

CASUALTY REPORT

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Case: 199940518

DIVISION FOR INVESTIGATION
OF MARITIME ACCIDENTS

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STEVNS POWER

Capsizing and foundering during anchor handling operation on 19 October 2003



The purpose of investigating accidents at sea is to obtain information about the actual circumstances of the accident and to clarify the causes and the sequence of events that led to the accident in order that the Danish Maritime Authority or others can take measures to reduce the risk of recurrences. The aim of such investigations is not to take a position on the aspects of criminal liability or liability for damages in connection with the accidents.

Unauthorised translation. This is a translation of the authentic report in Danish language.

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1. Summary

STEVNS POWER was operating as anchor-handling vessel for the derrick pipe lay vessel CASTORO OTTO that had begun the laying of a gas pipe off the coast of Nigeria. They had begun the laying of the gas pipe in September 2003. However, STEVNS POWER had been operating for CASTORO OTTO regularly the previous two years

On 19 October 2003, late in the afternoon, STEVNS POWER was going to relocate anchor no. 10 to a new position. The ship sailed to the anchor buoy, took it on board and pulled in the wire making the anchor clear of the seabed. This was informed to CASTORO OTTO. After this, they began to pull in the anchor wire on CASTORO OTTO. STEVNS POWER was manoeuvring astern towards CASTORO OTTO concurrently with the anchor wire was recovered.

When 2/3 of the anchor wire had been pulled in, STEVNS POWER began to make a turn while the ship continued astern. This was done in order to make the wire follow a straight line to the new anchor position and this was a normal procedure.

During the turn where they continued to pull the anchor wire from CASTORO OTTO, STEVNS POWER's speed sailing astern reached 6-8 knots, which is high during anchor handling. Furthermore, the pulling of the wire became more athwart because of the turn.

The turn, the relatively high speed and the athwart-ships' pull made STEVNS POWER heel over. As the ship had a low freeboard, water emerged on the aft deck in the port side.

STEVNS POWER called "stop pulling" on the portable radio, but the heeling over was increasing. At CASTORO OTTO, they had seen STEVNS POWER heel over and they stopped pulling the wire. However, STEVNS POWER heeled over completely and turned upside down. During approximately one minute only, nothing but the stern of the ship was above water.

Rescue boats came to the accident area in few minutes, but even though the weather and visibility were good, none of the 11 crewmembers were found.

2. Collecting of data

None of the crewmembers on STEVNS POWER survived when the ship was lost. Therefore, it has not been possible to retain precise information on what happened on STEVNS POWER immediately before the accident occurred.

The day after the accident, the Division for Investigation of Maritime Accidents went to Nigeria and on board CASTORO OTTO where the Division talked with the crewmembers and the witnesses. Furthermore, the Division studied the actual practise of anchor handling.

The Division for Investigation of Maritime Accidents was on board the other anchor-handling vessel MAERSK TERRIER, which was not involved in the accident. The

crewmembers had witnessed the accident, as the ship was positioned approximately 600 metres from STEVNS POWER.

The Division for Investigation of Maritime Accidents was on board the ROV vessel INSPECTOR, which had been chartered to control the placing of the pipe in the seabed using submarine recordings. Several of the crewmembers had witnessed the accident. Furthermore, the vessel carried several submarine recordings of the wreck of STEVNS POWER both before and after the Division of Investigation of maritime Accidents went to the place of the accident. These recordings have been of great value to the investigation.

The Division for Investigation of Maritime Accidents has obtained information on the operation of STEVNS POWER from the shipping company.

The Division has obtained information about CASTORO OTTO from SAIBOS.

The Division has talked with several experts in anchor handling from other shipping companies together with instructors who teach anchor-handling at Maersk Training Centre.

The Division for Investigation of Maritime Accidents hereby wishes to thank everybody for their assistance and cooperativeness.

3. The Casualty

Type of casualty:	Capsized and foundered
Location of casualty:	West Africa – off the coast of Nigeria Position 03°57,8' N - 007°18,1 E
Date and time:	19 October 2003 at 1715 hours local time (UTC +1)
Casualties:	11
Weather:	According to CASTORO OTTO: Wind SSE 14 knots, waves SSE 0.5 meters, swell WSW 1 meter According to INSPECTOR: Fine weather and long easy swell According to MAERSK TERRIER: Wind SW 4 m/s, waves and swell 0.5 meter
Current:	CASTORO OTTO: SSE direction, approx. 1 knot There is no current meter on CASTORO OTTO and the current is not registered. INSPECTOR: The current at the seabed normally runs from NE to SV but it can be different. The current at the surface was running in a ESE direction on the day of the accident

4. Ship's particulars

<i>Name of Ship:</i>	STEVNS POWER
<i>Home Port:</i>	Svendborg
<i>Control No:</i>	D 3913
<i>Call Sign:</i>	OZZO2
<i>IMO No:</i>	7523178
<i>Type of Ship:</i>	Anchor handling tug vessel (AHT)
<i>Construction year:</i>	1976 – Odense Staalskibsværft (shipyard)
<i>Tonnage:</i>	766 BT – 499,44 brt.
<i>Length/breadth/draft:</i>	40,43 m / 12,00 m / 6,00 m
<i>Length oa:</i>	45,17 m
<i>Draft at summer load line:</i>	4.96 m
<i>Engine Power:</i>	5884 kW. (2 X 12 Cyl V diesel 4 T-e 8000 HK AtlasMAK). Bow thrusters 300 HK.
<i>Crew:</i>	11
<i>Owner:</i>	Partrederiet Stevns Multi Ships II
<i>Operator:</i>	Nordane Shipping A/S
<i>Classification Society:</i>	Lloyds Register - +10A1, Tug ICE Class 3, +LMC

Trading area according to sailing permit certificate: World Wide Trade (A1 + A2 + A3).

The classification society's last survey on board the vessel was in Las Palmas on a shipyard on 14 August 2003. All certificates of the vessel were valid.

The ISM Code was not applicable to STEVNS POWER because the vessel was measured to 499.44 Grt at the time of construction (1948 loadline convention).



STEVNS POWER

General arrangement – see enclosure 1.

The vessel has before been registered as:
MAERSK BEATER 1976-85 – Danish register.
MAERSK BEATER 1985-93 - Bahamas.
SEA WOLF 1993-97.
SEAWARD FOX 1997-2000 – French register.

The vessel was bought by the company and registered in the Danish International Ship register (DIS) in November 2000 under the name STEVNS POWER.

Odense Staalskibsværft (shipyard) built in 1976-77 five sister vessels of MAERSK BEATER.

STEVNS POWER was chartered as anchor handling vessel for CASTORO OTTO during a pipe laying project in the Black Sea from 15 July to 30 November 2001 and 7 February to 18 March 2002. In the Black Sea the water depth was 400-80 metres. Furthermore, STEVNS POWER participated in the towing of CASTORO OTTO through the Bosphorus Strait to Sicily from 6 June to 3 July 2002.

STEVNS POWER was chartered again as anchor handling vessel for CASTORO OTTO in a pipe laying project off Point Noire, West Africa in the period between 15 September 2002 and 12 July 2003.

STEVNS POWER was once more chartered as anchor handling vessel for CASTORO OTTO off the coast of Nigeria on 1 September 2003.

CASTORO OTTO

CASTORO OTTO is one of the largest pipe laying vessels in the world. Besides pipe laying the vessel also work with heavy lifting. The vessel has only a limited propulsion engine capacity and it is normally towed over longer distances.

Derrick Lay Vessel CASTORO OTTO.

Home Port: Monrovia – Liberia

IMO No: 7422001

Call sign: ELBY6

Length (oa) and breadth: 191.40m and 38.60m

Moulded depth: 15.30m

BT: 33862 t

NT: 10158 t

Type of ship: Derrick pipe lay vessel

Propulsion engine: 2x4000 HK.

Construction year: 1976

Crew: Approx. 200 persons work on board.

Owner: SAIBOS Costrucoes Maritimas

Classification Society: AB RI NV



CASTORO OTTO

5. The Crew

STEVNS POWER

The master: Signed on 6 August 2003. Born 1946. Danish. Took degree as master in 1969.

Certificates: Certificate as master. Certificate as radio operator.

Other certificates: Transport of dangerous cargo 1999; ARPA 1999; Paragraph 16 safety 1996; Oil, gas and chemical vessels 1989; Tank cleaning 1989, Chemical vessels 1988.

1969-88: Employed in Svitzer on towing supply and anchor handling vessels.

1990-2000: Master in standby vessels (Esvagt), bulk carriers, container feeder vessels and heavy lift vessels (T & C).

2000: Employed by Nordane Shipping A/S as master on STEVNS POWER.

The chief officer: Signed on 15 October 2003. Born 1949. Danish.

Certificates: Certificate as master (restricted). Certificate as radio operator.

Other certificates: Transport of dangerous cargo 1999; Radar observation 1998; ARPA 1999; Oil tank vessels 1995; Oil, gas and chemical vessels 1988; Paragraph 16 safety; Fire fighting; Health treatment.

1978-85 and 1987-88: Navigation officer in the coaster fleet.

1985-87 and 1988-2000: Master in minor towing vessels.

2000 to 30 March 2003: Master in the coaster fleet.

The company had just employed him. He had no experience on board anchor handling vessels.

The navigation officer: Signed on 28 August 2003. Born 1955. Danish. Took degree as master (restricted) in 2000.

Certificates: Certificate as master (restricted). Certificate as radio operator.

Other certificates: Health treatment; Fire fighting 1998; AB seaman 1986.

Employed by the company on 21 January 2003. Was on board STEVNS POWER from January to June 2003. Signed on again on 28 August 2003.

The chief engineer: Signed on 22 January 2003. Born 1954. He was from the Philippines.

Certificate: RC Chief Engineer (code (PC). STCW reg. III/2.

Other certificates: Paragraph 16 Safety 2002; Danish maritime law 2002.

He had been employed on board STEVNS POWER since 2000.

The second engineer: Signed on 22 January 2003. Born 1953. He was from the Philippines.

Certificate: Second Engineer officer, no limitations, STCW reg. III/2.

Before employment in Nordane Shipping A/S, he had been employed on ocean going towing vessels and anchor handling vessels.

The oiler: Signed on 22 January 2003. Born 1967. He was from the Philippines.

Certificate: STCW reg. III/4.

He had signed on STEVNS POWER three times - each period 10-11 months.

AB seaman: Signed on 28 August 2003. Born 1955. He was from the Philippines.

He had previously been signed on STEVNS POWER from 1 November 2001 to 18 October 2002.

AB seaman: Signed on 15 October 2003. Born 1948. He was from the Philippines.
Certificate: STCW reg. II/4.

Cook: Signed on 15 October 2003. Born 1955. He was from the Philippines.

Crewmember: Signed on 28 August 2003. Participated in anchor handling on deck. Born 1970. He was from the Republic of Congo. According to the agreement between seafarer and owner/master, he was signed on due to requirement from the Authority of the Republic of Congo. According to the agreement he was not fit for lookout duty. Rank, certificate of competency and medical examination were not stated in the agreement. He had been on similar vessels before according to information from the company.

Crewmember: Signed on 28 August 2003. Born 1974. He was from the Republic of Congo. Was signed on due to agreement with the Authority of the Republic of Congo. Rank, certificate of competency and medical examination were not stated in the agreement. He had previously been signed on STEVNS POWER from 16 September 2002 to 8 January 2003.

Minimum Safe Manning Document issued by the Danish Maritime Authority on 17 November 2000:

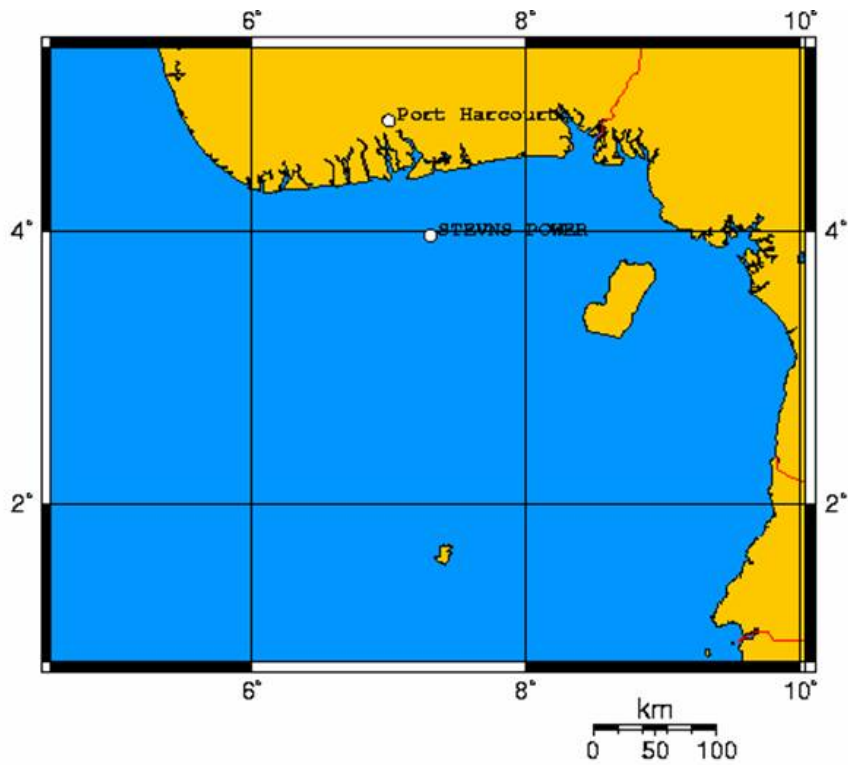
Master – II/2 Master (restricted)
Chief Officer – II/2 Mate, 3rd Class
Chief Engineer – III/3 Mechanist 1st Class
Second Engineer – III/3 Mechanist 2nd Class
2 Able Ships' Assistants - II/4
(2 Able Seamen can replace 2 Able Ship's Assistants)

The company has cooperated with a shipping office – Crystal Shipping – in the Philippines the last 14 years. When the company needs new crewmembers, they forward qualification requirements to the office. The office then forward information on possible new crewmembers, their qualifications and information on which vessels they have been signed on previously.

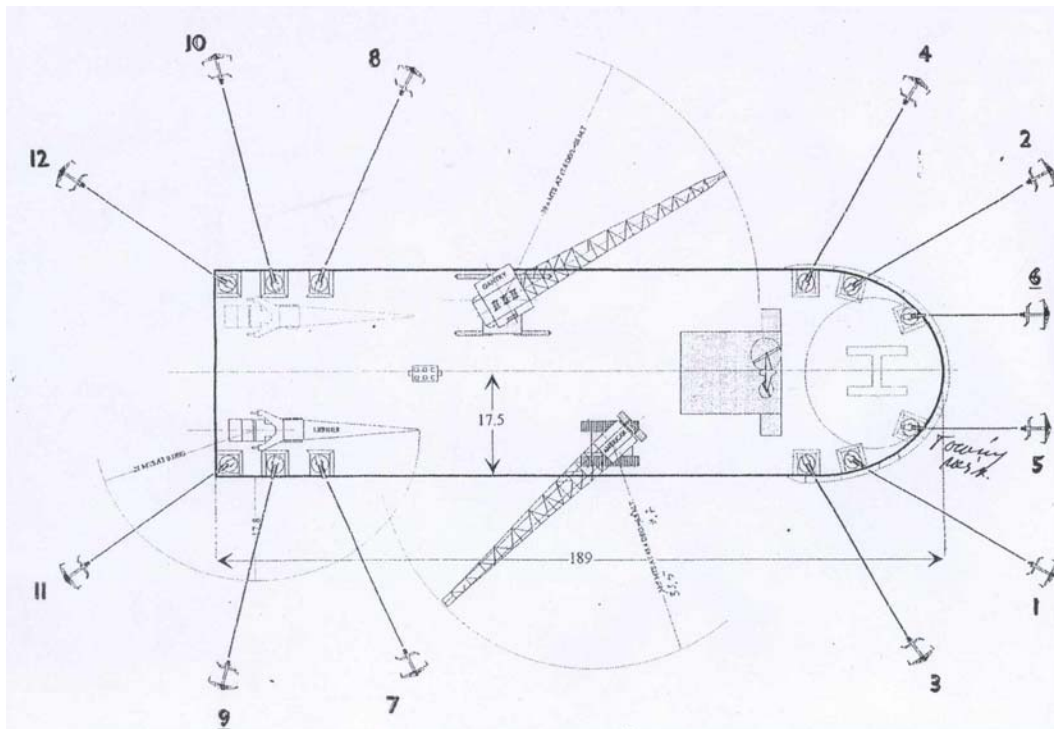
6. Narratives

Narrative based on information from the crewmembers of CASTORO OTTO

The derrick pipe lay vessel CASTORO OTTO began the laying of an 8-inch gas pipe from the FPSO vessel JAMESTOWN (floating production storage and offloading vessel) to the oilfield Okpoho P/ma.



CASTORO OTTO was manoeuvring by using 12 anchors, while the pipe was being laid. The anchor handling tug vessels STEVNS POWER and MAERSK TERRIER had been chartered for the relocating of the anchors.



CASTORO OTTO with 12 anchors.

