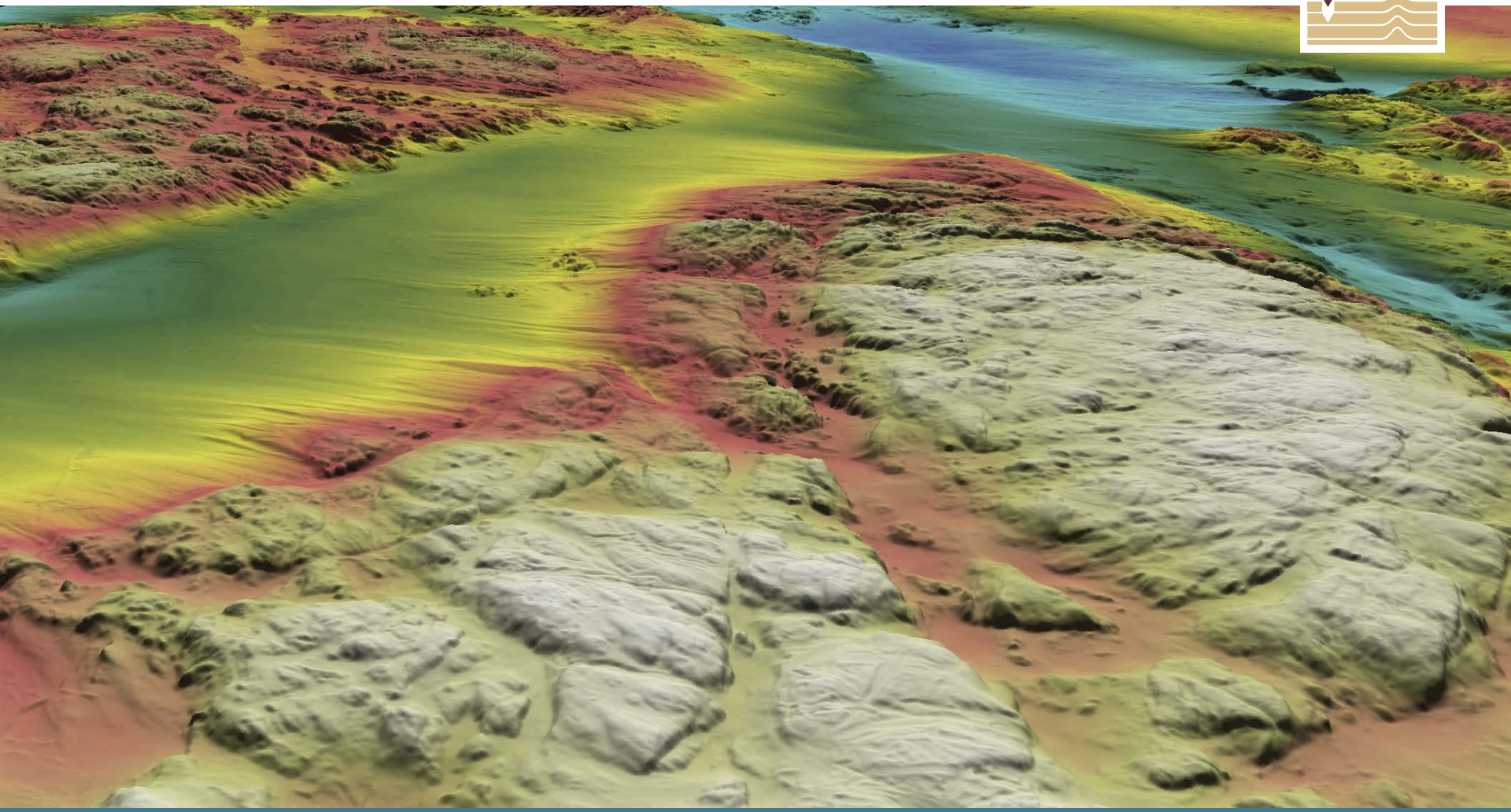


Contribution to Seabed 2030 from the private sector

FUGRO‘s commitment and coordination

FUGRO OSAE GmbH – part of FUGRO group since 2006

Founded in 1983 as

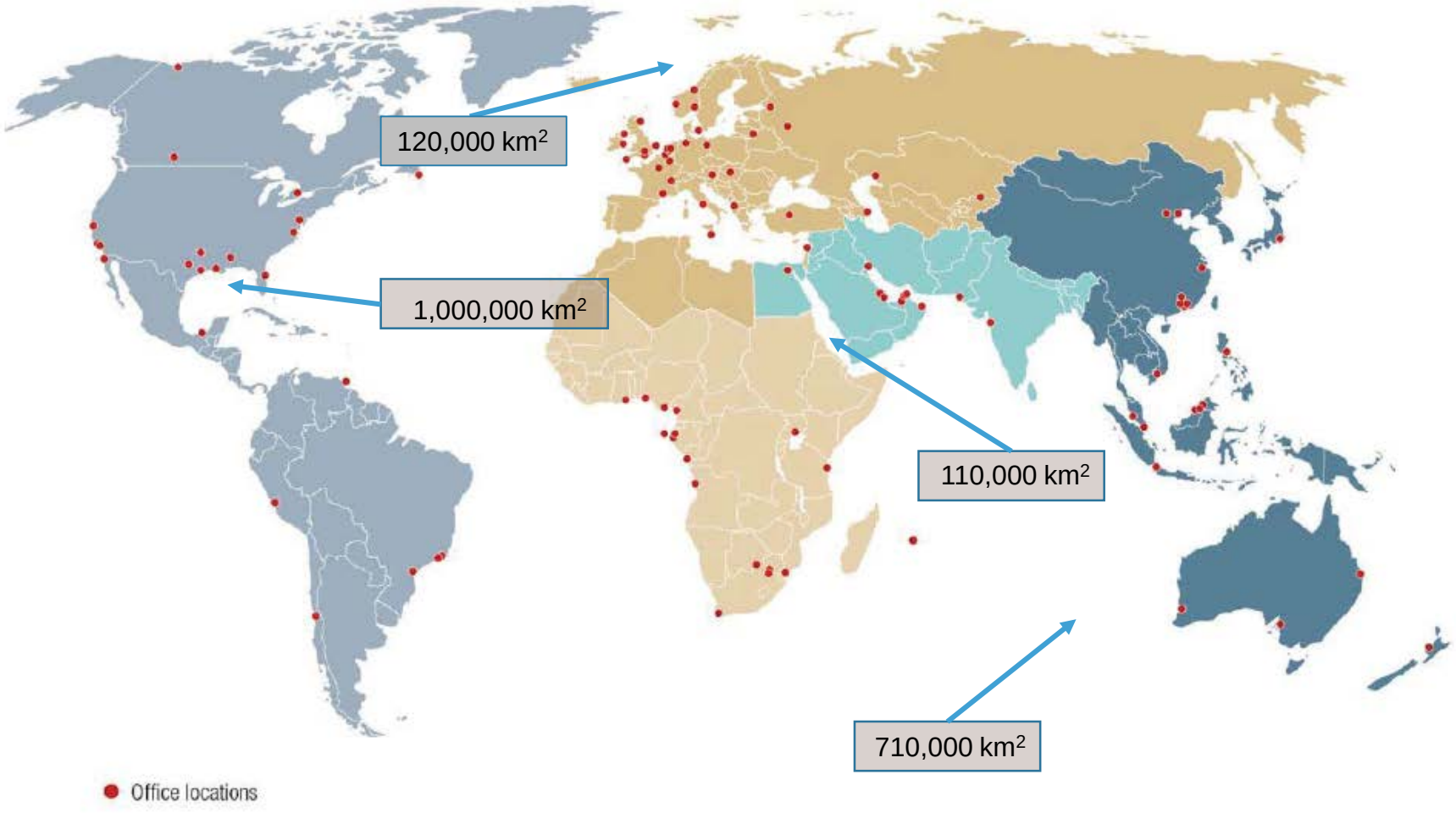
OFFSHORE SURVEY AND ENGINEERING

Gesellschaft für Seevermessung mbH.

Within FUGRO group “Excellent Cluster Hydrography &
Telecommunication Cable Route Surveys”

- Multibeam Survey (large area, high resolution) (bathymetry, ENC)
- Cable Route Survey (Offshore) (DTS, consultancy, geophysical and geotechnical survey, inspection)
- Offshore-Wind (site, CRS) (Visibility study, spatial planning and DTS, construction site survey, CRS, UXO survey, Inspection (annual) of subsea installations, scour monitoring)

Large Area Owned Data & Unowned Data



Fugro acquires on the order of 1,000,000 km^2 of MBES data per year, but these data are most often owned by our customers

Northern Hemisphere - MAREANO

Fugro´s contribution to the Mareano program

Collecting multibeam echosounder, high resolution datasets (bathymetry, normalised backscatter, water column imaging) and gravimeter data.

