Marine Small Scale LNG Distribution

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VCC NGV Forum
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We provide world-class transportation and maritime services

- Maersk Line, Limited (MLL), an American company, was established in 1983 to support the conversion and operation of five Maritime Prepositioning Ships
- We continue to be a leading operator, maintainer and charterer of ships for the U.S. Navy’s Military Sealift Command
- Leveraging our unparalleled global network, we offer flexible and reliable end-to-end distribution
- Drawing from our experience as a ship owner and operator, we provide innovative technical solutions to reduce total ownership costs and increase operational reliability
- Our significant and sustained investment in the U.S. Merchant Marine and our fleet has made MLL the largest U.S. flag carrier in international trades
The Case for Natural Gas & LNG

• Abundant Supply NG
  – Domestic Shale Gas
    o U.S. – LNG Imports way down
    o Marcellus Shale – Globally in Top 5 Gas Fields
  – Advances in Drilling and Stimulation – Horizontal Dir Drilling & Hydrofracking

• Availability of LNG
  – Regional Liquefaction production - sources possible from pipeline gas
  – LNG Import Terminals

• Environmental Driver
  – Significant Reduction of CO₂, SO₂, NOₓ and Particulates (PM)
  – Marine Environment: International / US East Coast ECA & SOx ECA – Higher Fuel Costs (ultra low sulphur) & Equip Mods (scrubbers)

• Economic Driver – The Price (July Clean Cities Alt Fuel Price Report)
  – Gasoline (regular) $3.68 / Diesel $3.95 / CNG $2.07 per GGE
The Case for Natural Gas and LNG

• **LNG / CNG as Fuel**
  - Reduced emissions
  - Reduced fuel cost
  - Transportation fuel
    - Road Vehicles (heavy duty trucks, buses)
    - Marine Fuel – Growth Need (import auxiliary generators, propulsion)
  - CNG from LNG (cars, fleet vehicles)

• **LNG as Marine Fuel – The Driver**
  - Shipping: Phased in emission requirements set by International Maritime Organization (IMO)
  - IMO North American ECA in force 2015; Sulphur content < 0.10%
  - IMO NA ECA in force 2016: NOx reduction
  - Ship Owner Choices
    - Install stack gas scrubbers
    - Burn fuel < 0.10% sulphur (very expensive / ?? Availability ?? / + additives)
    - **USE LNG**
AT/B Design Concept

AT/B LNG/C :
Bulk and Intermodal
Design Concepts

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
Articulated Tug / Barge (AT/B): Design Concepts

- Serves Customers not near a pipeline and eliminates need for pipeline extension

- **Bulk AT/B Transportation:**
  - < 20,000 m³: Bulk Type C Tanks (approx 1/10th capacity of LNGC)
  - Utilizes Existing LNG Terminals
  - Minimal Shore-side Resources
  - Flexible Delivery Options – “Swap and Drop”
  - Simplifies Distribution Start-Up (to access locations w/o pipelines)

- **Intermodal AT/B Transportation:**
  - < 10,000 m³: ISO LNG Containers (Tanktainers)
  - Utilizes Established & Proven Intermodal Network
  - Enhances Safety, Flexibility & Distribution Economics
  - Simplifies Distribution Start-Up
AT/B Design Concept

Bulk AT/B LNG/C:
Built to: - International Gas Carrier Code (IGC)
- Classification Society Construction Rules
- U.S. Coast Guard
AT/B Design Concepts

Intermodal LNG AT/B
LNG Fuel Intermodal Distribution System

- **Containerized LNG**
  - ISO / US DOT Certified Intermodal LNG Tanks (Tanktainers)
  - Replaces bulk liquid transfers
  - No land-based storage tanks

- **Simplifies Distribution Start-up**

- **LNG Terminal to End User:**
  - Vessel
  - Truck
  - Rail
  - Filling Stations

- **Enables Mid-Large Scale Production vs. Local Production**
  - More Efficient / Less Expensive
Design Concepts – The AT/B Distribution Demo

- http://argentmarine.com/videos.html
LNG Fuel Distribution

- **Similar Distribution Model as Distillate Distribution**
- **Shoreside:**
  - Distribution Systems
    - Independent of Pipeline
      - Supplement to pipeline
      - Alternative to pipeline
    - Road Transportation
  - Applications:
    - From Import Terminal or Liquefaction Terminal to End User
      - Vessel / Fleet Yards / Refueling Stations
      - Port Support Equipment
- **Marine:**
  - Applications:
    - Base Load / LNG Peak Shaving Facilities
  - Hub & Spoke Distribution System
    - Vessel Bunkering – in the future
    - LNG Lightering – in the future
Advantages of AT/B LNG Fuel Distribution

• Affords Maximum Operating Flexibility

• Hub & Spoke Distribution from Any Terminal

• Bulk Barge:
  – “Drop and Swap” Deliveries (two Barges / one tug)
  – AT/B Cargo Units Can Be Re-Located as Needed
  – AT/B Cargo Unit (barge) as storage tank (vice land storage tank)

• Intermodal Barge:
  – Deliveries Sized to Volume / Demand
  – Multiple Deliveries per Voyage with Intermodal
  – Use Existing Port Infrastructure – container terminals
**LNG – Safety Record**

**The Safety Record / Marine Transportation**
- LNG Tankers have been operating for 50 years; 350 ships globally
- LNG used as a marine propulsion fuel since 2001
- 20 ships (ferries) sailing in Norwegian waters
- Gas fuelled engines available from major manufacturers (Wartsila, Rolls-Royce, MAN Diesel)
- Major Classification Societies have issued classification rules for LNG-fuelled ships
- Regulations: IMO IGC Code, IMO Interim Guidelines for Gas-Fuelled vessels

**LNG Facts:**
- In over 50 yrs of commercial transport, no major accidents have occurred
- No collision, fires, explosions or hull failures resulting in a loss of LNG containment in 50 yrs
- LNG is not stored under pressure, and when vaporized it is not explosive in an uncontained environment
- FERC Chair has stated, “The Sandia report provides a scientifically supported validation of the view that the risks of LNG are low and manageable.” (2004)
Conclusions

- **LNG / CNG Positives:**
  - LNG / CNG is a solution to compliance with stricter environmental emissions requirements (Vehicles and Marine Fuel)
  - LNG’s marine transportation safety record is excellent
  - LNG marine transportation technology is proven over 50 years experience

- **AT/B Design Concept Positives:**
  - Small Scale / Small Quantities / Lower Risk and Consequence
  - Small Footprint / Limited Visibility
  - Uses Existing Facilities
  - Development of Small Scale LNG distribution network promotes use of LNG / CNG for marine and vehicle use as fuel
  - Port of Virginia is excellent location / positioned to be regional hub

- **Challenges:**
  - Challenges exist in implementing an efficient, scalable, affordable distribution infrastructure
  - Challenges exist in developing / aggregating regional demand
  - Challenges exist in public perception of LNG
Thank You

Larry Bowling
Maersk Line, Limited
lbowling@mllnet.com
757-531-7799 (office)
757-377-9013 (mobile)