



Bundesstelle für Seeunfalluntersuchung
Federal Bureau of Maritime Casualty Investigation
Bundesoberbehörde im Geschäftsbereich des Bundesministeriums
für Verkehr, Bau- und Wohnungswesen

Investigation Report 49/02

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Very Serious Marine Casualty:

**Sinking of the
GOTLAND**

on 15 June 2002 near Damp

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Summary

On 15 June 2002 at 14.15 h the sailing-vessel GOTLAND sank on her voyage from Kiel-Holtenau to Kappeln about 5 nm on the beam of Damp with W/SW-ly winds from the land with the average force of 6 Bft. The crew could be rescued. The ship was raised on 6 July 2002. This very serious accident at sea must be attributed to an insufficient stability of the vessel.

The GOTLAND had been inspected by an expert following the Safety Regulations for traditional vessels (SIRI), but the official ship's safety certificate had not yet been issued. Following the SIRI, a sufficient stability must be guaranteed during the whole voyage with existing freeboard and varying weather conditions.

Already during the investigation on 11 April 2003, the BSU made the following safety recommendation:

The owner, managers and navigator of the ship are asked to check whether in traditional vessels existing or still in course of reconstruction, alterations with modified height of the centre of gravity have entrained consequences for the stability of the ships that could result in endangering the ship, crew, and other persons on board.



Photo 1, GOTLAND

Vessel particulars

Name of ship:	GOTLAND
Nature of incident:	Very serious accident at sea and sinking of the ship
Date:	15 June 2002
Location:	Damp, position 54°34,8'N 010°10,9'E
Type of ship:	Sailing-vessel with motor
Nature of ship:	Remodeled war fishing cutter
Ship's call sign:	DEUA
Trade range:	Voyages in coastal waters
Building yard:	Ernst Burmester Schiffswerft KG, Swinemünde-Ost
Year built:	1942
Flag:	Federal Republic of Germany
Marine Shipping Register:	Kiel
Port of Registry:	Heikendorf
Classification:	None, surveyed following the Safety Regulation for Traditional Vessels
Construction:	Oak/larch wood on steel frames
Gross tonnage:	73,09 GRT
Length without jib-boom:	24,30 m
Draft:	F: 1,80 m A: 2,80 m
Engine type:	Diesel
Speed:	9 kn
Engine rating:	324 kW
Persons on board:	Four
Personal injury:	Four slightly injured
Property damage:	From the insurance point of view, write-off (important material damage, about 24 times the residual value, deck and wheelhouse bulged by soaking, equipment, engine and electrical equipment totally damaged)

Marine casualty

On 15 June 2002 at 14.15 h, the GOTLAND sank on her voyage from Kiel-Holtenau to Kappeln about 5 nm on the beam of Damp (see Photo. 2). Before the ship sank, the vessel OBAN, which was about 500 m ahead, made a distress call for the GOTLAND to the Maritime Rescue Coordination Centre (MRCC) Bremen. The crew of the GOTLAND, consisting of the navigator, two adult persons and a baby, could be rescued by the OBAN, a Dutch sailing-vessel.

Course of the voyage

On 15 June 2002 at 10.00 h, the GOTLAND left Kiel-Holtenau with SW-ly wind of a force of 2-3 Bft. In the Kieler Förde, the main sail (68 m²), schooner sail (65 m²) and three foresails (inner jib, outer jib, jackyard topsail) with 30 m² sail surface each and a total sail surface of 223 m² were set.

At the height of Stollergrund the SW-ly wind freshened up to 4-5 Bft. At Schwedeneck the wind came from WSW with a wind force of 6 Bft, in showery gusts it was 7 to 8 Bft, and the typical wave height was 1-1.5 m with periods of about 3 to 4 s. The schooner sail was struck in the wind. The sail surface was now 158 m².

Immediately after striking the sail, the GOTLAND fell behind until she was almost before the wind. When luffing up in a gust at a wind velocity of 42 kn. (Bft 9) shown on the anemometer, the ship heeled at first by 45° to the starboard side, without righting by her own, until she finally lay on her side, after the starboard side passage had been washed. There was no time left to make an attempt to loosen the sheet ropes.

In the outer control cabin, the skipper could hear the distress call made by the OBAN on the capsizing of the GOTLAND. After that, he jumped into the water, started the EPIRB and swam to the fore edge of the deck house. He helped his wife and child to get out of the deck house on deck, while the other crew member was already on deck. After that, all of them went to the port side of the hull. The vessel remained lying on her side despite the gust calming down and did not get back to her normal sailing position.

The water entered the ship via the starboard ventilation shaft of the engine (see Photo 13), the starboard window of the aft cabin, the starboard bathroom window and via the skylights (see Photos 18, 19, 20).

The skipper did not want to release the liferaft, fearing that it would inflate in the area between mast, deck, foremast and stay. The skipper took his child with him in a carrying-strap and had the lifebelts picked up. When the ship started to sink after about 10 minutes, all of them went into the water and were shortly afterwards recovered by the rubber dinghy of the OBAN.

After taking over to the OBAN, the shipwrecked people were looked after and, following the statements by the crew of the OBAN landed at Damp at about 04.00 h p.m. for further medical care.



Photo 2, Place of accident of the GOTLAND

Investigation

The surveys and investigations based on expertises, hearings and reports of the GOTLAND, which in the meantime has been raised, showed that several times the ship was sold to new owners and altered.

The GOTLAND was put into service in November 1942 as a war fishing cutter (KFK 146, see Photo 3), and at first served the Marineoberkommando Ost as "M 3117". From March 1943 to June 1944, the ship was in action as "NB 53" in the harbour guard flotilla of Bergen (Norway). Then the ship sailed as "V 5523" in the 5. Küstensicherungsverband, and at the end of the war, she was in Bergen, where she served the "German Mine-Sweeping Administration" and was a war-booty of the U.S. forces. In July 1946, the ship was transferred to Kiel, and in August 1946 put into service for the OMGUS (Office of Military Government for Germany of the United States). In September 1947, the vessel was reconstructed with the HDW of Kiel (Howaldtswerke-Deutsche Werft) to become a fishery vessel (see Photo 4), and by 1991, she sailed as "KIE 709", "BX 553", "SO 283" and "SK37" in the fishing industry. Due to an agreement between the government of the Federal Republic of Germany and the government of the United States of America on August 20th, 1953, all rights to the vessel were transferred to Germany. In 1955 the former "KFK 146" was registered as GOTLAND with the Maritime Ships' Register of Kiel.

The type of ship "war fishing cutter" (KFK) was designed as outpost and harbour guard craft, equipped with cannons fore and aft, with the option to use the ship later as a fishing cutter after some alterations. In total, at least 1072 KFK were ordered. In 1944, 536 KFK were in action. After the war, at least 322 KFK were used in mine-sweeping, which later were mainly rebuilt to become fishing cutters, but also surveying and wreck search vessels. Today, about 20 former KFK are still in service. The hull is robust, and was built in a composite construction of pine wood and oak wood on steel frames. As ballast, heavy spar, barite, barium sulphate, stones, or cement concrete with a weight of about 10 t each were chosen, which were stowed between the floor-plates or, in case of the cement concrete, were planked under the frame floors. The light shipweight was about 70 t with a GM of 1.1 m. In isolated cases, the hulls of the KFK were also transformed into sailing-vessels. For special actions, in 1943, the navy charged the Eckmannwerft of Hamburg-Finkenwerder to rebuild the KFK 203 and KFK 204 into sea-going sailing-vessels with a mast height of up to 21 m above deck and a sail surface of 263 m². For this purpose, additional box-type keels of 10 t weight were mounted with bolts. The displacement of the ketches was 125 t. The planning of the sails and the calculation of the stability were done by the well-known German engineer Henry Gruber.

