouse door and thus bring the door's coaming to the height of the deck (approx. 0.46 m). This would greatly reduce the risk of flooding the wheelhouse further (and thus the entire boat) if the cockpit flooded while the door was open.*

7. *Other structural measures like a watertight bulkhead in the forward section would help to prevent foundering but would provide hardly any additional safety when operating the boat.*

8. *When sailing on open water, it may be useful to carry a self-inflating liferaft.*

9. *In general, good seamanship and foresighted sailing helps to prevent critical situations, of course.*

6 CONCLUSIONS

The GEO PROFILER capsized via the sternpost with door open in the evening at about 1940 in turbulent waters, which developed into a steep wind sea of 6-7 Bft with a wave height of up to 3 m due to the current flowing in the opposite direction. The wash of the waves then caused an enormous amount of water to enter the superstructure and the crew lost control. The prevailing situation provided no opportunity to make an emergency call or ready the liferaft stowed at the forward edge of the superstructure. The inflatable lifejackets with PLB could not be donned, either. Even though the GEO PROFILER did not founder and her prow was above water, the crew lost sight of her as they floated away. The crew thus drifted without alerting the rescue services and without a cold protection suit wearing a lifejacket and a lifebuoy in the cold water (20 °C), until they reached a sandbank on the following morning and could be picked up exhausted by the sea rescue cruiser THEODOR STORM at about 1300 after an extensive search involving several rescue agencies.

Thanks to the alert of the GEO Group in Wilhelmshaven, which was responsible for them, on the morning after the day of the accident and the extensive rescue operation, the incident ended fortunately for the crew. Nevertheless, it should be noted that there were deficits in seamanship, e.g. no safety equipment was worn, the return voyage was not started on time and the door to the superstructure was left open, meaning watertight integrity could not be established. The boat would not have flooded immediately and capsized via the sternpost if she was closed. She could have capsized over the longitudinal axis, however. With respect to riding out the waves, experienced and skilled seamanship would be necessary here, too, because the GEO PROFILER was only certified for a wave height of 2 m. The crew had not expected such a deterioration in the weather and relied on the weather forecasts. The shipping forecast published in the morning at 0400 CEST predicted changing wind directions of force 2-4 Bft for the afternoon and evening in the area of the German Bight with the swell rising to 0.5 m.

Given the new risks identified in the wake of the accident, the GEO Group has re-appraised its risk assessment as part of the quality management system and responded by improving its procedural instructions. For example, liferafts will be installed on deck at sea to make them easier to reach. In addition, training courses are planned so as to raise safety awareness and practise the use of safety appliances. The BSU can only support these measures.

However, the BSU has noted systemically relevant deficiencies in terms of the safety partnership under the SchSG between administrative bodies and operators, which could not be resolved by the operator alone. There is no authorisation on the part of the Ship Safety Division (BG Verkehr) to issue a safety and minimum safe manning certificate for less than 8 m in length. Only a certificate of competency for vessels of less than 500 GT would be possible under certain circumstances. However, the BSU believes this would not be permissible for a vessel of 7 m in length, such as the GEO PROFILER, in the intended operating area and would also be excessive. Nevertheless, there is a national certificate of proficiency for small vessels of less than 24 m and this would be the appropriate certificate from the perspective of the

BSU. To this end, the GEO PROFILER would have to be recognised as an inspection vessel or the scope of application of section 29(3) See-BV would have to be extended to include such ships. At any event, a training pathway would have to be developed because at present this certificate can only be applied for in conjunction with a more advanced nautical certificate.

If there are no appropriate and proportionate official regulations for this class of boat, then ensuring the work equipment used does not endanger anyone is the sole responsibility of the employer. The *Produktsicherheitsgesetz (ProdSG)* [German Product Safety Act] has been ratified since 8 November 2011. It constitutes the central legal provision for the safety of systems, installations and equipment, regardless of size or whether used commercially or privately. Market surveillance agencies in Germany, e.g. the trade supervisory office, checks whether the legal requirements for product safety are complied with. In addition, the *Betriebssicherheitsverordnung (BetrSichV)* [German Ordinance on Industrial Safety and Health] obliges every employer to ensure that work equipment can be used safely under the intended operating conditions when procuring it.

