# INDONESIAN COAL TRANSPORTATION

# UTILISING SELF DISCHARGE BARGES

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## 1. BACKGROUND

PT Arutmin Indonesia is a wholly owned subsidiary company of the BHP group. PT Arutmin has been established within Indonesia and has a Contract of Work with the Indonesian Government coal agency Perum Tambang Batubara to develop coal mines in South Kalimantan, Indonesia. Exploration over a number of years has identified a series of deposits of saleable quality coal in a number of locations close to the coastline.

Two mine sites have been developed and stockpile areas established on the coastline to handle the mine production. Coal is trucked from the mine sites to stockpile areas located near the coast on meandering shallow estuaries which are not conducive to construction of deepwater ports. The region has for many years used flat top barges for moving cargo on the river systems and BHP has adopted the same approach.

The barge loadout ports are located at Satui on the south coast of Kalimantan and Air Tawar on the south east coast of Kalimantan. These port sites are approx 100 nautical miles apart and are designed to handle flat top barges which transfer the cargo to waiting geared/grabbed vessels at anchor off the coast.

Once the coal is stockpiled at the barge port and the shipping schedule is produced, each barge is loaded and waits for the ocean vessel to arrive. Tugs then manoeuvre the barges alongside where ships gear is used to self load and trim the cargo. Tugs of shallow draft design are necessary in the port of Satui as a sand bar at the entrance to the river restricts the max allowable draft to approx 3.5 mtrs. The port of Air tawar has deeper water available and can accept larger tugs with a draft of 4.5 mtrs.

The present barge fleet consists of a number of flat top barges fitted with side boards and having deadweight capacities from 1,500 dwt upto 7,000 dwt. The larger barges are also operating in domestic and International trades within the

ASEAN region on a regular basis and provide good freight economics over small distances ie, upto 400 nautical miles.

Our operations in Indonesia have been hampered by the lack of deepwater facilities where large vessels can be loaded quickly and efficiently. As charterers, PT Arutmin have been forced to charter only vessels which are geared and grabbed and incur a premium on charter rates to engage in this coal trade.

The port of Satui is only capable of handling small barges upto 3,500 dwt due to constraints in draft and the meandering river which imposes a length restriction. The port of Air Tawar is less restricted and can accommodate barges up to 7,000 dwt. Both ports have similar load facilities with a fixed head loader capable of 1,000 wmt per hour load rates. In the near future both ports will have two fixed head loaders each rated at 1,000 wmt per hour.

The present production of approx 3.0 mtpa is being easily handled by the current barge fleet but it has been established that with projected growth to 6.0 mtpa by end 1993, the system will not be capable of providing an efficient barging service.

## 2. PORT DEVELOPMENT

In 1990 plans were developed to provide for the construction of a deepwater port on the island of Pulau Laut which will allow vessels upto 150,000 dwt to load at the terminal. As can be seen from the attached maps the mine sites are located in Kalimantan while the terminal is located on the island of Pulau Laut.

A stockpile with a capacity of approx 500,000 wmt will be established at the terminal site requiring barging of all tonnage from each mine site to the terminal.By 1995, coal will be mined in five (5) locations in south east kalimantan and shipped through four (4) barge loadports ie,

Air Tawar ( East and West Senakin )

Ata

Selaru ( Pulau Laut )

Satui

## 3. BARGE DEVELOPMENT

Movement of coal from each port site to the stockpile area on the island of Pulau Laut can only be accomplished by sea. In planning for the barge movement of coal the following factors had to be taken into account:

Barge loadout restrictions.

Tug requirements

Shore infrastructure

Capital cost of barges

Owning and operating versus chartering of tugs/barges.

Maintenance of the shore based discharge equipment

Flexibility to enter other trades if required.

## 4. SELF DISCHARGE BARGE DEVELOPMENT

BHP Transport was asked to carry out a feasibility study into barge methods available to move the coal from loadouts to stockpile. There are basically three barge types available to perform the task required, ie.

Flat top (dumb)

Self Discharge (dumb )

Self Discharge and Self Propelled

Loading at any of the four load ports previously mentioned was possible for all barge types and our study assumed that all barge types could be constructed to suit the loadport restrictions. Barges to be used with the Satui port would always be the smaller barges with a max dwt of 3,500 mt while all other ports could accept barges upto the 7,000 dwt size.

Discharge of the barges into stockpile could be achieved in one of the following ways:

Shore based equipment
Self discharge equipment

Shore Based equipment would need to be one of the following types:

Grabs.
Excavators
Continuous screw unloaders
Continuous bucket elevators
Suction unloaders.