Phase one 2006 - 2010:

Norwegian Sea

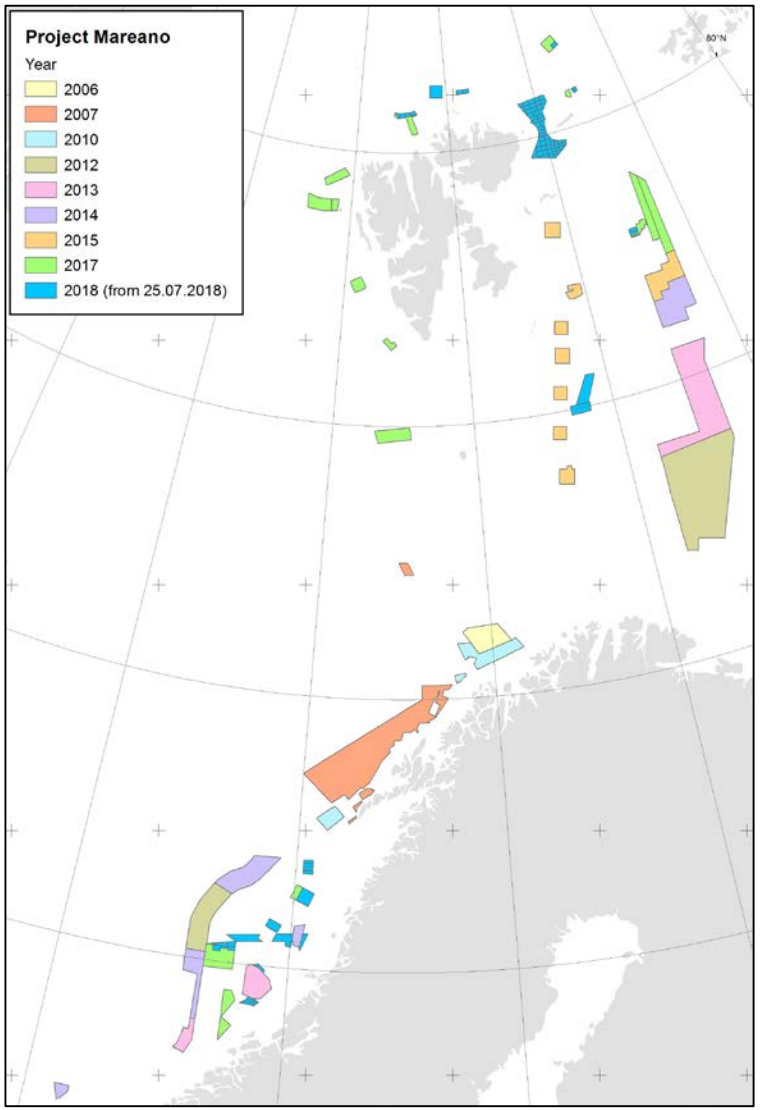
Phase two 2012 - present:

also Barents Sea / Artic Ocean

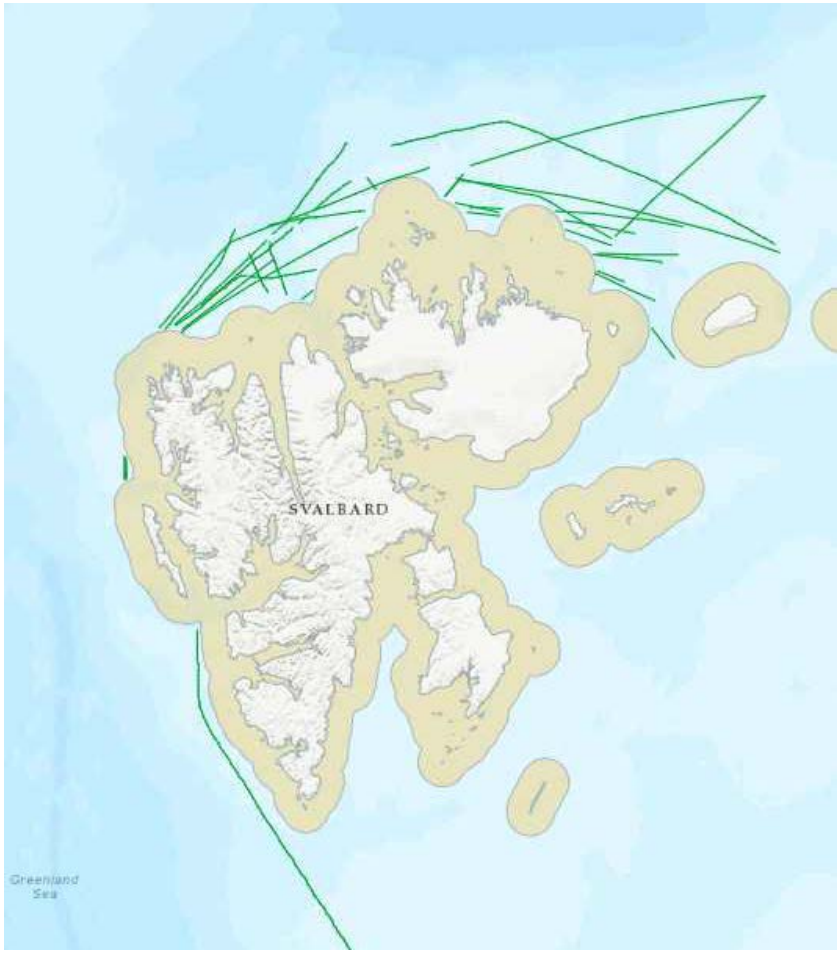
Fugro successfully delivered 2006 to 2017 :