The pipes were sailed to CASTORO OTTO by, among others, the cargo ship OIL TRADER. At CASTORO OTTO, the pipes were welded and laid through a stinger aft of the vessel.

The vessel INSPECTOR was chartered to control the placing of the pipe in the seabed. This was done by the usage of a ROV – Remote Operated Vessel – equipped with underwater camera. Therefore, the INSPECTOR was normally in a position approximately 300 metres astern of CASTORO OTTO.

On 19 October 2003, at 1645 hrs, CASTORO OTTO was in position 03°57' N - 007°18' E. The vessel was working - laying the 8-inch gas pipe.

The water depth in the area was 75 metres. The top of the seabed consisted of multi-levelled coat of mud.

A chief officer, a 3rd officer, three winch operators, and the sub-sea surveyors calculating positions were on duty when the accident occurred. The chief officer was in charge. All of them were at the bridge except for the 3rd officer who was standing aft on the port side at anchor winch No. 10 to keep an eye on the winch and the wire.

On 19 October, STEVNS POWER had relocated 16 anchors for CASTORE OTTO. STEVNS POWER had relocated anchor No. 9 briefly before the accident.

MAERSK TERRIER was relocating anchor No. 2 and the ship was 30-40 degrees on the port side of CASTORO OTTO's bow. INSPECTOR was approximately 300 metres aft of CASTORO OTTO and was doing ROV-recordings of the pipeline. OIL TRADER was moored on starboard side of CASTORO OTTO. OIL TRADER was transferring pipes.

CASTORO OTTO and the assisting ships communicated on VHF channel 71. This channel was their mutual operation channel. All the ships listened in on VHF channel 16.

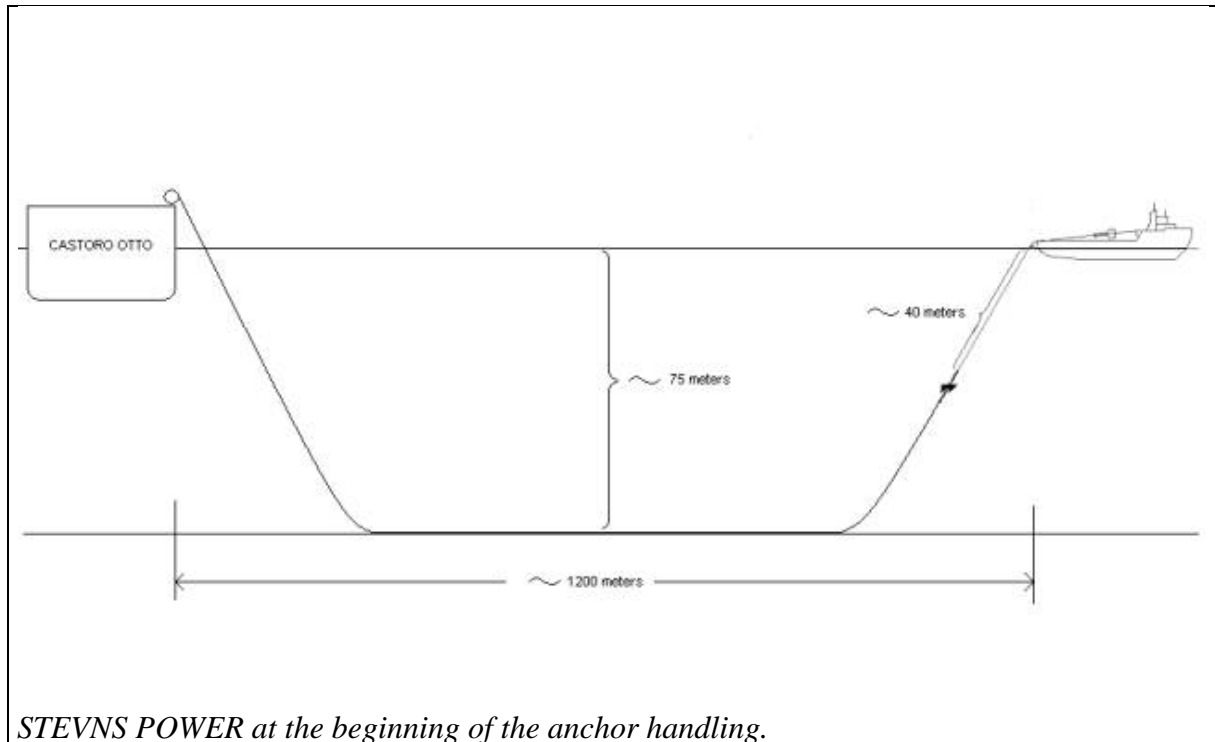
Using a portable radio, the chief officer on CASTORO OTTO communicated with the 3rd officer.

At approximately 1645 hrs, the chief officer of CASTORO OTTO told STEVNS POWER to relocate anchor No. 10. Anchor No. 10 was in a distance of approximately 1300 metres from CASTORO OTTO's port quarter.

The chief officer told the sub-sea surveyors that STEVNS POWER were heading towards anchor No. 10 after which they set the new position for anchor No. 10 on a navigation monitor. The monitor was also available to the chief officer and on board the two anchor handling vessels.

STEVNS POWER sailed to the anchor buoy, took it aboard and pulled in on the pennant wire. At approximately 1705 hours, STEVNS POWER advised that the anchor had been clear of the seabed. The chief officer on CASTORO OTTO replied that they would begin to recover the anchor wire. CASTORO OTTO began to pull in the anchor wire at approximately 1710 hours.

According to the instruments on the instrument desk of the winch, there were 1,260 metres of wire when the crew on CASTORO OTTO began to pull in the anchor wire. When this kind of length of wire is on a depth of 75 metres, a large part of the anchor wire is lying on the seabed.



According to the chief officer and the winch operator, the anchor wire was pulled in with normal rate of speed on CASTORO OTTO. As was normal practise, the winch was set on “high speed” and they recovered the wire with a speed holding the tension meter on approx.15 metric tonnes. The maximum pull was 20 metric tonnes.. The winch operator who was operating winch No. 10 was keeping an eye on the maximum pull on the tension meter. There was not a clear view from the winch instrument desks gathered in port side of the bridge. At the winch desks, there was a portable radio that had been tuned in on channel P1. The purpose of the portable radio was so that the 3rd officer, who was positioned on the port quarter of the CASTORO OTTO in order to maintain a visual observation of the anchor handling operation, could advise the bridge, i.e. the chief officer and the winch operator, should it become necessary. This allowed the bridge team (chief officer and winch operator) to concentrate on the instruments. When the accident occurred, the 3rd officer immediately advised the bridge on channel P1 as soon it became apparent to him that STEVNS POWER had problems. The winch operator immediately stopped the winch.



Winch desks on CASTORO OTTO.

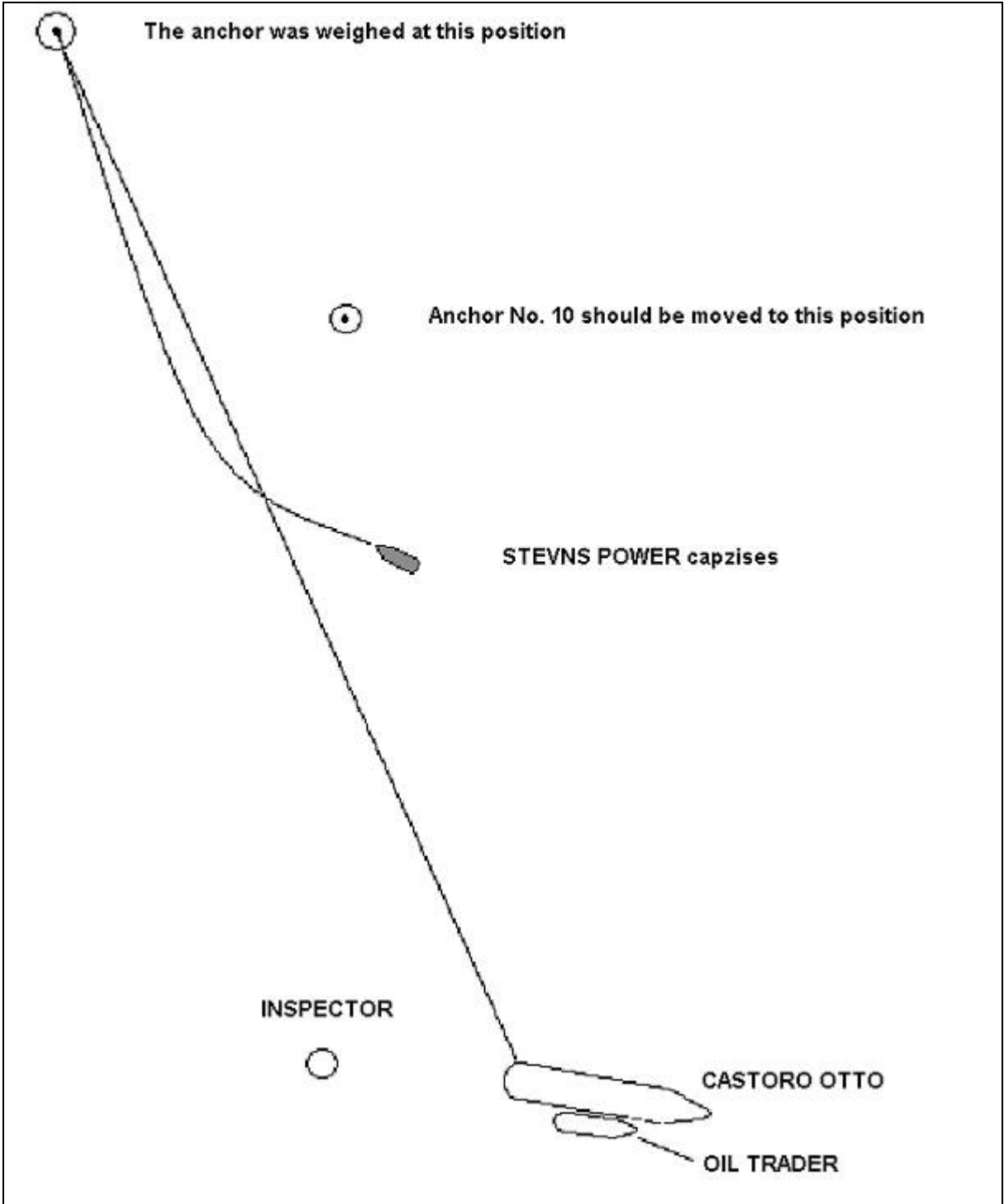
STEVNS POWER was manoeuvring astern towards CASTORO OTTO while CASTORO OTTO recovered the wire. They had to recover the anchor wire to the extent where it would be almost clear of the seabed. Thereby, the anchor wire – after it had been laid again – would follow a straight line from CASTORO OTTO to the anchor's new position. They could not lay the anchor wire in a curve on the seabed. If doing so, they could risk that the wire would be dug down in the mud. In the actually situation, they were going to pull until there was 500-600 metres wire out before the anchor wire could be eased off and STEVNS POWER could approach the new position.

According to the chief officer's information, there were no obstructions on the seabed where the anchor wire could get caught. The chief officer had his information from the pre-lay survey carried out by the survey vessel INSPECTOR prior to the laying of the pipe.

As STEVNS POWER came closer to CASTORO OTTO and as the anchor wire was shortened, STEVNS POWER began to alter its course astern in a curve to get closer to the line the anchor wire had to follow to the new position. This was normal procedure in order to make the anchor wire follow a straight line and not in a curve from CASTORO OTTO to the new position of the anchor.

The 3rd officer was standing aft at the port side at anchor winch No. 10. Everything seemed to be normal while the anchor wire was pulled in. There was no more draw/tension in the anchor wire than normal, according to the 3rd officer's visual observations. He did not see any persons on deck on STEVNS POWER.

Suddenly at approx. 1715 hrs, the 3rd officer saw that STEVNS POWER began to heel over to port side and a bit to the astern. Thereby, STEVNS POWER got a more aft trim. He saw black smoke coming out of the funnel as if they were manoeuvring the engine.



STEVNS POWER's track during relocation of anchor no. 10.

The 3rd officer spoke loudly in the portable radio to the bridge telling them to stop pulling the anchor wire. He spoke in Italian, because the bridge team and he are Italian and they use this language for internal communication on board CASTORO OTTO.

The chief officer on CASTORO OTTO heard the 3rd officer call out loud in Italian , on the portable radio, to make them stop pulling the anchor wire. Immediately, the chief officer became aware of the fact that something was wrong and ordered the winch operator to stop the pulling. The winch operator, who had also heard the 3rd officer's call, immediately stopped to pull.

The chief officer went out of the aft bridge door, which was directly behind him and saw that STEVNS POWER heeled over to port and was taking in water on aft deck in the port side. Immediately after, STEVNS POWER heeled over to one side and sank very fast with the stern first. The winch operator saw the same through a window. It all went very fast and, in less that one minute, the ship was lying vertically in the water with only the stem above water.

The 3rd saw also at that moment that STEVNS POWER heeled over very fast. STEVNS POWER had now a 90 degrees list to port. The stern of the vessel sank very fast.

When the accident occurred, STEVNS POWER was in a distance of approx. 600 metres from CASTORO OTTO's port quarter. By this time, there was 590 metres anchor wire out according to the instruments on the winch desk. With 590 metres anchor wire between CASTORO OTTO and STEVNS POWER, the anchor wire has probably not touched the seabed.

CASTORO OTTO's master was in his office when the accident occurred. He was told at approx. 1715 hrs. and he went directly to the bridge. Only the stem of STEVNS POWER was above the water when he came to the bridge. The master took charge on the bridge and of the rescue operation.

CASTORO OTTO immediately sent a rescue boat to the scene of the accident to search for crewmembers from STEVNS POWER. The boat, which was in the water as the accident occurred, was at the scene few minutes later. No one of STEVNS POWER's crewmembers were found. MAERSK TERRIER and INSPECTOR were at the scene shortly after and they participated in the search.

Four liferafts; an EPRIB, life jackets and lifebuoys were found next to the wrecked and sinking ship. The anchor buoy which had been taken on the aft deck had come clear of the pennant wire and was also floating in the water.

The chief officer on board CASTORO OTTO believes he saw two persons in the wheelhouse of STEVNS POWER before the accident.



STEVNS POWER after capsizing.

Narratives based on information from the crew on MAERSK TERRIER

MAERSK TERRIER was just about to finish the relocation of anchor No. 2 when the accident occurred. The chief officer and the 2nd officer were sitting in the chairs aft on the bridge where they had a view over that aft deck. They could not see STEVNS POWER from there.

At 1715 hours they heard a person yelling “stop pulling” five times over the VHF radio on channel 71. The language was English. It was the chief officer’s assumption, however, that the person was talking with a Danish accent and furthermore, that the call came from STEVNS POWER.

The 2nd officer ran to a window further ahead on the bridge from where he could see that STEVNS POWER had capsized.

STEVNS POWER was 500-700 metres from MAERSK TERRIER – on MAERSK TERRIER’s starboard side.

When the chief officer came to the window, STEVNS POWER had a list of approx. 60 degrees. Few seconds later, STEVNS POWER had a list of 90 degrees. STEVNS POWER heeled further over making the bottom visible and the ship began to sink with the stern. The chief officer and the 2nd officer on MAERSK TERRIER did neither observe the propeller nor the anchor wire on board STEVNS POWER.

An AB and an engineer who were on the aft deck of MAERSK TERRIER were also witnessing the capsizing. The engineer saw STEVNS POWER heel over 70 degrees to the starboard side. After this, he ran to the bridge to alarm the officers. When he saw the ship again, only the stem was above the water. When the AB saw STEVNS POWER for the first time after it had taken a list, the ship was lying with the bottom up.

It only lasted approx. 1 minute from the chief officer observed STEVNS POWER with a 60 degrees list to the ship was lying vertically in the water with only the stem above the surface.

The chief officer saw the water spray out of a porthole while STEVNS POWER was lying on the side.

The chief officer activated the general alarm on MAERSK TERRIER and the vessel approached the scene to participate in the rescue.

At 1719 hrs., a boat from CASTORO OTTO reached STEVNS POWER which only had the forecastle above the water.

At 1721 hrs., MAERSK TERRIER launched a lifeboat and participated in the search. CASTORO OTTO launched yet another boat. None of the crewmembers from STEVNS POWER were observed.

At 1746 hrs, STEVNS POWER sank.



