



UNIVERSIDADE DA CORUÑA



Escuela Politécnica Superior

Trabajo Fin de Grado

CURSO 2019/20

*BULKARRIER PORTACONTENEDORES
40 000 TPM*

Grado en Ingeniería Naval y Oceánica

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TÍTULO Y RESUMEN

1.1 Título y Resumen

En este trabajo, se va a desarrollar el anteproyecto de un buque bulkcarrier portacontenedores de 40 000 t. Primeramente vamos a realizar un dimensionamiento preliminar, así como una predicción de potencia. Cabe destacar que la elección de las dimensiones del buque se ha hecho teniendo en cuenta varias combinaciones posibles, tomando como cifra de mérito el coste del buque.

Posteriormente, se procederá a un cálculo más detallado de los pesos del buque, así como a una definición de las formas del casco.

También detallaremos el compartimentado del buque, el cálculo de estabilidad en las diferentes situaciones de carga, una predicción de potencia más detallada, así como el diseño del timón y el cálculo del servomotor.

Llevaremos a cabo el cálculo estructural básico del buque, según el Bureau Veritas.

Con los datos obtenidos a lo largo del proyecto, elaboraremos los planos de disposición general del buque.

También se hará el cálculo del balance eléctrico del buque en las diferentes situaciones de demanda eléctrica.

Por último, haremos el cálculo del coste del buque, detallando cada partida.

1.2 Título e Resumo

Neste traballo, váise desenrolar o anteproxeito dun buque bulkcarrier portacontenedores de 40 000 t. Primeiramente imos face-lo dimensionamento preliminar, así coma unha predición de potencia. É preciso destacar que a elección das dimensións do buque fíxose tendo en conta varias combinacións posibles, tomando como cifra de mérito o coste do buque.

Posteriormente, procederáse a un cálculo máis detallado dos pesos do buque, así coma a unha definición das formas do casco.

Tamén detallaremos o compartimentado do buque, o cálculo da estabilidade nas diferentes situacións de carga, unha predición de potencia máis detallada, así coma o deseño do timón e o cálculo do servomotor.

Levaremos a cabo o cálculo estrutural básico do buque, según o Bureau Veritas.

Cos datos obtidos ó longo do proxecto, elaboraremos os planos de disposición xeral do buque.

Tamén se fará o cálculo do balance eléctrico do buque nas diferentes situacións de demanda eléctrica.

Por último, faremos o cálculo do coste do buque, detallando cada partida.

1.3 Tittle and Abstract

In this project will be developed the pre-project of a containership bulkcarrier of 40 000 tn. In the first place, it makes a preliminary sizing and power prediction. Its necessary to be noticed that the dimensions were choosen by making several posible combinations taking the minimun building cost as the criteria to minimize.

After that, it makes a more detailed calculation of the ship weights as well as a definition of the hull shapes.

It is also detailed the behaviour of the ship, the stability calculation in all the diferent cargo situations, a more detailed power prediction as well as the rudder design and the servo calculation.

In addition to that, it develops a basic stuctural calculation of the ship according to the Bureau Veritas.

With all the obtained data in the project, it will obtain the drawing of the ship general arrangement.

It also elaborates the electric balance for all the diferent situations of electric demanding.

Finally, it makes the calculation of the cost of the ship, detailing each item.



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**TRABAJO FIN DE GRADO
CURSO 2019/20**

*BULKCARRIER PORTACONTENEDORES
40 000 TPM*

Grado en Ingeniería Naval y Oceánica

Cuaderno 1

**ELECCIÓN DE LA CIFRA DE MÉRITO Y DEFINICIÓN DE
ALTERNATIVAS. SELECCIÓN DE LA MÁS FAVORABLE.**

GRADO EN INGENIERÍA NAVAL Y OCEÁNICA
TRABAJO FIN DE GRADO

CURSO 2 019-2 020

PROYECTO NÚMERO: 18-14

TIPO DE BUQUE: *Bulkcarrier y Portacontenedores*

CLASIFICACIÓN, COTA Y REGLAMENTOS DE APLICACIÓN: *Bureau Veritas, MARPOL, SOLAS.*

CARACTERÍSTICAS DE LA CARGA: *40 000 TPM. Grano, mineral, carbón. 2 Pilas de contenedores / madera sobre las tapas de escotillas. Madera.*

VELOCIDAD Y AUTONOMÍA: *15 nudos en condiciones de servicio al 85% MCR y 15% de margen de mar. 12 000 millas a la velocidad de servicio.*

SISTEMAS Y EQUIPOS DE CARGA / DESCARGA: *Escotillas de accionamiento hidráulico. Con grúas carga-descarga.*

PROPULSIÓN: *Motor diésel acoplado a una hélice de paso fijo. LNG para operaciones en puerto.*

TRIPULACIÓN Y PASAJE: *20 personas.*

OTROS EQUIPOS E INSTALACIONES: *Los habituales en este tipo de buques.*

Ferrol, 11 de marzo de 2019

ALUMNA: **D^a Marta González García**

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1. INTRODUCCIÓN

1.1. Contenido a desarrollar en el presente cuaderno

- Presentación. Introducción al cuaderno. Descripción de las características del buque proyecto.
- Selección de la base de datos de los buques de referencia y fichas técnicas de los citados buques.
- Cálculo de las dimensiones principales. Basado en regresiones por formulación en programas de cálculo.
- Cálculo de coeficientes de arquitectura naval. Basado en formulación.
- Cálculo de la cifra de mérito y de sus diferentes componentes para la solución inicial. Análisis de diversas cifras.
- Exploración de alternativas y validación técnica de cada una de ellas.
- Definición de la configuración inicial y dimensiones y características dimensionales y coeficientes de arquitectura naval de cada alternativa a explorar. Criterios y elección de la solución más favorable.
- Validación técnica de la solución más favorable. Estimación preliminar de pesos, potencia propulsora y validación de francobordo. Comprobación de carga útil, peso muerto y autonomía.
- Croquis preliminar de la sección transversal y de la disposición general de la solución elegida.

1.2. Presentación

En este primer cuaderno procederemos a la determinación de las dimensiones principales de nuestro buque. Para ello comenzaremos con la elaboración de una base de datos compuesta por un total de 30 buques similares al nuestro (40 000 toneladas de peso muerto como dato prioritario). A partir de esta base, obtendremos una primera solución de las dimensiones principales, para, posteriormente, realizar sucesivas variaciones sobre las mismas de modo que tengamos un amplio abanico de soluciones de dimensionamiento posibles.

Una vez realizado esto hemos de seleccionar el criterio mediante el cual escogeremos la solución óptima. Al conjunto de variaciones obtenidas a partir de la solución inicial, le aplicaremos una serie de filtros con objeto de asegurarnos de que los parámetros filtrados se encuentren dentro de los límites marcados a partir de la base de datos.

Partiendo de esa solución óptima, procederemos a realizar también una serie de estimaciones de carácter diverso correspondientes a nuestro buque, así como la adjudicación de una nota de clase y una especificación preliminar basadas en buques similares.

2. GENERALIDADES

Los buques denominados *bulkcarriers* están especialmente diseñados para el transporte de carga seca a granel, en sus más diferentes variedades. Este tipo de carga hace que se abaraten los costes del transporte debido a que no existen los costes de envasado y la carga y descarga se puede hacer de manera más sistemática y por lo tanto más rápida. En estos buques se transporta grano, sal, minerales, fosfatos, carbón, etc. No obstante, estos buques también pueden transportar ocasionalmente contenedores e incluso cargas líquidas (crudos o productos petrolíferos).

Los *bulkcarriers* en su diseño clásico son buques de una sola cubierta, y sus bodegas disponen de una configuración de tanques laterales altos y bajos con mamparos inclinados que permiten la autoestiba de la carga. Especial problema presenta el corrimiento de la carga a granel, ya que su efecto es similar al de las superficies libres de tanques con líquidos, lo cual debe tenerse en cuenta cuando se proyecta el buque, prestando especial atención al número y disposición de las bodegas.

Los graneleros se clasifican en siete categorías principales:

- Mini-bulker: Transportan hasta 10 000 TPM.
- Handysize: Transportan entre 10 000 y 39 999 TPM.
- **Handymax/Supramax: Transportan entre 40 000 y 59 999 TPM.**
- Panamax: Transportan entre 60 000 y 79 999 TPM.
- Post-Panamax: Transportan entre 80 000 y 109 999 TPM.
- Capesize: Transportan entre 110 000 y 199 999 TPM.
- Very Large Ore Carriers (VLOC): Transportan más de 200 000 TPM.

Como se ha descrito anteriormente, el buque a proyectar en este trabajo será un *bulkcarrier* de tipo *Handymax* capaz de transportar grano, mineral, así como carbón en sus bodegas. A su vez, estará dispuesto para transportar sobre sus escotillas dos pilas de contenedores de tamaño estándar y, en su defecto, madera adecuadamente estibada.

Debido a la particularidad de su carga, el buque proyecto requiere un reforzado en las tapas de escotilla y un espacio para acoplar los conos para la estiba y sujeción de los contenedores, así como elementos para su trincaje.

Además, puesto que nuestro buque consta de tres grúas sobre cubierta, estarán adecuadas tanto para la manipulación de las cargas a granel como de los contenedores.

3. BASE DE DATOS

Partiendo de la RPA impuesta para la realización del presente proyecto, podemos realizar una base de datos tomando como referencia aquellos buques cuyas características sean similares a nuestro buque a proyectar. De este modo podremos conocer las dimensiones preliminares del mismo.

Para realizar la base de datos hemos seleccionado una serie de *bulkcarriers* próximos a las 40 000 *TPM*.

A continuación, se muestra la base de datos elaborada con los buques de referencia los cuales están adjuntos como Anexo I:

NOMBRE	AÑO	ESLORA TOTAL (m)	ESLORA PP (m)	MANGA (m)	PUNTAL (m)	CALADO (m)	FB (m)	TPM
JIN HUI	2 000	189,99	182,00	32,26	16,90	11,90	5,00	50 777
AGIOS ANATASIOS	2 001	189,90	182,00	32,26	17,10	12,00	5,10	52 068
APL VENEZUELA	2 001	220,50	210,20	32,24	18,70	12,45	6,25	42 210
CEDAR ARROW	2 001	189,80	181,80	31,00	18,50	12,60	5,90	47 818
ADAstra	2 002	183,00	175,33	30,95	16,40	11,80	4,60	46 493
IVS VISCOUNT	2 003	179,28	172,00	28,00	15,20	10,65	4,55	34 676
STAR OSHIMANA	2 003	199,00	189,00	32,26	19,00	12,00	7,00	48 661
BIG GLORY	2 005	189,90	185,00	32,26	17,80	12,50	5,30	55 809
BOSSCLIP TRADER	2 006	178,70	170,00	28,00	14,00	9,79	4,21	30 634
GRACE	2 006	175,60	169,17	28,40	14,80	10,42	4,38	35 283
E.R. BERGAMO	2 009	187,88	182,50	32,26	18,30	11,30	7,00	55 500
STAR KIRKENES	2 009	208,73	197,40	32,20	19,50	12,00	7,50	49 924
BULK NEPTUNE	2 009	189,99	182,97	32,26	17,90	12,57	5,33	55 657
THALASSINI AXIA	2 010	196,00	189,00	32,26	18,60	13,00	5,60	58 608
ALGOMA MARINER	2 011	225,56	219,32	23,74	15,00	10,15	4,85	38 000
DRAGONERA	2 011	180,00	176,75	30,00	14,70	10,10	4,60	34 613
HALKI	2 011	186,40	178,00	27,80	15,60	10,90	4,70	36 850
ACACIA	2 011	179,99	172,32	28,20	14,30	10,10	4,20	33 677
NORD HONG KONG	2 011	179,90	171,50	28,40	14,10	10,15	3,95	32 290
ARKADIA	2 012	197,08	189,00	32,26	18,50	13,00	5,50	56 348
STX ARBORELLA	2 012	199,90	191,80	32,26	19,30	12,70	6,60	57 539
MILLION BELL	2 012	197,00	194,00	32,26	18,10	12,67	5,43	58 665
AMBER CHAMPION	2 013	199,85	194,50	32,26	18,50	13,30	5,20	63 525
WUCHANG	2 013	179,99	176,65	30,00	15,00	10,50	4,50	39 128
ANDALUCIAN ZEPHYR	2 014	179,96	174,00	30,00	14,05	9,80	4,25	34 436
CASCADE	2 014	179,90	176,85	30,00	14,80	10,60	4,20	38 737
INLAND SEA	2 014	179,97	173,52	29,80	15,00	10,54	4,46	37 543
TRUE LOVE	2 015	179,95	177,00	32,00	15,00	10,50	4,50	38 800
VENTURE GOAL	2 015	189,99	187,05	30,00	15,00	10,70	4,30	43 500
TIAN ZHEN	2 016	189,99	187,00	28,50	15,80	11,00	4,80	36 900

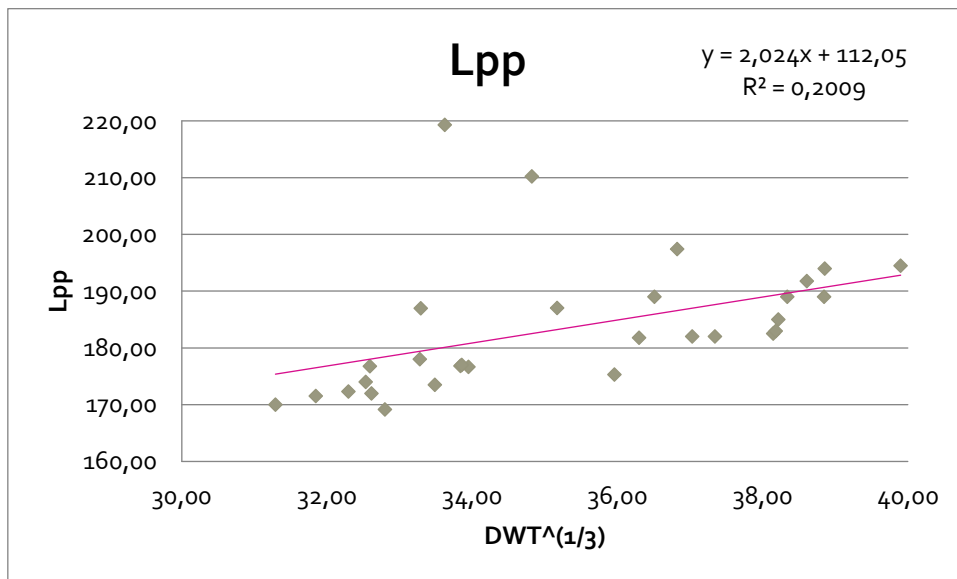
4. CÁLCULOS PRELIMINARES

4.1. Dimensionamiento

A partir de la base de datos anterior, realizaremos un primer dimensionamiento mediante relaciones estadísticas (regresiones) que relacionen los diferentes parámetros adimensionales en función de la variable principal de dimensionamiento.

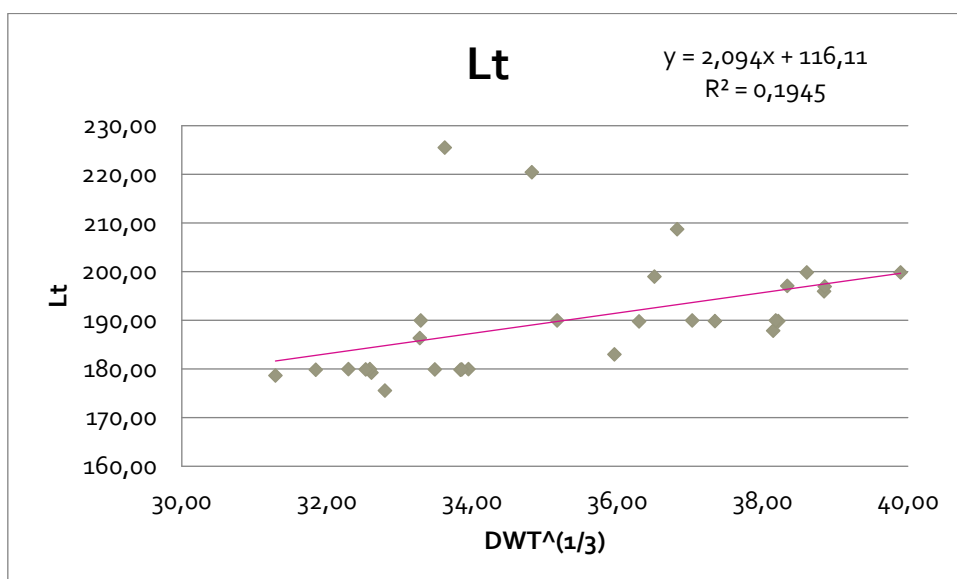
Para el cálculo de todos los parámetros necesarios, hemos realizado varias relaciones y el resultado final será la media de todas ellas.

4.1.1. Eslora entre perpendiculares

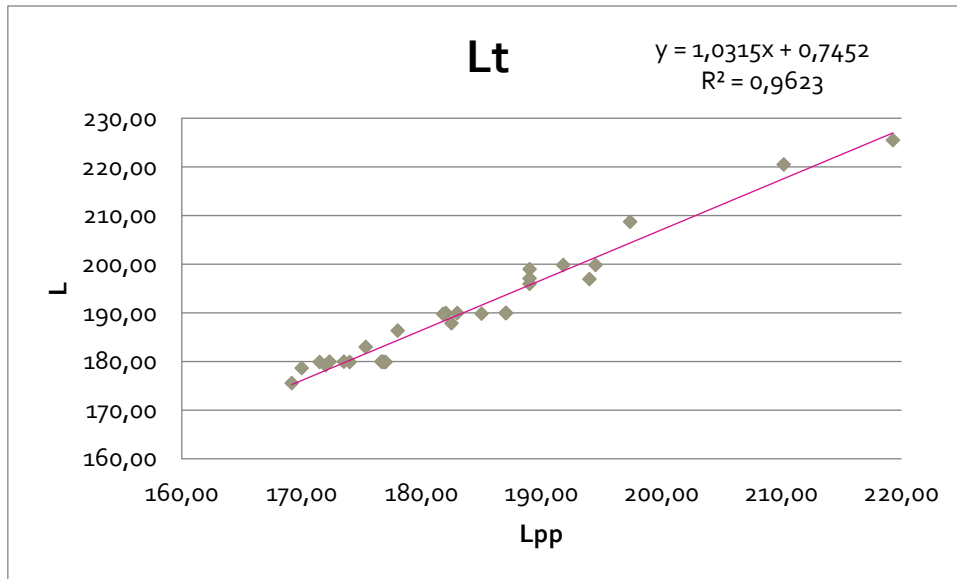


$$L_{pp} = 2,024 \cdot DWT^{1/3} + 112,05 = 2,024 \cdot 40\,000^{1/3} + 112,05 = 181,270 \text{ m}$$

4.1.2. Eslora total

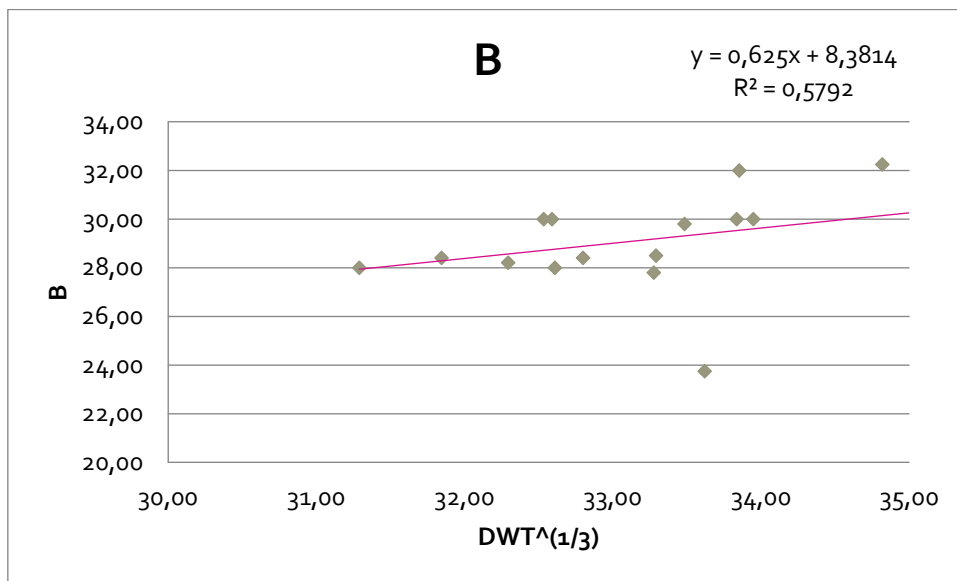


$$L_t = 2,094 \cdot DWT^{1/3} + 116,11 = 2,094 \cdot 40\,000^{1/3} + 116,11 = 187,724 \text{ m}$$

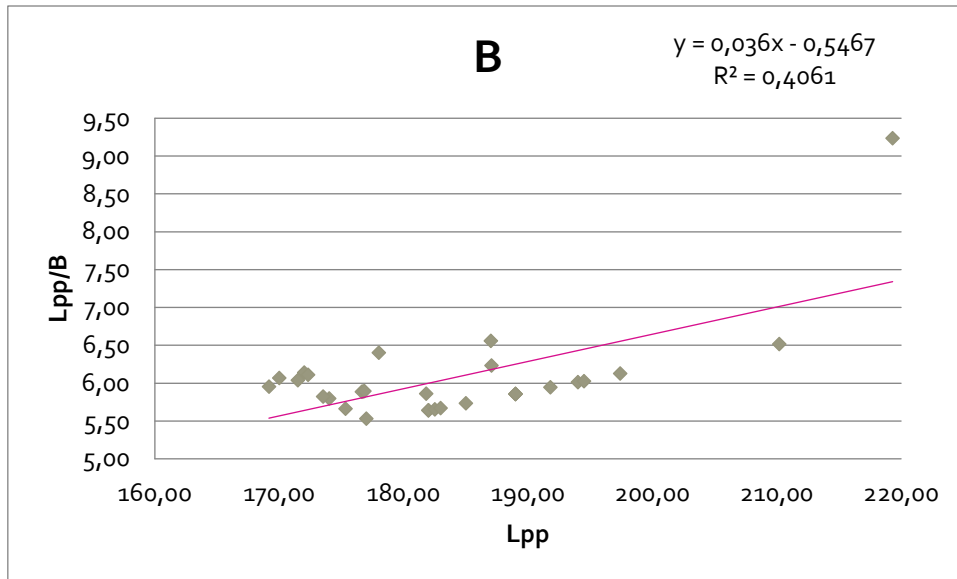


$$Lt = 1,0315 \cdot Lpp + 0,7452 = 1,0315 \cdot 181,270 + 0,7452 = 187,725 \text{ m}$$

4.1.3. Manga

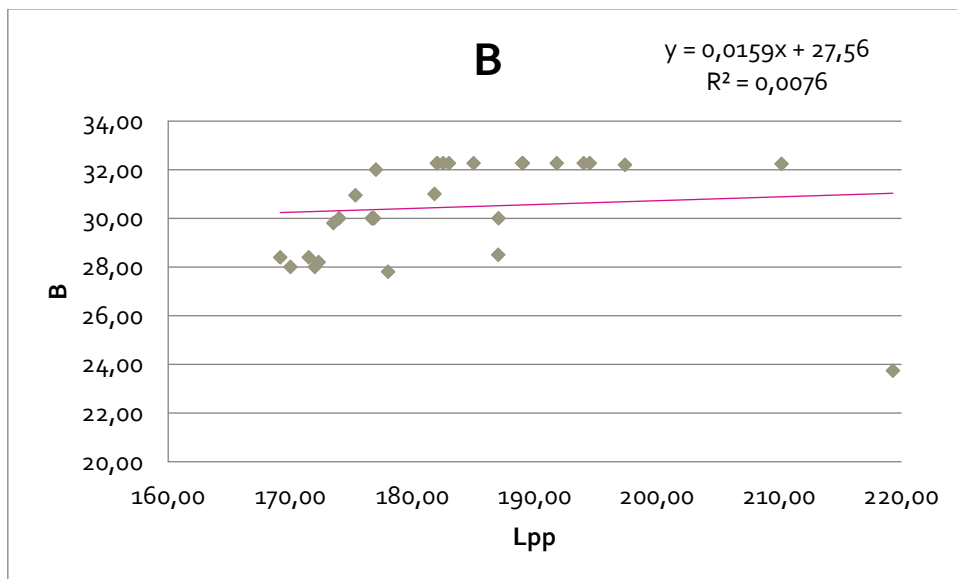


$$B = 0,625 \cdot DWT^{1/3} + 8,3814 = 0,625 \cdot 40\ 000^{1/3} + 8,3814 = 29,756 \text{ m}$$



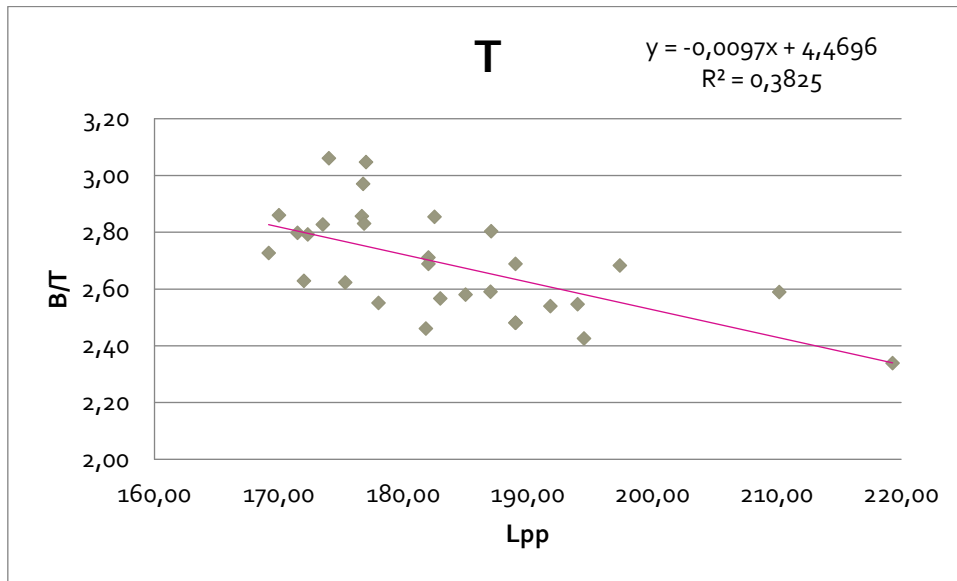
$$\frac{L}{B} = 0,036 \cdot Lpp - 0,5467 = 0,036 \cdot 181,270 - 0,5467 = 5,979$$

$$B = \frac{Lpp}{\frac{L}{B}} = \frac{181,270}{5,979} = 30,318 \text{ m}$$



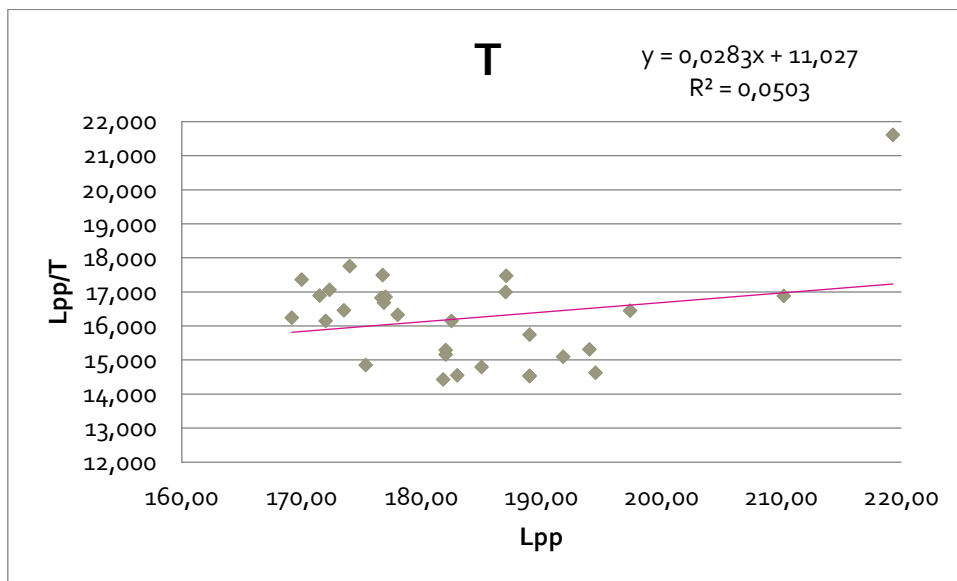
$$B = 0,0159 \cdot Lpp + 27,56 = 0,0159 \cdot 181,270 + 27,56 = 30,442 \text{ m}$$

4.1.4. Calado



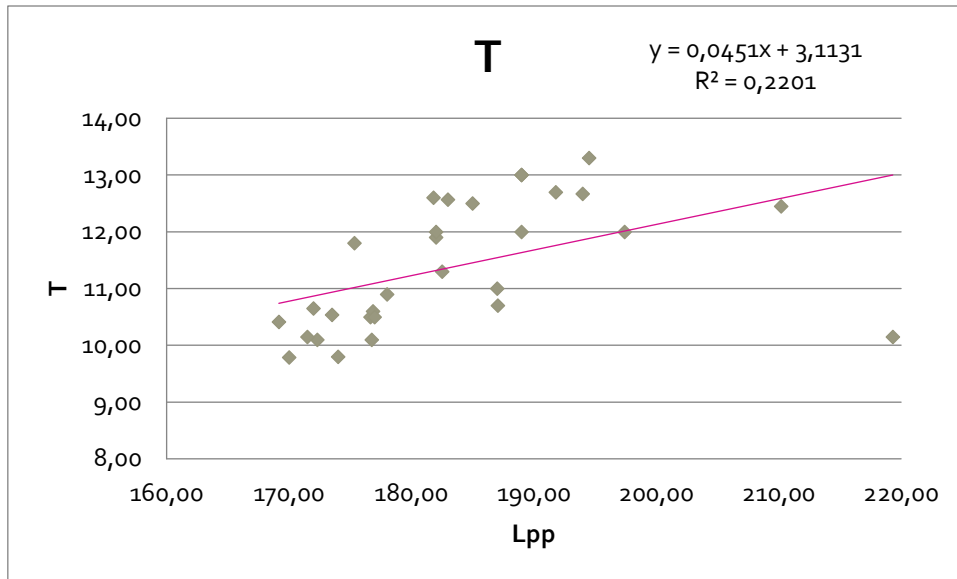
$$\frac{B}{T} = -0,0097 \cdot Lpp + 4,4696 = -0,0097 \cdot 181,270 + 4,4696 = 2,711$$

$$T = \frac{B}{\frac{B}{T}} = \frac{30,318}{2,711} = 11,182 \text{ m}$$



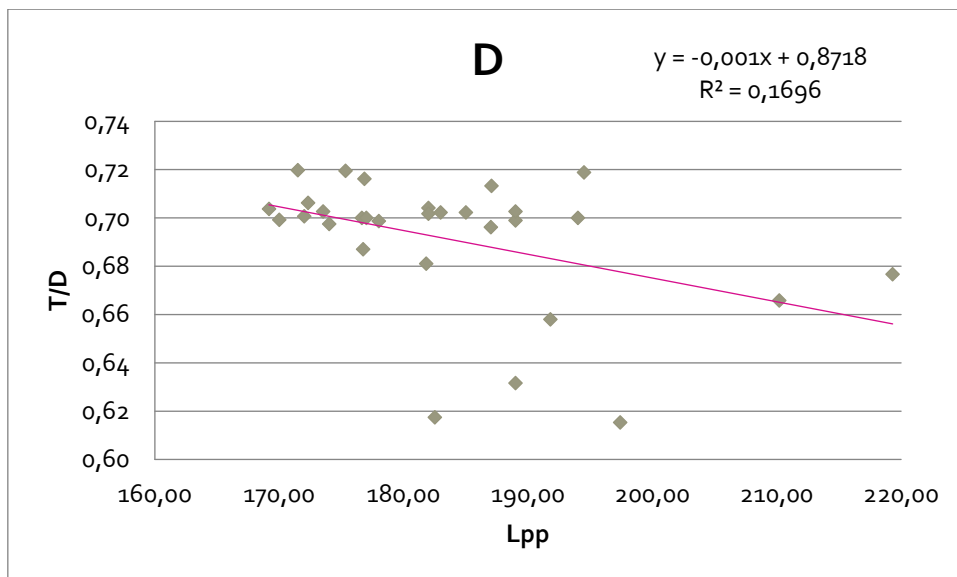
$$\frac{Lpp}{T} = 0,0283 \cdot Lpp + 11,027 = 0,0283 \cdot 181,270 + 11,027 = 16,157$$

$$T = \frac{Lpp}{\frac{Lpp}{T}} = \frac{181,270}{16,157} = 11,219 \text{ m}$$



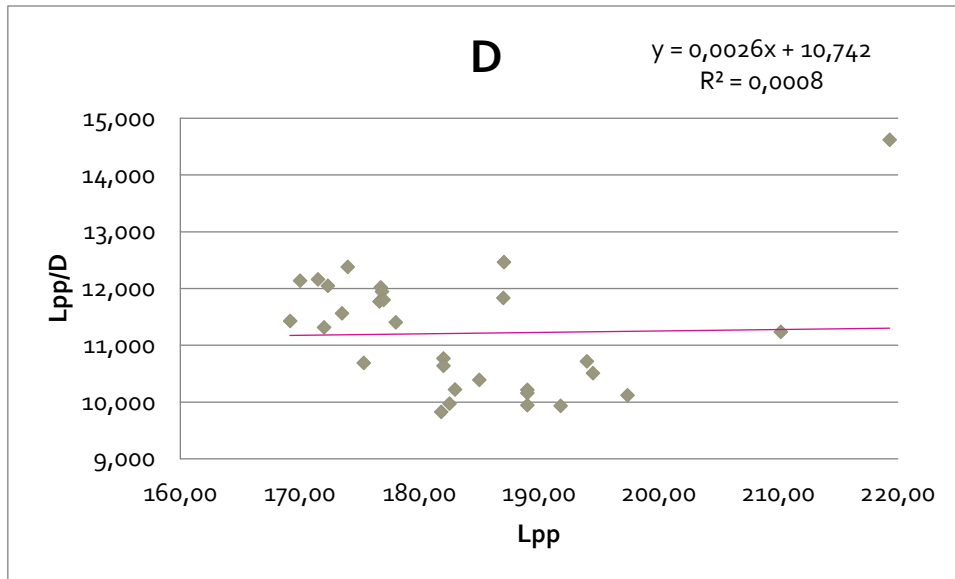
$$T = 0,0451 \cdot Lpp + 3,1131 = 0,0451 \cdot 181,270 + 3,1131 = 11,288 \text{ m}$$

4.1.5. Puntal



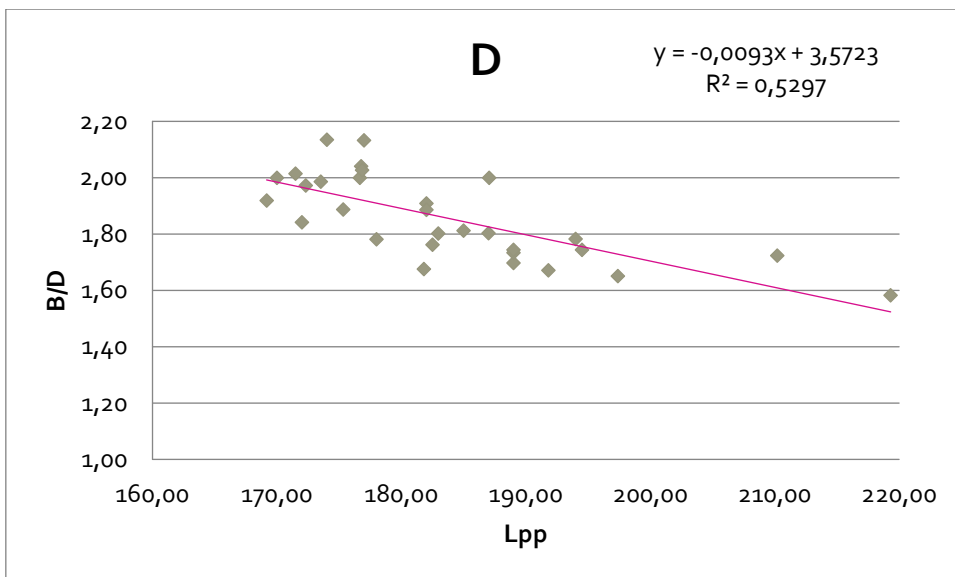
$$\frac{T}{D} = -0,001 \cdot Lpp + 0,8718 = -0,001 \cdot 181,270 + 0,8718 = 0,691$$

$$D = \frac{T}{\frac{T}{D}} = \frac{11,182}{0,691} = 16,193 \text{ m}$$



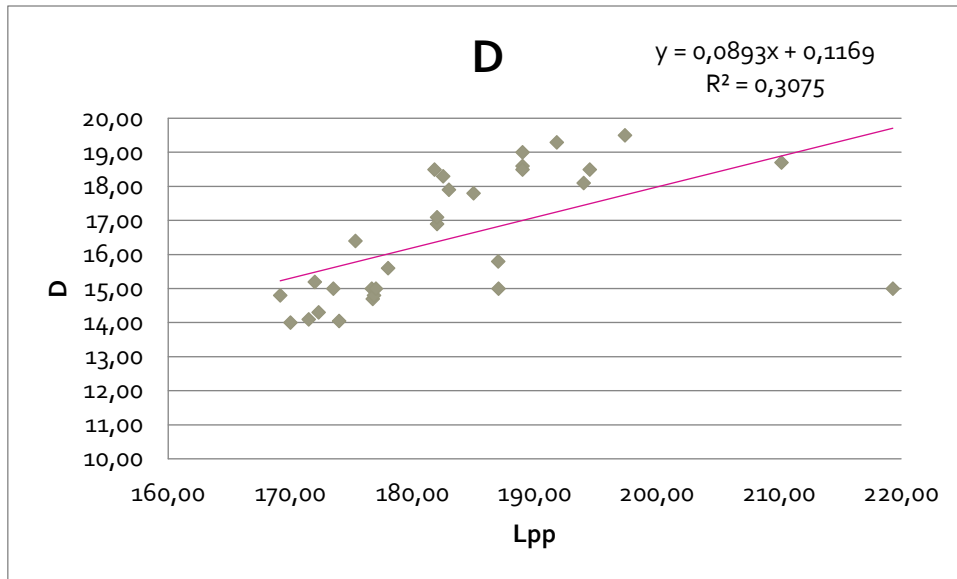
$$\frac{Lpp}{D} = 0,0026 \cdot Lpp + 10,742 = 0,0026 \cdot 181,270 + 10,742 = 11,213$$

$$D = \frac{Lpp}{\frac{Lpp}{D}} = \frac{181,270}{11,213} = 16,166 \text{ m}$$



$$\frac{B}{D} = -0,0093 \cdot Lpp + 3,5723 = -0,0093 \cdot 181,270 + 3,5723 = 1,886$$

$$D = \frac{B}{\frac{B}{D}} = \frac{29,756}{1,886} = 15,773 \text{ m}$$



$$D = 0,0893 \cdot Lpp + 0,1169 = 0,0893 \cdot 181,270 + 0,1169 = 16,304 \text{ m}$$

4.1.6. Resumen

$$L_t = \frac{187,724 + 187,725}{2} = 187,724 \text{ m}$$

$$L_{pp} = 181,270 \text{ m}$$

$$B = \frac{29,756 + 30,318 + 30,442}{3} = 30,170 \text{ m}$$

$$T = \frac{11,182 + 11,219 + 11,288}{3} = 11,230 \text{ m}$$

$$D = \frac{16,193 + 16,166 + 15,773 + 16,304}{4} = 16,108 \text{ m}$$

DIMENSIONES PRELIMINARES		
Eslora total	187,724	m
Eslora entre perpendiculares	181,270	m
Manga	30,171	m
Calado	11,230	m
Puntal	16,108	m

4.2. Coeficientes

Una vez hallado todo el dimensionamiento básico, se calcularán todos los coeficientes y datos previos necesarios para continuar con el cálculo de las dimensiones finales.

4.2.1. Número de Froude

Este coeficiente se estima en una primera aproximación a través de fórmulas de diversos autores. La velocidad del buque a proyectar, que es un dato dado en los requerimientos del proyecto, es de 15 nudos.

$$Fn = \frac{v}{\sqrt{g \cdot Lpp}} = \frac{15 \cdot 0,5144}{\sqrt{9,81 \cdot 181,27}} = 0,1829$$

4.2.2. Coeficiente de bloque

Para el cálculo del coeficiente de bloque utilizaremos varios métodos y obtendremos el final mediante la media aritmética.

4.2.2.1. Scheneekluth

Para $0,48 < Cb < 0,85$

$$Cb = \frac{0,14}{Fn} \cdot \frac{\frac{Lpp}{B} + 20}{26} = \frac{0,14}{0,1829} \cdot \frac{\frac{181,27}{30,17} + 20}{26} = 0,765$$

$$Cb = \frac{0,14}{Fn^{2/3}} \cdot \frac{\frac{Lpp}{B} + 20}{26} = \frac{0,14}{0,1829^{2/3}} \cdot \frac{\frac{181,27}{30,17} + 20}{26} = 0,71$$

4.2.2.2. Townsin

$$Cb = 0,7 + \frac{1}{8} \cdot \arctan\left(\frac{23 - 100 \cdot Fn}{4}\right) = 0,7 + \frac{1}{8} \cdot \arctan\left(\frac{23 - 100 \cdot 0,1829}{4}\right) = 0,8083$$

4.2.2.3. Van Lammeren

$$Cb = 1,37 - 2,02 \cdot Fn = 1,37 - 2,02 \cdot 0,1829 = 1$$

4.2.2.4. Minorsky

$$Cb = 1,22 - 2,38 \cdot Fn = 1,22 - 2,38 \cdot 0,1829 = 0,78$$

4.2.2.5. Kerlen

Para $Cb > 0,78$

$$Cb = 1,179 - 2,026 \cdot Fn = 1,179 - 2,026 \cdot 0,1829 = 0,80$$

4.2.2.6. Katsoulis

Con factor f para graneleros: $f = 1,03$

$$Cb = 0,8217 \cdot f \cdot Lpp^{0,42} \cdot B^{-0,3072} \cdot T^{0,1721} \cdot VS^{-0,6135} = 0,8217 \cdot 1,03 \cdot 181,27^{0,42} \cdot 30,17^{-0,3072} \cdot 11,23^{0,1721} \cdot 15^{-0,6135} = 0,76$$

4.2.2.7. Coeficiente de bloque final

$$Cb = \frac{0,765 + 0,71 + 0,808 + 1 + 0,78 + 0,80 + 0,76}{7} = 0,8032$$

4.2.3. Coeficiente de la sección media

Para el cálculo del coeficiente de la sección media utilizaremos varios métodos y obtendremos el final mediante la media aritmética.

4.2.3.1. Kerlen

$$Cm = 1,006 - 0,0056 \cdot Cb^{-3,56} = 1,006 - 0,0056 \cdot 0,8032^{-3,56} = 0,994$$

4.2.3.2. El Hsva

$$Cm = \frac{1}{1 + (1 - Cb)^{3,5}} = \frac{1}{1 + (1 - 0,8032)^{3,5}} = 0,996$$

4.2.3.3. J. Torroja

Para $Fn < 0,5$

$$Cm = 1 - 2 \cdot Fn^4 = 1 - 2 \cdot 0,1829^4 = 0,998$$

4.2.3.4. Coeficiente de la sección media final

$$Cm = \frac{0,994 + 0,996 + 0,998}{3} = 0,996$$

4.2.4. Coeficiente prismático

$$Cp = \frac{Cb}{Cm} = \frac{0,8032}{0,996} = 0,8064$$

4.2.5. Coeficiente de la flotación

Para el cálculo del coeficiente de la flotación utilizaremos varios métodos y obtendremos el final mediante la media aritmética.

$$Cf = 1 - 0,3 \cdot (1 - Cp) = 1 - 0,3 \cdot (1 - 0,8064) = 0,9419$$

$$Cf = Cm \cdot Cp + 0,1 = 0,996 \cdot 0,8064 + 0,1 = 0,9032$$

$$Cf = \frac{1}{3} + \frac{2}{3} \cdot Cm \cdot Cp = \frac{1}{3} + \frac{2}{3} \cdot 0,996 \cdot 0,8064 = 0,8688$$

4.2.5.1. Coeficiente de la flotación final

$$Cf = \frac{0,9419 + 0,9032 + 0,8688}{3} = 0,9046$$

4.3. Desplazamiento

Para un cálculo preliminar del desplazamiento utilizaremos los datos hallados anteriormente.

$$\Delta = \rho \cdot (1 + s) \cdot Cb \cdot Lpp \cdot B \cdot T = 1,030 \cdot 0,8032 \cdot 181,27 \cdot 30,17 \cdot 11,23 = 50.810 \text{ t}$$

En resumen, nuestras dimensiones y datos preliminares son los siguientes:

DIMENSIONES PRELIMINARES		
Eslera total	187,724	m
Eslera entre perpendiculares	181,270	m
Manga	30,171	m
Calado	11,230	m
Puntal	16,108	m
Francobordo	4,878	m

Peso muerto	40 000,00	t
Número de Froude	0,183	
Coefficiente de bloque	0,803	
Coefficiente de la maestra	0,996	
Coefficiente prismático	0,806	
Coefficiente en la flotación	0,905	
Desplazamiento	50 809,16	t
Peso en rosca	10 809,16	t
Velocidad	15	nudos
Potencia	8 133,747	kW

Así mismo realizamos un simple cálculo para tener un rango al que ceñirnos en los ratios principales en función de nuestra base de datos:

	Cb	Lpp/B	Lpp/T	B/T	Lpp/D	T/D	B/D	FB
MÁXIMO	0,9000	9,238	21,608	3,061	14,621	0,720	2,135	7,500
MÍNIMO	0,7860	5,531	14,429	2,339	9,827	0,615	1,583	3,950
BUQUE PRELIMINAR	0,8032	6,0082	16,1418	2,6866	11,2535	0,6972	1,8730	4,878

5. PESOS DEL BUQUE BASE

5.1. Peso en rosca

Para un valor de peso en rosca previo, tendremos en cuenta el desplazamiento calculado en el anterior apartado así como el peso muerto estipulado en el proyecto.

$$PesoRosca = \Delta - PesoMuerto = 50\,810 - 40\,000 = 10\,810\,t$$

5.1.1. Peso de acero

5.1.1.1. J.L. García Garcés

Para graneleros comprendidos entre $75\,m > Lpp > 280\,m$

$$WST = 0,02432 \cdot Lpp^{1,5} \cdot B \cdot D^{0,5} = 0,02432 \cdot 181,270^{1,5} \cdot 30,171 \cdot 16,108^{0,5} = 7.187,25\,t$$

5.1.1.2. Murray

$$\begin{aligned} WST &= 32,76596 \cdot 10^{-3} \cdot L^{1,65} \cdot \left(B + D + \frac{T}{2} \right) \cdot (0,5 \cdot Cb + 0,4) \\ &= 32,76596 \cdot 10^{-3} \cdot 181,270^{1,65} \cdot \left(30,171 + 16,108 + \frac{11,230}{2} \right) \\ &\quad \cdot (0,5 \cdot 0,803 + 0,4) = 7.255,73\,t \end{aligned}$$

5.1.1.3. Peso del acero final

$$PS = \frac{7.187,25 + 7.255,73}{2} = 7.221,49\,t$$

5.1.2. Peso de equipos y habilitación

Emplearemos una fórmula del libro “Proyectos de buques y artefactos”:

$$\begin{aligned} M_{E+H} &= 0,8 \cdot L^{0,797} \cdot (B + 0,8245 \cdot D + 1,85 \cdot T)^{0,797} \\ &= 0,8 \cdot 181,270^{0,797} \cdot (30,171 + 0,8245 \cdot 16,108 + 1,85 \cdot 11,230)^{0,797} \\ &= 1.392,29\,t \end{aligned}$$

5.1.3. Peso de la maquinaria

Para el cálculo del peso de la maquinaria seguiremos las recomendaciones del libro “Proyectos de buques y artefactos” el cual nos dice que este peso se dividirá en dos apartados: el peso del motor principal y el peso de la instalación restante de la maquinaria.

