

Building Korea's Maritime IoT Network

From Field Validation to Nationwide Deployment

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Why Maritime IoT?



From Validation to a Nationwide Network

1 DONE

2021 - 2025

Develop and validate

- 3GPP NB-IoT Release 16 system
- Real-sea test: 30 km+, 30 terminals

2 NOW

2026 - 2030

Pilot networks

- Busan, Ulsan, Masan
- 24/7 operation

3 NEXT

2031 onward (plan)

Nationwide network

- Expand along the coast
- Maritime data services

From Problems to the Right Technology

1 Problems

Terminal cost
Remote units can be costly

Data fees
Grow with device count

Limited power
Battery and solar sites

Coverage gaps
Remote coasts and islands

2 Requirements

- **Small data payloads**
- **Wide-area coverage**
- **Long battery life**
- **Low-cost terminal**
- **Global standard**
- **High data rate** *not the priority*

3 3GPP NB-IoT Release 16

A practical balance of **coverage, power efficiency, device cost** and **standards-based operation**

Technology Driven by National Policy

2021 - 2025
Ministry of Oceans and Fisheries national R&D (about USD 13 million)

ETRI
End-to-end technology development (about USD 4.6 million)

1. **National policy need**
   Dedicated public maritime IoT infrastructure
2. **3GPP NB-IoT Release 16**
   Global standard, commercial chipsets, supply chain availability
3. **Low power, low cost, wide coverage**
   Lower total cost of ownership

Next-Generation AtoN: Digital Infrastructure at Sea

From navigation information to maritime digital innovation

1



Digital innovation

Stable remote monitoring and control of AtoN

2



Maritime big data

Maritime data supporting autonomous navigation

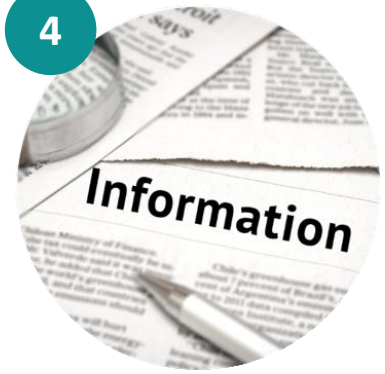
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Safety response

Early detection of maritime hazards and safety risks

4



Information service

Real-time information tailored to users

AtoN remains essential to navigation safety while evolving into a key part of maritime digital infrastructure

