SEA-Japan

No. 433 Oct. - Nov. 2025

Kawasaki Delivers LPG-powered LPG/NH3 Carrier CRYSTAL ODYSSEY

Kawasaki Heavy Industries, Ltd. announced the delivery of the CRYSTAL ODYSSEY (Kawasaki hull no. 1765), an 86,700 m3 liquefied petroleum gas (LPG) and ammonia (NH3) carrier powered by LPG fuel.

Boasting an increased cargo capacity compared with existing 84,000 m^3 LPG carriers and having ammonia loading capability, the CRYSTAL ODYSSEY is the eighth of Kawasaki's newest-design 86,700m^3 capacity LPG-fueled LPG/NH3 carriers. Kawasaki has completed fifteen LPG-propelled vessels to date, and the CRYSTAL ODYSSEY is its seventy-eighth LPG carrier.

The CRYSTAL ODYSSEY – an LPG-powered LPG/NH3 carrier

This carrier is equipped with separate cargo tanks and capable of simultaneously transporting LPG, which is already in widespread use as a low-carbon-emission energy source, and ammonia, which is expected to serve as a useful new fuel amid widespread efforts toward the realization of a low- or zero-carbon emission society. Furthermore, this carrier is designed to increase cargo tank capacity, while keeping its principal dimensions like LOA and beam similar to conventional-type vessels so that it can be berthed at major LPG terminals around the world.

In consideration of increasingly strict environmental regulations around the world, and based on action plans such as the Sustainable Development Goals (SDGs), Kawasaki will continue to develop and provide customers with environmentally friendly ship technologies with a focus on LPG and LPG/NH3 carriers powered by LPG, as well as other types of merchant vessels that comply with the latest environmental regulations—including carriers for liquefied hydrogen, a fuel that is gaining popularity as a next-generation energy source. In this way, Kawasaki will contribute toward the realization of low- and zero-carbon-emission societies.

<Specifications>

Length overall:	229.90m
Molded breadth:	37.20m
Molded depth:	21.90m
Molded draft:	11.65m
Speed:	Approx. 17.0knots
Crew complement:	29
Gross tonnage:	49,561t
Deadweight:	56,331t
Cargo tank capacity:	87,099m^3

Main engine: One Kawasaki-MAN B&W 6G60ME-C10.5-LGIP diesel engine

Classification/country of registration: Nippon Kaiji Kyokai (ClassNK)/Singapore

Delivery date: June 29, 2025

<Features>

1) This carrier is equipped with the Kawasaki-MAN B&W 6G60ME-C10.5-LGIP, a Kawasaki-made, electronically controlled, LPG-injection marine diesel engine (ME-LGIP engine). By utilizing LPG as fuel, it significantly reduces sulfur oxide (SOx) and CO_2 emissions in exhaust gases compared with ships running on conventional marine fuel oil, complying with SOx emission standards and the EEDI phase 3 regulations.
2) The propulsion system is compliant with the nitrogen oxide (NOx) Tier III requirements and utilizes EGR and SCR equipment. Thanks to this system, the vessel is able to travel in NOx emission control areas (ECAs) even when operating on conventional low-sulfur fuel.
3) Fuel consumption amounts are reduced through the inclusion of the Kawasaki RBS-F (Rudder Bulb System with Fins), the Kawasaki SDS-F (Semi-Duct System with contra Fins), and energy-saving fins around the propeller.
4) The concept design for a system that utilizes ammonia as fuel on this vessel has been approved by Nippon Kaiji Kyokai (ClassNK). Therefore, it is possible to modify ship design specifications to enable the use of ammonia as fuel in the future.

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【Visit to the Member Shipyard Vol.1】
Kawasaki Heavy Industries, Ltd.
Sakaide Shipyard

The Next Generation Ship “Liquified Hydrogen Carriers” Preparing for Widespread Adoption after 2030

The Seto Inland Sea is a scenic region designated as the largest national park in Japan, also known for its long history of being the area with shipbuilding industry. The Sakaide Shipyard of Kawasaki Heavy Industries, Ltd. (KHI) is located near the Seto Ohashi Bridge in Kagawa Prefecture.

