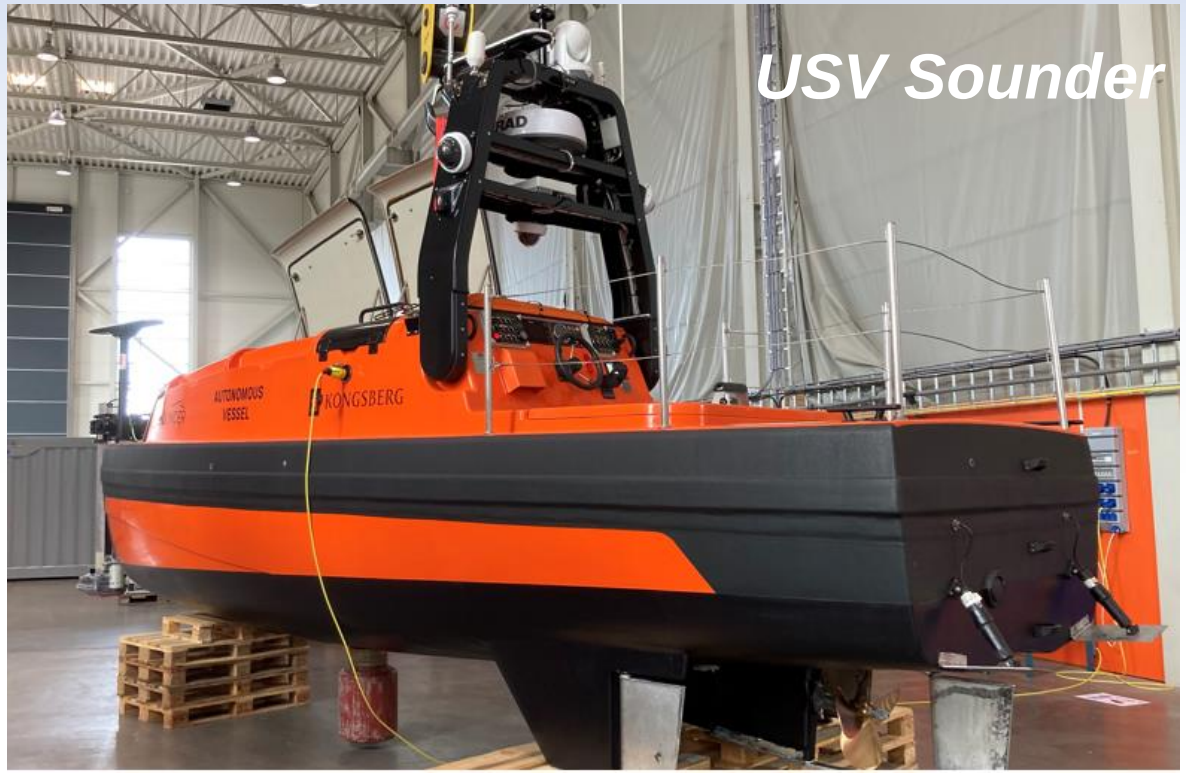
New autonomous vehicles at IMR

Jan Arne Vågenes Fartøyinstrument



AUV - **A**utonomous **U**nderwater **V**ehicle

USV - **U**nmanned **S**urface **V**ehicle

Munin+

Tekniske data
Length: 5.4 meter
Veight: 870 kg
Depth rating: 1500 meter
Survey speed: 3-4 knop
Batterikapasitet: 19.8 kWh, >24 timer @ 3 knop
Charging: 2 timer (0-90%)

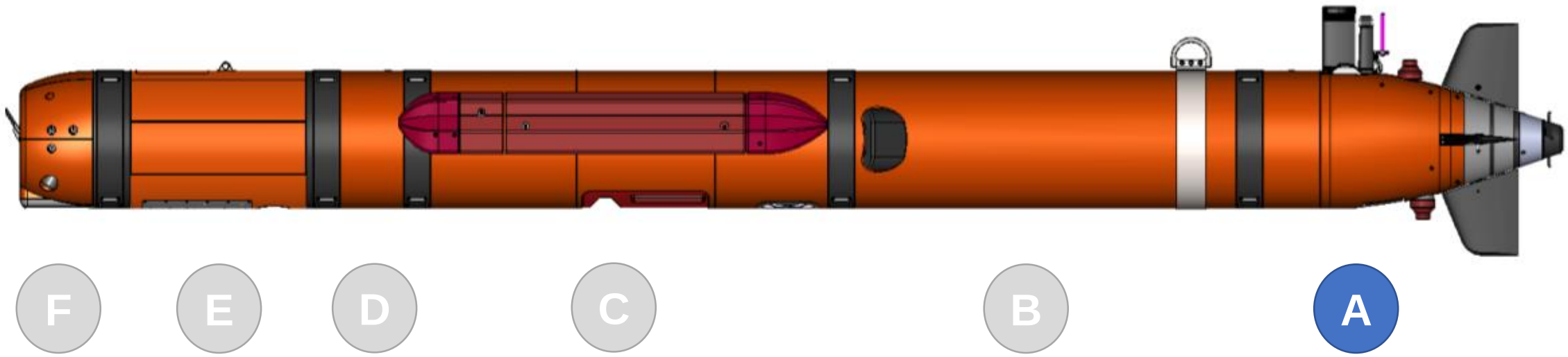
Nyttelast (Payload sensors)

- EM2040M – multistråle ekkolodd
- HISAS 2040 - Høyoppløst Interferometrisk Syntetisk Aperture Sonar, Range Independent Resolution
- Edgetech Sub-Bottom Profier (SBP)
- Cathx Ocean stillbildekamera

Munin+

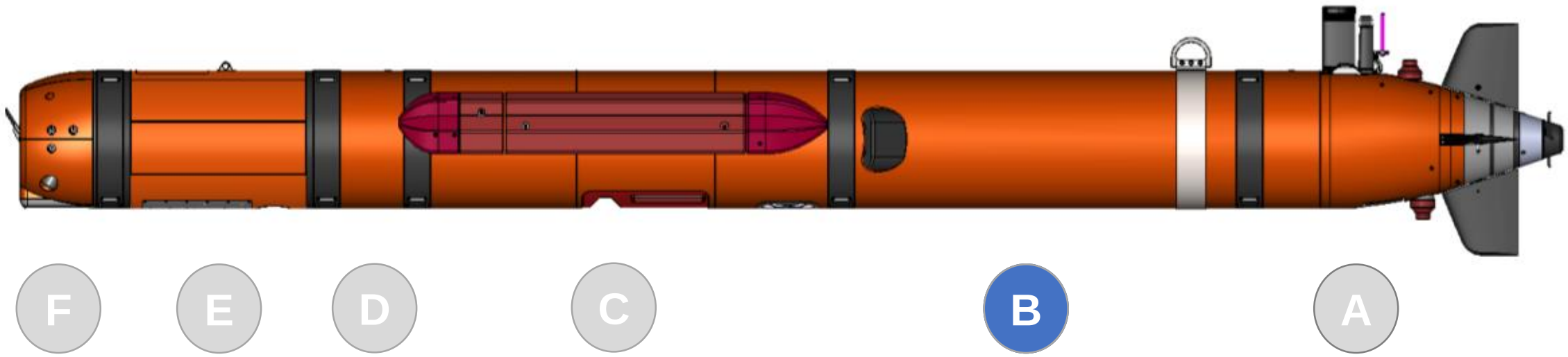
F E D C B A

Munin+



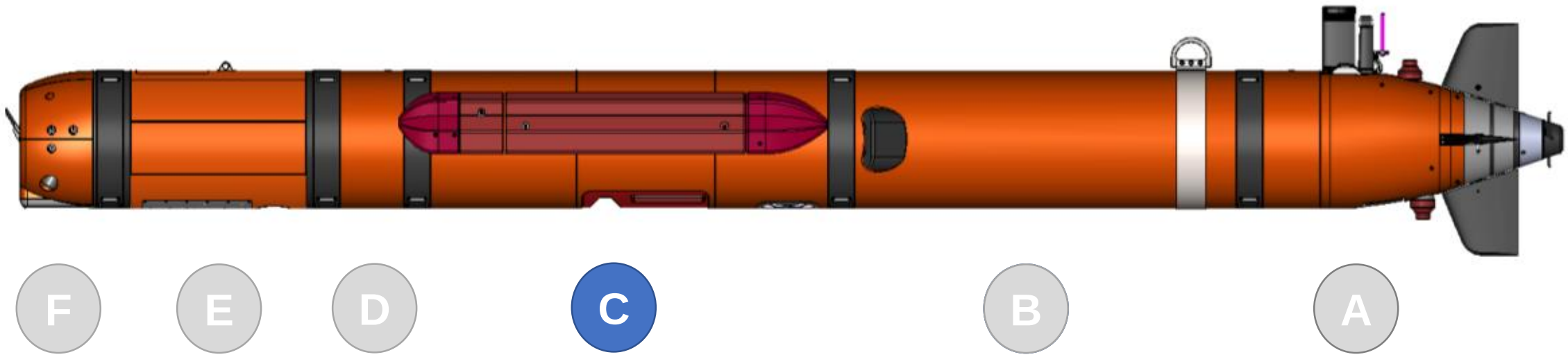
A Tail section:
The Tail section holds the **propulsion system**, Depth and CT sensors, **antennas** (RF, GPS, Iridium and WLAN), cNODE **acoustic link system**, Recovery strobe light, **Drop weight unit** and On/Off magnetic switch.

