

# CloudNet Journey to 5G

## Maritime Ops

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CloudNet IT solutions

[www.cloudnet.scot](http://www.cloudnet.scot)



# CloudNet Roadmap

## Wireless Internet Service Provider

- Fixed Wireless Access
  - Business/Residential Properties
  - Ship to Shore Comms
  - Aquaculture – Salmon Farming Comms and Sensing
  - IoT Gateways and Sensing
- Fibre infrastructure providers
- Innovation Testbed and Trials
  - TV Whitespace – Internet Connectivity to Passenger Ferries
  - 5G Testbed and Trial
    - 5GRuralFirst [www.5gruralfirst.org](http://www.5gruralfirst.org)
    - 5GNewThinking [www.5gnewthinking.co.uk](http://www.5gnewthinking.co.uk)
- ***Private Shared Spectrum 5G Standalone (SA) Networks with LEO Connectivity –at Sea***

So?

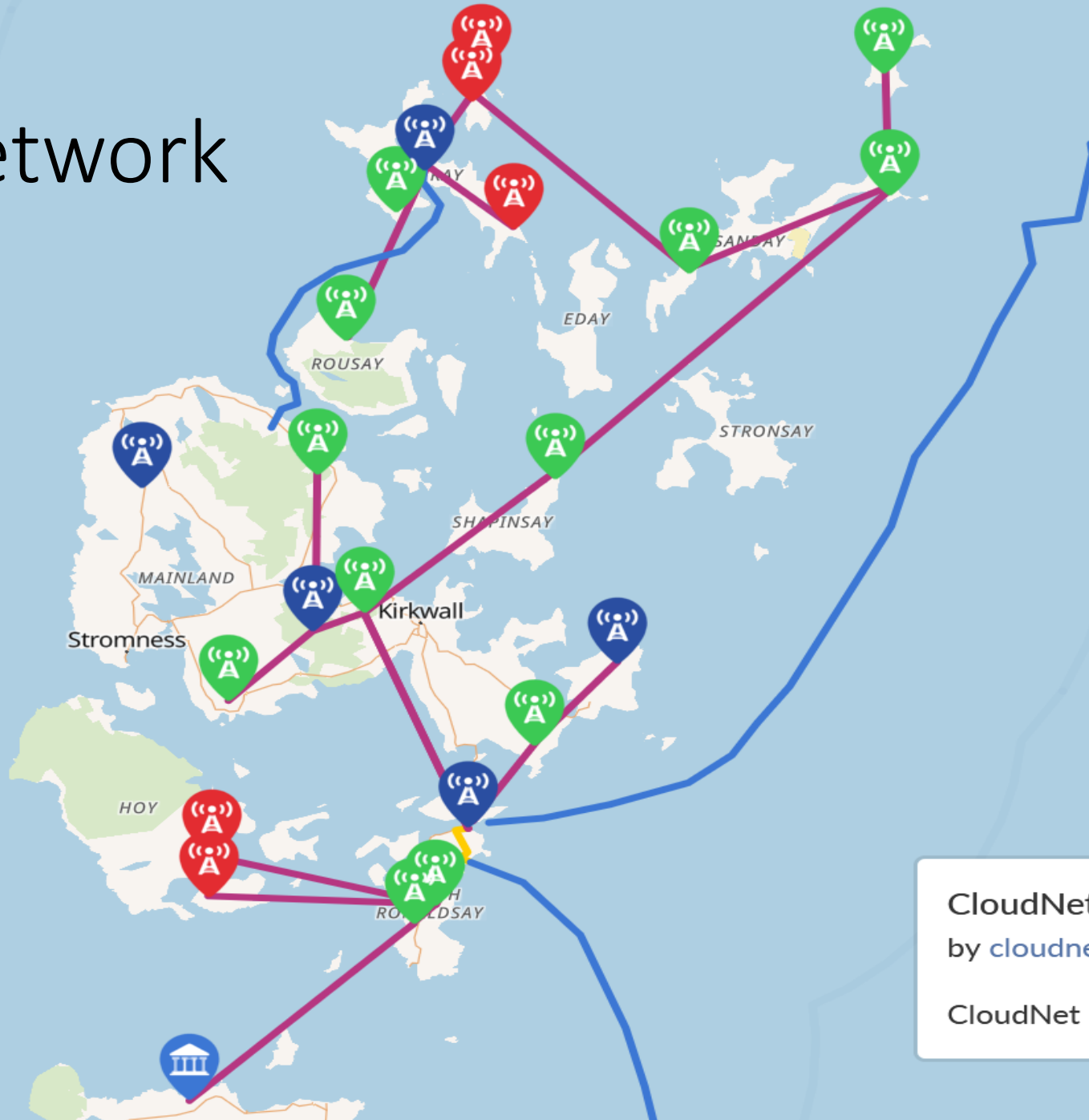
Where is Orkney?



