

Small Scale LNG Distribution by Articulated Tug / Barge LNGC (AT/B LNGC)



Argent Marine Companies

 **MAERSK LINE, LIMITED**

LNG /Transportation

- Argent Marine Development since 1997
- Proprietary ATB Design for Propulsion Unit, and Cargo Unit
- 4,000M³ – 20,000M³ Designs
- Trade Specific for Offshore and Inland Routes
- Meets IGC Code and US Regulatory Requirements
- Preliminary Designs for Loading and Receiving Terminals

Current Concept LNG AT/B

- Advanced AT/B Design
- Current LNG Technology
- Established LNG Carrier Design and Operating Standards
- Current Economics

Advanced AT/B Design

- Highly successful concept. Vessel of choice for US coastal routes
- Advanced hydrodynamics
- Near ship speeds
- No weather limitations
- No towing winch fitted
 - ◆ Emergency tow hawser only
 - ◆ No need to go on hawser due to robust and reliable connection system

Current LNG technology

- Boil-off control
 - ◆ Pressure build
 - ◆ Re-liquefaction (full and partial)
 - ◆ Use boil-off as fuel
- IMO IGC Code type C containment
- Deepwell LNG pumps
- OCIMF loading / discharge manifolds
- OCIMF mooring

LNGC Operating Principles

- No compromise on safety
- Do not confuse with un-inspected towboats
- Crew appropriately licensed and qualified per LNG carrier standards
- Manning reduced vs. ship form, but unique requirements of LNG fully accounted for

Advantages of Using AT/B LNGC

Maximum Operating Flexibility

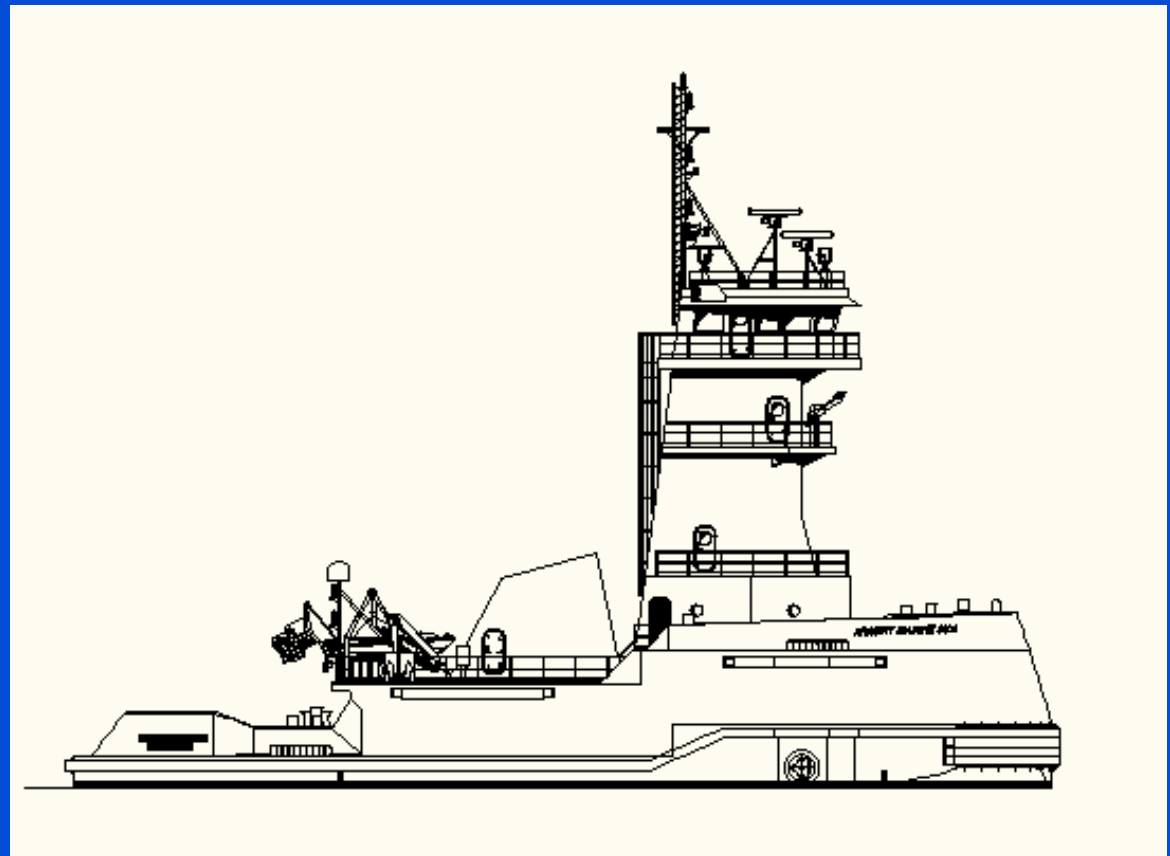
- Hub & Spoke Distribution from Any Terminal
- Multiple Receiving Depots as Required
 - ◆ Small Land Based Tanks and AT/B Cargo Unit Storage
 - ◆ AT/B Cargo Units Can Be Re-Located as Needed
- Multiple Deliveries per Voyage
- “Drop and Swap” Deliveries
- Deliveries Sized to Volume/Demand
- Optimize LNG Production and Demand/Delivery

