147001 10/79

MINERAL LEASE APPLICATION

RINGAROOMA BAY

MINING METHOD

and

COMPANY BACKGROUND

BLAXAND SEADREDGE

147002

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BLAXAND SEADREDGE

July 16, 1979.

Director of Mines,
G.P.O. Box 124B,
HOBART, TASMANIA, 7001.

MINERAL LEASE APPLICATION - RINGAROOMA BAY.

Dear Sir,

This document is submitted with an Application for sixteen (16) Mineral Leases in Ringarooma Bay.

It briefly describes mining method and Company background.

Sincerely,
BLAXAND SEADREDGE

JAMES A. COLLINS.

BLAXAND SEADREDGE PTY. LTD.
Box 570 Surfers Paradise, Queensland 4217 Australia. Phone (075) 313 074 Reg. Office: 109 Cameron Street, Launceston Tasmania. Phone (003) 314 433

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CONTENTS

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1. GENERAL

In 1967, about US$500,000 was spent on an exploration program for tin and other minerals in Ringarooma Bay North East Tasmania.

This exploration led to the discovery of a relatively large low grade alluvial tin, zircon and rutile deposit in water depths of 60 to 120 feet.

Assuming a cut-off grade of two ounces tin metal per cubic yard, the deposit contains between 3,300 and 4,500 long tons of tin metal. However, the seas of Bass Strait were considered too rough to allow a conventional dredge to exploit the deposit and the exploration lease expired.

Blaxand Seadredge Pty. Ltd., a Tasmanian Company, was formed by principals of Ipcomarine of Singapore, to make application to the Director of Mines for sixteen mineral leases in Ringarooma Bay. The lease plan, as submitted, is shown in Figure 1. The technical background of Ipcomarine is appended, Appendix 5.

If granted a mineral lease, Blaxand Seadredge Pty. Ltd. shall mount a conventional bucket wheel suction dredge ladder onto a semi-submersible platform, in the following manner.

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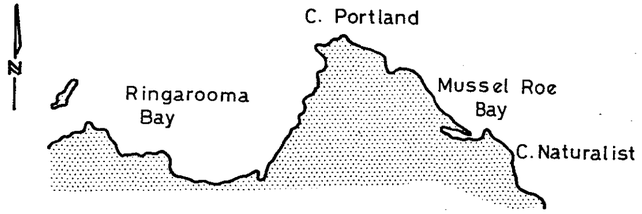
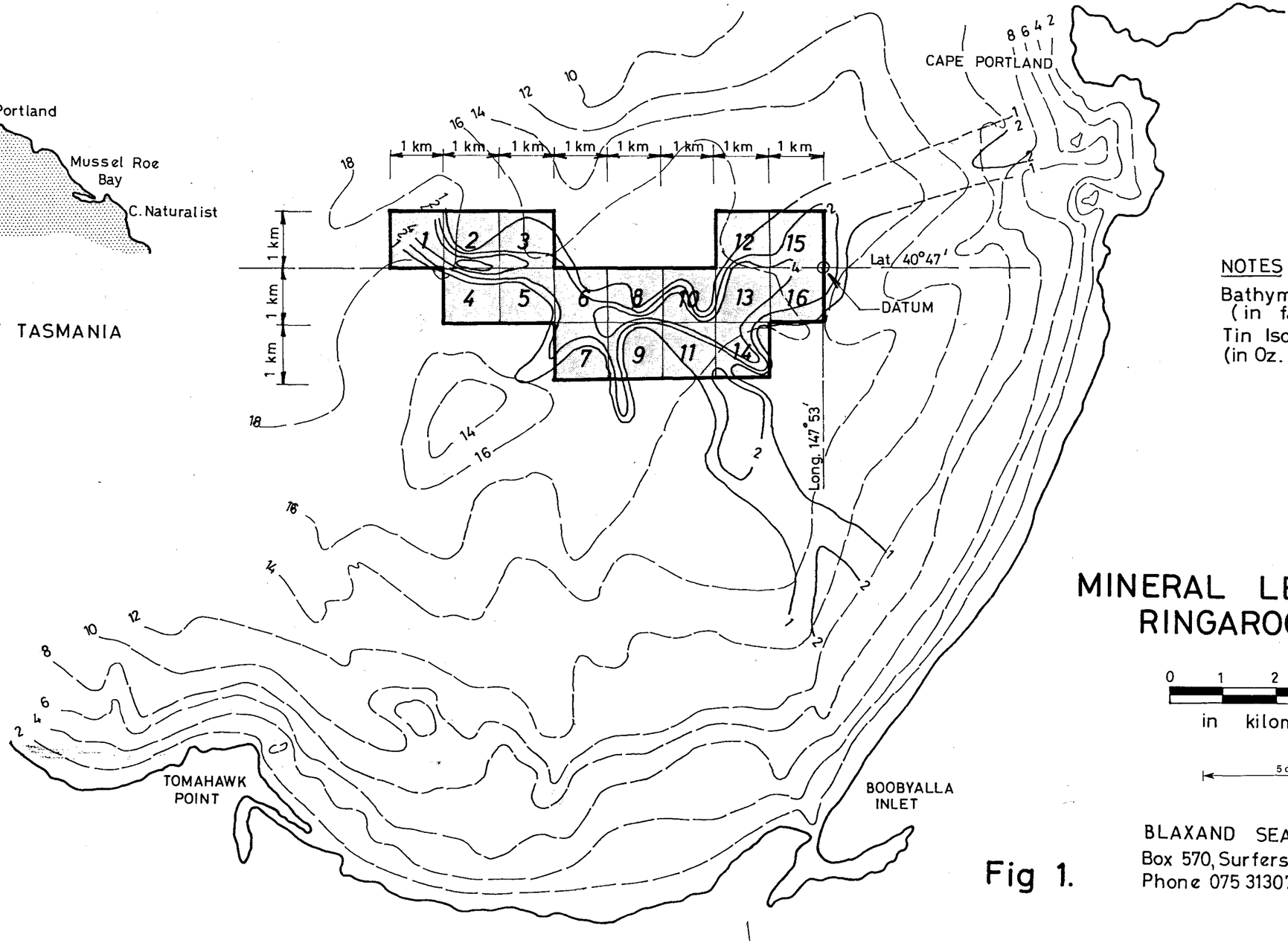
leases 36M/79 → 51M/79

plotted Oct 1979.



NORTH EAST TASMANIA



NOTES

Bathymetric Contours (in fathoms) 12—12

Tin Isograds (in Oz. per yd³) 2—2

MINERAL LEASE PLAN RINGAROOMA BAY

0 1 2 3 4

in kilometers.

5 cm

Fig 1.

BLAXAND SEADREDGE PTY. LTD.
Box 570, Surfers Paradise Q 4217
Phone 075 313074 July 1979

2. SEMI SUBMERSIBLE PLATFORM

The accompanying fold out drawing Figure 2, depicts the semi submersible platform. This hull configuration reduces the effect of wave amplitudes by a factor of four to ten by placing the twin pontoons below the wave motion. The semi submersible platform principle is now well established, particularly in the North Sea, which is considered the roughest marine environment in the world. A study of data from the Tasmanian Bureau of Meteorology covering a thirteen year period indicates that a semi submersible hull of the size contemplated could be worked for a 95% production time up to and including sea state 5. It would have a survival capability of up to sea state 8, or wave heights of 30 to 45 feet.

The platform is moored and advanced by an eight point mooring system, the anchors of which are reset by an anchor boat.

Accurate positioning will be achieved by the use of a microwave positioning system.