All above discharge systems require major capital expenditure early in the project and will have varying utilisation rates until throughput reaches design capacity.

With Grab discharge systems, damage to the flat top barge will be excessive requiring numerous repairs and reducing the availability of the barge. Front end loaders would also need to be placed aboard each barge for final trimming out of cargo which also reduces the nett discharge rate of the system.

Shore based systems require mechanically complex pieces of equipment requiring high maintenance levels in order to retain a high availability factor. Skilled operators and maintenance personnel would also need to be employed in order to maintain low levels of damage and high levels of maintenance.

Self propelled and self discharge barges also require major capital investment but negate the need for major capital investment in shore based discharge facilities at any time in the life of the project. Expansion of the barge fleet capacity can be done at any time in increments of approx 500,000 wmt per annum as mine production grows.

Flexibility to increase and decrease available barge capacity to cover the shipping task of this mining operation is a feature of the Self Discharge Barge concept.

This project also requires two 35 tonne Bollard Pull tugs be available in the port for berthing and deberthing of the ocean vessels using the terminal. Tugs of this size will be used to tow our 7,000 dwt barges and operate in the short sea trades always within approx 3hrs steaming of the terminal. Smaller tugs of 20 tonne Bollard Pull capacity will be used with the smaller 3,500 dwt barges on the longer trade to the Satui loadport.

The use of Self Propelled barges for this project was considered not necessary given that tugs would be required in the port and only have a utilisation factor of approx 3.2% as harbour tugs. By using these large tugs in a dual role we can maximise their benefit to the project.

Small tugs are also readily available from the market if required in order to replace one of the project tugs in the event of accident or damage. Damage to the engine of a self propelled barge would mean the loss of the barge from the system until such time as repairs could be effected.

Self Discharge barges allow projects to commence operations without major investment in shore side facilities. A self discharge barge only requires a small set of breasting dolphins and a hopper strategically placed to allow cargo access from the discharge boom.

Flexibility in trades other than a dedicated trade is achievable with self discharge type barges as long as a small berthing area is available. These barges have been designed to discharge onto a berth, trucks, rail wagons or a hopper which when combined with a conveyor system allows cargo to be discharged direct into stockpile.

The Pt Arutmin project' requires that these barges operate efficiently and cost effectively at all times making it essential to have flexibility and simplicity of

design to achieve results. The self discharge barge concept can provide the lowest possible freight in short sea trades and allow cargo receivers to commence operations with a minimal capital investment in port infrastructure

## 5. BARGE SYSTEM MODELLING

The task of evaluating and deciding on the number of tugs and barges required for this project was complex and required use of computer modelling techniques available through the BHP Information Technology group.

BHP Transport supplied the basic data which consisted of a broad outline of the operation together with assumptions with respect to the following:

Loadport particulars.
Barge load and discharge rates
Number of loadports in barge system
Number of barge discharge berths available
Barge discharge rate.
Number of grades of coal and stockpile size.
Distances from each loadport to the terminal
Expected towing speeds for each tug size.

The computer model was then designed to simulate the movement of coal from each mine loadport to the stockpile area at North Pulau laut and maintain a one month stock of coal at all times. Random arrivals for ocean vessels was also assumed but in reality would be known some months in advance. In all cases where input data was required a conservative approach was adopted.

The results obtained from this modelling technique provided the basis on which the financial evaluation of the Marine Transportation requirements could be made.The model also provide useful information in the following areas:

Main berth utilisation.
Voyages required from each mine loadport

Despatch and Demurrage forecasts

Maximum system capacity.

Particular areas of delay within the system enabling redesign of those areas.

Model also allows "What if" analysis to be run.

## 6. SELF DISCHARGING BARGE DESIGN

The Barges are designed to carry coal loaded into a deck hopper and discharged ashore by means of a two conveyor system. The main conveyor, located in a longitudinal centreline recess, runs the full length of the hopper, but rising aft to feed a bin which discharges onto a short swinging conveyor which deposits the coal ashore.

The advantages of locating the longitudinal conveyor in the recess include:

A. The V.C.G. is kept as low as practicable.

B. The lateral wind resistance is reduced.

C. The distance of the hopper capping above the neutral axis is minimised.

As the barges are not fitted with trimming tanks or a bilge and ballast system, careful design, accurate construction and careful operation will be called for to ensure that the barges operate on an even keel, particularly in the shallows.

