

# ATS

## Autonomous Transfer System

*...enabling multiple Jetty-Less LNG Terminal configurations...*



US Patent Pending

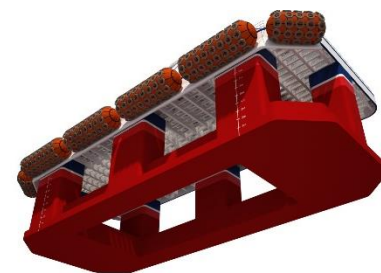
Presented by:



7 Seas LNG & Power AS

### FLNG GLOBAL

Amsterdam | May 8-9<sup>th</sup> 2017



# ATS | Autonomous Transfer System

US Patent Pending



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



Conventional Buoy Mooring (CBM) system shown. The Generic ATS design enables use of multiple alternative LNGC mooring configurations.

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

Quick disconnection of LNG hoses and mooring.  
LNG terminal (ATS) will depart ship instead of ship departing terminal.

- **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

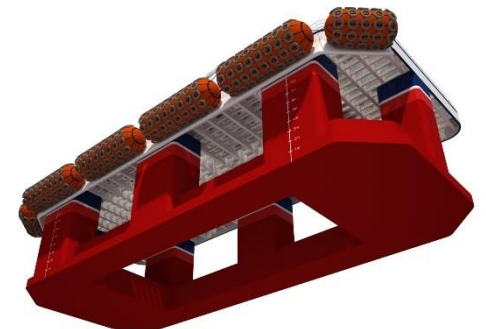
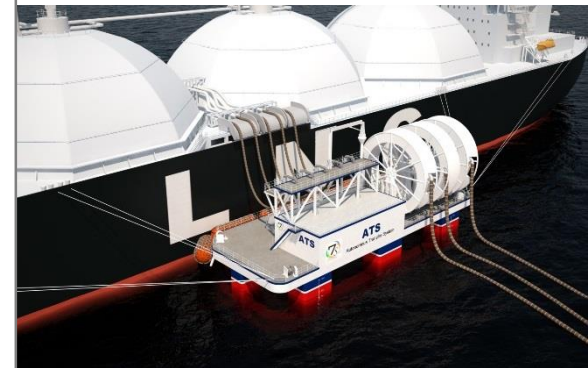
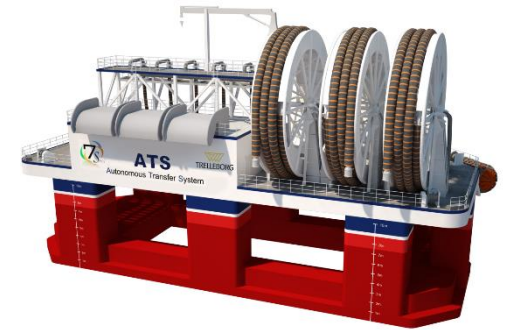
Trelleborg CRYOLINE LNG Hoses  
2 hoses for LNG and 1 for vapour return  
Flow rate up to 10,000 m<sup>3</sup>/h  
LNG import shown - Same set-up for export terminal

Simple ATS interface  
3 x 20" flanges

Hose Connection to LNG Storage (onshore or floating)



# Basis of Design



# 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



# Technical Data





# ATS | Autonomous Transfer System

US Patent Pending



Any Conventional LNG Carrier  
Spread Moored with Conventional  
Buoy Mooring System

LNG Hoses connected to midship manifold.  
Remotely quick release system for hoses and  
+ Mooring Quick Release Hooks.

Trelleborg CRYOLINE  
LNG Hoses to storage

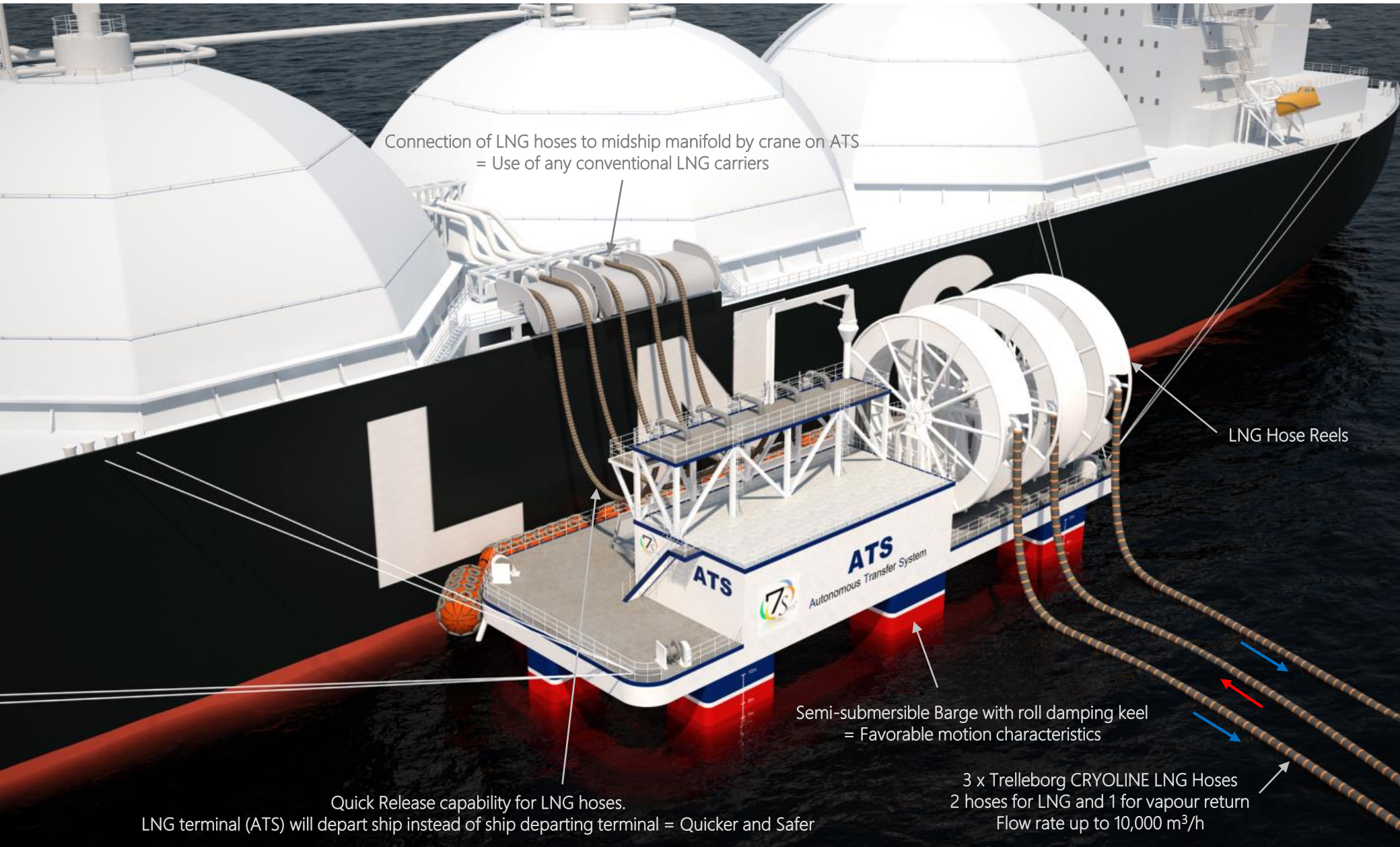
ATS – Autonomous Transfer System  
All required systems and equipment on one unit

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



# ATS | Autonomous Transfer System

US Patent Pending



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

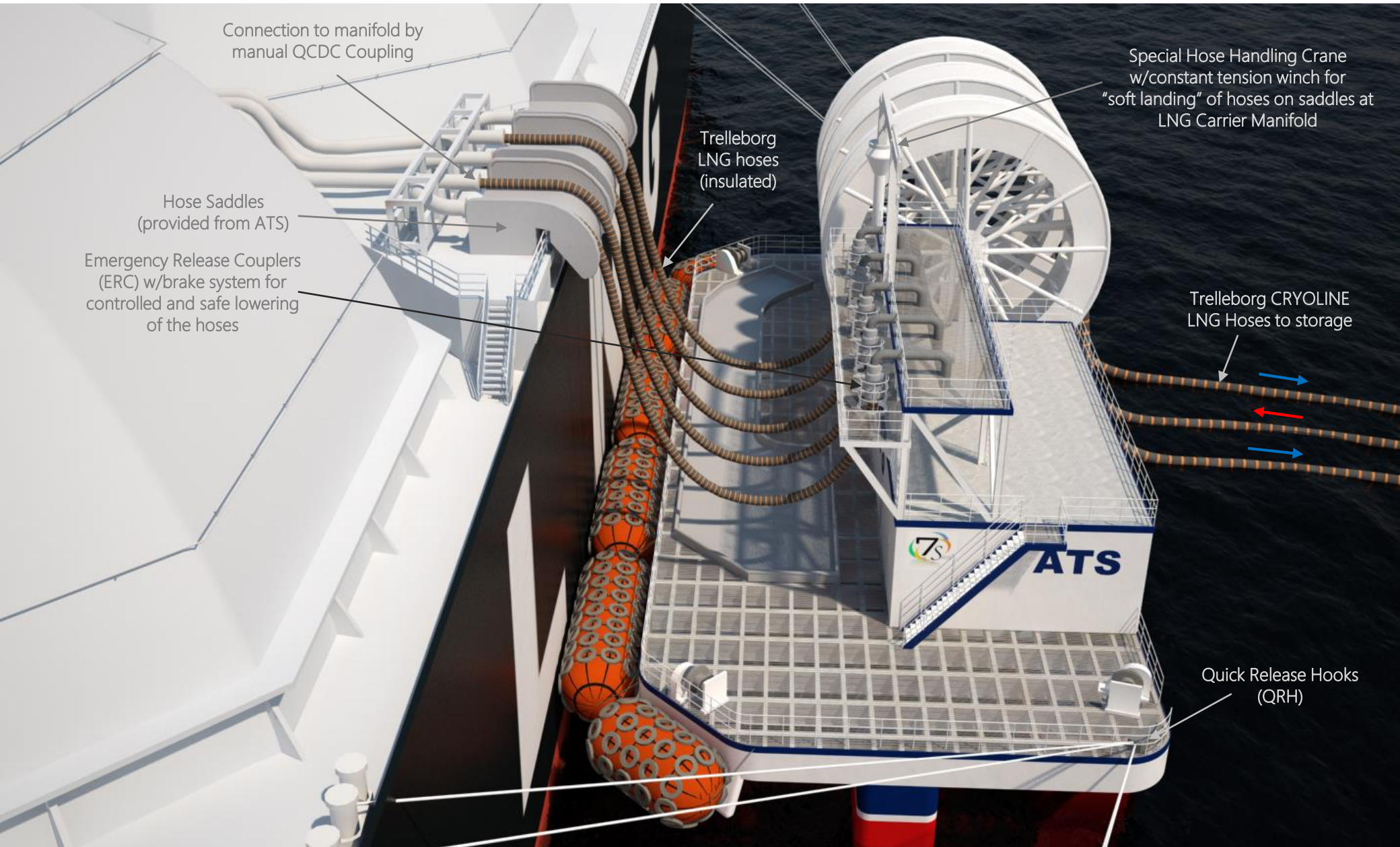
Quick Release capability for LNG hoses.  
LNG terminal (ATS) will depart ship instead of ship departing terminal = Quicker and Safer