3. DREDGE LADDER AND EQUIPMENT

The dredge ladder swings between the pontoons for an affective dredge face width of 30 metres, and to a maximum depth of 40 metres below sea level. A suction type bucket wheel excavator is located in the end of the ladder. The wheel excavator is used in lieu of an orthodox cutterhead, to give a higher solids concentration and to maximise the recovery of heavy materials. The submerged dredge pump is mounted some two thirds down the ladder, which also increases the solids concentration. The dredge pump and cutter wheel are in the magnitude of 1,000 and 500 HP respectively, and will dredge at the rate of 1,000 tons per hour via a 500 mm suction pipe.

The ladder hoist and swing winches are fitted with hydraulic compensators to nullify the effect of excessive wave motion.

This type of ladder and components are presently available and well within the scope of modern dredging technology.

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Fig. 2

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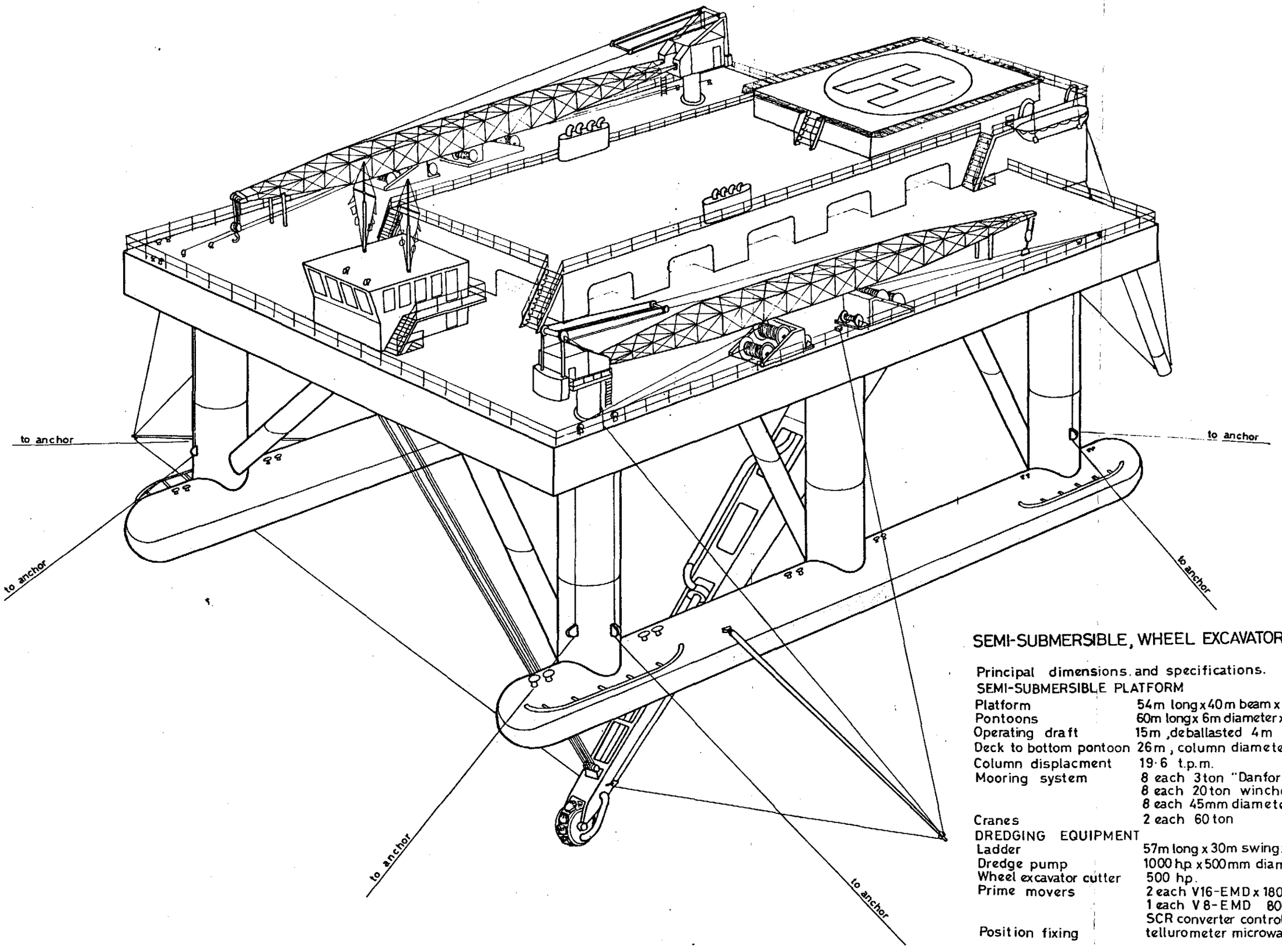

SEMI-SUBMERSIBLE, WHEEL EXCAVATOR , SUCTION DREDGE

Principal dimensions and specifications.

SEMI-SUBMERSIBLE PLATFORM

Platform	54m long x 40m beam x 4m depth
Pontoons	60m long x 6m diameter x 3000 tonnes displacment
Operating draft	15m , deballasted 4m
Deck to bottom pontoon	26m , column diameter 5m
Column displacment	19·6 t.p.m.
Mooring system	8 each 3ton "Danforth" anchors 8 each 20ton winches 8 each 45mm diameter x 750m long wires
Cranes	2 each 60 ton

DREDGING EQUIPMENT

Ladder	57m long x 30m swing x 43m depth.
Dredge pump	1000 hp x 500mm diameter discharge
Wheel excavator cutter	500 hp.
Prime movers	2 each V16-EMD x 1800 hp 1 each V 8-EMD 800 hp SCR converter control system
Position fixing	tellurometer microwave system MRD I

4. PROCESSING

The cassiterite alluvium shall be processed on the deck of the platform to 30% - 40% concentrate. A maximum deck roll and pitch of three degrees, and weight limitations has dictated the use of heavy mineral sand technology.

The wet process plant is designed to accommodate the dredging rate of 1,000 tons per hour.

The 30% to 40% concentrate shall then be pumped into the hold of a workboat and transferred ashore for tin shed cleanup to 70% concentrate.

The preliminary flowsheet and plant details for the Wet Plant is shown on the following pages as Figures 3 and 4.