MIoT System Overview

1
AtoN and sensors
Generate status and sensing data

2
NB-IoT terminal
Low-power transmission

3
Base station
450 MHz coastal connectivity

4
Core and platform
Manage connectivity, devices and data

5
Users and applications
Monitoring and information services

Fixed network
Coastal macro base stations

Standalone small cells
Ships and remote maritime sites

End-to-End System, Developed In-House



1 Base station

NB-IoT base station



2 Terminal

Low-power NB-IoT device

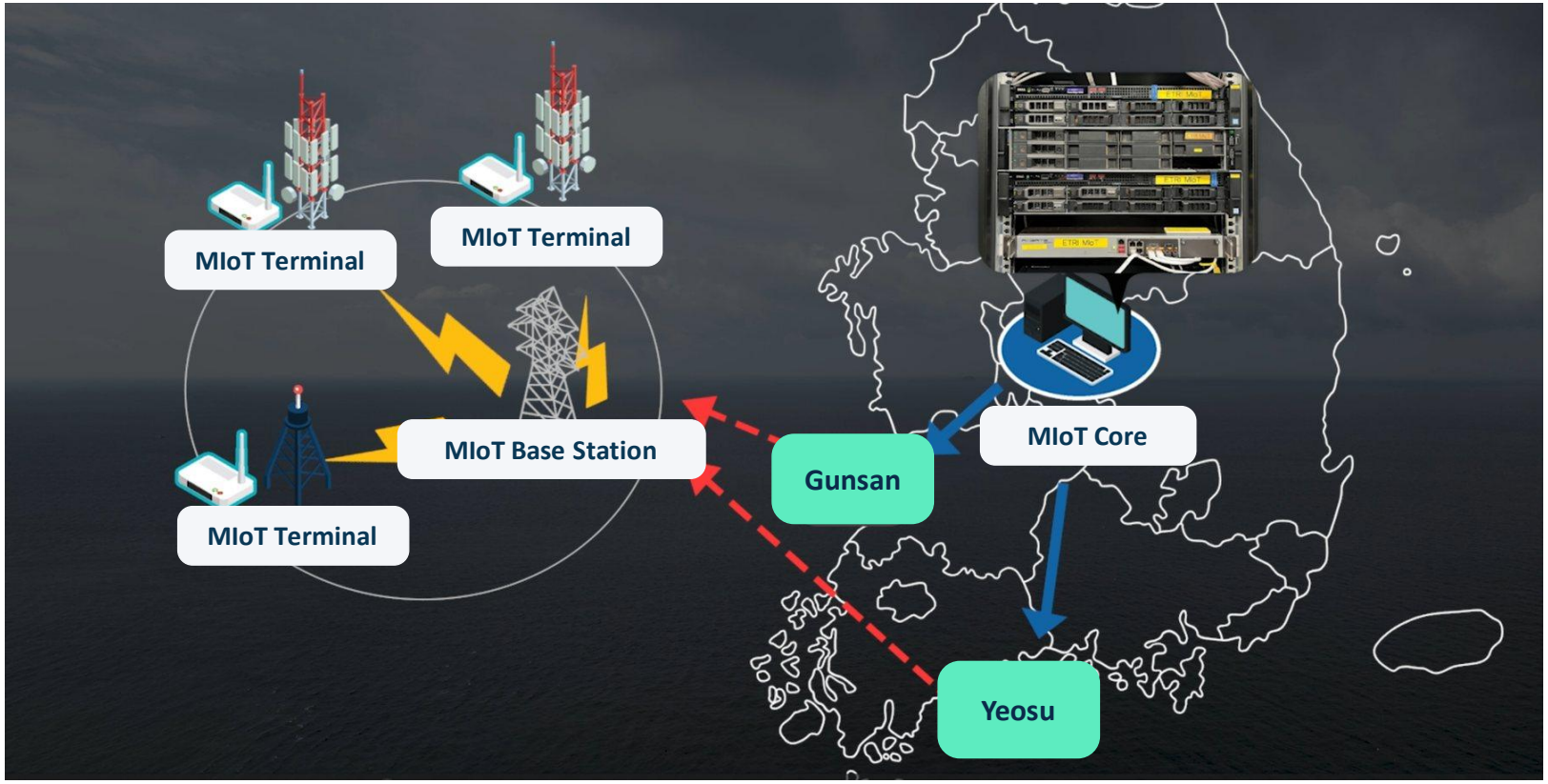


3 Core and operation system

Core network and platform

Not just a radio link: connect devices · exchange data · deliver it to the operator