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



# ATS | Autonomous Transfer System

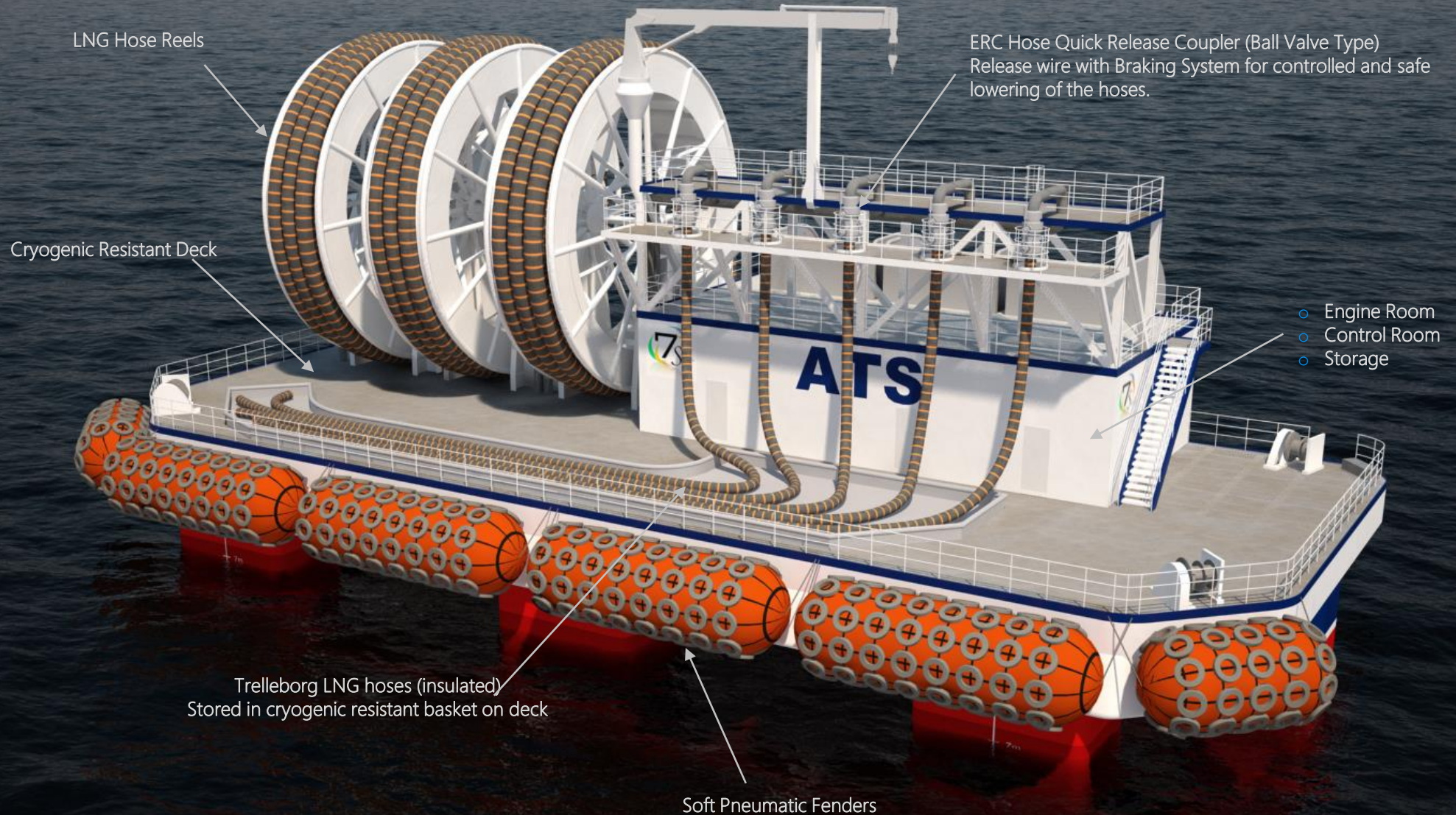
US Patent Pending





# ATS | Autonomous Transfer System

US Patent Pending





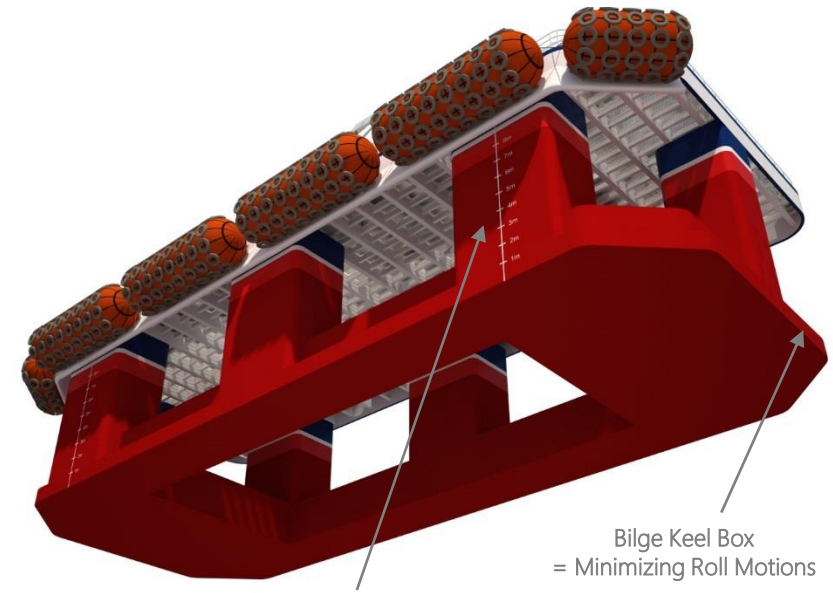
# Operational Limit | Cyclone/Hurricane Survival



- ATS designed with Small Waterplane Area (SWA) → Provides favorable motions
- Safe LNG Transfer in up to **Hs 2.0 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



# Trelleborg Cryoline LNG Hose Design



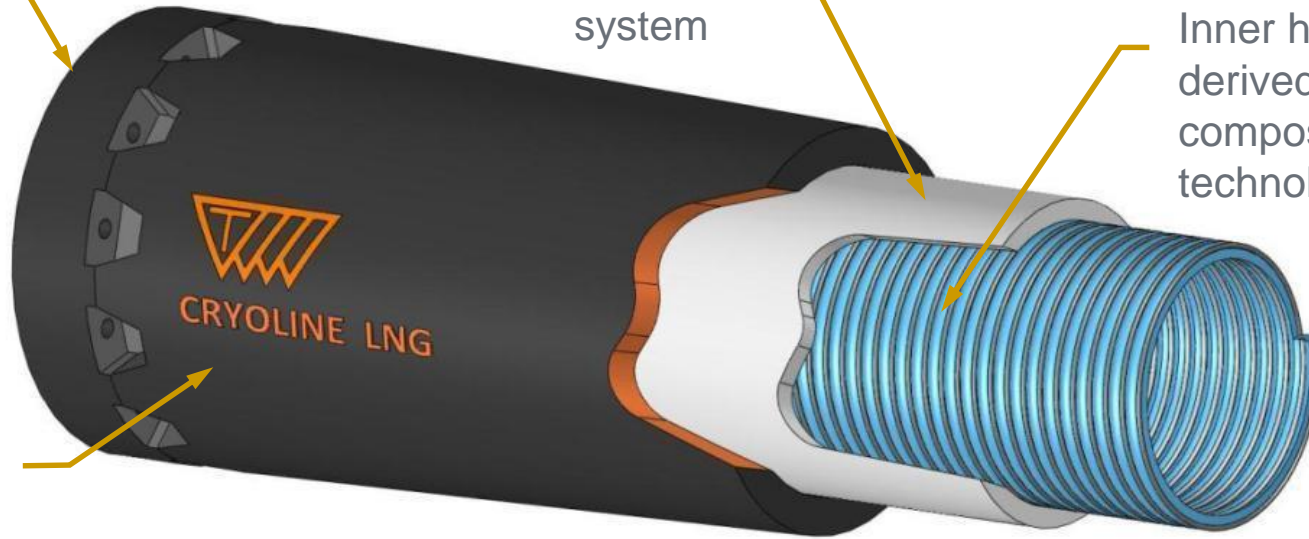
Compact and  
specific  
connection  
system

Innovative and efficient  
insulation material  
+ Leak monitoring  
system

**Certified according to  
EN 1474-2 standard**

Inner hose  
derived from  
composite hose  
technology

Outer protective  
hose based on  
bonded flexible  
hose technology



## Objectives

- Ensure LNG transfer with minimum BOG generation
- Meet LNG offloading requirements vs. safety, flowrate, availability...
- Combine high flexibility, reliability and long service life

Proposed Class Notation by DNV GL:

## OI Floating Offshore Installation LNG Loading Unit

**DNV GL**

7 Seas Oil & Gas Group  
Att: Svein B. Hellesmark  
800 Town & Country Blvd • Suite 300 •  
Houston • TX 77024 • USA

DNV GL AS  
Offshore Class Approval  
Offshore Equipment & Diving  
P.O.Box 300  
1322 Høvik  
Norway  
Tel: +47 67 57 99 00  
[Enterprise No]

**Date:**  
2016-04-04

**Our reference:**  
MOANO374/STOR/  
72400000-J-5706

**Your reference:**


**NACNO374, Id. No. 72400000  
LNG Transfer System**

Reference is made to your letter dated 28 March 2016 with information on and description of the Autonomous Transfer System (ATS).

