

# Field test of a pilot small sea area ship information system using Maritime Cloud and smart phones

Yasuyuki NIWA

National Maritime Research Institute  
Japan



# Contents

- Introduction/Background
- Ondo Strait (Ondo-no-seto)
- Maritime Cloud
- Small Sea Area Ship Information System
- Field Test/Analysis
  - Position Accuracy, Time Delay, Throughput...
- Summary/Conclusion
- Acknowledgements

# Introduction/Background

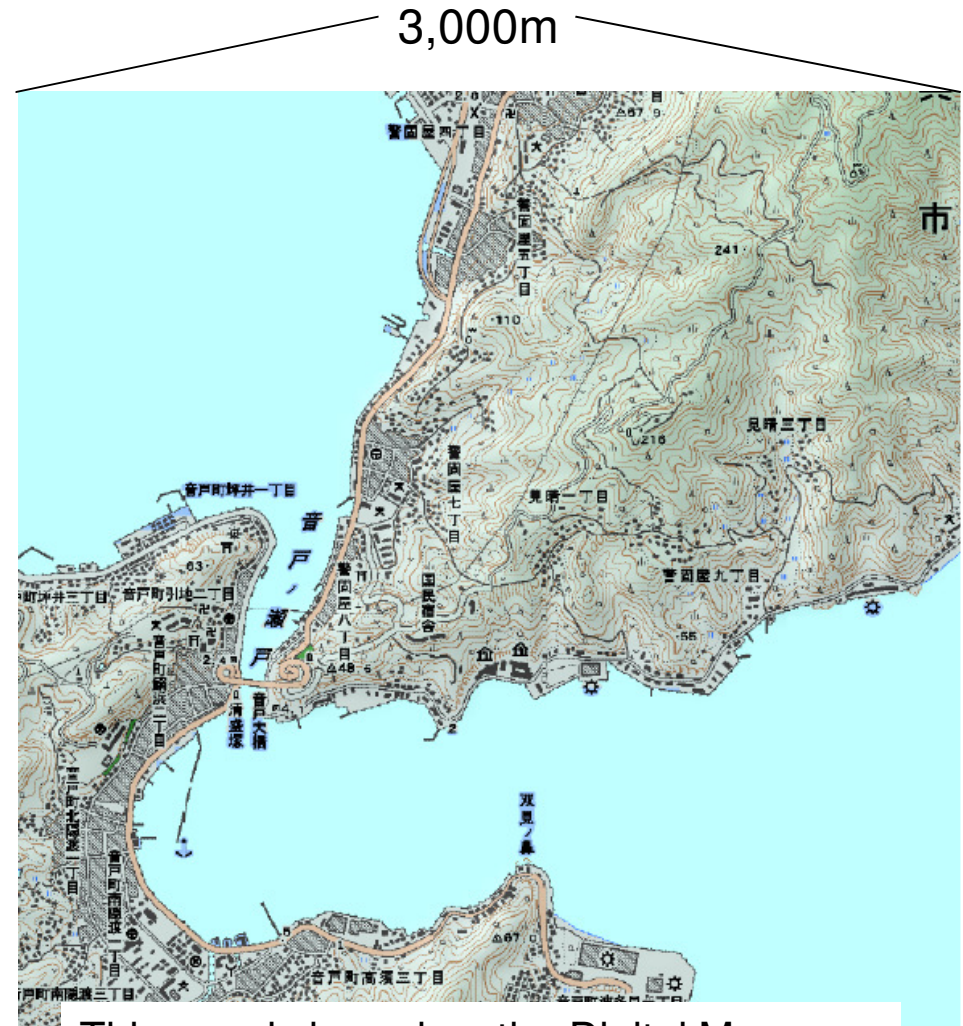
- Demands to reduce marine accidents
  - Information supports for sharing ships' position information including non-AIS ships are demanded.
- Demands to get non-AIS ships' position information



- **Development of Small Sea Area Ship Information System;**
  - Provides location sharing information by using smartphones and Maritime Cloud.

