HYDRO 2024

Conference & Exhibition, 05-07 November, Rostock-Warnemünde

„Fusing Navigation: ECDIS, drones and aviation“

Gunnar Tietze, SeaTopic

Fabienne Vallée, BrestPort

Tim Strohbach, Fraunhofer - IFAM

Interreg North Sea DIOL

Co-funded by the European Union

Horizon 2020 European Union Funding for Research & Innovation

OVERHEAT

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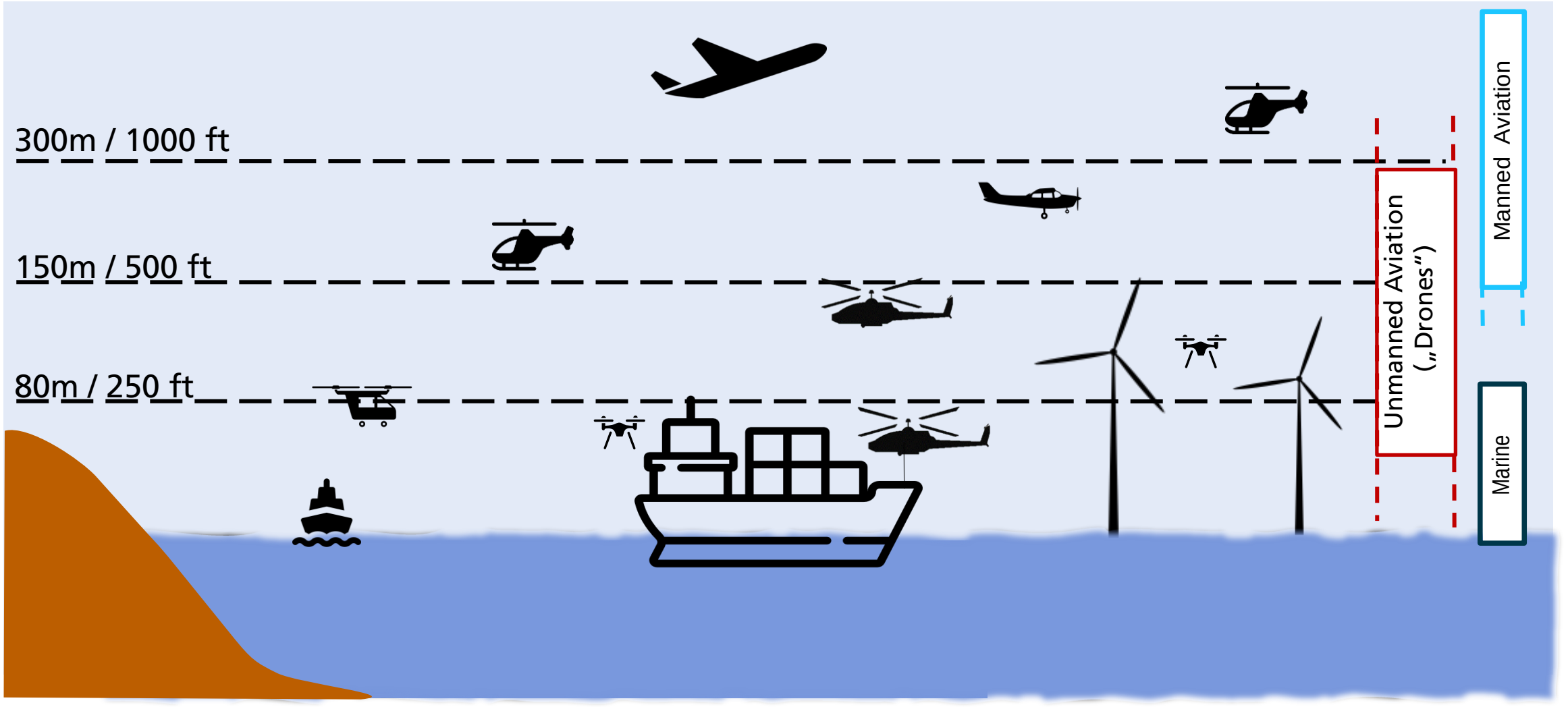
Why do we need to „rethink“?



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The situation

- **Yesterday evening**: Two separated worlds
  → The maritime world: highly and globally regulated, standardized, IMO, IHO, IALA, SOLAS, UNCLOS etc.
  → The aviation world: highly and globally regulated, standardized, ICAO, ……. etc.
  Both are highly professional and have similar systems/processes which have different names (example)

- **Today:** There is a new-comer: drones
  → The drone world: highly regulated, standards are evolving → still a lot in progress
  → S-57 to S-100, a door opens to real time data and M2M communication

- **Tomorrow**: Unmanned aviation is coming soon

- **Challenge**: working together in integrated operations
  → Setup and maintenance of offshore structures (oil & gas, wind parks etc.)
  → Accidents, examples: machine failure/blackout, fire on board (Fremantle Highway)

- **Wish, dream, requirement**:
  → Awareness „about each other“
  → **Sharing a common situational picture**

Sharing the common situational picture

- **Maritime world**:
  → The work horse is ECDIS, the S-100 family of standards, S-200, S-300 etc.

  It runs on every bridge of any slightly bigger vessel
  It runs on the PPU of the pilots, the portable pilot unit
  It runs on the VTS control tower

- **Suggestion:**
  - Let's integrate drones (and aviation) into ECDIS via specific additional layers taking over their information and displaying it to the maritime world.
  - Let's avoid additional separate systems for drones (and aviation)

- **The aviation and drone world:** Hand-over to **Tim Strohbach** → Aviation & drones

- **Further agenda:**
  Fabienne Vallée → Maritime = ECDIS + harbour trials
  Gunnar Tietze → conclusion + take aways

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Two Separate Worlds

Example IMO vs. ICAO

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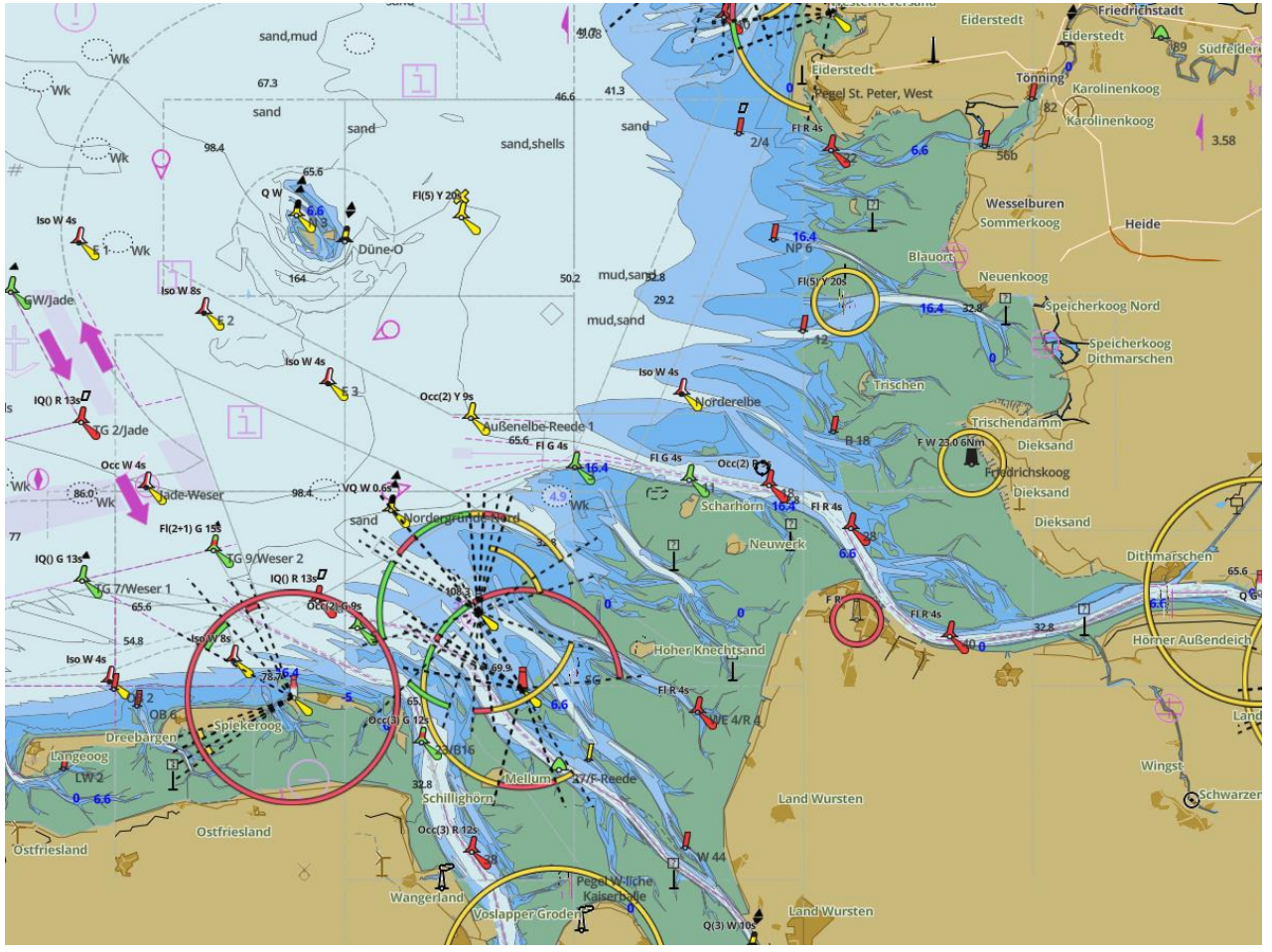
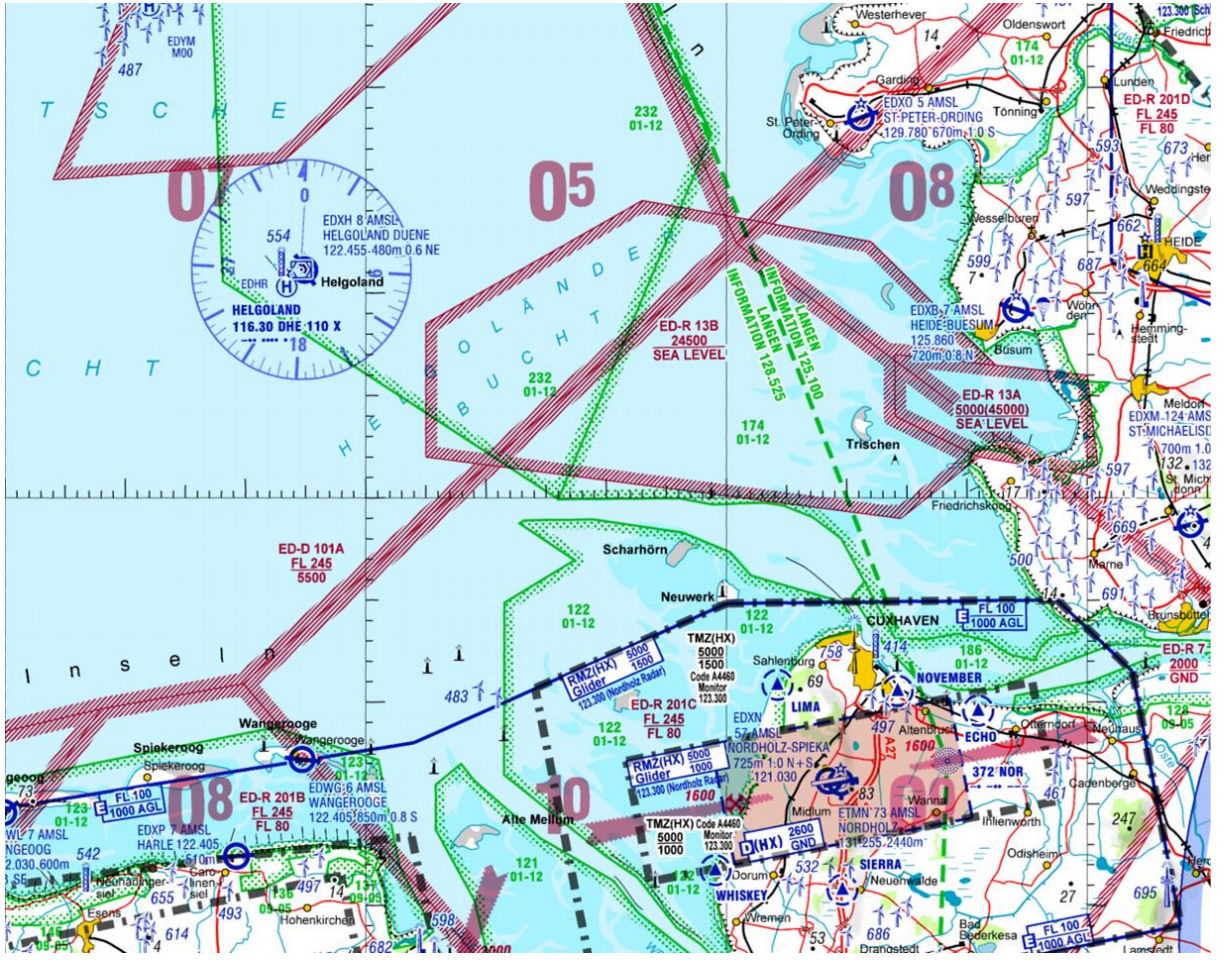
Two Separate Worlds

