CONTENTS

SUMMARY

The Panamanian registered bulk carrier *Starfish* sailed from Port Walcott, Western Australia on 22 March 1991 with 53549 tonnes of iron ore fines for the Polish port of Swinoujscie.

It is reported that the *Starfish* diverted to Port Louis, Mauritius on 1 April, when the ship's crew observed the vessel to be riding low in the water and water was discovered in numbers 6 and 7 cargo holds. The vessel arrived off Port Louis on 3 April, but was ordered from the outer anchorage on 7 April when the ship threatened to cause a major pollution incident.

The *Starfish* was escorted to deep water, 40 miles west of Mauritius and some 60 miles north of Ile de La Reunion, by a vessel of the Mauritius National Coast Guard. The crew of the *Starfish* was taken on board the Coast Guard vessel before the *Starfish* sank on 8 April.

The Australian Marine Investigation Unit, in accordance with the International Maritime Organisation Resolution A440 (XI) "Exchange Of Information for Investigations into Marine Casualties" and under the provisions of the Navigation (Marine Casualty) Regulations, undertook an investigation of the evidence that was available within Australia to assist the Panamanian Authorities.

Both Nippon Kaiji Kyokai, the ship's Classification Society, and Robe River Iron Associates were invited to comment on a draft of this report in accordance with Regulation 16 of the Navigation (Marine Casualty) Regulations. Where appropriate their comments have been adopted into the text. Where the Inspector has been unable to accept the submissions made these are outlined at Appendix 1.

PERSONS INTERVIEWED

R H Baxter	Acting Manager Cape Lambert Services
R I Grafton	Shipping Officer Cape Lambert Services
RLKing	Sub-Collector of Customs
D L Holt	Draught Surveyor
B McKew	Agent Lynn & Elders
P Hall	Providor
D Ward	Tug Master
T McKenzie	Chief Engineer
S McDonald	Tug Master

PROVISION OF STATEMENTS

Cape Lambert Services:

R H Baxter	Acting Manager,
R I Grafton	Shipping Officer
D H Marland	Superintendent, Production
R J Jones	Production Foreman
G M McClurg	Leading Hand
S L Blackler	Plant Operator
LCDay	Operator/fitter
B J Braggs	Plant Operator

Tug Masters:

W S McDonald	Master *Tai-o*
D Ward	Master *Roebourne*

OTHER INFORMATION

Australian Bureau of Meteorology

Nippon Kaiji Kyokai

THE STARFISH

Starfish was a seven hold, 28147 gross tonnage, 56277 deadweight, bulk carrier, specially strengthened for heavy cargoes, built by Maizuru Jukogyo K.K, Maizuru Japan in 1970. (Attachment 1)

Originally named *Genkai Maru* the ship sailed under the Japanese flag until sold to Ultraocean S A of Buenos Aires, Argentina in 1983, when it was renamed *Starfish.*

On 15 March 1991, whilst *Starfish* was at Singapore, the country of registration was changed from Argentina to Panama. Interim International Safety Certificates, valid to 14 August 1991, were issued by the Classification Society (Nippon Kaiji Kyokai).

CARGO LOADING

Starfish arrived off Port Walcott from Singapore, at 1020 local time 21 March 1991 to load a full cargo, approximately 53000 tonnes, of "sinter fines" iron ore for Swinoujscie, Poland. The vessel's previous cargo had been grain from Port Arthur, United States to Fukuyama, Japan. The voyage from Japan to Singapore and Singapore to Port Walcott was made in ballast.

The pilot boarded at 1035 and conducted the ship to the Cape Lambert loading terminal. Two tugs assisted in the berthing operation, *Tai-o* made fast on the port bow and *Roebourne* made fast, utilising two bow lines, on the port side immediately forward of the bridge front. The pilot reported that the ship landed squarely alongside number 2 berth. He felt no contact from either the berth or the tugs at any stage, and no such contact was brought to his attention by either the Master or any of the ship's crew.

Starfish was reported as taking longer than other ships to make fast once alongside. This was apparently because a number of the crew were unfamiliar with the ship, having only joined in Singapore, otherwise berthing operations appear to have been normal. *Starfish* was all fast, starboard side to the berth, at 1230.

Prior to loading the Master was provided with a 'Bulk Cargoes Declaration' (Attachment 2), stating that the moisture content of the cargo was 6.0 - 7.5%, that the angle of repose at the stated moisture content was 32 - 34.5 degrees and that the cargo held no chemical hazards. A letter to the Master (Attachment 3) also advised that "the responsibility for safe and correct loading of the vessel rested entirely with the Master, that the shore personnel were not qualified in the skills of correct stress loading of vessels", also that tonnages by the shore belt scale were approximate only and that no reliance was to be placed on these for correct stress loading of the vessel.

The loading sequence requested by the Master and accepted by the Terminal was :

SEQUENCE	HOLD	TONNAGE	SEQUENCE	HOLD	TONNAGE
1	7	7000	6	3	7225
2	1	7000	7	5	7500
3	5	7000	8	7	6000
4	3	7000	9	1	1000
5	1	3000	10	7	1000

This provided for a total cargo of 53,725 tonnes with a distribution of:

HOLD	TONNAGE
1	11,000
3	14,225
5	14,500
7	14,000

According to the draught survey report (Attachment 6) water ballast on board on arrival amounted to 12670 tonnes, located mainly in the forepeak tank, the side tanks and number 4 hold, with small amounts in the double bottom tanks (Attachments 7 & 7A). Although it is not mentioned in the draught survey report there was also a small quantity of water in number 3 hold, which the crew were having difficulty in removing and which subsequently caused a departure from the planned loading schedule.

Loading of cargo commenced at 1541 21 March 1991 and proceeded according to plan until the end of the third pour, when the water remaining in number 3 hold prevented loading into that hold. Rather than stop the loading the Chief Officer changed the planned loading sequence, requesting that a further 1000 tonnes be poured into number 5 hold. This pour was completed at 1955.

The water in number 3 hold still had not been removed so the Chief Officer then requested a 1000 tonnes pour into number 7 hold, followed by a 3000 tonnes pour into number 1 hold, and then a further 1000 tonnes into number 5 hold, which was completed at 2121. Mr Graeme McClurg of Cape Lambert Services, the leading hand responsible for the loading of the ship on behalf of the shore installation, boarded the vessel on a number of occasions to investigate the change in sequence requested by the ship through the inability of the ship to discharge the water from number 3 hold. He stated that he was aboard the vessel at 2100 and that he observed members of the crew in number 3 hold in the process of removing an access plate from the tank top at the after port side. Whether this access plate was to the bilge suction well or to the double bottom tank is not known, but it is likely that it was to the double bottom tank. An officer requested that the ship loader, loading into number 5 hold should distribute ore on the starboard side to list the ship to shift the water in number 3 hold clear of the port side while the access plate was being removed. Once the plate was removed the pour was then directed to the port side to give a port list and allow the water to drain away through the opening. This operation was successful and loading into number 3 hold commenced at 2140.

