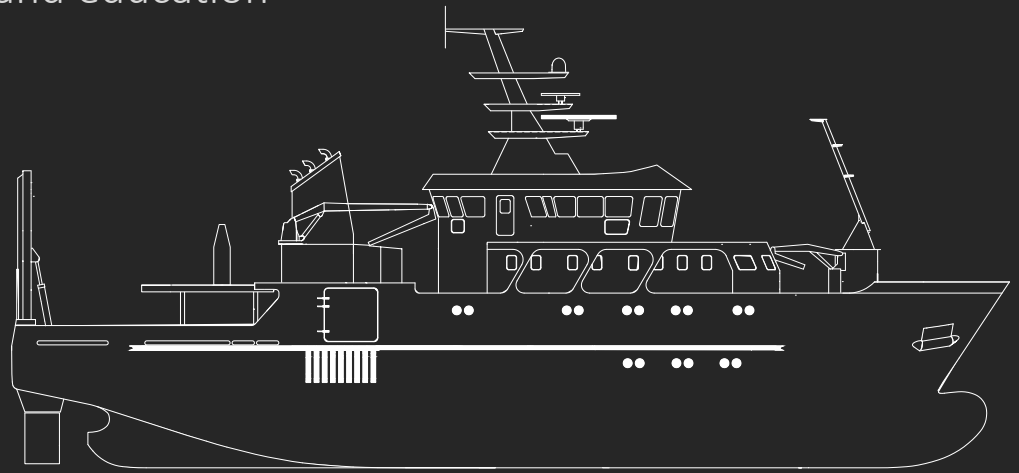
UNIVERSITY OF GOTHENBURG

The Skagerak Facility

Providing world-class infrastructure and services in support of advanced and multidisciplinary marine research and education



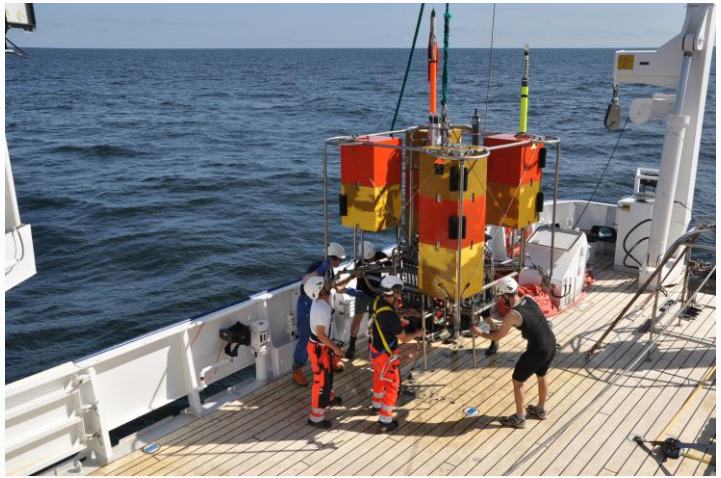
The Skagerak Facility

The Skagerak Facility is a research infrastructure of the University of Gothenburg and includes:

- RV Skagerak
- Kongsberg Hugin AUV
- Inventory of scientific equipment
- Marine data
- Technical expertise/support

Vision:

To provide high quality research infrastructure and services in support of advanced and multidisciplinary marine science and education for global societal benefit



RV Skagerak

49m Special Purpose vessel
Polar Ship Certified

Dimensions

Length Overall:	49.15 m
Length waterline:	46.44 m
Width:	11.25 m
Depth to maindeck:	2.1 m
Draft (max):	3.9 m
Air draft:	22 m
Gross Tonnage:	916
Light ship weight:	916.45

RV Skagerak

Delivered 2021; fully operational since September 2022

Owned by University of Gothenburg; crew, hull and machinery managed by Northern Offshore Services

