LNG

THE FUTURE IS TODAY

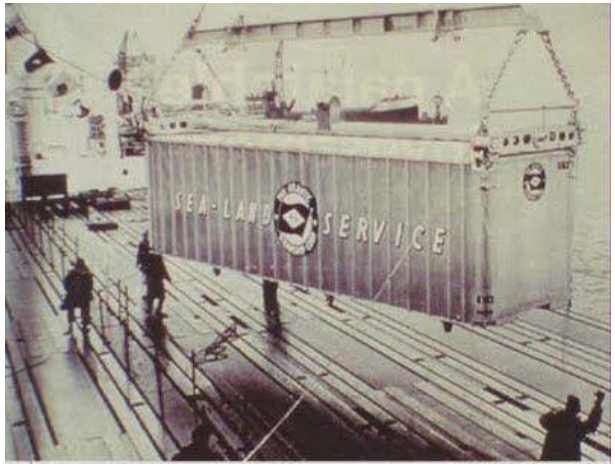
ROYAL INSTITUTION OF NAVAL ARCHITECTS

PETER KELLER

NOVEMBER 19, 2015

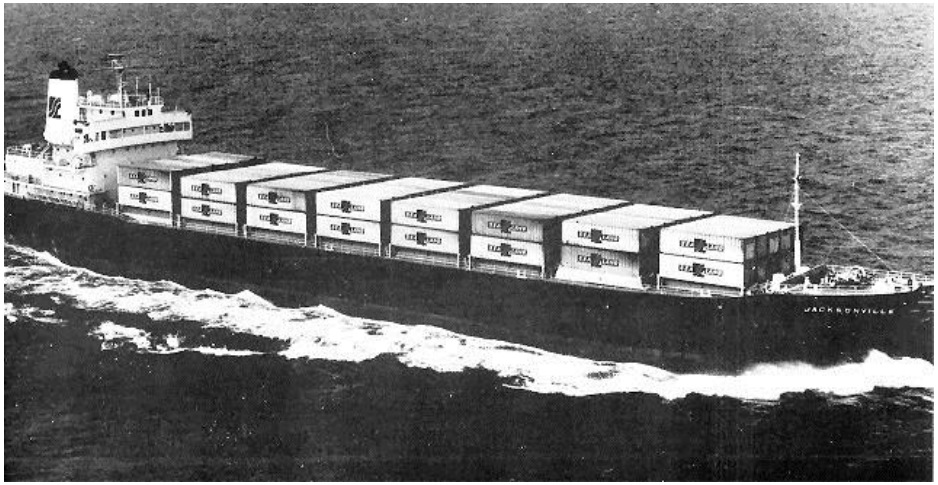
Evolution of Maritime in the Container World