The Chief Officer then requested a change to the loading sequence as follows:

SEQUENCE	HATCH	TONNAGE	SEQUENCE	HATCH	TONNAGE
8	3	8000	11	7	5000
9	5	5500	12	1	1000
10	3	6225	13	5	400
			14	3	600

Loading was completed at 0456 22 March 1991 and according to the loader operators all holds had been loaded reasonably level, with no undue peaks. However, one operator remarked that during the loading the bow had been unusually high.

From the Terminal loading record sheet the actual pour amounts and rates of loading for respective holds were:

SEQUENCE	HATCH	TONNAGE POURED	TIME START	TIME FINISH	LOADING RATE AVRG T.P.H.
1	7	6950	1541	1651	5960
2	1	7030	1701	1818	5480
3	5	7940*	1825	1955	5290
4	7	910	1958	2016	3030
5	1	3070	2026	2103	4980
6	5	1190	2108	2121	5950
7	3	7950	2140	2312	5180
8	5	5500	2317	0012	6000
9	3	6260	0024	0147	4530
10	7	5090	0200	0304	4800
11	1	1020	0335	0350	4080
12	5	510	0431		
13	3	690		0456	3000

(* Includes the extra 1000 tonnes requested by the ship when the original loading sequence was amended through the inability to discharge water from number 3 hold.)

Stoppages of 31 minutes and 41 minutes occurred following pours 10 and 11 respectively for the purpose of carrying out draught checks and calculation of cargo/trimming requirements by the ship's officers.

According to interim shore figures the *Starfish* loaded a total of of 54,110 tonnes of iron ore fines. Based on this figure the average rate of loading was approximately 5000 tonnes per hour, in an actual loading (pour) time of 10 hours 37 minutes. The maximum rate o,f loading was 6000 tonnes per hour.

The cargo quantity ascertained by draught survey was 53,549 tonnes, the figure utilised for Bills of Lading purposes.

Total cargo quantity differential Bill of Lading/hold totals is 0.9896322, which applied to the hold totals provides a corrected distribution of:

HOLD	TONNAGE
1	11,005
3	14,745
5	14,983
7	12,816

Ballast remaining on board on completion of loading, as determined by the Chief Officer, was 464 tonnes: 382 tonnes in number 4 hold, the remainder distributed in small quantities amongst the double bottom tanks (Attachment 7 and 7A)

Draught on completion of loading, as detailed in the Draught Survey Report was:

Forward	12.046 metres		
Aft	13.094 metres		
Mean	12.570 metres	Stern Trim	1.048 metres
Mid Port	12.530 metres		
Mid Stbd	12.590 metres		
Mid Mean	12.560 metres	Hog	0.010 metres

Departure formalities completed, *Starfish* sailed from Port Walcott at 0920 22 March 1991. For departure, tug *Roebourne* made fast on the port bow whilst *Tai-o* stood by to assist if necessary. No incidents occurred during unmooring or the outward pilotage. *Starfish* cleared the pilot station at 1100 22 March 1991 bound for Swinoujscie via the Cape of Good Hope.

THE FOUNDERING

The Australian Customs Service "Boarding Report" notes the route as Indian Ocean, Cape Agulhas, Atlantic Ocean, etc. However, the *Starfish* did not file a 'Sailing Plan' with the Australian Marine Rescue Coordination Centre, as required under section 269F of the Navigation Act 1912, nor did the ship participate in the voluntary Australian Ship Reporting System whilst in the Indian Ocean, east of longitude 75 degrees East, being an area for which Australia has marine search and rescue responsibilities under the International Search and Rescue Convention. Therefore, whilst the general route was outlined in the "Boarding Report", precise details of the actual route taken are not known.

The South Indian Ocean weather at that time was dominated by a high pressure system centred on latitude 35 South, moving slowly eastwards and the 'twin' tropical cyclones 'Fatima' and 'Errol' (Attachment 8).

Starfish's route would have taken it between the high pressure cell and the cyclone systems. Accordingly the winds experienced on the voyage would have initially been the southeasterly trades, which would have gradually backed to the east and increased in strength to around 25 knots as the *Starfish* progressed westwards.

Starfish would probably have passed about 550 miles to the south of 'Fatima' on 28/29 March, after which a decreasing wind strength would have been experienced.

Analysis by the Australian Bureau of Meteorology (Attachment 9) suggests that in the early stages of the voyage the swell would have been from the southeast at around 3 meters. As the wind increased and backed the swell would also have increased to around 4 meters and would have moved around towards the east. Around 27 March, *Starfish* would also have been experiencing a 4 - 5 meter swell from the northeast, emanating from the cyclones. This swell would have been experienced through to the 31st.

On 26 March a low pressure system developed around 43 South 55 East and by 28 March *Starfish* would also have encountered a low swell from the southwest, resulting in a rather confused sea condition.

It is reported that, at dawn on 1 April 1991, *Starfish* was noted to have a greatly reduced freeboard and investigation by the crew revealed that holds 7 and 6 had become flooded. The Master decided to divert to Port Louis, Mauritius, which was the closest port of refuge and *Starfish* anchored in the outer roads anchorage at Port Louis on 3 April 1991.

In response to a request for information from the Port Master of Port Louis, he advised that he was first contacted by the Master of *Starfish* during the weekend 6/7 April, when the Master requested his assistance in securing a barge in order to off-load about 1400 tonnes of bunkers, also making brief mention that some holds ;were flooded and that there was a possibility of pollution. On 7 April, following investigation by the Mauritius Coast Guard, the Port Master ordered *Starfish* to leave the anchorage and Mauritius territorial waters in order to avoid pollution to the local environment.

Due to concern for the safety of the crew *Starfish* was accompanied by a Mauritius Coast Guard Patrol Boat. The *Starfish* was subsequently abandoned in a position approximately 40 miles west of Mauritius and some 60 miles north of the Iles de Reunion, and the crew taken aboard the patrol boat. It was reported that the *Starfish* slowly flooded and eventually sank at 1815 local time 8 April 1991.