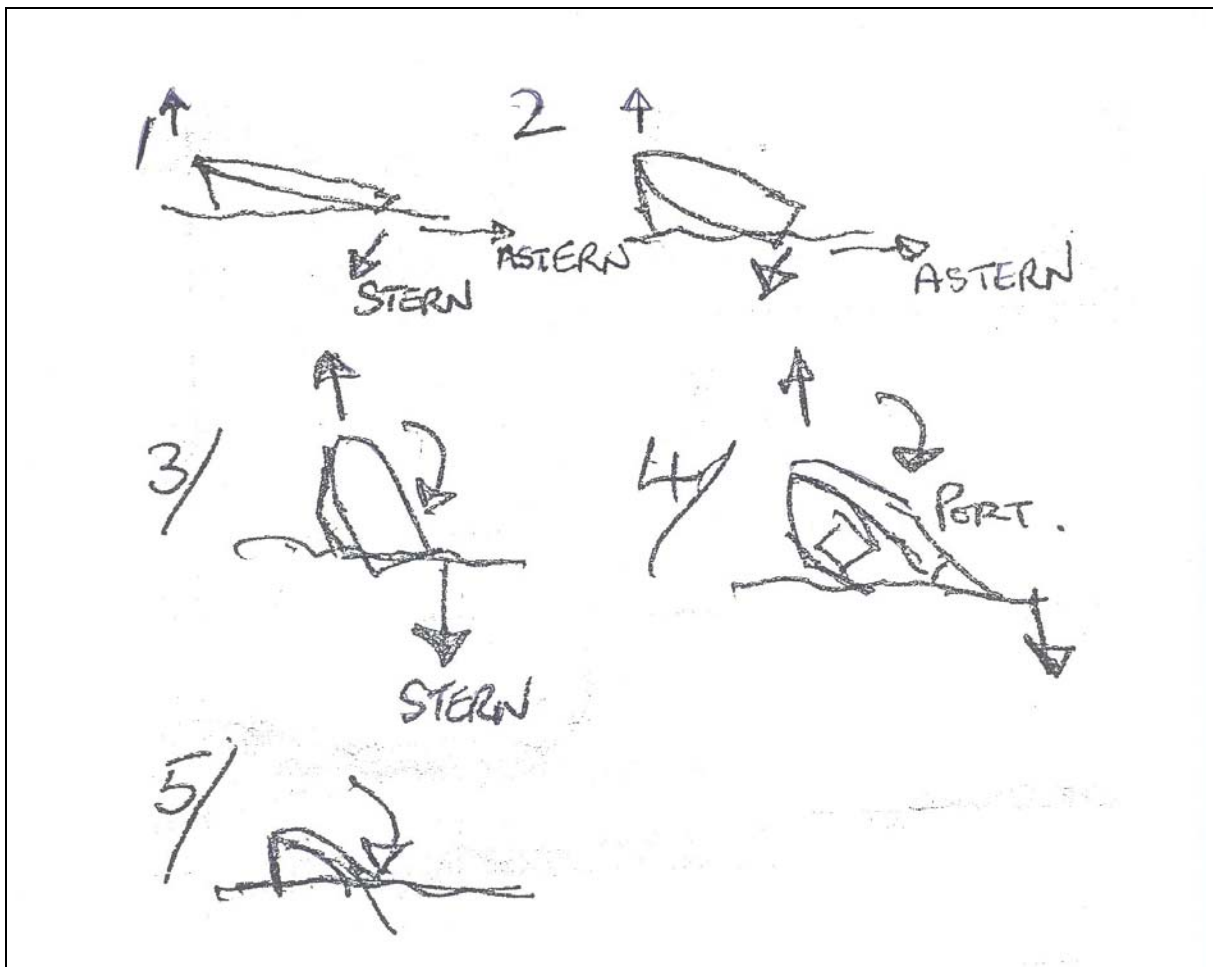
MAERSK TERRIER

Narratives based on information from the crewmembers on INSPECTOR

The chief officer on INSPECTOR was on duty when the accident occurred. At VHF channel 71, he heard a yelling in English and he realised that something was wrong on STEVNS

POWER. He saw STEVNS POWER heeling over and sinking with the stern. He was very chocked and surprised by the rapidity.

The person in charge of the ROV-operations on INSPECTOR watched STEVNS POWER shortly before the ship capsized and he could see that something was wrong. The stern of STEVNS POWER was lying very low. Smoke was coming out of the funnel as if they were giving full speed ahead. After this, STEVNS POWER capsized. It all happened in few seconds.



The officer in charge of the ROV-operation draw the situation as he saw it.

INSPECTOR immediately took the ROV aboard the ship and sailed towards STEVNS POWER, which was lying with only the stem above water. INSPECTOR soon put out the ROV again in an attempt to find crewmembers from STEVNS POWER. For approx. 4-5 minutes, they managed to record a video through the windows of STEVNS POWER's wheelhouse. From the video recordings, they observed the back of a lifeless man. Before they could manage to do anything further, STEVNS POWER began to sink and they took the ROV away from the ship.

Narratives based on information from the crew on OIL TRADER

OIL TRADER is transporting pipes to CASTORO OTTO. OIL TRADER was moored alongside the starboard side of CASTORO OTTO when the accident occurred. Because that

they were not able to see STEVNS POWER, which was on the port side of CASTORO OTTO.

The 2nd officer of OIL TRADER was on the bridge when the accident occurred. He heard on VHF canal 71 that somebody shouted “stop pulling” three times. The master of OIL TRADER came to the bridge after the accident.

7. Further information on anchor handling

Anchor handling on CASTORO OTTO

It is normally a chief officer who has the command on board CASTORO OTTO during anchor handling. There are two chief officers on board who share the watch. The master only takes command during special operations, which was not the case at the time of the accident. Besides the chief officer there is also a navigation officer on duty to assist.



CASTORO OTTO

When CARSTORO OTTO is on a pipe laying project, the vessel is normally assisted by two anchor handling vessels, which relocate the anchors. CASTORO OTTO has 12 anchors out, when the pipe laying work is done. The purpose of the anchors is to keep CASTORO OTTO in position and to pull the vessel ahead concurrently with the laying of the pipe. In principle, CASTORO OTTO is kedged ahead.

The 12 anchors must currently be moved ahead as the work goes on. In average each anchor handling vessel relocate 15 anchors each 24 hours. Up to 3,6 km pipeline is laid each 24 hours.

There are also two sub-sea surveyors on the bridge of CASTORO OTTO. The sub-sea surveyors calculate and inform the chief officer about which anchors to relocate and at which new positions to relocate the anchors.

When an anchor is to be relocated, the chief officer on CASTORO OTTO call the anchor handling vessel and ask the vessel to relocate the anchor. The weight of an anchor is approx. 20 tons. The anchor handling vessel proceeds to the anchor buoy, take the buoy on the deck and start to pull on the pennant wire. The pennant wire runs from the anchor to the anchor buoy. Between the anchor and the pennant wire is a chain four meters in length.

When the anchor is off the seabed and lifted from the seabed as required, the anchor handling vessel calls CASTORO OTTO and informs them to recover the anchor wire. If a pipeline is going to be passed, the anchor must be taken on board the anchor handling vessel during the relocation. It is the chief officer on CASTORO OTTO who informs the anchor handling vessel, if the anchor must be taken on board the anchor handling vessel.

On board CASTORO OTTO, they do not begin to recover the anchor wire before the anchor handling vessel has informed them that they are ready or before CASTORO OTTO has asked them if they are ready and has received confirmation on this.

Normally, a crewmember is positioned at the fairlead on board CASTORO OTTO to keep an eye on the anchor wire.

It is normal procedure that the anchor handling vessel calls CASTORO OTTO if the anchor wire is recovered too fast.

When the necessary length of the anchor wire is recovered, the chief officer gives order to stop pulling on the winch. He informs the anchor handling vessel about this and he asks the vessel to proceed to the new position of the anchor. The anchor wire is now eased off from CASTORO OTTO.

Operation of winch on board CASTORO OTTO

The anchor winches of CASTORO OTTO are operated from the bridge. It is possible to pull with “low speed” or “high speed” on the winch. “High speed” provides faster recovering speed and lower recovering power. “Low speed” provides slower recovering speed but high recovering power.

“Low speed” is only used when the anchor is in position on the seabed and CASTORO OTTO is pulled ahead concurrently with the laying of the pipe. When the winch is on “low speed”, the winch operator keeps the tension meter on approx. 50 metric tonnes, but the pulling can reach 100 metric tonnes.

When an anchor is going to be relocated, which was the case when the accident occurred, the winch is always on “high speed”. Two winch motors are on. Each winch motor can pull with approx. 10 tonnes.

When the anchor wire is recovered during relocation of an anchor, the winch operator watch that the tension is kept on approx. 15 metric tonnes and maximum reach 20 metric tonnes according to the tension meter on the panel. The tension can momentarily reach approx. 30

metric tonnes, if there is resistance on the anchor wire. The winch operator controls the recovering by using the speed regulation. If the tension exceeds approx. 30 metric tonnes, the winch stops the recovering and there is a risk that the anchor wire runs out uncontrolled. In that case the wire can be lost or damaged. The winch operator is therefore very careful not to exceed 20 metric tons on the tension meter.



Tension meter on the winch panel

The winch operator does not have a free view to the anchor handling vessel from the winch panels, which are located on the port side on the bridge. The winch operator has his attention focused on the instruments on the winch panel. He only occasionally sees the anchor handling vessel.

General information on anchor handling vessels working for CASTORO OTTO

When a message from CASTORO OTTO about relocation of an anchor is given, the anchor handling vessel proceeds to the anchor buoy and takes the buoy on deck. The pennant wire, which goes through the buoy, is connected to the winch on the anchor handling vessel and they recover the pennant wire until the anchor is well off the seabed. Sometimes the anchor is taken on deck. This is always done if the vessel, during the anchor handling, is going to pass something, which can be damaged e.g. pipes, cables or other anchor wires. It is CASTORO OTTO, which gives the message, if the anchor must be taken on deck.

When the anchor is lifted to the desired height above the seabed or when it is taken on deck, the anchor handling vessel starts to manoeuvre aft towards CASTORO OTTO. At the same time, they start to recover the anchor wire on board CASTORO OTTO.

At the beginning, the anchor handling vessel may have the engines on slow astern in order to have a little speed astern, when CASTORO OTTO starts the recovering of the anchor wire. When the recovering from the pipe laying vessel is going on, the anchor handling vessel normally puts the engines on slow ahead, while CASTORO OTTO pulls the vessel aft. This is done to restrict the wire a little to lift it more off the seabed.

It is normal that the anchor handling vessel is manoeuvred by the two propellers, while the rudders are kept amidships when the vessel has speed astern during the anchor handling operation.

It is not unusual that the anchor handling vessel's speed astern is 5-7 knots. With this speed, the thrusters normally have no effect.

Observation of a relocation of anchor no. 10

The marine accident investigator of the investigation division was present during a relocation of anchor no 10 done by MAERSK TERRIER few days after the accident. The anchor handling was done almost in the same way as STEVNS POWER was doing it when the accident occurred. When the anchor handling began, more than 1000 metres of anchor wire were out and the tension meter on the winch panel showed approx. 30 metric tonnes. The indication of the tension meter decreased to approx. 15 metric tonnes, when 700 metres of wire were out. A representative of SAIBOS informed that the tension was high in the beginning because the wire was lying on the seabed.

When MAERSK TERRIER came closer to CASTORO OTTO, the anchor handling vessel altered course by manoeuvring astern in a curve in order to get the anchor wire in the direction of the heading of CASTORO OTTO. This was done in the same way as the witnesses had told that STEVNS POWER manoeuvred when the accident occurred.



MAERSK TERRIER during relocation of anchor no. 10.

Manoeuvring of STEVNS POWER during anchor handling

STEVNS POWER had two propellers, two rudders and a bow thruster. Sitting in the chair of the aft bridge, the navigator had an engine control on each side. The rudders were operated by a tiller which was operated by the navigator by the knees..



STEVNS POWER in dock in Las Palmas.

When the vessel had increased the speed, the thrusters had no effect. It was probably not used at the time of the accident.

A former master of STEVNS POWER has told the investigation division that it was normal that the anchor was pullet up to the stern roller. If the anchor hung 40 meters below the stern roller, which probably has been the case at the accident, it is more difficult to manoeuvre the vessel astern.

Another former master of STEVNS POWER has told that it was normal that the anchor only was lifted some few meters over the seabed, if the water depth was as low as it was off Nigeria.

According to information from CASTORO OTTO, it was not unusual or abnormal for STEVNS POWER to handle the anchor with it hanging 40 meters below the stern roller and that this system of hanging the anchor above the seabed, where there are no underwater obstructions, is normal practice.

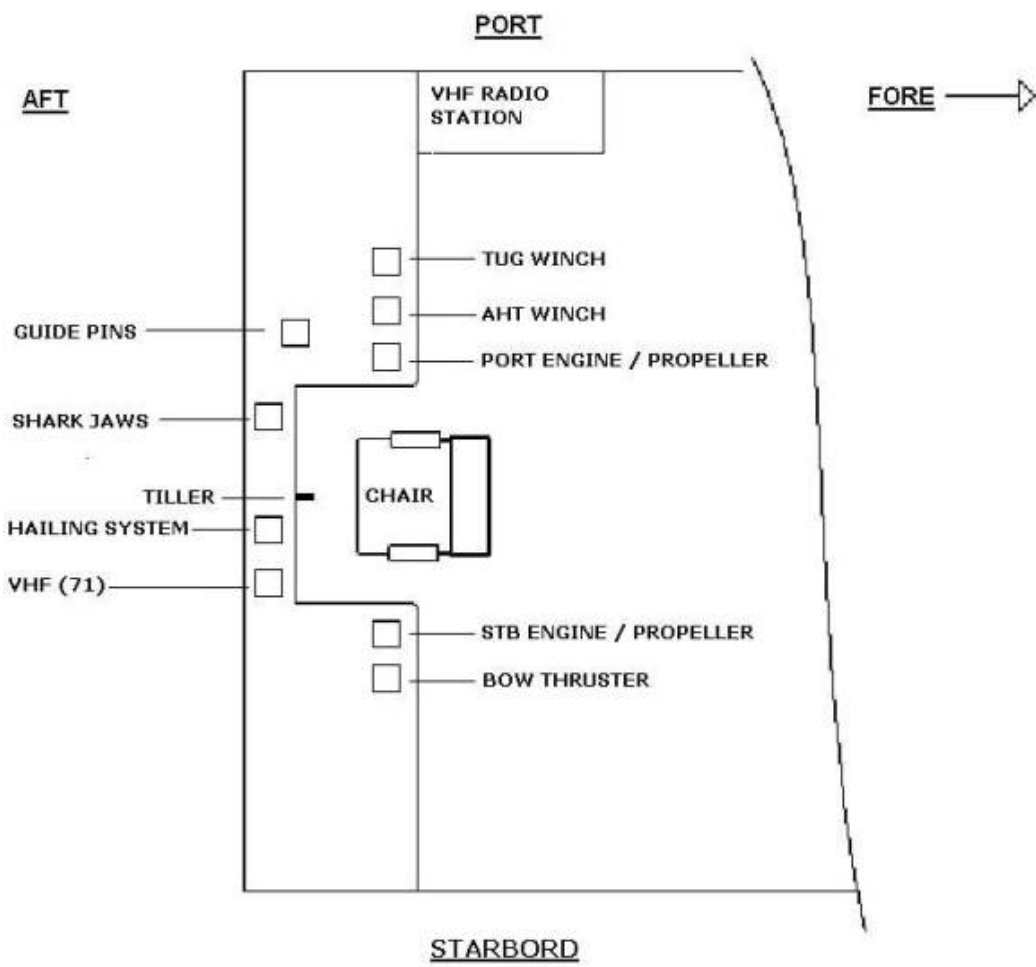
A former master has said that when STEVNS POWER was manoeuvred astern during anchor handling the rudders was normally in an amidships position. The speed astern was restricted a little by the engines i.e. the engines were put on 1/3 ahead. It was an act of balance to keep the vessel on the course astern. The two propellers, but also the rudders were used to keep the vessel on course astern.

When the aft deck was flooded by seawater, it was normal procedure on STEVNS POWER was to give more power ahead on the engines and at the same time call CASTORO OTTO

on canal 71 and ask them to stop pulling. There was a VHF radio hanging right beside the chair on the aft part of the bridge.

It was not normal procedure on board STEVNS POWER to ease off the pennant wire quickly, when the aft deck was flooded by seawater.

When STEVNS POWER was manoeuvred and pulled astern with high speed, the rudders sometimes did not stay in the amidships position but were pressed to starboard or port. In order to avoid this, the navigator had to use the tiller which was placed in a position where the navigator could operate it with the knees.



Aft part of the bridge on STEVNS POWER

Another former master had explained that when the vessel were going to make a turn while the vessel was manoeuvred and pulled astern as in the actual situation, rudders should be turned to starboard, the port engine should be put on astern and the starboard engine should be put on slow ahead. If a situation arose during a turn while the vessel was going astern and where the deck at the port quarter came under water, the navigator should not put the port engine on ahead, but put both engines on stop. The stern of the vessel would then come out of the water, if the vessel had been closed watertight. The stern of the vessel would then be pulled towards CASTORO OTTO.

The same master has said, that an anchor handling vessel can be manoeuvred in several different ways, and that experience in manoeuvring an anchor handling vessel is very important.

Anchor handling winch, powered guide pins and powered stopper on STEVNS POWER

The towing and anchor handling winch was placed amidships aft of the accommodation. There were separate drums for towing wire and anchor handling (pennant wire). The winch could be operated both from the bridge and the deck.

It was possible to quick release the drum on the winch on which the towing wire was placed. The quick release was activated on a button on the aft bridge.

It was not possible to quick release the drum on the winch, which was used during anchor handling for the pennant wire. The drum for the pennant wire was clutched during the anchor handling. The brake of the drum for pennant wire went automatically to the brake position, when the handle was put on neutral (stop). When easing off, it took less than 5 seconds before the brake was completely off the drum. It was possible to ease off very fast on the drum.