In the Beginning *Will this really work?*

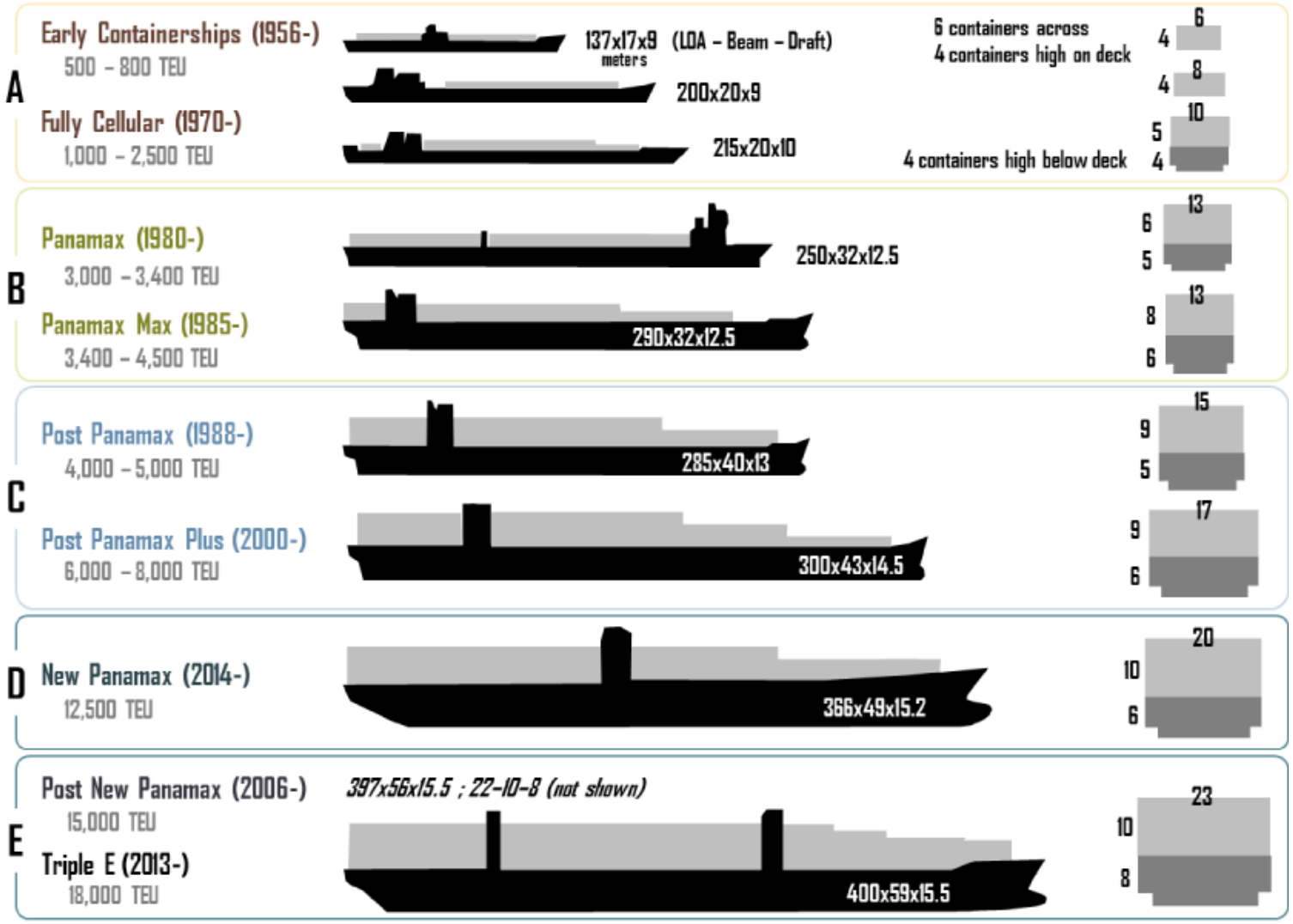


The first container ship, the Ideal X, was a combination tanker with a deck for 62 "sea chests" above. Her first voyage was April 26, 1956.

It Works *Faster and Bigger*



The World Standard *Growth*



Mine is Bigger than Yours *Fuel Efficiency*

Environmental Consciousness

The New World Reality

Building the best, by land, air and sea.