C O M M E N T S

Condition of the *Starfish*

Prior to the arrival of the Starfish in Port Walcott, and whilst negotiations were under way to charter the ship for the iron ore cargo, a telex addressed to Pilbara Port Railroad and Resource Company Limited, dated 25-02-91, advised that Japanese Charterers and Receivers for the consignment of grain from Port Arthur to Japan were:

> *"very cautious about vessel's conditions and obviousb vessel was passed/accepted by the US Coast Guard. - Owners themselves say that the vessel is in good condition/no problems."*

A facsimile cover note from Robe River Limited to Cape Lambert Services, forwarding details of *Starfish* and dated 26-02-91, states:

> *"We are in a position to 'have' to take this vessel - hopefully it will be OK."*

It would appear that the Japanese Charterers and Robe River entertained some reservations about the age or condition of the *Starfish.*

Starfish was over 20 years old and, at interview several people remarked on the visual impression that the *Starfish* made. The ship was described as "run down", "rusty" and, more generally, "a typical vessel for her age", although considered by some as "better than many, at least inside the accommodation". The Master of the tug *Roebourne,* stated that the hull was rusty and that there was a large "dent" by way of where the tug had been instructed to make fast. This was confirmed by the engineer, who had been instructed by the tug's Master to go forward and inspect the *Starfish's* hull before he made fast. However, the Classification Society's records reportedly contain no note of such an indentation.

Advice received from a London firm of consultants indicates that the Master of *Starfish* claimed that one of the tugs had made heavy contact alongside number 7 hold during berthing operations and that this contact may have resulted in a leak developing in the heavy sea conditions encountered after departure.

From the records held at Port Walcott and from interviews with the pilot and tug masters there would appear to have been no incident of heavy contact during berthing or departure procedures that may have compromised the integrity of the seaworthiness of the *Starfish.* No report of any contact was brought to the attention of the pilots by the Master or any of the ship's officers. No report or protest was made by the Master to the ship's agent or any shore official regarding possible contact damage.

Port State Control

Under the provisions of the International Maritime Organization's 'Control of ships' (Port State Control) the Australian Maritime Safety Authority endeavours, in line with international practice, to inspect, on a random basis, around 25% - 30% of ships visiting Australian ports. Unless the appearance of a ship justifies otherwise, in line with the provisions of the control measures, an inspection would normally be limited to confirmation that all safety certificates and crew qualifications are in order.

Starfish was not inspected under Port State Control procedures whilst it was at Port Walcott.

Cargo Loading Operation

The cargo of iron ore fines, as presented for loading, was in accordance with Marine Orders, Part 34 (Solid Bulk Cargoes) and the International Code of Safe Practice for Solid Bulk Cargoes, with respect to low moisture content and the physical properties of the iron ore.

It is not known whether or not the *Starfish* was fitted with an operational loading computer, or whether the Chief Officer carried out any longitudinal stress calculations for the planned or actual loading sequence. The loading sequence as originally requested by the master would appear to create a hogged condition (Attachment 4), even allowing for appropriate sequential deballasting, but may well have been within acceptable stress loading parameters. However, the amended sequence of loading, as a consequence of water remaining in number 3 hold (Attachment 4), would have resulted in different stresses upon the ship. By loading 10100 tonnes into number 1 hold, 9130 tonnes into number 5 hold and 7860 tonnes into number 7 hold (approximately half the total cargo) before loading any cargo into number 3 hold (Attachment 5) the stresses would have increased appreciably. The indications are that at this stage of loading *Starfish* would have been considerably hogged.

Unless the stresses placed upon the hull had been calculated and found to lie within safety limits it would have been prudent for the Master to suspend loading at 1955 when hold numbers 1, 5 and 7 had received the first pours.

The actual loading sequence would have accounted for the ship being appreciably by the stern during loading, a condition remarked upon by one of the shore loader operators.

Based upon the times and quantities logged in the 'Hatch Loading Sequence' sheet the overall average loading rate was approximately 5000 tph, with a maximum rate of 6000 tph being achieved during the first pour into No. 7 hold at commencement of loading and again during the third pour into No. 5 hold (sequence 8). These rates are standard for the port.

In order to expedite loading it is desirable to reduce the number of hatch changes to the minimum consistent with safety. The master of *Starfish* elected pour quantities of 7000 tonnes, which provided for only eight pours/changes before topping off procedures. Whereas pour quantities of 7000 tonnes may be appropriate for larger bulk carriers, for a vessel the size of Starfish (56277 tonnes deadweight) such quantities are liable to cause considerable localised load stresses.

Discharge of Ballast

In order to avoid the introduction of foreign organisms into Australian waters by way of ballast water taken aboard ships in foreign ports the Australian Quarantine Inspection Service (AQIS) has made recommendations on the voluntary change of such ballast water whilst ships are on passage to Australia. *Starfish* did not follow the AQIS recommendations and the ballast water was not changed on the voyage from Fukuyama and Singapore, therefore such an operation is not relevant to this investigation.

Mr Ronald Grafton, the Shipping Officer from Cape Lambert Services who attended the *Starfish* on arrival overheard the ship's officers talking of a problem with the ballast pump, which evidently had an electrical problem. From final draught survey notes it is evident that all ballast had not been discharged prior to sailing.

The draught survey established that 464 tonnes of ballast remained on board after completion of loading, of which the bulk, 382 tonnes, remained in number 4 hold with eight double bottom ballast tanks accounting for the remaining 82 tonnes (Attachments 7 & 7A).

Number 3 hold was not a hold designated as containing ballast. It would seem that the quantity of water in that hold on arrival was not great but it is not clear whether the water was residual ballast, or whether it had leaked from the ballast in number 3 topside tanks, double bottom tanks, or from number 4 hold.

Change of Registry

The *Starfish* changed its country of registry from Argentina to Panama at Singapore on 15 March 1991, the vessel, however, remained under her original classification society, Nippon Kaiji Kyokai (NK).

When a vessel changes registration from one country to another the international safety certificates issued by the administration of the former flag State become void and it is necessary for new certificates to be issued by, or on behalf of, the new flag State. In the case of *Starfish* new, interim, certificates were issued by NK on behalf of the Panamanian Authorities. (Short term interim certificates are issued by the local office pending issue of full term certificates by the Head Office).

According to advice from the Prefectura Naval Argentina an International Load Line Certificate was issued by them on behalf of the Argentine Administration on 1 June 1990 (with an expiry date of 26 May 1995) following satisfactory inspection on 26 May 1990; an International Safety Construction Certificate was issued by them on 30 May 1990 (with an the expiry date of May 1992), for which the vessel underwent a satisfactory 'dry hull' inspection 8 - 12 May 1990; they also advised that the International Safety Equipment Certificate was due to expire in May 1991.