Real-Sea Validation: West and South Coasts



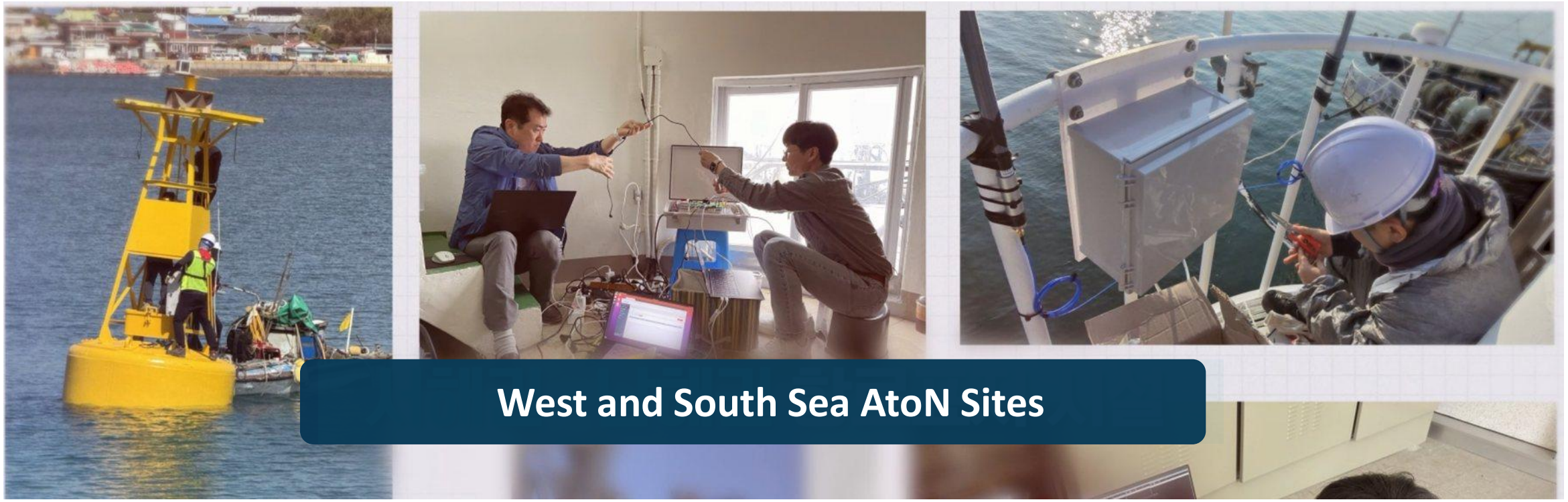
Core network and application system: National Maritime PNT Office, Okcheon