120 000.00 km²

2018 = first year of data collation during transits requested by NHS (client)

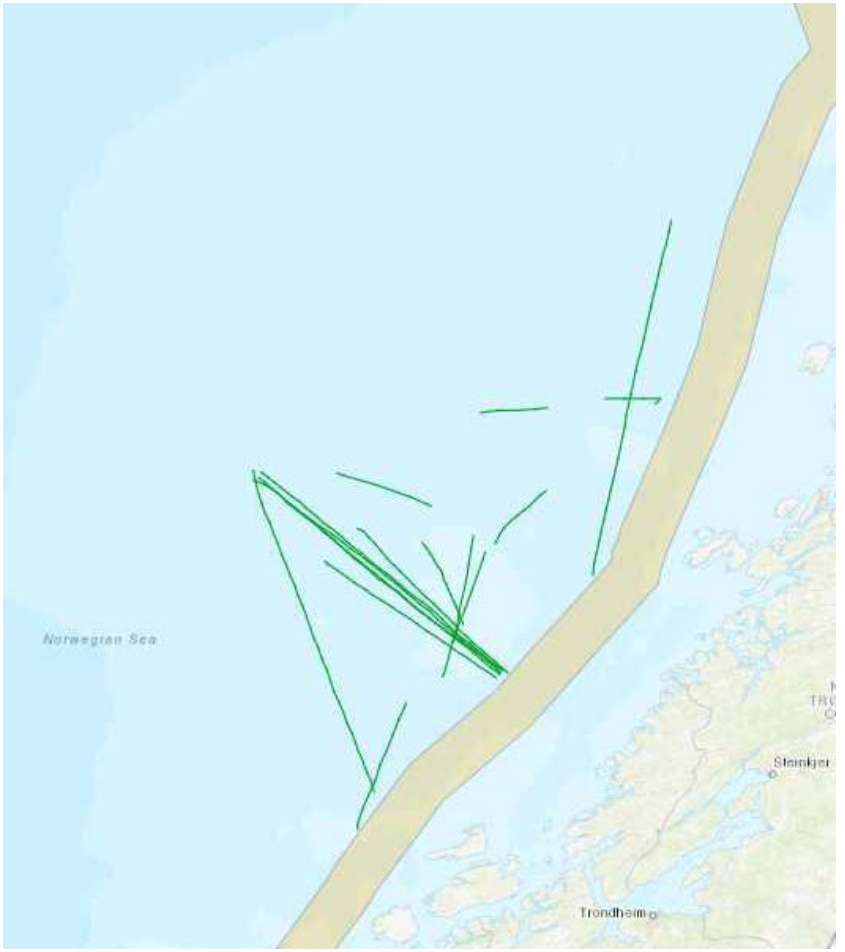


Actual achieved track lines during transit - MAREANO



MAREANO additional survey tracks during transit between survey areas plus port calls around Svalbad; approx. 3,290 km (Mid Sept.)

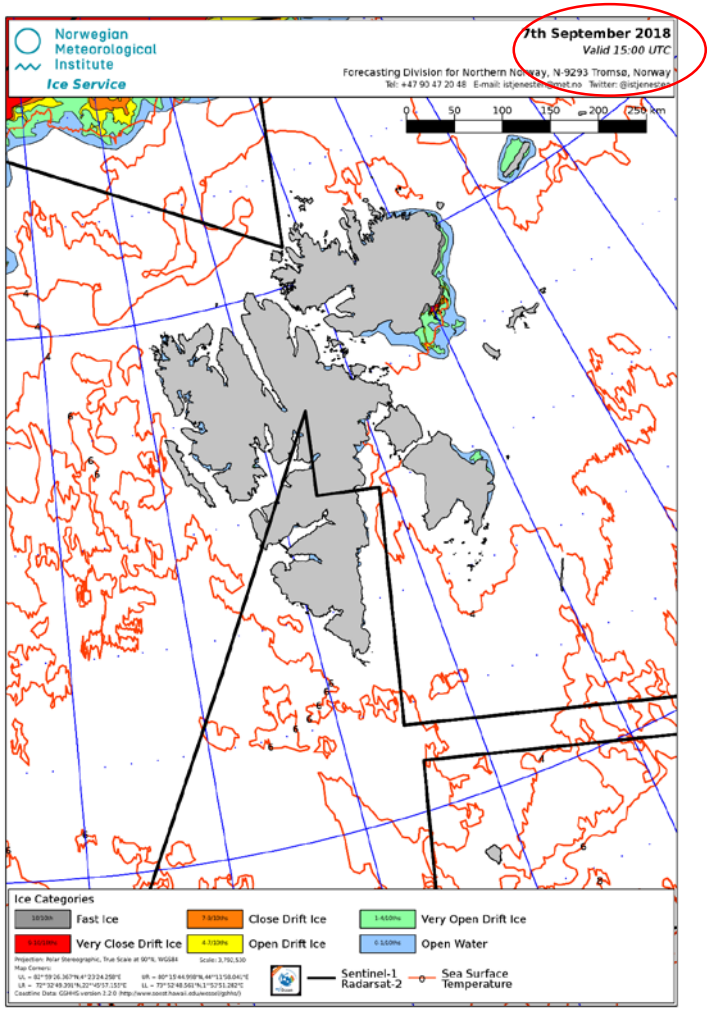
(all tracks from Victor Hensen)

