

# Jetty-Less™ LNG to Power Solutions

Minimizing CAPEX | High Availability | Safe LNG Transfer | Relocatable



US Patent Pending

Presented by:



7 Seas LNG & Power AS

In cooperation with:

**wood.**

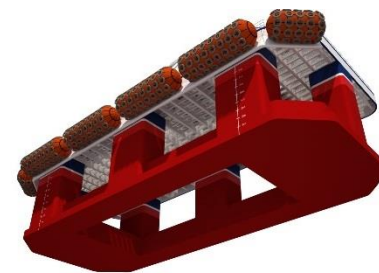


**ScanaOffshore**

Presentation at:

**FLNG  
Global**

Amsterdam | May 15<sup>th</sup> 2018

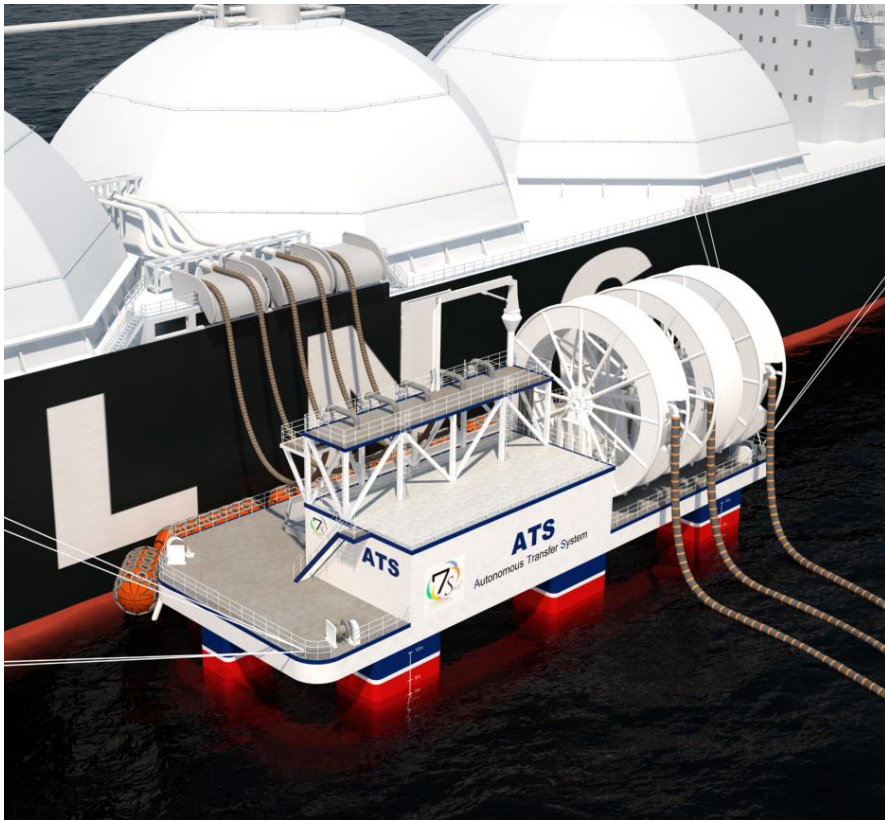




# The LNG Technology Provider

## ATS™

Autonomous Transfer System



## SRP™

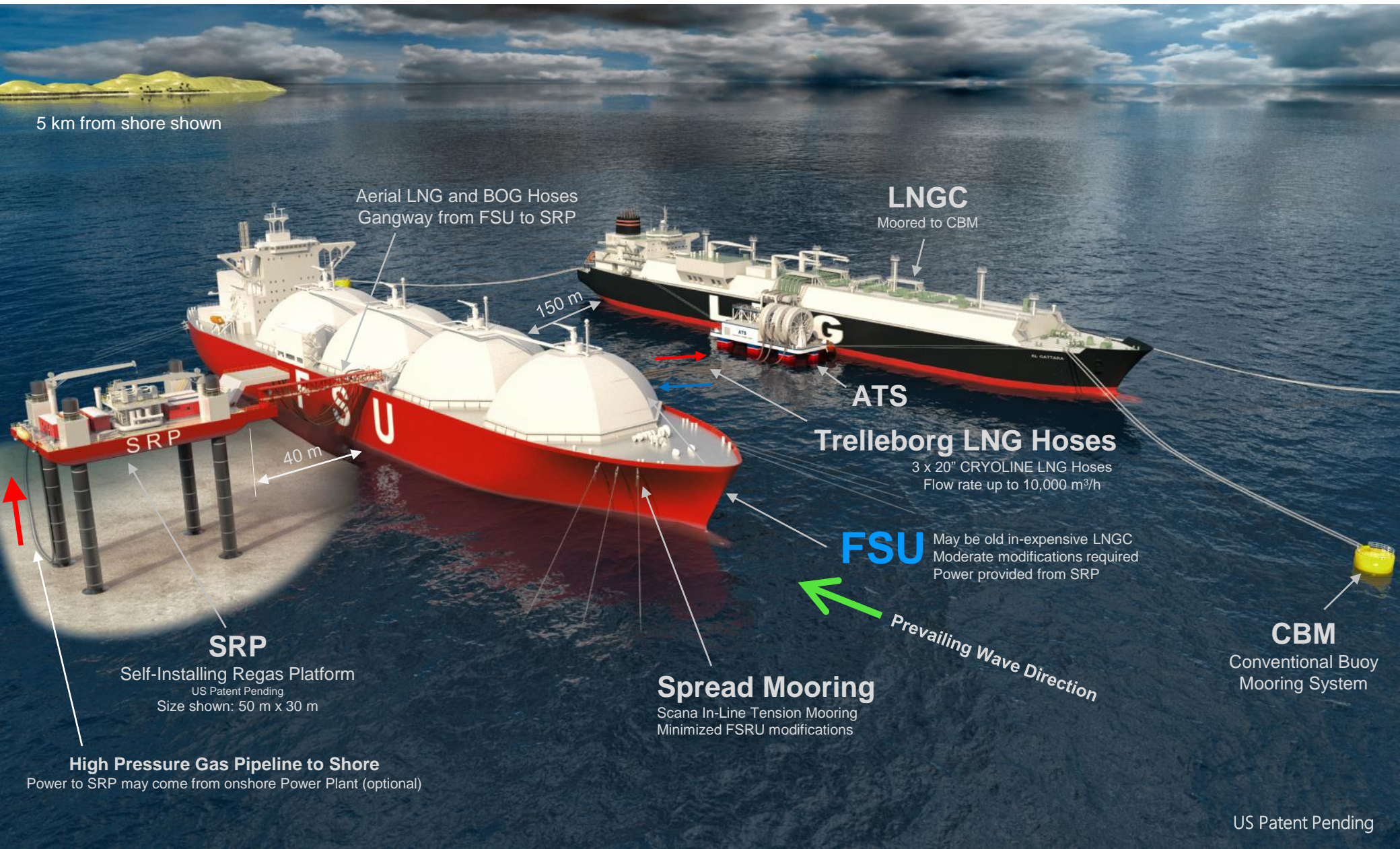
Self-Installing Regas Platform



***...Enabling Multiple Cost Effective Jetty-Less™ LNG Terminal Solutions...***



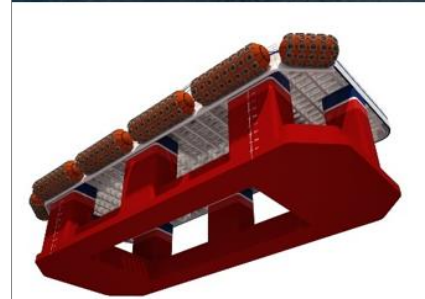
# LNG Terminal Overview | ATS + SRP (Regas Platform)



