Navigation & Piloting

Trelleborg Marine & Infrastructure

June 2023

TRELLEBORG

Agenda

I. Company Overview

II. Maritime Pilot Needs

III. SafePilot Solutions:

    i. SafePilot Pro

    ii. SafePilot Offshore

    iii. SafeCaptain

    iv. SafeTug

    v. SafeCrane

IV. Hardware Range

V. Buy or Lease?

TRELLEBORG MARINE & INFRASTRUCTURE

TRELLEBORG

Trelleborg Marine & Infrastructure
Business unit overview

6 Factories

5 Technical Centers

~1000 Employees

Oil & Gas Transfer

Marine Systems

Navigation & Piloting

Marine Construction

Infrastructure

TRELLEBORG

Trelleborg Marine & Infrastructure

Business unit overview

6 Factories

5 Technical Centers

~1000 Employees

Oil & Gas Transfer

Marine Systems

Navigation & Piloting

Marine Construction

Infrastructure

TRELLEBORG

N&P Milestones

1995

Docking & Mooring product line started

1998

First PPU introduced

1988

Marimatech was founded.
Hydrographic survey equipment and software

TRELLEBORG MARINE & INFRASTRUCTURE

TRELLEBORG

2013
SafePilot introduced

2017
Docking & Mooring production
closed down

2016
Marimatech acquired by Trelleborg

2018 ➢
Sole focus on Navigation and
Piloting

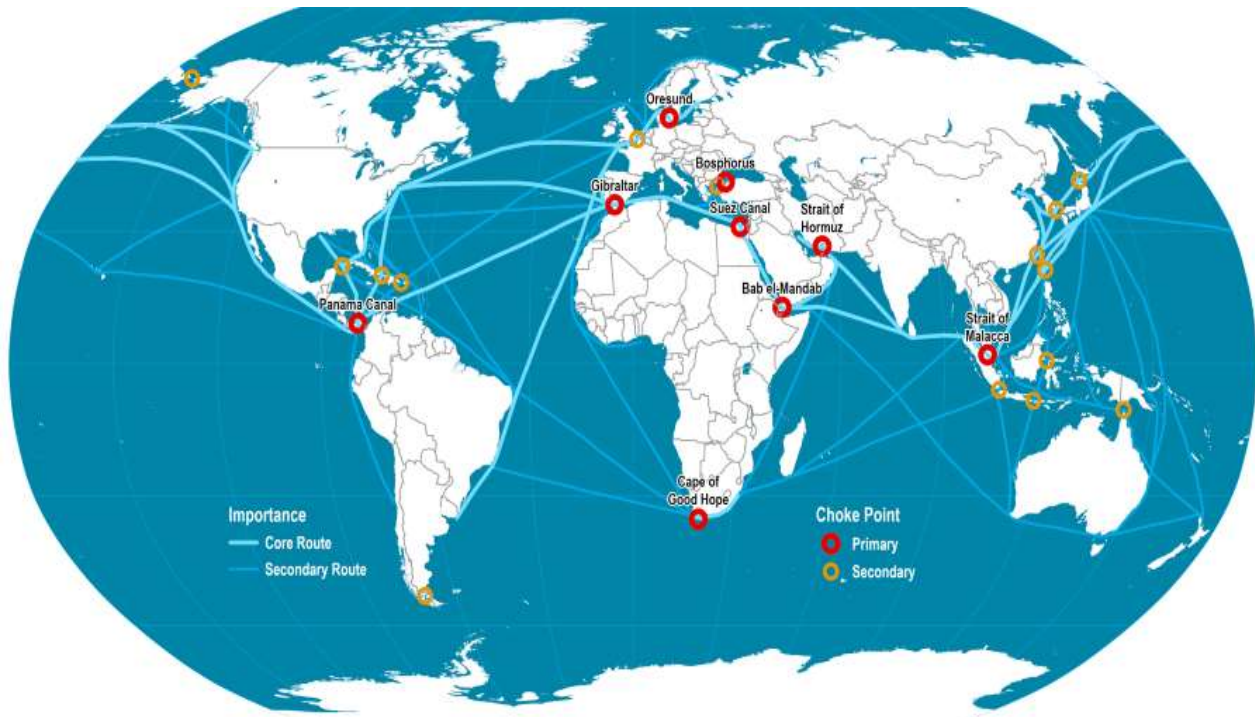TRELLEBORG MARINE & INFRASTRUCTURE

TRELLEBORG

Trelleborg Marine & Infrastructure

A pioneer in navigation and piloting solutions

25+
years as
a pioneer

TRELLEBORG

TRELLEBORG MARINE & INFRASTRUCTURE

TRELLEBORG MARINE & INFRASTRUCTURE

TRELLEBORG

Global maritime industry

Overview

Key facts	Demand drivers

90%
of global trade
is seaborne
(~850 ports)

+160%
TEU* capacity of
container vessels
since 2000

Outdated port
infrastructure

Increasing
vessel size

Quicker
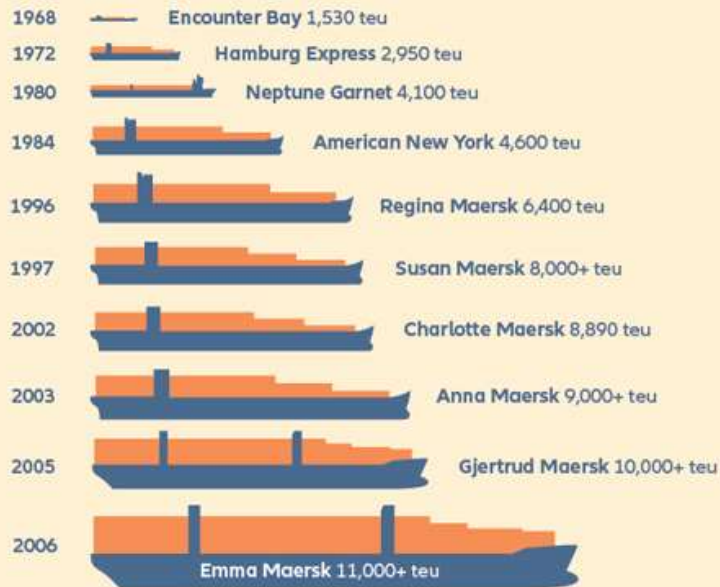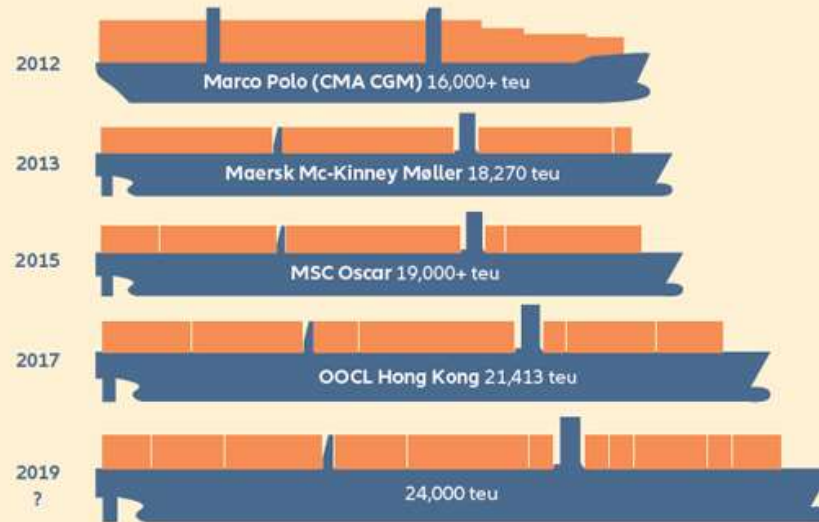turnaround

Sustainability

TRELLEBORG

50 Years of Container Ship Growth

50 YEARS OF CONTAINER SHIP GROWTH

Container-carrying capacity has increased by around **1,500% since 1968** and has almost doubled over the past decade

- 1968 — Encounter Bay 1,530 teu
- 1972 — Hamburg Express 2,950 teu
- 1980 — Neptune Garnet 4,100 teu
- 1984 — American New York 4,600 teu
- 1996 — Regina Maersk 6,400 teu
- 1997 — Susan Maersk 8,000+ teu
- 2002 — Charlotte Maersk 8,890 teu
- 2003 — Anna Maersk 9,000+ teu
- 2005 — Gjertrud Maersk 10,000+ teu
- 2006 — Emma Maersk 11,000+ teu

- 2012 — Marco Polo (CMA CGM) 16,000+ teu
- 2013 — Maersk Mc-Kinney Møller 18,270 teu
- 2015 — MSC Oscar 19,000+ teu
- 2017 — OOCL Hong Kong 21,413 teu
- 2019 ? — 24,000 teu

Approximate ship capacity data: Container-transportation.com; AGCS

Source: Allianz Global Corporate & Specialty (AGCS)

TRELLEBORG

Maritime Pilot

The pilot's main role is **handling ships on and off the port wharfs and facilities and ensuring the safe transit of shipping in and out of port during what is recognized as the high-risk element of a ship's passage**.