KHI was established in Tokyo in 1878 as Kawasaki Tsukiji Shipyard and opened Kawasaki Hyogo Shipyard in 1881. In 1886, the company leased and merged with the government-operated Hyogo Shipyard (Kobe) and renamed itself Kawasaki Dockyard by consolidating the yards in Tokyo and Kobe. In 1896, it was incorporated as Kawasaki Dockyard Co., Ltd (Kobe). The Sakaide Shipyard was established to meet the demand for larger tankers during the period of high economic growth, they have focused on constructing merchant vessels. Since completing its first ship in 1967, the shipyard has delivered as many as 355 vessels of different types. For the past decade, its main product lines had been LPG

(Continued on Page 3)

Name	Sakaide Shipyard		
Location	1, Kawasaki-cho, Sakaide, Kagawa		
Foundation	1967	Site Area	911,000m^2
Employees	1,082 (Production Workers : 71%, Designer/Management etc. : 29% , Female Ratio : 4%)		
Main Type of Vessel	LPG/NH3 Carrier		
Equipments	Dock : Length × Wide × Depth (with Crane capacity) No.1 Building Dock 380m × 62m × 10.3m (200t × 2 sets) No.2 Repairing Dock 450m × 72m × 12.3m (80t × 2 sets) No.3 Building Dock 420m × 75m × 11.0m (800t × 2 sets) Quay : 4 Locations		
Shipbuilding Volume	4 Vessels/year		

(Continued from Page 2)

carriers, but recently its focus have shifted to building LPG/Ammonia carriers as main products. Their VLGCs account for around 15% of the global market share.

The Sakaide Shipyard has three docks, and No.3 Dock is currently the main facility. It has abundant space to build LPG/Ammonia carriers – the dock has the capability to build VLCCs –, and, to shorten the construction periods in the dock, they assemble the cargo tanks and insulation work in parallel with the hull blocks. No.2 Dock was a repairing dock in the past but is now used as a final dock. The construction period for an LPG/Ammonia carrier takes over a year, yet they deliver 4 vessels a year utilizing these docks.

No.1 Dock is prepared for manufacturing cargo tanks for liquefied hydrogen (LH_2) carriers. Amid the energy transition, KHI is trying to contribute to the establishment of a hydrogen supply chain. In 2021, they built "Suiso Frontier", which is the world's first liquefied hydrogen carrier at the Kobe Shipyard. Although the hydrogen market is immature, they aim to rapidly gain market share during the growth phase by advancing preparations for hydrogen tank manufacturing and carrier construction. They plan to complete the first commercial demonstration vessel for hydrogen transport by 2030 (see the illustration on Page 2). After 2030 when mass production is expected to gain momentum, KHI plans to enhance factory facilities. This includes expanding the crane capacity at No.1 Dock.

KHI is also tackling productivity improvements based on the policy called "Kawasaki Production System (KPS)", which thoroughly eliminates of workers, materials and facilities. Unlike mass production industries, the shipbuilding industry cannot build prototypes; instead, they are working toward realizing "Digital Twin", or virtual ships that will be deployed in real. KHI is developing this method through cross-departmental initiatives that break down the entire shipbuilding process into segments. By centralizing information including materials, tools, consumables, equipment, and qualifications for each step, KHI can manage progress smoothly.

Furthermore, the company is working to robotize the workplace with their own robotics expertise, as well as to promote automation by digitizing and accumulating individual knowledge. Their goal is to automate every field including the logistics in the yard. Twenty robots are actively used for in-house processes such as cutting and assembling components. Drones are used for inspections to improve safety and efficiency. KHI expects robots to improve efficiency in fields that are complex or relying on specialized skills, such as pipe manufacturing, plate rolling, and pipe welding.

The Sakaide Shipyard is adjacent to a national park; so it must comply with the most strict environmental regulations to prevent air / water / soil pollution. The shipyard maintains a high level of environmental safety awareness through joint disaster prevention drills with neighboring companies and local governments while striving to build high-quality vessels.

As a part of a technology-focused conglomerate, that leverages comprehensive technological capabilities cultivated through global operations across diverse fields, KHI is steadily advancing to become the first mover in the new fuel era.

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From this volume, we start a new series of occasional articles and will introduce shipyards in Japan from among our member companies.