# Company Structure

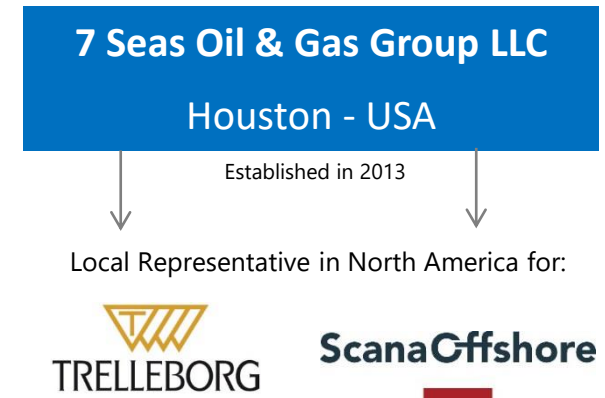
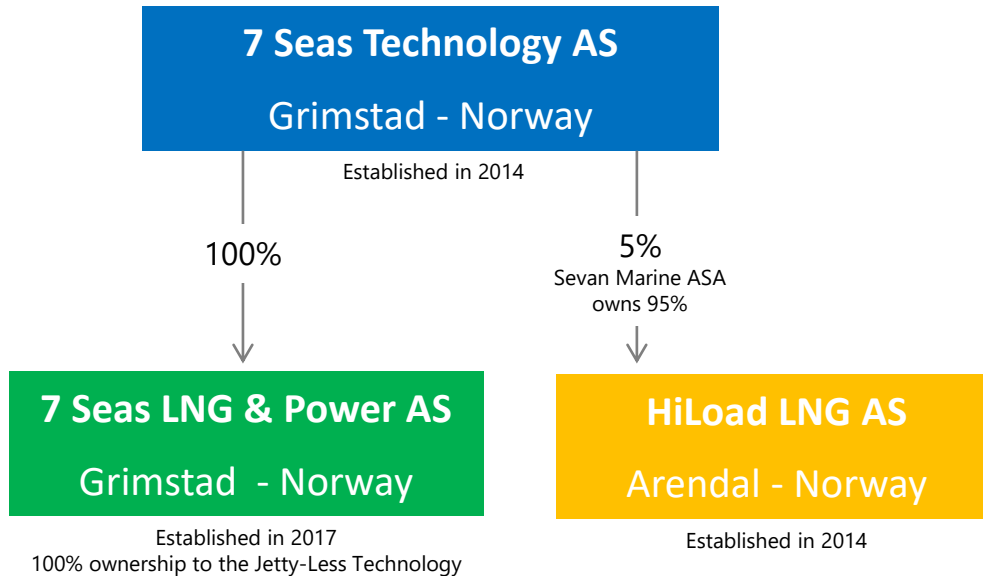
## Project Model

## Partners





# Company Structure | 7 Seas



7 Seas Office - Grimstad - Norway



**Technology License**

+

**Class Approved  
Design Package**

+

**Engineering Support**

Engineering Partner:

**wood.**

55,000 employee

**EPCI  
Providers**

**Detail Engineering**

+

**Construction**

+

**Installation**



**Turn Key Delivery**

**End  
Clients**

**LNG Terminal  
Developers**

**Power Plant  
Developers**

**Oil & Gas Companies**

**LNG Suppliers**



## **Engineering**

Oslo - Houston

55,000 employee



## **Operation**

Arendal - Houston - Manila

11,000 employee



## **Key Equipment**

Oslo (Norway)



## **Floating LNG Hose**

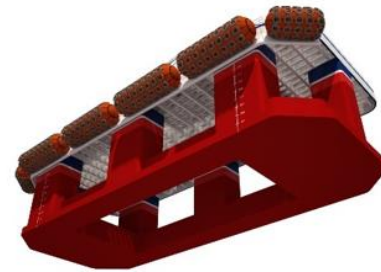
Clermont Ferrand (France)

