

# UNMANNED VEHICLES

## INTEGRATED ENVIRONMENTAL SURVEILLANCE USING UNMANNED VEHICLE SYSTEMS

**VEGARD EVJEN HOVSTEIN**  
**CEO, MARITIME ROBOTICS**



Brattørkaia 11 – Pirterminalen  
7010 Trondheim  
Norway

Tel: (+47) 73 40 19 00  
info@maritimerobotics.com  
[www.maritimerobotics.com](http://www.maritimerobotics.com)

# UNMANNED SYSTEMS FOR MARITIME OPERATIONS





**MARITIME  
ROBOTICS**

- Established in 2005
- Located in Trondheim, Asker and Eggemoen
- Step-by-step growth
- 14 employes

# MARITIME ROBOTICS DELIVERS

- Unmanned Vehicle Systems
  - Products (MBS, UAS, USV)
  - Training
  - After-sales/support
  
- Services with Unmanned Vehicle Systems
  - Moored Balloon Systems (OceanEye)
  - Unmanned Aircraft Systems
    - Multi-copters
    - Fixed-wings
  - Unmanned Surface Vehicles



# Oil - Spill - Response

Vehicle Control Station (VCS)



P31015 (UAS)



OCEANEYE\* (MBS)



Optionally Unmanned Boat (USV)



MARINER (USV)



Multicopter (UAS)