Machinery/Propulsion/Electricity/DP

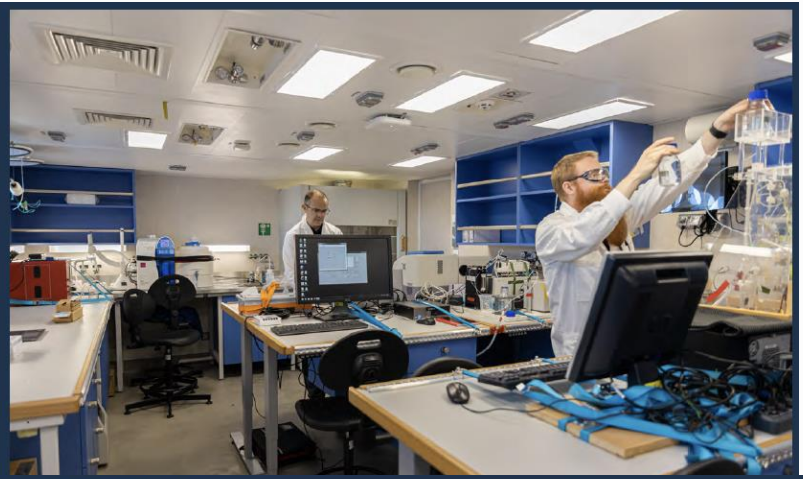
Propulsion:	Diesel Electric. Main engine: Nidec 1120 kW
Generator sets:	4 x Volvo Penta D16, 420 kW
Bow/Stem Thrusters:	Brunwoll 250 kW
Dynamic Positioning:	DP1

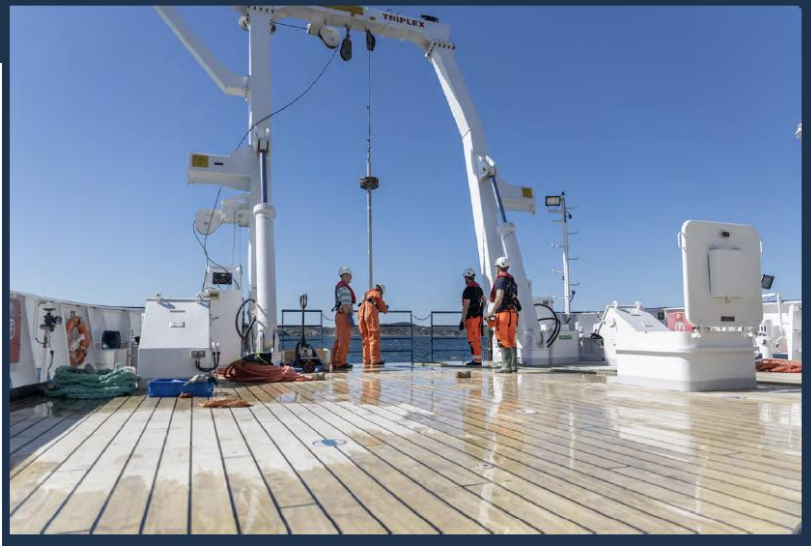
Capacities

Speed:	Service speed 11.5 knots, max. speed approx. 14 knots
Time at sea:	Up to 3 weeks
Crew:	5-7 depending on operations
Fuel:	93.8m^3 HVO or Diesel
Freshwater:	46 m^3 + on-board production
Sewage sludge:	3.0 m^3
Sewage holding tank:	7.5 m^3

System	Equipment
Ferrybox Jena engineering -4H-	SBE38
	SBE45
	Cyclops-7
	Wetlabs FLNTU
	Aanderaa Oxygen Optode 4835
Weather station	Observator OMC-160
	Observator OMC-506
	Observator OMC-406
	Kipp & Zonen PQS 1
	Kipp & Zonen CMP11
ADCP	Ocean Surveyor 75 kHz (2008)
CTD	Seabird911 with 24 bottle rosette
	SB3
	SB4
	SBE43
	Wetlabs FLNTURT
	Wetlabs FLNTURT
Echos sounders	Kongsberg EM2040-07
	Kongsberg TOPAS PS40
Acoustic positioning system	Kongsberg HIPAP 501

Four laboratories, including atmospheric, dry lab, wet lab and main laboratory. Access to gas outlets, sea water, underway data, presentation screens, fume hoods and storage.