15,000 employee

# Technical Data

## SRP

Self-Installing Regas Platform

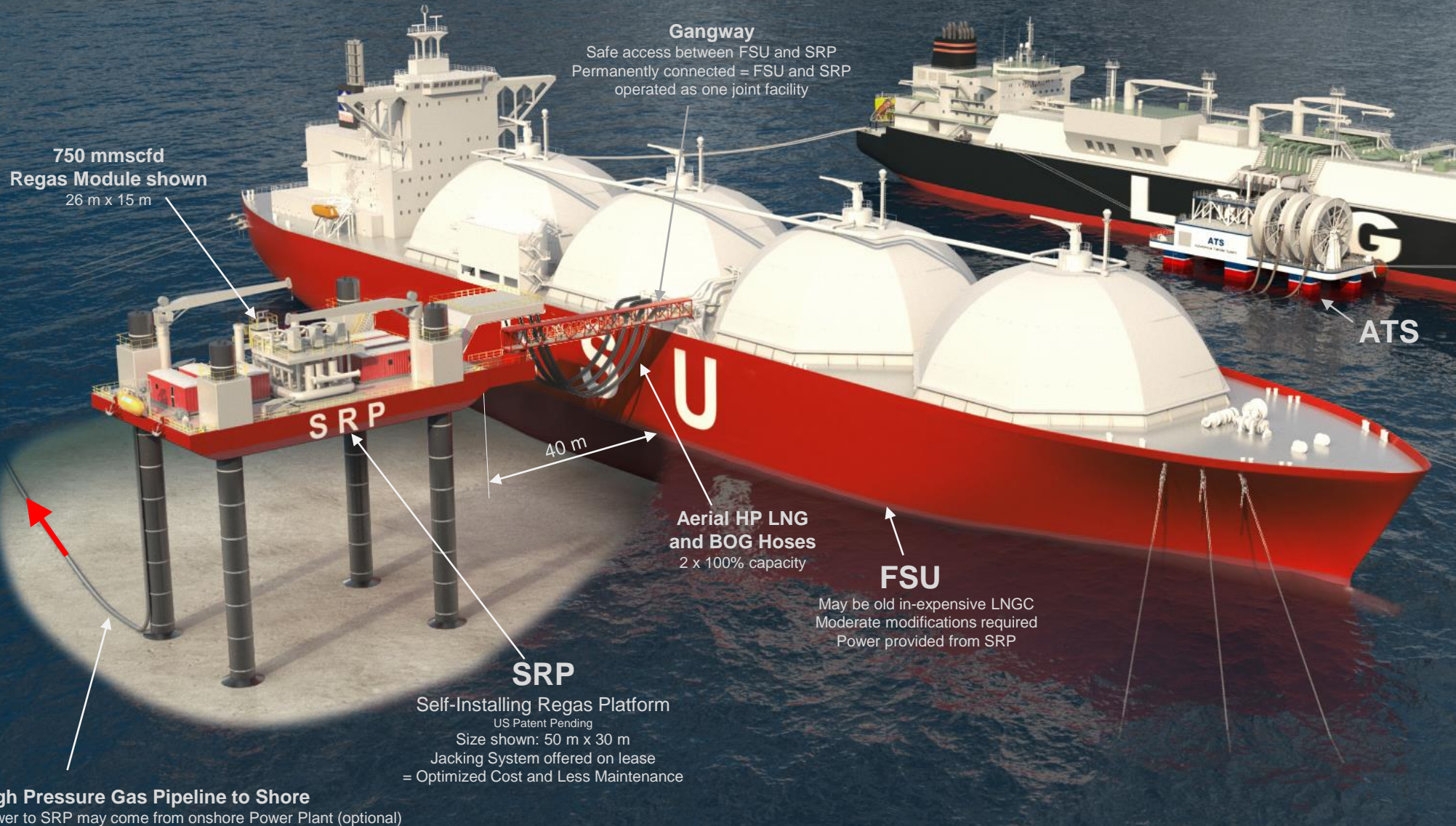




# Self-Installing Regas Platform (SRP)



US Patent Pending





# Why Self-Installing Regas Platform (SRP)?



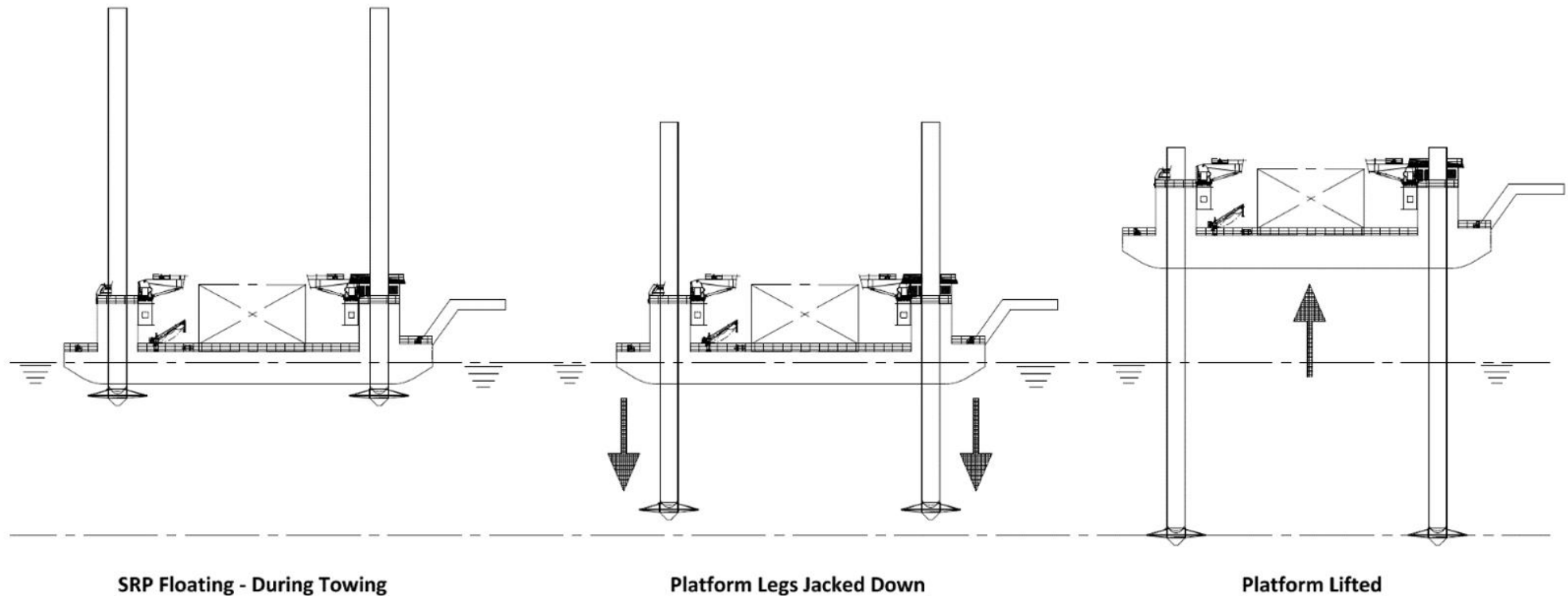
- Regas System separated from LNG Storage - Old inexpensive FSU can be used
- SRP constructed at cost effective yard - All systems new - No FSRU conversion risk
- Moderate FSU modifications required = Long FSRU conversion period avoided
- SRP not exposed to waves - Enable installation in harsh conditions (typ up to Hs 5.0 m)
- HP Flexible Gas Risers not exposed to waves = Enable installation in shallow water
- Low installation cost - Relocatable
- SRP may be combined with a Self-Installing Power Platform = Power + Gas to shore



# Self-Installing Regas Platform | Installation



- Towed from Construction Yard (or by use of submersible barge if long distance)
- Installed without use of expensive Installation Vessels
- Generic Jacking System offered on lease - Save cost - Less maintenance
- SRP is relocatable



SRP Floating - During Towing

Platform Legs Jacked Down

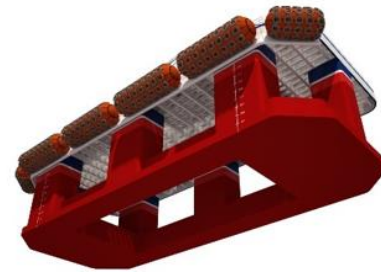
Platform Lifted



# Technical Data

## ATS

Autonomous Transfer System



# ATS | Autonomous Transfer System

US Patent Pending



*...the Jetty-Less LNG Terminal Solution...*



Conventional Buoy Mooring (CBM) system

ATS – Autonomous Transfer System  
All required systems and equipment on one unit

Quick disconnection of LNG hoses and mooring.  
ATS departing ship instead of ship departing terminal.

Trelleborg CRYOLINE LNG Hoses  
2 hoses for LNG and 1 for vapour return  
Flow rate up to 10,000 m<sup>3</sup>/h

Simple ATS interface  
3 x 20" flanges to FSU

FSU or  
Onshore

- **Fully Autonomous**  
All systems/equipment at one generic unit – Fully Autonomous – Simple LNG storage interface
- **Low Cost**  
No Mooring Jetty - No Breakwater, Short hook-up time = Substantial cost savings
- **High Uptime**  
High operational uptime - Less exposed to waves/swell – Tsunami and Earthquake resistant
- **Flexibility**  
Generic design - Same ATS at any terminal - Relocatable
- **Environment**  
Small environmental footprint - No large mooring structure - No breakwater - Less dredging
- **Safety**  
Quick disconnection capabilities - Not manned during LNG transfer



# Basis of Design - Generic ATS Units

NOTE: Customized ATS Units also available upon request



## Large Scale LNG - ATS 10 000

- LNG Transfer Rate: 10 000 m<sup>3</sup>/h
- LNGC size: 125 000 - 266 000 m<sup>3</sup>
- LNG Hose size: 2 x 20" + Vapour Return



