Bundesstelle für Seeunfalluntersuchung
Federal Bureau of Maritime Casualty Investigation
Federal Higher Authority subordinated to the Ministry of
Transport, Building and Urban Affairs

Investigation Report 474/06

Serious Marine Casualty

Collision of CMV KLENODEN with CMV HANJIN CAIRO on 9 September 2006 in Hamburg

15 July 2007

The investigation was conducted in conformity with the law to improve safety of shipping by investigating marine casualties and other incidents (Maritime Safety Investigation Law - SUG) of 16 June 2002.

According to this the sole objective of the investigation is to prevent future accidents and malfunctions. The investigation does not serve to ascertain fault, liability or claims.

The present report should not be used in court proceedings or proceedings of the Maritime Board. Reference is made to clause 19 para. 4 SUG.

The German text shall prevail in the interpretation of the Investigation Report.

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1 Summary of the Marine Casualty

About 05:54 p.m.[1] on 9 September 2006, in the port of Hamburg, the motor vessel KLENODEN sailing under Finnish flag collided with the German container vessel HANJIN CAIRO, which had moored at the Predöhlkai.

The cause for the collision were problems with the variable pitch propeller system of KLENODEN, which have to be attributed to an assembly error during previous maintenance work. As a consequence, the vessel's command was no longer aware of the pitch of the propeller blades. An emergency anchoring performed could not prevent the collision.

By the collision, the bow area of KLENODEN was heavily incised at a length of about 8.5 m and a height of about 3.6 m, and the foremast was bent. The stem of HANJIN CAIRO was dented by the impact at about 5 m above the waterline, whereby a hole of about 10 x 10 cm was caused in the hull. In addition, the bulbous bow was ripped at a width of about 80 cm and a height of 3.50 m.

Subsequent to the collision, KLENODEN could be hauled to her berth at the Burchardkai with the assistance of tugs.

Neither were any persons injured by the accident, nor were any harmful substances released.

[1] Any times mentioned in the report refer to the Central European Summer Time (CEST) = Universal Time Code (UTC) + 2 hours.

2 Scene of the Accident

Nature of the incident:	Serious Marine Casualty
Date/time:	9 September 2006, 05:54 p.m.
Location:	Waltershofer Hafen, Hamburg
Latitude/longitude:	φ 53°31,6' N λ 009°55,5' E

Section from the Chart 3010, Federal Maritime and Hydrographic Agency

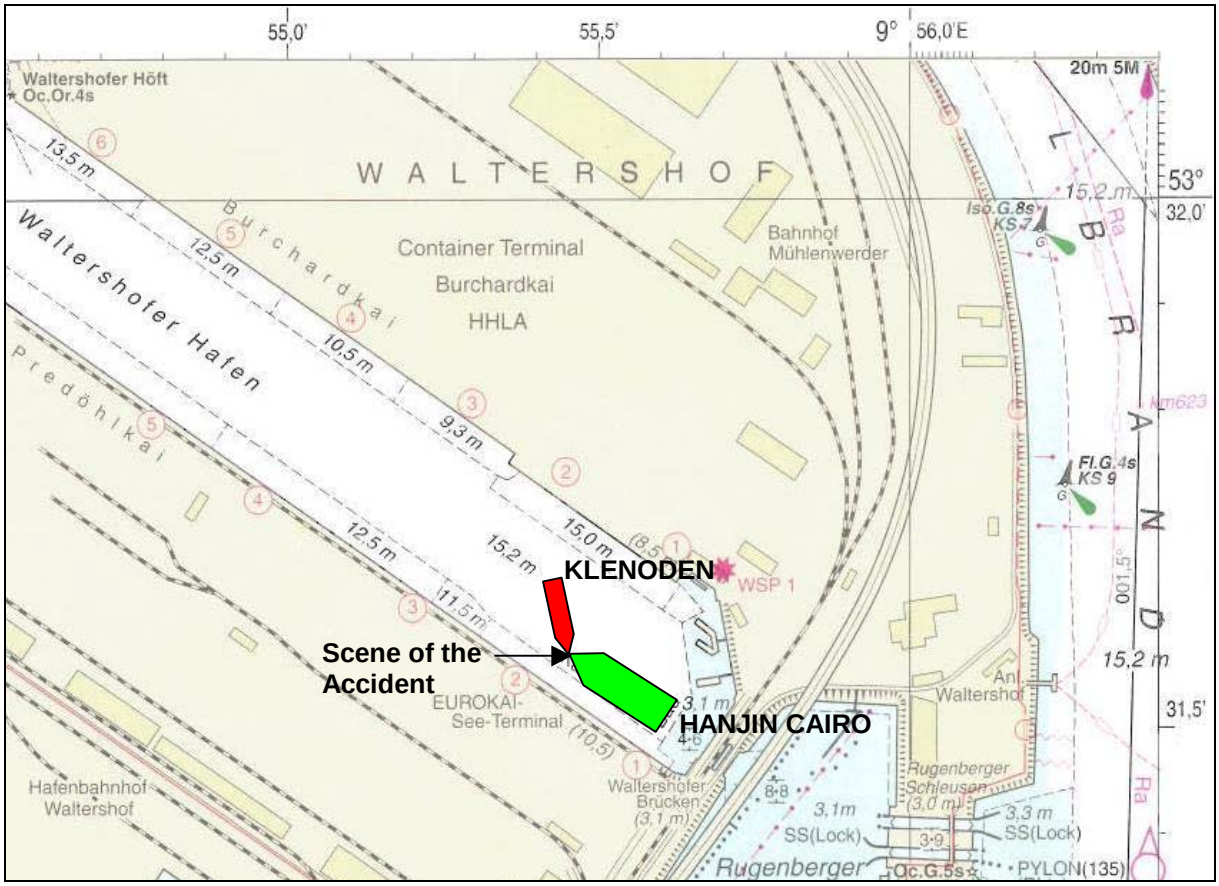

Figure 1: Chart

3 Vessel Particulars

3.1 Photo of KLENODEN

Figure 2: Photo of KLENODEN

3.2 Particulars of KLENODEN

Name of vessel:	KLENODEN
Type of vessel:	Container vessel
Nationality/flag:	Finland
Port of registry:	Nagu
IMO number:	8917730
Call sign:	OJDD
Vessel operator:	Rederi Ab Engship, Finland
Year built:	1991
Building yard/building number:	J.J. Sietas KG Schiffswerft GmbH & Co., Hamburg / 1060
Classification society:	Germanischer Lloyd AG
Length overall:	103.50 m
Breadth overall:	16.24 m
Gross tonnage:	3,828
Deadweight:	4,453 t
Draft at time of accident:	5.7 m
Engine rating:	2,960 kW
Main engine:	Wärtsilä VASA 9R 32D
Speed:	15.3 kn
Hull material:	Steel
Number of crew:	9