Munin+



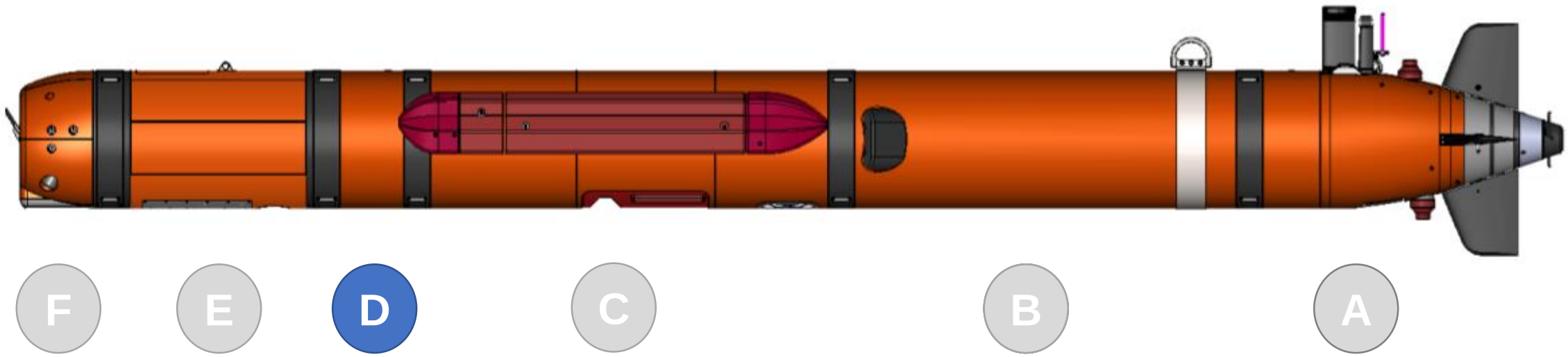
B Energy section:
The Energy section is a watertight section containing up to 12 **Battery modules** with internal electronics for charging and safety circuitry, with a communication link to the Battery control station (BCS). Buoyancy elements, **Trim weights and Trim bladders** can be installed on each side of the Energy section to adjust buoyancy of the AUV.

Munin+



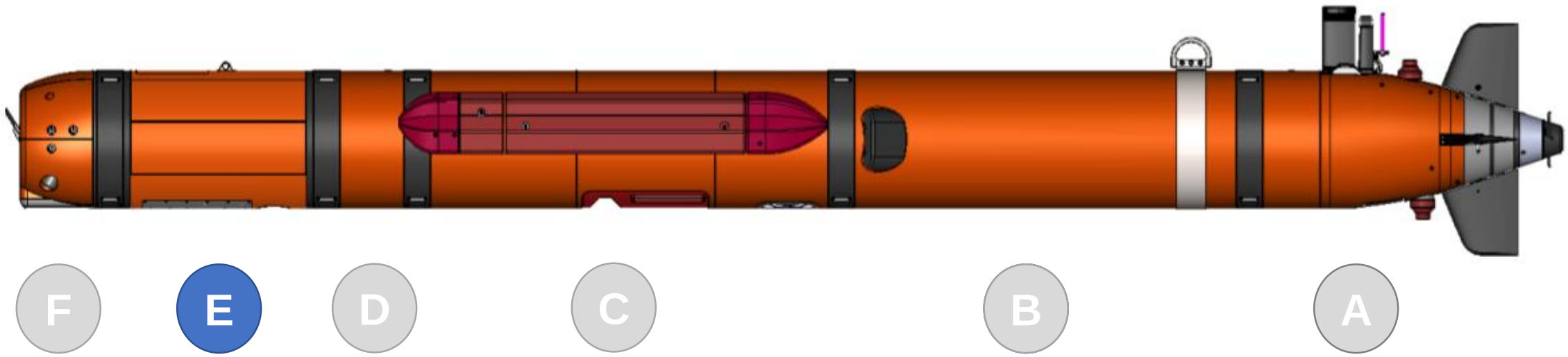
C Navigation/Payload section:
The Navigation/Payload section is a watertight section containing the payload and control system electronics and processing units, Inertial measurement unit, Doppler velocity log, **EM 2040M** sonar head and **HISAS 2040** arrays.

Munin+



D Forward endcap section:
The Forward endcap section is a watertight section containing electronics related to the LED panel and **Swappable NAS**. An On/Off magnetic switch is installed on the Forward endcap section.

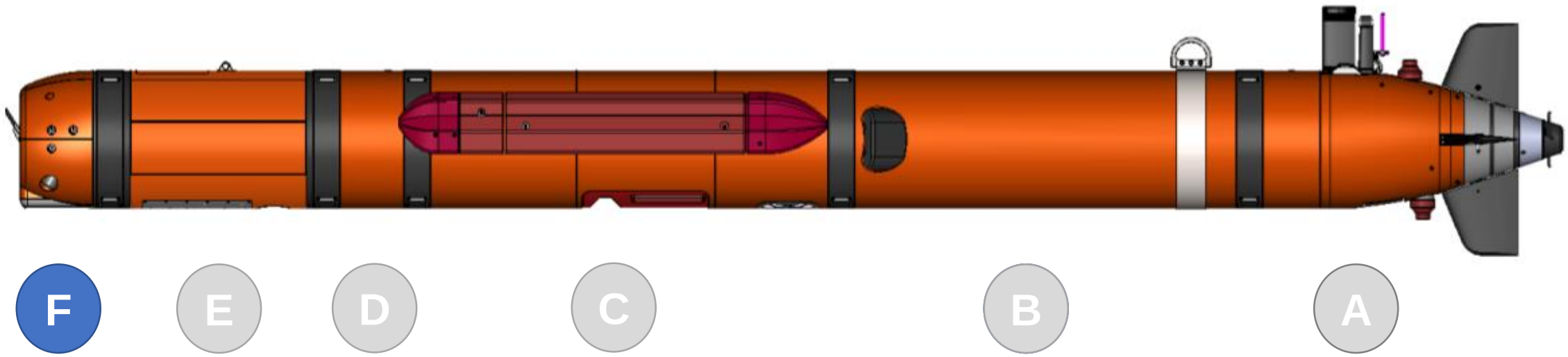
Munin+



E Wet payload section:
The Wet payload section supports the installation of various sensors and watertight equipment.