TRELLEBORG

Maritime Pilot

The pilot's main role is **handling ships on and off the port wharfs and facilities and ensuring the safe transit of shipping in and out of port during what is recognized as the high-risk element of a ship's passage**.

- Level of independency needed?
- How many Transit / How busy?
- Can you use vessel instrument – Heading?
- How long is each transit?
- What is the level of accuracy needed?
- LNG tanker?
- Is there corrections available?
- Do you need UKC information?

TRELLEBORG

TRELLEBORG MARINE & INFRASTRUCTURE
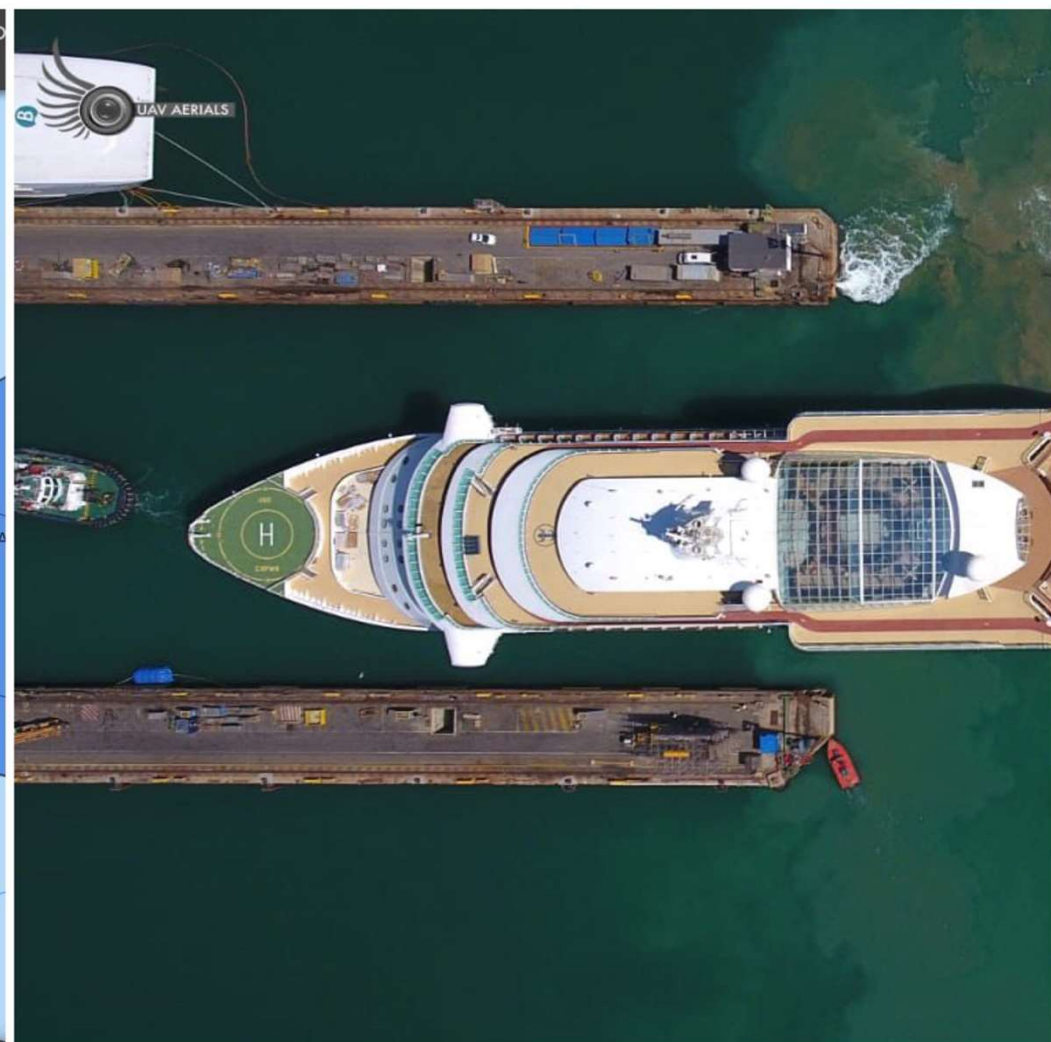
What we offer

Hardware

- PPU, different models

- Solution determines what's necessary

Software

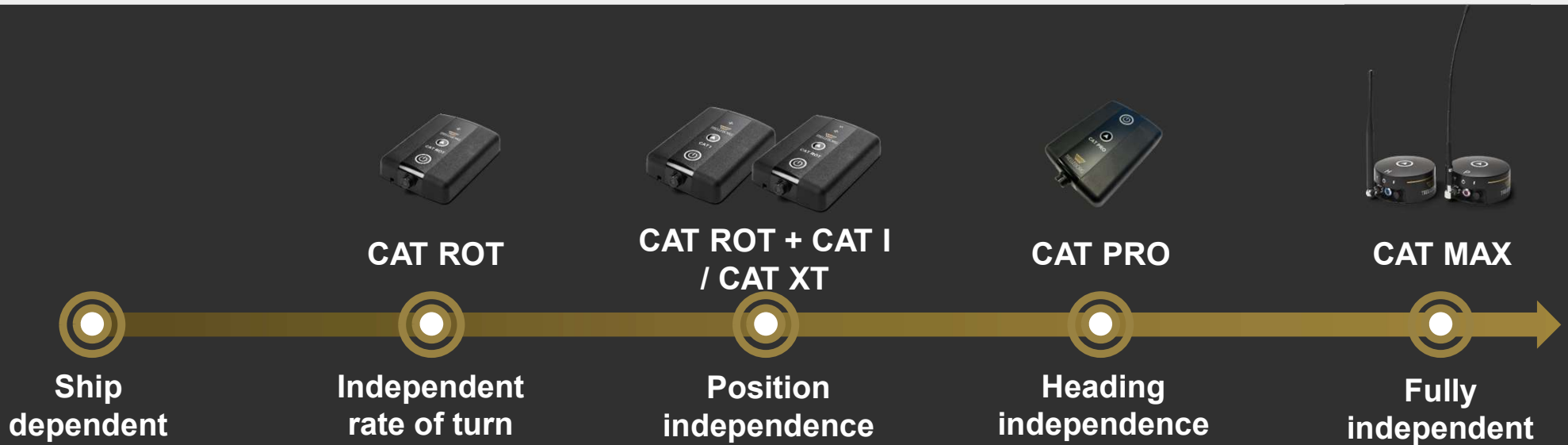- Modules includes navigation data, planning function, route, arrival times, recordings, chart handling, predictions and history.

- User-friendly format direct to iPad or Apple Watch.

TRELLEBORG

SafePilot
Choosing the right solution

CAT ROT

CAT ROT + CAT I / CAT XT

CAT PRO

CAT MAX

Ship dependent

Independent rate of turn

Position independence

Heading independence

Fully independent

TRELLEBORG

SafePilot
Choosing the right solution

Independent from vessel

NO → Interchangeable units

NO → **CAT ROT / CAT I**
- 60cm SBAS accuracy
- 1cm/sec speed
- <0.5°/min Rate Turn
- 0.1° Heading

YES → **CAT XT**
- 60cm SBAS accuracy
- 1cm/sec speed
- <0.5°/min Rate Turn
- 0.1° Heading

YES →

UHF corrections
Precision roll/pitch
Built in AIS receiver

NO → **CAT PRO**
- 1cm RTK accuracy
- 1cm/sec speed
- 0.1°/min Rate Turn
- 0.05° Heading

YES → **CAT MAX**
- 1cm RTK accuracy
- 1cm/sec speed
- <0.1°/min Rate Turn
- 0.01° Heading

TRELLEBORG

- Designed for pilots – by pilots
- Global market – thousands of pilots around the world
- Context based – focus on the current operation
- Modules – customized for each operation