Example Electronic Navigational Chart (ENC) S-57 vs. ICAO Chart





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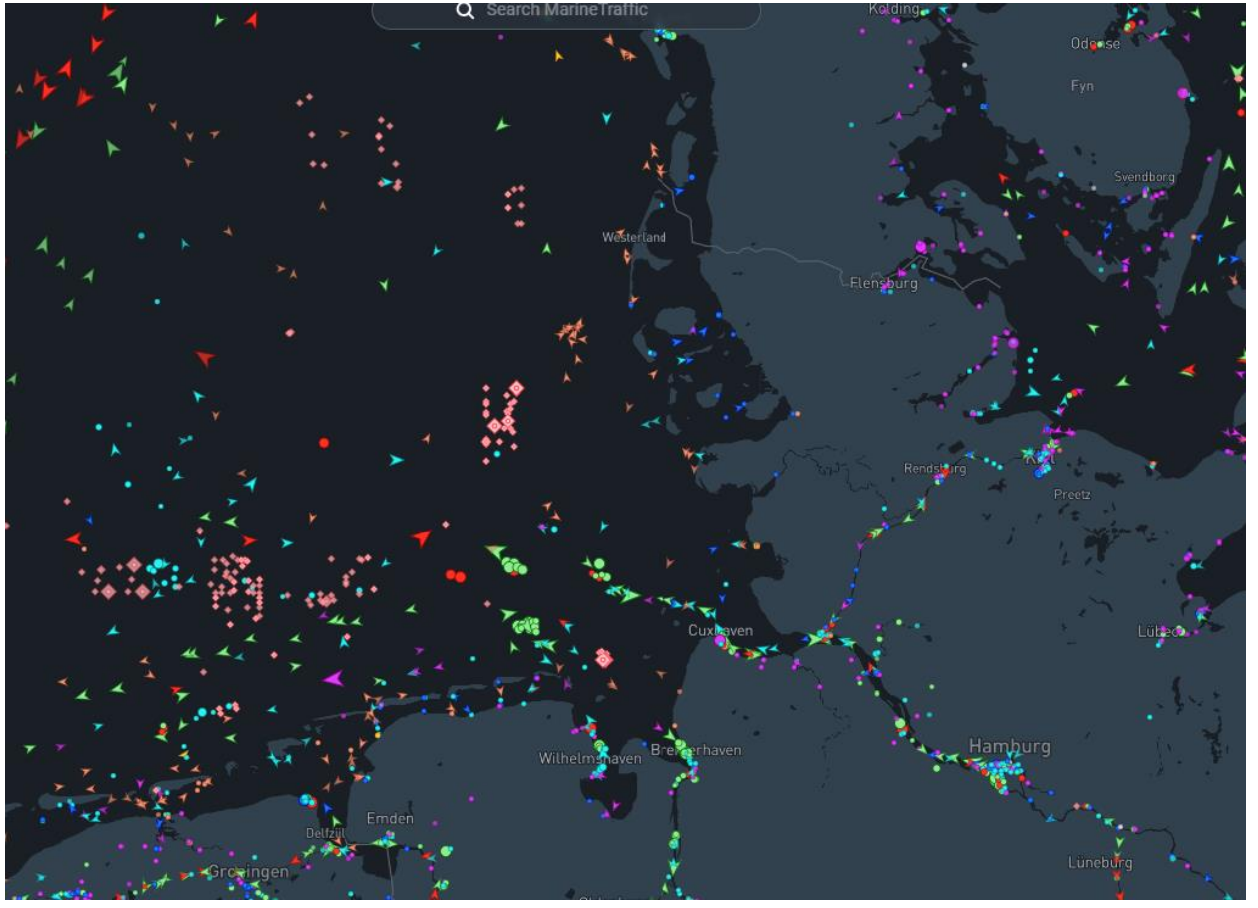
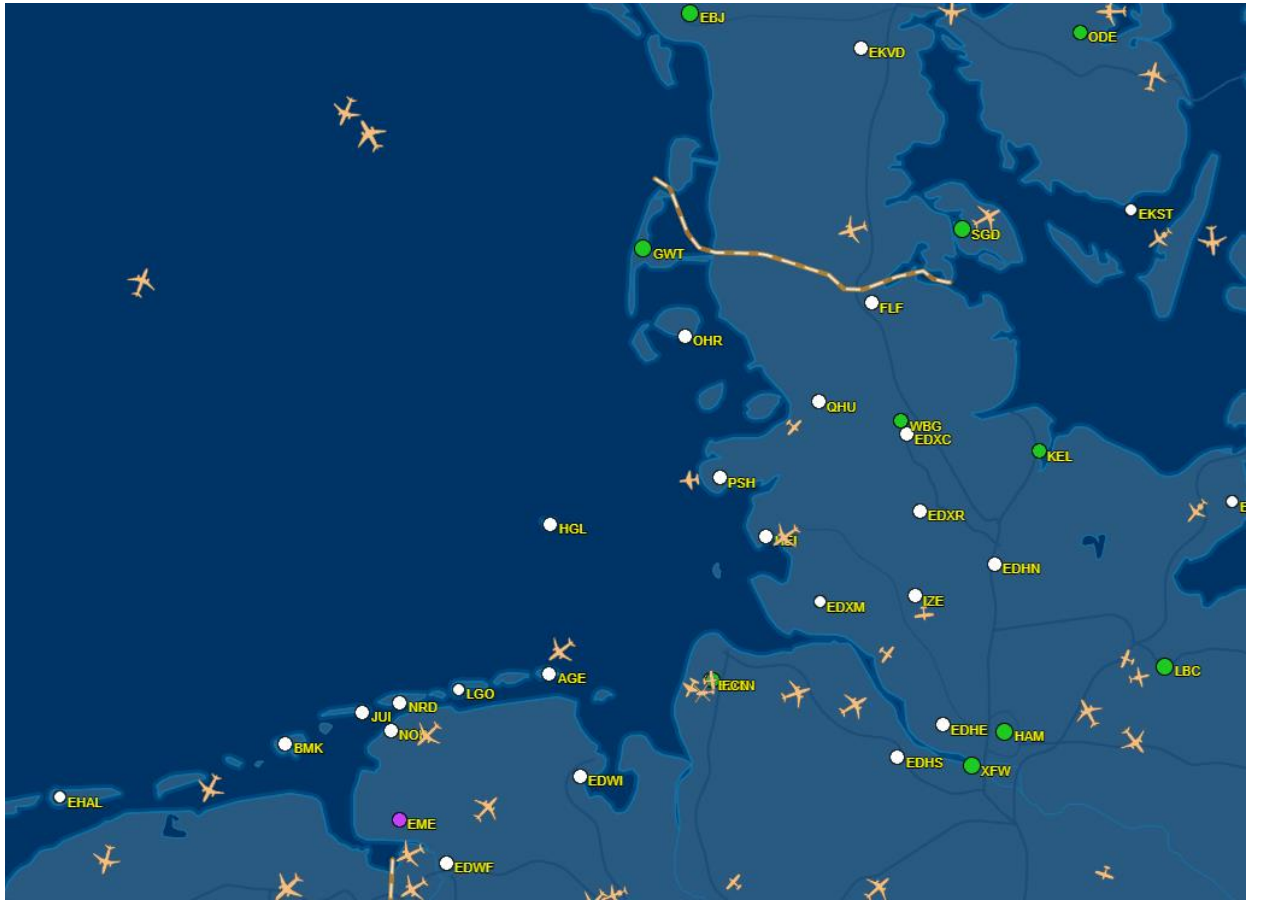
Two Separate Worlds

Example AIS vs. ADS-B



© marinetraffic.com/en/ais



© flightaware.com/live/map

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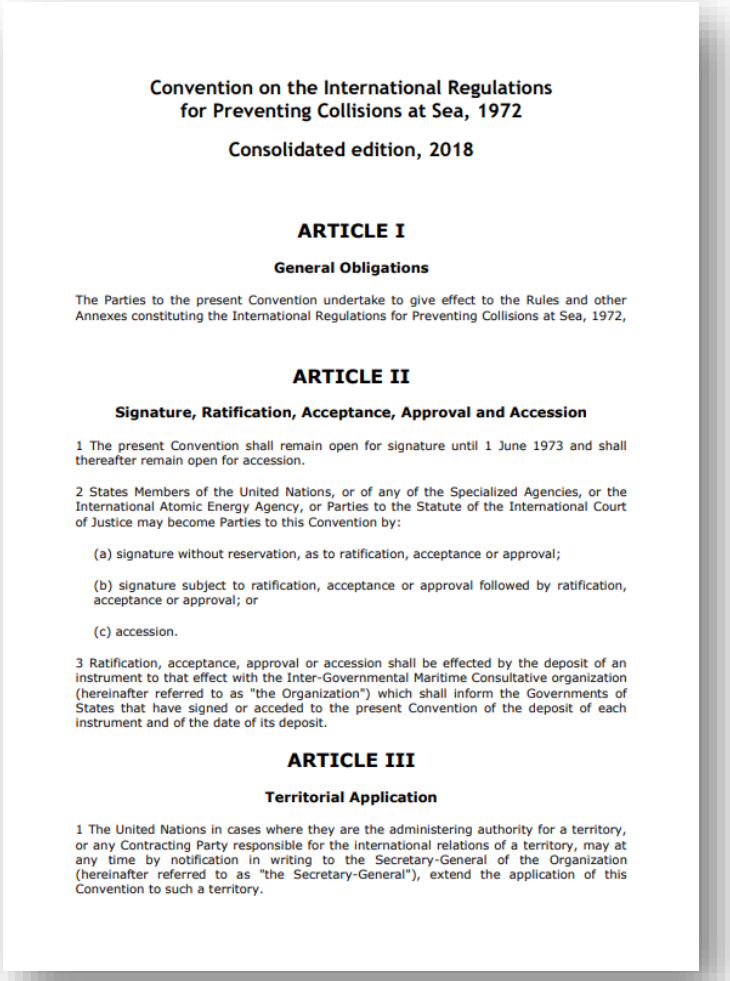
Example „COLREGs“ vs.“ICAO Annex 2: Rules of the Air“



Convention on the International Regulations
for Preventing Collisions at Sea, 1972

Consolidated edition, 2018

ARTICLE I

General Obligations

The Parties to the present Convention undertake to give effect to the Rules and other Annexes constituting the International Regulations for Preventing Collisions at Sea, 1972,

ARTICLE II

Signature, Ratification, Acceptance, Approval and Accession

1 The present Convention shall remain open for signature until 1 June 1973 and shall thereafter remain open for accession.

2 States Members of the United Nations, or of any of the Specialized Agencies, or the International Atomic Energy Agency, or Parties to the Statute of the International Court of Justice may become Parties to this Convention by:

(a) signature without reservation, as to ratification, acceptance or approval;

(b) signature subject to ratification, acceptance or approval followed by ratification, acceptance or approval; or

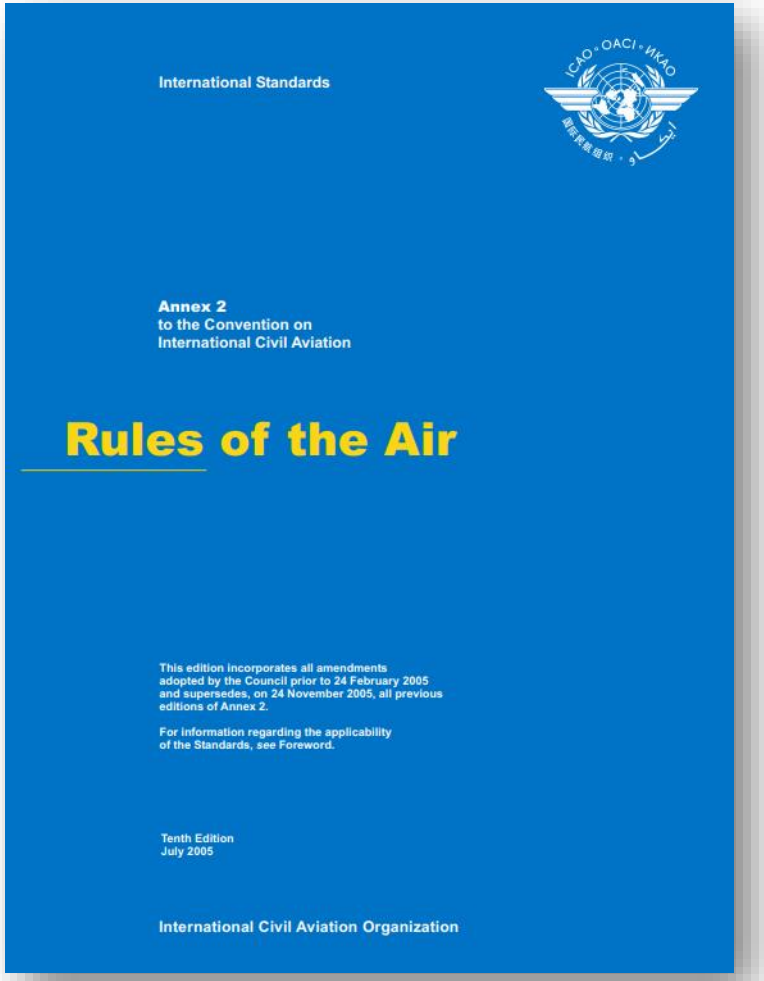
(c) accession.

3 Ratification, acceptance, approval or accession shall be effected by the deposit of an instrument to that effect with the Inter-Governmental Maritime Consultative organization (hereinafter referred to as "the Organization") which shall inform the Governments of States that have signed or acceded to the present Convention of the deposit of each instrument and of the date of its deposit.

ARTICLE III

Territorial Application

1 The United Nations in cases where they are the administering authority for a territory, or any Contracting Party responsible for the international relations of a territory, may at any time by notification in writing to the Secretary-General of the Organization (hereinafter referred to as "the Secretary-General"), extend the application of this Convention to such a territory.



International Standards

Annex 2
to the Convention on
International Civil Aviation

Rules of the Air

This edition incorporates all amendments adopted by the Council prior to 24 February 2005 and supersedes, on 24 November 2005, all previous editions of Annex 2.

For information regarding the applicability of the Standards, see Foreword.

Tenth Edition
July 2005

International Civil Aviation Organization

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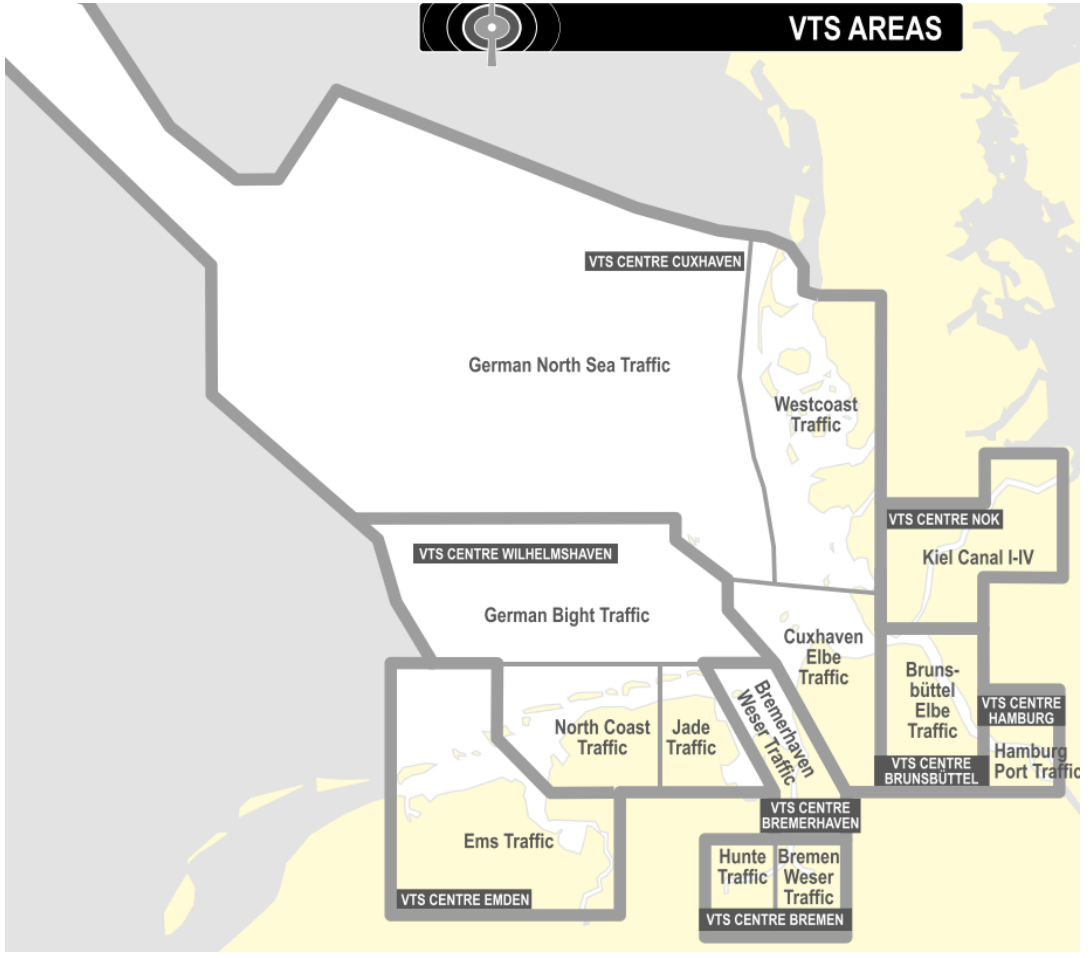
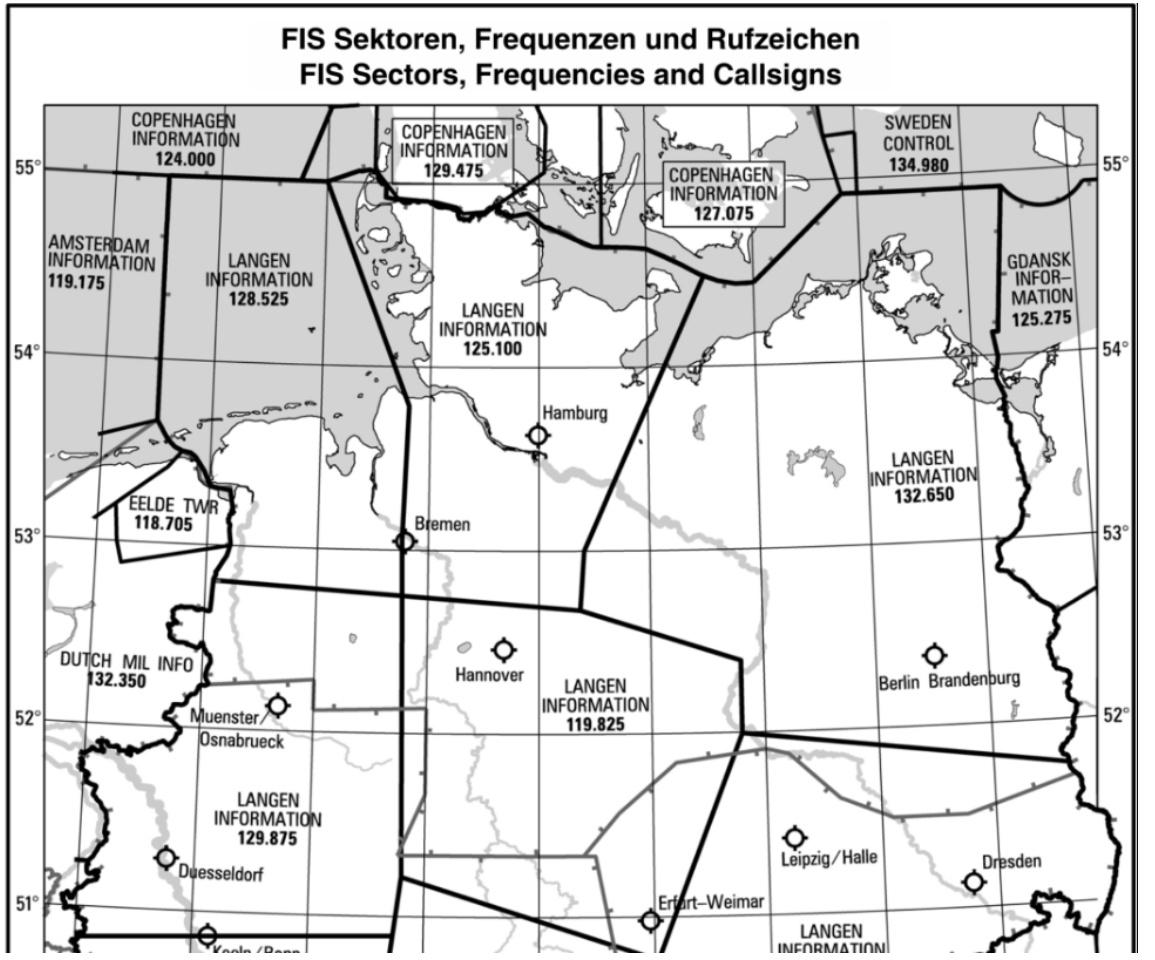
Two Separate Worlds

Example VTS vs. FIS





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What is different to today?