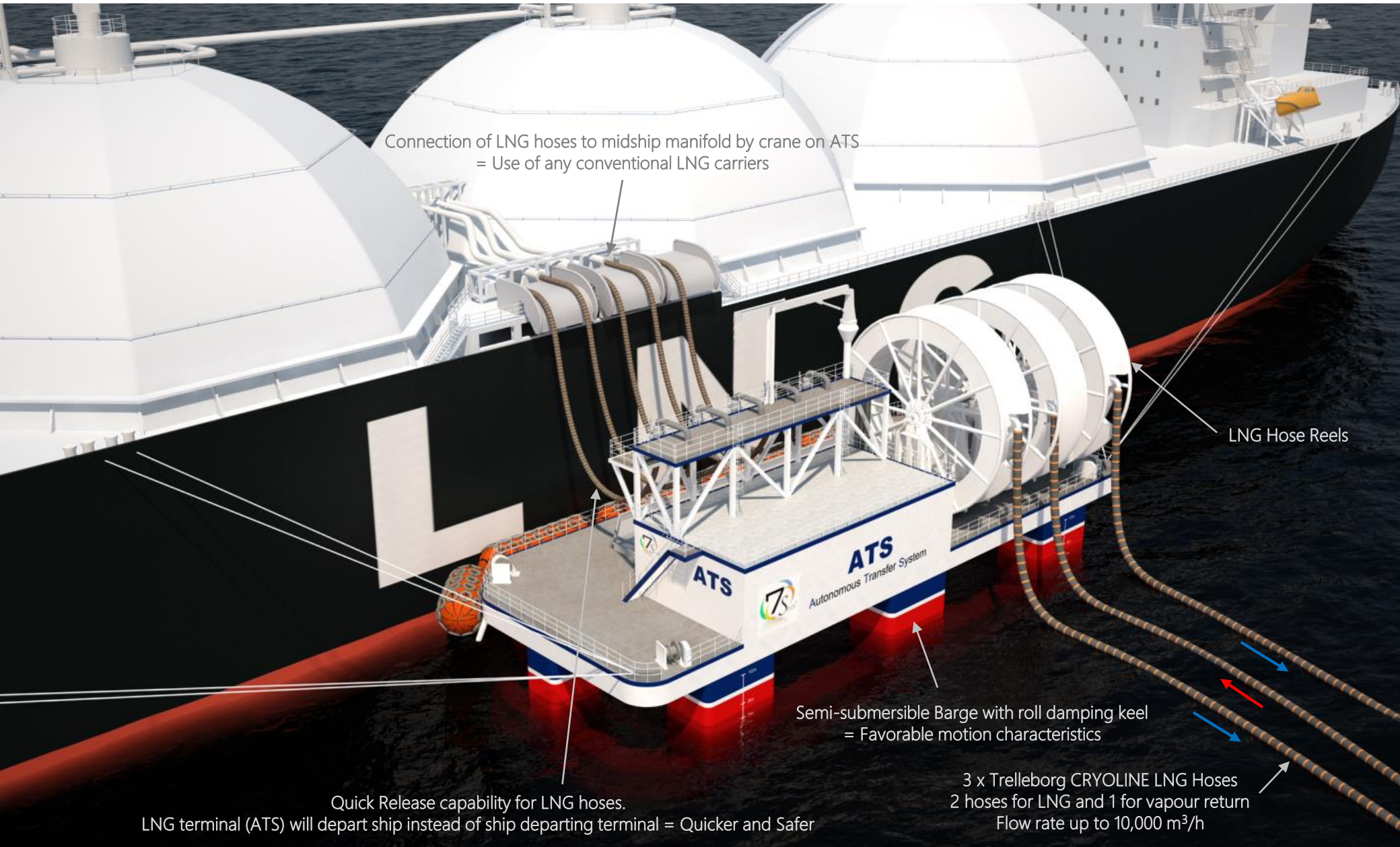
## Small Scale LNG - ATS 1 500

- LNG Transfer Rate: 1 500 m<sup>3</sup>/h
- LNGC/Barge size: 2 000 - 30 000 m<sup>3</sup>
- LNG Hose size: 2 x 12" + Vapour Return





# ATS | Autonomous Transfer System



Connection of LNG hoses to midship manifold by crane on ATS  
= Use of any conventional LNG carriers

LNG Hose Reels

Semi-submersible Barge with roll damping keel  
= Favorable motion characteristics

Quick Release capability for LNG hoses.  
LNG terminal (ATS) will depart ship instead of ship departing terminal = Quicker and Safer

3 x Trelleborg CRYOLINE LNG Hoses  
2 hoses for LNG and 1 for vapour return  
Flow rate up to 10,000 m<sup>3</sup>/h

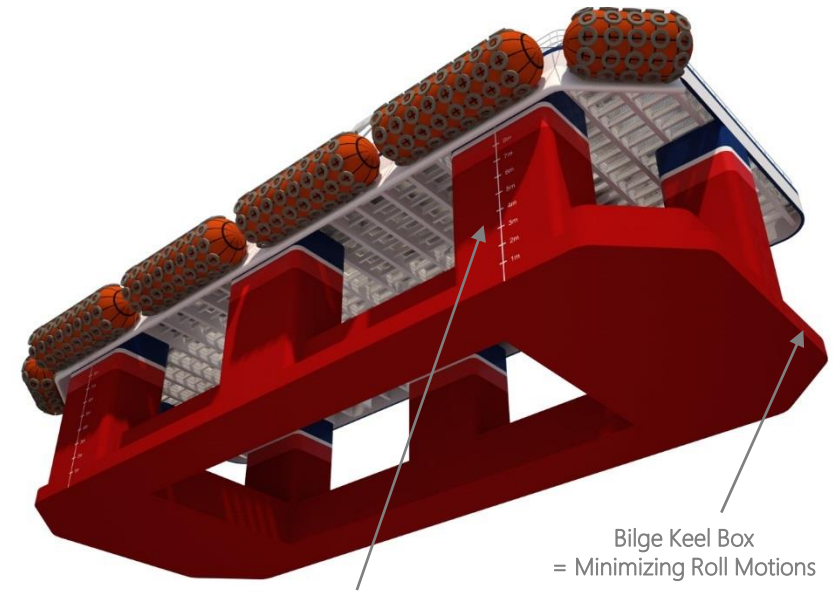
# Operational Limit | Cyclone/Hurricane Survival



- ATS designed with Small Waterplane Area (SWA) → Provides favorable motions
- Safe LNG Transfer in up to **Hs 2.5 m** - Large unit = Stable and Robust
- In case of Cyclone/Hurricane - ATS disconnected and towed to sheltered area
- Lightship draft < **3.0 m** = Possible to enter majority of harbour's/ports



LNG Hoses disconnected from  
Shore Connection



Small Waterplane Area (SWA)

Bilge Keel Box  
= Minimizing Roll Motions



# First Operation with Trelleborg Cryoline LNG Hoses



- First operation with Trelleborg floating LNG Cryoline hoses carried out in Norway in October 2017 - LNG Transfer from LNGC to onshore LNG storage
- 2 x 85 m of 10" floating LNG hoses were used during the operation
- The LNG transfer operation was successfully carried out by Trelleborg in cooperation with Gas Natural Fenosa (GNF) and Connect LNG

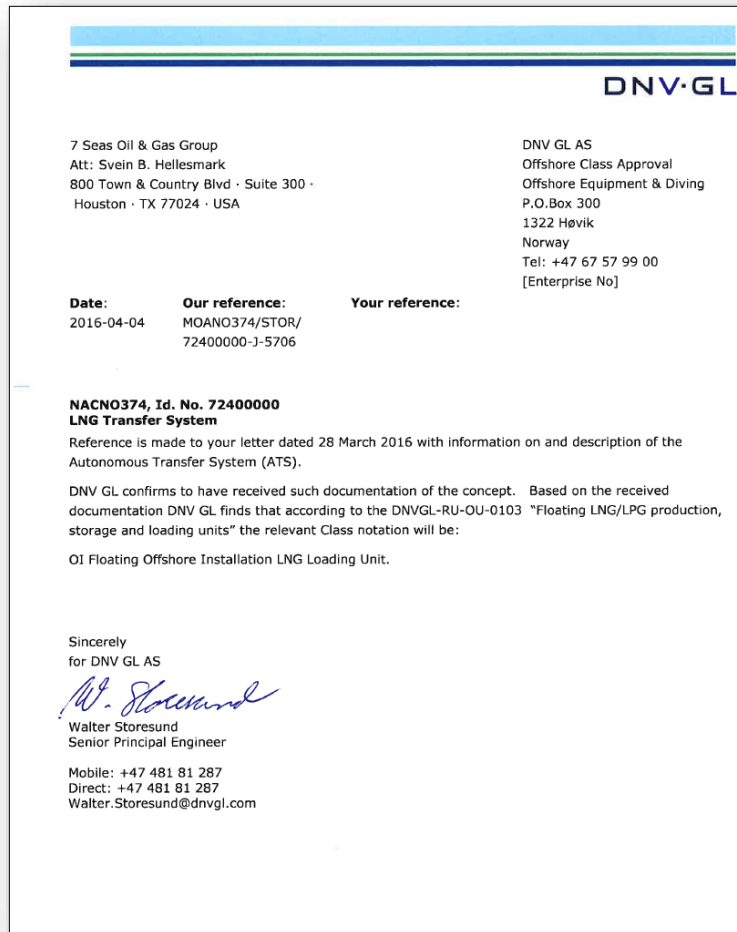


2 x 85 m of 10" Floating  
Trelleborg Cryoline LNG Hoses  
during LNG Transfer Operation



