

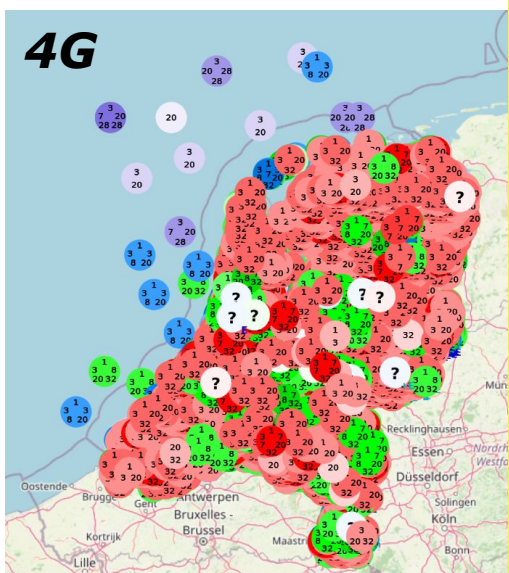
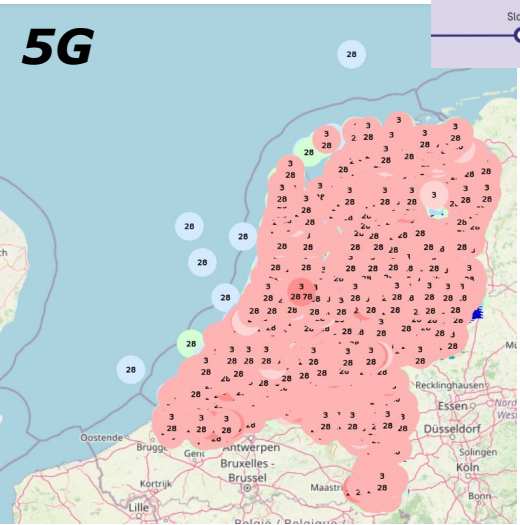
Rijkswaterstaat
Ministerie van Infrastructuur en Waterstaat

North Sea Connectivity *an ecosystem approach*

‘The use of digital infrastructure should be possible for everyone, even when the market does not provide it itself.’

***The State of Digital Infrastructure
The backbone of our digital economy***

Ministry of Economic Affairs & Climate – January 22, 2024)





Connectivity Fieldlab North Sea

An ecosystem approach from Rijkswaterstaat (RWS)

Fred Hage

Abstract:

At present we witness ever growing economic activities on the North Sea such as energy and food production and oil & gas exploitation. Important maritime and aviation routes crossing the North Sea contribute to passenger and cargo transport.

In all these activities large amount of data is sensed, collected and exchanged to support safety and security of processes, Coastguard operations, vessel and airplane traffic management, observations and ecological monitoring. Creation of a reliable telecommunication network with wide coverage is considered as an essential enabler for these use cases.

Design of such a network should take into account connectivity requirements of various users, network sovereignty and should exploit existing and planned energy and digital infrastructure at sea and combine them with land based infrastructure. Rijkswaterstaat is validating these aspects through various studies and pilots that will be presented.

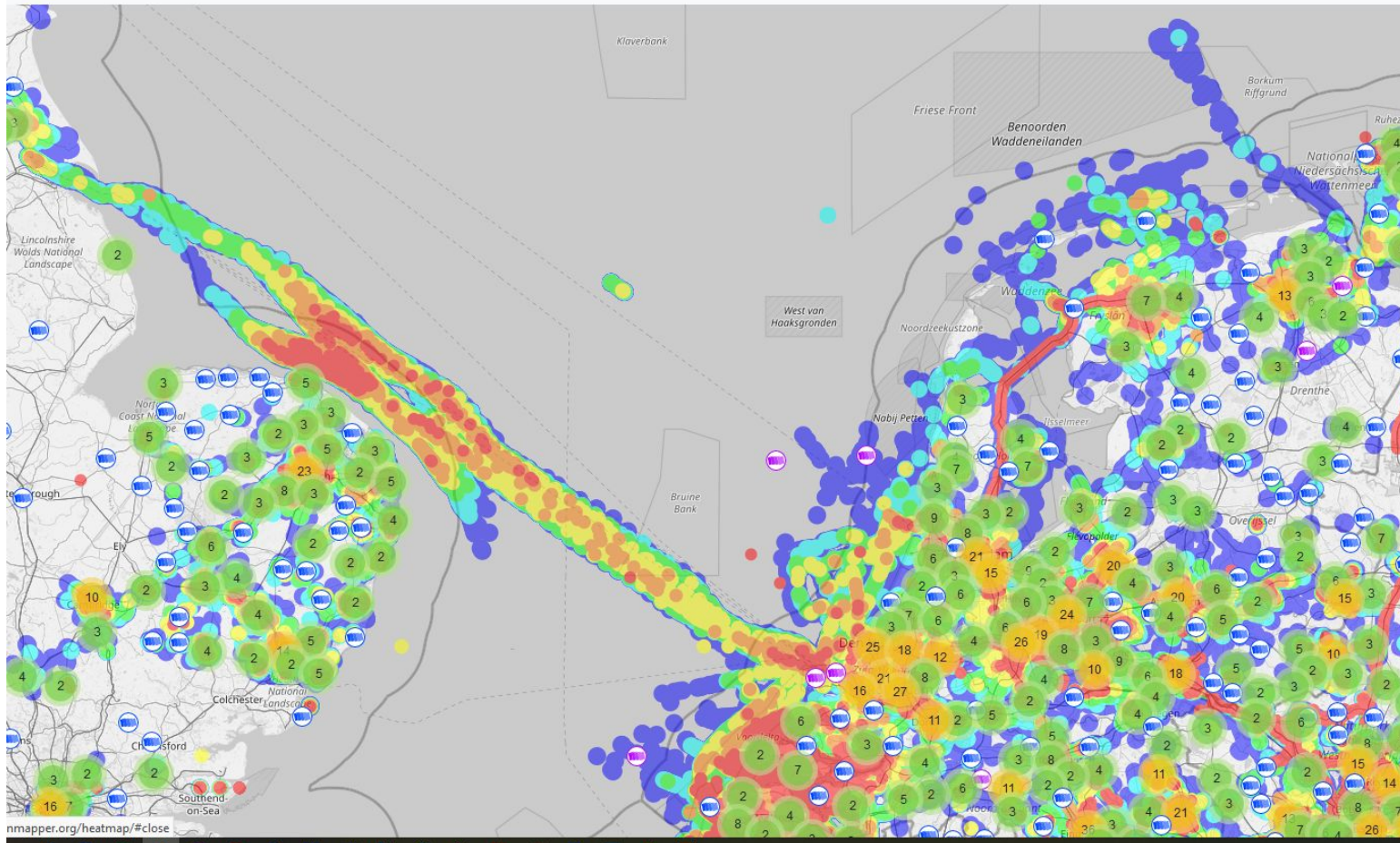
Outline:

- IoT connectivity, ie LoraWAN, VDES
- broadband technologies, i.e. satcom (GEO, MEO, LEO), 4&5G terrestrial →link to next TNO presentation by Relja = how to combine these?
- connectivity requirements for legal duties, i.e. Coastguard, vessel and airplane traffic management, ecological monitoring in different areas of the NCP
- (growing) economic activities on the North Sea like energy and food production, declining(?) oil&gas
- combining the energy and digital infrastructure at sea,
- security, sovereignty, integration with land based infrastructure
- community fieldlab approach: setup of CFNS
- current studies and pilots (highlights):
 - Maritime 5G Open RAN
 - 4/5G coverage territorial waters
 - LTE450 pilot
 - BVLOS drone flight to open sea
 - and more...
- Q&A



LoRaWAN on the North Sea

TTN Mapper Heatmap Beams Advanced maps Acknowledgements Helium Docs



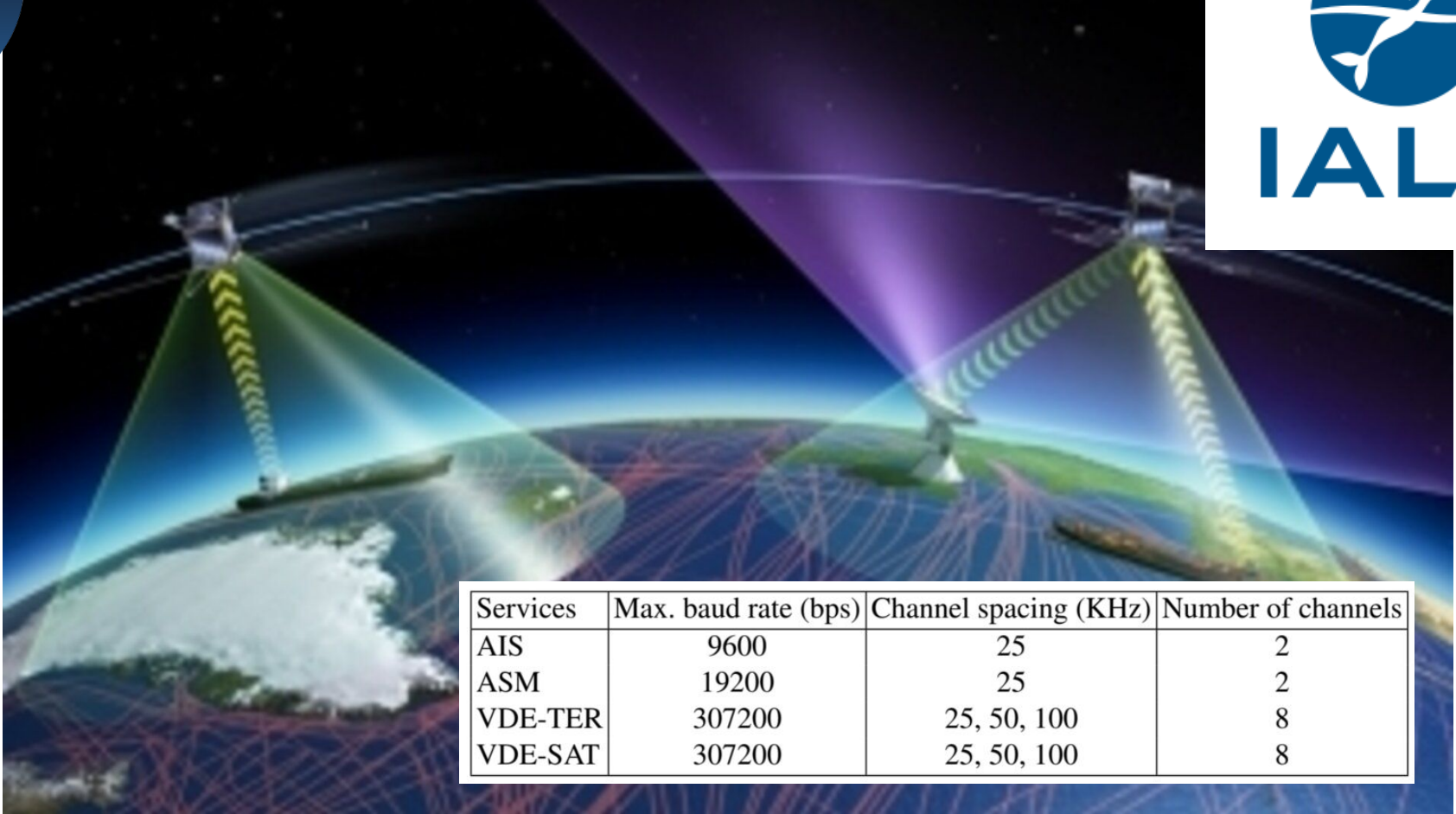


LoRaWAN on the North Sea





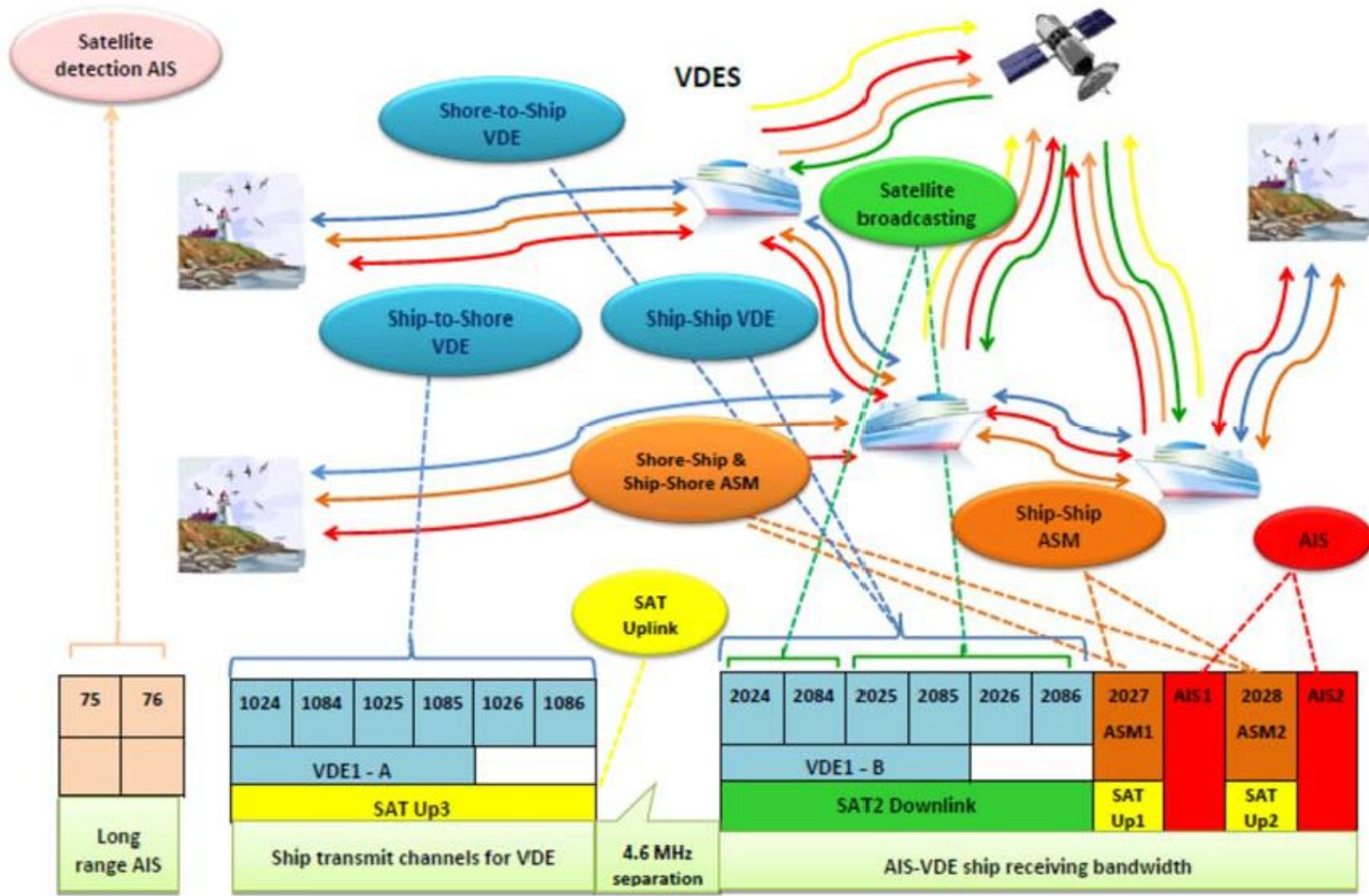
VHF Data Exchange – VDES



| Services | Max. baud rate (bps) | Channel spacing (KHz) | Number of channels |
|----------|----------------------|-----------------------|--------------------|
| AIS | 9600 | 25 | 2 |
| ASM | 19200 | 25 | 2 |
| VDE-TER | 307200 | 25, 50, 100 | 8 |
| VDE-SAT | 307200 | 25, 50, 100 | 8 |



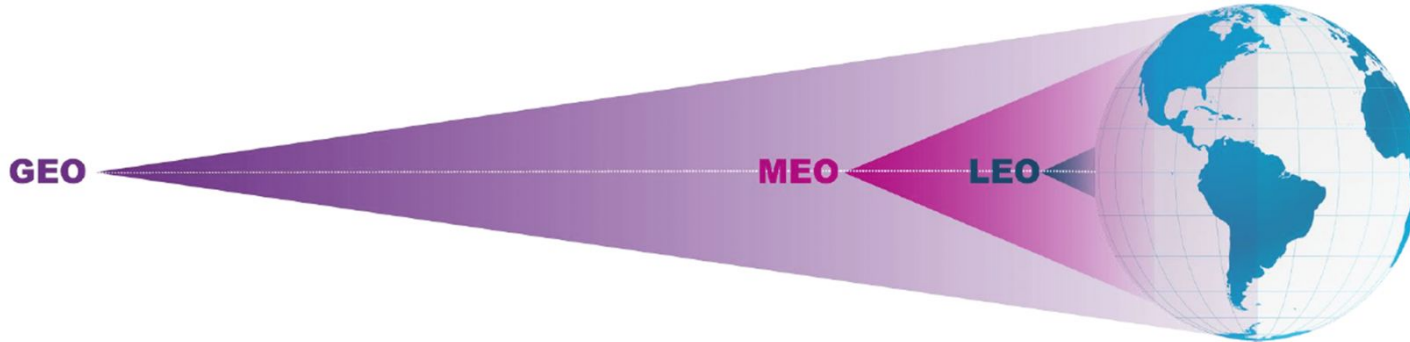
VHF Data Exchange – VDES





Broadband Satcom on the North Sea

GEO, MEO and LEO Satellites

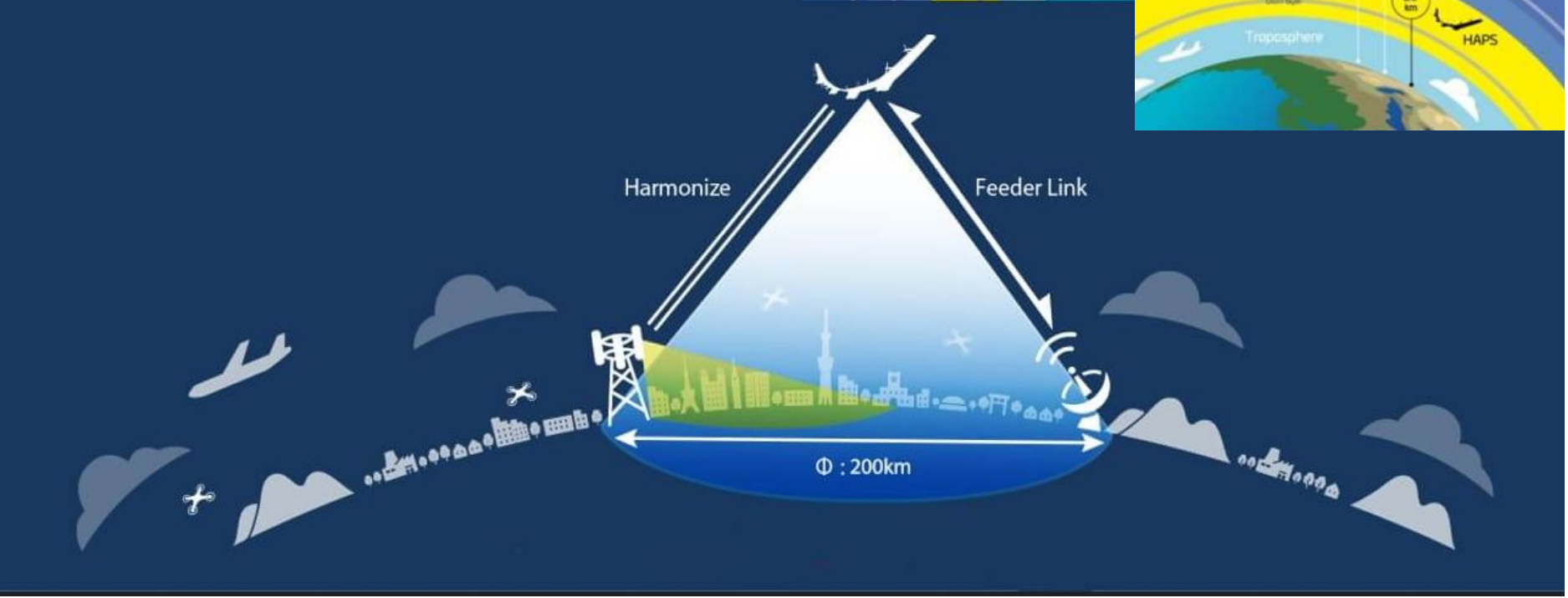
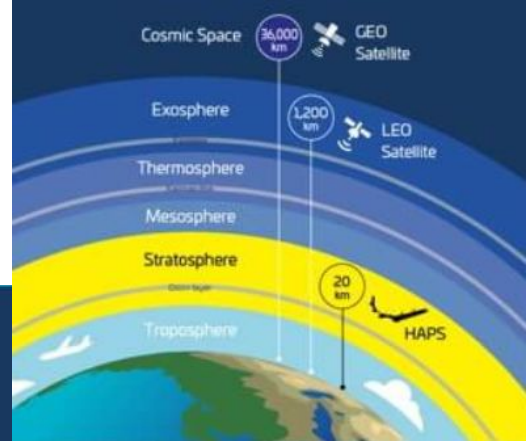