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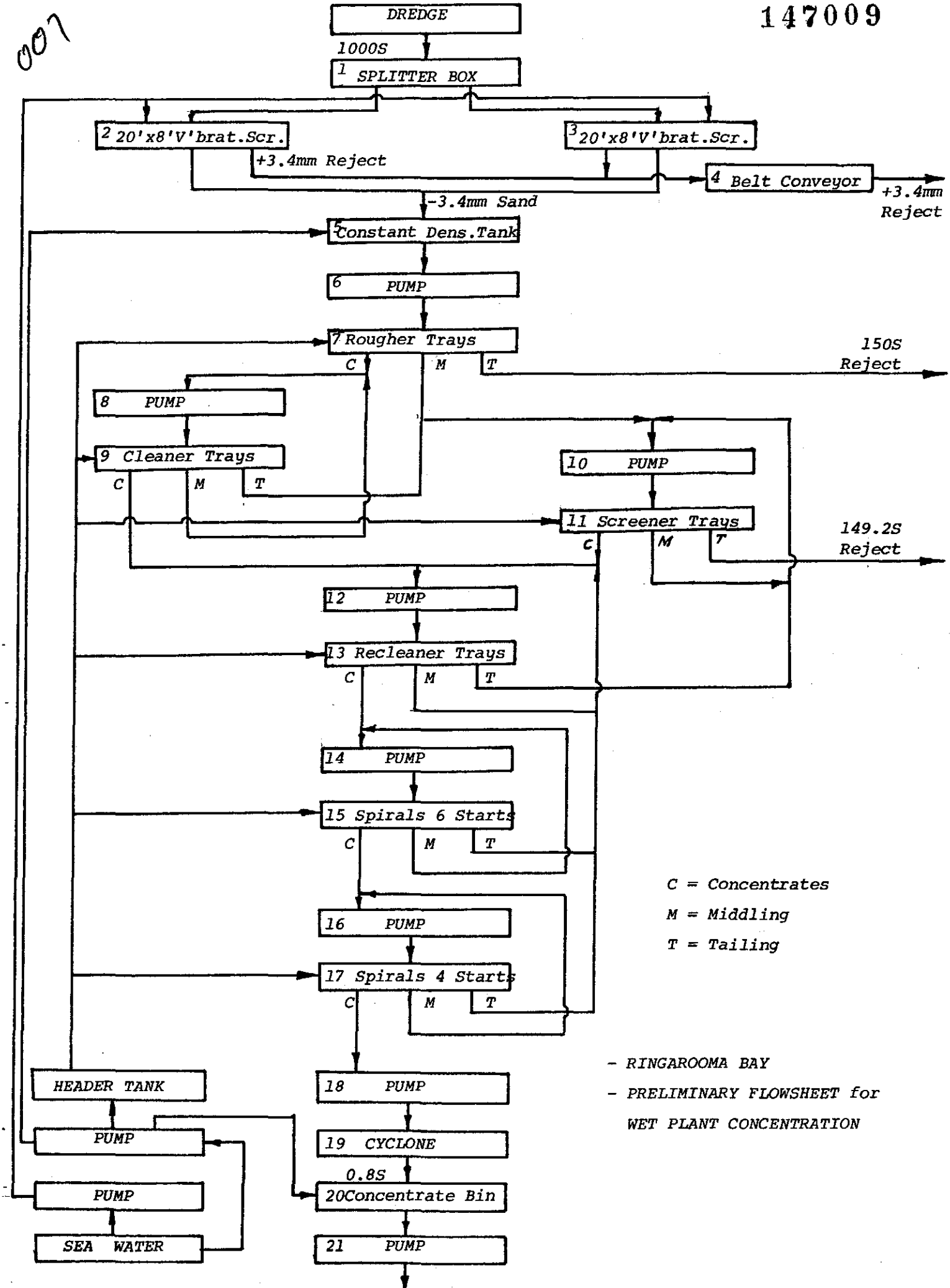

C = Concentrates

M = Middling

T = Tailing

- RINGAROOMA BAY
- PRELIMINARY FLOWSHEET for WET PLANT CONCENTRATION

Fig. 3.

Fig. 4

RINGAROOMA BAY PLANT PRELIMINARY ESTIMATES

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ITEM	DESCRIPTION	Weight Empty Kg	Weight Loaded Kg	K.W.
1.	Splitter Box	1,500	2,000	-
2.	Allis Chalmers 8' x 20' SH Ripl-Flo 3 Deck Screen plus 2 x 4 Pole Motors	14,533	19,500	45
3.	As for 2.	14,533	19.500	45
	Screen Mountings	15,050	15,050	-
4.	Reject 1.5M x 30M Conveyor	10,000	12,350	5
5.	Constant Density Tank 6.25M diameter plus Support	4,500	149,700	-
6.	Warman 8/6 E-AM Pump & Motor	2,235	2,250	56
7.	3 x 16 Starts Wright Trays	6,027	9,000	-
8.	Warman 6/4 D-AM Pump & Motor	1,118	1,120	38
9.	2 x 16 Starts Wright Trays	4,018	6,000	-
10.	Warman 6/4 D-AM Pump & Motor	1,524	1,530	56
11.	2 x 16 Starts Wright Trays	4,018	6,000	-
12.	Warman 4/3 C-AM Pump & Motor	610	620	19
13.	1 x 16 Starts Wright Trays	2,009	3,000	-
14.	Warman 3/2 B-SC Pump & Motor	254	260	6
15.	3 x 2 Start Spirals	320	480	-
16.	Warman 1½-1 BM Pump & Motor	203	210	4.5
17.	2 x 2 Start Spirals	220	330	-
18.	Warman 1½-1 BM Pump & Motor	183	190	2.5
19.	6R Warman Cyclone (Adjustable Spigot)	23	50	-
20.	Concentrate Bin (Set into Deck)	3,000	13,9500	-
22.	Warman 8/6 E-AM Concentrate Pump	2,235	2,250	56
23.	Process Water Pumps 2 x K,L5-9	2,236	2,250	60
24.	Process Water Header Tank 2000L.	400	2,400	-

RINGAROOMA BAY PLANT PRELIMINARY ESTIMATES

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ITEM	DESCRIPTION	Weight Empty Kg	Weight Loaded Kg	K.W.
	Pump Hoppers			
	2 x 6/4 D-AM 185 gal.	835	6,976	-
	1 x 4/3 C-AM 100 gal.	281	1,387	-
	1 x 3/2 B-SC 55 gal.	136	745	-
	2 x 1½-1 BM 55 gal.	272	1,490	-
	Electrical Wiring 393 KW @ $145/KW (Allow say WT = 10,000 Kg)	10,000	10,000	-
	Plumbing allow 6% on above (Allow say WT = 10,000 Kg Empty, 50,000 Kg Loaded)	10,000	50,000	-
	TOTALS	1127.71	466.138	393
	Say	115 T	470 T	400Kw

5. MINING RATE AND RESERVES

At a mining rate of 1,000 tons per hour and an effective minimum working time of 6,000 hours per annum, the present estimates reserves of 23 million cubic metres of alluvium shall require six years mining time.

6. SCHEDULE

After the granting of a mining lease by the Department of Mines, it is anticipated that detailed drilling of the deposit could be commenced within six months.

Fabrication of the semi-submersible hull and dredging equipment would require another six months.

7. LABOUR REQUIREMENTS

At this preliminary stage, it is envisaged that a labour force of 60 persons are required to man the platform for two shift 24 hour production. An additional 10 persons are required to man the onshore tin shed.

The resumes of key personnel follow as Appendices 1, 2, 3 and 4.

APPENDIX 1.

JAMES A. COLLINS.

Mr. Collins is Tasmanian born and is qualified in Civil and Mechanical Engineering. He is a Member of the Institution of Engineers, Australia and the American Society of Civil Engineers.

Two years experience in the design and construction of specialised marine structures and vessels in New Zealand was followed by six years in Vietnam in the design and construction of piers, oil terminals, concrete vessels, roads, bridges, elevated water tanks and high rise structures.

Mr. Collins then worked with International Project Consultants in Singapore and Australia. As Project Manager he supervised the design and construction of a wide variety of marine and industrial facilities. Projects included the development of a 740 acre riverfront complex and the design of complete port facilities for a granite crushing operation in Indonesia.

In 1976, Mr. Collins was the Project Manager for the bidding, contract negotiation, fabrication and installation of a jackup pier facility for barge operations in Jeddah for the Saline Water Conversion Corporation of Saudi Arabia.

Recently he was responsible for securing and managing a US$24 million construction contract for the Royal Commission for Jubail and Yanbu in Yanbu, Saudi Arabia. The project was completed on schedule and included the following works: total earthworks approximately 750,000 cubic metres (causeways, haul roads, storage areas, etc.), electrical generating systems (total capacity 2615 KVA), jackup pier 390 metres in length for 72,000 DWT vessels and other related works. The work force, primarily from South-east Asia, numbered over 300 men.

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APPENDIX 2.