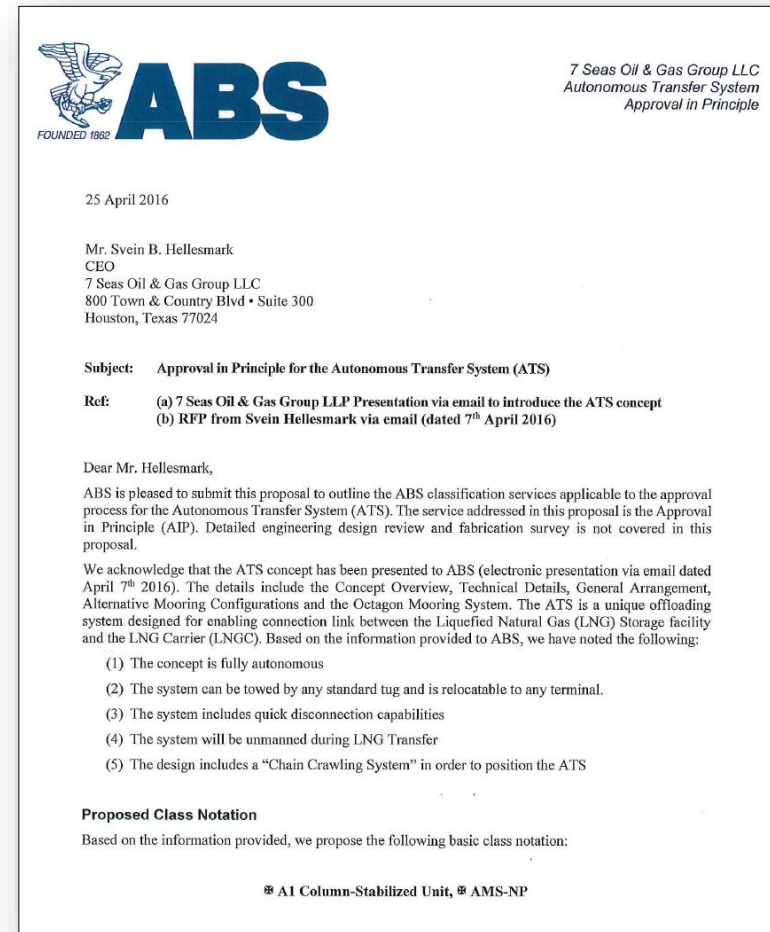
Proposed Class Notation by DNV GL:

**OI Floating Offshore Installation LNG Loading Unit**



Proposed Class Notation by ABS:

**⊠ A1 Column-Stabilized Unit, ⊠ AMS-NP**



# ATS for FSU | Between STS Operations



CBM for LNGC

ATS

Scana ITS Spread Mooring

FSU



# ATS for FSU | LNGC Arriving



CBM for LNGC

ATS

Scana ITS Spread Mooring

FSU

LNGC

Approach with Tug Support



# ATS for FSU | LNGC Moored



CBM for LNGC

ATS

Scana ITS Spread Mooring

LNGC

FSU



# ATS for FSU | LNG Transfer



CBM for LNGC

3 x 20" Trelleborg CRYOLINE LNG Hoses  
Flow rate up to 10,000 m<sup>3</sup>/h

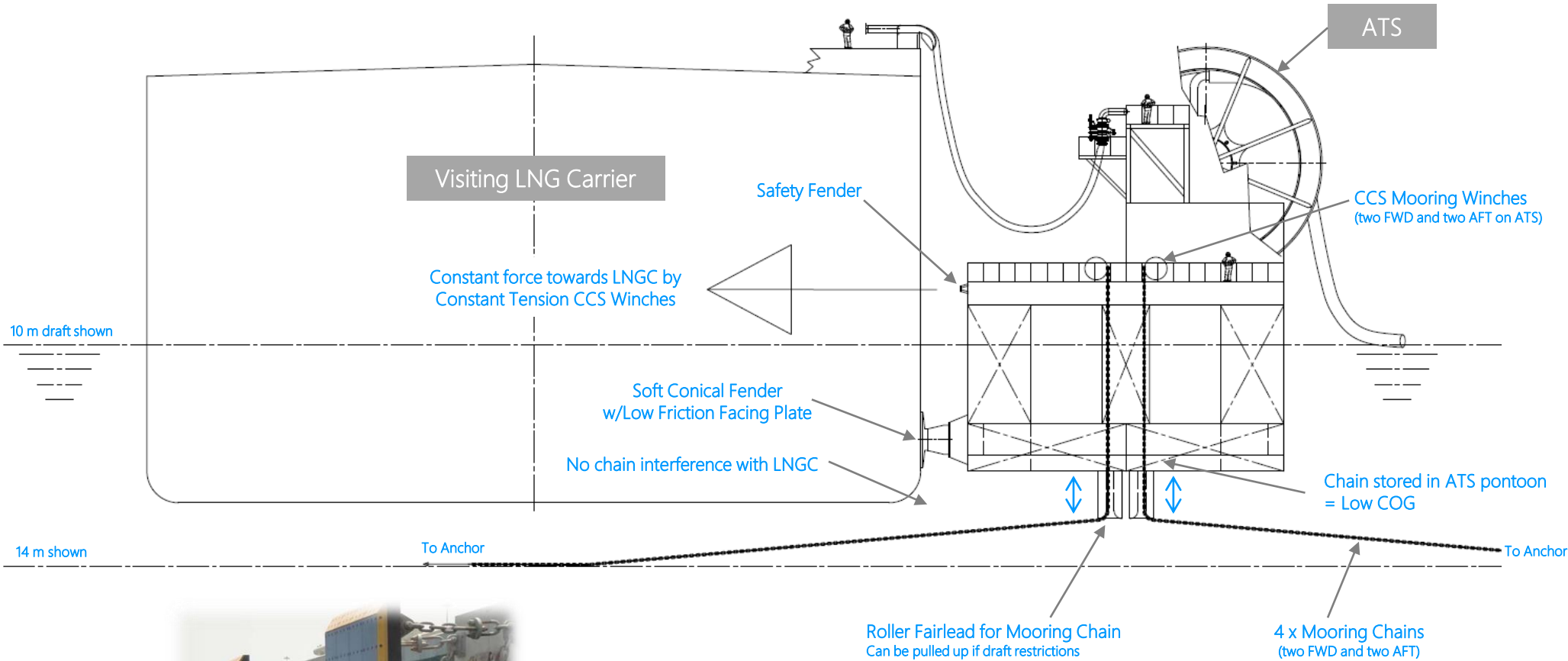
ATS

LNGC

Scana ITS Spread Mooring

FSU

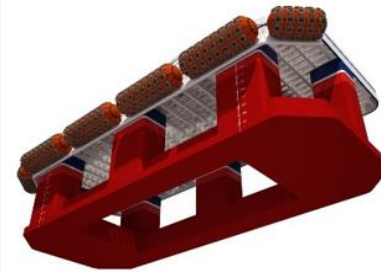
# Chain Crawling System (CCS)



