



# EIVA

ROTVs

STABILISED SENSOR PLATFORMS FOR STUDYING THE WATER  
COLUMN AND UNDERWATER TOPOGRAPHY

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# ENGINEERING EXCELLENCE WITH THE FLEET OF COVELYA COMPANIES

EIVA

 Chelsea  
Technologies

FORCYS

covelya  
GROUP

 WAVEFRONT

 Sonardyne

VOYIS 

# REMOTELY OPERATED TOWED VEHICLE

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## ADVANTAGES OF AN ACTIVE TOWED SYSTEM

- Automatic modes
  - Follow seabed
  - Undulation
  - Obstacle avoidance
- Large operation window
  - Less to none winch operation
  - Automatic height control
- Stable platform
  - Active rudder stabilisation
- Minimum operator inputs
  - Minimise risk of failures



# SCANFISH: DETAILS & NEW DEVELOPMENTS

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- Variants
- Customisation
- Operation modes



# SCANFISH AS SENSOR PLATFORM

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## SCANFISH III SINCE 2012

- Towed behind a vessel with a speed of 3-10 knots
- Able to position itself horizontally (3D steering) and vertically in the water column using internal sensors
- Large payload capacity for survey equipment
- Offers higher speed and lower cost compared to ROVs & far better control than passively towed systems
- 115 systems currently produced since 2012



# SCANFISH BASICS

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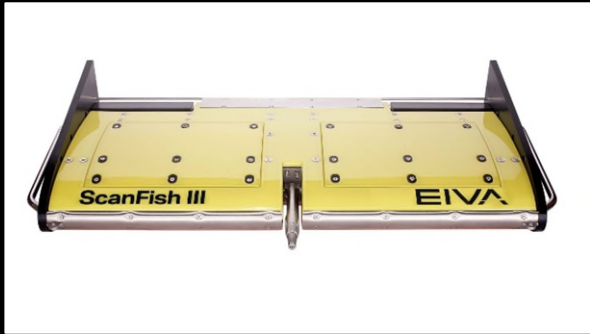
## DIMENSIONS AND PERFORMANCE

- Weight air 75 kg
- Weight in water 0 kg
- Length 0.90 m
- Height 0.26 m
- Width 1.80 m
- Towing speed 3–10 kt
- Depth rating 400 m
- Dive/climb speed 0–2 m/s
- Pay load 50 kg



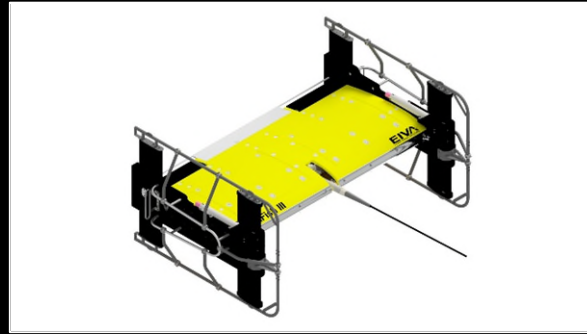
# SCANFISH

## MULTIPLE VARIANTS – TAILORED TO YOUR NEEDS, INCLUDING...



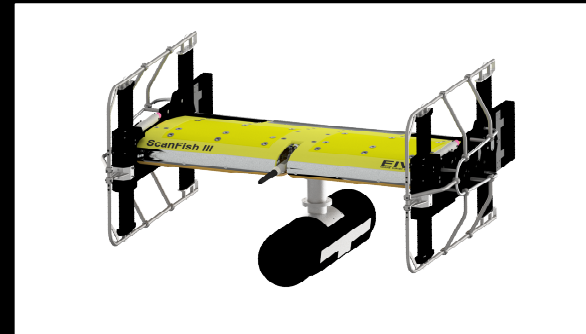
**SCANFISH ROCIO**

Multi-purpose ROTV for oceanographic surveys



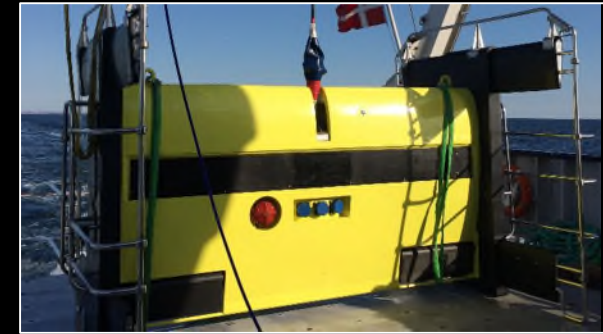
**3D STEERING**

Enhance the manoeuvrability and flight path capabilities with horizontal steering



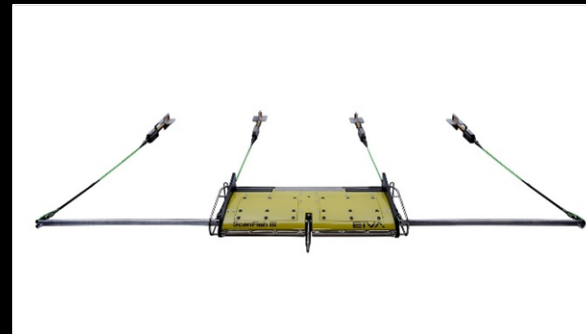
**EQUINOX**

Multi-aperture sidescan solution for UXO surveys with market-leading positioning



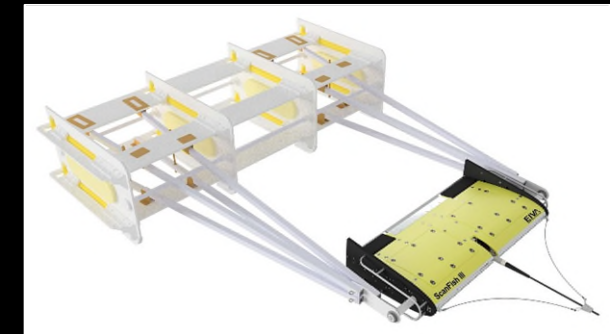
**SCANFISH XL**

Multi-purpose, high payload capacity up to 400 kg



**SCANFISH KATRIA**

Intelligent wide-sweep ROTV for UXO/magnetometer surveys



**TAILORED SOLUTIONS**

Matching your project setup and sensor spread

# SCANFISH

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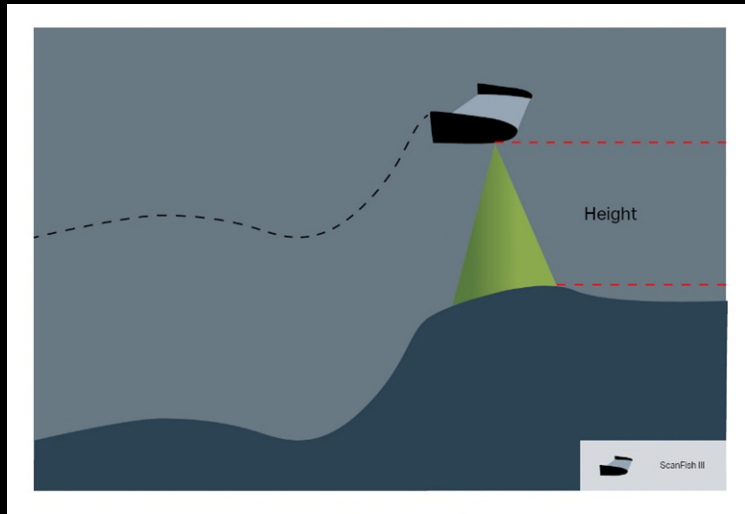
## RICH POSSIBILITIES FOR CUSTOMISATION

- Power supply
  - 600 / 1000 W
- Serial payload ports
  - RS-232 / 422 / 485
- Ethernet payload ports
  - 10 / 100 / 1000 Mb/s
- Dual payload voltage rail
  - 24 V DC
  - 12 – 48 V DC
- Various telemetry solutions
  - Up to 6 Mb/s via coax cable
  - 1 Gb/s via fiber optic cable



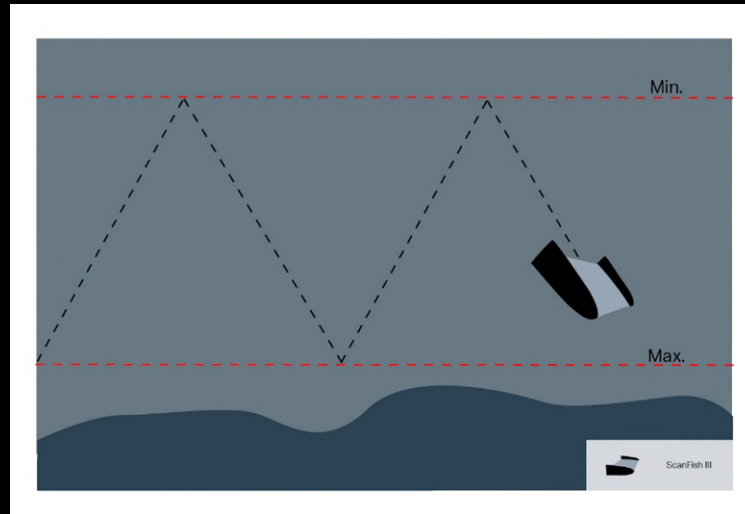


# SCANFISH AUTOMATIC MODES



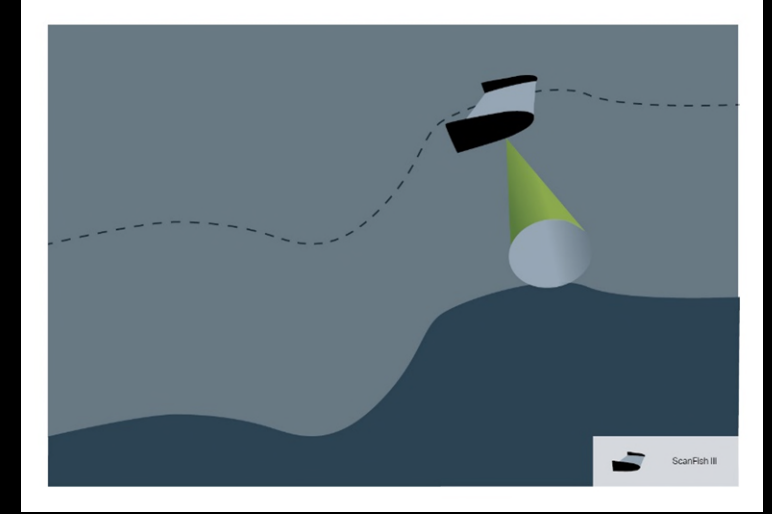
## Automatic follow seabed

- Follow the seabed contour in a fixed user-defined height
- Magnetometer, sidescan sonar, multibeam echosounder