1 Two regions
Gunsan (west),
Yeosu (south)

2 One common core
PNT Office, Okcheon

3 Not one location
Repeatable results

MIoT Deployed at Real AtoN Sites



1 Real AtoN facilities
Installed and tested at sea

2 Power and Antennas
Adapted to site conditions

3 Harsh marine environment
Weather, corrosion and maintenance

Base Stations on Lighthouse Sites

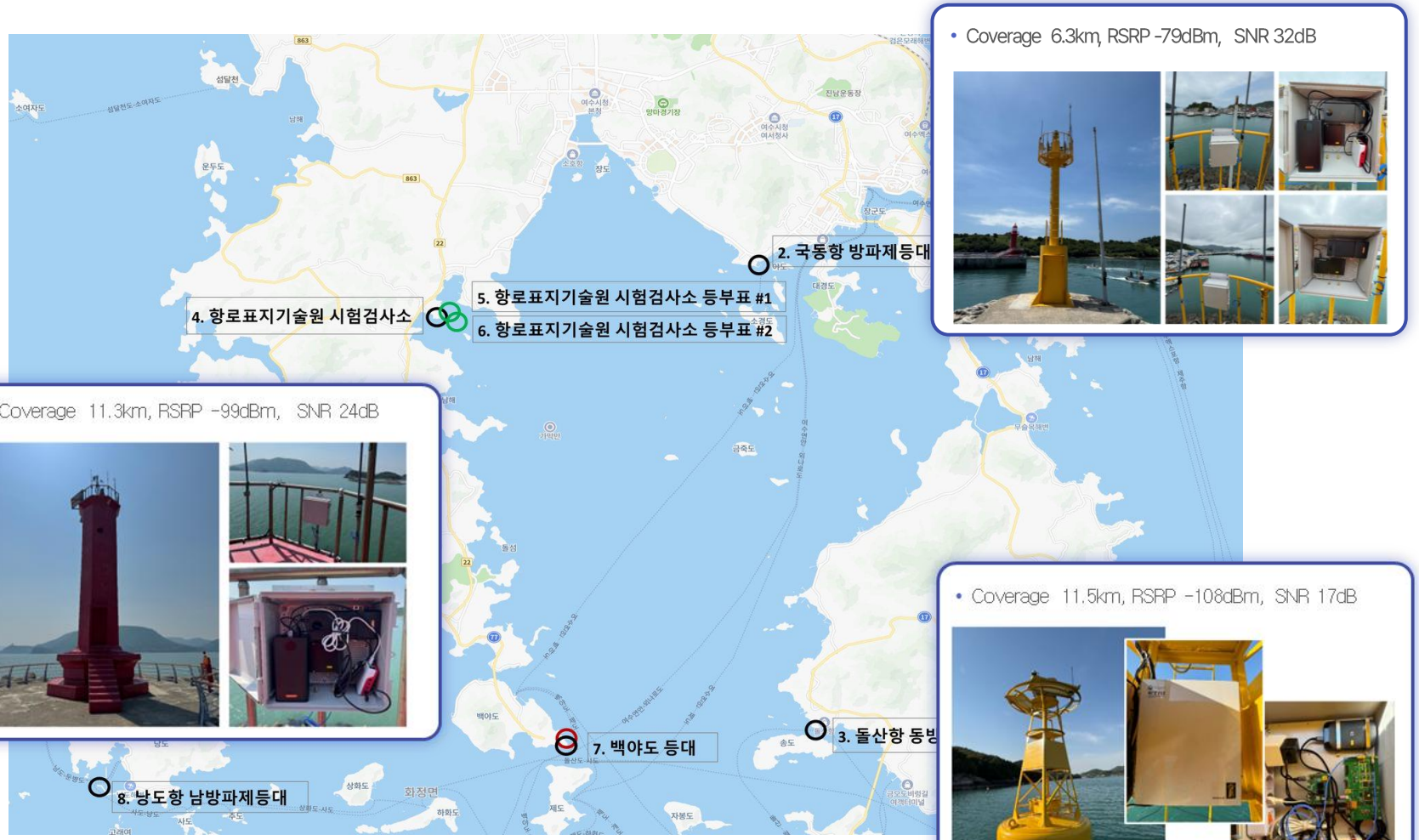


1 Lighthouse sites
Odongdo, Baegyado, Maldo

2 Power and height
Existing power · Elevated antenna sites

3 Lower deployment cost
Reuse existing infrastructure

30 Real Terminals in the Test Area



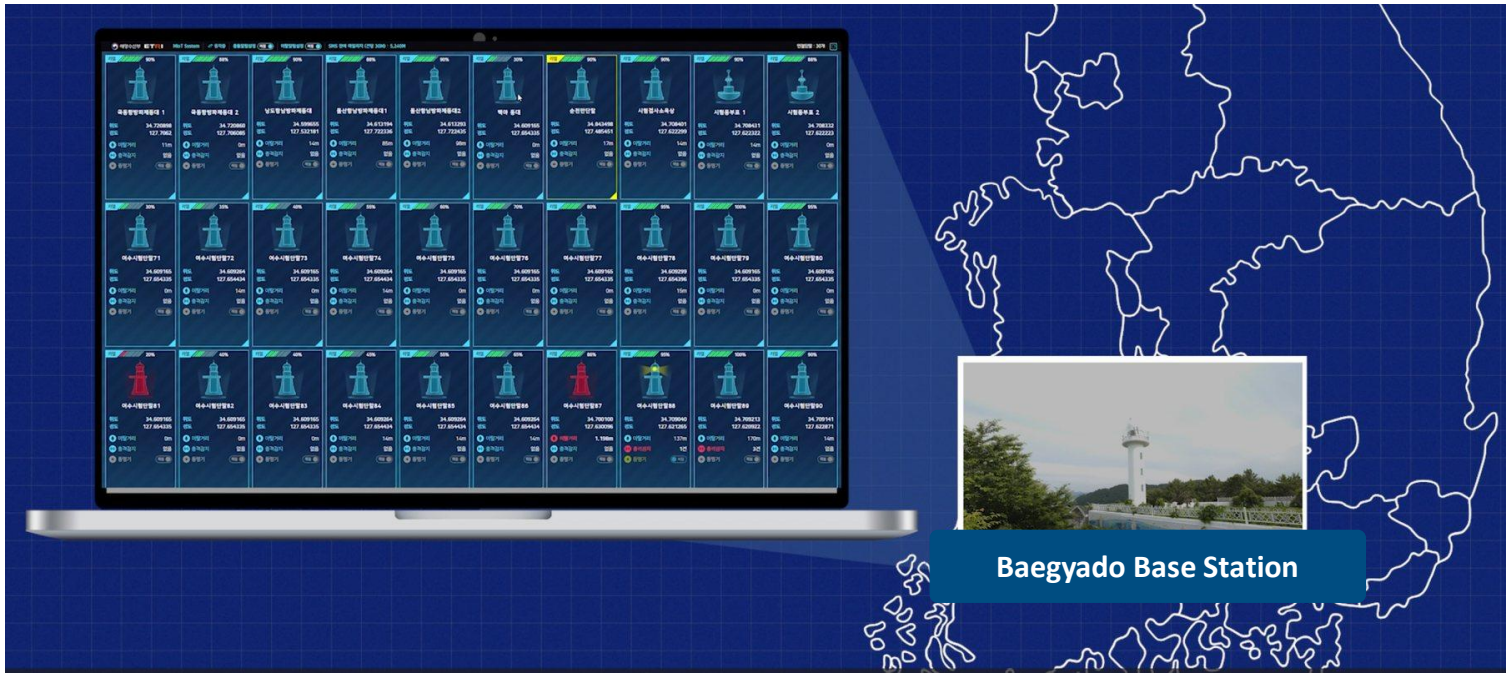
1 **30 real terminals**
Varied locations