Para estimar la potencia propulsora se utilizará la fórmula de Watson.

$$\begin{aligned} POT &= \frac{0,889 \cdot \Delta^{2/3} \cdot \left(40 - \frac{Lpp}{61} + 400 \cdot 0,1^2 - 12 \cdot Cb \right)}{15\,000 - 1,81 \cdot N \cdot \sqrt{Lpp}} \cdot V^3 \\ &= \frac{0,889 \cdot 50\,809,16^{2/3} \cdot \left(40 - \frac{181,270}{61} + 400 \cdot 0,1^2 - 12 \cdot 0,803 \right)}{15\,000 - 1,81 \cdot 110 \cdot \sqrt{181,270}} \cdot 15^3 \\ &= 10\,488,3\,CV = 7\,822\,kW \end{aligned}$$

Donde:

- N : Revoluciones por minutos de la hélice a la velocidad de servicio.
- V : Velocidad en nudos, en condiciones de prueba a plena carga.

5.1.3.1. Motor principal

$$M_{MP} = 0,075 \cdot MCR + 300 = 0,075 \cdot 10\,488,3 + 300 = 1\,086,62\ t$$

5.1.3.2. Equipo restante

$$\begin{aligned} M_{ER} &= 120 + 32,29 \cdot 10^{-3} \cdot L \cdot (B + 0,8245 \cdot D + 1,85 \cdot T) \\ &= 120 + 32,29 \cdot 10^{-3} \cdot 181,270 \\ &\quad \cdot (30,171 + 0,8245 \cdot 16,108 + 1,85 \cdot 11,230) = 495,94\ t \end{aligned}$$

5.1.3.3. Peso maquinaria final

$$M_M = M_{MP} + M_{ER} = 1\,086,62 + 495,94 = 1\,582,56\ t$$

5.1.4. Peso en rosca total

$$M_{TOT=} = PS + M_{E+H} + M_M = 7\,221,49 + 1\,392,29 + 1\,582,56 = 10\,196,34\ t$$

5.2. Desplazamiento

Hallaremos ahora el nuevo desplazamiento con estos nuevos valores:

$$\Delta = DWT + M_{TOT} = 40\,000 + 10\,196,34 = 50\,196,34\ t$$

Como nuestro desplazamiento calculado mediante el análisis de pesos en detalle es inferior al calculado de forma más genérica con anterioridad, comprobaremos que nuestro buque cumple.

5.3. Carga útil

Lo que corresponde en este caso es el cálculo de la carga útil del buque, ya que tenemos peso muerto como la característica fundamental del proyecto.

5.3.1. Tripulación y pasaje

El número de tripulantes es de 20, como establece la RPA. Siguiendo las recomendaciones del libro "Proyecto de buques y artefactos" se considerarán 125 kg por tripulante.

$$P_{tr} = 20\ \text{personas} \cdot 125 \frac{\text{kg}}{\text{tripulante}} = 2\,500\ \text{kg} = 2,5\ t$$

5.3.2. Pertrechos

En este apartado tomaremos un valor supuesto ya que sería un valor que debería ofrecernos el Armador.

$$P_{per} = 60\ t$$

5.3.3. Consumos

Los consumos del buque dependerán de la autonomía del buque la cual viene definida en la RPA y son 12 000 millas.

Considerando que esas millas serán recorridas a la velocidad de servicio obtendremos los días de autonomía de nuestro buque.

$$Autonomía = \frac{12\,000 \text{ millas}}{15 \text{ nudos}} = 800 \text{ horas} = 33,3 \text{ días}$$

5.3.3.1. Combustible

El motor utiliza HFO como combustible el cual presenta un consumo medio de 180 g/kWh, lo que haría que necesitésemos:

$$P_{HFO} = 180 \frac{g}{kW \cdot h} \cdot 800 \text{ h} \cdot 11\,750 \text{ kW} = 1\,692 \text{ t}$$

5.3.3.2. Aceite

En el caso del aceite se recomienda que sea sobre un 3-4% del peso total del combustible de propulsión. Tomaremos pues un 3,5% del peso del diésel en el modo diésel.

$$P_{ace} = 0,035 \cdot P_{HFO} = 0,035 \cdot 1\,692 = 60 \text{ t}$$

5.3.3.3. Agua

Además, se dispondrá de una capacidad de tanques de agua potable de 200 litros por persona y día.

$$P_{agua} = 200 \frac{\text{litros}}{\text{pers. día}} \cdot 20 \text{ personas} \cdot 33,3 \text{ días} = 133,2 \text{ t}$$

5.3.3.4. Víveres

Por último, el peso de víveres recomendado para buques mercantes es de 5 kg por persona y día.

$$P_{viv} = 5 \frac{kg}{\text{pers. día}} \cdot 20 \text{ personas} \cdot 33,3 \text{ días} = 3,33 \text{ t}$$

5.3.3.5. Consumos totales

Finalmente, el peso total de los consumos será:

$$P_{cons} = P_{HFO} + P_{ace} + P_{agua} + P_{viv} = 1\,126,4 + 60 + 133,2 + 3,33 = 1\,303 \text{ t}$$

5.3.4. Carga útil total

$$P_{cu} = DWT - (P_{tr} + P_{per} + P_{cons}) = 40\,000 - (2,5 + 60 + 1\,303) = 38\,634,5 \text{ t}$$

6. NOTA DE CLASE

I ✘ HULL ✘ MACH Bulk carrier CSR CPS (WBT) BC-B ESP GRAB [20] SP20 Tier III unrestricted navigation AUT-IMS COMF CLEANSHIP SUPER BWE equipped for carriage of containers LASHING

6.1. Definición de notaciones

6.1.1. Símbolo de clase

[Part A, Ch 1, Sec 2, [2]] → El símbolo de clase expresa el grado de cumplimiento del barco con los requisitos de la norma en cuanto a su construcción y mantenimiento.

I [Part A, Ch 1, Sec 2, [2.1]] → El símbolo de clase “I” está asignado a los buques construidos de conformidad con los requisitos de las Reglas u otras reglas consideradas como equivalentes.

6.1.2. Marcas de construcción

[Part A, Ch 1, Sec 2, [3]] → La marca de construcción identifica el procedimiento bajo el cual el barco y su equipo principal o disposiciones han sido supervisados para la designación inicial de la clase.

✘ [Part A, Ch 1, Sec 2, [3.2]] → Ésta marca se asigna a la parte correspondiente del barco que ha sido inspeccionado por la Sociedad de Clasificación durante su construcción.

HULL [Part A, Ch 1, Sec 2, [3.1.2]] → Símbolo referente al casco del buque.

MACH [Part A, Ch 1, Sec 2, [3.1.2]] → Símbolo referente a la maquinaria del buque.

6.1.3. Notas de servicio con notaciones de servicio adicionales

[Part A, Ch 1, Sec 2, [4]] → Las notaciones de servicio definen el tipo y/o servicio del buque que hayan sido consideradas para su clasificación de acuerdo con los requerimientos de clasificación firmados por la parte interesada.

Bulk carrier [Part A, Ch 1, Sec 2, [4.3.1]] → Nota de servicio referida a buques autopropulsados destinados al transporte de carga seca a granel.

ESP [Part A, Ch 1, Sec 2, [4.3.1]] → Indica que el barco está sometido al “Enhanced Survey Program”.

BC-B [Part A, Ch 1, Sec 2, [4.3.2]] → Para bulkcarriers diseñados para transportar cargas secas a granel de densidad 1,0 t/m³ y superior.

CSR → [Part A, Ch 1, Sec 2, [4.3.2]] Servicio adicional para completar la nota de servicio **bulk carrier ESP** en buques de eslora superior o igual a 90 m contratados después del 1 de abril de 2006.

GRAB [X] [Part A, Ch 1, Sec 2, [4.3.2]] → Empleado para complementar las nota de servicio **CSR BC-B**, se define de acuerdo a la “Regla NR522: Reglas estructurales para graneleros” la cual nos define $X=20$ para buques de eslora menor de 200 m.

CPS (WBT) [Part A, Ch 1, Sec 2, [4.3.2]] → Complementario a la nota **CSR** y definida en la “Regla NR530: Rendimiento de revestimiento estándar”, aplicada a buques que cumplan los requerimientos de la NR522 y relativa a la protección de los revestimientos del casco en los tanques de lastre para buques Bulk Carriers de eslora superior a 150 m.

SPxxx [Part A, Ch 1, Sec 2, [4.17.1]] → Para buques que cumplan el Código IMO de Salvamento para Buques de Propósito Especial que transporten más de 12 tripulantes especializados. Se define $xxx=20$.

Tier III [Part A, Ch 1, Sec 2, [4.17.2]] → Se asigna a buques cuyo motor principal y auxiliar están cubiertos por el “EIAPP: Certificado Internacional de Prevención para los Gases Contaminantes” del Convenio MARPOL.

6.1.4. Notaciones de navegación

[Part A, Ch 1, Sec 2, [5.1]] → Define las limitaciones del buque para navegar en determinados espacios.

unrestricted navigation [Part A, Ch 1, Sec 2, [5.2.1]] → Esta notación es asignada a los buques destinados a operar en cualquier área y en cualquier periodo del año.

6.1.5. Notaciones de clase adicionales

[Part A, Ch 1, Sec 2, [6.1]] → Una notación de clase adicional expresa la clasificación de equipamiento adicional o disposición específica que haya sido solicitada por la parte solicitada.

unattended machinery space (AUT-IMS) [Part A, Ch 1, Sec 2, [6.4.2]] → Esta notación se asigna a los buques que están equipados con instalaciones automatizadas que permiten espacios de maquinaria que puedan permanecer periódicamente desatendidos en todas las condiciones de navegación, incluyendo maniobras y que adicionalmente están provistos de sistemas integrados que permiten manejar el control, seguridad y monitoreo de la maquinaria.

comfort on board ships (COMF) [Part A, Ch 1, Sec 2, [6.7.1]] → Se tiene en cuenta la evaluación de la comodidad, tanto el nivel de ruido como el de vibración.

pollution prevention (CLEANSHIP SUPER) [Part F, Ch 9, Sec 2, [3]] → esta notación adicional es asignada a los buques diseñados y equipados para controlar y limitar la emisión de sustancias contaminantes en el mar y en el aire.

ballast water exchange (BWE) [Part A, Ch 1, Sec 2, [6.8.5]] → Se asigna a los buques destinados al intercambio de agua de lastre en mar y cuyo diseño cumple con las disposiciones técnicas del convenio BWM del 2004.

equipped for carriage of containers [*Part D, Ch 2, Sec 2, [2]*] → Aplicado para barcos que adicionalmente presentan el servicio de transportar contenedores.

LASHING [*Part A, Ch 1, Sec 2, [6.1.5]*] → notación que complementa el **equipped for carriage of containers** y que se asigna a buques equipados con equipo móvil de amarre de contenedores.

7. CIFRA DE MÉRITO

Los criterios para la selección de alternativos utilizados con más frecuencia son los siguientes:

- Coste de construcción.
- Inversión total.
- Coste del ciclo de vida.
- Flete requerido.
- Rendimiento neto del Capital Propio.
- Tasa de rentabilidad interna del capital propio.
- Tasas de rentabilidad interna.

La cifra de mérito, será la herramienta que usaremos para seleccionar, de entre todas las alternativas generadas, la más favorable, por lo tanto dicha cifra ha de expresar criterios puramente financieros. En nuestro caso nos situaremos bajo el punto de vista del astillero, por lo que el criterio a seguir será el coste de construcción, de manera que éste será nuestra cifra de mérito.

7.1. Costes de construcción buque base

7.1.1. Costes de materiales a granel

$$CMg = cmg \cdot PS = ccs \cdot cas \cdot cem \cdot ps \cdot PS = 1,075 \cdot 1,115 \cdot 1,065 \cdot 750 \cdot 7\,850,05 \\ = 7\,515\,648,68 \text{ €}$$

Los valores de los coeficientes deben estar entre:

$$1,05 < ccs < 1,10 \text{ hasta } 1,50 \\ 1,08 < cas < 1,15 \\ 1,03 < cem < 1,10$$

Dónde:

- *cmg*: Coeficiente de coste de material a granel.
- *PS*: Peso de aceros del buque.
- *ccs*: Coeficiente ponderado de las chapas y perfiles de distintas calidades de acero.
- *cas*: Coeficiente de aprovechamiento del acero en relación con el pedido de materiales (Peso bruto/peso neto).
- *cem*: Coeficiente de incremento por equipo metálico incluido en la estructura.
- *ps*: Precio unitario del acero para referencia.

MATERIALES A GRANDEL		
ccs	1,075	
cas	1,115	
cem	1,065	
ps	750,00	€
PS	7 850,05	€
CMg	7 515 648,68	€

7.1.2. Costes mano de obra

$$CMm = chm \cdot csh \cdot PS = 30 \cdot 40 \cdot 7\,850,05 = 9\,420\,056,64 \text{ €}$$

Dónde:

- *CMo*: Coste de la mano de obra.
- *CMm*: Coste de la mano de obra de montaje del material a granel.
- *CMe*: Coste de la mano de obra de montaje de los equipos e instalaciones del buque.
- *chm*: Coste horario medio del Astillero.
- *csh*: Coeficiente de horas por unidad de peso.
- *PS*: Peso de acero del buque.

MANO DE OBRA		
chm	30	
csh	40	h/ton
PS	7 850,05	€
CMm	9 420 056,64	€

7.1.3. Costes equipos del buque y su montaje:

$$CEq + CMe = CEp + CHf + CEr = 3\,090\,823,89 + 816\,000,00 + 1\,329\,896,81 \\ = 5\,236\,720,70 \text{ €}$$

$$CEp = cep \cdot BP = 380 \cdot 8\,133,75 = 3\,090\,823,89 \text{ €}$$

$$CHf = chf \cdot nch \cdot NT = 34\,000 \cdot 1,2 \cdot 20 = 816\,000,00 \text{ €}$$

$$CEr = ccs \cdot ps \cdot PEr = 1,3 \cdot 750 \cdot 1\,364 = 1\,329\,896,81 \text{ €}$$

Dónde:

- *CEq*: Coste de los equipos.
- *CMe*: Coste mano de obra montaje equipos.
- *CEp*: Coste de los equipos de propulsión, de sus auxiliares y de su montaje.
- *CHf*: Coste de la habilitación y la fonda, incluido el montaje.
- *CEr*: Coste de los equipos restantes, incluido el montaje.

EQUIPOS Y MONTAJE		
cep	380	€/kW
BP	8 133,75	kW
CEp	3 090 823,89	€
chf	34 000,00	€/trip.
nch	1,2	
NT	20	tripulantes

CHf	816 000,00	€
ccs	1,3	
ps	750,00	€
K	0,045	
PEr	1 364,00	
CEr	1 329 896,81	€
CEq+CMe	5 236 720,70	€

7.1.4. Costes varios aplicados

$$CVa = cva \cdot CC = 0,1 \cdot 22\,172\,426,02 = 2\,217\,242,60$$

$$CC = CMg + CMm + (CEq + CMe) \\ = 7\,515\,648,68 + 9\,420\,056,64 + 5\,236\,720,70 = 22\,172\,426,02 \text{ €}$$

$$0,05 < cva < 0,10$$

El coeficiente *cva*, coeficiente de los costes varios del astillero referidos al coste de construcción del buque, lo supondremos de 0,1.

7.1.5. Coste construcción total

$$CC = CMg + CMm + (CEq + CMe) + CVa \\ = 7\,515\,648,68 + 9\,420\,056,64 + 5\,236\,720,70 + 2\,217\,242,60 \\ = 24\,389\,668,63 \text{ €}$$

Dónde:

- *CC*: coste de construcción.
- *CMg*: Coste de los materiales a granel.
- *CEq*: Coste de los equipos del buque.
- *CMm*: Coste de la mano de obra.
- *CVa*: Otros costes del astillero.

TOTAL CONSTRUCCIÓN		
CC	22 172 426,02	€
cVa	2 217 242,60	
CC TOTAL	24 389 668,63	€
CC TOTAL M€	24,390	M€

8. ALTERNATIVAS

Para la realización de las alternativas de nuestro buque, variaremos los valores de eslora y de manga en un 7,5% y los valores del coeficiente de bloque en un 3%. Realizando todas las posibles combinaciones tendremos un total de 735 iteraciones.

	Dimens. prel.	Porcentaje variación	Separación	Máximo	Mínimo
Lpp	181,270	13,595	1,360	194,865	167,675
B	30,171	2,263	0,754	32,433	27,908
Cb	0,803	0,024	0,012	0,827	0,779

Iteraciones	
10	21
3	7
2	5
TOTAL	735

DIMENSIONES ALTERNATIVAS		
Lpp	B	Cb
194,865	32,433	0,827
193,506	31,679	0,815
192,146	30,925	0,803
190,786	30,171	0,791
189,427	29,416	0,779
188,067	28,662	
186,708	27,908	
185,348		
183,989		
182,629		
181,270		
179,910		
178,551		
177,191		
175,832		
174,472		
173,113		
171,753		
170,394		
169,034		
167,675		

Componiendo una tabla con todos los posibles valores de eslora entre perpendiculares, manga y coeficiente de bloque, calcularemos para cada uno: puntal,

calado, desplazamiento, francobordo, coeficientes de Froude, maestra, prismática y flotación, así como los ratios de Lpp/B , Lpp/D , B/D , B/T , T/D y les aplicaremos las restricciones anteriormente citadas. Gracias a esta "criba" pasaremos de tener 735 alternativas a tener 150.

Además calcularemos los costes, que anteriormente habíamos calculado para nuestro buque preliminar, pero esta vez para todas esas alternativas. Una vez presentamos los costes totales de construcción, los ordenaremos de manera que se nos presente en primer lugar el de menor valor (por ser ésta nuestra cifra de mérito).

Incluiremos también los pesos totales de todas las alternativas compuestos por el peso del acero, el de la maquinaria y el de equipos y habilitación.

A continuación mostraremos las 15 alternativas que presentan un coste más bajo y en verde se muestra nuestra elección.

Lpp (m)	B (m)	Cb	D (m)	T (m)	Δ (t)	Fn	CM	CP	CF
170,394	30,171	0,827	17,136	11,557	50379,246	0,189	0,998	0,829	0,927
170,394	30,171	0,815	17,136	11,733	50402,956	0,189	0,997	0,817	0,915
171,753	29,416	0,827	17,436	11,767	50410,942	0,188	0,998	0,829	0,927
171,753	30,171	0,827	17,000	11,476	50427,199	0,188	0,998	0,829	0,927
171,753	30,925	0,827	16,586	11,200	50443,254	0,188	0,998	0,829	0,927
170,394	30,171	0,803	17,136	11,915	50426,665	0,189	0,997	0,806	0,903
171,753	29,416	0,815	17,436	11,946	50434,771	0,188	0,997	0,817	0,915
171,753	30,171	0,815	17,000	11,651	50451,028	0,188	0,997	0,817	0,915
173,113	29,416	0,827	17,299	11,685	50458,656	0,187	0,998	0,829	0,927
171,753	30,925	0,815	16,586	11,371	50467,083	0,188	0,997	0,817	0,915
173,113	30,171	0,827	16,867	11,397	50475,042	0,187	0,998	0,829	0,927
173,113	30,925	0,827	16,456	11,122	50491,224	0,187	0,998	0,829	0,927
170,394	30,171	0,791	17,136	12,102	50450,374	0,189	0,996	0,794	0,891
171,753	29,416	0,803	17,436	12,131	50458,599	0,188	0,997	0,806	0,903
171,753	30,171	0,803	17,000	11,832	50474,856	0,188	0,997	0,806	0,903

Lpp/B	Lpp/D	B/D	B/T	T/D	FB
5,648	9,944	1,761	2,611	0,674	5,579
5,648	9,944	1,761	2,571	0,685	5,403
5,839	9,850	1,687	2,500	0,675	5,670
5,693	10,103	1,775	2,629	0,675	5,524
5,554	10,355	1,865	2,761	0,675	5,386
5,648	9,944	1,761	2,532	0,695	5,222
5,839	9,850	1,687	2,462	0,685	5,490
5,693	10,103	1,775	2,589	0,685	5,349
5,885	10,007	1,700	2,517	0,675	5,614
5,554	10,355	1,865	2,720	0,686	5,215
5,738	10,263	1,789	2,647	0,676	5,470
5,598	10,520	1,879	2,780	0,676	5,333

5,648	9,944	1,761	2,493	0,706	5,034
5,839	9,850	1,687	2,425	0,696	5,305
5,693	10,103	1,775	2,550	0,696	5,169

PS (t)	dPS (t)	CMg (€)	CMm (€)	BP (BHP)	CEp (€)	CHf (€)
7 501,97	-348,08	7 182 401,05	9 002.366,61	10 323,00	3 922.739,85	816 000,00
7 525,68	-324,37	7 205 100,43	9 030 817,84	10 373,97	3 942 107,58	816 000,00
7 539,70	-310,35	7 218 516,95	9 047 634,00	10 328,59	3 924 863,69	816 000,00
7 539,70	-310,35	7 218 516,95	9 047 634,00	10 330,81	3 925 707,47	816 000,00
7 539,70	-310,35	7 218 516,95	9 047 634,00	10 333,00	3 926 540,68	816 000,00
7 549,39	-300,66	7 227 799,82	9 059 269,07	10 424,96	3 961 486,50	816 000,00
7 563,52	-286,52	7 241 330,48	9 076 228,30	10 379,63	3 944 260,29	816 000,00
7 563,52	-286,52	7 241 330,48	9 076 228,30	10 381,86	3 945 107,83	816 000,00
7 577,31	-272,74	7 254 527,56	9 092 769,42	10 336,33	3 927 806,74	816 000,00
7 563,52	-286,52	7 241 330,48	9 076 228,30	10 384,07	3 945 944,76	816 000,00
7 577,31	-272,74	7 254 527,56	9 092 769,42	10 338,57	3 928 657,03	816 000,00
7 577,31	-272,74	7 254 527,56	9 092 769,42	10 340,78	3 929 496,67	816 000,00
7 573,10	-276,95	7 250 499,20	9 087 720,30	10 475,99	3 980 876,59	816 000,00
7 587,35	-262,70	7 264 144,00	9 104 822,59	10 430,71	3 963 668,13	816 000,00
7 587,35	-262,70	7 264 144,00	9 104 822,59	10 432,95	3 964 519,44	816 000,00

PEr (t)	dPEr (t)	CEr (€)	CEq+CMe (€)	Cva (€)	CC total (€)	CC total (M€)
1 282,16	-81,84	1 250 103,00	5 988.842,85	2.217 361,05	24 390 971,56	24,39
1 282,16	-81,84	1 250 103,00	6 008 210,58	2 224 412,89	24 468 541,74	24,47
1 276,13	-87,87	1 244 226,57	5 985 090,26	2 225 124,12	24 476 365,33	24,48
1 292,39	-71,61	1 260 077,23	6 001 784,70	2 226 793,56	24 494 729,21	24,49
1 308,44	-55,55	1 275 730,96	6 018 271,63	2 228 442,26	24 512 864,85	24,51
1 282,16	-81,84	1 250 103,00	6 027 589,50	2 231 465,84	24 546 124,22	24,55
1 276,13	-87,87	1 244 226,57	6 004 486,85	2 232 204,56	24 554 250,19	24,55
1 292,39	-71,61	1 260 077,23	6 021 185,06	2 233 874,38	24 572 618,21	24,57
1 286,23	-77,77	1 254 075,33	5 997 882,07	2 234 517,90	24 579 696,95	24,58
1 308,44	-55,55	1 275 730,96	6 037 675,72	2 235 523,45	24 590 757,94	24,59
1 302,62	-61,38	1 270 051,45	6 014 708,48	2 236 200,55	24 598 206,01	24,60
1 318,80	-45,20	1 285 829,09	6 031 325,76	2 237 862,27	24 616 485,01	24,62
1 282,16	-81,84	1 250 103,00	6 046 979,59	2 238 519,91	24 623 719,00	24,62
1 276,13	-87,87	1 244 226,57	6 023 894,69	2 239 286,13	24 632 147,41	24,63
1 292,39	-71,61	1 260 077,23	6 040 596,67	2 240 956,33	24 650 519,58	24,65

Mm (t)	Me+h (t)	Mtot (t)
1 555,59	1 349,11	10 406,67
1 561,21	1 354,45	10 441,34
1 558,24	1 355,73	10 453,66

1 557,61	1 353,38	10 450,69
1 557,23	1 351,75	10 448,68
1 566,88	1 359,94	10 476,21
1 563,91	1 361,20	10 488,63
1 563,24	1 358,72	10 485,48
1 560,22	1 359,91	10 497,44
1 562,81	1 356,96	10 483,30
1 559,63	1 357,65	10 494,59
1 559,28	1 356,11	10 492,70
1 572,61	1 365,59	10 511,30
1 569,64	1 366,83	10 523,82
1 568,92	1 364,21	10 520,49

8.1. Dimensiones finales alternativas

DIMENSIONES FINALES		
Eslora total	176,506	m
Eslora entre perpendiculares	170,394	m
Manga	30,171	m
Calado	11,557	m
Puntal	17,136	m
Francobordo	5,579	m
Peso muerto	40 000,00	t
Número de Froude	0,189	
Coefficiente de bloque	0,827	
Coefficiente de la maestra	0,998	
Coefficiente prismático	0,829	
Coefficiente en la flotación	0,927	
Desplazamiento	50 379,25	t
Peso en rosca	10 379,25	t
Velocidad	15	nudos
Potencia	10 323,00	BHP
Potencia	7 697,86	kW

9. POTENCIA PROPULSORA

A continuación, realizaremos un cálculo preliminar de la potencia propulsora de nuestro buque mediante el software *NavCAD*. Por encontrarnos en la fase preliminar del diseño, algunos de los datos que necesitará el programa para el cálculo de la potencia se podrán calcular mientras que otros, por el contrario, se estimarán mediante el propio programa. Nuestra estimación se llevará a cabo mediante el método Andersen por encontrar el método *Holtrop* un fallo no resuelto.

En primer lugar, introduciremos los valores básicos solicitados por el programa y determinaremos un rango de velocidades para nuestro buque teniendo como condición de diseño nuestra velocidad de 15 nudos.

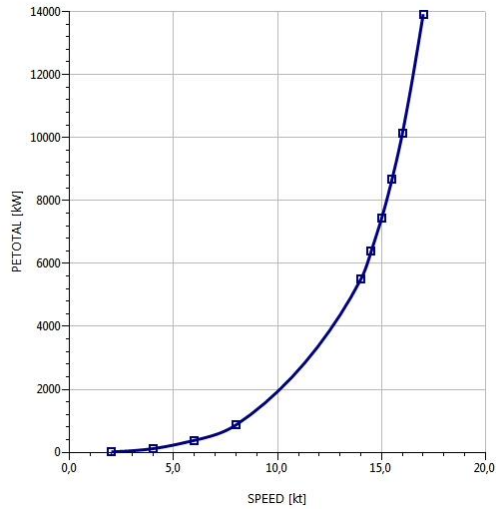
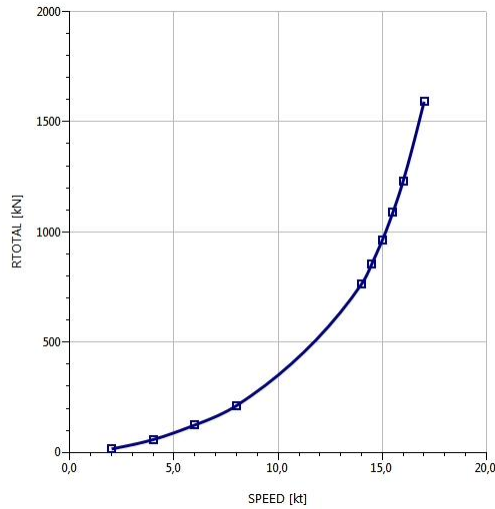
Continuaremos introduciendo los datos requeridos por el programa teniendo en cuenta que será una estimación basada en nuestro buque base:

Project			Hull		
Project ID:			Configuration:	Monohull	
Description:			Chine type:	Round/multiple	
Summary			General		
Scope:	ITTC-78 (CT)		Length on WL:	176,500	m
Configuration:	Monohull		Max beam on WL:	30,171	m
Chine type:	Round/multiple		Max molded draft:	11,157	m
Length on WL:	176,500	m	Displacement:	50379,25	t
Displacement:	50379,25	t	Wetted surface:	8077,8	m ²
Propulsor type:	Propeller		Demi-hull spacing:		m
Count:	1		ITTC-78 (CT)		
Water properties			LCB fwd TR:	88,250	m
Water type:	Salt		LCF fwd TR:	98,683	m
Density:	1026,00	kg/m ³	Max section area:	317,1	m ²
Viscosity:	1,18920e-6	m ² /s	Waterplane area:	4976,4	m ²
Speeds			Bulb section area:	35,0	m ²
Speed [01]:	2,00	kt	Bulb ctr below WL:	0,000	m
Speed [02]:	4,00	kt	Bulb nose fwd TR:	180,500	m
Speed [03]:	6,00	kt	Imm transom area:	40,0	m ²
Speed [04]:	8,00	kt	Transom beam WL:	20,000	m
Speed [05]:	14,00	kt	Transom immersion:	0,000	m
Speed [06]:	14,50	kt	Half entrance angle:	59,58	deg
Speed [07]:	15,00	kt	Bow shape factor:	1,0	[WL flow]
Speed [08]:	15,50	kt	Stern shape factor:	1,0	[WL flow]
Speed [09]:	16,00	kt	Planing		
Speed [10]:	17,00	kt	Proj chine length:		m
Design condition			Proj bottom area:		m ²
Design speed:	15,00	kt	LCG fwd TR:		m
			VCG below WL:		m
			Aft station (fwd TR):		m
			Deadrise:		deg

También tendremos que tener en cuenta el porcentaje y margen de diseño basado no solamente en el casco, sino que además tendrá en cuenta otros márgenes que se oponen en la resistencia al avance del buque como pueden ser las olas o el viento.

Appendage		Margin	
Definition:	Percentage	Design margin:	10 %
Percent of hull drag:	5,00 %	Basis:	Hull + added dr...

Gracias a estos datos obtendremos el cálculo de la resistencia al avance del buque en kN frente a la velocidad de avance, así como el de la potencia efectiva necesaria para moverse a la velocidad de servicio.



En vista de estos cálculos tendremos que el buque ofrece una resistencia total al avance de 963,82 kN siendo necesaria una potencia efectiva de 7 437,5 kW navegando a la velocidad de servicio de 15 nudos.

Se adjunta como Anexo II el reporte obtenido del programa Navcad.

Prediction results									
SPEED [kt]	SPEED COEFS		ITTC-78 COEFS						
	FN	FV	RN	CF	[CTLT/CF]	CR	dCF	CA	CT
2,00 !	0,025	0,054	1,53e8	0,001961	1,344	0,000001	0,000000	0,000488	0,003125
4,00 !	0,049	0,109	3,05e8	0,001783	1,344	0,000001	0,000000	0,000477	0,002875
6,00	0,074	0,163	4,58e8	0,001690	1,344	0,000001	0,000000	0,000454	0,002727
8,00	0,099	0,217	6,11e8	0,001629	1,344	0,000001	0,000000	0,000432	0,002621
14,00	0,173	0,380	1,07e9	0,001518	1,337	0,000673	0,000000	0,000374	0,003076
14,50	0,179	0,394	1,11e9	0,001511	1,335	0,000828	0,000000	0,000370	0,003216
+ 15,00 +	0,185	0,407	1,15e9	0,001505	1,334	0,001008	0,000000	0,000366	0,003382
15,50	0,192	0,421	1,18e9	0,001499	1,332	0,001217	0,000000	0,000362	0,003575
16,00	0,198	0,434	1,22e9	0,001493	1,330	0,001455	0,000000	0,000358	0,003799
17,00	0,210	0,462	1,30e9	0,001482	1,325	0,002032	0,000000	0,000350	0,004347
RESISTANCE									
SPEED [kt]	RBARE [kN]	RAPP [kN]	RWIND [kN]	RSEAS [kN]	RCHAN [kN]	RTOWED [kN]	RMARGIN [kN]	RTOTAL [kN]	
2,00 !	13,71	0,69	0,00	0,00	0,00	1,44	1,44	15,83	
4,00 !	50,45	2,52	0,00	0,00	0,00	5,30	5,30	58,28	
6,00	107,67	5,38	0,00	0,00	0,00	11,31	11,31	124,36	
8,00	183,96	9,20	0,00	0,00	0,00	19,32	19,32	212,47	
14,00	661,17	33,06	0,00	0,00	0,00	69,42	69,42	763,66	
14,50	741,52	37,08	0,00	0,00	0,00	77,86	77,86	856,45	
+ 15,00 +	834,48	41,72	0,00	0,00	0,00	87,62	87,62	963,82	
15,50	942,05	47,10	0,00	0,00	0,00	98,92	98,92	1088,07	
16,00	1066,53	53,33	0,00	0,00	0,00	111,99	111,99	1231,85	
17,00	1377,81	68,89	0,00	0,00	0,00	144,67	144,67	1591,37	
EFFECTIVE POWER									
SPEED [kt]	PEBARE [kW]	PETOTAL [kW]	CTLR	CTLT	RBARE/W				
2,00 !	14,1	16,3	0,00001	0,04537	0,00003				
4,00 !	103,8	119,9	0,00001	0,04174	0,00010				
6,00	332,3	383,9	0,00001	0,03959	0,00022				
8,00	757,1	874,4	0,00001	0,03805	0,00037				
14,00	4761,9	5500,0	0,00977	0,04466	0,00134				
14,50	5531,3	6388,7	0,01202	0,04669	0,00150				
+ 15,00 +	6439,4	7437,5	0,01464	0,04910	0,00169				
15,50	7511,8	8676,1	0,01766	0,05191	0,00191				
16,00	8778,8	10139,5	0,02112	0,05515	0,00216				
17,00	12049,7	13917,4	0,02950	0,06311	0,00279				

10. ESTIMACIÓN DEL FRANCOBORDO

Dentro del proceso de definición de las características principales de un proyecto preliminar, ha de calcularse el valor mínimo reglamentario de francobordo, para comprobar en las posteriores fases de diseño que el francobordo asignado está siempre por encima de este. Es por ello, que el cálculo del francobordo es una operación muy repetida en la espiral de diseño.

A continuación, vamos a realizar una primera aproximación del cálculo de francobordo siguiendo las indicaciones del *Convenio Internacional de Líneas de Carga de 1966*.

10.1. Francobordo tabular

En primer lugar, se trata de establecer de qué tipo de buque se trata (tipo A o B):

- Un buque tipo A es aquel buque destinado a transportar cargas líquidas a granel, con una alta integridad de la cubierta expuesta a la intemperie, así como una gran resistencia a la inundación debido a su grado de subdivisiones.
- Un buque tipo B será todo aquel que no cumpla con los criterios del tipo A.

Nuestro buque será, por tanto, de tipo B.

Introduciendo ciertos valores como son el 96% de la eslora en la flotación al 85% del puntal o la eslora entre perpendiculares al 85% del puntal, obtendremos el valor del francobordo tabular para nuestro buque:

$$FB_T = 2\,760\text{ mm}$$

10.2. Correcciones

10.2.1. Corrección por coeficiente de bloque

$$C_{cb} = \frac{Cb_{85\%D} + 0,68}{1,36} = \frac{0,835 + 0,68}{1,36} = 1,14$$

10.2.2. Corrección por puntal

$$C_D = \left(D - \frac{L}{15}\right) \cdot R = \left(17,136 - \frac{172,3}{15}\right) \cdot 250 = 1\,415\text{ mm}$$

10.2.3. Corrección por superestructuras

Si la longitud de la superestructura del buque es menor que la eslora del buque, se aplica la corrección un producto según la siguiente tabla:

E/L	0	0,1	0,2	0,3	0,4	0,5	0,6	0,7	0,8	0,9	1
Tipo A	0	7	14	21	31	41	52	63	75,3	87,7	100
Tipo B	0	5	10	15	23,5	32	46	63	75,3	87,7	100

La superestructura de nuestro barco medirá aproximadamente 15 *metros*. Su relación eslora-manga es entonces:

$$\frac{E}{L} = \frac{15}{172} = 0,08 \approx 0,1$$

Por lo tanto, para nuestro buque tipo B con una relación de 0,1, el producto de la corrección será de 5.

$$C_s = 1\,070 \cdot 5\% = 53,3 \text{ mm}$$

10.2.4. Corrección por arrufo

$$\begin{aligned} C_{arr} &= \left(1 - \frac{A}{100}\right) \cdot (4,168 \cdot L + 125) \cdot \left(0,75 - \frac{E}{2 \cdot L}\right) \\ &= \left(1 - \frac{0}{100}\right) \cdot (4,168 \cdot 172 + 125) \cdot \left(0,75 - \frac{15}{2 \cdot 172}\right) = 594,71 \end{aligned}$$

Dónde:

- A: porcentaje del área de la curva real de arrufo respecto al área de la curva estándar. Nuestro buque no tendrá arrufo, así que consideraremos este dato igual a 0.

10.3. Francobordo mínimo total

$$FB = FB_T \cdot C_{Cb} + C_D - C_s + C_{arr} = 2\,760 \cdot 1 + 1\,415 - 53,3 + 594,71 = 4\,716,41 \text{ mm}$$

11. DIMENSIONAMIENTO FINAL

DIMENSIONES FINALES		
Eslora total	176,50	m
Eslora entre perpendiculares	170,40	m
Manga	30,17	m
Calado	11,56	m
Puntal	17,14	m
Francobordo	5,58	m
Francobordo mínimo	4,72	m
Peso muerto	40 000,00	t
Número de Froude	0,189	
Coeficiente de bloque	0,827	
Coeficiente de la maestra	0,998	
Coeficiente prismático	0,829	
Coeficiente en la flotación	0,927	
Desplazamiento	50 379,25	t
Peso en rosca	10 379,25	t
Velocidad	15	nudos
Potencia	9 973,69	BHP
Potencia	7 437,50	kW

12. ESPECIFICACIÓN PRELIMINAR

La especificación es una descripción del buque, y de sus servicios que, con mayor o menor definición forma parte del *Proyecto de Oferta y Proyecto de Contrato del buque*. La Especificación incluye los siguientes apartados:

- Generalidades.
- Casco.
- Equipo, armamento e instalaciones.
- Maquinaria auxiliar de cubierta.
- Instalación propulsora.
- Maquinaria auxiliar de propulsión.
- Cargos, pertrechos y respetos.
- Instalaciones especiales.

12.1. Generalidades

12.1.1. Tipo de buque

Se diseñará un buque tipo *bulkcarrier portacontenedores* de 40 000 toneladas para el transporte de grano, carbón y mineral, así como dos alturas de contenedores en cubierta. Además, podrá llevar madera estibada en cubierta.

La tendencia en este tipo de buques de peso muerto a la hora de su construcción es la de darles el mayor tamaño posible con el objetivo de tener la ventaja de su economía de escala: cuanto más grande el buque, mayor el de carga y con ello mayor beneficio. Es por esto que poseen grandes bodegas cubiertas con amplias escotillas que faciliten en gran medida los trabajos de carga y descarga.

Los espacios de maquinaria se sitúan a popa al igual que el bloque de acomodación que coincide justo por encima de este espacio y se levanta sobre la cubierta principal.

Las tapas de escotillas se dimensionarán para el transporte de contenedores de 20 y 40 *pies*.

La carga y descarga de la mercancía se realizará por medio de una serie de grúas situadas en cubierta.

Como espacios de lastre se aprovecha el doble fondo del buque y en caso de necesitarlo, cuenta además con tanques encima de las bodegas para el agua de lastre que dan a la bodega forma de tolva, lo que facilita la acomodación de la carga y evita los posibles corrimientos de la misma.

12.1.2. Características principales

El buque contará aproximadamente con las siguientes características:

CARACTERÍSTICAS PRINCIPALES		
Eslora total	176,506	m
Eslora entre perpendiculares	170,394	m

Manga	30,171	m
Calado	11,557	m
Puntal	17,136	m
Francobordo	5,579	m
Peso muerto	40 000,00	t
Desplazamiento	50 379,25	t
Velocidad	15	nudos
Potencia	7 500	kW
Tripulantes	20,00	personas

12.1.3. Tripulación

La tripulación consta de 20 personas distribuidas de la siguiente forma:

TRIPULACIÓN							
PUENTE		SALA DE MÁQUINAS		CUBIERTA		COCINA	
Capitán	1	Jefe de máquinas	1	Contraestre	1	Cocinero	1
Oficiales	3	Oficiales	3	Marineros	3	Camarero	1
		Engrasador	1	Bombero	1	Marmitón	1
		Electricista	1	Mozos	2		

El buque dispondrá de veintiún camarotes individuales con aseo privado, uno de ellos dispuesto en la cubierta de gobierno para el Práctico y cuatro de ellos dotados de despacho. Contará, además, con un camarote doble para alumnos y otro con aseo y despacho para el Armador.

Se encontrarán los siguientes locales de servicio a lo largo de buque:

- Pañoles diversos.
- Gambuzas.
- Lavandería.
- Aseo público en cubierta.
- Vestuario y taquillas.
- Cocina.
- Comedores de oficiales y marinería.
- Salas de estar de oficiales y marinería.
- Sala de fumadores.
- Enfermería.
- Gimnasio.
- Sala de juntas.
- Aseo público en la cubierta de puente.

12.1.4. Capacidades

La capacidad total de las bodegas rondará los 55 000 m³ repartidos en cinco bodegas dispuestas de proa a popa.

La capacidad de carga de los contenedores que pueden ser transportados sobre las tapas de escotilla dependerá los requisitos mínimos de estabilidad pero será cercana a los 160 *TEUS*.

12.1.5. Peso muerto

El peso muerto del buque viene fijado por la RPA del proyecto y corresponde a 40 000 *TPM*.

12.1.6. Formas y estabilidad

La proa llevará bulbo y las cubiertas no dispondrán de arrufo.

12.1.7. Potencia y velocidad

Una vez conocidas las características principales del buque realizaremos una predicción de la potencia teniendo en cuenta lo que nos indican los requerimientos de diseño, es decir, velocidad de servicio de 15 *nudos*; 85% *MCR* y 15% margen de mar.

12.1.8. Ensayos en el canal de experiencias

Con el fin de lograr un mejor rendimiento “potencia/velocidad”, las formas de la carena del buque serán sometidas a estudio de un Canal de Experiencias, desarrollándose por dicho Centro los ensayos y estudios siguientes:

- Remolque a cuatro calados (Lastre, plena carga, carga intermedia y pruebas de mar).
- Autopropulsión a los cuatro calados indicados anteriormente.
- Propulsor aislado.
- Cavitación.
- Ensayo de líneas de corriente a plena carga.
- Ensayo de determinación de estela a plena carga.
- Dimensionamiento del timón.

12.1.9. Vibraciones

El Constructor efectuará un estudio y análisis del proyecto y planos constructivos de la estructura, para limitar los niveles de ruidos y vibraciones del buque, a aquellos que se establezcan en esta Especificación como aceptables, asegurando de esta manera el confort de la tripulación y evitando posibles daños en las instalaciones y equipos del buque que puedan alterar el correcto funcionamiento de los mismos.

En el caso de apreciarse en el buque terminado, vibraciones no aceptables, el Astillero a su cargo, tomará las medidas oportunas para reducir dichas vibraciones a niveles aceptables, siguiendo las recomendaciones de la Sociedad de Clasificación.

Se prestará especial atención al proyecto estructural de la zona de popa para evitar vibraciones debidas a la acción de la hélice.

Se calcularán las frecuencias y vibraciones torsionales de la línea de ejes y del sistema propulsor, y los valores que resulten de tales cálculos se someterán a la aprobación de la Sociedad Clasificadora, fabricante del motor y se enviará al Armador para su información.

Durante las pruebas del buque, se realizarán las mediciones correspondientes por el Astillero y certificadas por la Sociedad de Clasificación, para determinar la cumplimentación de los límites establecidos. Estas mediciones se realizarán de acuerdo con un método aprobado por la citada Sociedad de Clasificación. A dichas mediciones asistirá también la inspección del Armador.

Si durante el periodo de garantía hubiese vibraciones anormales a juicio de la Sociedad de Clasificación, el Constructor corregirá esta diferencia sin coste adicional para el Armador, de acuerdo con el Contrato.

12.1.10. Clasificación y reglamentos de aplicación

El buque, con todo su equipo y maquinaria, será construido de acuerdo con los Reglamentos y bajo vigilancia especial de la Sociedad de Clasificación Bureau Veritas.

Con independencia de las exigencias anteriores, el buque cumplirá además con:

- Organización Marítima Internacional (OMI). Reglamento del SOLAS 1974. Consolidado 2009.
- Organización Marítima Internacional (OMI). Reglamento del MARPOL 73/78. Edición refundida 2011.
- Código Internacional de Estabilidad sin avería, 2008 (Código IS 2008), adoptado el 4 de diciembre de 2008 mediante Resolución MSC 267(85).
- Resolución MSC 143(77) (adoptada el 5 de junio de 2003). Adopción de Enmiendas al Protocolo de 1988 relativo al Convenio Internacional sobre Líneas de Carga, 1966.
- Convenio Internacional 23 de junio de 1969, sobre Arqueo de Buques hecho en Londres. BOE núm. 221.

12.1.11. Planos y documentos

La Especificación y planos contractuales estarán redactados en castellano, así como los planos principales.

Todas las indicaciones, placas rótulo, etc., de todo el buque, estarán en castellano. Los libros de instrucciones estarán en inglés y en castellano, siempre que sea posible.

Se adjuntarán los siguientes planos:

- Plano de formas.
- Plano de tanques.
- Planos de Disposición General.
- Cuaderna Maestra.

12.1.12. Pruebas

Además de las pruebas exigidas por la Sociedad de Clasificación, el buque será sometido a una serie de pruebas antes de su entrega, con objeto de comprobar que todas sus instalaciones, equipos y maquinaria se comportan correctamente, de acuerdo con los objetivos que de ellos se pretende, así como con los requisitos de la presente Especificación y Contrato.

Entre dichas pruebas se encuentran: pruebas de equipos y servicios, pruebas de taller (motor propulsor, motor diésel...), pruebas de estabilidad, sobre amarras y funcionamiento general y pruebas de mar.

12.2. Casco

El casco se construirá con chapas y perfiles de acero. La construcción será totalmente soldada al igual que el doble fondo.

En la Cámara de Máquinas se reforzará especialmente, de manera que se eliminen las vibraciones anormales.

Todas las cubiertas serán totalmente de acero. Toda la superestructura será de acero, salvo en la zona en que requieran otra cosa.

12.3. Equipo, armamento e instalaciones

12.3.1. Equipo de fondeo, amarre y remolque

Se dispondrá de:

- 3 anclas sin cepo (una de respeto).
- Cadena con concreto.
- 2 escobenes de anclas.
- 1 cable de remolque de 200 metros de longitud.
- 2 molinetes.
- 4 winches.
- Bitas dobles de amarre y remolque.

El amarre y fondeo se controla con el numeral de equipo, el cual se definirá con lo especificado en el citado Reglamento.

12.3.2. Medios de salvamento

De acuerdo con el capítulo III del SOLAS, se instalan en el buque proyecto los siguientes dispositivos y medios de salvamento:

- Aros salvavidas: cumpliendo con la Regla 32.1, Capítulo III, Parte B, Sección III del SOLAS, llevará 12 aros salvavidas.
- Chalecos salvavidas: cumpliendo con la Regla 32.2, Capítulo III, Parte B, Sección III del SOLAS, se debe disponer en este caso de 20 chalecos salvavidas, uno por cada persona a bordo.