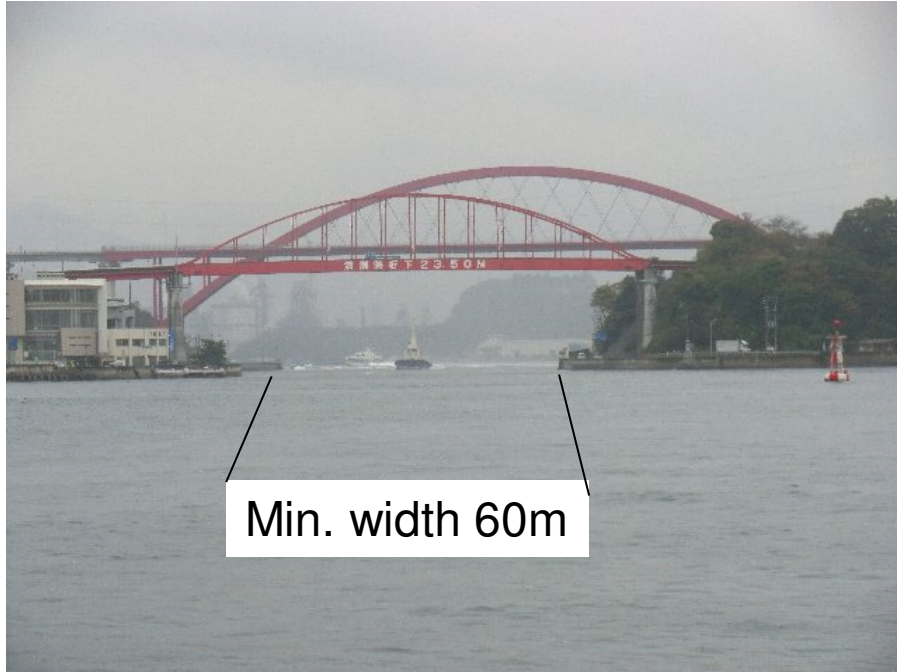
# Ondo Strait (Ondo-no-Seto)

- Characteristics
  - West of Japan
  - 50km from Hiroshima
  - Narrow and bend
  - Minimum width: 60m
  - Crossing a very small ferry
  - Change of tidal currents



This map is based on the Digital Map 25000 (Map Image) published by Geospatial Information Authority of Japan