Economics

- Capital Costs
 - ◆ Options to Construct propulsion and cargo Unit at Separate Yards
 - ◆ Maximize Shipyard Competitiveness
- Operating Costs
 - ◆ AT/B Manning Flexibility
- Optimize Capital and Operating Cost Vs. Market Growth

Tug / Propulsion Unit

LOA: 121' (36.9 m)
Beam: 42' (12.8 m)
Draft: 19'-6" (5.9 m)
Connection: Articouple
Propulsion: Diesel Electric
Fuel: 100% Gas or
Marine diesel
Propulsion: 2 x 4,000 Hp
(2 x 2983 kW)
Safety: SOLAS / FIFI I



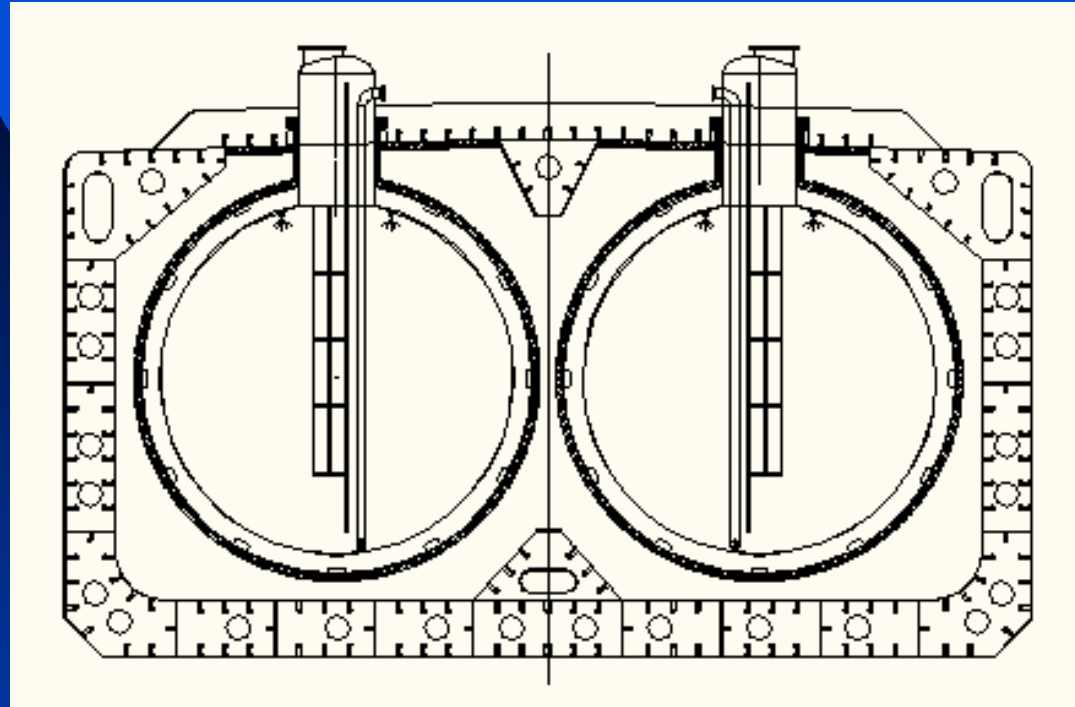
Typical Connection Pin



Barge / Cargo Unit Connection



AT/B LNGC Cargo Unit Structure



Cargo Tanks:
Capacity:
(100% cold)

IMO IGC Type C
4 x 3338 m³

Total Cargo Vol:

13,352 m³

Material:

304 Stainless Steel

MARVS:

60 psig (4.1 bar g)