Because of the deck recess 1.6m deep, 5.2m wide and more than 90m long, the influence of entrapped sea or rain water can be significant. Special attention to drainage was therefore required.

IMO barge stability criteria has been met in all conditions of loading with the barges being classed with ABS for "unrestricted ocean service".

## 7. GENERAL PARTICULARS OF TUGS AND SELF UNLOADING BARGES

### 7,000T DEADWEIGHT SELF UNLOADING BARGE

| | |
|---|---|
| Length Overall | 103.0m |
| Length W.L. | 101.0m |
| Breadth Moulded | 23.5m |
| Depth Moulded | 6.6m |
| Draught Moulded | 4.5m |
| Load Displacement | 9345.5tonnes |
| Deadweight | 7170.5tonnes |
| Lightship (estimated) | 2175.0tonnes |
| Fresh Water Capacity | 712.5tonnes |
| Coal in Hopper | 4587.92tonnes |
| Coal in Peak | 2412.08tonnes |

| | |
|---|---|
| Self Discharging Equipment | Consilium CMH |
| Discharging Rate | |
| Maximum | 2000t/hour |
| Normal | 1600t/hour |

## 3500T DEADWEIGHT SELF UNLOADING BARGE

| | |
|---|---|
| Length Overall | 79.2m |
| Length W.L. | 77.2m |
| Breadth Moulded | 20.5m |
| Depth Moulded | 5.6m |
| Draught Loaded Moulded | 3.5m |
| Displacement Loaded | 4964.74tonnes |
| Deadweight | 3576.74tonnes |
| Lightship (estimated) | 1388.0tonnes |
| Fresh Water Capacity | 508.9tonnes |
| Coal in Hopper | 2542.49tonnes |
| Coal in Peak | 987.51tonnes |

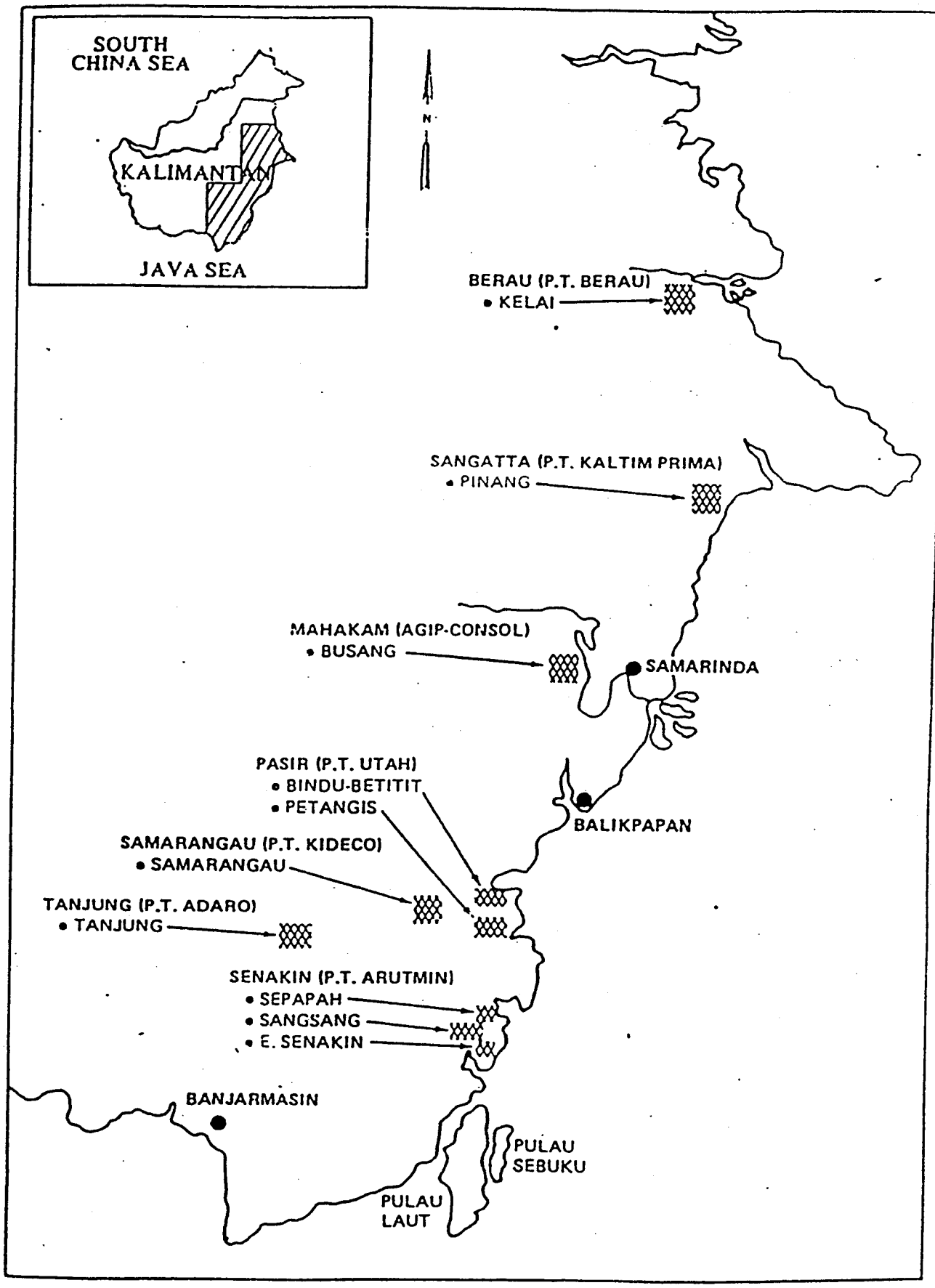
| Self Discharging Equipment | Consilium CMH |
|---|---|
| Discharging Rate | |
| Maximum | 2000t/hour |
| Normal | 1600t/hour |