## Automatic undulation

- Undulates within a user-defined...
  - min and max depth
  - ascend and descend speed
- Scientific measurements



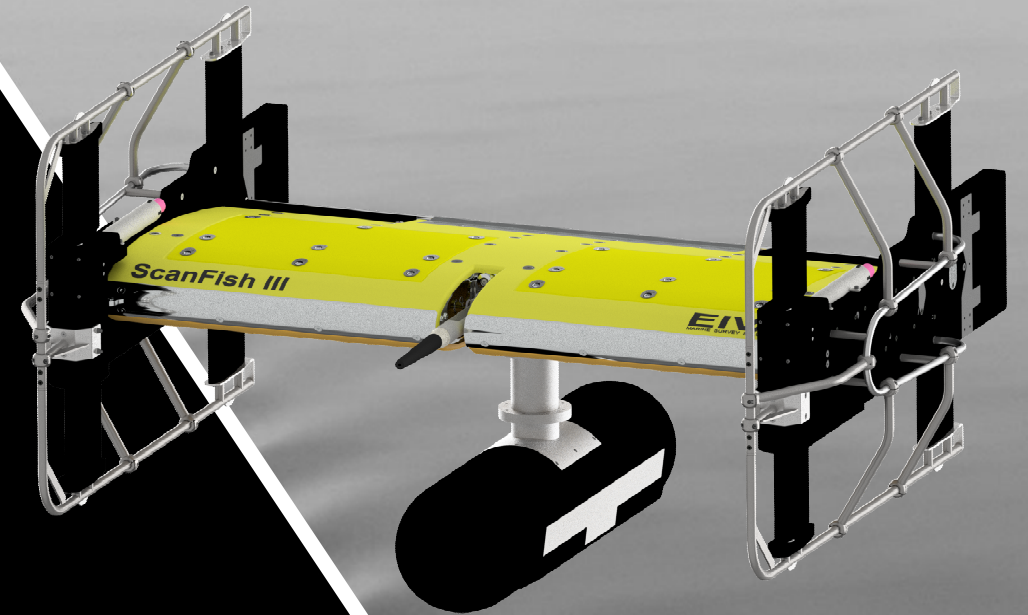
## Automatic obstacle avoidance

- ScanFish will avoid obstacles within a user-defined range

# SCANFISH EQUINOX

## SCANFISH III 3D – IDEAL PLATFORM FOR SOLSTICE

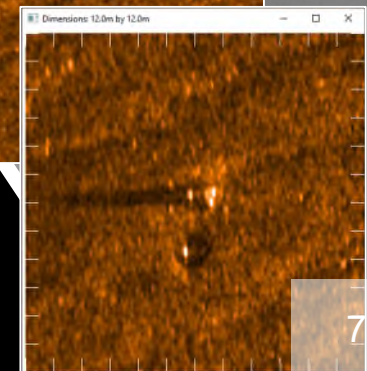
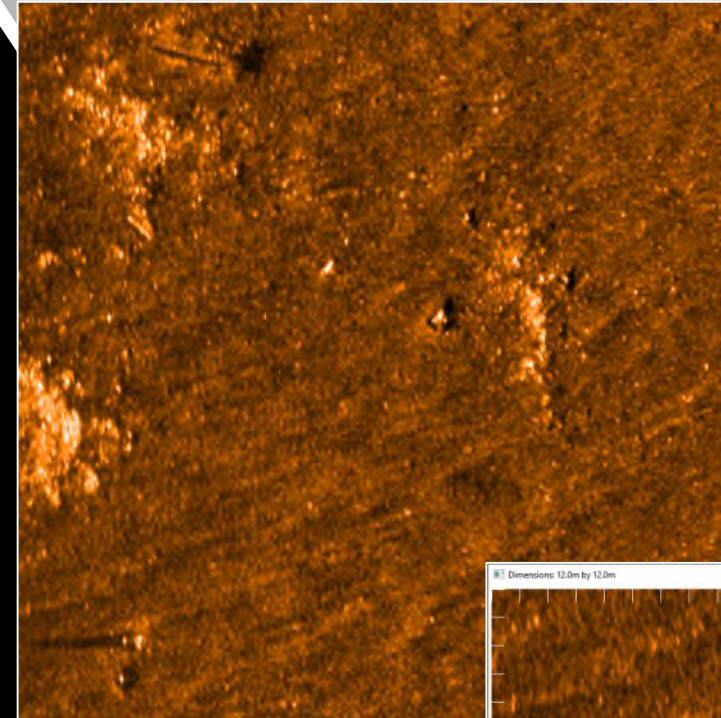
- Active ROTV platform with automated flight software
  - Automatic flight mode ‘follow seabed at 7.5 m height’
  - Automatic roll stabilisation
  - Automatic emergency climb with on-board battery to avoid obstacles or climb in case of power loss
  - Pre-flight checks and system alarms
- Autopilot control
  - Horizontal positioning and ability to automatically follow runline from NaviSuite Kuda
  - Forward-looking terrain following using DTM of area or vessel mounted multibeam sonar
- Extra payload capacity, power and communication ports (IP or RS232) for adding extra sensors
- 1 Gbit/s fiber telemetry for real-time streaming of data



# SCANFISH EQUINOX

## TOP OF THE LINE SENSORS AND SONAR

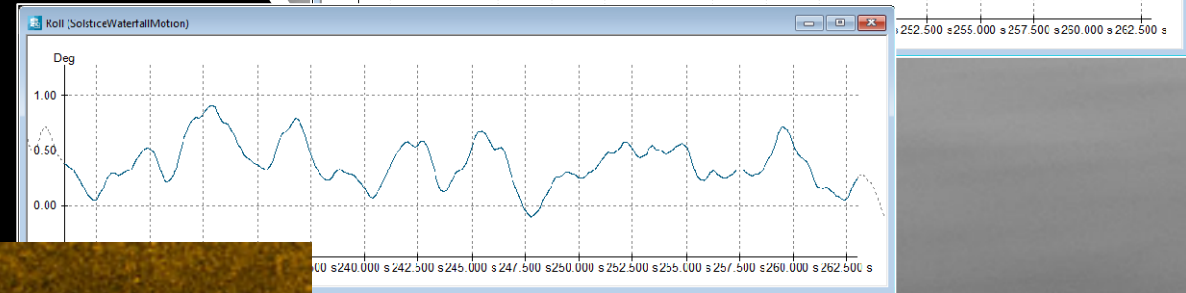
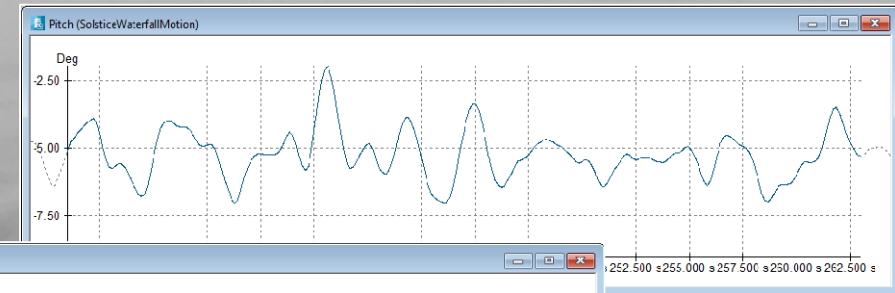
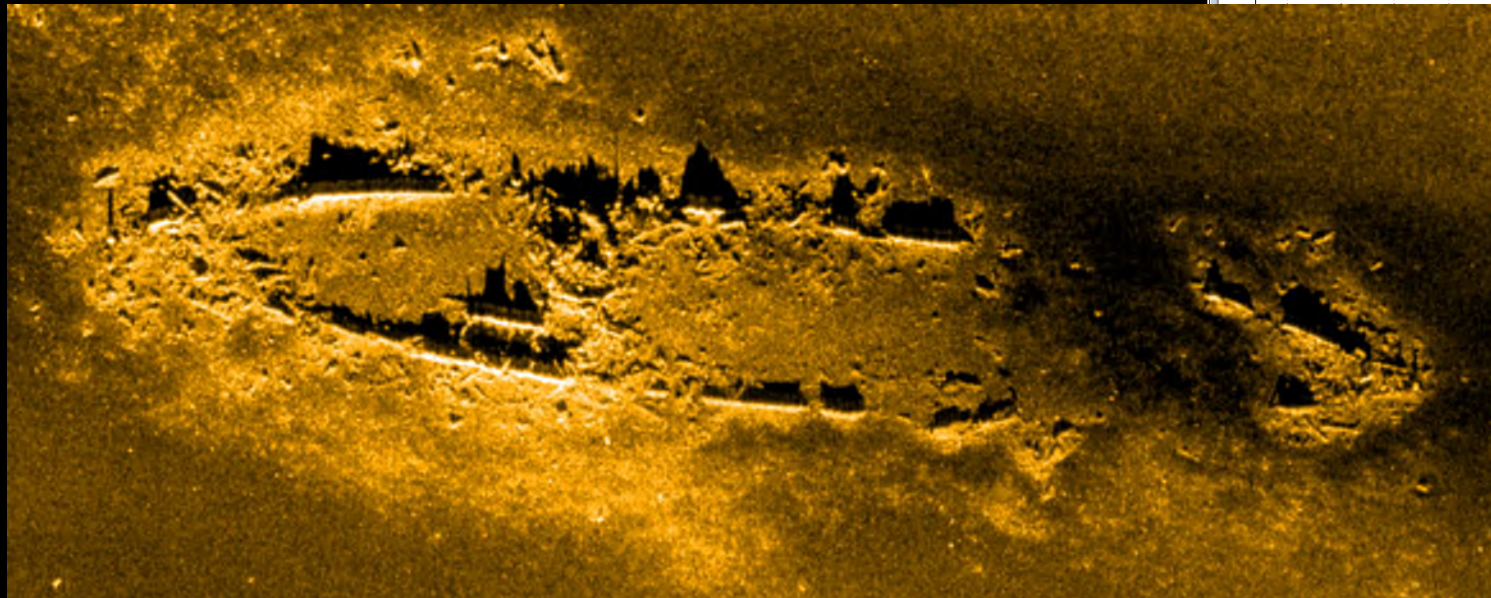
- Solstice multi-aperture sonar array
  - Wide swath, 100 m to each side
  - High resolution images
- Mini-Ranger 2 USBL + Sprint INS
  - Operating range up to 4,000 m
  - High heading and pitch/roll accuracy
- This combination allows for identification of targets on the outer beams with 1 m DRMS