3.3 Photo of HANJIN CAIRO

Figure 3: Photo of HANJIN CAIRO

3.4 Particulars of HANJIN CAIRO

Name of vessel:	HANJIN CAIRO
Type of vessel:	container vessel
Nationality/flag:	Germany
Port of registry:	Hamburg
IMO number:	9231743
Call sign:	DPSQ
Vessel operator:	NSB Niederelbe Schiffahrtsgesellschaft mbH & Co. KG, Buxtehude
Year built:	2001
Building yard/building number:	Hyundai, Ulsan (Korea) / H 1381
Classification society:	Germanischer Lloyd AG
Length overall:	274.68 m
Breadth overall:	40.00 m
Gross tonnage:	65,131
Deadweight:	68,086 t
Draft at time of accident:	forward 11.90 m, aft 12.60 m
Engine rating:	57,100 kW
Main engine:	Hyundai MAN B&W, Type 10K98MC-C
Speed:	26.5 kn
Hull material:	Steel
Number of crew:	22 + 6 visitors

4 Course of the Accident

4.1 Course of the Voyage

On 9 September 2006 after her voyage from Mäntilyuoto/Finland to Hamburg, KLENODEN had first moored at Süd-West Terminal (S.W.T.) in Hamburg. On the day of accident, the service technician of a maintenance company repaired a leakage of the Oil Distribution/OD box of the right-handed variable pitch propeller, which is located aft amidships. A subsequent two hours' performance check of the hydraulic pitch control system at the pier revealed no problems. In particular, the pitches of the variable pitch propeller were shown within the scaled range of the pitch indication after operating the control lever and after alternately operating the push buttons "Pitch Astern" and "Pitch Ahead".

On completion of the performance check, KLENODEN left the Süd-West Terminal in order to shift to her next berth at Burchardkai 3. The passage through the main fairway of the river Elbe was uneventful.

The visibility was clear, and a light wind was blowing from northwest. Within Waltershofer Hafen no remarkable current was noted.

KLENODEN approached her berth at Burchardkai 3 at a speed between 5 and 6 kn. Is was planned to make fast with the port side to the quay. At that moment the Master was alone on the bridge, in order to perform the berthing manoeuvre from the bridge wing control position on port side. There was no port pilot on board, as KLENODEN was exempt from the obligation to accept a port pilot. The 1st Nautical Officer and an able bodied seaman were on the forecastle, the 2nd Nautical Officer and an ordinary seaman were at the stern. The Chief Engineer and the 2nd Engineer were in the engine control platform.

Within the scope of the berthing manoeuvre it was tried to reduce the vessel's speed. In doing so, the vessel's command noticed that all pitch indications of the variable pitch propeller had failed. The pitch indicators lay permanently outside the scaled range on "Astern" and did not react neither to an actuation of the control lever nor to an actuation of the push buttons for emergency operation. The control board in the engine control stand displayed a CPP alert (Control Pitch Propeller). From the engine room, a roaring was heard repeatedly, accompanied by a clear decrease of the speed of the main engine. As the engine speed was too slow, the shaft-driven generator, by which the bowthruster is supplied with energy, was automatically cut off the power system due to the low revolution speed, whereby the bowthruster could not be used any longer.

For reasons which cannot be comprehended after the event, due to the lack of details provided by the vessel's command, a deviation to starboard occurred in heading of KLENODEN. This resulted in KLENODEN heading for the opposite pier on which HANJIN CAIRO was firmly moored (see fig. 4).

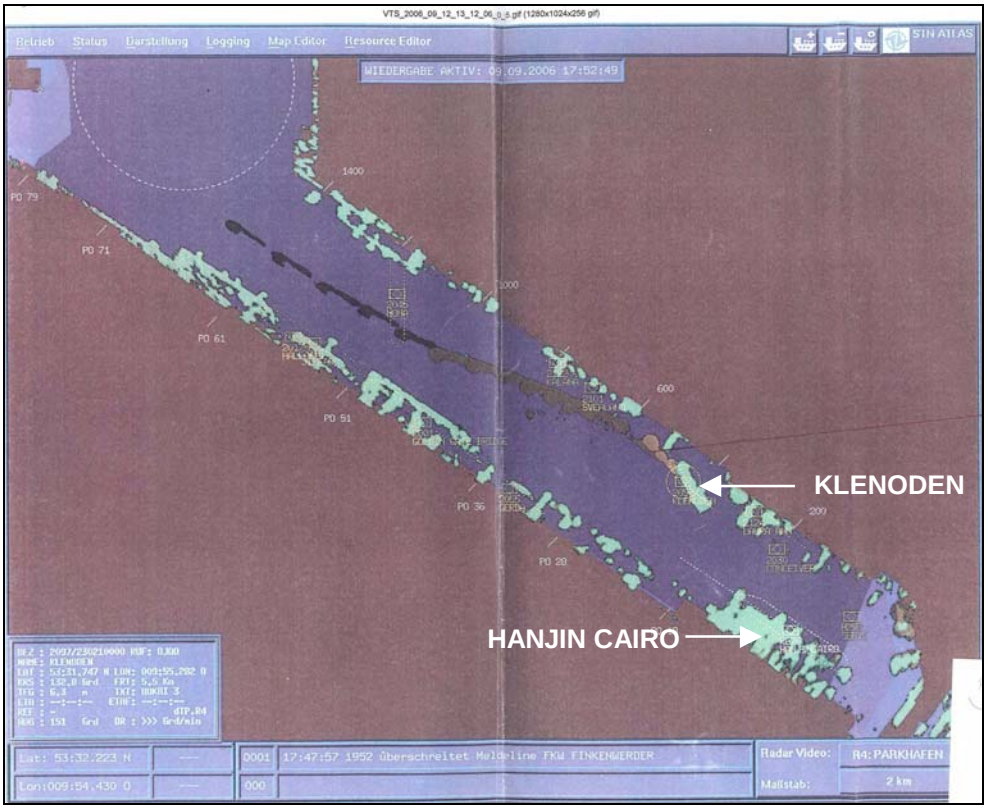

Figure 4: Radar plot VTS Hamburg, 9 September 2006, 05:52:49 p.m.

The two crew members on the forecastle of KLENODEN, as instructed by the Master, hardly succeeded in letting go the starboard anchor by 1.5 to 2 shackles and pulling the belt brake, before they sought shelter.