Data SIO, NOAA, U.S. Navy, NGA, GEBCO  
Image IBCAO  
Image Landsat / Copernicus

Google Earth

# Core Network



CloudNet Core Network ×  
by cloudnet  
CloudNet Core Network

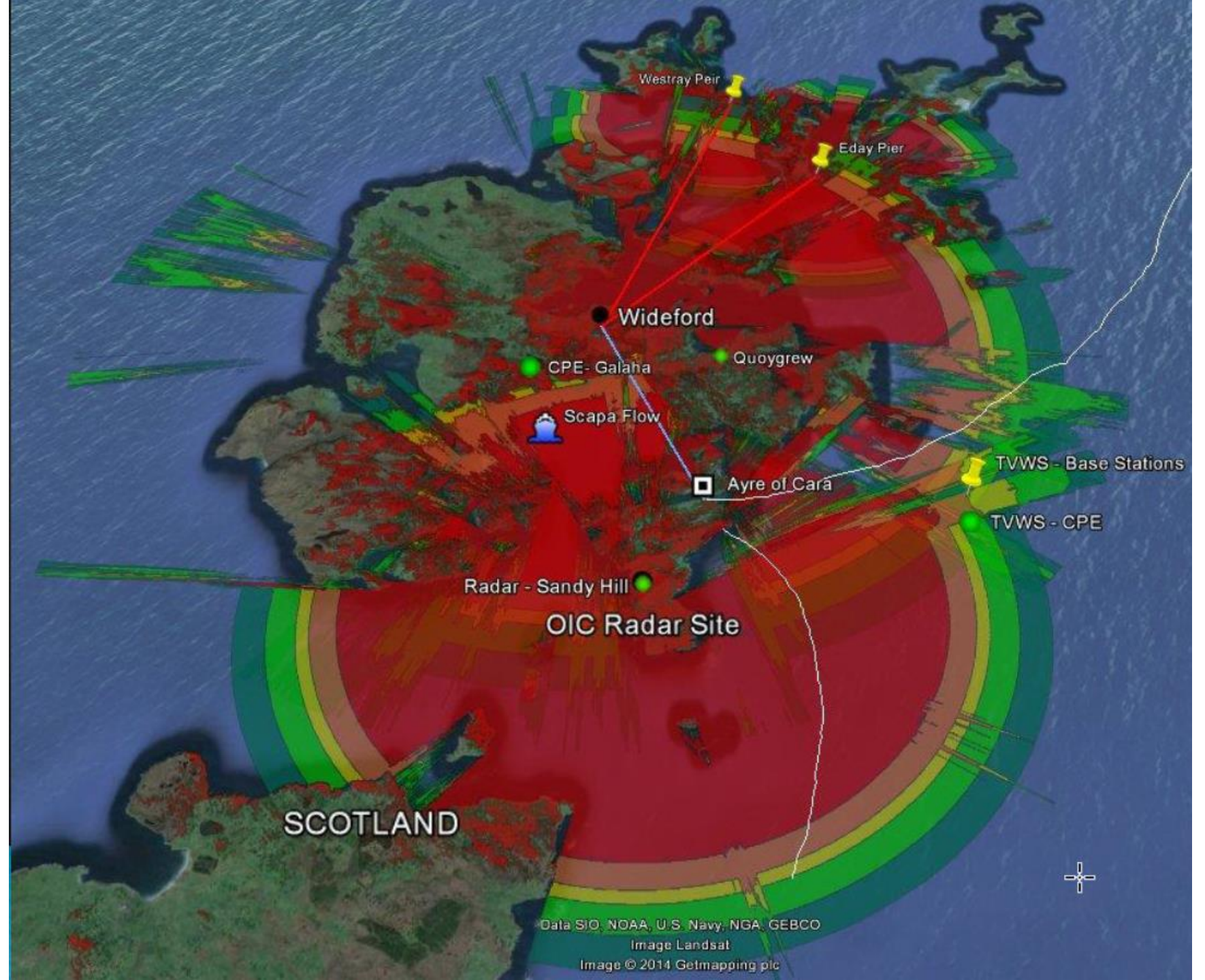
# Lets Talk TV White Space - Why?