# Ondo Strait (Ondo-no-seto)



Min. width 60m



Crossing a very small ferry



High speed ship



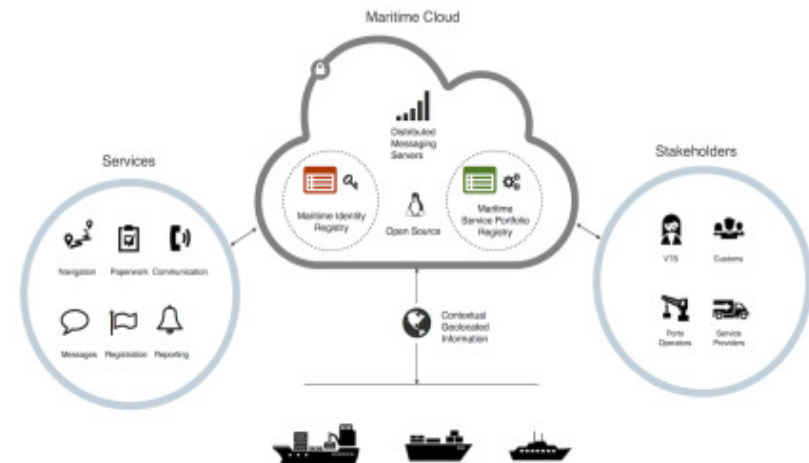
# Maritime Cloud

## Definition:

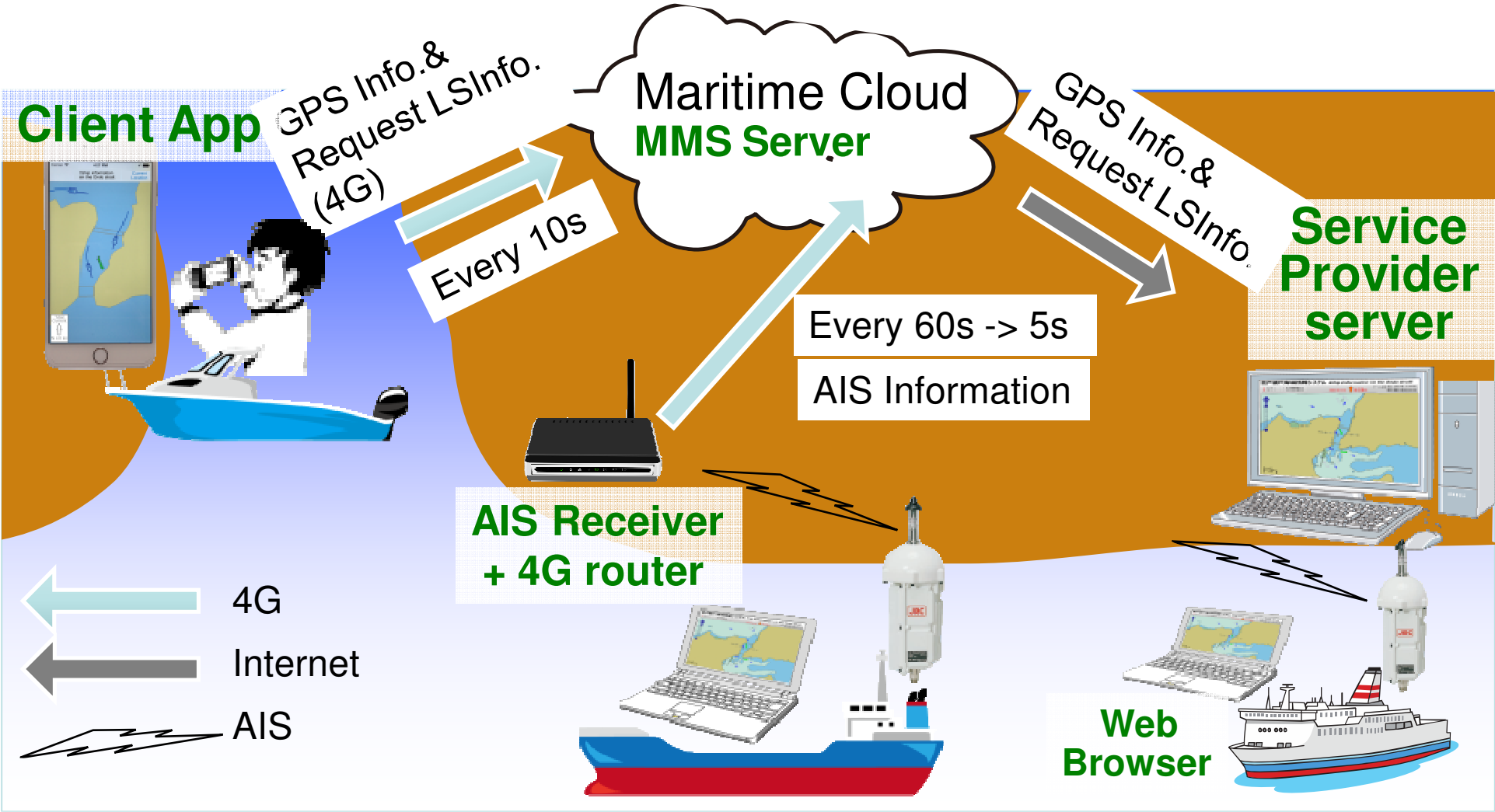
A *communication framework enabling* efficient, secure, reliable and seamless *electronic information exchange* between all authorized maritime stakeholders across available communication systems.