The GOTLAND was built as KFK 146 Type G with the dimensions overall length = 24,30 m without jib-boom, length between perpendiculars = 20,57 m, width = 6,25 m, height = 3,00 m, depth = 2,82 m. At the reconstruction into a fishing cutter in September 1947, about 90 m² of sail surface were planned. A comparison to the dimensions of smaller sailing-cutters that were put in service before the First World War and had sail surfaces of 180 to 275 m² shows easily that the sail surface of 90 m² of the KFK does not constitute an actuation, but supporting sails that should damp the

rolling. In this connection, the sail surface was selected in such a way that in case of a failure of the engine there was still a chance to come near an emergency harbour with the sails set (statutes of the Finkenwerder Unterelbe-Versicherungskasse).

Since 1991, the GOTLAND is in private use and has been sold several times. Among others, she served the research project Kieler Hansekogge as base vessel and tug. The present owner rebuilt the ship on various shipyards to a sailing-vessel in 1998. Masts, the raised deck and the steel deck house were dismantled (see Photo 5). The hull was restored, and the ballast, which was cast in concrete (about 7-9 t), was removed. Following the owner's statement, 13 t lead ballast were replaced, whereas in the expertise 16 t were stated. L-profiles were welded between the frame floors, and the lead was secured against slipping by means of stainless steel ribbons. The restoration of the hull took two years. In total, 220 m of planking were replaced. By the end of 2000, the deck house was rebuilt again, and the engine was overhauled in a lock smithery.

For the masts, trees were cut that had been selected by the owner. In a transfer voyage to Klaipeda (Lithuania), the masts were lost in tow, and after a total failure, the engine could not be repaired again.

In Klaipeda, over seven months, a steel rig with masts of 24 m height above keelson and a weight of about 4 t was installed at the "Western Shiprepair Yard". These masts and the whole rig were built by the shipyard, as for the stability, following the provisions of the Germanischer Lloyd submitted by the owner. In addition, a new engine of the type Deutz 12M716 with 324 kW was installed, and various work was done on the outer planking, the electrical installations and the completion of the interior. No drawings on the rig could be submitted to the BSU.

During the reconstruction period, the sails were sewed in Poland. Late in July 2001, the vessel was transferred into the Bay of Gdansk by means of the engine, in order to pick up the sails and to continue the voyage to Rostock. In September 2001 the sails were mounted at Warnemünde. With aft winds at a force of 3-4 Bft and a maximum heeling of 12°, the GOTLAND was transferred to Elsfleth with the sails set for some remaining work to be done. No remarkable features were noted on the sailing characteristics. In April 2002 the GOTLAND participated, with guests, in the "Volvo Ocean Race" as an escort. Since June 2002, the GOTLAND had her berth at Kiel.

From the point of view of shipbuilding, over the years several alterations were performed on the hull, as compared to the reconstruction of 1947. Among others, the bulkhead to the steering gear house as well as the stern tube bulkhead were opened, but the reassembly was not done in a watertight manner. The fore engine room bulkhead was shifted for three frames towards the aft, the fore cargo bay bulkhead for two frames towards the bow, and the reassembly was not watertight either. The collision bulkhead, as the only watertight bulkhead, was a new installation by the present owner.

Qualification and crew

The ship was conducted by the 39 year old owner. He submitted the BSU a navigator's certificate for ocean-going leisure crafts with an entry as navigator of traditional vessels and a nautical Certificate of Competency with operational level as well as a General Operational Certificate. Following the owner's statement, he had served as a nautical officer on minesweepers of the Bundesmarine for five years. In addition, he had world-wide experience sailing experience with about 35,000 nm. covered. His 33 year old wife has a navigator's licence for sea-going leisure crafts and the BR sailing licence and has a sailing experience of about 12,000 nm covered. During the voyage, she mainly had to take care of her daughter, 4 months old, who was travelling with her parents. The third adult person on board was a fellow yachtsman, who had sailing experience in inland waters. However, he was well versed in the rig and the engine of the GOTLAND. Following the SIRI and the Regulation on driving licences for leisure crafts, the vessel was thus manned as prescribed.

Sailing permit

The owner intended to run the vessel as "traditional vessel following the German Regulation on the Safety of Vessels § 6 Para. 1". To this purpose, a "Gemeinnütziger Verein zur Förderung der Traditionsschifffahrt [non-profit association for the assistance of the operation of traditional vessels]" was founded on 13 July 1999. The owner has been elected president of this society for an indefinite time. The direction consists of one person. The society offers various activities via the Internet, like, e.g. wreck diving, radar training, seminars on board, sailing voyages booked by individuals and full charter operation.

Due to a jamming of applications with the Gemeinsame Kommission für historische Wasserfahrzeuge e.V. (Joint Commission for historical watercrafts, GSHW) and the sinking of the GOTLAND in the meantime, the treatment of the application was suspended. The GSHW will only perform a plausibility check, without surveying the ship herself on board. Subsequently, the records will be submitted to the See-BG for the issue of a safety certificate. Following the owner's statement, the vessel was run as leisure craft at the moment of the sinking.

Stability

For the sailing-vessel GOTLAND, no documents with calculations on the stability could be submitted to the BSU.

In 1971 a combined inclining and rolling period experience in presence of the See-BG was performed on the fishing cutter GOTLAND. Such tests are prescribed in the Regulations for the Prevention of Accidents (UVV) for fishing vessels. At this moment, the GOTLAND was still a fishing vessel with supporting sails.

The test was analyzed by the Germanischer Lloyd (GL) by order of the See-BG. During the test, a GM of 1.16 m was present, if one assumes a lading capacity of 104 t. The KG/H ratio calculated from this resulted in 0.74, the correction value for the rolling period in 0.73.

With a load of 60 t in the rooms and 10 t on deck indicated in the test record, a remaining freeboard of 0.23 m would be left. The side of the deck would come into the water at 4°, h_{30° would be 0.13 m. According to the letter by the See-BG dated 30 June 1971, these values must be considered insufficient with respect to the stability. As ordered by the See-BG, a freeboard of at least 0.45 m must be respected. Then the side of the deck would come into water at about 8°, the maximum load would be 45 t.

With the deck load stated of 10 t, acting about 0.80 m above the side of the deck, and a remaining load in the rooms of 35 t, the calculation results in the following stability values, which would still be sufficient: GM = 0.94 m, h_{30° = 0.27 m.

In February 2002, the owner had an inclining and rolling period experiment performed on the GOTLAND. As heeling weights, 12 persons were used. The rolling period was 7 s, and the extent of stability calculated by the owner from this value was 65°. All calculations and records were stored only on the board computer. Following the owner's statement, these are no more available as a result of the destruction of the computer in the sinking.

The experts for traditional vessels did not perform his own calculations of the stability, he certifies in his expert opinion on the value that 16 t of lead ballast will ensure a sufficient stability even in the heaviest sea and weather conditions. He further adds that the criteria for the stability for the sister ship NORDWIND and a ballast plan of the sister ship FREDDY as well as a graph of the lever arm with an extent of stability of 65° had been submitted. The owner did not submit neither a calculation of the stability nor a stability book.

The graph of the curve of statical stability presented by an expert of the insurance after the sinking of the GOTLAND with an extent of stability of 65° refers to vague assumptions. There were no concrete measurements of any values.

Inflatable liferaft

The liferaft was hired by the owner completely with cradle for the season and fixed temporarily with its cradle on the port side of the main deck by means of lashing straps. The pelican hook intended for the release of the raft was on the rear side and only hard to access (see Photo 16).

Stand-by craft/Sufficiently motorized craft

Following the statement by the expert of the insurance, a rubber dinghy is said to have been on deck in folded condition. The appertaining 40 HP outboard engine was stowed in a separate place. The equipment could not be found after the salvage. According to the SIRI a sufficiently motorized craft must be at hand, which can put into the water quickly and easily. Following the safety plan, the craft should be placed on the main deck at the fore edge of the bridge. However, at the survey by the BSU on 4 March 2003, no fixing devices, like lashing eyes or racks, respectively, for the storage of the craft were present.