PATRICK R. HAMMILL

Mr. Hammill, a British citizen, served in the Royal Navy for ten years as a salvage diver with special training in explosive operations. Following the Navy he worked as an independent diver and also as Captain of a seismic support vessel and later a 180 foot landing craft transporting and supporting land drilling rigs on the north coast of Africa.

Mr. Hammill was employed by the Oasis Oil Company for two years as a Diver and Relief Marine Superintendent for the installation and maintenance of their offshore terminal in Libya. He then worked with Oceaneering International for four years as a diving supervisor on drilling rigs in Mexico and South-East Asia. He also supervised the under water work on various marine construction projects including the installation of a 44 inch submarine pipeline in Singapore, several SBM and Conventional Buoy Mooring systems and various explosive projects.

As Manager of diving and marine construction services with Comex Far East, Mr. Hammill was responsible for the assembly, operation and maintenance of bell, mixed-gas and surface-oriented diving systems. He also designed and supervised the installation of two pipelines in 130 feet of water off East Kalimantan. He worked on the uprighting and refloating of the "Malaysia Kita" 15,000 DWT, sunk in Singapore and he designed and fitted an 80' x 17' steel patch on the 12,000 DWT "Ta Peng", holed in a collision.

During 1966 and 77 Mr. Hammill was Construction Manager for the erection of IpcoMarine's Jack-up pier systems at Jeddah and Yanbu. He also selected and mobilised all plant and personnel necessary for the erection phase.

Recently Mr. Hammill has been employed by Martech International of Singapore as Project Manager responsible for the operation of a crane/diving vessel engaged on marine and underwater maintenance work in the Indian Oil & Natural Gas Commission's Bombay High Oilfield. One significant project was the successful repair of a pipeline in 250 feet of water.

PETER H. STITT - PROCESS CONSULTANT

Mr. Stitt is the principal of Peter H. Stitt and Associates specialist mining and geological consultants. He graduated from the University of New South Wales with degrees in Mineral Processing and applied Geology.

His initial work with A.C.I. Ltd. involved exploration for and assessment of raw material prospects for the glass and ceramic industry. Towards the end of this twelve year period Mr. Stitt was associated with the development of beneficiation processes for glass and ceramic raw materials. He was responsible for process development for A.C.I's Lang Lang, Victoria, sand plant; the first such operation in Australia involving froth flotation.

A.C.I. set up a research and development facility in 1963 (A.C.I. Technical Centre Pty. Ltd.) and Mr. Stitt was responsible for research and development in the fields of glass furnace technology, ceramics and mineral processing. Finally he was appointed to the position of Chief Scientist A.C.I. Technical Centre Pty. Ltd.

He left A.C.I. Ltd. in December 1970 to take up the position of General Manager, Secmin Ltd., seeking commercial opportunities studying prospects and streamlining existing operations.

In November 1971 Mr. Stitt set up as a Mining Geological Consultant specialising in industrial minerals, glass and ceramic raw materials, construction materials and heavy mineral sand mining. His bias has been towards processing technology, process development, plant design and construction and feasibility studies.

His consulting experience having direct relevance to the Ringarooma operation includes:

(a) Project co-ordinator for Rutile Zircon Mines for their Tomago Sand Bed project north to Newcastle. A high grade heavy mineral sand deposit situated within sand beds forming part of Newcastle's water supply. Major environmental consideration.

(b) Assessment of an alluvial tin mining operation on the Carrai Plateau, N.S.W.

(c) Assessment of alluvial tin prospects in the Kangaroo Hills/ Hidden Valley area N.W. of Townsville.

(d) Assessment of alluvial tin prospects on the Atherton Tableland, North Queensland.

(e) Assessment of alluvial tin prospects and operations in the New England district, N.S.W.

(f) Assessment of mineral sands operation on Kangaroo Is., South Australia.

(g) Assessment of an alluvial tin operation in southern N.S.W.

(h) Evaluation of a project aimed at scavenging tin tailings in Malaya with a view to producing tin concentrate and flint grade glass sand.

(i) Assessment of an iron sand project in the Phillipines.

APPENDIX 4

H. KEITH TURNER - MINING ADVISOR

Mr. Turner's career spans nearly fifty years, and culminated with his appointment as Consulting Director to Endurance Tin in 1950. In 1960 he gained Directorships in the following companies:

Aberfoyle Holdings, Aberfoyle Tin, North Australian Uranium Corporation, Storey's Creek Tin, Ardlethan Tin, Greenbushes Tin and Paringa Mining & Engineering Co. Ltd.

He was appointed a Director of C.M. Murchison Ltd., Minefields Exploration, Consolidated Exploration Ltd., Amber Gold Ltd., Quest Mining & Engineering Ltd., and Colortone Holdings Ltd. in 1969.

Mr. Turner began his career in the Underground Office of the Zinc Corporation in 1929. In 1935 he was appointed Assistant Underground Manager with B.H.P. He then worked with the Societe Chimique du Chrome in New Caledonia and Wellington Alluvials in N.S.W. as a Mining Engineer.

The beginning of the Second World War saw Mr. Turner in Thailand as Assistant Manager of Ronpibon Tin Ltd., where in 1942, he was incarcerated as a P.O.W. In 1946 he was appointed Manager of Dorset Tin Tasmania. The well known Dorset Dredge operated continuously on the flats of the Ringarooma River for 18 years handling nearly 30 million cubic yards of alluvials and yielded 2,500 tons of concentrate and 7,500 ounces of gold.

Mr. Turner is listed in Who's Who Australia, and is a Member of the Australasian Institute of Mining and Metallurgy.

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APPENDIX 5

COMPANY HISTORY - IPCOMARINE

IpcoMarine is Singapore based and registered in Hong Kong is engaged in the design, supply and rapid installation of specialised structures, facilities and equipment.

In March 1977 IpcoMarine was awarded a US$24 million contract by the Royal Commission of Jubail and Yanbu for the Yanbu Construction Support Port, Saudi Arabia. The port is being used to unload pipe, material and equipment from vessels up to 72,000 DWT for the construction of the Trans-Saudi Pipeline and The Yanbu Industrial Development Project.