# MOORED BALLOON SYSTEMS




**OCEANEYE®**


**MOORED BALLON SYSTEM**



# OceanEye<sup>®</sup> components



 **Weight:** 425 kg / 936 lbs (with all system components packed)

 **Length x Wide x Height:** 1.20 x 0.80 x 1.59 m / 47.3 x 31.5 x 62.6 inches



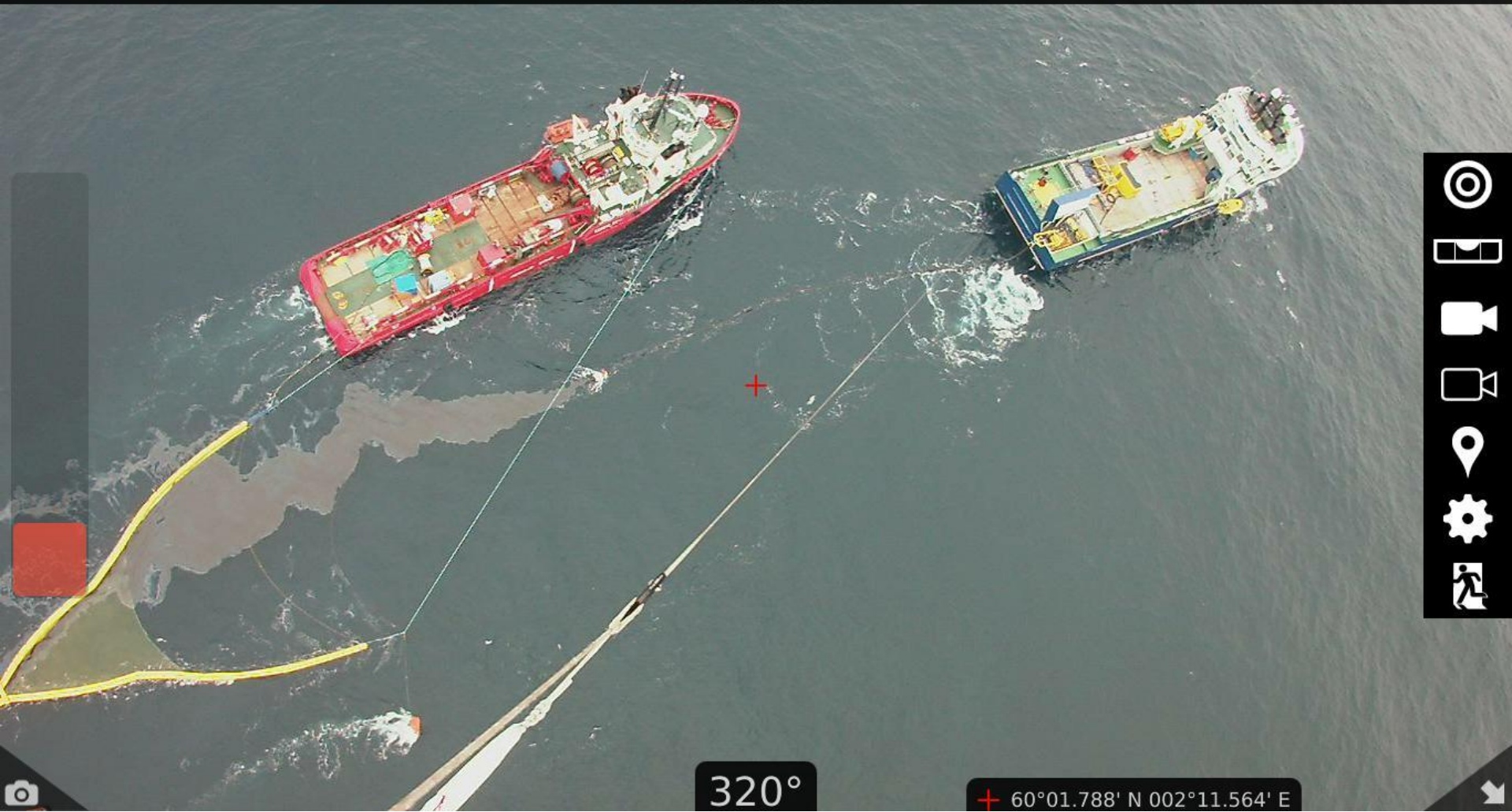




Link  N/A Battery  Gust  GNSS: Fixed

128.0m

Tension  N/A VT battery  11:33



- 
- 
- 
- 
- 
- 
- 

320°

+ 60°01.788' N 002°11.564' E

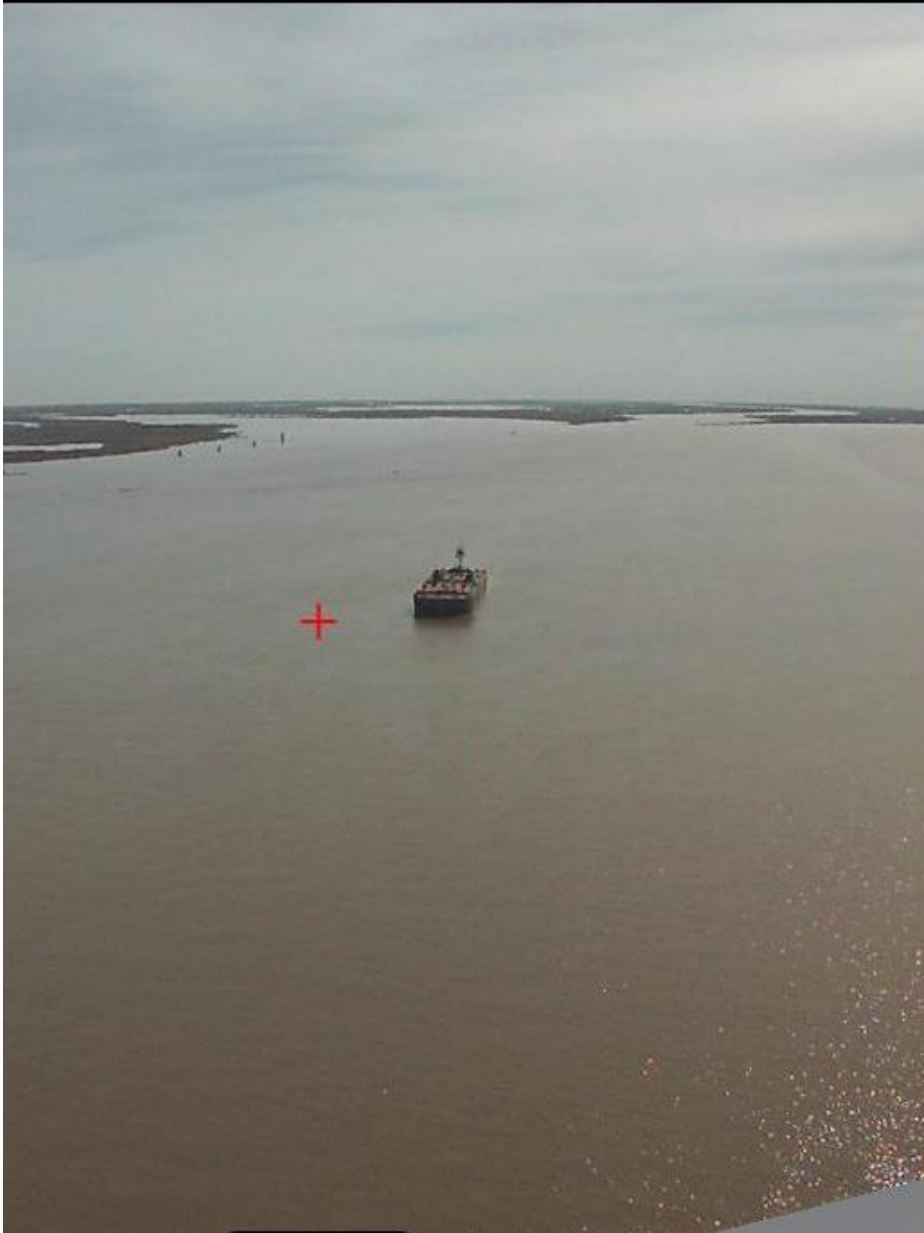
DATE:



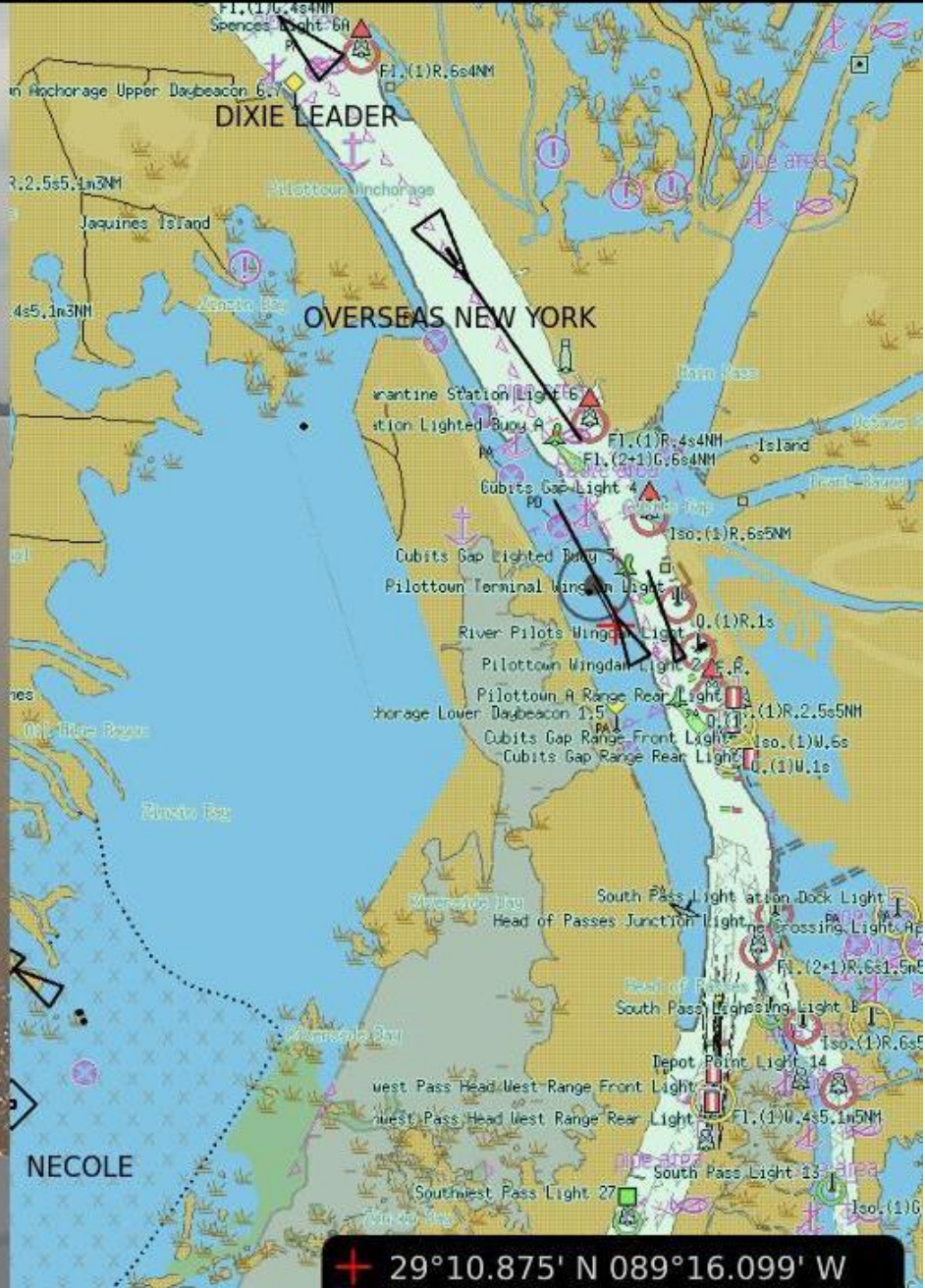
ry  Gust  GNSS: Fixed

278.9ft

Tension  VT battery



152°



+ 29°10.875' N 089°16.099' W

# OceanEye – *your own eye in the sky*



# OceanEye – *your own eye in the sky*





 **MARITIME  
ROBOTICS**

# OceanEye – *aiding oil recovery operations*





# OceanEye – *aiding oil dispersant operations*



# OceanEye – aiding oil dispersant operations



# OceanEye – *aiding oil dispersant operations*



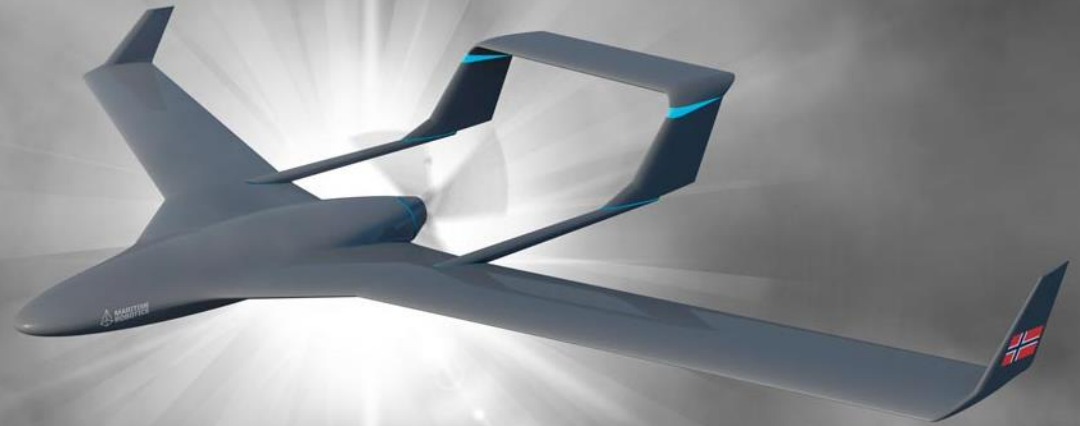
# OceanEye – *arctic operations and ice management*