DNV GL confirms to have received such documentation of the concept. Based on the received documentation DNV GL finds that according to the DNVGL-RU-OU-0103 "Floating LNG/LPG production, storage and loading units" the relevant Class notation will be:

OI Floating Offshore Installation LNG Loading Unit.

Sincerely  
for DNV GL AS




Walter Storesund  
Senior Principal Engineer

Mobile: +47 481 81 287  
Direct: +47 481 81 287  
Walter.Storesund@dnvgl.com

Proposed Class Notation by ABS:

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



FOUNDED 1862

7 Seas Oil & Gas Group LLC  
Autonomous Transfer System  
Approval in Principle

25 April 2016

Mr. Svein B. Hellesmark  
CEO  
7 Seas Oil & Gas Group LLC  
800 Town & Country Blvd • Suite 300  
Houston, Texas 77024

**Subject:** Approval in Principle for the Autonomous Transfer System (ATS)

**Ref:** (a) 7 Seas Oil & Gas Group LLP Presentation via email to introduce the ATS concept  
(b) RFP from Svein Hellesmark via email (dated 7<sup>th</sup> April 2016)

Dear Mr. Hellesmark,

ABS is pleased to submit this proposal to outline the ABS classification services applicable to the approval process for the Autonomous Transfer System (ATS). The service addressed in this proposal is the Approval in Principle (AIP). Detailed engineering design review and fabrication survey is not covered in this proposal.

We acknowledge that the ATS concept has been presented to ABS (electronic presentation via email dated April 7<sup>th</sup> 2016). The details include the Concept Overview, Technical Details, General Arrangement, Alternative Mooring Configurations and the Octagon Mooring System. The ATS is a unique offloading system designed for enabling connection link between the Liquefied Natural Gas (LNG) Storage facility and the LNG Carrier (LNGC). Based on the information provided to ABS, we have noted the following:

- (1) The concept is fully autonomous
- (2) The system can be towed by any standard tug and is relocatable to any terminal.
- (3) The system includes quick disconnection capabilities
- (4) The system will be unmanned during LNG Transfer
- (5) The design includes a "Chain Crawling System" in order to position the ATS

**Proposed Class Notation**

Based on the information provided, we propose the following basic class notation:

⊠ A1 Column-Stabilized Unit, ⊠ AMS-NP



# ATS for At-Shore LNG Storage and Power Plant



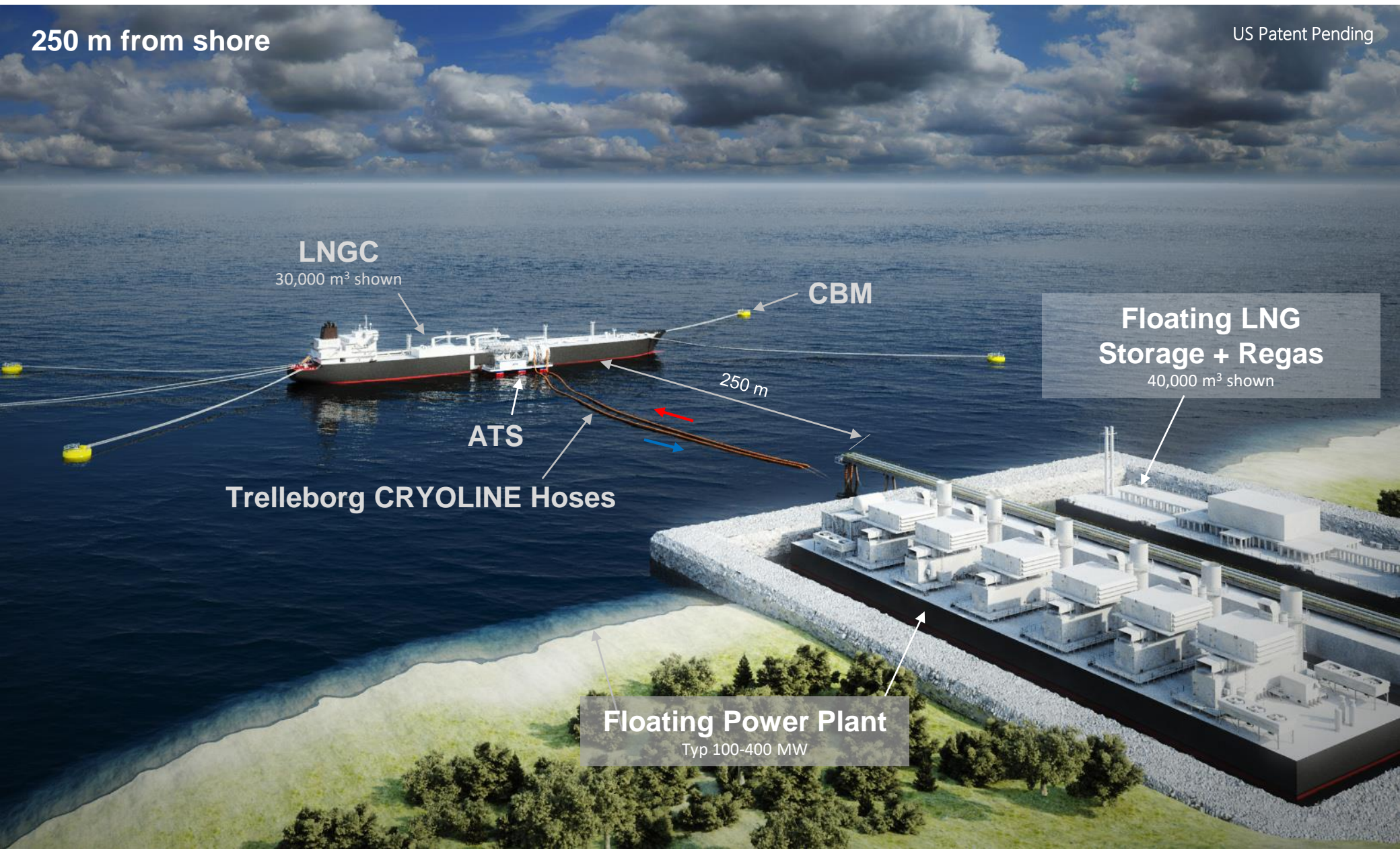


# At-Shore | Floating LNG Storage and Power Plant



US Patent Pending

250 m from shore



**LNGC**

30,000 m³ shown

**CBM**

**Floating LNG  
Storage + Regas**

40,000 m³ shown

**ATS**

**Trelleborg CRYOLINE Hoses**

**Floating Power Plant**

Typ 100-400 MW

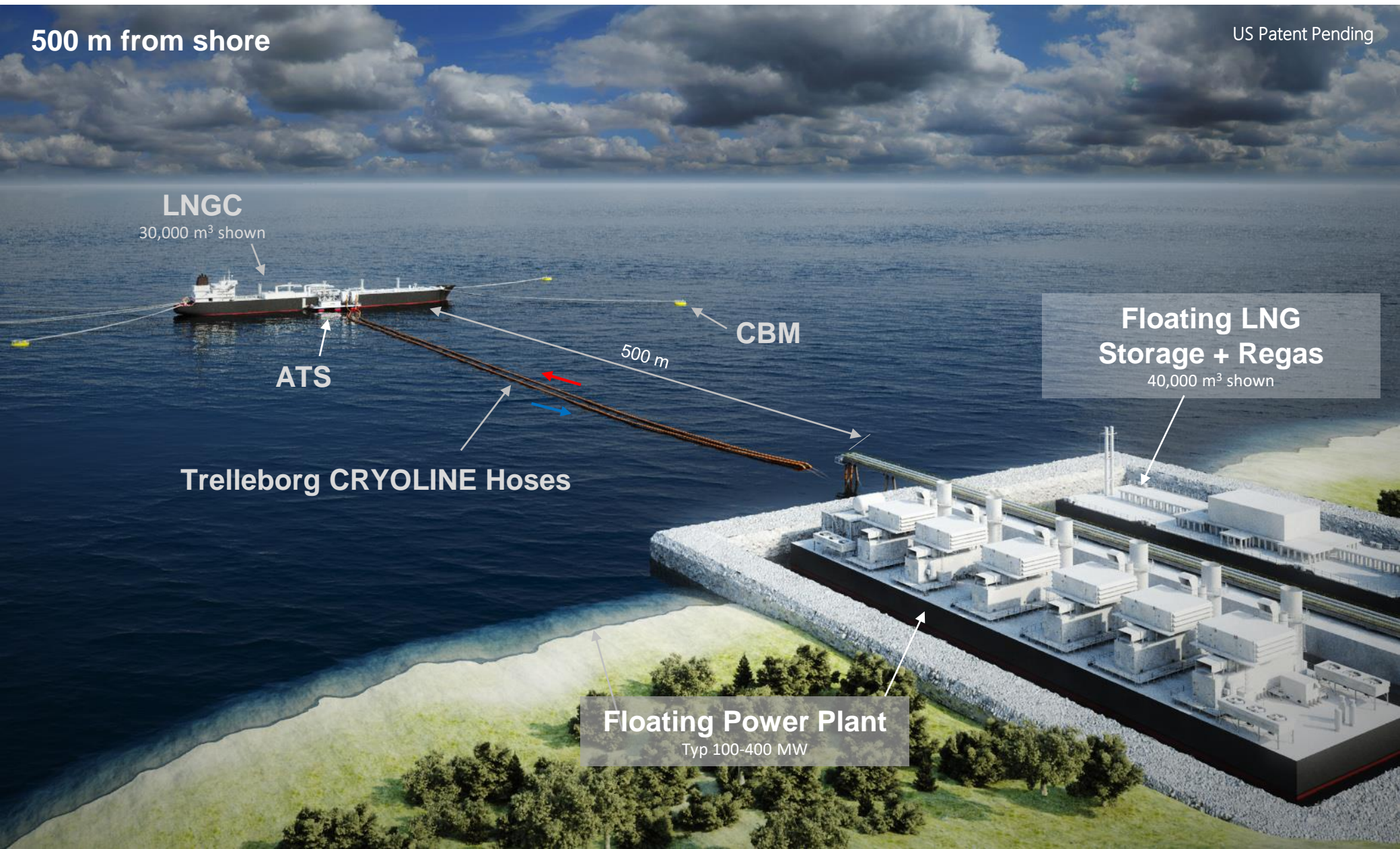


# At-Shore | Floating LNG Storage and Power Plant



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

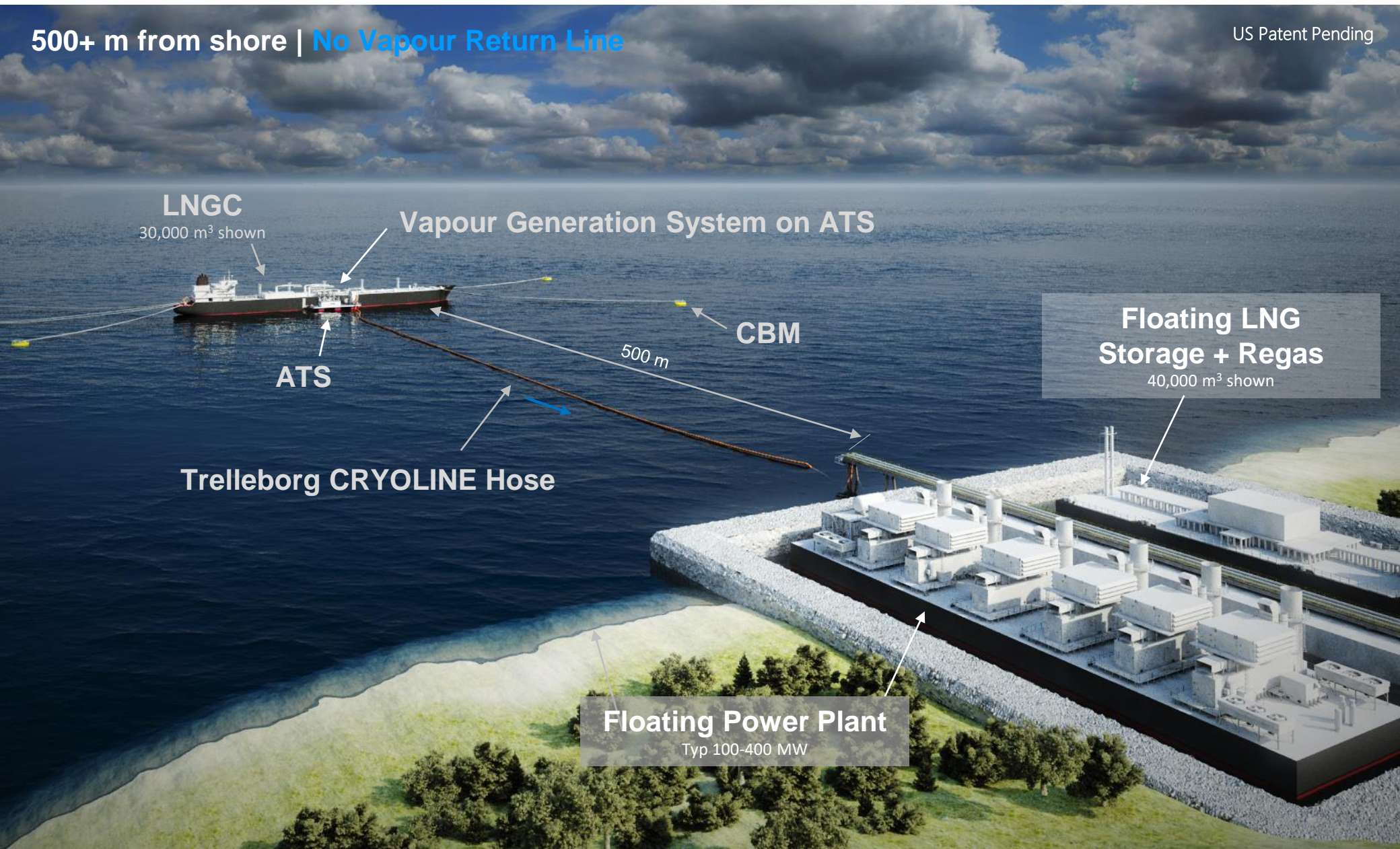


# At-Shore | Floating LNG Storage and Power Plant



500+ m from shore | **No Vapour Return Line**

US Patent Pending



**LNGC**

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

**Vapour Generation System on ATS**

**ATS**

**CBM**

500 m

**Trelleborg CRYOLINE Hose**

**Floating LNG  
Storage + Regas**

40,000 m<sup>3</sup> shown

**Floating Power Plant**

Typ 100-400 MW



# At-Shore | Floating LNG Storage and Power Plant



**Floating LNG Storage + Regas**

40,000 m<sup>3</sup> shown

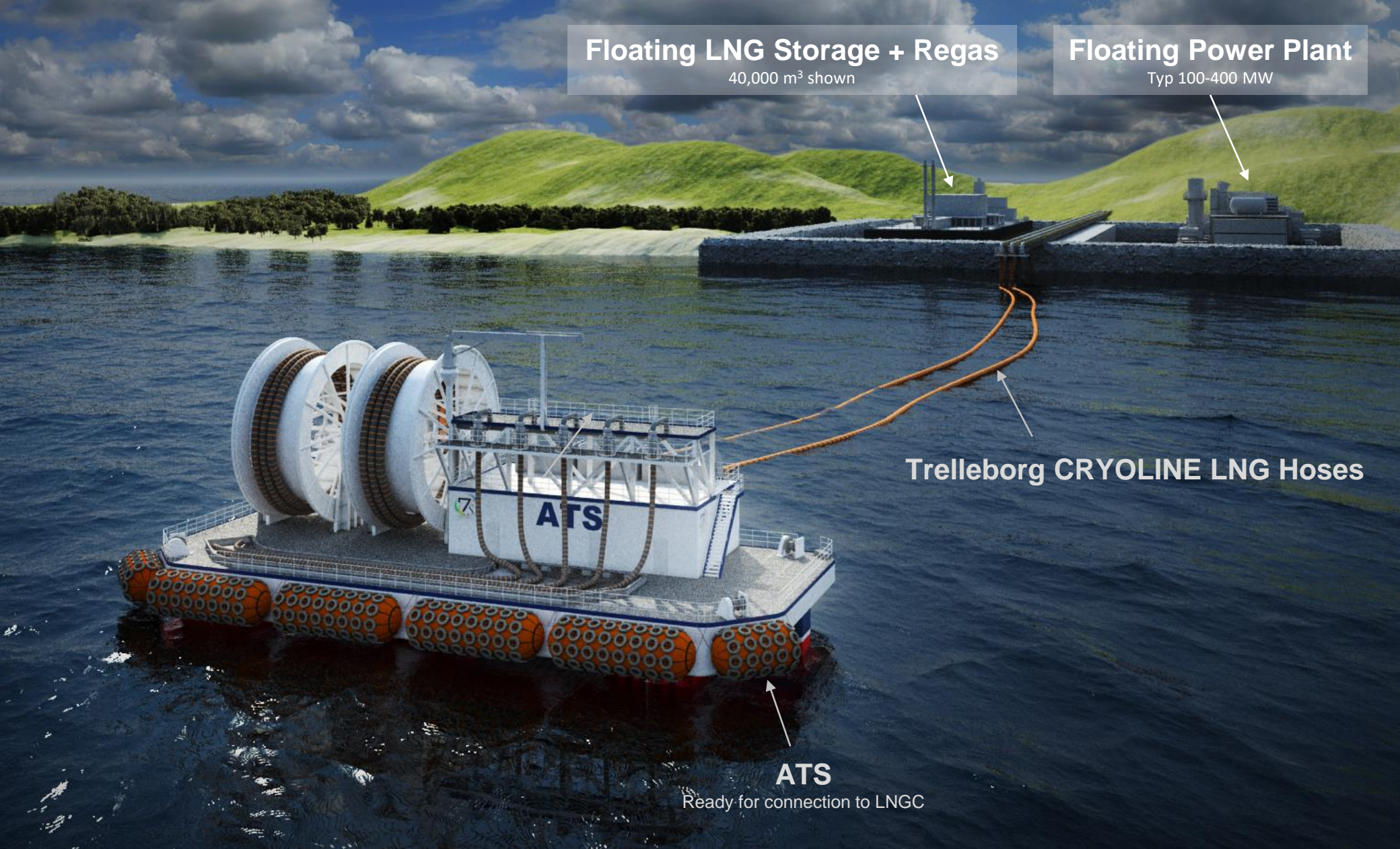
**Floating Power Plant**

Typ 100-400 MW

**Trelleborg CRYOLINE LNG Hoses**

**ATS**

Ready for connection to LNGC





# ATS for Offshore Floating LNG Solutions



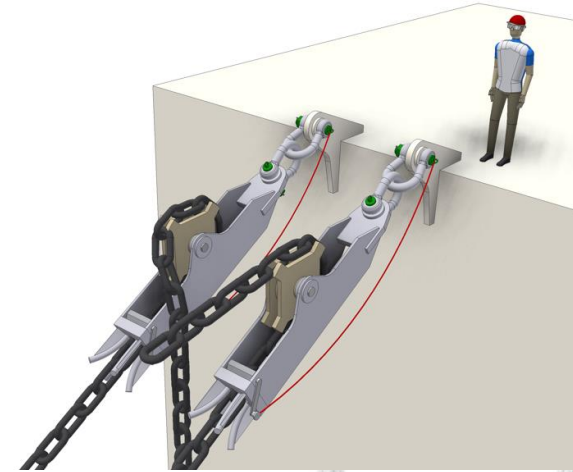


# New Permanent Spread Mooring Solution



## Scana Offshore | In-Line Tensioning System (ITS)

### ScanaOffshore



- No mooring winches on deck
- Installation done by AHTS
- Moderate vessel modification
- **Result: Reduced Cost**