# SCANFISH EQUINOX

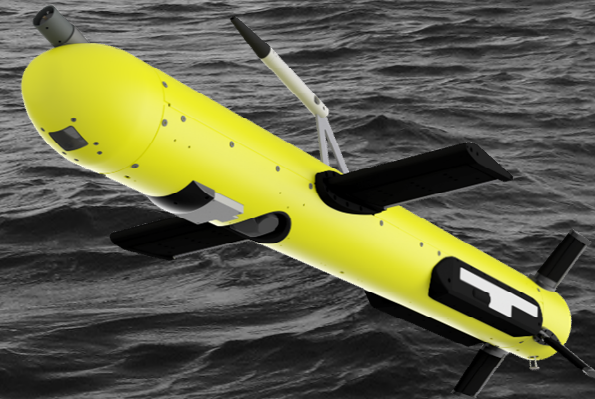
## SCANFISH ROTV STABILITY

- Less than 1 degree roll



## VIPERFISH: DETAILS

- Sensor integration
- Technical specifications
- Operation modes



# VIPERFISH FOR UAVS AND VESSELS

- Increased interest in autonomous operations
- Based on ScanFish concept
- An all-in-one remote operated towed vehicle system (ROTV)
- Streamlined hardware design for deployment from unmanned surface vessels (USV)
- 3D steering with control in both vertical and horizontal directions
- Integrated with autopilot software (NaviSuite Flight)
- Multiple payloads
  - sidescan sonar
  - multi-beam echo sounder (MBE)
  - magnetometer
  - sound velocity sensor (SVS)
  - positioning sensors (DVL/INS and USBL)