It was advantageous for the GEO PROFILER accident that the GEO Group had introduced a quality management system and that a risk assessment was available at the time of the accident. If the employer has experience and expert advice, then it satisfies its duties of care. The skipper's proficiency to operate the GEO PROFILER was documented by an SBF. This is an official licence to operate pleasure craft on inland and maritime waterways up to 3 nm. It is important to consider that the term 'pleasure craft' is exclusively associated with recreational activities on the water and that pleasure craft may therefore be used only in this sense commercially, e.g. as a training boat for the acquisition of corresponding licences for such craft. The GEO PROFILER is a survey boat, which is used for other purposes commercially. The next higher qualification would be the officially recommended *Sportküstenschifferschein (SKS)* [international certificate for operators of pleasure craft in coastal waters not exceeding 12 nm from the mainland] for operating yachts with engine and under sail. Analogous to the training for the national certificate for skippers of small vessels, the SKS would be roughly comparable. Apart from the nautical training, one major difference to the SBF is the certification for 300 nm on yachts in coastal waters (see Annexes).

All in all, the BSU believes there is a need for a separate certificate of competency for operating small commercial vessels. In addition to the present accident, this is supported by the almost identical case involving the RIGI, which capsized in Danish coastal waters in a freshening wind, also in 2018.[11] A training opportunity for obtaining such a qualification alone does not currently exist, even though the requirements for this are already defined in Annex 3 of section 30 See-BV. Such training would involve at least 12 months of recognised seagoing service on deck and would have to be created and recognised by the BSH. There should also be the possibility of recognition for skippers who already practise this profession. However, this would also require a ship safety and minimum safe manning certificate issued by the Ship Safety Division (BG Verkehr). Responsibility remains solely with the operator of such vessels for as long as neither exist.

According to the GEO Group's quality requirements, surveys with a multi-beam echo sounder should only be carried out in light swell and wave heights of no more than 0.5 m so that meaningful findings can be made with this class of boat. These weather conditions would be the normal case for assessing from the outset whether a survey voyage is promising. This wave height was predicted at 0630 in the coastal weather report for that morning. Only the shipping forecast at 1400 CEST predicted a significant sea of 1 m, which explains why the crew set sail and was surprised by stormy seas, contrary to their expectations. The crew was not used to this sea, which led to the above deficits in seamanship due to a lack of experience with poor weather. Better training would have been necessary here.

Another question concerns product safety and therefore the boat herself. The GEO PROFILER was a pleasure craft with CE certification. The shipyard had issued a declaration of conformity for the hull and supplied boat drawings and a stability calculation. However, the actual characteristics of the boat could only be evaluated insufficiently. It is for this reason that the GEO Group engaged an external expert in the wake of the accident, who investigated how the stability of the boat should be assessed in general, whether she complies with CE requirements in her current condition and what can be done to increase safety during operation. The boat satisfies the CE stability criteria of ISO 12217-1, category C, for which she was also built, with her current level of equipment. A category C boat is designed to withstand a significant wave height of up to 2 m and a steady wind of 6 Bft. Such conditions may be encountered on unsheltered inland and near-coastal waters in moderate weather conditions. A washboard for the wheelhouse door could raise the coaming to the height of the deck (0.46 m) and delay flooding if watertight integrity cannot be established promptly.

[11] This also concerned a small vessel operating in near-coastal waters which ultimately capsized due to deteriorating weather conditions. It claimed the life of one person. The full report of the Danish authorities is available at http://www.dmaib.com/News/Sider/MarineaccidentreportaboutthefounderingofRIGIon23April2018.aspx

The shipyard issued a declaration of conformity for recreational craft in accordance with module A of Directive 94/25/EC. The declaration refers to the bare hull, which is built according to designer van Vossen's drawings. This defines a maximum wind force of 6 Bft up to and including a wave height of 2 m for near-coastal waters and certifies floatation and sufficient stability during flooding. Although this is correct, it could only be proven during the inclining test. Only module Aa requires extensive stability documents from a notified body, e.g. a classification society.

The designer supplied a design drawing and a stability curve for the bare hull. The range of stability specified is 115°. It is reasonable to assume that the structure was taken into account in the closed state, otherwise this relatively high value would not have been achieved. However, the boat should basically be regarded as an open boat because she would capsize as soon as the bulwark is submerged and the aft deck floods. The range of stability would then be 39°. Consequently, the documents supplied by the designer are misleading.