(Written by Tomo Nakabayashi)

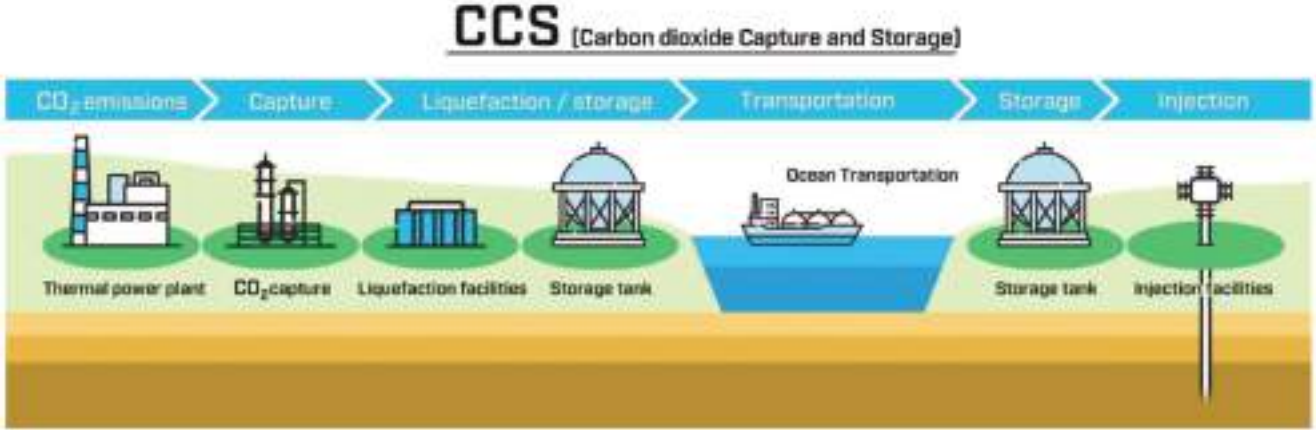
Technical Collaboration Agreement with Taiwanese Company Regarding EPC of Spherical Tanks for Liquefied CO_2 Storage Concluded

Kanadevia Corporation has recently signed a technical collaboration agreement with Taiwanese process equipment manufacturer LIANG LIAN INDUSTRIES CO., LTD. (Kaohsiung City, hereinafter referred to as LIANG LIAN INDUSTRIES) for the EPC (engineering, procurement, and construction) of liquefied CO_2 storage spherical tanks required for CCS (CO_2 Capture and Storage) and CCUS (CO_2 Capture, Utilization, and Strategy).

Currently, many countries, including Japan, have set a goal of achieving carbon neutrality by 2050 under the "Carbon Neutral 2050" initiative. To achieve this, CCS and CCUS are considered to play a crucial role. In Japan, the Japan Organization for Metals and Energy Security (JOGMEC) is promoting and supporting multiple Advanced CCS Projects. However, in order to implement CCS and CCUS in society, tanks for storing liquefied CO_2 are required, and manufacturing capacity for these storage tanks is considered a challenge. There are spherical and cylindrical types of liquefied CO_2 storage tanks. Kanadevia is actively advancing the liquefied CO_2 storage tank business by signing the technical collaboration agreement with LIANG LIAN INDUSTRIES, a company with extensive experience in the design and construction of spherical tanks in addition to cylindrical ones, which can be addressed with conventional technologies

The liquefied CO_2 storage tanks that Kanadevia is considering for EPC are expected to be in the range of 1,000 to 6,000 tons per unit. The Japanese government aims to achieve a CO_2 storage capacity of 6 to 12 million tons annually by 2030, and a certain level of demand for storage tanks is also expected.

With nearly 100 years of experience in the pressure vessel business, Kanadevia has advanced expertise in bending, welding, assembling, and installing ultra-thick steel plates. In line with the goal of achieving the "Carbon Neutral 2050" target, the company will contribute to the social implementation of next-generation technologies by manufacturing and constructing storage tanks essential for CCS and CCUS, as well as new fuels such as ammonia, which will serve as alternatives to coal and oil.



Process of CCS

Ceremony for the Signing of the Joint Venture Agreement

JMU Delivers Next-Generation Suezmax Tanker "IONIC SEMELI"

In July 2025, Japan Marine United Corporation (JMU) delivered "IONIC SEMELI", a newly developed next-generation Suezmax tanker. By gathering JMU's latest technologies and all of the expertise on oil carriers that it has accumulated over a long period of time, the vessel has achieved more energy savings and environmentally friendlier performance. It has improved fuel consumption compared with previous vessels, and with a SOx scrubber equipped, it complies with both the NOx Tier III and EEDI Phase 3 requirements.