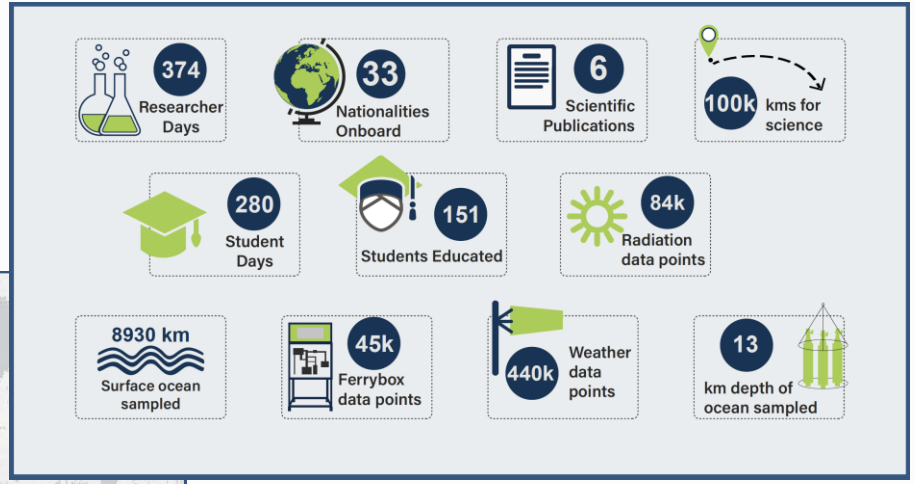


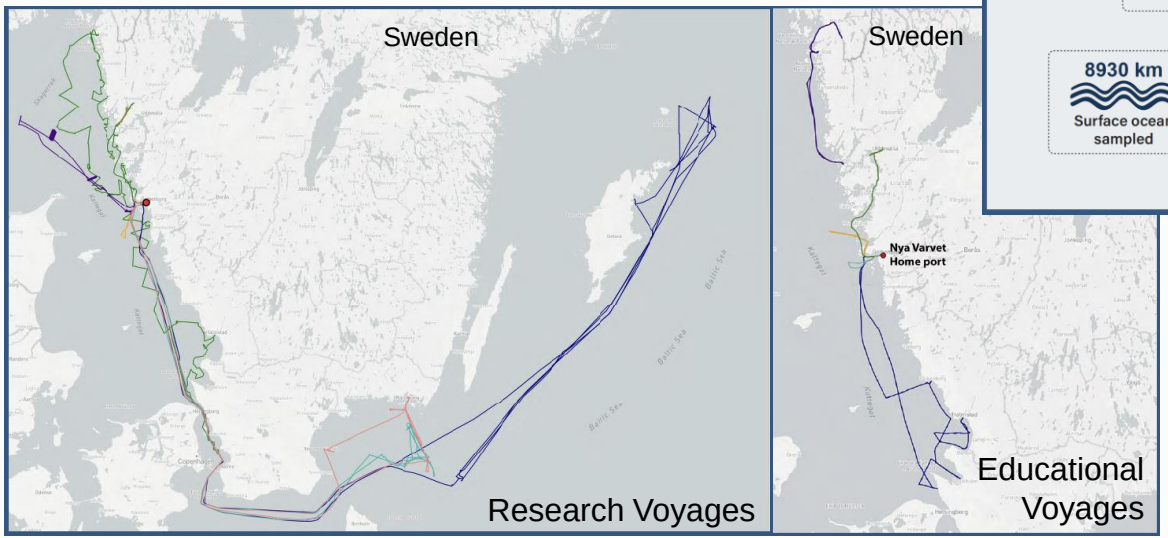


Large aft deck (110 m²), with moveable A-frame (8t at 7m reach). Multiple fittings for containerised laboratories and equipment. Ideal for deployment of large scientific platforms (AUVs, ROVs, Landers)