The bow of KLENODEN collided with the bow of HANJIN CAIRO at an angle of about 45° (see fig. 5). After the impact, KLENODEN very slowly drifted backwards, whereupon the port side anchor was let go as well. By this, the crew succeeded in stopping KLENODEN. The main engine, which at this moment was nearly overcharged, was stopped by the 2nd Engineer by using the emergency shutdown.

Finally, KLENODEN was shifted by two tugs to her berth in consultation with a port pilot.

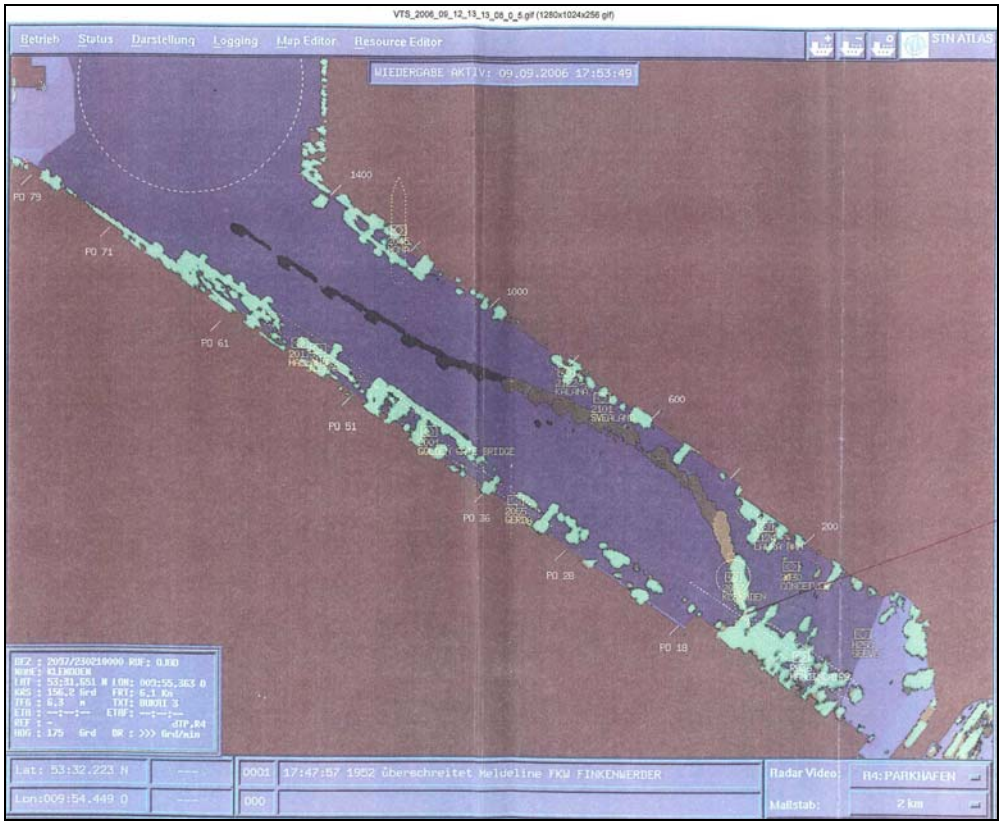

Figure 5: Radar plot VTS Hamburg, 9 September 2006, 05:53:49 p.m.

4.1.1 Report by the Master

The Master of KLENODEN describes the course of the passage immediately before the collision as follows:

At about 200 m before reaching the berth, the engine rating decreased, as he switched the control lever to “Astern” in order to stop the vessel. As no reduction of the speed took place, he twice repeated the engine command on the lever of the central control position, however, without success. Although the main engine did work, the vessel was no longer manoeuvrable. During the decrease of performance, a slight deviation in heading to starboard occurred, so that the vessel headed for the opposite side of the harbour basin. He shortly waited whether the “engine would get going”, however, this failed.

He put the helm to starboard and once again tried to adjust the variable pitch propeller to “Astern”. As again there was no reaction, he ordered an emergency anchoring in the midst of the harbour basin. However, the speed was so high that the collision with HANJIN CAIRO could not be prevented.

4.1.2 Report by the Chief Engineer

The Chief Engineer describes the course of the accident as follows:

Shortly after he arrived at the engine control platform, a roaring was heard from the engine room, and the remote control on the alert board showed the alert “CPP CONTROL F”. Then he and the 2nd Engineer ran to the engine room. The roaring became less frequent, and the noise of the engine subsided. However he stated that the accessory filter on the compressor had partly become loose and was “fluttering”.

After they had returned to the engine control room, they answered the alert. The Master complained about the lack of the engine rating. At this moment he, the Chief Engineer, noticed that the pitch indication of the variable pitch propeller did show “Astern”, but lay beyond the scaled range.

All along, the main engine was nearly overcharged. The shaft-driven generator and the bowthruster were “cut off the power system”. As it seemed impossible to gain control over the engine speed from the bridge, he asked to temporarily switch the control to the engine room. By means of the standby systems available there he wanted to regain the control over the variable pitch propeller.

After switching the control to the engine room, he at first tried to reduce the pitch of the variable pitch propeller via the push buttons in the engine control position, however, without success. Then he attempted it – again without success – by means of the emergency buttons of the hydraulic unit in the engine room and then went back to the engine control position. There the master warned him of the collision on the telephone.

Finally the 2nd Engineer switched off the main engine after the collision.

4.2 Damages Caused by the Accident

KLENODEN was heavily incised by the collision in the area of the stem at a length of about 8.5 m and a height of about 3.6 m, and the foremast was bent (see fig. 6).

The amount of the damage to property was not advised by the vessel’s operator.

Figure 6: Damages on the stem and foremast of KLENODEN

The stem of HANJIN CAIRO was dented by the impact at about 5 m above the waterline, whereby a hole of about 10 x 10 cm was caused in the hull (see fig. 7; hole marked by the red circle).