# OceanEye™

## Ice management experiments on East-Greenland

# UNMANNED AIRCRAFT SYSTEMS



# PENGUIN MR

## UNMANNED AIRCRAFT SYSTEM





Penguin [UAS]





S/N: 4883  
TAS: 54.3 [kts]  
BALT: 581.8 [ft]  
DALT: 622.3 [ft]  
RPM: 6547  
RSSI: -103.8  
ERR: RSSI

Kr7kv7g UAS

Fosna UAS

Orlandet

Orland Uthavn

LRSK UAS

488.4  
600  
300  
200  
0  
On  
ETE: 3:42 R

System - PicoKob '4883'

System	30	
TWC	28.00	199
Downlink	0	200
Uplink	100	200
Power	3.5	200
Weight	12.40	100
SMA	0.12	100
SVD	0.30	100
Internal	OK	
IMU	Internal	
CPU %	43	

Plot Sample %:   
Plot Uplink [Hz]: 11

Internal Radio:  
Freq [MHz]: 2441.700  
Ch./Tx Amp: 11  
Power [W]: 1.000

Encryption:  
AES Off

Bandwidth - Internal:   
Send

telemetry: 1 Hz  
Navigation: 25 Hz  
Control: 25 Hz

Aircraft:  
Dynamic:   
Set Pos:   
Set

Ground Station Slander  
11:49:38, 17 Nov 2015  
PicoKob UAS  
- 488.4  
- 2441.700

- Com
- From Ground Station  
Dist: 0.014(m)  
Bearing: 285.7(°)  
Elev: 0.544(m)  
Fuel: 3.55 (l/m)
- Location
- Orientation

Transponder - PicoKob '4883'

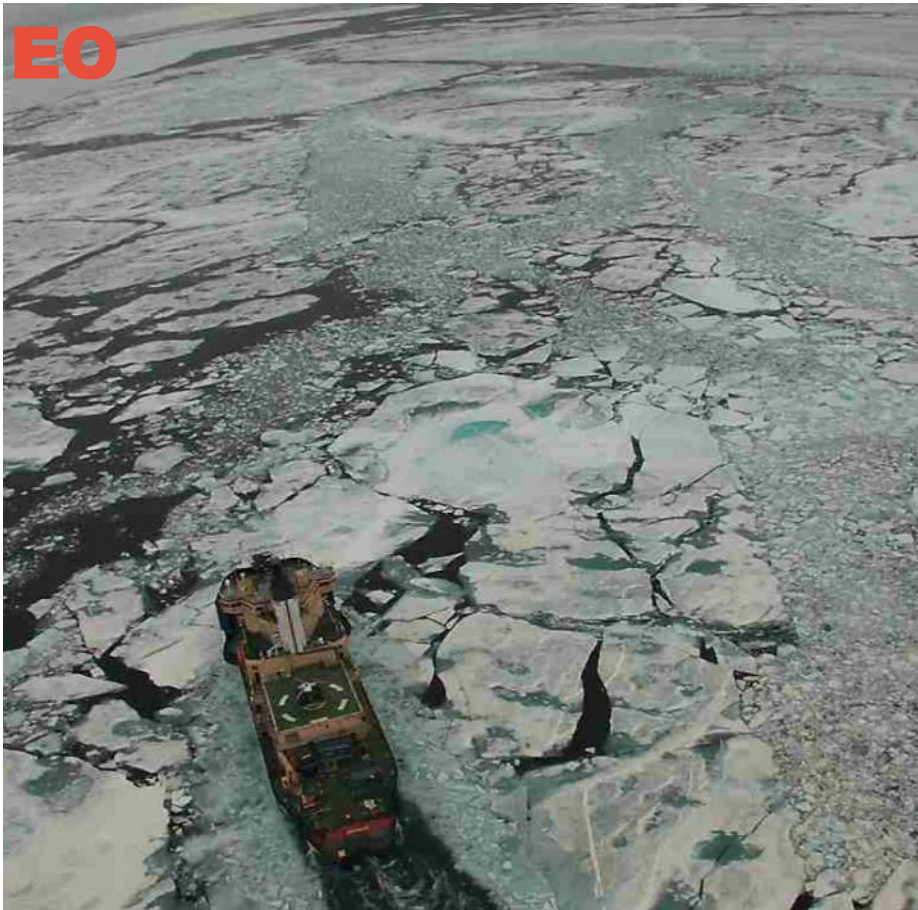
Mode	Control	Alt	Speed
------	---------	-----	-------

# MULTICOPTER

## UNMANNED AIRCRAFT SYSTEMS



EO



IR



- Day-light camera (EO)

- Captures still images or video
- Intuitive and easy understandable information
- Limited by weather and darkness

- Infrared (IR)

- "Sees" the infrared spectrum day and night
- May give add-on info to EO (heat, thickness etc)
- Affected by dense fog and rain etc



## Ubemannet luftfarttøy, droner og RPAS



OM DRONER



OFTTE STILTE  
SPØRSMÅL



SIKKERHETS  
BREV



ONLINE  
DRONEKURS



DEKLARERE  
OG SØKE



SKJEMA



OPERATØR-  
OVERSIKT



FORSKRIFT  
(LOVDATA.NO)



ENGLISH

## Nyheter

### Dronelek

Skal du bruke drone for lek og hobby?  
Les våre enkle regler og retningslinjer her.