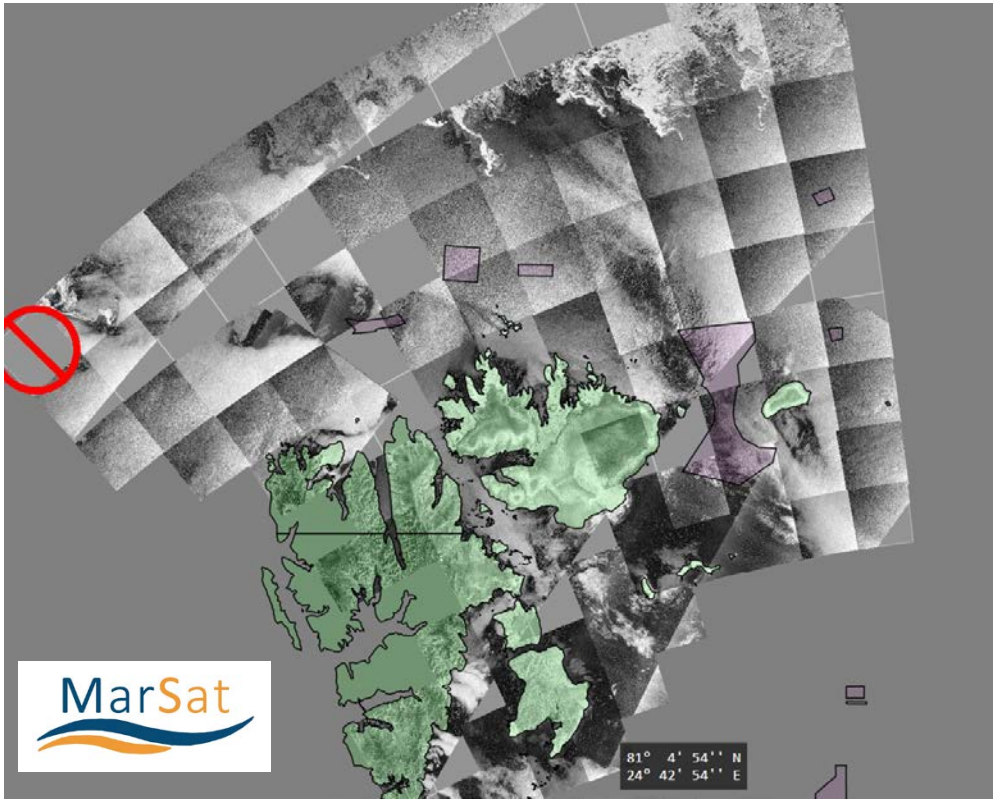


MAREANO additional survey tracks during transit between survey areas plus port calls Norwegian Sea; approx. 1,360km (Mid Sept.)

(all tracks from Fugro Gauss + Victor Hensen)

