Departmental investigation into the grounding of the bulk carrier TASSOS N off the port of Fremantle W.A. on 10 January 1997

Report No. 107

Australia
Department of Workplace Relations and Small Business

Contents

Navigation Act 1912
Navigation (Marine Casualty) Regulations investigation
into the grounding of the bulk carrier
TASSOS N
off the port of Fremantle W.A.

on 10 January 1997

Published: February 1998

ISBN 0 642 19990 6

The Investigation into marine casualties occurring within the Commonwealth's jurisdiction are conducted under the provisions of the Navigation (Marine Casualty) Regulations, made pursuant to sub section 425 (1) (ea) and 425 1 AAA of the Navigation Act 1912. The Regulations provide discretionary powers to the Inspector to investigate incidents as defined by the regulations. Where an investigation is undertaken the Inspector must submit a report to the Secretary of the Department. It is Departmental policy to publish such reports in full as an educational tool.

For further information please contact:

Inspector of Marine Accidents
Marine Incident Investigation Unit
P O Box 594 CANBERRA ACT 2601
AUSTRALIA

Phone: **+61 2 6274 7324**
Fax: **+61 2 6274 6699**
Email: **miiu@miiu.gov.au**

MIIU on the INTERNET

Information relating to this report and other marine investigation reports can be located from the Marine Incident Investigation Unit's Internet homepage at our URL: http://www.miiugov.au.htm

Summary

At 0500 on 10 January 1997, the 39,630 tonne Cypriot flag bulk carrier *Tassos N* departed the Alcoa wharf at Kwinana W.A., bound for Ferndale in the USA with a cargo of 37,775 tonnes of alumina.

The weather was fine and calm and the visibility good. With a Fremantle Pilot on board, the ship safely negotiated the Calista Channel and then the Stirling Channel. As it entered the Parmelia channel, however, a steering gear fault occurred which resulted in the ship not responding properly to the movements of the helm.

The ship's head swung either side of the intended track. As the Pilot attempted to arrest the swing, the bows swung sharply to starboard. The Master switched from No.1 to No.2 steering systems but then, seeing no response from No.2, he immediately switched back to No.1.

In spite of the Pilot's helm and engine orders, and dropping the port anchor, the ship grounded in the channel on a heading of 032° with 'L' beacon abeam and only 30 metres from the bridge.

The vessel had grounded only forward and was refloated later that day with the aid of tugs and a change of trim through ballasting by the stern. Damage was confined to the paintwork on the ship's bottom.

The incident was investigated by the Marine Incident Investigation Unit under the provisions of the Navigation (Marine Casualty) Regulations.

Sources of Information

The Master and officers of Tassos N

Australian Maritime Safety Authority

Fremantle Pilots

Bureau Veritas

The Inspector gratefully acknowledges the assistance of the Australian Maritime Safety Authority in allowing the Senior Marine Surveyor, Fremantle, to be appointed an investigator and to assist in the conduct of the investigation on behalf of the Inspector.

Acknowledgement

Tassos N

Tassos N is a Cypriot flag, 5 hold, 5 hatch bulk carrier of 39,630 tonnes deadweight. It has a length of 189.9 m, a beam of 29.6 m and a moulded depth of 15.5 m. The main engine is a 6 cylinder Sulzer two-stroke single-acting diesel engine of 7,194 kW driving a single screw and giving the vessel a maximum service speed of 17.3 knots. The vessel is classed with Bureau Veritas. It is not classed as UMS and operates with a manned engine room.

The ship was built in 1985 in Keelung, Taiwan, by the China Shipbuilding Corporation (Keelung Division). The vessel was originally named *Reina Ballena,* but its name was changed to S*tar Ballena,* then to *Ballena* and in 1993, to *Tassos N.* It is owned by Marksea Maritime Co. Ltd. based in Limassol, Cyprus and operated by A.M. Nomikos Transworld Shipping Agencies S.A. of Athens.