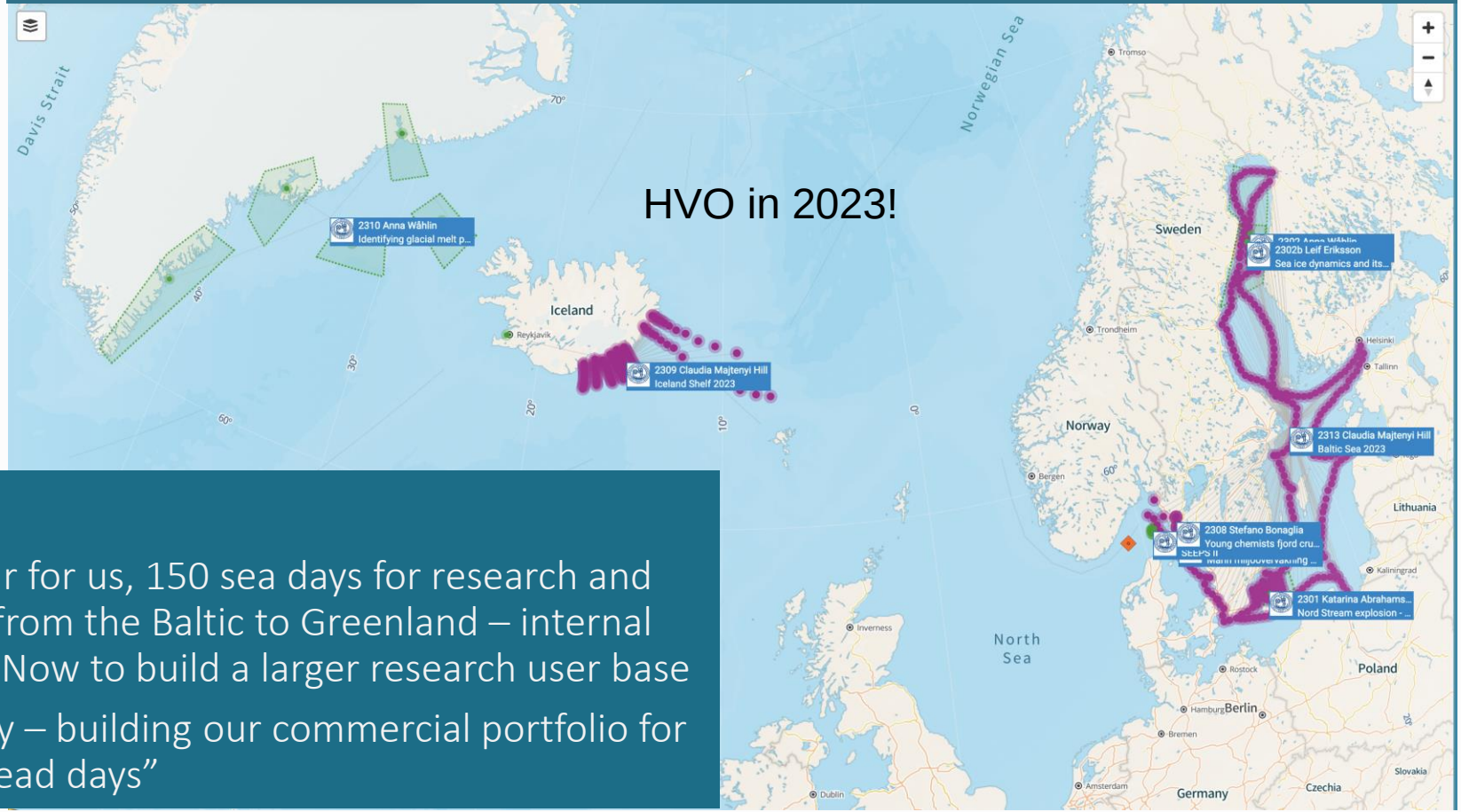
2022

The first full year of (potential) operation and included many milestones as the Facility worked to establish operational standards and procedures, complete the ship build and run calibration and testing of all onboard equipment. Regardless, we achieved 80 sea days for research and education, across the Skagerrak, Kattegat and Baltic Seas





MFP | Portal



2023

A great year for us, 150 sea days for research and education from the Baltic to Greenland – internal users only. Now to build a larger research user base

Additionally – building our commercial portfolio for filling in “dead days”

Scientific Equipment Inventory

7m RIB boat

Sediment samples (multi-, box-, piston- and gravity corers)

Benthic landers

Gliders

Sail buoys

Nets (multi-nets, plankton nets etc)

ADCPs

Portable CTDS

Microstructure profilers

Cold container laboratory

Small ROV

Contros sensors

AUV *'Ran'*

A Kongsberg Hugin 3000 m Autonomous Underwater Vehicle

Dimensions	Depth rating and range	Power supply	Endurance
Length: approx. 6.5 m Diameter: 875 mm Weight: 1850 kg	3000 m 300 km	4 (max 6) rechargeable and swappable Lithium Polymer batteries	36 hours

Funded by Knut & Alice Wallenberg Foundation

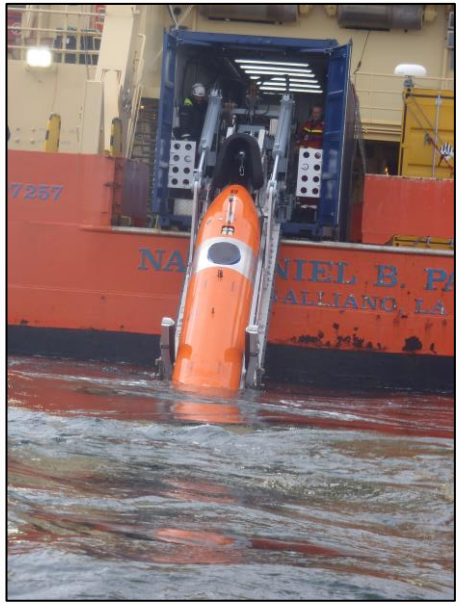
https://www.gu.se/en/skagerak/new-rv-skagerak/autonomous-underwater-v