- Trajes de inmersión: se dispondrá de 20 trajes, uno por persona, entendiendo por traje de inmersión un traje protector que reduce la pérdida de calor corporal de un náufrago que lo lleve puesto en aguas frías.
- Botes salvavidas: cumpliendo con la Regla 31.1, Capítulo III, Parte B, Sección III del SOLAS, el buque dispondrá de dos botes salvavidas totalmente cerrados que cumplan con lo prescrito en la sección 4.6. del Código con una capacidad de 20 personas a cada banda.
- Balsas salvavidas: se dispondrá de dos balsas con capacidad para 14 personas cada uno de ellos.
- Bote de rescate: cumpliendo con la Regla 31.2, Capítulo III, Parte B, Sección III del SOLAS, los buques de carga deben llevar al menos un bote de rescate.

12.3.3. Habilitación de alojamientos

El buque dispondrá de diez camarotes individuales dotados de despacho y cinco camarotes dobles. Se dispondrá además de un camarote con aseo para el Armador. La disposición de la habilitación será aprobada por el Armador y variada por el mismo siempre que no se altere el volumen total ocupado, ni los equipos y materiales a emplear. Todos los muebles serán de madera noble barnizada.

Los mamparos de aseos, cocina, gambuza, local de CO_2 , pañoles y locales de maquinaria en general serán de acero. En el resto de los locales serán no metálicos. Se pondrá especial atención en el aislamiento de la cámara de máquinas así como en los alojamientos y zonas habitables.

En los locales de cocina, gambuza, lavandería y gimnasio se dispondrá de todos los equipos necesarios para crear un ambiente funcional y práctico para la tripulación.

12.3.4. Aire acondicionado y ventilación

Cada bodega de carga dispondrá de troncos de entrada y salida y hongos para obtener un cambio de aire por hora.

En la zona de acomodación se instalará un sistema general de ventilación mecánico y natural, que cumplirá con lo especificado en el SOLAS.

12.3.5. Equipos de navegación y comunicaciones

Se dispondrá a bordo de los aparatos necesarios para el equipo de comunicaciones del buque con el exterior. Este sistema cumplirá con los requerimientos para GMDSS internacionalmente aceptados. Contará como es común en estos buques con un equipo de comunicación vía satélite y una estación de radio (radiobalizas de emergencia, sistema Navtex, radioteléfonos VHF con DSC...).

Además contará con un equipo de comunicaciones interiores (sistema de interfonos de cubierta, sistema de órdenes y avisos generales con altavoces en diferentes zonas...).

12.3.6. Medios de contraincendios

Se dispondrá una instalación sofocadora de incendios por medio de gas CO₂, capaz de cubrir la cámara de máquinas, el local del generador de emergencia así como las bodegas de carga. Las baterías de botellas estarán dispuestas de modo que el accionamiento de la salida de gases pueda ser realizado desde el exterior de la cámara de máquinas. Esta instalación estará dividida en secciones, con el fin de que un incendio en un departamento no deje inundados los otros.

Se dispondrá a su vez de:

- 1 conexión internacional a tierra.
- 2 equipos de bombero completos.
- 15 extintores de polvo seco.
- Diversas bocas de contraincendios.
- 15 mangueras de lona de tejido tupido provistas cada una de acoplamiento y boquilla.
- 2 sistemas fijos de detección de incendios y de alarma contraincendios dispuestos de detector de humos y avisadores acústicos y visuales.

12.3.7. Equipo de servicio de carga

El buque tendrá cinco bodegas totalmente moduladas para el transporte de grano, mineral y carbón. Cada una de ellas contará con escotillas estancas de accionamiento hidráulico.

Las escotillas se dimensionarán y dispondrán de los apoyos pertinentes para poder estibar los contenedores de 20 y 40 *pies*.

Contará con tres grúas de carga y descarga sobre cubierta.

12.3.8. Instalación eléctrica principal

El buque dispondrá de una instalación eléctrica en corriente alterna trifásica a 50 *Hz* compuesta por dos redes trifásicas a 380 *V*, para fuerza, una principal y otra de emergencia, y otra a 220 *V* monofásica para los servicios de alumbrado, comunicaciones y aparatos de pequeño consumo.

Se instalará en un local todo lo necesario para la conexión con tierra, la cual estará prevista para una intensidad de 200 *A* y manguera de 80*m*.

El buque dispondrá de las luces de navegación y señales necesarias según el *Reglamento Internacional de Abordajes*.

Se dispondrán enchufes para contenedores frigoríficos autónomos en cubierta.

12.3.9. Botiquín

Se suministrará un botiquín, de acuerdo con las exigencias de las Autoridades españolas.

12.3.10. Paños y cajas de almacenamiento

Se dispondrán los pañoles del Contra maestre, Máquinas, etc. según Disposición General. Los pañoles estarán dispuestos de las baldas necesarias y de los elementos de fijación de los respetos.

Sobre la Cubierta Principal, y según disposición aprobada por el Armador, se dispondrán cajas metálicas con tapa y trincas, para almacenar todas las trincas y fittings para la estiba de contenedores.

12.4. Maquinaria auxiliar de cubierta

12.4.1. Equipo de gobierno

El buque será maniobrado mediante un servo electrohidráulico con consola eléctrica de mando en el puente y conexión a piloto automático.

Este servomotor estará dimensionado para ser capaz de efectuar un giro de banda a banda de 65°, con máximo calado y con velocidad de servicio, en no más de 28 segundos.

12.4.2. Timón y mecha

El timón será semisuspendido con perfil currentiforme. La mecha se acoplará al timón por medio de un cono ajustado, en su extremo inferior, por una tuerca.

12.4.3. Equipos de maniobra de cubierta

Para la maniobra de amarre y fondeo del buque, se dispondrán en el castillo de proa de dos molinetes provistos cada uno de barbotén, cabirón y carretel. Para el accionamiento de los mismos se dispondrá de dos bombas, una para cada máquina.

Además se dispondrán en popa dos maquinillas para la maniobra de amarre provistas cada una de ellas de cabirón y carretel.

12.5. Instalación propulsora

12.5.1. Motor propulsor

El motor propulsor ser de dos tiempos y capaz de administrar una potencia continua de aproximadamente 11 000 kW.

12.5.2. Línea de ejes

Estará compuesta por una hélice de paso fijo, el eje de cola, una reductora y el acoplamiento elástico.

Además contará con una hélice transversal en proa para maniobras en puerto.

12.6. Maquinaria auxiliar de propulsión

12.6.1. Servicio del motor propulsor

Todas las bombas y restantes aparatos correspondientes a los servicios del Motor Propulsor serán de las características que el fabricante fije de dicho Motor.

Su distribución en la Cámara de motores se hará de forma tal que quede espacio suficiente para facilitar el manejo, mantenimiento y desmontaje de dichos aparatos y máquinas, así como de las tuberías y conducciones eléctricas.

12.6.2. Contraincendios y baldeo

El buque contará con una instalación de extinción de incendios por medio de agua salada. Las tuberías de este servicio también se usarán para labores de baldeo.

Ambos servicios usarán una red de tuberías centralizadas en un colector que se extenderá a lo largo de la eslora del buque, de él se derivarán distintos ramales hacia los locales pertinentes.

El *Capítulo II-2, Parte A, Regla 5 del SOLAS* detalla las prescripciones relativas a los medios de extinción de incendios en los espacios de máquinas.

Este buque estará provisto de un sistema de extinción de incendios con CO_2 que cubrirá la cámara de máquinas, el local del generador de emergencia y las bodegas de carga.

12.6.3. Lastre, sentina y agotamiento

Se dispondrá de un servicio de lastre que podrá realizar el lastrado y deslastrado de todos los tanques destinados a tal fin, pudiendo, además, efectuar el trasiego de tanques de proa a los de popa y viceversa, para corregir el trimado del buque. Asimismo, las bombas de lastre podrán hacer el trasiego entre los tanques laterales previstos para la corrección de escora.

El achique normal de sentina será realizado mediante electrobombas. Se dispondrá de dos aspiraciones en cada bodega, una a cada banda y situadas lo más cerca posible del mamparo de popa de cada una de las bodegas. En cámara de máquinas deben achicarse cada cuatro horas las pérdidas de agua, combustible, aceite, etc.

Para el vaciado total de tanques se dispondrán, en el lugar más conveniente, tapones de fondo.

12.6.4. Instalaciones y servicios sanitarios

Se contará con agua dulce sanitaria para ser empleada en duchas, retretes y lavandería así como de un calentador para el agua dulce para suministrar duchas, cocina, lavandería, oficios, lavabos y purificadores de combustible y aceite.

Todas las descargas se centralizarán en una planta séptica de adecuada capacidad para el tratamiento de aguas fecales y que cumpla con MARPOL.

Tanto la cubierta principal como la superestructura contarán con sus correspondientes imbornales.

12.6.5. Taller

Existirá un taller con las herramientas y equipos necesarios para un óptimo trabajo de los mecánicos del buque.

12.6.6. Sistemas MARPOL

Dispondrá de una planta de tratamiento de aguas residuales, un separador de sentinas, un sistema de tratamiento de residuos y un incinerador con las características y correspondiente equipación que estipula el *Convenio MARPOL*.

12.7. Cargos y respetos

Todos los cargos del buque serán suministro del Armador. Los respetos reglamentarios y herramientas de las instalaciones suministras por el Constructor, serán suministrados por el mismo.

Serán suministro del Astillero todos los equipos y elementos de material náutico, salvamento y contraincendios reglamentarios y relacionados en esta Especificación.

El Astillero estibarà a bordo los respetos extra suministrados por el Armador.

Se suministrarán las herramientas especiales de desmontaje de la diferente maquinaria del buque, que se tendrán que considerar en los pedidos del Astillero a los diferentes suministradores.

12.8. Instalaciones especiales

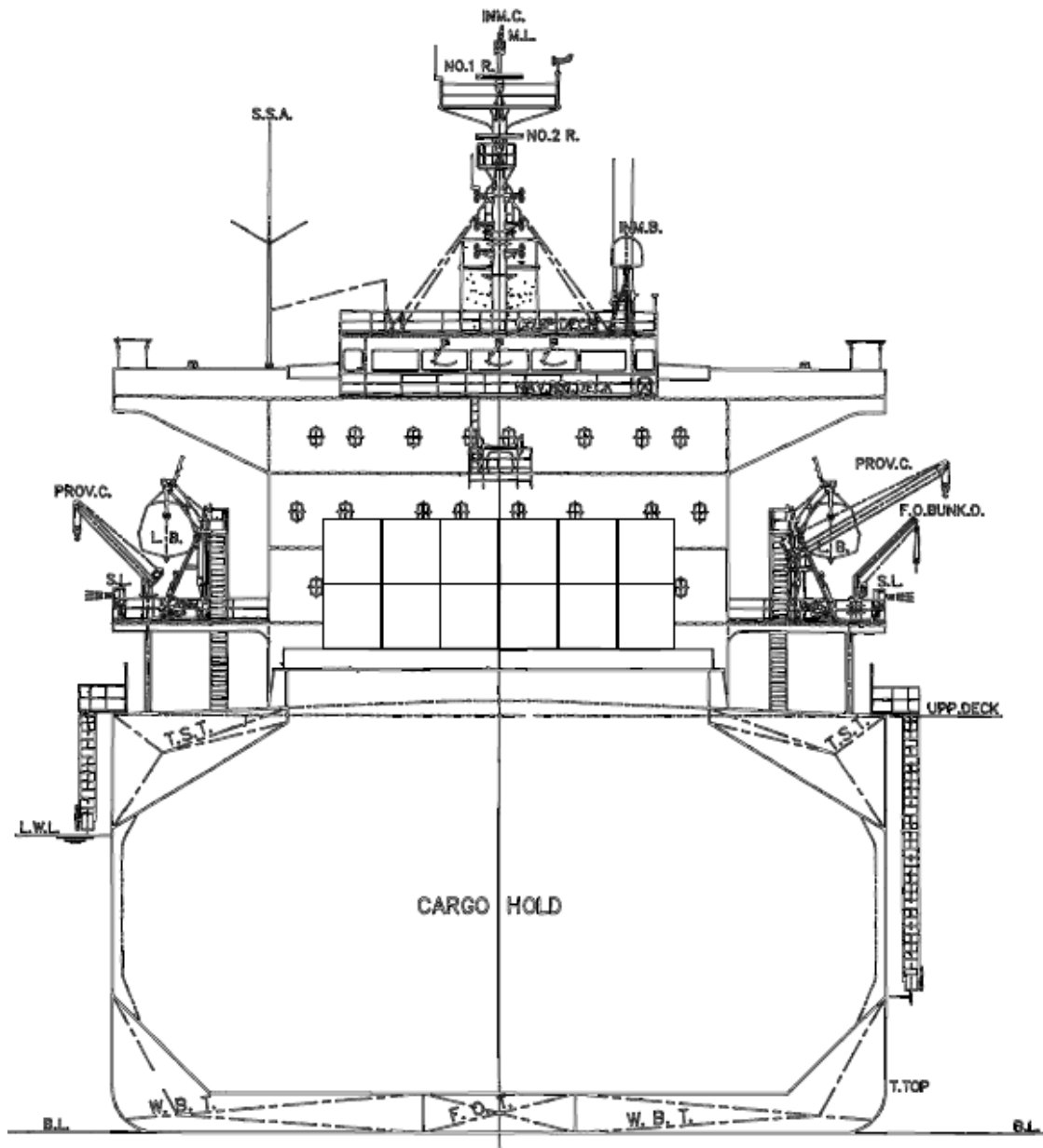
El buque dispondrá de una cabina de control de máquinas, un centro de control en el puente de gobierno y sistemas de control local de equipos auxiliares.

Contará con sistemas de estabilización pasiva y sistemas especiales de corrección de escora y asiento.

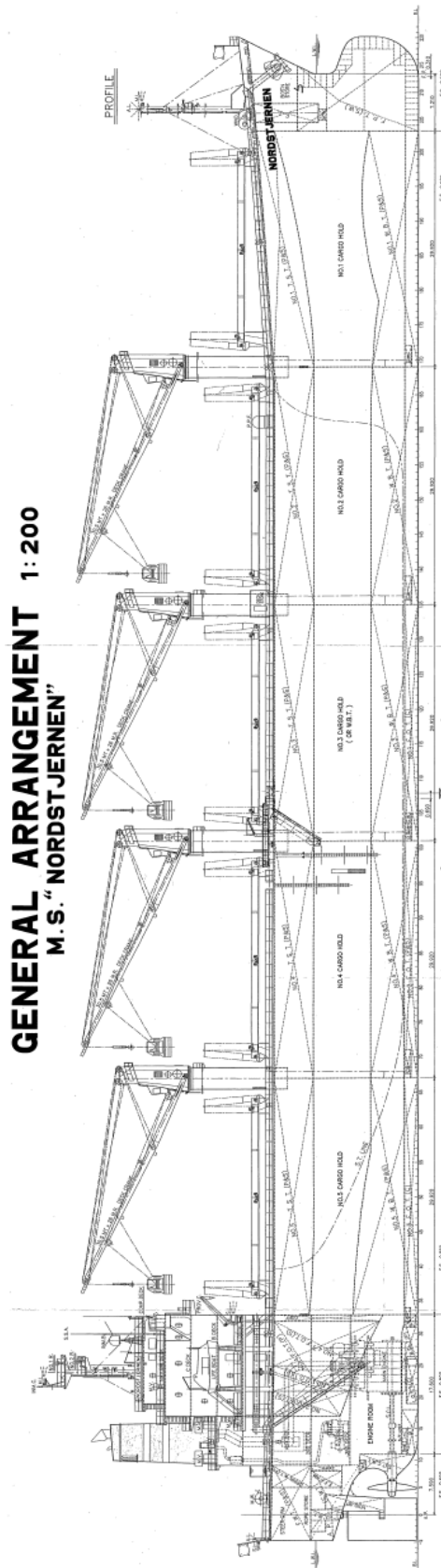
Además, dispondrá de instalaciones y equipos especiales de contraincendios de carácter estructural, instalaciones rociadoras de agua y equipos detectores de incendios en cámara de máquinas.

13. CROQUIS PRELIMINAR

13.1. Sección transversal



13.2. Sección longitudinal



ANEXO I

Base de datos



JIN HUI: innovative bulk carrier design from Oshima

Shipbuilder: ...Oshima Shipbuilding Co Ltd, Japan
 Vessel's name:*Jin Hui*
 Hull number:10258
 Owner/operator:
*Jin Hui Marine Inc, Hong Kong*
 Designer:
*Oshima Shipbuilding Co Ltd, Japan*
 Flag:*Hong Kong*
 Total number of sister ships already completed:
 Total number of sister ships still on order:

O SHIMA Shipbuilding has become something of a specialist in bulk carrier design since its founding in 1976 and, since 1992, it has promoted the view that double-skin construction is a major factor in bulk carrier safety, and has developed its designs accordingly. However, accepting that for various reasons, opinion is not yet fully convinced of the advantages of the concept, the yard has now developed its imaginative Newbulk design, aimed at overcoming some of the main objections to a double skin.

It is understood that the design complies with the new IACS unified bulk carrier rules, and that the yard have now patented the concept, which, as demonstrated by *Jin Hui*, has been conceived as a part double-hull arrangement with only the first and last hold (in this case Nos 1 and 5 of the five-hold vessel) having a double skin. As well as underlining the long-stated benefits of the double hull, providing an inner skin and thereby a smooth surface in these two holds, which are the ones most affected by narrowing hull shape, it is additionally beneficial to cargo handling and hold cleaning by eliminating most of the awkward spaces where cargo can accumulate.

At present, the Newbulk design is available in four shallow draught sizes: 30,000dwt, 48,000dwt, 51,000dwt (as *Jin Hui*) and 74,000dwt. The principle has also been partially adopted for a 90,000dwt collier, but with the double skin in only No 7 (the aftermost hold).

Nos 2, 3 and 4 holds have been built to conventional bulk carrier design with top and bottom wing tanks, and the double-bottom space is divided into three by two longitudinal girders, with the side compartments joined with the bottom wing tanks to form a common water ballast space. The centre tanks are used for bunkers. Bodily sinkage in the ballast condition is aided by making No 3 hold (midships) floodable. A feature of Oshima's recent designs has been the use of inward-

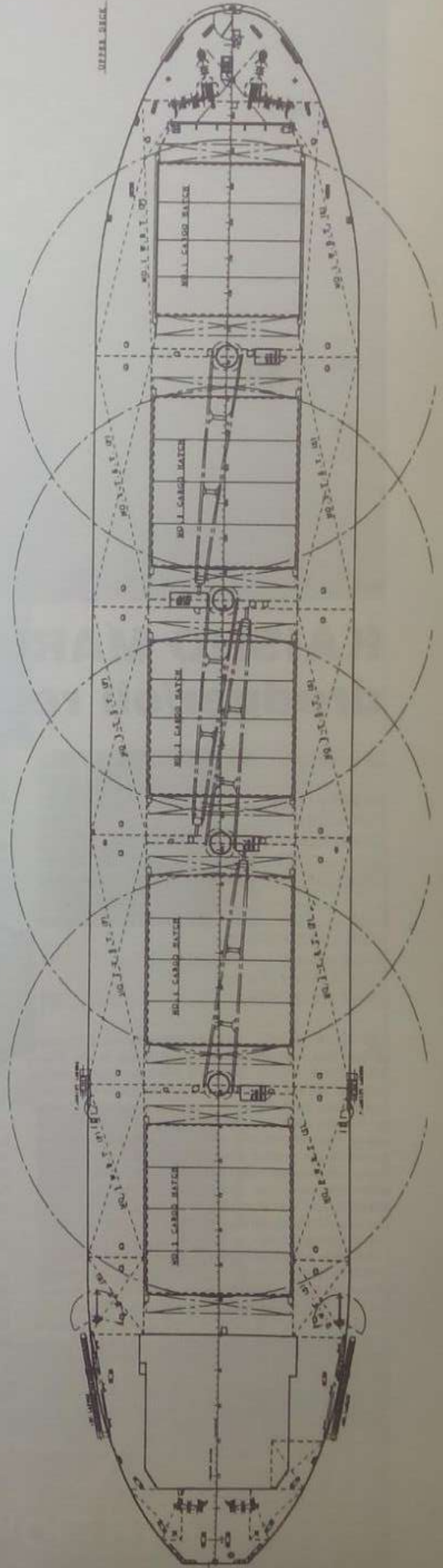
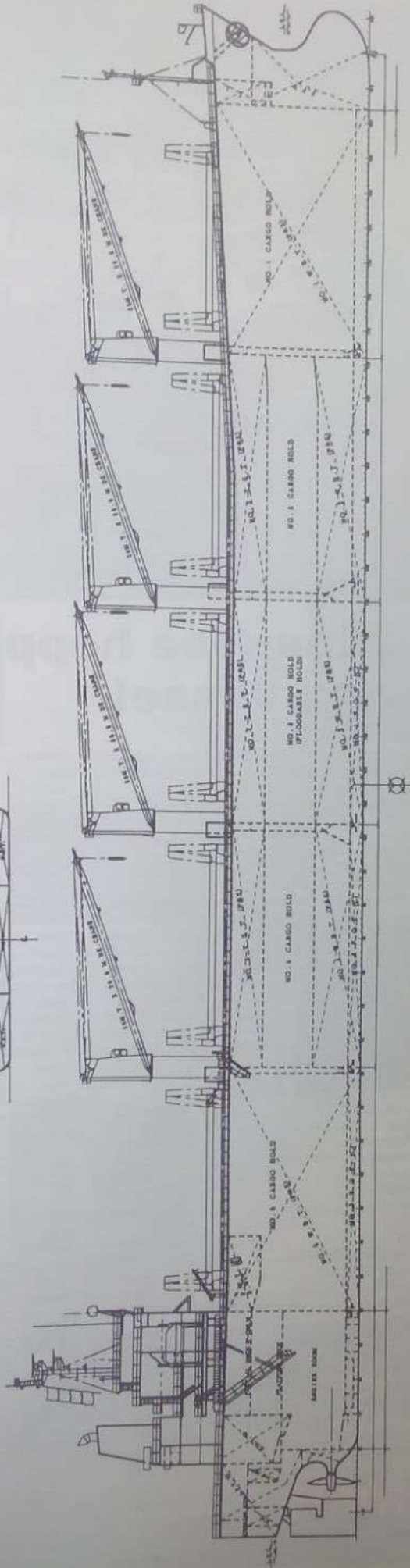
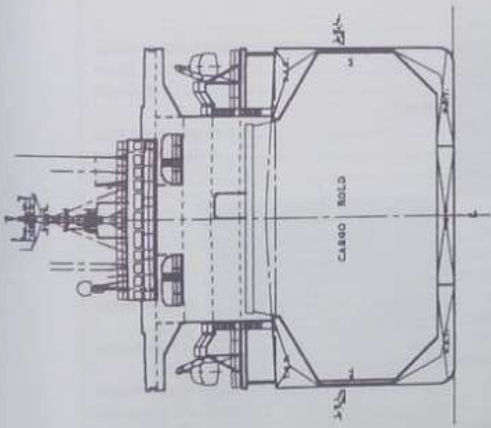
sloping hatch coamings, and this practice is adopted here, with the hatches closed by covers of the hydraulically operated folding pair type.

Jin Hui is single-decked, without forecastle, but gains some weather protection forward from a significant amount of sheer, and a breakwater abaft the mooring equipment. Four Tsuji 30tonne deck cranes are fitted, having a working radius of 26m and a speed of 19m/min. Accommodation for 27 crew plus one 'spare' is arranged in a five-tier deckhouse aft, set above the machinery space in conventional manner. Alternative choices of either Sulzer 6RTA48TB or MAN B&W 6S50MC main engine are available with the design, with *Jin Hui's* owner opting for the first named, in this case supplied by Diesel United. Developing 11,000bhp at 118rev/min, it is directly coupled to a FP propeller to give a service speed - allowing a 15% sea margin - of 14.80knots. Electrical supply is derived from three 490kW diesel-alternator sets powered by Daihatsu prime movers.

PRINCIPAL PARTICULARS

Length, oa	189.99m
Length, bp	182.00m
Breadth, moulded	32.26m
Depth, moulded to main deck	16.69m
Gross	28,707gt
Deadweight	
design	44,579dwt
scantling	50,777dwt
Draught	
design	10.75m
scantling	11.90m
Speed, service	14.80knots
Cargo capacity	
bale	64,000m ³
grain	65,252m ³
Bunkers	
heavy oil	1781m ³
diesel oil	138m ³
Water ballast	28,411m ³
Fuel consumption	30.90tonnes/day
Classification	American Bureau of Shipping +A1 E, Bulk Carrier Strengthened for Heavy Cargoes, Nos 2 and 4 Holds may be Empty, +AMS, +ACCU, SH, HCS, ESP
Percentage of high-tensile steel used in construction	approx 60%
Main engine	
Design	Sulzer
Model	6RTA48TB
Manufacturer	Diesel United
Number	1
Output	11,000bhp/118rev/min
Propeller	

Material	Nickel-aluminium-bronze
Manufacturer	Nakashima Propeller Co Ltd
Number	1
Pitch	Fixed
Speed	118rev/min
Diesel-driven alternators	
Number	3
Engine make/type	Daihatsu
Alternator make/type	
Output	3 x 490kW/720rev/min
Boiler	
Number	1
Type	Vertical composite
Make	Miura
Output	5.5kg/h
Cargo cranes	
Number	4
Make	Tsuji Heavy Industries
Capacity/speed	30tonnes/19m/min/26m radius
Mooring equipment	
Number	2 x mooring winch/windlass
Make	2 x mooring winch
Type	Nippon Pusnes
Hatch covers	Electro-hydraulic
Make	Nakata Mac Co Ltd
Type	Weathertight folding, double skin
Ballast control system	
Make	Nakakita Seisakusho
Type	Electric touch display type
Complement	
Officers	12
Crew	15
Spare	1
Fire detection system	
Make	Nohmi Bosai
Type	Thermal and ionisation
Fire extinguishing system	
Cargo holds and engineroom	Fixed CO ₂
Cabins and public spaces	Sea water fog jet
Radars	
Number	2
Make	Japan Radio Co Ltd
Models	1 x JMA-9253-9CA
	1 x JMA-9303-CA
Satellite navigation system	
Make	Japan Radio Co Ltd
Model	JLR-7700
Computers on ship	
Number	1
Make	IBM
Task	Loading computer
Contract date	
Launch/float-out date	19 April 2000
Delivery date	2 June 2000





AGIOS ANASTASIOS: Handymax bulker from Sanoyas

Shipbuilder:..... Sanoyas Hishino Meisho Corp, Japan
 Vessel's name:..... *Agios Anastasios*
 Hull number:..... 1184
 Owner/operator:..... -Levant Maritime International, Greece
 Designer:..... Sanoyas Hishino Meisho Corp, Japan
 Flag:..... Bahamas
 Total number of sister ships already completed:..... 3
 Total number of sister ships still on order:..... 3

Note: Illustration shows sister vessel *Agios Andreas*.

SANOYAS already has a substantial reference list covering bulk carriers in the 46,000/48,000dwt range, and has recognized a further demand for vessels of this, so called, Handymax size. *Agios Anastasios* is one of a series ordered by Levant Maritime to a recently developed design, which offers increased hold capacity and deadweight, together with improved propulsive performance and, consequently, better fuel consumption, when compared with many other similar vessels.

Built with a Panamax beam, although considerably shorter than is the norm for most bulkers of this type-designation, this new class has a capacity on scantling draught of 52,000dwt. A conventional single-skin hull configuration has been adopted, with top and bottom wing ballast tanks enhancing self-trimming characteristics, and assisting with grab discharge of coal and other bulk cargoes. Four grabs are included in the equipment, stowed alongside the cranes when not in use.

Agios Anastasios is self-sustaining with her five holds, served by an outfit of Tsuji electric-hydraulic deck cranes. This is comprised of three single units which provide coverage over all holds, plus a twin-crane positioned between Nos 3 and 4 holds. The latter gives additional capacity in either single or twin mode at these midship compartments.

As single units, each crane lifts 30tonnes at 25m/min (without grabs), whilst working as a pair, 60tonnes can be handled. This arrangement allows heavy cargoes such as hot-rolled steel coils and pipes to be loaded, making use of batches more than 20m long, closed by MacGregor-Kayaba weathertight folding steel covers that stow in pairs at each end of the hatch. The design also caters for the carriage of dangerous cargoes, and the holds are fitted with a mechanical ventilation system, CO₂ fire extinguishing, and smoke-tube fire detection.

The main engine is a Diesel United-Sulzer 6RTA48T-B unit developing 8738kW at 127rev/min, driving a 5900mm diameter FP propeller. Allowing a 15% sea margin and operating at 85% MCR, service speed is 14.8knots. Three Daihatsu/Nishishiba 650kW alternators are fitted, and a composite boiler satisfies steam requirements. The installation complies with the American Bureau of Shipping ACCU unmanned engine room notation. Total complement is 25, accommodated in single cabins in a six-tier deckhouse.

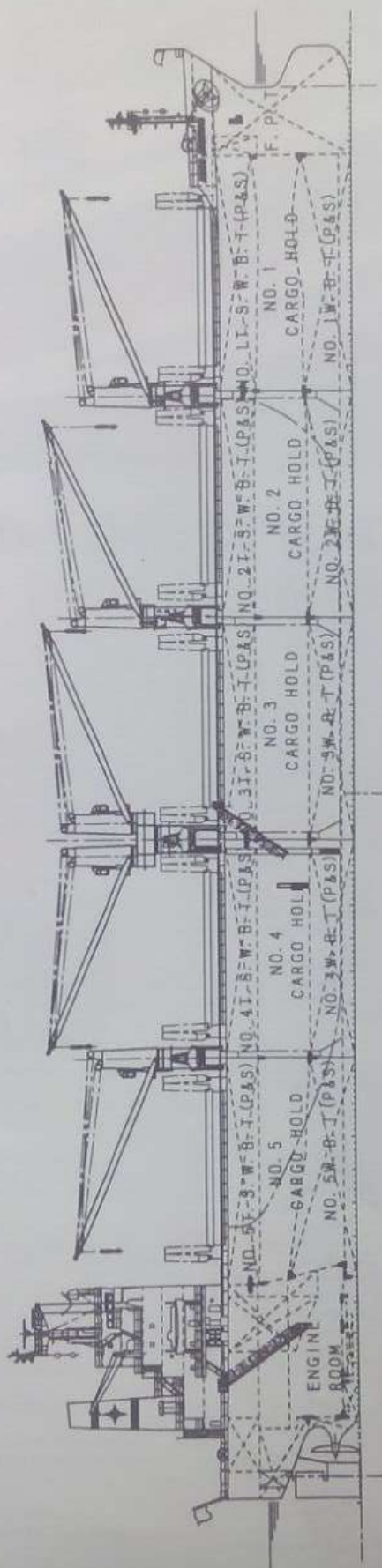
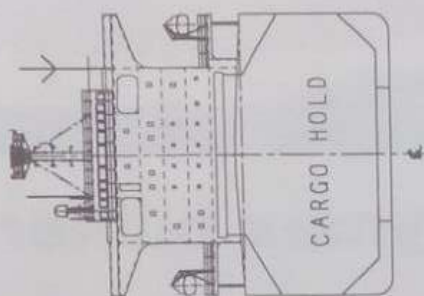
PRINCIPAL PARTICULARS

Length, oa	189.90m
Length, bp	182.00m
Breadth, moulded	32.26m
Depth, moulded to main deck	17.10m
Gross	29,499gt
Deadweight	
design	45,108dwt
scantling	52,068dwt
Draught	
design	10.75m
scantling	12.00m
Speed, service 85% MCR, 15% sea margin	14.80knots
Cargo capacity	
bale	64,545m ³
gram	66,597m ³
Bunkers	
heavy oil	2268m ³
diesel oil	318m ³
Water ballast	14,527m ³
Fuel consumption	
main engine only	30.1tonnes/day
auxiliaries	1.8tonnes/day
Classification	American Bureau of Shipping
Percentage of high-tensile steel used in construction	68%
Main engine	
Design	Sulzer
Model	6RTA48T-B
Manufacturer	Diesel United
Number	1
Output	8738kW/127rev/min
Propeller	
Material	Nickel-aluminium-bronze
Manufacturer	Nakashima Propeller Co Ltd
Number	1
Pitch	Fixed
Diameter	5900mm
Speed	127rev/min
Diesel-driven alternators	
Number	3
Engine make	Daihatsu
Alternator make/type	Nishishiba

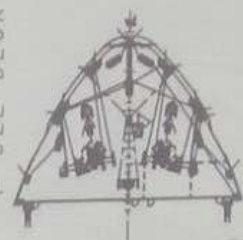
Output	3 x 650kW/900rev/min
Boiler	
Number	1
Type	Composite
Make	Osaka Boiler
Output	
oil side	1000kg/h
exhaust gas	950kg/h
Cargo cranes	
Number	3 x single, 1 x twin
Make/type	Tsuji/electric-hydraulic
Capacity	3 x 30tonne/25m/min 1 x twin - 2 x 30tonne/25m/min
Mooring equipment	
Number	2 x mooring winch/windlass, 2 x mooring winch
Make	Kawasaki
Type	Electro-hydraulic
Hatch covers	
Make	MacGregor-Kayaba
Type	Weather-tight folding pairs
Ballast control system	
Make	Mitsubishi
Type	Local remote control
Complement	
Officers	10
Crew	15
Rooms	Single
Fire detection system	
Make	Kawasaki Safety Service
Type	Smoke tube
Fire extinguishing systems	
Cargo holds	CO ₂
Make	Kawasaki Safety Service
Engine room	CO ₂ , High-expansion foam
Radars	
Number	2
Make	Furuno
Models	1 x FAR-2835SW-TAF, 1 x FAR-2825W-4A
Satellite navigation systems	
Make	Furuno
Model	GP-80
Waste disposal plant	
Incinerator	
Make	Sunbeam
Model	OSV-360SA
Sewage plant	
Make	Toho-Kiwa
Model	SBT-40
Contract date	2000
Launch date	
Delivery date	9 January 2001

AGIOS ANASTASIOS

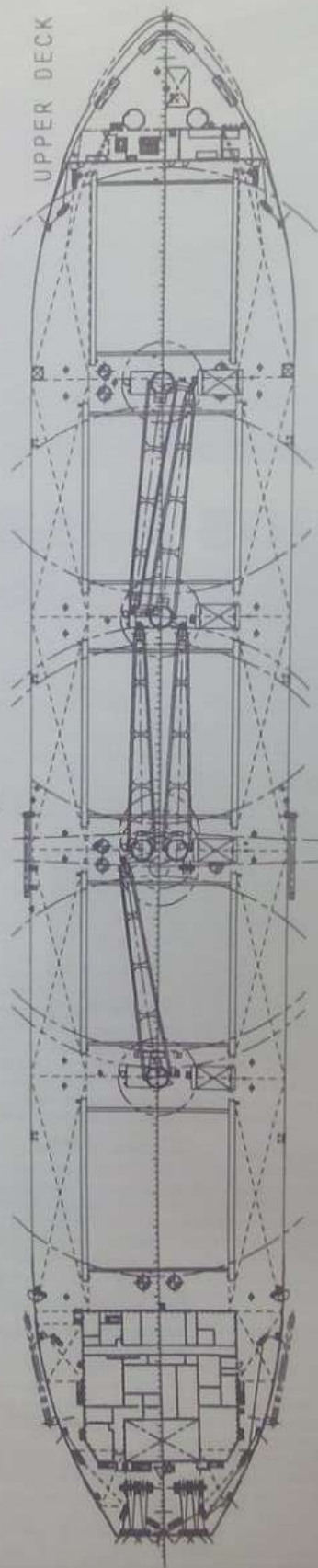
HOLD SECTION
HOLD FRONT VIEW



F' CLE DECK



UPPER DECK





APL VENEZUELA: new container ship series for German operator

Shipbuilder: Stocznia Szczecinska SA, Poland
 Vessel's name: APL Venezuela
 Hull number: B178-I/1
 Owner/operator: Peter Döhle GmbH, Germany/APL Ltd, USA
 Designer: Stocznia Szczecinska SA, Poland
 Flag: Antigua & Barbuda
 Total number of sister ships already completed: Nil
 Total number of sister ships still on order: 14

THE fruitful combination of Polish shipyards building for German owners specialising in the liner-charter trades continues with this new B-178 series from Szczecinska. This extends a successful range of similar designs from the company, some already featured in *Significant Ships* reports, for example, *CCNI Angol* in our 1998 edition. *APL Venezuela* is the first of 15 vessels, and with her two immediate sisters will operate on a charter which does not require cargo gear. Nevertheless, other ships in the class will be fitted with cranes, and a facility to retrofit this earlier trio with three slim cranes - each rated at 45tonnes swl at 27.5m outreach, or 40tonnes at 30.5m, positioned between holds 1/2; 3/4 and 5/6 - is built into the structure. Tank testing was carried out at CTO, Gdansk.

The B-178 is designed with excessive freeboard and has a double-skin hull containing six cargo holds fitted with cell guides suitable for 20/40ft containers, with 45/49ft units also carried on deck. No 1 hold is accessed through a long forecabin partly covered by a shelter/breakwater, and is arranged to carry dangerous cargoes of class 1.1 to 1.5, with classes 1.4, 2, 3, 4, 5, 6 and 8 allowed in holds Nos 2, 3, 4 and 5.

Of particular note are the stoppers fitted to the cell guides 5.25m above the tank top in holds 2 to 5, which allow break-bulk cargo to be loaded below 40ft containers, and the large refrigerated container capacity available: 300 units on deck and 200 in holds 2, 3, 4 and 5.

A tweendeck is arranged in the side tanks P&S providing pipe/cable ducts and access passages. At the aft end, this forms a full deck with store rooms, hobby room, and accommodation for a Suez Canal crew. The engineroom is positioned forward of the eight-tier superstructure (which is built with a void between level 7 and the wheelhouse in order to give visibility over the containers); this leaves free deck over the main engine for maintenance access and additional cargo space. A notable feature is the inclusion of large back-stay brackets aft of the very short super structure to limit vibrations.

The propulsion unit is an MAN B&W 7K80MC-C unit built by Polish licensee H Cegielski and rated at 26,270kW when running at 104rev/min. Operating at 87.5% MCR, it gives a service speed of 22.04knots. Four Cegielski-MAN B&W/van Kaick diesel-alternator sets

are installed - two producing 1000kW each, and two sized for 1200kW, to satisfy the demands of the reefer connections and a 1200kW/331rev/min bow thruster.

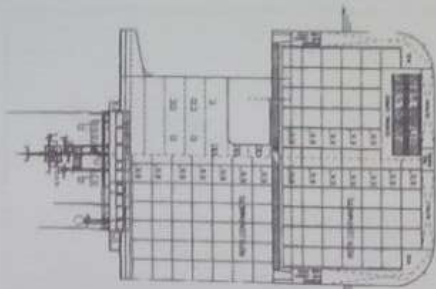
The Simplex-Mariner type rudder is operated by an Ulstein-Frydenbö steering gear which has a high turning angle of 70deg, although this capability is only available at manoeuvring speeds and is automatically locked-out above 10knots. Anti-heel tanks are positioned between holds 3 and 4, and second-order moment compensators are fitted to control vibration in the tweendeck night aft.

PRINCIPAL PARTICULARS

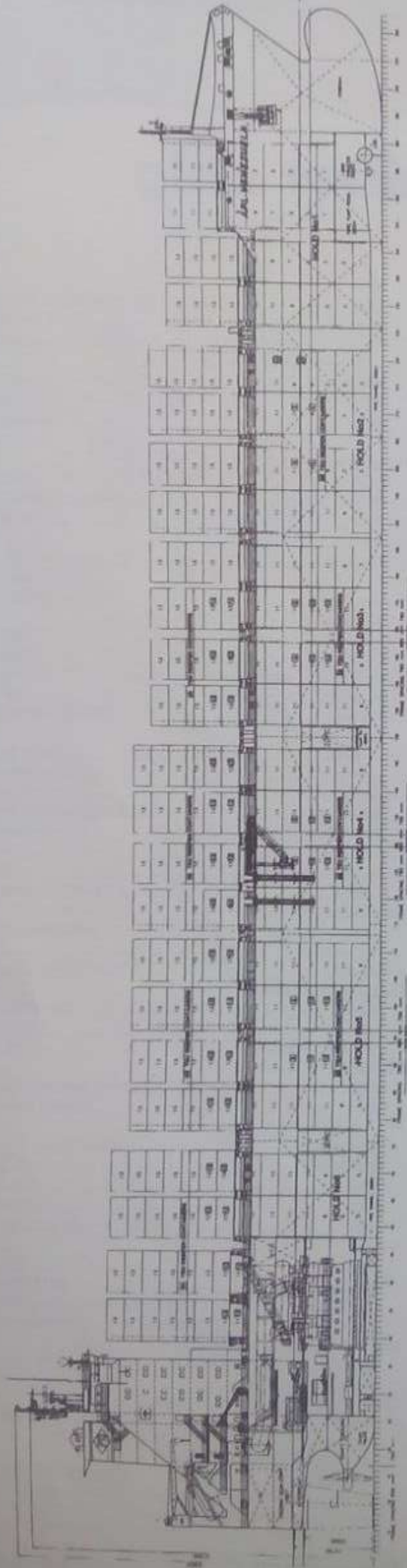
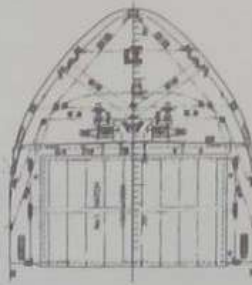
Length, oa	220.50m
Length, bp	210.20m
Breadth, moulded	32.24m
Depth, moulded to main deck	18.70m
Width of double skin	
side	1.97m
bottom	1.73m
Gross	35,645gt
Displacement	57,251tonnes
Lightweight	15,041tonnes
Deadweight	
design	32,209dwt
scantling	42,210dwt
Draught	
design	10.50m
scantling (freeboard)	12.45m
Speed, service at 87.5% MCR	22.04knots
Cargo capacity	
bale	56,930m ³
grain	64,196m ³
Bunkers	
heavy oil	4357m ³
diesel oil	287m ³
Water ballast	15,348m ³
Fuel consumption	
main engine only	99tonnes/day
auxiliaries	19.50tonnes/day
Classification	Germanischer Lloyd +100A5 Container Ship, IW, NAV-O, SOLAS II-2, Reg 54, R3D, +MC, AUT
Percentage of high-tensile steel used in construction	approx 40%
Heel control system	Frank Mohn pumps
Main engine	
Design	MAN B&W
Model	7K80MC-C
Manufacturer	H Cegielski
Number	1
Output	26,270kW/104rev/min
Propeller	
Material	Cualion
Manufacturer	Mecklenburger Metallguss
Number	1
Pitch	Fixed
Diameter	7420mm
Speed	104rev/min
Diesel-driven alternators	
Number	4 (2+2)
Engine make/type	2 x MAN B&W 5L28/32H 2 x MAN B&W 6L28/32H
Alternator make/type	van Kaick/2 x DSG-99M1-10, 2 x DSG-99L1-10
Output	2 x 1000kW/720rev/min, 2 x 1199.2kW/720rev/min
Boilers	
Number	1 x composite

Type	Mission OC model 4000
Make	Aalborg
Output	3200kg/h oil fired, 2700kg/h exhaust gas
Mooring equipment	
Number	2 x mooring winch/windlass, 4 x mooring winch
Make	Towimor
Type	Electric
Hatch covers	
Designer	MacGregor
Manufacturers	Fugo, Zremb. (Poland)
Type	Lift-away pontoons
Containers	
Lengths	20ft, 40ft, plus 45ft, 49ft, on deck
Cell guides	Holds
TEU capacity	
holds	1408
on deck	1700
Homogeneity loaded to 14tonnes	2250
Reefer plugs	500
Heights	8ft 6in, 9ft 6in
Tiers/across	
deck	7/13max
holds	8/11max
Complement	
Officers	10
Crew	14 + 6 Suez
Pilot	1
Spare	1
Cabins	25 x single, 1 x 6
Bow thruster	
Make	ABB-Zamech
Number	1
Output	1200kW/331rev/min
Bridge control system	
Make	Meramont
Type	UCN 41
One man operation	Yes
Fire detection system	
Make	Scana Servoteknikk
Type	Debeg 8304
Fire extinguishing systems	
No 1 hold	Water spray, CO ₂
Remainder	CO ₂
Make	Unitor
Cabins	Water
Make	Shipbuilder
Radars	
Number	2
Make	STN Atlas
Models	Radarplot Atlas 1006/ARPA (1 x 288X-band, 1 x 3B14S-band)
Satellite navigation systems	
Make	STN Atlas
Models	2 x Debeg 4403B
Other navigation systems	
Make	Tansas Navi-Sailor
Model	2 x NS2400 electronic chart
Waste disposal plant	
Incinerator	Teamtec GS500C
Waste compactor	Vesconav 8251
Waste shredder/compactor	Vesconav 526
Sewage plant	Hamworthy STSA
Contract date	5 May 2001
Launch/float-out date	3 September 2001
Delivery date	

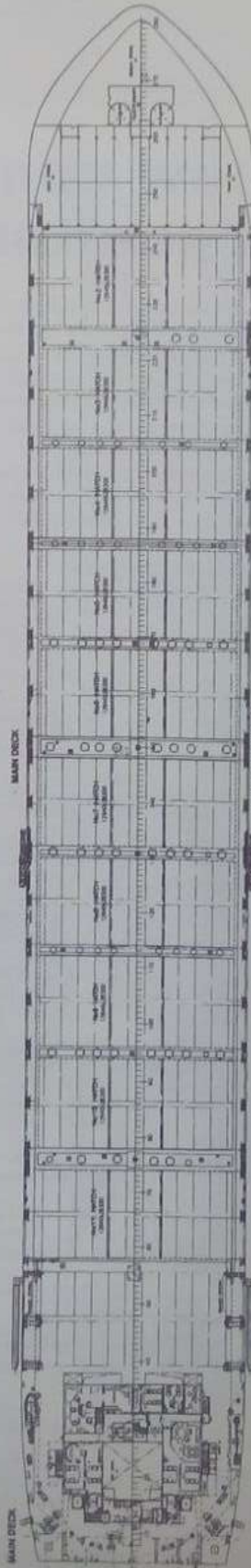
APL VENEZUELA



FORECASTLE DECK

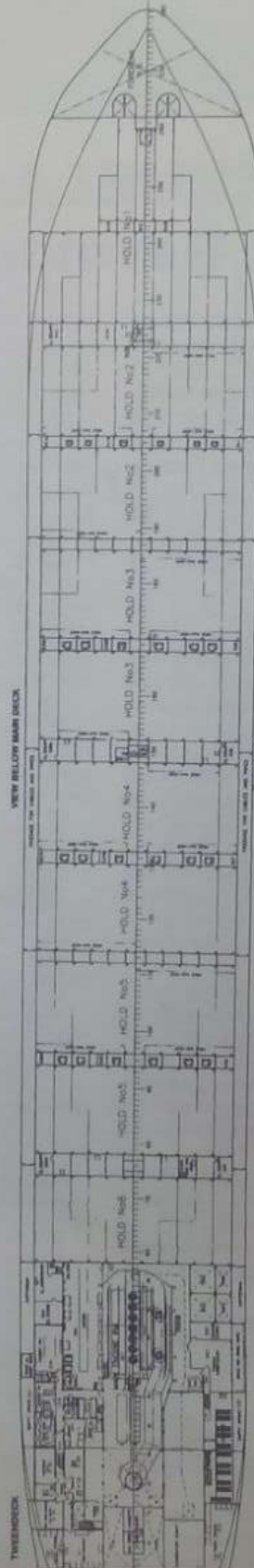


MAIN DECK

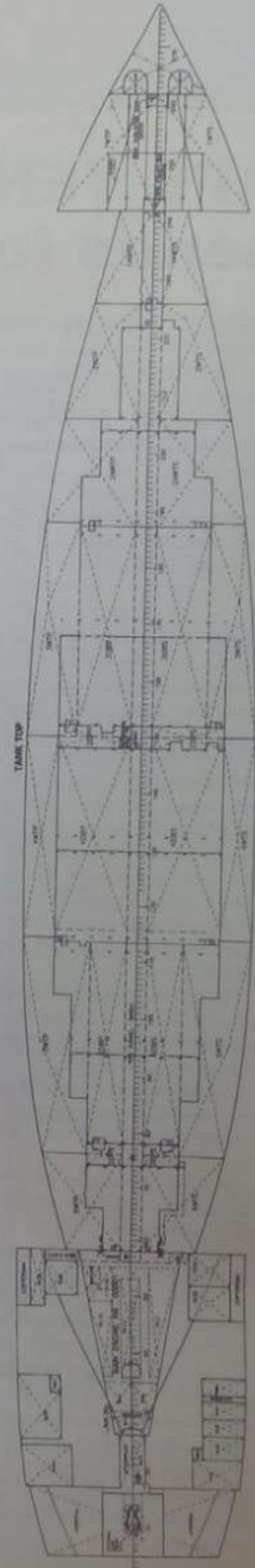


VIEW BELOW MAIN DECK

VIEW BELOW MAIN DECK



VIEW BELOW MAIN DECK



TANK TOP



CEDAR ARROW: upgraded standard bulker from Gdynia/Gdansk

Shipbuilder: Stocznia Gdanska (Grupa Stocznia Gdynia SA), Gdansk Shipyard, Poland
 Vessel's name: Cedar Arrow
 Hull number: 6684/21
 Owner/operator: Gearbulk Shipowning Ltd, Norway
 Designer: Gdansk Shipyard, Poland
 Flag: Bahamas
 Total number of sister ships already completed: Nil (see text)
 Total number of sister ships still on order: 3 (plus 2 options)

AFTER several years of uncertainty, Gdansk Shipyard now operates under the control of Stocznia Gdynia, and the pairing has returned to one of the former's successful bulk carrier designs (the B684, developed in 1997), as a basis for a new series of open-hatch vessels for the Gearbulk group. Within a hull which retains the well-proven lines of the earlier design, the entire cargo area has been substantially modified and now features double-skin bulkheads, instead of troughed types, as transverse divisions between the seven holds.