Wind force measured

Following an expert opinion by the Deutscher Wetterdienst, at 02.00 p.m. at the place of the accident there was an off-coast, w/sw'ly wind, which achieved a force of 6 Bft on average and in showery gusts forces of 7 to 8 Bft. Gusts of the force of 9 Bft (> 41 kn) were not even measured at the lighthouse of Kiel in an anemometer height of 30 m. The heaviest gusts measured here were after the capsizing with 37 kn (8 Bft) between 03.00 and 04.00 h p.m..

Salvage

Before raising the GOTLAND, main mast and schooner mast were welded off under water. (see Photo 17). Both masts were disposed of. At the survey by the BSU on 4 March 2003, only the mast stump of the main mast, present in the superstructure, and parts of the schooner mast could be found.

On the main deck at the aft edge of the schooner mast, the cover of the starboard skylight was missing (see Photo 18). The cover of the skylight at the fore edge of the wheelhouse were loosely lying on the coaming (see Photo 19).

After the salvage it became evident that parts of the solid ballast in the form of plumb blocks had slipped by about 1,3 m.

Survey at the shipyard

On 4 March 2003, the BSU surveyed the GOTLAND at the “Heinrich Eberhard Werft” at Arnis (see Photo 6).

Various work was done on the vessel. An additional keel was installed with side plates and a keel plate. The additional keel is supported by means of bolts, which are screwed vertically through the wooden keel with nuts on the inner keel. In addition, the plates are horizontally “heat-riveted” by means of bolts through the outer keel (see Photo 14).

The engine (see Photo 9), two settling tanks, one daily service tank, one water tank and one sewage tank were measured.

The bulkheads have been shifted, with the exception of the aftpeak bulkhead and the aft engine room bulkhead – both bulkheads are not watertight (see Photos 10, 11). The fore collision bulkhead is the only bulkhead to be watertight .

The bulwark heights are amidships 0.80 m, near the main-mast 1.08 m and at the bow 1.30 m (see Photo 12).

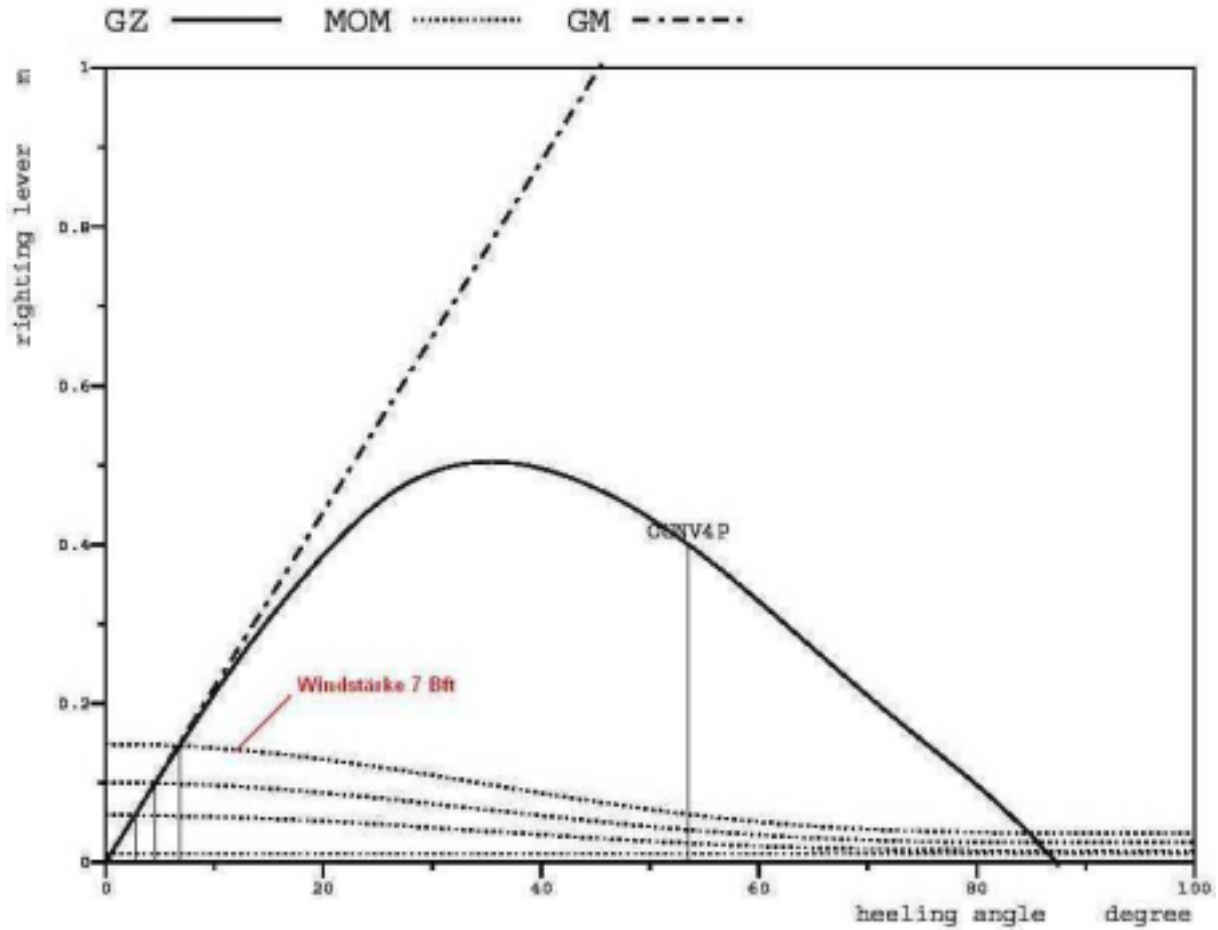
The additional weights of the alterations, measured at Arnis on 4 March 2003, and calculated following the documents submitted, are in total 6345 kg with a height of the centre of gravity of 9.22 m above the base (inner edge of the keel on the main frame). This includes the schooner mast, main mast, yard, schooner boom, main boom, jib-boom, wheelhouse, the tiled bathrooms and the wheelhouse top and main deck made out of Kambala.

At the moment of the sinking, following the navigator’s statement, the daily service tank was full, water, sewage, and settling tanks almost empty; the fore draught was: 1.70 m, aft: 2.70 m.