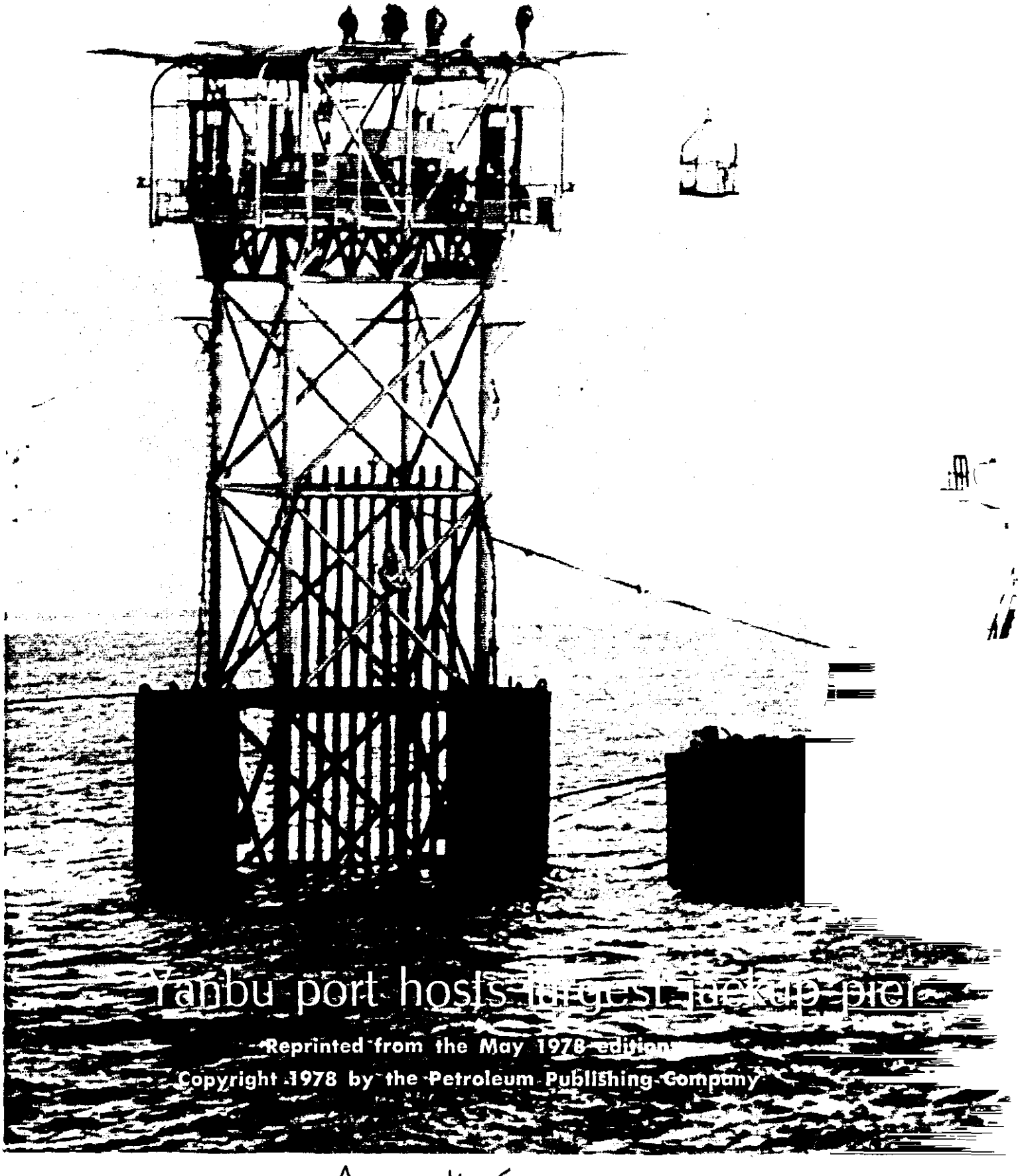
The Offshore Pier contract called for the design, fabrication and installation of a 270 x 30 M steel jack-up pier in 18 M of water with a 120 x 18 M trestle approach. Installation time on site was only 5 weeks and the whole structure was completed within the 6½ months contract period. The pier is fitted with lighting, fire fighting equipment, navigational aids and a Port Manager's Office (complete with SSB and VHF communication systems).

The Onshore Base was subcontracted to Thiess Petrosea International (a subsidy of Thiess Australia) and included a 20 M wide Causeway from the shore 1 km out across the reef to the Pier, 4 km Haul Road, Transit Storage Area, Pipe Storage Area, Water and Fuel Pipelines and Tanks, Prefabricated Offices and Electrical Power System. Earthworks totalled 750,000 cubic metres of fill and armour rock. These onshore works were completed on schedule.

In 1976 IpcoMarine successfully completed the design, fabrication and installation of a jack-up pier system for the Saline Water Conversion Corporation of the Kingdom of Saudi Arabia. This contract was for a jack-up pier with a 107 x 10.5 M approach section and a 59 x 20 M T-head for the unloading of equipment for the construction of the US$1 billion Jeddah Desalination Plant Extension. Included in this contract was the supply of a 400 BHP tug, two 300 tons cargo barges and a 100 ton crawler crane. From contract signing to completion took seven months.

IpcoMarine has offices in Hong Kong, Singapore, Jeddah, London and representatives in the Gulf States and U.S.A. The company operates with local partners in Saudi Arabia as IpcoMarine Saudi Arabia.

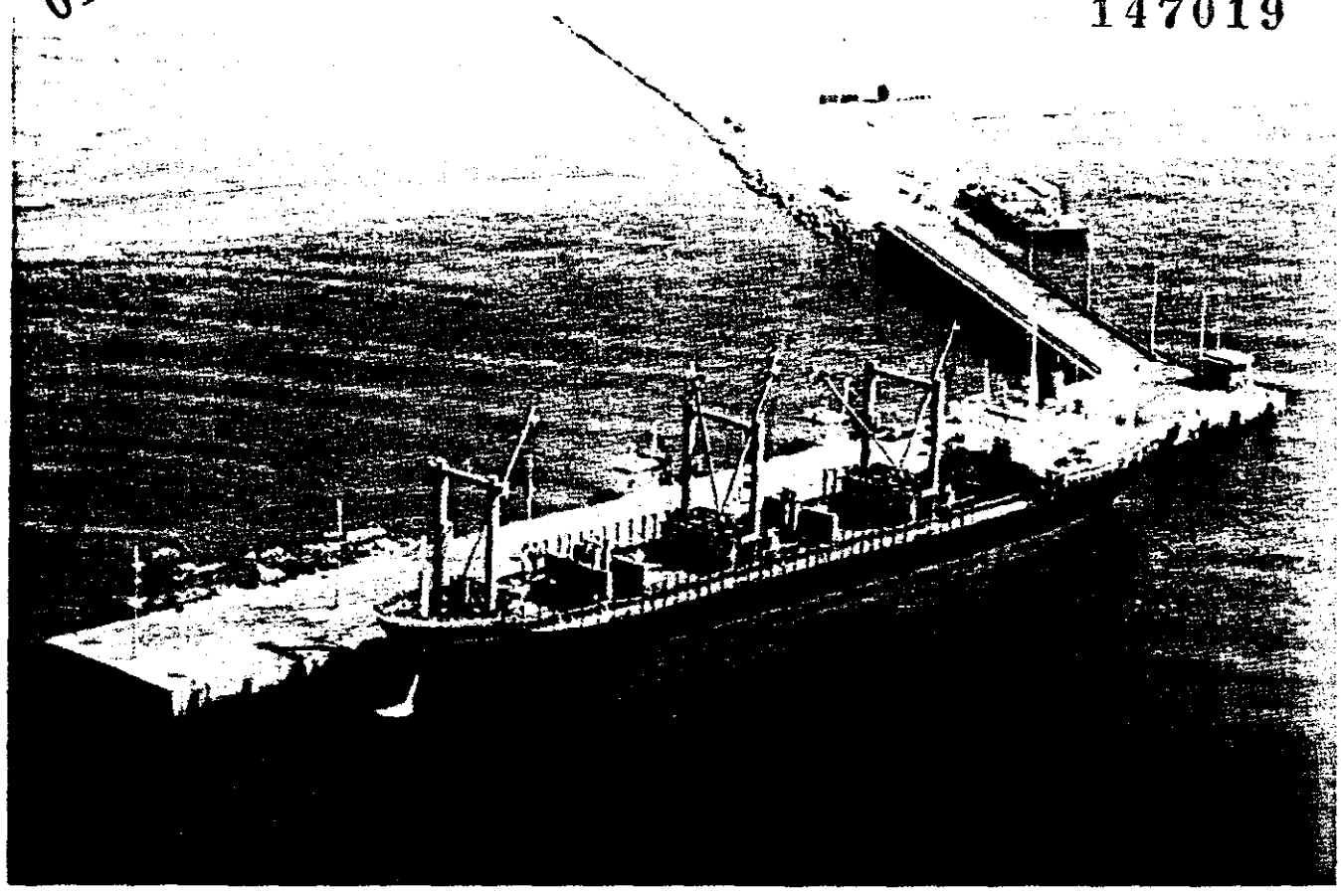
Offshor



Yanbu port hosts largest pick-up pier

Reprinted from the May 1978 edition

Appendix 6



Yanbu port hosts largest jackup pier

ON THE first of October 1977 all was quiet on the newly completed pier for the Pioneer Port of Yanbu, Saudi Arabia. IpcoMarine's 90-man erection crew had completed installation of the world's largest jackup pier and were awaiting the final inspection party. The jackup pier, designed to berth 72,000 ton vessels, measures 270 meters by 30 meters with an approach section of 120 meters by 18 meters.