Gearbulk's involvement in the forest products trades has greatly influenced the development of this design, notably the hold ventilation arrangements which include a dehumidification system suitable for the carriage of paper. These utilise side tunnels above the wing tanks which supply air to a dehumidifying station at the poop front, with the double-skin divisional bulkheads providing air-ducting into the holds.

Cedar Arrow is strengthened to carry a full cargo with alternate holds empty, and Nos 4 and 5 holds are arranged to be flooded in harbour so as to reduce air draught. Subdivision of the hull has been particularly considered to provide a higher than rule standard of damage stability.

The hatch covers have been built to MacGregor design by the shipyard, and comprise a 'piggy-back' arrangement for holds 2 to 7, operated by external hydraulic cylinders and drive systems, and a 'pivoting' cover for No 1 hold. The irregular shape of this cover on the B684 (1997) design has been changed to rectangular for the more recent ship, but is similarly operated by external hydraulic cylinders.

The covers are of closed construction and can accept a uniformly distributed static lumber loading of 2.5tonnes/m² or a two-tier container stack load of 40tonnes (TEU) or 61tonnes (FEU). Each cover has flush-fitting feeder hatches for grain and cement, and in an emergency can be handled by the ship's four Tsuji 36tonne, hydraulic ram-luffing, deck cranes, fitted on pedestals between holds 1/2; 3/4; 5/6; and aft of hold 7.

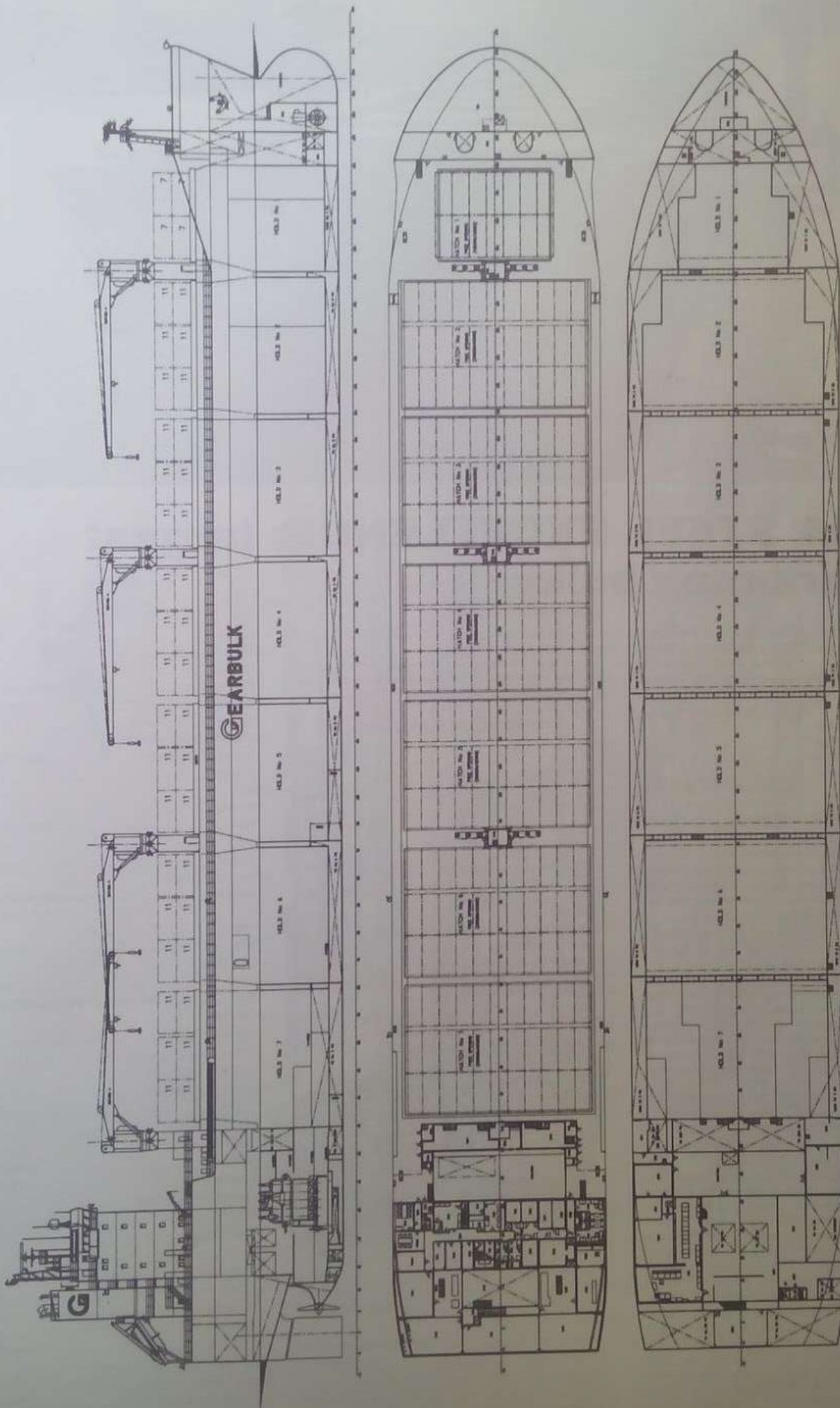
The main engine is of MAN B&W 5S60MC design constructed by H Cegielski and develops 8900kW at 101rev/min. Electrical supply is from three Cegielski-MAN B&W/Dozamel 1050kW diesel-alternator sets, and two boilers of 1600kg/h and 1200kg/h output satisfy steam requirements. A Schilling rudder is fitted aft and an ABB-Zamech 1500kW thruster operates forward. The accommodation block is right aft and is laid out for a complement of 12 officers and 11 crew.

PRINCIPAL PARTICULARS

Length, oa	189.80m
Length, bp	181.80m
Breadth, moulded	31.00m
Depth, moulded to upper deck	18.50m
Width of double-skin	
side	2.20m
bottom	1.95m
Gross	32,458gt
Deadweight	
design	43,585dwt
scantling	47,818dwt
Draught	
design	12.00m
scantling	12.80m
Speed, service, 85% MCR	14knots
Cargo capacity	
grain	61,339m ³
Bunkers	
heavy oil	2124m ³
diesel oil	258m ³
Water ballast	17,752m ³
Classification	Det Norske Veritas
Percentage of high-tensile steel used in construction	approx 15%
Main engine	
Design	MAN B&W
Model	5S60MC
Manufacturer	H Cegielski
Number	1
Output	8900kW/101rev/min
Propeller	
Material	High-tensile bronze
Manufacturer	ABB Zamech
Number	1
Pitch	Fixed
Diameter	6900mm
Speed	101rev/min
Diesel-driven alternators	
Number	3
Engine make/type	Cegielski-MAN B&W
Alternator make/type	Holeby/5L28/32H
Output	Dozamel/WG-031176
Boilers	3 x 1050kW/720rev/min
Number	2

Type	1 x VX816-111
	1 x VP833-110
Make	Marine Metal (Poland)
Output	1 x 1600kg/h; 1 x 1200kg/h
Cargo cranes	
Number	4
Make/type	Tsuiji/SSCL3626 S
Capacity/speed	360kN/up to 40m/min; 26m radius
Mooring equipment	
Number	2 x winch/windlass; 4 x winch
Make	Towmor
Type	High-pressure electric-hydraulic
Hatch covers	
Design	MacGregor
Manufacturer	Shipbuilder
Type	1 x pivoting; 6 x 'piggy-back'; hydraulic operation
Containers	
Lengths	20ft; 40ft
TEU capacity (upper deck)	424
Tiers/across	2/11
Ballast control system	
Make	Hoppe
Type	Hydraulic
Complement	
Officers	12
Crew	11
Pilots	1
Cabins	24 x single; 4 x double
Special rudder	Schilling type
Bow thruster	
Make	ABB-Zamech
Number	1
Output	1500kW/291rev/min
Bridge control system	
Make	STN Atlas
Type	NACOS 35-4
One man operation	No
Fire detection system	
Make	Servoteknikk
Type	MSB-904
Fire extinguishing systems	
Holds and engine room	High-pressure CO ₂
Make	Unitor
Waste disposal plant	
Incinerator	
Make	Teamtec A/S
Model	OG 200C
Sewage plant	
Make	DVZ
Model	DVZ 2500 PC OilChop
Contract date	12 April 2000
Launch/floatout date	13 June 2001
Delivery date	15 October 2001

CEDAR ARROW



Classification No. : **021695**
IMO No. : **9258557**
Official No. : **47308-PEXT**
Signal Letters : **3FQF6**
Flag : **Panama**
Port of Registry : **Panama**
Ship's Name : **ADASTRA**
Former Name 1 : **COPOSA**

Registered Owner 1 : **ASTARTE SHIPPING LTD.**

Management Company 1 : **TRANSBULK MANAGEMENT INC.**

Classification Characters, Notations : **NS*(BC, SHC 2,4 E)(ESP)**
MNS*

Descriptive Notes : --

Installation Characters : **CHG, MPP, LSA, RCF, AFS, BWM**

Installation Descriptive Notes

Special Description : --

Other Classification : --

Type of Ship -Purpose(intended service) : **BULK CARRIER**
- Certificates - SC/SE/SF : **Bulk carrier (SOLAS IX Reg. 1.6)**
- OPP : **Other than Oil Tanker**
- EE : **Bulk carrier**
- SMC/ISSC : --

Tonnage Gross (Registered) : **25,554**
Tonnage Net (Registered) : **15,898**
Tonnage Gross (Local) : --
Tonnage Net (Local) : --
Tonnage Gross (TM69) : **25,554**
Tonnage Net (TM69) : **15,898**
Deadweight : **46,493**

Summer Freeboard (mm) : **4,631**
Summer Draught (m) : **11.807**
Lf (m) : **175.330**
Continuous Max. Speed (kt)
(Sea Trial) : **16.2**

Overall Length (m) : **183.000**
Moulded LxBxD (m) : **174.300 x 30.950 x 16.400**
Registered LxBxD (m) : **175.330 x 30.950 x 16.400**

Cargo Capacity
(m3 / No. of Containers, etc.) : **B 57,083.00 G 58,209.00**
No. of Passengers : --
Capacity of Tanks (m3) : **FO 2,133.00 FW 301.00**

Lifeboats Type, No. & Person : **3 2x(25)**
Rescue Boats Type, No. & Person : **1 1x(6) (at combined use for lifeboat)**
Liferafts Type, No. & Person : **1 1x(6) 1 2x(25)**
Radio Installations : **GMDSS A1+A2+A3**
Navigation Equipment : **MC, GYRO, HCS, GPS, RDX, 2RDX, ARPA, AIS, LOG, ES, STGTEL, DSL, LRIT, BWAS, S-VDR**

No. & Kind of Engines : **1D : 2 SA 6 CY**
Bore x Stroke (mm) : **500.0 x 2,000.0**
Power (kW) : **7,024**
Revolution (rpm) : **104.0**
Manufacturer : **Kawasaki Heavy Industries, Ltd.**

No. & Kind of Boilers : **1 AUX VB**
Pressure (MPa) : **0.69**
Evaporation : **2.40 (ton/h)**
Manufacturer : **AALBORG(QINGDAO) BOILER COMPANY LTD.**
***Evaporation rate: Thermal output (kW) to be filled up in case of TOH.**

No. & Capacity of Generators (kVA) : **4 AC 1,750**
Kind of Propeller Shaft : **1B**
No. & Shaft Diameter (mm) : **1 x 460**

Shipbuilder : **Oshima Shipbuilding Co., Ltd.**
Hull No. : **10339**
Date of Keel Lay : **14 Mar 2002**
Date of Launch : **14 Jun 2002**
Date of Build : **30 Jul 2002**
Date of Conversion : --



IVS VISCOUNT: another Algoship bulker

Shipbuilder:	Xingang Shipyard, People's Republic of China
Vessel's name:	IVS Viscount
Hull number:	SB334
Owner/Operator:	Dockendale Shipping Co Ltd, Bahamas
Designer:	Algoship Designers Ltd, Bahamas
Model test establishment used:	Shanghai Ship & Shipping Research Institute, People's Republic of China
Flag:	Bahamas
Total number of sister ships already completed:	3
Total number of sister ships still on order:	2

THE new Valiant class is another of five bulk carrier designs currently building in various Chinese yards, developed by GTR Campbell in conjunction with its Bahamian associate Algoship Designers, and introduced in this review with the Great Lakes-fitted *Cinnamon*. *IVS Viscount* is larger than that Fortune Mk 2 vessel, and is offered as a high-specification, Handysize bulker, of robust construction for long, reliable service and optimal life cycle cost, which meets anticipated IACS and IMO regulatory requirements.

A raised forecastle and Class B freeboard ensure drier decks in loaded conditions, with self-trimming grain loading and strengthening against slamming at light draught (which reduces the need to ballast No 3 hold). These are salient features of a structural design which contains only a minimum quantity (around 16%) of high-tensile steel in low stress areas only, and which complies with ABS Ice Class D0 rules. Troughed transverse bulkheads form five cargo holds, arranged within a double hull space which has ballast tanks in the lower parts, and full-length, port and starboard galleries above; these carry pipelines and electric cables, and serve as fore and aft access passageways. Double-bottom ballast, bilge and bunker piping, with associated valves, runs through a duct keel, since no pipes or cables are laid on deck.

The structural arrangements in and around the cargo spaces provide a smooth and flush interior and allow wide hatch openings with minimum overhangs; hatches are closed by one-man-operated, hydraulic, end-folding, double-skin steel covers with integral mechanical ventilation. Cargo handling is by means of four 30tonne/26m hydraulic cranes with grab facilities, fitted on the centreline. The holds are suitable for the carriage of a wide range of cargoes, including specified dangerous goods, and are served by explosion-proof exhaust fans and natural ventilation, with provision made for gas and temperature monitoring. For added safety, water ingress alarms cover all holds, galleries, duct keel, and forecastle.

Main propulsion is by a Yichang-Sulzer 6RTA48TB slow-speed diesel engine, developing 7650kW at 116.3rev/min and directly coupled to a FP propeller running in a wake-improving nozzle, for a service speed

of 14.50knots. Sufficient reserve power is provided for regular economic performance, with cover for fouling and ageing.

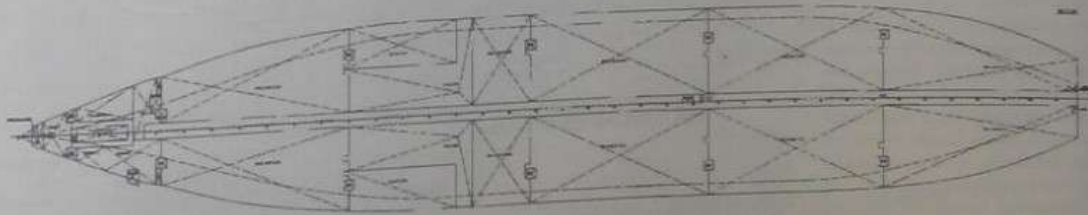
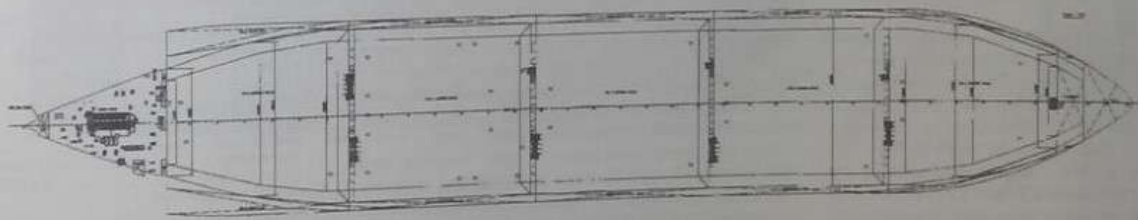
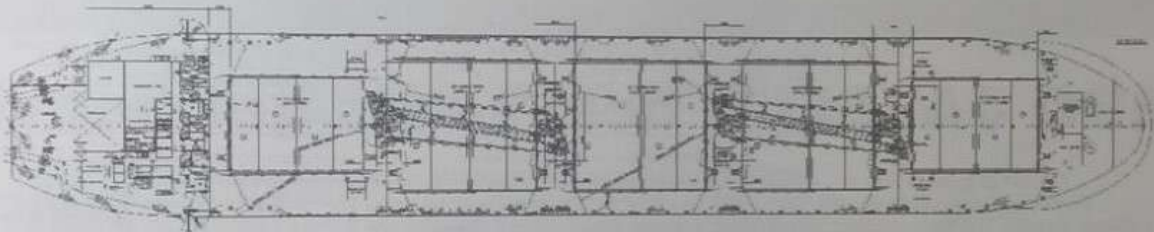
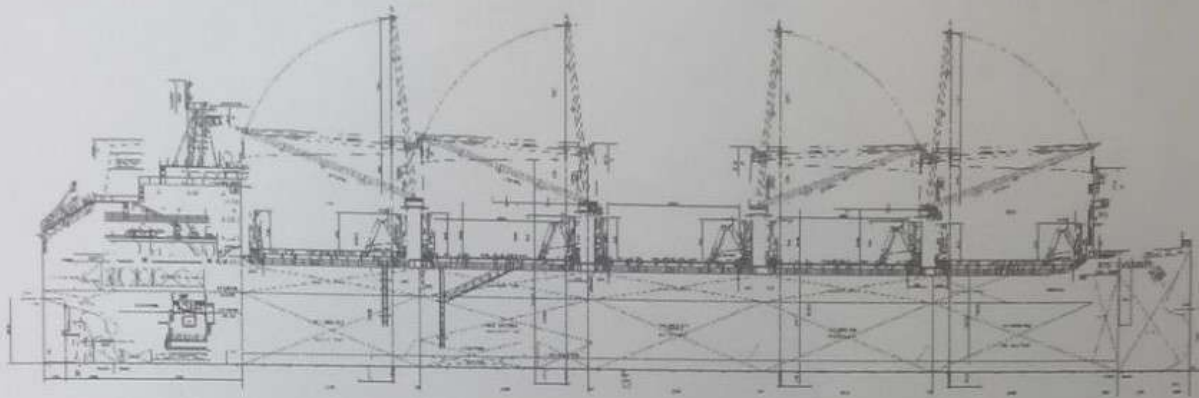
Three 560kW alternator sets driven by dual-fuel (heavy or diesel oil) diesel engines are fitted, whilst the emergency set is sized to provide safety power to the engineers' workshop, galley, and domestic fresh water system, in addition to satisfying its statutory SOLAS performance. Arrangements for safe, simple and user-friendly operation with the least manpower include centralised ballast control, ergonomically arranged engine room, an engine control room with automation and monitoring systems, and remote bridge control. Central fresh water cooling is provided, and GRP ballast piping, high-specification ballast tank coatings, and sacrificial anodes should ensure a low-maintenance service life.

The wheelhouse offers 270deg vision and was specially designed to ensure a logical layout. A freefall lifeboat, a rescue craft, and inflatable liferafts are carried.

TECHNICAL PARTICULARS

Length, oa	179.28m
Length, bp	172.00m
Breadth, moulded	28.00m
Depth, moulded	
to upper deck	15.20m
Width of double skin	
side	1.20m
bottom	1.78m
Draught	
design	10.20m
scantling	10.65m
Gross	22,072gt
Displacement	
design	41,745tonnes
scantling	43,734tonnes
Lightweight	9058tonnes
Deadweight	
design	32,687dwt
scantling	34,676dwt
Block coefficient	0.8256
Speed, service, 85% MCR, 15% sea margin, design	
draught	14.50knots
Cargo capacity	
grain	44,020m ³
bale	42,500m ³
Bunkers	
heavy oil	1700m ³
diesel oil	117m ³
Water ballast	
in ballast tanks	11,800m ³
in No 3 hold (deeptank)	9501m ³
Fuel consumption	
main engine only	25.20tonnes/day
auxiliaries	2.35tonnes/day
Classification	American Bureau of Shipping, +A1(E) Bulk Carrier, +AMS, +ACCU, SH, Ice Class D0, GRAB with description of ESP and Strengthened for Carriage of Heavy Cargoes - Certain Holds may be Empty
Percentage of high-tensile steel used in construction	15.12%
Main engine	Sulzer
Design	

Model	6RTA48TB
Manufacturer	Yichang Marine Diesel Engine Plant
Number	1
Output	7650kW/116.3rev/min
Propeller	
Material	Nickel-aluminium-bronze
Designer/manufacturer	
Number	1
Pitch	Fixed
Diameter	6050mm
Speed	116.3rev/min
Diesel-driven alternators	
Number	3
Engine make/type	Yanmar/6N21L-CV
Alternator make/type	Taiyo Electric/-
Output/speed	3 x 560kW/720rev/min
Cargo cranes	
Number	4
Type	Electro-hydraulic
Make	Tsuji
Performance	30tonnes/22m/min; 3.5>26.0m radius
Mooring equipment	
Number	2 sets
Make	Wuhan-IHI
Type	Electro-hydraulic
Lifesaving equipment	
Number	1 x 35person free-fall lifeboat
Make	Berai
Hatch covers	
Design	Hamworthy KSE
Manufacturer	Xingang Shipyard
Type	Hydraulic folding
Ballast control system	
Make	Hoppe
Type	Electro-hydraulic
Complement	
Officers	8
Crew	13
Spare	2 each officers/crew
Suez/repair crew	8
Stern appendages	Wake-improving propeller nozzle
Bridge control system	
Make	Norcontrol
Type	AC-4
One man operation	Yes
Fire detection system	
Make	Thorn Security
Type	Optical and thermal sensors
Fire extinguishing systems	
Cargo holds	CO ₂
Make	Nohmi-Bosai
Engine room	CO ₂ and local mist
Make	Nohmi-Bosai and Tyco UK
Integrated bridge system	No
Waste disposal plant	
Incinerator	
Make	Nanjing-Luzhou
Model	OSG400C
Sewage plant	
Make	Taiko-Kikai
Model	SBT-25/3m3/h
Contract date	
Launch/float-out date	9 May 2003
Delivery date	23 July 2003





STAR OSHIMANA: open-hatch, cargo/container ship

Shipbuilder: Oshima Shipbuilding Co Ltd, Japan
 Vessel's name: Star Oshimana
 Hull number: 10330
 Owner/operator: Masterbulk Private Ltd, Singapore
 Designer: Oshima Shipbuilding Co Ltd, Japan
 Flag: Singapore
 Total number of sister ships already completed: Nil
 Total number of sister ships still on order: 4

Oshima's expertise in the world of bulk carrier design and construction is now considered by the yard to be sufficient to warrant the claim made in its publicity that the company is 'the bulker builder'. References cover many innovative vessels of this type, with a particular speciality being the 'open-hatch, general cargo/container carrier' which first appeared in the company's portfolio a decade ago. Vessels were built for operation worldwide by a consortium of Norwegian and Japanese owners (*Saga Spray, Significant Ships of 1994*). *Star Oshimana* is the lead ship of the latest series of this class, which now, by virtue of modest increases in dimensions above those earlier units, is believed to include the biggest deadweight capacity of such vessels using the Panama Canal.

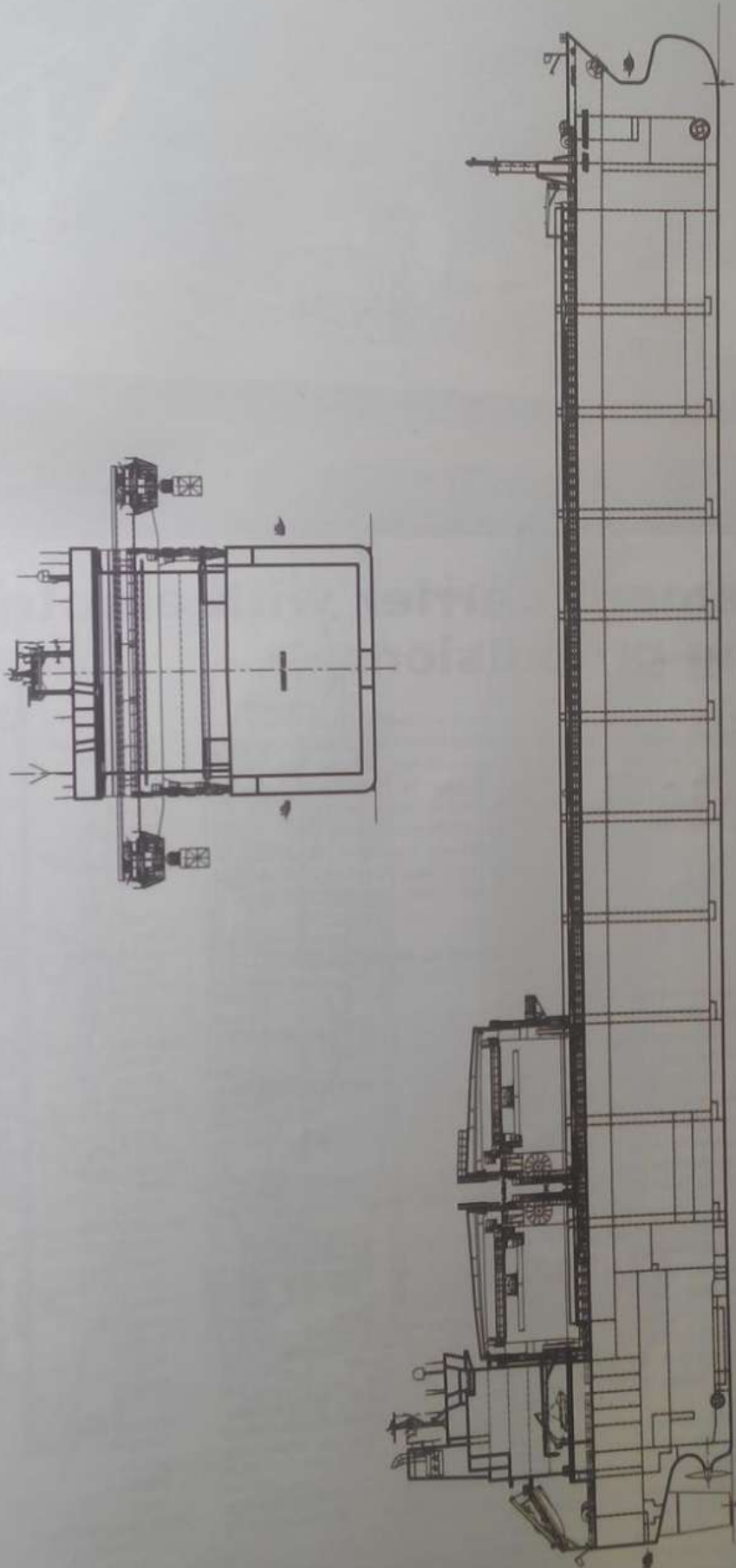
The main feature of this design is the cargo handling installation, which comprises a twin, electric, Kone Munkloader gantry crane arrangement; this runs along tracks at the hatch sides, straddling the 11 cargo holds, which are closed by weathertight pontoons handled by the cranes. Two sets of non-watertight pontoons are also provided, and these can be fitted in each of holds 4 and 8 to form tweendecks suitable for a loading of 5.5tonnes/m³. Stowage for the panels is arranged in number 11 hold when not in use. The cranes are computer-controlled and are fitted with athwartship-traversing trolleys; each has a lifting capacity of 68tonnes. They can be turned through ±190deg and operated over the ship's side P&S on extending arms. A fixed roof over the gantries provides rain protection whilst working cargo, with retractable covers for the arms performing the same duty over the quayside.

The double-hull structure forms combined L-shaped side and bottom tanks divided by a duct keel at the centreline. They enclose virtually box-shaped holds with flush surfaces, suitable for a wide variety of bulk and packaged cargoes. Containers can also be loaded, with a total TEU capacity in the holds and on deck of 2286 (including 22 refrigerated units).

TECHNICAL PARTICULARS

Length, overall: 199.00m
 Length, bp: 189.00m
 Breadth, moulded: 32.26m
 Depth, moulded, to upper deck: 19.00m
 Width of double skin side: 2.38m
 Draught design: 11.50m
 scantling: 12.00m
 Deadweight design: 45,656dwt
 scantling: 48,661dwt
 Gross: 36,324gt
 Speed, service, 90% MCR: 16.10knots
 Capacity bale: 65,873m³
 grain: 65,338m³
 Bunkers heavy oil: 3018m³
 diesel oil: 137m³
 Water ballast: 16,180m³
 Classification: Det Norske Veritas +1A1 General Cargo Carrier, Container, HC-EA, GRAIN-U, EO LCS, (DGIS), Dk (+), HA (+), IB (+), 2286TEU, TMON, NAUTICUS (Newbuilding)
 Main engine Design: MAN B&W
 Model: 6S60MC
 Manufacturer: Kawasaki Heavy Industries
 Number: 1
 Output: 11,515kW/101rev/min, MCR
 10,364kW/97.5rev/min, NCR
 Propeller Material: Nickel-aluminium-bronze
 Manufacturer: Nakashima Propeller Co
 Number: 1
 Pitch: Fixed
 Diameter: 6600mm
 Speed: 97.5rev/min
 Diesel-driven alternators Number: 3
 Engine make/type: 2 x STX-MAN B&W 6L28/32H
 1 x STX-MAN B&W 5L28/32H
 Alternator make/type: 2 x Hyundai
 HFC 6 566-14K-SB-2

1 x Hyundai HFC 6 566-14K-SB-1
 Alternator outputs: 2 x 1470kVA; 1 x 1250kVA
 Cargo cranes Number: 2
 Make: Kone Cranes
 Type: Munkloader travelling electric gantry with traversing crane trolley
 Duties: 2 x 68tonnes/24m/min
 Mooring equipment Number: 2 x mooring winch/windlass
 2 x mooring winch
 Make: Nippon-Pusnes
 Type: Electric-hydraulic
 Hatch covers Make: Tsuji Heavy Industries
 Type: Upper deck: Weathertight pontoons
 Other decks: Non-tight pontoons serving as portable tweendecks in Nos 4 & 8 holds
 Containers Lengths: 40ft, 20ft
 Cell guides: No
 Total TEU capacity: 2286
 Reefer plugs: 22
 Tiers/across Upper deck: 3 or 4/11
 Holds: 4/11
 Ballast control systems Make: Nakakita Seisakusho
 Type: Electric touch display, hydraulic remote control valves
 Complement Officers: 14
 Crew: 11
 Special rudders: Schilling high lift
 Bow thruster Make: Rolls-Royce (Ulstein)
 Number: 1
 Output: 1500kW
 Stern thruster Make: Rolls-Royce (Ulstein)
 Number: 1
 Output: 940kW
 Fire detection Make: Kawasaki
 Type: thermal, ionic and flame
 Fire extinguishing systems Cargo hold/engine room: CO₂
 Make: Untor
 Radars Number: 2
 Make: Furuno
 Models: 1 x FAR-2835S; 1 x FAR-2825
 Waste disposal plant Incinerator Make: Sunflame
 Model: OSV-602SAI
 Sewage plant Make: Taiko Kikai Industries
 Model: SBT-40
 Contract date: 7 December 2000
 Launch/float-out date: 21 May 2003
 Delivery date: 29 July 2003





BIG GLORY: Kawasaki adopts SEA-Arrow bow for bulker

Shipbuilder	Kawasaki Shipbuilding Corp, Japan
Vessel's name	<i>Big Glory</i>
Hull No	1557
Owner/operator	White Reefer Line Corp, Panama
Designer	Kawasaki Shipbuilding Corp, Japan
Flag	Panama
Total number of sister ships already completed	4
Total number of sister ships still on order	10

KAWASAKI has developed the design of this Handymax bulk carrier from that of earlier, smaller-series vessels in its portfolio, and enhanced it by incorporating the company's patented SEA-Arrow (Sharp Entrance Angle Bow as an Arrow) fore-end configuration which, it is claimed, produces a ship's propulsive performance higher than that for a conventional ship under average full load and ballast conditions, with a required horsepower lower by 6% in the full load condition.

The concept was conceived particularly for vessels with a full hull and blunt bow waterline such as LPG carriers (*Crystal Marine*, presented in *Significant Ships of 2005*); however, the similar characteristics of bulk carriers has now led to its first use with that type of vessel. With SEA-Arrow, the bulbous bow has been 'slimmed down' underwater and incorporated into the main hull. The load waterline now extends to the bulb's forward extremity, and a vertical stem line has been introduced from that point to the upper deck (with a 4.90m outward extension at the bow chock) making a smoother bow waterline and providing a profile reminiscent of ships of yesteryear.

Big Glory is a single deck, five-hold, single-skin vessel with forecastle. Top and bottom wing tanks are arranged throughout the cargo space, with the latter joined with a centrally divided double bottom to provide common ballast tanks. The vessel can sail with Nos 2 and 4 holds empty, and No 3 hold can be flooded to provide extra ballast. MacGregor-Kayaba double-skin, hydraulically operated end-folding hatch covers are fitted, and the holds are served by an outfit of four Kawasaki 30tonnes swl, centreline-mounted, deck cranes with a working radius of 26m.

The extent of Kawasaki's activities in the total shipbuilding process is well illustrated with *Big Glory* by the group's involvement (including Kawasaki Heavy Industries) in aspects of hydrodynamic research, construction, crane and deck machinery manufacture,

also installation of fire detection and extinguishing systems, and main machinery, where the company's engineering division is a market leader with both diesel and turbine propulsion machinery.

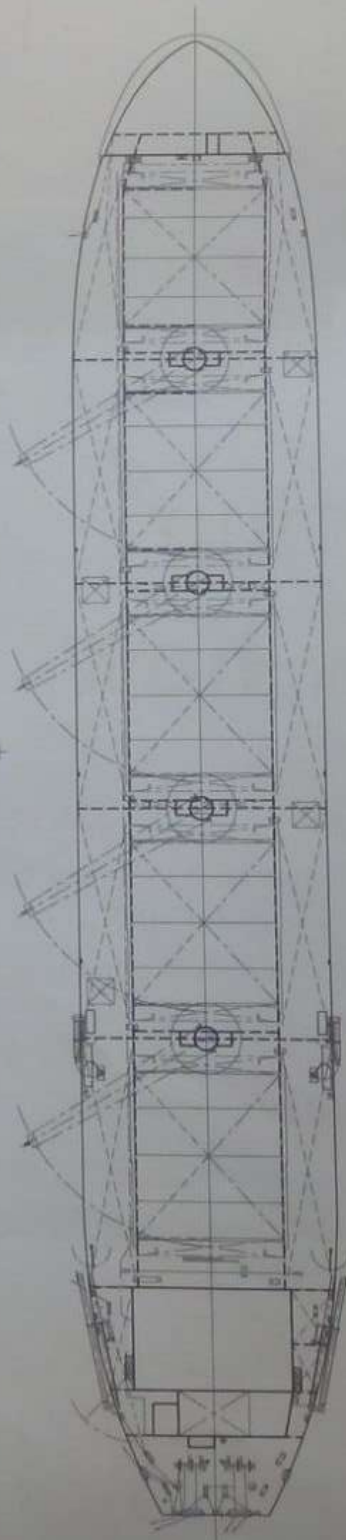
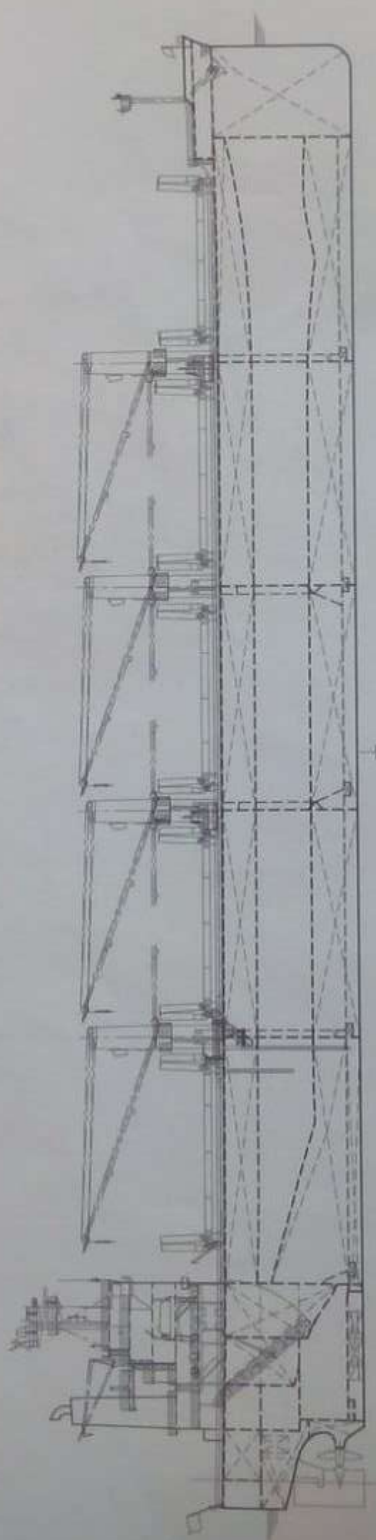
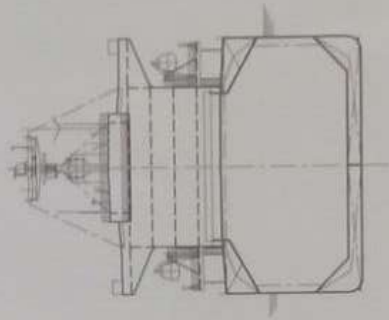
Here, it has supplied a MAN B&W 6S50MC-C main diesel engine for the subject vessel. This develops 8200kW (MCR) or 6970kW (NCR) to drive a FP propeller, running in an open-water sternframe at 110rev/min, for a service speed of 14.6knots at 85% full power. The division is also responsible for the research and development of numerous energy-saving features, such as the patented Rudder Bulb with Fins system fitted to *Big Glory*. Electrical supply is derived from three Yanmar/Taiyo 480kW diesel-alternator sets, and a composite boiler has a steam output of 1000kg/h. Complement is eight officers and 13 crew, with provision for four supernumeraries.

TECHNICAL PARTICULARS

Length, overall	189.90m
Length, bp	185.00m
Breadth, moulded	32.26m
Depth, moulded to upper deck	17.80m
Draught	
design	11.10m
scantling	12.50m
Gross	30,777gt
Deadweight	
design	47,965dwt
scantling	55,809dwt
Speed, service at 85% MCR	14.60knots
Cargo capacity	
grain	69,450m ³
Bunkers	
heavy oil	1980m ³
diesel oil	170m ³
Water ballast	
total	16,600m ³
excluding No 3 floodable hold	13,500m ³
Fuel consumption	
main engine only	29.9tonnes/day
Classification	Bureau Veritas 1 + Hull, + Mach, Bulk Carrier ESP, Unrestricted Navigation, Nonhullload (Nos 2 and 4 holds may be empty), +AUTUMS
Percentage of high-tensile steel used in construction	approx 70%
Main engine	
Design	MAN B&W
Model	6S50MC-C
Manufacturer	Kawasaki Heavy Industries
Number	1
Type of fuel	HFO
Output	8200kW/110rev/min
Propeller	
Material	Nickel-aluminium-bronze

Designer/manufacturer	Nakashima Propeller Co
Number	1
Pitch	fixed
Diameter	6100mm
Speed	110rev/min
Special adaptations	Rudder Bulb with Fins
Diesel-driven alternators	
Number	3
Engine make/type	Yanmar/6N18AL-UV
Type of fuel	HFO
Output/speed of each set	550kW/900rev/min
Alternator make/type	Taiyo Electric/FE-41C
Boilers	
Number/type	1 x composite oil fired/exhaust gas
Make	Osaka Boiler Mfg
Output	1000kg/h each side
Cargo cranes	
Number	4
Make	Kawasaki Precision Machinery
Type	Electro-hydraulic
Performance	30tonnes/26m radius
Mooring equipment	
Number	4
Make	Kawasaki Precision Machinery
Type	Electro-hydraulic
Hatch covers	
Designer/manufacturer	MacGregor-Kayaba
Type	Steel, double-skin, end folding, hydraulic
Complement	
Officers	8
Crew	13
Spare	4
Stern appendages	Rudder Bulb with Fins
Bridge control system	
Make	Nabtesco
Type	M-800 III
One man operation	No
Fire detection system	
Make	Kawasaki Safety Service Industries/Type
Type	T1000
Fire extinguishing system	
Engine room	CO ₂
Make	Kawasaki Safety Service Industries
Radars	
Number	2
Make	Japan Radio Co
Models	JMA-9932-SA, JMA-9922-6XA
Integrated bridge system	No
Waste disposal system	
Incinerator	
Make	Mitsubishi
Model	BGW-30N
Sewage plant	
Make	Sasakura Engineering
Model	SD2A
Contract date	20 June 2000
Launch/float out date	18 December 2004
Delivery date	25 February 2005

BIG GLORY





BOSSCLIP TRADER: another innovative Campbell/Algoship standard bulk carrier

Shipbuilder...Cochin Shipyard Ltd, Cochin, India
 Vessel's name...Bossclip Trader
 Hull number...O14
 IMO number...9320295
 Owner/operator...Clipper Group Ltd, Denmark/Dockendale Shipping Co Ltd, Bahamas
 Designers...Algoship Designers Ltd, Bahamas/Mastek Heavy Industries Co Ltd, Korea
 Model test establishment used...Korea Research Institute of Ships and Ocean Engineering, Korea
 Flag...Bahamas
 Total number of sister ships already completed...Nil
 Total number of sister ships still on order...4 (plus units at other Far Eastern shipyards)

transverse bulkheads between the holds. Cargo is handled by four sets of Tsuji HDSS 3026 hydraulically operated, level-luffing deck cranes, of 30tonne x 26m radius and mounted on tall pedestals to facilitate stowage of deck cargoes. The cranes are positioned between holds number 1 and 2/2/3/3/4 and 4/5, with a capability for operation with radio-controlled grabs.

The main engine is a MAN B&W 6S42MC Mk7 unit manufactured by STX, in Korea, and developing 6480kW MCR when running at 136rev/min to give a service speed of 14.0knots. Electrical supply is delivered from three Yanmar/Taiyo 500kW diesel-alternator sets, and a composite boiler produces 1500kg/h/1100kg/h of steam. Complement comprises eight officers and 13 crew together with three spare cabins and six repair crew, served by a Beihai 30-person, free-fall lifeboat operating over the stern.

TECHNICAL PARTICULARS

Length, oa...178.70m
 Length, bp...170.00m
 Breadth, moulded...28.00m
 Depth, moulded to upper deck...14.00m
 Width of double skin side...1.40m
 bottom...1.50m
 Draught design...9.50m
 scantling...9.79m
 Gross...19,918gt
 Displacement...38,557tonnes
 Lightweight...7923tonnes
 Deadweight design...29,367dwt
 scantling...30,634dwt
 Block coefficient (0.85% depth)...0.8174
 Speed, service at 85% MCR...14.00knots
 Cargo capacity grain...40,975m³
 bale...39,589m³
 Bunkers heavy oil...1682m³
 diesel oil...185m³
 Water ballast...20,519m³
 Fuel consumption main engine only...23tonnes/day
 auxiliaries...2tonnes/day
 Classification...American Bureau of Shipping +A1(E), Bulk Carrier, BC-A, +AMS, +ACCU, SH, SHCM, with description 'ESP' and 'Strengthened for Carriage of Heavy Cargoes, holds 2 and 4 may be empty', LWILD, TCM
 Percentage of high-tensile steel used in construction...65%
 Main engine Design...MAN B&W
 Model...6S42MC Mk7
 Manufacturer...STX Engine Co Ltd
 Number...1
 Type of fuel...HFO
 Output, MCR...6480kW/136rev/min
 Propeller Material...Nickel-aluminium-bronze

Designer/manufacturer...Silla Metal Co Ltd
 Number...1
 Pitch...Fixed
 Diameter...5600mm
 Speed...130.8rev/min
 Diesel-driven alternators Number...3
 Engine make/type...Yanmar/6N18L-EV
 Type of fuel...HFO
 Output/speed...3 x 550kW/720rev/min
 Alternator make/type...Taiyo/FE 547A-10
 Output/speed...3 x 500kW/720rev/min
 Boiler Number...1
 Type...Composite, type MCC83P32
 Make...KangRim
 Output...1500kg/h/1100kg/h
 Cargo cranes Number...4
 Make...Tsuji
 Type...HDSS 3036 level-luffing
 Performance...30tonnes/3.5-26m radius
 Mooring equipment Number...4
 Make...Tong Myung Heavy Industries
 Type...Electric-hydraulic
 Lifesaving equipment Lifeboats...1 x 30-person free-fall
 Make...Beihai
 Hatch covers Design...Seohae
 Manufacturer...Shipbuilder
 Type...Hydraulic end-folding pairs
 Ballast control system Make...Pleiger Far East Co
 Type...Electric-hydraulic
 Complement Officers...8
 Crew...73
 Spare cabins...3
 Suez/repair crew...6
 Bridge control system Make...Daeyang
 Type...Desk console
 One man operation...No
 Fire detection system...Seaplus
 Fire extinguishing system Cargo holds/engine room...High-pressure CO₂
 Make...Seaplus
 Radars Number...2
 Make...Furuno
 Models...1 x FAR 2827 X-band, 1 x FAR 2837S S-band
 Integrated bridge system...Daeyang
 Waste disposal plant Incinerator Make...Hyundai Atlas
 Model...Maxi 100SL-1
 Waste shredder/crusher Make...Electrolux
 Model...500 Series
 Sewage plant Make...RWD
 Model...WWT 3810PUR
 Contract date...20 January 2004
 Launch/float-out date...12 August 2005
 Delivery date...10 April 2006

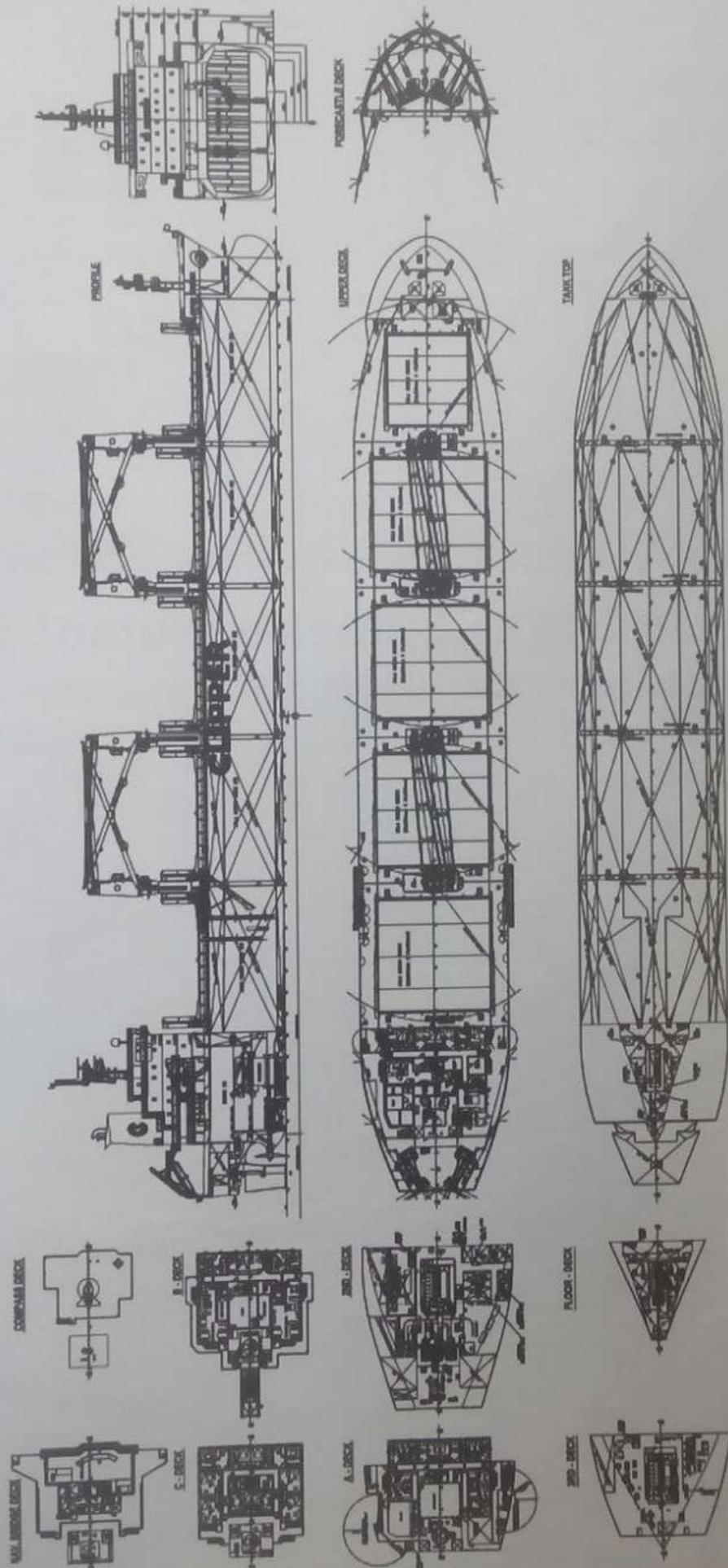
CLOSE to 40 years have elapsed since the then Canadian-based GTR Campbell consultancy introduced its first standard cargo vessel - the celebrated Freedom Liberty-ship replacement, to the international market. Since then, Campbell, and its Bahamian associate Algoship, has regularly had on offer a successful portfolio of series-produced, mainly Handysize bulk carrier designs. Some have been presented in earlier editions of *Significant Ships*. Latest of these is the Trader type, a 29,300dwt double-skin, five-hold vessel, developed in conjunction with trading partners Clipper Group, handling chartering and operations, and Dockendale Shipping, looking after technical management.