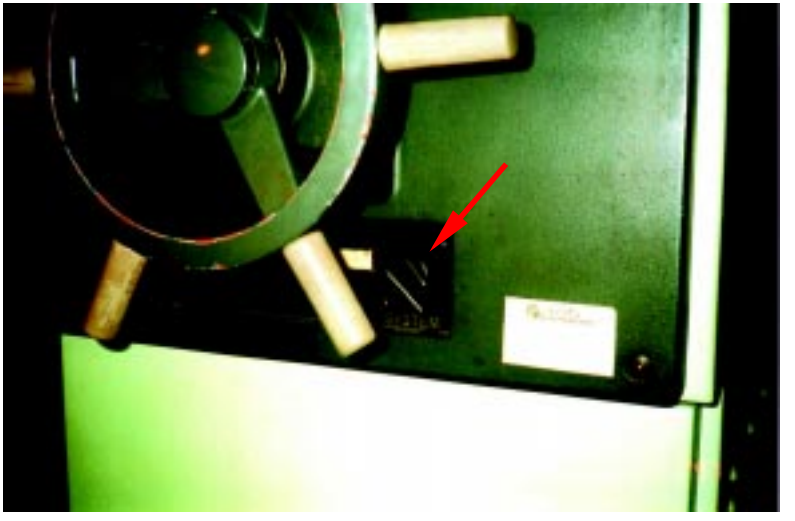
It has a crew of 26 consisting of the Master, 3 deck officers, radio officer, 4 engineer officers, electrician, bosun, 6 seamen, 7 engine-room ratings and two cooks.

The Master, Chief Engineer, Second Engineer and the Cook were Greek nationals while the remainder of the crew was composed of a mixture of Russian, Ukrainian, Filipino, and Bulgarian nationals in roughly equal numbers.

Steering gear

The steering gear of *Tassos N* is a Mitsubishi-Janney H2 type, built by Mitsubishi Heavy Industries of Japan and utilising Janney variable-delivery pumps to provide the hydraulic power to move the rudder.

The control system for this steering gear consists of three main sub-systems, all manufactured by the Yokogawa Hokushin Electric Co. in Japan, these are:



Front of steering console showing system change-over switch beneath wheel

1. The bridge steering unit, a PT11 series Digital Autopilot
2. The electrical telemotor system
3. The servo-control system, a type J2C PV006

Both the electrical telemotor system and servo-control systems are fully duplicated and either no.1 or no.2 system is selected by a manual change-over switch on the front of the bridge steering unit. (See photo page 4)

These systems are described in more detail under the heading “Comment and Analysis” on page 13.

The Incident

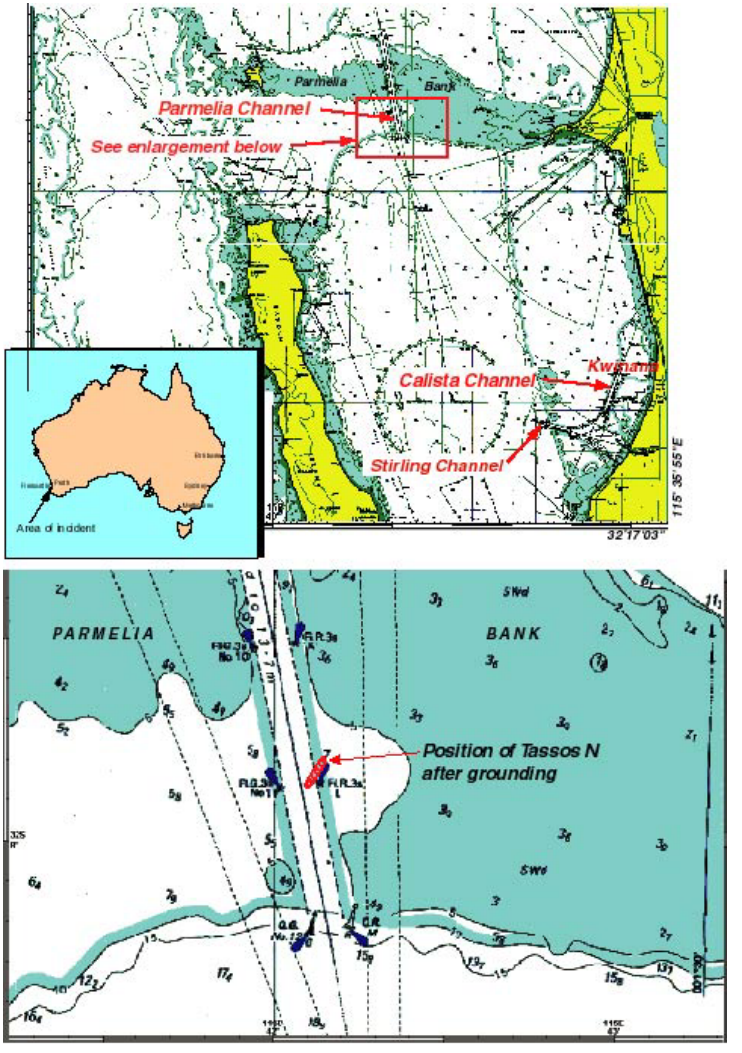
On 10 January 1997, *Tassos N* was lying at the Alcoa wharf at Kwinana, Western Australia. The ship had arrived at the anchorage from Geraldton on 6 January and had berthed in the early hours of the morning of 8 January. It was due to sail for the United States port of Ferndale at 0500 on 10 January, having loaded 37,775 tonnes of alumina at Kwinana.