## Core services:

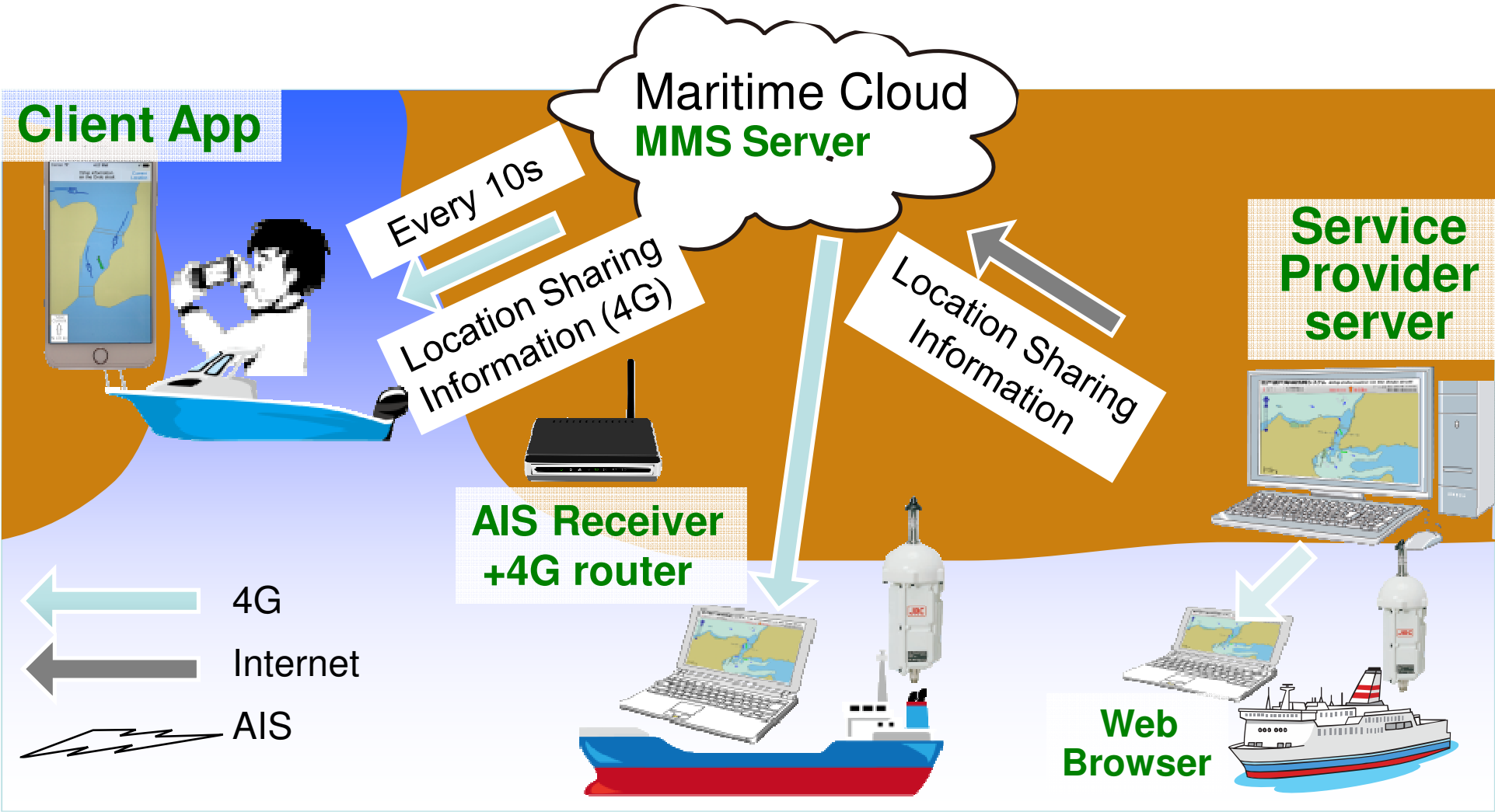
- **Maritime Identity Registry.**
  - A centralized authority for identities of persons, organizations or ships that are using the Maritime Cloud.
- **Maritime Service Registry.**
  - A centralized repository of service standards and provisioned services world wide.
- **Maritime Messaging Service (MMS) server.**
  - A communication protocol on top of TCP/IP. Supporting reliable delivery of messages and geocasting.