A former crewmember has explained that there had been problems with the operation of the winch from the bridge. The company and a former master on STEVNS POWER has confirmed this. The winch was repaired before the vessel went to Las Palmas in June 2003.

A former master of STEVNS POWER has said that it was practise that the pennant went through the powered stopper during anchor handling. The powered guide pins was not used during anchor handling. The stopper kept the pennant wire in position and had the same function as a hawse-hole. The wire could not jump out of the shark jaws of the stopper but it was possible to ease off the wire between the shark jaws.

The stopper was hydraulic operated and could only be operated from the bridge not from the deck. There were buttons to operate the stopper up and down in the deck and buttons for opening and closing of the shark jaws when the stopper was up. According to the company the stopper had been on the vessel since the vessel was built or shortly after.

From the chair on the aft part of the bridge it was possible to have an overview of the winch.

Another former master on STEVNS POWER has explained that they normally used the hydraulic guide pins when he was on board.

On the day of the accident the chief officer on MAERSK TERRIER had noticed earlier in the afternoon that STEVNS POWER was yawing during anchor handling as the vessel was manoeuvring astern. According to the chief officer who years before had been officer on board STEVNS POWER, it is not possible to manoeuvre astern if the stopper is not used. There is no information, however, indicating that there should have been problems with the stopper.

According to the chief officer on MAERSK TERRIER the stopper was used on board STEVNS POWER to control the wire during anchor handling, when the vessel was manoeuvred astern.

On other anchor handling vessels the powered guide pins is used to control the wire during anchor handling instead of the stopper.

If the hydraulic failed on board STEVNS POWER, the shark jaws of the stopper was kept in a locked position.

The stopper was overhauled on a shipyard in July 2003.



Shark jaws – same type as on board STEVNS POWER.

Watch shift and procedures during anchor handling

Two watch shifts were used on STEVNS POWER during anchor handling: 00-06, 06-12, 12-18 and 18-24. Information on the watch shift used during anchor handling hung on the bridge and in the mess room.

Normal dinnertime was 1730 hours for the crewmembers not on watch and 1800 hours for the crewmembers who were going to be relieved.

There were always two crewmembers on the bridge, two crewmembers on deck and one crewmember in the engine room during anchor handling. A navigator had the command on the bridge. The other crewmember on the bridge – a navigator or the oiler – would operate the anchor handling winch.

The master and a navigation officer were during anchor handling on the bridge from 06-12 and from 18-24. A navigation officer and an oiler were on the bridge from 00-06 and from 12-18. It is not known who was on the bridge at the time of the accident. The company and a

former master suppose that the 1st officer, who had experience with anchor handling, and the oiler were on duty from 12-18. They suppose that the master was on bridge with the chief officer, who had signed on few days before. He had no experience with anchor handling.

A former master of STEVNS POWER has told the investigation division that there were two crewmembers on deck during anchor handling. When they had finished the work with the buoy and anchor, they went away from the aft deck and waited beside the winch until they again had work to do on the deck. It was normal procedure that they stayed out, i.e. they did not go into the accommodation before the anchor handling was ended.

One of the AB seamen on deck was carrying a portable radio. On board were also loud speakers, which could be heard all over the vessel and also on deck. One loud speaker was placed above the winch. The loud speakers were operated from the bridge.

The AB seamen were wearing working jackets (inflatable lifejackets), safety helmets and safety boots when they worked on deck during anchor handling.

The engine room was manned on board STEVNS POWER. The chief engineer was on watch in the engine from 06-12 hours and from 18-24 hours. The second engineer was on watch from 00-06 and from 12-18 and he was probably on watch at the time of the accident.

A former master of STEVNS POWER has told the investigation division that the two hatches on the aft deck should be closed during anchor handling, i.e. the hatch to the steering gear room and the emergency exit from the engine room. Watertight doors should also be closed. Doors to the accommodation should be closed during anchor handling and they were always closed because of the air condition.

On board was an instruction book on anchor handling.

The company began anchor handling operations when STEVNS POWER was bought. Since the company had no experience in anchor handling operations, they employed a master who had many years of experience in anchor handling. It was the same master who was on board when the accident occurred.

When STEVNS POWER started as anchor handling vessel for CASTORO OTTO off the coast of Nigeria in September 2003, the master and chief officer of STEVNS POWER were on board CASTORO OTTO to get information regarding the project. It was also normal that the master came on board the pipe laying vessel to get a briefing with regular intervals.

Communication in connection with the loss

The communication between CASTORO OTTO and STEVNS POWER in connection with the handling of anchor No. 10 was as follows:

- At approx. 1645 hours: CASTORO OTTO asked STEVNS POWER to pick up anchor No. 10.
- At approx. 1705 hours: STEVNS POWER informed CASTORO OTTO that the anchor was off the seabed.
- At approx. 1710 hours: CASTORO OTTO informed STEVNS POWER that they began to recover the anchor wire.

Neither the chief officer nor other on board CASTORO OTTO had communicated with STEVNS POWER subsequently. They were still recovering the anchor wire when the accident occurred.

The chief officer on CASTORO OTTO did not hear the call from STEVNS POWER when the accident occurred. The chief officer and the winch operator was informed by the 3rd officer on a portable radio in canal P1 that they had to stop pulling because STEVNS POWER were having difficulties. The winch operator immediately stopped the winch. It is not possible to say if the call from the 3rd officer came at the same time or just seconds after the call from STEVNS POWER. According to the information on what the witnesses saw, just after they had heard the call from either the 3rd officer or STEVNS POWER, the calls must have been made almost simultaneous.

The officers, the winch operators and the sub-sea surveyors on board CASTORO OTTO are Italian and use Italian language as working language on board. They communicate in English, when they communicate with the anchor handling vessels.

The radio operator on board CASTORO OTTO heard that somebody shouted “stop pulling” from STEVNS POWER, but he did not realise that an accident was going to happen. He thought it was normal communication. The Radio operator is placed one deck under the bridge. Just after 1715 hours, the radio operator and the master on CASTORO OTTO were informed about the accident. The radio operator is listening on VHF canals 16 and 71 (dual watch).

One of the sub-sea surveyors, who calculate the positions and who sits by their computers and equipment in starboard side of the bridge heard that somebody on the radio shouts “stop pulling”. He then looked out of a window and saw that STEVNS POWER was heading to port towards CASTORO OTTO.

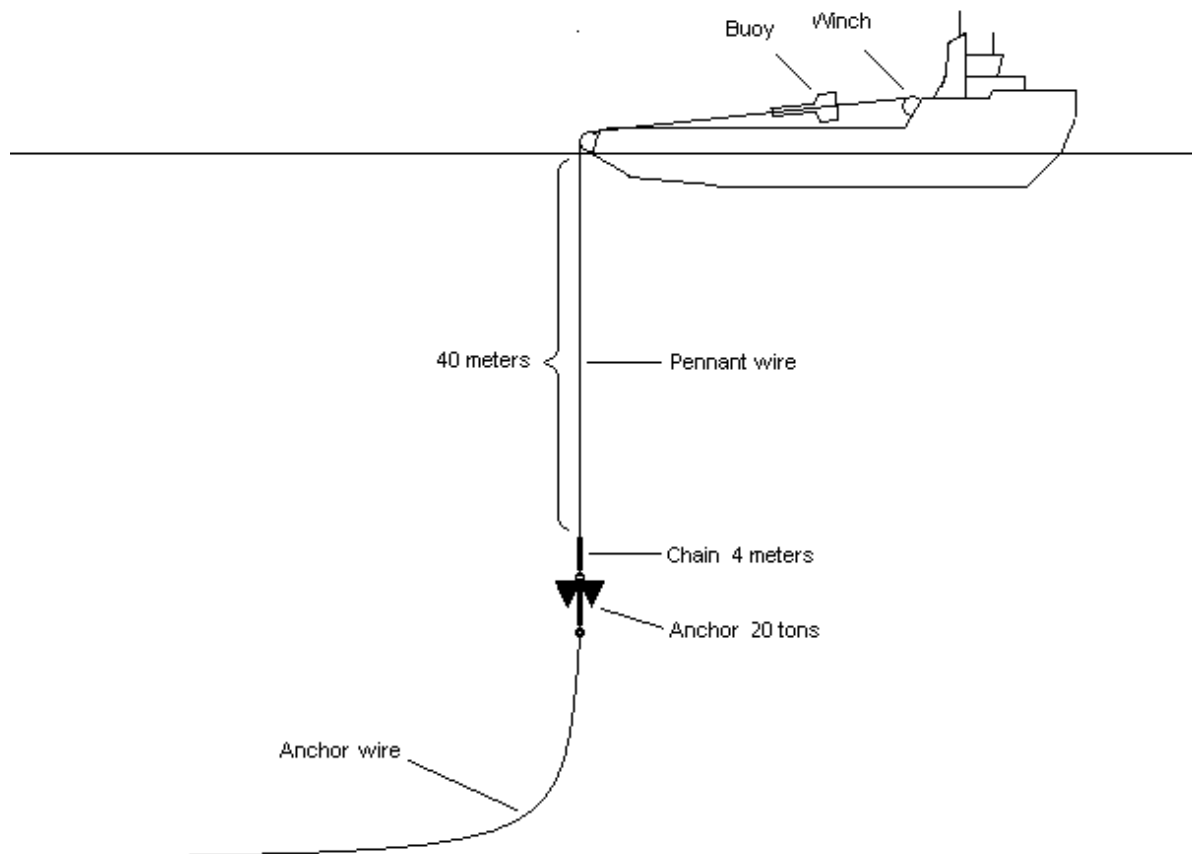
The chief officer and the 2nd officer on MAERSK TERRIER had not heard any communication between STEVNS POWER and CASTORO OTTO until they heard that somebody shouted, “stop pulling” on canal 71.

Information on the anchor, the buoy, the pennant wire and the breaking point of the pennant wire

The weight of the anchor is 20 tonnes. The weight of the anchor wire is 20 kg per meter. The pennant wire used was 180 metres unbroken. Between the anchor and the pennant wire is a chain 4 meters in length.

Anchor no. 10 was recovered on 20 October in the evening – approx. 24 hours after the accident. The length of the wire from the breaking point to the 4 meters chain on the anchor was measured to be 40 meters.

On a video taken by a ROV (Remote Operated Vehicle) it is possible to see the broken pennant wire. According to this, the pennant wire must have broken close to the stopper. This means that the anchor had hung 40 to 50 meters below STEVNS POWER during the anchor handling.



The anchor and pennant wire during anchor handling.

The pennant wire went through a pipe in the anchor handling buoy. When STEVNS POWER was capsized and floating with only the stem above the surface, the buoy came to the surface. At this moment the pennant no longer went through the buoy, meaning that the pennant wire had broken.

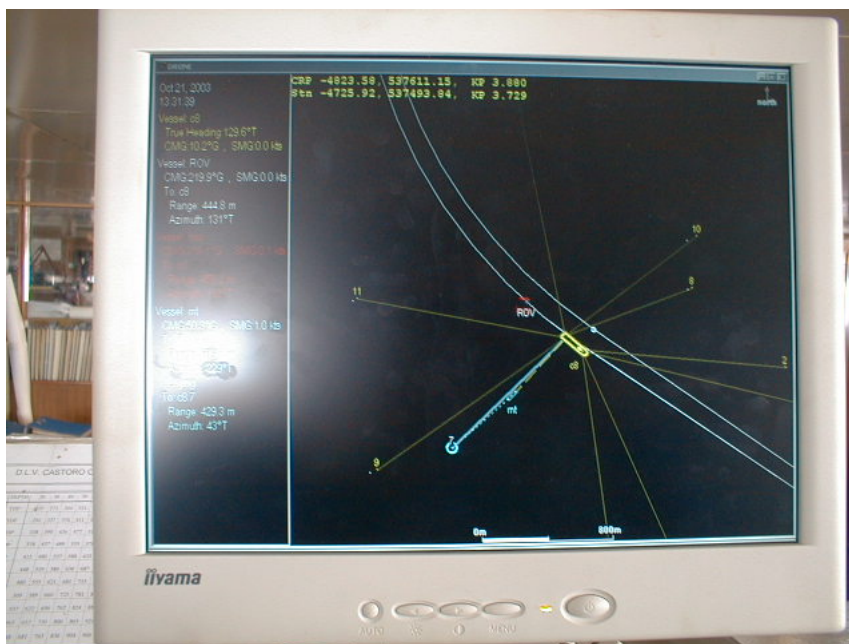
According to a former Master of STEVNS POWER, the weight of the anchor buoys is approx. 1.5 tons.



Photo showing pennant wire going through the buoy on aft deck.

Navigation in connection with the pipe laying project

On board CASTORO OTTO the British Admiralty Chart no. 1860 was used for ordinary maritime navigation. Special charts with UTM coordinates were used for the pipe laying project.



Screen used in connection with navigation.

Two sub-sea surveyors from the company FUGRO were on the bridge of CASTORO OTTO, when the accident occurred. FUGRO is the company in charge of the calculation of positions. The sub-sea surveyors control the positions of CASTORO OTTO and the

pipeline. This also includes the positions of the anchors. All positions are shown at a screen, which is available for the chief officer on board CASTORO OTTO and also available for the navigators on board the two anchor handling vessels. From the anchor handling vessels are sent information to the system about position, heading and speed whereby the movement of the vessels can be read directly on the screen during anchor handling.

It is the chief officer who determines which anchor needs to be moved in order to manoeuvre CASTORO OTTO in order to maintain the pipe stringer over the intended pipe laying location. However, in determining the extent to which an anchor can be moved and the suitability of the seabed, in relation to potential obstructions on the seabed, he will liaise closely with the sub-sea surveyors.

Information on the speed astern of STEVNS POWER at the time of the accident

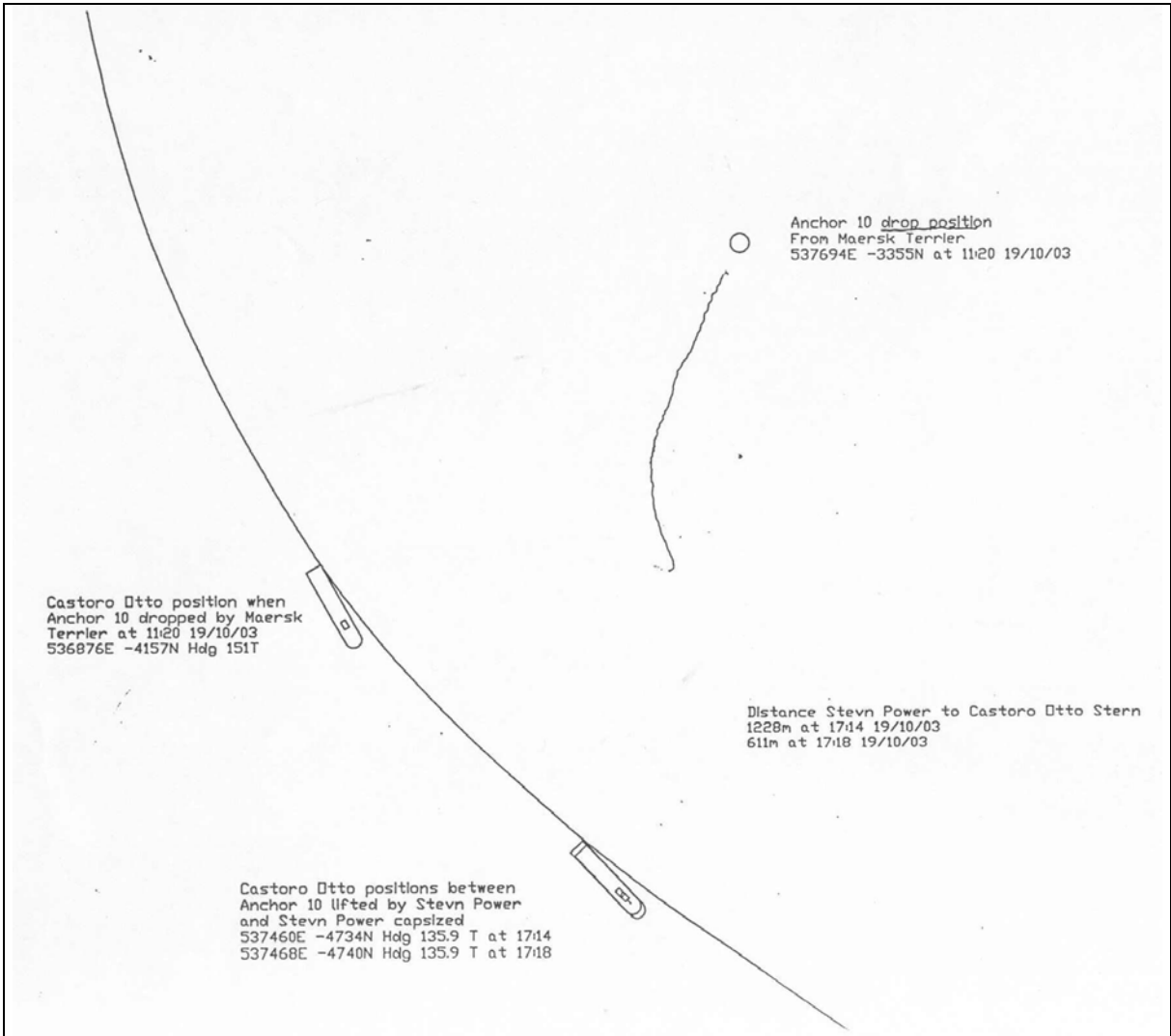
The precise length of the period when CASTORO OTTO began to recover the anchor wire to the capsizing of STEVNS POWER is not known.