- Today with manned aviation:
  Humans are looking out to avoid collisions (called VFR)
- With Drones operating in VLOS (Visual line of sight), we can do the same
- In the future more and more drones may fly automatically/autonomously in the vicinity of water ways
- When drones are remotely piloted, the human may still avoid collisions by using e.g. a live video stream, but limited scalability
- Already today, Captains are puzzled by the presence of drones
- Future:
  From „See and Avoid“ to „**detect and avoid**“
- New concepts for collision avoidance and more awareness about each other may be needed


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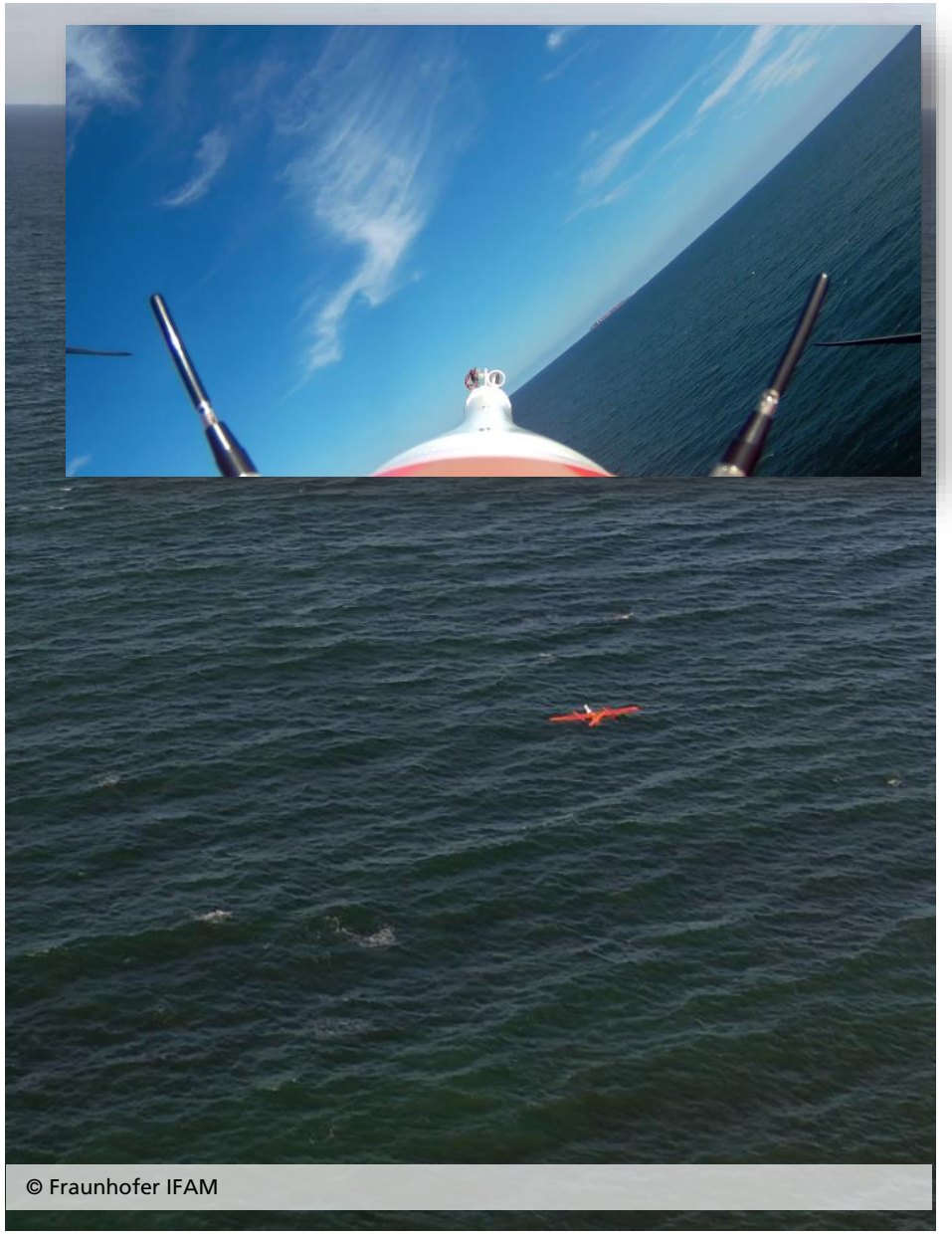

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Industrial example: EMSA

© https://www.emsa.europa.eu/rpas-activities/item/4373-emsa-provides-enhanced-surveillance-capacities-for-romanian-border-authorities-in-the-black-sea.html

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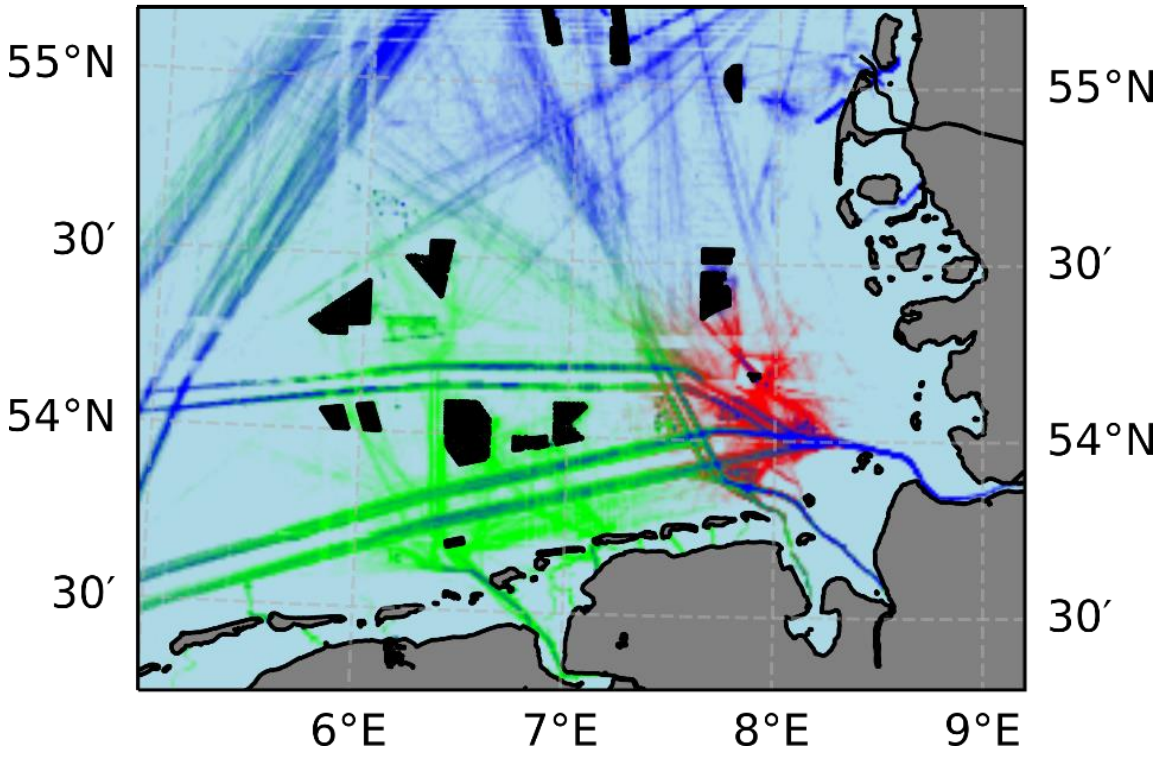
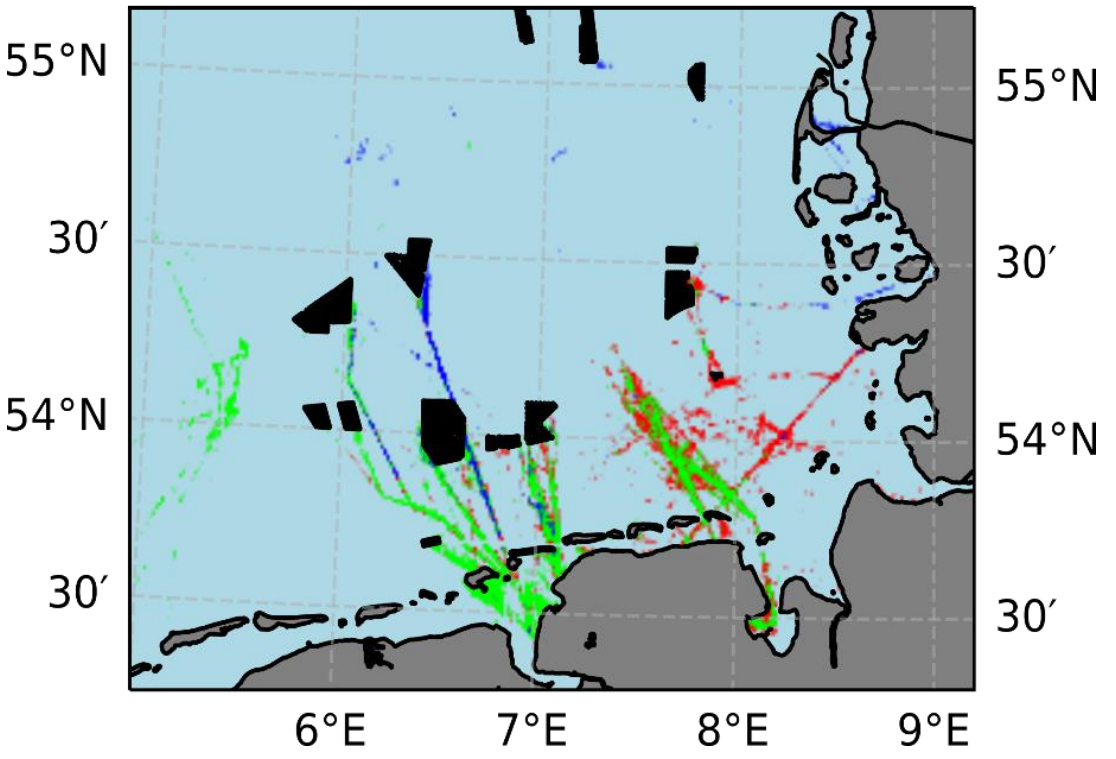
Why do we need to speak?

…Future drones will use „your“ air- and seaspace



Heatmap of ship signals (AIS)



Heatmap of helicopter signals (ADS-B/FLARM)

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The AVIATION view

Especially state aircraft often operate in low level airspace (e.g. 200ft ≈ 60m)

Image sources:
https://www.thb.info/rubriken/schifffahrt-service/detail/news/vertragsverlaengerung-fuer-wiking.html
https://www.airbus.com/en/newsroom/press-releases/2020-09-htm-helicopters-to-become-the-first-operator-to-use-the-new-h145
https://www.rth.info/news/news.php?id=2114
https://www.yacht.de/seenot-neue-hubschrauber-fuer-sar-einsaetze-in-nord-und-ostsee/
https://www.jetphotos.com/photo/5769879

The MARITIME view

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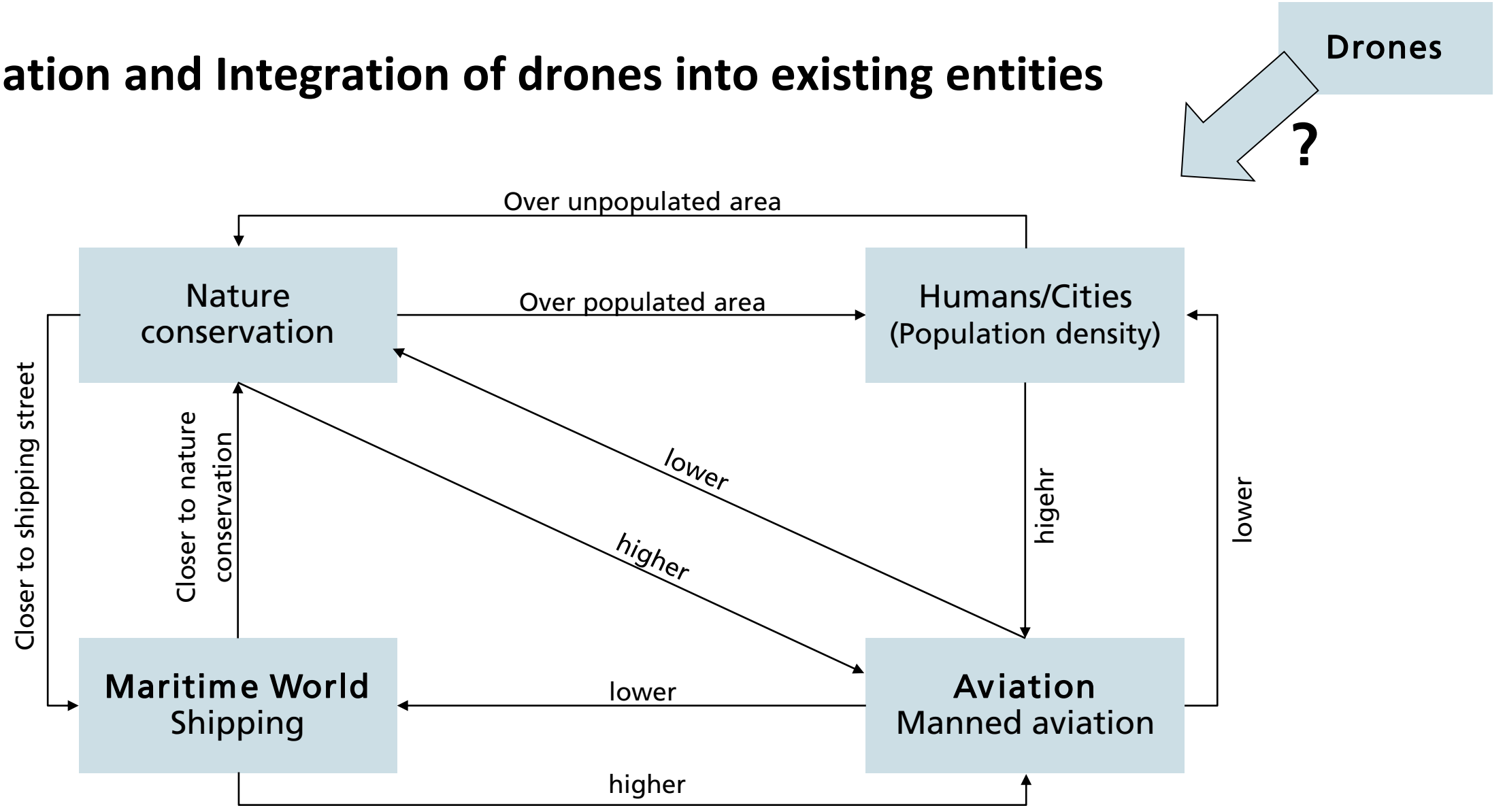
Coordination and Integration of drones into existing entities



Conclusion for coordination for the “drone world”