- Early on - Originally No Mobile connectivity and very little data
  - lucky if we could hold a telephone conversation
  - Lucky in some areas to access 4G services at ALL! Even now!
- Built Wireless networks since 2000, we know wireless and what could deliver.. Then.....
- OFCOM Launched TVWS applications for trials.
  - TVWS being the left over spectrum from the Analogue to digital changeover.
  - Why? Travel to isles long & routes vary from 1.5 – 3hrs. Not alot to do.
  - No internet/mobile coverage.
  - Marine/Water solutions never considered
    - Ideal from comms perspective
      - due to ships movement, alignment, distance, terrain.
- Throughput at time 57mbps - EXCELLENT @ the time.

# Network Deployment

- Complex infrastructure needs.
- No Backhaul at piers so we had to build out
  - Base Station 4 – Microwave backhauls
  - Tower site – 220m above sea level
  - Marine Services Radar Station (90m)
  - Piers x 2 – Sea level.
- CPE's - 3 Vessels – 3 Properties
- Properties whilst trialists were there baseline performance and services.

# Network Coverage





# Vessels



Type: Ro-Ro Vehicle and Passenger Ferry  
Built: 1989 @ McTay Ltd., England  
Gross Tonnage: 771  
Main Engines: 2 x Mirrlees @ 743kW each  
Speed: 12 knots  
Length: 45.0m  
Beam: 11m  
Draft: 3.155m

# Innovation – Unmanned Warrior/Automomous Vehicles

- Complex infrastructure needs.
- No Backhaul at piers so we had to build out
- Orkney network became the testbed for sea trials for unmanned warrior
- To develop autonomous communications network for Royal Navy trials – West of Scotland & Solent.
  
- Orkney Network - Littoral region because of Island Structures and challenges to learn and develop
- Where better to test and build before deployment elsewhere.

# Press Releases

- **Unmanned Warrior**

- <https://www.baesystems.com/en/article/bae-systems-at-the-heart-of-unmanned-warrior>

- Video <https://youtu.be/3dMHoLYRYmY>

- **Autonomous naval technologies in the solent**

- <https://www.baesystems.com/en/article/we-demonstrate-our-autonomous-naval-technologies-in-the-solent>

# Look, no hands! Autonomous capability trial makes waves

Dress rehearsal for Royal Navy's Unmanned Warrior 16 exercise demonstrates how our innovative technologies mean that threats at sea can be evaluated without endangering lives

A major security alert in the Solent. A highly manoeuvrable rigid-hulled inflatable boat (RHIB) is deployed to check out the situation. Reconnaissance complete, and fears allayed, the RHIB is returned to the shore, with no human beings put in harm's way.

This state-of-the-art boat, complete with unmanned aerial vehicles featuring 360-degree cameras, had no one at the helm. Instead it was operated by remote control, a safe distance away.

Sounds like fiction? No, this realistic scenario was actually trialled in Portsmouth's Langstone Harbour, thanks to leading-edge technology that we've developed in partnership with a number of companies, including Fareham-based ASV.

Called Unmanned Capability, this event showcased the impressive unmanned systems technologies that we offer to naval operations, and demonstrated the planning, tasking, control and monitoring of these systems.



At the heart of the demonstration was our Combat Management System, acting as the information hub for each of the unmanned vehicles and creating a single overall picture to support the command team's decision making. The system, which is in operation across the entire Royal Navy surface fleet, has been advanced for unmanned operations through an intelligent software enabler – developed in collaboration with QinetiQ and SeeByte – known as Maritime Autonomous Platform Exploitation (MAPLE).

ASV's intelligent network – our Combat Management System information hub is graphically demonstrated.

ASV's unmanned Warrior – the Pacific 950 RHIB in the Solent.

It all acts as a transportable command and control centre with the capability of integrating unmanned systems from different suppliers. This minimises the number of screens and controls needed to conduct missions, making the whole system highly efficient with minimum risk of human error.

Also integral to the demonstration was MarNet, technology: an intelligent maritime communications network that enables the type of high-speed communications essential for different vehicles from a range of suppliers to communicate in unmanned operations. This capability has been developed in collaboration with Cloudnet IT Solutions, which uses part of the ultra-high frequency spectrum made redundant by the digital TV switchover to provide high-bandwidth, long-range tactical communications.

It could mean that unmanned surface vessels may be able to operate up to 20 nautical miles away from a ship.