At 0120, in preparation for departure, the Third Mate tested the bridge controls which included the operation of the steering gear with each steering motor running, the response of the helm, the operation of the engine room telegraph and the ship's whistle. During the test of the steering gear, the ship's Electrician was present in the steering gear flat and observed the operation of the steering machinery.

These tests were logged as having been carried out and the equipment as operating correctly.

Loading of the cargo of alumina was completed at 0341 and, at 0400, with the ship still moored alongside the wharf, the main engine was tested with a brief movement in both the ahead and astern directions.

At 0435, a Fremantle Pilot boarded the vessel. The weather was fine and calm and the visibility was good. Whilst the Master was involved with final commercial



Portions of chart Aus 117 showing position of grounding of Tassos N

matters below, the Pilot took the opportunity to observe the bridge layout and the manoeuvring characteristics which were posted on the wheelhouse bulkhead. Later, when the Master arrived on the bridge, they discussed the passage plan using a photocopy of a pre-prepared chart of the pilotage area. The Pilot believed that the Master had understood the plan. The Master did not discuss the manoeuvring characteristics of the vessel.

At 0450 the tug *Challenger* was made fast on the starboard shoulder. When the engine-room telegraph was placed on "stand-by", the Master checked the indicator lights which showed that both steering motors were running and moved the rudder from the hard-a-port to hard-a-starboard positions. He also checked the rudder angle indicator, the radars and communications. A helmsman, one of the ship's crew, was placed at the wheel as is normal in pilotage waters.

Upon leaving the wharf, *Tassos N*'s draught read 10.97 metres; even keel.

In order to leave the berth, the Pilot directed they heave on the starboard anchor, which had been laid out during berthing approximately 4 points on the bow, then gave the engine a kick ahead, at "dead slow", and port rudder. Although the tug *Challenger* had been made fast it took no weight. The ship moved smoothly off the berth till the anchor drew ahead. Once the anchor was aweigh, he commenced the turn to port at dead slow ahead and increased the helm angle to "port 20", in order to speed the swing. The vessel turned easily to port under the influence of the rudder with the swing being arrested using starboard helm as it steadied on a course of 201° to negotiate the Calista Channel. The ship negotiated the Calista Channel, without difficulty, between 0527 and 0539.

With 'E' buoy abeam of the bridge on the starboard hand, the Pilot brought the vessel round with starboard 10 helm, increasing to 20, easing later to 10, whilst shaping up for the Stirling Channel. At 'C' beacon he increased speed to slow ahead then, on passing 'B' beacon, the tug *Challenger* was dismissed. Whilst in the channel, speed was increased to half ahead, and later full ahead at the end of the channel, where he ordered "starboard 10", to head for the Parmelia leads.

On standing the crew down from forward and after stations, the Master retained the Mate and the Bosun on the forecastle and received confirmation that both anchors were outside their hawsepipes, ready for letting

go.

After clearing the Stirling Channel, the approach to the Parmelia Channel was uneventful. The Pilot required minor adjustment of helm to pass the leads on the port side and, on so doing, was on a heading of approximately 339° with No 12 buoy ahead. With the bridge passing close to No. 1 lead beacon he ordered “starboard 10”, to align with the channel. As the head swung slowly to starboard he ordered the helm amidships, followed by “Steady on 349”, intending to line up with the centre of the channel. When the ship was between No 1 lead beacon and the southern entrance of Parmelia Channel he noticed an increase in the rate of turn to starboard and ordered counter helm which failed to arrest the swing. The Pilot also noticed the rudder indicator moving spasmodically, clicking very slowly, degree by degree and he had a momentary thought that the helmsman had fallen asleep.