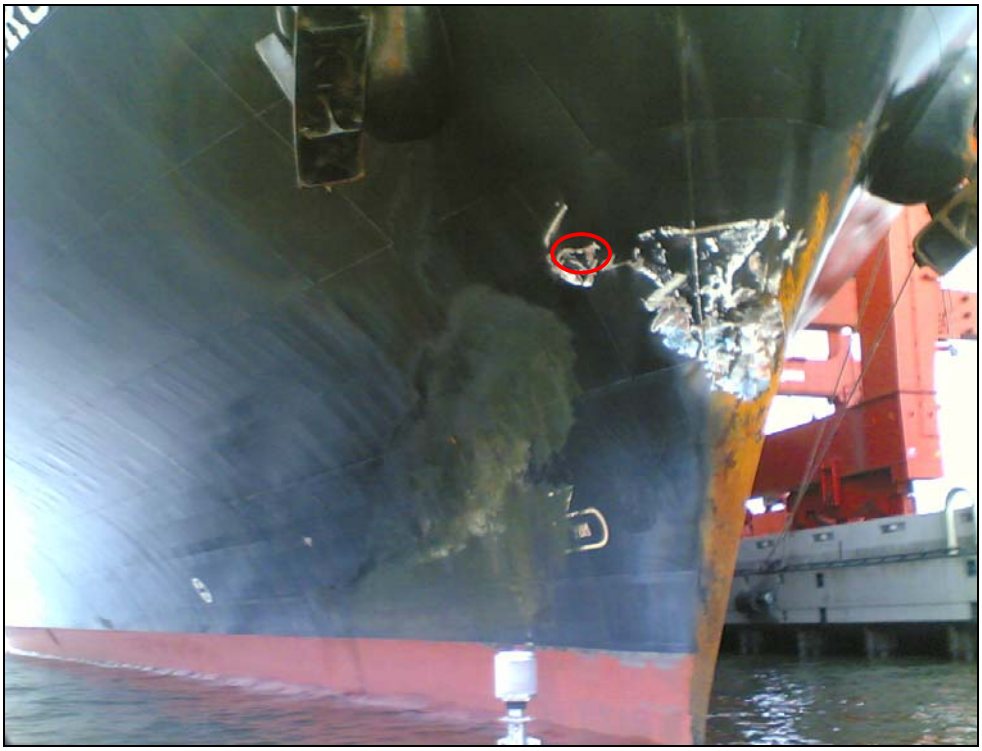

Figure 7: Damage on the stem of HANJIN CAIRO

In addition the bulbous bow of HANJIN CAIRO was ripped at a width of about 80 cm and a height of 3.50 m (see fig. 8).

Figure 8: Damage on the bulbous bow of HANJIN CAIRO

According to the statement by the vessel's operator, the amount of the damage was just under 124,000.00 EUR for repairs and just under 62,000.00 EUR for consequential loss.

5 Investigation

5.1 Propulsion of MV KLENODEN

KLENODEN is driven by a 9 cylinder VASA Motor with a turbocharger. The nominal power is 2,960 kW at 720 revolutions per minute (rpm). The bowthruster with a power of 294 kW is supplied by energy via a shaft-driven generator (electrical power: 625 kVA). The engine has an approval for the operation with heavy fuel oil and is operated with IFO 180. The propulsion of the vessel is controlled via a variable pitch propeller of LIPS with a nominal speed of 182 rpm, which is located aft amidships.

Due to the lack of information provided by the vessel's operator, a statement on the status of the maintenance of the systems is impossible. However, independent surveys of the engine room of KLENODEN by staff of the BSU and a technical investigator of the water police (WSP) did not show any evidence of negligence in the operation of the engine of the vessel.

5.2 Variable Pitch Propeller System of KLENODEN

The OD box of the pitch control system is located in the engine room on the outgoing power side of the main engine below the driving shaft (see fig. 9).

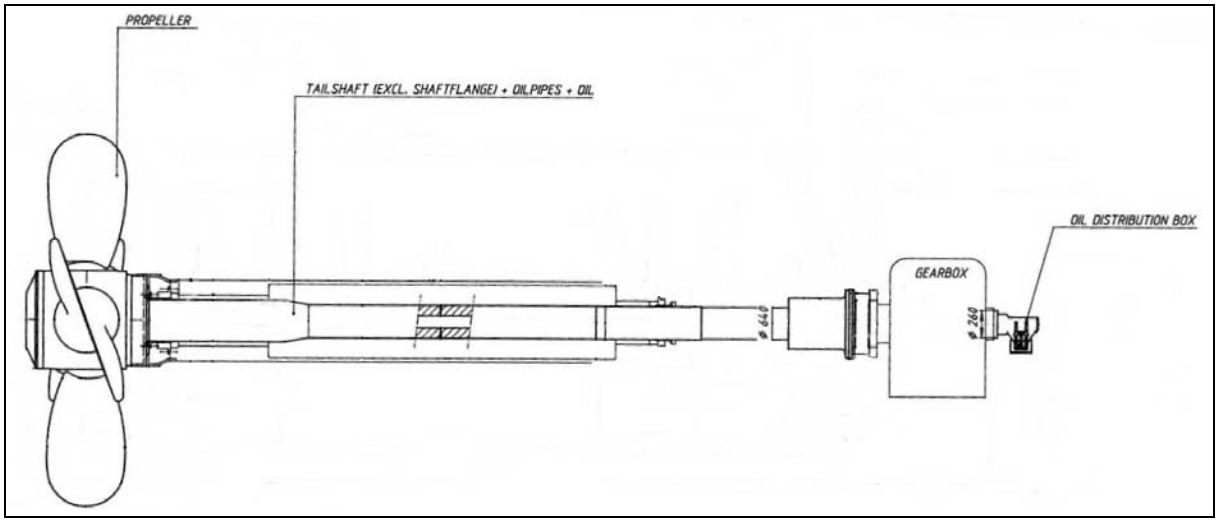

Figure 9: Schematic presentation of control system of the variable pitch propeller

The OD box hydraulically transmits the pitch ordered by the respective control position to the propeller blades and simultaneously to a mechanical pitch indication, which is located on the outside of the case of the OD box (see fig. 10).