Survey planning and setup - MAREANO





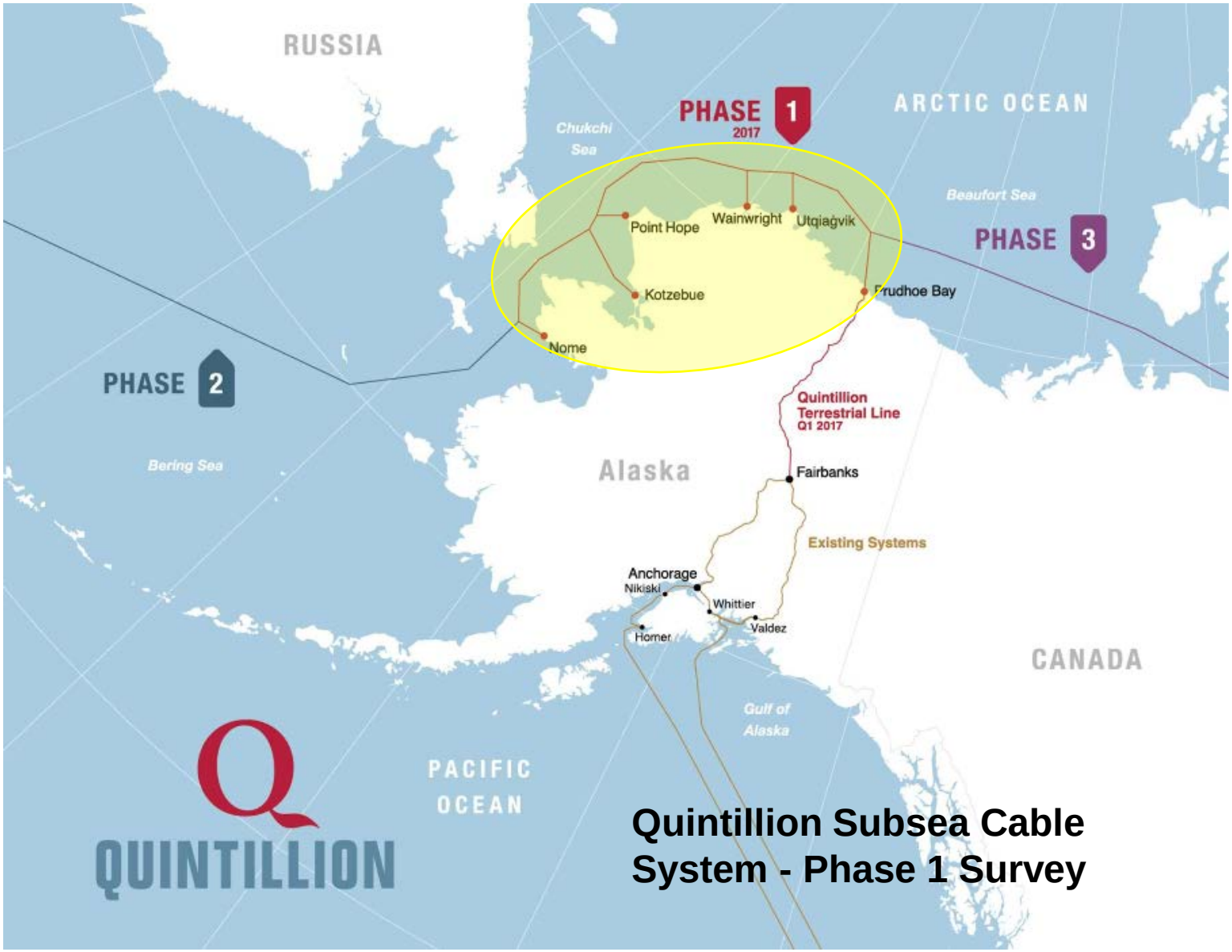
IcePad satellite images current day available on 10th Sept @ 0638. Generalized map still showing 7th Sept 2018.

Owned or unowned data

Telecom cable route surveys create a large footprint, but data might be not freely available as ownership is claimed by client.

- Ongoing review of contracts to clarify ownership of raw data
- If need gain approval from client to transfer data
- New contracts with freeing bathy data (at least reduced resolution in accordance with Seabed2030 requirement)