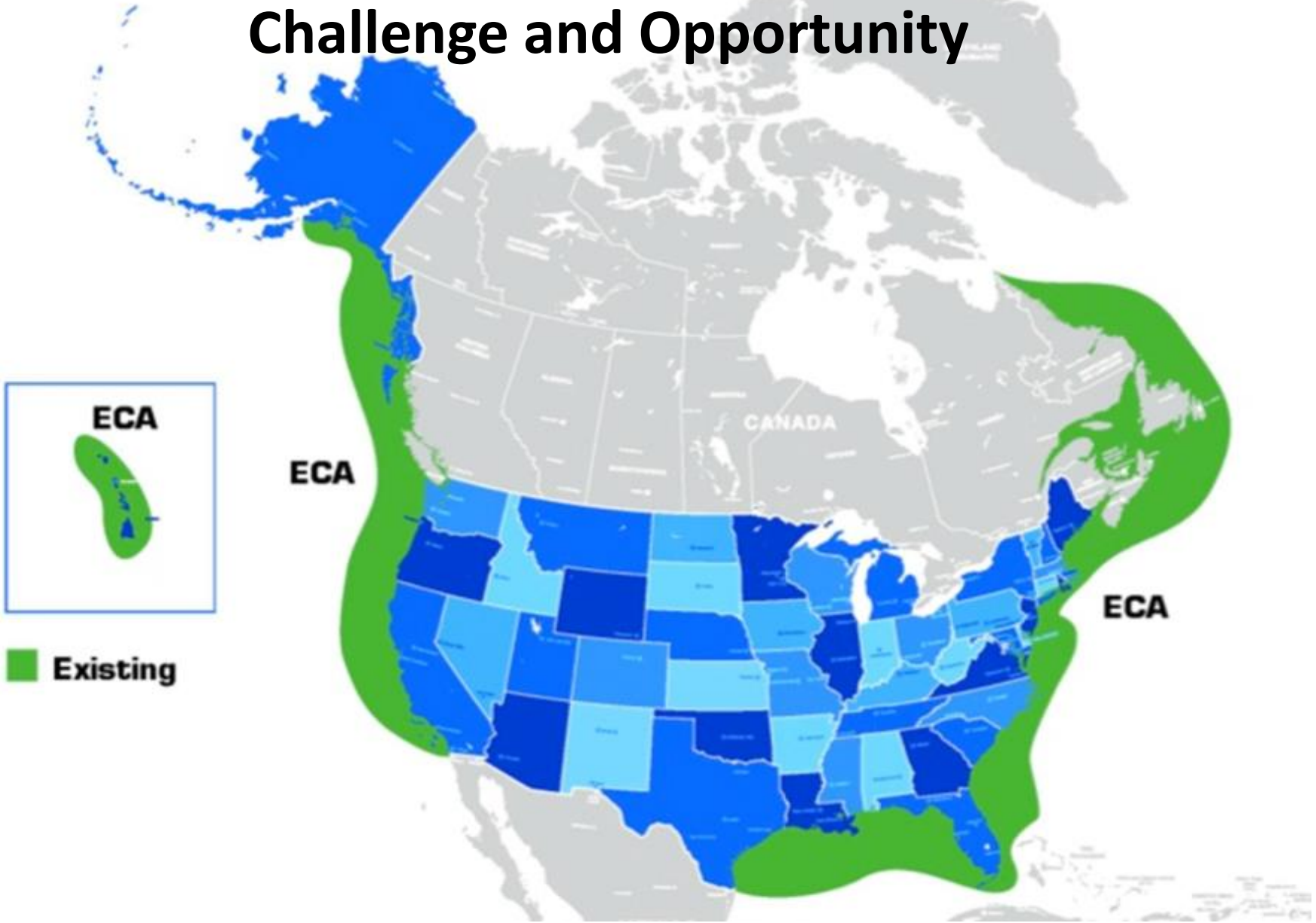
SALTCHUK

Our values: safety, reliability and commitment | Family owned and managed | $2.8 billion in annual revenues | More than 7,500 employees | Investment Grade credit rating | 90% of earnings reinvested

MARINE RESOURCES — FOSS	Largest coastal and harbor service company in the United States	Revenues $435M	Over 150 tugs and barges	2 Shipyards	International towing operations	Hawaii inter-island common carrier
TRUCKING — INTERSTATE	National full truckload operation	Revenues $300M	1,500 Tractors	5,600 Trailers	18 Terminals	
PETROLEUM DISTRIBUTION — NORTHSTAR PETROLEUM	Independent petroleum marketer and distributor in Alaska & Hawaii	Revenues $800M	Over 20 million gallons of fuel storage capacity			