This pier was completed on the date contracted with the Royal Commission for Jubail and Yanbu, exactly 6.5 months after the signing of the letter of intent for the pier plus related works including causeways, roads, pipe staging and transit storage areas, office buildings and small pipe lines for the construction of the basic facilities for the Yanbu Pioneer Port.

The port had been built within this time to meet the delivery requirements of the 48 in. pipe for the Trans Saudi Arabian crude oil line and the 32 and 28 in. pipe for the parallel natural gas line. These pipelines, which will transport oil and gas over 750 miles of desert from the Ghawar oil fields on the Arabian Sea, had been contracted for delivery starting in November. This was the first step in the ambitious program of the Royal Commission to develop an industrial complex over the next eight years at an estimated cost of $8 billion. The infrastructure necessary to support the planned refineries and petrochemical industries will eventually include a community for 200,000 people.

In preparation for the pier installation, a detailed bathymetric and environmental survey of the immediate coastal areas was conducted to select the best site. Borings were completed and indicated sand and silt underlaid by coralline limestone with interbedded layers of sandstone and dense sand.

Construction begins

Within four days of receiving the letter of intent in March 1977 construction of the pier sections commenced at four different shipyards in Singapore. The three main pier sections, each 90 x 30 x 4 meters, weighing approximately 1,500 tons each were constructed by Bethlehem Shipyard, Far East-Levingston and Singapore Slipway and Engineering. Bethlehem finished Yanbu I in two months, FELS completed Yanbu III in three months and SSE delivered Yanbu II in just over three months.

The two approach sections, 60 x 18 x 2.5 meters, each weighing approximately 500 tons, were fabricated by Sing Koon Seng Shipyard within two and a half months. The approach sections were fitted with pipe lines for fresh water and fuel oil.

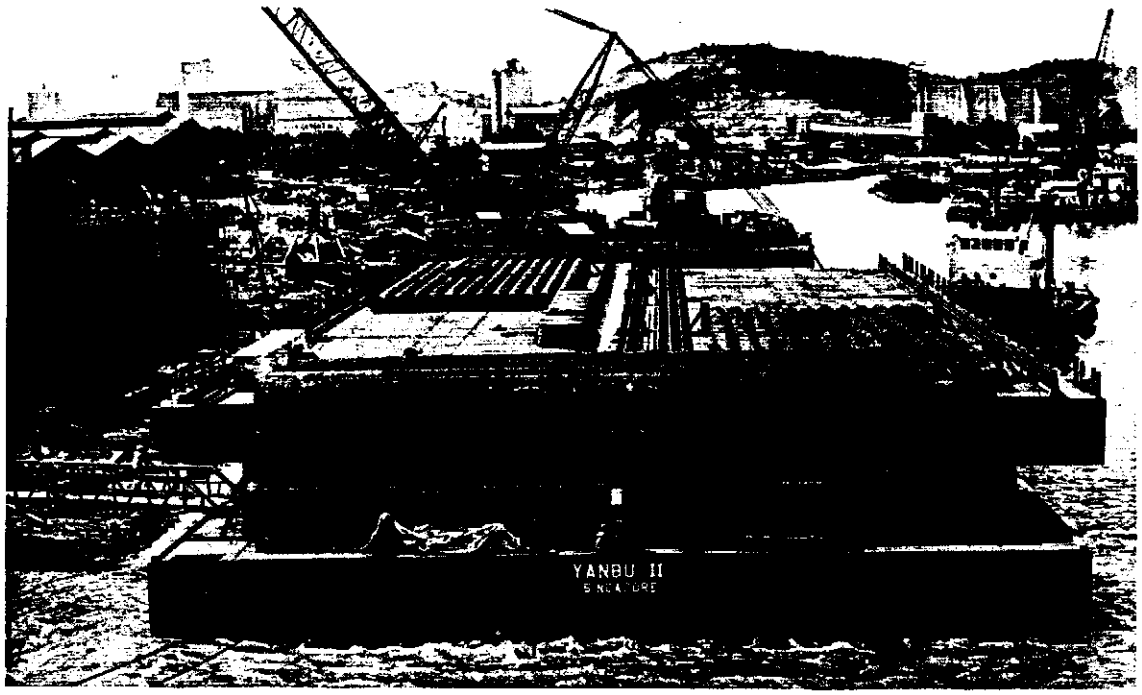
Internally the pier sections were fitted with an 8-in. firemain (supplying eight hydrants), wiring for lights, capstans, impressed current cathodic protection system and navigational aids. All units were painted with a zinc based epoxy coated Dimetcote system and a 3-in. hardwood deck was fitted. All pier sections were constructed under the supervision of ABS surveyors and in accordance with the classification requirements for "River and Harbor Service, Unmanned."

Assembling equipment

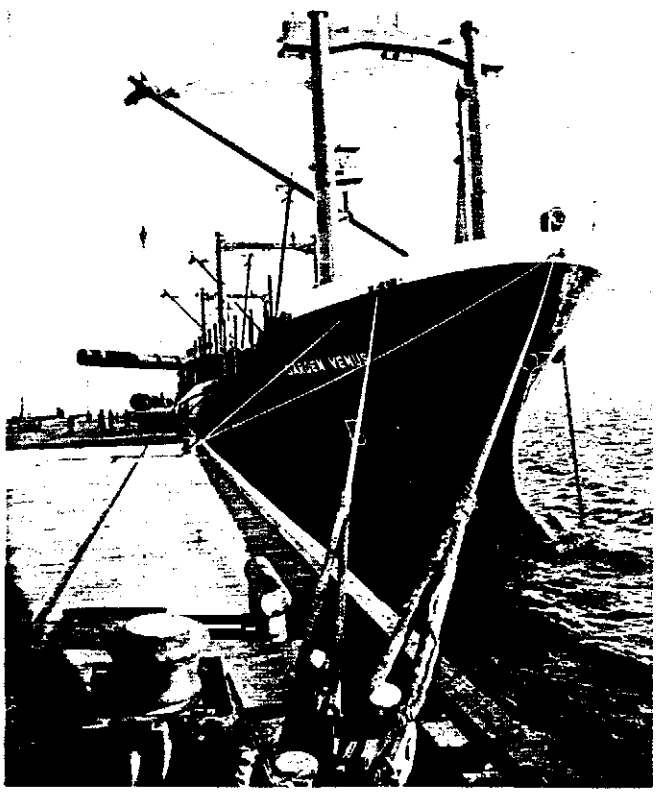
With construction underway, IpcoMarine ordered the legs, fenders, capstans, quick release hooks, 250 HP vertical fire pump and other equipment for outfitting the pier. 1,650 meters of 1.8 meter diameter x 32 mm API line pipe, 5 LX Grade X-42, and 580 meters of 0.9 meter diameter x 25 mm line pipe for the approach sections were ordered from Nippon Steel. On arrival of the pipe in Singapore,

Far East-Levingston spliced the forty foot joints into 80-ft lengths.