The manufacturer specifies the total weight in a loaded condition as 1800 kg. In fact, two people and equipment were determined for load case 1 as 2360 kg. However, this supposed overloading of 560 kg in relation to the hull was not a material factor in the boat capsizing, especially since the CE criteria are also still met. Moreover, there would still have been a freeboard reserve of 10 cm when the boat was heeling in load case 3 with four people on board.

7 SAFETY RECOMMENDATIONS

The following safety recommendations do not constitute a presumption of blame or liability in respect of type, number or sequence.

7.1 Federal Ministry of Transport and Digital Infrastructure (BMVI)

The Federal Bureau of Maritime Casualty Investigation recommends that the BMVI amend the SchSV and the SchBesV such that commercial workboats of less than 8 m in length are also covered. The term near-coastal voyage should be defined further in the See-BV with regard to national voyages, taking into account regulation II/3 of the Annex to the STCW Convention, to allow certificates of proficiency for the manning of workboats and other small vessels. At the same time, the qualifications of existing skippers should be taken into account.

7.2 German Social Accident Insurance Institution for Commercial Transport, Postal Logistics and Telecommunication (BG Verkehr)

The Federal Bureau of Maritime Casualty Investigation recommends that the Ship Safety Division (BG Verkehr) draw up regulations for commercially used workboats of less than 8 m in length, so that ship safety and minimum safety manning certificates can be issued for such vessels.

7.3 Federal Maritime and Hydrographic Agency (BSH)

The Federal Bureau of Maritime Casualty Investigation recommends that the BSH liaise with the *Ständigen Arbeitsgemeinschaft für das Seefahrtbildungswesen der Bundesländer* [permanent working group for maritime education of the federal states] and develop a training pathway specifically for the skippers of small vessels (NSF) operating on national voyages, as well as standards for the recognition of existing skippers who do not hold a nautical certificate of proficiency.

7.4 Owner and operator of the GEO PROFILER

7.4.1 The Federal Bureau of Maritime Casualty Investigation recommends that the owner or the operator of its small commercial vessels train crews operating in near-coastal waters for the official SKS at minimum until official safety relevant requirements must be complied with and official certificates are issued by the Ship Safety Division (BG Verkehr).

7.4.2 The Federal Bureau of Maritime Casualty Investigation recommends that the owner or operator obtain radio operating certificates for the use of their radiotelephone equipment on board.

7.4.3 The Federal Bureau of Maritime Casualty Investigation recommends that the owner or operator obtain a declaration of conformity from the shipyard in accordance with the certified module Aa, in which a stability calculation is required, for the Coenenboat CKB700 type of boat.

8 SOURCES

- Investigations of WSP Brunsbüttel

- Written statements
  - Crew
  - Operator

- Witness testimony

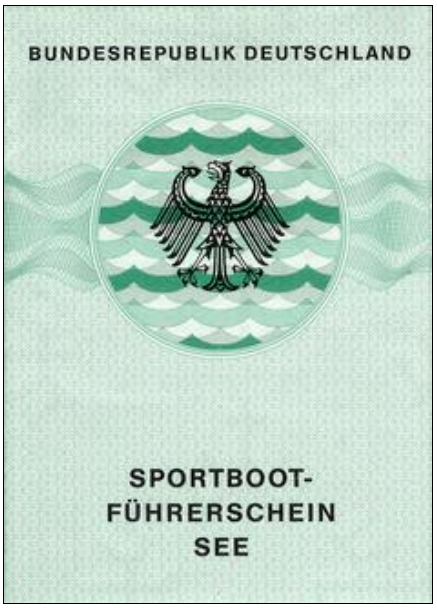
- Expert opinion/technical paper
  - Navigational charts of the BSH
  - BSH, qualification of seamen
  - Stability report from Takel-Ing. engineering company, Neuenkirchen

- Official weather report of the DWD

9 ANNEXES

Sportbootführerschein See (SBF See)

[international certificate for operators of pleasure craft on the waterways navigable by seagoing ships]



Mandatory licence for the operators of motorised boats and offshore skippers

The official SBF See entitles holders to operate motorised boats or sailing yachts under engine power in excess of 11.03 kW (15 hp) net power on German maritime waterways within the scope of the *Seeschifffahrtsstraßen-Ordnung (SeeSchStrO)* [German Traffic Regulations for Navigable Maritime Waterways] inside the 3 nm zone and fairways within the 12 nm zone.