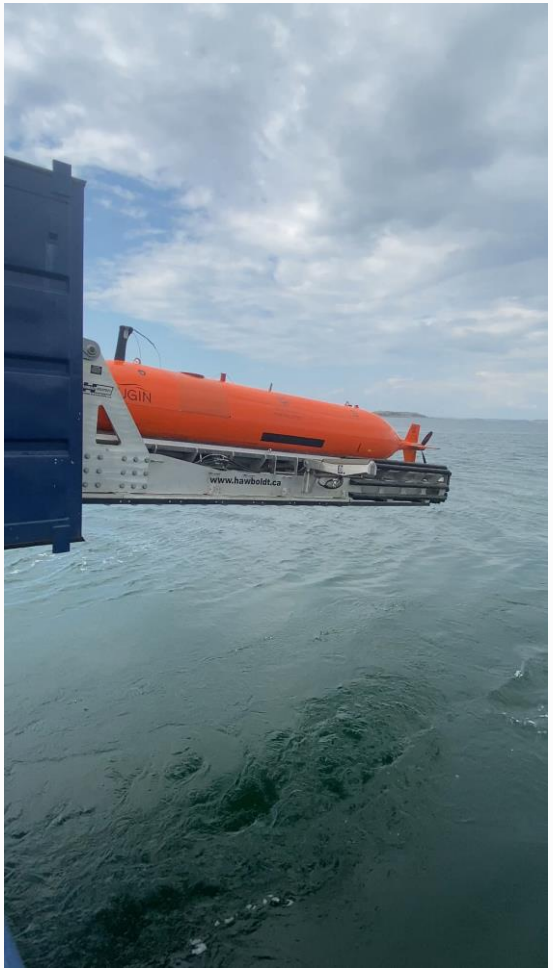
- Kongsberg multibeam echosounder EM2040C, 0.9x0.9 beam width– upward looking
- Kongsberg multibeam echosounder EM2040, 200-400Hz, 0.7x0.7 beam width– downward looking
- CTD - dual system Seabird 911 19plusv2
- Oxygen - Seabird SBE43 (dual system)
- Carbon dioxide - Contros HydroC
- Nitrate – SeaBird Deep SUNA
- Chlorophyll/turbidity – SeaBird WetLabs ECOtriplet (FLBBCD)
- Side scan sonar – EdgeTech 2205, 75/410kHz (1-6km range)
- Sub-bottom profiling sonar – EdgeTech DW216 with configurable chirp
- Nav system– DVL-supported Honeywell Hg9900, accuracy of >0.08% of distance travelled
- Acoustic communication below surface – 2-3km between ship and AUV
- Satellite, radio and WiFi communication in surface mode

Capacity to take 13 water samples (150 ml each): Ca 100 water samples from the ice shelf cavity in 2022. Isotopes, Chl-a, geology (particles) etc