TRELLEBORG MARINE & INFRASTRUCTURE

TRELLEBORG

TRELLEBORG MARINE & INFRASTRUCTURE

CAT PRO Modules – River / Channel Navigation

TRELLEBORG MARINE & INFRASTRUCTURE

CAT PRO Modules – Docking

TRELLEBORG MARINE & INFRASTRUCTURE

CAT PRO Modules – Locks

TRELLEBORG MARINE & INFRASTRUCTURE

SafePilot Pro

SafePilot Offshore

SmartPort Navigation Solution

SafeCaptain

SafeTug

SafeCrane

TRELLEBORG

SafePilot Offshore Video

TRELLEBORG MARINE & INFRASTRUCTURE

Offshore System Diagram — Trelleborg Marine Systems Denmark

Offloading buoy / SPM

- SPM Control Unit in Junction box EEx Zone 2
- UHF slave, GNSS Position, GNSS Heading
- Power 12/24 volt
- Solar Power Pack: Charge controller, Battery, Solar panel
- External IO (Serial / Lan / Digital):
  - 4 x RJ45 ethernet
  - 4 x RS422 / 485 / 232
  - 6 x digital input
  - 6 x digital output
  - 4 x analog input
  - Hawser tension, Battery status, Emergency release, WMS system, other (Optional)

Tanker

- iPad w. SafePilot Offshore
- AIS, GNSS, UHF slave, GNSS
- Heading unit — WiFi — Position unit
- Mobile data 3G/4G
- Cat Max RTK PPU
  - UHF
  - AIS
  - Roll / Pitch
  - 1cm position accuracy
  - 1cm/s speed accuracy
- Optional Cloud — For data exchange instead of UHF

Tug or other support vessels

- iPad w. SafeTug
- UHF slave, GNSS Position, GNSS Heading
- Mobile data 3G/4G
- SafeTug Control Unit — Fixed installation with permanent power. Optional portable system is available
- Optional Cloud — For data exchange instead of UHF

FPSO / FLNG / FSRU / On-shore

- Desktop
- 19" Rack (By others)
- SafePilot Control Unit 6U high
- UHF master, GNSS — Mounted on Monkey Island or anywhere high up
- 2 x Ecoflex 15 Antenna cable
- LAN / Ethernet
- Optional Cloud — For data exchange instead of UHF
- External IO (Serial / Lan / Digital):
  - 4 x RJ45 ethernet
  - 4 x RD422
  - 4 x RD485
  - 2 x RD232
  - 6 x digital input
  - 6 x digital output
  - 4 x analog input
  - Gyro, WMS system, AIS, DGPS POS, METEO buoy, Alarms, ESD, Other (Optional)

Data Architecture

Two different ways of exchanging information is possible. Either by UHF or by mobile data through our cloud system. For most offshore systems we recommend UHF as mobile is rarely available. For port based systems mobile data can be a better solution, due to higher bandwidth and no need for frequency allowance from authorities.

Data streams 2 way between the different systems.

The SPM Control Unit, SafeTug Control Unit and the SafePilot Control Unit are self contained units that are highly software configurable, too cater for a vast range of external I/O's.

The Tanker system is a carry onboard system that are battery powered. This systems parts communicate using a local WIFI network.

Trelleborg Marine Systems Denmark
Sommervej 31B
DK-8210 Aarhus V
Denmark
Phone: +45-86 91 22 55
e-mail: Toc.aar.sales@trelleborg.com

| MATR.: | | GENERAL TOL.: | | PROJECTION: | |
| DIM.: | | SCALE: | | | |

REV.NO.:	CHANGE:		INT.:	DATE:	TITLE:
1	Initial version		TM	2019-8	Offshore System Diagram

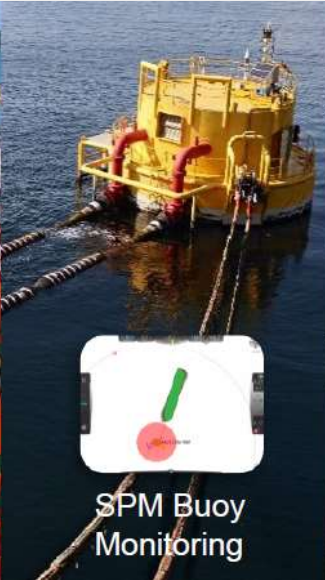| SIZE:	DRAWN BY:	AUTHORIZED COPY:	FIRST RELEASE:	DRAWING NO.:	REV.:	SHEET NO.:
A3	TGM		1.8.2019	Block Diagram of the system	1	1 of 1

SafePilot Offshore

Multiple Solutions

High Accurate Navigation | SPM Buoy Monitoring | Turret Monitoring | Manifold Alignment | Tandem Operations | STS operations

SafePilot CAT MAX

TRELLEBORG MARINE & INFRASTRUCTURE
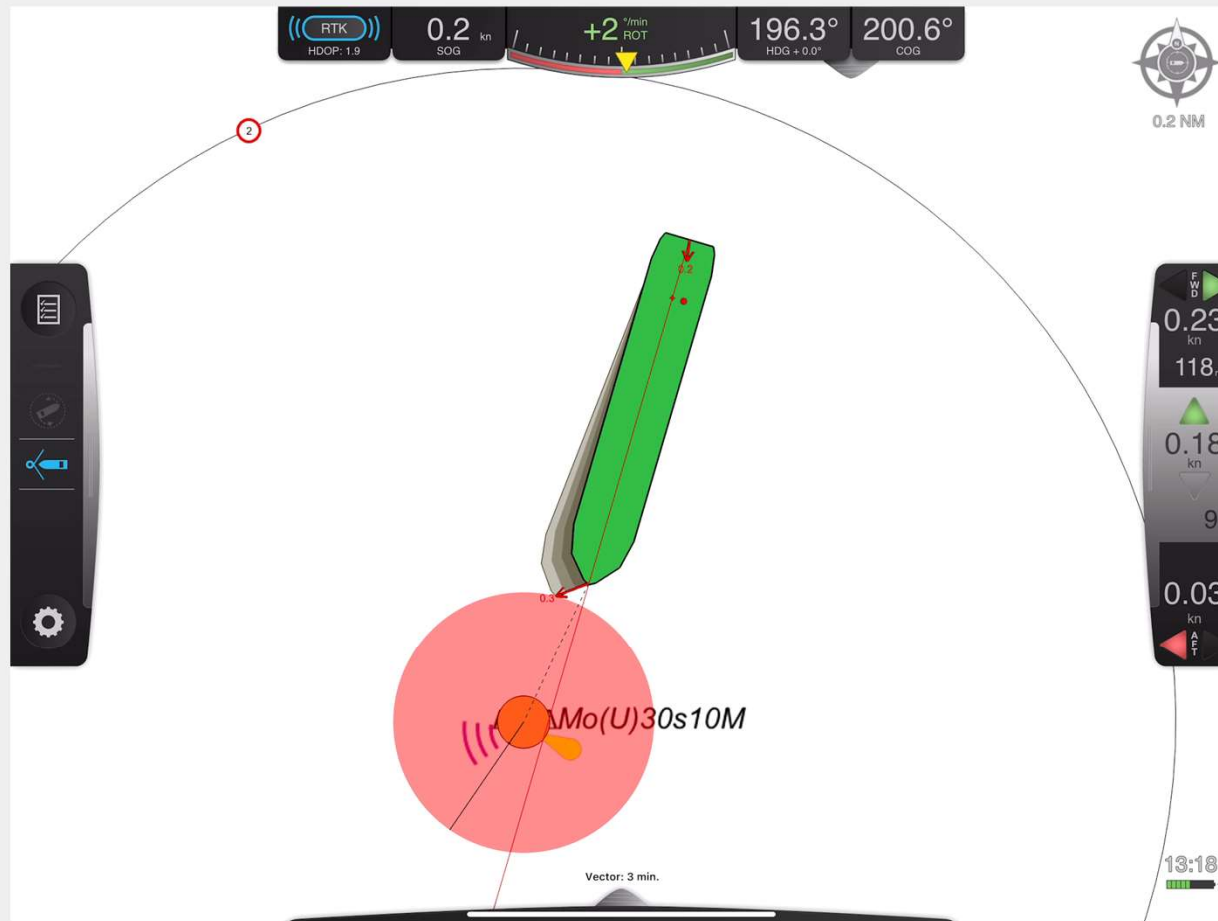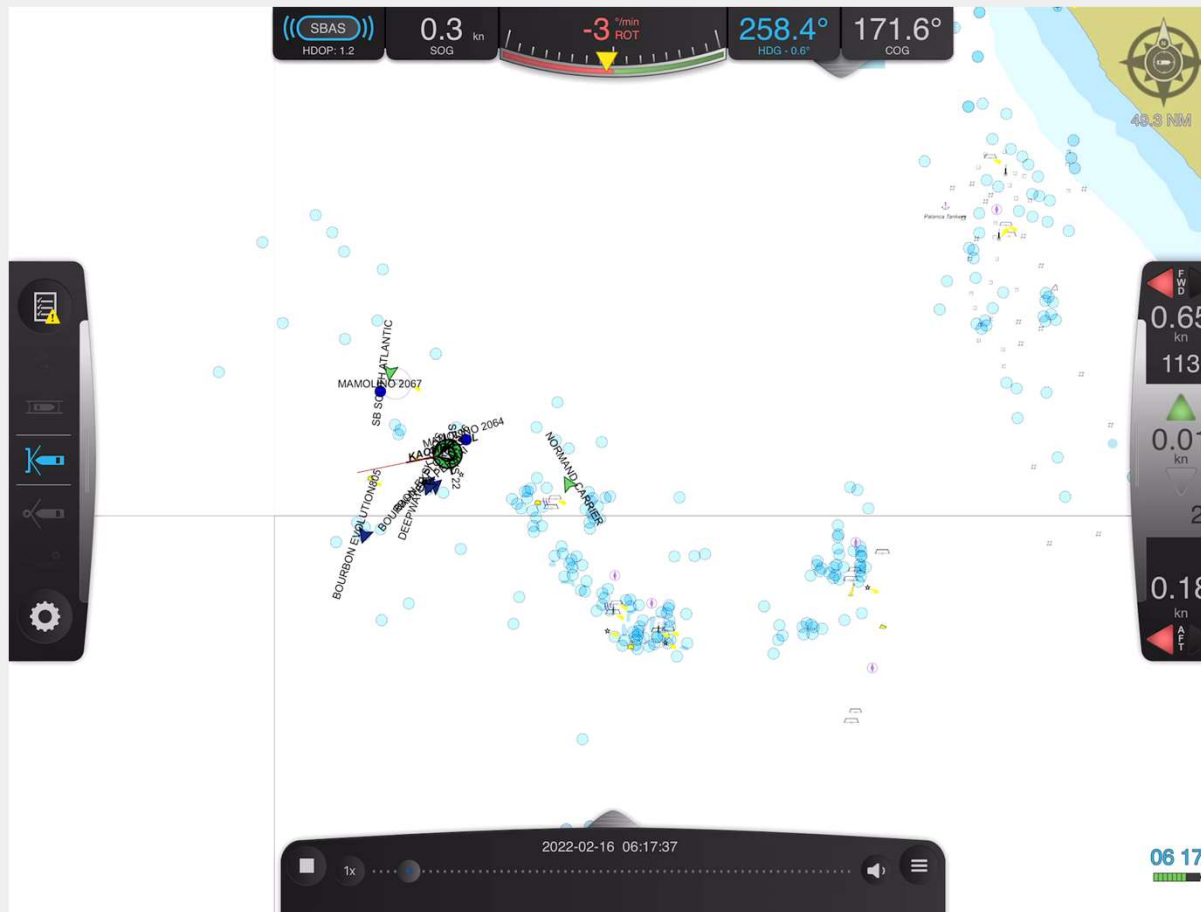
SafePilot Control Unit