# ATS for Small Scale FSRU + Power



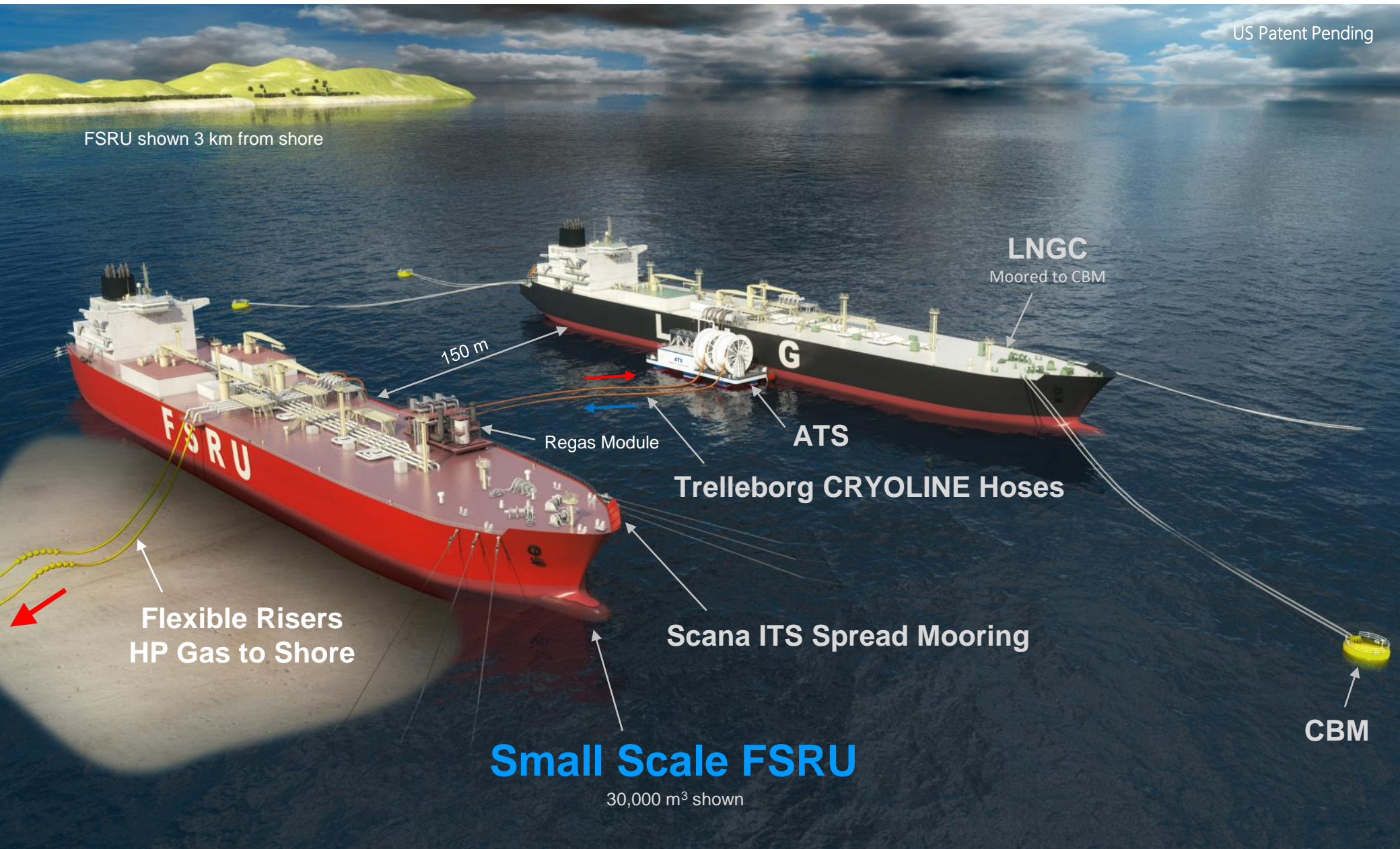


# Small Scale FSRU | Overview



US Patent Pending

FSRU shown 3 km from shore



150 m

LNGC  
Moored to CBM

Regas Module

ATS

Trelleborg CRYOLINE Hoses

Flexible Risers  
HP Gas to Shore

Scana ITS Spread Mooring

CBM

**Small Scale FSRU**

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



# Small Scale FSRU + Power | Overview



US Patent Pending



FSRU shown 3 km from shore

LNGC  
Moored to CBM

150 m

ATS

Trelleborg CRYOLINE Hoses

Power + Gas  
to Shore

Scana ITS Spread Mooring

CBM

**Small Scale FSRU + Power**

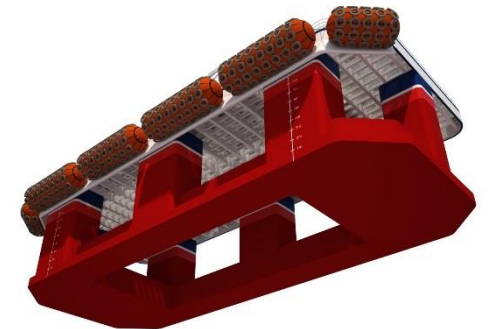
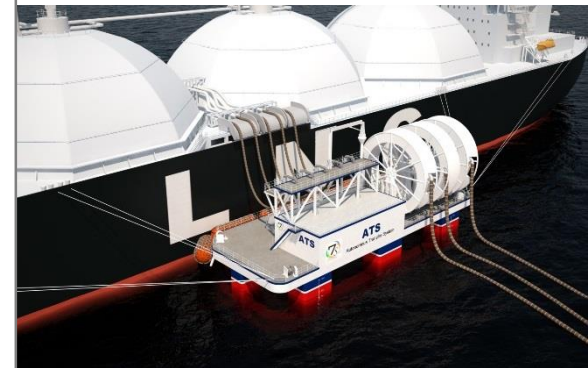
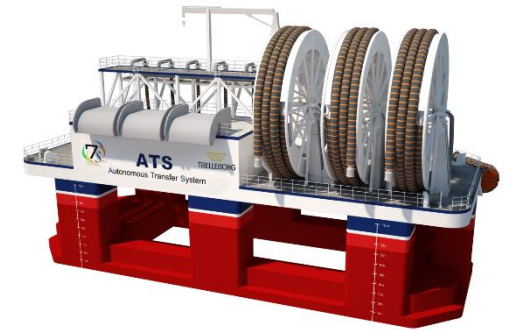
30,000 m<sup>3</sup> shown