After the accident, the sub-sea surveyors on board CASTORO OTTO have been able to reconstruct the track of STEVNS POWER. According to the time interval, the anchor wire was recovered in 198 seconds, i.e. 3 minutes and 18 seconds, but the engineer/surveyor who has reconstructed the track is not sure if the time interval is correct. However, he is certain about the positions of the track. According to the log of the engineer/surveyor where the times were written manually, they began to recover the anchor wire at 1714 hours and STEVNS POWER capsized at 1718 hours.

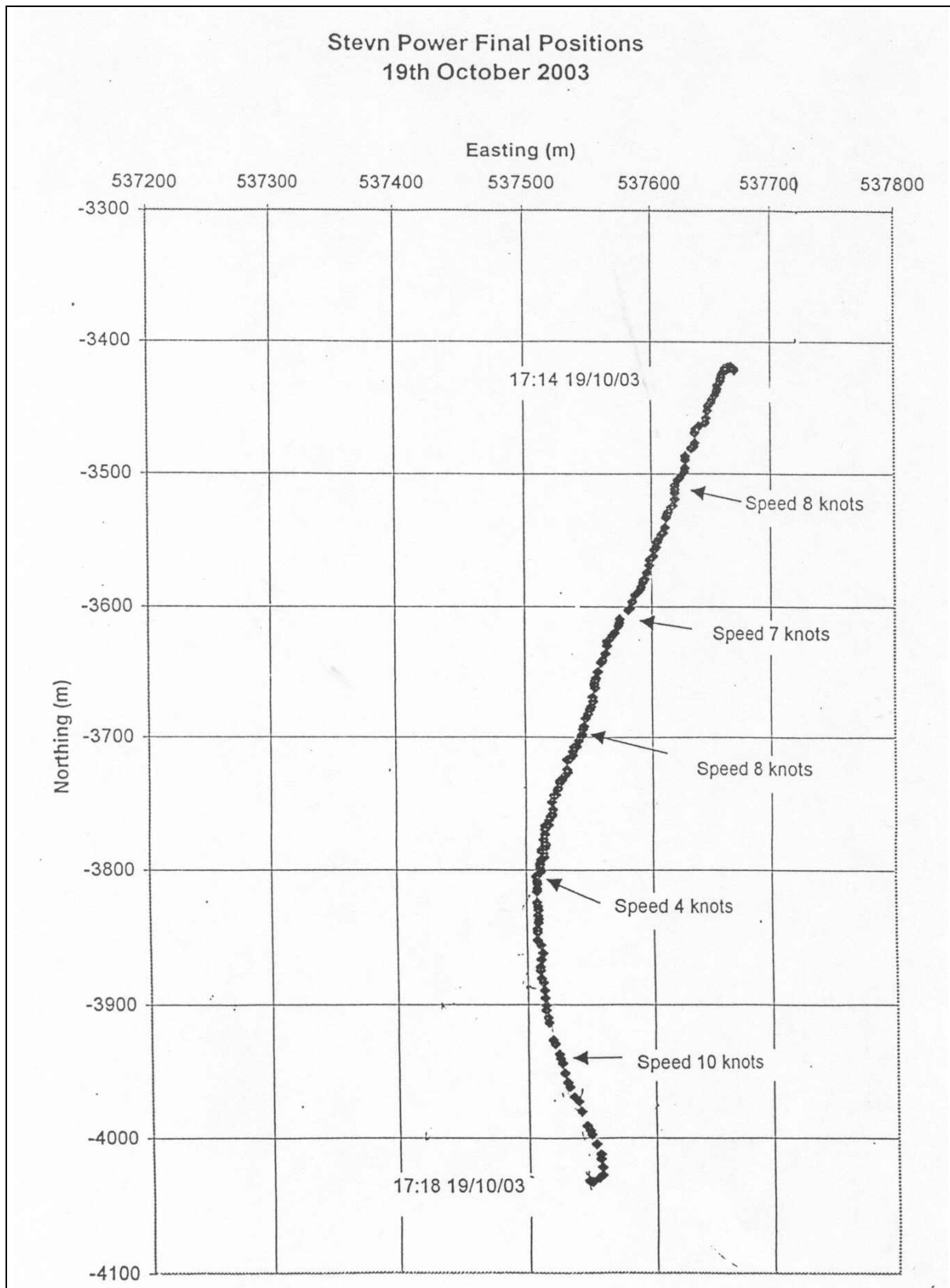
In the logbook of CASTORO OTTO, the chief officer has written that they began to recover the wire at 1710 hours and that STEVNS POWER capsized at 1715 hours. On MAERSK TERRIER, it was noted that STEVNS POWER capsized at 1715 hours.

It must be supposed from this information that the anchor wire was under recovery in 4 to 5 minutes before STEVNS POWER capsized.

From the data of the sub-sea surveyors, the precise track of STEVNS POWER during the recovering of the wire is available. The prints can be seen below.



Prints of track from the sub sea surveyors of CASTORO OTTO.



Print of track from the sub sea surveyors of CASTORO OTTO. The speed is written on the print by the surveyors and are according to them probably too high.

The distance between STEVNS POWER and CASTORO OTTO (starboard quarter) was 1228 metres when the anchor was lifted from the seabed. The distance between STEVNS

POWER and CASTORO OTTO (port quarter) was 611 metres when STEVNS POWER capsized. This makes a difference of 617 metres. Because STEVNS POWER altered course during the recovery of the wire the sailed distance is longer – approx. 650 metres.

If it is calculated that the anchor wire was under recovery in 4 minutes before STEVNS POWER capsized, the vessel had an average speed astern of approx. 5.3 knots. If it is calculated that the anchor wire was under recovery in 5 minutes before STEVNS POWER capsized, the vessel had an average speed astern of approx. 4,2 knots.

The information from the sub-sea surveyors shows that the speed astern of STEVNS POWER was approx. 1/3 higher than the average speed mentioned above when the vessel capsized. It is therefore not unrealistic to suppose that the speed astern of STEVNS POWER was between 6 and 8 knots when the vessel capsized.

Contributory to the increase of the speed before the capsizing may have been that STEVNS POWER during manoeuvring astern was altering course instead of approaching CASTORO OTTO directly. If the recovering speed of the anchor winch has been kept constant the speed astern of STEVNS POWER must have increased as the course became more parallel to the heading of CASTORO OTTO.

Recovering speed of anchor winch no. 10

The meter on the instrument panel for anchor winch no. 10 showed 1260 metres of wire when they began to recover the wire and 583 metres of wire, when STEVNS POWER capsized. This gives a difference of 677 metres. If the anchor wire was recovered in 4 minutes the average pulling speed was 169 metres per minute. If the anchor wire was under recovery in 5 minutes the average pulling speed was 135 metres per minutes.

Information about previous problems in STEVNS POWER due to a too high recovering speed.

According to the master of MAERSK TERRIER, a situation arose before noon on the 19 October – the day of the accident – between STEVNS POWER and CASTORO OTTO. STEVNS POWER was relocating an anchor. STEVNS POWER called CASTORO OTTO and told them that they had problems, because they were pulling too fast on the anchor wire.

On board INSPECTOR, they are also listening on VHF canal 71. On Saturday - the day before the accident - the master of INSPECTOR heard that STEVNS POWER asked CASTORO OTTO not to pull so hard.

The chief officer on board INSPECTOR had several times overheard STEVNS POWER telling CASTORO OTTO not to pull so hard at earlier anchor handling operations.

A former navigator of STEVNS POWER has stated that he had participated in a meeting on board, where it was decided to complain to CASTORO OTTO that the operation sometimes went on too fast. He had heard the now deceased master complain to CASTORO OTTO about this over the VHF radio.

The crew aboard the CASTORO OTTO have no recollection of STEVNS POWER making several requests that they should not pull so hard (or fast) during anchor recovery, prior to the incident.

In the minutes of the safety meetings on board STEVNS POWER there is no mentioning of hard/fast recovery of the anchor wire.

8. Additional information

Information on fuel oil, lubrication oil, ballast water, fresh water and spare parts on board STEVNS POWER

CASTORO OTTO receives information every day on the oil and water reserve on board the anchor handling vessels.

On the 18 October at 2400 hours STEVNS POWER said that they had 10985 litres lub. oil, 336 metric tonnes fuel oil and 36 tonnes freshwater on board.

A navigation officer who signed off on 15 October has told that STEVNS POWER bunkered fuel oil 4 or 5 days before he paid off. They began to use fuel oil from tank no. 1.

STEVNS POWER uses 4 to 5 tonnes fuel oil each 24 hours during anchor handling operations.

The navigation officer has also stated that the aft ballast tanks were full. He is certain that tank no 24 starboard and port were full. He thinks that ballast tank no 23 was also full. The aft ballast tanks were full in order to get the stern roller closer to the surface.

A spare towing wire of 20 tons was placed on deck starboard side. The spare towing wire has always been on board.

A former master has said that tank 8 and 9 were always empty. He has also told that it was normal with ballast in the aft tanks no. 23 and 24 sb+ps, when fuel oil was used from aft fuel oil tanks. Ballast was filled into the ballast tanks in order to get the roller more down, so it became easier to get buoys and anchors on deck.

Stability book

When STEVNS POWER was transferred to the Danish International Register, a new stability book was elaborated by NIELS MOSBERG ApS. The stability book was approved by the classification society.

The stability calculations were based on a lightship measuring and heeling test made in 1998, when the vessel was named SEAWARD FOX.

Stability of STEVNS POWER on the day of the accident

It is not known exactly which tanks contained fuel oil and ballast water. This stability calculation is based upon the information from CASTORO OTTO about fuel oil, lub. oil and fresh water on board STEVNS POWER the evening before the accident and the information from the signed off officer about ballast and use of fuel oil from tank no. 1. The calculated condition is the condition the vessel probably had on 19 October before the anchor handling operation had begun. The forces from the anchor and the anchorwire are therefore not included in this calculation of the stability. The calculation is made by NIELS MOSBERG ApS.

The calculation is built on the following assumptions:

F.O. tank aft. pos. 1 centre - 53,20 tonnes (full tank 94,58 tonnes).

F.O. tank aft. pos. 2 ps and 3 sb – almost full, total 97,62 tonnes.

F.O. DB. Tanks pos. 4 ps, pos. 5 sb and pos. 6 ps, pos. 7 sb all full, total 169.17 tonnes.

F.O. wingtank aft sb+ps and forward sb+ps - empty.

F.O. storagetank sb+ps - empty.

F.O. serv.tank aft and sett. tank forward - total 11.98 tonnes.

F.O. total 331.97 tonnes.

Lub.oil - total 9.88 tonnes.

W.B. tank pos. 23 aft centre - empty.

W.B. tank pos. 24 aft sb+ps - full, total 72,78 tonnes.

W.B. topside sb+ps – empty.

W.B. DB forward sb+ps – empty.

W.B. forepeak – empty.

F.W. tank sb+ps – 34,00 tonnes (full tanks 57,20 tonnes).

Hydr. Oil sb+ps – 1,15 tonnes

Crew, stores and prov. - 15 tonnes.

Buoy on deck 2,00 tonnes.

Pennant wire – 1,6 tonnes.

Enclosure 2: Plans of the tanks.

If the condition of STEVNS POWER was as assumed above, the trim of the vessel would be:

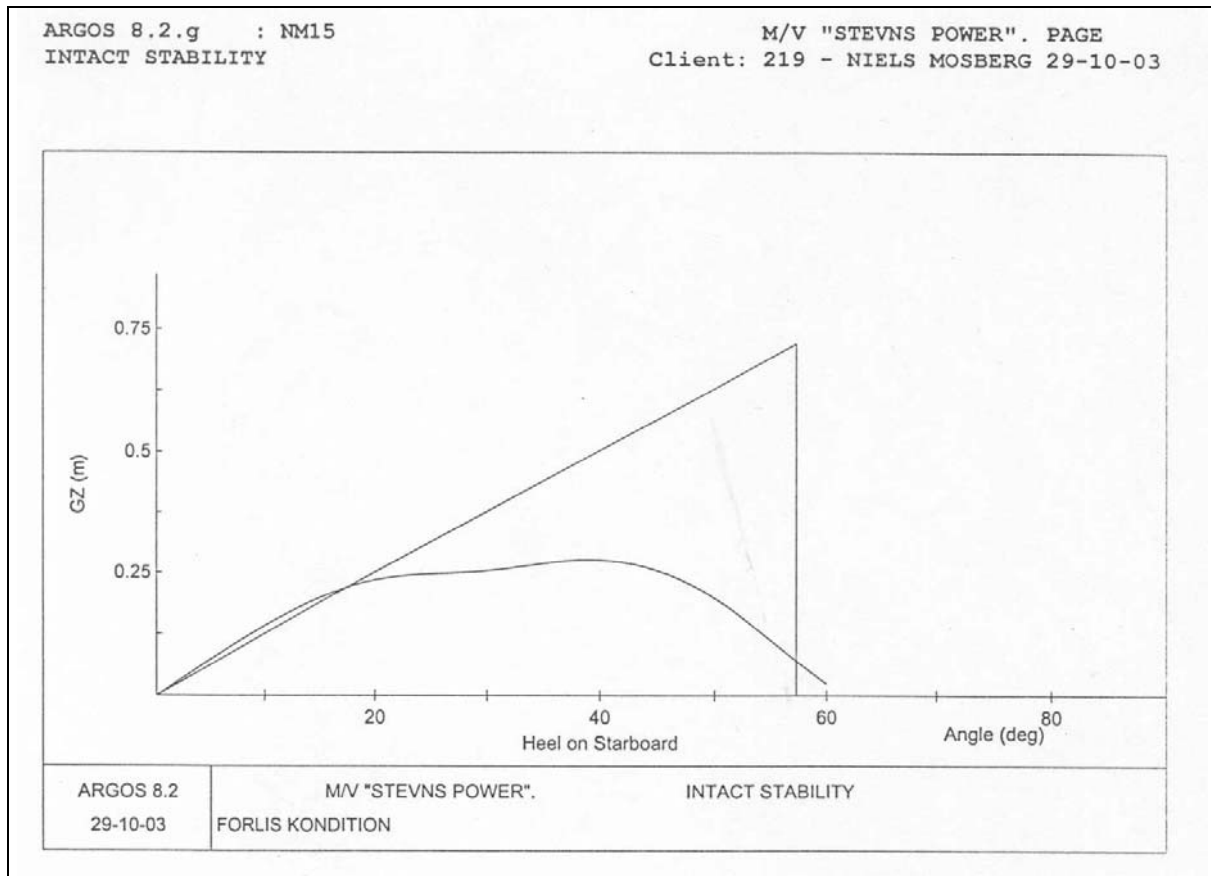
Draught at corresponding mark: For 3.85 metres, aft 5.38 metres, trim 1,53 metres aft.

The vessel would have fulfilled the minimum stability criteria as follows:

- The area under the GZ-curve up to 30° was 0.090 radian metres – requirement 0.055 radian metres.
- The area under the GZ-curve up to 40° was 0.137 radian metres – requirement 0.090 radian metres.

- The area under the GZ-curve between 30° and 40° was 0.047 radian metres – requirement 0.030 radian metres.
- The maximum righting moment GZ_{max} occurred at 39° - requirement minimum 25°.
- The righting moment GZ was 0.278 metres between 30° and 40° - requirement minimum 0.200 metres.
- The metacentric height GM was 0.721 metres – requirement 0.15 meters.

(No weathertight openings would be submerged at 40°).



The GZ-curve of STEVNS POWER on the day of the accident.

Information about the aft trim

The chief officer of MAERSK TERRIER noticed that STEVNS POWER was trimmed very much aft. He had himself years before been officer on board STEVNS POWER and his opinion is that the vessel was trimmed exceptionally much aft. 4 or 5 days before the accident, he noticed that the draft forward of STEVNS POWER was exactly 4.00 metres and that the vessel had only 0.30 metres aft freeboard.

According to the master of MAERSK TERRIER, STEVNS POWER had an abnormal aft trim the last 3 to 4 days before the accident. The forward draft of STEVNS POWER was 4.00 metres and the aft freeboard was maximum 0.50 metres. The crew of STEVNS POWER had not mentioned anything about the aft trim when talking to the crewmembers of MAERSK TERRIER over the radio.

The master of INSPECTOR noticed the day before the accident that the stern roller of STEVNS POWER was in the water surface.

The steering engine of STEVNS POWER

According to the crew of CASTORO OTTO, on the day of the accident, STEVNS POWER advised CASTORO OTTO at 9 AM that they had some problems with the steering gear. Five minutes later STEVNS POWER advised that the problems were resolved. The information was noted in the logbook of CASTORO OTTO.

The master of MAERSK TERRIER has stated that on the day of the accident at approx 9 o'clock, he had heard on the radio that the crew of STEVNS POWER would go down in the steering engine room for routine inspection. The master of STEVNS POWER told the master of MAERSK TERRIER that everything in the steering engine was as it should be.