AIR CARGO — NORTHERN AVIATION SERVICES	Largest all-cargo air carrier in Alaska & Hawaii	Revenues $165M	100-150 weekly scheduled flights	Ad-hoc 737 charter service in N.America		
DOMESTIC SHIPPING & LOGISTICS — TOTE	Leading domestic logistics & marine transportation provider	Revenues $700M	4 Vessels; 4 Sailings per week	Heavy Haul Trucking	170,000 square feet of warehouse	325 Tractors
INTERNATIONAL SHIPPING & LOGISTICS — Tropical SHIPPING	Cargo transportation to the Bahamas & The Caribbean	Revenues $500M	14 vessels	Ports from Canada to South Florida	Cargo insurance, consolidation and logistics	Fixed day sailings, fastest transit times

updated 8.15.14

North American Emission Control Area (ECA) Challenge and Opportunity



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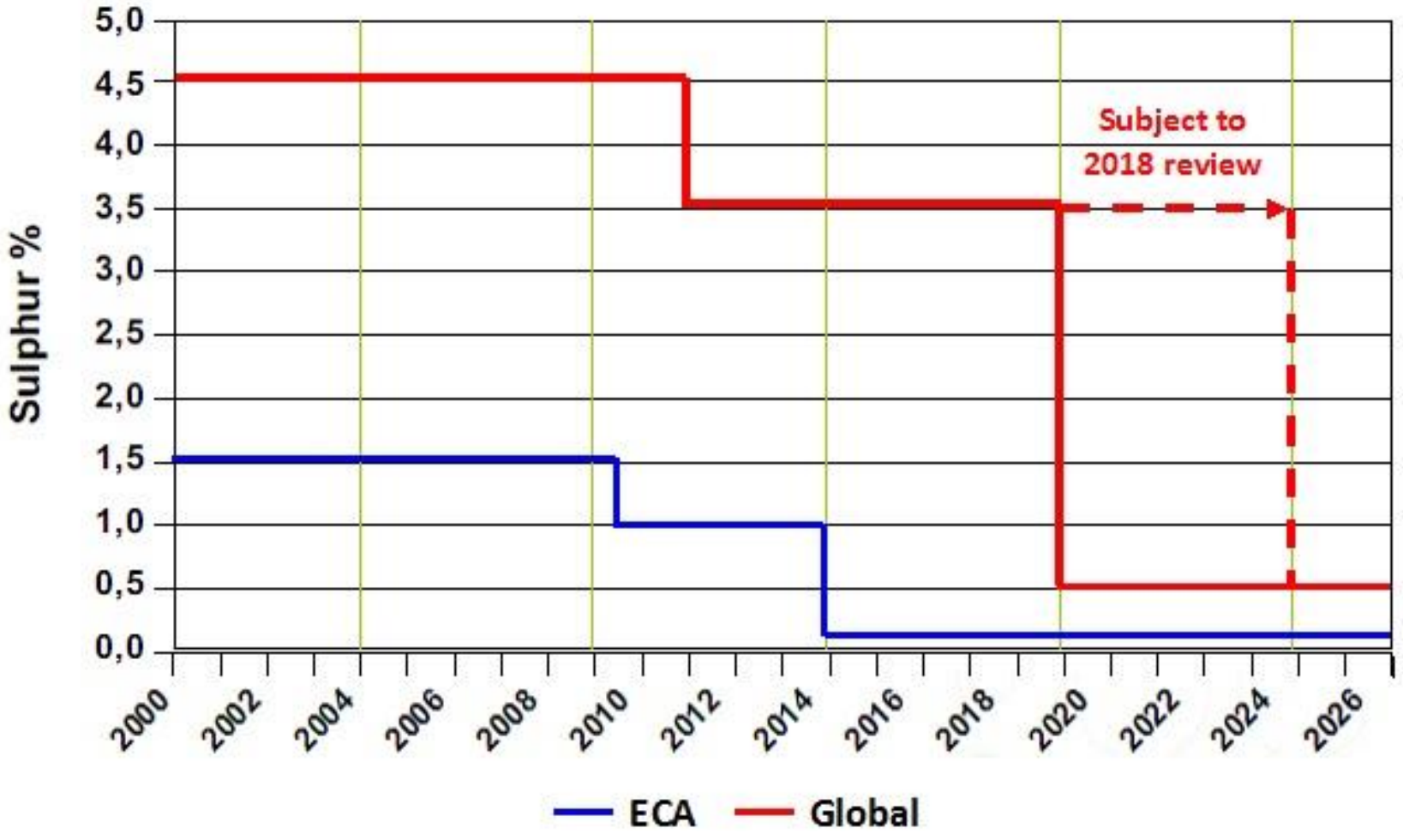