# Small Sea Area Ship Information System



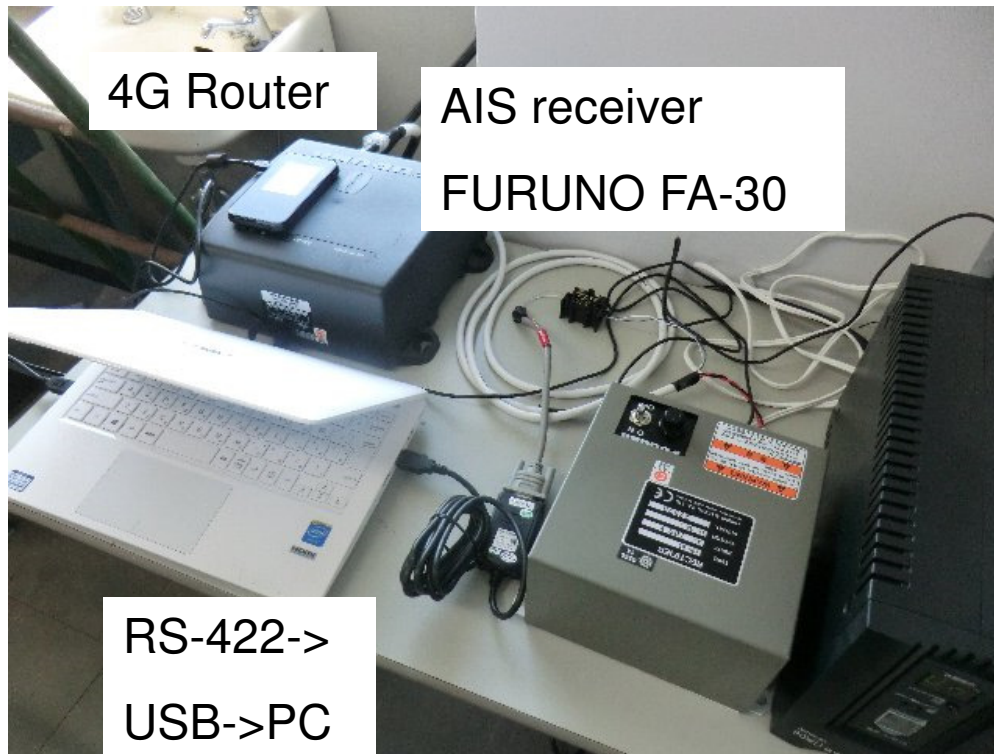
# Small Sea Area Ship Information System





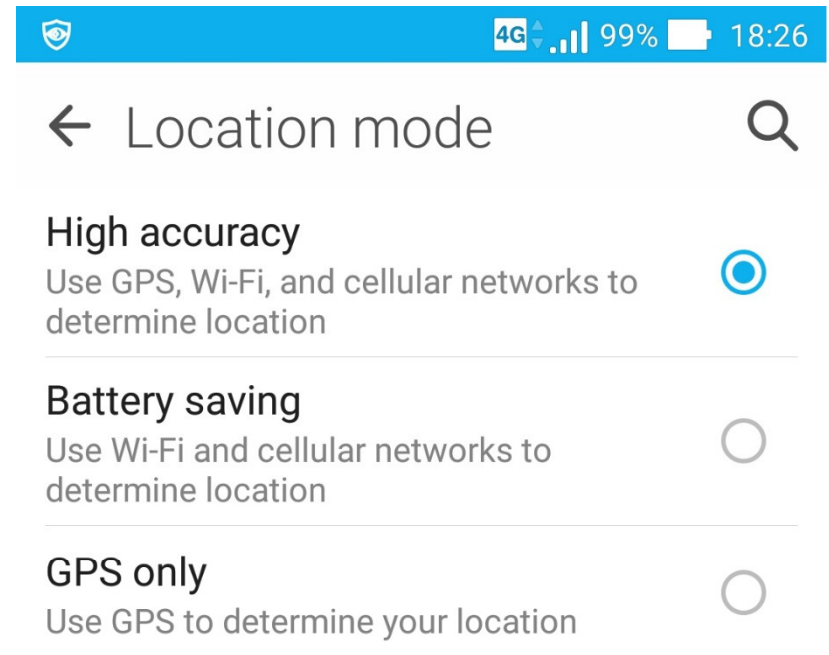
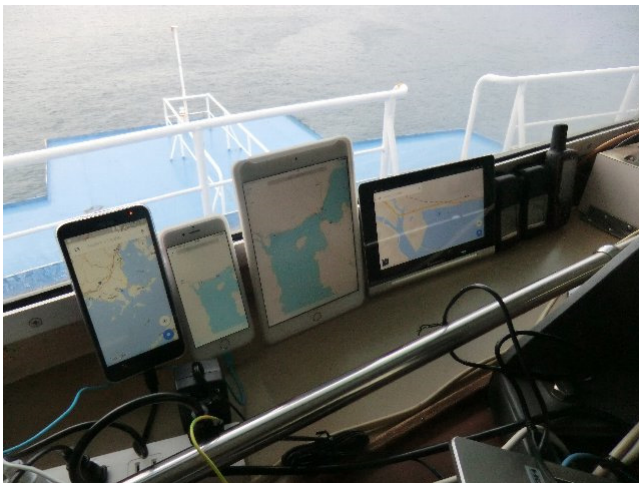
# AIS Receiver at JCGA (Japan Coast Guard Academy)