2 **Measured samples**

Distance	RSRP	SNR
6.3 km	-79 dBm	32 dB
11.3 km	-99 dBm	24 dB
11.5 km	-108 dBm	17 dB
30.3 km	-116 dBm	9 dB

3 **Multi-device network**
Not a single point-to-point test

From Real-Time Monitoring to Smarter AtoN Operations



DEMONSTRATED
Remote visibility of 30 field terminals

NEXT TO EVALUATE
Automated records · Predictive maintenance

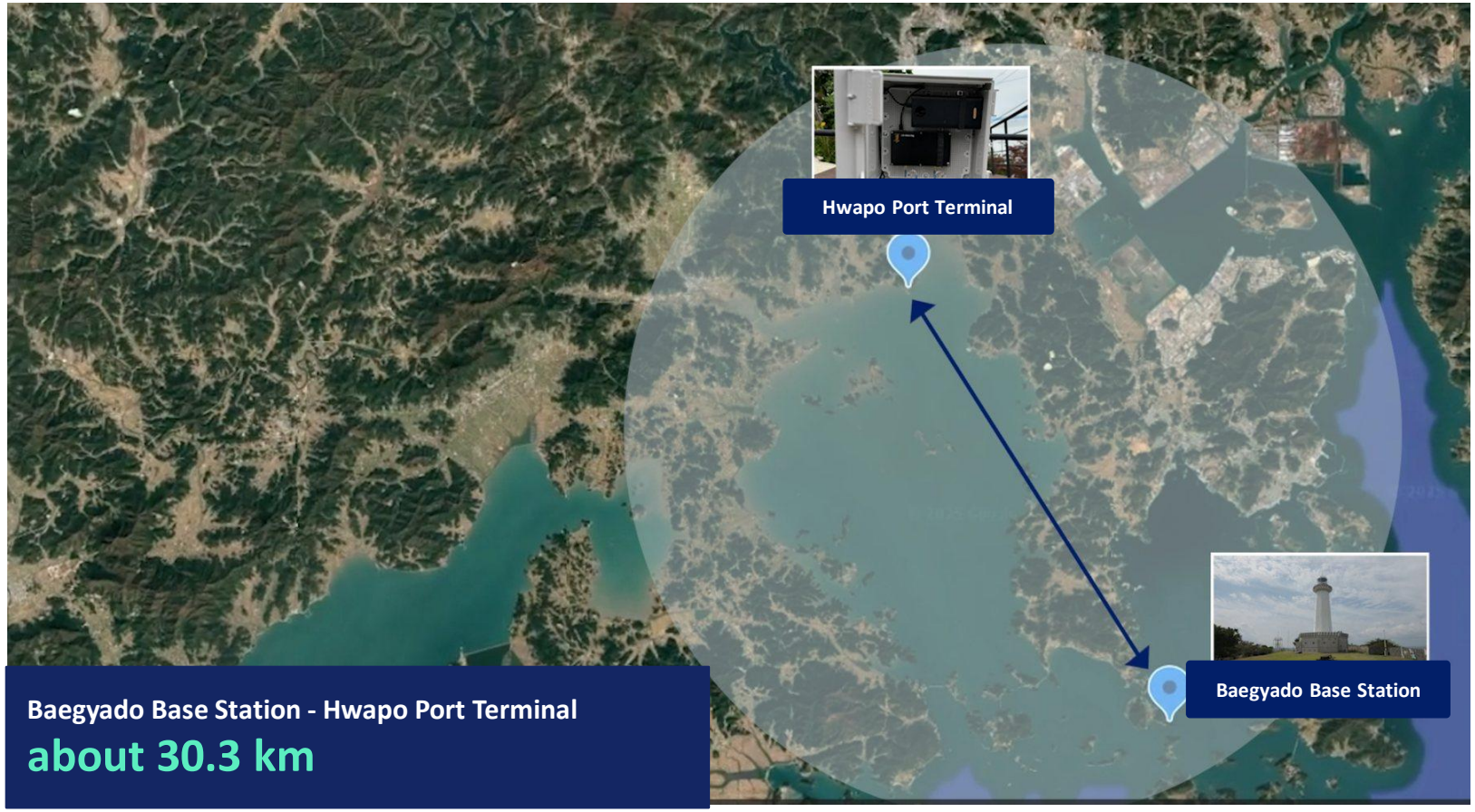
1 **30 terminals connected**
Status visible in the central system