As with most recent Campbell/Algoship designs, the Trader class is being built in association with an emerging or re-emerging Asian shipyard: in this case, the Cochin Shipyard, with other contracts placed elsewhere in India and China, now totalling more than 20 newbuildings. *Bossclip Trader* is currently operating in the parcel bulk trades between Brazil and the US Gulf, in a partnership between Clipper and Boss, of Rio de Janeiro.

She conforms with a typical bulk carrier layout having 1.4m wide side tanks joined within a 1.5m deep double bottom to provide combined side and bottom wing tanks and a central bottom tank. The two longitudinal bulkheads, which form the interior of the cargo space, are widely spaced in accordance with Algoship fashion, allowing hatches to occupy some 75% of the beam and to present minimum overhangs.

Hatch covers are hydraulically-operated, end-folding pairs, designed by Seohae and fabricated by the shipbuilder. Other features of the cargo space are small side hoppers, square bulkhead stools, and troughed

BOSSCLIP TRADER



Classification No. : **063936**
IMO No. : **9325116**
Official No. : --
Signal Letters : **4RFE**
Flag : **Sri Lanka**
Port of Registry : **Colombo**
Ship's Name : **GRACE**
Former Name 1 : **NEW CREATION**

Registered Owner 1 : **TOKYO CEMENT COMPANY, (LANKA) PLC**

Management Company 1 : **OCEAN SHIP MANAGEMENT (PTE) LTD., COLOMBO LIAISON OFFICE**

Classification Characters, Notations : **NS*(BC, SHC 2,4 E)(ESP)(PS-DA)
MNS***

Descriptive Notes : --

Installation Characters : **CHG, MPP, LSA, RCF, AFS, BWM**

Installation Descriptive Notes

Special Description : --

Other Classification : --

Type of Ship -Purpose(intended service) : **BULK CARRIER**
- Certificates - SC/SE/SF : **Bulk carrier (SOLAS IX Reg. 1.6)**
- OPP : **Other than Oil Tanker**
- EE : **Bulk carrier**
- SMC/ISSC : **Bulk carrier (SOLAS IX Reg. 1.6)**

Tonnage Gross (Registered) : **21,059**
Tonnage Net (Registered) : **11,954**
Tonnage Gross (Local) : --
Tonnage Net (Local) : --
Tonnage Gross (TM69) : **21,059**
Tonnage Net (TM69) : **11,954**
Deadweight : **35,283**

Summer Freeboard (mm) : **4,429**
Summer Draught (m) : **10.416**
Lf (m) : **169.170**
Continuous Max. Speed (kt) : **16.0**

Overall Length (m) : **175.600**
Moulded LxBxD (m) : **168.500 x 28.400 x 14.800**
Registered LxBxD (m) : **169.170 x 28.400 x 14.800**

Cargo Capacity : **B 44,052.00 G 46,185.00**
(m3 / No. of Containers, etc.) :
No. of Passengers : --
Capacity of Tanks (m3) : **FO 1,710.00 FW 320.00**

Lifeboats Type, No. & Person : **3 2x(24)**
Rescue Boats Type, No. & Person : **1 1x(6) (at combined use for lifeboat)**
Liferafts Type, No. & Person : **1 1x(6) 1 2x(25)**
Radio Installations : **GMDSS A1+A2+A3, SSAS**
Navigation Equipment : **MC, GYRO, HCS, ECDIS, GPS, RDX, RDS, ARPA, AIS, VDR, LOG, ES, STGTEL, DSL, LRIT, BNWAS**

No. & Kind of Engines : **1D : 2 SA 6 CY**
Bore x Stroke (mm) : **460.0 x 1,932.0**
Power (kW) : **6,656**
Revolution (rpm) : **109.0**
Manufacturer : **Mitsui Engineering & Shipbuilding Co., Ltd. Tamano Works**

No. & Kind of Boilers : **1 AUX VB**
Pressure (MPa) : **0.79**
Evaporation : **2.03 (ton/h)**
Manufacturer : **Osaka Boiler Mfg., Co., Ltd.**
*Evaporation rate: Thermal output (kW) to be filled up in case of TOH.

No. & Capacity of Generators (kVA) : **4 AC 1,580**
Kind of Propeller Shaft : **1B**
No. & Shaft Diameter (mm) : **1 x 440**

Shipbuilder : **Shikoku Dockyard Co., Ltd.**
Hull No. : **1029**
Date of Keel Lay : **19 Nov 2004**
Date of Launch : **16 Jul 2006**
Date of Build : **21 Sep 2006**
Date of Conversion : --



E.R. BERGAMO: First bulk carrier built by Hyundai Vinashin Shipyard

Shipbuilder: Hyundai Mipo Dockyard Co., Ltd., Korea
 Shipyard: Hyundai - Vinashin Shipyard Co., Ltd, Vietnam
 Vessel's name: E.R. Bergamo
 Hull No: S001
 Owner/Operator: E.R. Schiffahrt
 Country: Germany
 Designer: Hyundai Mipo Dockyard Co., Ltd
 Country: Korea
 Model test establishment used: Korea Ocean Research & Development Institute
 Flag: Liberia
 IMO number: 9483188
 Total number of sister ships already completed (excluding ship presented): 1
 Total number of sister ships still on order: 12

TECHNICAL PARTICULARS

Length oa: 187.88m
 Length bp: 182.50m
 Breadth moulded: 32.26m
 Depth moulded to upper deck: 16.30m
 Width of double skin:
 bottom: 1.70m
 Draught:
 scantling: 12.85m
 design: 11.30m
 Gross: 32,613gt
 Deadweight:
 design: 46,700dwt
 scantling: 55,500dwt
 Speed, service: 14.5knots
 Cargo capacity:
 Bale: 69,550m³
 Grain: 70,733 m³
 Bunkers:
 Heavy oil: 1920m³
 Diesel oil: 110m³
 Water ballast (m3): 15,542m³
 Daily fuel consumption:
 Main engine only: 32.15tonnes/day
 Classification society and notations: DNV / +1A1, Bulk Carrier ESP, GRAB(20), CSR, BC-A(Holds 2 & 4 may be empty), E0, DG-B, BIS, TMON, CRANE
 Main engine:
 Design: Hyundai - B & W
 Model: 6S50MC-C7
 Manufacturer: HHI-EMD
 Number: 1
 Type of fuel: HFO and MDO
 Output: 8820kW x 119 rev/min
 Propeller:
 Material: Nickel Aluminum Bronze
 Designer/Manufacturer: Hyundai Heavy Industries Co., Ltd
 Number: 1
 Fixed/Controllable pitch: Fixed
 Diameter: 6000mm
 Speed: 119rev/min
 Diesel-driven alternators:
 Number: 3
 Engine make/type: HHI-EMD / 6H17/28 x 3 set
 Type of fuel: HFO and MDO
 Output/speed of each set: 640kW x 900rev/min x 3 set
 Alternator make/type: HHI-EES / HFC7 504-84K x 3 set
 Output/speed of each set: 750kW x 900 rev/min x 3 set
 Boilers:
 Number: 1
 Type: Marine composite boiler, smoke tube & water tube
 Make: Kangnim Heavy Industries Co., Ltd
 Output: 1200kg/h

Cargo cranes/cargo gear

Number: 4
 Make: MacGregor
 Type: Conventional electro-hydraulic wire-luffing type
 Performance: 30tonnes SWL (24tonnes in grab mode) x 26m
 Other cranes:
 Number: 1
 Make: DMC
 Type: Motor driven
 Tasks: Provision handling
 Performance: SWL 2tonnes
 Mooring equipment:
 Number: 4
 Make: Rolls-Royce
 Type: Hydraulic
 Special lifesaving equipment:
 Number of each and capacity: 1 x 25persons
 Make: Hyundai LifeBoats
 Type: Free-fall
 Hatch covers:
 Design: MacGregor
 Manufacturer: MacGregor
 Type: Hydraulic end folding type
 Cargo control system:
 Make: Kongsberg
 Type: Integrated Monitoring & Control
 Ballast Control System:
 Make: Kongsberg
 Type: Integrated Monitoring & Control
 Complement: 25 + 6 (Suez crew)
 Stern appendages: Semi-spade rudder
 Bridge control system:
 Make: HHI-EES
 Type: Self-Standing type
 Is bridge fitted for one-man operation? Yes
 Fire detection system:
 Make: Consilium Marine AB
 Type: CS4000JL
 Fire extinguishing systems:
 Cargo holds: NK high pressure CO₂, sea water total flooding, sea water portable fire extinguisher, fixed local fire lighting system
 Engine Room: NK high pressure CO₂, sea water portable fire extinguisher
 Cabins: Sea water, portable fire extinguisher
 Public Spaces: Sea water, portable fire extinguisher
 Radars:
 Number: 2 sets
 Make: Furuno
 Models: FAR-2837S, FAR-3000
 Integrated bridge system:
 Make: Furuno
 Model: ECDIS FE8-3000
 Contract date: October 2009
 Launch/float-out date: March 2010
 Delivery date: 31 July 2010

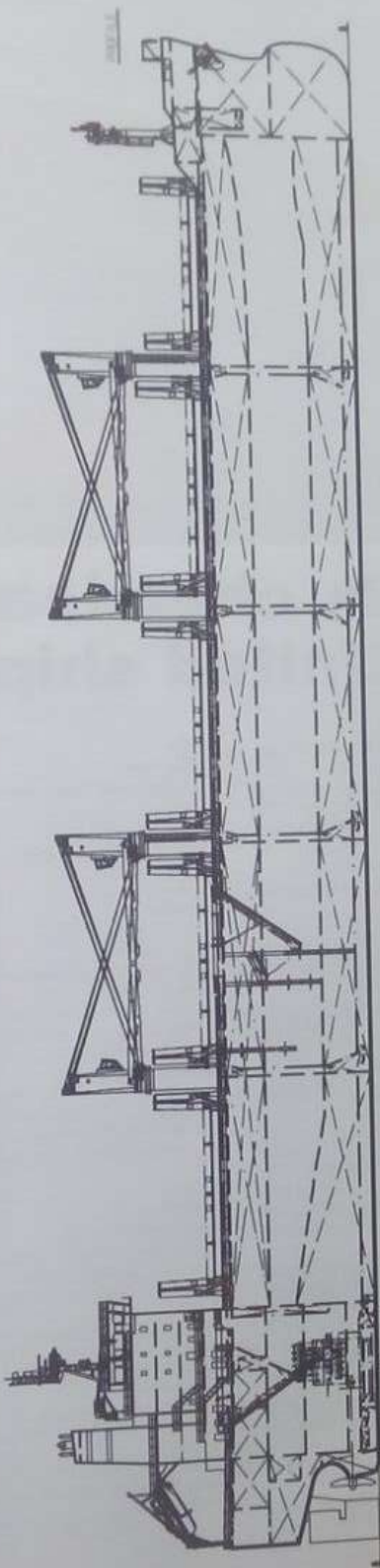
E.R. Bergamo is the first bulk carrier built by Hyundai Vinashin Shipyard. It is one of a series of 14 under construction for E.R. Schiffahrt of Germany and was delivered on 31 July 2009.

Hyundai Vinashin shipyard is a joint venture between the Korean builder, Hyundai, and the Vietnam Shipbuilding Industry Group. The shipyard has been active in the repair area since 1999 and *E.R. Bergamo* marks its entry into the new-construction field. Over US\$100million has been expended upgrading the shipyard's facilities for new construction activities.

E.R. Bergamo is an ocean going geared bulk carrier with bulbous bow, transom stern, flush deck with forecastle, open water type stern frame, single rudder and single screw propeller driven by a slow speed diesel engine. The cargo space is divided into five cargo holds and five pairs of water ballast tanks, each arranged as a double bottom tank connected to a top side wing tank. The No.3 cargo hold may be used for water ballast tank in a heavy weather ballast voyage. The propulsion machinery and living quarters, including the navigation bridge deck, are located aft. Four 30tonnes SWL deck cranes are installed on the Upper Deck, located between the holds.

The vessel is intended primarily for cargoes of grain, iron ore, coal and hot coils. Power is provided by a Hyundai-B & W 6S50MC-C7 diesel engine driving a 6.0m diameter fixed pitch propeller to give a service speed of 14.5knots.

E.R. Schiffahrt is a ship owning and ship management company with activities in container, bulk and offshore segments. The company currently controls 114 vessels in service and under construction. The company has ordered 24 bulk carriers of supramax and capesize class, aggregating some 2,600,000dwt, for delivery between July 2009 and October 2011. *E.R. Bergamo* is one of these vessels.



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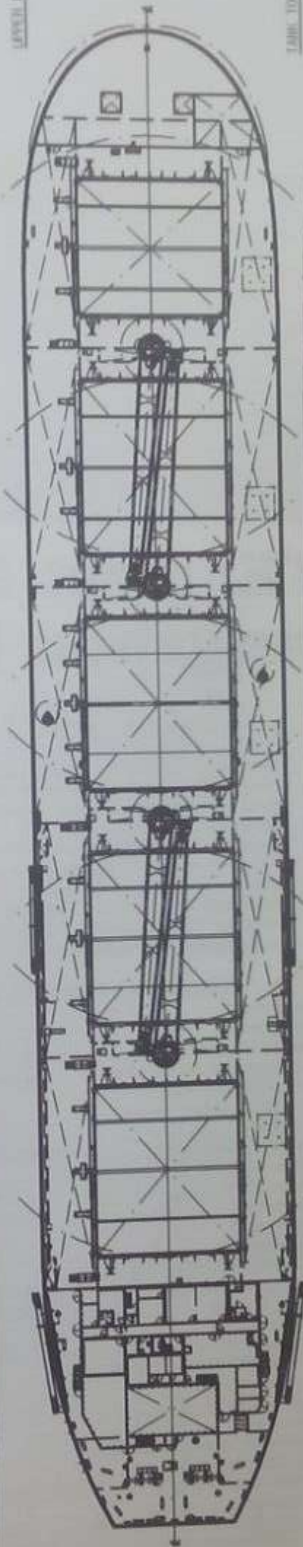
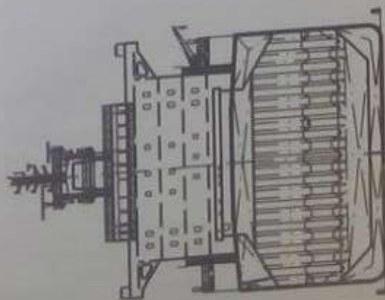
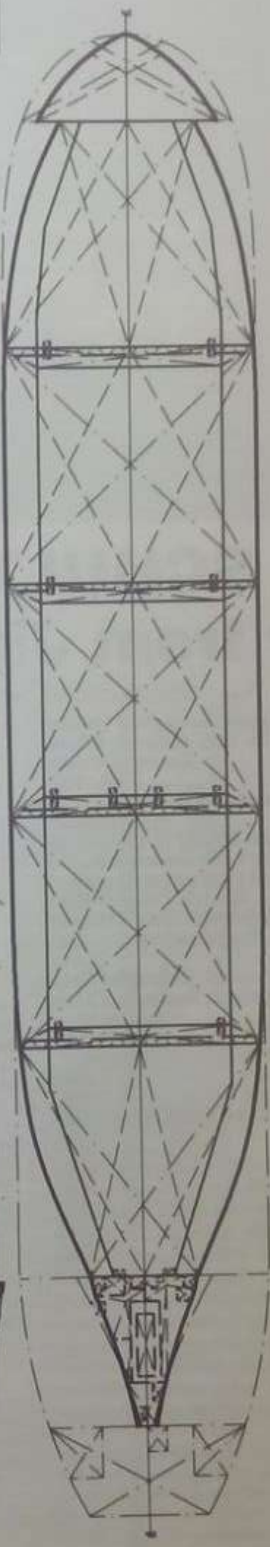


TABLE TOP



MIDSHIP SECTION



STAR KIRKENES: A 49,924dwt general cargo carrier with self-unloading capabilities

Shipbuilder: **Hyundai Mipo Dockyard Co., Ltd**
 Vessel's name: **Star Kirkenes**
 Hull No: **8001**
 Owner/Operator: **Grieg Shipping Norway**
 Designer: **Hyundai Mipo Dockyard Co., Ltd**
 Country: **Korea**
 Model test establishment used: **Hyundai Maritime Research Institute**
 Flag: **Norway**
 IMO number: **9396127**
 Total number of sister ships already completed (excluding ship presented): **2**
 Total number of sister ships still on order: **1**

to upper deck: 19.50m
 to other decks: 15.71m
 Width of double skin: 2.38m
 Side: 2.38m
 Bottom: 1.79m
 Draught: 12.34m
 scantling design: 12.00m
 Gross: 37,158gt
 Deadweight: design: 47,914dwt
 scantling: 49,924dwt
 Speed, service: 16knots
 Cargo capacity: Grain: 65,330 m³
 Bunkers: Heavy oil: 3130m³
 Diesel oil: 374 m³
 Water ballast: 20,700 m³
 Daily fuel consumption: Main engine only: 45.13tonnes/day
 Auxiliaries: 2.9tonnes/day
 Classification society and notations: DNV, +1A1, General Cargo Carrier, Container, HC-B*, HA(+), IB(+), TMON, EO, NAUT-OC, IB(+) notation to be applied for all holds except No 11 Hold. HC-B* notation to be applied as follows with exception of No.11 hold; Any one(1) hold empty or alternate loading such as No.1,3,5,7 & 9 holds empty or No.2,4,6,8 & 10 holds empty.

Main engine: Design: MAN B&W
 Model: 5S60MC-C8
 Manufacturer: HHI-EMD
 Number: 1
 Type of fuel: HFO and MDO
 Output: 11,900kW x 105rev/min

Propeller: Material: Nickel-Aluminum-Bronze
 Designer/Manufacturer: Hyundai Heavy Industries
 Fixed/Controllable pitch: 1 x Fixed
 Diameter: 5500mm
 Special adaptations: PBCF (Propeller boss cap fins)

Diesel-driven alternators: Number: 3
 Engine make/type: HHI-EMD / HIMSSEN 7H21/32 x 2 set, 5H21/32 x 1 set
 Type of fuel: HFO and MDO
 Output/speed of each set: 1440kW x 900rev/min x 2 set, 800kW x 720rev/min x 1 set

Alternator make/type: HHI-EES / Marine Design
 Output/speed of each set: 1350kW x 900rev/min x 2 set, 750kW x 720rev/min x 1 set

Boilers: Number & type: 1 x Vertical, forced draft, oil fired
 Make: Kangrim Heavy Industries Co., Ltd
 Output: 1600kg/h

Cargo cranes/cargo gear: Number & make: 2 x Tsuji Heavy Industries
 Type: Electric gantry crane
 Performance: SWL 70tonnes /each
 Other cranes:

Number & make: 1 x DMC
 Type: Overhead electric travelling crane
 Tasks: E/R overhead crane
 Performance: SWL: 4tonnes

Mooring equipment: Number & make: 5 x Rolls-Royce
 Type: Hydraulic

Special lifesaving equipment: Number of each and capacity: 1 x 32persons
 Make: Schat Harding
 Type: Free-fall

Hatch covers: Design & manufacturer: MacGregor
 Type (upper deck/other decks): lift-away type operated by Gantry craneContainers

Lengths: 6058mm
 Heights: 2438mm
 Total TEU capacity: 1453
 On deck: 635
 In holds: 618
 Homogeneously loaded to 14tonnes: 1310
 Tiers/rows (maximum): 4 / 11
 On deck: 4 / 11
 In holds: 3 / 11

Cargo & ballast control system: Make: Kongsberg
 Type: Integrated Monitoring & Control

Complement: 31
 Stern appendages/special rudders: Flap Rudder

Bow thrusters: Number & Make: 1 x Rolls-Royce
 Output: 1500kW

Stern thrusters: Number & Make: 1 x Rolls-Royce
 Output: 865kW

Bridge control system: Make & type: Kongsberg C20
 Bridge is fitted for one-man operation

Fire detection system: Make: Autronica
 Type: BS-320M

Fire extinguishing systems: Cargo holds: NK CO₂ fire extinguishing system, sea water, portable fire extinguisher
 Engine Room: NK CO₂ fire extinguishing system, sea water, portable fire extinguisher

Cabins: Sea water, portable fire extinguisher
 Radars: 2 sets Furuno
 Number & make: 2 sets Furuno
 Model: FAR-2837S, FAR-2827

Integrated bridge system: Make & model: Maris ECDIS900

Waste disposal plant: Incinerator: Teamtec GS 500CS
 Sewage plant: Jonghap Machinery Co., Ltd JMC-BIO AEROB-18

Contract date: May 2006
 Launch/float-out date: March 2009
 Delivery date: 25 June 2009

TECHNICAL PARTICULARS

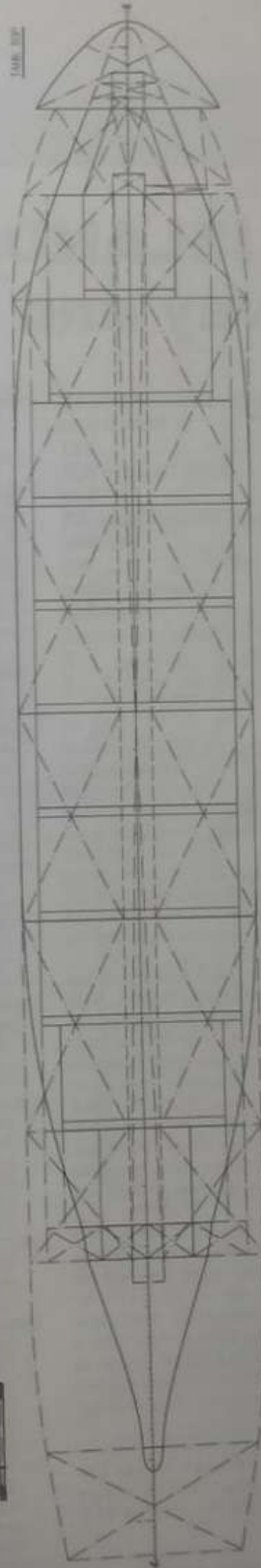
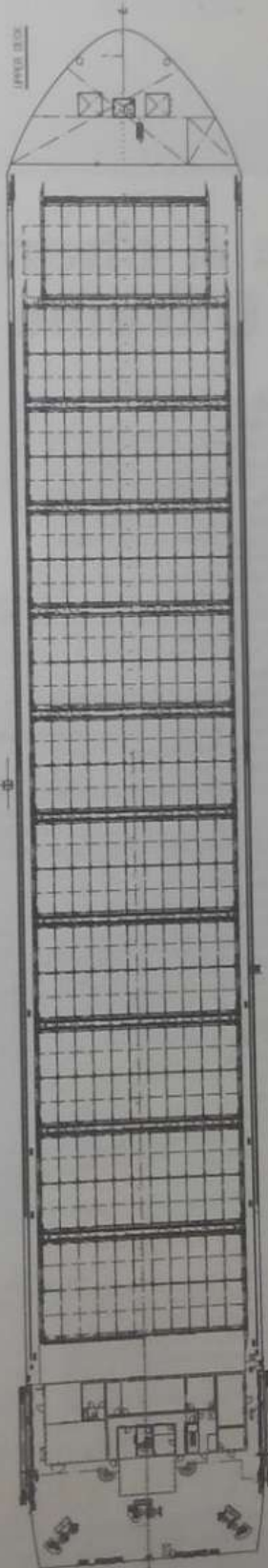
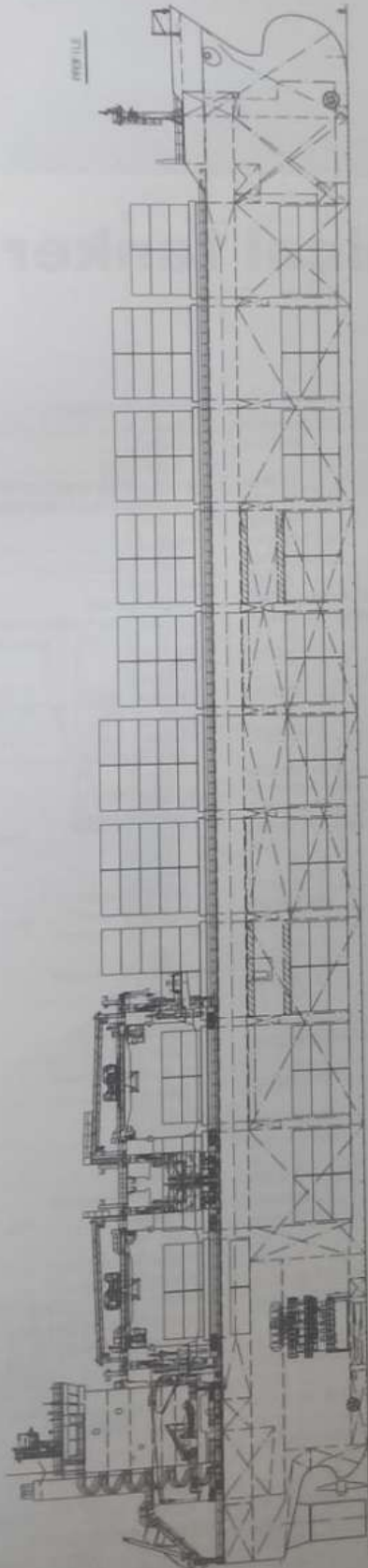
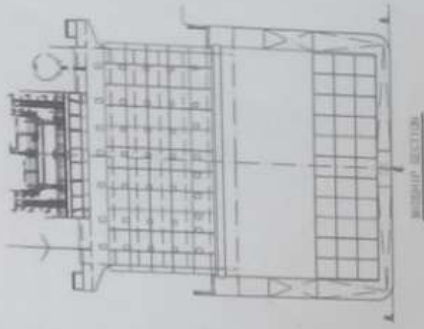
Length oa: 208.73m
 Length bp: 197.40m
 Breadth moulded: 32.2m
 Depth moulded:

The most noticeable features of *Star Kirkenes* are the two 70tonne SWL gantry cranes on the deck. With this self-unloading capability the ship can carry a wide variety of cargoes.

Star Kirkenes is an ocean going general cargo carrier with double bottom, double-hull, bulbous bow, transom stern, flush deck with fore-castle, open water type stern frame, single rudder fitted with bow and stern thruster and single screw propeller driven by a slow speed diesel engine. The vessel has transverse bulkheads dividing the cargo space into eleven cargo holds and nine pairs of water ballast tanks. The transverse bulkheads in way of the cargo holds are of double plate construction to give smooth-skinned holds. Under deck passageways are provided on port and starboard sides in way of the cargo hold space and hold access is provided from the starboard side under deck passage with ladders inside the transverse bulkhead spaces.

Weather tight steel hatch covers for cargo holds are of the pontoon type operated by the hydraulic cylinders arranged inside the gantry travelling cranes' legs. The cargo height on the hatch covers is limited by SOLAS requirements for visibility from the bridge. Three tiers of 8'6" high containers may be loaded in all cargo holds except Hold No.11 over the Engine room which is limited to one tier of containers. The holds generally are box-shaped for container carriage except for holds Nos 1, 2, 9 and 10 which have side benches to accommodate the vessel's hull shape.

With its scantling deadweight of 49,924dwt and overall length of 208.73m *Star Kirkenes* on delivery was the largest ship in the Grieg Shipping fleet.



Classification No. : **092373**
IMO No. : **9430844**
Official No. : **40412-09-A**
Signal Letters : **3FYC6**
Flag : **Panama**
Port of Registry : **Panama**
Ship's Name : **BULK NEPTUNE**
Former Name 1 : --

Registered Owner 1 : **MI-DAS LINE S.A.**

Management Company 1 : **APEX SHIP MANAGEMENT PTE LTD.**

Classification Characters, Notations : **NS*(BC-A)(ESP)(IWS)**
MNS*

Descriptive Notes

Design Condition : **Strengthened for heavy cargo loading where hold nos. 2 & 4 may be empty**

Installation Characters : **CHG, MPP, LSA, RCF, M0, AFS, BWM**

Installation Descriptive Notes

Automatic and Remote Control Systems : **The ship has complied with the requirements of Chapter II-1, Part E of SOLAS, "Periodically unattended machinery spaces (UMS)".**

Special Description : --

Other Classification : --

Type of Ship -Purpose(intended service) : **BULK CARRIER**
- Certificates - SC/SE/SF : **Bulk carrier (SOLAS IX Reg. 1.6)**
- OPP : **Other than Oil Tanker**
- EE : **Bulk carrier**
- SMC/ISSC : **Bulk carrier (SOLAS IX Reg. 1.6)**

Tonnage Gross (Registered) : **31,259**
Tonnage Net (Registered) : **18,516**
Tonnage Gross (Local) : --
Tonnage Net (Local) : --
Tonnage Gross (TM69) : **31,259**
Tonnage Net (TM69) : **18,516**
Deadweight : **55,657**

Summer Freeboard (mm) : **5,375**
Summer Draught (m) : **12.573**
Lf (m) : **182.970**
Continuous Max. Speed (kt)
(Sea Trial) : **16.5**
Equipment No. : **3,039**

Overall Length (m) : **189.990**
Moulded LxBxD (m) : **182.000 x 32.260 x 17.900**
Registered LxBxD (m) : **182.970 x 32.260 x 17.900**

Cargo Capacity
(m3 / No. of Containers, etc.) : **B 68,116.00 G 70,855.00**
No. of Passengers : --
Capacity of Tanks (m3) : **FO 2,645.00 FW 428.00**

Lifeboats Type, No. & Person : **3 2x(24)**
Rescue Boats Type, No. & Person : **1 1x(6) (at combined use for lifeboat)**
Liferafts Type, No. & Person : **1 1x(6) 1 2x(25)**
Radio Installations : **GMDSS A1+A2+A3, SSAS**
Navigation Equipment : **MC, GYRO, HCS, GPS, RDX, RDS, ARPA, AIS, VDR, LOG, ES, STGTEL, DSL, LRIT, BNWAS**

No. & Kind of Engines : **1D : 2 SA 6 CY**
Bore x Stroke (mm) : **500.0 x 2,000.0**
Power (kW) : **9,480**
Revolution (rpm) : **127.0**
Manufacturer : **Mitsui Engineering & Shipbuilding Co., Ltd. Tamano Works**

No. & Kind of Boilers : **1 AUX VB**
Pressure (MPa) : **0.69**
Evaporation : **2.97 (ton/h)**
Manufacturer : **Osaka Boiler Mfg., Co., Ltd.**
***Evaporation rate: Thermal output (kW) to be filled up in case of TOH.**

No. & Capacity of Generators (kVA) : **4 AC 1,900**
Kind of Propeller Shaft : **1C**
No. & Shaft Diameter (mm) : **1 x 470**



Thalassini Axia: Supramax bulk carrier from SPP Shipbuilding

Shipbuilder: SPP Shipbuilding Co., Ltd
 Vessel's name: **Thalassini Axia**
 Hull No: **H-1030**
 Owner/operator: **Enesel S.A**
 Country: **Greece**
 Designer: **Korea Maritime Consultants (KOMAC)**
 Country: **South Korea**
 Model test establishment used: **Maritima and Ocean Engineering Research Institute, KORDI (MOERI)**
 Flag: **Malta**
 IMO number: **9452490**
 Total number of sister ships already completed (excluding ship presented): **3**
 Total number of sister ships still on order: **0**

THALASSINI Axia is the first Supramax bulk carrier design in a series of four, to be constructed at SPP Sacheon Shipyard that has a deadweight of 58,608dwt that was delivered to its Greek owner Enesel S.A in March.

The vessel is an ocean going bulk carrier with a bulbous bow, a single cambered upper deck with forecastle, a transom stern, a single rudder, and a single screw propeller. The cargo area consists of five cargo holds having double bottom water ballast tanks with hopper and top side wing ballast tanks.

Thalassini Axia is 196m in length overall and a width of 32.26m with a depth of 18.60m. The 58,608dwt bulk carrier is the first of its type to be constructed at the shipyard. The vessel is powered by a MAN B&W Licensee 6S50MC-C produced by Doosan that has a power output of 7795kW giving the vessel a service speed of 15.15knots at 121.5 rev/min when running at 90% MCR power with a 15% sea margin.

The heavy fuel oil tanks are arranged in two pairs with No.4 and 5 top side wing tanks that are protected by water ballast tanks and in a deep tank located between the engine room and No.5 hold. The vessel is primarily intended for coal, iron ore, grain, steel coil, and cement. Performance Standard for Protective Coating (PSPC), also applies to the vessel to protect water ballast tanks from corrosion. Deck machinery system have been arranged to safely come alongside a pier by mooring rope. Also, a control lever on the hydro motor for the winch can be remotely operated. The hold traffic is suitably designed for the vessel in

compliance with guideline in AMSA Marine Orders Part 32.

TECHNICAL PARTICULARS

Length oa: 196.00m
 Length bp: 189.00m
 Breadth moulded: 32.26m
 Depth moulded: 18.60m
 To main deck: 18.60m
 Draught (mid.): 13.00m
 Scantling: 11.10m
 Design: 34,318gt
 Gross: 69,919.8tonnes (at Scantling)
 Displacement: 11,311tonnes
 Lightweight: 47,493dwt
 Design: 58,608dwt
 Scantling: 0.8585 (at Scantling)
 Block co-efficient (please state relevant draught): 14.6 knots
 Speed, service: 70,733m³
 Bale: 75,530m³
 Grain: 15,588m³
 Liquid volume: 2,198m³
 Heavy oil: 145.8m³
 Diesel oil: 16,045m³
 Water ballast: ABS +A1,
 Classification society and notations: Bulk Carrier, BC-A(holds 2 and 4 may be empty), +AMS, +ACCU, CSR, AB-CM, ESP, GRAB[20], TCM, UWILD, POT, CRC, CPS

Main engine
 Design: MAN DIESEL
 Model: 6S50MC-C (Mark8)
 Manufacturer: DOOSAN ENGINE
 Number: 1
 Type of fuel: HFO with MDO for cold condition
 Output of each engine: 9960Kw

Propeller(s)
 Material: Ni-Al-Bronze (type4)
 Designer/Manufacturer: Silla Metal / Silla Metal
 Number: 1
 Fixed/Controllable pitch: Fixed pitch
 Diameter: 5.9m
 Speed: 127rpm at mic

Diesel-driven alternators
 Number: 3
 Engine make/type: Yanmar Diesel / 6N21L-LV
 Type of fuel: HFO with MDO for cold condition
 Output/speed of each set: 660kW / 720rpm
 Alternator make/type: TAIYO / FE547B-10
 Output/speed of each set: 600Kw / 720rpm

Boilers
 Number: 1

Type: MC (composite type boiler)
 Make: SPP Machine Tech Co., LTD.
 Output, each boiler: 1200kg/h (fire side)
 / 1200kg/h (exh. Side) x 7kg/cm²

Cargo cranes/cargo gear
 Number: 4
 Make: MacGregor
 Type: Electro-hydraulic single jib
 Performance: SWL 36tonnes, working radius 26m

Other cranes
 Number: 1
 Make: SPP Machine Tech
 Type: Electric
 Tasks: Provision
 Performance: SWL 3tonnes, working radius 9m-3.1m

Mooring equipment
 Number: 6
 Make: Rolls-Royce
 Type (electric/hydraulic/steam): Electric-hydraulic

Special lifesaving equipment
 Number of each and capacity: 1 x 24P
 Make: Hyun-dai life boat
 Type: Free fall launching
 vertical or sloping chutes: Sloping chutes

Hatch covers
 Design: MacGregor
 Manufacturer: Tanktech
 Type (upper deck/other decks): Flooding type (upper deck)

Cargo tanks
 Number: 5

Ballast control system
 Make: Scana Korea Hydraulic Ltd.
 Type: Horizontal panel

Complement
 Officers: 15
 Crew: 9
 Suez/Repair Crew: 6

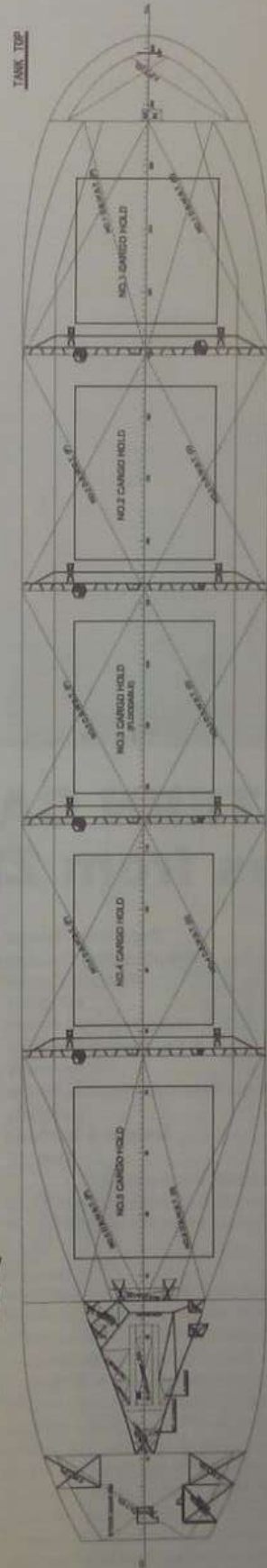
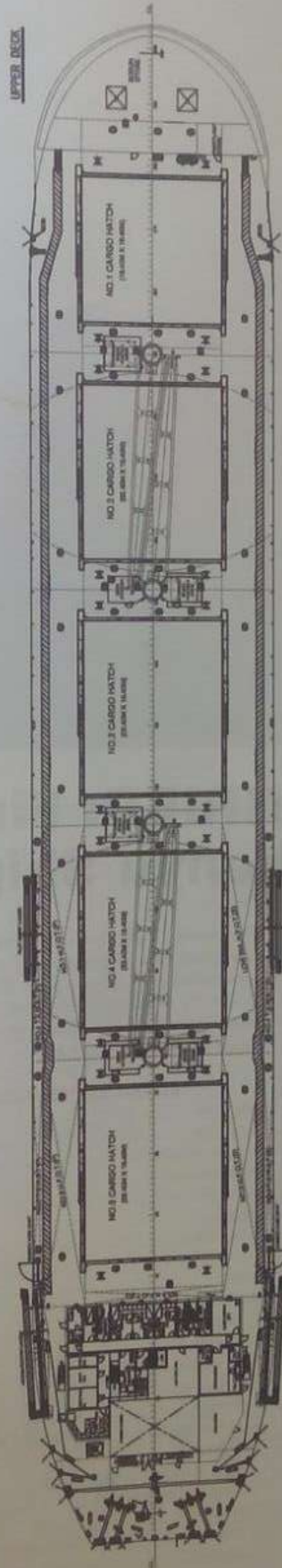
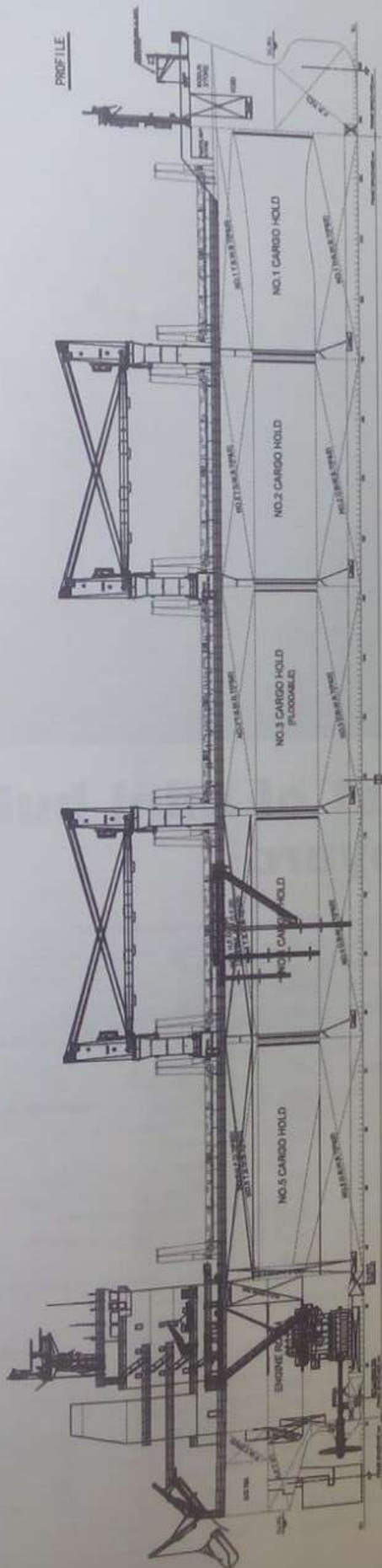
Bridge control system
 Make: Yokogawa Denshikiki Co., Ltd.
 Type: PT500A-J-N2

Fire detection system
 Make: Consilium Marine AB
 Type: CS4000/3L

Fire extinguishing systems
 Cargo holds: NK / High Pressure CO₂
 Fire Extinguishing System & Smoke Detecting System
 Engine room: NK / High Pressure CO₂
 Fire Extinguishing System & Smoke Detecting System

Radars
 Number: 2
 Make: Japan Radio Co., Ltd.
 Models: JMA-9132-SA/9122-9XA

Contract date: 29 May 2007
 Launch/float-out date: 30 December 2009
 Delivery date: 24 March 2010





ALGOMA MARINER: New Laker for Algoma Central Corporation

Shipbuilder: **Cheng Xi Shipbuilding Heavy Industries Co., Ltd**
 Vessel's name: **Algoma Mariner**
 Hull No: **CX0324**
 Owner/operator: **Algoma Central Corporation**
 Country: **Canada**
 Designer: **Deltamarin/ CS Marine ER, Accommodation/ Forebody**
 Country: **Finland/ People's Republic of China**
 Model test establishment used: **HSVA**
 Flag: **Canada**
 IMO: **9587893**
 Total number of sister ships already completed (excluding ship presented): **1**
 Total number of sister ships still on order: **nil**

self-unloading equipment within the tunnel, loop and boom fitted onboard is certified for carriage of hazardous materials in accordance with the latest Transport Canada requirements. Dust control and cargo handling enhancements have also been included in the system design.

TECHNICAL PARTICULARS

Length oa: 225.56m
 Length bp: 219.32m
 Breadth moulded: 23.74m
 Depth moulded: 15.00m
 To upper deck:
 Width of double skin:
 Side: 1.2m
 Bottom: 1.35m
 Draught:
 Scantling: 10.15m
 Design: 10.00m
 Gross: 24,535gt
 Displacement: 49,000tonnes
 Lightweight: 11,000tonnes
 Deadweight:
 Design: 37,300dwt
 Scantling: 38,000dwt
 Block co-efficient: 0.90 T=10.0m
 Speed, service: 14knots @ 85% MCR
 Cargo capacity:
 Grain: 39,000m³
 Bunkers:
 Heavy oil: 860m³
 Diesel oil: 35m³
 Water ballast: 15,000m³
 Daily fuel consumption:
 Main engine: 24tonnes/day
 Auxiliaries: 2tonnes/day
 Classifications society and notations: LR 100A1, IWS, LI, LMC, UMS, NAV1, Caribbean Class
 % high tensile steel used in construction: 25%
 Main engines:
 Design: MAN Diesel
 Model: 6S46MC-C7-T1
 Manufacturer: Hudong Heavy Machinery Company
 Number: 1
 Type of fuel: HFO
 Output of each engine: 7200kW
 Propellers:
 Material: Ni-Al-Copper
 Designer/manufacturer: MAN Diesel - Alpha
 Number: 1
 Fixed/ controllable pitch: CPP
 Diameter: 5.65m
 Speed: 118rpm
 Special adaptations: Ice Class 1C, moderate skew
 Diesel-driven alternators:
 Number: 3
 Engine make/type: MAN 6M20C
 Type of fuel: HFO
 Output speed of each set: 1020kW/ 900rpm
 Alternator make/type: AEM/ SE500 S8
 Output/speed of each set: 1200kVA 575V/ 900rpm

Boilers:
 Number: 2
 Type: Thermal Oil heater, Eg Economiser
 Make: Aalborg
 Output, each boiler: 1500kW, 1000kW
 Cargo cranes/ cargo gear:
 Number: 1
 Make: EMS-Tech Inc.
 Type: Gravity fed self-unloading system
 Performance: 5450tonnes/hour boom length = 80m
 Other cranes:
 Number: 1
 Make: South China Marine Machine Co Ltd
 Type: Gantry crane
 Tasks: Hatch covers
 Performance: 180kN
 Mooring equipment:
 Number: 7
 Make: Colomatic (Wilf's), Hattapa
 Type: Electro-hydraulic, electric
 Special lifesaving equipment:
 Number of each and capacity: 1 x 25 persons
 Make: JingYin Neptune
 Type: Frefall lifeboat
 Hatch covers:
 Design: TTS
 Manufacturer: TTS
 Type: 22 Lift-on lift-off
 Cargo control systems:
 Make: EMS-Tech
 Type: Gravity fed self-unloading
 Ballast control system:
 Make: Nordic Controls
 Type: Ballast Ring Man
 Complement:
 Officers: 8
 Crew: 11
 Stern appendages/ special rudders: 70° range (P or S) with Costa bulb
 Bow thrusters:
 Make: Wuhan Kawasaki
 Number: 1
 Output: 1200kW
 Bridge control system:
 Make: Sperry
 One-man operation: Yes
 Fire detection system:
 Make: Tyco
 Type: Minerva CS4000
 Fire extinguishing systems:
 Engine room: Safetec/ CO₂
 Radars:
 Numbers: 2
 Make: Northrop Grumman Sperry Marine
 Waste disposal plant:
 Incinerator: CSSC LZ Teamtec/ OGS 200C
 Waste compactor: Kangli
 Sewage plant: DVZ/ SKA-50 Biomaster Plus
 Contract date: October 2007
 Launch/float-out date: July 2009
 Delivery date: May 2011

Algoma Mariner is the second and final vessel in a series of self-unloading bulk carriers delivered to Canadian ship operator Algoma Central Corporation, with the first vessel in the series, *Algobay*, delivered in 2010. The vessel was delivered from Cheng Xi Shipbuilding Heavy Industries Co., Ltd in May.