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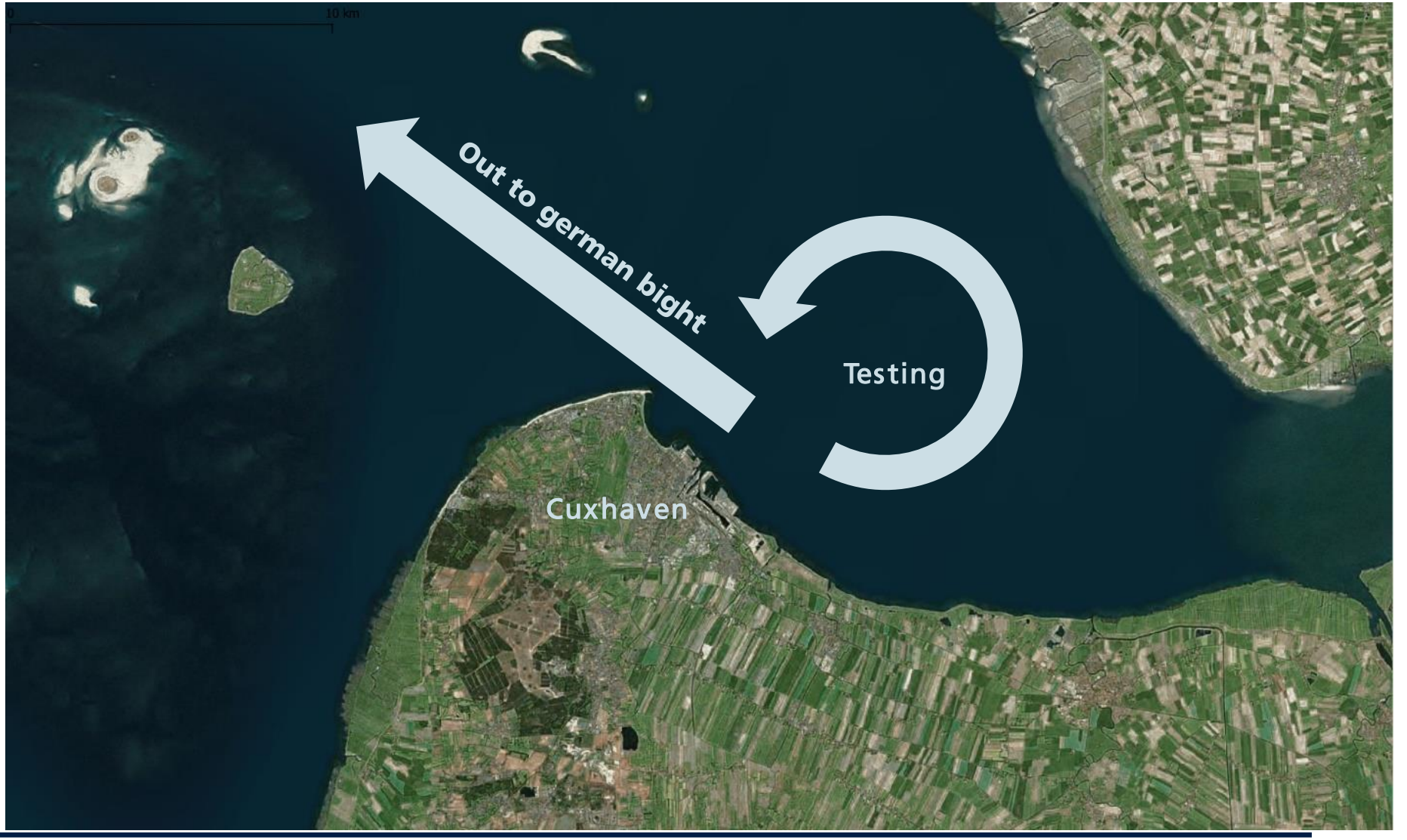
How to find a corridor for drones - 1) Satellite image

- Example here: „Research over water“
- Roughly define where you want to go
- What you want to do



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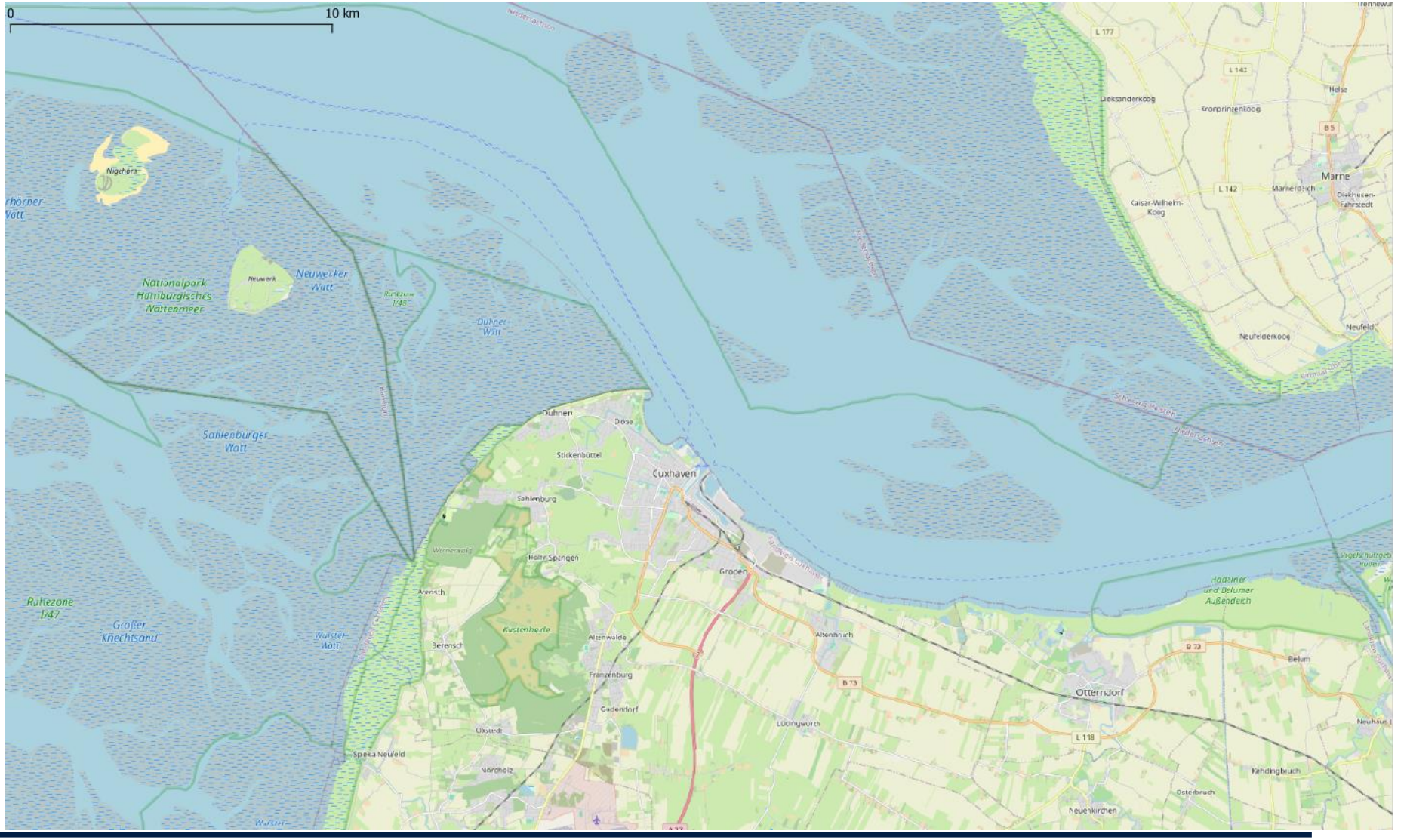
How to find a corridor for drones – 2) A map

- Get an overview of infrastructure



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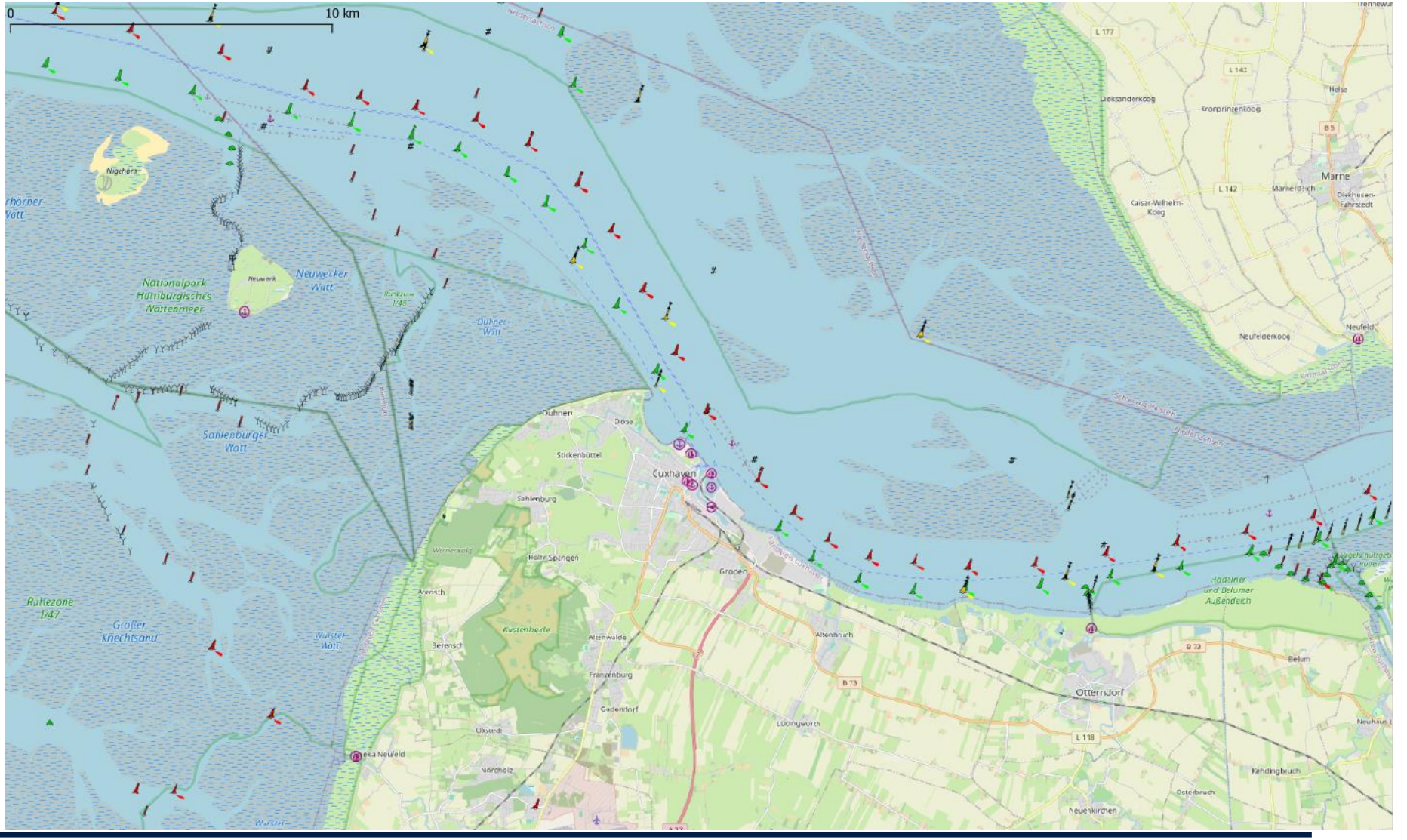
How to find a corridor for drones – 3) Open Sea map

- For our use case, add the shipping entities



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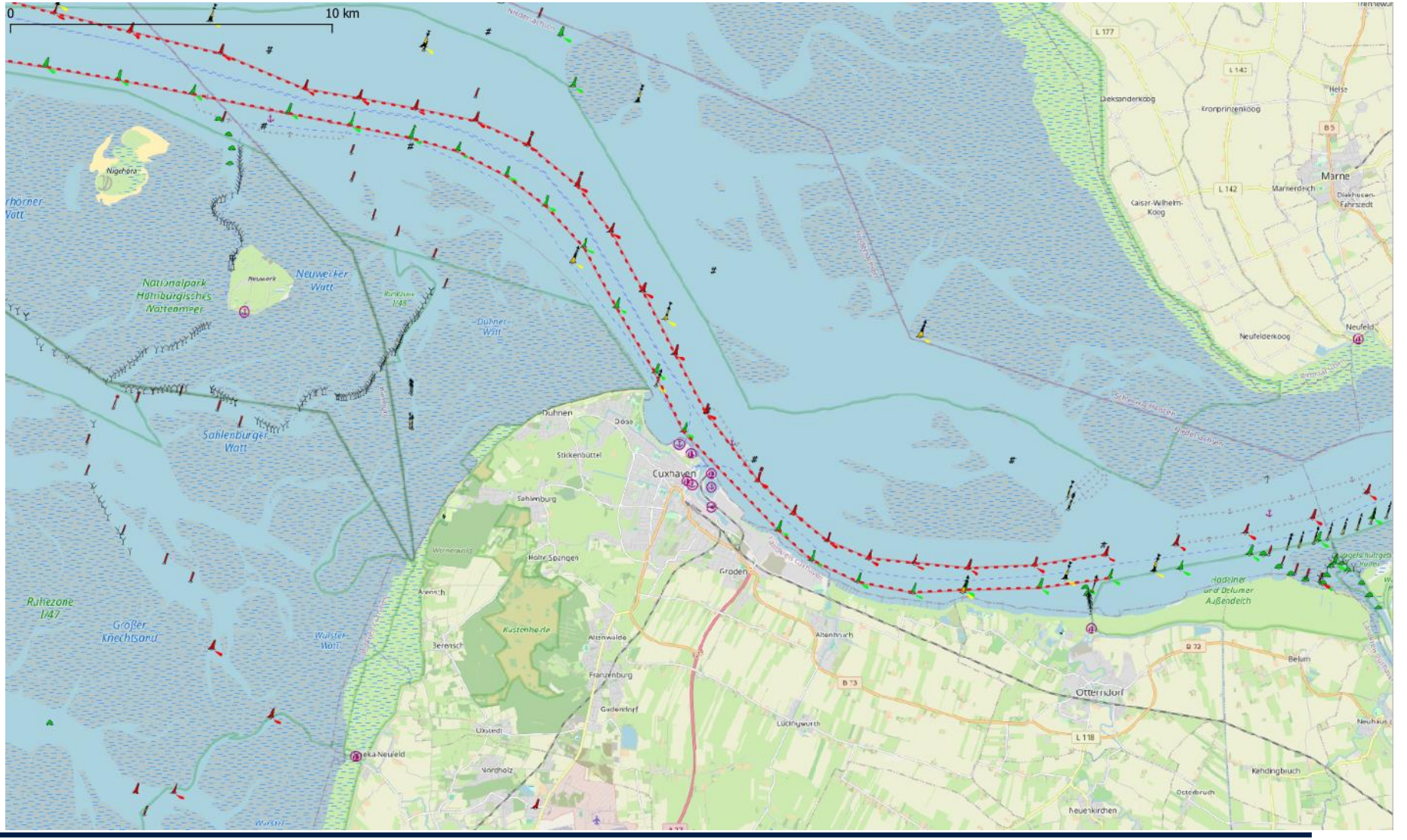
How to find a corridor for drones – 4) Water way

- Stay out of the water way a much as possible



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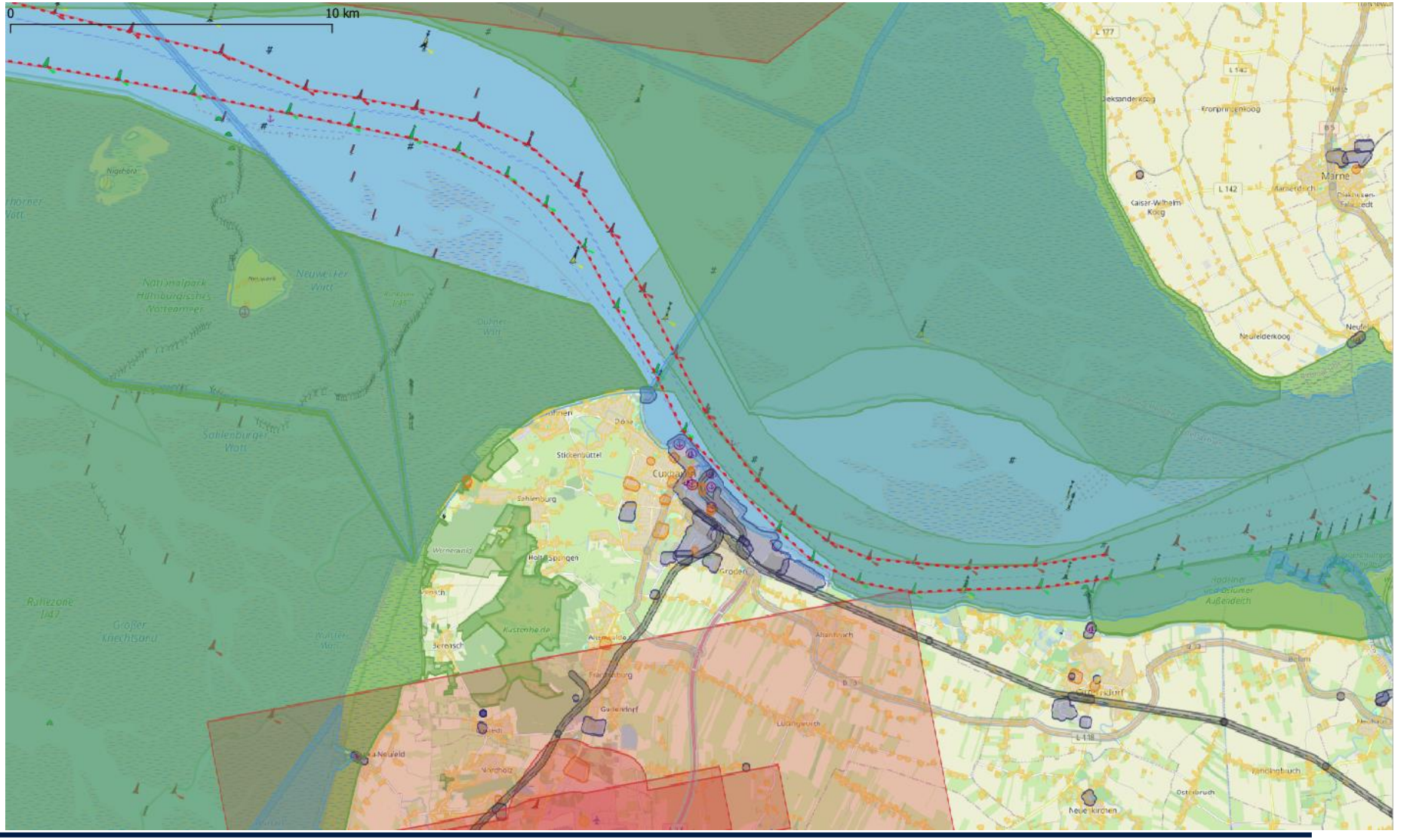
How to find a corridor for drones – 5) Geo zones