| | GEO (~36,000 km) | MEO (~8,000 km) | LEO (~1,000 km) |
|--|-------------------------------|-------------------------------|--|
| Latency | Medium (~700 m/s) | Low (~150 m/s) | Very low (~50 m/s) |
| Network size for global services | 3 satellites (99% coverage) | 6 satellites (96% coverage) | Thousands of satellites (100% coverage) |
| Data gateways required | Few, fixed | Several, flexible | Numerous, local |
| Technology readiness level | Proven, deployable technology | Proven, deployable technology | Technology still in development for satellite internet |
| Cost to deploy network | \$1 - 1½bn | Approx. \$1½bn | \$5 - 15bn |
| Satellite design life (replacement cycle) | 15 years | 12 years | 5 - 7 years |

www.dgtlinfra.com



HAPS (also) on the North Sea?

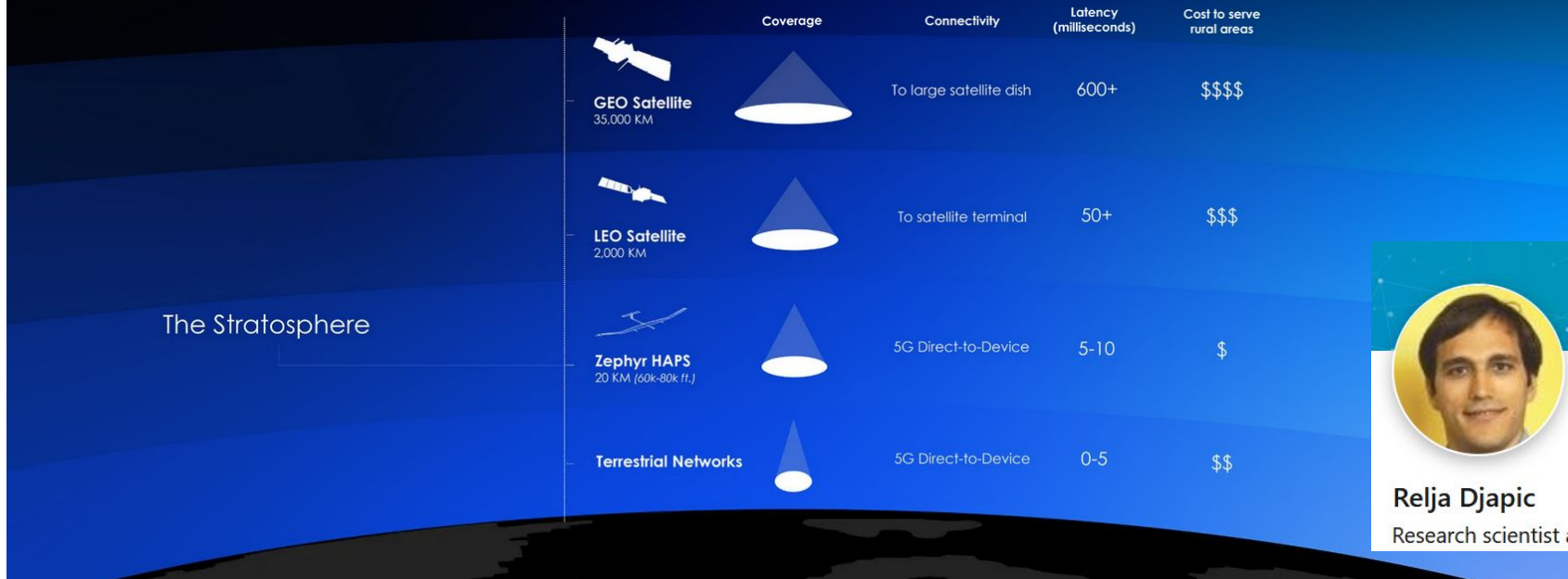




HAPS (5G D2D) on the North Sea?