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Sonardyne WSM 6+USBL

OFG RM hypermags

Wavefront Solstice multi aperture sonar

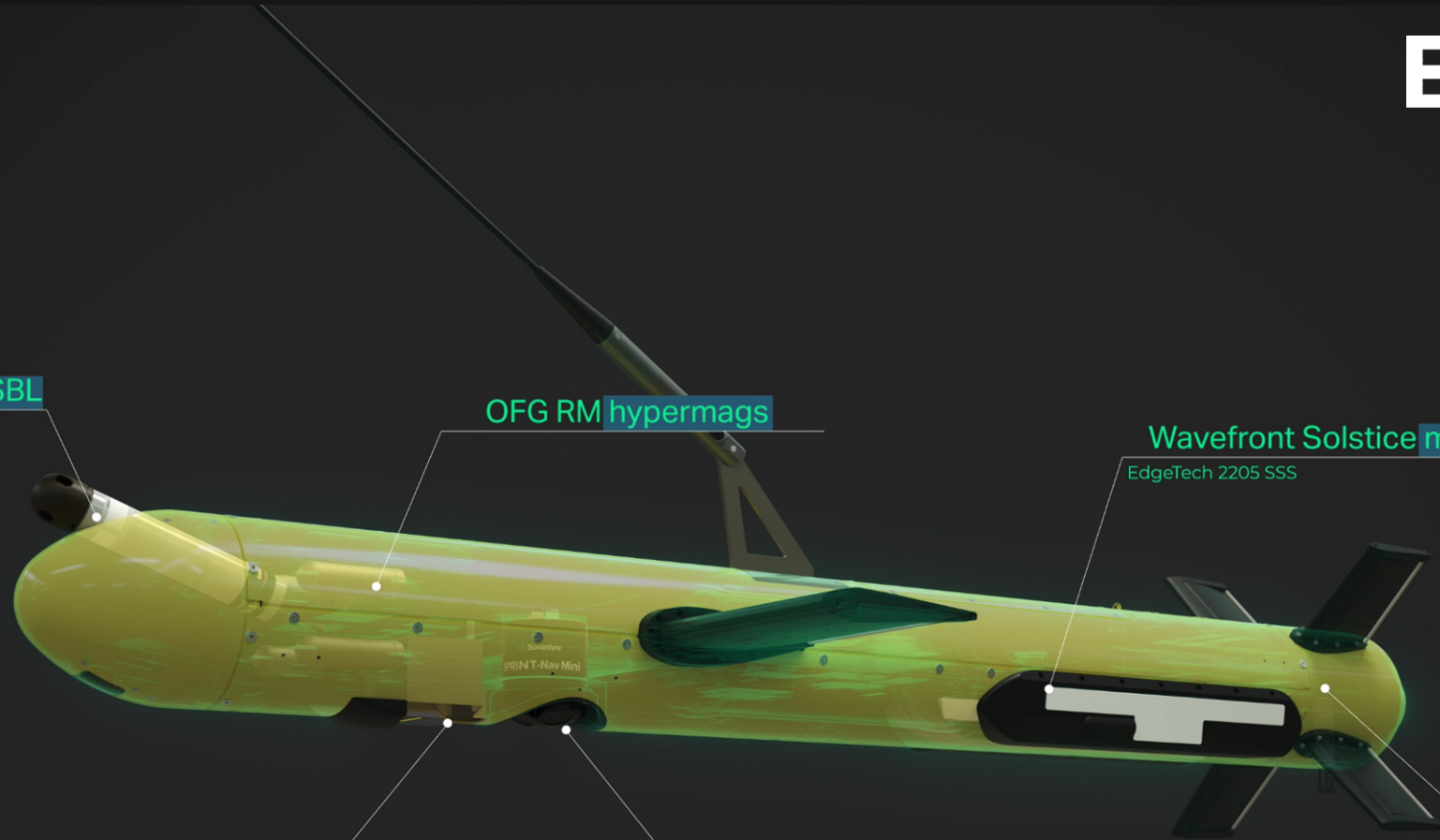
EdgeTech 2205 SSS

Payload

R2Sonic 2020 MBES

Sonardyne SPRINT-Nav Mini

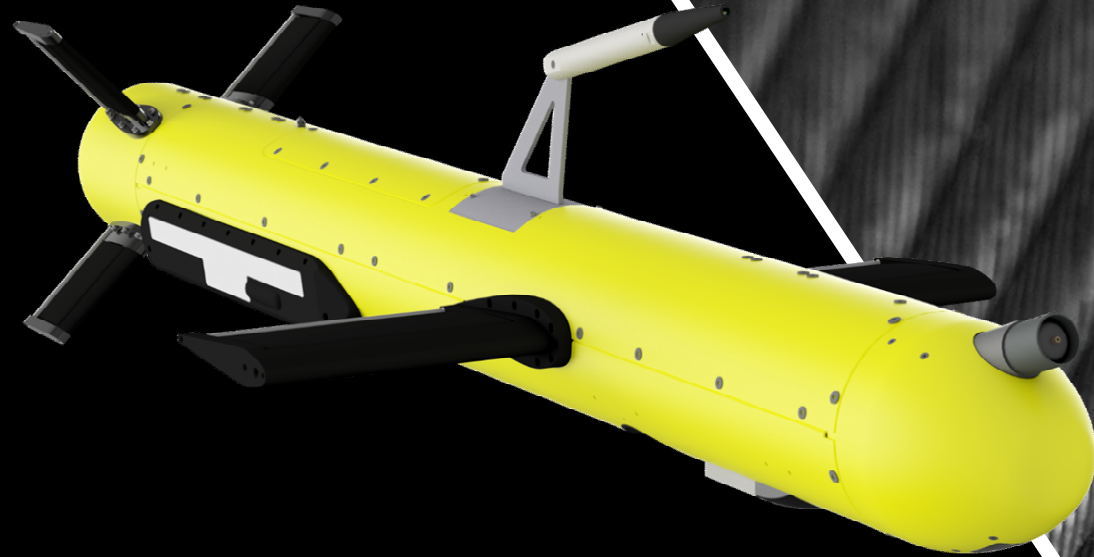
Valeport SVS



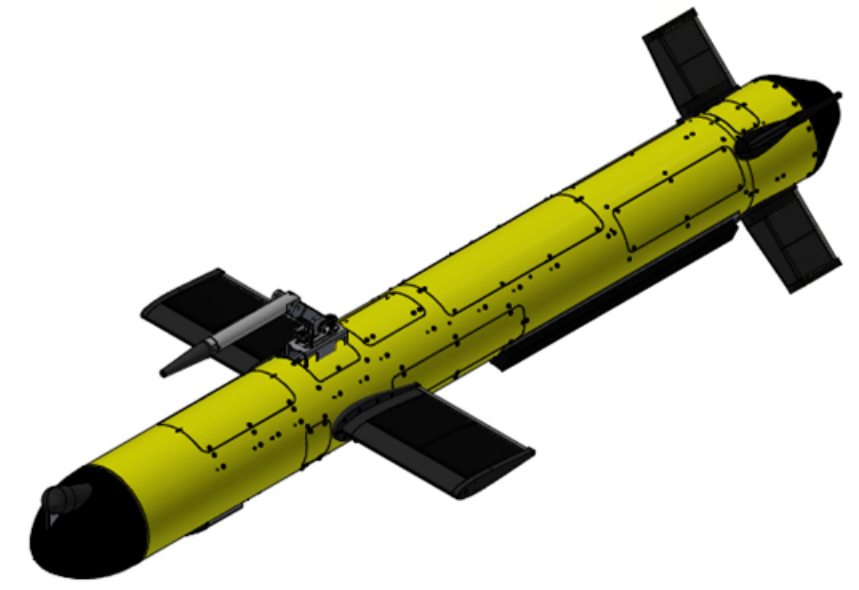
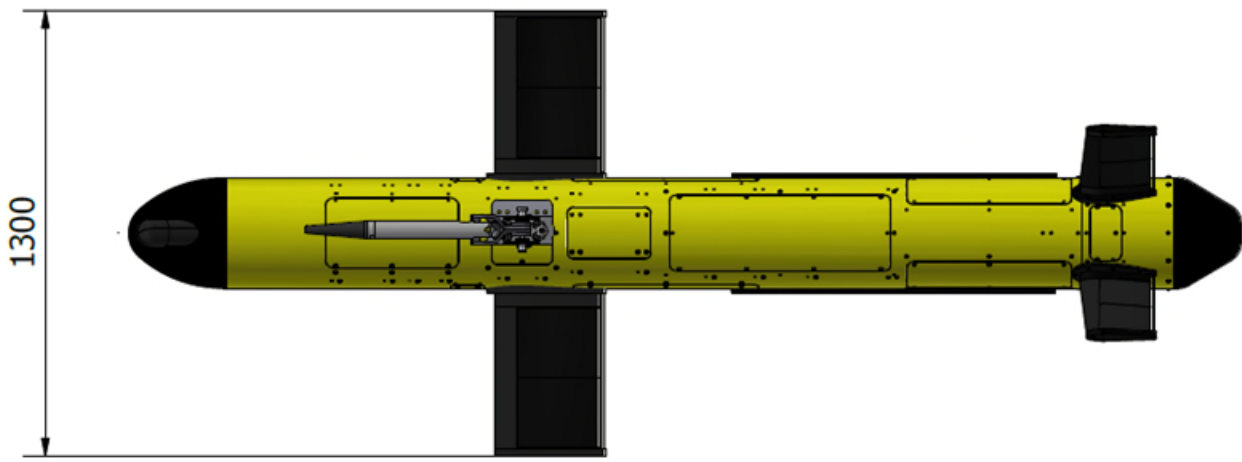
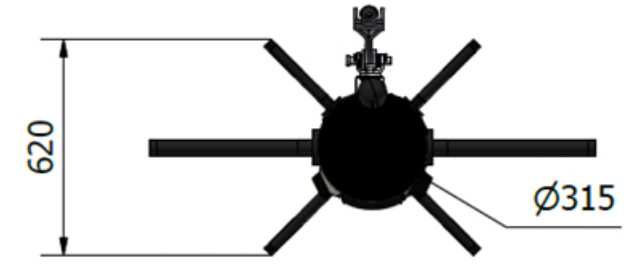
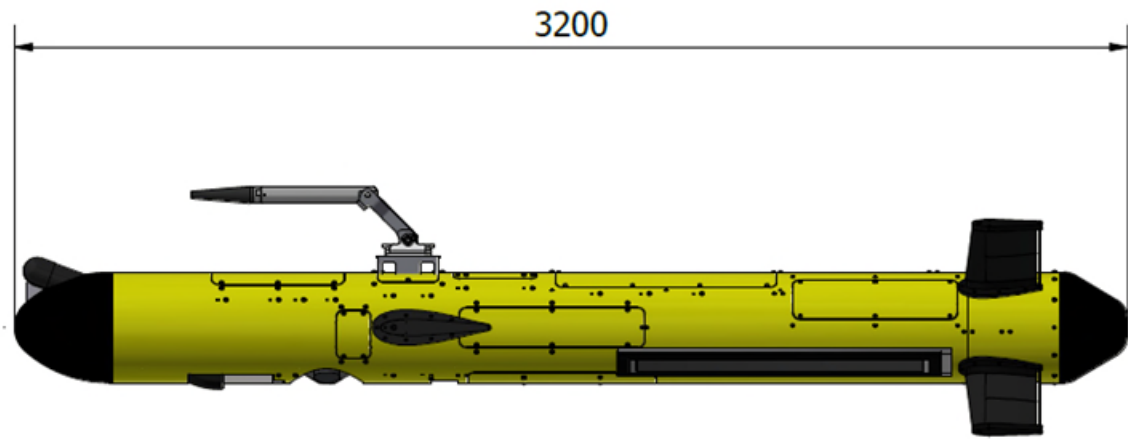
# VIPERFISH SPECIFICATIONS

## VIPERFISH ROTV – REMOTELY OPERATED TOWED VEHICLE

- Weight in air 145 kg
- Weight in water 5 kg
- Length 3.2 m
- Diameter Ø 315 mm
- Speed 2-10 knots
- Depth rating 200 m
- Dive/climb speed 0-2 m/s









Single hull



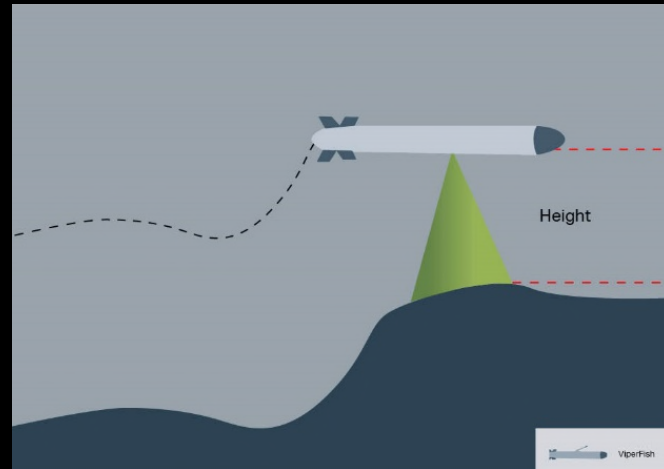
Catamaran

## USE CASES

### AUTONOMOUS REMOTE OFFSHORE WIND INSPECTION, NAVIGATION AND DEPLOYMENT

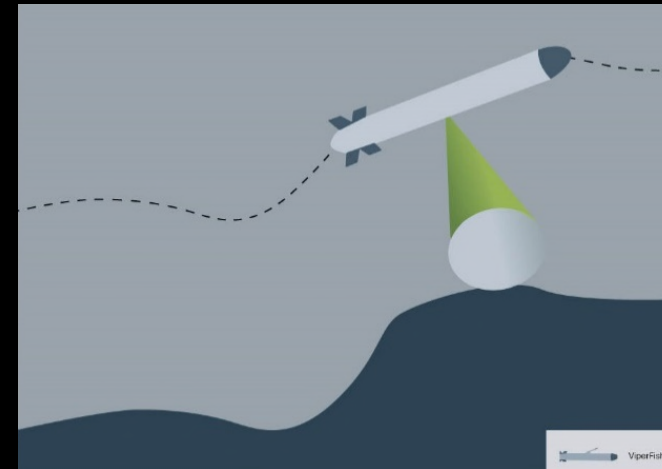
- USV operations
  - Catamaran
    - Fixed position between pontoons
    - ViperFish stays in water
  - Single hull
    - A-frame deployment
- Autonomous launch / recovery

# AUTOMATIC OPERATION MODES



## Automatic follow seabed

- Follow the seabed contour at a fixed user-defined height
- Magnetometer, sidescan sonar, multi-beam echo sounder