- Add the legal geo zones
- One of the U-Space Services



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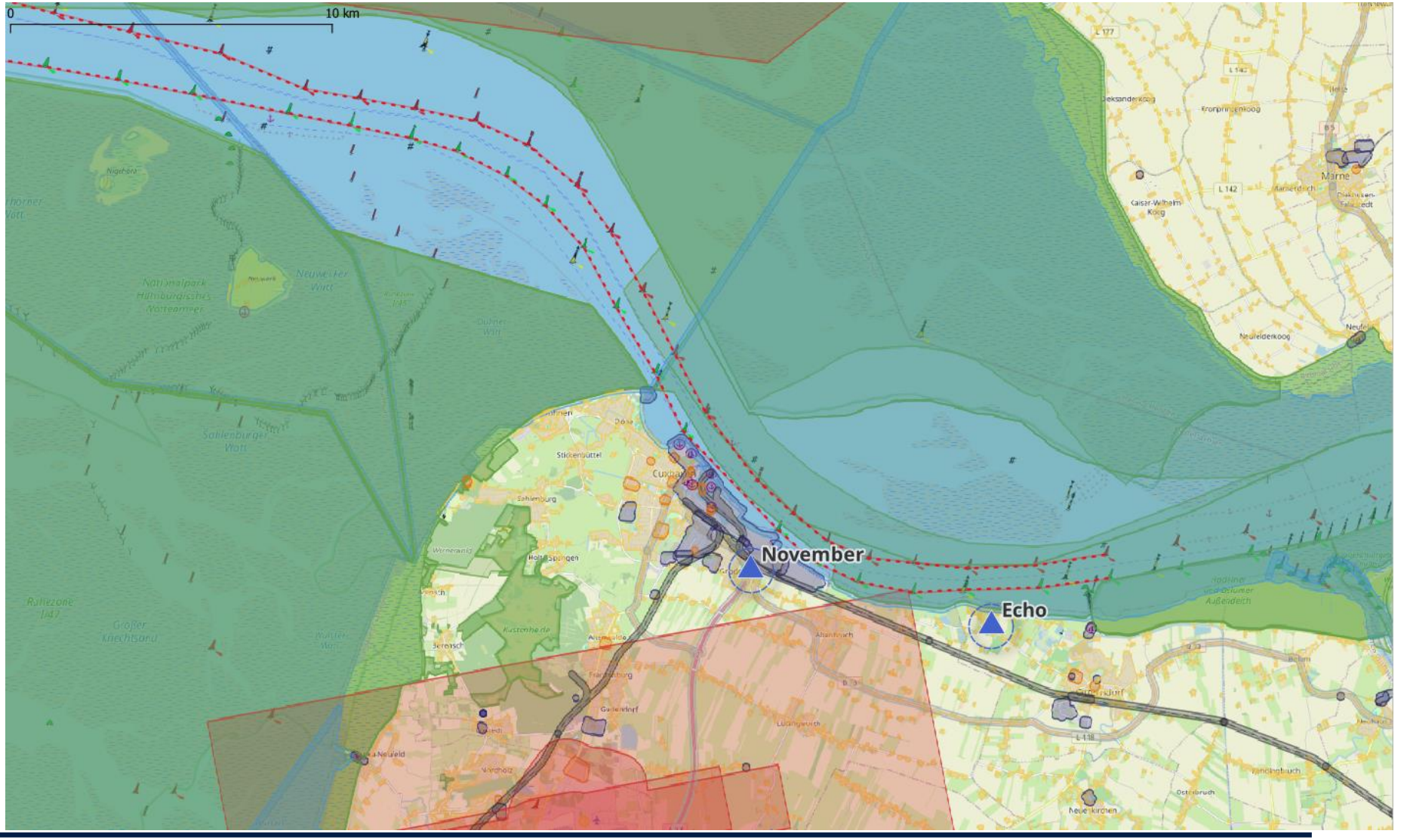
How to find a corridor for drones – 6) Detailes of manned aviation

- Compulory reporting points
- Heli routes (not visible on the image)
- Heli decks
- Areas where pilots are transported by heli



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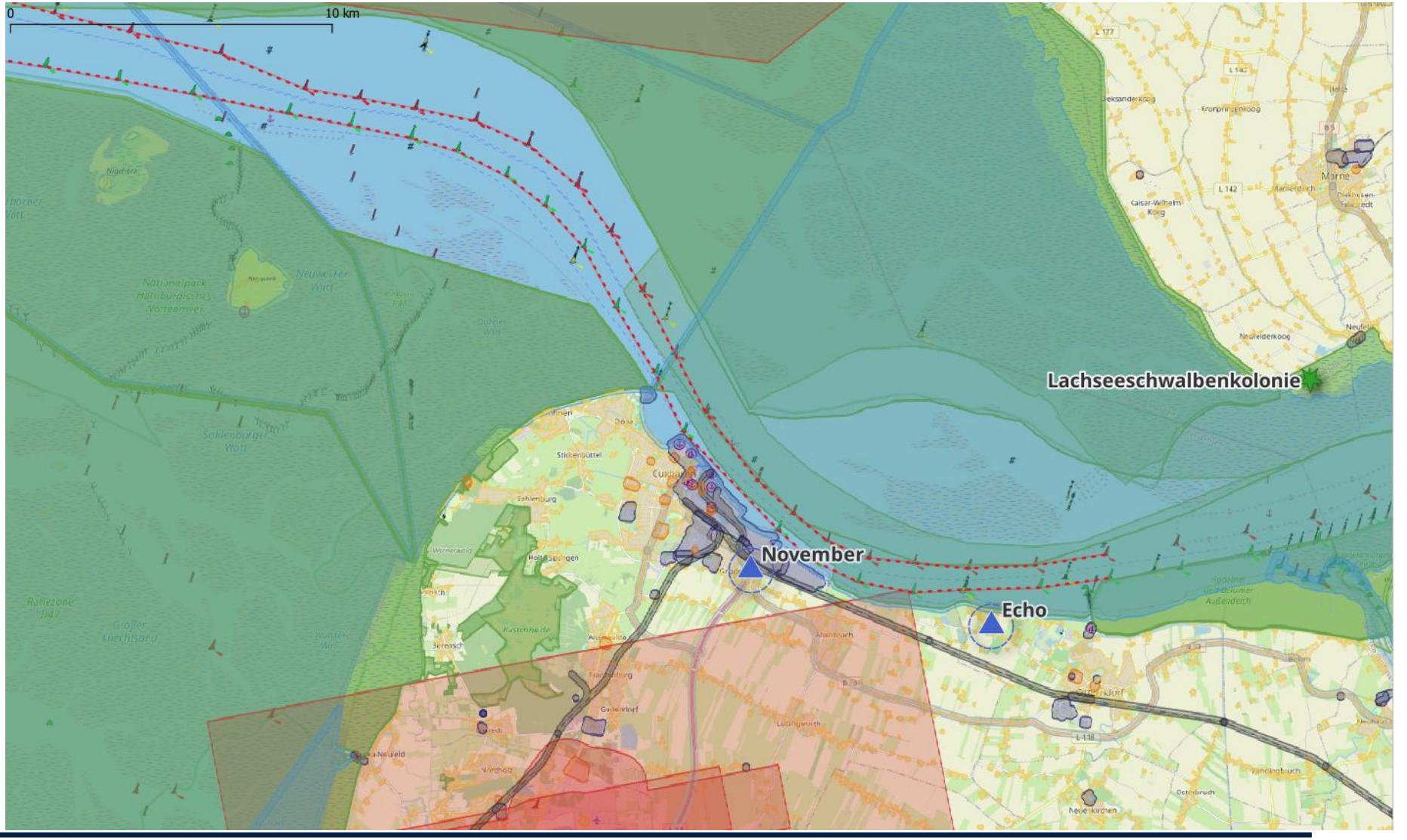
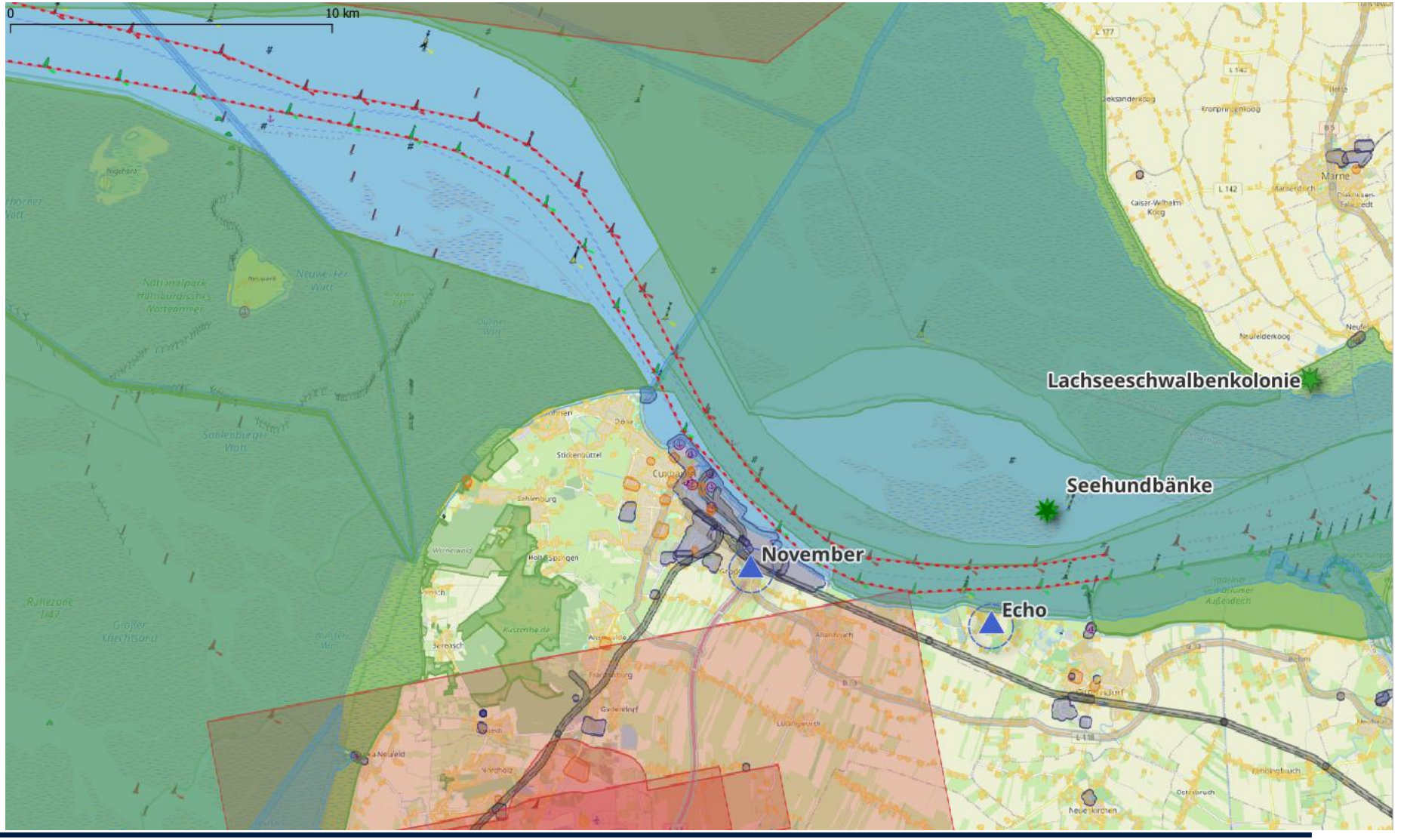
How to find a corridor for drones – 7) Rare bird populations

- Gull-billed tern collony



How to find a corridor for drones – 8) Seal banks

- Known areas of of seal gatherings



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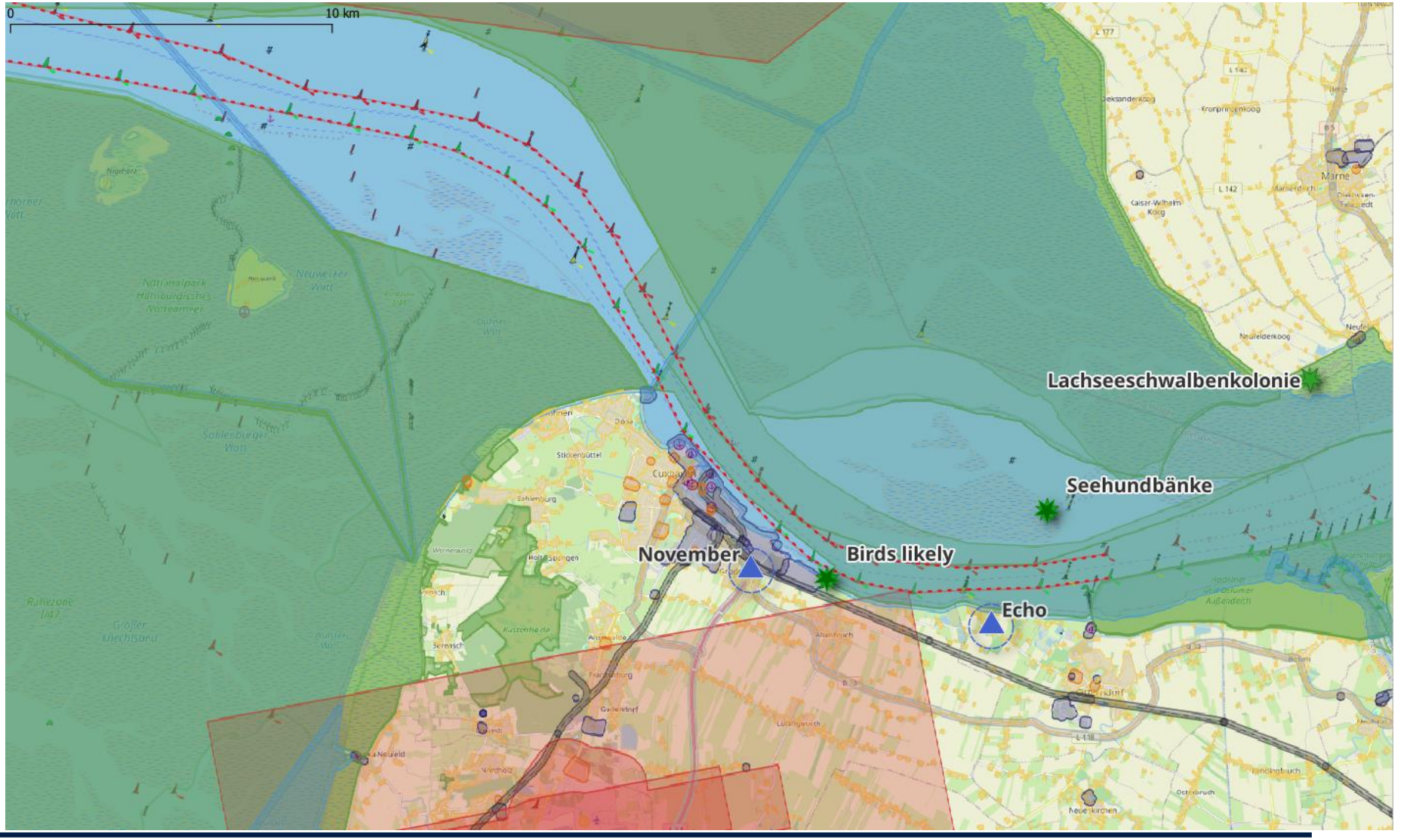
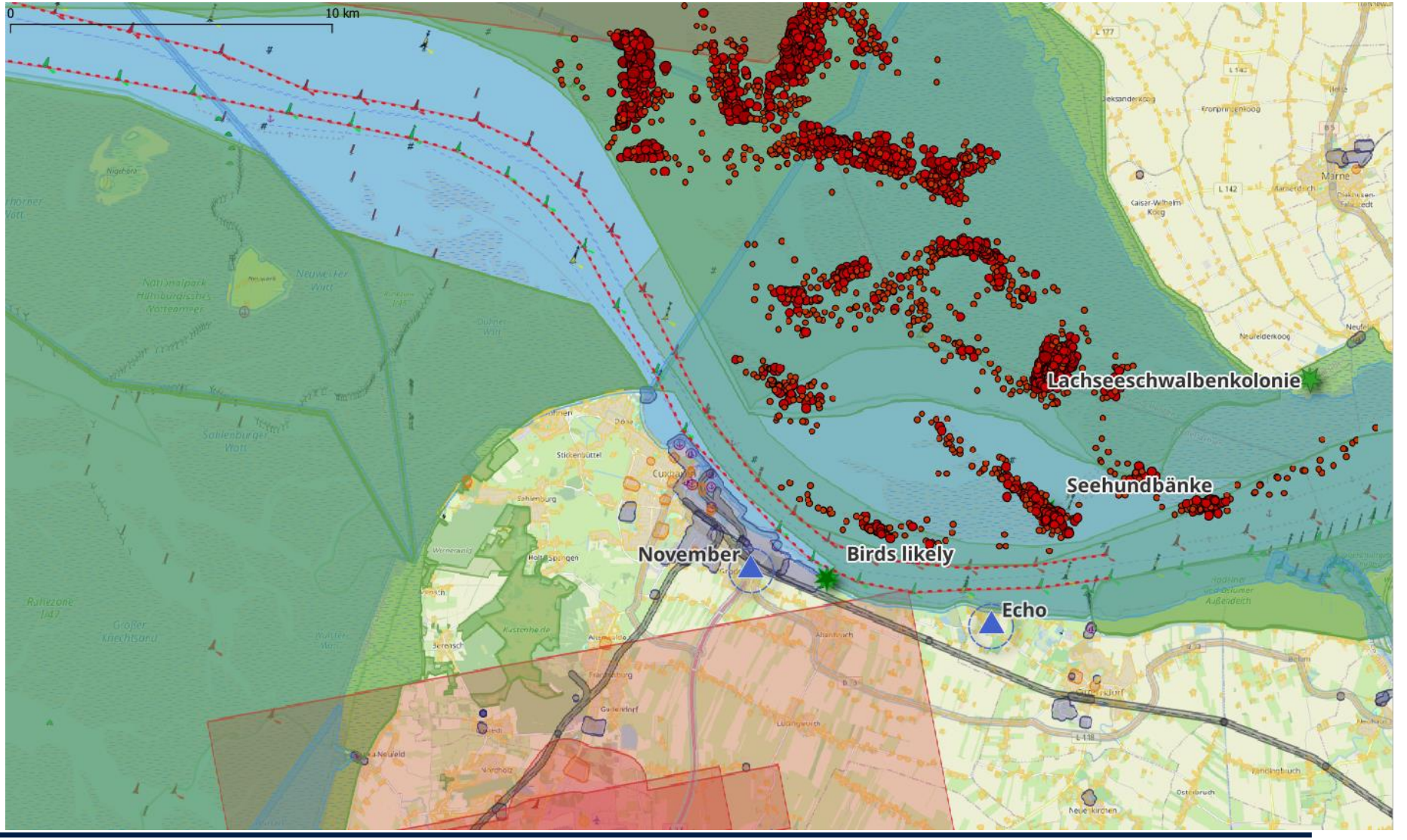
How to find a corridor for drones – 9) Breeding grounds