ENABLING A NEW FRONTIER FOR MOBILE
CONNECTIVITY

DIRECT-TO-DEVICE, LOW LATENCY, 5G NON-TERRESTRIAL
MOBILE CONNECTIVITY

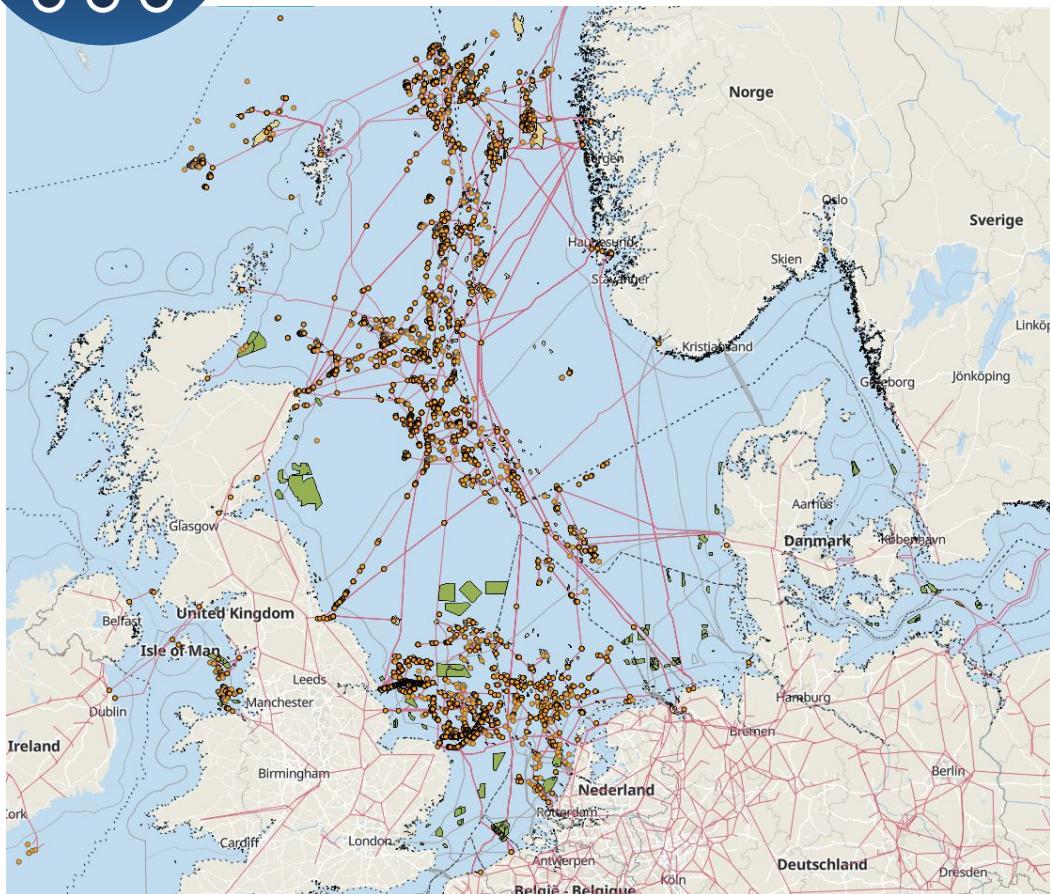


Relja Djapic
Research scientist at TNO-ICT

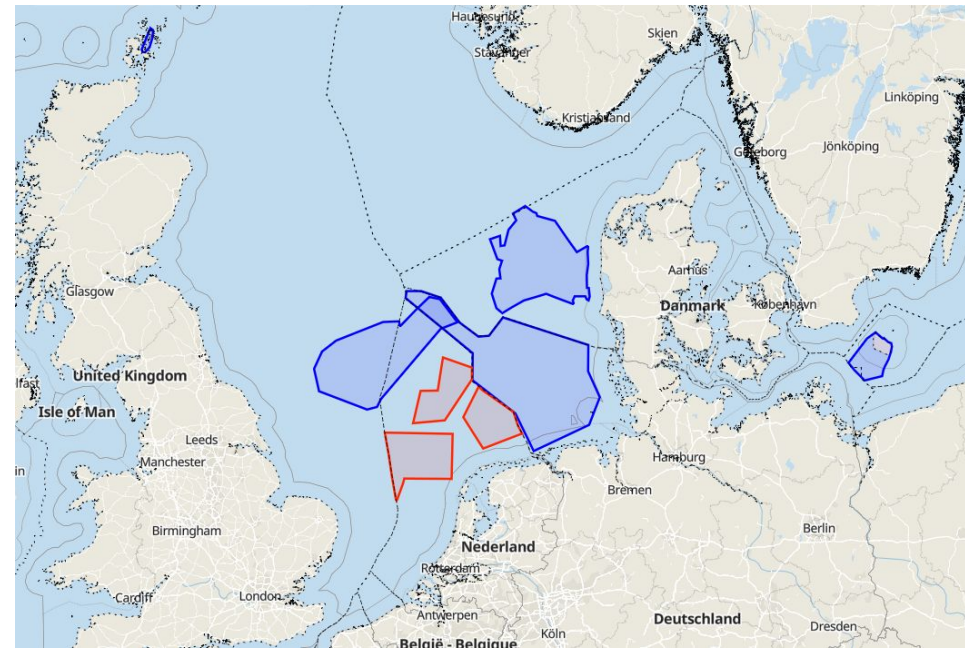


Energy on the North Sea

Currently installed energy production and transport infrastructure at the North Sea



Envisioned energy hubs are the building blocks and nuclei of offshore system integration in the NSE program. Energy hubs are envisioned as multi-carrier offshore energy systems consisting of energy production, conversion and/or storage that are connected to the shore via national (transport) corridors or interconnected internationally.

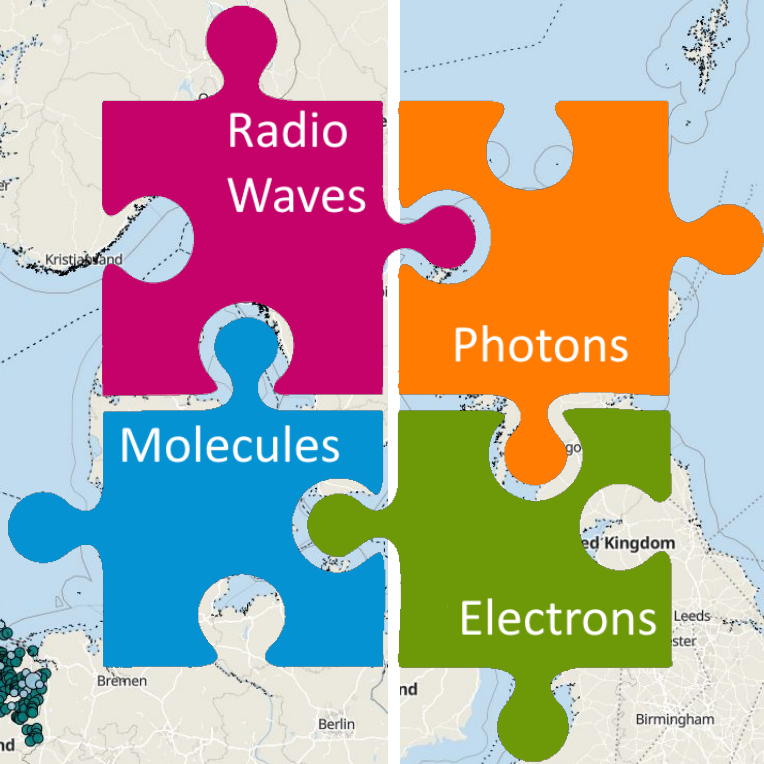
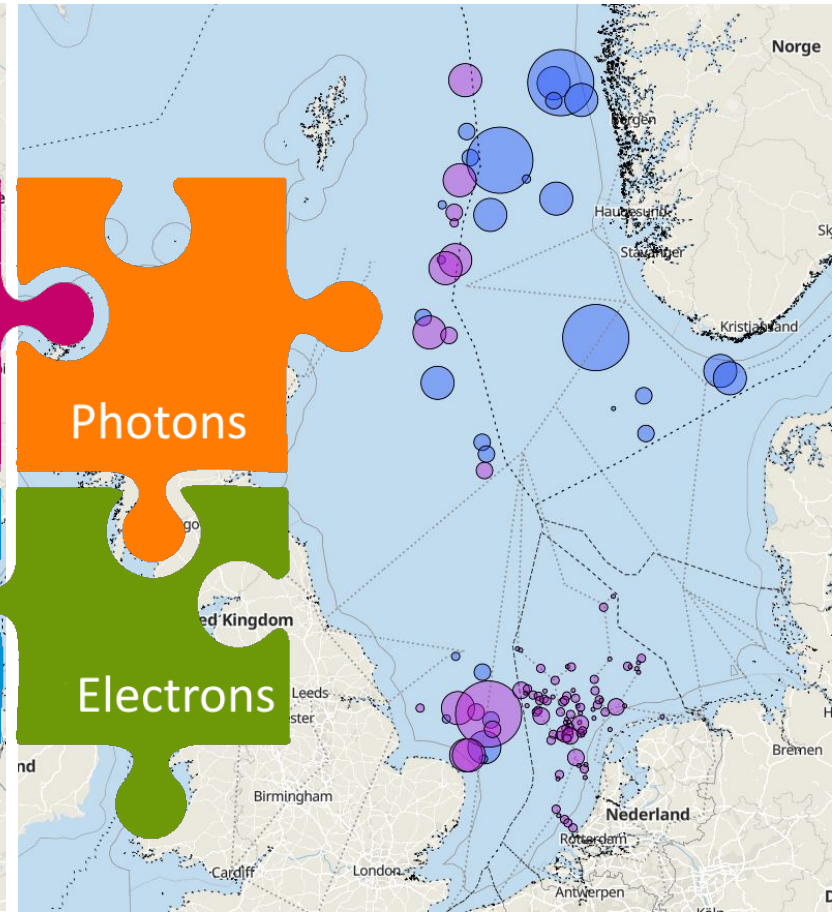
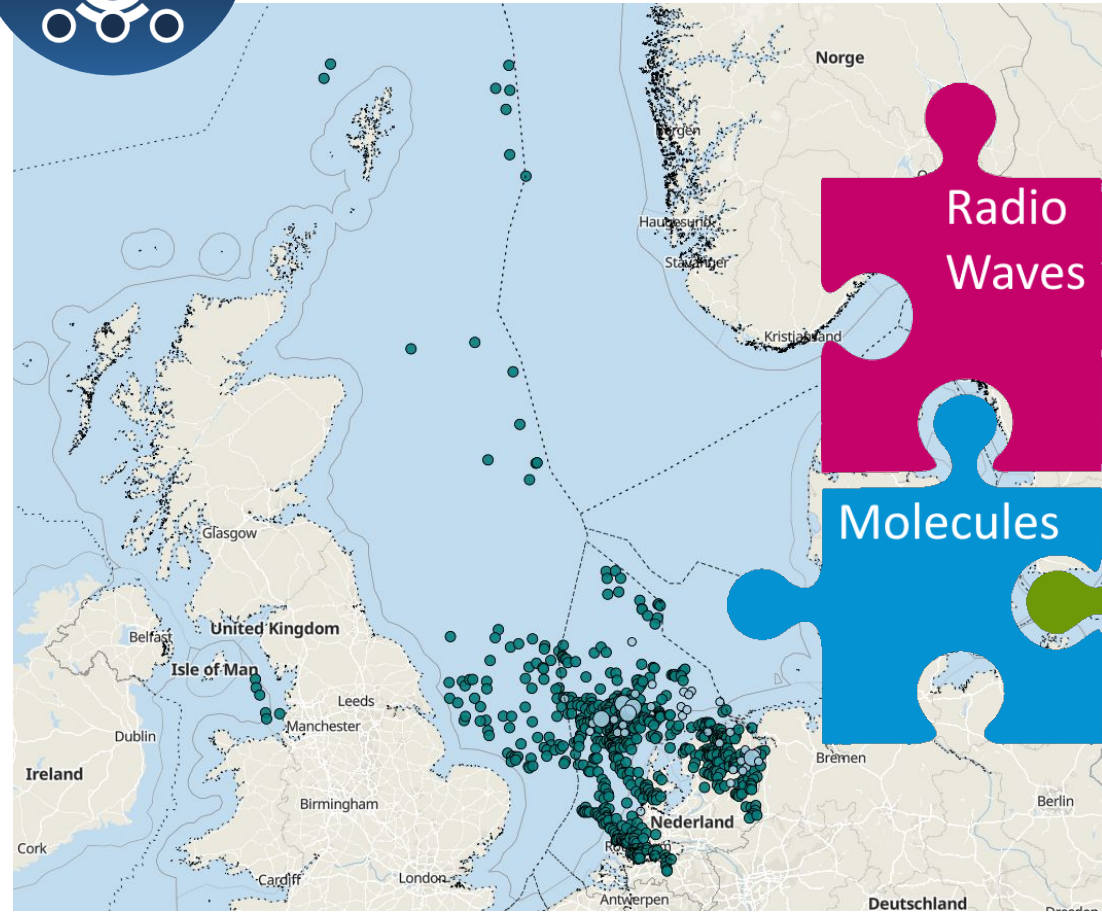




