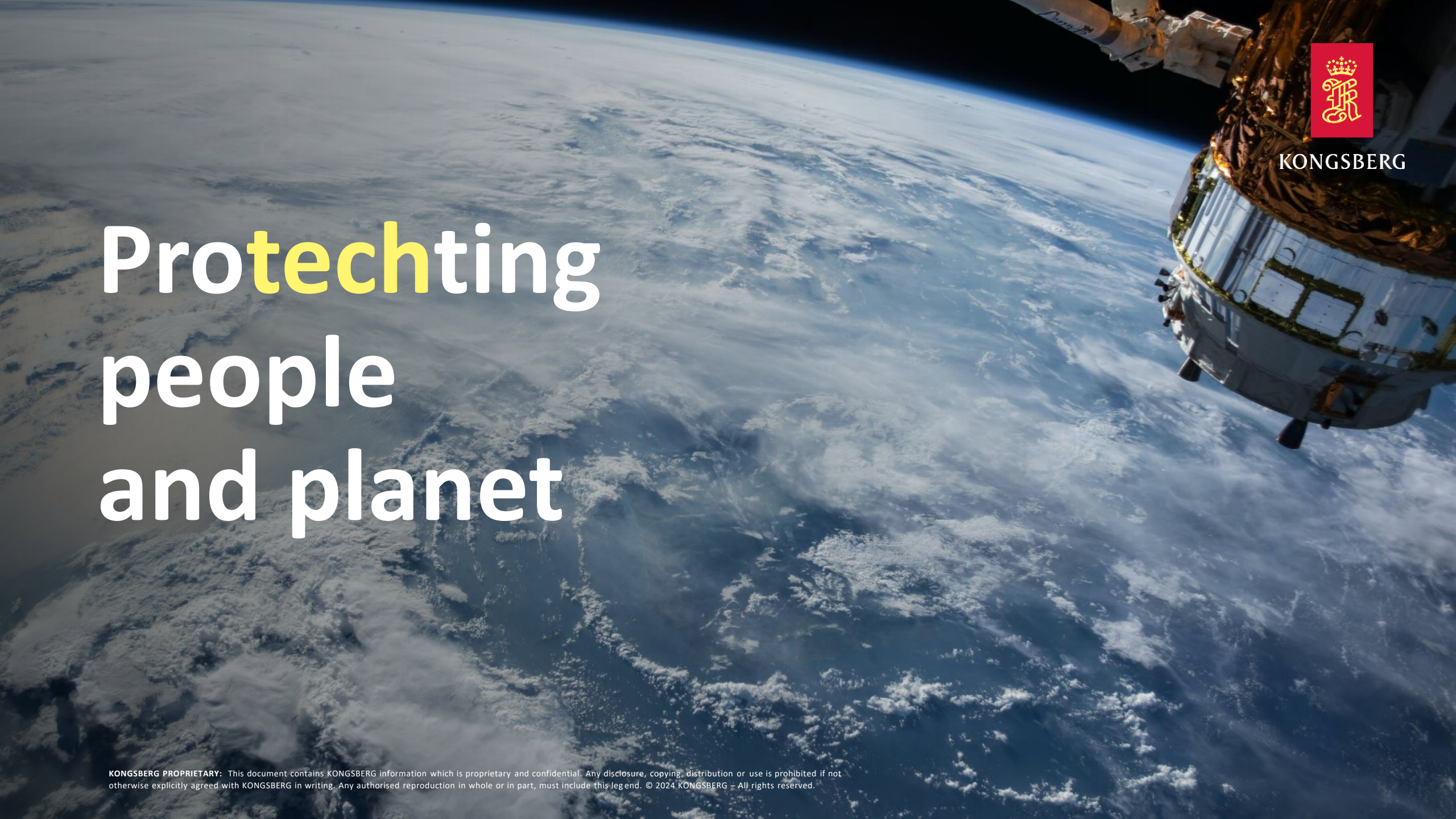

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Maritime EGNOS

EGNOS Workshop, Dublin March 13th, 2024

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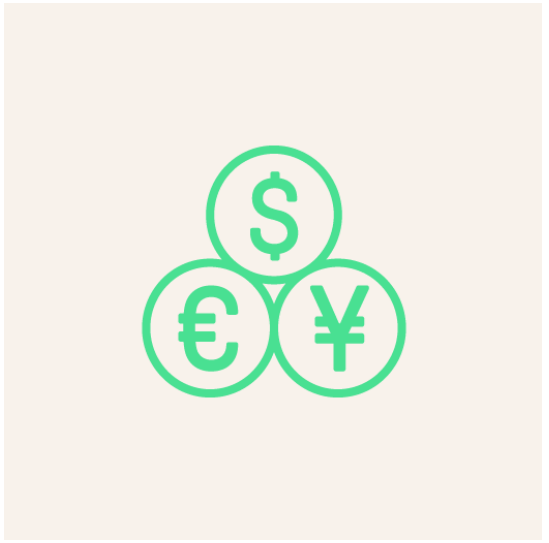
KONGSBERG Group

Size and scope (2023)

12 500 employees

40 countries

31.8 BNOK revenues



4 business areas

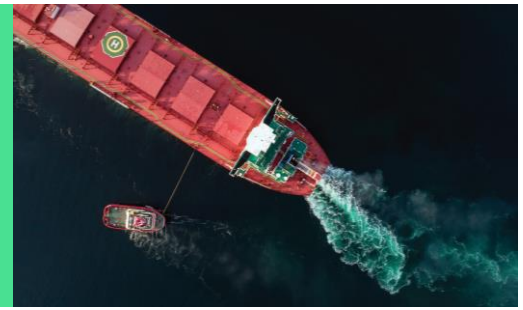
See Statement of Proprietary information