Possible Solutions

- **Do nothing:** Cost of 1% compliant IFO 380 is significantly higher with further increases expected in 2015 and beyond
- **Install exhaust gas cleaning system:** Scrubbers use existing fuel with added costs
- **Convert to Natural Gas:** Meet all current and future emissions requirements, cleanest of all options

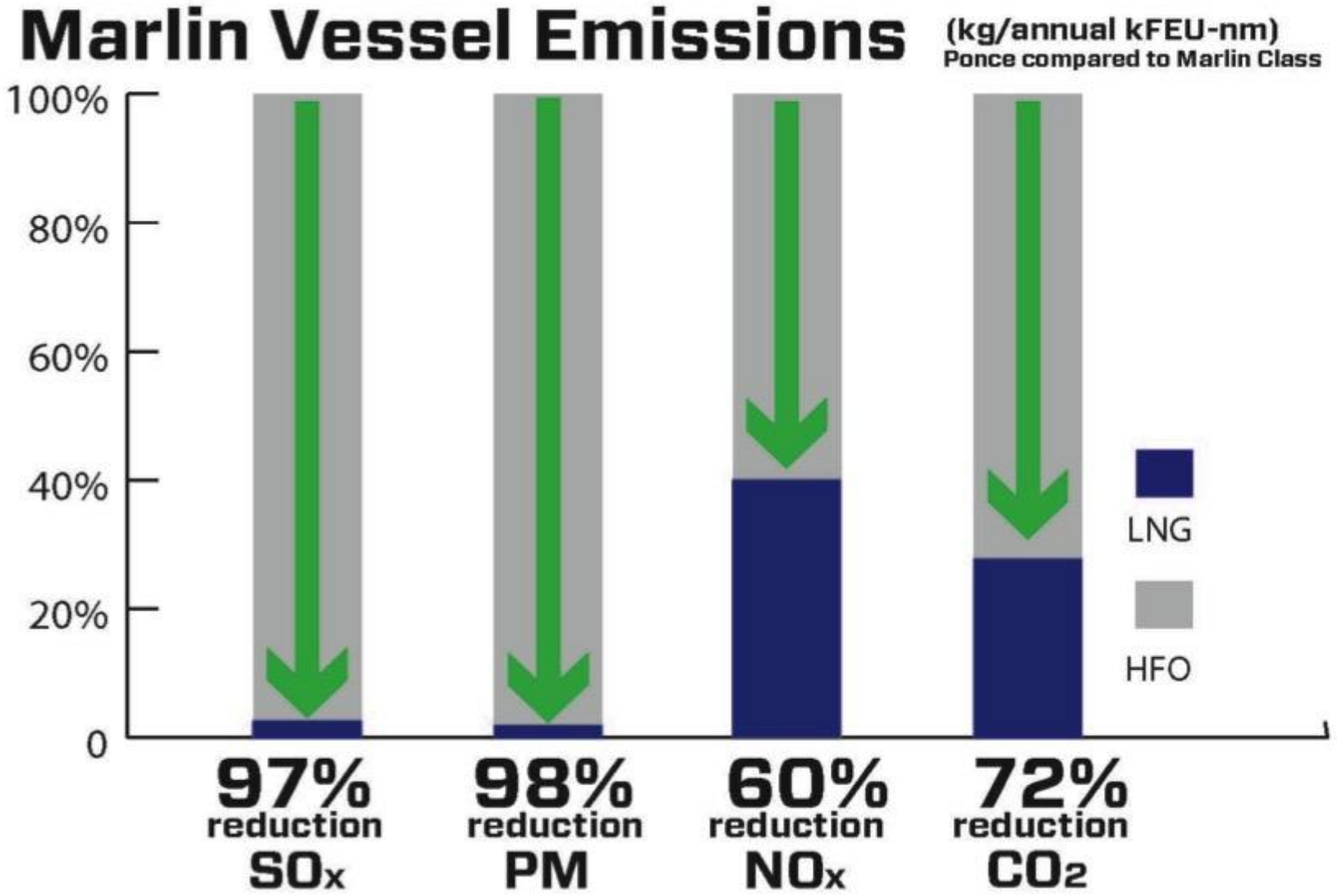
Address the CORE Issue

LNG – A Clean & Safe Fuel

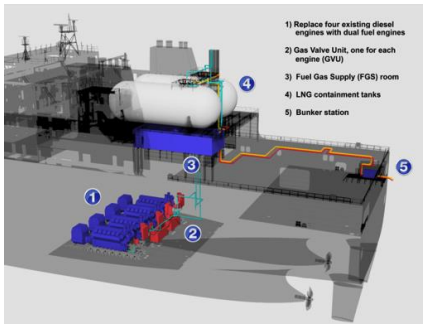
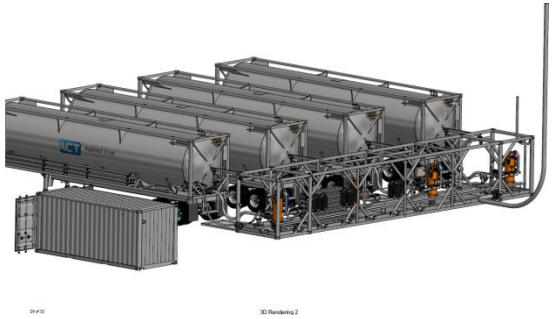