While both *Algoma Mariner* and *Algobay* are sister ships with respect to cargo carrying and discharge capabilities and have identical vessel forebodies, *Algoma Mariner* has a very different aft section, machinery and accommodation areas. The stern hull form of the *Algoma Mariner* is a completely new design for the vessel by Deltamarin, designers of Algoma's new Equinox Class dry-bulk cargo vessels. The optimised hull and rudder have been designed to improve fuel efficiency and reduce wake.

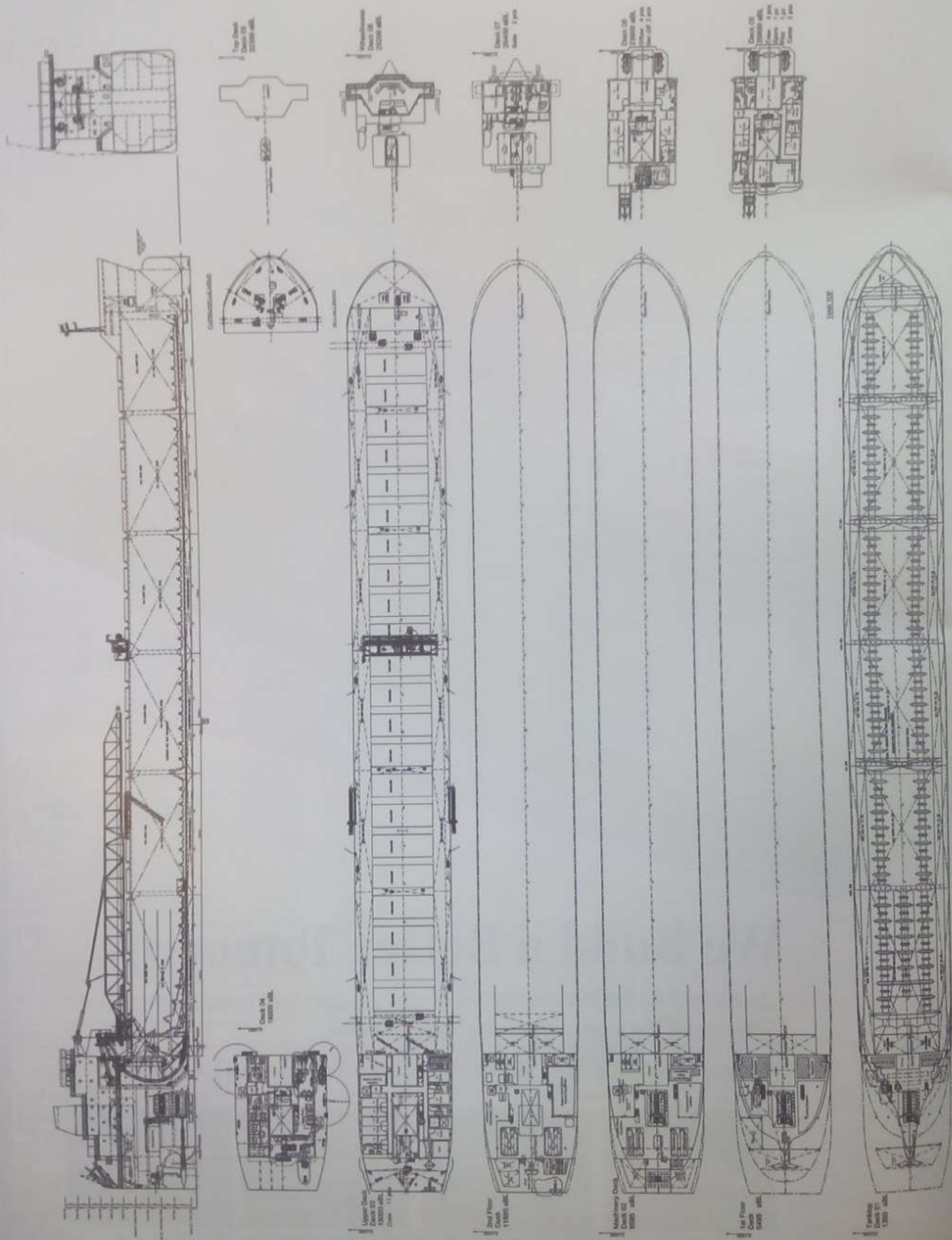
This new vessel is powered by a single slow speed engine which provides better fuel efficiency. This combined with the controllable pitch propeller and a modern advanced control system that interprets the power demand from the bridge and responds with the most efficient combination of engine speed and propeller pitch at any given load, giving a significant improvement in performance compared to other vessels currently in the bulk carrier fleet.

The electric power generation and distribution system also takes full advantage of electronic control and monitoring from the same platform as the propulsion control system. A power management system (PMS) monitors vessel power demand and ensures that sufficient generating capacity is available at all times. It starts and stops the generators automatically based on the power demand as well as having various operating modes to accommodate specific operating conditions such as unloading and transiting the St. Lawrence Seaway locks, ensuring sufficient capacity is available at all times.

The engine room has been designed as an Unmanned Machinery Space (UMS) which provides for remote and redundant alarm and monitoring systems. *Algoma Mariner* is powered by a MAN Diesel 6S46MC-C7-T1 and operates at speeds of 14knots at 85% MCR.

The vessel has six cargo holds that have a total capacity of 39,000m³, the vessel is able to carry approximately 26,000tonnes (in St. Lawrence Seaway); and approximately 38,000tonnes (maximum capacity in coastal waters). All the

ALGOMA MARINER





DRAGONERA: First Seahorse 35 bulk carrier

Shipbuilder:	Qidong Daoda Heavy Industry Co., Ltd (DDHI)
Vessel's name:	Dragonera
Hull No:	DD-017
Owner/operator:	Falcon Maritime
Country:	Denmark
Designer:	Grontmij A/S
Country:	Denmark
Model test establishment used:	Force technology
Flag:	Malta
IMO number:	9536428
Total number of sister ships already completed (excluding ship presented):	2
Total number of sister ships still on order:	4

Dragonera is the first in a series of six green ships built to Grontmij's design. The Seahorse 35 bulk carriers have an optimised hull that has no bulbous bow as Grontmij say this is unnecessary and can be counter-productive if the vessel's bow is not always in the water.

The first six vessels will be delivered to Falcon Maritime of Denmark and were designed around four years ago. Grontmij say they have substantially up graded the latest versions of the Seahorse 35 design and later models will sport a Mewis Duct, a larger propeller and a smaller more efficient engine. Overall the *Dragonera* offers a 10% improvement in fuel efficiency on comparable vessels, but *Dragonera* is at the beginning of the changes and later models will be a further 25% more efficient compared to the early Seahorse design.

Improvements in efficiency can be added through the addition of waste heat recovery systems from Aalborg and exhaust gas recirculation units added to the latest engines from MAN Diesel & Turbo. Scrubbers also from Aalborg will allow the ships to operate in emission control areas (ECA) using more cost effective HFO rather than the significantly higher priced MDO or MGO.

The Seahorse 35 is designed for "economical and efficient operation, environmental friendliness and maintenance, safety, loading flexibility and to meet the latest regulations for bulk carriers, say the designers.

The vessel is designed with a shallow draught that maximises the cargo space. It has five flush double-skinned cargo holds, wide hatches and no hopper tank tops, which provides easy access and cargo storage in all the vessel's holds.

Short turn-around times are achieved through effective cargo hold cleaning by portable washing machines. "Outlets of water and compressed air are arranged in all cargo holds at tank top-level. A permanent washing water return line is arranged in each cargo hold at tank top level. A portable pneumatic pump can, via the return line, transfer dirty washing water to two cargo hold washing water holding tanks arranged for temporary storage to enable cargo hold cleaning in sensitive and restricted areas," say the design team.

The double-skin configuration allows easy access to staff for structural inspections of the vessel, even when the vessel is loaded. All fire main line, hydraulic and fresh water (FW) piping and electrical cables in cargo the area are arranged in upper deck pipe ducts, avoiding cargo and green water damage and thereby requiring a minimum of maintenance work. A slender afterbody and a highly efficient NPT propeller offers optimal performance with minimum fuel consumption and a vertical stem has been adopted to improve the fuel efficiency in adverse weather conditions.

TECHNICAL PARTICULARS

Length oa:	180m
Length bp:	176.75m
Breadth moulded:	30m
Depth moulded:	
To upper deck:	14.70m
Width of double skin:	
Side:	1.70m
Bottom:	1.60m
Draught:	
Scantling:	10.10m
Design:	10.10m
Gross:	24,210gt
Displacement:	45,009tonnes
Lightweight:	10,396tonnes
Deadweight:	
Design:	34,613dwt
Scantling:	34,613dwt
Speed, service:	14knots
Cargo capacity:	
Bale:	45,654m ³
Grain:	46,733m ³
Bunkers:	
Heavy oil:	1586m ³
Diesel oil:	402m ³
Water ballast:	12,943m ³

Daily fuel consumption:	26.4tonnes/day
Main engine:	2tonnes/day
Auxiliaries:	2tonnes/day
Classification society and notations:	DNV +1A1
	Bulk Carrier ESP-ES(D), ICE-1C,
	BC-A, DG-B, BWM(s.f) Holds (2,4)
	May Be Empty GRAB(20) ha(+)
	dk(+), TMON BIS FUEL B380cSt,
	991kg/m ³ , -15°C) BWM-E(s.f),
	COAT-PSCB(B), ICE-1C

Main engines:	
Design:	MAN
Model:	5S50MC-C7
Manufacturer:	STX
Number:	1
Type of fuel:	HFO
Output of each engine:	7500kW
Propellers:	
Designer/manufacturer:	Stone Marine Propulsion
Number:	4
Diameter:	5.6m
Speed:	124rpm

Diesel-driven alternators:	
Number:	3
Engine make/type:	Hyundai Heavy Industries Co., Ltd/6H17/28
Type of fuel:	HFO and MGO
Output/speed of each set:	654kW x 900rpm
Alternator make/type:	marine three-phase
Output/speed of each set:	600kW x 900rpm

Boilers:	
Number:	1
Type:	MC5901R1
Make:	Kangrim
Output, each boiler:	1800kg/h
Cargo cranes/cargo gear:	
Number:	4

Other cranes:	
Number:	3
Mooring equipment:	
Number:	4

Stern thruster:	
Make:	Changzhouzhonghao
Number:	1
Output:	7500kW

Waste disposal plant:	
Incinerator:	Nanjing Luzhou Co. Ltd
Waste compactor:	Hansun Marine Technology Co. Ltd
Contract date:	17 November 2008
Launch/float-out date:	5 March 2011
Delivery date:	26 August 2011



HALKI: 37,000dwt bulk carrier

Shipbuilder: **Hyundai Mipo Dockyard Co., Ltd**
 Vessels name: **Halki**
 Hull No: **6094**
 Owner/operator: **J.K Maritime**
 Designer: **Hyundai Mipo Dockyard Co., Ltd**
 Country: **Korea**
 Model test establishment used: **HMRI**
 Flag: **Marshall Island**
 IMO number: **9543419**
 Total number of sister ships already completed (excluding ship presented): **nil**
 Total number of sister ships still on order: **nil**

Halki was delivered to its owner J.K. Maritime from Korean shipyard Hyundai Mipo Dockyard Co., Ltd in July and is the first vessel of its type for its owner.

The vessel is a 37,000dwt ocean going geared bulk carrier with bulbous bow, transom stern, flush deck with forecastle, open water type stern frame, single rudder and single screw propeller, driven by a slow speed diesel engine. The vessel has a continuous deck from stem to stern, transverse bulkheads and double bottom in way of the cargo hold part and in engine room; with the propulsion machinery and living quarters including the navigation bridge to be located aft of the vessel.

Halki has a special Notation of "DG-B", which enables her to carry the Dangerous Cargoes. The vessel has been designed to carry grain, iron ore, coal, hot coil and can load the two-layers of steel coil weighing up to 20tonnes, which is in distinction from the old series.

Halki has a total of six heavy fuel oil storage tanks that are protected by the double hull structure in the top side wing tanks, but the diesel oil storage tanks are of single hull structure in engine room double bottom in compliance with MARPOL Annex.1 Ch.3 Reg. 12A Ph.11 "Accidental oil fuel outflow performance standard" to be provided and one of these heavy fuel oil storage tanks could be used for low sulphur HFO tank at the Buyer's discretion. The cargo space is divided into five cargo holds, five pairs of water ballast tanks to be arranged in the double bottom and two pairs of water ballast tanks which can be connected to the top side wing tank.

Halki is 186.40m in length overall and has a width of 27.80m and depth of 15.6m with a scantling deadweight of 37,000dwt. The vessel is powered by a MAN Diesel & Turbo 6S46MC-C8.1 that has a power output of 7860kW giving the vessel a service speed of 14.80knots at 85% MCR.

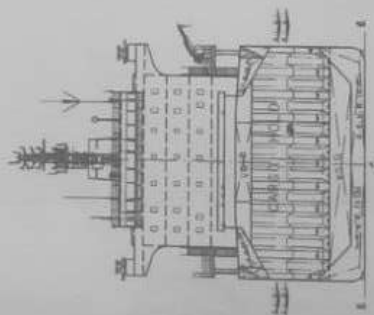
Halki is to service the Gibraltar route, which will increase the amount of vessels serving the Gibraltar and Tangiers route to six.

Width of double skin	
Bottom	1.7m
Draught	
Scantling	10.90m
Design	9.80m
Gross	22,680gt
Deadweight	
Design	31,800dwt
Scantling	36,850dwt
Speed, service	14.80knots
Cargo capacity	
Bale	46,200m ³
Grain	47,900m ³
Bunkers	
Heavy oil	1520m ³
Diesel oil	105m ³
Water ballast	20,500m ³ (No 3 Cargo floodable 9800m ³)
Daily fuel consumption	
Main engine only	27.9tonnes/day at NCR based on MDO, LCV 42,700kj/kg
Auxiliaries	7.9tonnes/day for 3 G/E at MCR based on MDO, LCV 42,700kj/kg
Classification society and notations	DNV, +1A1, Bulk Carrier ESP, BC-A (Hold No 2 & 4 may be empty), Grab[20], CSR, E0, BIS, TMON, DG-B
% high tensile steel used in construction	62%
Main engine	
Design	MAN Diesel & Turbo
Model	6S46MC-C8.1
Manufacturer	Hyundai Heavy Industries
Number	1
Type of fuel	HFO, MDO, DFO
Output of each engine	7800kW
Propellers	
Material	Ni-Al-Bronze
Designer/manufacturer	Hyundai Heavy Industries
Number	1
Fixed/controllable pitch	Fixed
Diameter	5.6m
Speed	14.8knots
Special adaptations	Net cutter
Diesel-driven alternator	
Number	3
Engine make/type	Hyundai Heavy Industries /Mitsen 5H17/28
Type of fuel	HFO, MDO, DFO
Output speed of each set	575kW x 900rpm
Alternator make/type	Hyundai Heavy Industries /HFC7 504-84K
Boilers	
Number	1
Type	Composite boiler
Make	Kangrim
Output, each boiler	Oil fired section 1200kg/h, exhaust gas section 900kg/h
Cargo cranes/cargo gear	
Number	4
Make	MacGregor
Type	Hydraulic

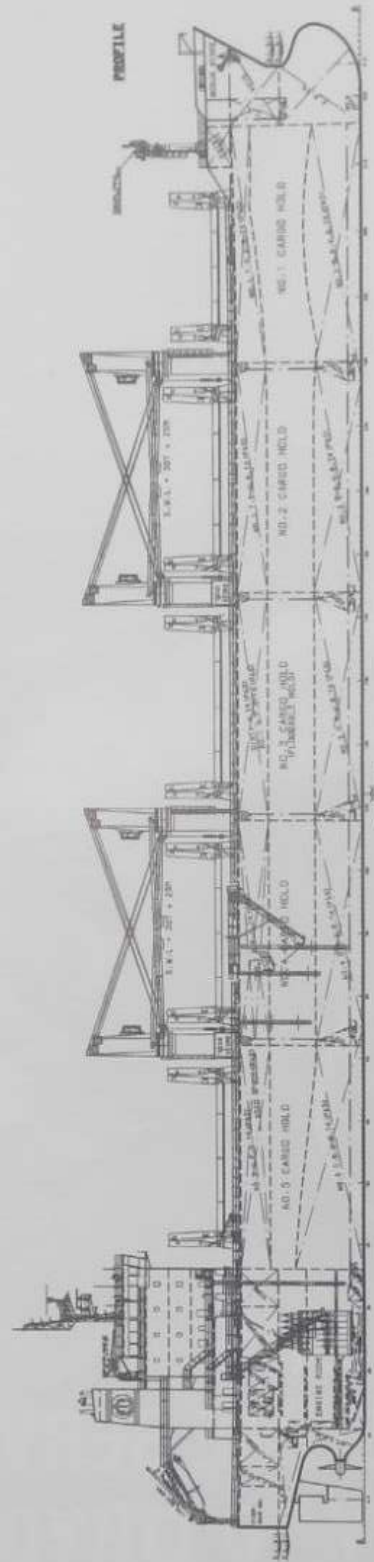
Performance	Hoisting, luffing, slewing
Other cranes	
Number	1
Make	Dongham Marine Crane Co. Ltd
Type	Electric-hydraulic
Tasks	Provisions
Performance	Hoisting, luffing, slewing
Other cranes	
Number	1
Make	Oriental
Type	Motor driven E/R overhead crane
Tasks	E/R equipment overhaul
Performance	SWL 2tonnes
Other cranes	
Number	1
Make	Oriental
Type	RD-22-35
Tasks	Rescue boat/liferaft handling davit
Performance	Hoisting, slewing
Moorings equipment	
Number	4
Make	Rolls-Royce
Type	Electric-hydraulic
Special lifesaving equipment	
Number of each and capacity	1 x 25 persons
Make	Hyundai Lifeboats Co., Ltd
Type	Totally enclosed lifeboat
Vertical or sloping chutes	Sloping chutes
Hatch covers	
Design	MacGregor
Manufacturer	Dong-won heavy industry, Corp
Type	Cylinder folding
Ballast control system	
Make	Emerson
Type	Piano console
Complement	
Officers	12
Crew	13
Bridge control system	
Make	Hyundai Heavy Industries
Fire detection system	
Make	Consilium/NK
Type	Salwido cargo smoke detecting system for cargo hold
Fire extinguishing systems	
Cargo holds	CO ₂ / NK High pressure
Engine room	LFSS/ NK water mist
	GGK High pressure
Radars	
Number	2
Make	Furuno
Models	FAR-2837S, FAR-2827
Waste disposal plant	
Incinerator	Kangrim/ KFB-50
Sewage plant	Il Seung/ ISS-25N
Contract date	May 2010
Launch/float-out date	May 2011
Delivery date	July 2011

TECHNICAL PARTICULARS

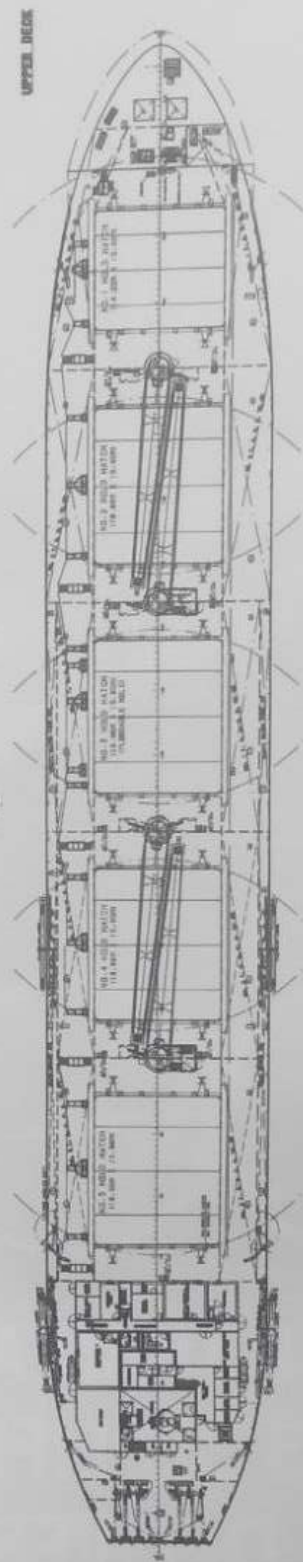
Length oa	186.40m
Length bp	178m
Breadth moulded	27.80m
Depth moulded	
To upper deck	15.6m



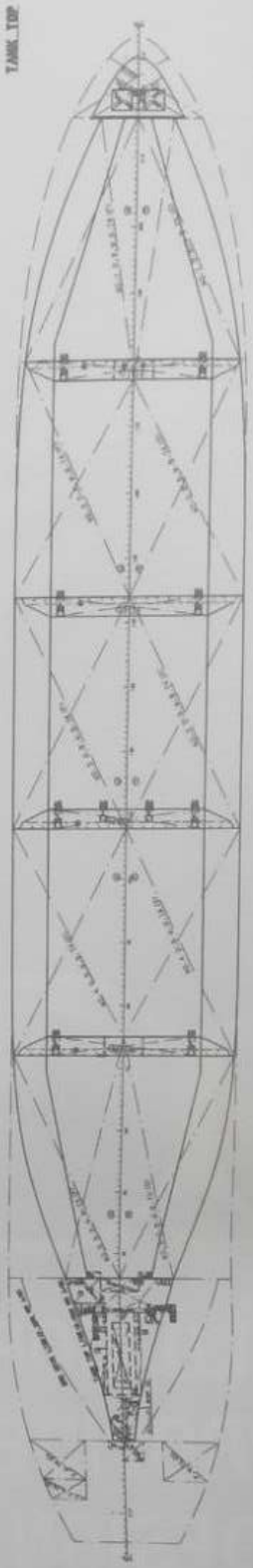
HULL SECTION



PROFILE



UPPER DECK



TANK TOP

Classification No. : **114560**
IMO No. : **9597642**
Official No. : **400816**
Signal Letters : **9V5201**
Flag : **Singapore**
Port of Registry : **Singapore**
Ship's Name : **ACACIA**
Former Name 1 : **BORONIA K**

Registered Owner 1 : **ACACIA MARINE PTE. LTD.**

Management Company 1 : **AYDIN DENIZ ISLETMECILIGI A.S.**

Classification Characters, Notations : **NS*(BCM, BC-XII, GRAB)(WS)**
MNS*

Descriptive Notes

Design Condition : **Double hull construction applied to all cargo holds**

Installation Characters : **CHG, MPP, LSA, RCF, MO, AFS, BWM**

Installation Descriptive Notes

Automatic and Remote Control Systems : **The ship has complied with the requirements of Chapter II-1, Part E of SOLAS, "Periodically unattended machinery spaces (UMS)".**

Special Description : --

Other Classification : --

Type of Ship -Purpose(intended service) : **BULK CARRIER**
- Certificates - SC/SE/SF : **Bulk carrier (SOLAS XII Reg. 1.1)**
- OPP : **Other than Oil Tanker**
- EE : **Bulk carrier**
- SMC/ISSC : **Other cargo ship**

Tonnage Gross (Registered) : **21,194**
Tonnage Net (Registered) : **11,615**
Tonnage Gross (Local) : --
Tonnage Net (Local) : --
Tonnage Gross (TM69) : **21,194**
Tonnage Net (TM69) : **11,615**
Deadweight : **33,677**

Summer Freeboard (mm) : **4,266**
Summer Draught (m) : **10.101**
Lf (m) : **172.320**
Continuous Max. Speed (kt)
(Sea Trial) : **16.0**
Equipment No. : **2,291**

Overall Length (m) : **179.990**
Moulded LxBxD (m) : **172.000 x 28.200 x 14.300**
Registered LxBxD (m) : **172.320 x 28.200 x 14.300**

Cargo Capacity
(m³ / No. of Containers, etc.) : **B 43,164.00 G 44,038.00**
No. of Passengers : --
Capacity of Tanks (m³) : **FO 1,621.00 FW 310.00**

Lifeboats Type, No. & Person : **3 2x(25)**
Rescue Boats Type, No. & Person : **1 1x(6) (at combined use for lifeboat)**
Liferafts Type, No. & Person : **1 1x(6) 1 2x(25)**
Radio Installations : **GMDSS A1+A2+A3, SSAS**
Navigation Equipment : **MC, GYRO, HCS, ECDIS, GPS, RDX, RDS, ARPA, AIS, VDR, LOG, ES, STGTEL, DSL, LRT**

No. & Kind of Engines : **1D : 2 SA 6 CY**
Bore x Stroke (mm) : **450.0 x 1,840.0**
Power (kW) : **6,250**
Revolution (rpm) : **118.0**
Manufacturer : **KOBE DIESEL CO., LTD.**

No. & Kind of Boilers : **1 AUX VB**
Pressure (MPa) : **0.69**
Evaporation : **1.85 (ton/h)**
Manufacturer : **TORTOISE ENGINEERING CO., LTD.**
***Evaporation rate: Thermal output (kW) to be filled up in case of TOH.**

No. & Capacity of Generators (kVA) : **4 AC 1,751**
Kind of Propeller Shaft : **1B**
No. & Shaft Diameter (mm) : **1 x 460**



NORD HONG KONG: Green bulk carrier

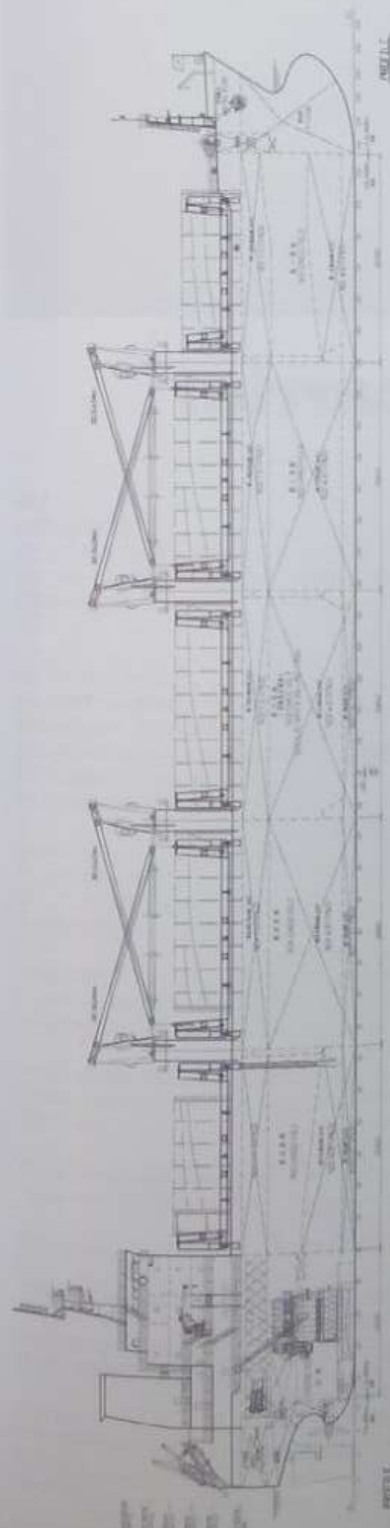
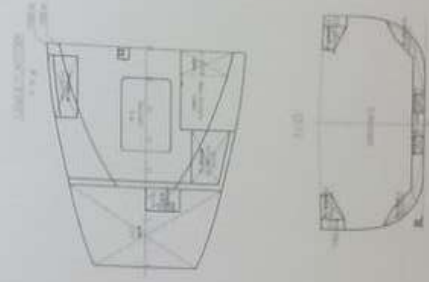
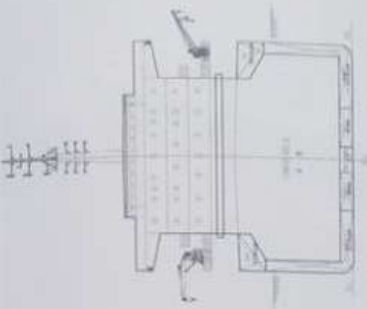
Shipbuilder: **Jianmen Nanyang Ship Engineering Co., Ltd**
 Vessel's name: **Nord Hong Kong**
 Hull No.: **JNS128**
 Owner/operator: **Norden Shipping (Singapore) Pte. Ltd.**
 Country: **Singapore**
 Designer: **Shanghai Bestway Marine Engineering Design Co., Ltd**
 Country: **China**
 Model test establishment used: **China Ship Scientific Research Centre**
 Flag: **Singapore**
 IMO number: **9599004**
 Total number of sister ships already completed (excluding ship presented): **nil**
 Total number of sister ships still on order: **1**

Depth
 To main deck: 14.10m
 To upper deck: 14.10m
 To A deck: 17.60m
 To B deck: 20.35m
 To C deck: 23.10m
 To bridge deck: 25.85m
 To compass deck: 28.60m
 Width of double skin
 Side: 1.40m
 Bottom: 1.65m
 Draught
 Scantling: 10.15m
 Design: 10.00m
 Gross: 20,969gt
 Displacement: 41,748tonnes
 Lightweight: 9459tonnes
 Deadweight
 Design: 31,630dwt
 Scantling: 32,290dwt
 Block co-efficient: 0.815 at design draft
 Speed, service: abt. 13.8knots at 90% SMCR
 Cargo capacity
 Bale: 41,101m³
 Grain: 43,477m³
 Bunkers
 Heavy oil: 1659m³
 Diesel oil: 156m³
 Water ballast: 10,470m³ excl. heavy ballast hold No.3
 Daily fuel consumption
 Main engine: abt. 23 tonnes/day
 Auxiliaries: abt. 2tonnes/day
 Classification society and notations: LR 100A1, Bulk Carrier, CSR, BC-A, HOLD No. 2 AND 4
 MAY BE EMPTY, GRAB(25), Timber Deck Cargoes, ESP, IWS, LI, with the descriptive notes
 ShipRight9SCM,BWMP(F)) LMC, UMS
 Main engines
 Design: MAN B&W
 Model: 6S46MC-C8
 Manufacturer: STX Heavy Industries
 Number: 1
 Type of fuel used: HFO
 Output of each engine: 6000kW
 Propellers
 Material: Ni-Al-Bronze
 Designer/Manufacturer: Stone Marine Propulsion
 Number: 1
 Fixed/controllable pitch: Fixed
 Diameter: 5.54m
 Special adaptations: NPT design from Stone Marine Propulsion
 Diesel-driven alternators
 Number: 3
 Engine make/type: CME-MAN B&W/ 5L16/24
 Type of fuel: HFO
 Output/ speed of each set: 500kW/ 1200rpm
 Alternator make/type: CM-Hyundai/ HFC6 454-64K

Output/speed of each set: 440kW/ 1200rpm
 Boilers
 Number: 1
 Type: OC-Tci 1200/ 900kg/h
 Make: Aalborg Industries
 Cranes/cargo gear
 Number: 4
 Make: Wuhan
 Type: H305190-240
 Performance: 30.5 SWL at 24m outreach
 Other cranes
 Number: 2
 Make: Jiangyin Xinjiang FR.P Co., Ltd
 Type: JYRC21, JYRC105 crane
 Tasks: Rsecue boat davit, provisions crane
 Performance: 21kn SWL at 5m outreach, 15kn SWL at 5m outreach
 Mooring equipment
 Number: 4
 Make: Hatlapa/ Nanjing Luzhou
 Type: Electro-hydraulic
 Special lifesaving equipment
 Number of each and capacity: 1 x 25 persons
 Make: Jiangyin Xinjiang FR.P Co., Ltd
 Type: JY-FN-3.80
 Hatch covers
 Design: TTS Hau Hai Ships Co., Ltd
 Manufacturer: Jianmen Nanyang Ship engineering Co., Ltd
 Type: Hydraulic folding
 Ballast control system
 Make: Nordic flow control Pie Ltd
 Type: Valve remote control system HPU 150
 Complement
 Officers: 4
 Crew: 21
 Fire detection system
 Make: Thorn of Tyco
 Type: 1121E
 Fire extinguishing systems
 Cargo holds/Engine room: Unitor/ CO₂ HP System
 Local application: Shanghai Aoshan Marine Company/ HP water mist
 Public spaces: Fair/ 9L portable foam
 Radars
 Number: 2
 Make: Furuno
 Models: FAR-2837S FAR-2827
 Waste disposal plant
 Incinerator: CSSC Nanjing Luzhou
 Waste shredder/crusher: Enviroment Protection Co., Ltd/ DG 200C
 Sewage plant: Loipart AB/ 400 series
 Jiangsu Nanji Mechanical Co., Ltd
 WCMBR-30
 Contract date: 6 November 2006
 Launch/float-out date: 15 July 2011
 Delivery date: 12 October 2011

TECHNICAL PARTICULARS

Length oa: 179.90m
 Length bp: 171.50m
 Breadth moulded: 28.40m



BRIDGE

DECK

DECK

DECK

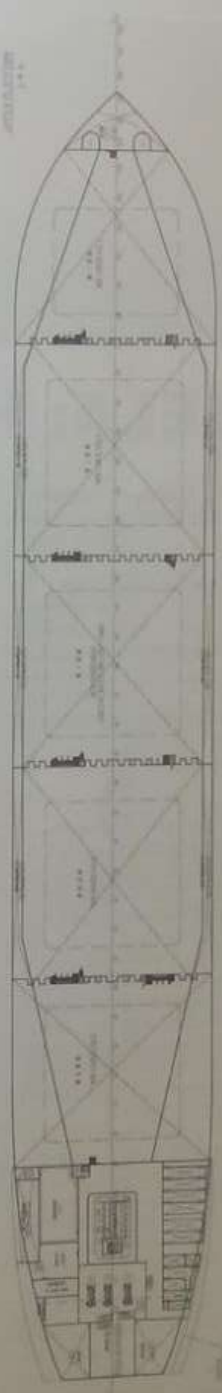
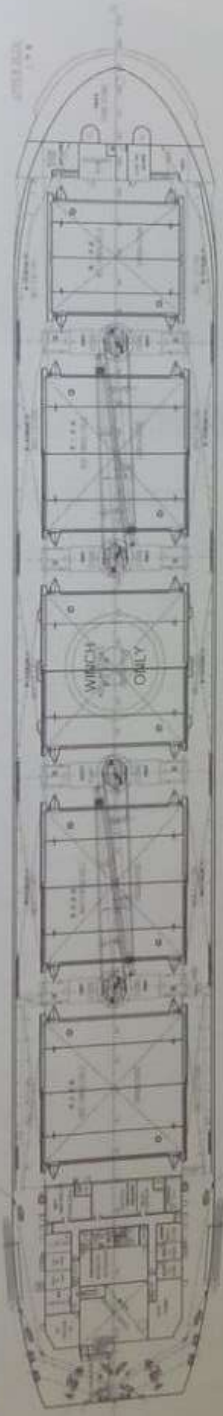
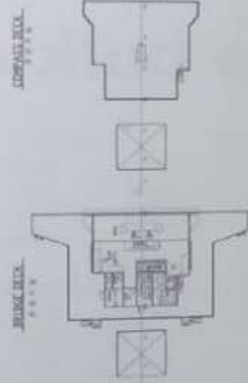
DECK

DECK

DECK

DECK

DECK





ARKADIA: 56,000dwt handymax built in Vietnam

Shipbuilder	Hyundai-Vinashin Shipyard
Vessel's name	Arkadia
Hull No.	S042
Owner/operator	ESL Shipping
Country	Finland
Designer	Hyundai Mipo
Country	Korea
Mosel test establishment used	Hyundai Maritime Research Institute/Aker Arctic Technology Inc.
Flag	Finland
IMO number	9590797
Total number of sister ships already completed (excluding vessel presented)	1
Total number of sister ships on order	nil

It is expected that the new vessel will further strengthen ESL Shipping's position as the leading dry cargo transport company. *Arkadia's* sister vessel was also completed and introduced in the summer 2012.

TECHNICAL PARTICULARS

Length oa	197.08m
Length bp	189.00m
Breadth moulded	32.26m
Depth moulded	
To main deck	18.50m
To upper deck	18.50m
Width of double skin	
Side	1.3m
Bottom	1.7m
Draught	
Scantling	13.00m
Design	11.00m
Gross	33,958gt
Displacement	68,418tonnes
Lightweight	12,070tonnes
Deadweight	
Design	45,161dwt
Scantling	56,348dwt
Speed, service	14.5knots
Cargo capacity	
Grain	70,055m ³
Bunkers	
Heavy oil	2,010m ³
Diesel oil	115m ³
Water ballast	19,200m ³
Daily fuel consumption	
Main engine only	33.6tonnes/day
Classification society and notations	DNV, +1A1, Bulk Carrier, ESP, CSR, BC-A [Holds 2&4 may be empty], GRAB(20), E0, COAT-PSPC(B), NAUT-OC, ICE-1A, BIS, TMON, BWM-T
Main engine	
Design	Hyundai Heavy Industry Co., Ltd
Model	7S50MC-C8
Manufacturer	Hyundai Heavy Industry Co., Ltd
Number	1
Type of fuel	HFO
Output of each engine	11,820kW x 127rpm
Propeller	
Material	Stainless Steel (SUS)
Designer/manufacturer	Rolls-Royce
Number	4
Fixed/controllable pitch	Controllable
Diameter	6.2m
Speed	127rpm
Boilers	
Number	1
Type	Composite boiler
Make	SAAKE
Output, each boiler	1,600kg/h (oil fired)/1,200kg/h (exhaust gas section)
Cargo cranes/cargo gear	
Number	4
Make	Cargotec

Type	Electro-Hydraulic
Other cranes	
Number	1/1
Make	DMC
Type	Motor driven/ Electro-hydraulic
Tasks	E/R overhead crane/ provision handling
Performance	SWL 2tonnes
Mooring equipment	
Number	4
Make	Rolls-Royce
Type	Electro-hydraulic
Special lifesaving equipment	
Number of each and capacity	1 x 25persons
Make	Hyundai Lifeboat Co., Ltd
Type	Electro-hydraulic freefall type
Hatch covers	
Design	Cargotec
Manufacturer	Cargotec
Type	Folding type
Cargo tanks	
Number	5
Grades of cargo carried	Bulk
Product range	Grain, iron ore, hot coil, limestone, steel pipe, fertilizer
Water ballast treatment system	
Make	Panasia
Capacity	2 x 1,000m ³ /h
Complement	
Officers	11
Crew	13
Bow thruster	
Make	Hyundai Heavy Industries Co., Ltd
Number	1
Output	117kN
Stern thruster	
Make	Hyundai Heavy Industries Co., Ltd
Number	1
Output	117kN
Bridge control system	
Make	Hyundai Heavy Industries Co., Ltd
Type	Self standing
Fire detection system	
Make	Consilium
Type	715_FC Cargo/4L
Radars	
Number	2
Make	Furuno
Model	FAR-2837S, FAR-2826
Integrated bridge system	
Make	Furuno
Model	FEA2807
Waste disposal plant	
Incinerator	Hyundai-Akai
Sewage plant	ISawing
Contract date	06 May 2010
Launch/float-out date	15 June 2011
Delivery date	02 January 2012

ARKADIA is the first Ice Class dry bulk vessel built in the Hyundai-Vinashin yard for shipowner ESL shipping and it was delivered at the beginning of 2012.

With financial decline and lack of stability in the economy Vietnamese shipbuilding has fallen away in recent years. However, Korean shipyards such as Hyundai have teamed up with Vietnamese yards to build more vessels. The vessel *Arkadia* signals that all may not be lost for Vietnamese shipbuilding and will mean that we will see more projects coming from this region in the future.

Arkadia is tailor-made for operations in demanding conditions such as those met in the Baltic Sea area. *Arkadia* is the first of two Supramax class bulk carriers that is 197m in length overall and has a maximum draft of 13.0m fully laden. The vessel also features built-in cranes and a ballast water treatment system (BWTS). The BWTS installed onboard *Arkadia* consists of two treatment plants from Panasia that have a capacity of 1,000m³/h.

The vessel is an ocean going bulk carrier with bulbous bow, transom stern, flush deck with forecabin and open water type stern frame, single rudder and single screw propeller driven by a slow speed diesel engine. The propulsion machinery and living quarters including navigation bridge are located at the aft of the vessel.

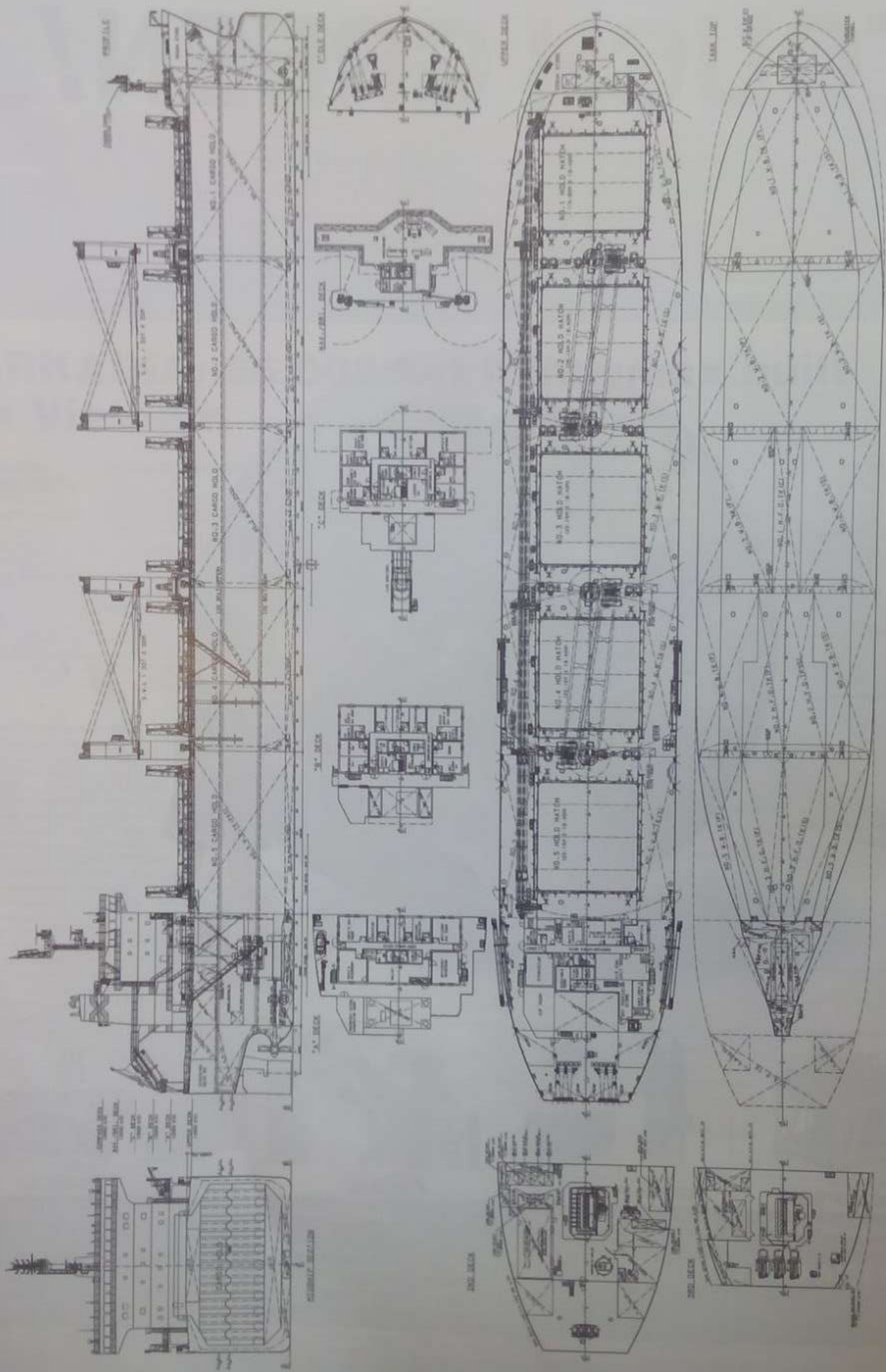
For the vessel to have a continuous deck from stern, transverse bulkheads and double bottom and double side in way of the cargo space has the following subdivisions of fore peak tank, void space, chain lockers, bow thruster and emergency fire pump space and bowan store.

The cargo space is divided into five cargo holds and five pairs of water ballast tanks. No.3 cargo hold may be used for water ballast tank at heavy weather ballast voyage. Four sets of deck cranes are installed on upper deck between each cargo holds. Heavy fuel oil storage tanks are arranged in cargo hold double bottom, engine room and diesel oil storage tanks in engine room double bottom in compliance with MARPOL Annex 1-Ch.3-Reg.12A-Ph.11 "Accidental oil fuel outflow performance standard".

After peak tank, steering gear compartment, fresh water tanks and stern tube cooling water tank. The notation of NAUT-OC is applied for the one-man operation of the bridge control.

The vessel is painted to the PSPC specification and has a double-hull structure, with Ice-1A which has been applied to the vessel so that it can sail through polar regions.

ARKADIA





STX ARBORELLA: open-hatch bulker

Shipbuilder:	STX Offshore & Shipbuilding Co., Ltd
Vessel's name:	STX Arborella
Hull No:	S1539
Owner/operator:	POS Maritime CA S.A/ STX PanOcean Co., Ltd
Country:	Korea
Designer:	STX Offshore & Shipbuilding Co., Ltd
Country:	Korea
Model test establishment used:	MOERI
Flag:	Marshall Islands
IMO number:	9613288
Total number of sister ships completed (excluding ship presented):	nil
Total number of sister ships still on order:	9

STX Arborella is the first order for STX Offshore and Shipbuilding for an open-hatch type bulk carrier with a removable deck for open-hatch and hold to accommodate heavy-lift cargo in the holds, valued at 20 to 30% higher than other bulk carriers of a similar size. *STX Arborella* is the first in a series of 10 vessels for STX Pan Ocean.

STX Pan Ocean signed a contract for the specialised vessels with Fibria of Brazil in October 2010. Subsequently, in October 2011, it signed an additional transportation contract worth US\$246 million.

The ship is the first of a total of 230 open hatch general cargo carriers ordered by STX Pan Ocean and will be deployed on the trade lanes between Brazil and the Americas, Europe and Asia, beginning in September 2012. *STX Arborella* will be on a 25-year long-term charter contract with Fibria to export wood pulp. The nine ships in the series are scheduled to be delivered in due order by 2014.

STX Arborella was optimally designed to suit the characteristics of wood pulp freight. This ship is expected to contribute to Fibria being able to maintain its competitiveness in its distribution costs, leading the market in the future and present an opportunity for STX Pan Ocean to strengthen its status as the leading maker of specialised shipping vessels in the world's wood pulp market.

Shipping companies from northern Europe have mainly operated the South American wood pulp transportation market. The order for the vessel and the 25-year charter sees the first Asian-based shipping firm to operate in the wood pulp market.