Expressed very simply, these are the territorial seas and adjacent waters. The SBF See is an international certificate with which holders can demonstrate their qualifications in other countries. The SBF See is also a mandatory requirement for more advanced coastal sailing licences.

Eligibility:

- at least 16 years of age;
- medical certificate for SBF applicants (form);
- presentation of a valid motor vehicle driving licence or certificate of good conduct (document type 0)/waiver for minors;
- participants under the age of 18 require a certified declaration of consent from their legal guardian (form can be requested).

The **theoretical examination** for the SBF See comprises a list of questions.
Sufficient knowledge of

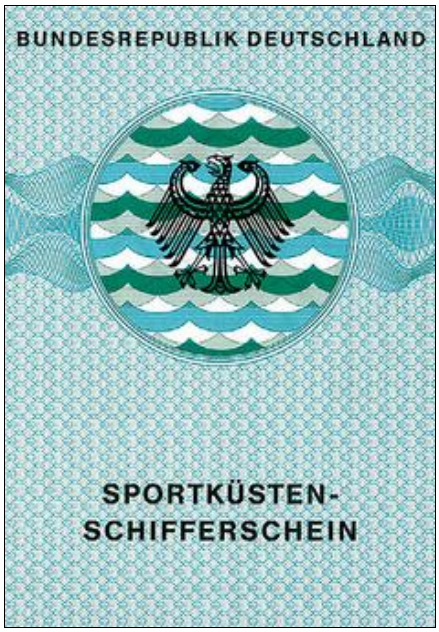
- navigation;
- seamanship;
- maritime law;
- meteorology, and
- vessel management

must be demonstrated.

The **practical examination** for the SBF See involves implementing and applying the theoretical knowledge on a boat under engine power. Various manoeuvres (including the rescue manoeuvre) and knots must be demonstrated.

Sportküstenschifferschein (SKS)

[international certificate for operators of pleasure craft in coastal waterways not exceeding 12 nm]



This is the right sailing licence for offshore sailors in coastal areas

The SKS is usually the first milestone in the career of prospective offshore sailors.
Eligibility:

- at least 16 years of age;
- SBF See;
- proof of 300 nm sailed on yachts in coastal areas.

A theoretical and a practical examination must be taken for the SKS. The entire examination must be completed within 24 months.
The **theoretical examination** comprises a list of questions, a chart assignment and possibly an oral examination. Advanced knowledge of

- navigation;
- seamanship;
- maritime law, and
- meteorology

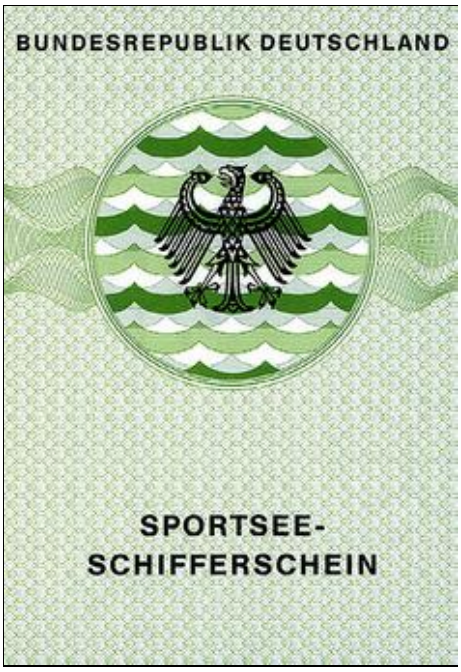
must be demonstrated.

The **practical examination** involves implementing and applying the theoretical knowledge of sailing a yacht in coastal waters. In addition to the mandatory assignment (rescue manoeuvres), selected manoeuvres and other skills must be demonstrated.

Why do the SKS?
The SKS is recommended for skippers who intend to sail a yacht in coastal areas up to 12 nm off the coast. Many yacht charter companies require the SKS as proof of competency.

Only the combination of SBF See and SKS provides the knowledge in seamanship, maritime law, navigation, tides and meteorology required at sea.