In addition, many more advanced technologies are applied to the vessel which contribute to improving performance. The latest engineering analysis has helped to pursue utmost propulsion efficiency in developing its hull form. The vessel has not only high efficiency propellers but also JMU's original energy saving devices such as "Super Stream Duct®", "SURF-BULB®" and "ALV-Fin®", all of which are optimized to particular hulls. Those technologies significantly improve propulsion performance and reduce fuel oil consumption. Moreover, both "Ax-Bow®", which reduces wave resistance, and low wind-resistance accommodations are applied to the vessel to improve performance in actual sea conditions.

In order to comply with various environmental regulations, the vessel has electronically controlled engines, a ballast water management system and an inventory of hazardous materials. It only emits less NOx than the NOx Tier III requirements. Furthermore, low friction paints are applied on its hull. Also, both of its cargo oil and ballast water tanks are coated in accordance with the IMO PSPC requirements that improve the anticorrosive performance of the vessel.

<Principal Particulars>

L (o.a.) x B (mld.) x D (mld.): 274.30m x 48.00m x 23.15m
GT / DWT: 82,909/Approx. 159,000
Service Speed: 14.5kt
Main engine: Mitsui MAN-B&W 7S60ME-C10.6-EGRBP
Complement: 28persons
Classification: LR
Registration: Marshall Islands

SANOYAS Completes ULTRAMAX Bulk Carrier "ARIES MIZUKI"

ULTRAMAX bulk carrier M/V "ARIES MIZUKI" being under construction at SHIN KURUSHIMA SANOYAS MIZUSHIMA SHIPYARD was named on 26th June and delivered on 27th June, 2025.

This is the 7th vessel of a series of the SANOYAS newly developed 64,000DWT type ULTRAMAX bulk carriers. The vessel not only complies with the latest rules such as CSR B&T and the NOx Tier III regulations, but also has large deadweight although being less than 200m in length. And the vessel meets the requirement of a 30% reduction of CO_2 emissions (Phase 3) set forth in the IMO's EEDI (Energy Efficiency Design Index : grams of CO_2 per ton nautical mile) regulation, which applies to ships for which building orders are placed in and after 2025.

To improve its propulsion efficiency, the vessel is equipped with a low-speed, long-stroke electronically controlled main engine combined with high-efficiency propellers and rudder appendages. Furthermore, our patented energy saving devices such as SANOYAS developed "STF" (Sanoyas-Tandem-Fin) and ACE DUCT (Sanoyas Advanced flow Controlling and Energy saving DUCT) are applied. These energy saving devices, which are improved from previous designs, have achieved over an 8 % reduction of energy consumption so that EEDI Phase3 is surely satisfied.

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Considering eco-friendly features, various countermeasures such as a main engine with EGR complied with the NOx emission Tier III limit for the prevention of air pollution and dedicated low Sulphur diesel oil tanks to cruise in ECA (Emission Control Area), are applied. In addition, countermeasures such as a Ballast Water Treatment System and independent holding tanks for rainwater on upper deck for the protection of marine environment, are also incorporated.

The vessel has five cargo holds with hatch openings, which are maximized to load various cargos such as grain, ore, coal, hot coils and steel pipes. Four 31-ton deck cranes for handling cargo are installed. Furthermore, to improve maintenance, access trunks are arranged for access from its upper deck to double bottom even on laden conditions.

SANOYAS ULTRAMAXES will be around in the seven seas as "ECO-ships".

<Particulars>

Ship No. :	1405
Keel Laying:	20th November, 2024
Launched:	28th April, 2025
Delivered:	27th June, 2025

Dimensions

Length (o.a.):	199.99m
Breadth (mld.)	32.24m
Depth (mld.)	19.22m
Summer Draft (ext.)	13.522m

Tonnage

Gross Tonnage:	36,372
Deadweight Tonnage:	63,988mt
Cargo Hold Capacity (grain):	81,490m^3
Classification:	NIPPON KAIJI KYOKAI
Complement:	25 persons
Service Speed (at C.S.O. with 15% sea margin):	about 14.1knots

Naikai Zosen Completes 15,600-GT Ro/Ro-Passenger Ferry SUNFLOWER PIRKA

On Thursday, June 26, 2025, Naikai Zosen Corporation completed the delivery of 15,600-gross-ton Ro/Ro-passenger ferry that had been constructed at its Innoshima shipyard for MOL Sunflower Ltd. (ordered by Mitsui O.S.K. Lines, Ltd.). Features and particulars of the SUNFLOWER PIRKA are described below.