KONGSBERG Group

From deep sea to outer space

Airborne

Seaborne



Digital frontier

Landbased

Outer space

Deep sea

See Statement of Proprietary information

KONGSBERG Group

Four strong business areas

Kongsberg Maritime

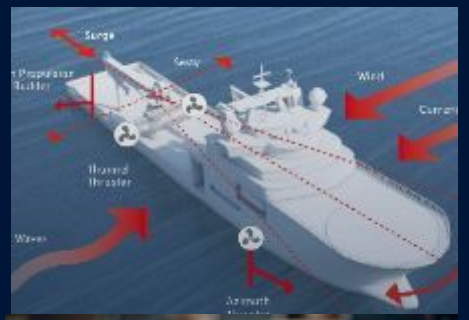
Kongsberg
Defence & Aerospace

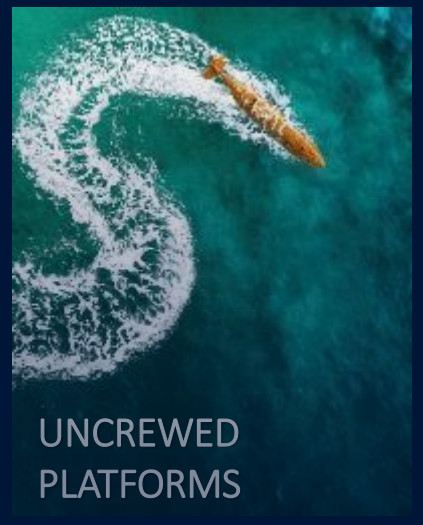
Kongsberg Digital

Kongsberg Discovery

See Statement of Proprietary information

KONGSBERG DISCOVERY 2023





GLOBAL SALES AND MARKETING

CUSTOMER SUPPORT

SUPPLY CHAIN

1,000+
employees

3 BNOK
Order intake (2022)

Strong