- Potential breeding grounds of birds (even when not a conservation area)



How to find a corridor for drones – 10) Seal sightings

- seal sightings over the last 10 years



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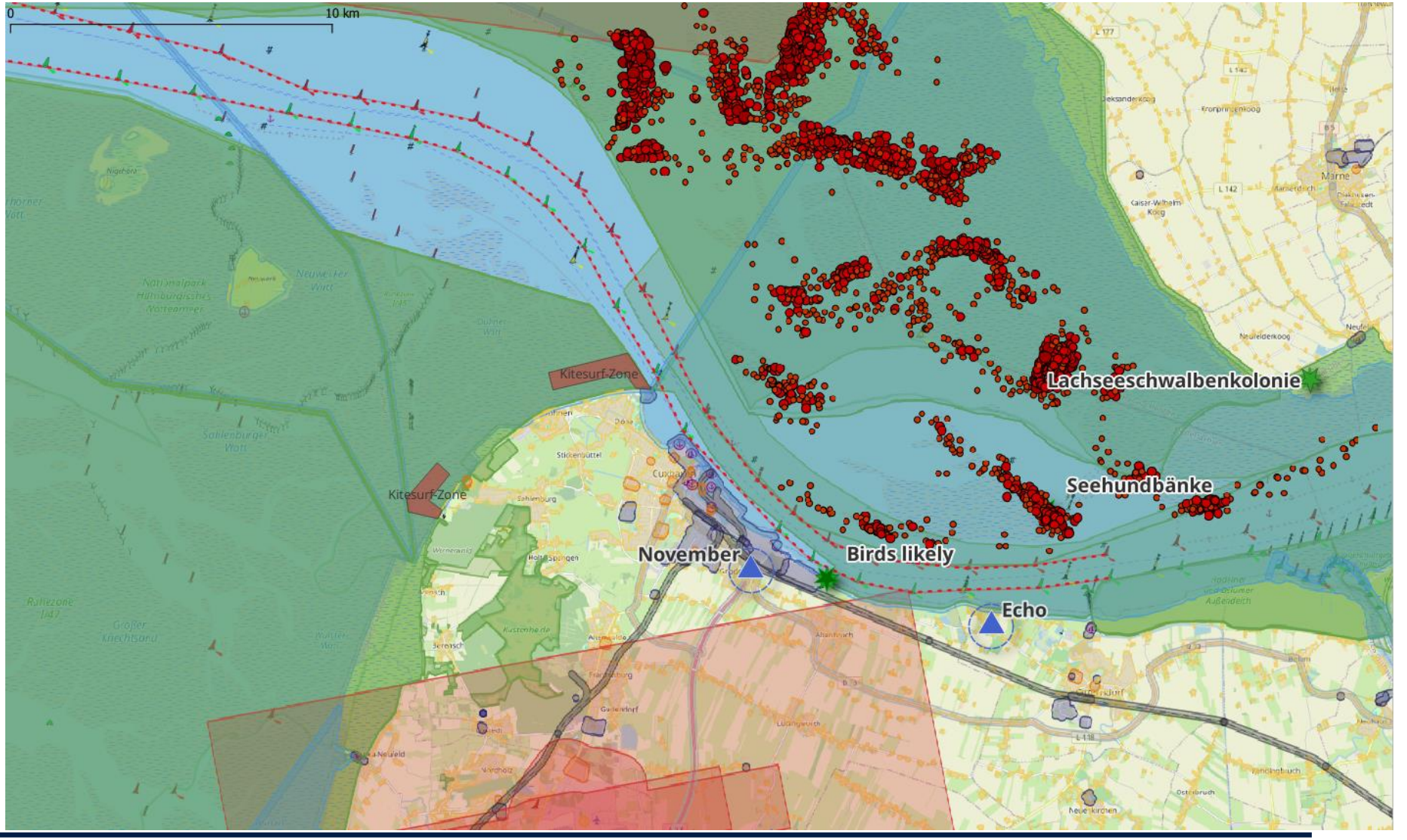
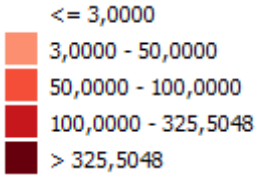
How to find a corridor for drones – 10) Kite surfing

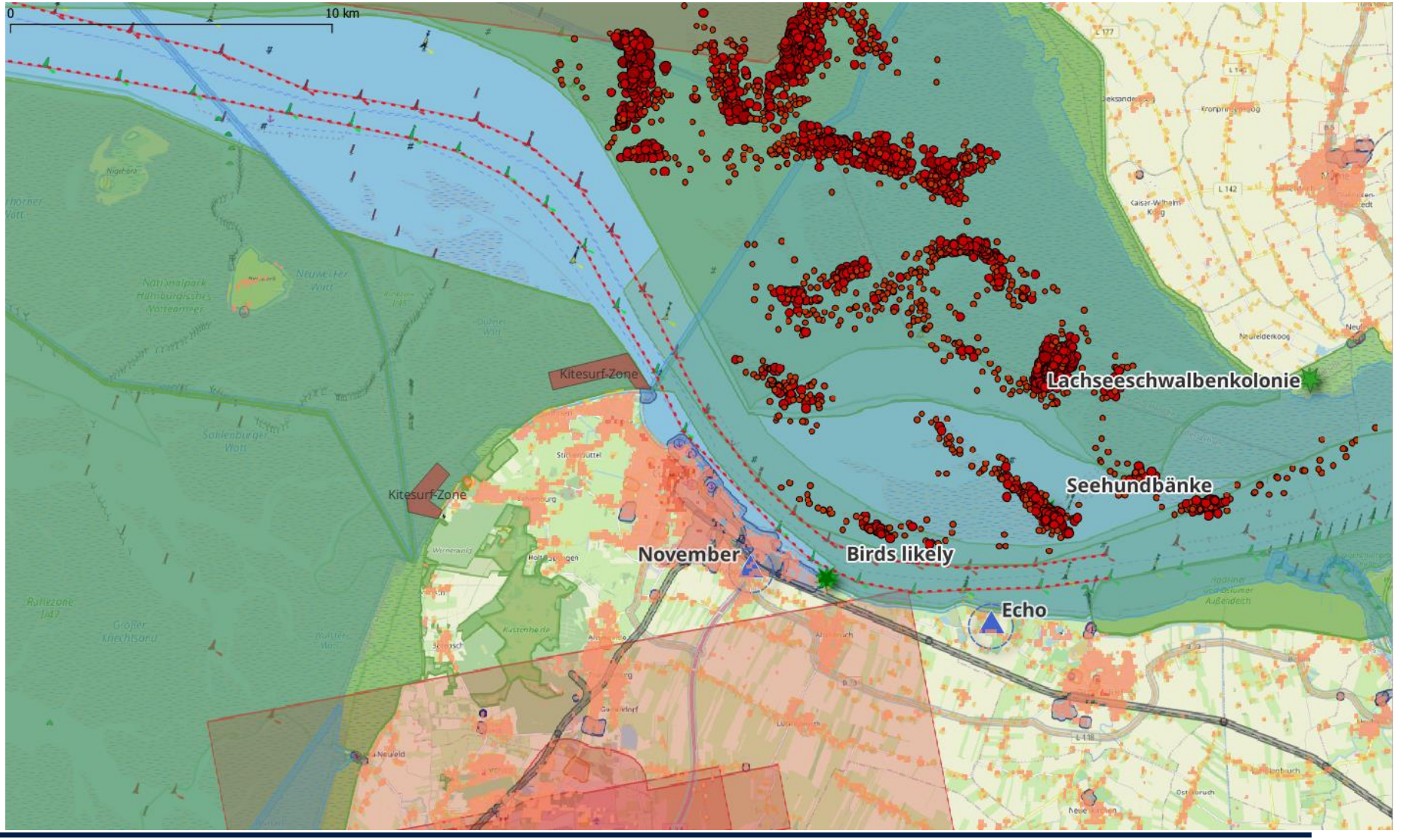
- Kite surfing zones



How to find a corridor for drones – 11) Population

- Population density estimation by using the global human settlement layer





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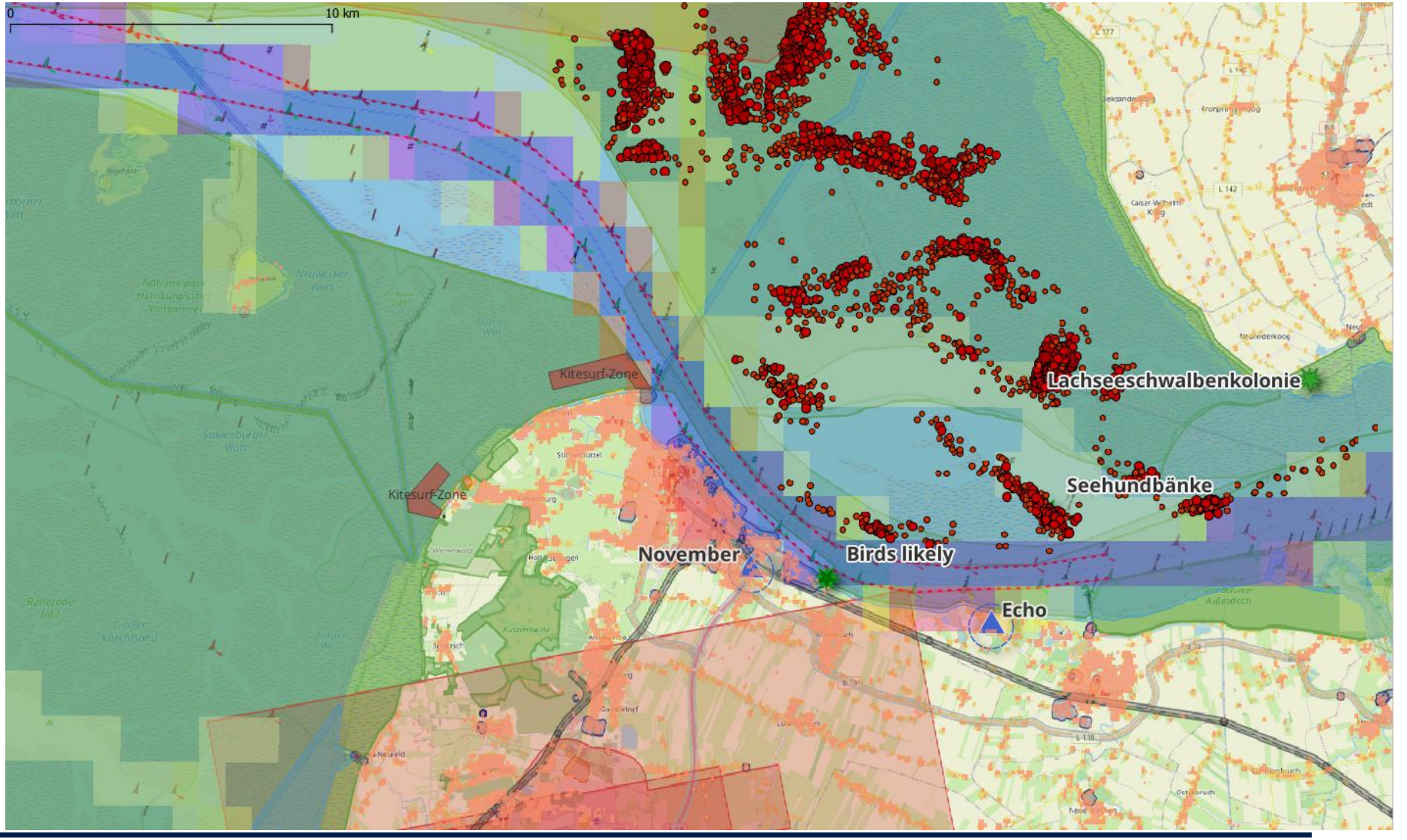
How to find a corridor for drones – 12) Ship traffic density

- AIS signals for esitamting the ship traffic density



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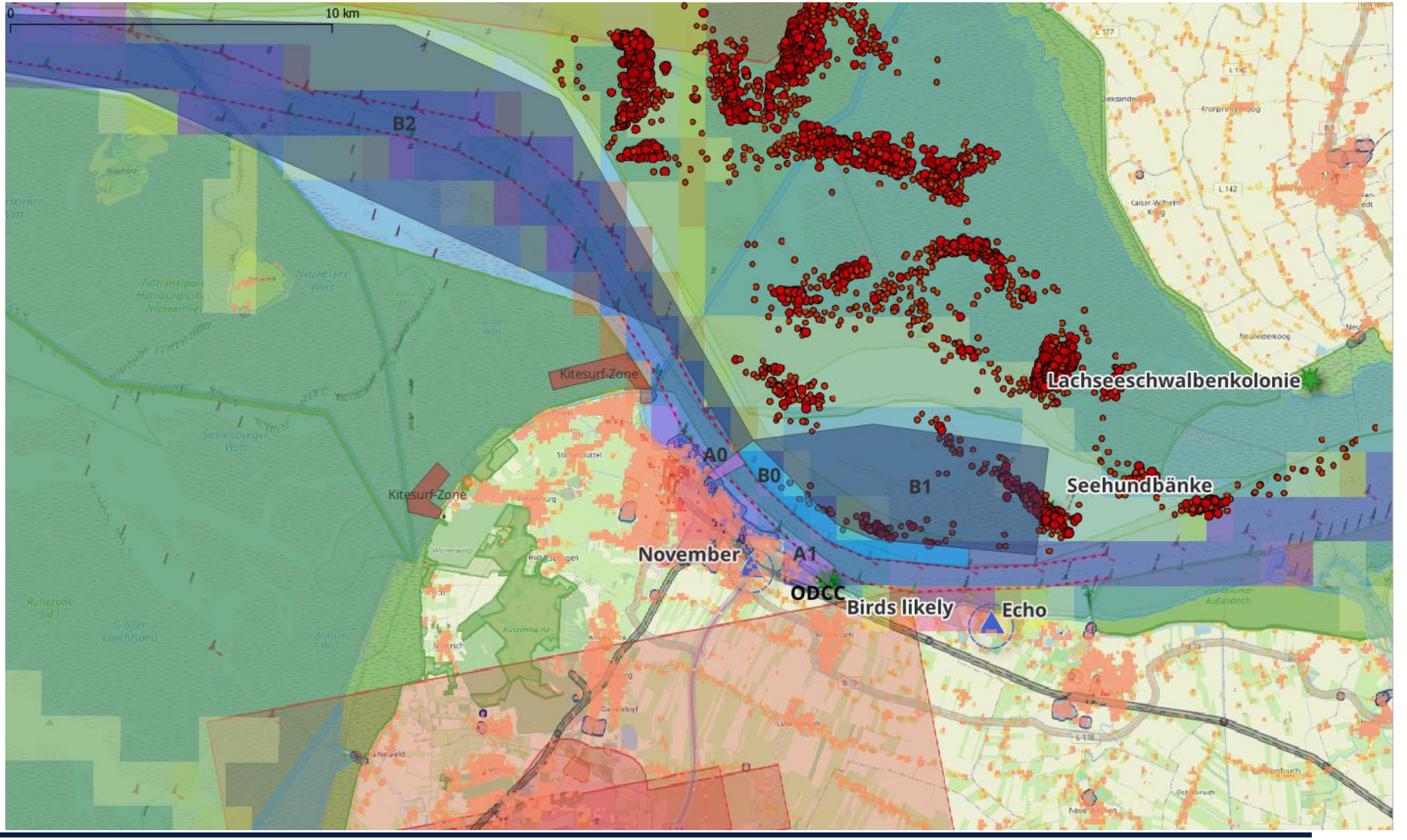
How to find a corridor for drones – 13) Define Areas for drone flight