Typical Conical Terminal Fenders. Image courtesy: Trelleborg



# Why Jetty-Less<sup>TM</sup> LNG Terminals?



# Jetty-Less Solution | Key Advantages



## ■ COST

- ✓ Significant cost reduction compared to jetty moored FSU/FSRU

## ■ SCHEDULE

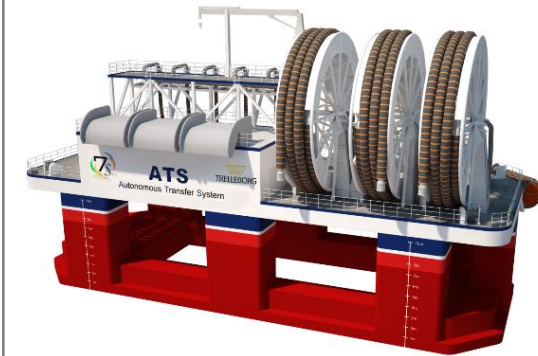
- ✓ Minimized infrastructure = Quicker gas to market

## ■ SAFETY

- ✓ Safe distance between FSU and visiting LNGC
- ✓ 150 m vs 5 m for traditional STS = Improved overall safety

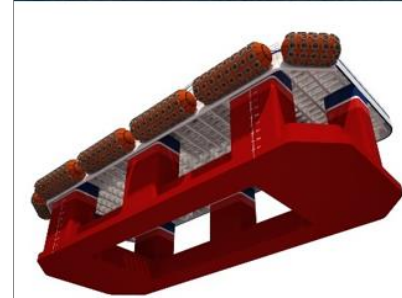
## ■ AVAILABILITY AND UPTIME

- ✓ Spread Mooring System designed for permanent mooring of FSU
- ✓ Ensures up to 100% gas delivery regularity
- ✓ High STS availability - LNGC moored independently 150 m away  
Particular important in long period swell conditions
- ✓ Tsunami and Earthquake resistant



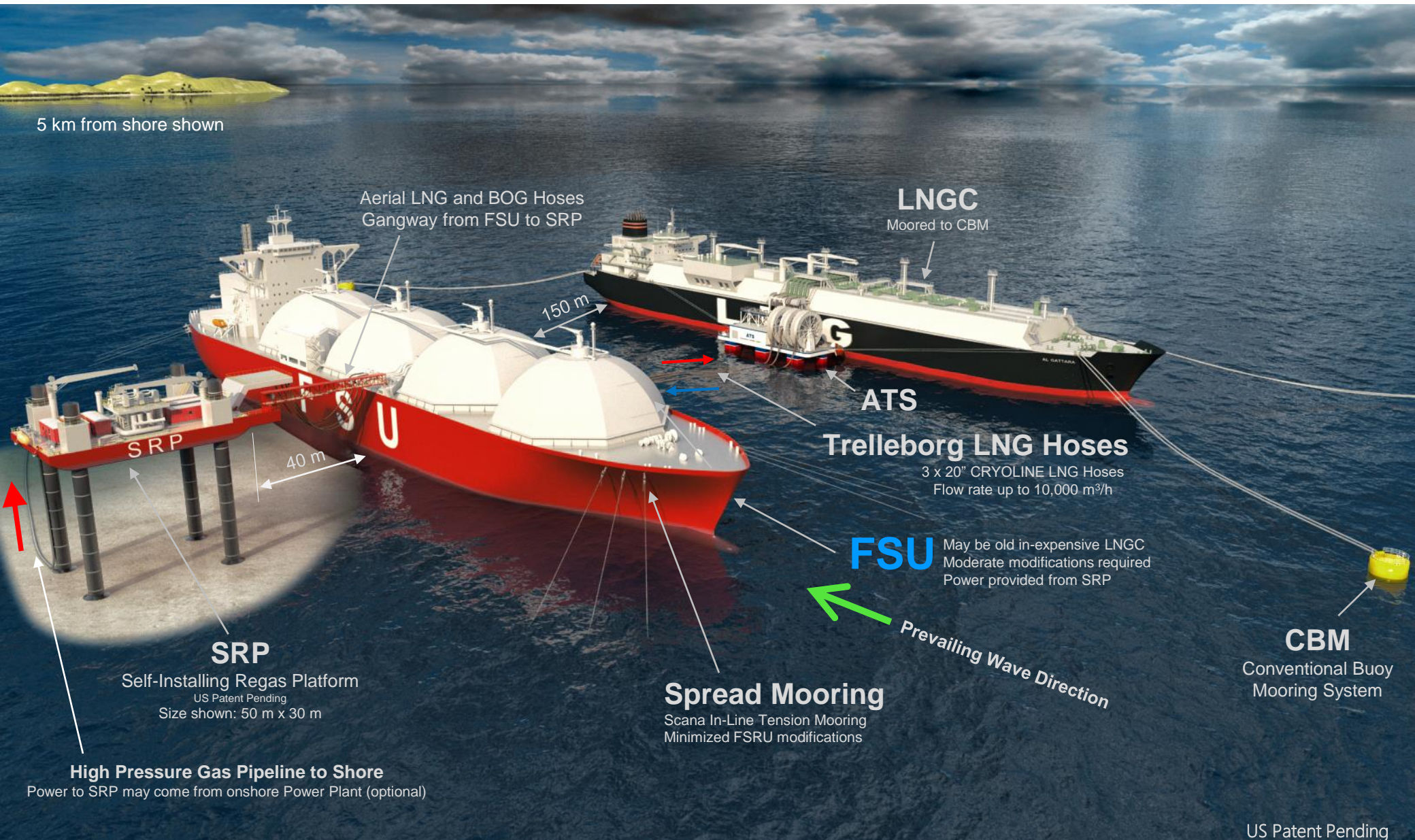
# Alternative Jetty-Less™ LNG Terminal Configurations

Floating Storage





# Alternative 1 | ATS + FSU + SRP (Regas Platform)





# Alternative 2 | ATS + FSU + PIP + Onshore Regas



5 km from shore shown



Piles  
(not shown)

## Tripod Tower

Enables safe and dry connection between  
LNG/BOG Hoses and PIP's - No wave loads on Hoses  
Enables installation in shallow water  
US Patent Pending

## Spread Mooring

Scana In-Line Tension Mooring  
Minimized FSRU modifications

## LNG to onshore Regas Plant by Pipe-In-Pipe

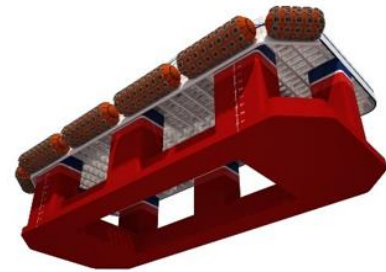
Typical flow: 600 m³/h = Regas of 300 mmscfd  
Size: 2 x 8" ID + 1 x 8" for BOG



