

› SUBSEA WI-FI

What's in a name | Henry.Dol@tno.nl

TNO innovation
for life



INTRODUCTION

TNO

- › Netherlands Organization for Applied Research
- › Not-for-profit
- › Around 2900 employees
- › Active in a variety of domains (see www.tno.nl)
- › Funding: 1/3 funding government, 2/3 market

Dr. ir. H.S. Dol (Henry)

- › Senior Scientist in Acoustics & Sonar group (The Hague, Oude Waalsdorperweg 63)
- › Specialized in underwater acoustic communication
- › Main customer is the Royal Netherlands Navy
- › Underwater acoustic communication is *dual-use / general-purpose enabling technology*



WI-FI UNDERWATER?

- › IEEE 802.11: Wireless Ethernet or Wi-Fi
 - › Radio waves (electromagnetic)
 - › 2.4 GHz and/or 5 GHz (20-160 MHz bandwidth)
 - › Data rates between 1 Mbit/s and 1 Gbit/s
- › Skin depth in sea water is less than 1 centimetre!
- › I.e., no practical use underwater, so why use the name?
- › Good question!
- › We need to go back a bit in history...



IN THE NEWS ON 3 MAY 2013...

Nederland brengt wifi onder water

door Roy Klopper

DEN HAAG, vrijdag

Ons land vervult een voortrekkersrol in de wereld bij de ontwikkeling van 'onderwaterinternet'. Defensie en TNO werken in internationaal verband aan een systeem van 'vloeibare wifi' om ook beneden de zeespiegel draadloos te kunnen communiceren.

De Telegraaf

IN THE NEWS ON 3 MAY 2013...



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Defensie kan onder water internetten

Door een onzer redacteurs
AMSTERDAM. TNO en Defensie hebben een manier gevonden om een 'draadloos onderwatersnetwerk' op te zetten. Op zich is draadloze onderwatercommunicatie niet nieuw, maar tot nu toe was alleen een 'enkelvoudige verbinding' – van A naar B – mogelijk. Nu kunnen meerdere schepen of onderwaterrobots onderling communiceren in een draadloos netwerk. De maximale afstand tussen twee punten is vijf tot tien kilometer.



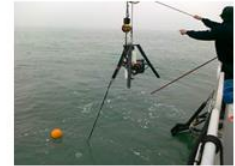
Meest gelezen

1. Defensie werkt aan 'onderwaterinternet'
2. Microsoft beëindigt migratie Hotmail naar Outlook.com
3. Gmail kan data direct als afspraak in Google Calendar zetten
4. Google erkent Palestina
5. .xxx-pornodomeinen na rechtszaak tijdelijk goedkoper




SO WHAT ACTUALLY HAPPENED?

- › Testing of an underwater *acoustic* network on the North Sea (offshore Callantsoog) by an international defence R&D consortium (EDA-RACUN, 2010-2014)
 - › Acoustic carrier wave (4-8 kHz), not electromagnetic
 - › Acoustic ranges up to 5 nautical mile
 - › Data rates around 100 bit/s
 - › “Internet-of-Things”