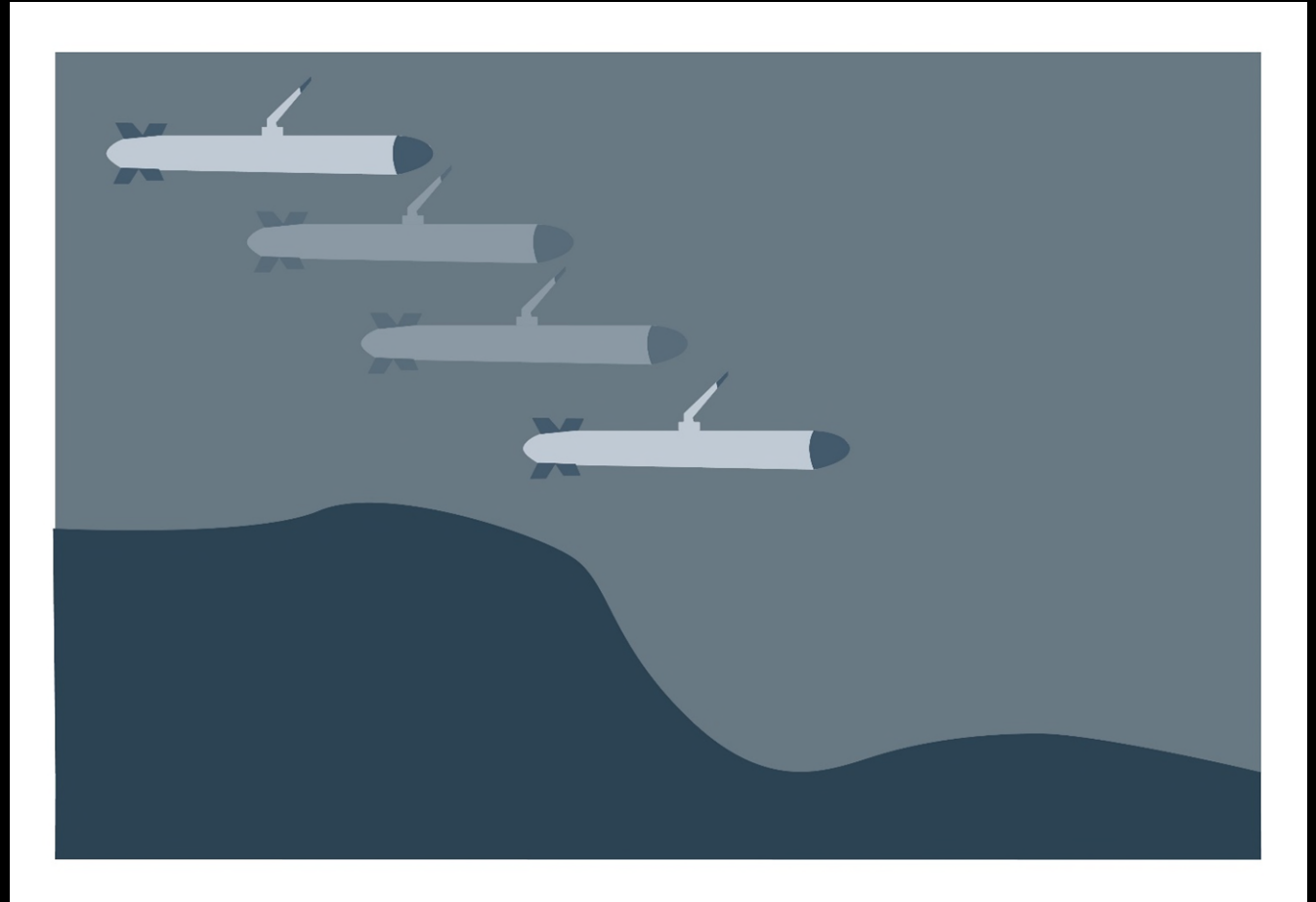
## Automatic obstacle avoidance

- ViperFish will avoid obstacles within a user-defined range

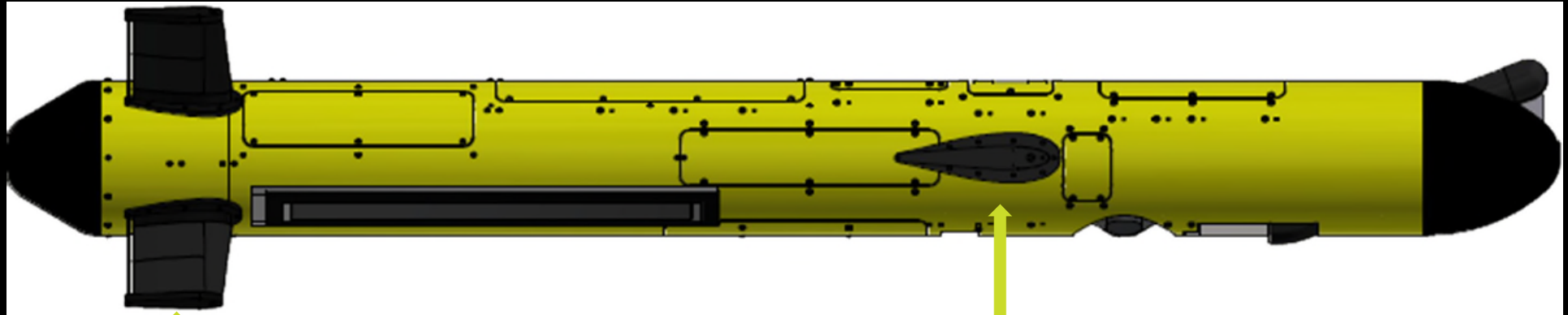
# PITCH STABILISATION

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- Minimise pitch changes when following seabed
- Parallel shift the system when changing height
- Achieved by having active flaps bow and stern



# ACTIVE FLAPS

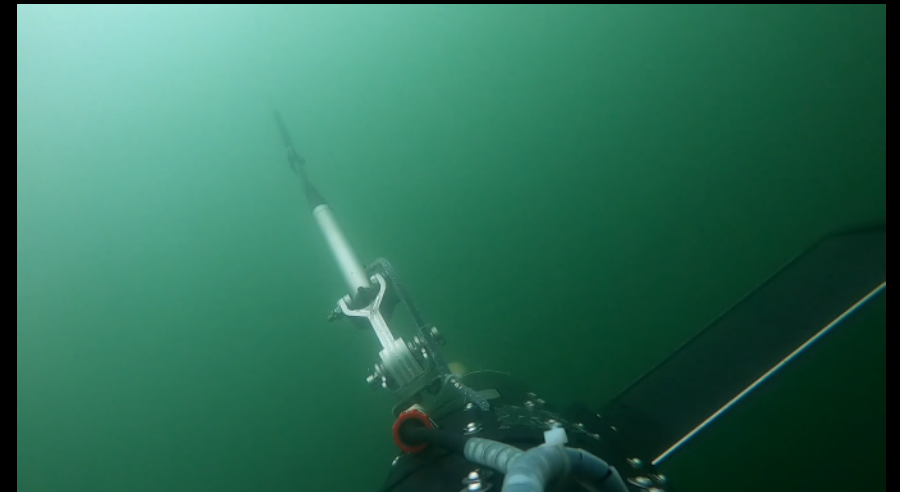
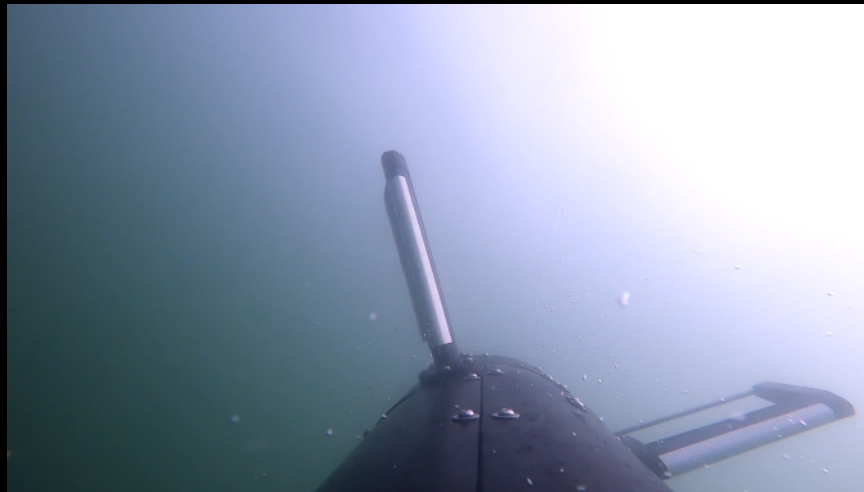


Stern flaps

- Pitch stabilisation
- Yaw movement

Bow flaps

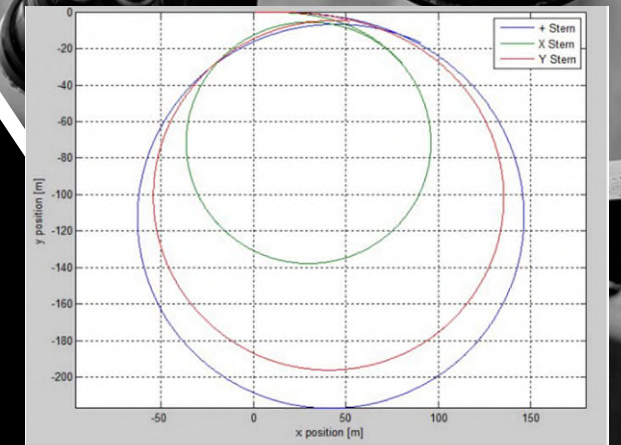
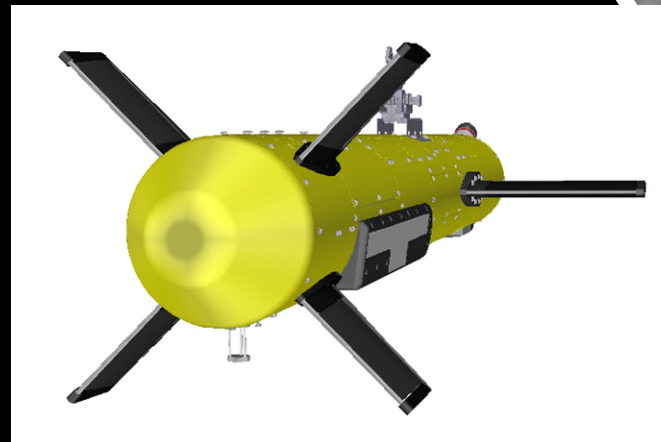
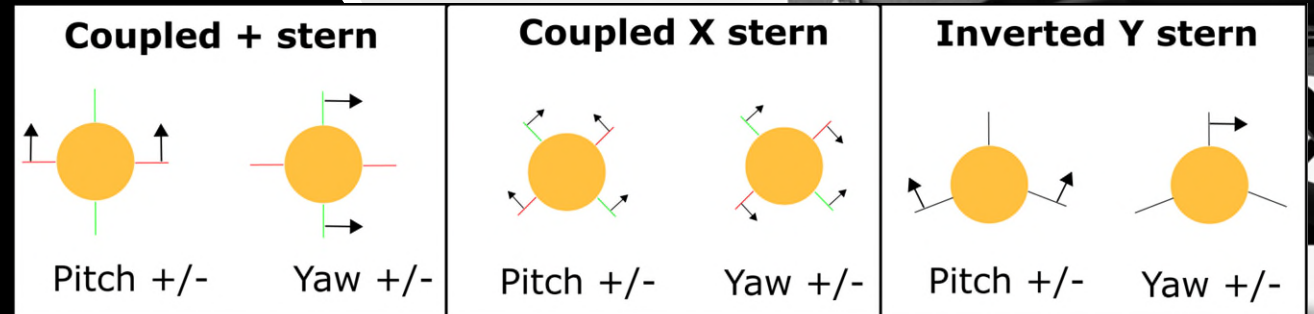
- Roll stabilisation
- Vertical positioning