SafePilot Offshore
Software Demonstration – Chevron El Segundo – Multiple Anchorage

SPM buoy operation - SafePilot
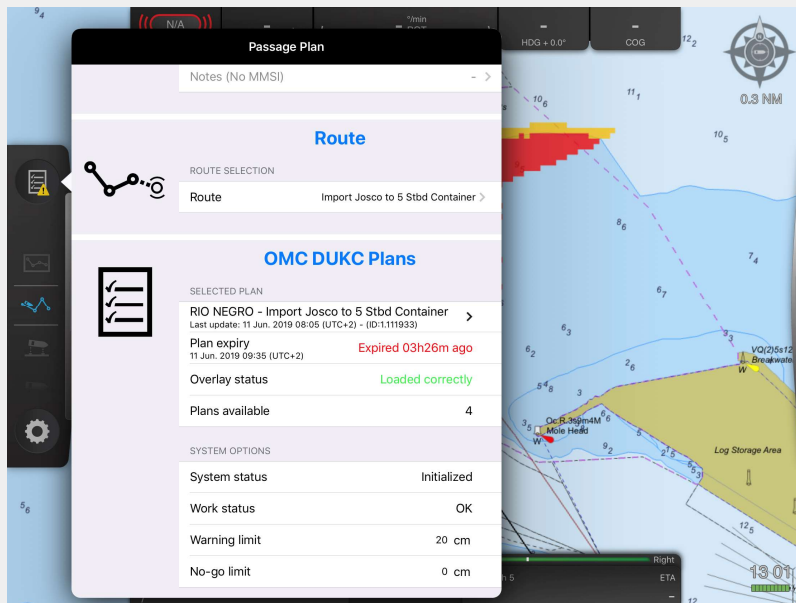
Tandem LOADING Operation – SafePilot (Total Angola)

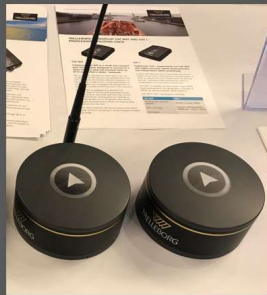# Real Time Under Keel Clearance
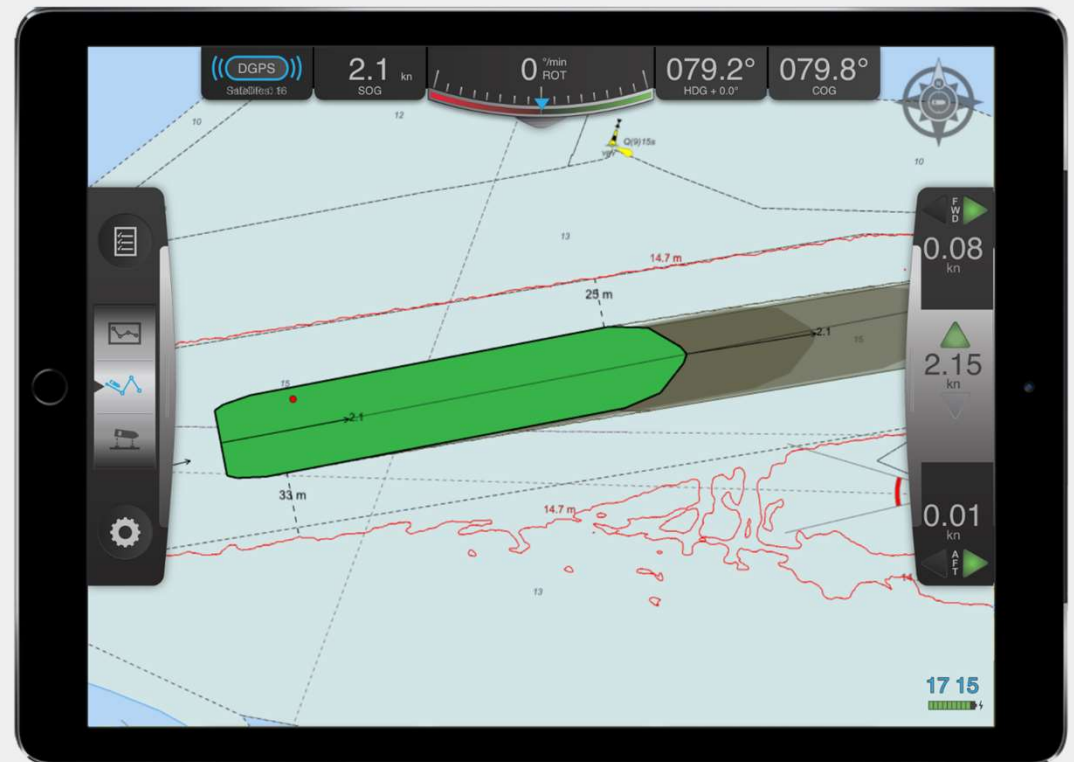
Real Time UKC

Real Time Under Keel Clearance - OMC DUKC Integration

Passage planning - UKC Plans

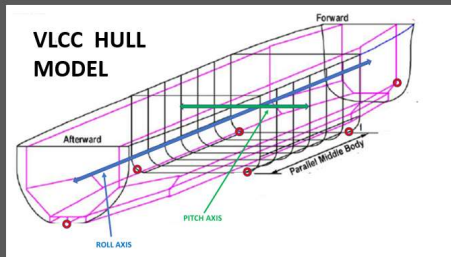# Real Time Under Keel Clearance - Long Beach