However, at that instant, the helmsman alerted the Pilot to the fact that the rudder was not responding correctly to the applied helm. Immediately the Pilot shouted to the Master, who had been standing beside the engine manoeuvring console on the starboard side of the wheelhouse, that they had a serious problem with the steering. The Pilot ordered “hard a port, slow ahead”. At this stage the vessel was heading for ‘M’ buoy. The vessel started to respond as the bows entered the channel and the Pilot ordered “hard a starboard - full ahead” to correct the swing and re-align the vessel with the centreline of the channel. No. 11 beacon now lay on the starboard bow and, as the swing to starboard developed, he ordered “hard a port” to dampen the swing. Although the helmsman’s responses were prompt, the rudder did not respond to the helm applied and the rate of turn to starboard increased rapidly. As the bow cleared ‘L’ beacon, the Pilot ordered “stop”, then “full astern” and he noticed the bow fall off quickly to starboard in response to the transverse thrust.

In the interim and in response to the Pilot’s warning, the Master had moved quickly to the steering console and had switched steering control from No.1 system to No.2 system, noticing as he did so that the vessel’s head had fallen off to starboard with the astern movement. The Pilot then ordered the port anchor to be dropped. The Master’s attention was thus directed to ensuring that the Pilot’s instructions were followed and, as No.2 system had not responded, he switched back to No.1 system.

The anchor ran out to 7 shackles, leading on the port quarter. Shortly after, the vessel touched bottom at a speed of 8 to 9 knots and eventually grounded on a heading of 032° with 'L' beacon abeam and lying only 30 metres from the bridge.

The Master telephoned the engine room to advise the Chief Engineer of the steering gear failure, and the Chief and the Electrician went to the steering gear flat to trace the fault.

The Pilot reported the situation to Fremantle Port Control on VHF and requested the assistance of tugs from Kwinana, the nearest point for response. The tug *Champion* departed immediately, but the tug *Challenger* was given permission to change crew - a procedure which occupied approximately 5 minutes.

The Pilot obtained an indication from the Master of the location of the *Tassos N*'s bunker tanks. Soundings, being taken around the ship, indicated that the hull was intact. Shortly afterwards, the Pilot was advised by the Port Safety Manager, on VHF channel 12, that the Port Authority's vessel *F.P. Response* had been rapidly manned and was on its way to assist.

Soundings, taken by *F.P. Respons*e upon its arrival, showed that *Tassos N* had grounded forward. The Master assessed the situation and decided to ballast the ship in order to reduce the draught forward, while the Port Authority instructed the tug *Wambiri* to assist. *Wambiri*, however, was not despatched immediately, as its Master had reserved rights of salvage upon instruction from his Head Office.

The Master of *Tassos N* stipulated his preference for a single early attempt to refloat the vessel using *Champion*, which had arrived alongside. However, in view of the proximity of *Tassos N*'s stern to the western bank of Parmelia Channel the Pilot advocated the use of two tugs. The Master of *Tassos N* was also reluctant to use *Wambiri*, on account of its conditional offer of assistance, and had been constantly on the telephone, over a period of about an hour to his owners. He appeared, to those present, to be under considerable pressure to wait to refloat the vessel at the next high water and to use not more than one tug. Predictions showed that high tide was next due to occur at midnight. In the meanwhile, as the channel was blocked to traffic, the Port Authority wanted the vessel refloated as early as possible.

In the meantime, the tug *Wambiri* had been despatched and was standing by. The tug *Champion* secured aft through the centre lead, while *Challenger* secured to the port shoulder. Working her engines to assist

the tugs, *Tassos N* moved about five metres and then stopped on a heading of 026°.

In view of the changed attitude of the Master, following his discussions with the owners, the Pilot requested the attendance of the Port Safety Manager who arrived on board shortly afterwards. Both he and the Pilot informed the Master that the tide, as a result of the wind conditions, was 15cm above prediction at the time. The Master estimated that, as a result of the addition of ballast to No.5 double bottom and after peak tanks, the trim would have changed by approximately 2 metres. In addition, at about 1030, the Master informed the Pilot that a fault had been found in No.1 servo-control system and that the steering gear had been repaired and was working satisfactorily.