# STERN FLAPS

## X-CONFIGURATION

- 4 active flaps
  - Larger surface area → smaller flaps
  - More efficiency / smaller turn radius
- Opposite coupled flaps
  - Only two motors necessary
- Practical
  - Easier to design cradle, due to rotation



Source: <https://doi.org/10.1051/mateconf/201817701024>

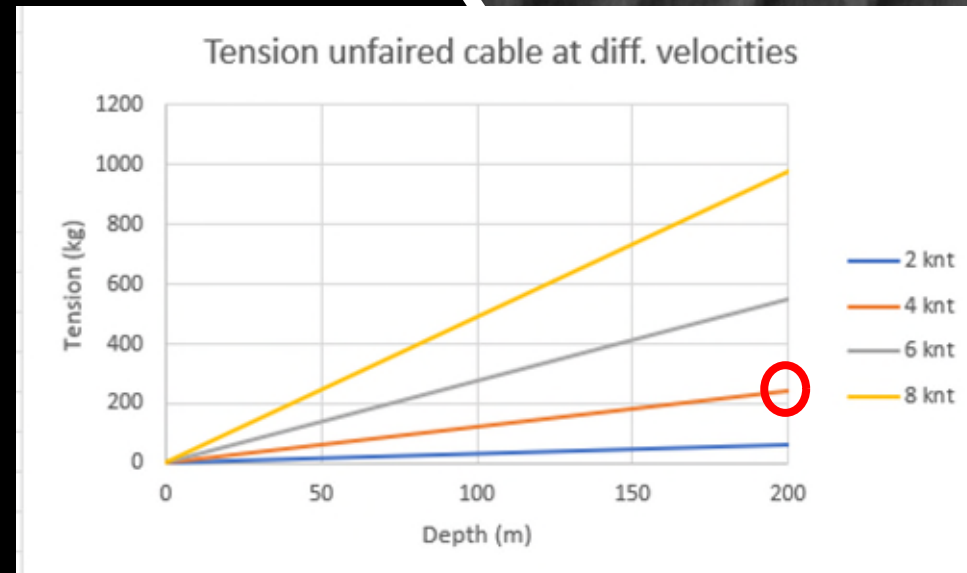
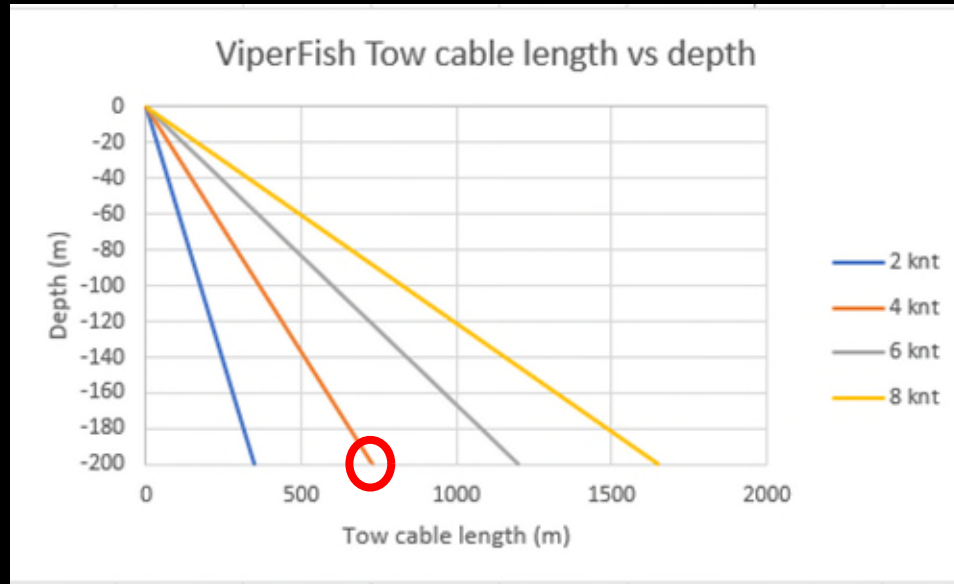
$$L_{\text{ift}} = C_L \times \frac{1}{2} \rho v^2 s$$

Labels for the equation:

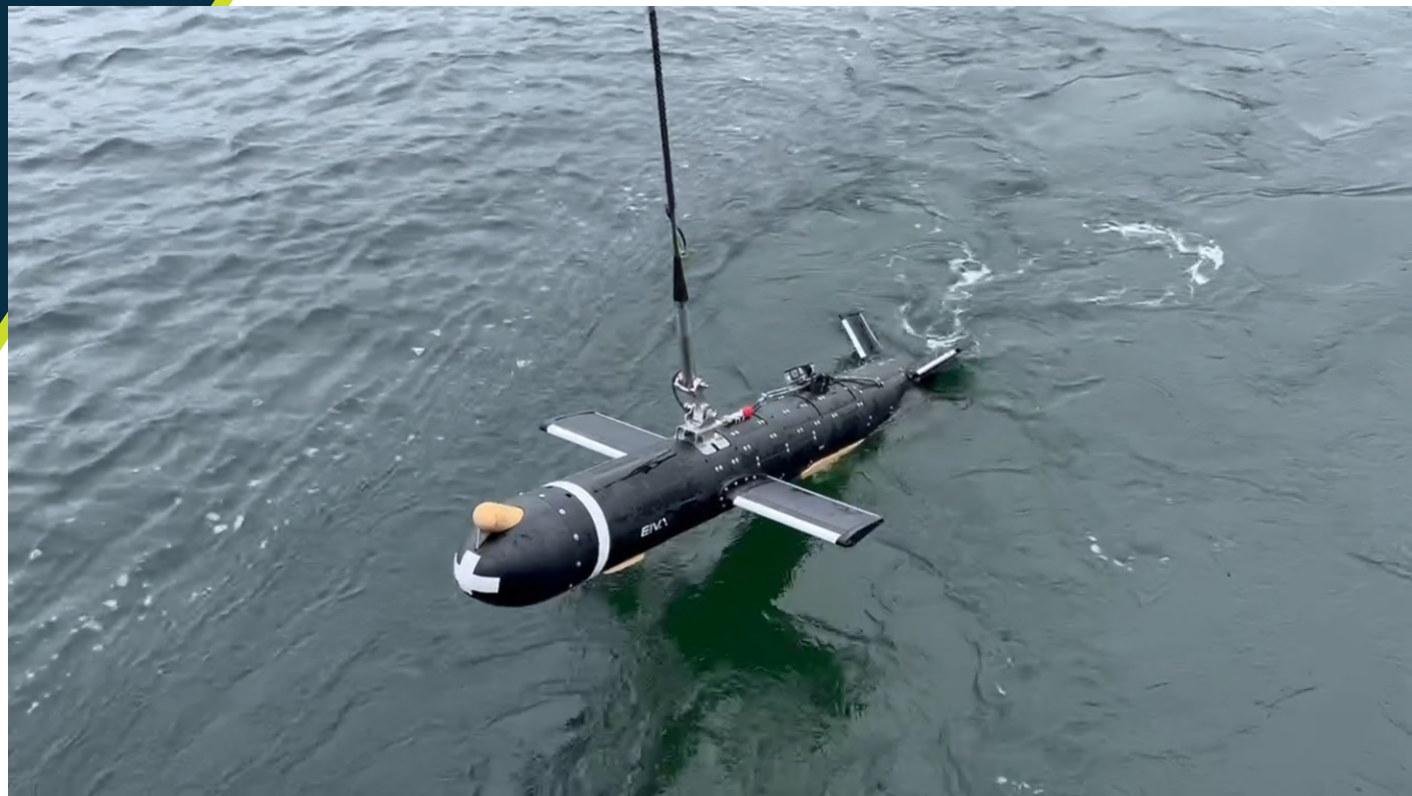
- Angle of Attack (red arrow pointing to  $C_L$ )
- wing shape (purple arrow pointing to  $C_L$ )
- density (green arrow pointing to  $\rho$ )
- wing surface area (blue arrow pointing to  $s$ )
- speed (red arrow pointing to  $v$ )