Energy on the North Sea

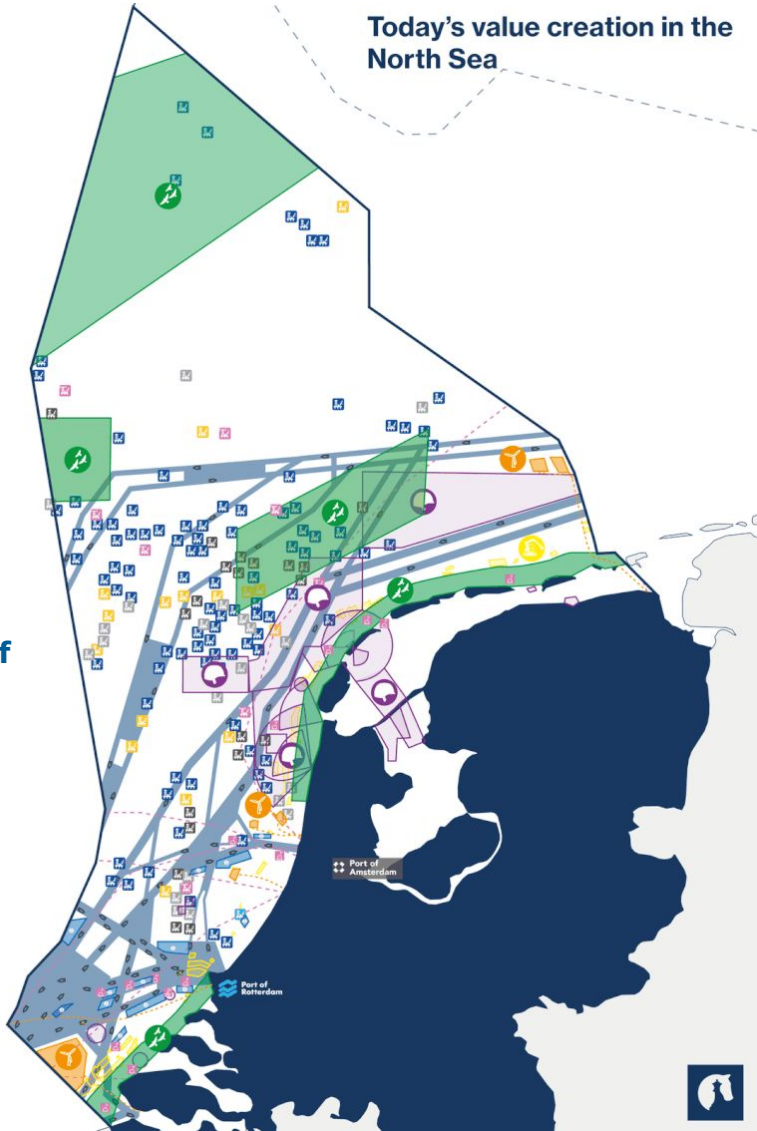
Potential H2 storage capacity North Sea

Potential carbon capture North Sea





Today's value creation in the North Sea



Future value creation in the North Sea: 2050



Source:

The High Value of
The North Sea
(HCSS report,
November 2021)



Stratix Position Paper – Frequency Policy and the Dutch Continental Shelf, December 2021 | *Some highlights:*

(page 17:)

There is an increasing demand for connectivity on the Dutch Continental Shelf, and there is an urgent need for a frequency policy tailored to the special characteristics of this 57,800 km² area.

A first priority now should be to better organize the current, suboptimal situation, so that the end users can operate in a normal way for this type of market, without being forced by frequency policy into a situation of forced shopping with often unwilling parties.

This leads logically to the conclusion that the Ministry of Economic Affairs should set up an integral review "North Sea Frequency Policy", in cooperation with the Directorate-General for Public Works and Water Management, which already has already has coordinating responsibilities in various areas. This policy will be very different from the Frequency Policy on the Dutch mainland, one of the most densely populated parts of the world.