In agreeing to the Pilot's request for a second attempt, the Master stated that he had been restricted by the owners to only one go with a third tug. The tug *Champion* remained on the after lead while *Challenger* was placed to push on the starboard shoulder. At about 1143, the second attempt was made with *Tassos N*'s engine working astern, from full to slow, both tugs being used at full power, and by heaving simultaneously on the port anchor. In response, the vessel started to move and swing to port. *Champion's* tow line parted and the tug was then utilised to keep the starboard quarter clear of the beacon. *Wambiri* was made fast at the starboard waist and instructed to pull. The problem confronting the Pilot was manoeuvring a vessel the size of *Tassos N* back into the narrow channel.

However, at about noon the vessel was refloated, swung into the channel and held in position by tugs as the anchor was retrieved. During this process *Champion* was resecured on the centre lead aft in order to pull the vessel, stern first, out into Cockburn Sound.

Once the ship had been refloated, and having finally cleared the channel at about 1300, it returned to the anchorage where an underwater examination of the hull was carried out by divers. The divers reported that damage was confined to the bottom paintwork.

Following repairs to No.1 steering servo-control system by ship's staff, the steering gear was extensively tested by the classification society's surveyor and the Australian Maritime Safety Authority. It was found to be in good working order and, its Certificates of Classification for Hull and Machinery having been endorsed, *Tassos N* continued on its voyage later that night.

Comment and Analysis

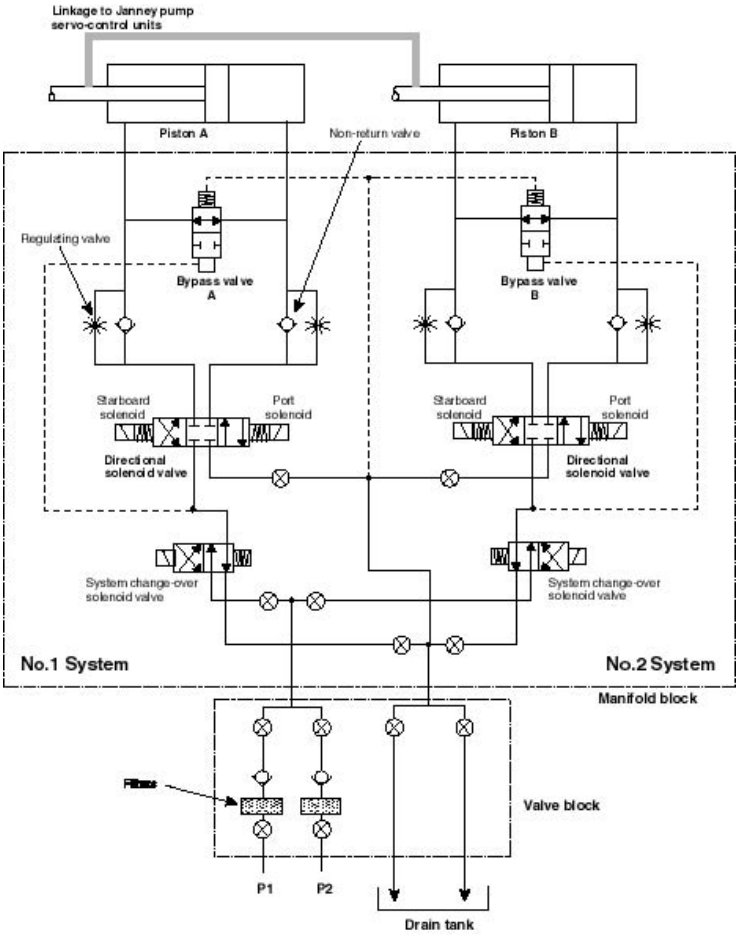
The grounding occured as a result of loss of directional control when the rudder did not respond correctly to the wheel movements on the bridge.

Steering gear

The steering system of *Tassos N* consists of:

1. The bridge steering unit which generates electrical signals either from the autopilot or manual input in the form of movements of the wheel.
2. The electrical telemotor system which sends these electrical signals from the steering unit on the bridge to the servo-control system in the steering flat.
3. The servo-control system which, in response to signals from the telemotor, modulates the stroke of the running variable-delivery hydraulic pump.
4. The steering gear, of conventional ram and Rapson slide type, with two main hydraulic rams and two Janney hydraulic pumps which work on the servo-controlled, variable-stroke principle to provide the hydraulic power to move the rudder.