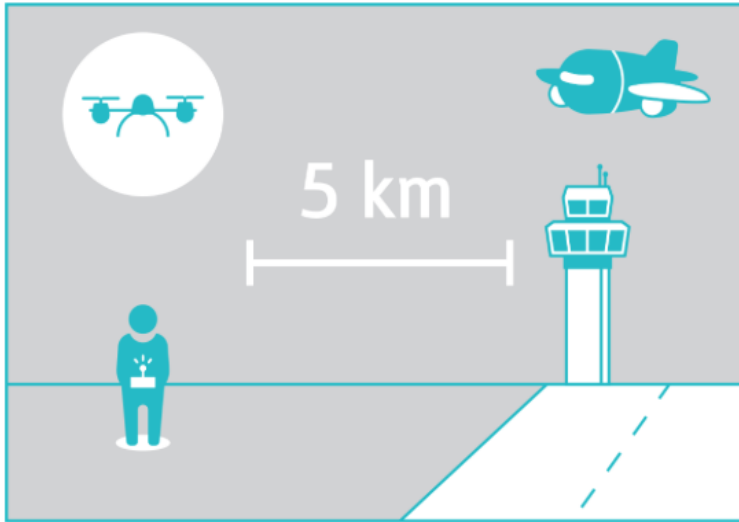
[www.dronelek.no](http://www.dronelek.no) (bokmål)

[www.droneleik.no](http://www.droneleik.no) (nynorsk)

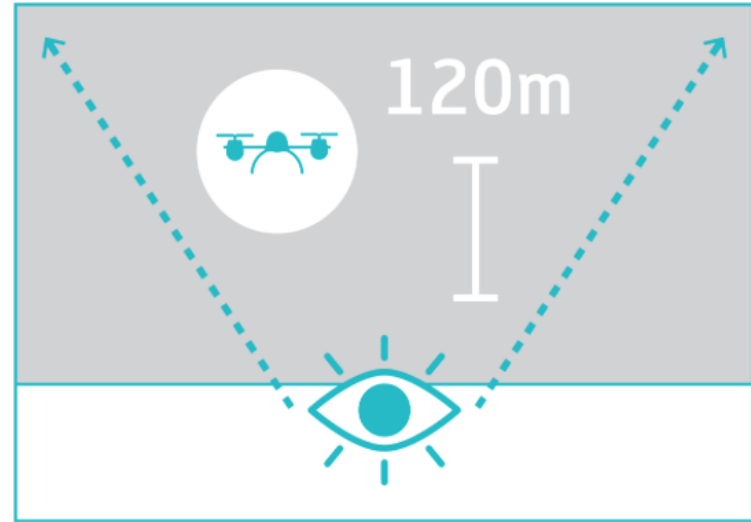
### Status for droneeksamen

Pilot og fartøysjef i RO2 og RO3 må bestå en eksamen for å kunne utføre flyging. Eksamen vil gjennomføres elektronisk ved bruk av PC. Det vil bli utarbeidet flervalgs spørsmål som har 4 alternative svar, der ett av svaralternativene er korrekt. For å oppnå bestått må kandidaten ha minimum 75 % rette svar.

Luftfartstilsynet jobber med en samarbeidspartner for å få på plass ordning for gjennomføring av eksamen. Dette vil ta tid og inngå i et større prosjekt. Fristen for å bestå eksamen var i utgangspunktet fastsatt til 1. juni 2016, men siden etableringen av eksamensordningen tar lengre tid enn forventet, flyttes fristen til 1. februar 2017.