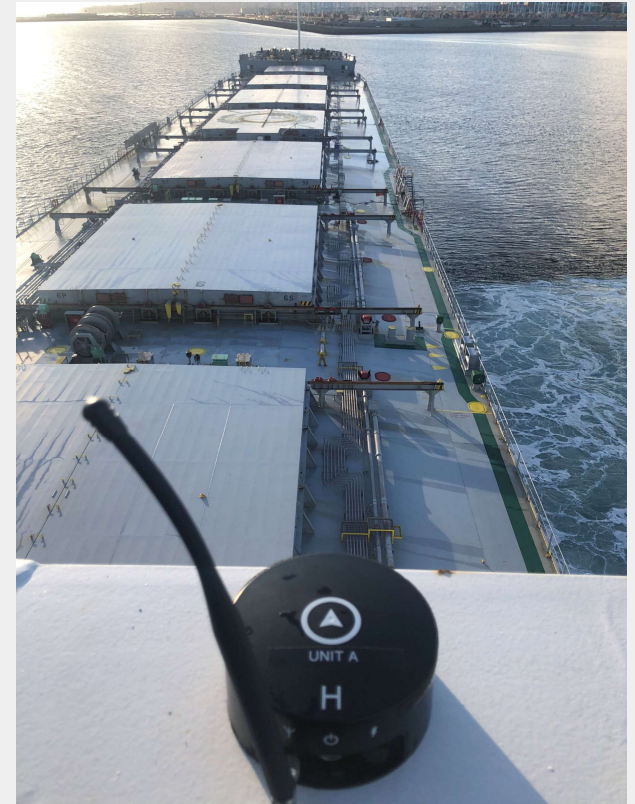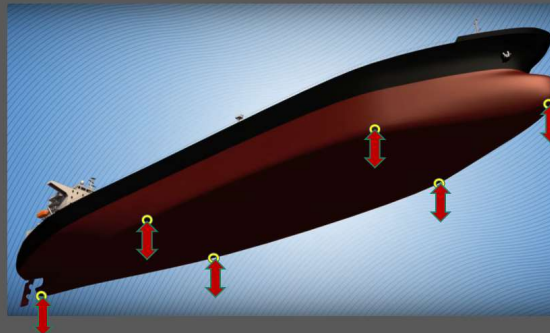**3D NAV. SYSTEM**

MULTI-BEAM BiENC CHART

LONG BEACH MAIN CHANNEL

DIGITAL HULL MODEL

VLCC HULL MODEL

Forward

Afterward

Parallel Middle Body

PITCH AXIS

ROLL AXIS

REAL-TIME UKC MONITORING

UNIT A

H

SafePilot Pro

SafePilot Offshore

SmartPort Navigation Solution

SafeCaptain

SafeTug

SafeCrane

TRELLEBORG MARINE & INFRASTRUCTURE

TRELLEBORG

TRELLEBORG MARINE & INFRASTRUCTURE

TRELLEBORG
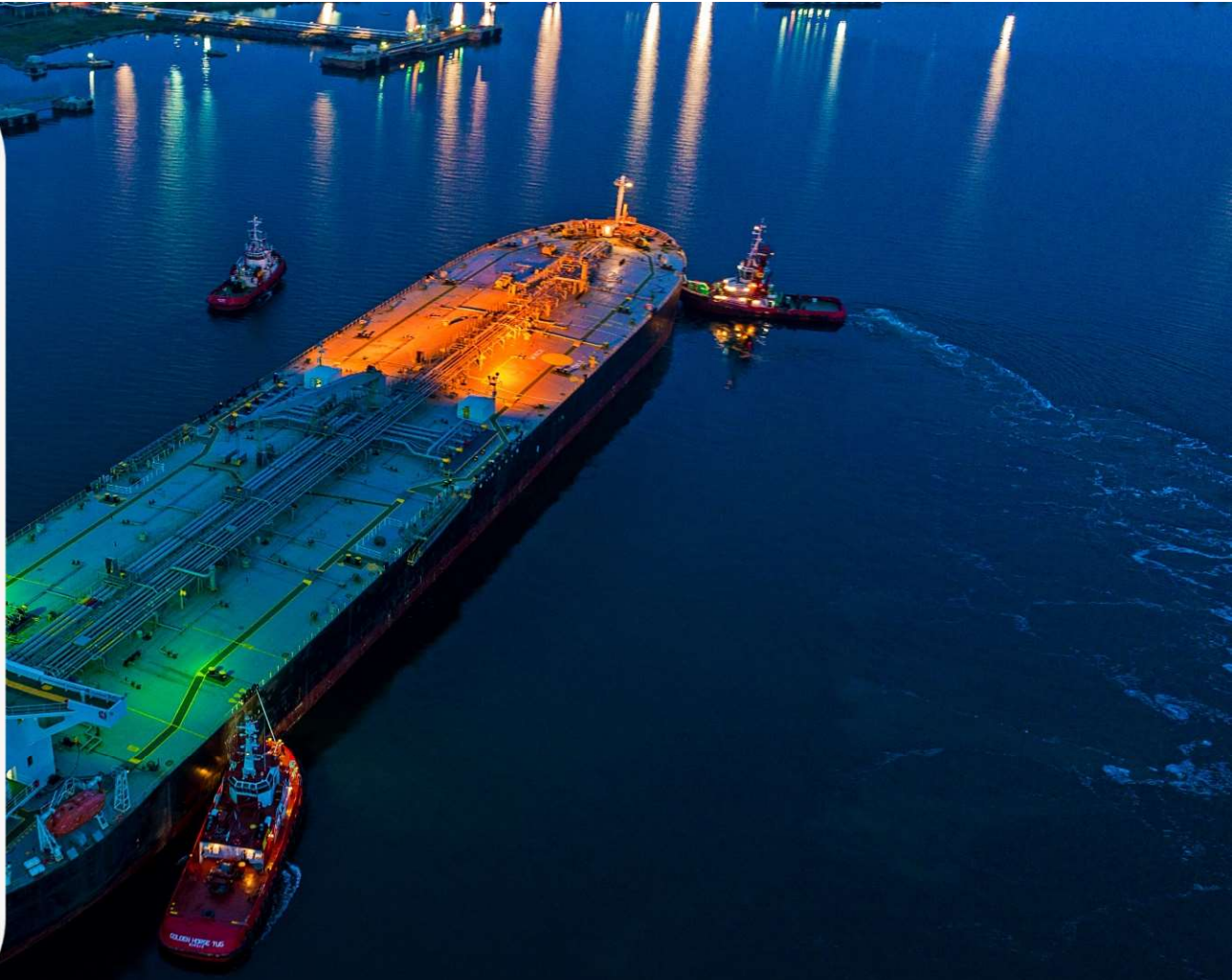
SafeTug

SafeTug - Finland

SafeTug in Operation

SafeTug Assisting
Vessel Turn

SafeTug Assisting Vessel Docking

TRELLEBORG MARINE & INFRASTRUCTURE

SafePilot Shore System
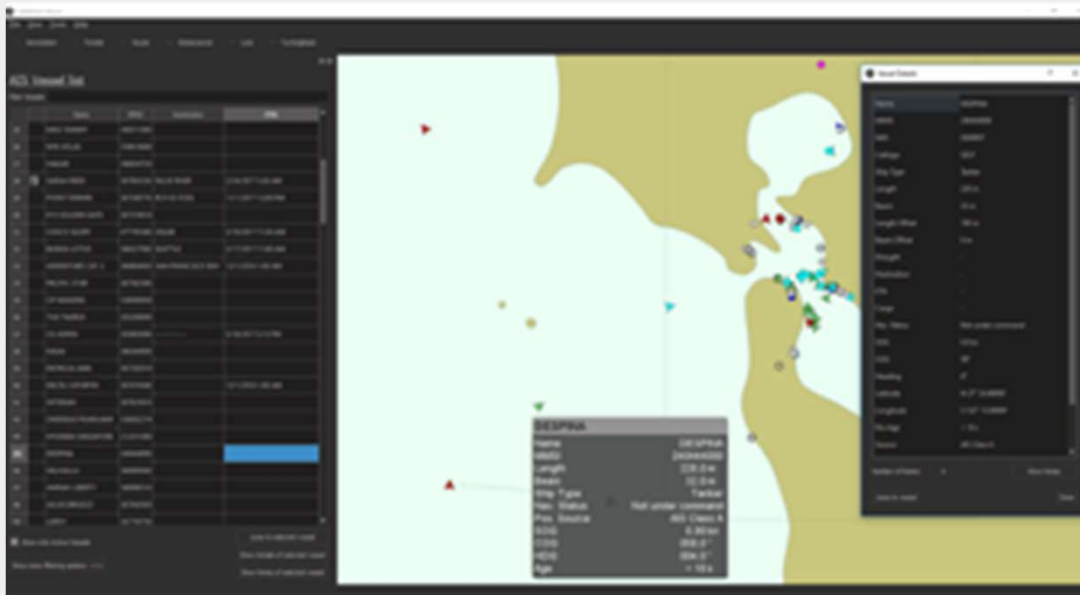
- Shore based monitoring