STX Arborella is 199.9m long, 32.26m wide and 19.3m high, can ship more than 55,000tonnes of wood pulp as the largest-scale ship of the Supramax-grade open hatch ship type. The vessel has eight cargo holds that have a double bottom with water ballast tanks and side ballast water tanks. The longitudinal passageway (P&S) is arranged at the port and starboard sides under the upper deck.

Another notable point about this series of vessels is that they will have dual classification with both DNV and the Korean Register (KRS) classifying the vessel. DNV will be the classification society for the first five Vessels (Hull No: S-1539/40/41/42/43), which will be classed to DNV +1A1 General Cargo Carrier, HC-A (Holds 2, 4, 6 & 8 may be empty Maximum Cargo Density 3.0t/m³), BIS, COAT-PSPC(B), BWM-T, E0, TMON, NAUTICUS (Newbuilding), GRAB[20].

Whereas, the second five vessels will be dual classed by KRS. In this case, DNV shall be the main class and KRS shall be entitled as sub-class. In addition, if there is any discrepancy in the rules, following an inspection, between DNV and KRS, DNV shall have the overall say.

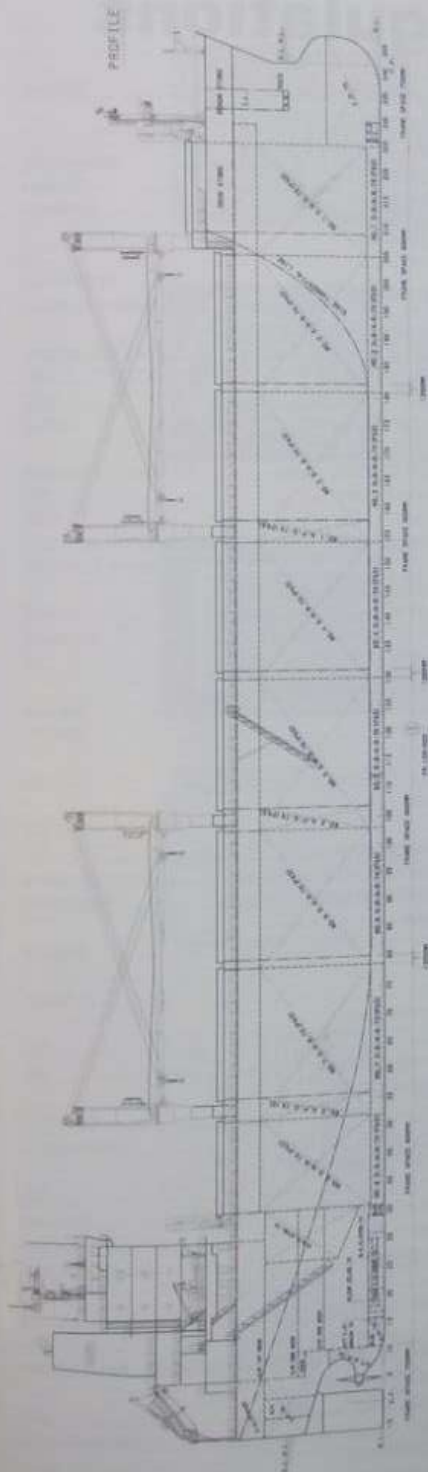
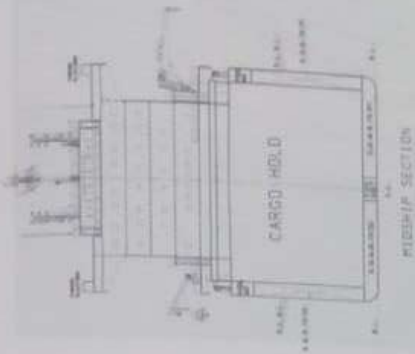
For the second five Vessels (Hull No: S-1544/45/46/47/48) will be classed to KRS, +KRS1-Cargo Ship General Dry Cargo HC (Hold No 2, 4, 6 and 8 may be empty with maximum cargo density 3.0t/m³), GRAB[20], IWS, PSPC, ENV (IBWM, IAFS, IOPP, ISPP, IAPP), CHA, LI, +KRM1-UMA, STCM.

STX Arborella will transfer wood pulp cargoes for Votorantim Celulose e Papel (VCP) and Arauzru two of the largest wood pulp manufacturers in Brazil. Also, the vessel is able to transfer to other cargoes such as steel coil, grain, coal, sulphur.

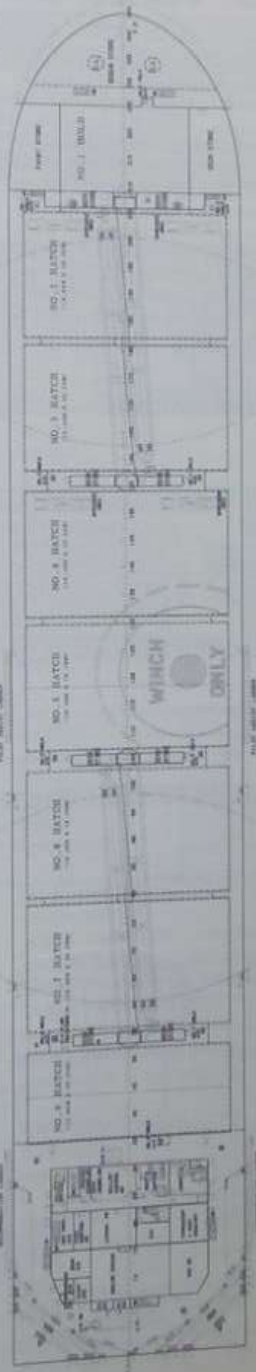
TECHNICAL PARTICULARS

Length oa:	199.9m
Length bp:	191.8m
Breadth moulded:	32.26m
Depth moulded:	
To main deck:	19.3m
To upper deck:	19.3m
To other decks:	16.4m
Width of double skin:	
Side:	2.03m
Bottom:	1.9m
Draught:	
Scantling:	12.7m
Design:	11.0m
Gross:	39,009gt
Displacement:	70,605tonnes
Lightweight:	13,065tonnes
Deadweight:	
Design:	47,171dwt
Scantling:	57,539dwt
Block co-efficient:	0.8746
Speed, service:	13.9knots
Cargo capacity:	
Grain:	68,539m ³
Bunkers:	
Heavy oil:	3,149m ³
Diesel oil:	250.7m ³
Gas oil:	162.5m ³
Water ballast:	23,019m ³
Daily fuel consumption:	
Main engine:	37.2tonnes/day
Auxiliaries:	449tonnes/day
Classification society and notations:	DNV, +1A1 General Cargo Carrier, HC-A (Holds 2, 4, 6 & 8 may be empty maximum cargo density 3.0tonnes/m ³), BIS, COAT-PSPC(B), BWM-T, E0, TMON, Nauticus (newbuilding), GRAB[20]
Main engines:	
Model:	MAN 6S50MC-C8.1
Manufacturer:	STX Heavy Industries
Number:	1
Type of fuel:	HFO
Output of each engine:	9,960kW x 127rpm
Propellers:	
Material:	Ni-Al-Bronze
Designer/manufacturer:	STX/SILLA Metal
Fixed/controllable pitch:	Fixed
Diameter:	6m
Special adaptations:	PBCF
Diesel-driven alternators:	
Number:	L23/30H-S-1539
Engine make/type:	STX engine/ 6L23/30H

Type of fuel:	HFO, MDO, MGO
Output/speed of each set:	960kW x 900rpm
Alternator make/type:	Hyundai/ HFC7 508-B4K
Output/speed of each set:	910kW x 900rpm
Boilers:	
Number:	MPS012011STV
Type:	Composite boiler
Make:	SeAH E&T Co., Ltd
Output, each boiler:	1,200kg/h (oil fired), 1,100kg/h (exhaust gas)
Cargo cranes:	
Make:	MacGregor
Type:	Electro hydraulic
Other cranes:	
Make:	Oriental
Type:	Electro hydraulic, single jib type
Tasks:	Provision and engine part handling
Performance:	SWL 2tonnes
Mooring equipment:	
Number:	2 x Windlass, 4 x winches
Make:	Flutek-Kawasaki
Type:	Electro hydraulic
Special lifesaving equipment:	
Number of each and capacity:	1 x 24 persons, 1 x 6 persons, 2 x 25 persons, 1 x 6 persons
Make:	Oriental Viking
Type:	Freefall, rescue boat, liferafts
Hatch covers:	
Manufacturer:	MacGregor
Type:	Piggy bag type & folding
Cargo tanks:	
Number:	8
Coated tanks make:	Jotuni/ Jotacote Universal
Ballast control system:	
Make:	Lyngso Marine
Type:	MQS2200
Water Ballast Treatment System:	
Make:	Techcross electro chamber unit
Capacity:	2 x 1,000m ³ /h
Complement:	
Officers:	11
Crew:	13
Bridge control system:	
Make:	Tokyo-Keiki
Type:	PR-6000
Fire detection system:	
Make:	B-I Industrial Co., Ltd
Type:	BDS-4000
Fire extinguishing systems:	
Cargo holds:	NK/ CO ₂ seawater
Engine room:	NK/ CO ₂ seawater
Cabins:	NK/ Portable fire extinguisher
Public spaces:	NK/ portable fire extinguisher
Radars:	
Make:	SAM Electronics
Model:	NACOS Platinum
Waste disposal plant:	
Incinerator:	Hyundai Machinery Co., Ltd/ MAXI NG 100SL WS
Waste compactor:	SAM/JO/ BSS20
Sewage plant:	Il-Seung/ ISS-25N
Contract date:	13 December 2010
Launch/float-out date:	6 December 2012
Delivery date:	9 November 2012



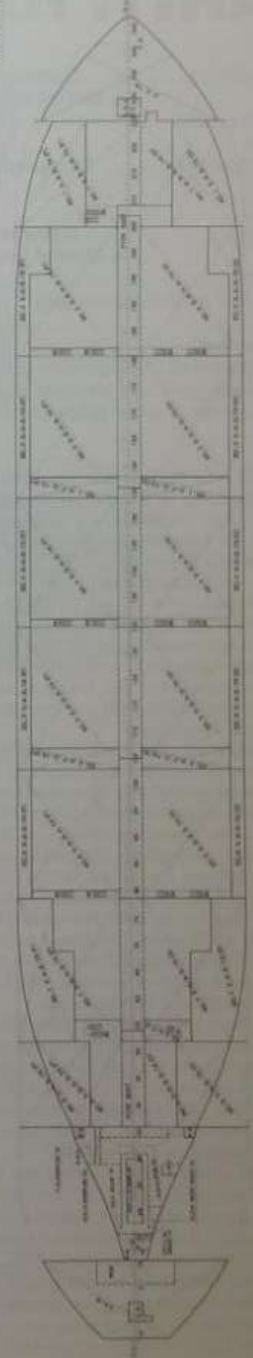
UPPER DECK



2ND DECK



TANK TOP



Official No. : **44368-12-B**
Signal Letters : **3FCC2**
Flag : **Panama**
Port of Registry : **Panama**
Ship's Name : **MILLION BELL**
Former Name 1 : --

Registered Owner 1 : **VIOLA SHIPPING S.A.**

Management Company 1 : **NEW CENTURY OVERSEAS MANAGEMENT, INC.**

Classification Characters, Notations : **NS*(CSR, BC-A, BC-XII, GRAB 20, PSPC-WBT)(ESP)(PSCM)
MNS*(M0)**

Descriptive Notes

Design Condition : **Strengthened for heavy cargo loading where hold nos. 2 & 4
may be empty**

Installation Characters : **CHG, MPP, LSA, RCF, M0, AFS, BWM**

Installation Descriptive Notes

Automatic and Remote Control Systems : **The ship has complied with the requirements of Chapter II-1,
Part E of SOLAS, "Periodically unattended machinery spaces
(UMS)".**

Special Description : --

Other Classification : --

Type of Ship -Purpose(intended service) : **BULK CARRIER**
- Certificates - SC/SE/SF : **Bulk carrier (SOLAS IX Reg. 1.6)**
- OPP : **Other than Oil Tanker**
- EE : **Bulk carrier**
- SMC/ISSC : **Bulk carrier (SOLAS IX Reg. 1.6)**

Tonnage Gross (Registered) : **33,084**

Tonnage Net (Registered) : **19,142**

Tonnage Gross (Local) : --

Tonnage Net (Local) : --

Tonnage Gross (TM69) : **33,084**

Tonnage Net (TM69) : **19,142**

Deadweight : **58,665**

Summer Freeboard (mm) : **5,477**
Summer Draught (m) : **12.676**
Lf (m) : **194.000**
Continuous Max. Speed (kt)
(Sea Trial) : **16.3**
Equipment No. : **3,107**

Overall Length (m) : **197.000**
Moulded LxBxD (m) : **194.000 x 32.260 x 18.100**
Registered LxBxD (m) : **194.000 x 32.260 x 18.100**

Cargo Capacity **B 70,963.00 G 73,614.00**
(m³ / No. of Containers, etc.) :
No. of Passengers : --
Capacity of Tanks (m³) : **FO 2,198.00 FW 392.00**

Lifeboats Type, No. & Person : **8 1x(25)**
Rescue Boats Type, No. & Person : **1 1x(6)**
Liferafts Type, No. & Person : **1 1x(6) 1 1x(25) 2 1x(25)**
Radio Installations : **GMDSS A1+A2+A3**
Navigation Equipment : **MC, GYRO, HCS, ECDIS, GPS, RDX, RDS, ARPA, AIS, VDR, LOG, ES, STGTEL, DSL, LRIT, BNWAS**

No. & Kind of Engines : **1D : 2 SA 6 CY**
Bore x Stroke (mm) : **500.0 x 2,000.0**
Power (kW) : **8,630**
Revolution (rpm) : **116.0**
Manufacturer : **KAWASAKI HEAVY INDUSTRIES, LTD.**

No. & Kind of Boilers : **1 AUX VB**
Pressure (MPa) : **0.80**
Evaporation : **3.00 (ton/h)**
Manufacturer : **MIURA Co., Ltd.**
***Evaporation rate: Thermal output (kW) to be filled up in case of TOH.**



AMBER CHAMPION: First Dolphin 64 design delivered from Chengxi

Shipbuilder: Chengxi Shipyard Co., Ltd
 Vessel's name: Amber Champion
 Hull No: CX0601
 Owner/operator: Ray Champion Shipping
 Country: Hong Kong, China
 Designer: Shanghai merchant Ship Design & Research Institute (SDARI)
 Country: China
 Model test establishment used: HSVA
 Flag: Hong Kong
 IMO number: 9637210
 Total number of sister ships already completed (excluding ship presented): 1
 Total number of sister ships still on order: nil

Adequate ballast water capacity is provided in the double sides and double bottom. The cargo holds are equipped with compressed air, power and wash water supply. Wash water holding tanks are included for the storage of clean and dirty cargo hold wash water. The concept design features a ballast water treatment system as well as holding tanks and a treatment system for sewage and bilge water.

Amber Champion is further equipped with wide foldable double-skin steel hatch covers and four energy efficient fully electric deck cranes with variable frequency drive that are of 30tonnes and 30m outreach. The mooring systems and windlass are also electrically driven. The stern tube bearing features water lubrication instead of oil.

TECHNICAL PARTICULARS

Length oa	199.85m
Length bp	194.50m
Breadth moulded	32.26m
Depth moulded	
To main deck	18.50m
To upper deck	18.50m
Draught	
Scantling	13.30m
Design	11.30m
Gross	36,332gt
Displacement	75,196tonnes
Lightweight	11,671tonnes
Deadweight	
Design	51,099dwt
Scantling	63,525dwt
Block co-efficient	0.877
Speed, service	14.48knots
Cargo capacity	
Bale	73,680m ³
Grain	78,771m ³
Bunkers	
Heavy oil	2,018m ³
Diesel oil	242m ³
Water ballast	17,705m ³
Daily fuel consumption	
Main engine	27.3tonnes/day
Auxiliaries	3.1tonnes/day
Classification society and notations	DNV +1A1
Bulk Carrier, ESP, ES(S), CSR, Nauticus (Newbuilding), COAT-PSPC(B) BC-A (Holds No 2&4 may be empty), Grab(20), EO, TMON, BIS	
% high-tensile steel used in construction	82%
Main engine	
Design	MAN B&W
Model	5S60ME-C8.2
Manufacturer	Hyundai
Number	1
Type of fuel	HFO, MDO, MGO
Output of each engine	8,050kW x 89rpm
Propellers	
Material	Ni-Al-Bronze, CU3

Designer/manufacturer	CSSRC
Number	1
Fixed/controllable pitch	Fixed
Diameter	6.7m
Diesel-driven alternators	
Number	3
Engine make/type	5DK-20e
Type of fuel	HFO, MDO, MGO
Output/speed of each set	700kW x 900rpm
Alternator make/type	Siemens E1FC5
Output/speed of each set	616kW x 900rpm
Boilers	
Number	1
Type	CMB-V5
Make	Saake
Output, each boiler	1,500/750kg/h
Cargo cranes/cargo gear	
Number	4
Make	Masada-Mitsubishi
Type	Hydraulic deck crane
Performance	30tonnes x 30m
Mooring equipment	
Number	2 x combined windlass
Type	2 x mooring winch
Make	Masada
Type	Electric-hydraulic
Special lifesaving equipment	
Number of each and capacity	1 x 26 persons
Make	Jiangyinshi Beihai LSA
Type	Freefall lifeboat
Hatch covers	
Design	TTS
Manufacturer	TTS
Type	Folding type hatch cover
Water ballast treatment system	
Make	BSKY
Capacity	2 x 1,000m ³
Complement	
Crew	13
Bridge control system	
Make	JRCS
Fire detection system	
Make	Tyco
Type	Addressable type
Fire extinguishing systems	
Cargo holds	CO ₂
Engine room	CO ₂
Cabins & public spaces	Water
Radars	
Number	2
Make	JRC
Model	NKE-1125, NKE-1139
Waste disposal plant	
Incinerator	Hunsun/HSINC-50A
Sewage plant	Luzhou/STC-2
Contract date	3 August 2011
Launch/float-out date	31 October 2012
Delivery date	28 March 2013

THE Dolphin 65 concept design was developed by DNV GL and SDARI for a new eco-friendly handymax design. The concept has now become a reality in the form of Amber Champion that was constructed at Chengxi Shipyard, China for Ray Champion Shipping.

Amber Champion is a five-cargo-hold CSR double-hull bulk carrier with a large cubic volume and deadweight capacity of 63,800dwt, an 11% increase from 57,000dwt. The high transport capacity in combination with low fuel consumption and operational strengths such as no designated cargo hold for ballast water is expected to give the vessel a significant advantage in today's challenging market according to the company.

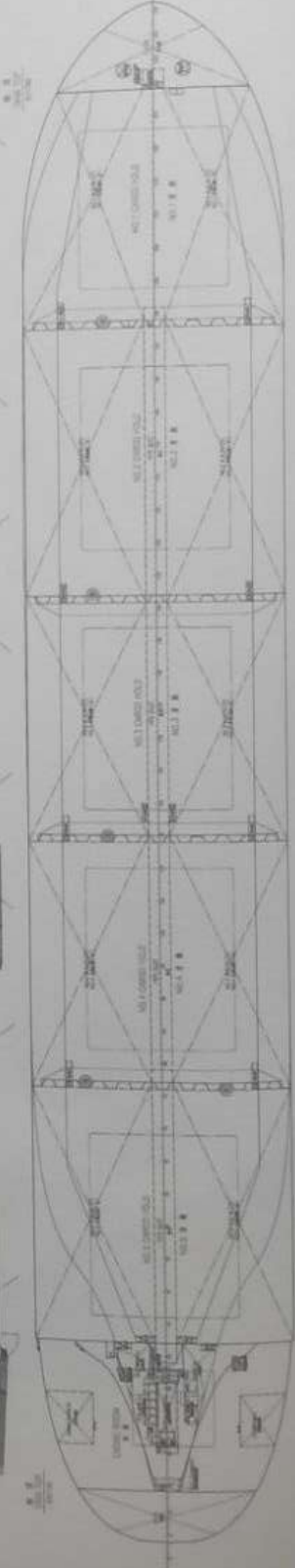
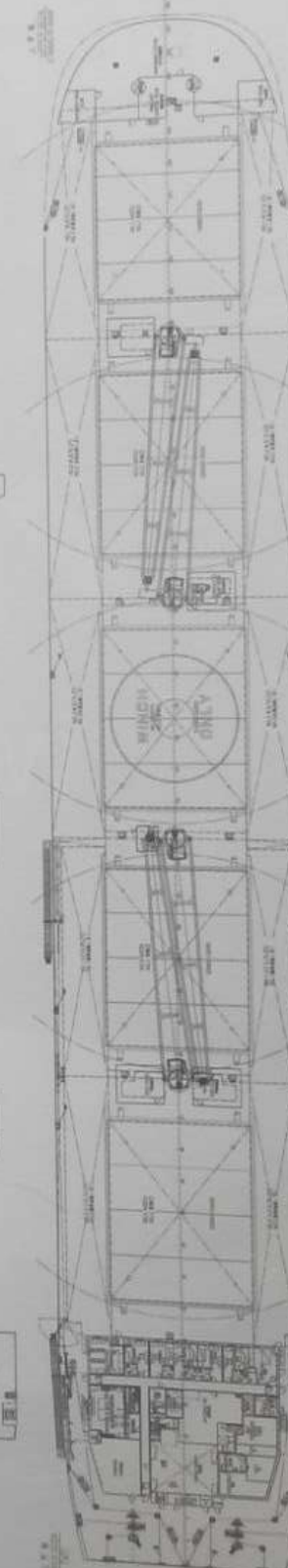
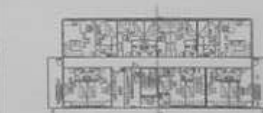
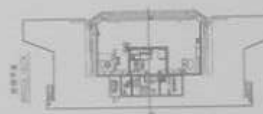
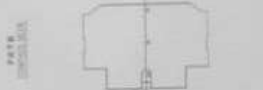
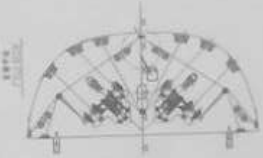
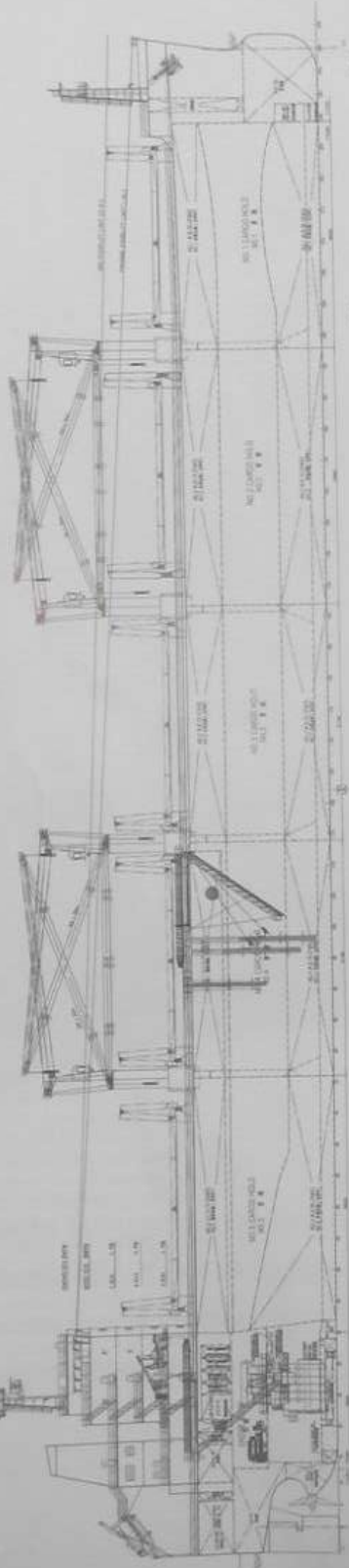
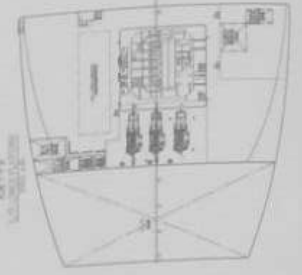
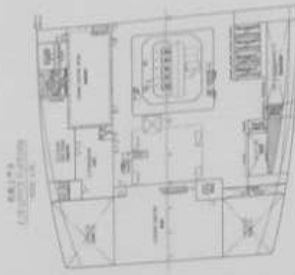
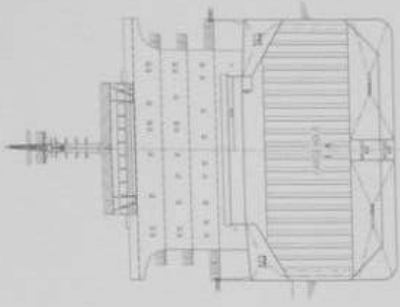
The hull is designed to achieve optimal fuel efficiency without compromising on strength and operational flexibility. For this the hull has been optimised with finer hull lines. The propulsion efficiency has also been increased through the fitting of a wake-equalising duct in front of a large-diameter, slow-rotating propeller. A rudder transition bulb and rudder fins reduce the hub vortex and recover some of the rotational losses.

Amber Champion is fitted with an efficient, Tier II compliant, Wärtsilä two-stroke low-speed main engine, a SRT-flex50-D. Several fuel tanks for different fuel grades ensure sufficient capacity and flexibility to carry a combination of HFO, low sulphur fuel oil/distillates as required, as well as allowing strategic fuel purchasing.

The daily main engine fuel consumption at 14knots at CSR with a 15% sea margin and 9.5m draught is 17.7tonnes (ISO Ambient Conditions, LCV=42,700 kJ/kg). The attained Energy Efficiency Design Index (EEDI) is more than 20% less than the required index set by the IMO reference line for bulk carriers, thus meeting the 2020 requirement.

The double hull with flush cargo holds (no hopper or top wing tanks in cargo holds 2, 3 and 4) and wide hatch openings improve the loading/discharge operations and facilitate the easy cleaning of the holds, thereby improving the port turnaround time. All fuel oil tanks are arranged aft of the forward engine room A-60 bulkhead, which means no fuel oil tanks are adjacent to cargo holds, making the ship suitable for carrying a wider range of dangerous bulk and package cargoes.

AMBER CHAMPION





Copyright: China Navigation Company

WUCHANG: First B.Delta 37 bulk carrier

Shipbuilder: **Chengxi Shipyard**
 Vessel's name: **Wuchang**
 Hull No: **CX0341**
 Owner/operator: **China Navigation Company (CNCo)**
 Country: **Singapore**
 Designer: **Deltamarin**
 Country: **Finland**
 Flag: **Singapore**
 IMO number: **9657844**
 Total number of sister ships already completed (excluding ship presented): **nil**
 Total number of sister ships still on order: **16**

TECHNICAL PARTICULARS

Length oa: 179.99m
 Length bp: 176.65m
 Breadth moulded: 30.00m
 Depth moulded
 To main deck: 15.00m
 Width of double skin
 Side: 1.40m
 Bottom: 1.70m
 Draught
 Scantling: 10.50m
 Design: 9.50m
 Gross: 24,785gt
 Displacement: 49,219tonnes
 Lightweight: 10,091tonnes
 Deadweight
 Design: 33,994dwt
 Scantling: 39,128dwt
 Block co-efficient: 0.8609
 Speed, service: 14knots
 Cargo capacity
 Bale: 43,991m³
 Grain: 48,908m³
 Bunkers
 Heavy oil: 1,197m³
 Auxiliaries: 3.1m³
 Classification society and notations: LR 100A1, Bulk Carrier, CSR, BC-A, GRAB[25], ShipRight (ACS(B,D), CM), *IWS, Li, ESP +LMC, UMS, CM, ShipRight (BWMP(S+F,T), SCM), Green Passport
 Main engines
 Design: Wärtsilä
 Model: 5RT Flex 50-B
 Manufacturer: Hudong Heavy Machinery
 Number: 1
 Type of fuel: HFO, MGO
 Output of each engine: 6,050kW
 Propeller
 Material: CU3
 Designer/manufacturer: Deltamarin/ Wärtsilä
 Number: 1
 Fixed/controllable pitch: Fixed
 Diameter: 6.00m
 Speed: 99rpm
 Diesel-driven alternators
 Number: 3
 Engine make/type: MAN 6L23/30H
 Type of fuel: HFO, MDO, MGO
 Output/speed of each set: 780kW x 720rpm
 Alternator make/type: CM-Hyundai/ HFC6
 Output/speed of each set: 700kW x 720rpm
 Boilers
 Number: 1
 Type: MC composite smoke tube boiler with ME + 2D/G sections + oil fired sections

Make: SPP
 Output, each boiler: 1,500/660/210/210 *7bar
 Cargo cranes/cargo gear
 Number: 4
 Make: MacGregor
 Type: Electric deck cranes/ GLBE3026-2/2426grab
 Performance: Hoist 25-45rpm, luff 40/58sec, slew 1.0/0.7rpm
 Other cranes
 Number: 1
 Make: Zhengjiang Marine Auxiliary Machinery Works
 Tasks: Stores crane
 Performance: 3tonnes
 Mooring equipment
 Number: 2 x Windlass/winch
 2 x Winches
 Make: Hatlapa/ Luzhou
 Type: Electric
 Special lifesaving equipment
 Number of each and capacity: 1 x 30 persons
 Make: Zhengjiang Marine Auxiliary Machinery Works
 Hatch covers
 Design: Hydraulic folding double skin type on upper deck only
 Manufacturer: TTS/ Chengxi shipyard
 Ballast control system
 Make: Pleiger
 Type: Remote control ballasting and tank level
 Water ballast treatment system
 Make: Techcross
 Capacity: 2 x 800m³/h
 Complement
 Crew: 12
 Stern appendages/special rudders: 2 reaction fins on hull, Costa bulb on rudder
 Bridge control system
 Make: Sperry/Maroka/Kongsberg
 Type: 2 x Sperry ECDIS, Kongsberg main engine controls, Marorka/Kongsberg integrated vessel performance system
 Fire detection system
 Make: Consilium
 Fire extinguishing systems
 Cargo holds: NK/CO₂
 Engine room: NK/CO₂, water mist
 Radars
 Number: 3
 Make: Sperry
 Model: Bridge Master
 Integrated bridge system
 Make: Imtech design/Sperry system
 Waste disposal system
 Incinerator: Detagasa/ IRLA-18/50E
 Sewage plant: Tecnicomar/ ECDomar 50-STP
 Contract date: 17 February 2012
 Delivery date: 18 October 2013

CHINA Navigation Company (CNCo) took delivery of *Wuchang*, the first of the 39,000dwt B.Delta 37 bulk carriers of Deltamarin design built under Lloyd's Register's approval and survey at Chengxi Shipyard in China in October.

Deltamarin's B.Delta 37 has been heralded as a design that stands out due to its performance in terms of a range of parameters such as low fuel oil consumption, low emissions, EEDI, deadweight intake and lightweight particulars for vessel type of its class (handymax segment). On top of this the vessel has good manoeuvrability and performance in heavy seas, which was proved during the vessel's sea trials.

This has been achieved through an optimised and energy efficient design with a particular focus on optimal hydrodynamic performance and lowest possible lightweight without compromising either the cargo intake or the hull structural integrity. Detailed structural finite element analysis and fatigue design assessments in accordance with IACS' Common Structural Rules (CSR) have been used to verify the hull structural integrity.

The high performing design characteristics have been validated during the sea-trial conducted prior to the vessel's delivery. The estimated lightweight particulars (weight and centre of gravity) are confirmed to be within the acceptable limits of the actual lightweight details derived from the inclining experiment, and accordingly the corresponding contracted cargo capacity are also confirmed.

Wuchang has been fitted with a low-speed Wärtsilä 5RT Flex 50-B that has a power output of 6,050kW, which gives the vessel a service speed of 14knots. In addition to this two reaction fins on the hull and a Costa bulb that has been fitted on the rudder have also been applied to give the vessel better propulsion.

Although *Wuchang* was contracted prior to the EEDI requirements were enforced, EEDI rules have been applied since 1 January 2013, CNCo and Deltamarin requested EEDI verification on a voluntary basis from Lloyd's Register. Accordingly the EEDI value has been calculated and verified based on model testing and during sea trials and the derived EEDI value is confirmed to be well over 20% below the applicable baseline for bulk carriers.



ANDALUCIAN ZEPHYR: First High Bulk 34E design

Shipbuilder: **Namura Shipbuilding**
 Vessel's name: **Andalucian Zephyr**
 Hull No: **366**
 Owner/operator: **Three Kingsss Shipping Corp. Limited**
 Country: **Panama**
 Designer: **Namura Shipbuilding Co., Ltd**
 Country: **Japan**
 Flag: **Panama**
 IMO number: **9667526**
 Total number of sister ships already completed (excluding ship presented): **nil**
 Total number of sister ships still on order: **nil**

TECHNICAL PARTICULARS

Length oa: 179.96m
 Length bp: 174.00m
 Breadth moulded: 30.00m
 Depth moulded
 To upper deck: 14.05m
 Width of double skin
 Side: 2.00m
 Bottom: 1.64m
 Draught
 Scantling: 9.80m
 Design: 9.80m
 Gross: 21,514gt
 Deadweight
 Design: 34,436dwt
 Scantling: 34,436dwt
 Speed, service: 14.7knots
 Cargo capacity
 Bale: 42,911.2m³
 Grain: 44,154.6m³
 Bunkers
 Heavy oil: 1,291.6m³
 Diesel oil: 150.2m³
 Water ballast: 14,663.8m³
 Daily fuel consumption
 Main engine only: 25.5tonnes/day
 Auxiliaries: 1.48tonnes/day
 Classification society and notation: Nippon Kaiji Kyokai NS* (BCM, BC-X-II, GRAB, PSPC-WBT) MNS* Double hull construction applied to all cargo holds.
 % high-tensile steel used in construction: abt. 65%
 Roll-stabilisation equipment: Bilge keels
 Main engine
 Model: Mitsubishi 6UEC45LSE-B2
 Manufacturer: Kobe Diesel Co., Ltd
 Number: 1
 Type of fuel: HFO and MDO
 Output of each engine: 6,840kW x 113.3rpm (MCR), 5,814kW x 107.3rpm (NCR)
 Propellers
 Material: Ni-Al-Bronze
 Designer/manufacturer: Nakashima Propeller Co., Ltd
 Number: 1
 Diameter: 5.6m
 Speed: 113.3rpm (MCR), 107.3 (NCR)
 Diesel-driven alternators
 Number: 3
 Engine make/type: Yanmar/ 6EY18ALW
 Type of fuel: HFO and MDO
 Output/speed of each set: 455kW x 900rpm
 Alternator make/type: Taiyo Electric/ FE 541B-8
 Output/speed of each set: 400kW x 900rpm

Boiler
 Number: 1
 Type: OVS2-80/60-22
 Make: Osaka Boiler
 Output, each boiler: Oil Fired side
 800kg/h x 0.59MPa/ Exhaust gas side 600kg/h x 0.59MPa
 Cargo cranes/ cargo gear
 Number: 4
 Make: Mitsubishi Heavy Industries
 Type: Electro-hydraulic, single type
 Performance: 30tonnes x 24/26m
 Other cranes
 Number: 1
 Make: Mansei
 Type: Electro motor driven, luffing type
 Tasks: Provisions
 Performance: 2tonnes x 6.5m
 Mooring equipment
 Number: 4
 Make: Mitsubishi Heavy Industries
 Type: Hydraulic oil motor driven
 Special lifesaving equipment
 Number of each and capacity: 1 x 24 persons (lifeboat), 1 x 24 persons (rescue boat)
 Make: Shigi Shipbuilding
 Type: FRP enclosed type
 Hatch covers
 Design: MacGregor
 Manufacturer: Genkal Technical Engineering
 Type: Double skin folding type
 Complement
 Officer: 9
 Crew: 12
 Stern appendages/ special rudders: NCF (Namura flow control fin) and Rudder-Fin
 Fire detection system
 Make: Consilium Nittan Marine
 Type: Salwico CCP
 Fire extinguishing systems
 Cargo holds: Fixed CO₂
 Engine room: Fixed CO₂
 Cabins/public spaces: Portable fire extinguisher
 Radars
 Number: 2
 Make: Japan Radio Co., Ltd
 Model: JMA-9132-SA/ 9122-6XA
 Waste disposal plant
 Incinerator: Miura Co., Ltd/ BGW-20N
 Contract date: 26 March 2012
 Launch/float-out date: 6 January 2014
 Delivery date: 12 March 2014

NAMURA Shipbuilding Co. Ltd delivered *Andalucian Zephyr*, a 34,436dwt bulk carrier, to Three Kings Shipping Corp limited at its Imari Shipyard & Works on 12 March 2014. This vessel is the first vessel of the latest series of 34,000dwt type bulk carriers called the High Bulk 34E, which has been developed in collaboration with one of the Namura group companies, the Hakodate Dock Co. UK, as a successor of the Hakodate Super Handy 32 design with the specifications that have been drastically reviewed and modified from its predecessor to respond to the needs of today's market.

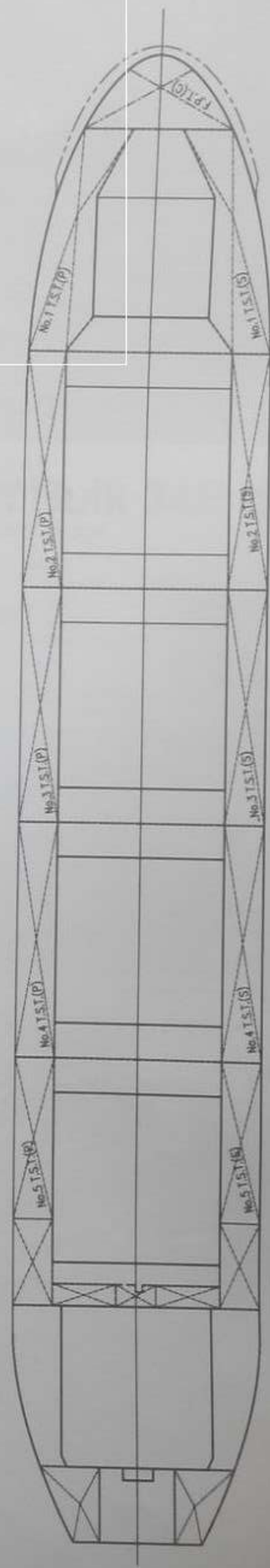
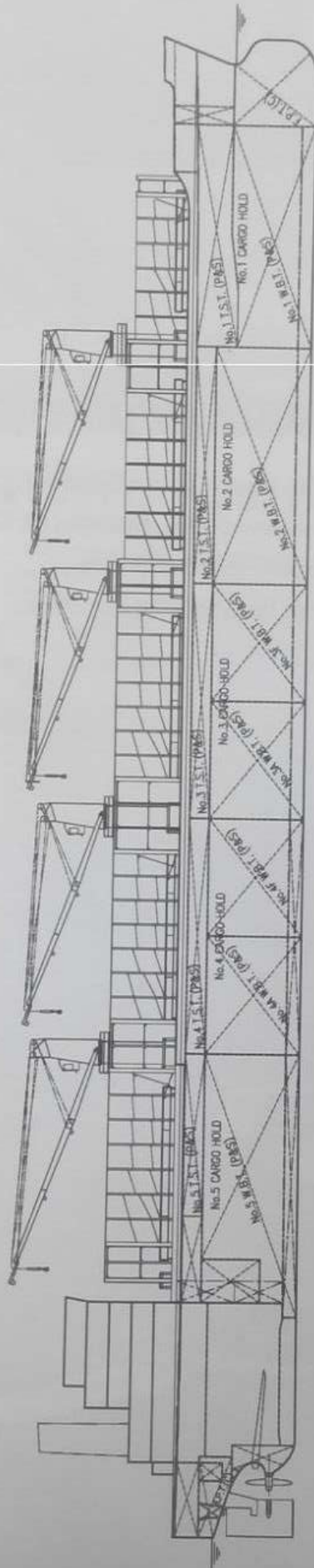
The vessel is designed for the carriage of grain, coal, steel products, and logs/lumber as a bulk carrier, and the shallower draught hull form is designed to maximise the capacity. The vessel has five semi-box shaped cargo holds, without a bilge hopper, and each hold has a larger size hatch opening. In addition the vessel features collapsible/folding and fixed type steel stanchions for log/lumber loading on the upper deck.

Improved propulsion performance and fuel saving has been achieved with the adoption of the Namura flow Control Fin (NCF) and Rudder-fin (R-Fin), both developed by Namura, along with the optimisation of the hull form. *Andalucian Zephyr* is powered by a Mitsubishi 6UEC45LSE-B2 with a power output of 6,840kW at MCR and a service speed of 14.7knots.

The vessel has four sets of deck cranes that each have a 30tonne capacity and have been installed along the centreline in between the hatch covers for handling cargoes at ports that do not have cargo-handling facilities. The water ballast tanks comply with the IMO PSC-WBT regulations for corrosion protection to increase the safety of the vessel, and the main engine and generator engines conform to IMO NOx emission regulations (Tier II).

ANDALUCIAN ZEPHYR

MIDSHIP SECTION





CASCADE: First Emerald 39,000dwt bulk carrier

Shipbuilder: **Jiangmen Nanyang Ship Engineering**
 Vessel's name: **Cascade**
 Hull No: **JNS134**
 Owner/operator: **CV1 CVF II Lux Master**
 Country: **Luxembourg**
 Designer: **Shanghai Bestway Marine Engineering Design**
 Country: **China**
 Model test establishment used: **China Ship Scientific Research Centre**
 Flag: **Panama**
 IMO number: **9670418**
 Total number of sister ships already completed (excluding ship presented): **nil**
 Total number of sister ships still on order: **28**

CASCADE is the first in the series of the Emerald 39,000dwt bulk carrier designs that was developed by Bestway Marine Engineering Design. The vessel was constructed by Jiangmen Nanyang Ship Engineering and delivered to its owner in June. *Cascade* is a typical double hull design with open hatch, which gives the vessel more flexibility in its cargo operation.

The design of the Emerald bulk carrier came from the need to develop eco-friendly vessels to meet with the needs of future environmental regulations. The company has said that economical and legislative drivers are motivating ship designers to consider the environmental impact of their designs.

When initially starting out on the design Bestway looked at what was needed for an environmentally friendly ship, which consisted of the application of the latest and proven technologies, a vessel that would satisfy future rules and regulations and also the whole lifecycle of the vessel, including health, safety, environmental efficiency, efficiency through ship life, whilst still being financially viable for the owner.

The Emerald bulk carrier design features ship lines optimisation, which has been carried out using Napa and Friendship software. Also, the design has reduced resistance, along with a lightweight design. The structural optimisation of the vessel has looked at determining reasonable longitudinal strength allowance, increase in the percentage of high tensile steel usage and an improved arrangement and detail of structure.

Cascade has been fitted with a MAN B&W 5S50ME-B9.2, which Bestway selected after calculation and analysis of some main engines, the 5S50ME-B9 was the first choice for the main engine of the Emerald class of ships in terms of fuel oil consumption (FOC) and greenhouse gas emissions, as well as its high net present value (NPV). The FOC of the 5S50ME-B9.2 fitted on *Cascade* is 17.5tonnes/day at CSR with 15% sea margin when design loading.

In addition, further efficiencies were found from the propulsion system through the optimisation of the propeller, by looking at the blade design, the number of rotations and the diameter of the propeller, which all adds to the improvement of the flow field at the stern.

In order to further improve the efficiency of the vessel a large diameter and slower rotating propeller, which was designed by conventional MAU screw propeller diagrams has been fitted. Modern propeller design theory methods were adopted for the optimisation design, overall design qualities of the propeller such as the efficiency, cavitation, blade strength and screw weight are taken into account by the design package.

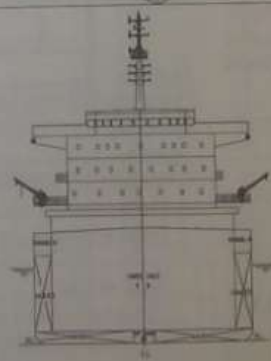
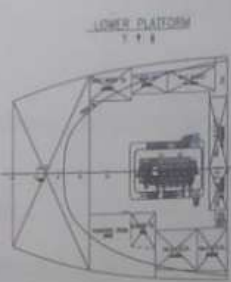
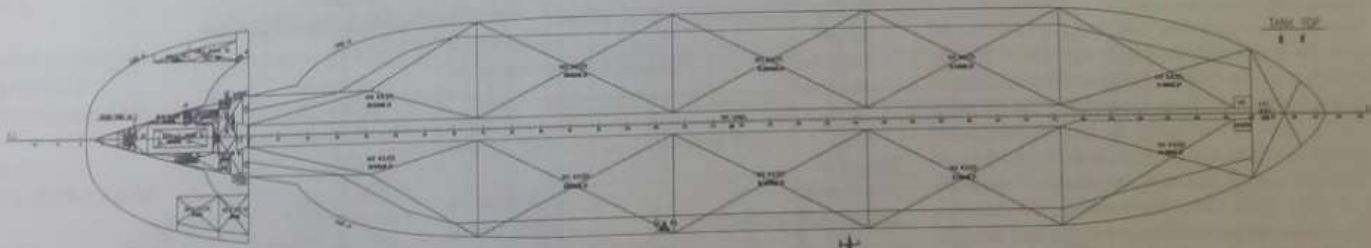
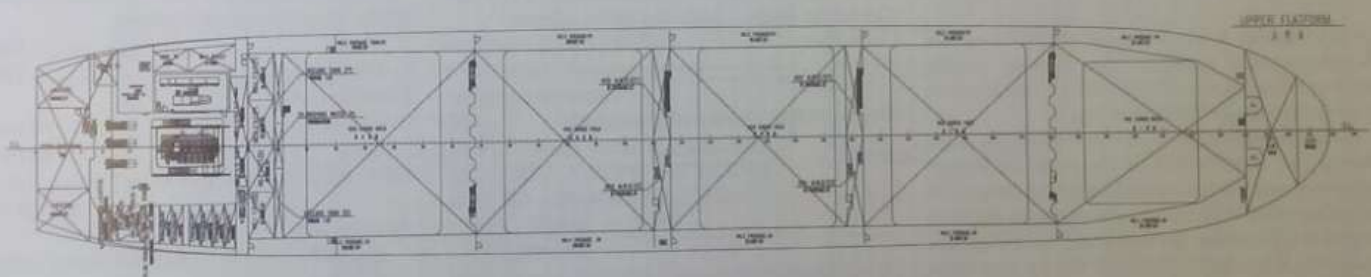
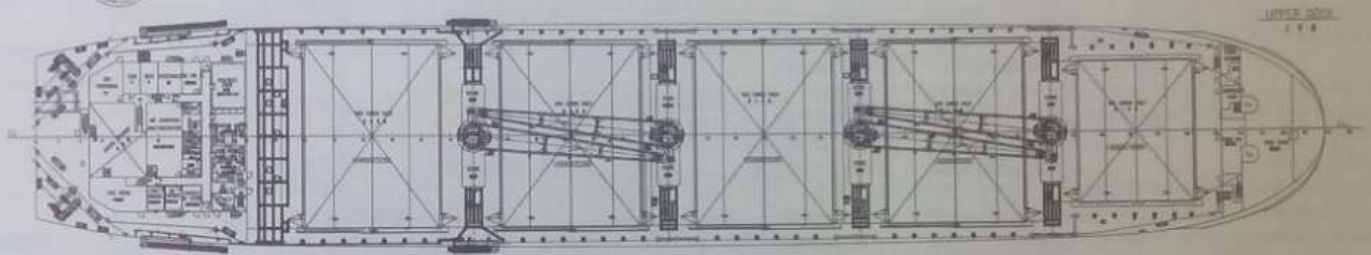
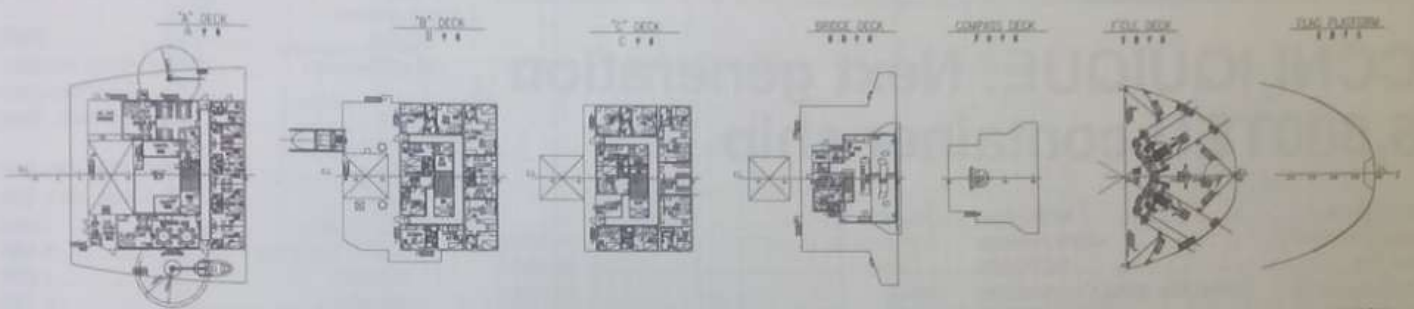
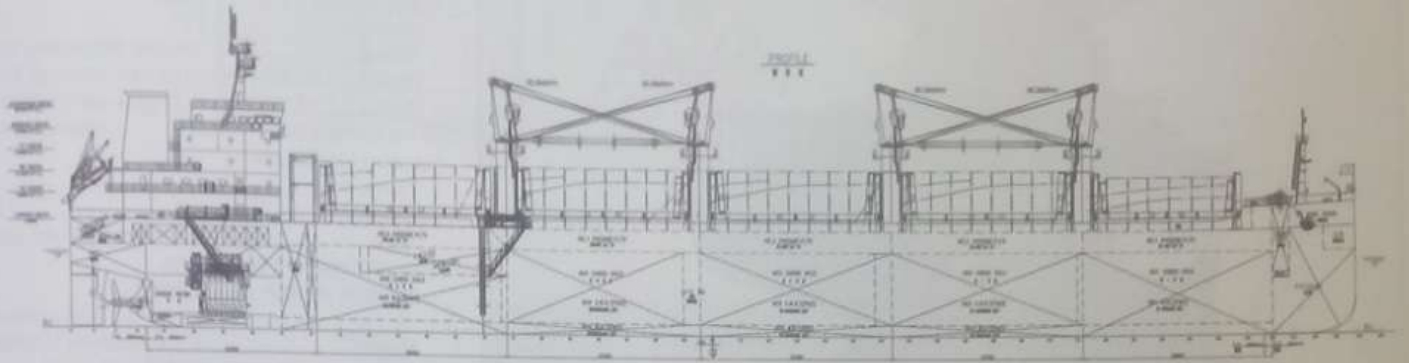
Further environmental features of *Cascade* are the reserved space onboard for a ballast water treatment system to be fitted at a later date. The hull of *Cascade* also has a hydrolysed type self-polishing paint, which will decrease the vessel's hull resistance.