technology
backbone

The ocean is vital to solve the four global crisis of today

Climate

Food

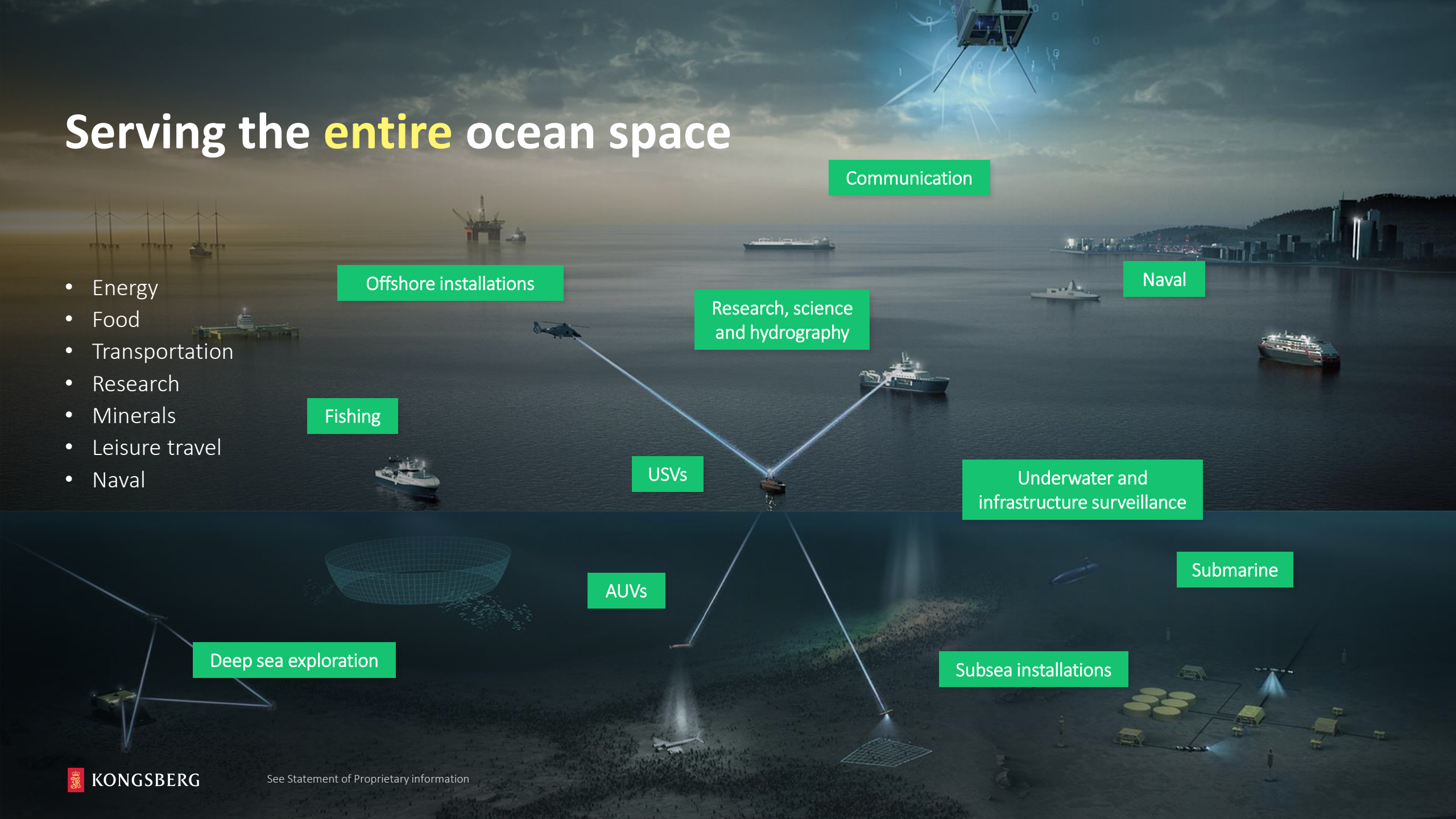
Energy

Geopolitical situation

See Statement of Proprietary information

Serving the entire ocean space

- Energy
- Food
- Transportation
- Research
- Minerals
- Leisure travel
- Naval



See Statement of Proprietary information

Mastering advanced technologies

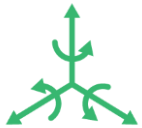
Hydro acoustics

- Signal processing
- Phased array
- Material technology (composites, ceramics)
- Transducer
- Synthetic aperture