Other information on STEVNS POWER

STEVNS POWER was equipped with water level alarm in the steering engine room and in the engine room.

At the winch were watertight doors to storeroom in both starboard side and port side. From the storerooms, there was a door opening, without a door, to the engine casing in both sides.

A former crewmember on STEVNS POWER has explained that these doors were open, when he was on board.

There were in both sides 3 to 4 steps up to a platform behind the winch from where there was access to the accommodation and in port side to the engine room. The doors to the accommodation were always closed because of the air-condition.

Life saving equipment

Four life rafts from STEVNS POWER were picked up after the accident. All the life rafts were inflated, as required. The life rafts, the EPIRB, the lifebuoys and the life jackets, which were found after the accident, were taken on board CASTORO OTTO.

Surveys

In connection with the change of flag, STEVNS POWER was surveyed by the Danish Maritime Authority and by the classification society Lloyd's Register of Shipping. The survey by the Danish Maritime Authority included survey on the working environment on board.

The last four surveys by the classification society were finished 16 January 2002, 3 July 2002, 21 February 2003 and 14 August 2003 respectively. All requirements had been fulfilled.

Docking

STEVNS POWER was in dock in June 2003 in Las Palmas. At the same time the vessel was surveyed by the classification society.

During the docking the following repairs were carried out:

- Bottom and vertical sides – Cleaning, blasting and painting.
- Pneumatic test to avoid space (pressure test of void space between steering engine and fuel oil tanks).
- Rudder pintles and tail shaft clearance recording.
- Sea chests grid – inspection, clean, scrap, paint.
- Cathodic protection.
- Valves. Bottom sea suction valves inspection, grinding, new gaskets, new bolts and nuts (total 6 butter fly valves)
- Strainer (sea chest replaced).
- Deck. To crop and renewal bulwark stays on deck.
- Bottom. Renew steel plates – 1.090 kilos.
- Nozzle port and starboard. Welding cracks.
- Side fender (repair).
- TOW PINS – Support guide, hydraulic pins, Shark Jaw (complete overhaul).
- Anchor Handling Winch (new hydraulic engines).
- Four liferafts. Check and issue certificates.
- Echo sounder. New one installed.
- M.E. Turbo blower rotor.
- Tail shaft and propeller-controllable pitch.
- Sterntube (inspection)
- Propeller. Repair one propeller blade.
- Rudder. Remove rudder blade and refit.
- Main engine cooling seawater piping. New pipes.
- Main switchboard. Winch control system.
- Fixed block.
- Several works. Cleaning of all fuel tanks. Cleaning and coating of freshwater tanks. Steel repair in water ballast tank (forepeak). Repair of steering gear (inspection of steering engine. Replacement of bolt.

A crewmember has explained that the fuel oil was sometimes contaminated by seawater.

The company has explained, that the tanks of STEVNS POWER were in good condition and approved by the classification society. As far as they know STEVNS POWER did not have engine spot because of contaminated fuel oil. The tanks were pressure tested on a shipyard in Turkey in 2002. On the shipyard in Las Palmas, a leak was detected between the aft dry tank and a fuel oil tank. This was repaired.

A former master on STEVNS POWER had no knowledge of contaminated fuel oil.

Procedures and management systems

STEVNS POWER should not comply with all international conventions because the vessel original was measured to be 499 Grt. The vessel was therefore not obliged to comply with the ISM regulation. The company was ISM certified and according to the company, it was

the intention also to have STEVNS POWER certified. On board STEVNS POWER they had started to use part of the ISM system, but they did not report to the company.

In the *Safety Management System (SMS)* of the company is among others information on:

- Minimum requirement for masters employed in the company.
- Instruction to the crewing agency to ensure that crewmembers have the right qualifications, certificates, health certificates, sufficient experience and relevant courses and education.
- Instruction to new crewmembers (familiarisation on board) – Safety check lists for deck crew and officers.

Anchor handling is not mentioned in the *Safety Management System* of the company.

The company has no written procedures on anchor handling in their office. Such procedures were only found on board.

A manual with risk assessments was on board STEVNS POWER. This was confirmed by the survey on working environment by the Danish Maritime Authority on 6 February 2001. A former master on STEVNS POWER, who participated in the writing of risk assessments on board has explained, that instruction on working on deck during anchor handling was elaborated.

CASTORO OTTO is ISM certified. On board CASTORO OTTO are general procedures on anchor handling.

Safety meetings

Eight safety meetings were held on board STEVNS POWER between 21 October 2001 and 2 October 2003.

The following related to anchor handling were mentioned in the summary records:

21 October 2001: An AB had broken a finger when he lifted a reeling hook on the pennant wire while the wire was recovered from the bridge. The causes to the accident were discussed. The master stressed the importance of good work planning, instructions and that they should ask again, if they had not understood an explanation. The risk of wire break was discussed. It was stressed that they should stay outside the cargo rail. The bridge should do the best to reduce tension on wires. Nobody was allowed on deck during heaving/slacking of anchors. Improvement of communication between bridge and deck and between bridge and engine was discussed.

9 February 2002: The matter of safety during anchor handling was once again brought up by the chief officer and he stressed the importance of working carefully on deck and on bridge. The master stressed that the crew should remember closing the watertight doors during anchor handling. The chief officer stressed that training of crewmembers still was essential to the safety.

17 April 2002: the master mentioned Anchor handling. The importance of safe working practise on deck was stressed, because of new crewmembers, who had not worked with this kind of gear before. Good order and securing of loose gear in connection with anchor

handling were discussed. It was stressed that watertight door should be kept closed during operations.

30 September 2002: The master stressed safety during anchor handling. All participants agreed that safety had improved since last meeting. Control of lifejackets (for use at work) and the importance in given the new crewmembers instruction in anchor handling were discussed. It was stressed that all watertight doors should be kept closed during operations.

16 April 2003: The members of the Safety Committee were satisfied with the safety on deck, but all agreed that better communication was needed between the deck and the bridge.

2 October 2003: All members agreed that the safety on board was good in general. Two things could be improved. It was stressed that all persons working on deck at sea should be wearing a lifejacket – also the officers. VHF communication between bridge and deck should be improved under all kinds of operations. The contract period for the crew was discussed. All agreed that 12 months contracts (foreign crewmembers) were far to much due to safety of the crew and vessel, especially during anchor handling operations, but also in general.

Information from the video of the ROV (Remote operated vehicle)

The wreck of STEVNS POWER was lying on the seabed on even keel on course 230°.

The upper 2 to 4 metres of the seabed consisted of mud. The video showed that the aft 5 to 6 metres of the deck was covered by approx. 1 meter of mud. This is probably due to STEVNS POWER hitting the seabed vertical with the stern and after that tipping down to its present position. Most of the visible damages are on the gunwale, bulwark and aft deck and has probably caused by the vessel hitting the seabed.

It was possible to follow the pennant wire from the winch and aft. Aft where the wire came out of the mud the wire was broken.

It was not possible to see the stopper on the video because of the mud on deck.

It was not possible to see rudders and propellers, which were down in the mud on the seabed.

The powered guide pins were down in the deck. The top of the starboard guide pin was 5 centimetres over deck.

There were no visible damages to the stern roller.

There were no visible scratch marks on the top of the cargo rail in port side. The pennant wire has therefore probably not been hanging over the cargo rail when the vessel capsized.

The hatch cover to the steering engine was closed and secured with wing nuts. The hatch was almost covered with mud.

The hatch cover of the emergency hatch to the engine room was tipped down. A sling is visible on the video in between the hatch coaming and hatch cover. This indicates that the hatch could have been open when the vessel capsized.

The reserve towing wire placed in starboard side of the deck was gone. INSPECTOR found the anchor after the accident. The distance between the position of the anchor and port quarter of CASTORO OTTO was approx. 600 metres.

The distance between the position of the anchor and the wreck of STEVNS POWER was approx. 200 metres.

Other information

An engineer on board INSPECTOR had been witness to a sudden list of STEVNS POWER on the 3 September 2003 in Point Noire, while the vessel was moored alongside.

The officer who signed off few days before the accident has told, that the vessel in Point Noire was loading pipes with a weight of each 21 tonnes. It was these pipes, which created the list during loading, but there were no problems on board.

9. Analysis

Chronology

On 1 September 2003 STEVNS POWER started a new anchor handling project for CASTORO OTTO off the coast of Nigeria.

On 15 October, the chief officer, an AB and the cook signed off and new crewmembers came on board.

On 18 October, the master of INSPECTOR heard on VHF channel 71 that STEVNS POWER asked CASTORO OTTO not to pull so hard.

On 19 October before noon, the master on MAERSK TERRIER heard that STEVNS POWER called CASTORO OTTO because CASTORO OTTO pulled too fast on the anchor wire.

On 19 October at approx. 1645 hours, CASTORO OTTO told STEVNS POWER that anchor no. 10 was to be relocated.

- At approx. 1705 hours, STEVNS POWER informed CASTORO OTTO that the anchor was off the seabed.
- At approx. 1710 hours, CASTORO OTTO began to pull on the anchor wire. STEVNS POWER followed on an astern course.
- Approx. 3 minutes later, STEVNS POWER began a turn while the vessel still was manoeuvred astern and while CASTORO OTTO was still pulling on the anchor wire. This was done for the purpose of bringing the wire closer to the line the anchor wire was going to follow to the new anchor position.

- At approx. 1715 hours, STEVNS POWER heeled to port and took in water on the aft deck in port side.
- At approx. 1715 hours the call “Stop pulling, stop pulling, stop pulling....” was heard on the VHF channel 71.
- At approx. 1715 hours, the 3rd officer on CASTORO OTTO saw that STEVNS POWER heeled over to the portside and got a more aft trim. Black smoke came out of the funnel. He immediately called the bridge and said that STEVNS POWER had problems. The winch operator on CASTORO OTTO immediately stopped pulling on the anchor wire. The chief officer and the winch operator on CASTORO OTTO then saw that STEVNS POWER was heeling to the portside and had water on the aft deck . Immediately after, STEVNS POWER capsized and sank with the stern.
- Approx. one minute later, STEVNS POWER was lying vertically in the water with only the stem over the surface.
- At approx. 1719 hours, a rescue boat from CASTORO OTTO arrived to the scene of the accident.
- At approx. 1721 hours, MAERSK TERRIER launched a rescue boat and participated in the search and rescue operation.
- At approx. 1740 hours, INSPECTOR launched the ROV at the still floating STEVNS POWER.
- At approx. 1746 hours, STEVNS POWER sank. None of the crewmembers of STEVNS POWER were found.

Factors which has or can have had influence on the accident

It is the opinion of the Investigation Division that the foundering of STEVNS POWER was caused by several circumstances. Considering the information the Investigation Division has obtained, some of the circumstances are well documented and some are likely to have happened. Other circumstances, the Investigation Division have not been able to prove or disprove. The circumstances are analysed below.

Procedures for cooperation on safety

Both the day before and earlier on the day of the accident, according to several statements situations arose where STEVNS POWER had to ask CASTORO OTTO to stop pulling on the anchor wire. Also before there had been situations, where this happened.

On the ground of these situations, it should have been recognized both on board CASTORO OTTO and on board STEVNS POWER that there were safety problems. Both the master on STEVNS POWER and the master of CASTORO OTTO should have reacted accordingly and have agreed on what should be done to prevent similar situations from happening again.

As part of the mutual cooperation between STEVNS POWER and CASTORO OTTO, the master and chief officer of STEVNS POWER were on board CASTORO OTTO to receive information on the project, when the pipe laying work was started off the coast of Nigeria. The Investigation Division can ascertain that the cooperation lacked because the situations described above.

In the opinion of the Investigation Division the occurrence of the accident indicates the need for standard procedures between STEVNS POWER and CASTORO OTTO on what to do if the anchor handling was done too fast. They could have agreed that:

- this should be considered as a near miss situation
- this immediately should be reported to the masters of both STEVNS POWER and CASTORO OTTO
- the two masters should find out together what had happened and they should agree on which precautions to make to avoid reiterations, before the anchor handling was continued,
- the situations were reported to the companies and
- if necessary, agreement on limits for maximum recovering speed of the anchor wire or maximum speed astern of the anchor handling vessel, were made.

STEVNS POWER

Stability and trim

The estimated stability condition STEVNS POWER had just before the anchor handling was started has been calculated. The vessel complied with all the stability criteria.

The calculated stability is not the stability the vessel had at the time of the accident because the influence of the anchor and the pulling on the anchor wire are not included in the calculations.

The stability of STEVNS POWER has been deteriorated in the moment the water flooded the deck and the engine room. In the opinion of the Investigation Division this deterioration has had considerable influence on the fact that the vessel capsized.

Before the anchor handling was started, STEVNS POWER had a freeboard aft of approx. 50 centimetres. During the anchor handling the freeboard must have been even lower because of the weight of the anchor and the wire and the pulling on the wire.

A low freeboard aft made it easier to bring buoys and anchors on deck. But it also made it easier for the water to emerge on the deck, and at the time of the accident, where the vessel was going astern with high speed, the water has been shovelled on deck. It has not been possible to establish if the freeboard aft of STEVNS POWER was lower than normal, but the master and chief officer on MAERSK TERRIER, who both knew STEVNS POWER, are of the opinion that the freeboard of the vessel was very low.

A former master on STEVNS POWER has explained that ballast was filled into the aft ballast tanks when fuel oil had been used from the aft fuel oil tanks. The chief officer, who signed off, has explained that on 15 October, there was ballast in the aft tanks although there still was a considerable quantity fuel oil in the aft fuel oil tanks.

Another former master has explained that a low freeboard aft was normal off the coast of Nigeria because the weather almost always was good. If the vessel was going to work in the North Sea, the vessel would not be trimmed so much aft.

It is the opinion of the Investigation Division that STEVNS POWER should have had a higher freeboard even if the handling of the buoys would become more difficult.

Hatches and doors

The ROV videos show that there is a sling in between the hatch and the hatch coaming at the emergency exit of the engine room. Regardless if the hatch was open or if the engineer on watch has opened the hatch in order to get out (the control panel in the engine room was close to the emergency exit), it must be assumed that large quantities of water have flooded the engine room this way. When the aft of the vessel sank as fast as it did, it is most likely that large quantities of water penetrated the vessel very fast.

It was not possible to see on the ROV videos whether the watertight doors to the storerooms in starboard and portside were open. There is directly access to the engine casings from the storerooms. A former crewmember has explained that these doors were open during anchor handling while he was on board.

It says in the summary of the safety meeting that it was pointed out that the watertight doors should be kept closed during anchor handling.

It may have been because of the good weather in the area that they did not focus sufficiently on keeping the watertight hatches and doors closed.

During anchor handling it is essential that all hatches and watertight doors are kept closed in case water should flood the deck.

Based on information from the ROV video and taken into consideration that STEVNS POWER sank with the aft part within 1 minute, it is the opinion of the Investigation Division that the emergency exit to the engine room was open and possibly so was doors, when the vessel sank.

It should have been standard procedure to control that hatches and watertight doors were closed before each anchor handling was started.

Possible technical defects

Besides that the rudders could turn to starboard or portside unintentionally, when the vessel was going astern, if the navigator did not prevent this by the tiller, there may have arisen a technical defect in the steering gear. The rudders can have turned to one side if the steering engine had a defect because of the high speed astern – e.g. a hydraulic pipe/hose. The Investigation Division has no information proving this. It was not possible to see the positions of the rudders on the ROV videos.

The Investigation Division has tried to establish whether the stability could have been reduced because of corrosion in tanks. If oil or ballast water had run unintentionally from one tank to another, the stability would have been reduced because of free surfaces. It has not been possible to establish this theory.

The spare towing wire could have been torn from its basis when the vessel heeled over and rolled to portside and aft. When STEVNS POWER was on shipyard in Turkey, a new basis was made for the spare towing wire. The weight of the wire was approx. 28 tons. On the ROV videos the spare wire is no longer where it was placed. According to the Division for

Investigation of Maritime Accidents, it is most likely that the wire was torn from its basis when the vessel had a considerable heeling or later.

If the stopper (shark jaws) had opened unintentionally, so the pennant wire could have got out and up on the cargo rail in the portside, it could have been a critical situation because of the athwartships pull in the wire. The Investigation Division finds it unlikely that the stopper opened. If the hydraulic pump had had a defect, the stopper would not have opened. Furthermore, the ROV videos show that there are no marks from a wire on the portside cargo rail, which had been painted in Las Palmas few months before.

Anchor handling at the time of the accident

The manoeuvres of STEVNS POWER

There is no precise information on how the engines, the bow thrusters and the rudders were used on board STEVNS POWER during the last anchor handling manoeuvre.

According to information from former crewmembers and other seamen with anchor handling experience, the manoeuvres could have been performed in the following way:

The manoeuvres were mainly performed by using the two engines. At the beginning, the rudders would have been in an amidships position. The thrusters would not have been used after the pulling on the anchor wire was started, because the thrusters were relatively small and had no effect when the vessel had some speed.

According to some seamen with anchor handling experience, it is more difficult to manoeuvre the vessel if the anchor is hanging 40 meters below the stern roller. In their opinion it is easier to manoeuvre the vessel if the anchor has been pulled to the stern roller. According to the information received by the Investigation Division, it was normal practice only to lift the anchor well off the seabed. The anchor was only taken on deck if they were going to pass a pipeline or other during the manoeuvre.