Under Regulation 6(b) of Chapter 1 of the Protocol of 1978 to the International Convention for the Safety of Life at Sea, 1974 Administrations may either institute arrangements for unscheduled inspections or establish mandatory annual surveys to ensure that the ship remains in all respects satisfactory for the service for which the ship is intended. The Argentine Administration had established a regime of mandatory annual surveys, therefore under the certificates issued by the Argentine Authorities annual surveys would have been due in June 1991.

In addition, it is understood that Classification Special (20 year) Survey was also due in June 1991, *Starfish* having undergone the previous Special Survey in June 1987. NK have advised that no time extension had been granted.

Starfish was over 20 years old and it is noted that the Argentine Administration in issuing a new Safety Constrnction Certificate on 30 May 1990 defined an expiry date of May 1992, whereas under Regulation I/I0 of SOLAS a maximum 5 year period is permitted. The reason for the issuance of a shorter term certificate is not known.

NK issued the relevant statutory certificates on behalf of the Panama maritime authority on the basis of the existing (previous) certificates issued under the Argentinian flag. NK confirmed that:

> *"on the basis of the review of the survey reports filed in the Society's Head Ofice .... the class of the STARFISH was maintained without outstanding recommendation as of 14 March 1991"*
>
> *and,*
>
> *"both load line and safety construction certifcates were automatically rewritten under Panamanian flag because the ship maintained her class without any recommendations".*

Under the Nippon Kaiji Kyokai "Guidance Notes for Surveyors Overseas" where there is a change of flag of a vessel interim certificates should be issued after an "occasional" survey, although the term 'occasional survey' does not appear to be defined. In this instance, although the NK Surveyor attended aboard the *Starfish,* the 'occasional survey' would appear to have been limited to confirmation that the existing certificates were valid and that there were no 'recommendations' in place.

According to NK records the statutory international certificates issued were:

Load Line (Interim)	valid to 14 August 1991
Safety Construction (Interim)	valid to 14 August 1991
Safety Equipment (Interim)	valid to 8 May 1991
Safety Radiotelegraphy (Interim)	valid to 17 May 1991
IOPP Certificate (Interim)	valid to 14 August 1991.

NK also advised that renewal surveys for both the International Load Line Certificate and the International Safety Construction Certificate were due on 10 June 1992.

The issue of the interim International Safety Certificates by the Classification Society, only a matter of days prior to the ship's arrival at Port Walcott, gave the Charterers the right to assume that *Starfish* was fully seaworthy and suitable to load cargo.

Weather Conditions on Passage

Although the Australian Bureau of Meteorology's analysis indicates that *Starfish* would have experienced strong winds resulting from tropical cyclones 'Fatima' and 'Errol' to the north these winds would have been quarterly. The sea and swells, resulting from the southeast trade winds and the cyclonic winds around 'Fatima' and 'Errol', would also have been quarterly. Only the low swell emanating from the southerly low pressure system would have been forward of the beam.

Such sea conditions are by no means extreme and would not give problems to a well-found vessel.

CONCLUSIONS

It is considered that:

1. The cargo of iron ore fines was presented in a proper manner, in accordance with the requirements of the Code of Safe Practice for Solid Bulk Cargoes.

2. The physical properties of the cargo were accurately detailed in documents handed to the Master.

3. The cargo was loaded in accordance with the instructions of the Master and ship's staff.

4. In the event that *Sta$~sh* foundered as a result of structural failure, in addition to the working stresses pertaining at the time, a relevant factor would be any excess stresses placed upon the hull in recent times. However in the absence of key witnesses and the ship's longitudinal strength data, the investigation was not in a position to reach any conclusion as to whether the permissible stresses were at any time exceeded during the loading operations at Port Walcott.

5. The issue of interim Statutory certificates provided prima facie evidence that the ship was seaworthy. Unless the Classification Society had recently conducted a comprehensive inspection of the ship, the issue of such certificates on the strength of the existing certificates means that they were issued without a full knowledge of the actual condition of the ship.

6. From the Bureau of Meteorology's analysis the wind and sea conditions prevailing at the time in the area through which *Sta$sb* passed should not have caused problems to a well found vessel.

7. There is insufficient evidence within Australia to indicate the cause of *Sta$sb* taking water into the cargo holds.

APPENDIX 1

Regulation 16 of the Navigation (Marine Casualty) Regulations makes provision, where a report refers to a person's affiirs to a material extent, for such a person to submit written comments or information relating to the report. Where such comment or information is received by the Inspector he may, where he considers appropriate, amend the report as a result of such comment or information.

In their submission Nippon Kaiji Kyokai expressed concern that the word "automatically" on page 12 may cause misunderstanding in that the certificates would have been issued whether or not a Class Surveyor had attended the ship. The term is a direct quote from advice given by the Society. The Inspector accepts that NK would not have issued the certificates without a surveyor visiting the ship on behalf of the Society. However, due to the fact that the ship held current certificates and, according to records, remained in class with the Society any survey carried out by the surveyor would appear to have been only cursory.

NK suggested the following amendment to conclusion 5:

> *"The issue of interim statutory certificates provided prima facie evidence that the ship's class was maintained".*

Although the Inspector agrees that this submission is technically correct the issue is considered to be that of seaworthiness. The shipping industry in general assumes that where a ship holds valid statutory certificates, especially when these have only recently been issued, the ship is seaworthy and fit to load the cargo for which it was designed.

Attachment 1

DETAILS OF SHIP

Name:	STARFISH
Port of Registry:	Panama
Year Built:	1970
Builder:	Maizuru Jukogyo KK, Japan
Classification Society :	Nippon Kaiji Kyokai
Owner:	Arlington Maritime Inc, Panama
Operator:	Ravenscorft, Miami, USA
L.0.A:	210.01 metres
Beam:	32.26 metres
Summer Draught:	12.526 metres
Summer Deadweight:	56,277 tonnes
GRT:	28,147
NRT:	21,345
Number of Holds:	7 strengthened for heavy cargoes
Service Speed :	14.75 knots

International Safety Certificates - Expiry Dates

Safety Construction (Interim)	14.08.91
Load Line (Interim)	14.08.91
Safety Equipment (Interim)	08.05.91
Safety Radio (Interim)	17.05.91
Oil Pollution Prevention (Interim)	14.08.91

ATTACHMENT 2

BULK CARGOES DECLARATION

SINTER FINES SHIPMENT

To the Master SS/MV _____STARFISH_____

Load Port PORT WALCOTT

The commodity to be loaded to your vessel is Robe River Iron Ore sinter fines and the following data has been derived via the use of recognised international and national test procedures as is required in the IMCO Bulk Cargoes code.