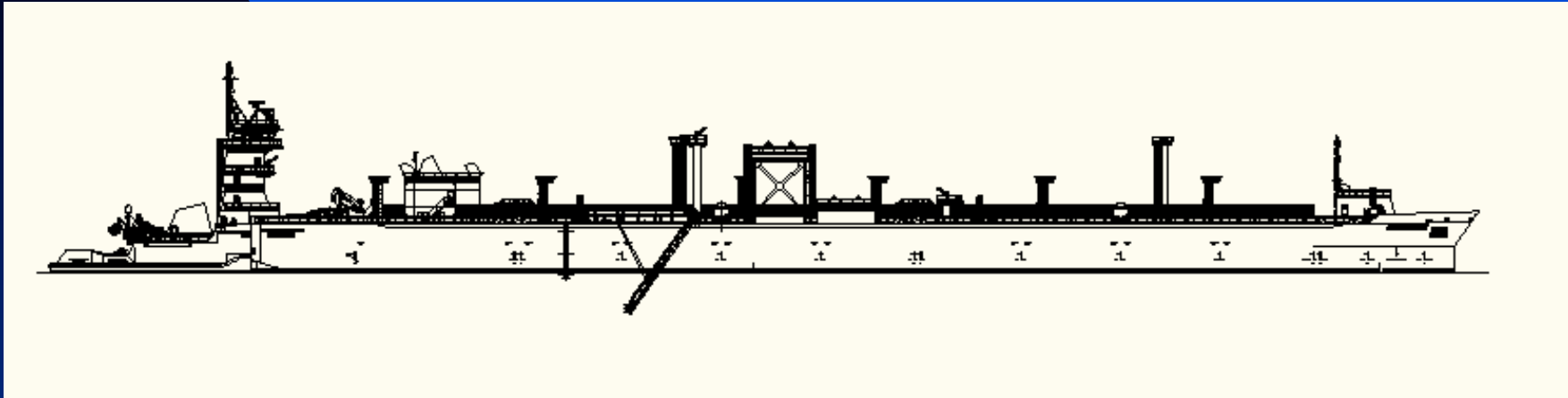
Cargo Sp Gr:

0.5

Min Temp:

-262 °F (-163 °C)

Combined AT/B LNGC



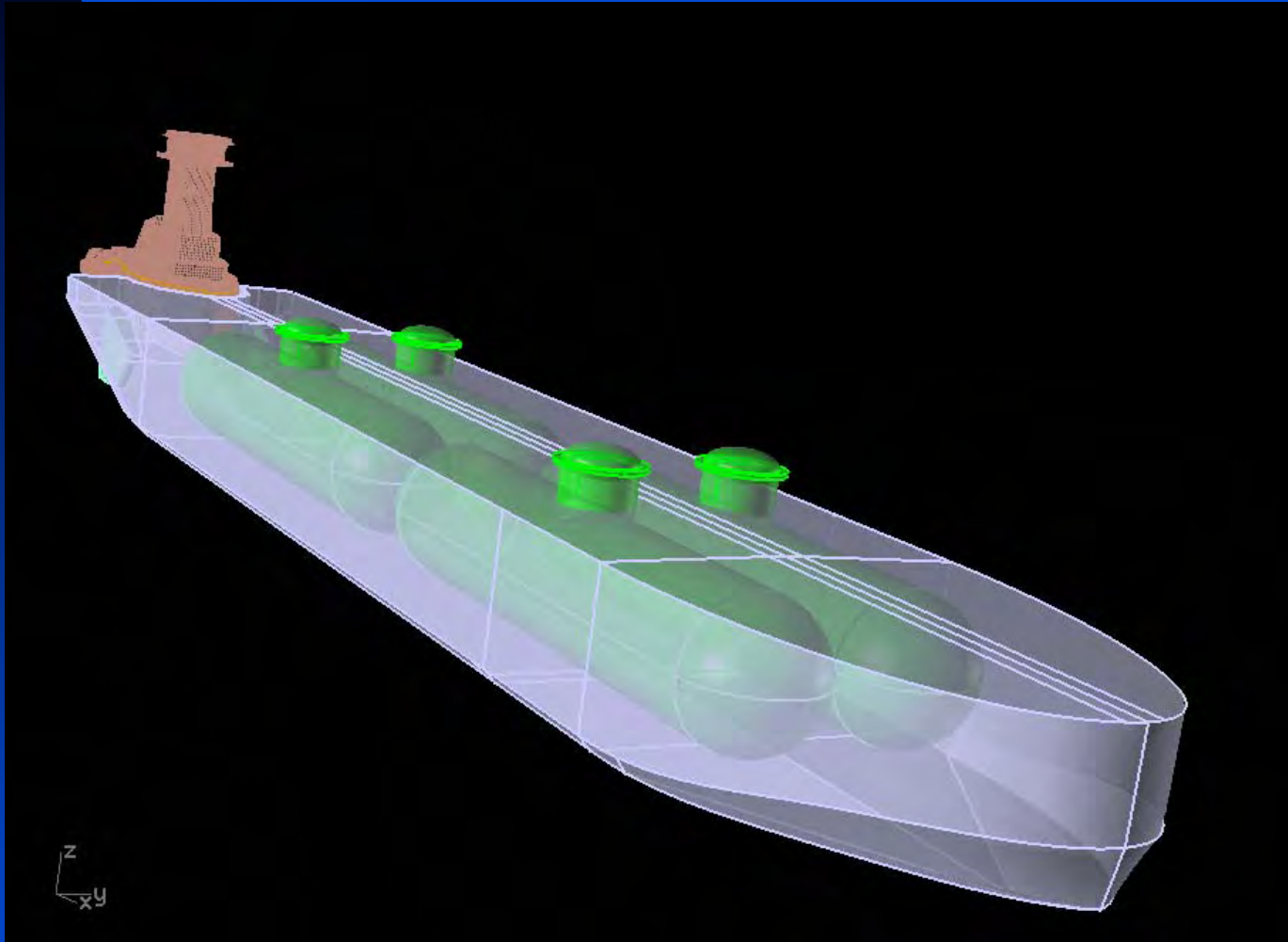
CARGO UNIT:

LOA: 516.4' (157.4 m)
LOA: 506' (154.2 m)
Beam: 78' (23.8 m)
Depth: 40.6' (12.4 m)
Design Draft: 20' (6.1m)

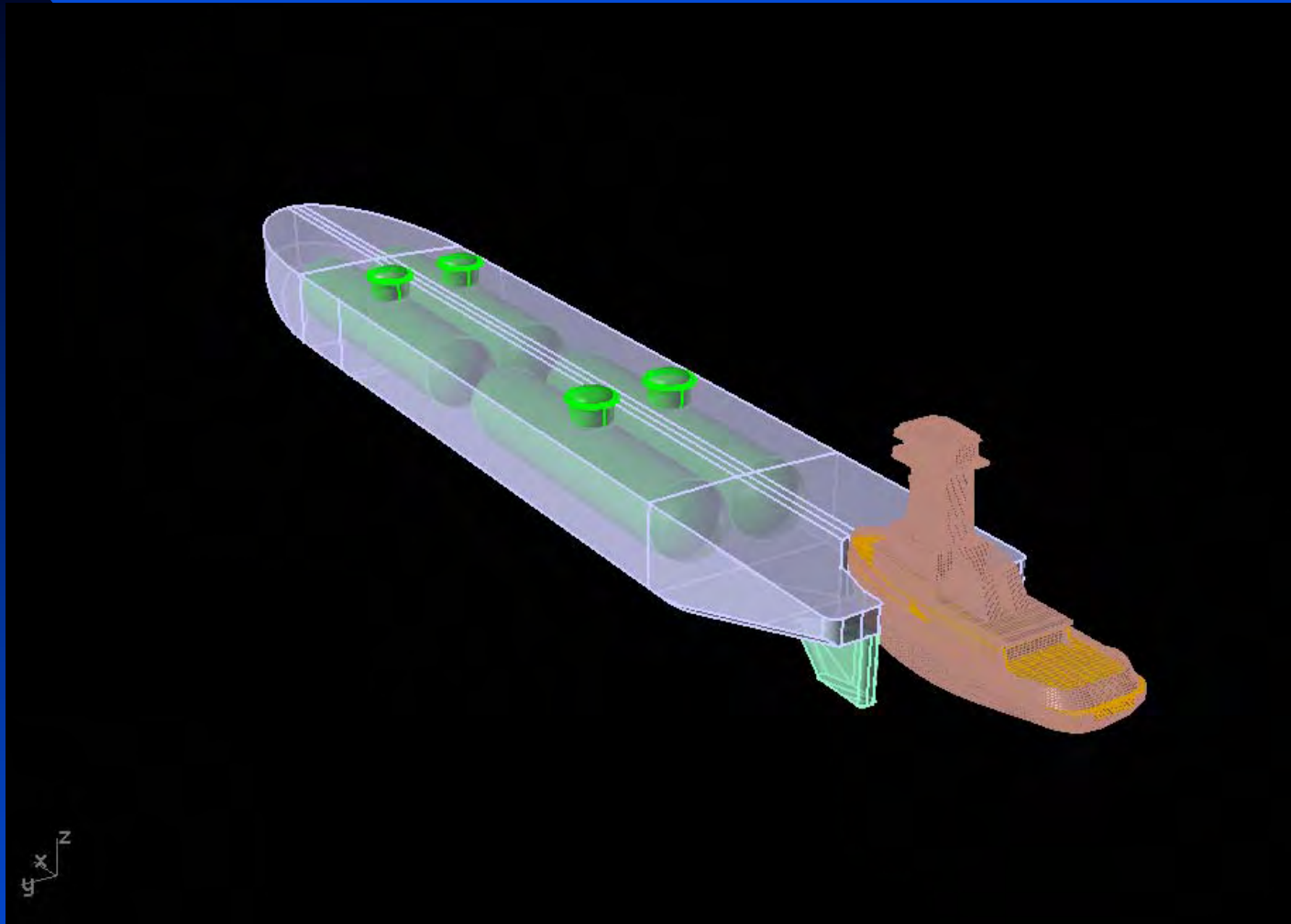
COMBINED VESSEL:

LOA: 591.1' (180.2 m)
Loaded Draft: 20' (6.1 m)
Service Speed: 12 Knots

Vessel Arrangement



Vessel Arrangement



AT/B Product Carrier "Brandywine"