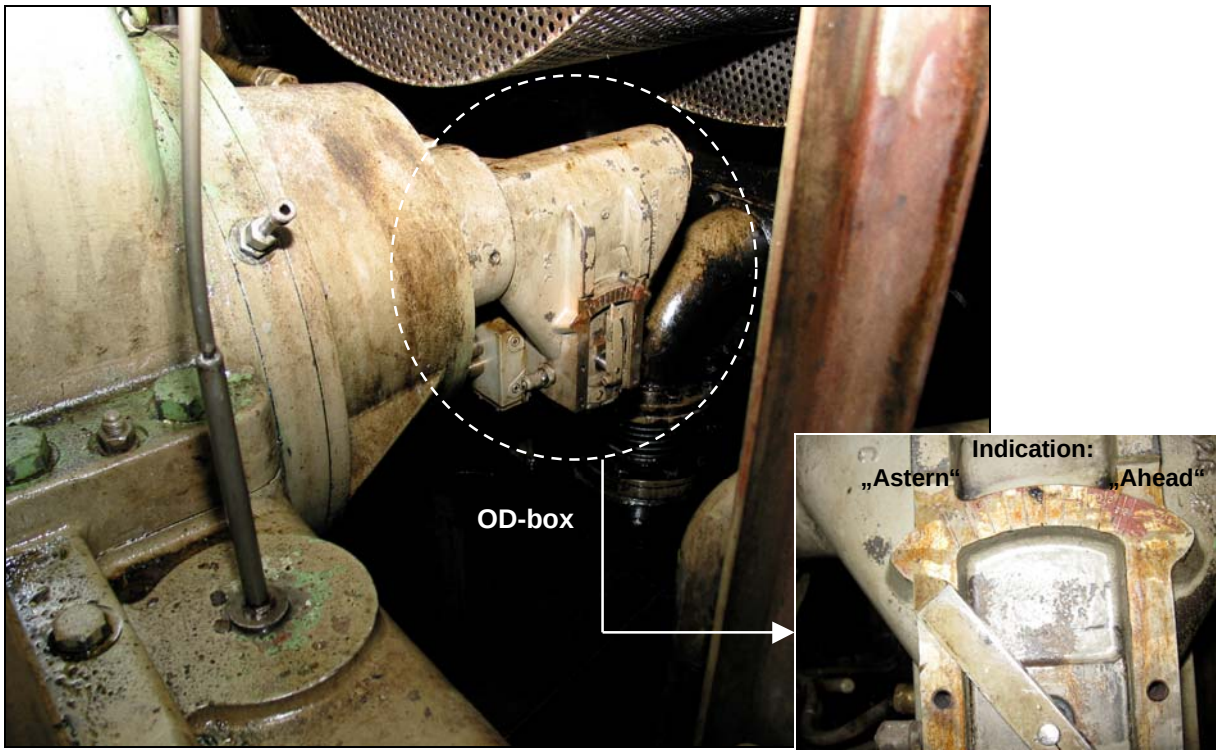

Figure 10: Mechanical pitch indication on the OD box;
small figure: Indication at time of accident

Below the cover of the OD box, a double sheave is mounted, fixed by four mounting bolts (see fig. 11).

Figure 11: Demounted double sheave from the OD box

This double sheave was demounted and remounted by the service technician during the repair of the leakage on the OD box. The groove of the double sheave serves the link block, which again serves as connection to the mechanical pitch indication on the OD box (see fig. 12).

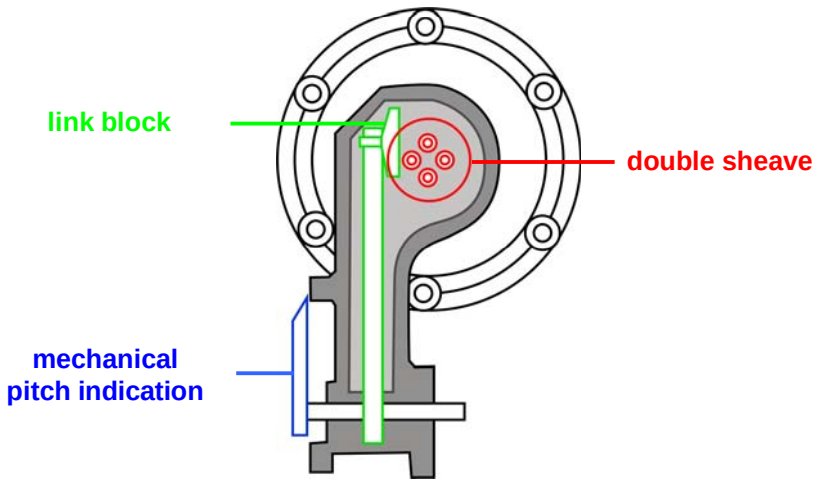

Figure 12: Schematic cross-sectional presentation of the OD box

The mechanical pitch indication is converted into an electric signal via two connected potentiometer and transmitted to the existing remote indicators in the engine room, in the engine control room, on the bridge and in both wings of the bridge. This ensures that all pitch indicators are synchronously. The scaling of the remote indication is from 100 % pitch “Ahead“ to 100 % pitch “Astern” (see fig. 13).

Figure 13: Pitch indicator in the engine control room

The pitch of the propeller blades can be adjusted by operating the push buttons “Pitch Astern” and “Pitch Ahead” located below the remote indicators in the engine control room, on the bridge and in the wings of the bridge. The buttons are intended for emergency operation, as by their actuation the pitch limitation for the propeller blades is automatically suspended. In addition, there are buttons to push directly on the hydraulic pump station in the engine room intended for emergency operation. The pitch indication is mounted laterally above it (see fig. 14, push buttons marked by red circles).

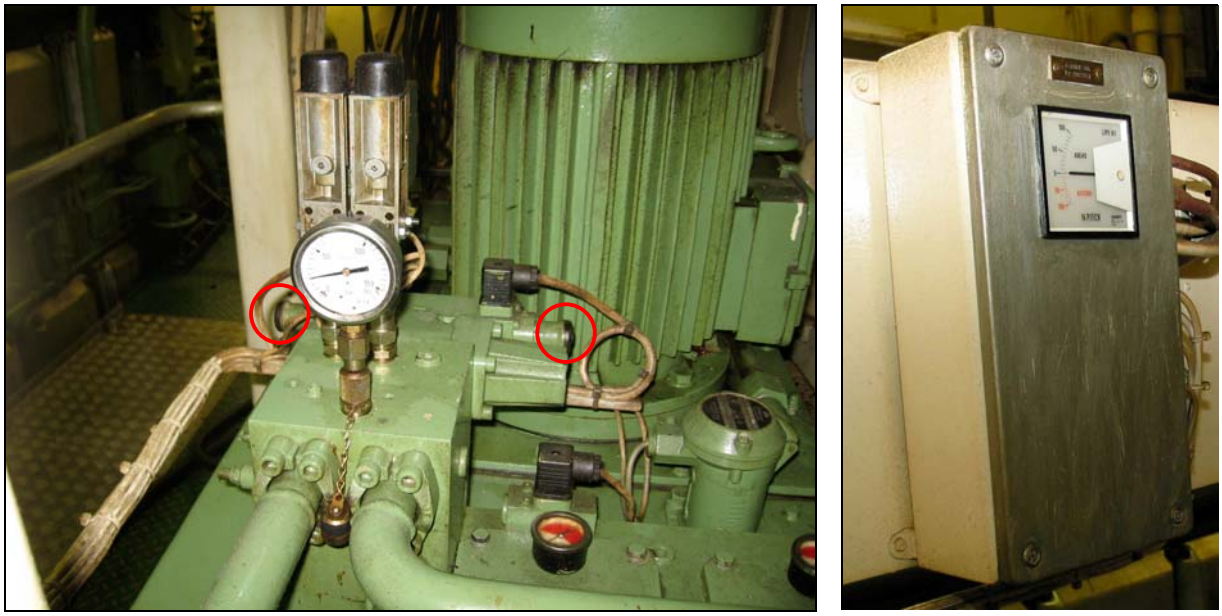

Figure 14: Pump station with pitch indicator placed above

In the engine control room of KLENODEN, the control board is located, from which, among others, the CPP alert (controllable pitch propeller-control) can be read. The "F" in the alert field is for "fault" (see fig. 15).