Owned Data & Unowned Data – Example Artic area

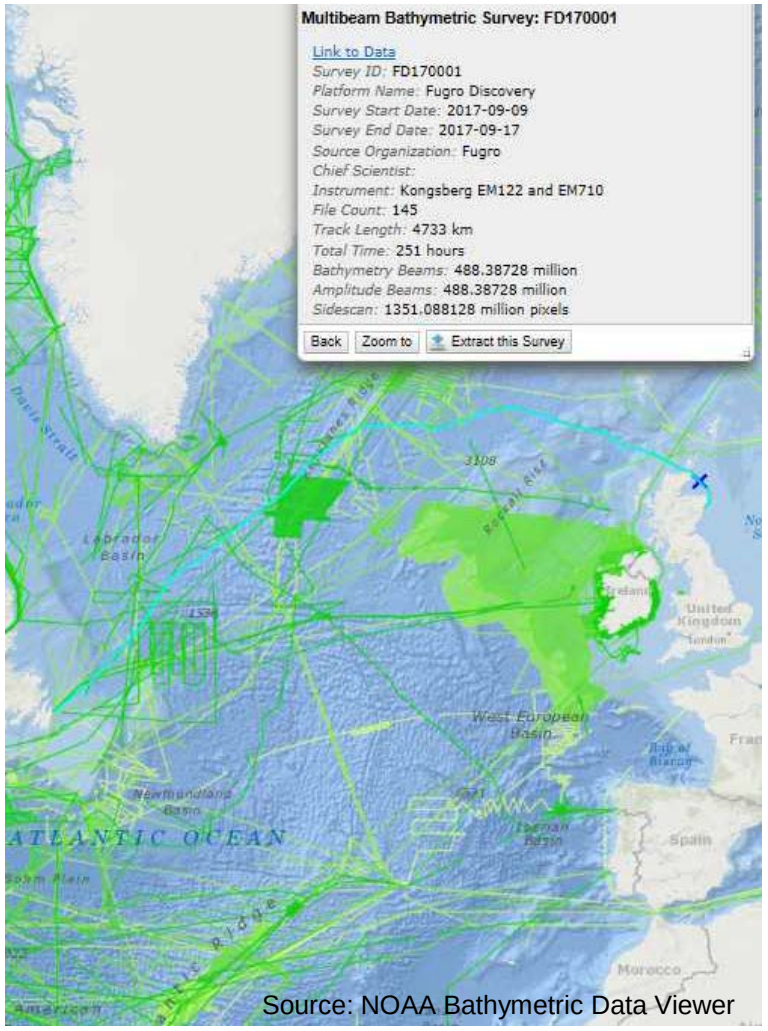


Transit Planning

To balance transit cost versus optimised data collation, FUGRO actually develops a web application accessable from FUGRO offices and vessels.

All track lines from FUGRO‘s own data aquisitions plus accessable data from e.g. NOAA Bathymetric Data Viewer shall show areas with data available.

Under provision of weather along the route, economic speed and time constrains (e.g. fixed project start time), transit route can be adjusted to deliver a meaningful contribution to the Seabed2030 initiative by filling gaps or extent data swath.