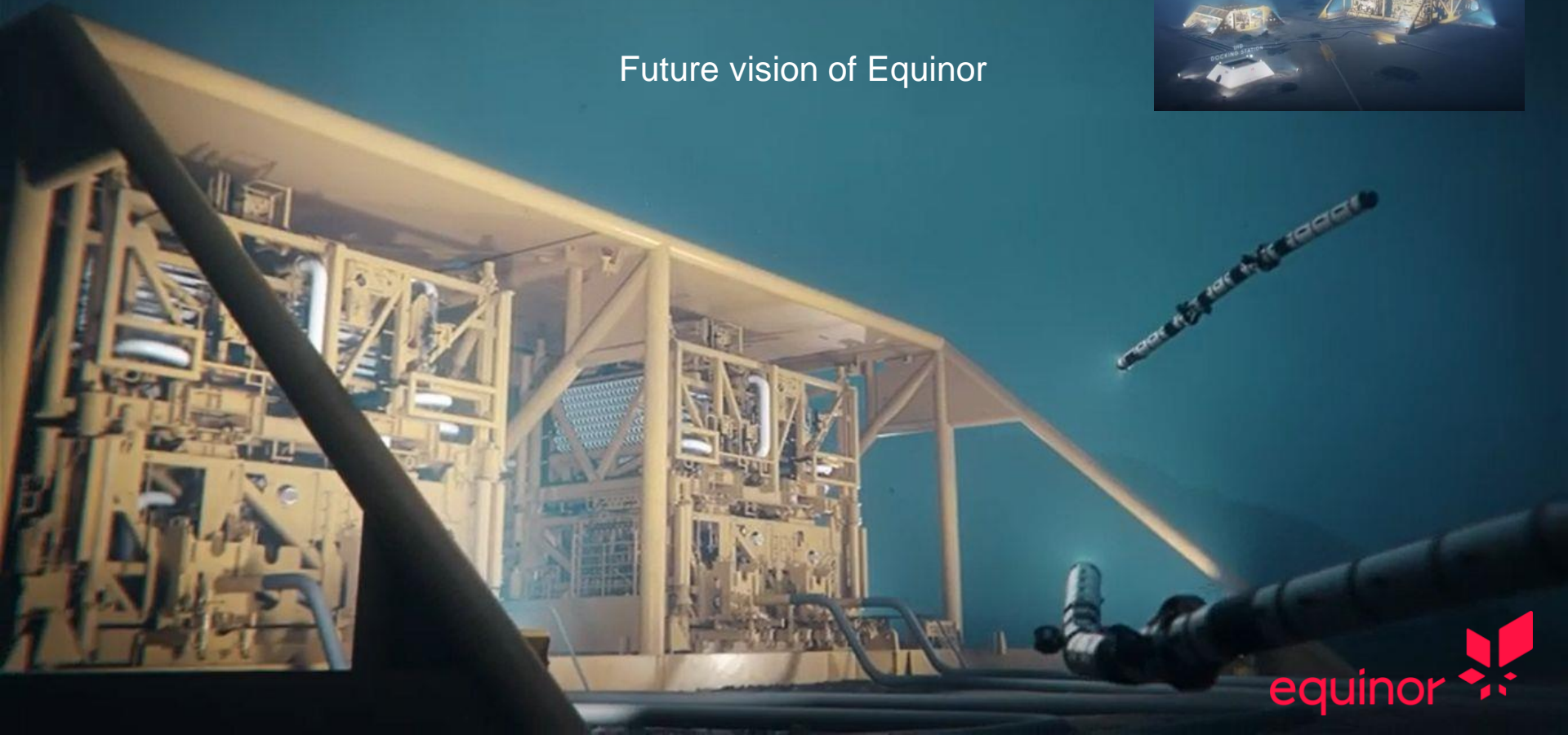


UNDERWATER / SUBSEA WI-FI

- › So why still call it “Underwater Wi-Fi” or “Subsea Wi-Fi”?
- › Because TNO business developers like it 
- › Or is there more?
- › Yes, it is the cellular character of Wi-Fi (or 4G) that matters
- › Think of a long-range LF acoustic, or even wired Ethernet, backbone network with LF-HF gateways
- › Think of robots only communicating short-range with the nearest HF access point (peer-to-peer)
- › Future?

ASGARD OIL & GAS FIELD

Future vision of Equinor



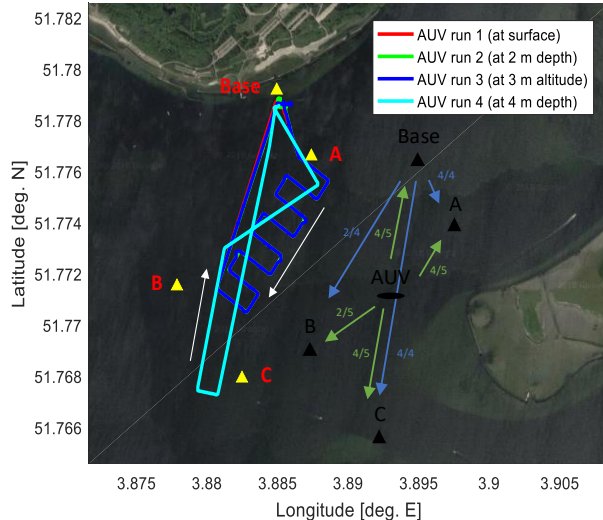
GREVELINGEN TEST AREA

Reality of TNO (2017)



RELATED TNO R&D IN 2015-2019

- › Dual-band cellular network
- › Larger bandwidths (up to 30 kHz)
- › Video “streaming” (snapshots)
- › QoS diversity
- › Smart adaptive links
- › Underwater autonomy



OUTLOOK FOR 2020

- › Standardization of underwater acoustic communication protocol for offshore industry
- › International Subsea Wireless Group (subseawirelessgroup.com) SWiG)))



An underwater scene featuring a red buoy with a green light at the top, set against a dark, murky background. The buoy is positioned vertically in the center of the frame. The text 'THANK YOU FOR YOUR ATTENTION' is overlaid on the left side of the image, with a small white arrow pointing to the right. Below the text, there is a white horizontal line that spans the width of the image, with a small white arrow pointing to the right at its end. The TNO logo and tagline are located on the right side of the image, below the white line.

› THANK YOU FOR YOUR ATTENTION

Take a look:
TNO.NL/TNO-INSIGHTS

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