(page 18:)

Access to frequencies is like oxygen for North Sea parties to enable innovations such as Smart Shipping, self-propelled boats, and dealing with increased congestion and complexity.

An obvious solution is a North Sea Frequency Policy Working Group to be formed, with a strong focus on the user side.

(page 19:)

Once again, the Netherlands has an opportunity to lead the way in innovative solutions in the mobile communications. To make this possible, however, concrete steps are needed in the short term.



Strict Research Paper: (5G) Broadband Connectivity around North Sea Wind Farms | November 2023 | *Some highlights:*

(page 41:)

The southern part of the Dutch EEZ can, with the parks being constructed through 2030, already can be largely

[http://cfns.nl/gallery/Breedband Connectiviteit Rond Windmolenparken op de Noordzee.pdf](http://cfns.nl/gallery/Breedband%20Connectiviteit%20Rond%20Windmolenparken%20op%20de%20Noordzee.pdf) provided with mobile broadband connectivity.

RWS MIVSP is already performing a number of management tasks together with TenneT and on behalf of the Ministry of Economic Affairs, in the realization of communication services in the wind farms for various government organizations. There is a potential role for RWS MIVSP in realizing the expansion of mobile broadband connectivity in and around wind farms in the North Sea.

The coverage of Tampnet does depend on the oil and gas platforms (also the main customers) and is therefore vulnerable to the deployed decommissioning over the next 2 decades. The arrival of new wind farms in the North Sea (also after 2030) can provide new antenna sites which may limit the decommissioning impact.

(page 43:)

The development of neutral host services of radio networks (shared RAN) provides the opportunity for multiple MNOs to use use the same active network equipment. This makes it possible to share investments and to offer users choice of connectivity services from multiple service providers.

Here again RWS's CFNS can play a role in developing the optimal operating model for the maritime environment.





| Theme | Innovation Idea / Project Portfolio 2022-23 | Priority | Status |
|--------------------------------|---|----------|--------|
| A. Multiconnectivity | A1 hybrid router / smart modem development / demo | | |
| | A2 LEO satellite datacommunication pilot | | |
| | A3 LTE450 pilot | | |
| | A4 Positioning, Navigation & Timing (PNT) | | |
| B. Maritime Edge | B1 shared Maritime Open RAN | | |
| | B2 optimal multipurpose grid | | |
| | B3 maritime edge cloud platform | | |
| | B4 fixed-mobile network integration | | |
| | (a) RWS fiber network & LAN | | |
| | (b) National Police Operational Network (LON) | | |
| | (c) other (critical) national infra networks | | |
| | (d) 4/5G coverage 12 NM-zone (territorial waters) | | |
| | (e) NL Cable Landing Site pilot (EuroHub) | | |
| | B5 Dynamic Spectrum Management & Sharing (DSMS) | | |
| C. Internationalization | C1 TIP C-Lab investigation | | |

| Status | Description |
|--------|---|
| | ideation and stakeholder search |
| | concrete objectives and approach |
| | dialogue with partners and other stakeholders |
| | in view of pick-up, funding & ownership / ongoing |

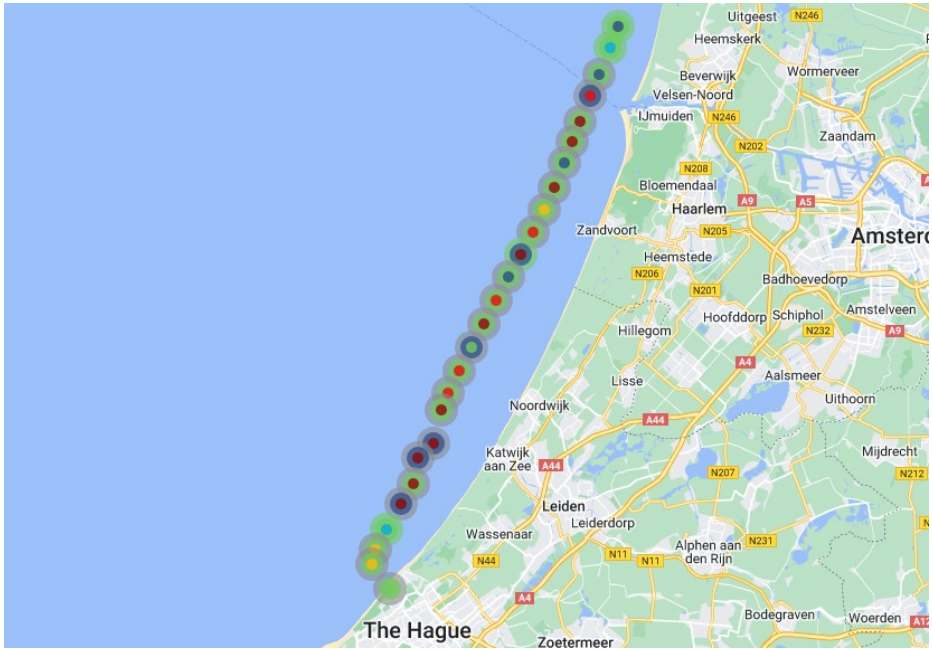


Innovation Portfolio 2024

| Theme | Innovation Idea / Project Portfolio 2023-24 | Priority | Status | Remarks |
|---|--|----------|--------|-------------------------------|
| A. Multiconnectivity | A1 hybrid router / smart modem development / satcom | | | 5G – satcom integration B4d |
| | A2 LEO satellite datacommunication pilot | | | 5G – satcom integration B4d |
| | A3 LTE450 pilot (Utility Connect, RIVM) | | | public-public cooperation |
| | A4 Positioning, Navigation & Timing (PNT) | | | |
| B. Maritime Edge | B1 shared Maritime Open RAN | | | |
| | B2 optimal multipurpose maritime network grid | | | |
| | B3 maritime edge cloud platform | | | also see B1 |
| | B4 fixed-mobile network integration | | | |
| | (a) RWS fiber network & LAN | | | National LTE450 MCN Land+Sea? |
| | (b) National Police Operational Network (LON – Umbrella) | | | |
| | (c) other (critical) national infra networks (GrIT, Utilities) | | | National LTE450 MCN Land+Sea? |
| | (d) 4/5G coverage 12 NM-zone (territorial waters) | | | prepared for A1, A2 |
| | (e) Dutch Sea Cable Coalition (ACLS-NL / EuroHub) | | | |
| B5 Dynamic Spectrum Management & Sharing (DSMS) | | | | |
| C. Ecosystem | C1 TIP C-Lab investigation / internationalisation | | | |
| | C2 DEI operationalisation PPP | | | including other cooperations |