- 10km from Ondo Strait



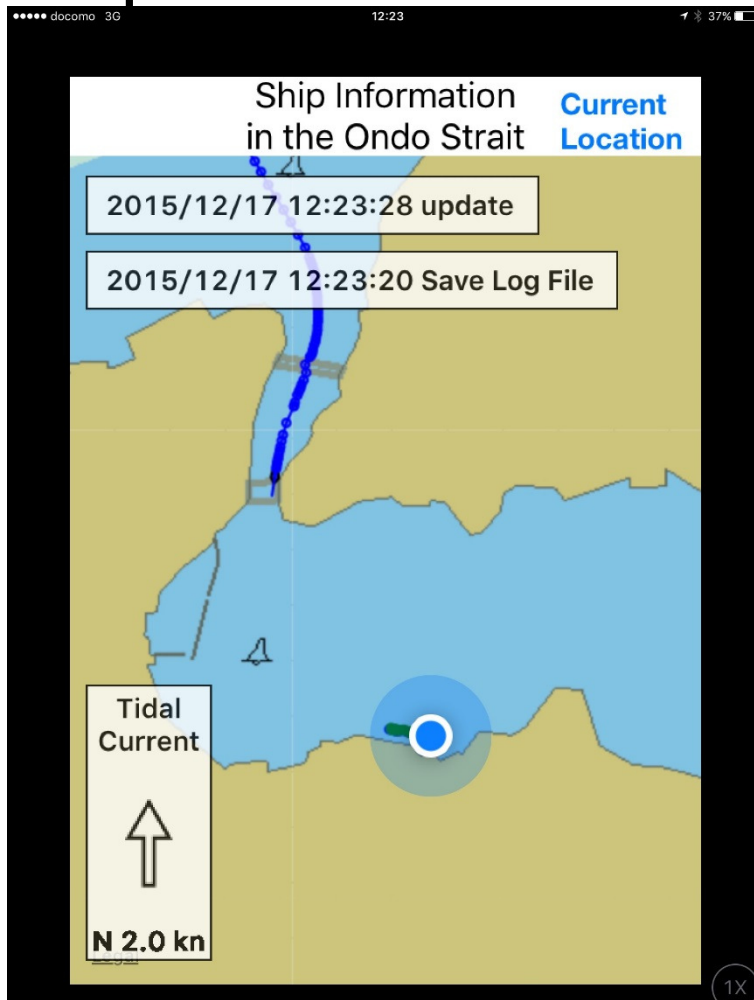
# Smartphones/Tablets(1)