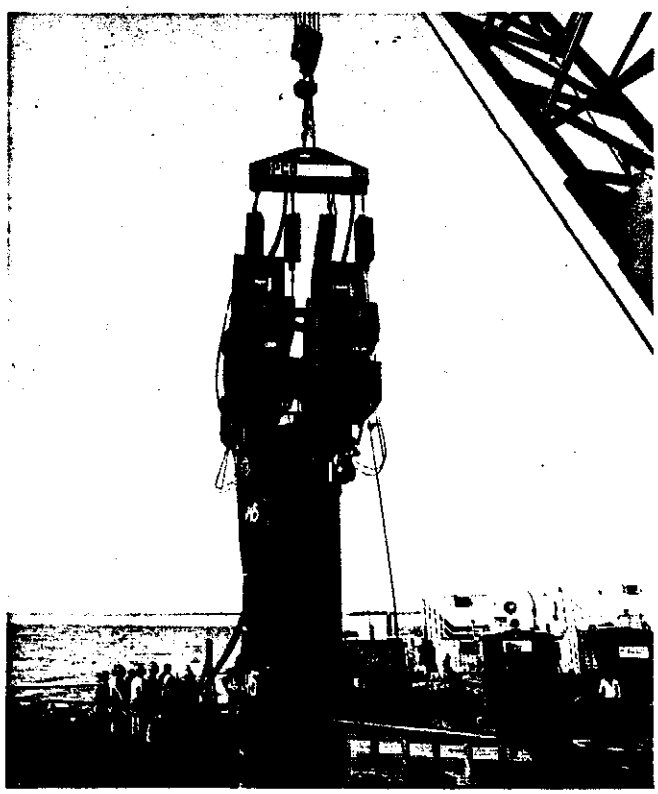
Bridgestone SM 800H 2 meter super arch fenders were ordered from Japan and fitted at 10 meter intervals along both sides of the main pier sections. These fenders and the piling system were designed to withstand the berthing energy and loads imposed by 72,000 dwt vessels approaching at a 10° angle with a normal velocity of 0.15 meters per second.



Picture shows the loadout of Yanbu II with two 500 ton approach units, onto loading ramps.



This photograph captures unloading of the first ship.



The vibro hammer is most powerful of its kind.

A hydraulic jacking system was designed by IpcoMarine. Final engineering and construction was completed by Hydranautics of California. The jacking system consisted of 10 pairs of jacks with a designed working pressure of 5,000 psi operated through three control stations and with a total lift capacity in excess of 3,000 tons. The system was fabricated and delivered to Singapore for load-out.

Final loadout

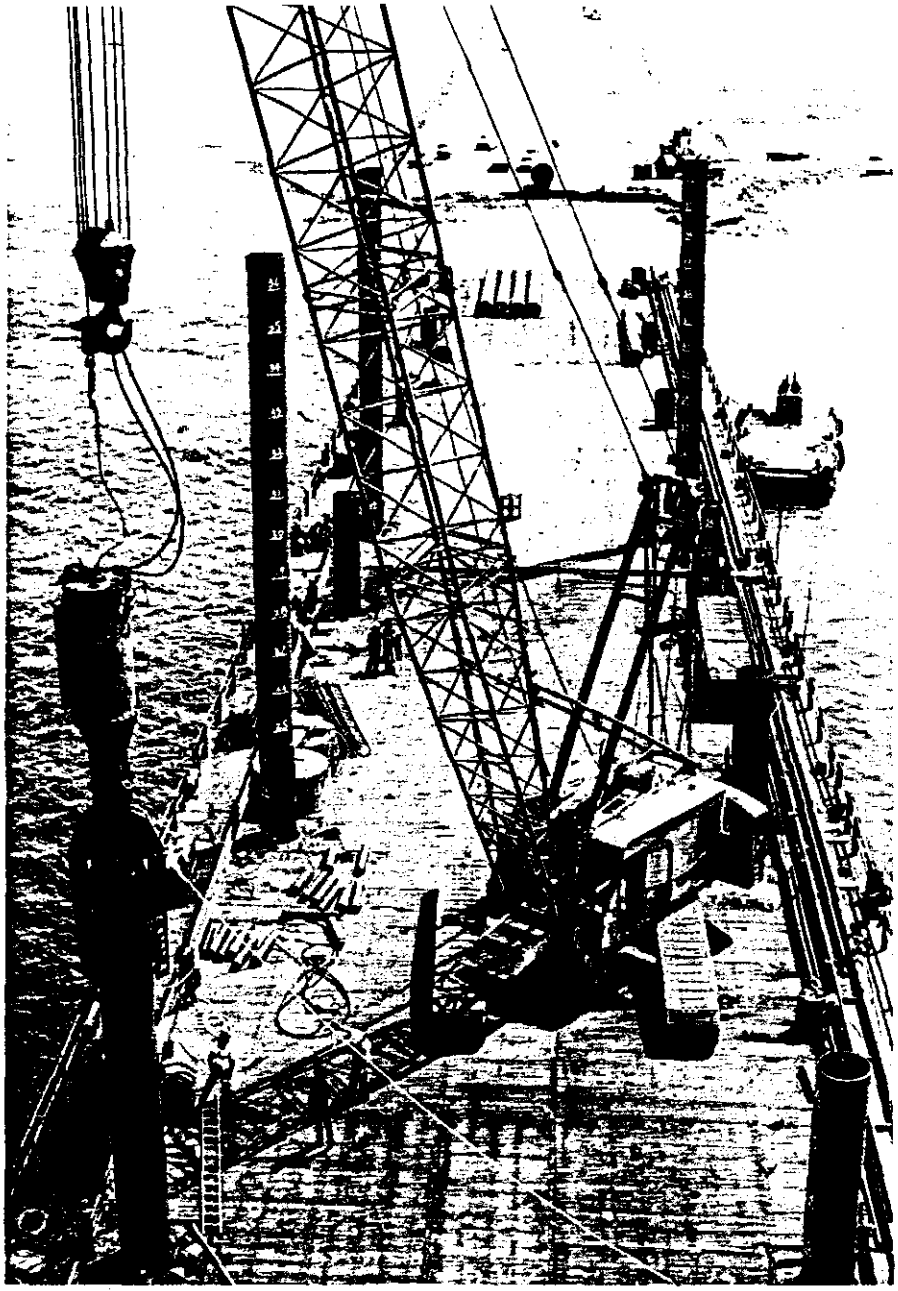
On June 26 final loading out of pier section Yanbu I commenced when IpcoMarine's 46 meter fully outfitted 90-man accommodation barge was lifted on board by a 300 ton floating sheerlegs. Manitowoc 4100W and Koehring 1000 crawler cranes were walked on board and then the remainder of the erection equipment was loaded out. The inventory included 25 welding machines, 400 gas bottles for cutting, two 250 hp workboats, a four point mooring system, the 3000 ton capacity jacking system, and related equipment. The 1.8 meter legs for Yanbu I were also loaded.

All loadout details were developed in coordination with the Salvage Association who, as surveyors for the underwriters, approved the mobilization plans and towage details. The American Bureau of Shipping made computer analyses of the pier sections and the load-out arrangements and then issued the "Provisional Load Line Certificates" and "Interim Class Certificates."

On July 12, Yanbu I was towed out of Singapore by the 3600 bhp supply boat OSA Puma of the Offshore Supply Association. This tow took 43.5 days to steam the 4,500 miles to Yanbu because of the severe monsoon seas encountered with waves of 6-10 meters for 25% of the tow.