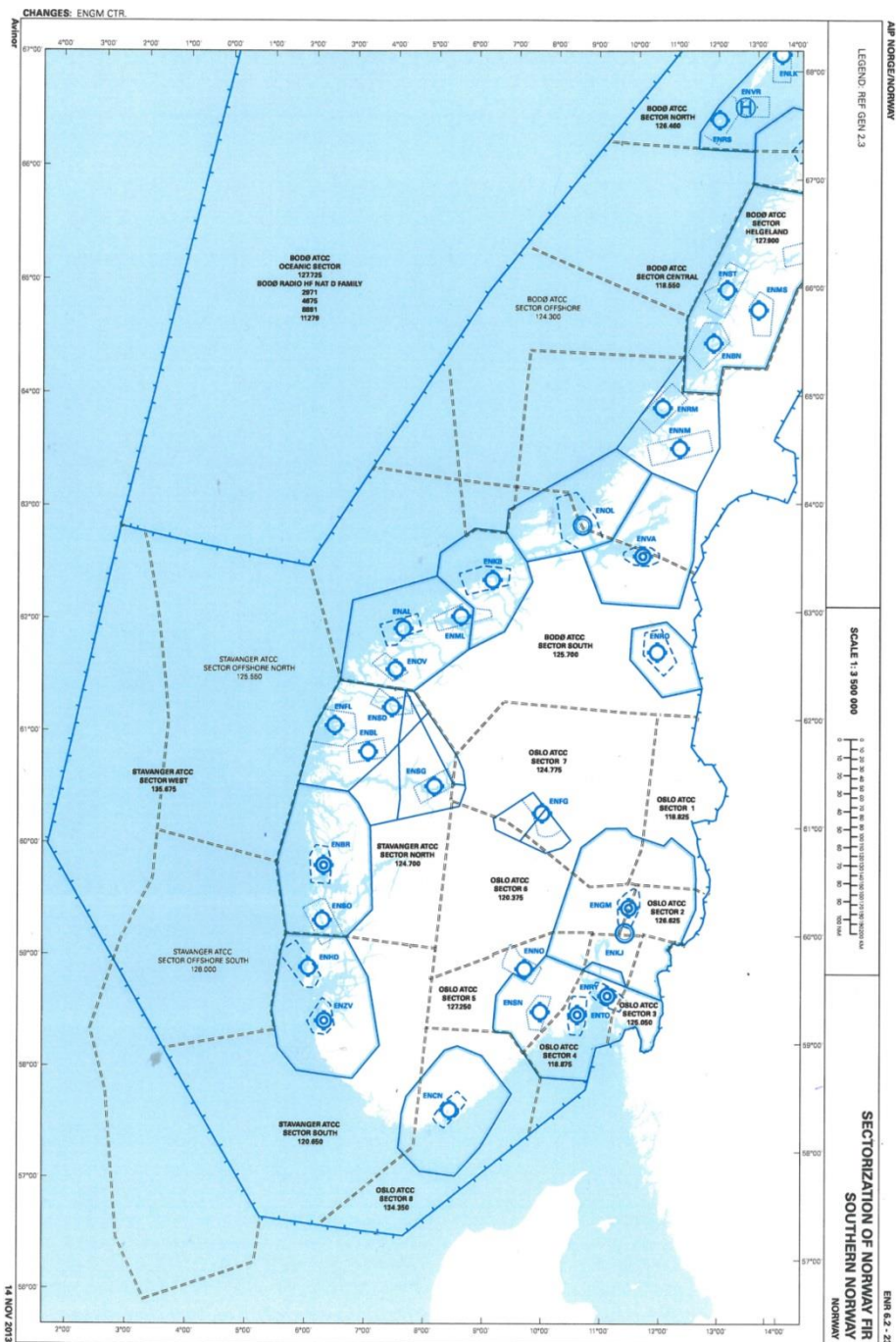
Hold avstand fra lufthavner:  
Ikke fly nærmere enn 5 km.



Du skal alltid kunne se dronen.  
Maksimal flyhøyde er 120 meter over bakken.



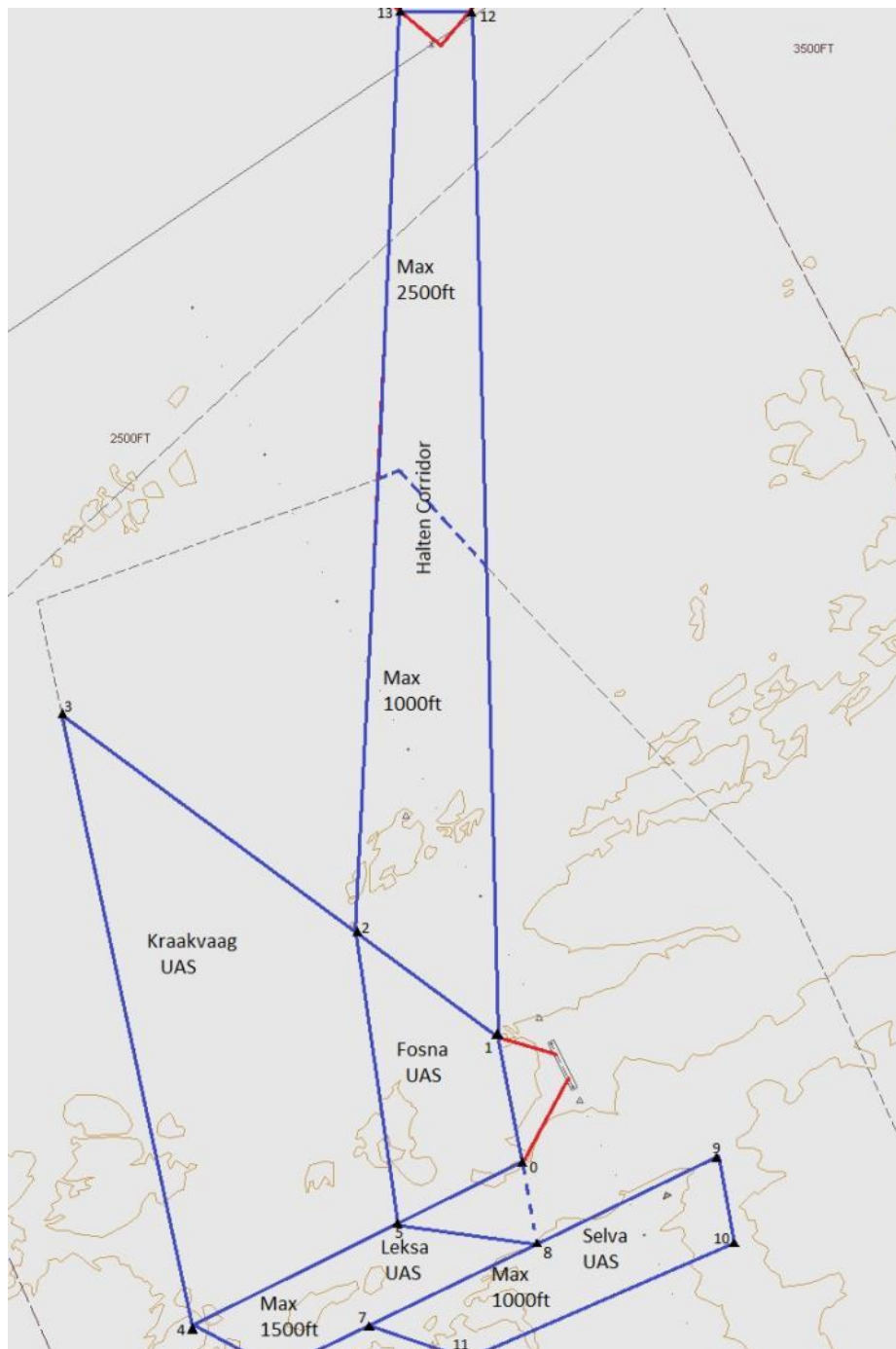
Hold en avstand på 150 meter fra folk, bygninger og trafikk. Gjelder trafikk på veier, på sjøen og i luften.