- Edgetech **Sub-Bottom Profier** (SBP)
- Cathx Ocean **stillbildekamera**

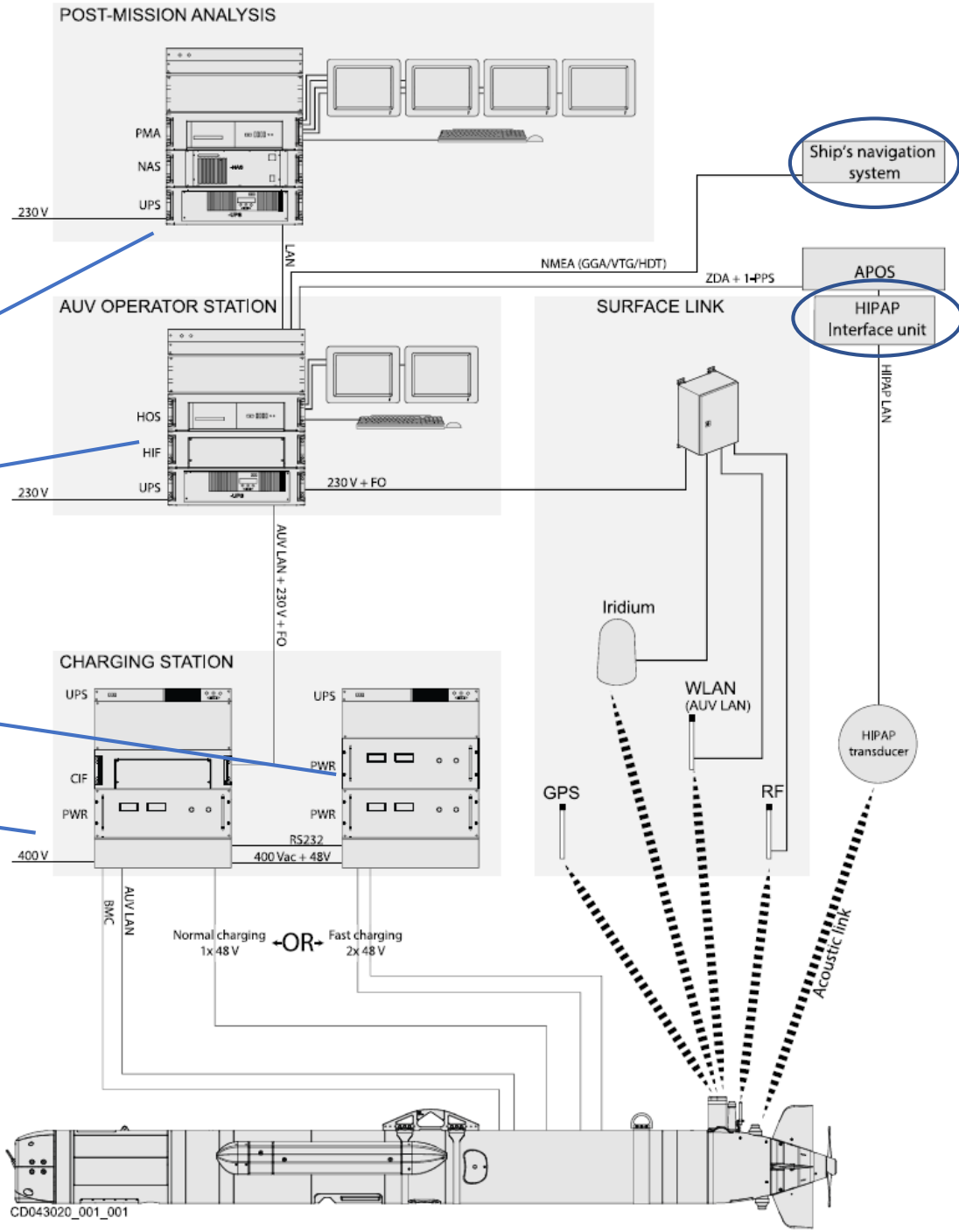
Munin+



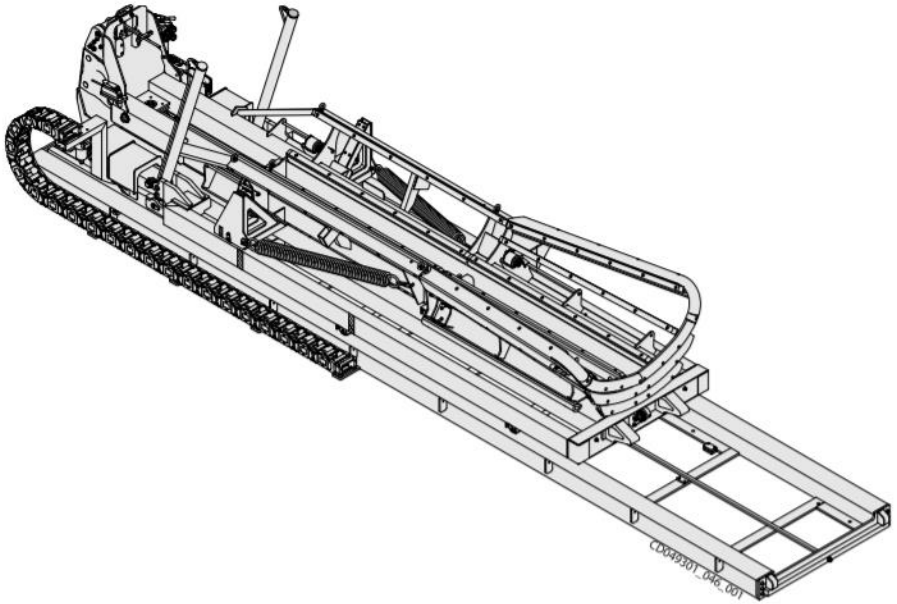
F Nose section:
The Nose section holds units required for **vehicle recovery** (Lifting bail, Drop nose), collision avoidance sensors (**Forward looking sonars**), data download port and the **LED panel** for the Underwater camera.