<Features>

1) The SUNFLOWER PIRKA is a Ro/Ro-passenger ferry with one engine, one shaft and one steering rudder. Automobiles are loaded through ramp doors located at the starboard bow and stern, the center of the stern;
2) The ISHIN (Innovation in Sustainability backed by Historically proven, INtegrated technologies) hull form is adopted, featuring a large windshield and a bow shape that are designed to reduce wind resistance and contribute to enhancing propulsion force. Also employed is a STEP (Spray TEaring Plate), a rectangular energy-saving device attached above the waterline of bow to absorb wave-making resistance in rough waters;
3) A fin stabilizer prevents The SUNFLOWER PIRKA from rolling while it is under way. Furthermore, maneuverability is boosted with two bow thrusters, a stern thruster, a pump-jet, a bulb-equipped rudder and a five-blade controllable pitch propeller (CPP);
4) The vessel's main engine, power generators and boilers are all dual-fuel, running on both heavy fuel oil and LNG; and
5) The vessel provides a comfortable time during voyage to all passengers including truck drivers with arrangements such as highly isolated cabins, a gym and a large bathroom.

<Particulars>

Length overall:	199.40m
Breadth (mld.):	28.60m
Depth (mld.):	22.15m
Designed load draft (mld.):	6.85m
Scantling draft (mld.):	6.87m
Gross tonnage:	15,512tons
Deadweight tonnage (at designed draft):	5,961tons
Vehicle loading capacity:	155 13-meter trucks 50 passenger cars
Passenger capacity:	157 persons
Crew:	30 persons
Main engine:	Mitsui E&S-MAN B&W 12S50ME-C8.5-GI dual-fuel diesel engine – one unit, one shaft
Maximum continuous output:	21,240kW x 135min-1 x 1
Service speed:	Approximately 24.0knots
Qualification:	JG second class (non-international)
Service route:	Oarai and Tomakomai
Commencement of construction:	February 14, 2024
Launch:	September 4, 2024
Completion of construction:	June 26, 2025

Approval in Principle (AiP) for World's First LCO_2 / Methanol Carrier

Mitsubishi Shipbuilding Co., Ltd., a part of the Mitsubishi Heavy Industries (MHI) Group, and Mitsui O.S.K. Lines, Ltd. (MOL) have acquired an Approval in Principle (AiP) from Nippon Kaiji Kyokai (ClassNK) for a jointly developed liquefied CO_2 (LCO_2)/methanol carrier. An AiP acquisition for this type of carrier marks the world's first .

Technologies for converting CO_2 into fuel or chemical products are attracting attention as a means of utilizing CO_2 in CCUS (Carbon dioxide Capture, Utilization and Storage). One such approach is an ongoing study toward realizing a supply chain for producing synthetic methanol from captured CO_2. Synthetic methanol is expected to serve as a marine fuel that will contribute to decarbonization in the maritime shipping industry.

The vessel for which Mitsubishi Shipbuilding and MOL have acquired the AiP is based on a low-pressure LCO_2 carrier. It aims to transport CO_2, which serves as a raw material, on outward voyages and synthetic methanol on return voyages. Using dedicated vessels for CO_2 or methanol results in empty-cargo operations in the half of their trips. If the dual transport of CO_2 and methanol is achieved, empty-cargo trips can be eliminated, thereby improving overall transport efficiency. Mitsubishi Shipbuilding and MOL will move forward with the development of the LCO_2/methanol carrier, building on the findings and technical challenges identified during the concept study. The goal is to commercialize the LCO_2/methanol carrier through collaboration with relevant companies in supply chains and other partners.

The MHI Group is currently pursuing strategic measures to strengthen its business for the energy transition. As part of this initiative, Mitsubishi Shipbuilding is making efforts to contribute to the advancement of the maritime industries in Japan and overseas by utilizing its shipbuilding-based marine engineering and conventional shipbuilding technologies. The development of LCO_2/methanol carrier is one example of these efforts. Collaboration with MOL also demonstrates the MHI Group's commitment to partnerships. Moving forward, Mitsubishi Shipbuilding will continue to build strategic global partnerships both to incorporate external expertise and actively advance the development of a CCUS value chain. Through these efforts, the company aims to provide its technologies, products and services to ever more customers.