- Finding areas for test flight and drone operations as a compromise



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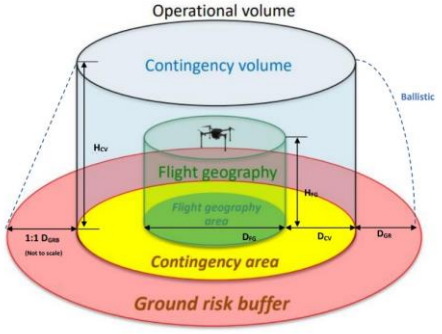
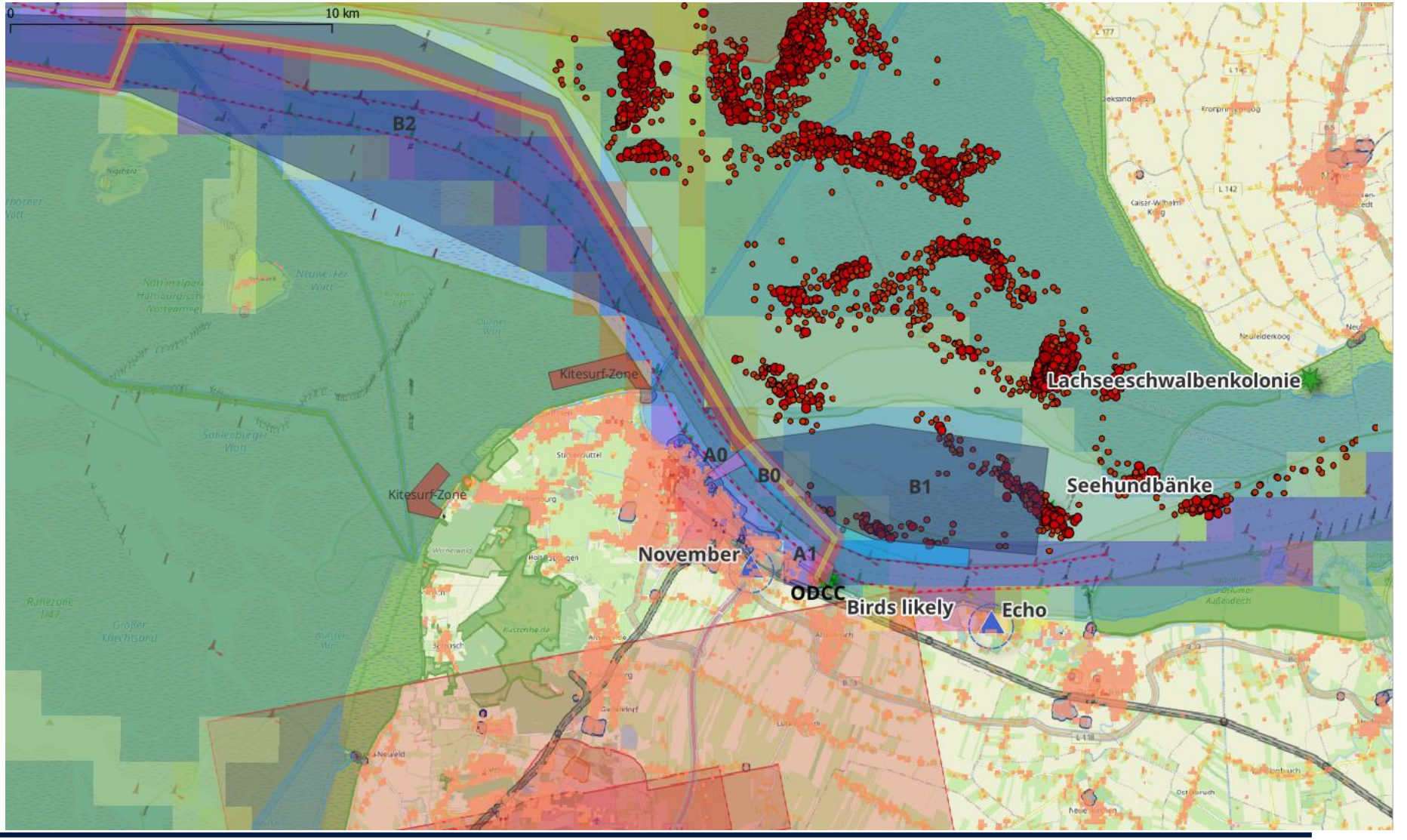
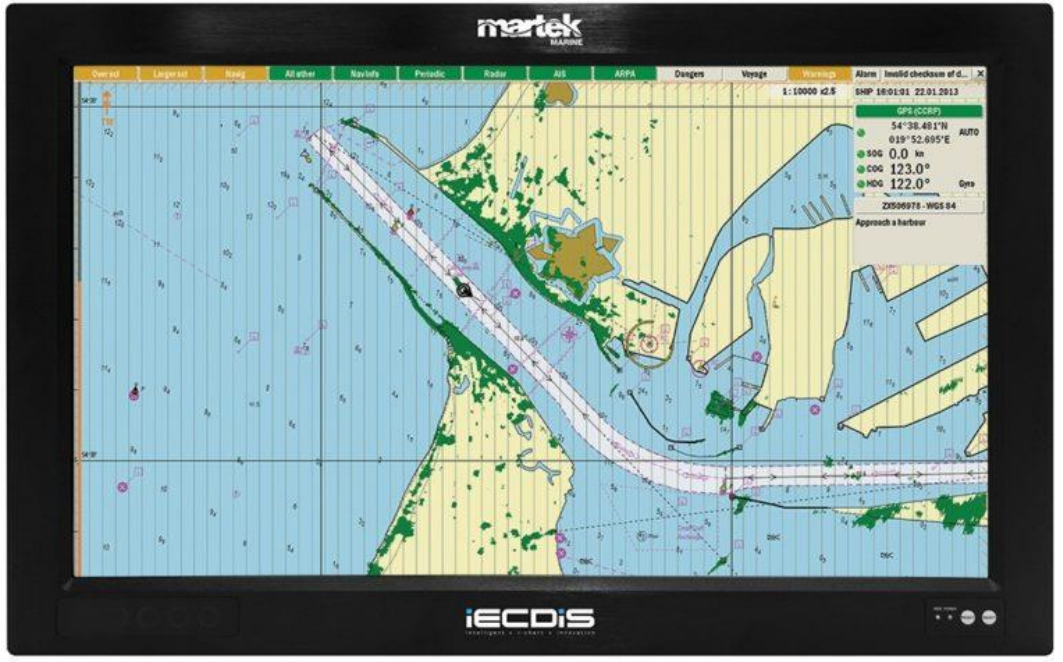
How to find a corridor for drones – 14) Define a drone flight path

- Find a compromise for the „best“ or „least disturing“ flight path for drone operation
- Calculate Ground risk buffer (GRC) in case of crash
- Contingency Volume and Flight geography

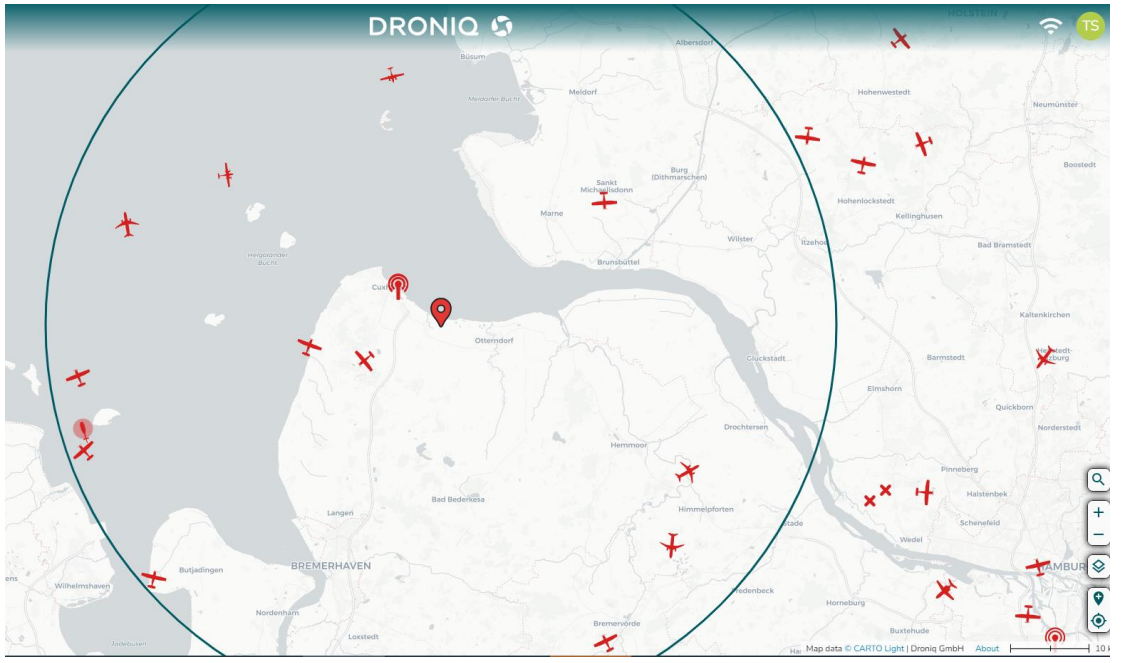




Connecting to two worlds



Maritime awareness for ships (ships only)



Airspace Awareness for drones (aircraft only)

What is missing? → A Connection

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Connecting to two worlds…with realtime data?

Source:
https://www.martek-marine.com/wp-content/uploads/2023/06/ecdis-charts-jpeg.webp

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Aircraft = Manned Aviation (Planes, Rotorcraft, Ballons, Gliders….)
Ship = Manned Maritime
UAV = Unmanned Aviation (UAS, VTOL, RPAS, ….)
USV = Unmanned Maritime (UVS)

Collision Avoidance - High Level Overview

Basic Rules: „Who is more agile gives way“ & „Right side has the right of way“

Strategic

- Operational Coordination in time (Slot & Flow management)
- Operational coordination in space (vertical/lateral and routes/procedures)

Tactical

Aircraft - Aircraft	Aircraft - Ship	UAV – other aircraft (aircraft or UAV)	UAV – Ship (can be USV as well)
IFR Predef. routes & ATC	VFR „See and avoid“	VLOS	See and avoid via live video stream
VFR „See and avoid“		BVLOS „Detect and avoid“	BVLOS „Detect and avoid“

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Brest, a port at the far west of Europe

pilot of digital navigation: why and why S-100?

BrestPort, a sunny day

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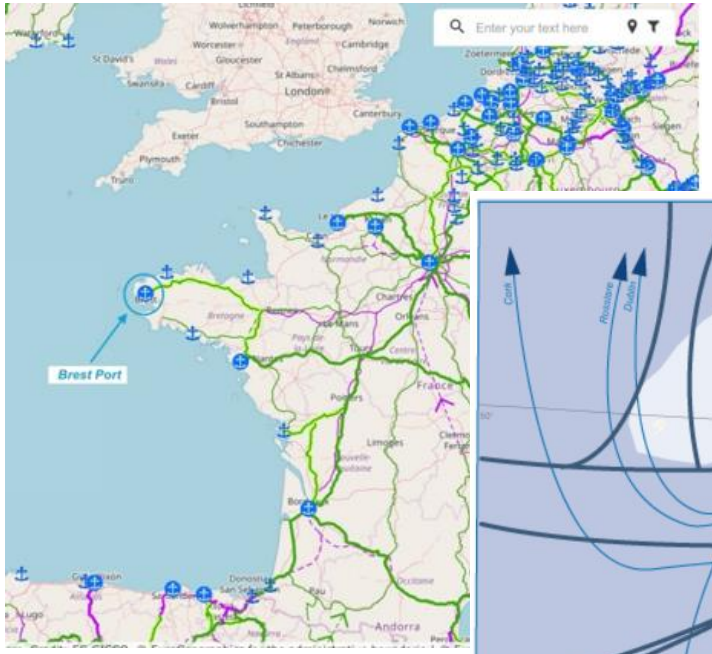
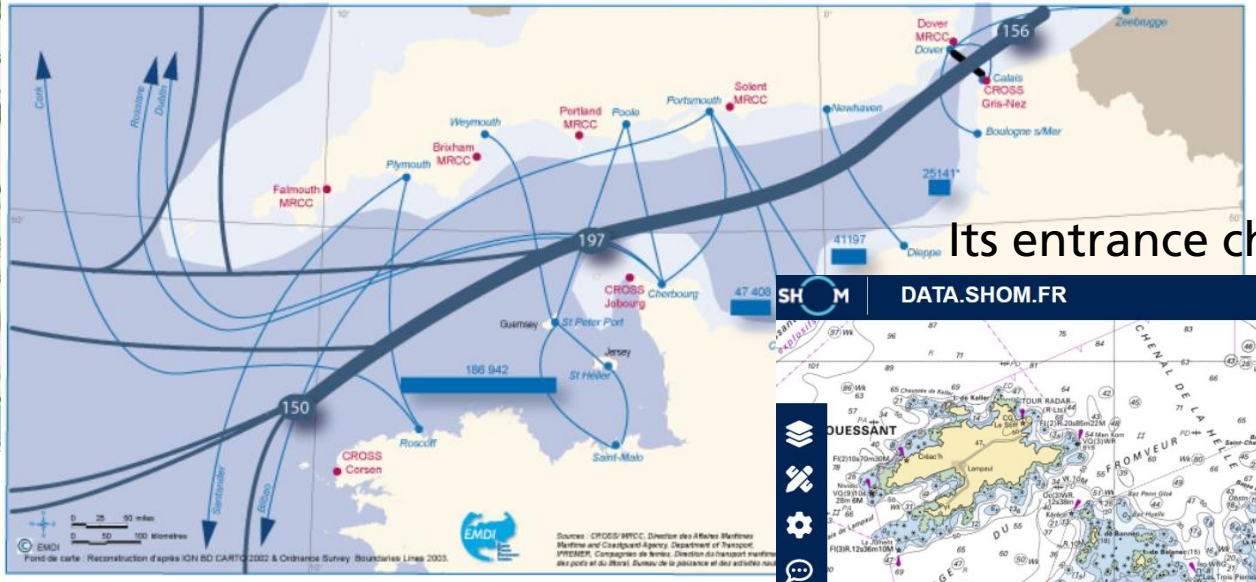
Since the early beginning the rationale is safety & security