A)	**PHYSICAL/CHEMICAL PROPORTIONS**	
1	Transportable Moisture Limit	Not applicable
ii	Moisture Content (IS0 3087)	6.0 - 7.5% (Continuous testing)
	Average moisture content will be confirmed by tests carried out during loading.	
iii	Angle of Repose at Moisture levels stated	32" - 34.5O
IV	Stowage Factor (Bulk Density)	**.50 - 0.55** m'/tonne **1.82 - 2.00 tonnes/m' 20** ft'/ton
V	**Iron Content**	**56.5 - 57.5% (Continuous testing)**

This commodity **is not considered to be a cargo which will** liquify **during transport.**

B)	**ctlEu1cAl HAzARDs**	
i	**Classification**	**Nil**
ii	**Description of Hazard**	**Nil**
iii	**Precautions to be taken**	**Nil**
iv	**Emergency Procedures**	**Nil**

It is cer$ified **that for the cargo nominated, any relevant hazards pertaining to marine transport have been properly described and that information given is based on the latest available including experience in storage prior to shipment.**

Signature _____

on behalf of ROBE RIVER IRON ASSSOCIATES

21-03-91

Cape Lambert Services Pty. Ltd. Correspondence ed&aao: PO Box 126. Wkkham. Watom Awtral
Telephon 1 871088 Facsimlb 081 871002 lolox AA 99150

ATTACHMENT 3

The Master
mv STARFISH
Ore Wharf
Cape Lambert
PORT WALCOTT WESTERN AUSTRALIA

We are authorfsed on behalf of Robe River Iron Associates to manage operations within Port Walcott.

In welcoming you to Cape Lambert, we would like to advise that your vessel is subject to various Port Health, Customs, Immigration, Maritime and other regulations as follows:

LOADING OPERATIONS

The responsibility for safe and correct loading of the vessel rests entirely with the Master.

Shore personnel are available to operate the loading machinery and to assist the vessel in every way they can, but it must be appreciated that they are not qualified in the skills of correct stress-loading of a vessel, nor in achieving a desired draft condition.

Masters must therefore ensure that a competent officer is on duty throughout the loading period, that he visits the deck frequently, and maintains a continuous check on the draft.

Communication between your Duty Officer and the Shiploader Operator is by a private VHF radio frequency. A radio and charger unit may be collected from the Shiploader Operator's Cabin by your Officer at the beginning of loading and returned immediately upon completion of loading. This must be done without delay. The responsibility of safekeeping and return of the Shipper's radio and charger remains the responsibility of the Ship's Master, who will be held liable for any loss or damage to the equipment.

One ship's crew member should at all times be available to communicate with shore personnel.

Tonnages indicated by the shore belt scale are to be taken as approximate only and no reliance is to be placed on these for correct stress-loading of the vessel, nor for the achievement of the final desired draft.

WASHING DOWN

Ore spillage on deck and dust which accumulates during the course of shiploading must not be washed into the berths. Vessels are required to defer wash-down until after they have cleared from the berth, outward.

../2

21-03-91

P" office: 9th Floor 12-14 St. George'8 Terrace. Perth. Western Australia 6OW
TelePhone 09 420 4747 FacsimileOB421477 Telex AA 92725 GPO Box P 1224, Perth, Western Australia 6001

SHORE LEAVE AND VISITORS

Robe River Iron Associates, as owners and operators of Cape Lambert port and mine-site areas, have asked us to draw to your attentlon the attached regulations relatlng to shore leave and vlsltors.

NOTICE TO PORT AND TOWAGE USERS

By-Law 75 promulgated under the Gazetted Cape Lambert Ore Wharf By-Laws.

Towaqe Rates and Conditions

The use of tug boats to assist vessels inwards and outwards shall be at the discretion of the Master. In all cases, the rates set out in the Second Schedule shall be payable in respect of towage services available to all vessels berthing and unberthing into and out of any berth, or any of the Company's marine facilities whether such services are used or not used.

It is the intent of this By-law that if tugs and workboats have been mobilised then they are available.

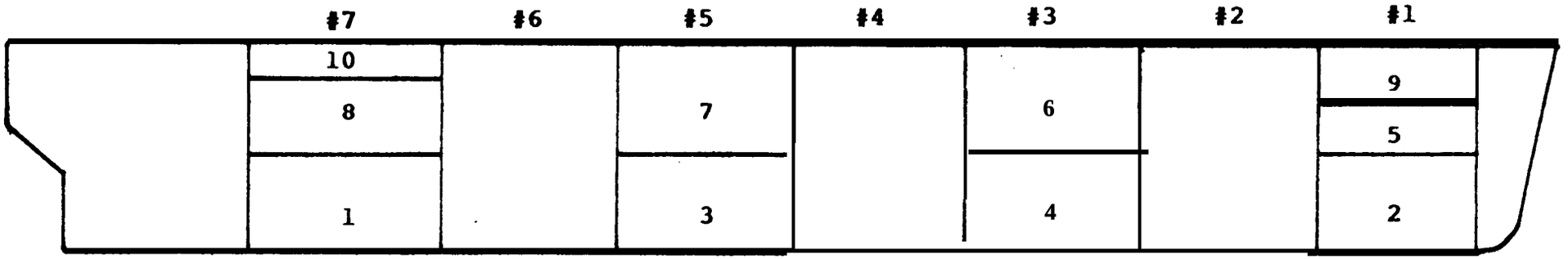
If the pilot chooses not to bring the tugs onto towlines, this is a matter for his judgement, however if tugs and craft are in attendance and available for use, then full payment at the gazetted rate is required irrespective of whether their services are used or not. Conversely, if tugs and craft are not available, no charges will be levied irrespective of whether the Master has signed an application form in accordance with By-law 75.

Your co-operation in these matters is appreciated. Kindly indicate receipt of this letter by-signing the attached copy.