Change of stroke in the running Janney pump, in response to movement of the output linkage of the



M.V. TASSOS N

Schematic of steering telemotor servo-control hydraulic system

servo-control hydraulic power unit, causes hydraulic oil to be delivered to the appropriate ram and thus determines both the direction and degree of movement of the rudder.

Both the electrical telemotor system and servo-control systems are fully duplicated and, at the time of the grounding, no.1 system was in use.

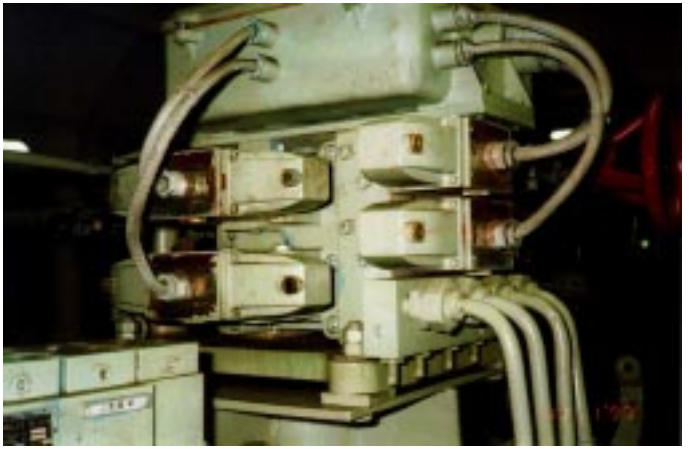
Automatic change-over, in case of failure in one of these control systems, is not required under the International Convention for the Safety of Life at Sea 1974 (SOLAS) and is not provided. The Convention does, however, require automatic change-over for electrical power supplies and automatic isolation of the main hydraulic power systems in case of loss of hydraulic oil. In *Tassos N* these requirements are met.

The steering gear can be controlled from two positions, either from the bridge (normal) or, in case of emergency, from the steering flat where a manual wheel can be engaged and used to vary the stroke of the main hydraulic pumps directly, thus by-passing systems 2 and 3 (above).

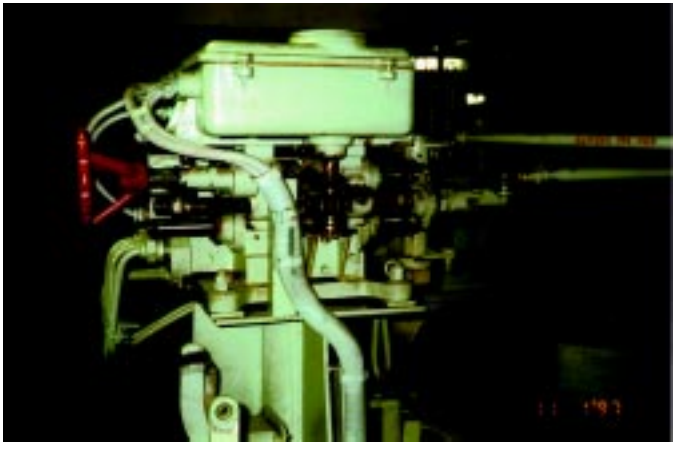
Servo-controller power unit

A diagram of the hydraulic circuit for the servo-controller power unit is shown on previous page. Servo oil pressure is provided by auxiliary hydraulic pumps driven off the main steering pump motors. When no oil pressure is being supplied by these pumps, both A and B oil paths are opened by the bypass valves A and B. These bypass valves close as soon as oil pressure, at about 10 kg/cm^2, is introduced into the supply ports P1 or P2.

Assuming that No.1 system is selected on the bridge, No.1 change-over solenoid valve will open and oil will be admitted to No.1 directional flow-control solenoid valve. If a starboard steering signal is received from the bridge via the electrical telemotor system, the “starboard” solenoid of this valve will be energised and the ports will open allowing oil to flow through the non-return valve to the piston A, thus moving the actuating linkage and putting the Janney variable-delivery pumps on stroke and moving the rudder to starboard. The exhaust oil from the left side of piston A, meanwhile, passes through the regulating valve to the exhaust oil system and back to the hydraulic tank. The speed at which the rudder moves to starboard is normally controlled by adjustment of this exhaust oil regulating valve.



Directional solenoid valves on Servo-control unit. No. 1 system “port”solenoid arrowed.