Calculation of the Stability

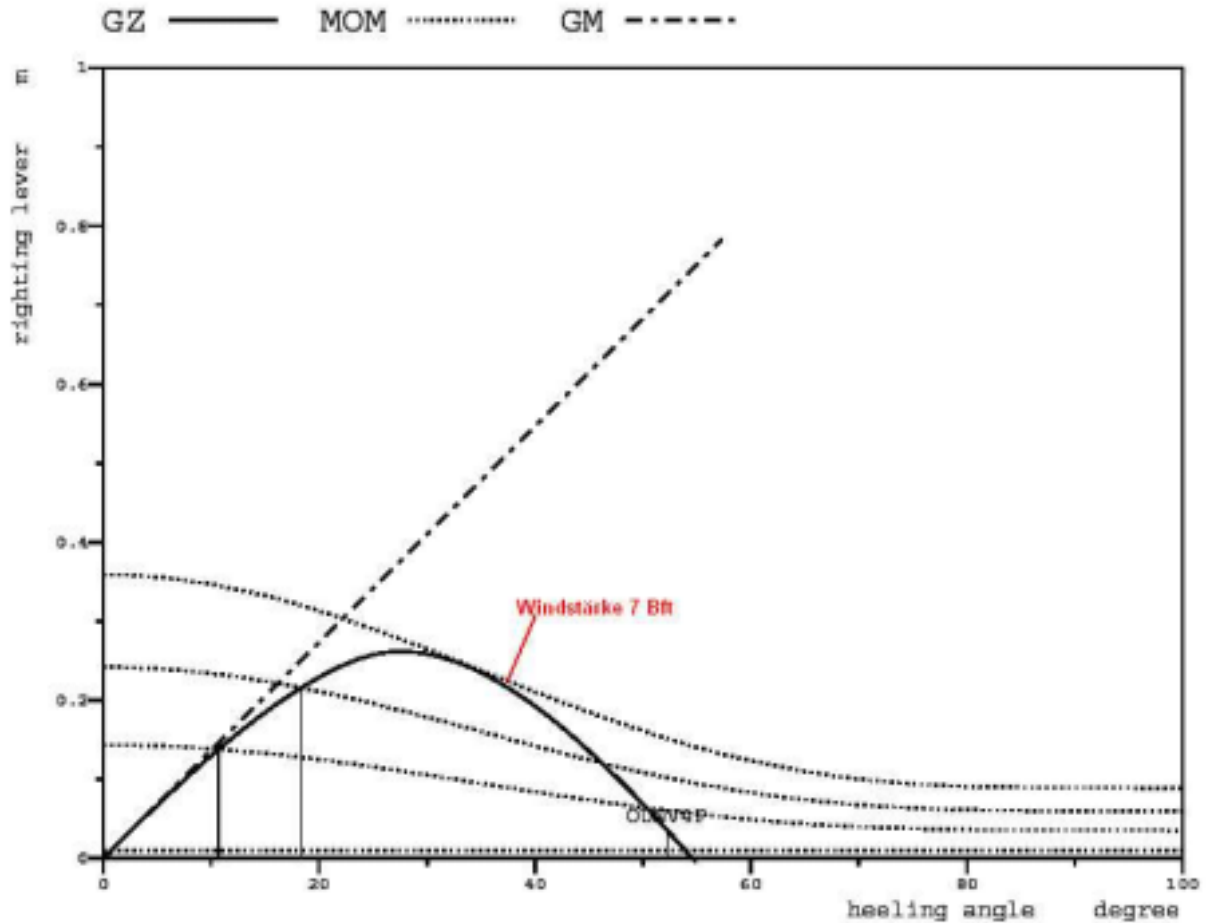
The “Fr. Lürssen Werft” in Bremen manages the archive of the shipyard which built and completed 389 KFK in the Second World War. Following the curve sheets and ship’s drawings of the “KFK 146”, which were handed out to us, as well as the calculations of the stability performed by the See-BG (see above) and the details given on the alterations, the BSU charged by the Company Ship Design & Consult GmbH with the calculation of the extent of the stability and the lower flooding angle of the openings at a water entry as well as of the leakproof condition in case of a flooding of the recreation-room of the GOTLAND at the moment of the accident. Following these calculations, the weight of the empty vessel after the reconstruction as sailing-vessel had increased by about 7% and the height of the centre of gravity with a GM of 0.78 m increased by about 21 %. The weight of the sails, consisting of the main sail, inner jib, outer jib and jackyard topsail, totalling to 71 kg, were omitted in the calculation of the stability.

Curve of statical stability for the fishing cutter before the reconstruction, with sails set



The dotted lines refer to the wind forces of 4-7 Bft. "OUNV4P" (see Photo 13) designates the ventilation shaft of the engine room after the reconstruction.

Curve of statical stability for the sailing-vessel with sails set at the moment of the accident



The dotted lines refer to the wind forces of 4-7 Bft. "OUNV4P" designates the ventilation shaft of the engine room, which was the first to make water.

Assessment

Due to the great number of KFK built, there are sufficient experiences with respect to the hull and the behaviour at sea of these vessels in their action during the war and in later alterations into fishing cutters. Generally, the vessels are attested an excellent behaviour at sea and good manoeuvring qualities. During the years of the war, the KFK 249 was the only one to be lost without enemy action in a storm at the western coast of Jutland.

In this reflection, however, one must distinguish between the types of KFK as a warship, as a fishing cutter and as a sailing-vessel. For industrial fishing cutters, the See-BG imposes certain conditions, so that sufficient freeboard and stability are respected. The GOTLAND was used as a KFK, as a fishing cutter and as a sailing-vessel, and for these different purposes, it was altered several times. In the original

condition, there were only few KFK that were used as sailing-vessels immediately after construction. KFK 203 and KFK 204 fall within this category. Contrary to the hulls of the other KFK, both the vessels had 10 t box-type keel fixed with bolts in addition to the permanent ballast of 10.6 t. The heights of the masts were 21 m above deck with a total sail surface of up to 263 m² and a displacement of 125 t. The stability was calculated by the shipyard.

Following the records by the BSU, the GOTLAND had, when she sank, a permanent ballast in the form of plumb plates of about 13 – 16 t, which were stowed between the frame floors. The underwater hull was not modified correspondingly by adding a keel on the underside that would have improved the stability. The height of the mast was with 24 m above keelson almost the same as in KFK 203 and KFK 204, and the total sail surface was 253 m² without the 90 m² of the wide foresail. Following the opinions by two experts the GOTLAND would have been capable to carry about 300 m² of sails.

The owner has no plans or records on the stability showing the condition of the GOTLAND at the moment of the sinking. The inclination and rolling period experiment performed by the owner himself is only useful with limitations and is not sufficient to assess the stability of the vessel. On the few voyages with the GOTLAND, there were no problems with the stability, as per the owner's statement. No sea trials were made with strong wind, in order to test the behaviour of the GOTLAND at sea. No inclination experiment by experts for the determination of the exact centre of gravity and the displacement, an experiment required as basis for the preparation of records on the stability, were performed on this vessel after the major alterations that deteriorated the stability.

The results by the experts from their surveys were partially incorrect. One must also doubt whether really 13-16 t of permanent ballast were present, as the mean draught is by 20 cm lesser than the designed draught and the draught determined in the inclination experiment ordered by the See-BG in 1971. The comparison with the sailing-vessels "Freddy" and "Nordwind" is only possible with limitations, as the rig and superstructures are not comparable. The expert opinion prepared after the sinking by the experts of the insurance concerning the assessment of the stability was based on lacking values measured and was useless.

In her original condition, the vessel has a sufficient stability and partially met the requirements for modern sailing yachts. The height of the centre of gravity raised by the reconstruction and at the same time the strongly augmented sail surface with a lateral centre of gravity increased in its turn, each of these two facts had a negative effect on the stability of the vessel. The righting moment of the vessel has decreased by the alterations, and the heeling moment by the wind has increased by the augmentation of the sail surface and the increased centre of gravity of the sails.

The calculation of the stability analyzed by the BSU and by the company of Ship Design & Consult GmbH showed that the summing up of these negative effects resulted in that the vessel had to capsize, with the sails assumed and with a wind force of about Bft 7 in gusts, as in this case the heeling lever arm is greater than the righting one, and the extent of the positive graph of the lever arm at the moment of the acci-

dent was only about 55°. In a checking up, a slipping of about 20 pieces of the plumb block ballast with a weight of 790 kg by 1.3 m resulted in a heeling angle of 0.8°, thus, it cannot be the cause of the capsizing. It is not clear whether the plumb blocks slipped before capsizing or only after the salvage. During the time as a fishing cutter, the extent of stability was almost 90°, and gusts of 10 Bft were not critical, following the calculations for the fishing cutter.

The seal of the vessel is not in keeping with the usual standards, as the openings on the main deck could not be closed in a watertight manner. The skylights have no sealings and dogs, so that it was technically impossible to close the openings against the blow of the sea. There was no possibility to mount blinds against bad weather or hatch tarpaulins (see Photo 18-20). However, this fact cannot be considered as cause of the accident, but it only accelerated the sinking of the vessel, as additional calculations show that with existing seal, the alteration of the GOTLAND was so serious that it would capsize without sails, i.e. before top and tackle, under static conditions and still water at right angles to the waves at a wind force of 11-12 Bft.

The shifting of the original bulkheads of the former cargo hold had as a result that on flooding this room, the vessel sinks about 0.4 m more than on flooding this room before the alteration, proceeding on the assumption that these bulkheads were installed completely watertight up to the outside planking. This fact reduced the safety of the vessel, but it had no major effect on the course of the accident, as the first opening to come to the water was the ventilation shaft (OUNV4P), thus the engine room would have been the first to be flooded in a capsizing, not the cargo hold/recreation room. This is confirmed by the owner's statement who says that the vessel first capsized and then sank over the poop. Then however, by sinking deeper and heeling, the skylights of the cargo hold/recreation room quickly reached the water and accelerated the sinking.