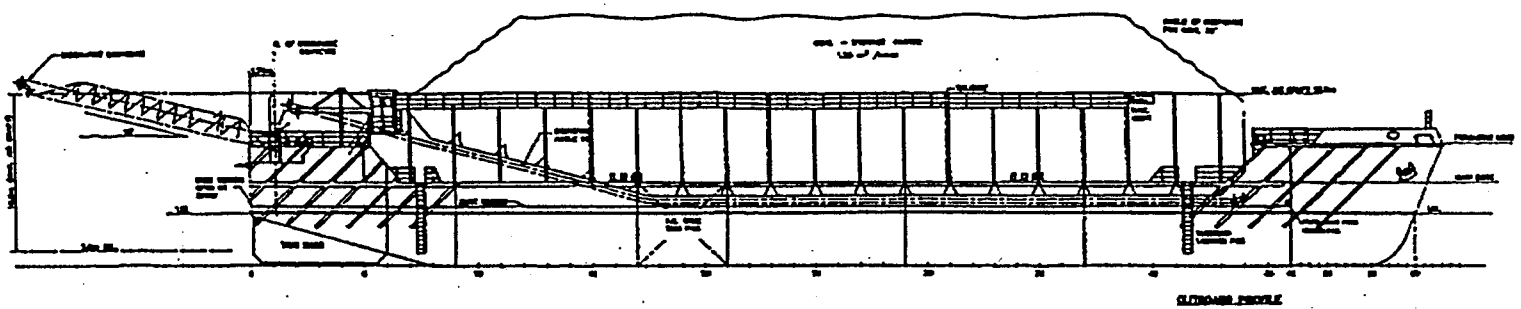
## 33m TUG

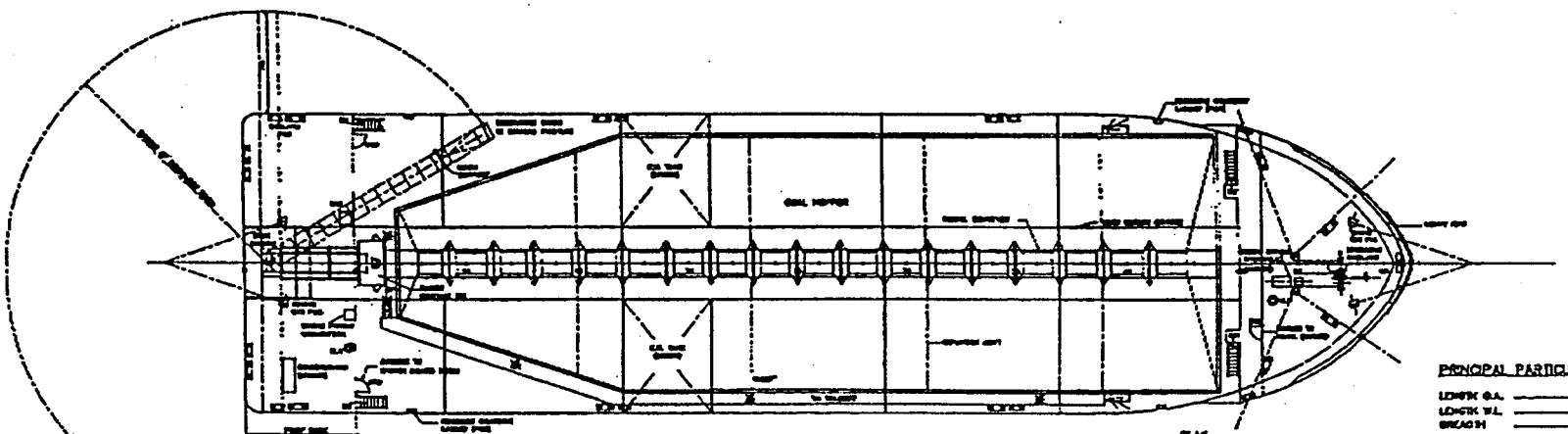
| | |
|---|---|
| Length Overall | 33.0m |
| Length B.P. | 31.8m |
| Breadth Moulded | 10.3m |
| Depth Moulded | 4.76m |
| Draught Moulded | 4.0m |
| Displacement | 698.0tonnes |
| Block Coefficient | 0.52 |
| L.C.B. | 0.174f |
| Machinery | 2 x Caterpillar 3516TA |
| Brake Horsepower | 2 x 1710 H.P. |
| R.P.M. | 1600 |
| Production Ratio | 5.84:1 |
| Propeller Revolutions | 274. |
| Propellers | 2 x Kaplan/Nozzle |
| Diameter | 2200mm |
| Pitch Ratio | 0.95 |
| D.A.R. | 0.73 |
| No. of Blades | 4 |

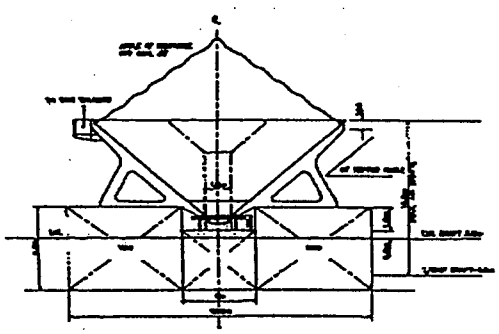
## 26m TUG

| | |
|---|---|
| Length Overall | 26.20m |
| Length B.P. | 25.00m |
| Breadth Moulded | 8.40m |
| Depth Moulded | 3.80m |
| Draught Moulded | 3.00m |
| Displacement | 386 tonnes |
| Block Coefficient | 0.598 |
| L.C.B. | 0.273f |
| Machinery | 2 x Caterpillar 3512TA |
| Brake Horsepower | 2 x 1360 H.P. |