AMM/Maersk AT/B LNGC Design

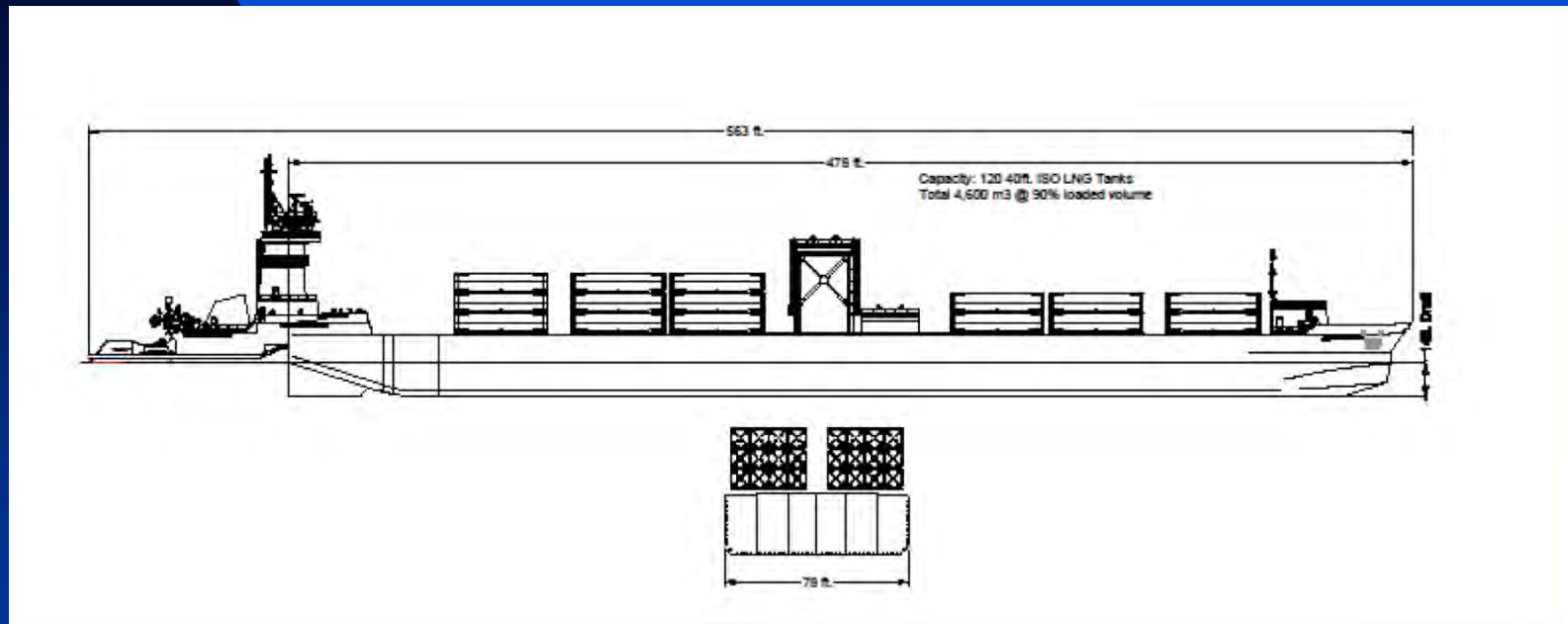
Specialized Features

- Proprietary “Boil-off” Control
- Propulsion – 100% Gas
- Exceptional Maneuverability
 - ◆ Redundant water jet bow thrusters
 - ◆ Twin screw nozzle propellers with shutter rudders
 - ◆ Diesel electric – high reliability / redundancy
- Designed for Winter North Atlantic Conditions