4/5G mobile coverage 12NM-zone



Vodafone

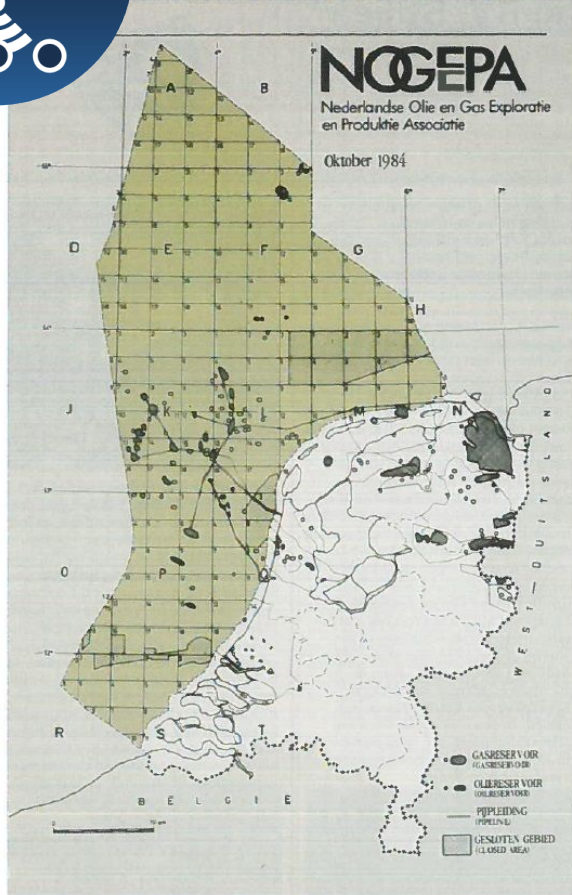


Tampnet



Regulatory, Dashbord, etc. Grid of the Dutch North Sea (NCP)

(NGF) IDON Digital North Sea Initiative



what's up & coming in 1984

| Survey RWS 2021 |
|------------------------------|
| 1 Wide Inland Waters |
| 2 Territorial Waters |
| 3 Offshore Installations |
| 4 Traffic separation systems |
| 5 Port Approach Areas |
| 6 Anchorages |
| 7 Natura 2000 |
| 8 Other - up to 40 NM |
| 9 Other – beyond 40 NM |

Mainly based on jurisdiction

Schets 2030



2030 & beyond



(Long-range) Low Band Spectrum for Mission Critical Networks (MCNs)



Utilities (smart grids)

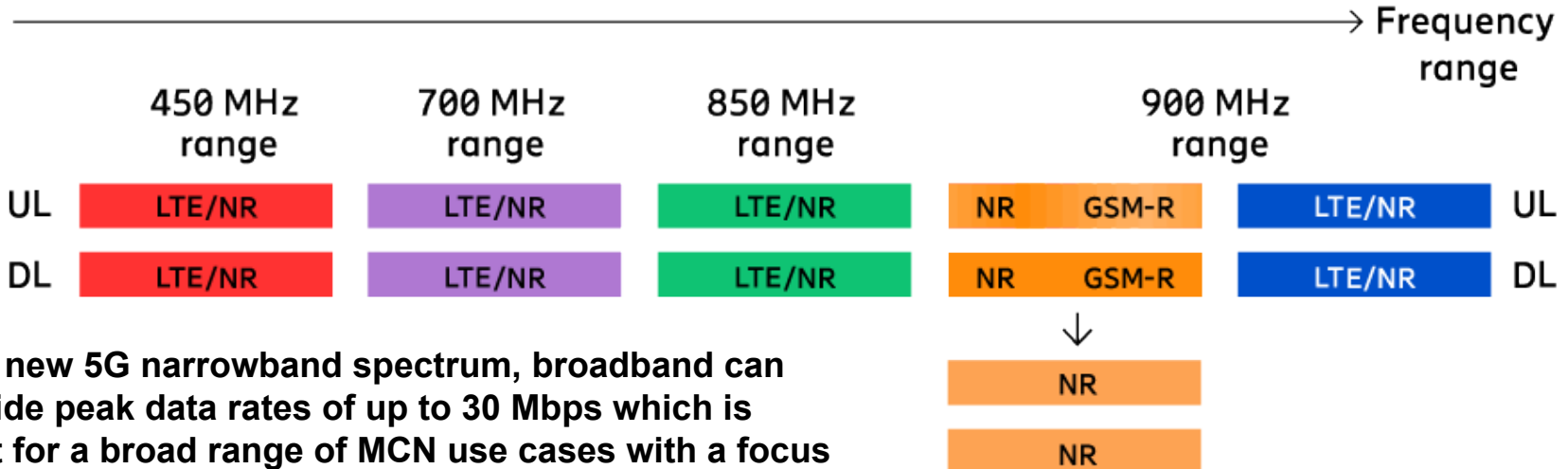
- 2x5 or 2x3 MHz FDD at 450 /850/900 MHz range (bands 31, 72, 106 and part of band 26)
- LTE upgradable to NR

Public safety and Defense

- 2x5 or 2x3 MHz FDD at 450/700 MHz range (bands 31, 72 and part of band 28)
- LTE upgradable to NR

European Rail (FRMCS)

- 2x5.6 MHz FDD at 900 MHz range (band n100)
- NR and GSM-R coex. with less than 5 MHz NR



‘With the new 5G narrowband spectrum, broadband can still provide peak data rates of up to 30 Mbps which is sufficient for a broad range of MCN use cases with a focus on geographical coverage.’ (Ericsson, February 2024)



Ecosystem Journey by



Inspire

Sept. 5th 2023

Roundtable Workshop
values, mission, stakeholders, etc.

Ideate

Nov. 2th 2023

Ideation
partner roles & workgroup formation

Experiment

Nov. 15th 2023

Start-up Fieldlab + showcase initiation:
drone BVLOS RDM
Next to open sea

Phase 1

Phase 2

Phase 3

Minor-Classes
learn how

Workgroup Sessions
co-creation of deliverables

Summit: here we are!
presentation deliverables + follow up

go / no-go

MWC 24 Barca

18/3 2024

go / no-go

Nov. 23rd 2023

innovation program
iBestuur

Fieldlab operational & expanded as Digital Ecosystem



To be discussed March 18, 2024



CFNS Ecosystem Journey – Phase 2 *Exemplary Themes:*



- Unmanned sailing and flying at sea – the Ultimate Use Case?
- Data Sharing / Spaces – (Live) Digital Twin North Sea
- Security (both: maritime, cyber)
- Frequency Plan for the North Sea (also international)
(or are we too late: 450 MHz, 700 MHz, 3,5 GHz....??)
- Regulatory Bottlenecks & Challenges (i.e. backhaul by TenneT)
- Spatial Planning of the Digital Infrastructure in the North Sea
- Governance and other Operationalization of the Fieldlab

Interested?

Mail to: cfns@rws.nl or mark@ecosystemservices.nl

Do you need some extra inspiration ?

www.digitalnorthsea.nl

The sea must digitize quickly, but it is complex (2023)



Rijkswaterstaat
Ministry of Infrastructure and Water Management

Connectivity Fieldlab North Sea

DIGITAL NORTH SEA

We call this initiative The Digital North Sea.

video

More inspiration in Dutch?

- [Deltaplan Duurzame Digitale Noordzee \(2020\)](#)
- [Infographics Digitale Connectiviteit op de Noordzee \(2020\)](#)
- [Scheepvaartveiligheid en windparken op zee](#)
- [Programma Noordzee 2022-2027](#)



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Ministry of Infrastructure and Water Management of the Netherlands