Yours faithfully,
CAPE LAMBERT SERVICES PTY LIMITED

C M ALLAN
Manager

21-03-91



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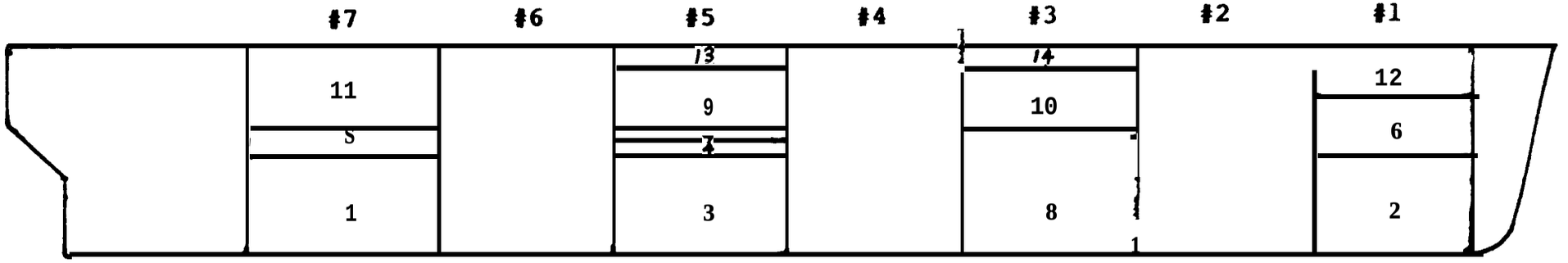
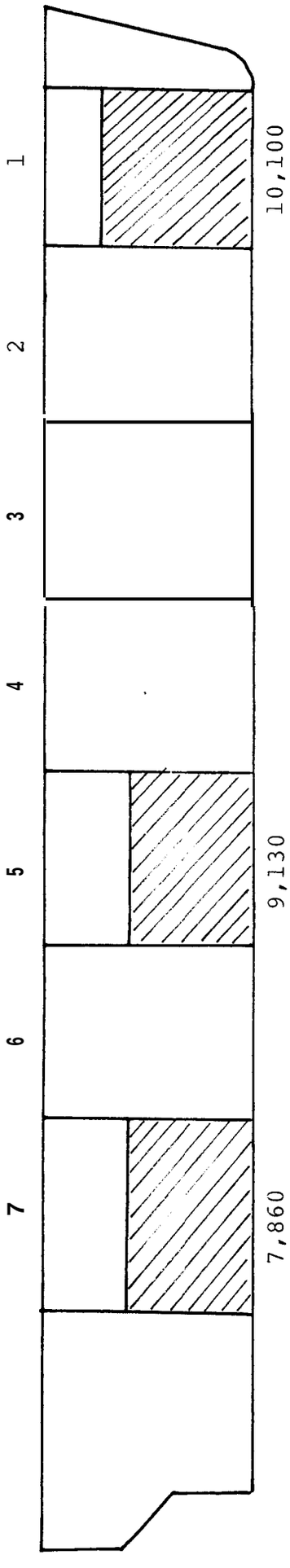


SEQUENCE AS LOADED

ATTACHMENT 4

ATTACHMENT 5



SITUATION CARGO HALF LOADED

NORTHERN AUSTRALIAN SUPERINTENDENCE PTY. LTD. 59

CARGO CONSULTANTS AND DRAFT SURVEYORS

Registered Office
29 Herbert Way
Wickham
Western Australia

Postal Address P.O. Box 416
Wickham. 6720
Western Australia

Telephone
All Hours 091-671928

DRAFT SURVEY REPORT

Shipment No. ....2226.....

Vessel STARFISH | Port of Reg. PANAMA | GRT 28148

Summer Draft 12.526m | Displ 67583 kt | LBP 200m

Cargo to Load/Disch. IRGN ORE FINES | Port: WALCOTT

	Initial:		Final:	
MTC	lo.6		28.04	
TPI/C	54.25	LCF -6.27	58.17	LCF -0.90
Trim	1.46	Den. 1.023	1.048	Den. 1.023
Dale	21 .03.91	Time 1300hr	22.03.91	Time 0510hr

Draft F (M)	4.69	12.05
Stern Corr.	.005-	.004-
Draft F.	4.685	12.046
Draft A (M)	6.10	13.06
Stern Corr.	.045	.034
Draft A	6.145	13.094
Draft Mid P.	4.68	12.53
Draft Mid S.	5.82	12.59
Draft Mid M.	5.25	12.56
F & A Mean	5.415	12.57
1st Mean	5.3325	12.565
2nd Mean	5.29125	12.5625
Displ.	27104	67781
Corr.	7	15
Displ.	27111	67796
Trim Corr.	243-	20-
Displ.	26868	67776
Density Corr.	52-	132-
Corr. Displ:	26816	67644
Lt. Ship	11306	11306
D.W.T.	15110	56338

Known Weights		Known Weights	
Ballast	12670	Ballast	464
Fresh Water	570	Fresh Water	457
F.O./D.O./L.O 1605,191,30	1906	F.O./D.O./L.O 2685,189,30	1904
Total	15146	Constant	36-
Constant	36-	Total	2789

From the draft taken and the ship's data made available for the survey, the total cargo was estimated to be as follows:

Metric Tonnes:— 53549 kt

Long Tons:- 52703 lt

Master: _____

Chief Officer: _____

Signed: _____ Surveyor

Name: D.HOLT

Date: 22nd March.1991

ATTACHMENT 7

TANK | INITIAL KT | FINAL 158

TANK	SOUNDING	CORRECTION	~~CUBIC METRES~~	SOUNDING	CORRECTION	CUBIC METR
FPT	15·75		2010	−15		
TST 10	F		444			
5	F		441			
20	5·30		1179			
5	F		1231			
30	5·40		1149			
5	F		1230			
40	4·60		853			
5	4·90		964			
OB 10	−05		5	−05		5
5	−25		32	−06		6
20	−20		20	−15		15
5	−07		5	−10		7
30	−36		97	−12		9
5	−15		14	−17		14
40	−62		137	−30		13
5	−30		30	−22		11
#4			2835	−85		373
						453
BALLAST DISTRIBUTION RECORD						464
				SAILING	F 12·55	
					F 12·03	
				TRIM 58 16	A 13·02	
				#1	F +6·35 A +2·95	
				#7	F −1·80 A +5·25	