2 **Check before visiting**
Remote view of AtoN assets before a site visit

3 **Operator needs**

- Lower equipment and communication costs
- Earlier fault detection
- Simpler inspection records

Over 30 km at Sea: South Sea



1 **A real sea path**
Not a laboratory cable test

2 **30.3 km**
Baegyado to Hwapo Port

3 **Not guaranteed everywhere**
Antenna height, terrain, installation

Same Result in the West Sea



1 **West Sea, Maldo**

2 **35 km and 30 km**

3 **Repeatable**
A different coastal environment

2025 Real-Sea Validation: Results

1

30 km+

Communication range at sea

2

30

Terminals connected, data sent and received

3

Core

Interworking with the central core network (Okcheon)

4

AtoN

Remote management tested: sensing data and control commands

End-to-end service chain validated, not only the wireless link

From Field Trials to Integrated Network Operations

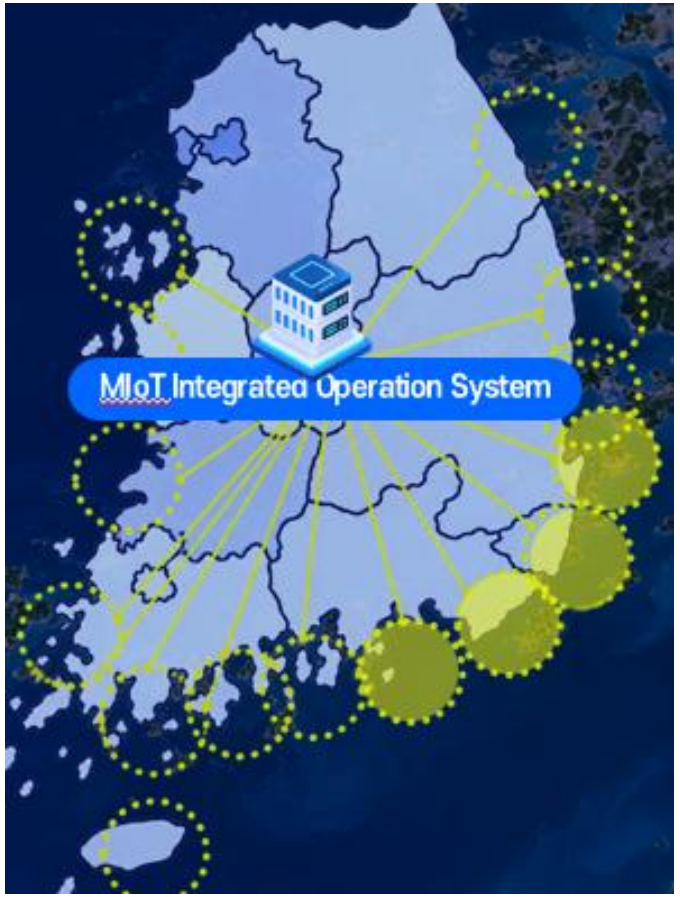
1

Integrated Operation System

Central core, Okcheon

- Core network
- Central monitoring
- Application services

Managed as **one operational network**



2

Regional pilot networks

Busan, Ulsan, Masan: next deployment stage

3

AtoN-based stations

Extend coastal coverage

4

Ship-borne stations

A flexible future option

Roadmap: From Pilot Regions to the Whole Coast

1

2029 (plan)

Pilot networks in Busan, Masan, Ulsan

2

2030 (plan)

Continuous operation, with integrated network management

3

2031 onward (plan)

Extend coverage to other coastal regions

MSIT-Funded National R&D Project

About USD 14 million

2026 - 2030, Development of Practical Technologies for the Nationwide MIoT Network

- Commercial-grade base station, terminal, core
- 3 services: AtoN, life jackets, sensing data
- Technical standards and regulations

Implementation targets, not outcomes already completed

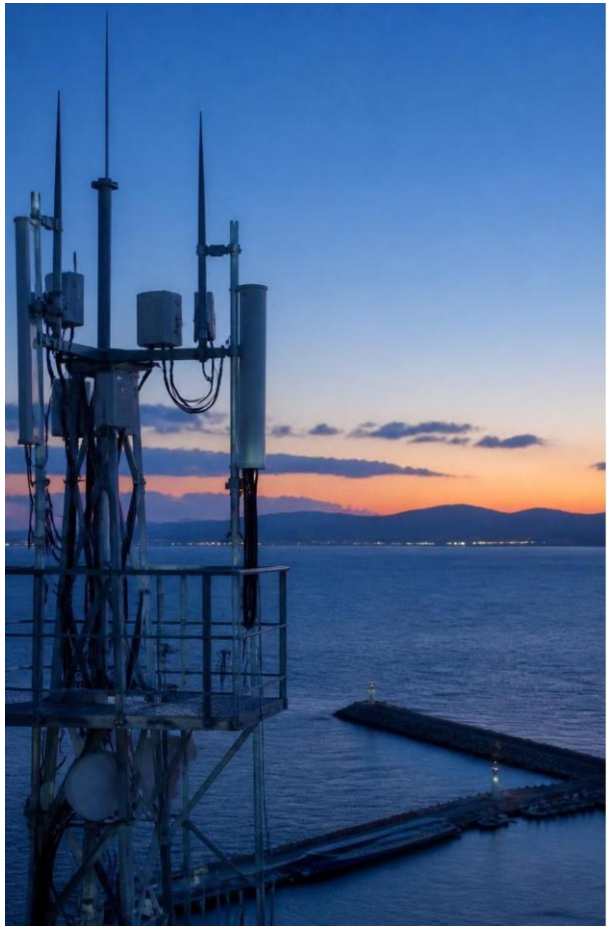
Scale Where Needed: A Practical Rollout Model

1. **Deploy a macro base station at a priority coastal site**
   Leverage existing maritime infrastructure where possible

2. **Start local monitoring once the base station is ready**
   Service becomes available within the covered area

3. **Add base stations as operational needs grow**
   Expand network coverage based on local demand

4. **Interconnect regional base stations**
   Through a shared core network and centralized management system



Network value does not have to wait for full coastal coverage

Standalone Small Cell: No Backhaul Needed

MIoT Standalone Small Cell

Base station + Local core network + Management software

Fishing gear
Location and status (potential)

Life jackets
Status information (potential)

Marine sensors
Ocean data (potential)