Sportseeschifferschein (SSS)
[international certificate for operators of pleasure craft in coastal waters not exceeding 30 nm]



The operator's licence/sailing licence for skippers on extended coastal seas

The SSS is the official and recommended certificate of competency for operating yachts (under sail or engine) in near-coastal sea waters (all seas up to 30 nm, including the Baltic Sea, North Sea and Mediterranean Sea). The SSS is a mandatory requirement for operating pleasure craft used commercially.

Eligibility:

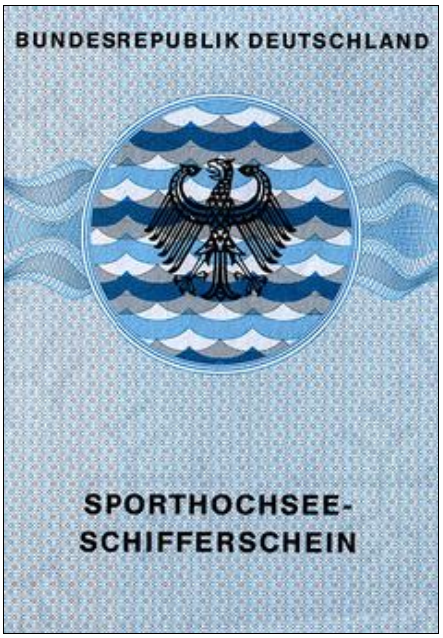
- at least 16 years of age;
- SBF See;
- proof of 1000 nm sailed on yachts in near-coastal areas (after acquisition of the SBF See) as watchkeeper or her/his representative.

The written and possibly oral **theoretical examination** covers four subjects: navigation, seamanship, maritime law and meteorology. Extensive knowledge must be demonstrated.

The **practical examination** for the SSS involves implementing and applying the theoretical knowledge of operating a yacht in near-coastal waters. In addition to the mandatory assignments (rescue manoeuvres, radar, navigational chart, sailing), selected manoeuvres and other skills must be demonstrated.

Sporthochseeschifferschein (SHS)

[certificate for all seas]



The sailing licence for voyages anywhere in the world

The SHS is the most advanced licence in recreational boating. It is the official and recommended licence for operating/sailing yachts under sail or engine on voyages anywhere in the world. The SHS is a mandatory requirement for operating pleasure craft used commercially.

Eligibility:

- at least 18 years of age;
- SSS;
- proof of at least 1000 nm sailed on yachts in sea areas (after acquisition of the SSS) as watchkeeper.

The written and possibly oral **theoretical examination** for the SHS covers three subjects: navigation, maritime law and meteorology. Extensive and in-depth knowledge in such fields as celestial navigation, international maritime law, tropical cyclones, as well as handling sextants must be demonstrated for the SHS.

A **practical examination** is not required for this licence.

Annex 3 to section 30 on the requirements for the demonstration of technical competence to obtain the certificate of proficiency for skippers of small vessels
(source: BGBl. I 2014, p. 484-485)

Skippers of small vessels shall acquire the knowledge and skills needed to carry out the activities listed in section 1 below. Having regard to the general training objectives set out in section 2, training shall include the knowledge and skills needed in the fields referred to in section 3.

1. Activities of the skipper
   Within the scope of their powers, their nautical service on small vessels shall include the following duties:

1.1 Navigating and manoeuvring a ship, operating and monitoring technical equipment on the bridge, organising and monitoring the duties on the bridge and of the watch.
1.2 Monitoring the sea room and commanding the ship.
1.3 Executing and monitoring maritime radio traffic.
1.4 Planning, executing and monitoring nautical works during ship operation.
1.5 Assessment of machinery operation processes.
1.6 Establishment and monitoring of the ship's seaworthiness.
1.7 Monitoring the completeness, operability and readiness of the fire protection, rescue and other safety systems on board the ship.
1.8 Executing and monitoring administrative tasks.
1.9 Exercising the duty of care for the crew.
1.10 Management of human resources during ship operation, planning and executing the employment of labour and training on board.
1.11 Maintenance.
1.12 Execution of the duties assigned by law and other regulations.
1.13 Execution of the duties assigned by the owner.

2. General training objectives
   Skippers must be able to safely apply knowledge and skills in the areas specified in section 3 and to assess technical contexts and processes during ship operation.