- Conversion to natural gas will reduce ship emissions well below even the world's most stringent air quality standards that are outlined in the North American Emissions Control Areas
- LNG will virtually eliminate Particulate Matter (PM) and dramatically reduce Sulfur Dioxide (SOx), Nitrous Oxide (NOx) and Carbon Dioxide (CO2).

No other viable fuel source provides the same levels of environmental safety

Emissions Comparison: *Ponce* versus *Marlin*



TOTE's LNG Projects

LNG Barge: Jacksonville	Marlin Class Ships: Jacksonville	Orca Class Ships: Tacoma
		
		

The TOTE LNG Program

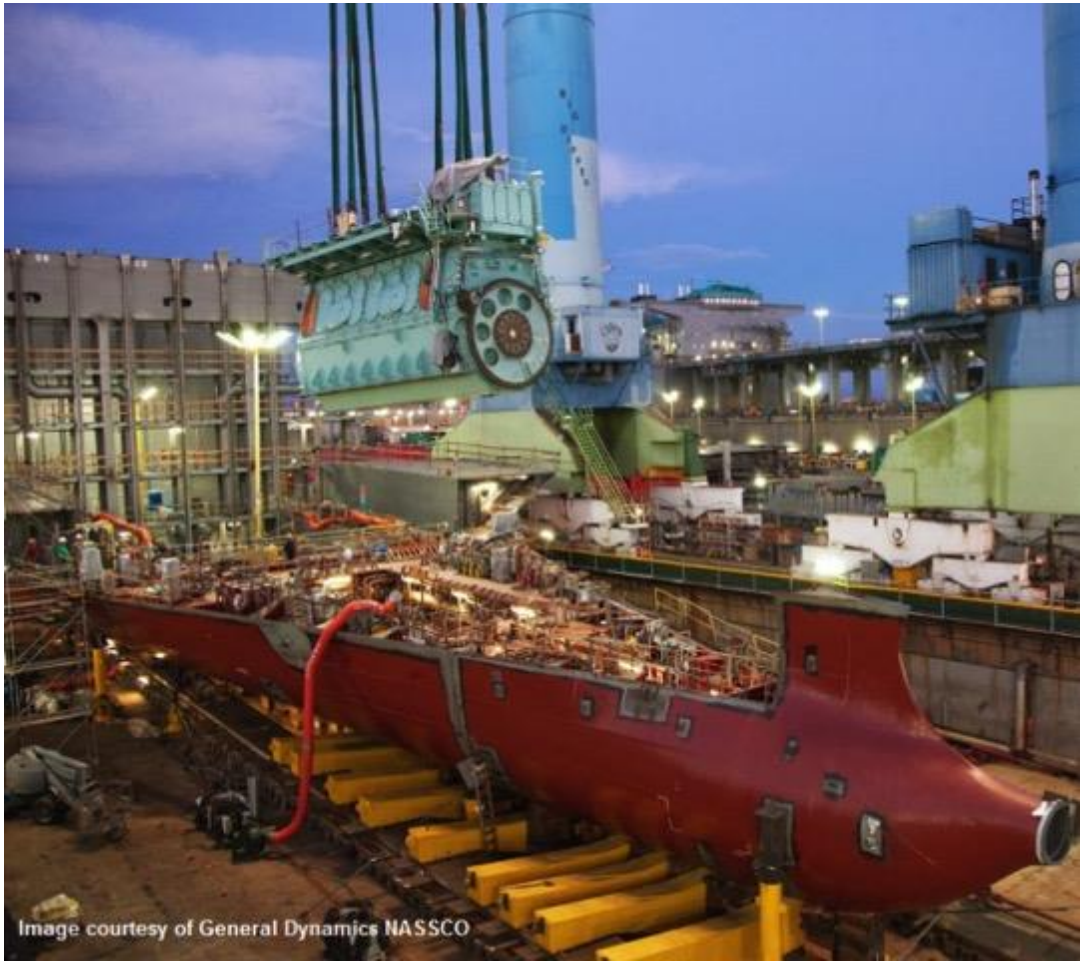
Encompassing every aspect of Maritime LNG