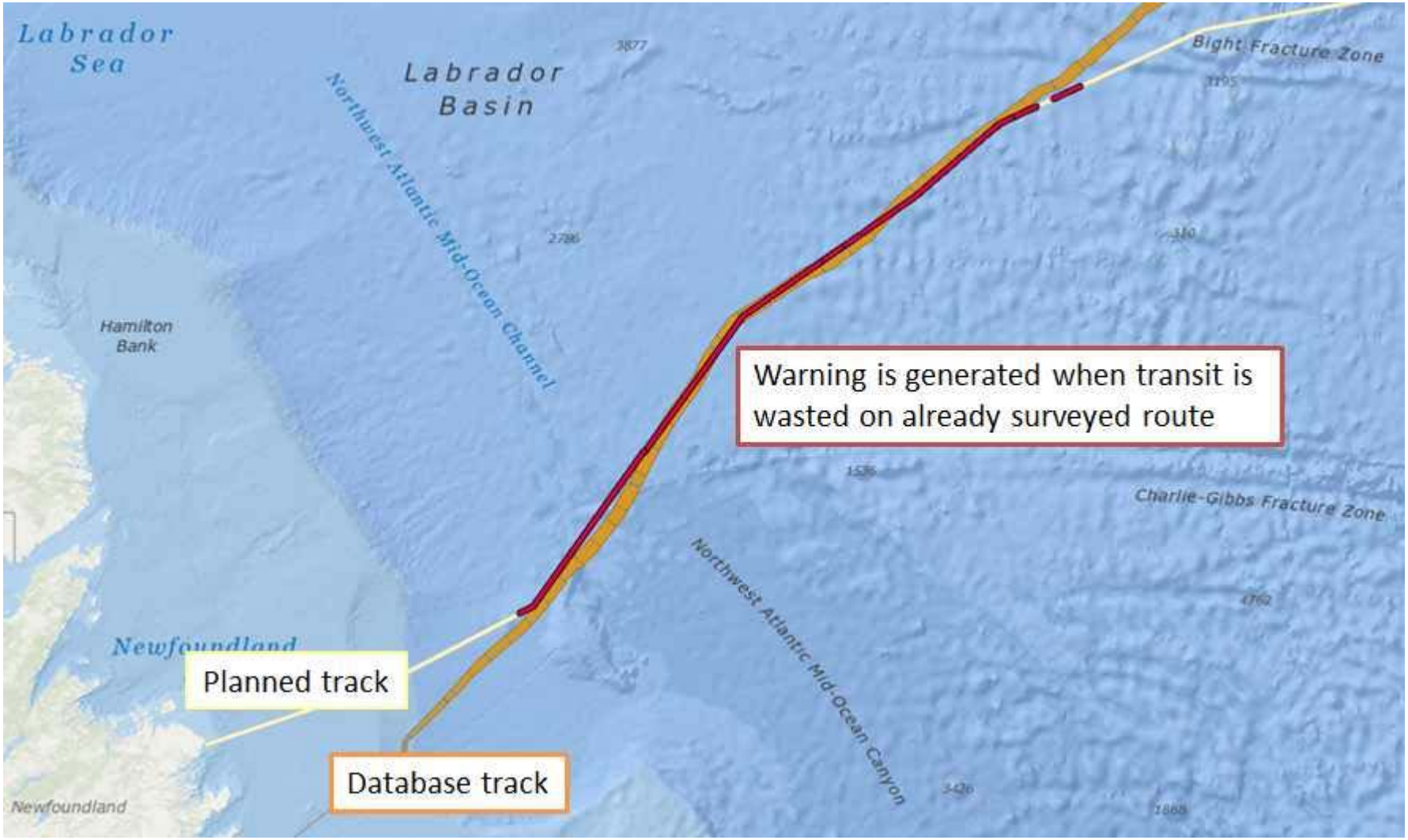
Source: NOAA Bathymetric Data Viewer

North Atlantic transit route as an example

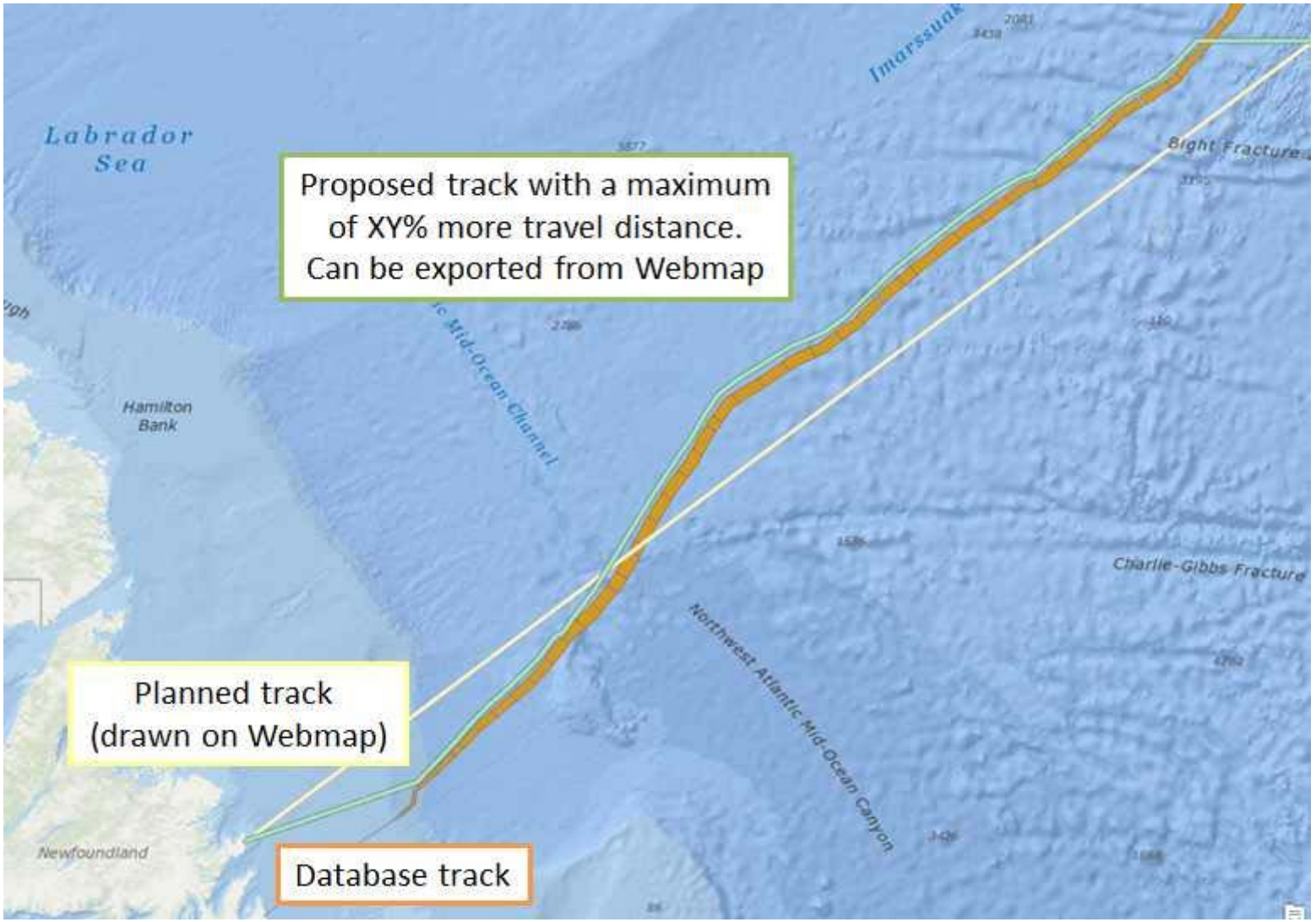
Bathymetric data swath collated during vessel transit from Europe to North America.

Route developed by vessel master with assistance from Fugro's Met Ocean office.

Transit Planning - Review



Transit Planning - Optimisation



OARS: Office-Assisted Remote Services

Remote survey solution to reduce cost for data collation during transit time

Relieves the need for an onboard surveyor but allows remote monitoring of data collation.

Thank you for your attention!

Dipl.-Geophy. Manfred Stender

Fugro Germany Marine GmbH, Bremen