The liferaft was fixed in inappropriate manner. The cradle was not lashed but temporarily, and the pelican hook pointed at the bulwark. By that, the release of the lashes was hampered. It would have been almost impossible to lift the liferaft allowed for 65 persons over the bulwark, due to its weight of 189 kg. A functional check at the maintenance company showed that the painter line had not been pulled out completely and about 1 m of the total length of 26 m was left in the receptacle.

If the GOTLAND had had a valid ship's safety certificate following SIRI a sufficiently motorized craft would have had to be on board. It could not be ascertained for a certainty whether there was a craft on board that also could have been used for rescuing the shipwrecked persons.

Conclusions by the BSU

The cause of the accident was the insufficient stability of the GOTLAND. No reliable and realistic calculation of the stability have been submitted. The expert opinion following the SIRI and the corresponding guidelines allow voyages without exact records on the stability on board. The expert for traditional vessels will only certify that

construction, design, materials used, safety equipment, fire protection and manning meet the requirements of the SIRI. In addition there is an instruction that the check list (guidelines) for traditional vessels is part of the so-called “Provisional Safety Certificate for Traditional Vessels”.

Annex 4 of the SIRI, sea state capability, Para. 6, makes the following demands: “A sufficient stability must be guaranteed during the whole voyage with existing freeboard and varying weather conditions.” The guidelines for the practical application of the SIRI, under the item sea state capability, do no longer include the question “Sufficient stability”.

An expert for traditional vessels may certify that the vessel meets the SIRI, without further conditions, and without putting this in concrete terms. Even the shipbuilding alterations were sufficient to meet the SIRI. Normally, this certification results, after a formal check by the GSHW and See-BG, in the issue of the ship’s safety certificates, without additional surveys being made. In Germany, the experts are appointed by the Chamber of Industry and Commerce following the regulations on experts. The precondition is the personal and professional qualification. For the professional qualification, the professional preconditions for nominations valid in the whole Federal Republic of Germany are taken as basis. For traditional vessels, there is a guideline and orientation for the field of the traditional vessels, which require, among others, that the experts must prove years of experiences in the restoration of traditional vessels, in particular in wooden constructions as well, referring to Annex 4, nos. 6 and 7 of the SIRI, which demands a “sufficient stability” and “stability of the hull”.

Contrary to the expert opinions, the seal of the vessel could not be obtained by technical means. The openings of the deck (skylights), fore edge of the wheelhouse on port and starboard side, and aft edge of the schooner mast on port and starboard side had neither rubber sealings nor dogs or other equivalent devices, in order to achieve a sea-tight sealing analogous to the freeboard agreement of 1966, Rule 18 combined with Rule 12 Para. 1. The coaming heights of the skylights were assessed very low.

The vessel first filled with water via the open ventilation shaft of the engine on the starboard side. The skylights, the open window of the fore edge of the bridge, and an open bathroom window as well as the open ventilation shaft of the engine on port side accelerated the sinking. The three hatches of the bulkheads were closed. However, in the aft portion, no watertight conditions towards the engine could be achieved, as the area of the tail wave was permeable. By the pressure of the water streaming in, the hatch in front of the collision bulkhead broke, which resulted in that the forecabin filled with water. An eye-catching feature of the design is the collision bulkhead, which, after the initial construction, was shifted far towards the bow, for which, apart from the sketch prepared by the BSU (see Photo 5), no drawings could be submitted to the BSU.

With sufficient stability, the wind and sea conditions would not have resulted in a capsizing. During the rescue, a rubber dinghy of the OBAN sufficed to rescue the shipwrecked persons, without any problems with seaway. The crew of the OBAN told about good sailing weather.

The inflatable liferaft was fixed in an inappropriate manner, and the fixation did not meet the SIRI. It was impossible for the raft to float freely. The liferaft would have started if the painter line would have been pulled completely.

The sheet ropes could not be released, in order to remove the pressure from the sails. The engine could not be started in time, in order to turn the ship into the wind and, if necessary, strike the mainsail and the foresails. The liferaft could not be raised over the bulwark. A possibly existing motorized craft, which was tightly lashed and uninflated, could not be put into the water. These neglects are possibly due to insufficient and unqualified crew.

In the SIRI and in leisure shipping there are no concrete instructions on the number of crew members. Here, the owner must decide based on his own good seamanship. § 11 of the Regulation on the navigator's certificates for sea-going leisure crafts directs only the principles for the normal manning of traditional vessels consisting with owners of nautical and technical qualification certificates. The determination of the sufficient number and the qualification of the crew members on his vessel must be done by the owner or the manager, respectively, taking into consideration the organization of the operations and the course of the voyage intended. With a hull length of 15 to 25 m, as in the case of the GOTLAND, it may be sufficient if at least one member of the nautical staff has the navigator's certificate for sea-going leisure crafts/sailing or navigator's certificate for ocean-going leisure crafts/sailing as qualification. Alternatively, the owner may also possess an analogous nautical Certificate of Competency with a sailing experience comparable to the proof of experience.

The procedure following the SIRI results in that a great deal of the competence of decisions is left to the expert, owner and navigator. If necessary, they are construction supervisors and experts at the same time and must decide following their own seamen's experience, as there are no exact requirements with respect to design alterations, stability, seal of the vessel and calculation of the leakage as well as number of crew members and passengers in the SIRI.

In the commercial shipping, the following procedure is observed in case of alterations:

- Preparation of drawings and calculations of the alterations as well as verification with a classification society
- Verification and approval of the documents submitted
- Alteration under the supervision of the classification society
- Final acceptance and issue of certificates or attestations

Contrary to the commercial shipping, in this case, the procedure following SIRI in surveying and assessment according to the existing standards was violated. The See-BG does not make any other findings, nor does it perform any surveys of its own for vessels following N^o 1.1 of the SIRI with less than 80 persons on board, if, among others, an expert opinion by an officially appointed and sworn expert has been submitted. Nor does the GSHW, in normal cases, make its own surveys.

Passenger-ships following SOLAS, in case of a deviation of 2 % in the empty weight of the ship or 1 % change in the height of the centre of gravity, must submit a new proof of sufficient stability. The weight of the ship is verified every fifth year. In the case of the GOTLAND, the empty weight of the ship has increased by 7 % and the height of the centre of gravity by about 21 %, without that the stability being examined sufficiently.

Safety recommendations

Due to the vague and inexact stability requirements of the SIRI as well as the responsibility, which falls on the experts for traditional vessels, owners and navigator, the BSU, in April 2003, issued the following safety recommendations.

The Bundesstelle für Seeunfalluntersuchung (BSU), following § 15 Para. 1 and § 15 Para. 10 Seesicherheits-Untersuchungs-Gesetz (SUG) (Maritime Safety Investigation Law) dated 24 June 2002, in connection with § 19 Flug-Unfall-Untersuchungs-Gesetz (FIUUG) (Law Relating to the Investigation into Accidents and Incidents Associated with the Operation of civil Aircraft) issues the following safety recommendation.

The Bundesstelle für Seeunfalluntersuchung (BSU) makes investigations in the case of a capsizing and subsequent sinking of a remodelled sailing-vessel still in the procedure of approval as traditional vessel in 2002 in the Baltic Sea at the height of Damp.

This examination is not yet finished, however, already at this moment it may be stated that following alterations with elevated weights and by the installation of heavy steel masts, in connection with an augmentation of the sail surface, a massive loss of stability as well as an insufficient seal existed before the capsizing.

After a consultation held with the See-Berufsgenossenschaft (See-BG) and the Gemeinsame Kommission für historische Wasserfahrzeuge e.V. (GSHW), the BSU addresses the owners, managers and navigator of traditional vessels existing or in course of alteration as well as the recognized experts for traditional vessels.

As due to the approaching season for traditional vessels one might have to face similar accidents and in some cases even human lives could be in danger, the BSU following § 15 Para. 1 SUG in connection with § 19 FIUUG refers to the following:

In the “Safety Regulations for traditional vessels” Annex 4 - sea state capability – point 6 concerning the stability says:

“During the whole voyage, sufficient stability must be guaranteed with existing freeboard and varying weather conditions.”