AMM/Maersk Intermodal LNG Vessel

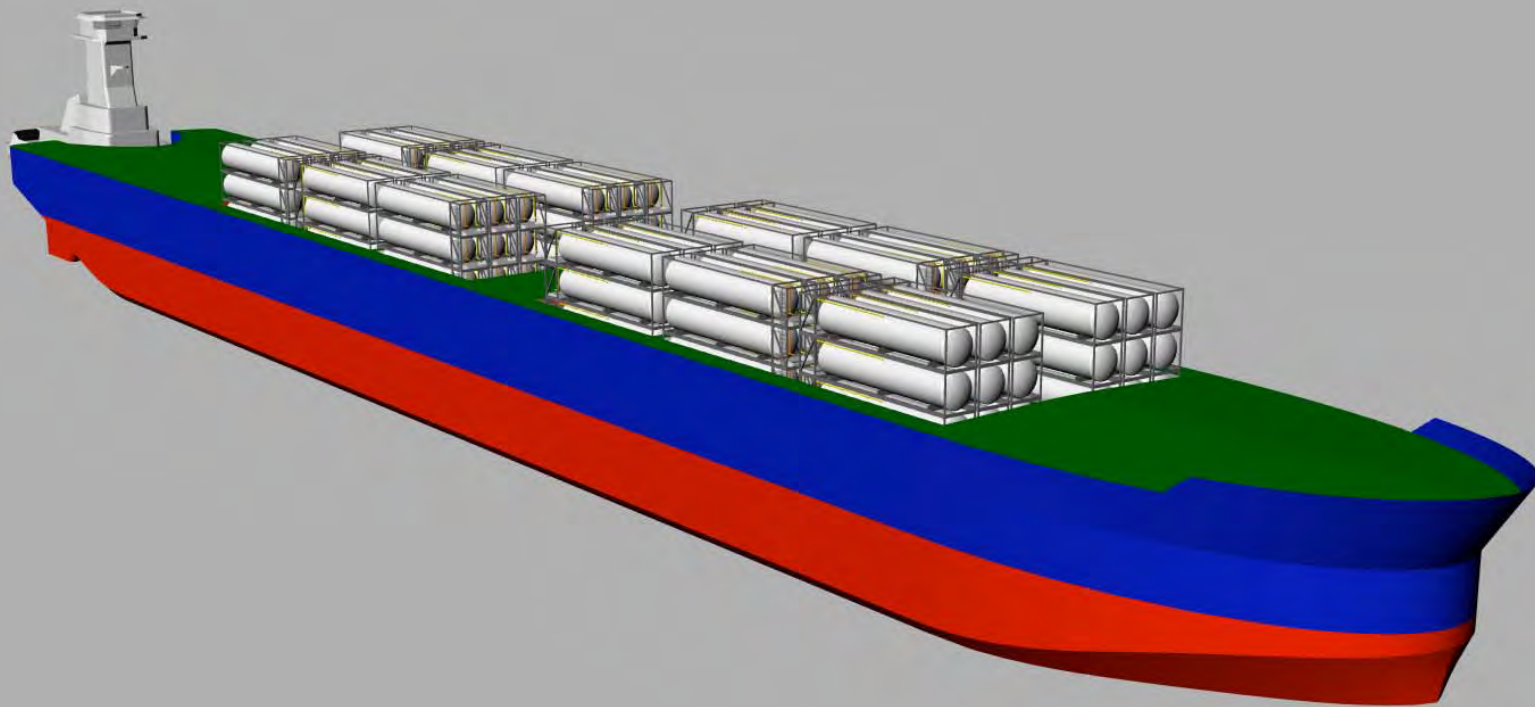
- Proprietary Vessel Design to Carry ISO LNG Containers (Patent Pending)
- Option to Offload Single Container or Bulk LNG
- Designs for Hub & Spoke Distribution and Bunker Vessel
- Utilizes Established Intermodal System
 - ◆ Eliminates Need for Land Based Tanks
 - ◆ Use All Container Port facilities
 - ◆ Enhances Safety, Flexibility, Distribution Economics