- New Builds – Marlin Class
- Re-engine – Orca Class
- Long Term LNG fuel procurement
- Development of Liquefaction plants with our partners
- LNG transfer to vessels
  - Multiple and mobile truck transfer to vessel
  - Barge to vessel transfer
  - Plant to vessel via cryogenic pipeline

Marlin Class

- Isla Bella (Hull 495) delivered Oct 16 and entered service Nov 6, 2015
- Perla del Caribe (Hull 496) launched on Aug 29 and scheduled to enter service early late February 2016

Marlin Class



- Slow speed MAN ME-GI engine fueled by LNG. (Engine No 1&2)
- Dual fuel capable
- Two 900 cubic meter LNG tanks
- Main and Auxiliary Engines manufactured by Doosan

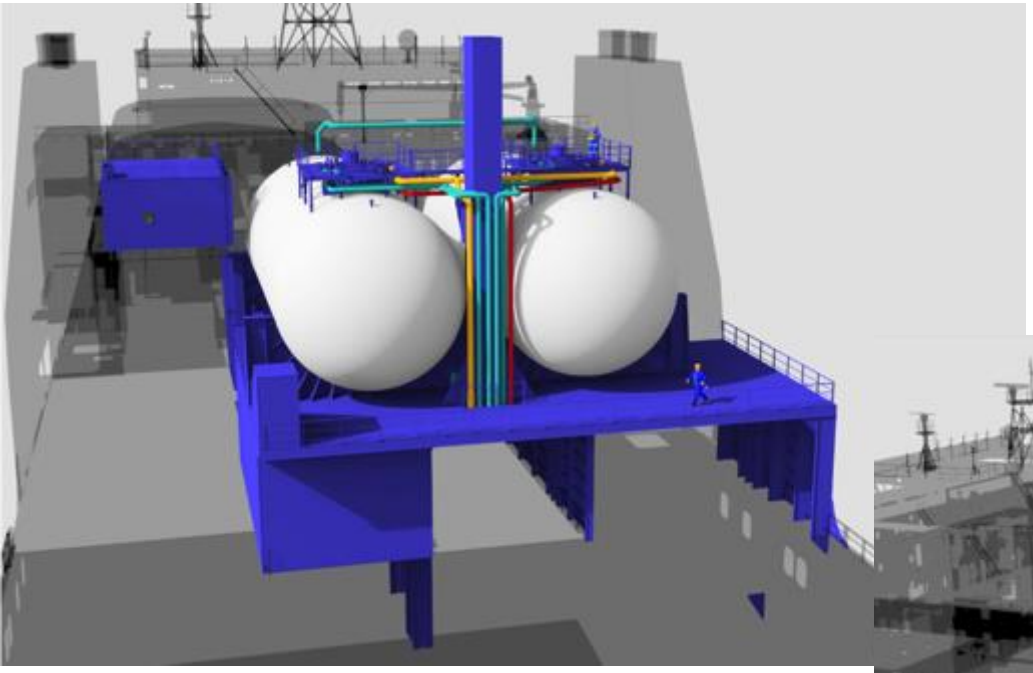
Marlin's Outfitting at NASSCO

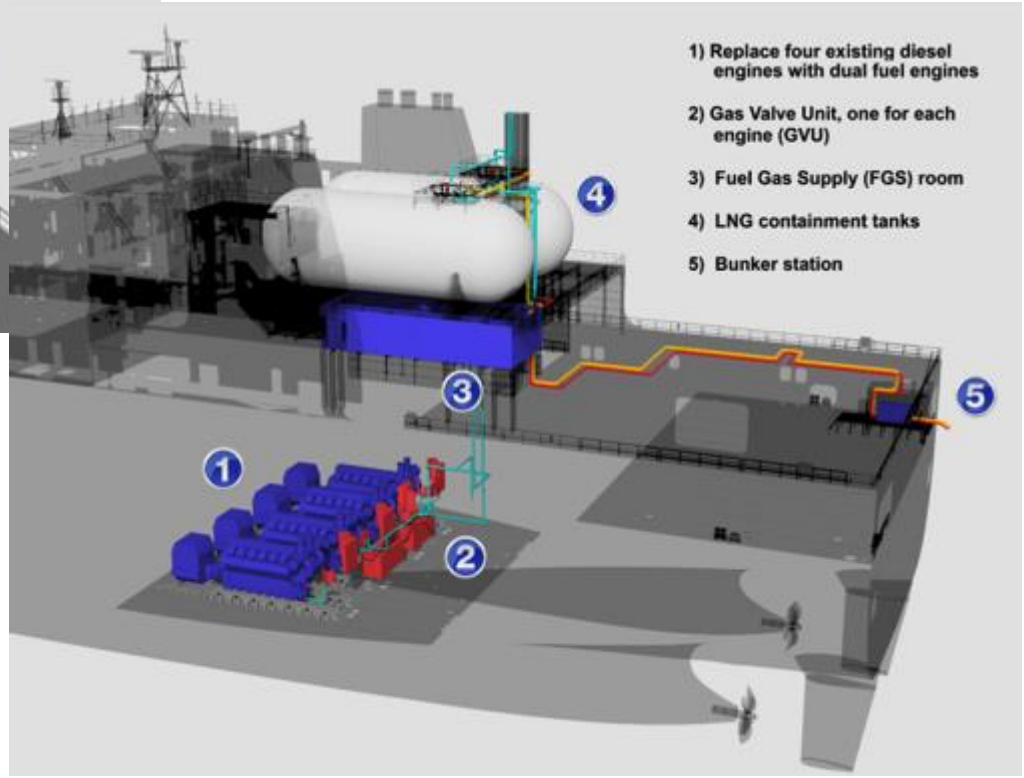
First sailing to San Juan

Orca Re-Engine

- Built for Alaska Trade
- Dual fuel capable Wartsila engines.
- Bunker in Tacoma
- Minimal out of service time during re-engining

Orca Class




1) Replace four existing diesel engines with dual fuel engines
2) Gas Valve Unit, one for each engine (GVU)
3) Fuel Gas Supply (FGS) room
4) LNG containment tanks
5) Bunker station
1
2
3
4
5

Orca Class Conversion

- Design work performed by NASSCO, vessels original builder
- Keppel Tuas in Singapore selected for conversion
  - Highly regarded and competent yard with a strong safety culture
  - Out of service time minimized
  - Quality and planning were key considerations
- Design complexities are unique
  - Wartsila engines, GE generators and controls
  - Performance criteria of the Orca Class vessels
- First Orca will be converted late 2016/early 2017 with the second vessel work performed late 2017/early 2018

LNG Supply to the Vessels

The Critical Issue

- No ready supply of fuel in any of the Ports served.
- Liquefaction plant development time exceeds vessel construction or conversion time – **An important planning element**
- Significant investment required in both Jacksonville, Florida and Tacoma, Washington
- Standard setting for future Maritime applications
- Provides fuel source for growth in Maritime and other modes such as truck, rail.

LNG Fuel Supply

Four Distinct Phases

- Jacksonville Short Term (Oct 2015)
  - Truck to vessel transfer
- Jacksonville Long Term (late 2016)
  - Plant to barge to vessel
- Tacoma Short Term (2nd Qtr. 2017)
  - Truck to vessel
- Tacoma Long Term (Late 2019)
  - Cryogenic pipeline to vessel