- Annotation sharing

- AIS / VTS integration

- Chart management

- Vessel management

- Etc…

SafeTug / SafePilot system

Vessel movement data →

Tug movement data ←

TMS Cloud

SafePilot user

Vessel movement data

Tug movement data

Assistance from
port control
in case of emergency →

Port Control
SafePilot shore user
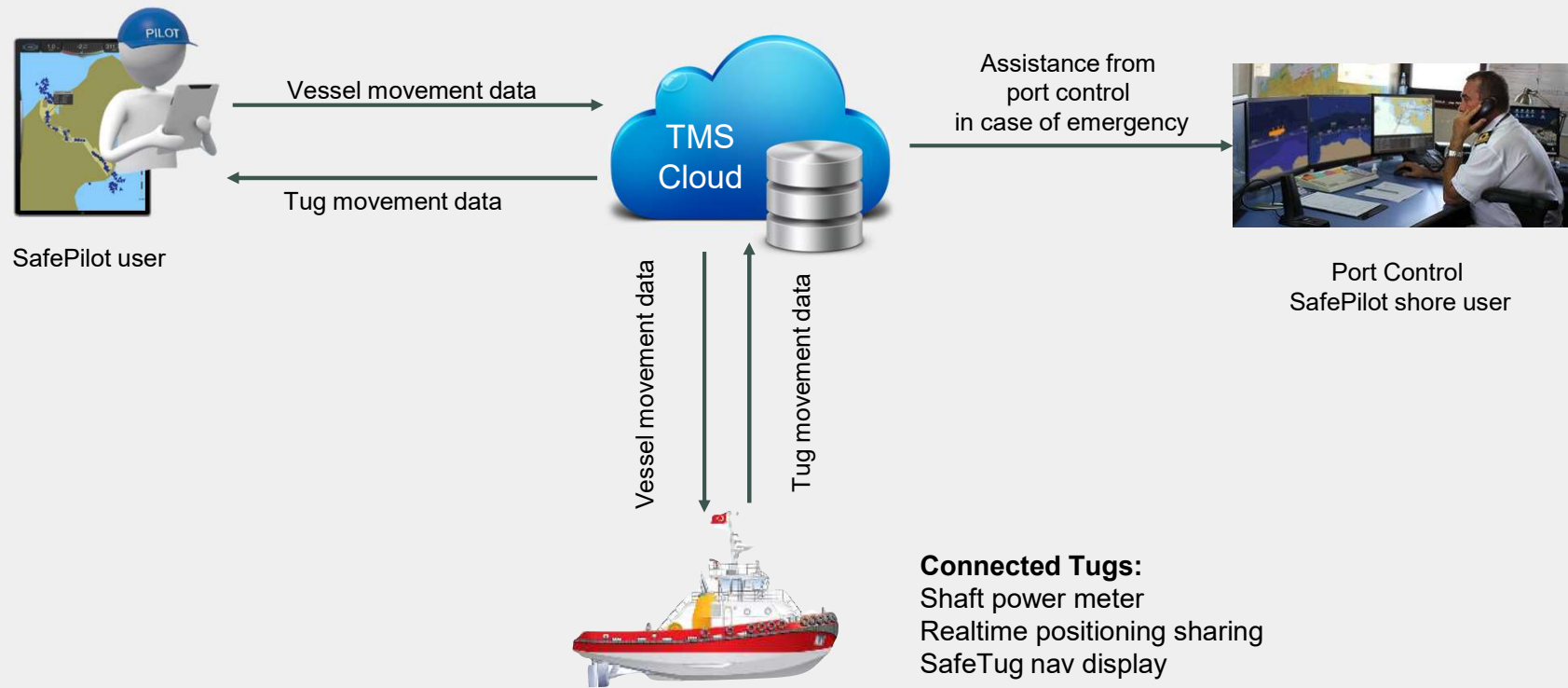
Connected Tugs:
Shaft power meter
Realtime positioning sharing
SafeTug nav display