The persons responsible for the respect of the sufficient stability are the owners, managers and navigator of the vessels. The guidelines for the practical application of the Safety Regulation for traditional vessels does not provide any verification and certification as for sufficient stability, stability criteria that are defined exactly, curves of the limits of stability as well as the existence of verified stability books.

In case of former commercial ships that now are in action as traditional vessels without alterations, there are normally records on the stability from their first use on board, which were issued based upon a inclining experiment at the shipyard. In case of major alterations that modified the centre of gravity after putting out of service, the "Merkblatt zur Sicherstellung der Stabilität von Traditionsschiffen" [Memorandum for ensuring the stability of traditional vessels] by the GSHW should be observed, as well as the advice of experts, like, e.g., the classification societies and the See-BG, should be sought.

Therefore, BSU makes the following recommendations:

The owners, managers and navigator are asked to check whether in traditional vessels existing or still in course of reconstruction, alterations with modified height of the centre of gravity have entrained consequences for the stability of the vessels that could result in endangering the vessel, crew, and other persons on board.

(issued on 11 April 2003)

After the completion of the examinations, the BSU recommends:

In addition to this safety recommendation dated 11 April 2003, the Safety Commission, following the Safety Regulation for traditional vessels (SIRI) Para. 5 "Adaptation of the Guideline", should verify the following proposals for the further development the guideline and its adaptation to the latest state of the art:

- **The Guidelines for the practical application of the SIRI should be revised under current N° 2.11 "sea state capability" in such a way that the experts will be obliged to verify, assess, and certify the existence of records on the stability.**
- **The See-BG or the GSHW, respectively should perform a ship's survey before the first issue of the ship's safety certificates and after major alterations.**
- **The SIRI should fix a minimum crew for each type of ship.**
- **In the SIRI, precise requirements for the stability, the calculation of the leakage, the seal and the procedure of approval for alterations should be defined.**
- **Larger alterations should be realized under the supervision by a classification society, the See-BG or a recognized expert.**

Sources

The examination report refers to the investigations made by the water police departments of Flensburg and Kiel, to an expertise on traditional vessels, an expertise prepared for the insurance, an expertise prepared by the company of Ship Design & Consult GmbH Hamburg ordered by the BSU, findings and interrogations as well as a ship's survey performed by the Bundesstelle für Seeunfalluntersuchung.

Other institutions that participated in the investigation are See-BG Hamburg, Germanischer Lloyd Hamburg, Deutscher Wetterdienst Hamburg, BSH Hamburg, the Gemeinsame Kommission für historische Wasserfahrzeuge e.V., the Chambers of Industry and Commerce of Hamburg, Flensburg and Kiel, the shipyards of Fr. Lürssen of Bremen, Howaldtswerke-Deutsche Werft AG of Kiel, Western Ship Repair of Klaipeda, the company of K&M Rettungsgeräte Liferaft-Service GmbH Kiel.

The investigation was conducted in conformity with the law to improve safety of shipping by investigating maritime casualties and other incidents (Maritime Safety Investigation Law - SUG) of 24 June 2002. According to this the sole objective of the investigation is to prevent future accidents and malfunctions. The investigation does not serve to ascertain fault, liability or claims.

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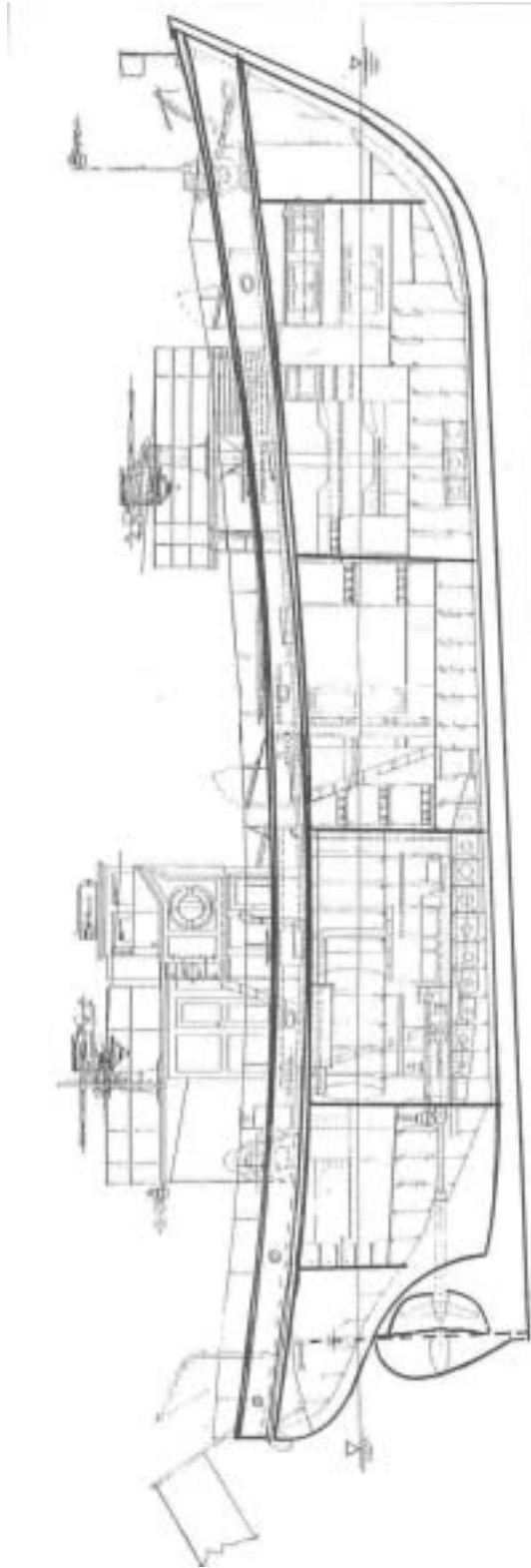


Photo 3, KFK (war fishing cutter)