US Patent Pending

# Alternative Jetty-Less™ LNG Terminal Configurations

Onshore Storage



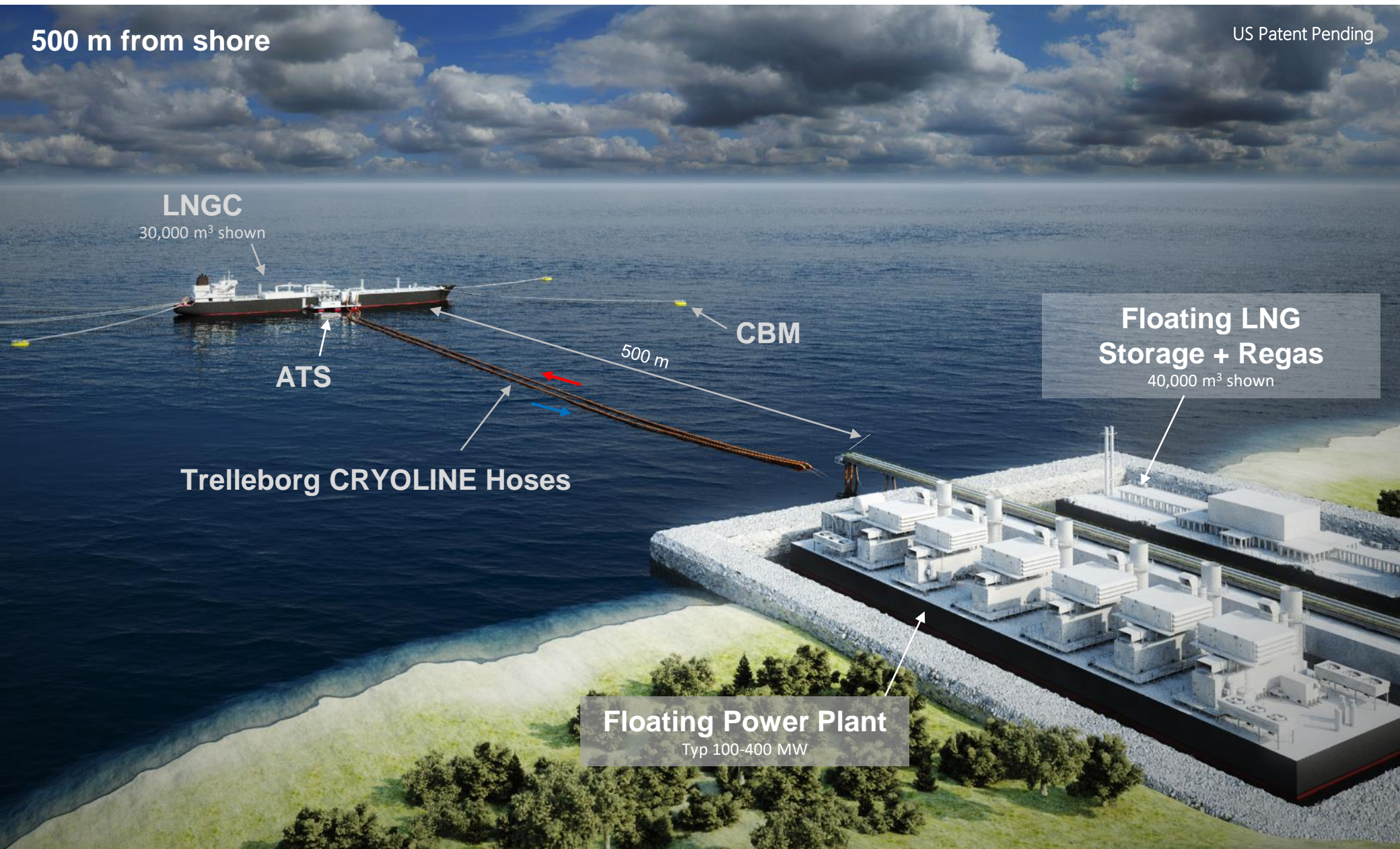


# Alternative 1 | At Shore LNG Storage and Power Plant



US Patent Pending

500 m from shore



**LNGC**  
30,000 m<sup>3</sup> shown

**ATS**

**Trelleborg CRYOLINE Hoses**

**CBM**

500 m

**Floating LNG  
Storage + Regas**  
40,000 m<sup>3</sup> shown

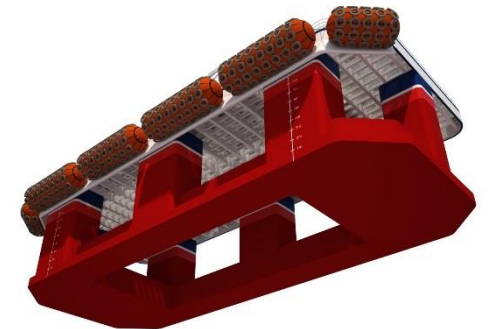
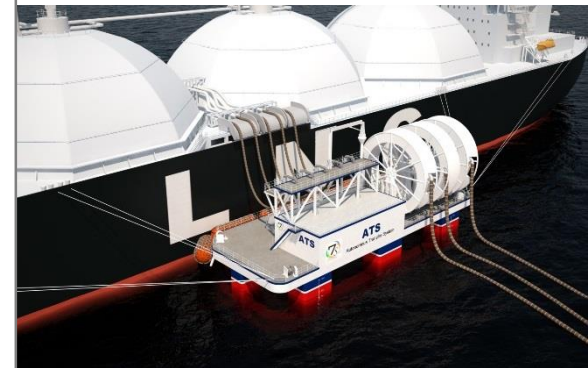
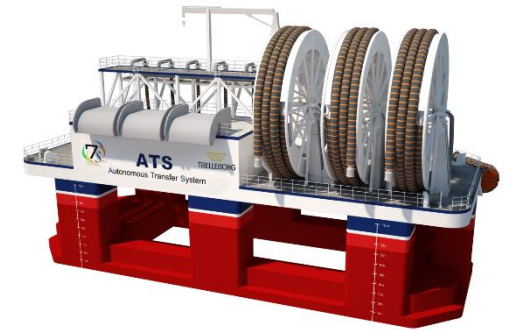
**Floating Power Plant**  
Typ 100-400 MW