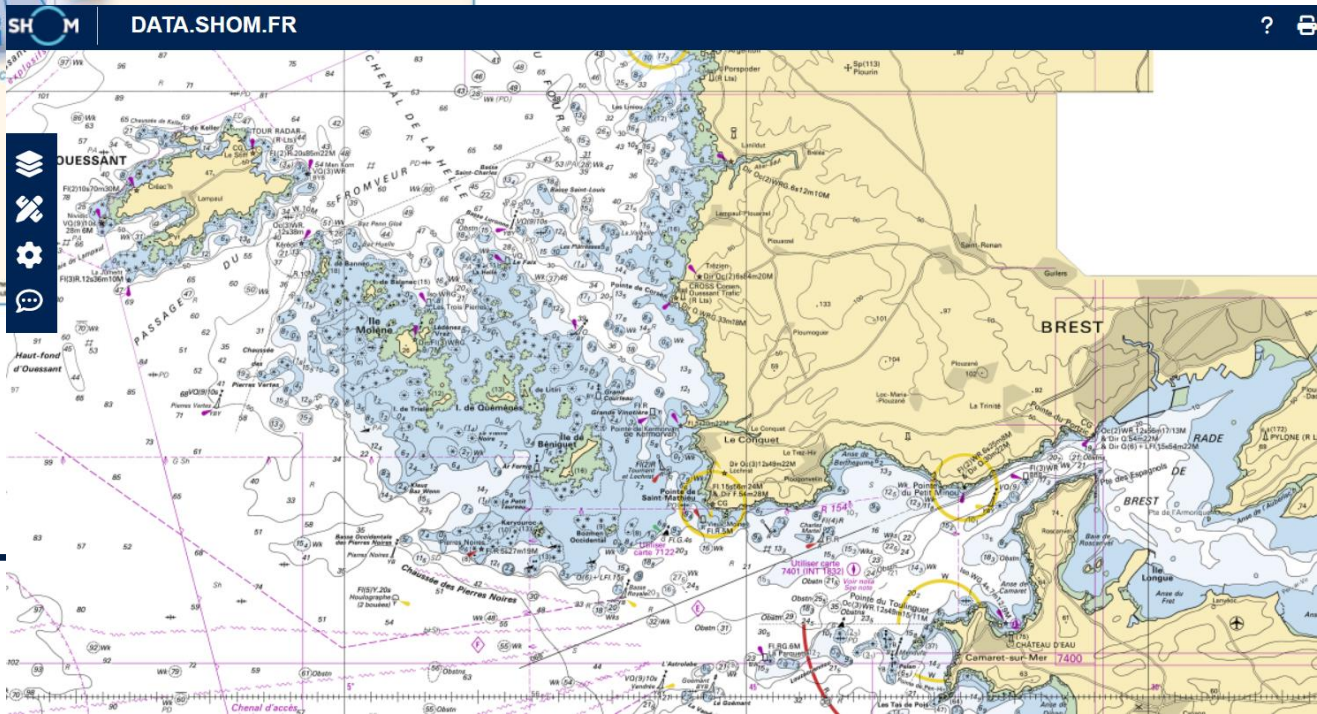
Brest is a TEN-T network, with duties in terms of provisioning of energy & goods but also maritime surveillance



Located at the cross point of intense Atlantic-North Sea trafic



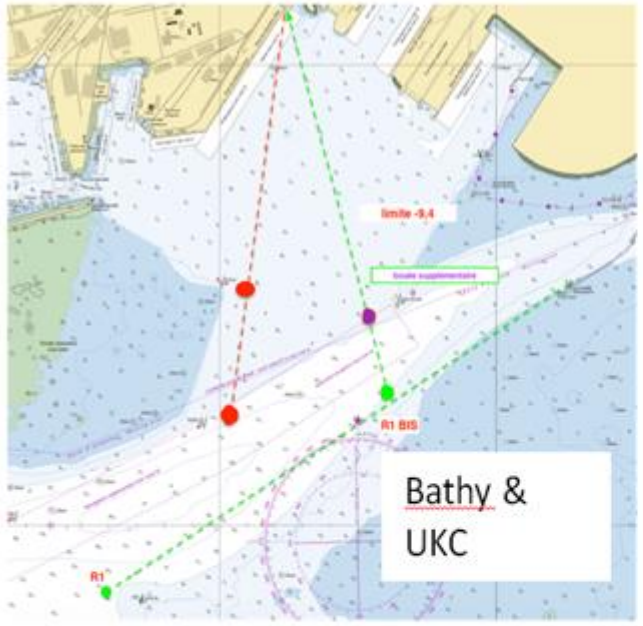
Its entrance channel surrounded by rocks & islands

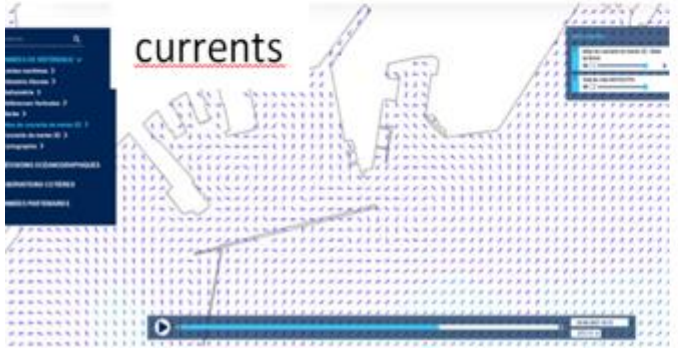


A challenge for captains and surveyors

It is naturally a port of refuge, but:

A narrow channel, strong currents, 8m tides, and strong&frequent winds: last one «Ciaran» winds of 255 km/h





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WE NEED DATA COMMUNICATION : WHAT WE HAVE DONE

- 2017-2022: a first tentative with Shom and SeaTopic to implement S-100 in Brest Port
  - Goal: to share environmental and trafic data on the navigation chart
  - Shom developed the high density S-111 current model
  - Result: BrestPort as data hub for environmental and trafic data and a test bed for e-navigation
- 2022-2023
  - Several unsuccessful trials to get financial support for a true switch to S-100
  - Deception of the local team: pilots, harbour master, BrestPort and more
- 2023:
  - Selection of the two prjects « DIOL » (Innovative Logistics for Offshore Wind) and OverHeat (avarie on bord)
    - DIOL in Brest: what are the critical data and services we must provide to the OW industry?
    - Overheat in Brest: the opportunity to finally develop S-100 based services for land-sea communication

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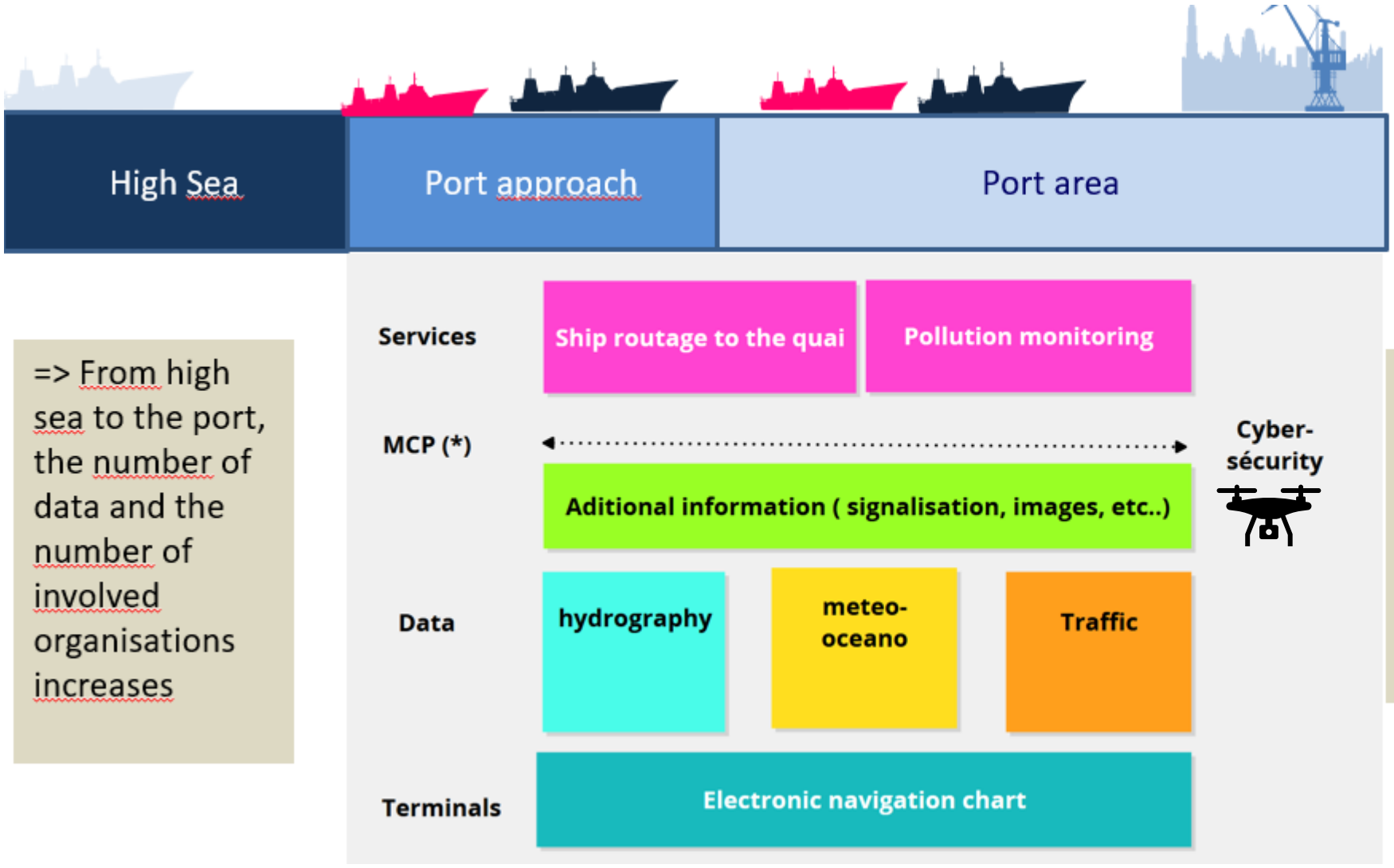
This is what we need (without drones)



=> From high sea to the port, the number of data and the number of involved organisations increases

<=1st scenario: routage of the ship from the point of embarkment of the pilots to the berth of destination:

- Requires basic data
- The port owns this data setp
- The port is a data hub

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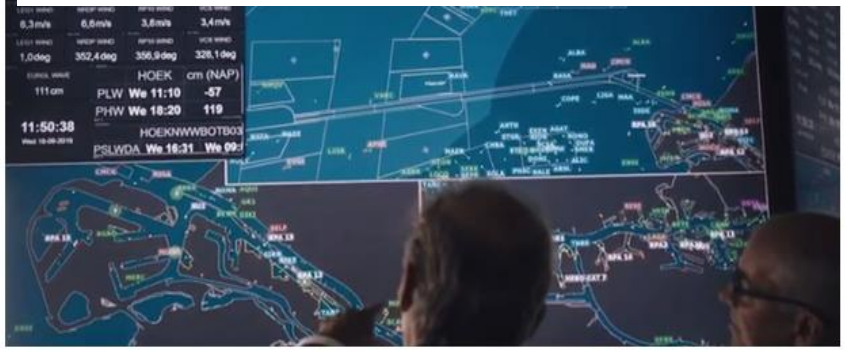
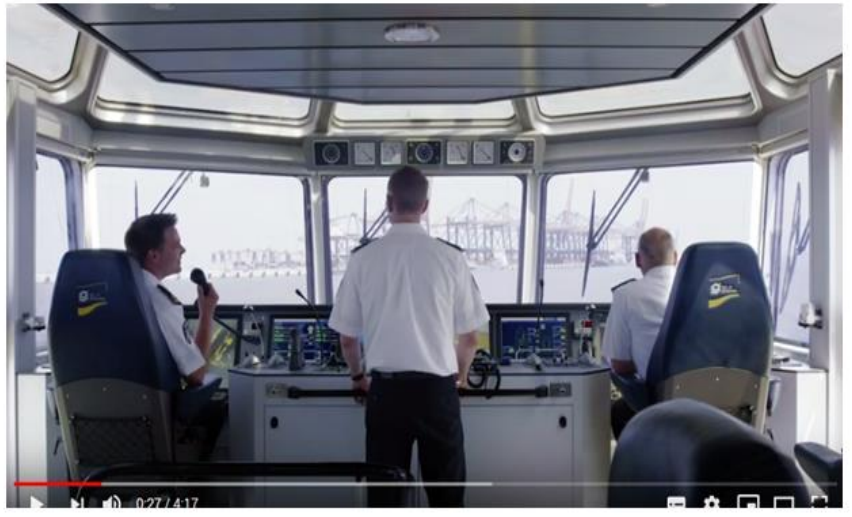
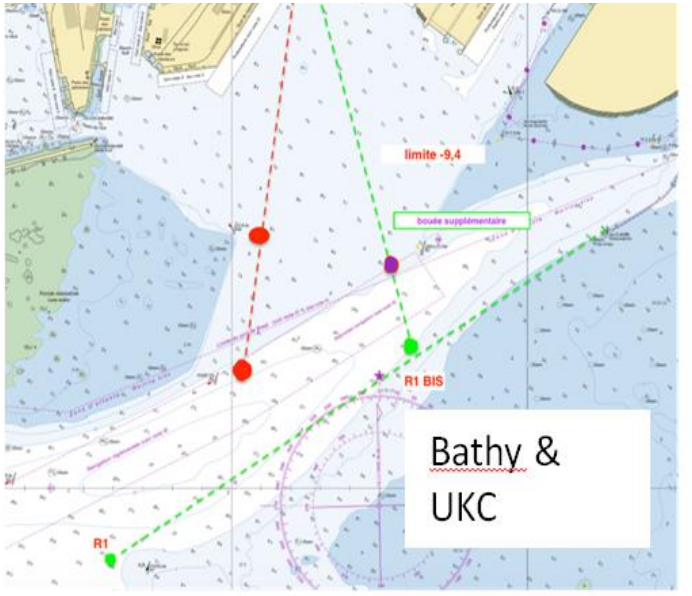
S-100 and data communication

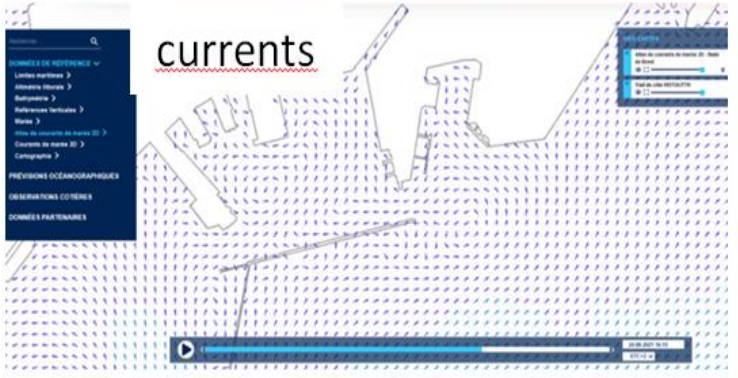
Shared vision of the situational picture between harbour master, pilots, the captain, teams on land (VTS stations, etc).



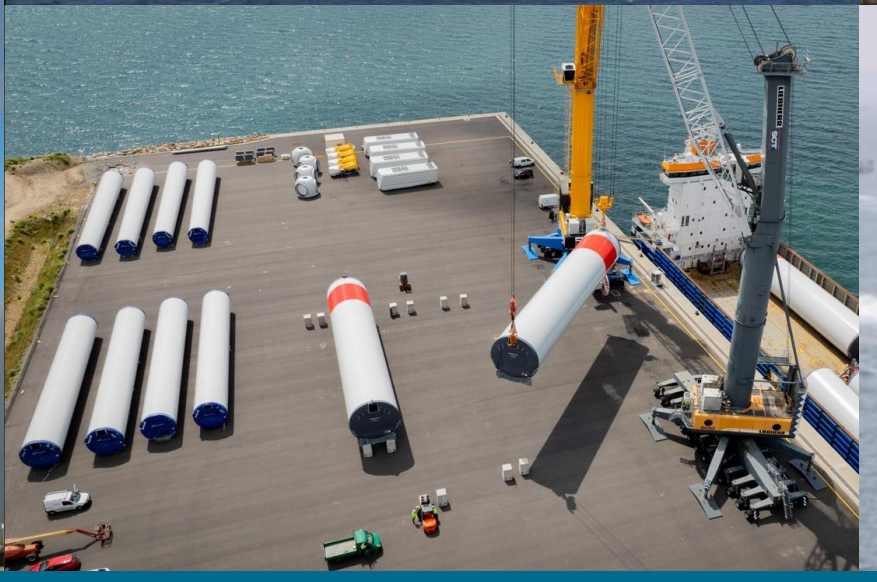
Additional information transfered in RT







And new comers: offshore wind energy



The requirements are stronger:

- Perfect knowledge of sea / meteo conditions, in RT and forecast modes
- Coordination of logistic means: maritime and aerian between != ports and airports
- Including drones? NO, not in Brest unless if they can be identified by the navy
-

This is for S-100 !

Conclusion and take home messages

- **The maritime world**:
  → Awareness and Integration of what is flying in the sky into ECDIS
    → identification and communication
    → building a bridge to aviation and drones → use of the SafeSky app (https://www.safesky.app/)
      to receive and display trajectories and other data → new S-xxx codes → new ECDIS layers

- **The aviation world:**
  → The maritime is asked to deliver their information to aviation.
    Almost all relevant information for the maritime situation is collected inside ECDIS
    Why not making a interface in in order to build this bridge to aviation and drones

- **Suggestion:**
  → ECDIS now is a **data sink** → Why not making ECDIS become a **data source** ?
    → May be better than recollecting the same data via another structure → make use of ECDIS
    → keeping the principle of singularity,
      no duplicating and diverting data or even contradictory information

- **Wish, dream, requirement**: → A way to awareness „about each other“ → **Sharing a common situational picture**

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Thank you for your attention

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