Yanbu II was loaded on July 4 with the two 500 ton approach units, using a 300 ton and a 250 ton floating sheerlegs, onto launching ramps set up for off-loading at the Yanbu site. On July 22 Yanbu II departed under tow by Crowley Maritime's Rig Builder, a 3,000 bhp supply boat. As in the case of Yanbu I, this tow encountered seas up to 30 ft and the towline broke off the coast of Somalia. Finally, after 48 days the tow arrived in Yanbu. There the starboard side of Yanbu II was ballasted to the water's surface and the two approach sections were successfully launched.

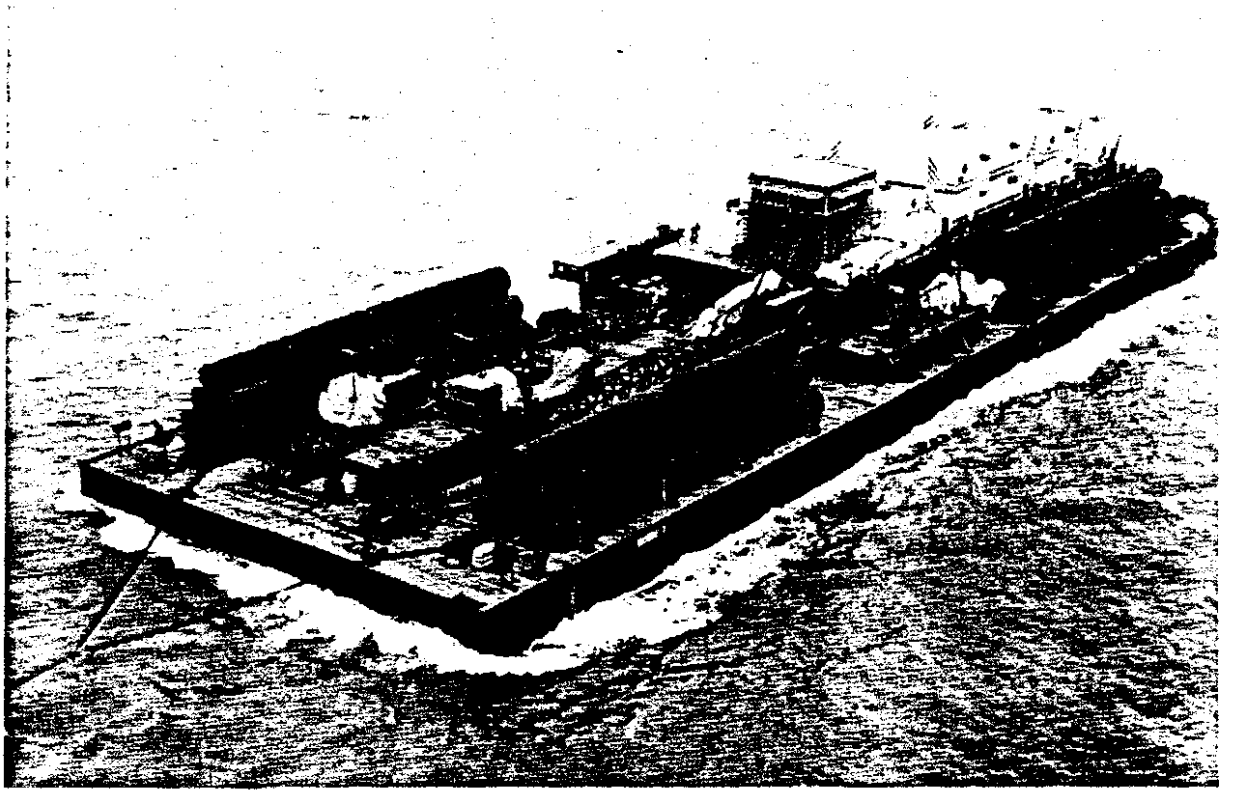
Yanbu III was loaded with its legs and over 2,000 tons of equipment for the onshore construction project. The equipment included 12 kilometers of pipeline, four prefabricated office buildings, cement mixing machinery, lightposts for the pier, roadways and transit storage area as well as fuel, water and sewage tanks. This unit left on July 17 under tow by Asiatic Navigation's 2,500 bhp tug Victory and arrived off Yanbu in 43 days. On site the bow of the barge was moored to the edge of the reef with lines to heavy earth moving equipment and held offshore by the Victory riding on her two anchors. All equipment was offloaded over a ramp in 60 hours of continuous work.



The ten legs in each section of the pier were driven into the sea bottom and the pier unit was jacked a distance of five meters above the water.

Work preparation

Yanbu I arrived on site August 25, only 36 days ahead of the contract completion date. Immediately the 40 man advance crew boarded Yanbu I and cut all fastenings. The stern was ballasted down to the water's surface and the 46 x 15 meter accommo-



Yanbu I was towed from Singapore loaded with pier sections, pier legs, pile driving and crane equipment.

dation barge was launched off the stern. All machinery was serviced and the erection operation started. The remainder of the 90 man crew arrived during the following week.

In the old port of Yanbu, a 180 ft barge was loaded with locally hired equipment, including a BSP 45 diesel piling hammer and a Linkbelt 150 ton crawler crane. This equipment was rented and additional personnel were flown out of Singapore to speed up the erection by working simultaneously on the main pier sections and the approach sections. The electro-mechanical double Tandem Vibro hammer, supplied by Procedures Techniques Co. of Paris, was assembled and loaded out on this barge along with its two synchronized 500 KVA generators.

This vibro hammer, weighing 38 tons, is the most powerful such unit ever built. Operating at 1,100 rpm, it had an eccentric moment of 160 and an energy rating of 200 tons with an amplitude of 1 cm.

The first step was positioning Yanbu I in 18 meters of water using theodolites and transits located at bench marks onshore. The 90 meter barge was moored in position with a four point anchor system and 80 ft leg sections were set, using the 200 ton Manitowoc, through the ten leg wells onto the seafloor. An additional 80 ft section was fitted on top of the lower section and spliced.

Starting construction

The vibro hammer then drove the legs 22 to 35 meters into the bottom with an average driving time per leg of 70 minutes. After the legs were driven, the jacking system was fitted and the pier section was lifted clear of the water to provide a final deck elevation of 5 meters above ISLW (Indian Summer Low Water).

The legs were pinned and welded off to the pier section. The piles were then cut off at deck level. Each pier section was positioned, raised and secured in place until the entire pier was standing.

A five meter concrete plug was then set in the bottom of each 6 ft diameter leg and then general fill was placed up to the level of the deck. The piles were then fitted with a heavy plate cover and the recess in the timber deck was filled with asphalt.

Once the pier was structurally complete the 250 hp Peerless vertical fire pump was installed and the 8 in. fire-main connected. All electrical systems were connected and tested and the cathodic protection anodes were hung. Eleven 18 meter tall lightposts were positioned and tested. The Port Manager's office, a two story building 6 x 6 meters, was lifted off the accommodation barge onto the pier and all systems connected including VHF and SSB radios.

Connecting onshore

Meanwhile, onshore, the earthworks on the causeway across the reef and into 10 meters of water were being pushed to meet the October 1 deadline. The 20 meter wide causeway was completed and the onshore team continued to construct facilities for the base including a pipe storage and staging area with berms totalling one million square meters, a 90,000 square meter transit storage area, four office buildings, generator sets with a total capacity of 2615 KVA, total earthworks approximately 750,000 cu meters, 10 km of fresh water and fuel oil pipelines, and related fencing, sewage systems, lighting, etc.

On November 1, the M/V Garden Venus, 35,000 DWT, berthed alongside the pier and unloaded its cargo of 9,000 tons of 48 in. pipe in 3days. □