- iPhone 6 (4G)
- iPad mini 4 (4G)
- Asus Zenfone2 (4G)
- Lenovo Tablet (No sim)
  - Wi-Fi :off (all devices)



# Smartphones/Tablets(2)

- Snapshots



# Focus Points for Analysis

- Position Accuracy of Smartphones/Tablets
- Time Delay of the System
- Throughput on Board
- If the GPS signal is weak in Environment

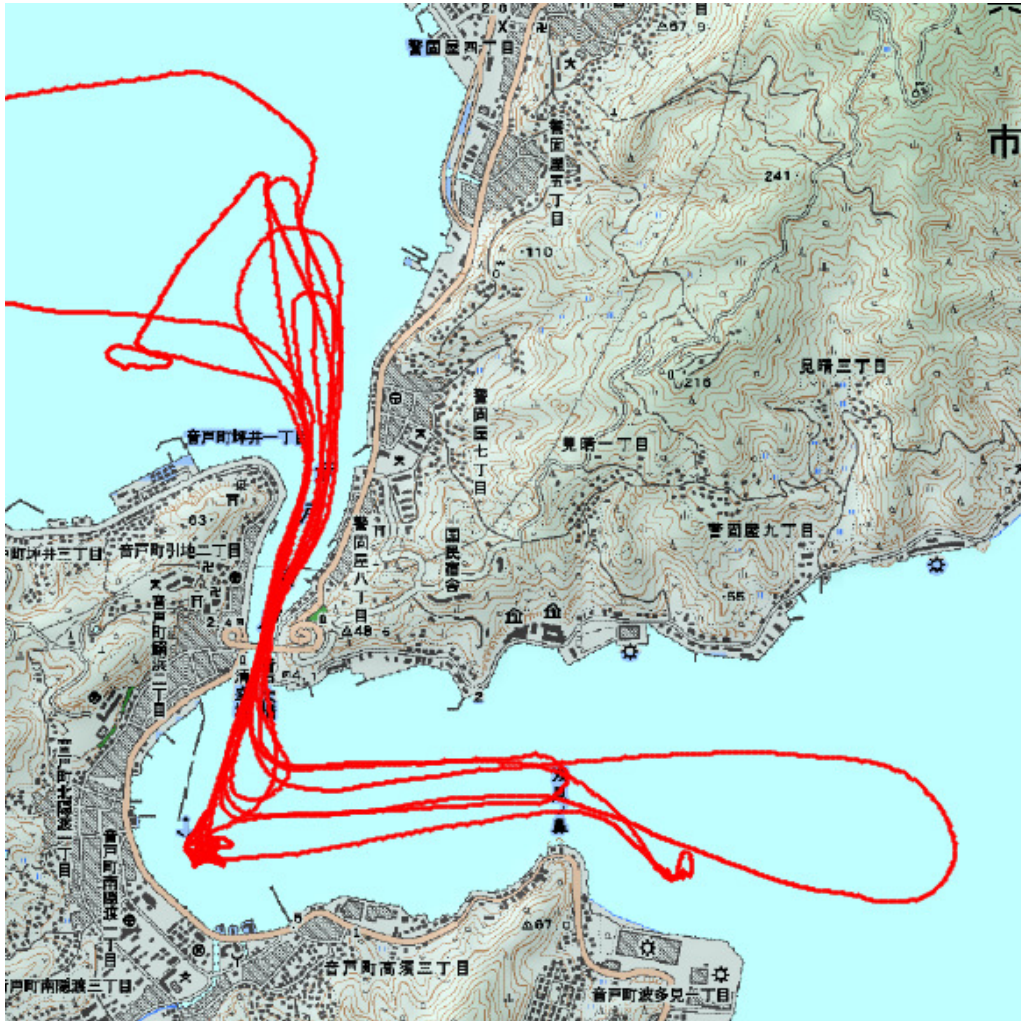
# Field Test

- Test Ship: Subaru (Oshima College, formerly Oshima National College of Maritime Technology)
  - 14.5m, 14ton
  - AIS (JRC JHS-180)
  - GPS Compass (FURUNO SC-50)