AMM/Maersk Intermodal LNG Vessel



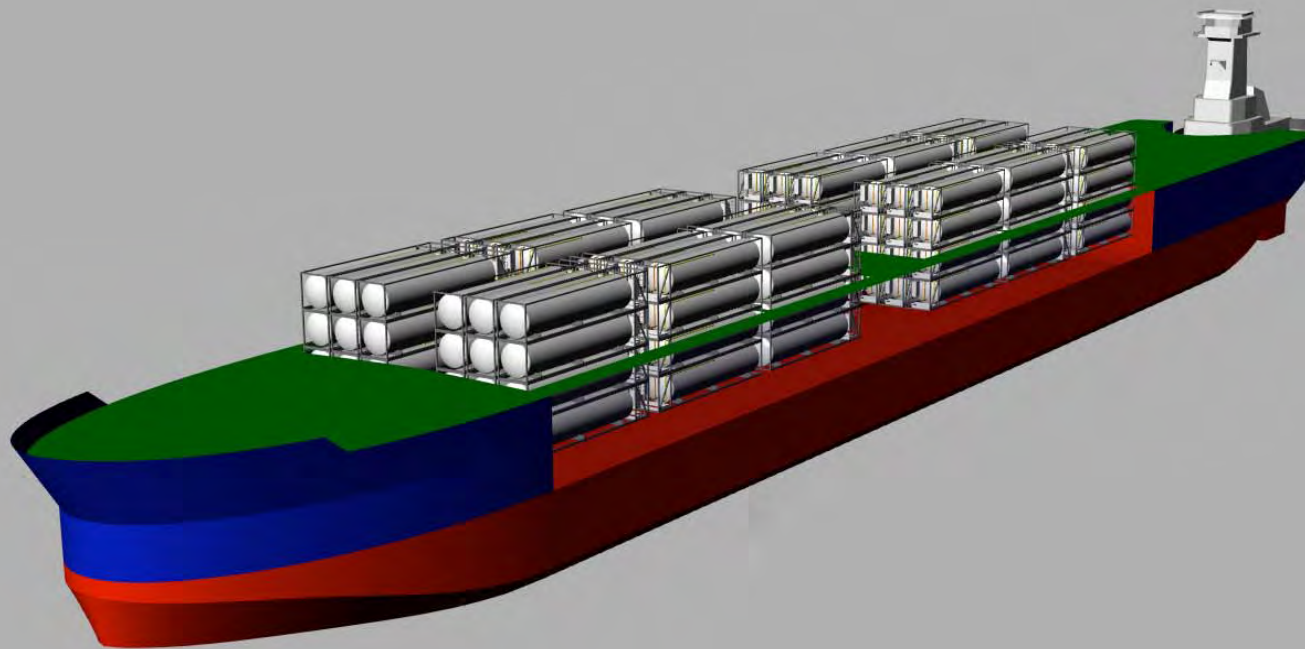
AMM/Maersk Intermodal LNG Vessel

Intermodal LNGC AT/B 3-D Representation



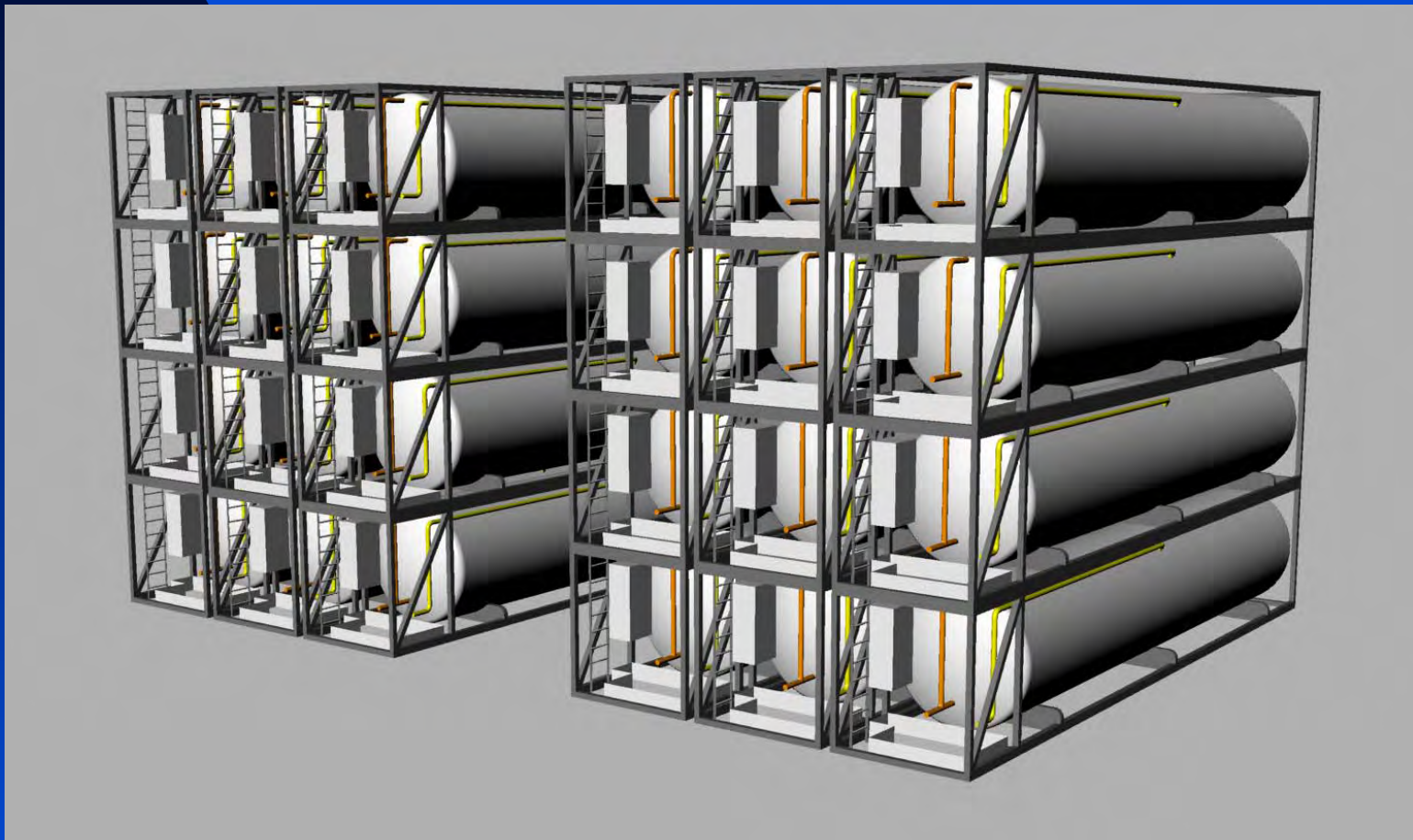
AMM/Maersk Intermodal LNG Vessel

Intermodal LNGC AT/B Cutaway



AMM/Maersk Intermodal LNG Vessel

Tanks Within One Hold Space



AMM/Maersk Intermodal LNG Vessel

- Designs for Ocean Vessel, River/Canal Vessel, Bunker Vessel
- Options for Total Cargo Volumes
- AT/B, LNGC, Harbor Vessel
- Proprietary B/O Control, Loading and Discharge Control
- Commercial Supply for Port Operations, Vessel Power, Vehicle Fuel