**Power Modules on deck**

+ Power from Gas Electric FSRU Machinery



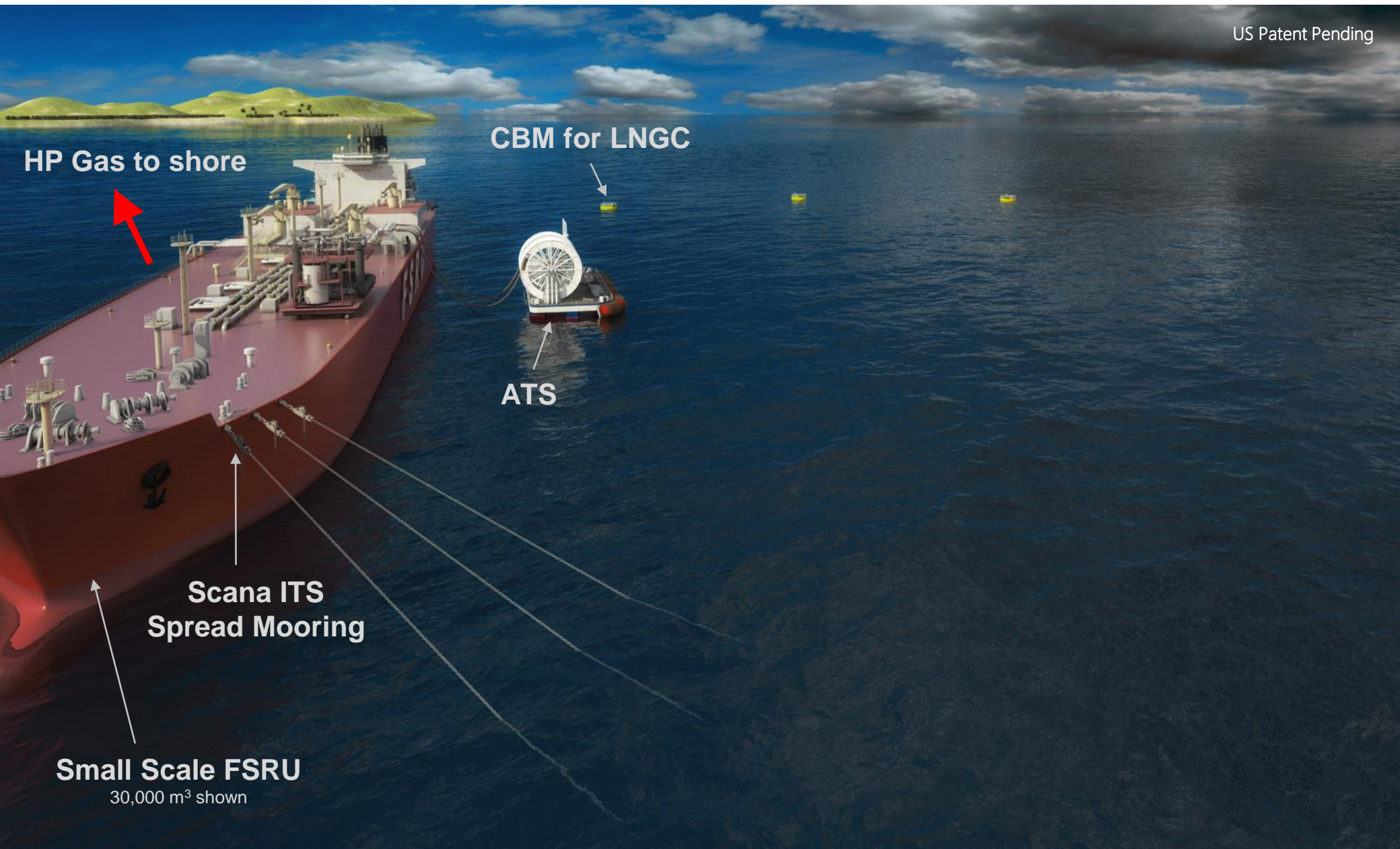
# Operation Step by Step



# ATS for FSRU | Between STS Operations



US Patent Pending



HP Gas to shore

CBM for LNGC

ATS

Scana ITS  
Spread Mooring

Small Scale FSRU

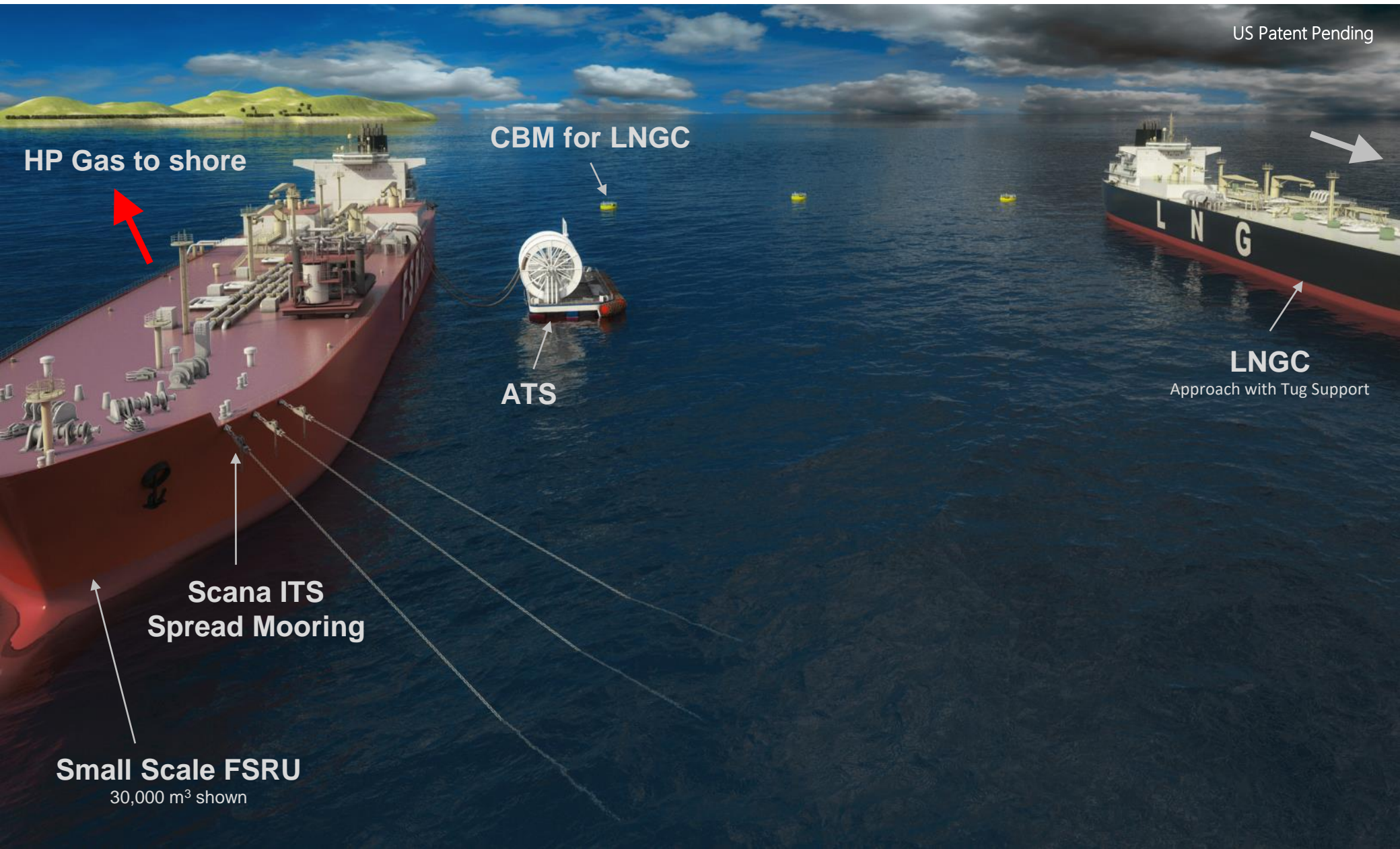
30,000 m<sup>3</sup> shown



# ATS for FSRU | LNGC Arriving



US Patent Pending



HP Gas to shore

CBM for LNGC

ATS

LNGC

Approach with Tug Support

Scana ITS  
Spread Mooring

Small Scale FSRU

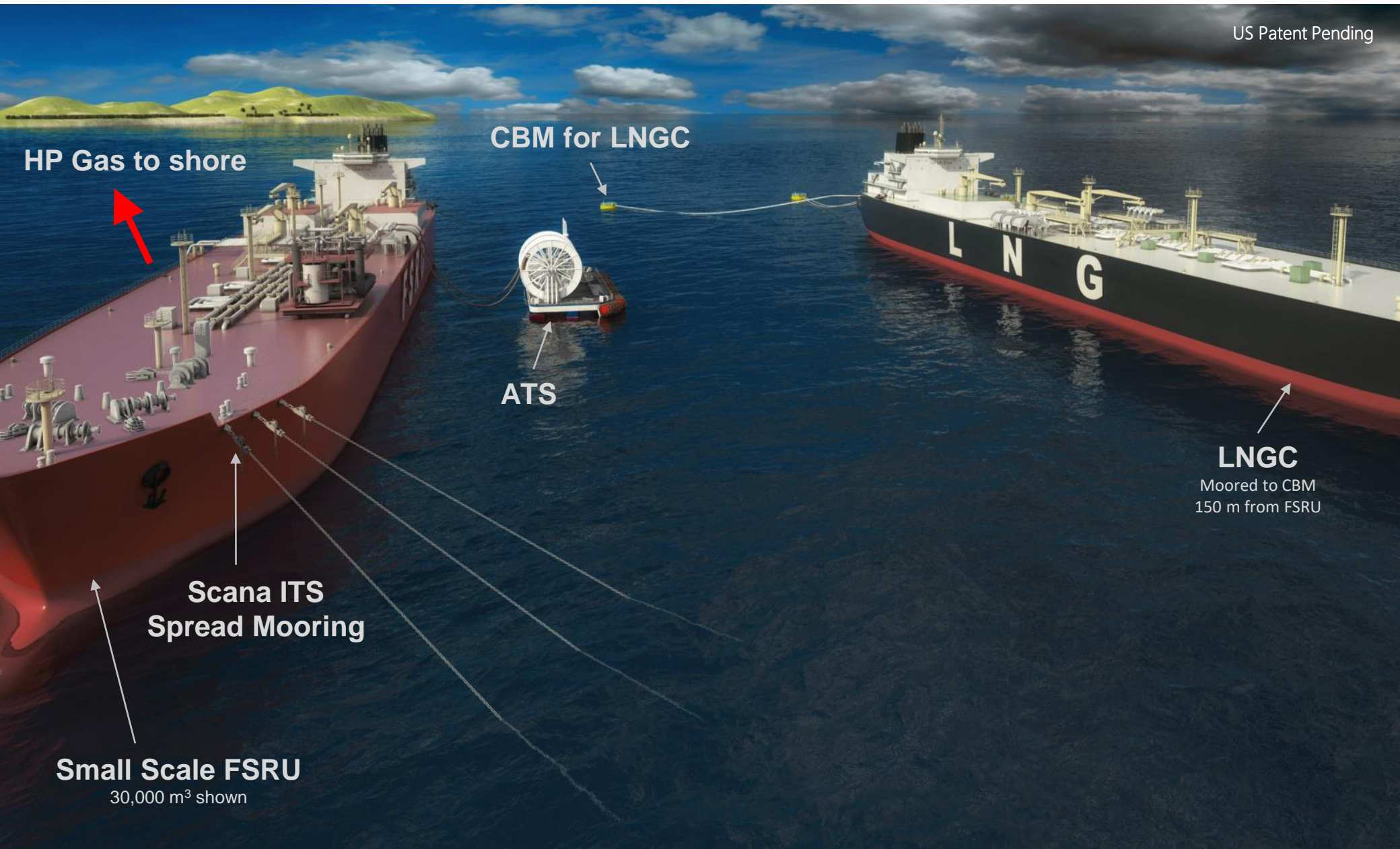
30,000 m<sup>3</sup> shown



# ATS for FSRU | LNGC Moored



US Patent Pending



HP Gas to shore

CBM for LNGC

ATS

LNGC

Moored to CBM  
150 m from FSRU

Scana ITS  
Spread Mooring

Small Scale FSRU

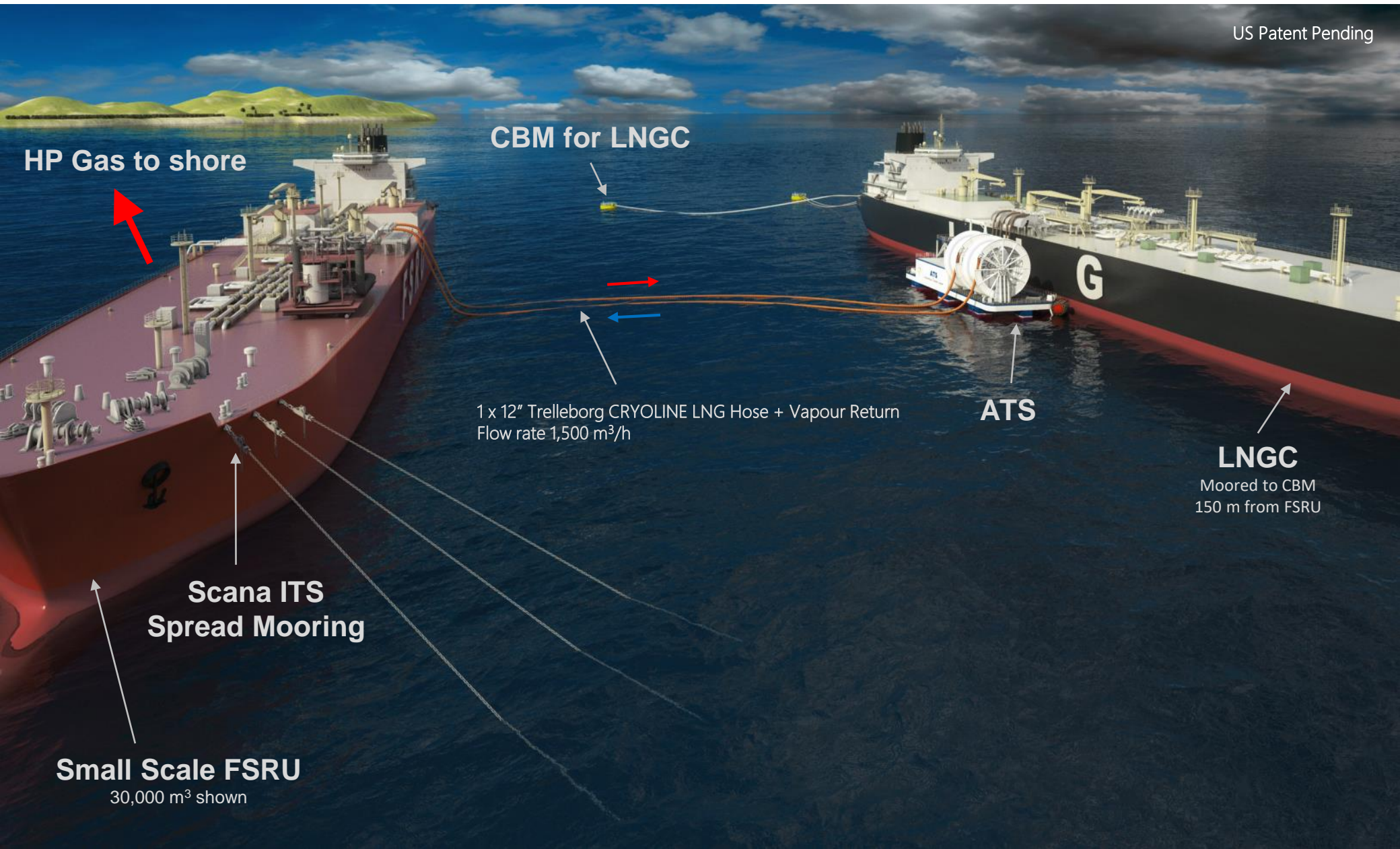
30,000 m<sup>3</sup> shown



# ATS for FSRU | LNG Transfer



US Patent Pending



HP Gas to shore

CBM for LNGC

1 x 12" Trelleborg CRYOLINE LNG Hose + Vapour Return  
Flow rate 1,500 m³/h

ATS

LNGC

Moored to CBM  
150 m from FSRU

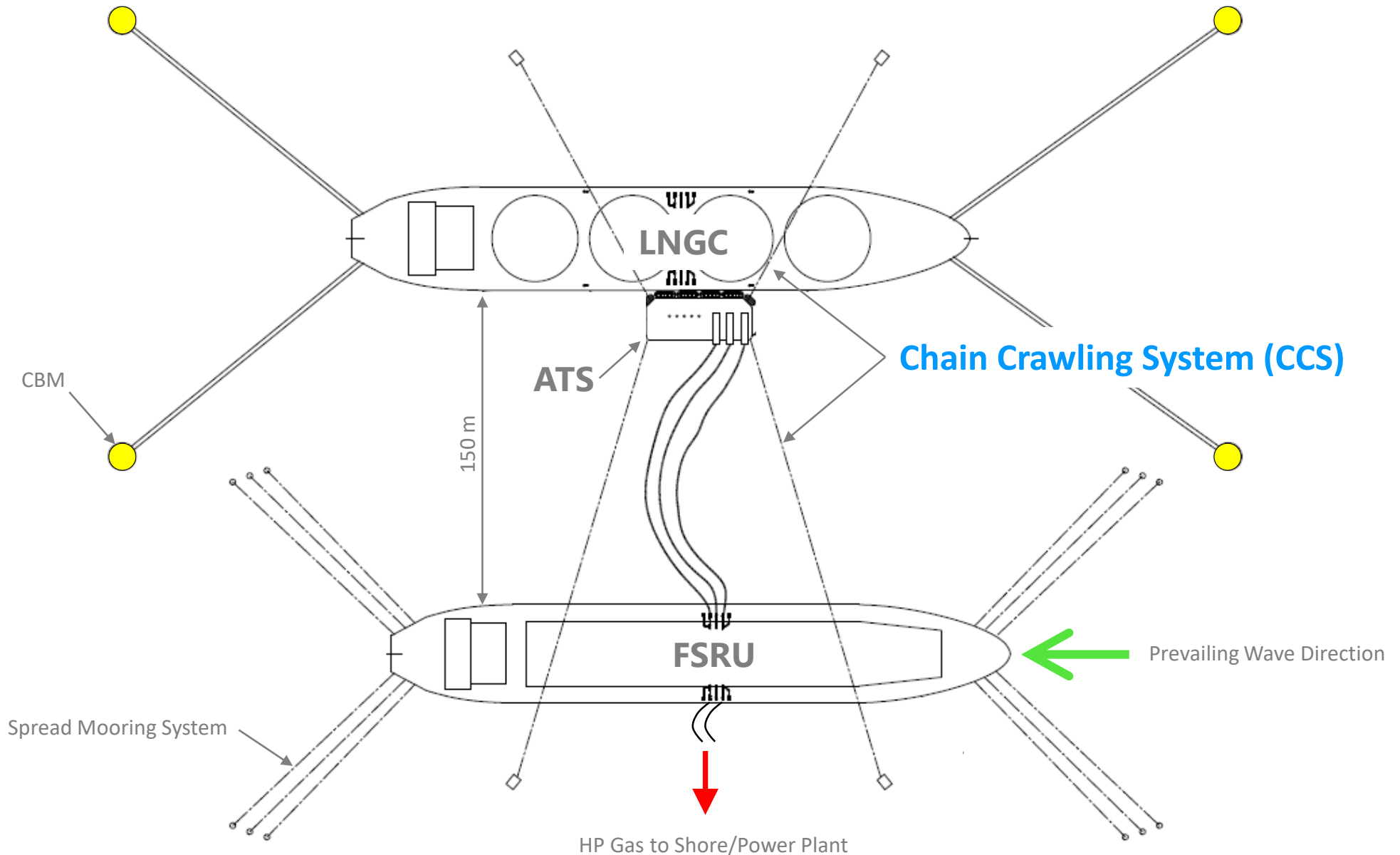
Scana ITS  
Spread Mooring

Small Scale FSRU

30,000 m³ shown

# Chain Crawling System (CCS)

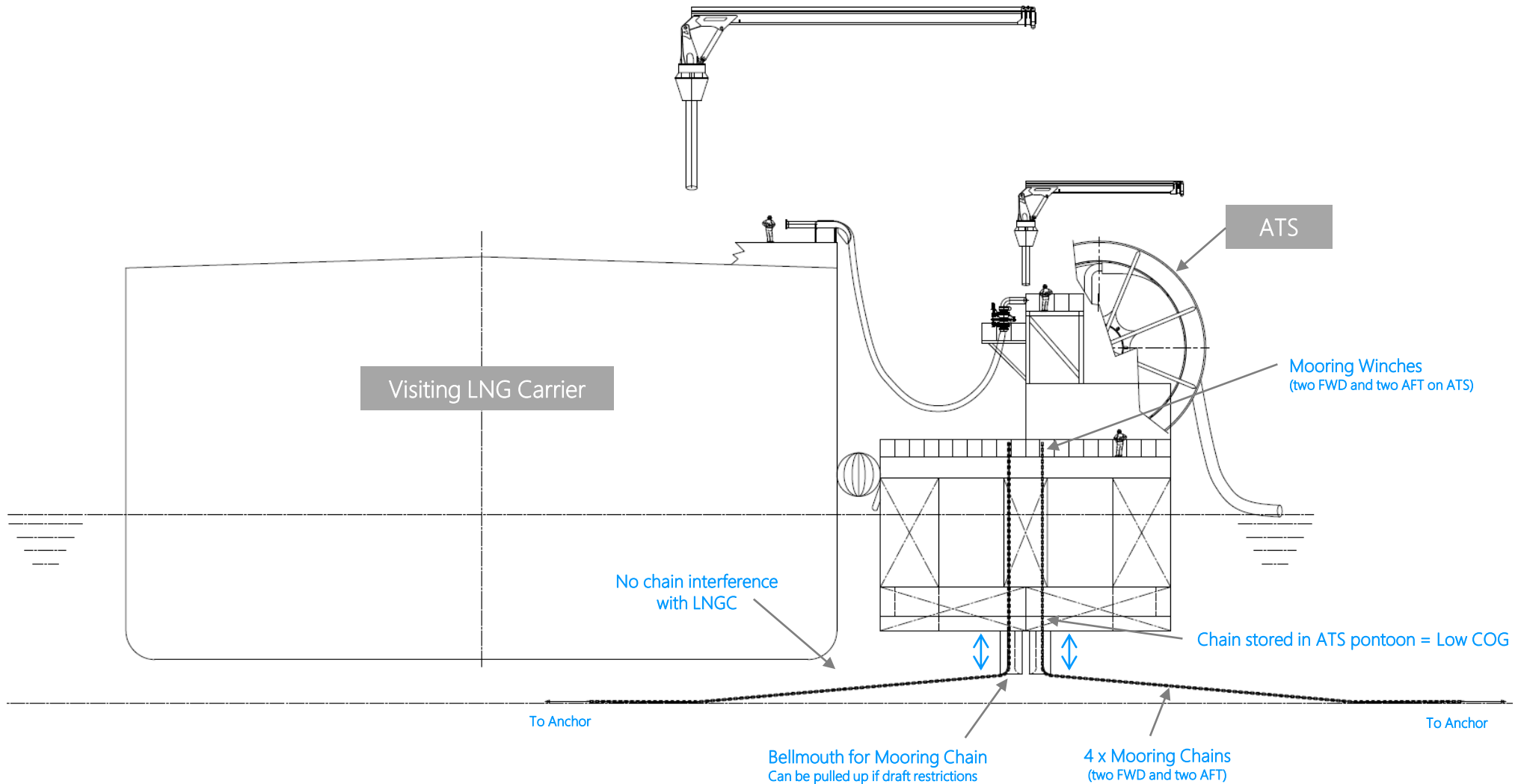