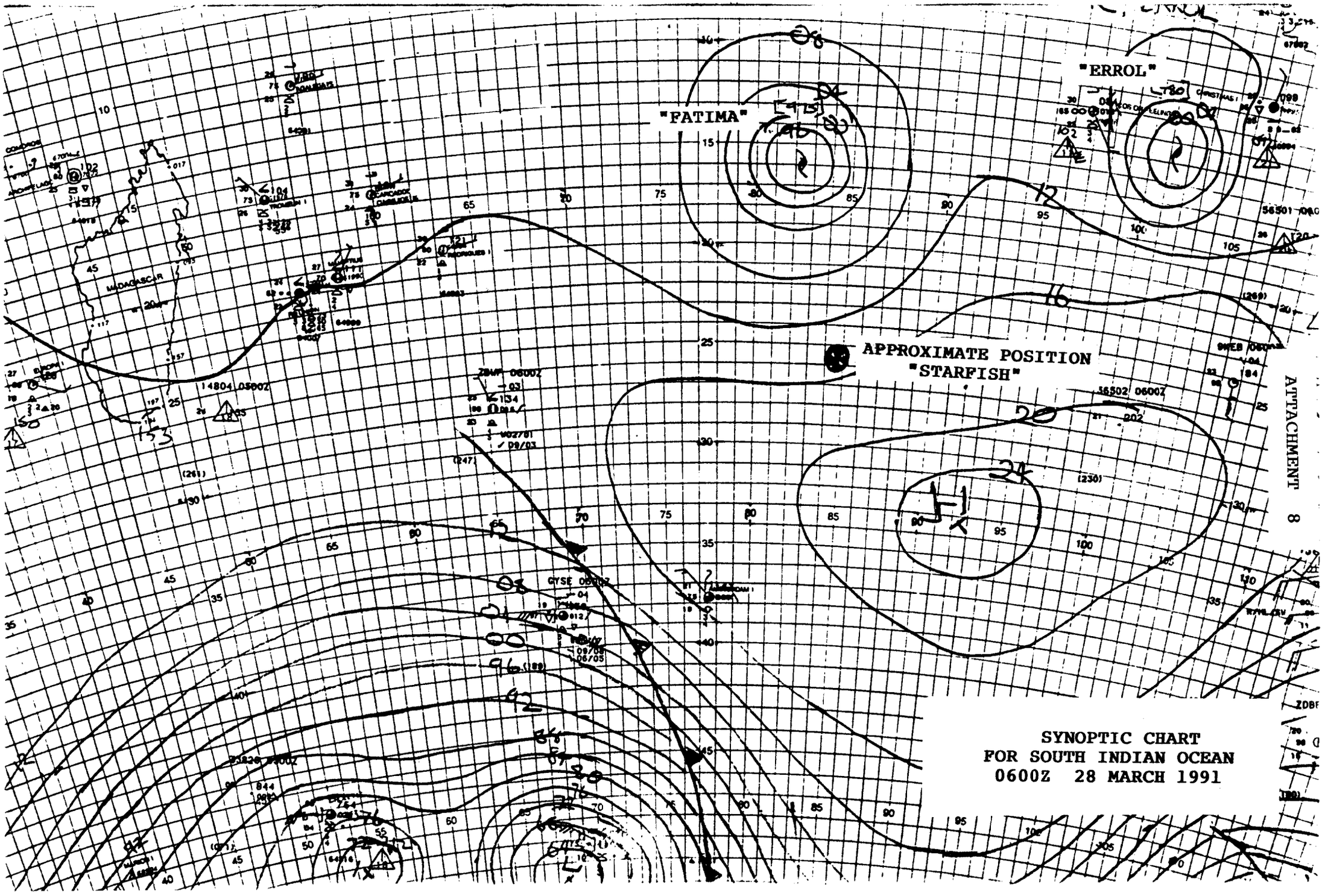
P		S		P 54050 S 53721		
4·69	F	4·69			F 12·00	12·05
4·68	✱	5·82	12·50	12 53	✱ 12·52	12·59
6·05	A	6·15			A 13·03	13 06

ATTACHMENT 7A

	INITIAL			***FINAL***		
	SOUNDING	**CORRECTION**	**KT**	SOUNDING	CORRECTION	KT
FPT	15.75		2010	**.15**		
TST **1P**	**F**		441			
S	F		441			
2P	5.30		1179			
S	**F**		1231			
3P	5.40		1149			
S	**F**		1230			
4P	41.60		853			
S	4.90		964			
DB **1P**	**.05**		5	**.05**		5
S	**.25**		32	**.06**		6
2P	**.20**		20	**.15**		15
S	**.07**		5	**.10**		7
3P	**.36**		92	**.12**		9
S	**.15**		14	**.17**		14
4P	**.62**		137	**.30**		13
S	**.30**		30	**.22**		11
#4			2835	**.85**		373
						453
						464KT
				SAILING	**}{ 12.55**	
					F 12.03	
				TPC 58.16	**A 13.02**	
				#1	**F +6.35**	
					A +2.95	
				#7	**F -1.80**	
					A +5.25	

P		S	P 54050		S 53725
4.69	F	4.69		F	(12.00) 12.05
4.68	**}{**	5.82	(12.50) 12.53	**}{**	(12.52) 12.59
6.05	A	6.15		A	(13.03) 13.06
}{:M					

BALLAST DISTRIBUTION - FAIR COPY



ATTACHMENT 8

ATTACHMENT 9

WEATHER SUMMARY 22-31 MARCH 1991 FOR AREA BOUNDED BY 2OS, 35S, 60E, AUSTRALIA

22 Fine wealher wilh moderale SE winds were likely east of 90E. The charts show a slow moving low near 33S 84E, with the sub-tropical ridge well to the south. Tropical Cyclone "Falima" was analysed near 7S 90E.

23 Furlher developmenl of tropical depressions conlinued in the tropics. The low that was near 33S 84E degeneraled, bul a cold front approached the southwest of Western Australia. Moderate SE trade winds persisted between latitudes 20S and 35S.

24 The front crossed the soulhwesl coast of W.A. bul did not affect regions norlh of 30S. A high with cenlral pressure near 1035hPa was cenlred near 40S 90E and was the dominant feature on the Indian Ocean analyses.

25 The high near 40S 90E moved only slowly maintaining the trade winds into the tropics where Tropical cyclone "Errol" near 10S100E joined "Falima", which was moving only slowly at this stage, in being the
active features in the tropics. Winds west of 80E were likely lo be moderate to fresh ENE, while east of 80E a fresh ESE wind was likely.

26 The slow moving pattern persisted wilh condilions generally unchanged, "Fatima" drifled slowly southwards. This would have resulled in a tightening pressure gradient between "Falima" and the high pressure system, and hence winds are estimated to have increased in that area.

27 At 0000UTC, "Falima" was analysed as 975hPa near 13S 81E, wilh "Errol" as 958hPa near 12S 100E. The high weakened slighlly, now having a central pressure of 1026hPa hear 35S 90E. During lhe day, the synoptic pattern become more "meridional" in response to the development of a low pressure system of approximately 982hPo near 47S55E at 1200UTC. West of 70E, winds would have shifted more to the NNE, while between 70E and 90E a general E'ly wind was most likely.
As Ihe southern depression moved eastward, the ridge of high pressure was displaced more northward.