TECHNICAL PARTICULARS

Length oa: 179.90m
 Length bp: 176.85m
 Breadth moulded: 30.00m
 Depth moulded
 To upper deck: 14.8m
 Width of double skin
 Side: 2.57m
 Bottom: 1.65m
 Draught
 Scantling: 10.60m
 Design: 9.5m
 Displacement: 48,978tonnes
 Lightweight: 10,241tonnes
 Deadweight
 Design: 33,100dwt
 Scantling: 38,737dwt
 Block co-efficient: 0.847

Speed, service: 14.08knots
 Cargo capacity
 Bale: 47,000m³
 Grain: 48,200m³
 Bunkers
 Heavy oil: 1,600m³
 Diesel oil: 278m³
 Water ballast: 16,465m³
 Daily fuel consumption
 Main engine only: 18.4tonnes/day
 Auxiliaries: 2.52tonnes/day
 Classification society and notations: LR
 +100A1, Bulk Carrier, CSR, BC-A
 (hold No. 2&4 maybe empty)
 ShipRight ACS(BD), Grab(2S)
 ESP, LI, *IWS, ECO(IHM), Timber
 deck cargoes, with the descriptive
 *ShipRight (SCM, BWMP(E+S)
 SERS* +LMC, UMS
 % high-tensile steel used in construction: 65%
 Main engines
 Design: MAN B&W
 Model: 5S50ME-B9.2
 Manufacturer: YMD
 Type of fuel: HFO
 Output of each engine: 6,050kW x 99rpm
 Propellers
 Material: Ni-Al-Bronze
 Designer/manufacturer: Bestway/ Wärtsilä
 CME Zhenjiang Propeller Co., Ltd
 Number: 1
 Fixed/controllable pitch: Fixed
 Diameter: 6.00m
 Speed: 94.9rpm
 Diesel-driven alternators
 Number: 3
 Engine make/type: Daihatsu/6DC-17AE
 Type of fuel: HFO/MDO
 Output/speed of each set: 610kW x 900rpm
 Alternator make/type: CM-Hyundai
 Output/speed of each set: 550kW x 900rpm
 Boilers
 Number: 1
 Type: Exhaust gas and fuel oil composite
 boiler ZYC1.2/206-0.7
 Make: Greens Shazhou
 Output, each boiler: Exhaust side 550kg/h,
 Fuel oil side: 12,00kg/h
 Cargo cranes/cargo gear
 Number: 4
 Make: Nantong Masada
 Performance: 30.5tonnes x 24m
 Mooring equipment
 Number: 4
 Make: Wuhan Marine
 Machinery Plant Co., Ltd
 Type: Hydraulic
 Special lifesaving equipment
 Number of each
 and capacity: 1 x 25 persons
 Make: Jiangsu Jiaoyan
 Marine Equipment Co., Ltd
 Type: Freefall lifeboat
 Complement
 Crew: 13
 Fire detection system
 Make: Tyco
 Type: T1216
 Fire extinguishing systems
 Cargo holds: CO₂
 Engine room: CO₂, fixed local application
 fire-extinguishing systems water mist,
 sea water fire extinguishing system
 Cabins/public spaces: Sea water
 + fire extinguishing
 Radars
 Number: 2
 Make: Furuno
 Model: FAR-2807-BB, FAR-2837S-BB
 Waste disposal plant
 Incinerator: Teamtec/ OG120C
 Launch/float-out date: 26 January 2014
 Delivery date: 03 June 2014

CASCADE



IMO NO. : **9675731**

Official No. : **5430**

Signal Letters : **V7DS9**

Flag : **Marshall Islands**

Port of Registry : **Majuro**

Ship's Name : **INLAND SEA**

Former Name 1 : --

Registered Owner 1 : **ASUKA KISEN CO., LTD.**

2 : **JOLLY FELLOW SHIPPING S.A.**

Management Company 1 : **MISUGA KAIUN CO., LTD.**

Classification Characters, Notations : **NS*(BCM, BC-XII, GRAB, EQ C DG, PSPC-WBT)(IWS)
MNS***

Descriptive Notes

Design Condition : **Strengthened for heavy cargo loading where hold nos. 2 & 4
may be empty / Double hull construction applied to all cargo
holds**

Installation Characters : **CHG, MPP, LSA, RCF, MO, AFS, BWM**

Installation Descriptive Notes

Automatic and Remote Control Systems : **The ship has complied with the requirements of Chapter II-1,
Part E of SOLAS, "Periodically unattended machinery spaces
(UMS)".**

Special Description : --

Other Classification : --

Type of Ship -Purpose(intended service) : **BULK CARRIER**

- Certificates - SC/SE/SF : **Bulk carrier (SOLAS XII Reg. 1.1)**

- OPP : **Other than Oil Tanker**

- EE : **Bulk carrier**

- SMC/ISSC : **Other cargo ship**

Tonnage Gross (Registered) : **23,281**

Tonnage Net (Registered) : **12,101**

Tonnage Gross (Local) : --

Tonnage Net (Local) : --

Tonnage Gross (TM69) : **23,281**

Tonnage Net (TM69) : **12,101**

Deadweight : **37,543**

Summer Freeboard (mm) : **4,500**
Summer Draught (m) : **10.540**
Lf (m) : **173.520**
Continuous Max. Speed (kt)
(Sea Trial) : **15.5**
Equipment No. : **2,603**

Overall Length (m) : **179.970**
Moulded LxBxD (m) : **173.000 x 29.800 x 15.000**
Registered LxBxD (m) : **173.520 x 29.800 x 15.000**

Cargo Capacity
(m3 / No. of Containers, etc.) : **B 45,238.00 G 46,994.00**
No. of Passengers : --
Capacity of Tanks (m3) : **FO 1,945.00 FW 294.00**

Lifeboats Type, No. & Person : **3 2x(25)**
Rescue Boats Type, No. & Person : **1 1x(6) (at combined use for lifeboat)**
Liferafts Type, No. & Person : **1 1x(6) 1 2x(25)**
Radio Installations : **GMDSS A1+A2+A3**
Navigation Equipment : **MC, GYRO, HCS, ECDIS, GPS, RDX, RDS, ARPA, AIS, VDR, LOG, ES, STGTEL, DSL, LRIT, BNWAS**

No. & Kind of Engines : **1D : 2 SA 6 CY**
Bore x Stroke (mm) : **460.0 x 1,932.0**
Power (kW) : **6,820**
Revolution (rpm) : **110.0**
Manufacturer : **MAKITA CORPORATION**

No. & Kind of Boilers : **1 AUX VB**
Pressure (MPa) : **0.80**
Evaporation : **2.00 (ton/h)**
Manufacturer : **MIURA Co., Ltd.**
***Evaporation rate: Thermal output (kW) to be filled up in case of TOH.**

No. & Capacity of Generators (kVA) : **4 AC 1,715**
Kind of Propeller Shaft : **1C**
No. & Shaft Diameter (mm) : **1 x 450**



TRUE LOVE: Bulk carrier

Shipbuilder:	Chengxi Shipyard, CSSC
Vessel's name:	<i>True Love</i>
Hull No.:	CX0365
Owner/Operator:	CSSC Leasing/ AQUAVITA International
Country:	China/Ukraine
Designer:	Shanghai Merchant Ship Design & Research Institute, CSSC
Country:	China
Model test establishment used:	HSVA
Flag:	Marshall Islands
IMO number:	9697143
Total number of sister ships already completed	2
Total number of sister ships still on order:	0

13.85knots at CSR with 15% sea margin at design draught. The attained EEDI is certified to be 24.3% lower than the IMO baseline.

Options including container fitted (2-tier on hatch covers), timber cargo (on hatch covers), dangerous solid goods, etc. could be chosen for operational flexibility.

TECHNICAL PARTICULARS

Length oa:	179.95m
Length bp:	177m
Breadth moulded:	32m
Depth moulded:	
To upper deck:	15m
Width of double skin:	
Side:	2.50m
Bottom:	1.78m
Draught:	
Scantling:	10.50m
Design:	9.50m
Gross:	25,515gt
Displacement:	48,900tonnes
Lightweight:	10,100tonnes
Deadweight:	
Design:	33,400dwt
Scantling:	38,800dwt
Block co-efficient (please state relevant draught):	0.786 at design draught, 0.799 at scantling draught
Speed, service (- %MCR output):	13.85knots, at design draught, 75%CMCR, with 15% sea margin
Cargo capacity:	
Bale:	49,600m ³
Grain:	50,873m ³
Bunkers:	
Heavy oil:	1,200m ³
Diesel oil:	400m ³
Water ballast (m ³):	16,700m ³
Daily fuel consumption (tonnes/day):	
Main engine only:	17.7tonnes
Auxiliaries:	3tonnes
Classification society and notations:	DNV +1A1 Bulk Carrier, ESP, CSR, BC-A, HOLDS(2-4) MAY BE EMPTY, HA(+), ICE-1C, GRAB(20) DG-B, BIS, TMON, BWM-T, CLEAN, ED, COAT-PSPC(B), Recyclable
% high-tensile steel used in construction:	70%
Main engine(s):	
Design:	Wärtsilä
Model:	5RT-flex50-D, Tier II
Manufacturer:	Hudong Heavy Machinery Co. Ltd.
Number:	1
Type of fuel:	HFO or MDO
Output of each engine:	6100kW x 99r/min
Propeller(s):	
Material:	Ni-Al-bronze(Gu3)
Designer/Manufacturer:	CSSRC/Zhenjiang Tongzhou Propeller, China
Number:	1
Fixed/Controllable pitch:	FPP
Diameter:	6.2m
Speed:	89.9r/min

Diesel-driven alternators	
Number:	3
Engine make/type:	Anqing CSSC Diesel Engine Co. Ltd. / 5DK-20e
Type of fuel:	HFO or MDO
Output/speed of each set:	660kW x 900r/min
Alternator make/type:	Zhenjiang China Marine Xiandai Gen. Co. Ltd / HFC6 502-84K
Output/speed of each set:	600kW x 900r/min
Boilers:	
Number:	1
Type:	Cylindrical vertical type boiler with burner and water regulator
Make:	ZhangJiaGang Greens Shazhou Boiler Co., Ltd
Output, each boiler:	Oil fired section: 1500kg/h, Exhaust gas section: about 510kg/h
Main engine:	(at CSR of M/E), Exhaust gas section_Aux. engine about 180kg/h for one A/E (the No.1 and No.2 A/E to be connected to the composite boiler)
Cargo cranes/cargo gear:	
Number:	4
Make:	WMPP
Type:	electric-hydraulic wire luffing type
Performance:	30tonnes x 26m
Other cranes:	
Number:	1
Make:	Jiangyin Anhai
Type:	Monorail crane
Tasks:	Lifting provision
Performance:	SWL 3t
Mooring equipment:	
Number:	4
Make:	WMPP
Type (electric/hydraulic/steam):	Hydraulic
Special lifesaving equipment (eg MES, free-fall lifeboats):	
Number of each and capacity:	1 set of freefall lifeboat(25P)
Make:	Jiangyin Neptune
Type:	Freefall lifeboat
Hatch covers:	
Design:	TTS Huahai
Manufacturer:	Chengxi Shipyard
Type (upper deck/other decks):	hydraulic operated folding type
Ballast control system:	
Make:	Emerson
Type:	One common hydraulic power unit, hydraulic actuators for valves
Water ballast Treatment System:	
Make:	Wuxi Brightsky Electronic Co. Ltd.
Capacity:	2 x 700m ³ /h
Complement:	
Officers:	12
Crew:	11
Supermarines/Spare:	two spare
Suez/Repair Crew:	6 Suez
Single/double/other rooms:	Single
Stern appendages/special rudders:	1 rudder
Bridge control system:	
Make:	SAM
Type:	PCS2200
Is bridge fitted for one-man operation?	No
Fire detection system:	
Make:	Consilium
Type:	Salwico cargo
Fire extinguishing systems:	
Cargo holds:	Make/Type: Tyco Seapius Co Ltd / CO ₂ fire extinguishing system
Engine room:	Make/Type: Tyco Seapius Co Ltd /Local water mist/CO ₂ fire extinguishing system
Radars:	
Number:	3
Make:	Furuno
Model(s):	FR-2837S-D, FAR-2117-BB, FR-2827-D
Integrated bridge system:	No
Waste disposal plant:	
Waste handled:	
Incinerator:	
Make:	Teamfac
Model:	OG 120C
Sewage plant:	
Make:	JOWA
Model:	STP2010-25
Contract date:	17 May 2013
Launch/float-out date:	8 December 2014
Delivery date:	12 May 2015

The Green Dolphin 38 concept design is the result of the first development phase of a joint project between Shanghai Merchant Ship Design & Research Institute (SDARI), Det Norske Veritas (DNV) and Wärtsilä since 2012. The next basic design and detailed design were carried out by SDARI independently.

TRUE LOVE, the leading vessel in the Green Dolphin 38 bulk carrier series, was delivered from Chengxi Shipyard in May 2015 and her sister vessel *DOUCE VITA* was also delivered in July this year. They are all owned by CSSC Leasing and operated by AQUAVITA International.

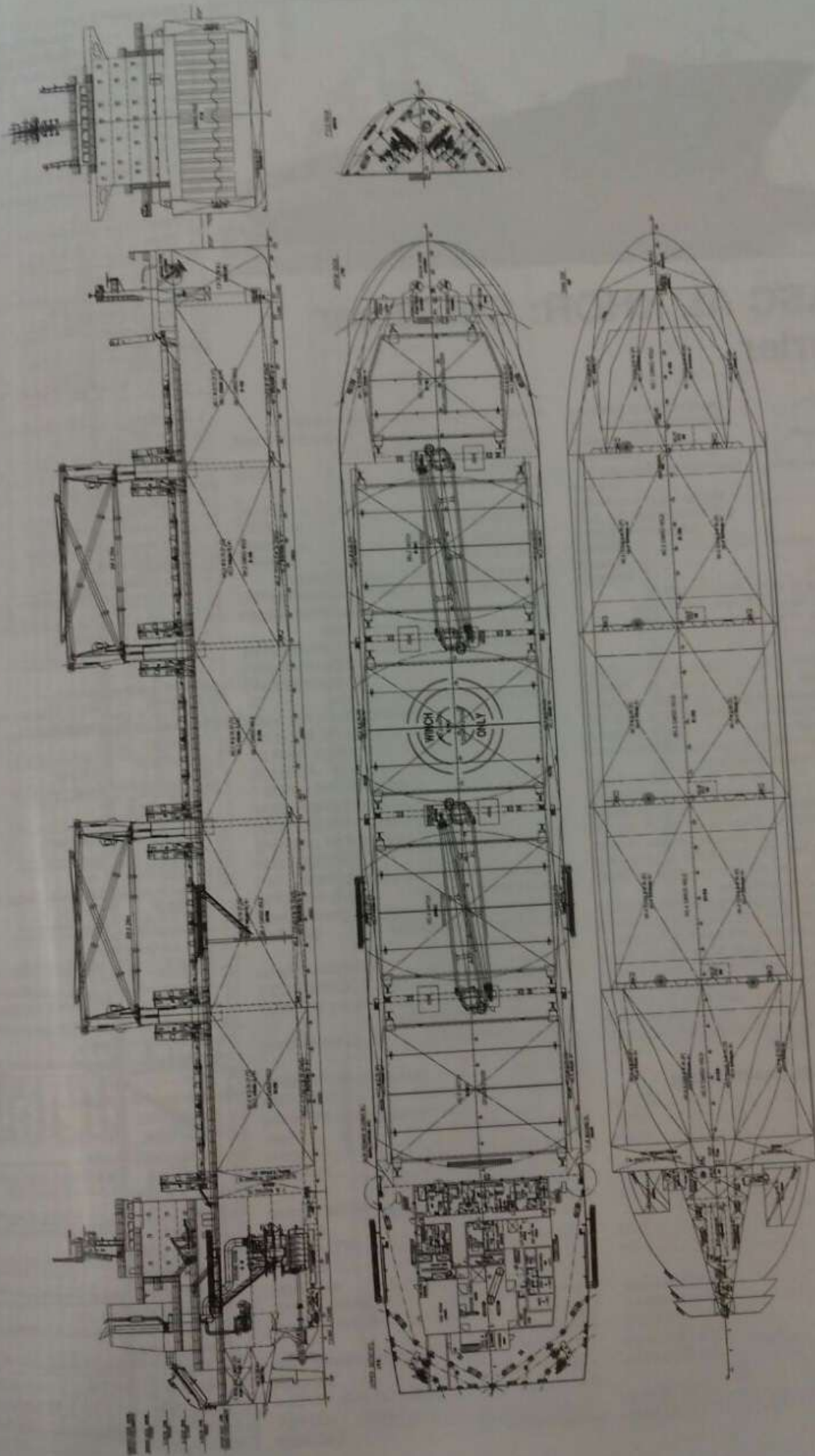
Green Dolphin 38 is a new generation eco-friendly handysize bulk carrier with low resistance hull lines and high propulsion efficiency resulting in low oil consumption.

The total cargo capacity of *True Love* is increased to over 50,800 cu.m by increasing the breadth moulded to 32m from 30m of the normal handysize breadth. However, the resistance in calm water and added resistance in rough sea are not increased after block coefficient/hull lines optimization, and the harbour operation will not be affected by the increased breadth during the concept design according to a market and logistic study of the handysize bulk carrier segment.

The section of No.2- No.4 cargo hold is designed to be box shaped (no hopper or wing tanks) so as to stow project cargoes and steel coils easily. No.2- No.5 hatch opening width is designed to 27m, up to 84.3% of ship's breadth, which provides operational flexibility and maintenance friendliness. Adequate ballast water capacity is provided by the double bottom and double sides, therefore there is no need to use No.3 cargo hold in heavy ballast condition.

The hull construction is designed in accordance with IACS Common Structural Rules (CSR) for bulk carriers with ICE-1C class. Continuous hatch openings with safe passage ways are provided for a safe working environment for the crew and vedores.

One 4-blade high-skew propeller is driven by a two-stroke engine (Wärtsilä 5RT-flex50-D), with total output of 6,100kW, the service speed is





VENTURE GOAL: B.Delta43 bulk carrier

Shipbuilder:	CSC Qingshan Shipyard, China
Vessel's name:	Venture Goal
Owner:	HBC Hamburg Bulk Carriers GMBH & Co KG
Country:	Germany
Designer:	Design Office / Ship Design Department Deltamarin Ltd
Country:	Finland
Model test establishment used:	HSVA
Flag:	Liberia
IMO number:	9670731
Total number of sister ships already completed (excluding ship presented):	6
Total number of sister ships still on order:	5

VENTURE GOAL, is a B.Delta43 bulk carrier built at CSC Qingshan Shipyard, designed by Deltamarin. The vessel is a new benchmark for Handymax bulk carriers, being a 190m long, high block co-efficient shallow draft vessel and CSR classed. The vessel has a maximum deadweight capacity of 43,500tonnes at 10.7m maximum draught, designed for very high operational flexibility and enhanced fuel performance and is intended for the worldwide dry bulk trades, being in full compliance with future environmental regulatory requirements.

The cargo hold structure is specially designed to carry a variety of dry bulk commodities, such as steel coils, timber, seed cakes, grains, bauxite, aluminium, coal, iron ore, sugar, unit cargoes, dangerous goods, deck cargoes, thus maximising trading versatility and utilisation.

The *Venture Goal* B.Delta43 ship has an EEDI value of more than 20% below the IMO reference line, which satisfies Phase 2 (>1/1/2020) of the EEDI rules, and provides a combination of the highest deadweight/draught ratio over the lowest daily fuel consumption in its class, thus maximising return on investment and assuring long-term profitability.

Distinctive features include:

- The lowest daily fuel consumption in its class of handymax dry bulk carriers, (i.e. 40.000

- 50,000dwt), with only 17.8mt/day, at ISO MDO fuel, a design draught of 9.50m, 15% sea margin included, and a design speed of 14kn, while maintaining high cargo carrying capacity in tons (43,500t) and cubic capacity (54,000m³).

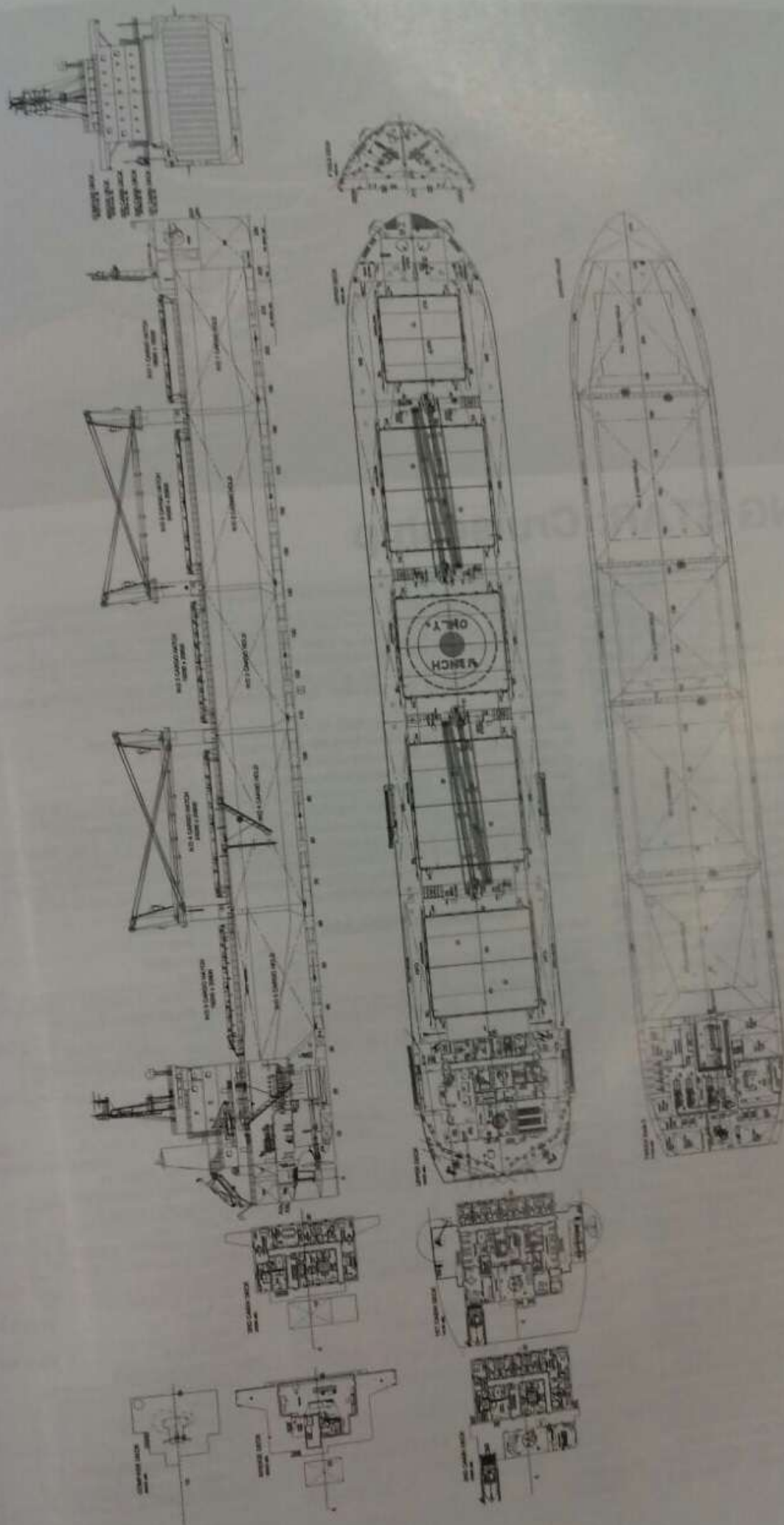
- Highest cargo carrying capacity over draught: Capable of carrying 43,500dwt, at a cubic capacity of 54,000m³ and only 10.7m draught, being unique in the existing fleet of that size, while being CSR (Common Structural Rules) classed.
- State-of-the-art, optimised hydrodynamics:
 - unique hull form development
 - propeller-rudder optimisation for higher efficiency
 - Reduced daily fuel consumption in all operating draughts (ballast, design, scantling), including slow steaming speeds.

TECHNICAL PARTICULARS

Length oa:	189.99m
Length bp:	187.05m
Breadth moulded:	30m
Depth moulded	
To main deck:	15m
Draught	
Scantling:	10.7m
Design:	9.5m
Gross	24,000gt
Deadweight	
Design:	37,000dwt
Scantling:	43,500dwt
Speed, service (--- %MCR output):	14.0knots
	/ 77.5 %MCR
Cargo capacity (m ³)	54,000 m ³
Bunkers (m ³)	
Heavy oil:	1300m ³
Diesel oil:	140m ³
Water ballast (m ³):	26,500m ³
Daily fuel consumption:	
Main engine only:	17.8tonnes/day
Auxiliaries:	2g/kWh

Classification society and notations: Lloyd's Register LR +100A1, Bulk Carrier CSR, GRAB(25), BC-A, (holds 2 and 4 may be empty), ShipRight (ACS (B.D), CM), *WS, LI, ESP +LMC, UMS, ECO(IHM), with the descriptive notes *ShipRight (BWP(S+F.T), SCM)

Main engine(s)	
Design:	Two stroke
Model:	5S50ME-B9.3 (Tier II)
Manufacturer:	MAN B&W
Number:	1
Type of fuel:	HFO/MDO
Output of each engine:	6,050kW
Diesel-driven alternators	
Number:	3
Engine make/type:	Daihatsu 6DK
Type of fuel (eg. HFO or MDO):	HFO/MDO
Output/speed of each set:	680 kW/720rpm
Boilers	
Number:	1
Type:	Composite Boiler
Output, each boiler:	1,600kg/h
Cargo Cranes	Electro hydraulic cranes 30t x 31m, 4 sets
Complement	
Crew:	25
Suez crew:	6
Ballast pumps:	800m ³ x 2
Power supply	
Diesel generators 3 x 715kW	
Emergency generator 1 x 150kW	
Navigation equipment	
Radar:	2
DGPS:	2
Autopilot:	1
VDR:	1
AIS:	1
Launch date:	May 2014
Delivery date:	January 2015





TIAN ZHEN: 36,000dwt general cargo ship

Shipbuilder: **Guangzhou Huangpu Shipbuilding Company Ltd, CSSC**
 Vessel's name: **Tian Zhen**
 Hull No.: **H3063**
 Owner/Operator: **COSCO Shipping Co. Ltd.**
 Country: **China**
 Designer: **Shanghai Merchant Ship Design & Research Institute (SDARI)**
 Country: **China**
 Model test establishment used: **HSVA (Germany)**
 Flag: **China**
 IMO number: **9722728**
 Total number of sister ships already completed (excluding ship presented): **8**
 Total number of sister ships still on order: **0**

side. Hydraulic folding hatch covers with fast operation velocity have also been fitted.

In the summer of 2016, as the sister ship of *Tian Zhen*, *Tian Xi* finished its first round voyage between China and Finland through the Arctic Northeast Passage, which initiated the woodpulp transportation business for COSCO Shipping. Under the aegis of China's "One Belt, One Road" state strategy and COSCO Shipping's expansion plan, this series of vessels is expected to play an important role traversing relevant trading routes in the future.

Note: This vessel is the first of its kind to be built by Guangzhou Huangpu Shipbuilding Company, but is part of a delivery of eight vessels split between Nantong COSCO KHI Engineering Co. and Guangzhou Huangpu Shipbuilding Company. Information could not be gathered on the vessels built first by Nantong COSCO KHI Engineering Co. and so *Tian Zhen*, a sister ship, has been selected for publication in their stead.

TECHNICAL PARTICULARS

Length oa: 189.99m
 Length bp: 187m
 Breadth moulded: 28.50m
 Depth moulded
 To upper deck: 15.8m
 Width of double skin
 Side: 2.95m (P) / 2.35m (S)
 Bottom: 1.78m
 Draught
 Scantling: 11m
 Gross: 26,700gt
 Deadweight
 Scantling: 36,900tonnes (excluding tween deck hatch covers)
 Speed, service (73 %MCR output): 13.77knots
 Cargo capacity
 Bale: 45,200m³
 Grain: 45,200m³
 Bunkers
 Heavy oil: 2,850m³
 Diesel oil: 250m³
 Water ballast: 14,300m³
 Daily fuel consumption
 Main engine only: 19.73tonnes/day
 Auxiliaries: 3.7tonnes/day (1set of GE)
 Classification society and notations: **CSA General Dry Cargo Ship, Equipped with Container Securing Arrangement, ERS, Ice Class B, Grab(20), PSPC(B), Loading Computer(S), G.D, In-water Survey, GPR, EEDI CSM, AUT-0**
 % high-tensile steel used in construction: 46%
 Heel control equipment: Anti-heeling Pump; 1 x 500m³/h
 Main engine(s)
 Design: Wärtsilä
 Model: 6RT-flex50-B
 Manufacturer: HHM
 Type of fuel: HFO
 Output of each engine: 6,960kW
 Propeller(s)
 Material: Ni-Al-Bronze Cu₂
 Designer/Manufacturer: Shanghai Marine Propeller Design Co. Ltd
 Fixed/Controllable pitch: Fixed pitch
 Diameter: 6.3m
 Speed: 89.1rpm

TIAN ZHEN is a 36,000dwt general cargo ship tailor-made for Chinese owner COSCO Shipping. It was delivered in January 2016. In total, eight ships of this series have been ordered, designed by SDARI, constructed by Guangzhou Huangpu Shipbuilding and Nantong COSCO KHI Ship Engineering respectively, and registered under CCS and Class NK. This series is the latest general cargo ship type with the largest deadweight and largest loadable area in COSCO Shipping's fleet. In June 2016, an additional three ships with Finnish-Swedish 1A ice class were ordered and will be built in Shanghai Shipyard.

Optimal fuel efficiency is the most significant feature of *Tian Zhen*. The hull form was developed based on the organic integration of SDARI's empirical method and numerical towing tank technology. An innovative vertical bow erasures better sea-keeping performance and reduces speed loss in rough seas. In addition, a flap rudder is fitted for better manoeuvrability in restricted waters. Through verification by numerous model tests in three basins (HSVA of Germany, ASMB of Japan and CSSRC of China), the hull form has been optimised to achieve maximum energy efficiency over the range of speeds and draughts it is predicted to operate at in service. Energy-saving Hub Vortex Absorbed Fins (HVAf) have been installed to further improve efficiency. The delivered power curve of this vessel ranks best within the speed range when compared with vessels of similar dimensions and block coefficients in HSWA's databank.

The main Wärtsilä 6RT-flex50-B engine, with a much derated CMCR at L4 point and Delta Tuning method, brings greater fuel savings at the economical speeds at which the ship often operates. From an ecological perspective, the vessel has been designed to improve its environmental footprint significantly. *Tian Zhen's* EEDI value satisfies Phase III of IMO regulations, and a water lubricated shaft bearing system is fitted to avoid potential oil leakage. For the following three ice-classed ships, stricter EU Ship Recycling Regulations will be met.

Another distinct characteristic of *Tian Zhen* is superior cargo adaptability and loading efficiency. Four open-hatch, totally box-shaped cargo holds with pontoon tweendecks at three different levels are suitable for carrying vehicles, steel products, bulk cargo, various general cargoes and dangerous cargoes. An open weather deck provides plenty of space for stowing large size project cargoes, and three sets of 100tonne and one set of 80tonne heavy cranes have been installed on the port

Design speed: 13.77knots
 Engine make/type: **Wärtsilä/6EY18ALW**
 Type of fuel: **HFO**
 Output/speed of each set: **800kW@900rpm**
 Alternator make/type: **Taiyo Electric Co. Ltd**
 Output/speed of each set: **750kW@900rpm**
 Boilers
 Number: **1 Composite marine boiler**
 Type: **CMB-VS-1 8+0 8/6**
 Make: **SAACKE**
 Output, each boiler
 Oil Fired section: **1,800kg/h**
 Exhaust gas section: **800kg/h**
 (73% MCR ISO)

Cargo cranes/cargo gear
 Make: **MacGregor**
 Type: **Electro-hydraulic wire luffing type single deck crane**
 Performance: **one - 80tonnes/50tonnes x 5m-22m/4m-30m**
two - 100tonnes/50tonnes x 6m-22m/4.5m-36m
one - 100tonnes/50tonnes x 6m-22m/5m-38m

Other cranes
 Make: **Shanghai Hengyan Marine Equipment Co. Ltd**
 Type: **Telescope hydraulic slewing crane**
 Tasks: **For provision**
 Performance: **4tonnes x 3m-18m**

Mooring equipment
 Make: **SEC Machinery & Equipment Co. Ltd**
 Type: **Electric**

Special lifesaving equipment
 Number of each and capacity: **1, 26 persons**
 Make: **Jiangyin Neptune Marine Appliance Co., Ltd. (NPT)**
 Type: **Free Fall Lifeboat**
 If MES, vertical or sloping chutes? **Sloping chute**

Hatch covers
 Design: **TTS**
 Manufacturer: **TTS**
 Type: **Hydraulically operated, weather tight, steel double skin, folding type (upper deck), lift-away closed pontoon type (tween deck)**

Containers
 Total TEU capacity:
 On deck: **1,015TEU**
 Reefer plugs:
 Tiers/rows (maximum)
 On deck: **5/11**
 In holds: **No**

Complement
 Officers: **13**
 Crew: **13**
 Suez/Repair Crew: **6**
 Stern appendages/special rudders: **One flap rudder**

Bridge control system
 Make: **Nabtesco**
 Type: **M-880-V**
 Is bridge fitted for one-man operation? **No**

Fire detection system
 Make: **Consilium**
 Type: **Salwico Cargo**

Fire extinguishing systems
 Cargo holds: **CO₂**
 Make/Type: **NK**
 Engine room: **CO₂**
 Make/Type: **NK**

Radars
 Make: **Furuno**
 Model(s): **FR-2837S-D, FAR-2117-BB, FR-2827-D**

Integrated bridge system? **No**

Waste disposal plant
 Incinerator
 Make: **HANSUN**
 Model: **HSINC-50A**

Sewage plant
 Make: **HANSUN**
 Model: **ST-20U**

Contract date: **November 2013**
 Launch/float-out date: **June 2015**
 Delivery date: **May 2016**

ANEXO II

Reporte Navcad

Resistance

14 nov 2017 05:28

HydroComp NavCad 2014

Project ID

Description

File name Pot.hcnc

Analysis parameters

Vessel drag		ITTC-78 (CT)	Added drag	
Technique:	[Calc]	Prediction	Appendage:	[Calc] Percentage
Prediction:		Andersen	Wind:	[Off]
Reference ship:			Seas:	[Off]
Model LWL:			Shallow/channel:	[Off]
Expansion:		Standard	Towed:	[Off]
Friction line:		ITTC-57	Margin:	[Calc] Hull + added drag [10%]
Hull form factor:	[On]	1,344	Water properties	
Speed corr:	[On]		Water type:	Salt
Spray drag corr:	[Off]		Density:	1026,00 kg/m3
Corr allowance:		ITTC-78 (v2008)	Viscosity:	1,18920e-6 m2/s
Roughness [mm]:	[On]	0,15		

Prediction method check [Andersen]

Parameters	FN [design]	CVOL	CB	LWL/BWL
Value	0,19	4,82	0,83	5,85
Range	0,05-0,33	4,00-6,00	0,55-0,85	5,00-8,00

Prediction results

SPEED [kt]	SPEED COEFS		ITTC-78 COEFS						
	FN	FV	RN	CF	[CTLT/CF]	CR	dCF	CA	CT
2,00 !	0,025	0,054	1,53e8	0,001961	1,344	0,000001	0,000000	0,000488	0,003125
4,00 !	0,049	0,109	3,05e8	0,001783	1,344	0,000001	0,000000	0,000477	0,002875
6,00	0,074	0,163	4,58e8	0,001690	1,344	0,000001	0,000000	0,000454	0,002727
8,00	0,099	0,217	6,11e8	0,001629	1,344	0,000001	0,000000	0,000432	0,002621
14,00	0,173	0,380	1,07e9	0,001518	1,337	0,000673	0,000000	0,000374	0,003076
14,50	0,179	0,394	1,11e9	0,001511	1,335	0,000828	0,000000	0,000370	0,003216
+ 15,00 +	0,185	0,407	1,15e9	0,001505	1,334	0,001008	0,000000	0,000366	0,003382
15,50	0,192	0,421	1,18e9	0,001499	1,332	0,001217	0,000000	0,000362	0,003575
16,00	0,198	0,434	1,22e9	0,001493	1,330	0,001455	0,000000	0,000358	0,003799
17,00	0,210	0,462	1,30e9	0,001482	1,325	0,002032	0,000000	0,000350	0,004347
	RESISTANCE								
SPEED [kt]	RBARE [kN]	RAPP [kN]	RWIND [kN]	RSEAS [kN]	RCHAN [kN]	RTOWED [kN]	RMARGIN [kN]	RTOTAL [kN]	
2,00 !	13,71	0,69	0,00	0,00	0,00	1,44	1,44	15,83	
4,00 !	50,45	2,52	0,00	0,00	0,00	5,30	5,30	58,28	
6,00	107,67	5,38	0,00	0,00	0,00	11,31	11,31	124,36	
8,00	183,96	9,20	0,00	0,00	0,00	19,32	19,32	212,47	
14,00	661,17	33,06	0,00	0,00	0,00	69,42	69,42	763,66	
14,50	741,52	37,08	0,00	0,00	0,00	77,86	77,86	856,45	
+ 15,00 +	834,48	41,72	0,00	0,00	0,00	87,62	87,62	963,82	
15,50	942,05	47,10	0,00	0,00	0,00	98,92	98,92	1088,07	
16,00	1066,53	53,33	0,00	0,00	0,00	111,99	111,99	1231,85	
17,00	1377,81	68,89	0,00	0,00	0,00	144,67	144,67	1591,37	
	EFFECTIVE POWER		OTHER						
SPEED [kt]	PEBARE [kW]	PETOTAL [kW]	CTLR	CTLT	RBARE/W				
2,00 !	14,1	16,3	0,00001	0,04537	0,00003				
4,00 !	103,8	119,9	0,00001	0,04174	0,00010				
6,00	332,3	383,9	0,00001	0,03959	0,00022				
8,00	757,1	874,4	0,00001	0,03805	0,00037				
14,00	4761,9	5500,0	0,00977	0,04466	0,00134				
14,50	5531,3	6388,7	0,01202	0,04669	0,00150				
+ 15,00 +	6439,4	7437,5	0,01464	0,04910	0,00169				
15,50	7511,8	8676,1	0,01766	0,05191	0,00191				
16,00	8778,8	10139,5	0,02112	0,05515	0,00216				
17,00	12049,7	13917,4	0,02950	0,06311	0,00279				

Resistance

14 nov 2017 05:28

HydroComp NavCad 2014

Project ID

Description

File name **Pot.hcnc**

Hull data

General		Planing	
Configuration:	Monohull	<i>Proj chine length:</i>	0,000 m
Chine type:	Round/multiple	<i>Proj bottom area:</i>	0,0 m2
Length on WL:	176,500 m	<i>LCG fwd TR:</i>	[XCG/LP 0,000] 0,000 m
Max beam on WL:	[LWL/BWL 5,850] 30,171 m	<i>VCG below WL:</i>	0,000 m
Max molded draft:	[BWL/T 2,704] 11,157 m	<i>Aft station (fwd TR):</i>	0,000 m
Displacement:	[CB 0,826] 50379,25 t	<i>Deadrise:</i>	0,00 deg
Wetted surface:	[CS 2,744] 8077,8 m2	<i>Chine beam:</i>	0,000 m
ITTC-78 (CT)		<i>Chine ht below WL:</i>	0,000 m
LCB fwd TR:	[XCB/LWL 0,500] 88,250 m	<i>Fwd station (fwd TR):</i>	0,000 m
LCF fwd TR:	[XCF/LWL 0,559] 98,683 m	<i>Deadrise:</i>	0,00 deg
Max section area:	[CX 0,942] 317,1 m2	<i>Chine beam:</i>	0,000 m
Waterplane area:	[CWP 0,935] 4976,4 m2	<i>Chine ht below WL:</i>	0,000 m
Bulb section area:	35,0 m2	<i>Propulsor type:</i>	Propeller
Bulb ctr below WL:	0,000 m	<i>Max prop diameter:</i>	0,0 mm
Bulb nose fwd TR:	180,500 m	<i>Shaft angle to WL:</i>	0,00 deg
Imm transom area:	[ATR/AX 0,126] 40,0 m2	<i>Position fwd TR:</i>	0,000 m
Transom beam WL:	[BTR/BWL 0,663] 20,000 m	<i>Position below WL:</i>	0,000 m
Transom immersion:	[TTR/T 0,000] 0,000 m	<i>Transom lift device:</i>	Flap
Half entrance angle:	59,58 deg	<i>Device count:</i>	0
Bow shape factor:	[WL flow] 1,0	<i>Span:</i>	0,000 m
Stern shape factor:	[WL flow] 1,0	<i>Chord length:</i>	0,000 m
		<i>Deflection angle:</i>	0,00 deg
		<i>Tow point fwd TR:</i>	0,000 m
		<i>Tow point below WL:</i>	0,000 m

Resistance

14 nov 2017 05:28

HydroComp NavCad 2014

Project ID

Description

File name Pot.hcnc

Appendage data

General		Skeg/Keel	
Definition:	Percentage	Count:	0
Percent of hull drag:	5,00 %	Type:	Skeg
Planing influence		Mean length:	0,000 m
LCE fwd TR:	0,000 m	Mean width:	0,000 m
VCE below WL:	0,000 m	Height aft:	0,000 m
Shafting		Height mid:	0,000 m
Count:	1	Height fwd:	0,000 m
Max prop diameter:	0,0 mm	Projected area:	0,0 m2
Shaft angle to WL:	0,00 deg	Wetted surface:	0,0 m2
Exposed shaft length:	0,000 m	Stabilizer	
Shaft diameter:	0,000 m	Count:	0
Wetted surface:	0,0 m2	Root chord:	0,000 m
Strut bossing length:	0,000 m	Tip chord:	0,000 m
Bossing diameter:	0,000 m	Span:	0,000 m
Wetted surface:	0,0 m2	T/C ratio:	0,000
Hull bossing length:	0,000 m	LE sweep:	0,00 deg
Bossing diameter:	0,000 m	Wetted surface:	0,0 m2
Wetted surface:	0,0 m2	Projected area:	0,0 m2
Strut (per shaft line)		Dynamic multiplier:	1,00
Count:	0	Bilge keel	
Root chord:	0,000 m	Count:	0
Tip chord:	0,000 mm	Mean length:	0,000 m
Span:	0,000 m	Mean base width:	0,000 m
T/C ratio:	0,000	Mean projection:	0,000 m
Projected area:	0,0 m2	Wetted surface:	0,0 m2
Wetted surface:	0,0 m2	Tunnel thruster	
Exposed palm depth:	0,000 m	Count:	0
Exposed palm width:	0,000 m	Diameter:	0,000 m
Rudder		Sonar dome	
Count:	0	Count:	0
Rudder location:	Behind propeller	Wetted surface:	0,0 m2
Type:	Balanced foil	Miscellaneous	
Root chord:	0,000 m	Count:	0
Tip chord:	0,000 m	Drag area:	0,0 m2
Span:	0,000 m	Drag coef:	0,00
T/C ratio:	0,000		
LE sweep:	0,00 deg		
Projected area:	0,0 m2		
Wetted surface:	0,0 m2		

Environment data

Wind		Seas	
Wind speed:	0,00 kt	Significant wave ht:	0,000 m
Angle off bow:	0,00 deg	Modal wave period:	0,0 sec
Gradient correction:	Off	Shallow/channel	
Exposed hull		Water depth:	0,000 m
Transverse area:	0,0 m2	Type:	Shallow water
VCE above WL:	0,000 m	Channel width:	0,000 m
Profile area:	0,0 m2	Channel side slope:	0,00 deg
Superstructure		Hull girth:	0,000 m
Superstructure shape:	Cargo ship		
Transverse area:	0,0 m2		
VCE above WL:	0,000 m		
Profile area:	0,0 m2		

Resistance

14 nov 2017 05:28

HydroComp NavCad 2014

Project ID

Description

File name **Pot.hcnc**

Symbols and values

SPEED = Vessel speed
FN = Froude number [LWL]
FV = Froude number [VOL]

RN = Reynolds number [LWL]
CF = Frictional resistance coefficient
CV/CF = Viscous/frictional resistance coefficient ratio [dynamic form factor]
CR = Residuary resistance coefficient
dCF = Added frictional resistance coefficient for roughness
CA = Correlation allowance [dynamic]
CT = Total bare-hull resistance coefficient

RBARE = Bare-hull resistance
RAPP = Additional appendage resistance
RWIND = Additional wind resistance
RSEAS = Additional sea-state resistance
RCHAN = Additional shallow/channel resistance
RTOWED = Additional towed object resistance
RMARGIN = Resistance margin
RTOTAL = Total vessel resistance

PEBARE = Bare-hull effective power
PETOTAL = Total effective power

CTLR = Telfer residuary resistance coefficient
CTLT = Telfer total bare-hull resistance coefficient
RBARE/W = Bare-hull resistance to weight ratio

+ = Design speed indicator
* = Exceeds parameter limit