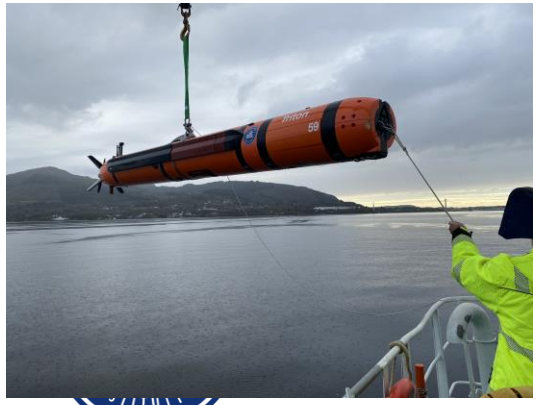
Munin+ Top side rack

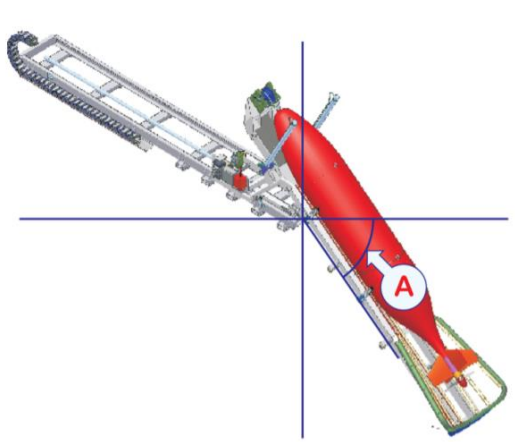
Kontroll kontainer

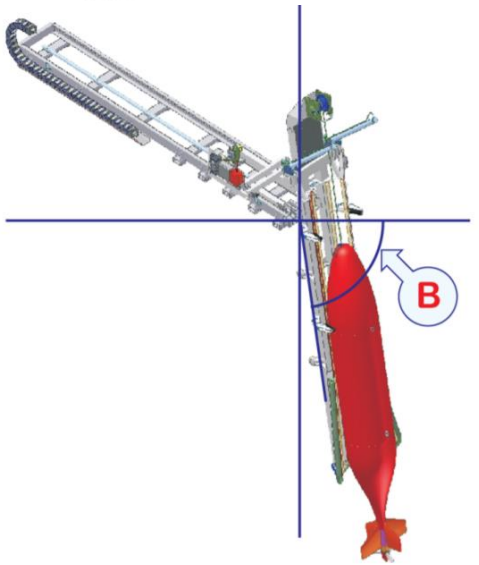


Stinger for launch and recovery

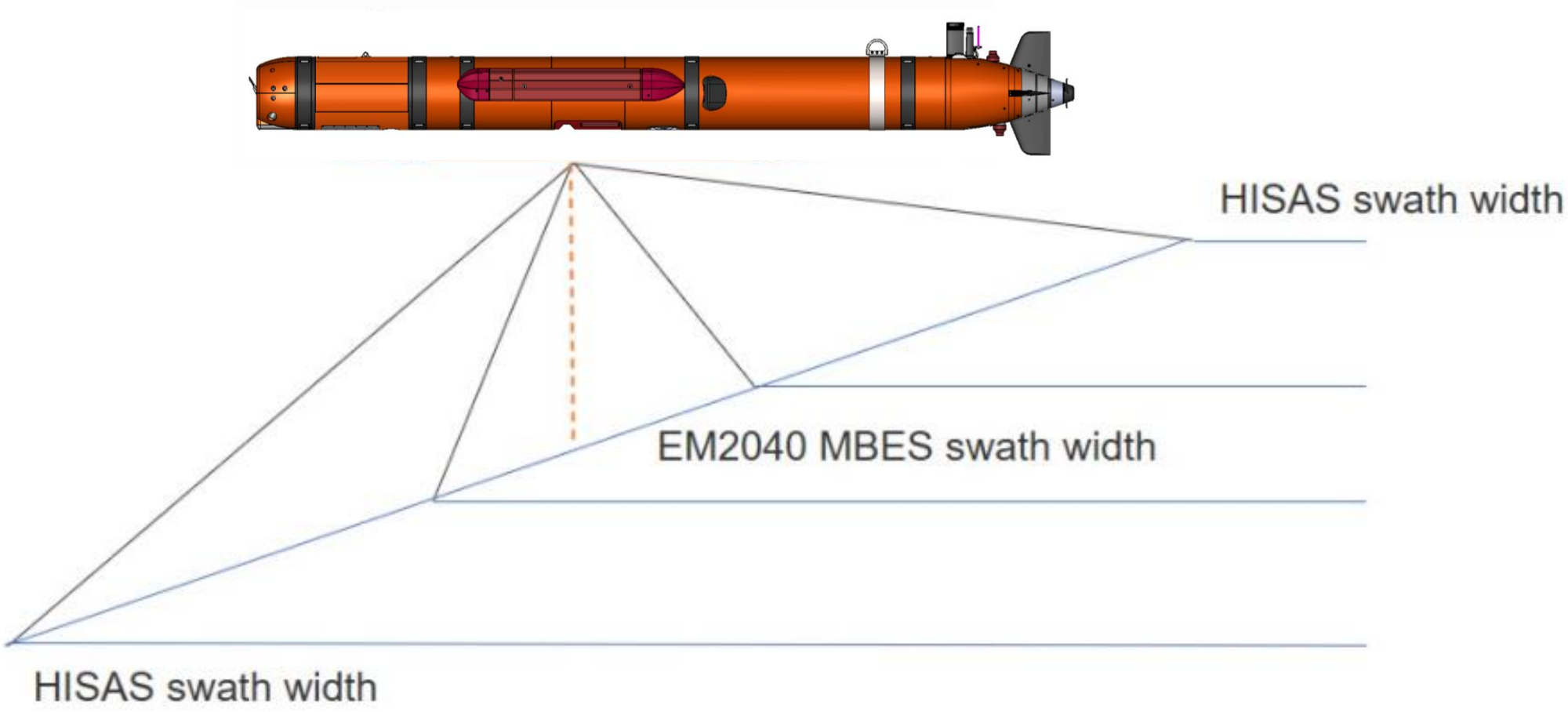








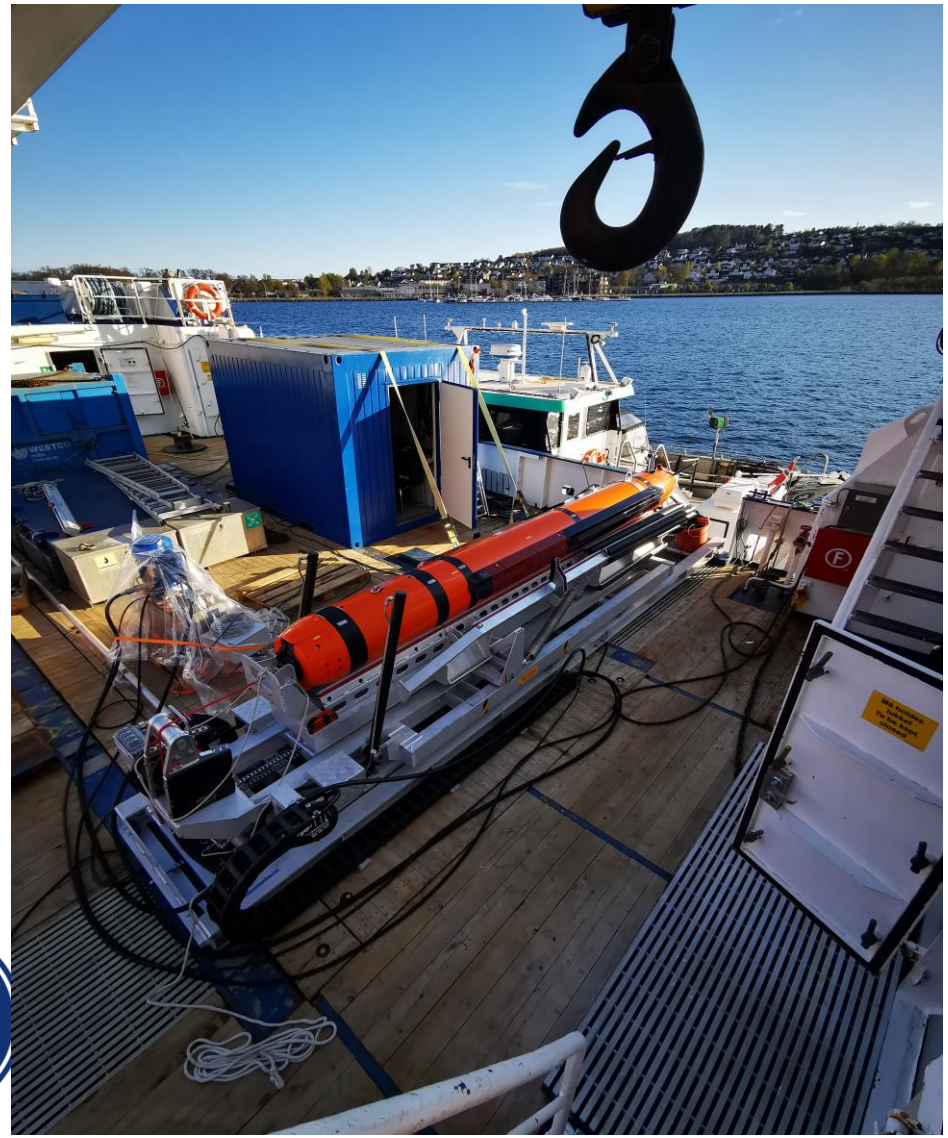
Munin+ swath width



HISAS 2040 has a practical resolution of 5cm x 5cm at all ranges.
HISAS 2040 har en range (pr side) @4 knop og 20 meter over bunn på 125m.
EM2040 swath dekning på ca 135 grader

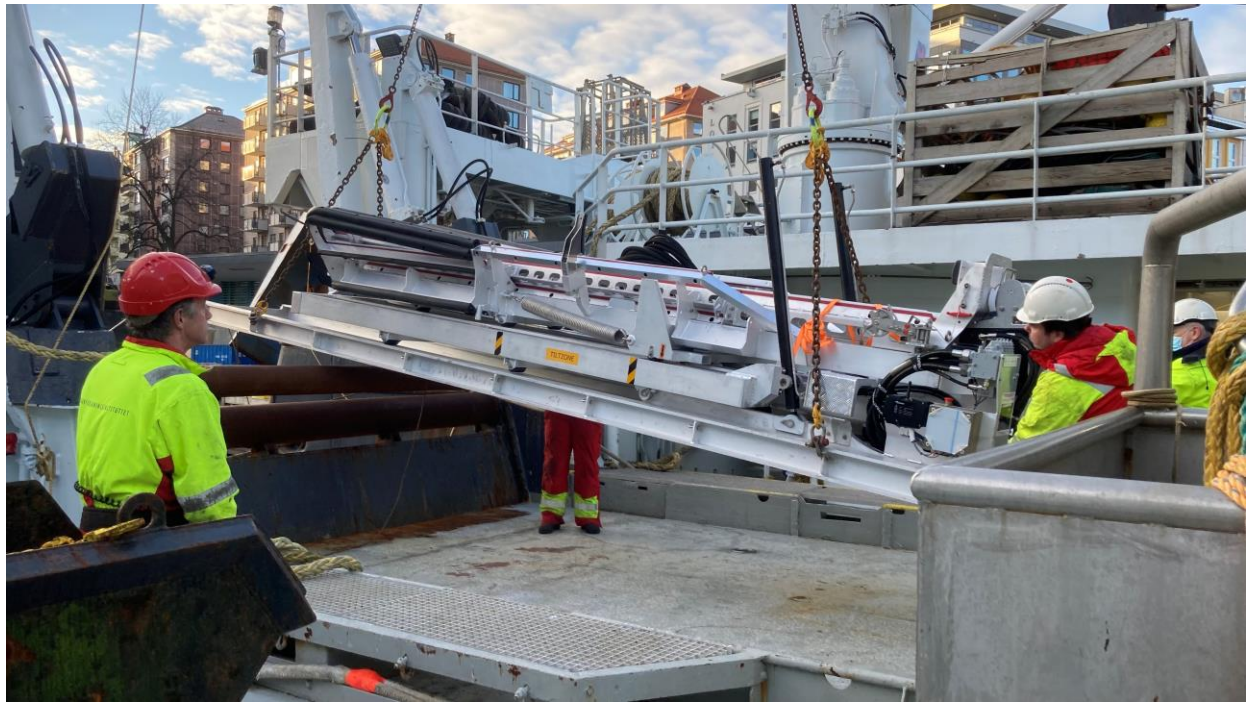
Testing of Munin+ and stinger on «Tyra»

Testing of Munin+ and stinger on «Hydrograf»



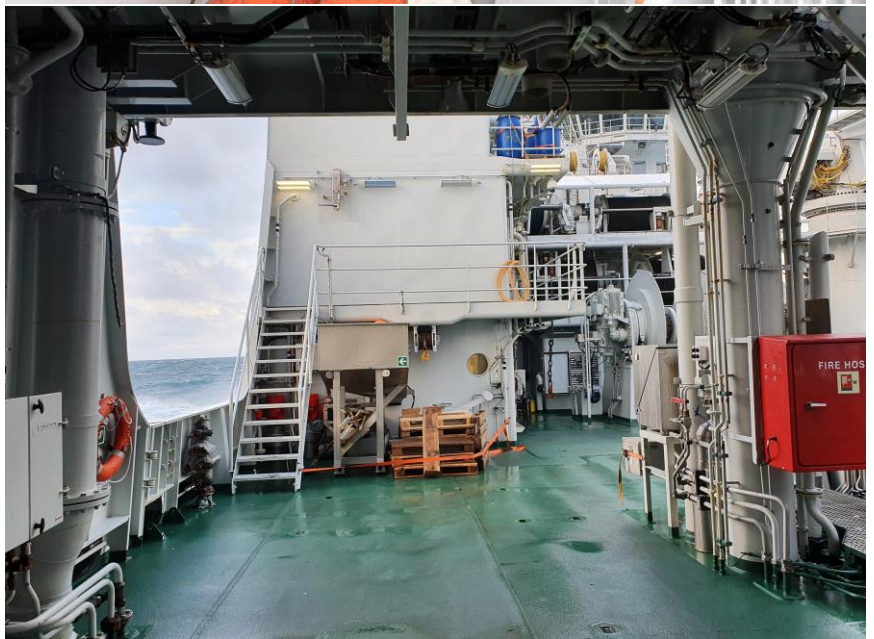
Kontroll container

Testing of Munin+ and stinger on «Johan Hjort»



Testing of Munin+ and stinger on «G.O.Sars»

Testing of Munin+ and stinger on «KH»