28 By 0000UTC, the high was analysed near 33S 90E with a ridge extending to 30S 60E. The effect of the ridge in this area was to ease the winds and while a moderate E'ly wind was likely north of 30S and east of 80E, only light winds would have occurred between 30S and 35S.

29 Al 1200UTC "falimo" was analysed ot 975hPa near 19s 81E and would probably have caused slrong lo gale force winds within al leas1 a generol radius of oboul 300nm of lhe cenlre. Fresh winds were likely furlher east al lhese loliludes grading lo strong lo gale force in the vicinity of "Errol". Generally lighl winds would hove occurred in most other areas bul the soulhern depression would probably have caused o freshening of winds neor 3% in the western section.

30 Al 1200UTC, "Fatima" was located neor 19s BOE, while "Errol" gradually degeneroled into o lropicol depression. A fresh W'ly wind wos likely near 3% in lhe vicinily of lhe soulhern depression west of BOE. In olher areas lhe prevailing ridge suggests only lighl winds generally.

31 The main high centre was onolysed neor 33s 105E at 06OOUTC ."Folimo" was locoled near 20s 79E at 0600UTC then neor 22.5s 79.5E 01 1200UTC. Although lhe ridge remoined near slalionory wilh associated light winds, the movemenl of "Fatima" soulhwords would resull in a greoler Oreo south of 20s being affected by slrong winds.

SUMMARY OF SWELL

The 24hour prognostic swell wave height model oulpul is provided for 22-31 March 1991. These charts cover the Auslrolion region, exlending wesl lo 90E. Unfortunately the model does not include influences from outside the Auslrolion region, so it is necessary lo inlerpret volues near the boundaries of the Oreo with some coulion. Cerloinly lhe model does not include effecls from Tropical Cyclone "Fatima". Nevertheless, these chorls ore a guide to swell eslimotes in eastern walers of the Indian Ocean and con be verified wilh ship observolions (rare os lhey may be). Hence, it is most useful in gouging lhe swell generated by lhe lrode wind flow. For walers elsewhere o subjeclive analysis is done in the absence of ship observolions. lt is particularly unforl,unote that the 'Starfish" herself did not give observolions.

Early in the period, in walers east of 95E, where lhe "Starfish was assumed lo be, the prevailing SE trade wind would have possible produced a swell lo 3m 01 limes.

Further into lhe period, (ie, ofler the 251h) o swell emonoling from the lwo tropical cyclones would hove offecled lhe "Slorfish". These long period swells may hove been loo weak to hamper the ship lo any noticeable degree. As the lwo @ems developed however, particularly "Folimo" which was the larger of the two cyclones and moved south in assumedly closer proximily to the ship which by this sloge must have been in the cenlral Indian Ocean, a rising swell is estimoted to hove affected the ship,

The ship, code ZBWF reported an increasing swell on the 29th reaching 5m al OOOOUTC 30 March in Ihe vicinity of 26s 75E , as outlined in Ihe aitached table. The ship was moving NE, then tracked easl as "Falima" approached. As Ihis swell originaled from the norlh east, regions furlher northeast of Ihis ship could have expected the swell to have arrived earlier and mosl likely ii could have been considerably higher than 5m. Hence, wilhin an area roughly norlhwest of a line joining 30s 70E and 20s 95E, a significant swell of al leas1 4m can be estimaied to have occurred from the 27th March,

From the 271h, near 35s in the western section (in proximity to the soulhern depression), a swell to 4m was possible. This swell would have propagaied to lhe NE, bui il is doubtful

if such a significant heighi would have eventualed in those walers. In other areas, especially in the far easlern Indian Ocean, a swell of smaller magnitude was likely, Unfortunately, a lack of observaiions make estimalions all lhe more difficult.

Ii is also important to consider ihe effect of lhe soulhern depression in the area offeded by the cyclones. A swell of long period from the SW may have interacled with Ihe other swells, Even if the magnilude was only of the order of 2m, ihe resullant sea stale al a given point could have quite chaoiic. The combined effecl of swells originating from three systems in addition 10 the seas from the local wind is exlremely complex and eslimalions of peak wave heights is virtually impossible in a purely subjective analysis.

Hence, in order lo determine maximum wave heights from lhese systems, a more ihorough investigation is required. As staled earlier, ihe ship positions are necessary lo make such a task worthwhile. Nevertheless, a significant swell of at least 4m can be estimated io have occurfed in a general area northwest of a line joining 30s 70E and 20s 95E al various limes after the 27th. It is possible thal a swell considerably higher ihan 5m may have occurred in this region.

WINDS NEAR TROPICAL CYCLONE "FATIMA"

The presence of "Falima" lo Ihe north of 20s on Ihe 24-27 March would have resulled in a fresh wind norih of opproximalely 27s and belween 75E-IOOE. This wind would have gradually strengthened as "Faiima" drifted southwards.

During Ihe 27ih, slrong winds are estimated lo have occurred north of 25s between BOE-90E grading lo galeforce near 20s on the 28th. This area would have slowly expanded in the following days as "Fatima" moved southward. Aciual details of wind speeds about "Faiima" are difficull lo estimale, however it appears thai lhe storm mainlained its iniensity wilh a cenlral pressure near 975hPa during lhis period. "Falimo" lhen possibly weakened from Ihe 31sl as it acceleraled souihwards.

ATTACHMENT 10

OBSERVATIONS FROM SHIP ZBWF EXTRACTED FROM THE MARCH 1991 INDIAN OCEAN MSLP CHARTS

DATETIME UTC	LAT °S	LONG °E	WIND Degrees	WIND Knots	SEA ht m	SEA period s	SWELL ht m	SWELL period s	WEATHER
28 0600	27.8	65.2	330	3-7	1.5	2	1.5	9	Nil
1800	27.2	68.2	340	3-7					Nil
29 0600	26.8	71.0	VRB	<3			2.0	4	Nil
1200	26.4	72.7	VRB	<3	0	0	4.0	9	Nil
300000	26.1	75.1	VRB	t 3	0	0	5.0	7	Nil
0600	25.2	75.5	130	8-12	1.0	4	4.5	12	Nil
1200	24.0	75.5	140	13-17	1.0	4	5.0	9	Nil
31 [illegible]	25.0	76.5	100	8-12	1.0	4	5.0	9	Recent showers
0600	25.3	77.5	100	18-22	1.5	5	4.0 4.5	11 12	Recent showers