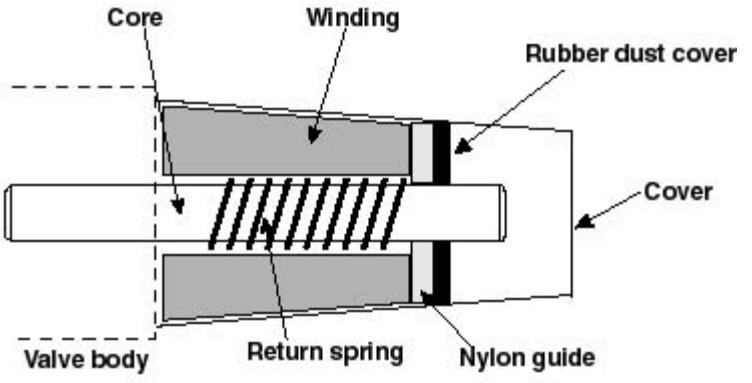
Steering gear hydraulic servo-control unit type J2C PV006 showing emergency steering wheel

Tassos N steering gear showing port hydraulic ram, rudder stock, port and starboard steering motors and servo -control unit (centre background).

When a port steering signal is received, operation is similar but the “port” solenoid of No.1 directional flow-control valve is energised, moving the valve in the opposite direction and admitting oil to the left side of the actuating piston A, while the exhaust oil from the right side of the piston passes through the opposite regulating valve which can be adjusted to control the speed at which the rudder moves to port.

While No.1 system is in operation, the bypass valve on No.2 system remains open so there is no resistance in cylinder B, the piston of which follows the motion of piston A to which it is mechanically linked.

Immediately after the grounding, the Chief Engineer engaged the emergency steering wheel in the steering flat and tested the operation of the steering gear from that position. Upon finding that it worked quite satisfactorily, attention was directed to the servo-control system. With further movements of the wheel on the bridge and number one telemotor and servo-system selected, it was found that the movement of the directional solenoid valve was slow and erratic in response to port helm movements, but satisfactory when starboard helm was applied, indicating a fault in this solenoid valve.



Diagrammatic sketch of "port" actuating solenoid

The solenoid valves are manufactured by Tokyo Kogyo (Osaka) and are labelled “Toyo-Oki” Model HO3 43 SGS BCA-03A. They are mounted directly on the power unit. (See photograph previous page)

The “port” solenoid was opened up and examined. It was found that a rubber dust cover on the end of the solenoid core had perished and broken up. (See sketch above).

Some small pieces of the perished rubber had found their way into the space between the core and the solenoid return spring, hence preventing free movement of the core when power was applied to the “port” solenoid. The solenoid was cleaned and spare parts fitted. Later that morning, the steering gear was

extensively tested to the satisfaction of the Bureau Veritas surveyor and was found to be operating satisfactorily.

Alarms

The steering system is fitted with running indication lights for the two motors and alarms which will indicate such things as electrical failure or automatic hydraulic system change-over as described previously. Failure of the telemotor system or the servo-control system, as occurred before the grounding, would not activate any of the steering alarms and, indeed, no alarm sounded. Immediately after the grounding, the Pilot observed that both of the green steering motor running indication lights were illuminated.

Bridge gear alarm panel showing green port and starboard steering motor indicator lights. (TOP)

Maintenance

Maintenance of the Yokogawa Hokushin Electric company's servo-control hydraulic power unit is described in the manufacturer's manual supplied to the vessel with the instruction book for the Mitsubishi electro-hydraulic steering gear.

At page 10, para. 4 under the heading "Maintenance and Inspection of the Power Unit" it states:-

"As long as the Power Unit is operating in good condition, it is not necessary to take any action of maintenance or inspection such as regular-time disassembly etc."

The manual continues with instructions on the replacement of components such as oil seals and packing, should oil leakage be observed.

In the opinion of the Engineer Investigator, and in accord with the statement in the maintenance manual, the solenoid which failed is not a component for which regular inspection or maintenance would normally be considered necessary.

Personnel

Shortly before the grounding occurred, the Master moved quickly from the engine manoeuvring console, at the starboard side of the bridge, to the steering console on the centreline and switched from No. 1 steering system to No.2 (telemotor and servo-control systems). Seeing no immediate response from No.2 system, he switched back to No.1. The vessel grounded within moments of the Master switching back to No.1 system.