AUV + all equipment comes in one 40-foot container and one 10 foot container

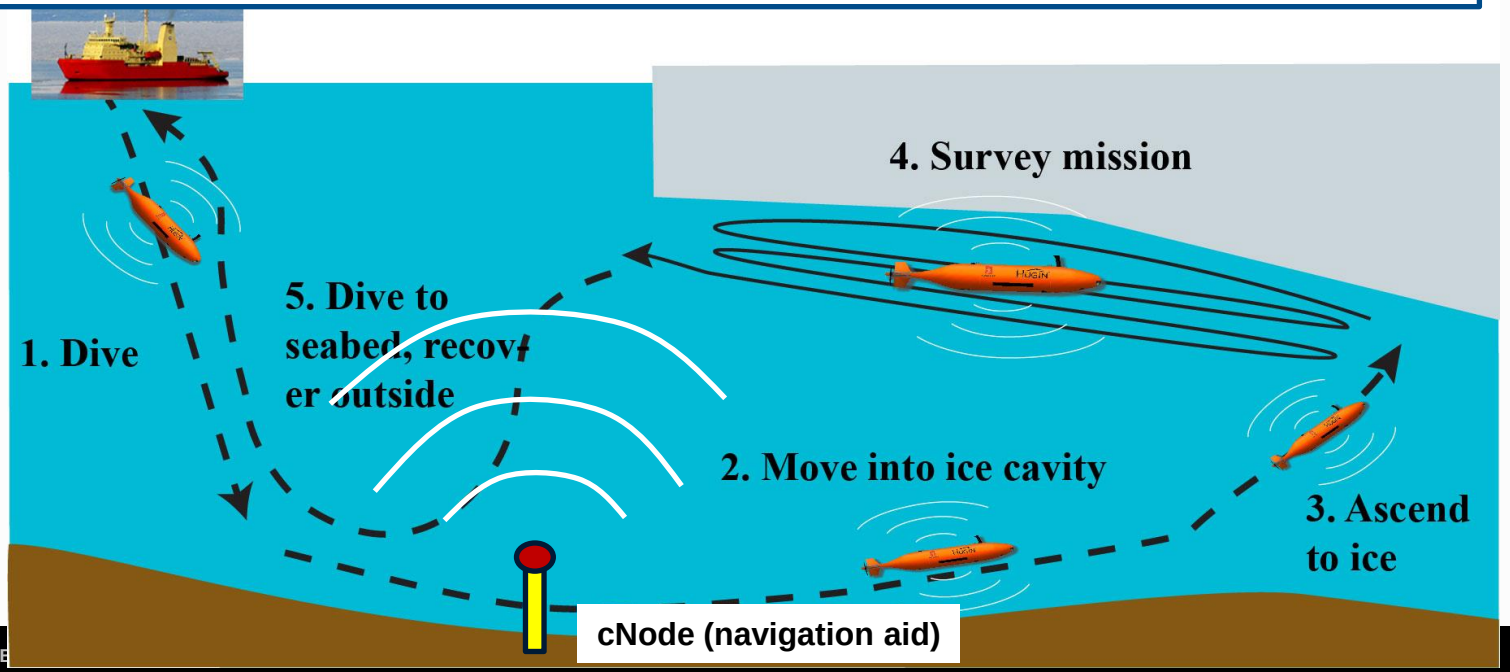
Launch and Recovery



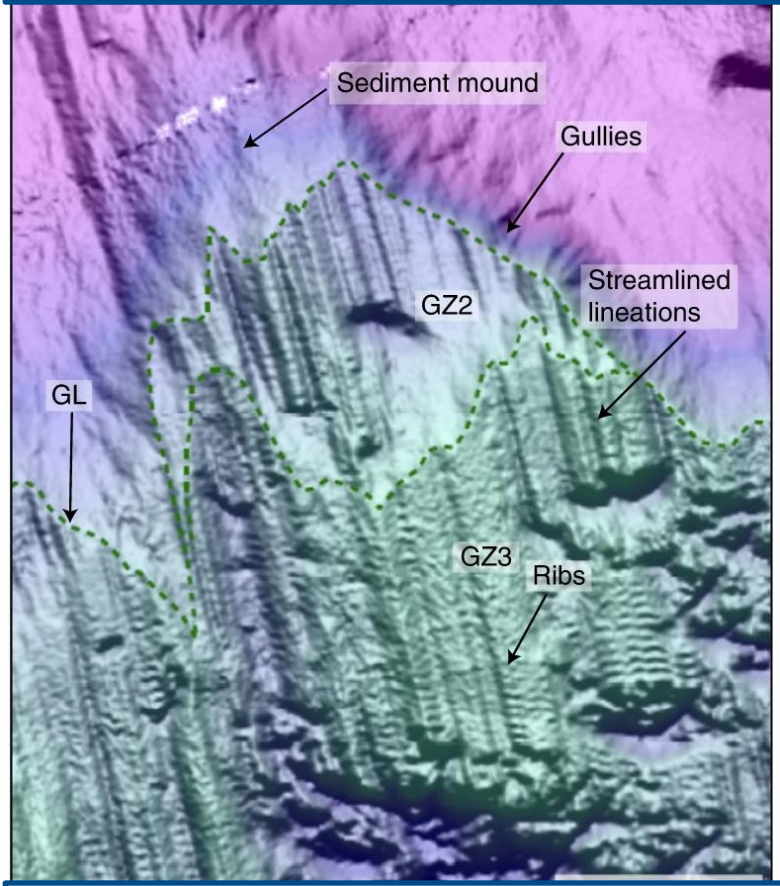


Jan – March 2022: 14 missions in Amundsen Sea (West Antarctica) from NB Palmer
Launch in safe, icefree place, dive down to seabed, swim into the cavity, swim up to ice, perform ice survey, then dive down to seabed and swim northwards for 1 h

1732 km distance traveled (1075 km under ice)
Data sets: High resolution (1 dm) maps of ice base, high resolution (<5 dm) maps of seabed, T, S and O_2, CO_2, nitrate, Fl, turbidity, about 100 water samples (150 ml each), and current velocity