# UAS AIR REGULATIONS

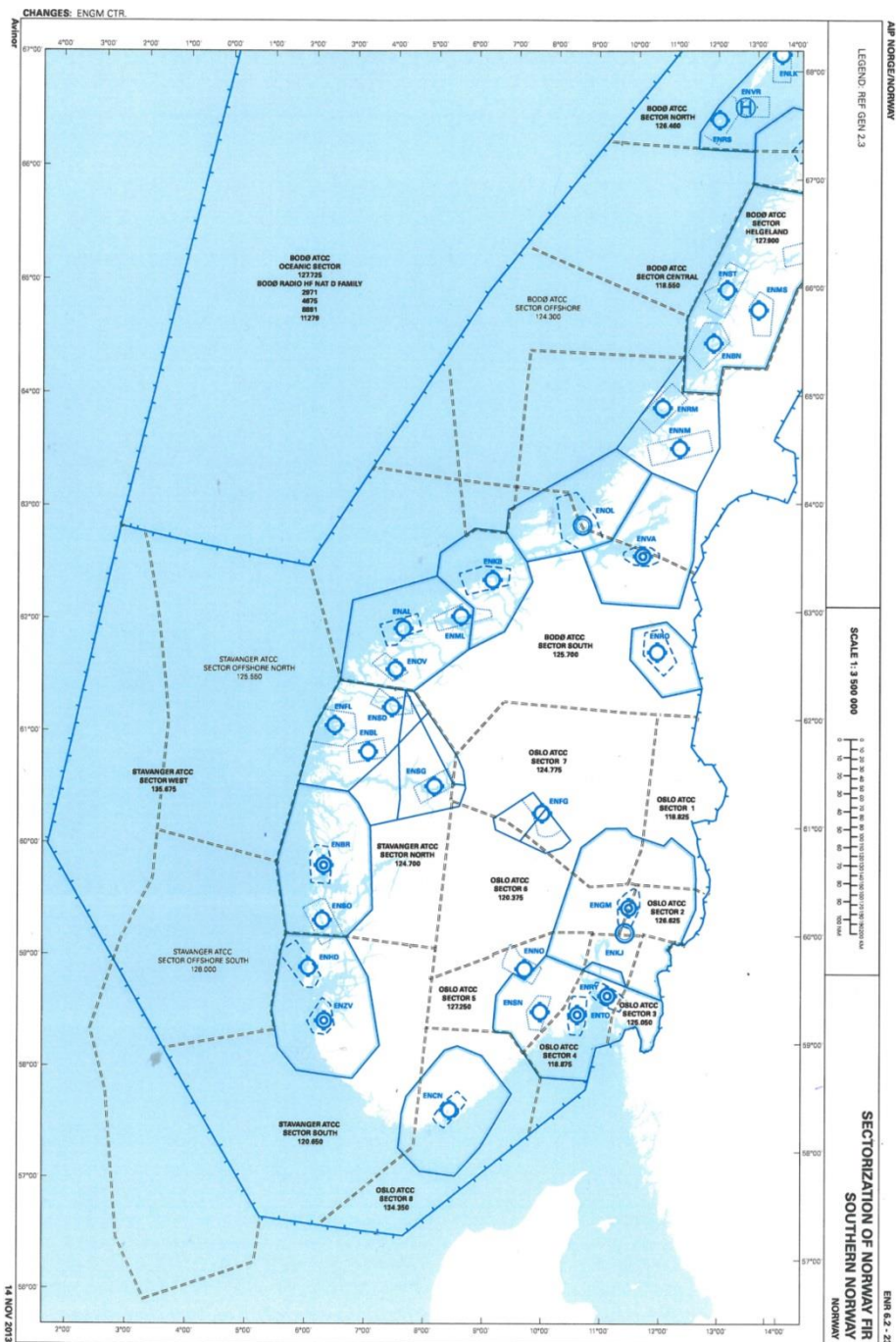
- An UAS is a flying object affected by national/international civil aviation laws
- Today's regulation
  - Visual Line of Sight (VLOS) operations is allowed below 500 feet and performed by a licensed UAS operator
  - Beyond Line of Sight (BLOS) operations is only allowed within a **segregated** airspace and performed by a specially BLOS licensed UAS operator
- BLOS today
  - Existing segregated airspace
    - Control zones, established danger areas etc
    - Establish procedures with nearest Air Traffic Control
  - Outside existing segregated airspace
    - After an application from the UAS operator, the Civil Aviation Authorities can define a temporary danger zone