Munin+ Mission planning SW

Mission Planning - HuginOS

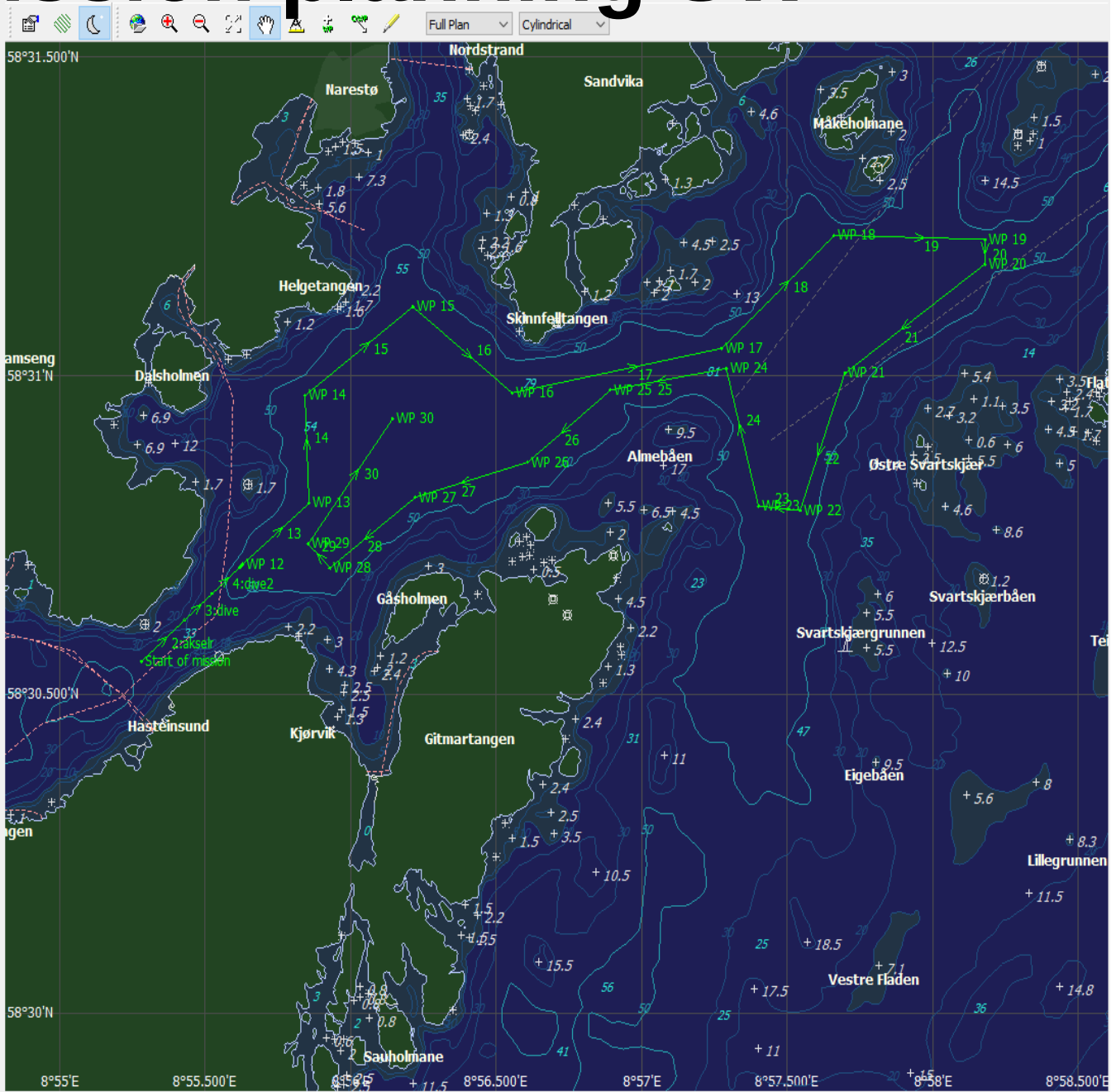
Session Preferences Help

AUV (1) New Vehicle Commands

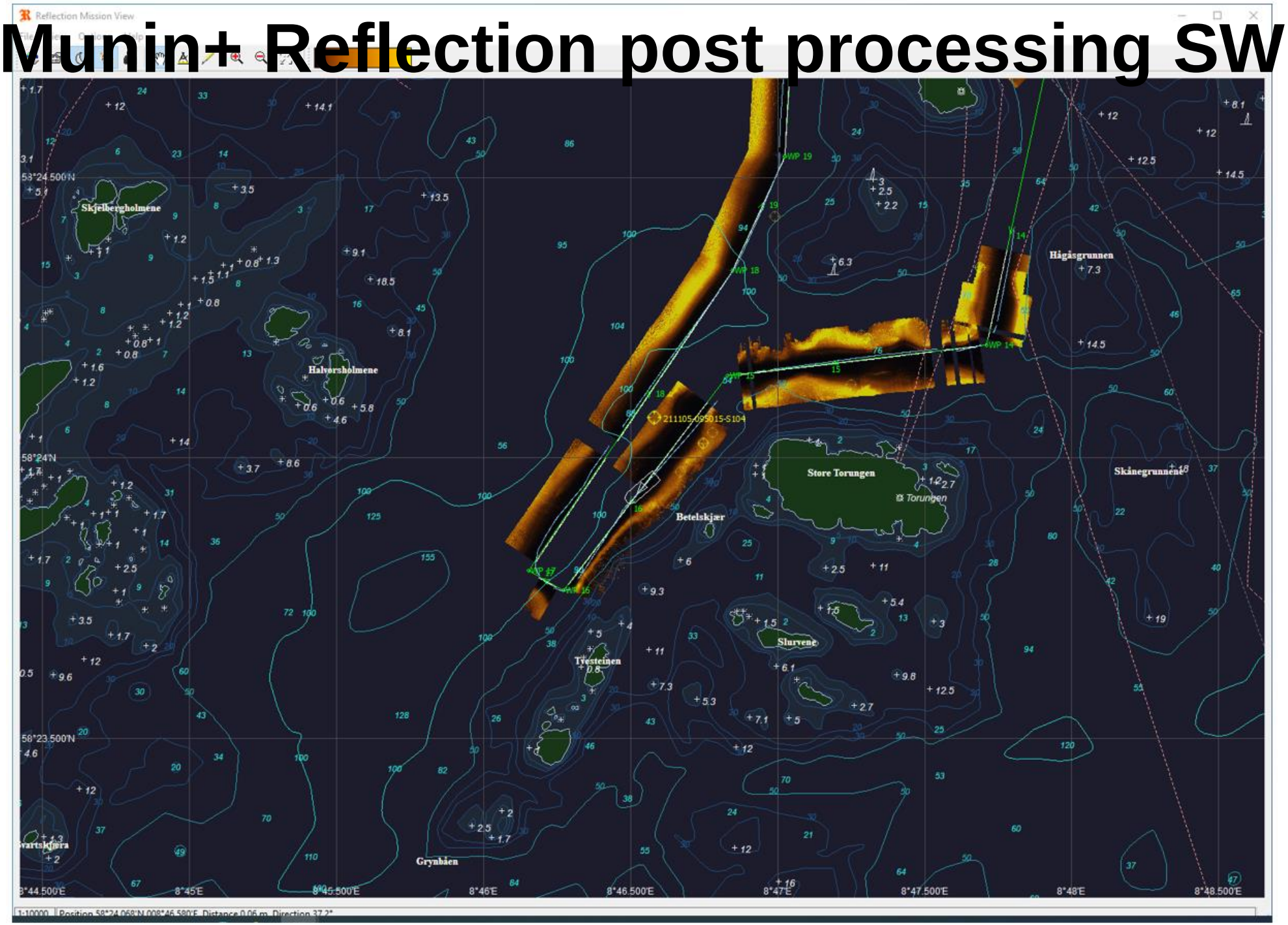
Mission Plan

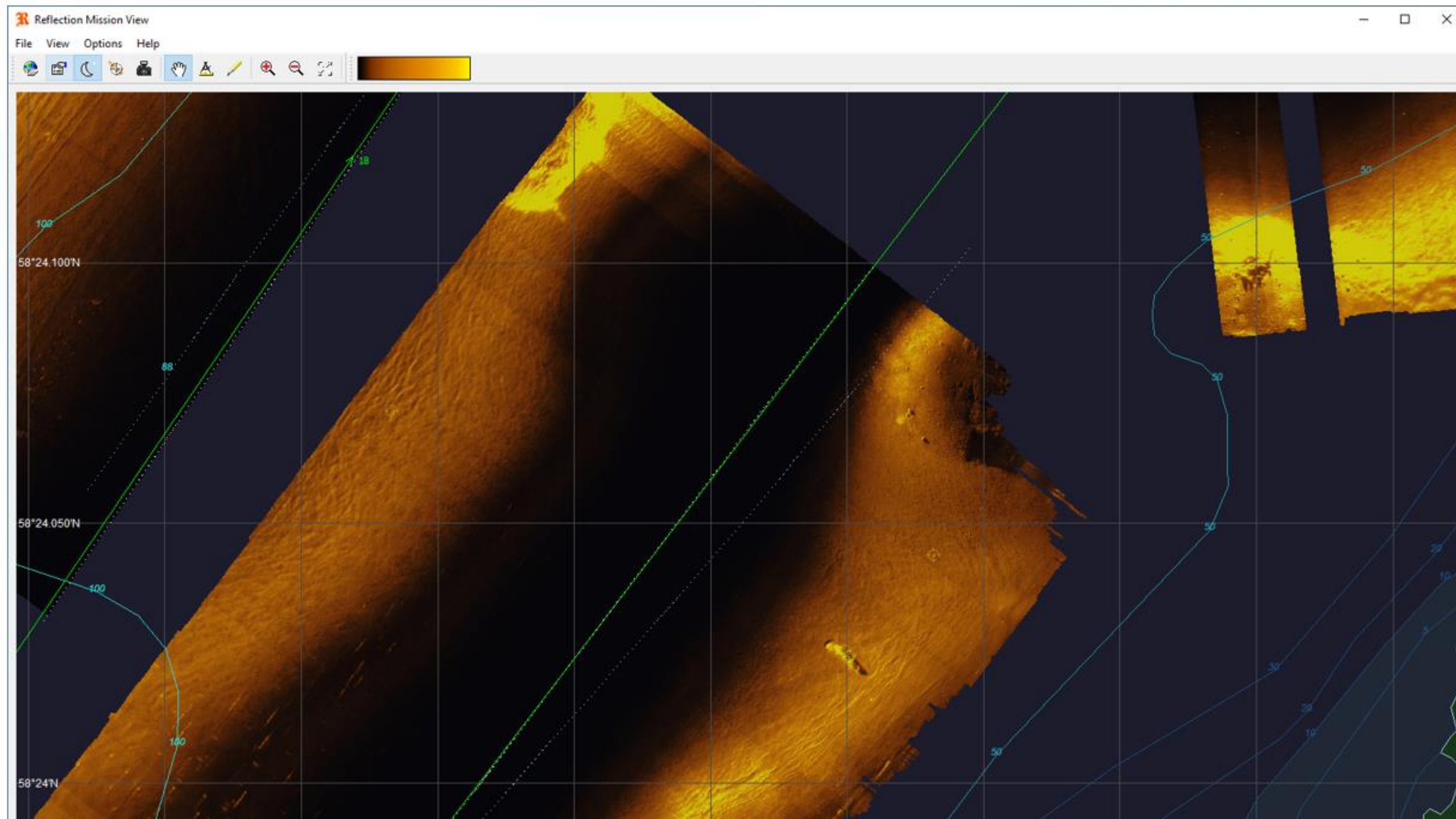
No:Tag	Depth	Alt	DMo	Latitude	Longitude	Course	GMo	RPM	Speed	SMo	Dur	Dist	Flags
# AUV i vannet, skip ut av farkostens planlegde kurs													
1:start	0.0	20.0	D	-	-	050	C	0	=	R	1:30	-	
# MUNIN akselererer med kurs 180 grader. Bro med. Verifiser at EM er standby													
2:akselr	=	=	=	-	-	=	=	250	=	=	1:00	-	
# dykk til mellomdybde, verifiser hipap og ellers ingen feilmeldinger													
3:dive	20.0	=	=	-	-	=	=	=	2.00	S	1:00	-	EMOn
# MUNIN mot havbunnen og folger denne.													
4:dive2	20.0	=	T	-	-	=	=	=	=	=	1:00	-	
5:	=	=	=	-	-	=	=	=	=	=	0:01	-	EM400Int
6:	=	=	=	-	-	=	=	=	=	=	0:01	-	DistTrigger
7:	=	=	=	-	-	=	=	=	=	=	0:01	-	SASPowerOn
8:	=	=	=	-	-	=	=	=	=	=	0:01	-	ETPowerOn
9:	=	=	=	-	-	=	=	=	=	=	0:01	-	SASOn
10:	=	=	=	-	-	=	=	=	=	=	0:01	-	SASHighPower
11:	=	=	=	-	-	=	=	=	=	=	0:01	-	ETOn
12:	=	=	=	58°30.705'N	008°55.629'E	=	=	=	=	=	-	-	