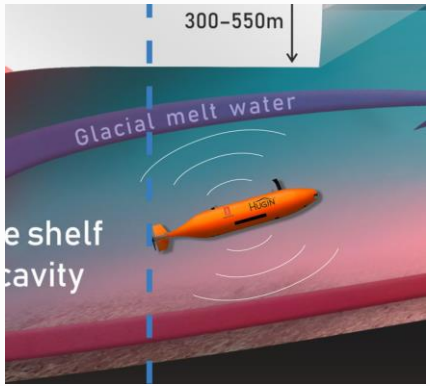
Downward-looking multibeam: High resolution images of the seabed – details visible that no one has seen before (need AUVs to get close to seabed)

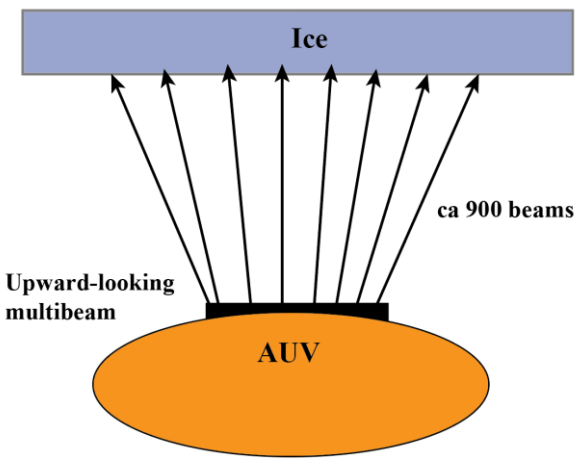


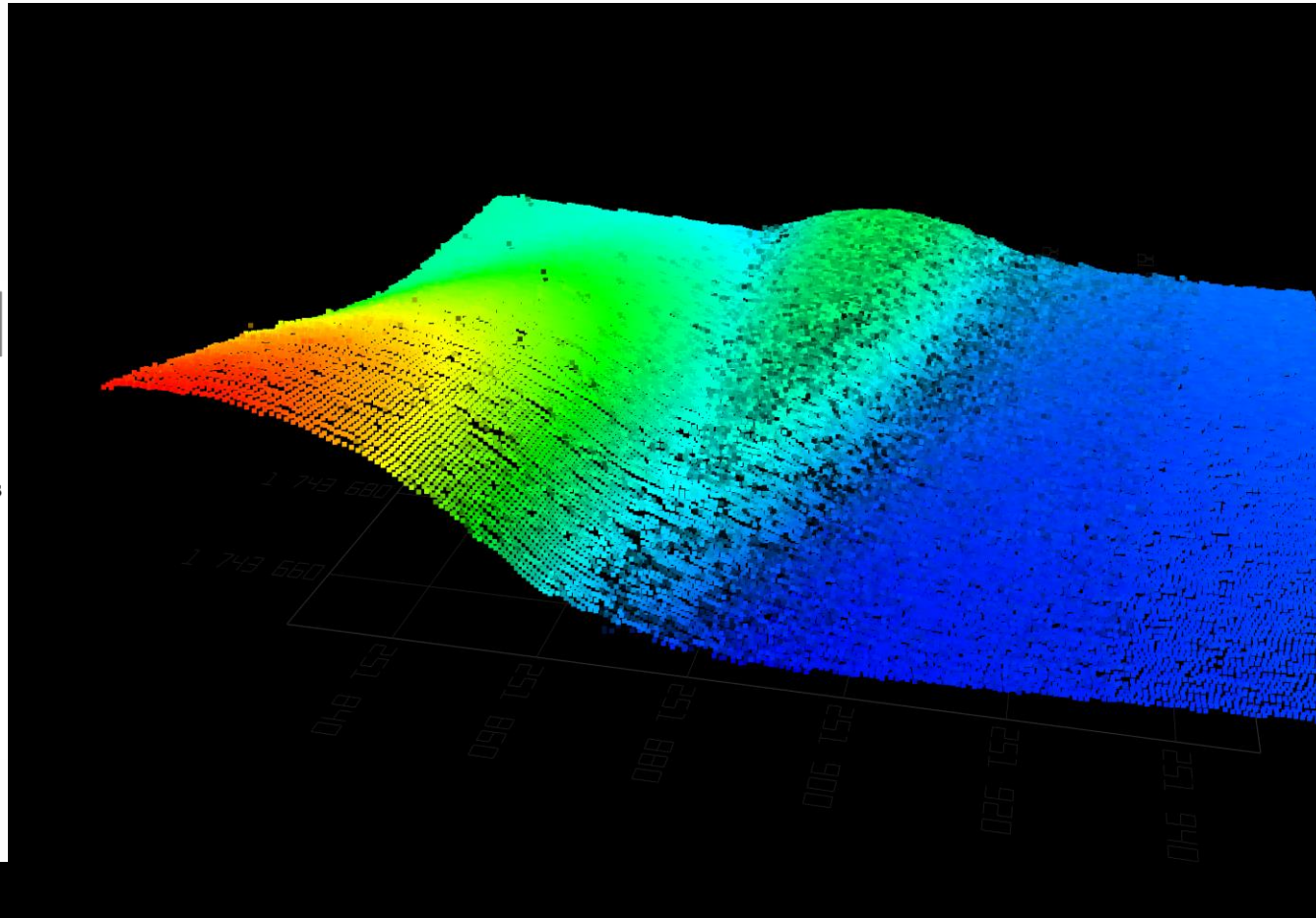
Graham et al, 2022. Rapid retreat of Thwaites Glacier in the pre-satellite era. Nature Geoscience, 15 (9) (part of the ITGC project)