1 **One package**

2 **Ship or remote site**

3 **Several km to 10+ km**
Depends on installation and radio

Local low-rate services | Field screen | Smartphone link (under study) | Local storage | Optional backhaul

Korea's Approach: What Other Countries Can Use

1

Standard-based

3GPP NB-IoT Release 16

Commercial chipsets

2

Public low-band spectrum

450 MHz in Korea

Chosen under national rules

3

Reuse AtoN sites

Lighthouses and buoys

Lower build cost

4

Cell-by-cell growth

Modular network deployment

Start service early

5

Standalone small cell

No backhaul needed

Ships and remote sites

6

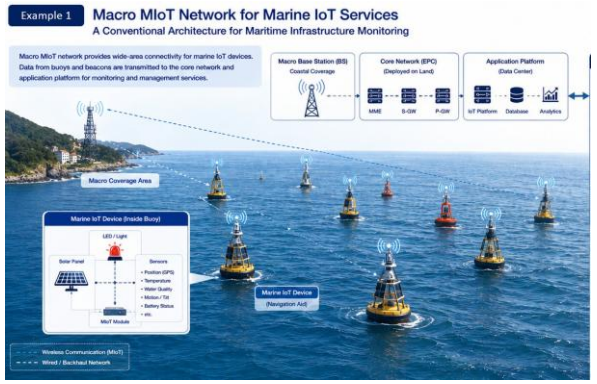
One infrastructure

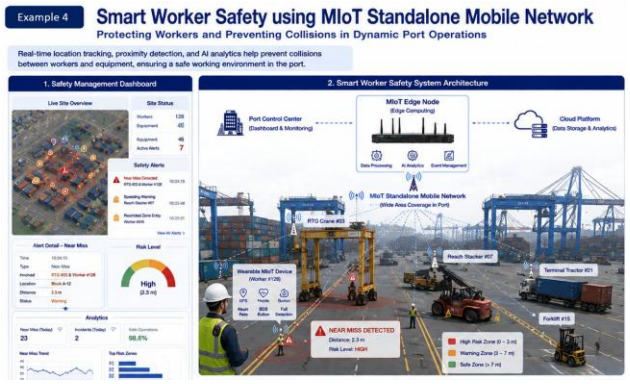
Many services

Shared by many users

Spectrum allocation is country-specific, but the deployment model is transferable.

One Shared Network, Multiple Maritime Services









1	**AtoN** Monitoring and remote control	Validated
2	**Fishing gear** Tracking and loss alerts	Potential
3	**Aquaculture** Environmental sensing	Potential
4	**Life jackets** Location and status monitoring for rescue support	Planned
5	**Marine weather** Distributed observation	Potential
6	**Standalone small cell networks** Coast Guard, Navy, private AtoN	Potential

One shared network enables diverse maritime services, each tailored to its operational needs

Complementary Layers for Ocean Data

TODAY: COMPLEMENTARY ROLES

1

LTE-Maritime

Broadband services for ships in coastal waters (Korea)

2

VDES

Data exchange between ships and shore

3

MIoT

Massive connectivity · Lower power · Low cost

NEXT: EXTENDING COVERAGE

4

Coastal macro cells
Today: 450 MHz

›

Mobile maritime cells
Standalone small cells

›

Ship-borne systems
Ships at sea

›

Satellite (NTN)
Wide ocean areas

›

Continuous ocean data

Different networks, different roles – working together for continuous ocean data

Beyond Connectivity: From National Deployment to Shared Value

KEY MESSAGES

1	**Validated**	**Standards-based, end-to-end MIoT proven at sea**
2	**Next challenge**	**From regional pilots to an integrated coastal network**
3	**Long-term value**	**Reliable maritime data supporting diverse services**

INTERNATIONAL COOPERATION

Shareable: standards · site reuse · phased rollout

Requirements	**Joint trials**	**Interoperability**	**Operational lessons**
Needs and use cases	Field performance	Devices and networks	Deployment experience

More than a communication network: **the foundation for a data-driven maritime future**


Connect the sea. Understand the sea. Predict the sea.
THANK YOU
Questions and discussion