13:	=	=	=	58°30.801'N	008°55.857'E	(051)	=	=	=	=	(2:21)	(283)	
14:	=	=	=	58°30.969'N	008°55.843'E	(358)	=	=	=	=	(2:36)	(313)	
15:	=	=	=	58°31.109'N	008°56.213'E	(054)	=	=	=	=	(3:41)	(443)	
16:	150.0	=	=	58°30.973'N	008°56.554'E	(127)	=	=	=	=	(3:28)	(416)	
17:	=	=	=	58°31.043'N	008°57.273'E	(079)	=	=	=	=	(5:55)	(711)	
18:	20.0	=	=	58°31.220'N	008°57.660'E	(049)	=	=	=	=	(4:09)	(499)	
19:	=	=	=	58°31.214'N	008°58.179'E	(091)	=	=	=	=	(4:12)	(505)	
20:	=	=	=	58°31.175'N	008°58.178'E	(181)	=	=	=	=	(0:35)	(71)	
21:	=	=	=	58°31.004'N	008°57.697'E	(236)	=	=	=	=	(4:42)	(565)	
22:	=	=	=	58°30.789'N	008°57.543'E	(200)	=	=	=	=	(3:33)	(427)	
23:	=	=	=	58°30.796'N	008°57.401'E	(275)	=	=	=	=	(1:09)	(139)	
24:	=	=	=	58°31.012'N	008°57.290'E	(345)	=	=	=	=	(3:27)	(415)	
25:	=	=	=	58°30.978'N	008°56.892'E	(261)	=	=	=	=	(3:15)	(392)	
26:	=	=	=	58°30.864'N	008°56.607'E	(233)	=	=	=	=	(2:53)	(348)	
27:	=	=	=	58°30.809'N	008°56.221'E	(255)	=	=	=	=	(3:14)	(389)	
28:	=	=	=	58°30.699'N	008°55.928'E	(234)	=	=	=	=	(2:55)	(351)	
29:	=	=	=	58°30.737'N	008°55.853'E	(314)	=	=	=	=	(0:50)	(101)	
30:	=	=	=	58°30.933'N	008°56.143'E	(038)	=	=	=	=	(3:49)	(460)	