# VIPERFISH TOW CABLE

## UNFAIRED TOW CABLE



# VIPERFISH LARS



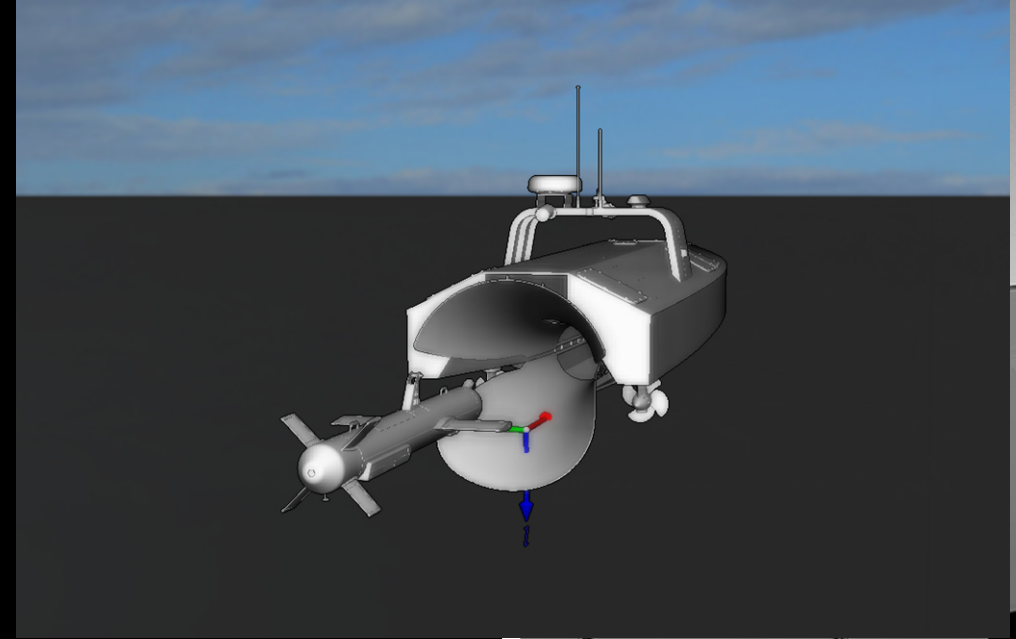
EIVA



# VIPERFISH LARS

## LAUNCH AND RECOVERY SYSTEM

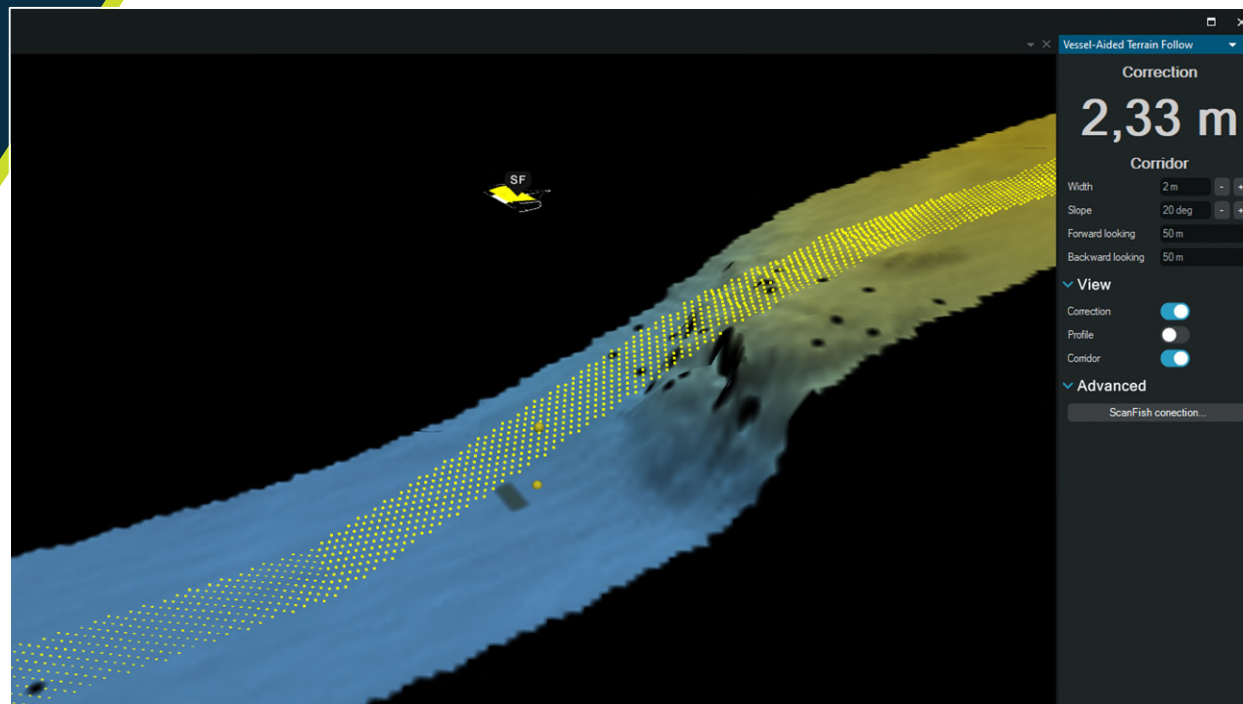
- As no vessel is the same, EIVA can provide customised LARS
  - Automatic articulated A-frame
    - For retrieving the ViperFish safely in the water and bring it on deck
  - Gondola docking cradle
    - For wet-docking beneath the hull or in-between pontoons on catamaran
  - Docking ramp
    - For sliding the ViperFish onboard
- LARS integrated with NaviSuite Flight for remote or autonomous operation



Courtesy of TUCO Marine Group

# VIPERFISH SOFTWARE

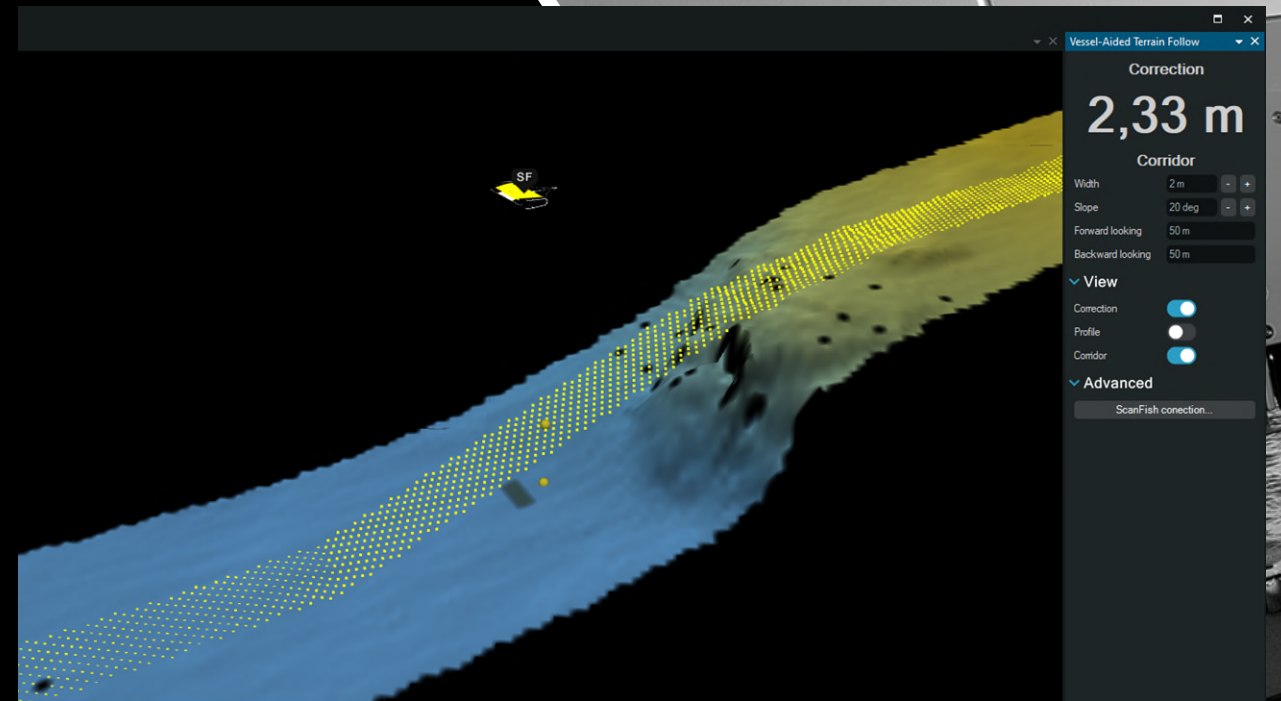
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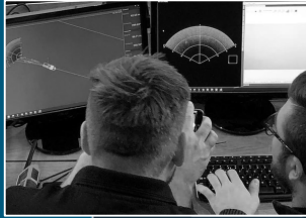
# VIPERFISH SOFTWARE

## NEW FLIGHT

- ViperFish operator software builds upon EIVA core
  - New generation of EIVA NaviSuite Flight
  - Close integration with winch, LARS and external operator API for full system integration
- Combined with NaviSuite Kuda a fully remote operated system is achievable