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# UNMANNED SURFACE VEHICLES



**MARINER**

**UNMANNED SURFACE VEHICLE**









# USV CONVERSION SYSTEM







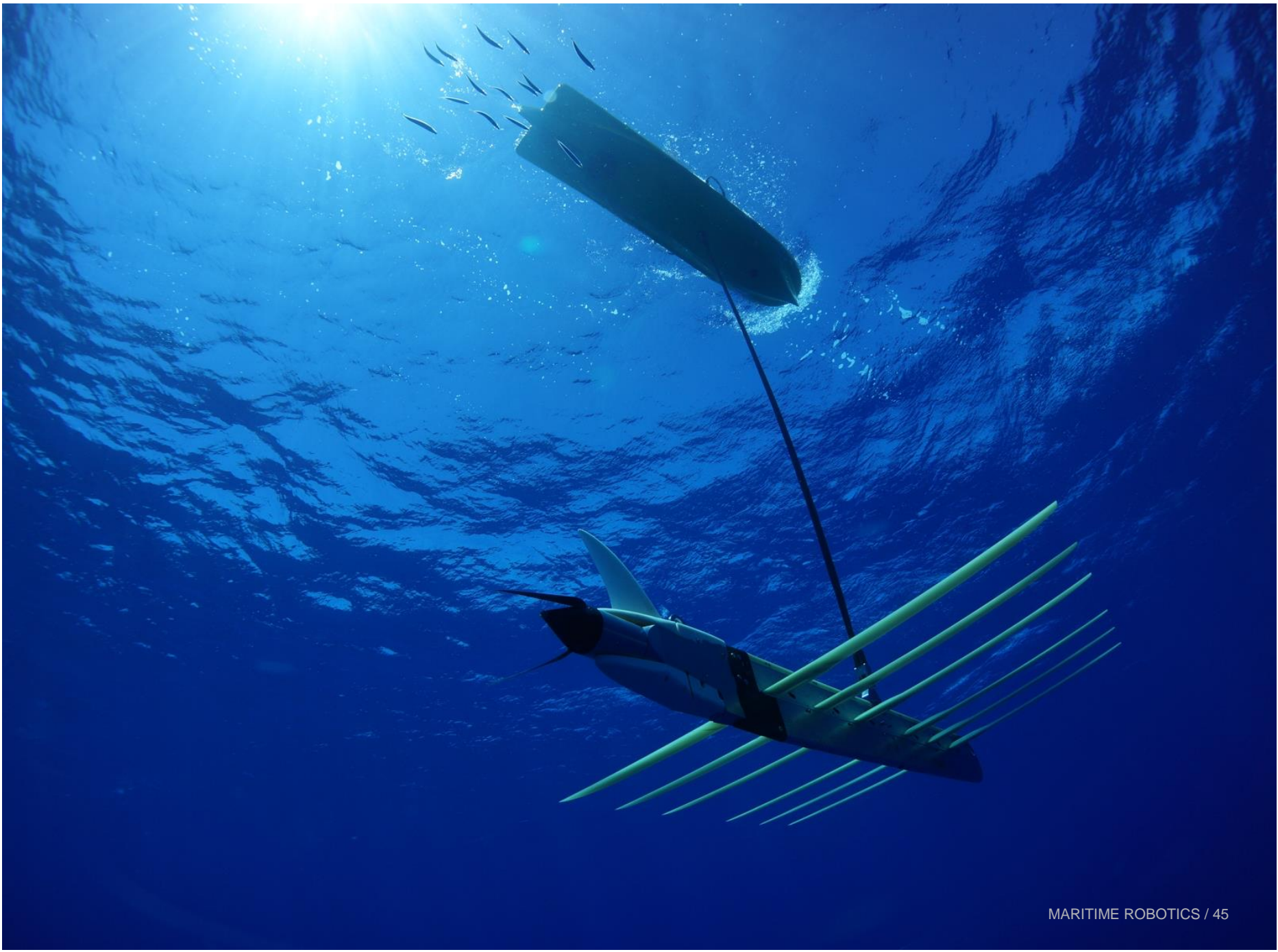


# Environmental Data Acquisition



**SENSORS**  
Fluorometer  
Echosounder  
Chemical sensors  
CO<sub>2</sub>  
O<sub>2</sub>









**THANK YOU FOR  
YOUR ATTENTION**