No.2 system, in fact, was operational and was not affected by the fault which had occurred in the solenoid fitted to No.1 servo-control system. Had the Master realised that No.2 system was operational, however, the grounding which occurred moments later would not have been averted on account of the very short time factor involved; switching back to No.1 system had no bearing on the incident.

After the incident, the Master was showing signs of fatigue, as were the officers and crew. The bridge log book showed that they had been involved in berthing operations, cargo operations, shifting ship and departure since 0200 on 8 January, over 48 hours previously. Although fatigue appeared to affect the Master's ability to recall detail during the investigation, which commenced very shortly after the incident, it does not appear to have been a factor contributing to the grounding. The Pilot had also noticed the fatigue of the ship's staff, but he noted also that they appeared to be carrying out their duties efficiently.

The Master expressed the opinion that the Pilot, who took *Tassos N* outbound on the morning of 10 January, was extremely capable and reacted properly to the situation in all respects.

From the time the Master first contacted the vessel's owners, he appeared to the Pilot and the Port Safety Manager to be under considerable pressure to resist any attempt at refloating the ship until the high tide at midnight. In addition, it was also apparent that he resisted using the third tug and only agreed to one attempt using the third tug after the Pilot and Port Safety Manager had pointed out to him all the weather and tidal factors. He expressed great reluctance to enter into a "contract situation".

The grounding

The distance between No.11 beacon and No.12 buoy in the Parmelia Channel is 750 metres and that

between Nos.11 and 10 beacons, 650 metres. The width of the bottom of the channel is 140 metres and the bottom is covered with ½ metre of granulated sand. *Tassos N* had grounded on the eastern side of the Parmelia Channel in soft ground with its port anchor and 7 shackles of cable lying across the channel to the western side.

The Port Authority's vessel, *F.P. Response*, has the capability of transmitting data electronically and hence, while sounding around *Tassos N*, the outline of the ship's waterline could be superimposed upon an hydrographic drawing of the channel and the adjacent bank. Thus a clear picture of the situation was immediately available to the Master and the Pilot.

Conclusions

These conclusions identify the different factors which contributed to the circumstances and causes of the incident and should not be read as apportioning blame or liability to any particular organisation or individual.

1. *Tassos N* grounded as a direct result of the failure of the steering gear.

2. The steering gear failed following the perishing and breaking-up of the rubber dust seal within an actuating solenoid on the servo-control hydraulic power unit. As a consequence of this failure, small pieces of rubber jammed the movement of the solenoid causing the failure of No.1 steering system.

3. It is specifically mentioned in the manufacturer's manual, relating to the servo-control hydraulic power unit, that regular inspection or maintenance of the power unit, of which the solenoid was a component, is not necessary.

4. On account of the short time available following the steering gear failure, neither the Master nor the Pilot could have taken action, beyond the measures which were taken, to avoid the grounding.

5. Although the Master changed over steering systems to the No.2 (stand-by) system at the steering console and then changed back to the faulty system, the time available was such that the grounding was inevitable, even had he realised that No.2 system was operational.

It is further considered that:

The Master and other members of the ship's complement were showing signs of fatigue both before and after the grounding. It is not considered, however, that fatigue was a contributing factor in this incident.

Submissions

The provisions of sub-regulation 16 (3) of the Navigation (Marine Casualty) Regulations require if a report, or part of a report, relates to a person's affairs to a material extent, the Inspector must, if it is reasonable to do so, give that person a copy of the report or relevant part of the report. Sub-regulation 16(4) provides that such a person may submit written comments or information relating to the report.

A copy of the draft of the report was sent to the vessel's owners, the Master and the Pilot.

A submission was received from the Pilot and his comments have been incorporated into the final report.

Details of Vessel

Name	TASSOS N
IMO No.	709928
Flag	Cyprus
Classification Society	Bureau Veritas
Ship Type	Bulk carrier
Builder	China Shipbuilding Corporation, Keelung,Taiwan
Year Built	1985
Owner	Marksea Maritime Co. Ltd.
Operator	A.M. Nomikos, Transworld Maritime Shipping Agencies S.A., of Athens
Summer deadweight	39,630 tonnes
Length overall	189.90 m
Beam	29.60 m
Depth (moulded)	15.51 m
Engine	Sulzer, 6RTA58, 6 cylinder
Engine power	7,194 kW
Service speed	13.7 knots
Crew	26, of five different nationalities