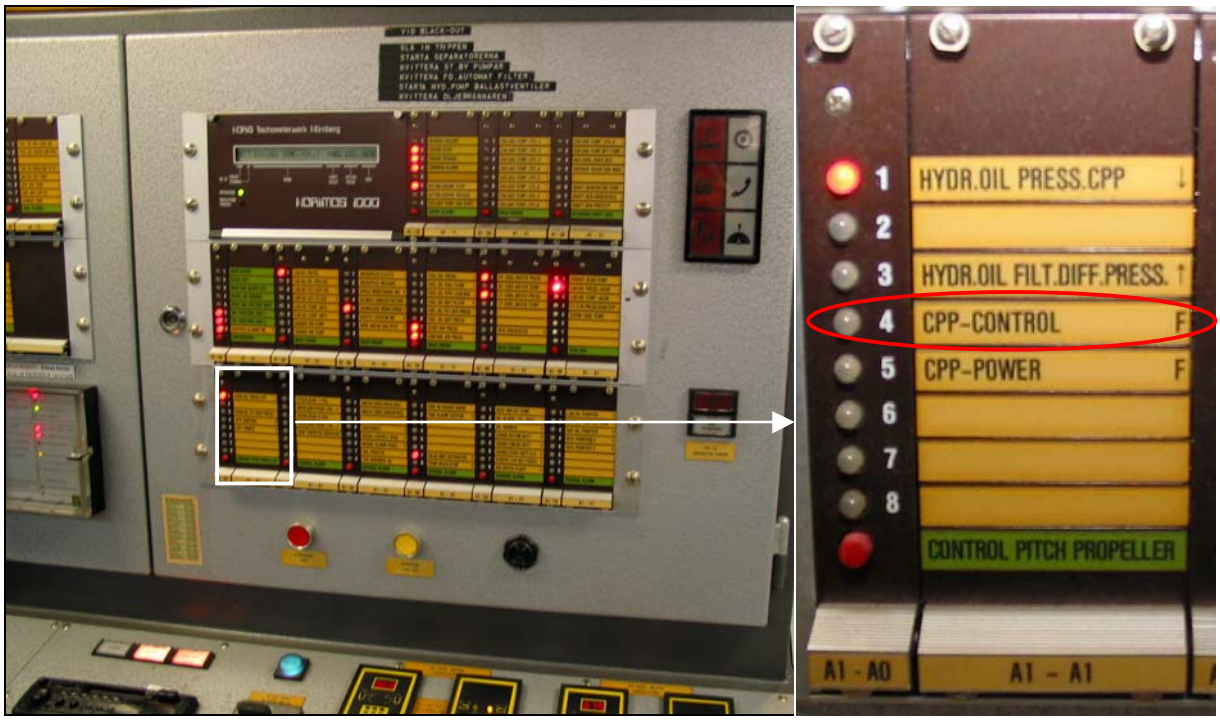

Figure 15: Alert board in the engine control room

5.3 Investigation by the Water Police

The scene of the collision was within the visual range of the office of the water police (WSP), which started the investigation without delay after the impact which could not be overheard. A vast documentation of photographs was prepared, the persons involved were questioned, and the data of the electronic chart display and information system (ECDIS) were secured.

Within the scope of the investigation, the technical investigator of the water police prepared a comprehensive report, in which, on the one hand, the repair on the OD box is described after consulting the service technician who had performed this work and, on the other hand, statements on the results of checks of the variable pitch propeller system are made.

5.3.1 Repair of the OD Box before the Collision

The stated leakage of the OD box was repaired by a service technician of the maintenance company on 9 September 2006 by replacing the sealing ring. In order to gain access to the sealing ring, the complete OD box was demounted. To this purpose, he at first had to demount the double sheave, which serves for transmitting the propeller pitch to the mechanical indication, and reinsert after replacing the defective sealing ring. The four mounting bolts fixing the double sheave on the rod assembly of the pitch control system were tightened individually and additionally secured by using of screw retention lacquer (Locktite). The work inside the OD box

was inevitably performed with only one hand and as “blind” work, i.e. without any possibility of seeing the parts, as the inside of the OD box is only accessible through a comparably small opening with a diameter of 8 cm (see fig. 16).

Figure 16: OD box of identical construction (demounted, upside down)

Subsequent to the repair, the service technician and the Chief Engineer of KLENODEN refilled the circulation and the compensating tank of the hydraulic pitch control system. They jointly did an operational test, by alternately actuating the push buttons “Pitch Astern” and “Pitch Ahead” below the pitch indication in the engine control room without starting the main engine and observing the change in the indicators. This was followed by additional test runs with the main engine running performed together with the master from the central control position on the bridge and from the bridge wings, during which KLENODEN slightly moved ahead and astern along the pier when operating the control lever. In total, trial runs were made of the repaired variable pitch propeller system from all control positions, which took about two hours. A check of the real position of the propeller blades or an observation of the propeller streaming on the stern, respectively, were not performed.

The service technician left the vessel, but immediately after the collision of KLENODEN was again called on board, in order to contribute to the investigation of the cause of the accident.

5.3.2 Survey of the Variable Pitch Propeller System by the Technical Investigator of the Water Police

On the day of the accident, the technical investigator of the water police, who himself holds a licence as engine watch officer (CIW), stated the following situation subsequent to his survey on board KLENODEN:

All of the remote indications for the pitch control system showed a pitch to “Astern” outside the scaling (see fig. 17).

Figure 17: Pitch indicator in the engine room after the collision

According to the statements by the crew, the alert printer in the engine control room had been out of service for several months. There was no visible leakage of the hydraulic system. The circulation and the compensation of the hydraulic system were filled with oil almost up to their maximum capacity.

The mechanical pitch indication on the OD box was beyond the scaling in the “Astern” position, as were the remote indicators (see fig. 10, small figure), the pointer being unusually freely movable.

A more detailed technical examination of the variable pitch propeller system was not carried out on the day of the accident, as KLENODEN after discharging her cargo was at first towed to Norderwerft for repair of the damages she had suffered.

During another survey on 13. September 2006, the OD box was opened by an employee of the maintenance company in the presence of the technical investigator of the water police and of the insurers.