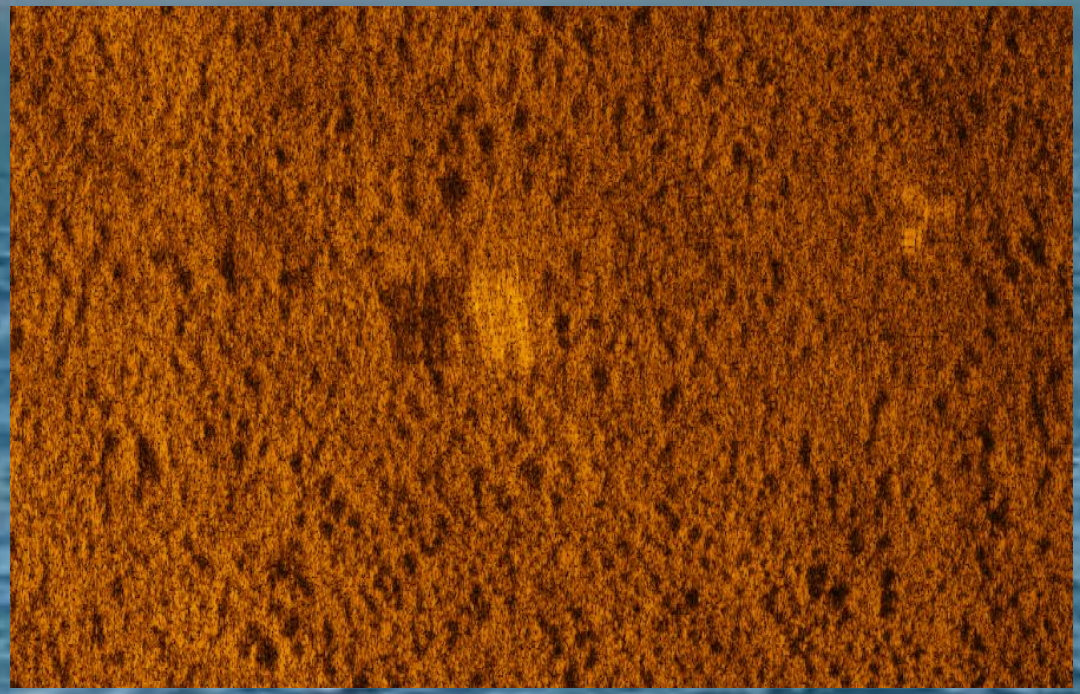
Send Clear Help

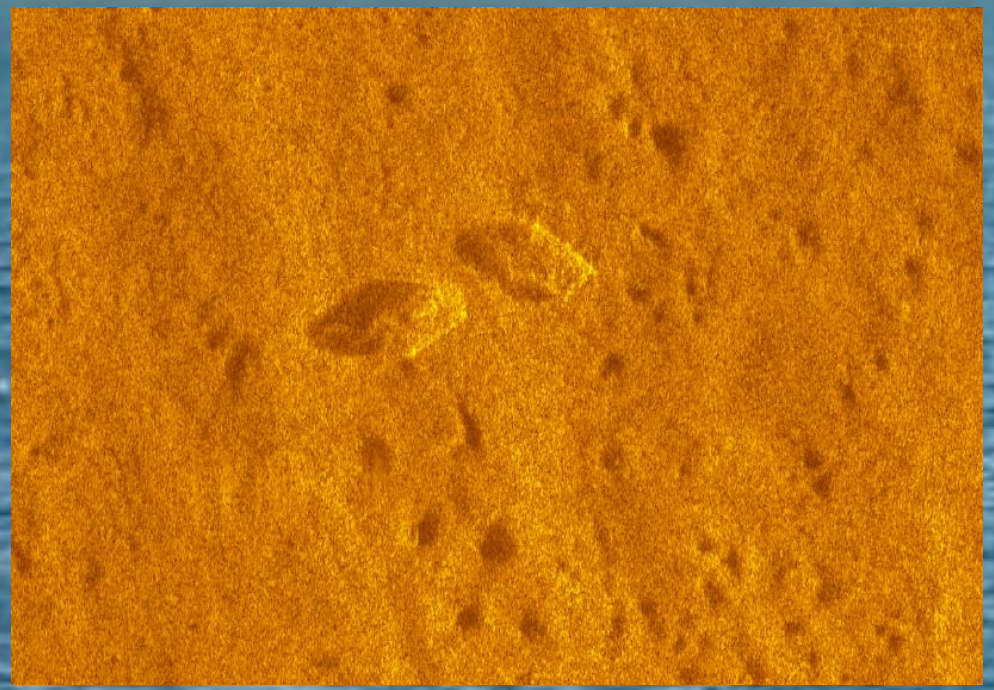


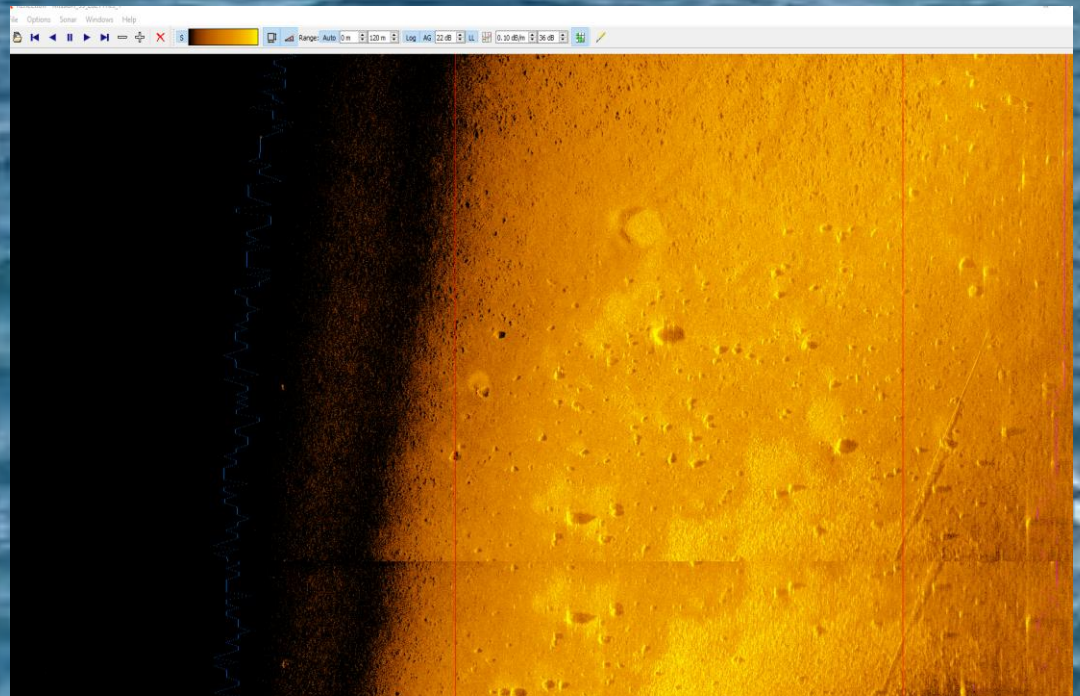
Munin+ Reflection post processing SW

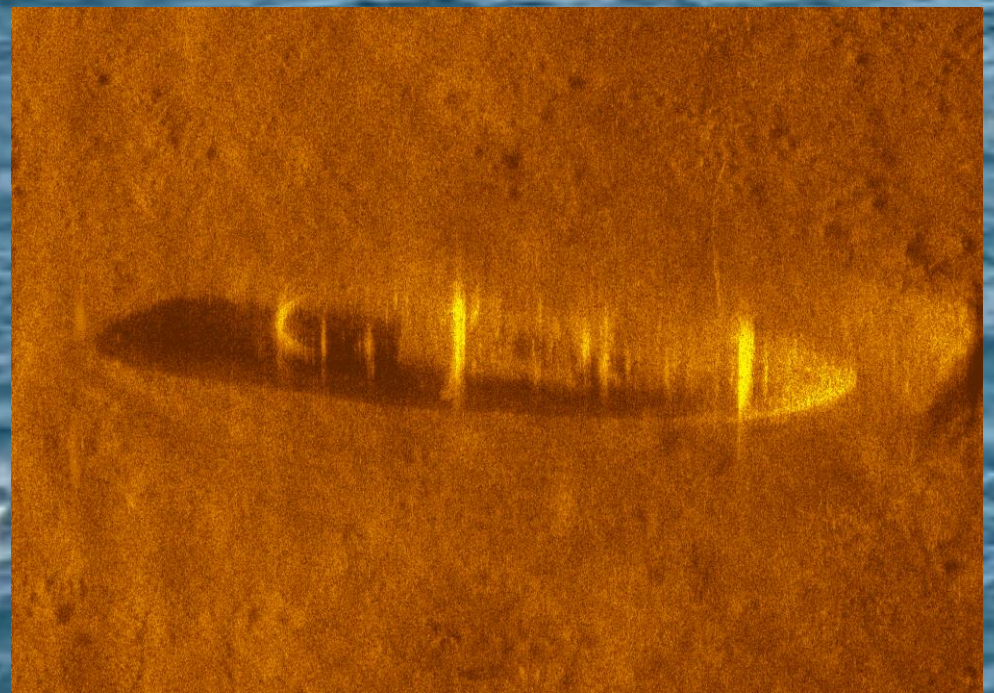



Reflection Mission View
File
View
Options
Help
58°24.100'N
58°24.050'N
58°24'N
100
88
100
100
18
50
50
50
50









Sounder

Tekniske data
Skrog: glassforsterket plast (GPR)
Produsent: VIKING Norsafe
Lengde: 8 meter
Vekt: 5000 kg
Fremdrift: 110kW/145bhp Steyr diesel motor
Survey hastighet: 4-8 knop (13 knop max)
Rekkevidde: 20 dager @4 knop (2x400 liter tank)
Kan kjøres autonomt eller fjernstyres

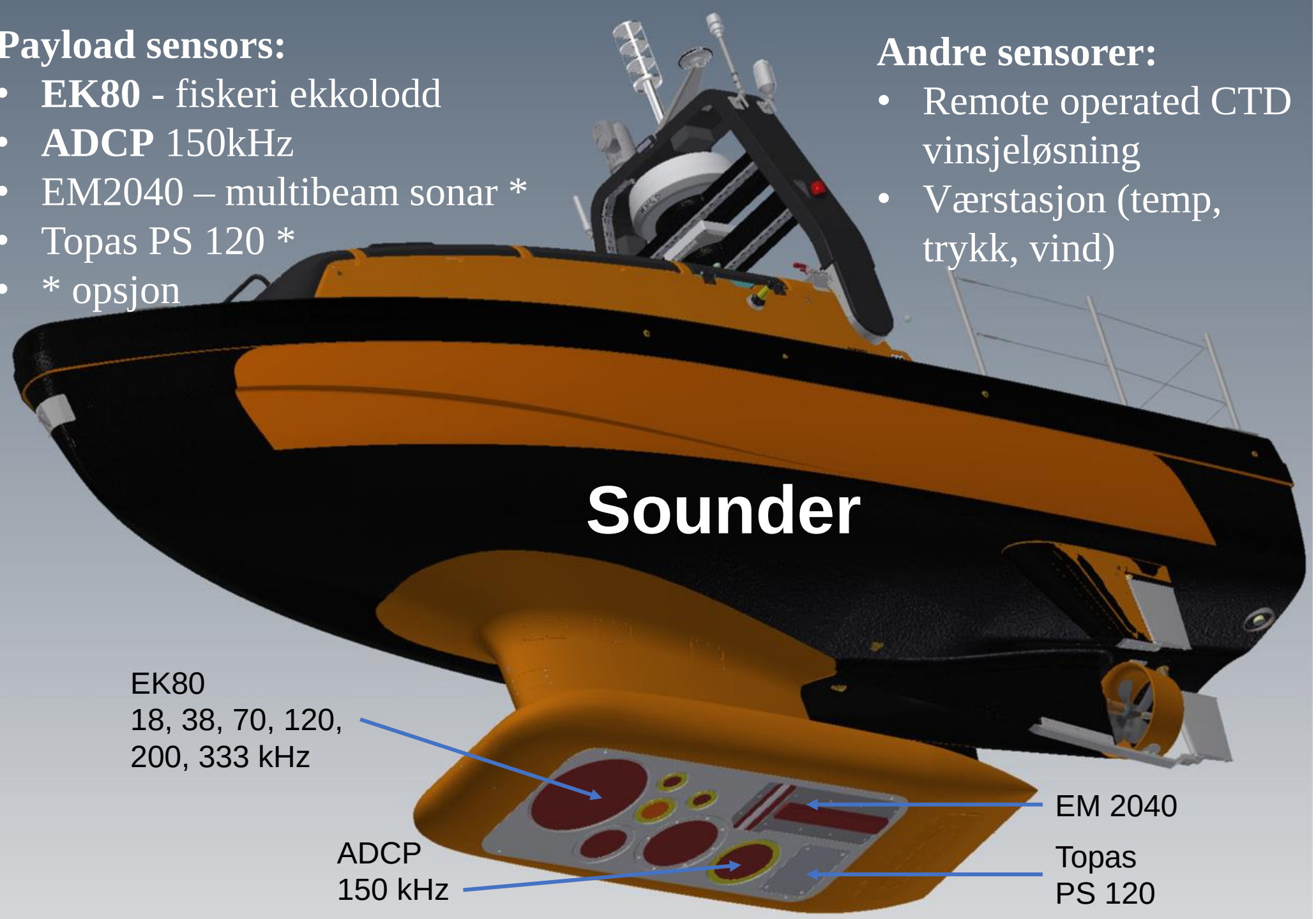
- Levering 19 september 2022

Payload sensors:

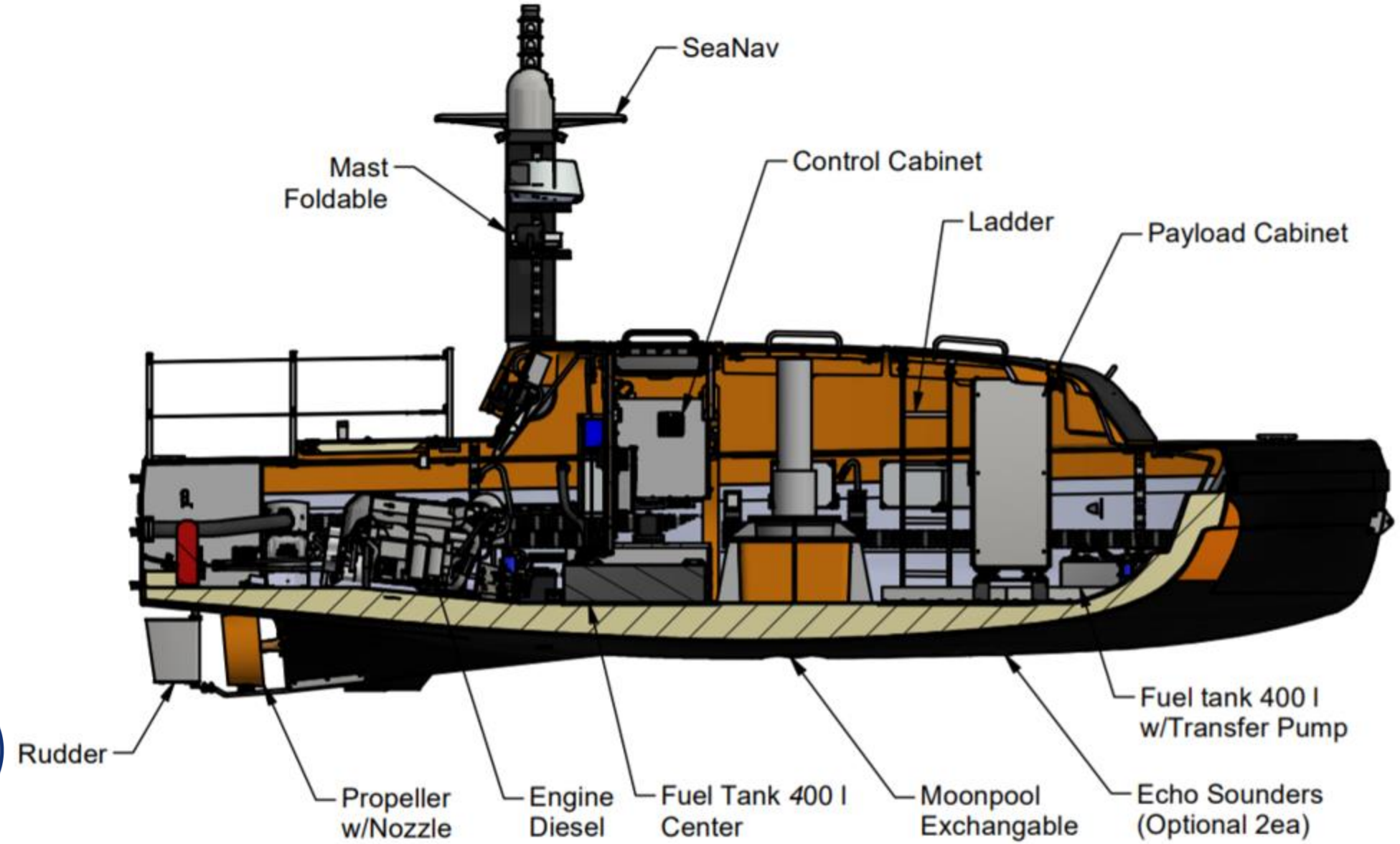
- **EK80** - fiskeri ekkolodd
- **ADCP** 150kHz
- EM2040 – multibeam sonar *
- Topas PS 120 *
- * opsjon

Andre sensorer:

- Remote operated CTD vinsjeløsning
- Værstasjon (temp, trykk, vind)



Sounder

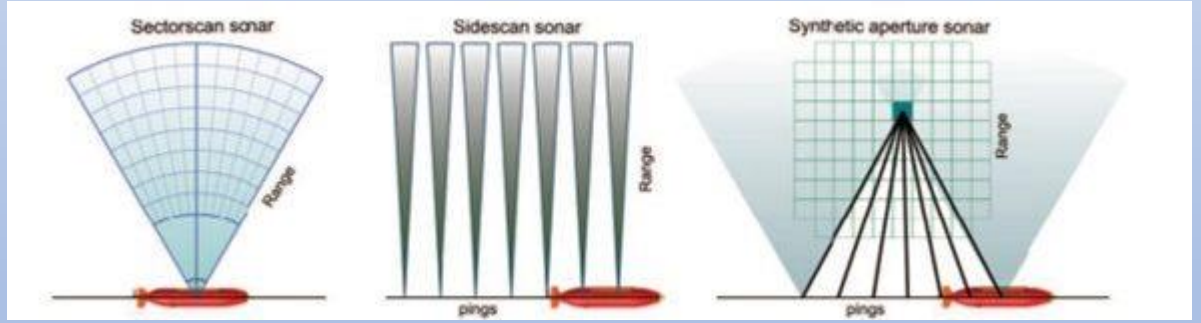

SeaNav
Mast
Foldable
Control Cabinet
Ladder
Payload Cabinet
Fuel tank 400 l
w/Transfer Pump
Rudder
Propeller
w/Nozzle
Engine
Diesel
Fuel Tank 400 l
Center
Moonpool
Exchangable
Echo Sounders
(Optional 2ea)

Sounder «båtkrybbe»

Experiences so far

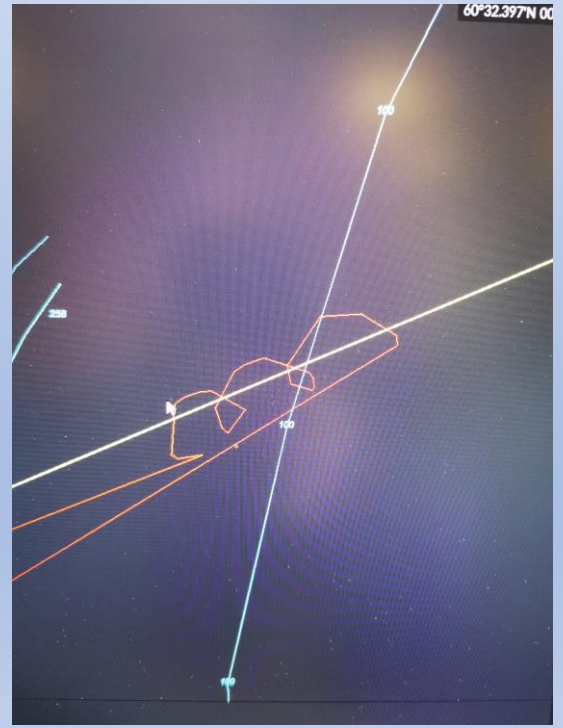
We had some problems at the beginning with diving in good weather when there were no waves.
We had to use a boat to create waves so that the craft would dive.
The solution to this problem was to run full rudder up until you have the right speed, and then full rudder down.
We and Kongsberg have tested this several times with 100% success
The AUV is also wildly sensitive when it comes to balancing in salt water.
Sometimes there may be less salt in the water in the end of the mission, then it may sink again.

We also had some problems with different layers in the water.
Our first deep water dive did not go quite to plan as the craft detected bottom in the various layers.
The solution is to set a value for the deepest layer in the configuration before the dive.
We check this by taking a CTD



https://www.kongsberg.com/no/maritime/products/ocean-science/mapping-systems/sonars/SAS/


Triton
59


60°32.397'N 00
100
250
100
100