When the pulling on the anchor wire was started, it is possible that the vessel had the engines on slow astern until the vessel had some speed, but immediately after they probably put the engines on slow ahead, while the vessel was pulled astern by the recovering of the anchor wire.

It is possible to see on the track (page 35) that the speed astern became lower just before the turn was initiated. At this moment they have probably put the engines a little more ahead in order to stretch the wire to get it as much as possible off the seabed.

When STEVNS POWER was going to turn approx. 3 minutes after the anchor handling manoeuvre was started, that could have been done by taking revolutions from the portside engine or by putting the portside engine on astern. Such a manoeuvre in connection with the pulling on the anchor wire from CASTORO OTTO will result in increased speed astern. The rudders can have remained in an amidships position or the starboard rudder can have been given in connection with the turn. The fact that the rudders could turn to one side unintentionally when the speed astern was high, if this was not prevented by the tiller, may have made the manoeuvring of the vessel more complex, especially if the navigator did not have sufficient experience.

When water flooded the deck in portside and the vessel heeled over, the engines probably were put on full speed ahead in order to sail the vessel out of the water. This is a normal procedure. Witnesses saw black smoke coming out of the funnel of STEVNS POWER, which could indicate that the engines had been put on ahead. A former master of STEVNS POWER has explained that in his opinion it was better to put the engines on stop, if water flooded the deck in connection with a turn.

When an anchor handling vessel is going astern with a low free board aft and with relatively high speed, the vessel will be heavily influenced by water entering the deck. The water will be shovelled on board with much power when the deck gets under the surface. When in addition the water enters on one side of the deck as was the case when the accident occurred, the vessel will heel.

The turning manoeuvre made STEVNS POWER lie almost on a parallel course with CASTORO OTTO when the accident occurred. Consequently, the pull on the wire was from the stopper on the aft deck to the portside. This has contributed to the heeling of the vessel and to the fact that the portside of the deck came under water.

Pulling speed on board CASTORO OTTO and the speed astern of STEVNS POWER

According to the information from CASTORO OTTO, the anchor wire was pulled in with a constant power of approx. 15 metric tons. There is no documentation indicating that there should have been pulled with more power than the approx. 15 metric tons which was normal.

STEVNS POWER had a bollard pull on approx. 100 tons. Experienced officers in anchor handling has explained to the Investigation division, that STEVNS POWER could have stopped the winch on CASTORO OTTO by putting both engines on full ahead, even if the wire was recovered on board CASTORO OTTO by considerable more than the 15 tons mentioned above.

The track STEVNS POWER followed from the anchor handling was started until the accident occurred is preserved. The precise period is not known.

The track shows that STEVNS POWER initiated a turn approx. 1-2 minutes before the capsizing. It can be established that the speed astern was increased after the turn was initiated and until the capsizing occurred. The time period is not known exactly but according to the information available it is not unrealistic to assume that the speed was between 6 - 8 knots and maybe even higher, when the vessel capsized. This is a high speed aft for a vessel engaged in anchor handling and especially in connection with a turn.

In the opinion of the Investigation Division, STEVNS POWER had a high speed astern both because the wire was pulled in too fast from CASTORO OTTO and because of the engine manoeuvres on board STEVNS POWER during the turn.

It is the Opinion of the Investigation Division that the indirect reason for the high speed is a general attitude amongst the crew on both the pipe laying vessel and the anchor handling vessel to work fast. However, saving a couple minutes in that part of the anchor handling, where the vessel is going astern is of minor importance seen in relation to the increased safety control over the situation.

Communication at the time of the accident

When they on board MAERSK TERRIER heard from the crew from STEVNS POWER calling “stop pulling”, the 2nd officer ran to a window and saw that STEVNS POWER heeling over. Therefore, it can be assumed that it only took few seconds after they called “stop pulling” until the vessel heeled over. This is, if the vessel was not heeling already when they called “stop pulling”.

The 3rd officer on CASTORO OTTO saw STEVNS POWER heel to the portside and he immediately reported this to the bridge on a portable radio. The 3rd officer stood at the portside quarter on CASTORO OTTO, where he had a free view to STEVNS POWER. The chief officer and the winch operator on the bridge heard the call from the 3rd officer and then they saw STEVNS POWER heel and shortly after capsize. The pulling on the anchor wire was stopped immediately when the 3rd officer called, i.e. when STEVNS POWER heeled over, but before the vessel capsized.

The chief officer on CASTORO OTTO did not hear the call “stop pulling” from STEVNS POWER, but together with the information from MAERSK TERRIER it must be assumed that the 3rd officer on CASTORO OTTO alarmed the bridge about the heeling of STEVNS POWER at the same moment as there was shouted “stop pulling” or few seconds later.

It is possible that the chief officer did not hear the call “stop pulling” because the 3rd officer called on the portable radio to alarm the bridge about the heeling of STEVNS POWER simultaneously. The chief officer was carrying the portable radio while the VHF radio, which was on channel 71, was placed few meters from where he was standing.

Human factors

Fatigue

All crewmembers on STEVNS POWER except the cook were on two-shifts watch. The anchor handling was done 24 hours a day from the beginning of September. Each of the crewmembers were off duty maximum 6 hours at a time in this period. Twenty-four hours a day, there was noise on board from the anchor handling manoeuvring with the engines, the usage of the thrusters and the buoys which were taken on deck.

Manoeuvring of a vessel during anchor handling is a very demanding task, which require the full attention of the participants. Especially, considering the safety of the crewmembers working on deck, but also the manoeuvring of the vessel itself.

According to a safety meeting on board STEVNS POWER, among other thing, the long periods where the foreign crewmembers are signed on were discussed as being a safety problem in connection with anchor handling.

In the opinion of the Investigation Division, it cannot be excluded that navigator has not been fully focused because of fatigue/ tiredness, but it is not possible to establish this assumption.

Regulation on resting periods are established in *Order no. 515, 28 June 2002 on resting periods for seafarers*. In case the crewmembers have been on two-shift watch as describes above the regulation on resting periods has been observed.

CASTORO OTTO

The chief officer on CASTORO OTTO and the winch operator controlling winch no. 10 both had long experience with anchor handling on board CASTORO OTTO.

Also the crewmembers on CASTORO OTTO were on two-shifts watch. As on board STEVNS POWER, it is a demanding job to continually perform anchor handling. On the day of the accident, they had done 16 anchor handlings with STEVNS POWER alone. In addition, to this, there were the anchor handlings done by MAERSK TERRIER. Therefore, it is also possible that the crew aboard CASTORO OTTO were not fully focused because of fatigue/tiredness, but it is not possible to establish this.

Experience of the crewmember – Instruction and training in anchor handling

The master who was on board at the time of the accident had long experience in anchor handling. The 2nd officer had altogether seven months experience in anchor handling. However, the chief officer had signed on four days before the accident and he had no experience with anchor handling. The new chief officer had experience from tugboats. The oiler who was on the bridge as winch operator had had three long periods on board STEVNS POWER.

There is no doubt that manoeuvring a vessel during anchor handling is a demanding task, which require good skills and experience from the navigator.

It has not been possible to establish who was in command on the bridge at the time of the accident. The master was probably on watch before noon, because he spoke with the master on MAERSK TERRIER at this time. Normally, the chief officer would be in charge in the afternoon.

The crewmembers were instructed in anchor handling after signing on. The work on deck during anchor handling was described in connection the writing of a risk assessments. There were no written instructions on how training in manoeuvring the vessel during anchor handling should be done.

The ISM Code was not applicable to STEVNS POWER and the ISM of the company, which was known on board STEVNS POWER, had information on instruction of new crewmembers (familiarisation on board). However, there was no information on instruction specific in anchor handling.

On board was a manual, which, among other things, contained risk assessments about anchor handling and a book about anchor handling and towing. There were no procedures about training the bridge team in anchor handling on board STEVNS POWER.

The master who had long experience in anchor handling and who had started up the anchor handling in the company when STEVNS POWER was bought did probably begin the training of the chief officer when he, on 15 October 2003 paid on. It is not known how far the chief officer was in this instruction when the accident occurred.

The company sent a chief officer, who was new in the company and who had experience with tugboats on board STEVNS POWER. However, he had no experience in anchor handling. The work on board including the manoeuvring of the vessel was demanding. When he signed on STEVNS POWER, they were on a project in which the chief officer had to be a part of the watch team at once.

It is the opinion of the Investigation Division that the company should have ensured that there was sufficient resources and time to train and instruct the chief officer on board, before he became a part of the normal watch team.

It is the opinion of the Investigation Division that it is very important that the bridge team knows exactly what to do when a dangerous situation arises. Training and experience are important factors.

On board STEVNS POWER, it was not normal practise in cases of dangerous situations to ease out the pennant wire. It was possible to ease out on the pennant wire so that the anchor would go to the seabed. It is not known if the bridge team tried to do this in this situation.

The opinion of the Investigation Division is that there should have been procedures for instruction and training of the bridge team in handling situations where water would emerge on the deck. It could e.g. be a task for the winch operator to be ready to ease out on the pennant wire with high speed if the officer ordered him to do so.

The remaining crewmembers

The remaining Danish and Philippine crewmembers had experience in anchor handling except for one Philippine AB, who signed on 15 October. There is no information about his experience in anchor handling.

The two crewmembers from Congo participated in the anchor handling on the deck. Their rank and date of medical examination were not written in the agreement form/crewmember form.

The Investigation Division is not acquainted with that the two crewmembers from Congo had any maritime education recognised by the Danish Maritime Authority. According to a contract between the seaman and the company “La Congolaise des Services” the seamen were found able (health condition) to be “homme de pont” according to national regulation of Congo. This is not recognised by the Danish Maritime Authority. The Danish Maritime Authority has stated that the two Congolese crewmembers, when signing on should have received instruction according to *Order no 772 on instruction of seamen newly signed on*. were extra to the safe manning document, because they were not part of the crew required according to the safe manning document.

Because these two crewmembers participated in anchor handling on deck, they should have received instruction in this work according to *Order on performance of work, rule 5* and the above-mentioned *Order no 772*. The same applies for other crewmembers participating in anchor handling. It would be possible to do this by following the ISM of the company (familiarisation on board) and the instruction according to the risk assessment on anchor handling. There is no documentation on whether this was done.

The Investigation Division has been told that crewmembers from Congo normally spoke and understood English. There is no exact information on the knowledge of languages on the two crewmembers from Congo on board at the time of the accident.

The shipping company and the master are responsible to fill in the agreement form correct and to forward correct filled in crewmember forms to the Danish Maritime Authority.

The Danish maritime only spot check whether the crewmember forms are correct filled in.

Minutes from safety meetings on board STEVNS POWER indicate that there has been focus on safe work on the aft deck during anchor handling.

Other possible circumstances

The anchor wire may have caught an obstruction on the seabed resulting in a suddenly change of the pulling and the direction of the pull. Investigations made by INSPECTOR before the pipe laying was started and sonar pictures of the seabed after the accident show, however, no sign of obstructions on the seabed.

Lifesaving equipment and chances of survival

The question have been raised why nobody were able to get to the surface after the capsizing. It is the opinion of the Investigation Division that the capsizing was very violent and happened very fast. All the crewmembers were most probably inside the vessel and they were overturned. All of the witnesses have stated that the vessel sank very fast with the stern so only the stem was above the surface. This happened within approx. one minute.

Rescue boats were very far at the scene of the accident. The life rafts and the EPIRB came to the surface. It was daylight and the weather was good. The Division of Investigation of Maritime Accidents is of the opinion that if any of the crewmembers had managed to get away from the vessel, they would have been found.

10. Conclusion

STEVNS POWER capsized and sank when the vessel during a relocation of an anchor was manoeuvred astern while at the same time CASTORO OTTO pulled in on the anchor wire. The vessel was in a turn and the speed astern was relatively high, when the vessel heeled to port and water emerged on deck in port side. The speed astern resulted in the water flooded the deck and increased the heeling which very quickly caused the vessel to capsize. The water flooded the engine room, so that the vessel within less than one minute after the capsize only had the stem above the surface.

The opinion of the Investigation Division is that the following factors have probably contributed to the capsize and foundering:

- Neither on STEVNS POWER nor on CASTORO OTTO, initiatives were taken to safeguard the anchor handling, after STEVNS POWER both on the day before and

on the same day had drawn attention to the fact that that the pulling of the anchor wire was too fast

- Procedures on cooperation on safety issues between CASTORO OTTO and STEVNS POWER were not sufficient.
- The turning manoeuvre and the pull from the wire, when STEVNS POWER was turned to and was almost parallel with CASTORO OTTO, contributed to the heeling of the vessel and water on deck
- The speed astern of STEVNS POWER was high. This was probably both caused by high pulling speed on CASTORO OTTO and the engine manoeuvres of STEVNS POWER during the turn
- STEVNS POWER was trimmed aft significantly in order to make the handling of the buoys easier. The forces from the anchor wire and the anchor increased the trim aft. This resulted in a low free board aft giving the water easy access to the deck.
- An open hatch and maybe open watertight doors resulted in water flooding the engine room. Therefore, the stern sank very fast.
- The stability of STEVNS POWER was deteriorated when water flooded the deck and the engine room.

It has not been possible to establish whether the following factors did influence the sequence of events leading to the accidents:

- The navigator who was manoeuvring STEVNS POWER at the time of the accident was in lack of experience.
- Failure/defect on the steering gear making the rudders go to starboard unintentionally.
- The navigator manoeuvring STEVNS POWER was in a moment not fully focused because of fatigue/tiredness.
- The spare wire on 28 tons could have been torn loose and contributed to the heeling.
- The anchor wire could have caught an object on the seabed and thereby changed the pull in the wire momentarily.

11. Recommendations

The Investigation Division recommends that written procedures on anchor handling vessels are elaborated:

- On cooperation with the vessel, which is going to have, it's anchors relocated.
- On measures at emergency situations during anchor handling.
- On following up on near miss situations and unintentional occurrences.
- On instruction and training of navigators and winch operators in anchor handling.
- On control of hatches and watertight doors before the anchor handling is started.

The Investigation Division recommends that there on pipe lay vessels are elaborated written procedures on anchor handling:

- On cooperation with the anchor handling vessel.
- On measures at emergency situations during anchor handling.
- On following up on near miss situations and unintentional occurrences.

The Investigation Division have talked with a number of seamen who are or have been working on board anchor handling vessels. Apparently, there is a culture on board both anchor handling vessels and pipe lay vessels saying that they have to work fast and effectively during anchor handling. The pipeline must be finished at a fixed date, and on board the anchor handling vessel, they would like to be chartered to a new project.

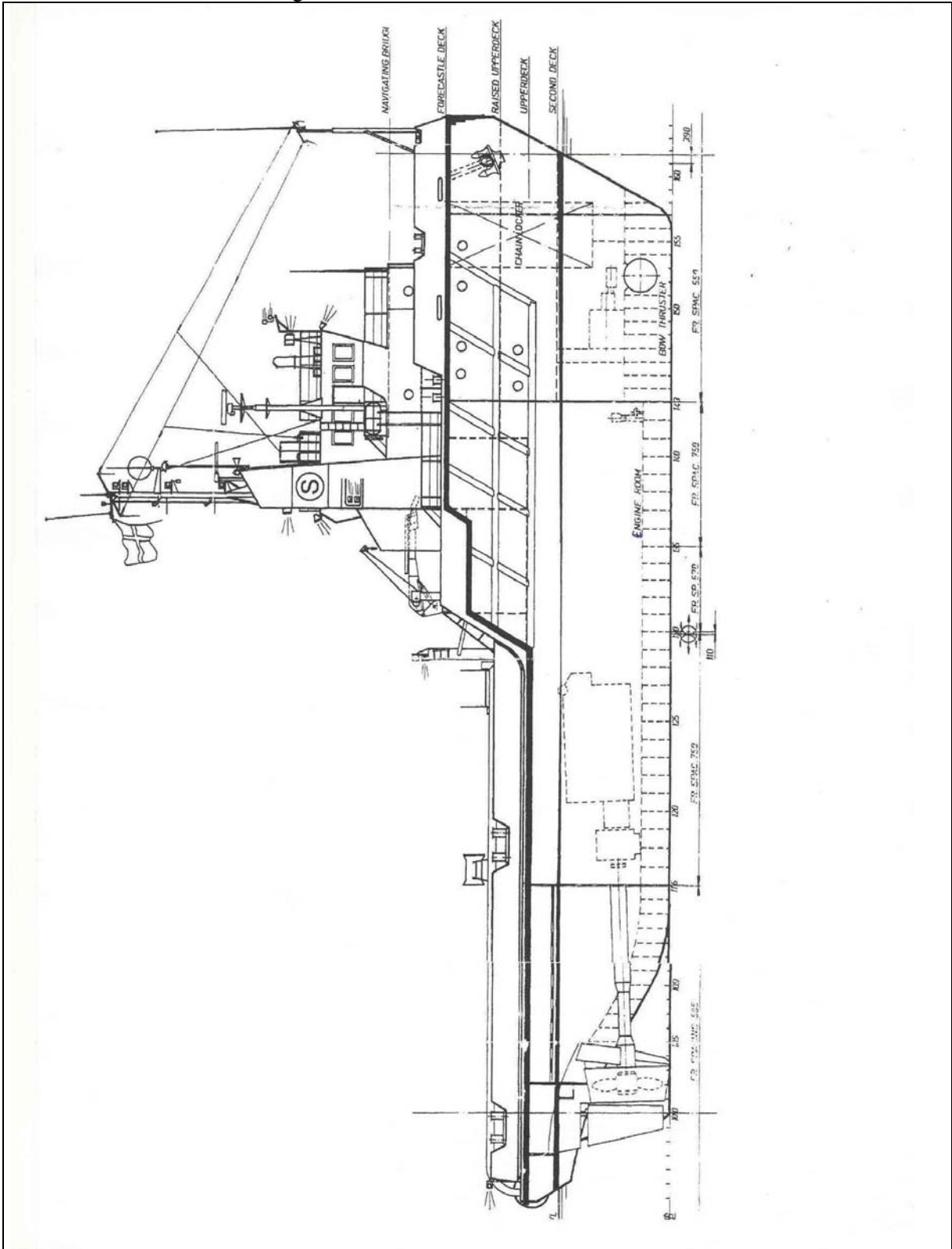
However, it is evident that the two or three minutes extra it would have taken to perform the manoeuvre and to pull in on the anchor wire at a slower speed, is without importance for the accumulated period it takes to lay the pipe. Alternative more anchor wire could have been recovered, by which the anchor handling vessel only should have performed a minor turn while manoeuvring astern in order to get the wire in the right position.