The MOL Group is currently working to build supply chains for synthetic fuel/methanol and CO_2 through initiatives such as an investment in HIF Global LLC, a U.S.-based company that develops, produces and transports synthetic fuel/methanol across North and South America and Australia. LCO_2/methanol carriers are expected to enhance the overall economic viability of such supply chains and contribute significantly to its realization. In accordance with the "MOL Group Environmental Vision 2.2," MOL is targeting net-zero emissions groupwide by 2050. By further accelerating initiatives to transport CO_2 as well as to develop and supply synthetic methanol, MOL aims to contribute to the realization of a low-carbon or decarbonized society.


ClassNK

APPROVAL IN PRINCIPLE

LCO2/Methanol Multi Cargo Carrier
developed by
Mitsui O.S.K. Lines, Ltd.
MITSUBISHI SHIPBUILDING CO., LTD.

AiP Certification

Conceptual diagram of LCO_2/methanol carrier operations

SG DAWN

Builder: Imabari Shipbuilding Co., Ltd.
Ship type: LNG Fueled 209,000 DWT Type Bulk Carrier
L (o.a.) x B x D: 299.99m x 50.00m x 25.00m
DWT/GT: 210,125t/110,845t
Main engine: 7S60ME-C10.5-GI x 1unit
Speed, service: about 14.0kts
Classification: NK
Completion: August 7, 2025

TRANS HARMONY EMERALD

Builder: Mitsubishi Shipbuilding Co., Ltd.
Ship type: Ro-Ro Cargo Ship
L (o.a.) x L (p.p.) x B (mld.) x D (mld.) (Upper Deck) x d (mld.): 195.00m x 185.00m x 30.60m x 30.56m x 8.50m
DWT/GT: 14,016t/49,264t
Main engine: Mitsui E&S 6S60ME-C10.5-GI MR 10,800 kW
Speed, service: abt. 19.5 kts
Classification: NK
Registration: Panama

DEJIMA CONFIDENCE

Builder: THE HAKODATE DOCK CO., LTD.
Hull No.: 923
Ship type: 40,000 DWT Type Bulk Carrier
L (o.a.) x B (mld.) x D (mld.) x d (mld.): 182.94m x 31.6m x 14.80m x 10.37m
DWT/GT: 40,426t/24,465t
Main engine: J-ENG 6UEC42LSH-Eco-D3-EGR
Speed, service: about 13.6kts
Classification: Nippon Kaiji Kyokai (NK)
Registration: Portugal
Completion: May 15, 2025

LEGENDARY DIVA

Owner: AZUMA BULK LIMITED
Builder: Oshima Shipbuilding Co., Ltd.
Hull No.: 11135
Ship type: Bulk Carrier
L (b.p) x B x D: 225.50m x 32.26m x 19.98m
DWT/GT: 82,189t/43,405t
Main Engine: MITSUI-MAN B&W 5S60ME-C10.5-EGRBP (Derating)
Speed, service: 14.3 kts
Classification: NK
Registration: Liberian
Completion: May 23, 2025

OXALIS DAISY

Owner: Singaporean Shipowner
Builder: SHIN KURUSHIMA HASHIHAMA DOCKYARD CO., LTD.
Hull No.: S-6257
Ship type: Product tanker
L (b.p.) x B x D: 106.50m x 19.20m x 9.913m
DWT/GT: 7,999t/6,011t
Main engine: HANSHIN 6L35MC6
Speed, service: 14.6kts
Classification: NK
Registration: Singapore
Completion: May 30, 2025

SOUTHERN RESONANCE

Builder: Sumitomo Heavy Industries Marine & Engineering
Hull No.: 1419
Ship type: Aframax tanker
L (b.p.) x B x D: 239.67m x 44.00m x 21.55m
DWT/GT: 114,945.3t/60,177t
Main engine: Mitsui MAN B&W 6G60ME-C10.5
Speed, service: 14.15kts
Classification: LR to NK (transferred upon completion)
Registry: Panama
Completion: September 19, 2025