TRELLEBORG MARINE & INFRASTRUCTURE

TRELLEBORG

SafePilot
Pro

SafePilot
Offshore

SmartPort
Navigation
Solution

SafeCaptain

SafeTug

SafeCrane

TRELLEBORG MARINE & INFRASTRUCTURE

TRELLEBORG

Navigation & Piloting
By Trelleborg

SmartPort®

Smarter solutions for efficient operations

TRELLEBORG

Conventional way of Pilotage through the Panama Canal

Setup
Boarding crew go to ship to setup gear

Pilotage
SafePilot communicates with ACP system for data exchange

Maintenance
System is charged / checked by technical crew

Pickup
Pickup equipment

Pilot
Pilot goes with SafePilot to ship

Take down
Crew boards ship to take down system

Transport
System is transported from Pacific to Atlantic side

TRELLEBORG

New way of Pilotage through the Panama Canal

Setup
Boarding crew does validation check

Pilotage
SafePilot P3 communicates with ACP system for data exchange

1 **2** **3**

Pilot
Pilot goes with SafePilot to ship

TRELLEBORG

SafePilot P3

Features

Cm accuracy

1 sec update rate

Black out battery powered

Motion sensor

Wifi to local display

UHF transponder

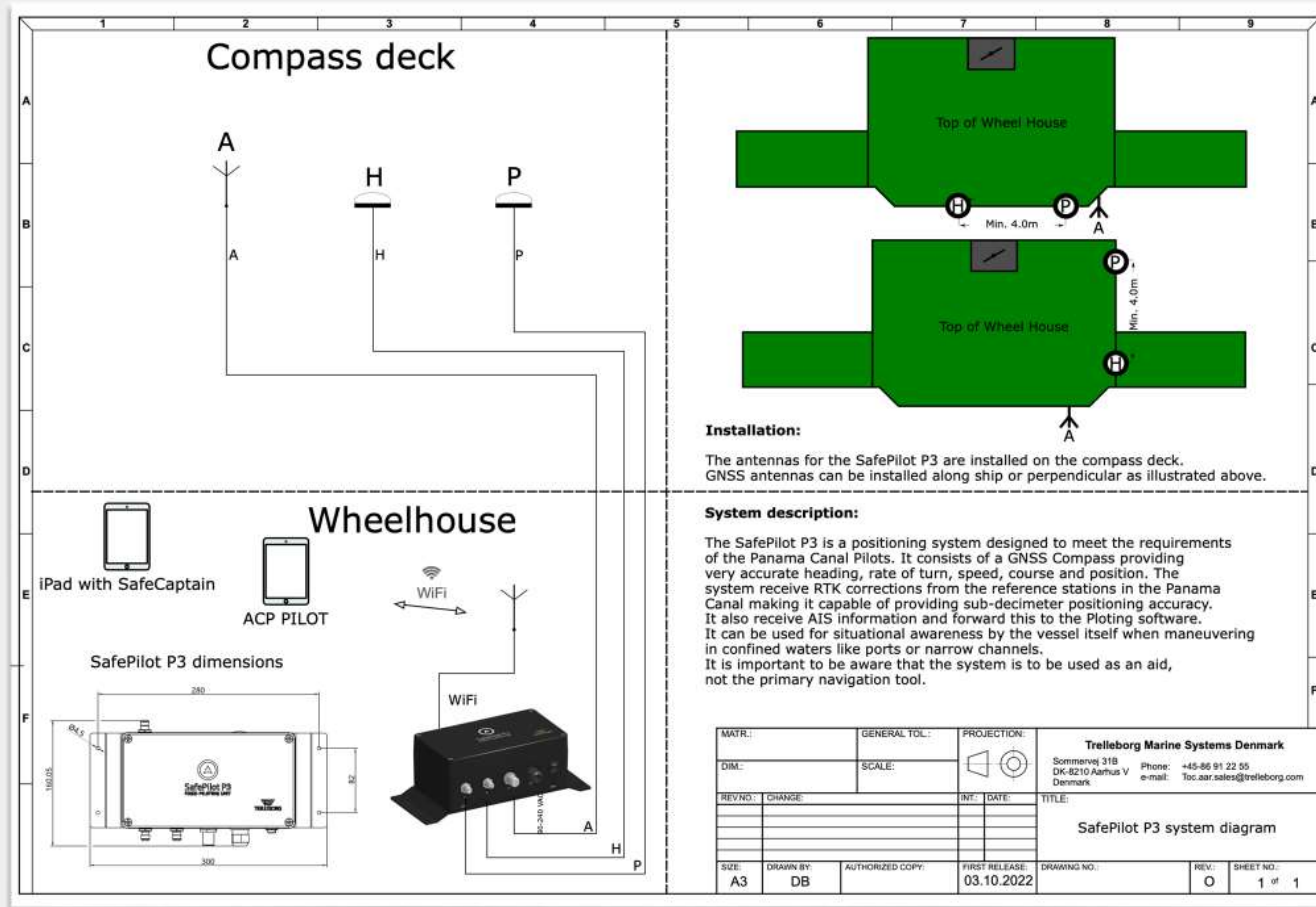AIS receiver

Dual antenna GNSS

Jamming / spoofing detection

TRELLEBORG MARINE & INFRASTRUCTURE

SafePilot P3
Contents

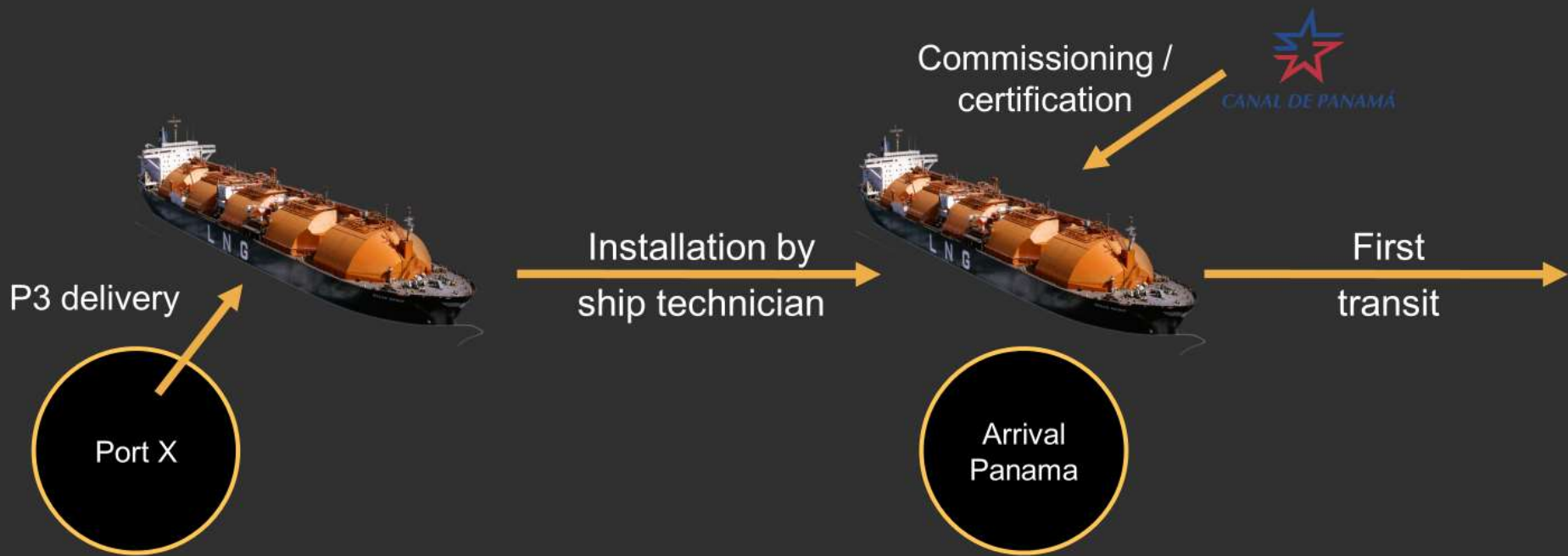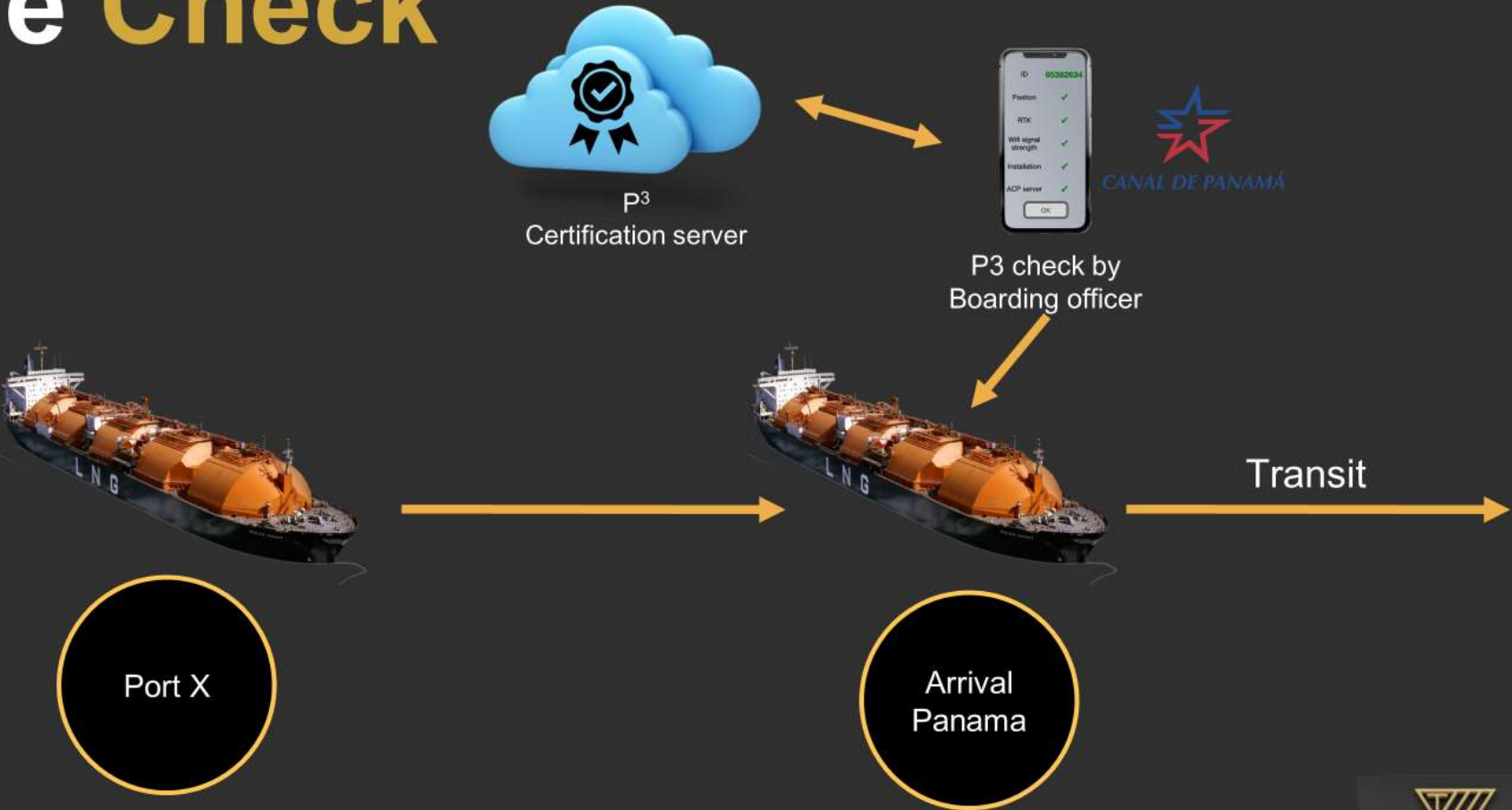|	
2 pcs.	Wi-Fi antenna – 3dBi and 9dBi
1 pc.	Wi-Fi antenna cable for roof installation(3m)
2 pc.	GNSS antenna
1 pc.	AIS antenna
3 pcs.	Mounting bracket for antenna
1 pc.	Coaxial cable for GNSS and AIS antennas (120m)
5 pcs.	TNC-connector for GNSS coaxial cable
3 pc.	N-Connector for AIS coaxial cable
7 pc.	Cable tags
1 pc.	Installation guide
1 pc.	Type plate with QR code
1 pc.	Cable ties (100 pcs)
1 pc.	Coax Connector Crimp tool
1 pc.	10m Vulcanizing tape
1 pc.	SafePilot P3 positioning unit
1 pc.	iPad with SafeCaptain
1 pc.	USB stick with related documentation

TRELLEBORG MARINE & INFRASTRUCTURE

TRELLEBORG

SafePilot P3
Technical

Compass deck

Top of Wheel House

A

H   P

Min. 4.0m

Top of Wheel House

Min. 4.0m

Installation:

The antennas for the SafePilot P3 are installed on the compass deck.
GNSS antennas can be installed along ship or perpendicular as illustrated above.