| R.P.M. | 1600 |
| Production Ratio | 5.75:1 |
| Propeller Revolutions | 278 |
| Propellers | 2 x Kaplan/Nozzle |
| Diameter | 2100mm |
| Pitch Ratio | 0.93 |
| D.A.R. | 0.62 |
| No. of Blades | 4 |


SOUTH
CHINA SEA
KALIMANTAN
JAVA SEA
N
BERAU (P.T. BERAU)
• KELAI
SANGATTA (P.T. KALTIM PRIMA)
• PINANG
MAHAKAM (AGIP-CONSOL)
• BUSANG
SAMARINDA
PASIR (P.T. UTAH)
• BINDU-BETITIT
• PETANGIS
BALIKPAPAN
SAMARANGAU (P.T. KIDECO)
• SAMARANGAU
TANJUNG (P.T. ADARO)
• TANJUNG
SENAKIN (P.T. ARUTMIN)
• SEPAPAH
• SANGSANG
• E. SENAKIN
BANJARMASIN
PULAU
SEBUKU
PULAU
LAUT







PRINCIPAL PARTICULARS

| | |
|---|---|
| LENGTH O.A. | 78.30m |
| LENGTH W.L. | 77.30m |
| BREADTH | 20.50m |
| DEPTH MLD | 5.80m |
| DRAFT LOADED | 3.90m |
| VOL. OF PEAK | 1500m³(cbm) |
| VOL. OF HOPPER | 2540m³(cbm) |
| DEADWEIGHT | 3600t At 3.5m |

3600 DWT SELF-UNLOADING COAL BARGE

GENERAL ARRANGEMENT

CONAN YU & ASSOCIATES

| | | | | | |
|---|---|---|---|---|---|
| | | | | 1:150 | CONST/3-1 |