GIF: Alastair Graham, BAS

Upward-looking multibeam: Kongsberg EM2040 CX







louise.newman@gu.se

Swedish Research Vessel Infrastructure for Marine Research (SWERVE)

National research infrastructure program that will:

- Support a National Marine Technicians Network for training, sharing and capacity development
- QC and standardised deliver of data to international data repositories (COPERNICUS, EMODnet)
- Funded ship-time for Swedish researchers

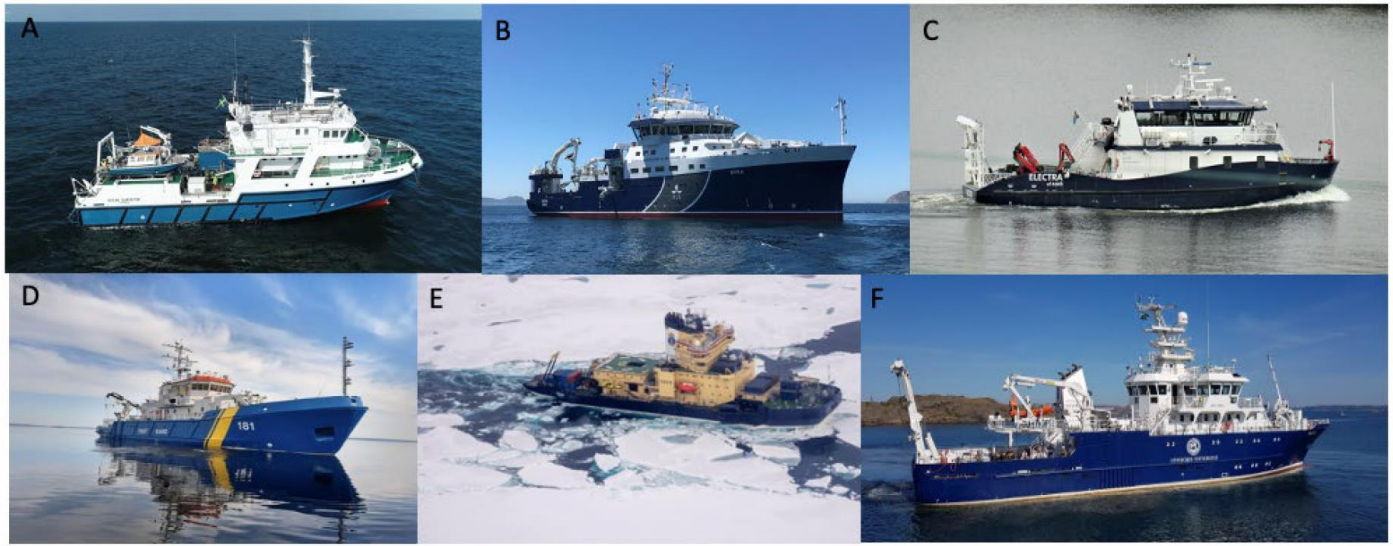


Fig. 3: The research vessel infrastructure involved in the SWERVE consortium. A) Ocean Surveyor (SGU); B) Svea (SLU); C) Electra (SU); D) KBV181 (UmU); E) Oden (SPRS); F) Skagerak (GU)