Wheelhouse

iPad with SafeCaptain

WiFi

ACP PILOT

SafePilot P3 dimensions

WiFi

System description:

The SafePilot P3 is a positioning system designed to meet the requirements
of the Panama Canal Pilots. It consists of a GNSS Compass providing
very accurate heading, rate of turn, speed, course and position. The
system receive RTK corrections from the reference stations in the Panama
Canal making it capable of providing sub-decimeter positioning accuracy.
It also receive AIS information and forward this to the Ploting software.
It can be used for situational awareness by the vessel itself when maneuvering
in confined waters like ports or narrow channels.
It is important to be aware that the system is to be used as an aid,
not the primary navigation tool.

MATR.:		GENERAL TOL:	PROJECTION:	**Trelleborg Marine Systems Denmark**		
DIM.:		SCALE:		Sommervej 31B DK-8210 Aarhus V Denmark	Phone: +45-86 91 22 55 e-mail: Toc.aar.sales@trelleborg.com	
REV.NO.:	CHANGE		INT.:	DATE:	TITLE:	
					SafePilot P3 system diagram	
SIZE: A3	DRAWN BY: DB	AUTHORIZED COPY:	FIRST RELEASE: 03.10.2022	DRAWING NO.:	REV.: O	SHEET NO.: 1 of 1

TRELLEBORG

Installation

P3 delivery

Port X

Installation by
ship technician

Commissioning /
certification

CANAL DE PANAMÁ

Arrival
Panama

First
transit

TRELLEBORG MARINE & INFRASTRUCTURE

TRELLEBORG

Pre Check

P³
Certification server

P3 check by
Boarding officer

CANAL DE PANAMÁ

Transit

Port X

Arrival
Panama

TRELLEBORG

Buy or Lease?

2023

All in price per User/Pilot

- 4 Years, only 1 year fixed

- Hardware / Software

- All in price

- After 4 years all equipment will be upgraded to last version

- Software updates included

- 24/7 support by phone

- Annual maintenance check (Optional)

Dedicated support
Throughout each project and beyond

- A certified pilot training program

- Remote and on-site training classes

- In-house technical staff with knowledge of hardware and software

- A remote factory acceptance test

- 24/7/365 emergency hotline

- On-site commissioning

- Yearly equipment checkup

- Dedicated workshops

- Spare parts
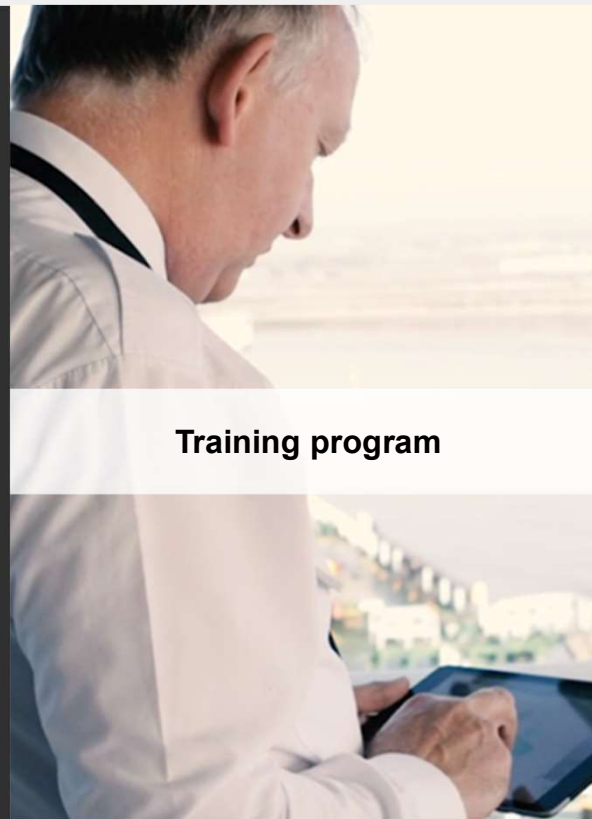
Training program

Maintenance program

TRELLEBORG

After-sales Support Maintenance and Repair Services

24/7/365 hotline phone support directly to our technical staff

Unit swap to minimize downtime

Classroom training in DK. Remote training. Onsite training.

Over-the-air updates. Cloud hosting

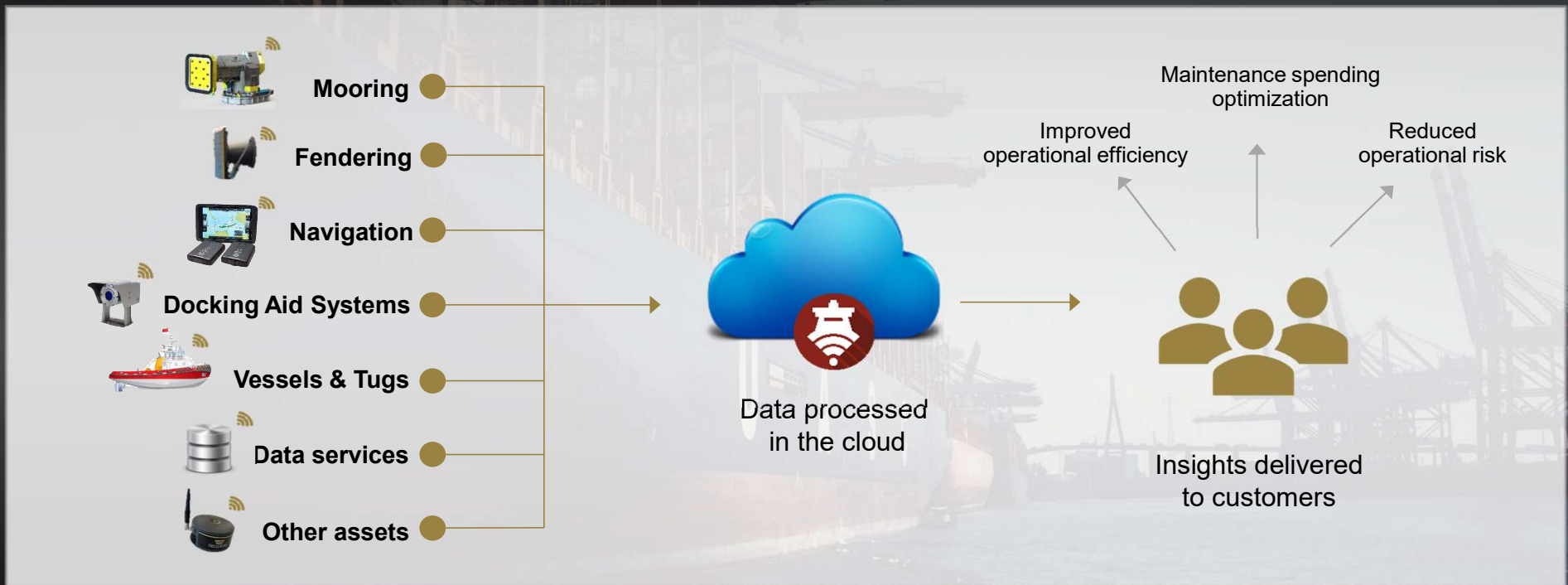3 service and support centers

Aarhus
Denmark

Melbourne
Australia

Houston
USA

TRELLEBORG

SmartPort by Trelleborg

Connecting critical assets to provide key insights for customers

Mooring

Fendering

Navigation

Docking Aid Systems

Vessels & Tugs

Data services

Other assets

Data processed in the cloud

Maintenance spending optimization

Improved operational efficiency

Reduced operational risk

Insights delivered to customers

TRELLEBORG

TRELLEBORG MARINE & INFRASTRUCTURE

ML1   Why don't we use the SmartPort visual we've purchased - the one we used in the 2022 desk calendar?
MeiLeng Lim, 12/2/2021

MA39   Done
Muge Alim, 7/2/2022