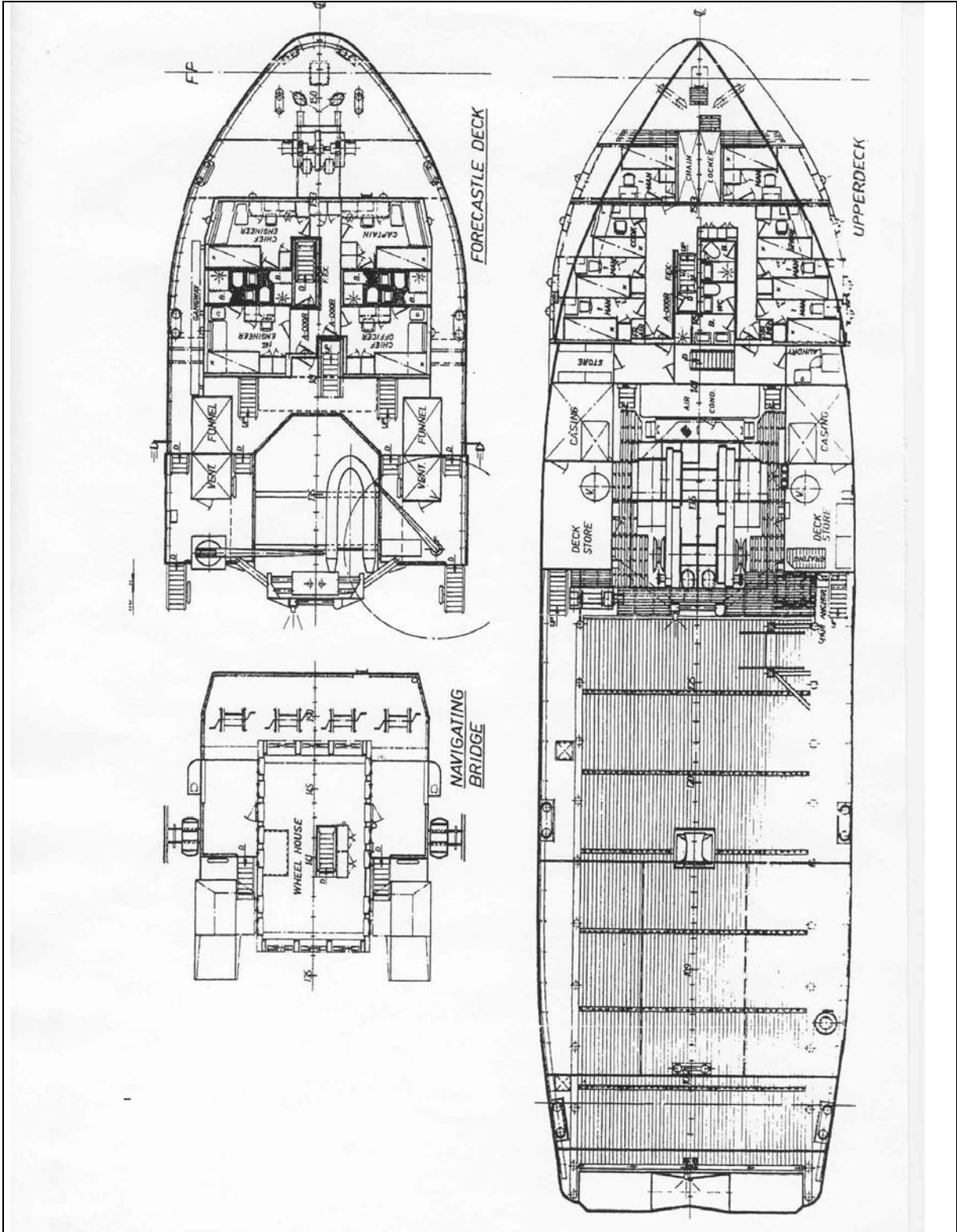
Therefore, The Investigation Division recommends all pipe lay vessels and anchor handling vessels to agree to perform at a safe speed in the relatively short periods during anchor handling where there is a considerable risk.

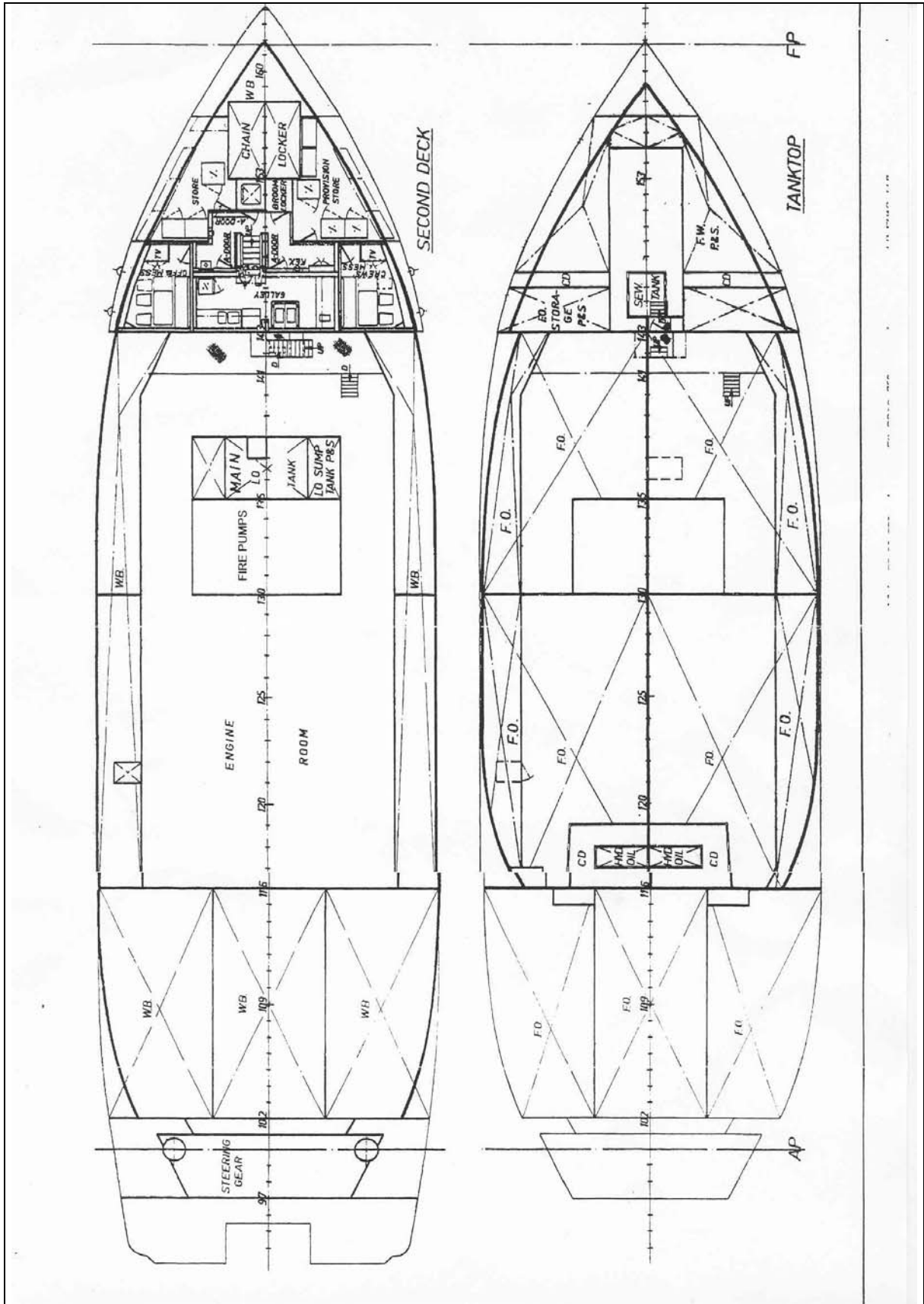
Lars Gerhard Nielsen
Head of Division
Division for Investigation of Maritime Accidents

12. Enclosures

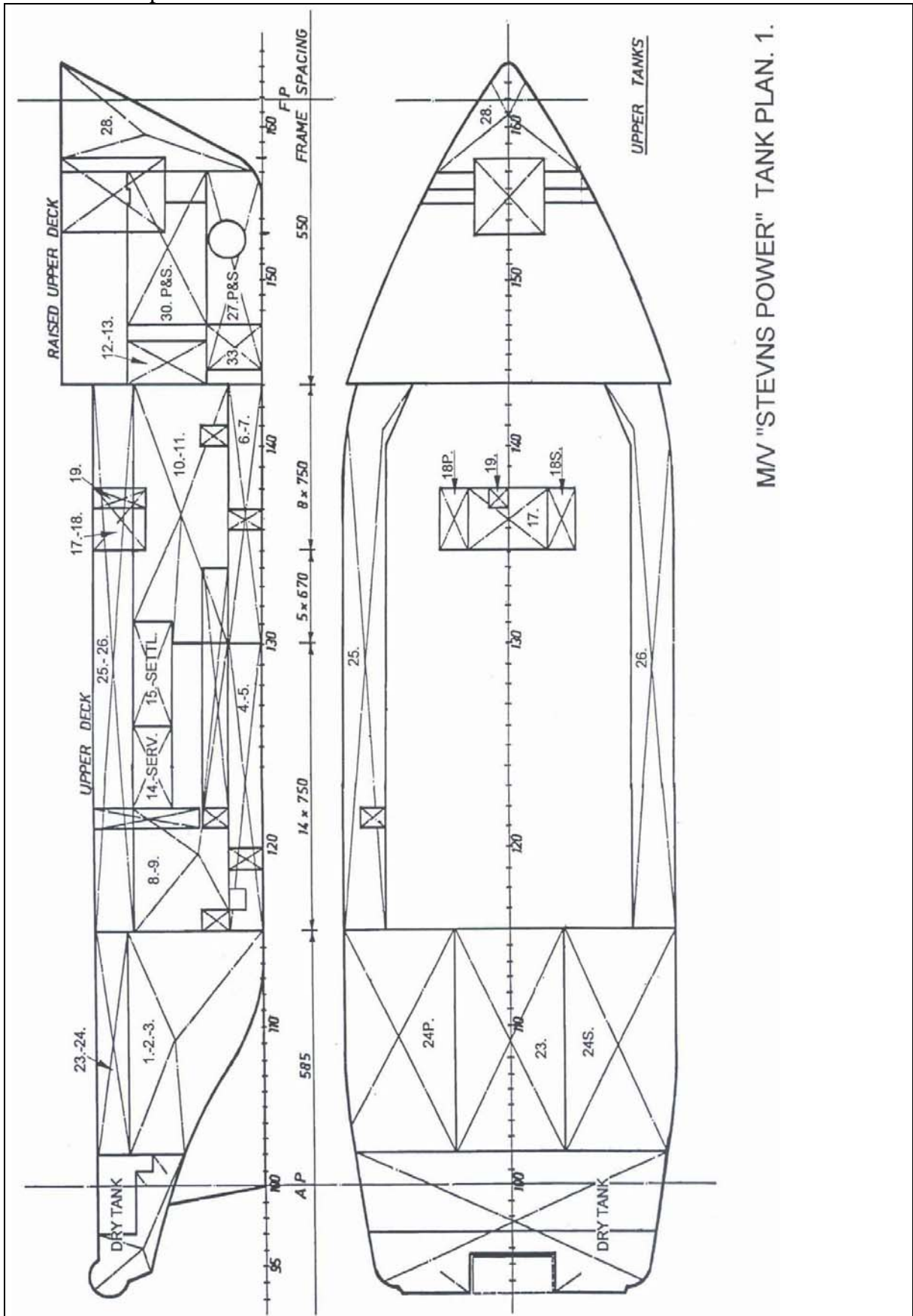
Enclosure 1 – General arrangement:



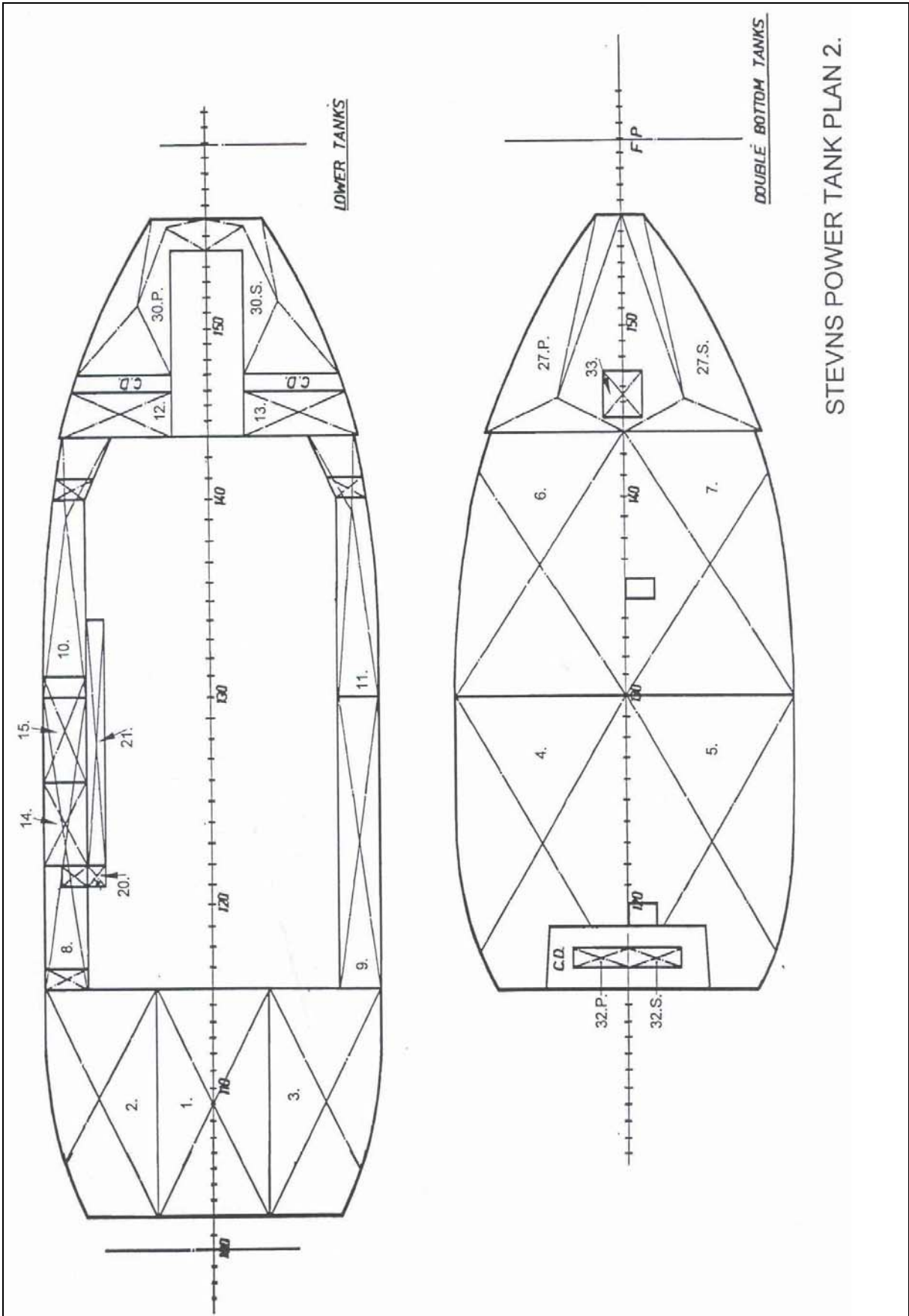




Enclosure 2 – plan of tanks:



MV "STEVENS POWER" TANK PLAN. 1.



STEVNS POWER TANK PLAN 2.