3. Fields of knowledge and skills
   To obtain a certificate of competency for skippers, the knowledge and skills needed must be demonstrated in the following areas:

3.1 Navigation.
3.1.1 Terrestrial navigation;
determination of the course;
position lines and ship's position;
tidal navigation;
nautical printed matters and publications;
work in the navigational chart;
nautical marks and buoyage systems;
bases of tidology.
3.1.2 Technical navigation;
operation of sounding and speed log systems;
operation of radio location systems;
operation of compass systems;
evaluation of measurements from sounding, speed log and radio location systems;
satellite navigation techniques;
radar navigation and plotting techniques;
ARPA systems;
operation of autopilot systems.

3.2 Maritime law.
Public maritime law and maritime labour law, in particular:
provisions on federal duties in the area of maritime shipping;
flag law;
Maritime Safety Investigation Law;
Maritime Labour Act and the ordinances enacted on the basis of that Act;
Ship Safety Act and Ship Safety Ordinance;
international and national regulations for the protection of the marine environment;
international and national traffic regulations;
telecommunications regulations;
legislation on rights over salvage and finds;
official ship papers;
ship clearance;
regulations relating to work protection and accident prevention;
guidelines and fact sheets from the employers' liability insurance association.

3.3 Seamanship.

3.3.1 Safety technology;
fire protection, firefighting;
rescuing people, ship and cargo;
conduct in the event of marine casualties;
survival in emergencies at sea;
security;
maintenance of safety equipment.

3.3.2 Design and construction of the ship;
shipbuilding components and assemblies;
shipyard documents, freeboard, surveying and classification.

3.3.3 Stability and trim of the ship;
techniques for determining, assessing and influencing trim and stability;
influences on stability;
stability and buoyancy of a damaged ship.

3.3.4 Manoeuvring;
manoeuvring behaviour and handling ships in harbours, in channels and at sea, in heavy weather and in ice.

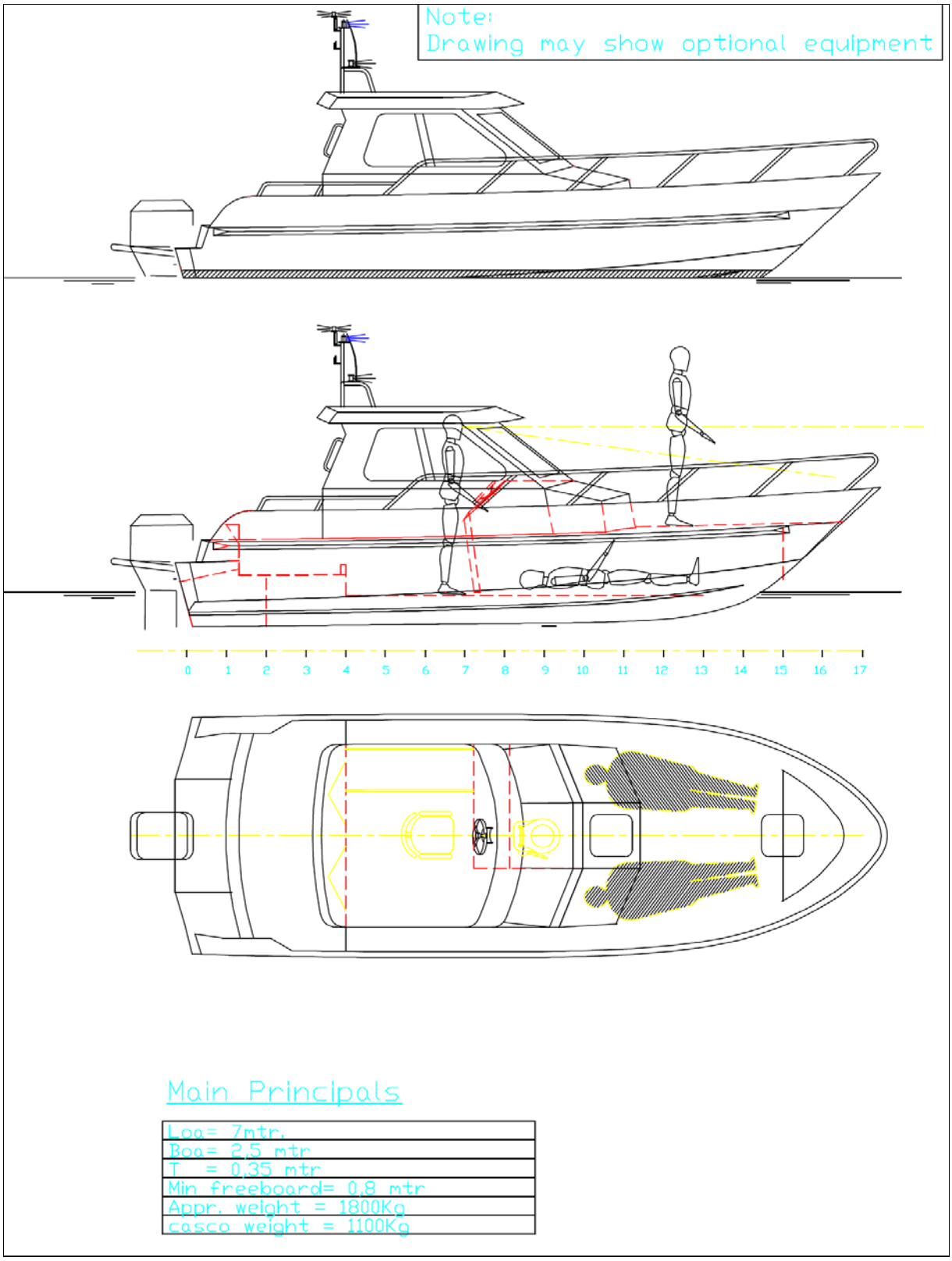
3.4 Operation and monitoring of marine engine systems up to 300 kW.