After the cover was removed it became apparent that the double sheave had completely dropped off, and, as a consequence, the con-rod transmitting the pitch

value to the mechanical indicators was no longer fitting in the groove of the double sheave. Therefore the mechanical connection of the hydraulic pitch control system to the pitch indicator was interrupted, whereby the pointer on the OD box lay outside the scaling. Via the potentiometer, this indication – independent of the actual propeller pitch – was transmitted to all of the remote indicators.

One of the total of four mounting bolts that served as fixation of the double sheave was bent.

From both surveys as well as from the discussions with the Chief Engineer and the service technician, who had demounted the OD box, the technical investigator of the water police concluded that, as a consequence of an error in assembling, the double sheave had worked loose during the shifting of KLENODEN. By the interruption of the indication of the pitch adjusted on the propeller blades, the vessel's command was no longer aware of the actual propeller pitch. In addition, by switching the variable pitch propeller adjustment to the push buttons, the electronic pitch limitation and hence the limitation of the load as well was suspended. By this, the propeller pitch could be increased to such an extent that the engine was run at its maximum load.

The too quick and too great increase of the load taken up by the main engine resulted in a reduction of the speed. During the rapid reduction of the speed, the turbocharger continued to operate at high speed and correspondingly supplied more air than could be consumed for the fuel combustion. In cases of the spare amount of air being pumped to and fro in the charge air duct between the turbocharger and the cylinders, this might have caused the rhythmic roaring described by the Chief Engineer. In case of a prolonged persistence of this condition, the turbocharger could be in danger of destruction of and thus causing a failure of the main engine.

5.4 Survey of the Vessel and Evaluations by BSU

Two investigators of BSU surveyed KLENODEN in the port of Hamburg on 30. November 2006. At this moment, a different crew was on board than on the day of accident.

Together with the Chief Engineer, in particular the engine room and the engine control room were surveyed. The OD box and the hydraulic pump unit of the variable pitch propeller were inspected. On this occasion it was noted that the access to the OD box was very cramped for space and design of the device additionally hampers the replacement of wearing parts, due to the opening with a small diameter (8 cm).

In order to better understand the difficulties found during repair and maintenance of an OD box, the BSU, after surveying KLENODEN, held consultations with the technical investigator of the water police as well as with the respective service technician of the maintenance company. The comprehensive preparedness to cooperation shown by both interlocutors as well as the responsible persons of the maintenance company itself, which as a further step enabled the detailed examination of a demounted OD box of identical construction, substantially contributed to the result of the investigation.

According to this investigation, it must be retained that the failure of the pitch indication caused by the loosening of the double sheave in the OD box cannot have had any effects on the mode of functioning of the variable pitch propeller system. Therefore, on principle, KLENODEN was manoeuvrable without any restrictions. The impression expressed in the opinion by the Master that KLENODEN was not manoeuvrable after the failure of the pitch indication, can be understood by the fact that at first it was tried to get a reaction of the pitch indicators by using the control levers on the bridge and later by using the push buttons to alter direction and thus the pitch (Ahead / Astern). By this it was no longer possible to stop the vessel within the short time left until the collision.

All control levers on the bridge and the bridge wings were inoperable after the failure of the pitch indication, due to an automatically generated safety procedure of the electronic system. The propeller pitch could only be altered by using the push buttons. In a mere hypothesis, the propeller pitch effected by consequent positioning of the push button “Pitch Astern” could have resulted in a stopping effect. But in view of the failure of the indications during the berthing manoeuvre, which was a surprise for the vessel’s command, it is understandable that at first it was tried to achieve a reaction of the pitch indicator and thus to find out the real propeller pitch. However, it was finally impossible to ascertain the real pitch due to the repeated “trials” using both buttons and thus impossible to achieve a stopping effect.

In addition, it was noticed within the scope of the investigations that according to the wiring diagram displayed in the engine control room both the auxiliary diesel engines (electrical power: 285 kVA each) do not provide enough power to supply the bowthruster and at the same time the other consumers on board as well (in particular the variable pitch propeller system) without the additional power supplied by the shaft-driven generators (electrical power: 625 kVA). During the estuary trading, this may have an adverse effect on the energy balance of the vessel and thus at the same time on the efficiency of the propelling engines and generators. There is the danger – as really happened on the day of the accident – that the shaft-driven generator will be cut off the power system and as a result the main engine will stop as the load it has to take up is too great. This in particular applies in case the automatic limitation of the pitch of the variable pitch propeller is suspended by operating the push buttons on the respective control position.

Besides, the interviews held by the officers of the water police in their parallel investigation as well as the evaluation of the VHF recordings of the day of the accident rose doubts as to the Master of KLENODEN’s sufficient knowledge of German language. According to clause 3 para. 3 lt. c of the Hamburg pilot ordinance (Hafenlotsverordnung, HmbGVBl. 1995, p. 433), sufficient knowledge of the German language is a stringent precondition for receiving a pilotage exemption certificate (PEC). Reportedly, the water police experienced significant communication problems during their investigation on board. The communication on board with water police as well as with VTS Hamburg and the port pilots requested subsequent to the collision could thus only be held in English. As the Master had declared sufficient language abilities to the Hamburg Port Authority (HPA) responsible for issuing PEC’s, HPA was informed by BSU about the case of doubt. According to the statement thereupon

received from HPA, the language abilities on board KLENODEN have been assessed and found sufficient.

Despite the kind assistance of the Accident Investigation Board of Finland in the communication for information, it was not possible for the BSU to clarify any unanswered questions – e.g. concerning the starboard deviation during the berthing manoeuvre – and at the same time gaining a more comprehensive view of the knowledge of the German language the vessel's command has, due to the restricted cooperation shown by the Finnish vessel's operators.

The administrative procedure for issuing regular PEC's actually does not include any assessment of German language abilities to be carried out by the relevant authority itself prior to the exemption. There do exist agreements, according to which VTS, water police and harbour pilots should report any notice of insufficient knowledge of German language - prior and after a PEC has been issued - to HPA. The agreement committed voluntarily by the harbour pilots requests them inter alia to pay attention to the German language skills of applicants during the voyages on pilot guidance, which are mandatory for a PEC. Noticeable problems may be recorded on the form (Annex to clause 3 para. 3 of the Hamburg pilot ordinance) and thus be noted by HPA.

6 Analysis

The collision of KLENODEN with HANJIN CAIRO was on the one hand caused by the incorrect mounting of the double sheave inside the OD box of the variable pitch propeller system of KLENODEN. Despite a two hours' trial run of the controllable pitch propeller system, the double sheave suddenly worked loose while the vessel was moving, which resulted in the failure of all pitch indicators. Therefore the vessel's command was not aware of the real propeller pitch during the planned berthing manoeuvre.