# REMOTE SURVEY OPERATIONS | NAVISUITE KUDA



## REMOTE OPERATION CENTER

NAVISUITE KUDA USER INTERFACE  
MISSION MANAGEMENT  
DATA PROCESSING

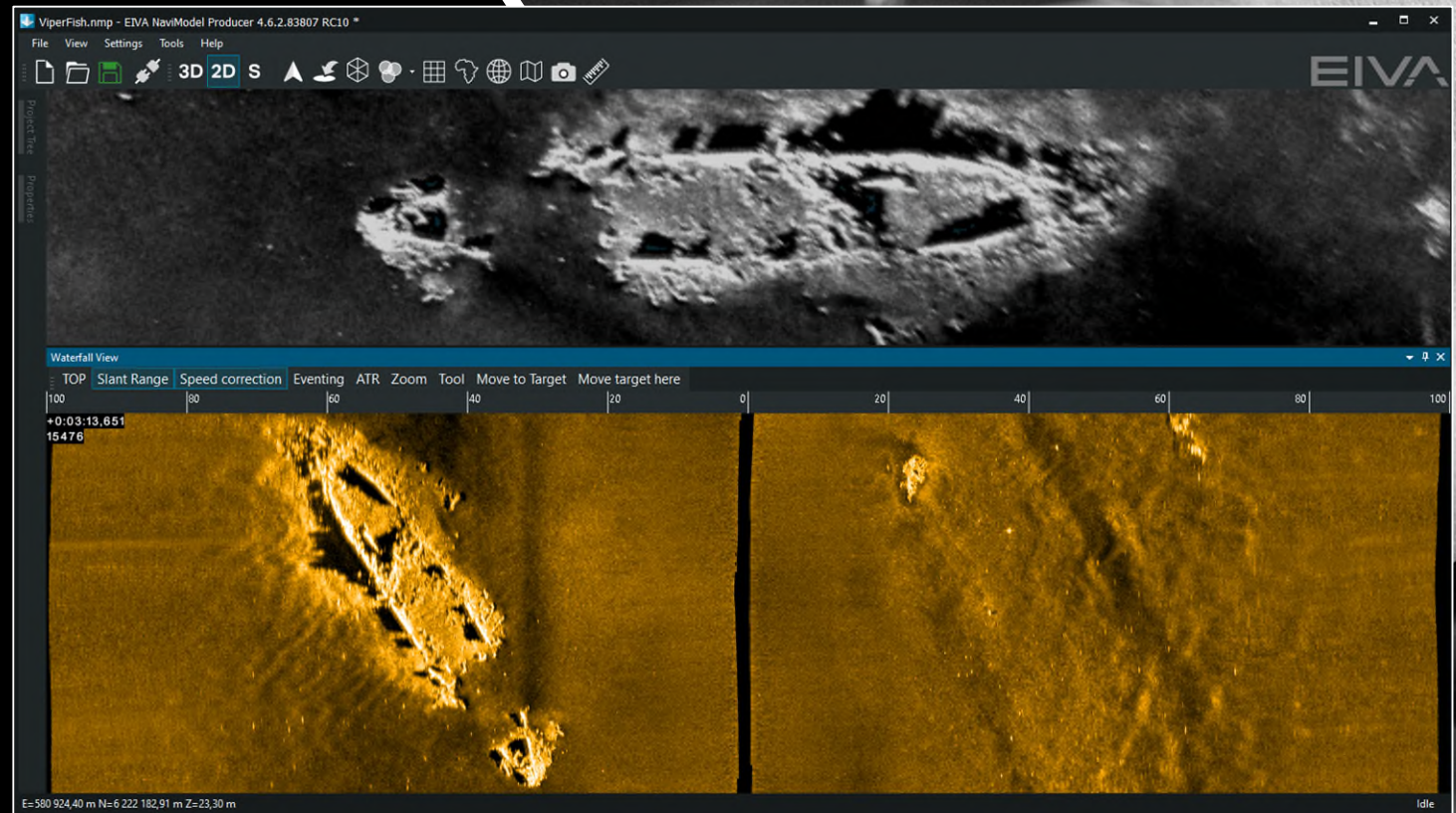
## LOCAL AREA CONTROL ... VIA RADIO LINK

NAVISUITE KUDA USER INTERFACE  
MISSION MANAGEMENT  
RC JOYSTICK

# UNMANNED / REMOTE OPERATIONS

## THE BASIC COMPONENTS

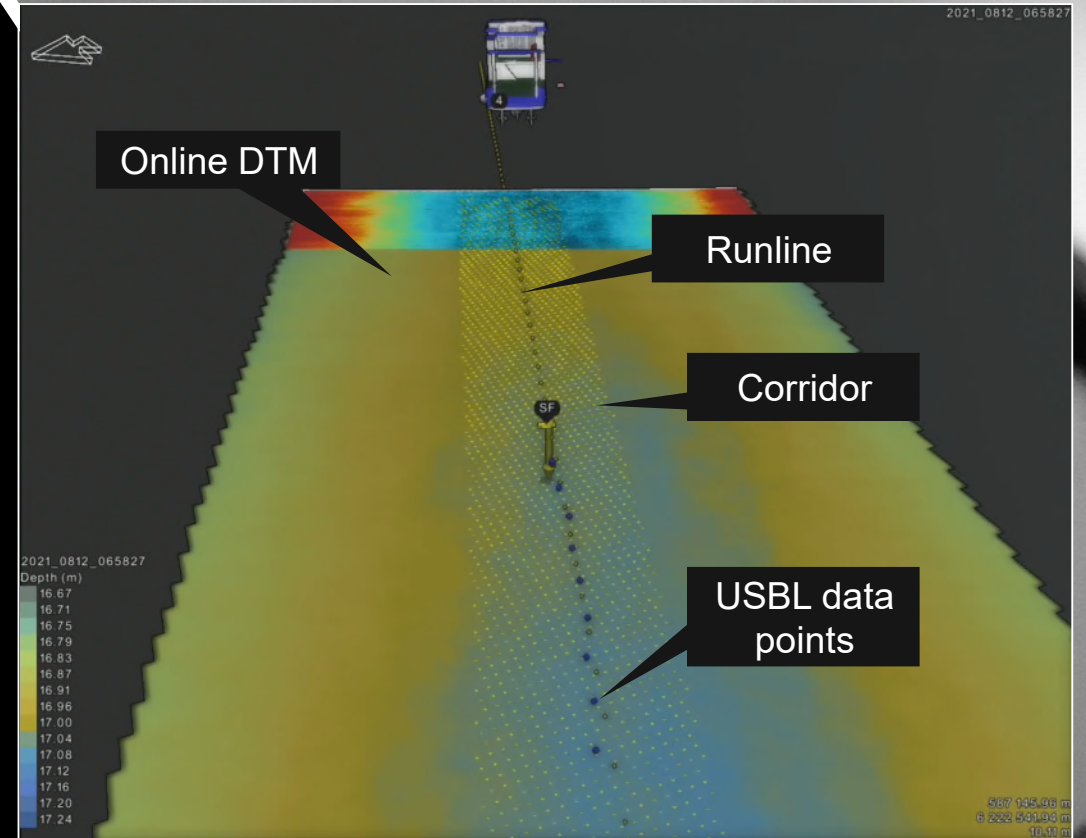
- All data recording and dynamic line planning happens onboard
- Remote supervisor monitors and controls the operation
- Running automatic data processing onboard
- Sonar data compression & down sampling for supporting QC on low bandwidth
- No TeamViewer or remote desktop



# VESSEL-AIDED FOLLOW TERRAIN MODE

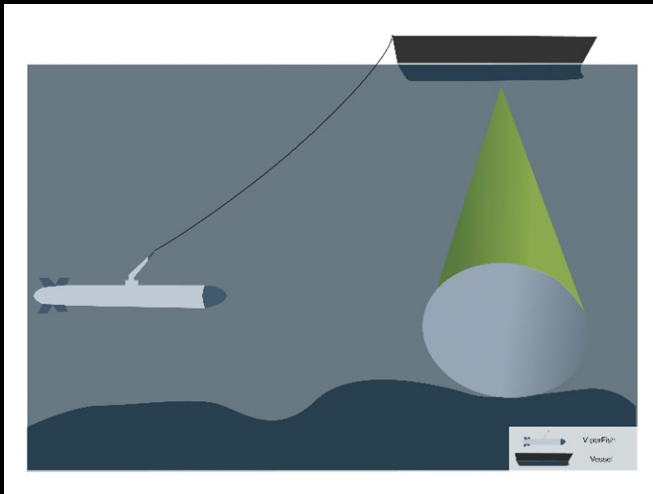
## CUSTOMISABLE BEHAVIOR

- Available for all ROTV systems
  - Upgradeable with a NaviSuite licence
- Equipment needed
  - USBL for positioning for ROTV
  - MBE on vessel for terrain measurement
  - NaviSuite Kuda for calculating vertical route
- NaviSuite
  - Handling navigation data from the ROTV
  - Collecting MBE data and creating online DTM or using a DTM from a former survey
  - Generating synthetic altimeter values for the ROTV

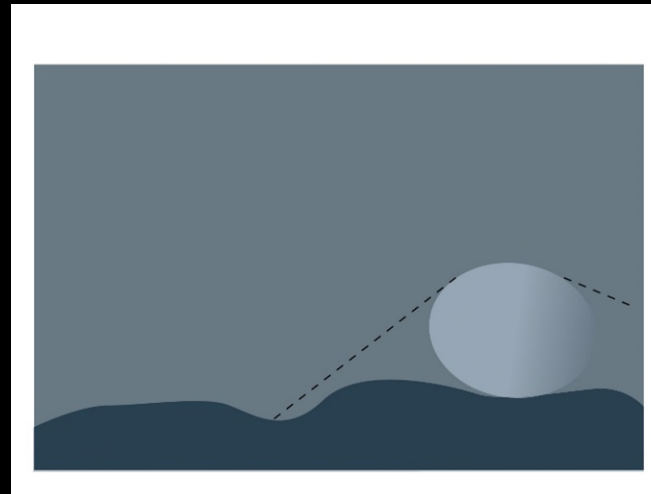


# VESSEL-AIDED TERRAIN FOLLOW MODE

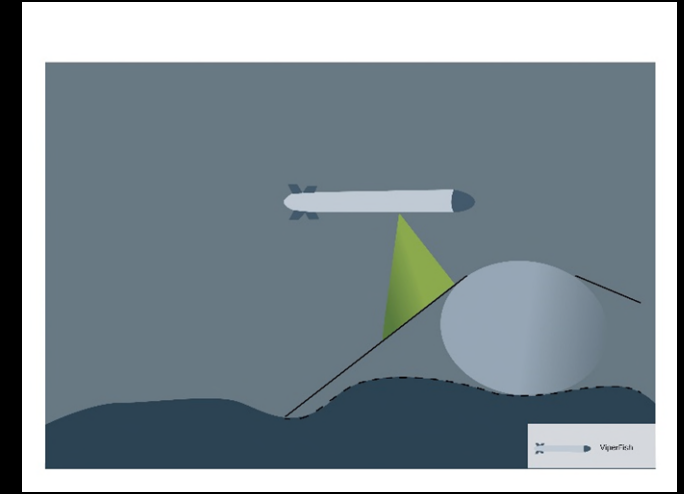
## AVOIDING OBSTACLES



Obstacle detected by vessel



NaviSuite Kuda calculated slope



ROTV following calculated slope

Correction  
0.2



**Vessel-Aided  
Terrain  
Follow mode  
in action**



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