3.5 Design, operation and reading of meteorological instruments.

3.6 Limited valid operating certificate for radio operators.

3.7 First aid.

3.8 English technical language, standard marine navigational vocabulary, ship's protests and reports in English.


Note:
Drawing may show optional equipment
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
Main Principals
Loa= 7mtr.
Boa= 2,5 mtr
T = 0,35 mtr
Min freeboard= 0,8 mtr
Appr. weight = 1800Kg
casco weight = 1100Kg

COENEN
YACHTS & BOATS

Konformitätserklärung
Sportboote
Richtlinie 94/25/EG

Hersteller: Coenen Yachts & Boats

Strasse: Siemensstr.23b PLZ: 47533 Stadt: Kleve

Land: (Abk.) DE (Druckschrift) DEUTSCHLAND

zertifiziert nach Modul: A ⊗ Aa □ B+C □ B+D □ B+F □ G □ H □

Auszufüllen, wenn Konformitätserklärung durch einen in der EU ansässigen Bevollmächtigten des o.g. Herstellers ausgestellt wird

Bevollmächtigter: _____

Strasse: _____ PLZ: _____ Stadt: _____

Land: (Abk.)_____ (Druckschrift) _____

v

Auszufüllen bei Beteiligung einer benannten Stelle

Name: Identifikations-Nr.: _____

Strasse: _____ PLZ: __ Stadt

Land: (Abk.) _____ (Druckschrift) Deutschland

sofern EG-Baumusterprüfbescheinigung erteilt (Nr., Datum): _

Beschreibung des Bootes

Schiffskörperidentifikations-Nummer (HIN): DE - CYBCKB70E511

Modellbezeichnung: Coenenboat CKB700 Typ oder Nummer: CKB 700

Länge (m) / Breite (m) / Tiefgang (m): 7,00 / 2,50 / 0,35

Bootstyp * : 13 - Motorboot Antrieb * : 42 Benzinmotor

Rumpftyp * : 21 - Einrümpfer Motor * : 51 - Außenborder

Baumaterial * : 31 - Aluminium Deck * : 61 - geschlossen

max. Motorleistung (PS/KW): 120 / _____ Entwurfskategorie: C

Ich erkläre und versichere hiermit, dass das oben bezeichnete Boot alle umseitig aufgeführten Anforderungen erfüllt und – sofern eine CE-Baumusterprüfbescheinigung ausgestellt worden ist – mit dem Modell übereinstimmt, für das eine CE-Baumusterprüfbescheinigung ausgestellt worden ist. Die Konformität bezieht sich auf den Ausbaurumpf der konform der Zeichnungen von VanVossen gebaut ist.

für den Hersteller bzw. den Bevollmächtigten:

Kleve 28.05.2011 Coenen, Thomas Kleve

Thomas Coenen
Siemensstr.23b
47533 Kleve
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Fax: 0049(0)2821/8969885
www.coenenyachts.com

COENEN
YACHTS & BOATS