US Patent Pending



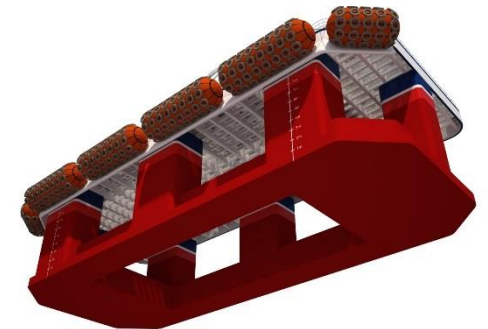
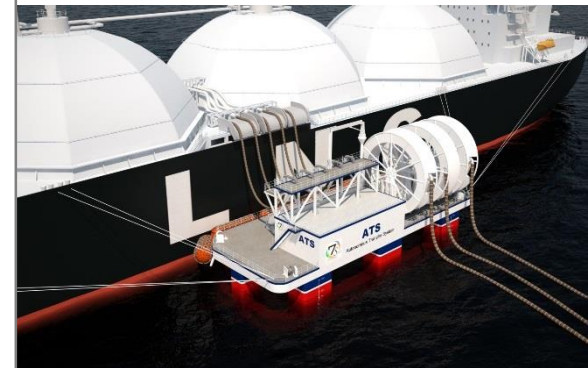
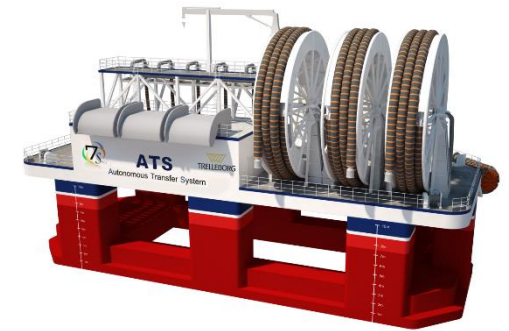


# Chain Crawling System (CCS)

US Patent Pending



# ATS for Offshore LNG FSU





# ATS for Offshore LNG FSU



CBM for LNGC

LNGC

ATS

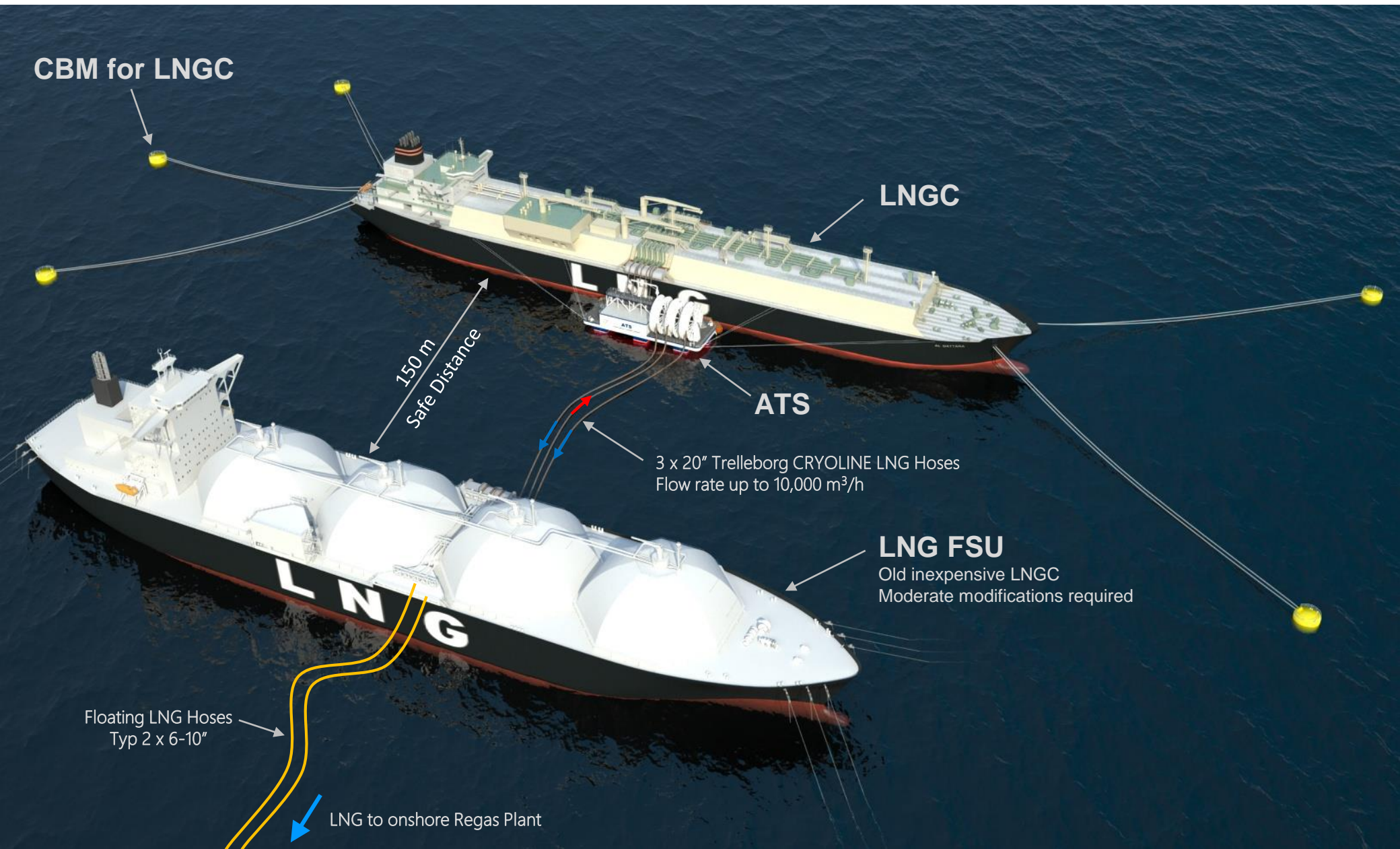
3 x 20" Trelleborg CRYOLINE LNG Hoses  
Flow rate up to 10,000 m<sup>3</sup>/h

LNG FSU

Old inexpensive LNGC  
Moderate modifications required

Floating LNG Hoses  
Typ 2 x 6-10"

LNG to onshore Regas Plant





# ATS for Offshore LNG FSU



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

**LNG FSU**

Old inexpensive LNGC  
Moderate modifications required



## ■ COST

- Significant cost reduction compared to jetty moored FSRU/FSU

## ■ AVAILABILITY AND UPTIME

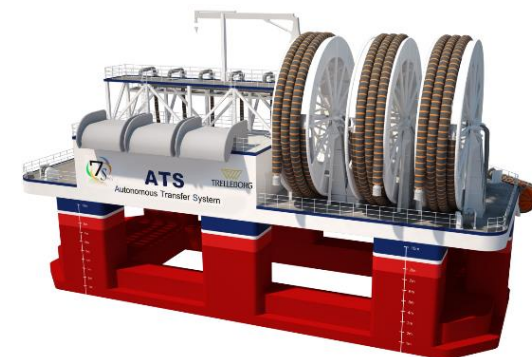
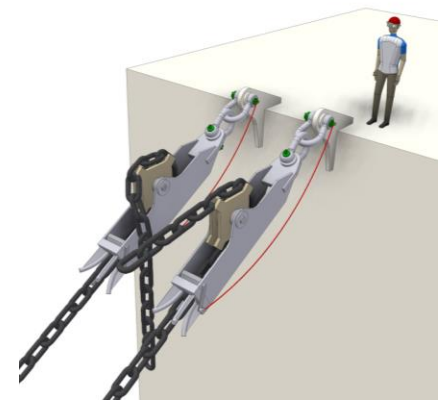
- Spread Mooring System designed for permanent mooring of the FSRU/FSU - no need to disconnect in extreme weather  
= Ensures 100% gas delivery regularity
- ATS enables high STS availability - vessels independently moored at 150 m distance - particular important in swell conditions
- All systems floating = Tsunami and Earthquake resistant

## ■ SAFETY

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

## ■ SCHEDULE

- Minimized infrastructure - Reduced schedule = Quicker gas to market



# Project Model







**Technology License**

+

**Class Approved  
Design Package**

+

**Engineering Support**

Engineering Partner:



**EPCI  
Companies**

**Detail Engineering**

+

**Construction**

+

**Installation**



**Turn Key Delivery**

**End  
Clients**

**LNG Project  
Developers**

**Power Plant  
Developers**

**Oil & Gas Companies**

**LNG Suppliers**

## JETTY-LESS

Floating Jetty-Less  
LNG Transfer 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

Same ATS design  
- multiple locations  
Design one - Build many  
- Relocatable

## OWN OR LEASE

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

## SAFETY

Unmanned during  
LNG transfer - Safe  
Quick disconnection  
capability - Terminal  
leaving ship



# For additional information, please contact:

7 Seas LNG & Power AS  
Grimstad - Norway

Svein B. Hellesmark  
President

Phone: +47 37 40 01 00

E-mail : [sbh@7Seas.no](mailto:sbh@7Seas.no)

[www.7Seas.no](http://www.7Seas.no)