AT/B LNGC Outlook

- AT/B LNGC distribution of LNG offers solutions to pipeline/terminal issues
- Primary Distribution System
 - ◆ Mini Base Load to isolated LDCs
- Secondary Distribution
 - ◆ Peak shaving
 - ◆ Virtual peak shaving
 - ◆ Satellite supplement
 - ◆ IPP – power generation
 - ◆ Vehicle Fuel
- Ports
 - ◆ Marine Fuel
 - ◆ Port support equipment / cranes / cargo handling
 - ◆ Trucking
 - ◆ Vessel fuel / alternate to “cold ironing”

LNG Hub and Spoke Delivery System

- Large import terminals and floating terminals/Re-Gas vessels as LNG HUB
- Small LNG AT/B receiving terminals as SPOKES
 - ◆ Existing peak shaving plants
 - ◆ Existing satellite plants
 - ◆ Power generation
- Water borne version of land based truck distribution of LNG currently in use
- Higher transportation efficiency with barges than trucks

"Hub and Spoke" LNG Delivery System

- Waterside peak-shaving / satellite plants / ports
 - ◆ Ability to shut down or reduce operating time of expensive liquefaction plants
 - ◆ Use "end of pipeline" Peak Shaving LNG Plant to feed local gas demand on year round basis relieve demand pressure on pipelines
 - ◆ Increase "Virtual" Peak shaving Plant capacity by ability to refill tank multiple times during peaking season

"Hub and Spoke" LNG Delivery System

- LDC supply
 - ◆ Increase gas supply without need for increase in pipeline capacity
 - ◆ Avoid annual pipeline transportation demand costs for seasonal demands
 - ◆ Significantly greater volumes achievable than portable vaporizer and trucked LNG or propane air
 - ◆ Gas supply to areas without ready access to pipelines

Illustrative Routes



Illustrative Routes



Illustrative Routes



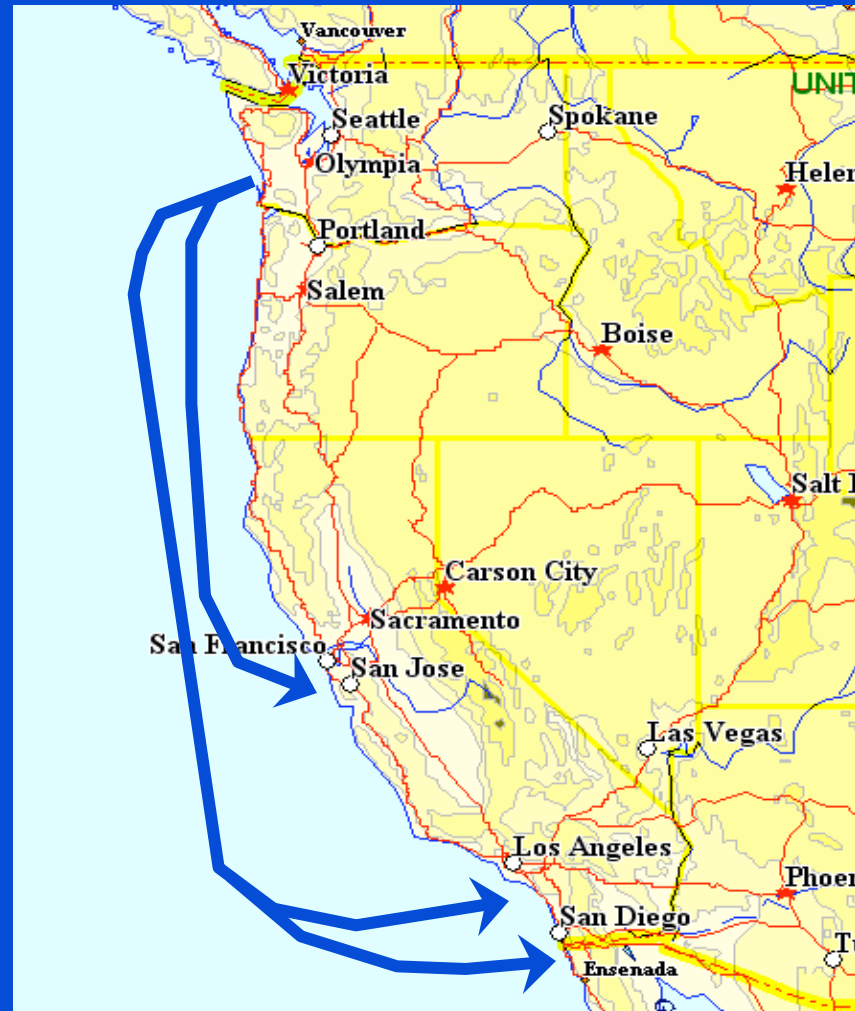
Illustrative Routes



Illustrative Routes



Illustrative Routes



Thank You

Argent Marine Companies
889 Alder Avenue
Suite 300
Incline Village, NV 89451
775-831-2400
www.ArgentMarine.com



Argent Marine Companies

 **MAERSK LINE, LIMITED**