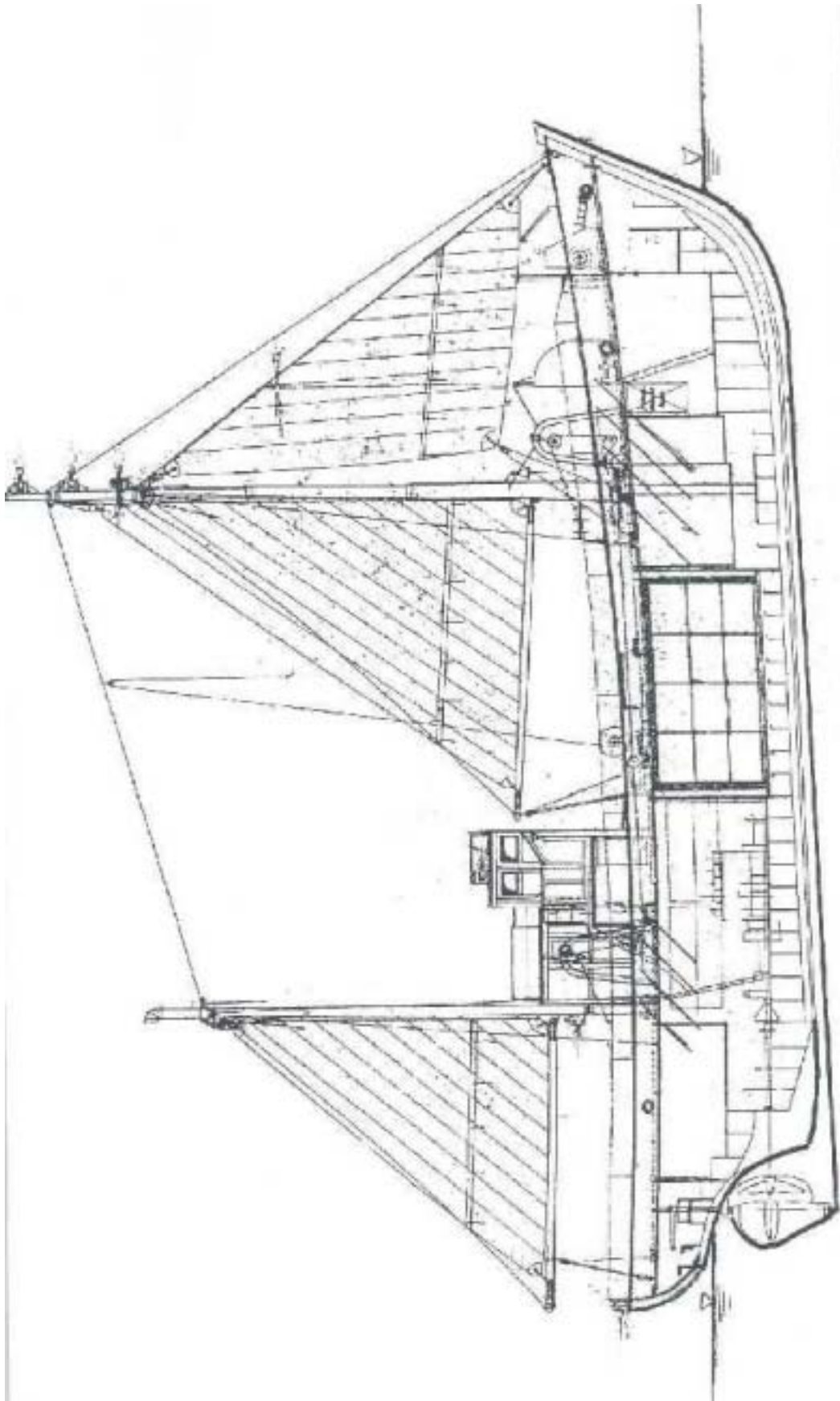


Photo 4, Fishing cutter

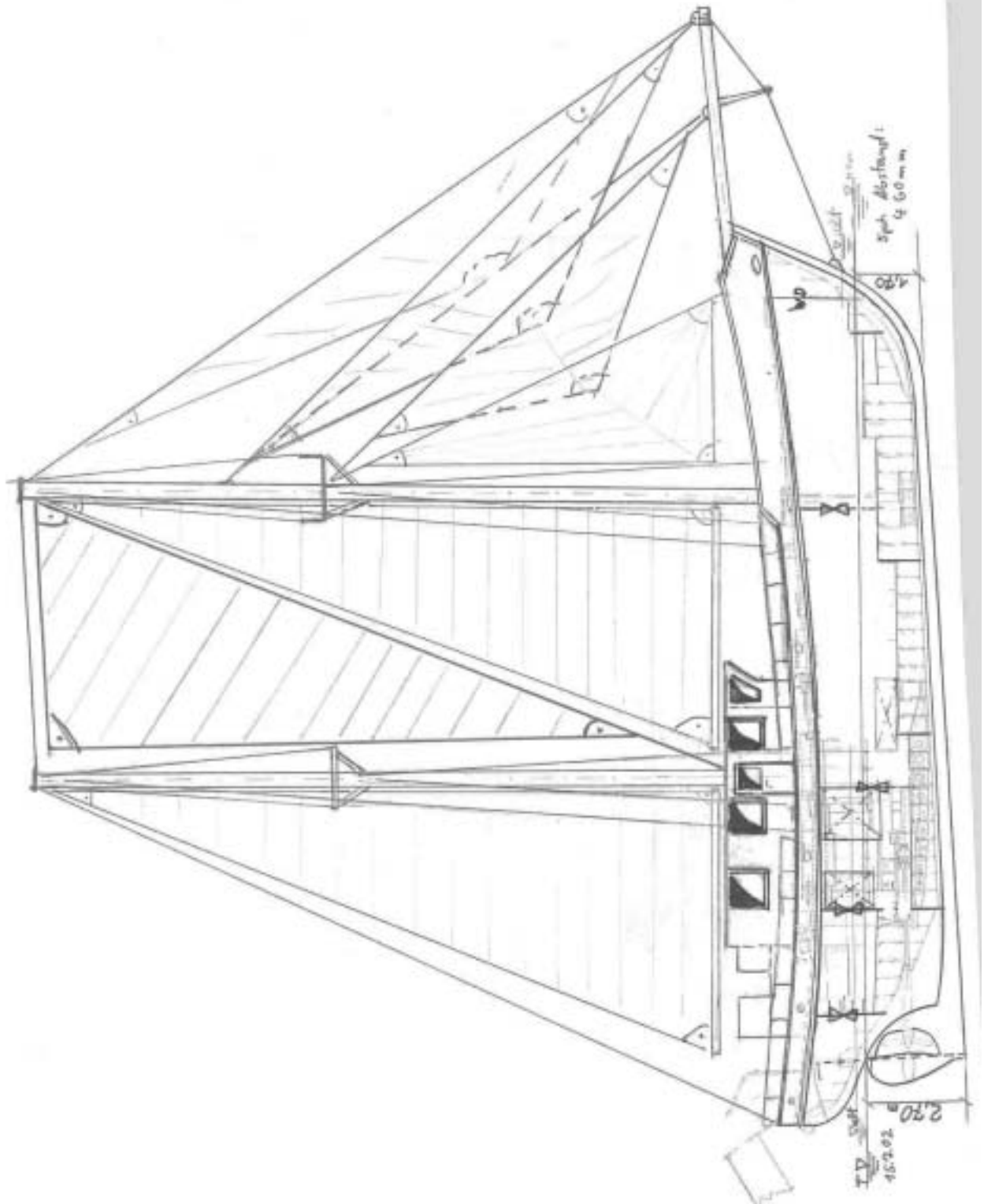


Photo 5, Sailing-vessel



Photo 6, Shipyard of Arnis



Photo 7, Superstructures



Photo 8, Portside bathroom



Photo 9, Engine



Photo 10, Aft bulkhead door



Photo 11, Front bulkhead door and skylight



Photo 12, Portside bulwark



Photo 13, Starboard ventilation shaft (OUNV4P)



Photo 14, Box-type keel



Photo 15, Deck superstructures



Photo 16, Liferaft support



Photo 17, Salvage



Photo 18, Skylight aft edge of schooner mast without cover



Photo 19, Skylight fore edge of wheelhouse, closed



Photo 20, Open skylight after the salvage



Bundesstelle für Seeunfalluntersuchung
Federal Bureau of Maritime Casualty Investigation
Bundesoberbehörde im Geschäftsbereich des Bundesministeriums
für Verkehr, Bau- und Wohnungswesen

Annex

to the

Examination Report 49/02

Differing Opinions
following § 17 FIUUG

15 September 2003

Very Serious Maritime Casualty:

**Sinking of the
GOTLAND**

on 15 June 2002 near Damp

Following § 17 FIUUG Para. 2, in connection with § 15 Para. 1 SUG, any differing opinions are enclosed as annexes to the examination report if they are not taken into consideration in the report itself. According to § 17 FIUUG Para. 1 in connection with § 15 Para. 1 SUG the BSU, after sending the draft of the report to the managers, owners, navigator and crew members as well as the See-BG, GSHW, BMVBW and the experts for traditional vessels, has received two opinions. Single statements from the opinions that were not taken into consideration in the examination report are quoted in the following:

Statement by the GSHW

The GSHW asks for the consideration of the following points of criticism, and in particular suggests to the recommendations in such a way that the basic principles of the procedure actually in force for issuing a safety certificates are always respected. This procedure is characterized by the owner's/manager's direct responsibility, by a survey and expert opinion – not by anybody, but by an officially appointed and sworn expert for the fields “voyages of traditional vessels” and “radio equipment”, by a person that has been recognized by BSH as expert for the field of marine radio, check by the GSHW of the whole application, including the expert opinion, for completeness and plausibility, based upon the SIRI for traditional vessels, and issue by the See-BG.

The very serious accident at sea must be attributed to a serious shortage in the manning of the vessel with crew members, to faults of seamanship in the control of an incoming gust, to serious faults in the feasibility of the closure and to the insufficient stability of the vessel.