On the other hand, the vessel's command was unaware of the fact that the control levers had been automatically disabled as a result of the occurred failure of the pitch indication. Due to attempts to stop the ship using the control levers, time was up for effectively avoiding the collision. However, it is to be considered that the vessel's command lacked time for reaction due to the speed of KLENODEN of 5 to 6 kn, as there is only a distance of 300 m between Burchardkai and the opposite pier in Waltershofer Hafen. Solely a consistent usage of the push button "Pitch Astern" for emergency operation possibly might have resulted in a stopping effect. It would have been necessary to get the control levers in a corresponding position to the actual pitch indication before they could have been reactivated.

Due to the narrow space, the emergency anchoring performed by the crew of KLENODEN could not prevent the collision with HANJIN CAIRO moored on the pier.

The design of the OD box as well as its arrangement in the engine room is prone to cause errors during maintenance or repair works of wearing parts. The narrow opening only allows working with one hand. As the OD box cannot be opened in such a manner as to enable an unrestricted view to the components to be mounted or demounted, any work must be performed as "blind" work. The restricted view onto the relevant components inside the OD box through the narrow opening is additionally rendered difficult by the fact that in the engine room there is only a small amount of light is available below the driving shaft in order to finally check whether the components are mounted correctly. Therefore an engineer who performs repair or maintenance work on the OD box must inevitably rely on his professional experience and on his sense of touch.

In order to ensure an equalised energy balance of the vessel during estuary trading and in order to prevent system overloads, the installation of another auxiliary diesel engine or the replacement of the existing auxiliary diesel engine by more powerful engines would be useful. Up to this time, decreases of power, as on the day of the accident, should be prevented by generally operating both of the auxiliary diesel engine in addition to the main engine during estuary trades.

The knowledge of German language of KLENODEN's Master did not contribute to the collision with HANJIN CAIRO. However, the arisen doubts lead to a detailed legal and factual review of the premises for pilotage exemption certificates.

The administrative procedure for regular PEC's has been discussed on principle by BSU with representatives of the relevant authorities as well as with representatives of

the Hamburg pilots and the German Federal Association of Sea and Harbour Pilots (BSHL). From BSU's point of view, the present administrative procedure could be improved, as the relevant authorities have not incorporated a language skill verification by own means. Therefore the authorities generally receive notice of insufficient language skills solely following reports of VTS, water police or pilots. In case a vessel's command benefiting from a PEC attracts attention - e.g. via VHF or in dangerous situations -, the relevant authority might be informed after the event. Thus oppressive measures (e.g. a verification of the language skills by the authority itself, revocation of the PEC) might be taken.

In the region of the collision between KLENODEN and HANJIN CAIRO in Hamburg, a voluntary agreement exists between HPA and the Hamburg pilots, generally enabling HPA to take preventive measures prior to issuing a PEC. BSU approves this cooperation in terms of a safety partnership, which has proved its value in practice. For the purpose of consistent standards and procedures for granting regular PEC's on navigable waterways in Germany, the aim should be to make preventive verification measures within the relevant authorities standard practice.

7 Safety Recommendations

7.1 Maintenance Companies and Shipyards

The Federal Bureau of Maritime Casualty Investigation recommends **companies and shipyards** that perform maintenance and repair work on OD boxes (oil distribution boxes) on seagoing vessels to assign their service personnel to check for a possible wedging of the double sheave and, if necessary, to perform suitable training measures. In addition, the required safe connection between the double sheave and the mechanical pitch indicator must be ensured by an extensive performance check with the main engine running, in order to minimize the danger of a failure of the pitch indicators as much as possible, in particular during estuary trading.

7.2 Vessel's Commands

The Federal Bureau of Maritime Casualty Investigation recommends **vessel's commands** not to make time-consuming attempts to reactivate the pitch indicators of the propeller blades by using the control lever in case the pitch indicators fail during estuary trading. Instead, the pitch push buttons for emergency operation should consistently be operated in one single pitch direction. This is the only chance to manoeuvre the vessel despite the failure of the indication while being unaware of the real pitch. In this regard, a simultaneous observation of the propeller stream can provide information about the real pitch of the propeller blades.

7.3 Authorities

The Federal Bureau of Maritime Casualty Investigation recommends the **authorities** competent for the exemption from the obligation to accept a pilot take any organisational measures that are suitable to verify and document insufficient knowledge of the German language by vessel's commands in due time before issuing a regular pilotage exemption certificate (PEC).

7.4 VTS, Water Police, Pilots

The Federal Bureau of Maritime Casualty Investigation recommends the staff of **VTS, water police an pilots** promptly inform the authority competent for the issuing of PECs whenever they recognize that traffic participants PEC do not sufficiently know the German language. A standardized flow of information is the precondition for the fulfilment of the requirement of sufficient knowledge of the German language by the respective vessel's command, which in turn is the precondition for a PEC.

The above safety recommendations shall not create a presumption of blame or liability, neither by form, number nor order.

8 Sources

- Witnesses' statements and correspondence:
  - Rederi Ab Engship
  - Master of KLENODEN
  - 1st Nautical Officer of KLENODEN
  - Chief Engineer of KLENODEN
  - Able-bodied seaman of KLENODEN
  - Service technician of the maintenance company
  - Port pilot for KLENODEN
  - NSB Niederelbe Schiffahrtsgesellschaft mbH & Co. KG
  - Master of HANJIN CAIRO
- Ship's log of KLENODEN
- Crew certificates of KLENODEN
- Mechanical documentation of the variable pitch propeller system of KLENODEN
- Pilot chart of KLENODEN
- Wiring diagrams of KLENODEN (main switchboard, important and incidental consumers)
- Exemption from the obligation to accept a pilot (PEC) dated 04. July 2006 for the Master of KLENODEN
- Ship's log of HANJIN CAIRO
- Survey Statements of the Germanischer Lloyd dated 10. and 12. September 2006 for HANJIN CAIRO
- Damage report by the Scandinavian Underwriters Agency for KLENODEN
- Investigation reports and photographic documentation by the water police (WSP) Hamburg
- Report, witness's statement and photographic documentation by the supporting officer for technical investigations of the WSP Hamburg
- Radar plots by the Traffic Centre (VTS) of Hamburg dated 9 September 2006
- VHF recordings channel 14 and channel 74 dated 9 September 2006
- Photograph of the vessel and photographic documentation of the damage by the shipping company NSB
- Proof of working hours of the maintenance company
- Nautical chart 3010 by the Federal Maritime and Hydrographic Agency (BSH)