Robotics

- Autonomy
- Integration
- Micro navigation
- Sensor fusion
- Communication

Inertial navigation



- Attitude determination
- Navigation
- North seeking

GNSS Positioning

- European initiatives
- Galileo
- EGNOS
- Jamming resilience
- Cyber security
- Advanced antenna technology

Laser

- LIDAR technology (Situational awareness)
- Relative positioning
- Communication

Radar/Communication

- Microwave
- Phased array antennas
- Beam forming
- Communication

Disruptive technologies

- Quantum technology
- Artificial intelligence
- Machine learning
- Technologies for future applications

Common technology

Embedded software, Cloud software, Signal processing, Low noise electronics,
Low power consumption, Beam forming (above and below surface), Artificial Intelligence

Lazy days in Aviation…

- One type of operation (take off/landing)
- Lands on airfields only
- Relaxed accuracy requirements
- Well defined antenna location and installation
- Certified equipment
- No (or little) multipath
- Low risk of interference / spoofing
- Little GNSS signal obstruction
- No other aircrafts coming too close
- Can go away if weather is too bad
- GNSS used as “sole means of navigation”

In Maritime operations you are not always this lucky

http://www.nrk.no/nyheter/okonomi/1.7375207

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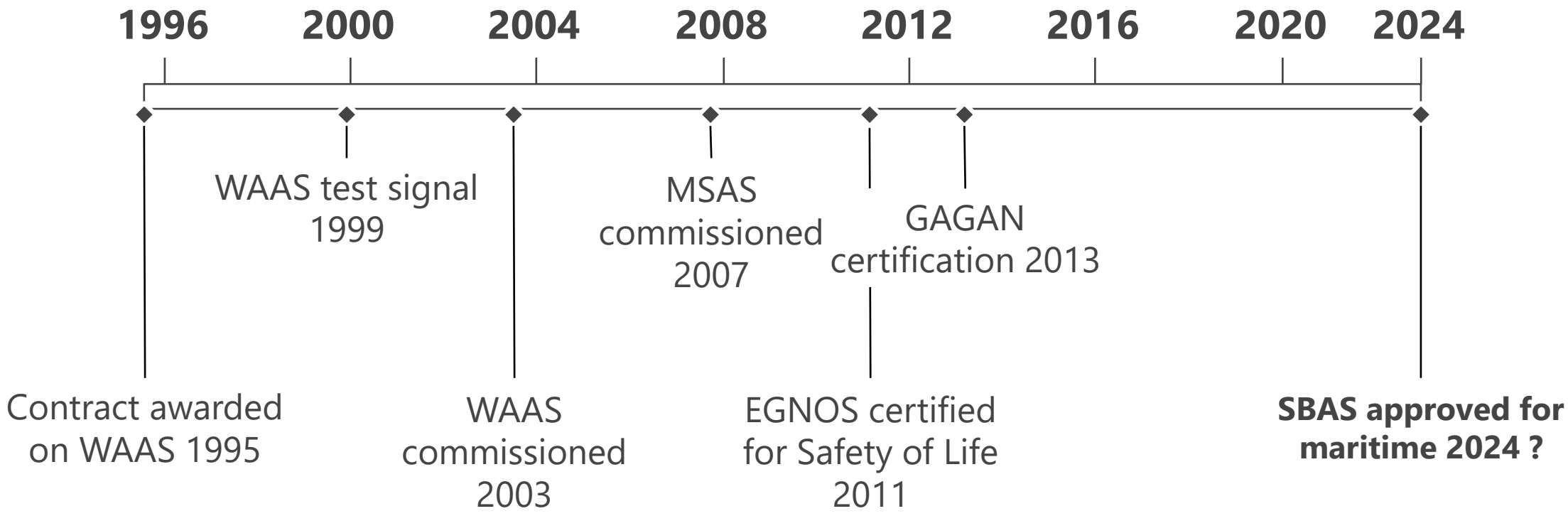
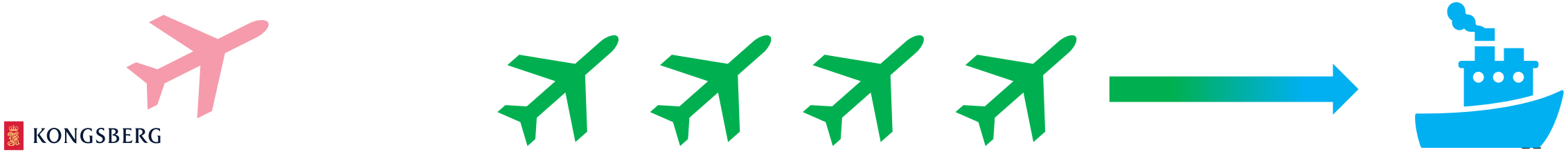
SBAS L1 GPS implementation