Even if a reduced stability was obviously a substantial cause of the accident, this conclusion is yet too unilateral, taking into consideration the operational attendant circumstances of the capsizing only to an insufficient extent:

- The number of crew members available for the control of the sails was not sufficient.
- The sheet ropes could not be released in time.
- The principles of seamanship were not respected.
- The seal could not be obtained.

Following the reporting it must be left undecided whether the vessel would have sunk if a seal could have been obtained and this would have done in time as well as if it had been possible to take the pressure from the sails. However, for the conclusions from the accident with respect to the safe operation of traditional vessels, such a determination and description would be important. Depending on the sail surface and wind force, even for stable sailing-vessels a “knock down” cannot be excluded. Therefore, a conclusion as to the conditions under which in this casualty the sinking would not have occurred, is an important aspect for safe working conditions.

Following the Regulation on navigator's certificate for leisure crafts, with respect to of the nautical staff the vessel was manned as prescribed by the owner's proof of qualification. The same result is obtained if one takes as a base the Regulation on navigator's certificates for sea-going leisure crafts, which, among others, rules the man-

ning of traditional vessels. According to that, on traditional vessels up to 25 m hull length with the sails set one owner of a navigator's certificate for sea-going leisure crafts (sailing) is prescribed as regular crew, and for voyages of more than 10 h, an additional owner of a navigator's certificate for sea-going crafts is required (§ 11 Para. 2 in connection with Annex 4 of the VO). These requirements were met in the owner's person, as no voyage of more than 10 h was planned.

However, the vessel was in extreme shortage of crew members, as sailing yacht and as a traditional vessel. As it was a sailing yacht, N° 2.1 of the Safety Regulations for sailing yachts of the cruiser department of the Deutscher Segler-Verband e. V. (DSV) in connection with § 3 SchSG applies, following to which the owner/skipper must do anything, in order to ensure that the yacht is manned with an experienced crew, who physically is able to stay bad weather. For traditional vessels the Regulation on navigator's certificates for sea-going leisure vessels prescribes that the owner/managers lays down the number and qualification of the crew members on his vessel, taking into consideration the operational organization and the intended course of voyage (§ 11 Para. 1 num. 5 of the VO). This has not been done here in any way. For sailing manoeuvres, on the GOTLAND you need, apart from the helmsman – here this was the navigator – at least three or four other deck-hands, that is, one or two on the forecastle for the control of the three foresails and one or two on the superstructure for the control of the mainsail and of the schooner sails. In fact only one deck-hand was on board, that was the fellow yachtsman, with sailing experience on inland waters. The owner's wife is completely out of question as a deck-hand, as she had to take care of her 4-months-old daughter and indeed did so.

The GSHW regrets a critical appreciation of the seamanship shown when the gust was approaching. A qualified navigator with sailing experience will observe the weather, recognize the fact that a gust is possible, and will see it coming in time, so that he is able to start counteractions. With the size of the vessel and the kind of tackle and arrangement of the lines, the sails, taking into consideration a single deck-hand, would possibly have had to be reduced even earlier and even more than in fact was done. Instead of charging the fellow yachtsman with the release of the sheet ropes, the navigator possibly sent him under deck to start the engine. Even the luffing up with standing sails would have to be queried from the point of view of seamanship.

With respect to the space on relatively small traditional vessels, the SIRI does not require the liferafts for traditional vessels to be manned outboards. Instead they should be able to float freely after release by the starter or released by the water pressure. In this respect, the position of the raft must be assessed. In addition, the function is not guaranteed if the painter line is too long and does not release. Here, a conclusion on the safety regulations, and, if necessary, the recommendation of a painter line is required.

The SIRI for traditional vessels demands stand-by crafts only for vessels of the group C in the foreign-going shipping all over the world. Vessels like the GOTLAND must have a sufficiently motorized craft on board. This craft is not prescribed as life preserver. Lifecrafts are not even required on merchant vessels of comparable size. The sufficiently motorized craft shall improve the possibility to rescue persons in case of

man overboard, especially on sailing-vessels, where the danger of falling overboard is assessed greater than on motor vessels. As for vessels of the group A, they totally do without crafts, as the manoeuvrability and side heights of these smaller vessels are more suitable for that by themselves.

The SIRI for traditional vessels must be revised in its Annex 4 “sea state capability” in such a manner that test criteria are prescribed, according to which the owners or the managers, respectively, must check the stability of their vessels, and that the result of the verification is documented in the guidelines and by the opinion of the expert. The planning of alterations and parts build in with respect to modifications in stability and qualification must be included immediately in a test procedure for the use by the owners or managers, respectively, which is also documented via the guidelines and in the safety expertise.

In a close and trustful co-operation GSHW, See-BG and the competent Chamber of Industry and Commerce ensure that the experts’ qualification meets the requirements.

Within the scope of the SIRI for traditional vessels the owners or managers, respectively, are obliged to determine the manning with qualified seamen depending from the requirements of the operation and to identify it in the log-book in a controllable manner. In cases of doubt, an expert must be called in for advice.

Statement by the Owner and navigators

The masts were not dimensioned by me, but I only made the prescriptions by GL which I had brought with me available to the shipyard. The shipyard designed the whole rig. I only marked off the drawings prepared there in the usual manner. Copies of these drawings should still exist at the shipyard.

An expertise on the weather may surely confirm the weather conditions and the direction and force of the wind. However, it cannot find out local circumstances retroactively, without exact data measured. From my point of view, the gust that caused the accident was a “micro-burst”, caused by a local “embedded CB”. This meteorological phenomenon is locally very much limited and cannot be refuted by a measure by an anemometer some miles apart. Such “micro-bursts” can develop considerable wind velocities, by far above the wind velocities of the surroundings and by far stronger than the usual gusts. Their force is concentrated in a very much restricted space. By the way, a phenomenon that is feared in aviation almost to the same extent as the “wake turbulences”, the whole forces of which can also concentrate in a space so much restricted that they can cause mechanical damages on aeroplanes. In any case, it is untrue that the skylights could not be closed. Rubber sealings are not prescribed – or do, for instance, the old stone fishermen or the like, who cover their cargo bays with wooden boards, dispose of rubber sealings? The freeboard agreement does not apply to this case. In these cases, there is no provisions on coaming heights. The assessment is merely subjective and incorrect.

Addition to the official expert opinion by the Deutscher Wetterdienst (DWD)

The BSU asked for an addition to the official expert opinion by the DWD dated 18-03-2003.

This addition is considered required, as in Exhibit 2 (navigator's statement) considerations are made that shall refute the declarations made in the expert opinion with respect to the meteorological statements on the wind.

The terms "micro-burst" and "embedded CB" referred to in Exhibit 2 are no terms usual in sea-navigation, but are clearly borrowed from the aviation, and thus are applicable mainly for the upper layers of the atmosphere.

Of course, in the boundary layer between water and air, turbulent thermal shifting processes take place as well, if the physical preconditions suitable for that are given. Unstable conditions of the layers, i.e. if cold air blows over a warm water surface, are favourable to the development or increase of gusty wind conditions due to convective vertical rearrangements. However, in almost all of the Central European sea areas these conditions exist in particular in the autumn months, but not in spring or early summertime.

On 15-06-2002 in the westerly Baltic Sea the layers in the lowest air layer (sailing layer, up to about 20 m height) were arranged in a stable manner, with a water temperature of 16°C and an air temperature of 18 to 19°C. Therefore, the development of a micro-turbulence caused by thermal currents that would additionally increase the gusts of the wind may be almost ruled out in this case.

Thermodynamic assessments for the upper air layers, in which with the prevailing weather, quite unstable conditions prevailed, resulted in that the preconditions for gusts of > 8 Bft would have been very unlikely.

In this respect, there is no reason why one should revise the statements made in the expert opinion with respect to the wind conditions, especially on the force of the gusts.

The investigation was conducted in conformity with the law to improve safety of shipping by investigating maritime casualties and other incidents (Maritime Safety Investigation Law - SUG) of 24 June 2002. According to this the sole objective of the investigation is to prevent future accidents and malfunctions. The investigation does not serve to ascertain fault, liability or claims.

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