In the Solent, the Pacific 950 unmanned RHIB was one of the main attractions of the demonstration. This RHIB is capable of 47 knots and provides unique ship-launched manoeuvrability and enhanced situational awareness to support the decision-making of its operators.

The unmanned technology is designed to be fitted to existing RHIBs, such as those already used extensively by the Royal Navy, as an affordable, modular upgrade.

Richard Williams, Naval Ships Combat Systems Director, said: "This is an exciting time. Through successful collaboration, we've effectively demonstrated this new technology and we've taken an important step forward in the process of properly integrating these novel unmanned systems into a warship's combat system. The feedback we've had from both the customer and our partners on the demonstration has been very positive. Big thanks must go to

everyone involved, including those who managed the event, staged the demonstration and provided presentations."

One of the key elements of the success of Unmanned Capability was the collaboration between Naval Ships and Maritime Services, who worked hand-in-hand to ensure a smooth event that told the combined story of our capability. A joint project team worked behind the scenes on this for months to develop the scenarios, compile the guest list and understand the stage management of the day.

The Portsmouth event was a major dress rehearsal for the Royal Navy's unmanned Warrior 16 exercise, which will be the largest event of its kind ever undertaken when it's staged off the coast of Scotland and Wales in October.

Our new technology will be vital in re-orientating this complex exercise, which will inform the Royal Navy's future capability planning.



Business Leader Award  
2016

CHAIRMAN'S  
AWARDS

BAE SYSTEMS  
INSPIRED WORK

# 5G Testbed and Trials

- 5G Ruralfirst [www.5gruralfirst.org](http://www.5gruralfirst.org)
  - Cruise Ships - Tourism
    - Created Shore 5G & Wifi using CISCOS WiFi6 and OpenRoaming to seamlessly roam over 5G network
    - 151,000 passengers to our shores yearly Busiest Port in the Scotland
    - OpenRoaming being no authentication and seamless connectivity
    - Passengers experiences 5G busses with 100% connectivity to main tours areas + OpenRoaming through the main street of town.
- 5G New Thinking [www.5gnewthinking.co.uk](http://www.5gnewthinking.co.uk)
  - Marine use cases –
  - Connecting Salmon Farms
    - CCTV
    - IoT Sensor – Fish Welfare & Security of Vessells
    - Passenger Ferry (School Boat) - connectivity for the local Passenger ferry taking School kids to Westray Junior High School.
- Speeds? - upto 180mbps

# Next Phase

- ***Private Shared Spectrum 5G Standalone (SA) Networks with LEO Connectivity –at Sea***
- Working with
  - Faroese Telecoms – 100% Population & Geographic Coverage Network Operator
  - University of Strathclyde
  - Government Agencies
- Deploy a fully tested production grade integrated LEO connected solution
- Introduce 5G SA private networks for use-cases for Marine Services to operate an at-sea private shared spectrum 5G SA network

# Next Phase

- System integration, testing and demonstrations will take place in and around Orkney Islands
- The 5G SA terrestrial network on LEO backhaul will operate in the Ofcom shared spectrum band (n77- 3.8 to 4.2 GHz) and is therefore completely 'unencumbered' with respect to the 'public' mobile network operators (MNO).
- The key deliverables are allow for complete local management and independence of network operation.
- Thorough initial testing using Local Ferry Services.
- This maritime use case will also inform the UK Ofcom shared spectrum licensing (SAL) evolution given these maritime private networks will be at sea and therefore moving and not static (i.e. review on a process for nomadic shared spectrum licences not fixed to specific land coordinates as required by SAL on land.

# ***Private Shared Spectrum 5G Standalone (SA) Networks with LEO Connectivity –at Sea***

- Use Cases being discussed and challenged
- Test LEO in Northern Waters
  - Weather/Storms/Swells/Pitch/Yaw/General Travel
- IoT Sensors
- Crew Welfare (Wi-Fi)
- Passenger Wi-Fi
- Ship-to-Shore -> Pier Wi-Fi handoff
- Resilient Backup/Failover solutions (5G/4G/Wi-Fi) Handoff
- Statutory Requirements – Ships Business
- Cash Transactions
- Portal Information – Tourism Info Pods. + Many More



# ***Private Shared Spectrum 5G Standalone (SA) Networks with LEO Connectivity –at Sea***

- Aims to test LEO @ Sea in the North Scotland
- Test LEO Nomadic solutions.
  - Throughput/latency/bandwidth etc.
- Compare 4G Vs LEO performance/range
- Test connectivity via 5G SA small cells and performance
- Seek Spectrum Licensing with OFCOM



# Thank you

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