# LNG Distribution

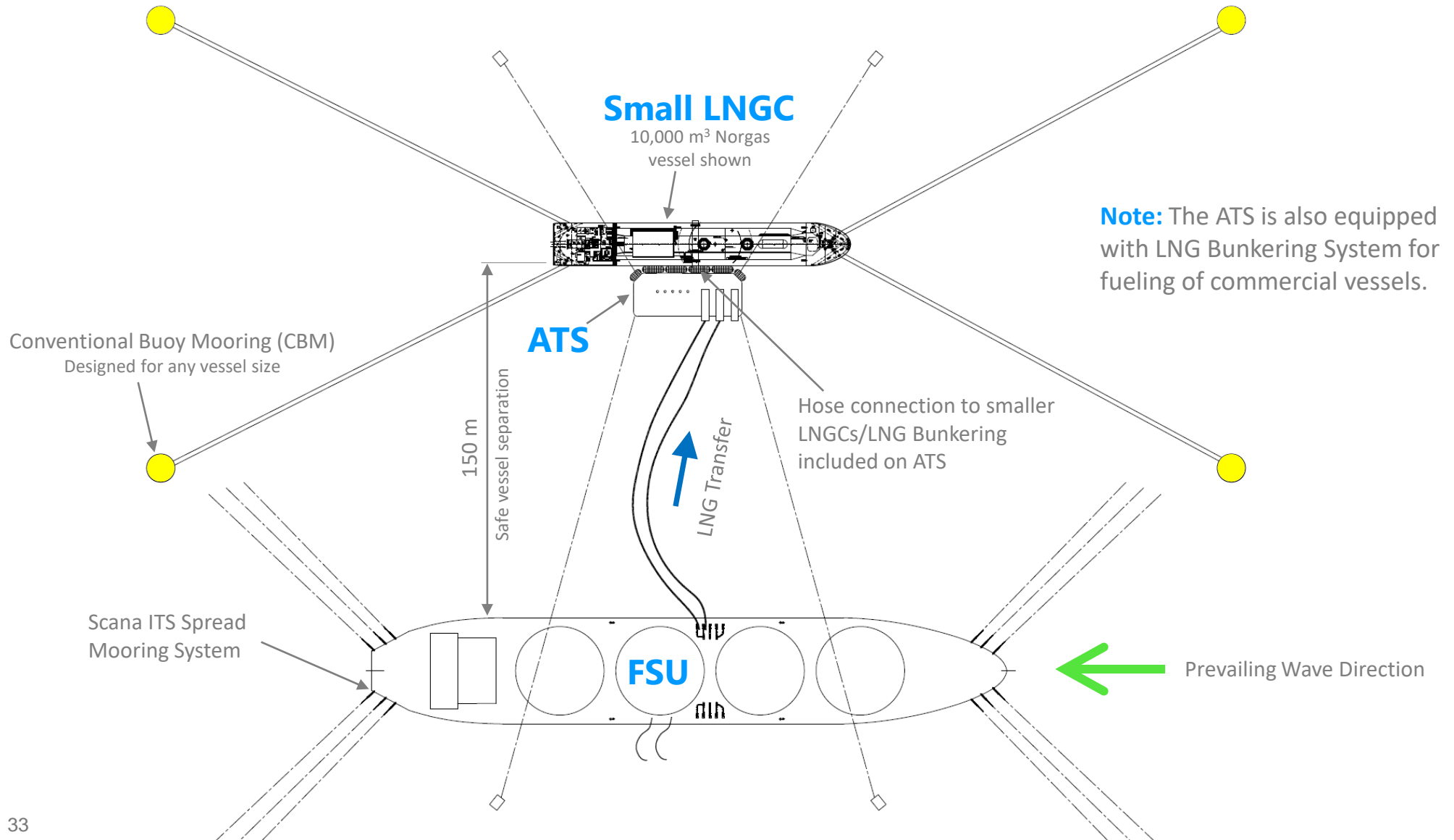
## LNG Bunkering



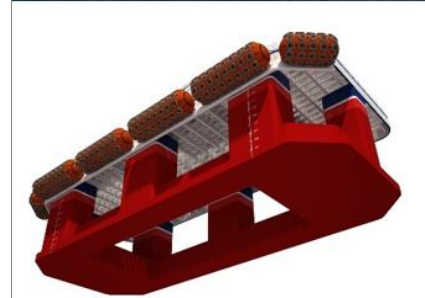


# LNG Distribution to Smaller LNGCs/LNG Bunkering

Opportunity to also use the ATS for LNG Distribution to Small LNG Carrier as well as LNG Bunkering



# Project Update





# Jetty-Less™ LNG to Power Solution | Bac Lieu - Vietnam



LNG Receiving Terminal + 2 x 500 MW Power Plants

Signing Ceremony - Vietnam May 4<sup>th</sup> 2018



ENERGY  
CAPITAL  
VIETNAM





# Jetty-Less™ LNG to Power Solution | Bac Lieu - Vietnam



## Bac Lieu

20 km shore | Not shown in scale

## FSU

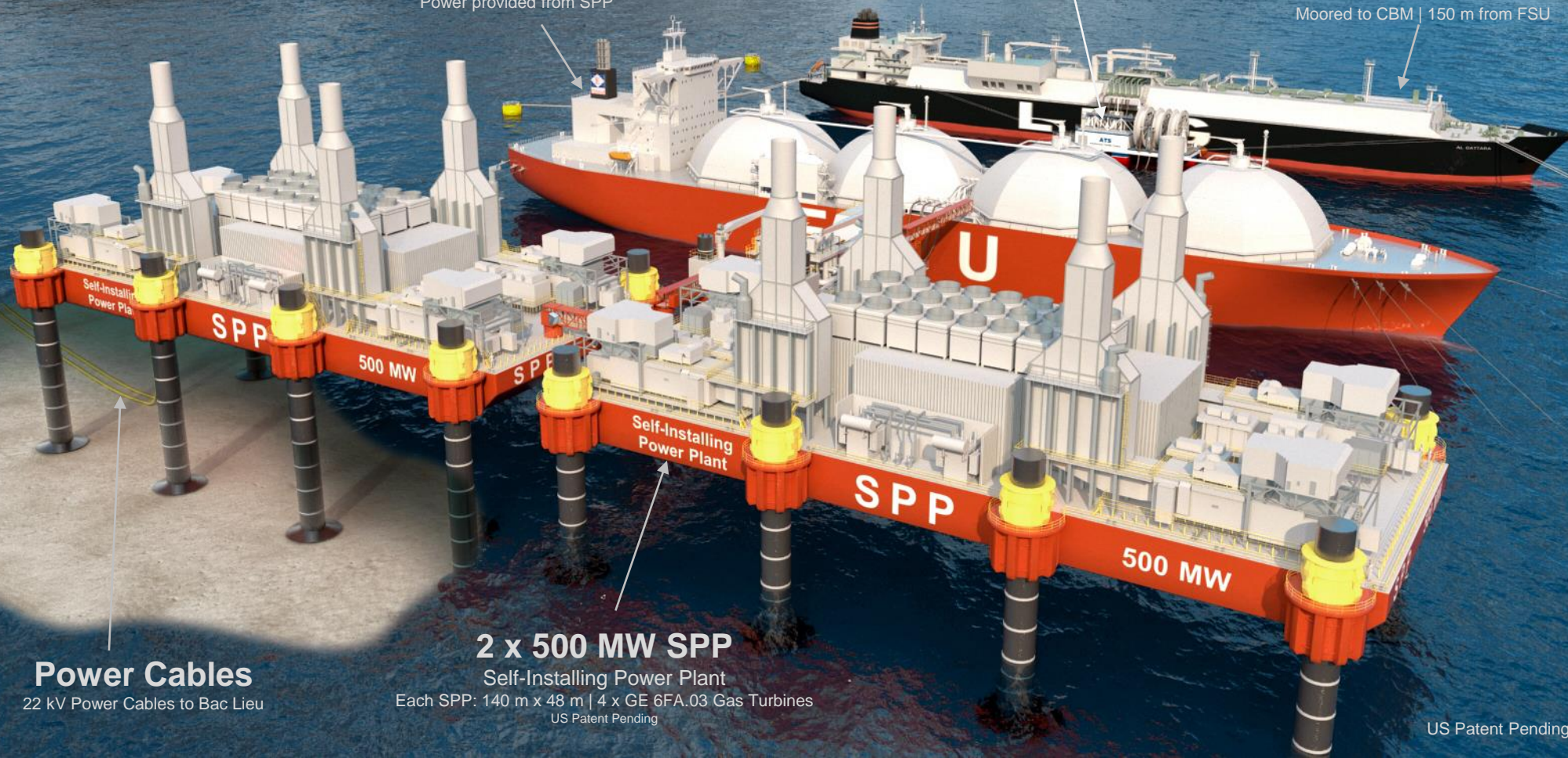
May be old in-expensive LNGC  
Moderate modifications required  
Power provided from SPP

## ATS

Autonomous Transfer System  
Enables Safe LNG Transfer from LNGC to FSU  
150 m Vessel Separation | 10,000 m<sup>3</sup>/h  
US Patent Pending

## LNGC

Moored to CBM | 150 m from FSU



## Power Cables

22 kV Power Cables to Bac Lieu

## 2 x 500 MW SPP

Self-Installing Power Plant

Each SPP: 140 m x 48 m | 4 x GE 6FA.03 Gas Turbines  
US Patent Pending

US Patent Pending



## **JETTY-LESS™**

Floating Jetty-Less  
LNG Terminal Solution  
No fixed expensive  
infrastructure

## **TSUNAMI RESISTANT**

Floating = Tsunami  
and Earthquake  
Resistant solution

## **ENVIRONMENT**

Small environmental  
footprint - no fixed  
structures - less  
inferences with fishing  
activities

## **GENERIC DESIGN**

Generic design  
- multiple locations  
Design one - Build many  
- Relocatable

## **OWN OR LEASE**

Tech. offered based on a  
Technology Design  
Package = Client can  
build at preferred yard  
- cost optimized - flexible  
Lease also an option

## **SAFETY**

150 m STS distance  
Unmanned during  
LNG transfer - Safe  
Quick disconnection  
- “Jetty” leaving ship

For additional information, please contact:

7 Seas LNG & Power AS  
Smith Petersens gate 6  
4876 Grimstad - Norway



Svein B. Hellesmark  
Managing Director  
Phone: +47 37 40 01 00  
E-mail : [sbh@7Seas.no](mailto:sbh@7Seas.no)  
[www.7Seas.no](http://www.7Seas.no)