Jacksonville LNG Supply

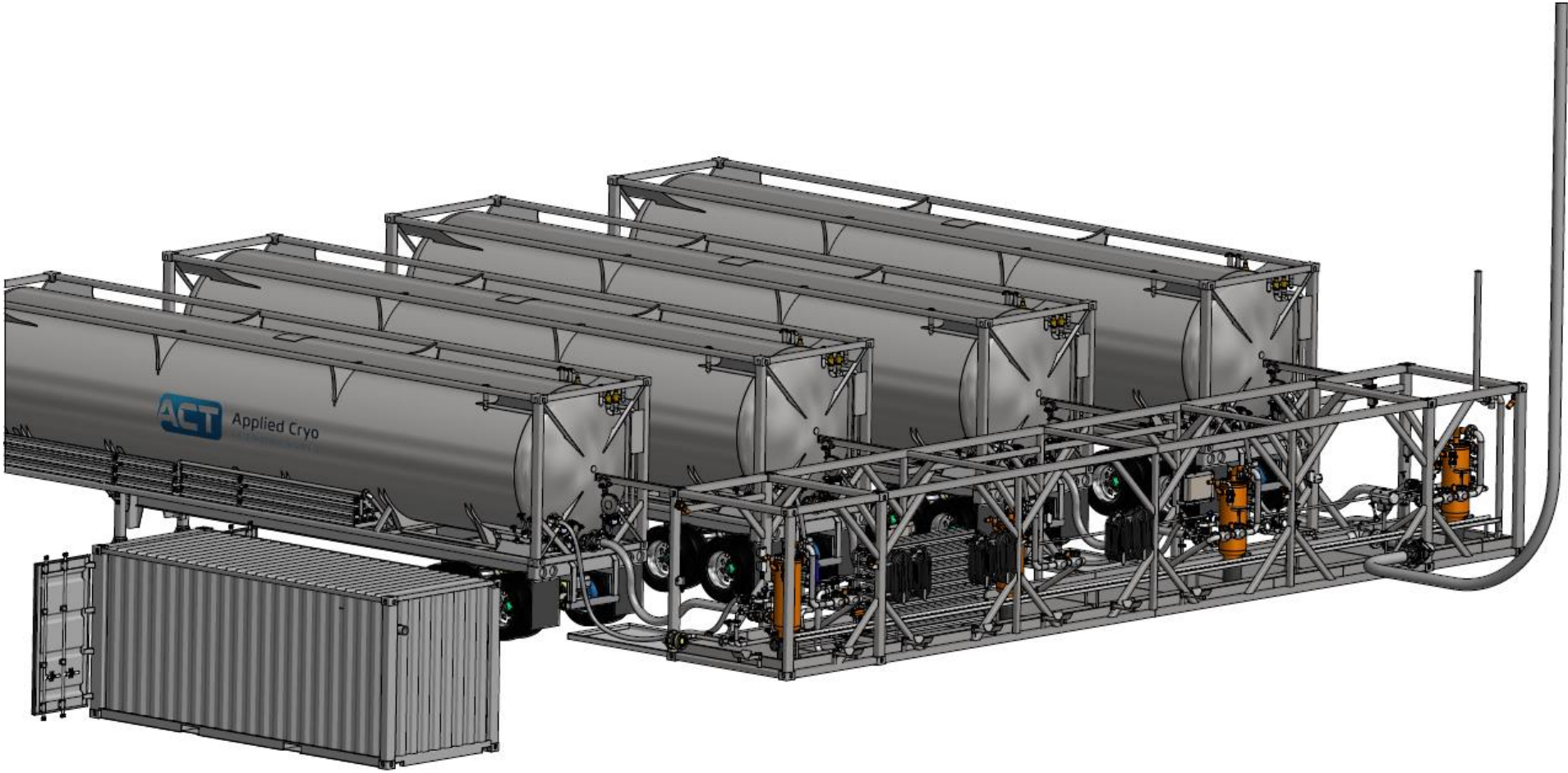
Collaborative activity among

our primary partners

Jacksonville

- Applied Cryo Technologies (ACT) has built special purpose ISO tanks and proprietary transfer pump skid
- Design and operations team comprised of ACT, Pivotal, Wespac, Clean Marine Energy, CH-IV, Moffat and Nichol, and TOTE
- Short Term configuration
  - 25 ISO tanks, 115 psi
  - Custom skid in 53 foot container frame for mobility
  - Transfer 200,000 LNG gallons in 6-8 hours while vessel works cargo

Jacksonville – Short term



3D Rendering 2

Test of Skid Process

JAX LNG Jacksonville Project

- LNG liquefaction plant and marine berth situated on 37 acre industrial water front property on the St. Johns River
- New build bunker barge
- Serve TOTE Maritime Puerto Rico and other marine customers situated in the Jacksonville area
- Actively targeting other markets, including power, trucking and rail
- Anticipated in-service date of end Q4 2016. On schedule

World's First Bunker Barge Using Membrane Technology

- Atmospheric tank versus pressurized C-Tanks provide improved space utilization
- Conrad Shipyard, Orange TX using GTT technology selected after exhaustive review of four other designs.
- ABS review of hull structure complete under 10-82. USCG MSC reviewing final LNG plans
- Keel Laid September 9, 2015
- Enters service in JAX late 2016 when plant commissioned

- GTT Mark III Flex Membrane
- GTT designed unloading arm
- 2 submerged cryogenic pumps
- Radar tank gauging
- High and high-high level alarms
- Pressure and temperature sensors
- Emergency Shutdown System (ESD) – manual and remote
- Boiloff gas reliquifiers – 6 cryocoolers

Tacoma LNG Supply

SHORT TERM -

- PSE will supply gas that Fortis BC will liquefy in the Vancouver area
- Truck to Tacoma and use similar loading methodology as Jacksonville

LONG TERM – Cryogenic pipeline from plant in Tacoma

Regulatory Issues

- All parties continue to gain experience, understanding, and a body of past precedent to improve the design review process going forward
- IGF code will be replacing the interim guidelines with an impact on projects on the drawing board now
- Early communication and an open dialog remain most important

Simple, straightforward approaches with regulators critical

Design for the unexpected

- LNG for the marine market continues to evolve
- TOTE has reassessed plans many times in light of new and unexpected developments
  - Changing partners
  - Simplifying concepts
- An extra Boil Off Gas (BOG) consumer, bunker station, or other redundancy might not be needed in the expected case, but prove invaluable when issues arise

Lessons Learned

- Environmental issues and doing what is right is important and sells!!
- Vessel technology is not THE major issue but LNG integration requires significant attention
- Having set deployments is a major advantage to LNG logistics but will change over time as LNG plants are developed and commissioned
- Long term commitments are essential. Must be **ALL IN!!**
- Partners are the key to success
  - Regulators are an integral part of the process
  - Need to have passion, expertise and look ahead
  - Leading edge does NOT have to be bleeding edge


SEA STAR
SEA STAR
TOTE Maritime