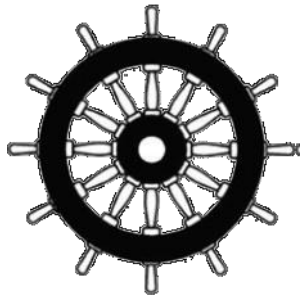


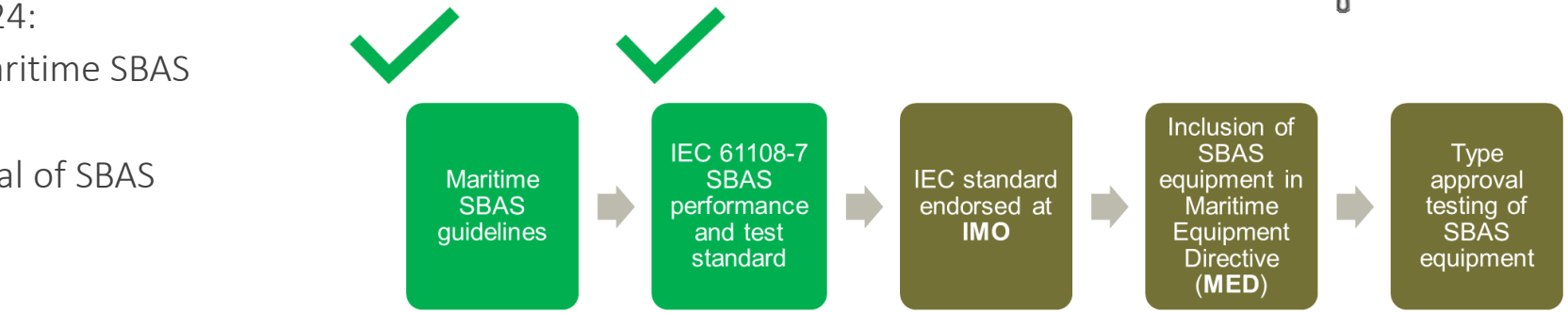
EGNOS in maritime applications

Current EGNOS V2 service

- GPS L1 service only
- Already in use by many maritime GNSS receivers without being standardised
- Guidelines for maritime use of EGNOS are available
- The guidelines have tested using maritime SOLAS and non-SOLAS receivers in the MAREC project
- Supplement/backup to IALA maritime DGNSS beacons
- EGNOS V2 is also used by some IALA DGNSS stations and converted into RTCM version 2.3 format
- IEC 61108-7 standard approved in 2024: Performance and test methods for maritime SBAS receiver equipment
- This will lead to maritime type approval of SBAS equipment – “Wheel mark”

Process towards the wheel mark





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EGNOS in maritime applications

Future EGNOS V3 service

- SBAS DFMC – Dual Frequency Multi Constellation service
- The SEGRA project is developing guidelines for maritime use of SBAS DFMC, based on signal specification ED-259A and maritime equipment standards
- SEGRA is developing a receiver for the SBAS L5 service, using augmented dual frequency GPS and Galileo according to the proposed requirements
- Testing with GNSS simulator is on-going according to the proposed type approval tests

- EGNOS V3 can be a game changer for adoption of SBAS and open up for innovative use of SBAS in many new maritime applications

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Thank you for the attention

stig.erik.christiansen@kd.kongsberg.com