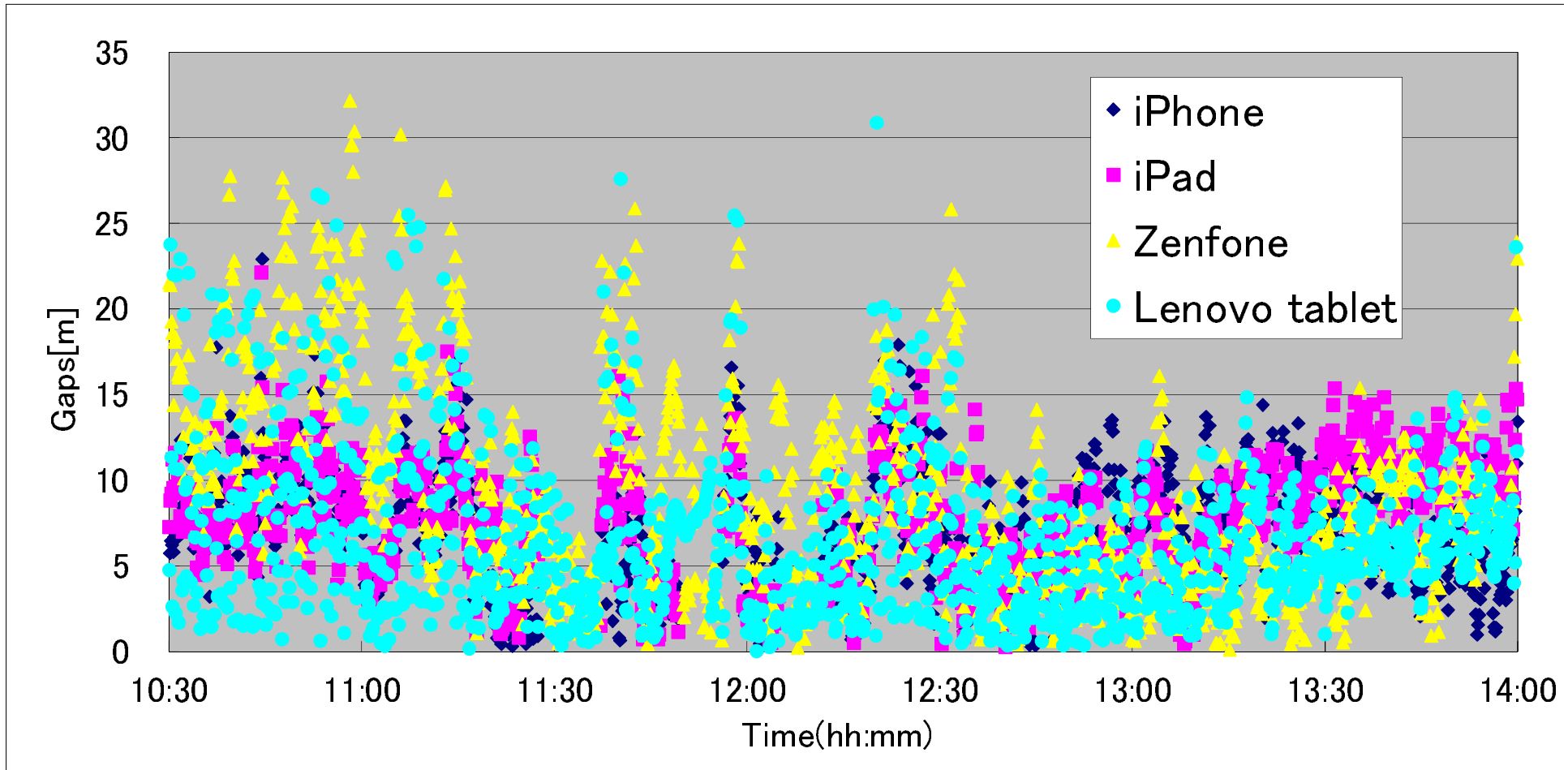
# Field Test

Trajectory (Jan 7<sup>th</sup> 2016)



# Position Accuracy

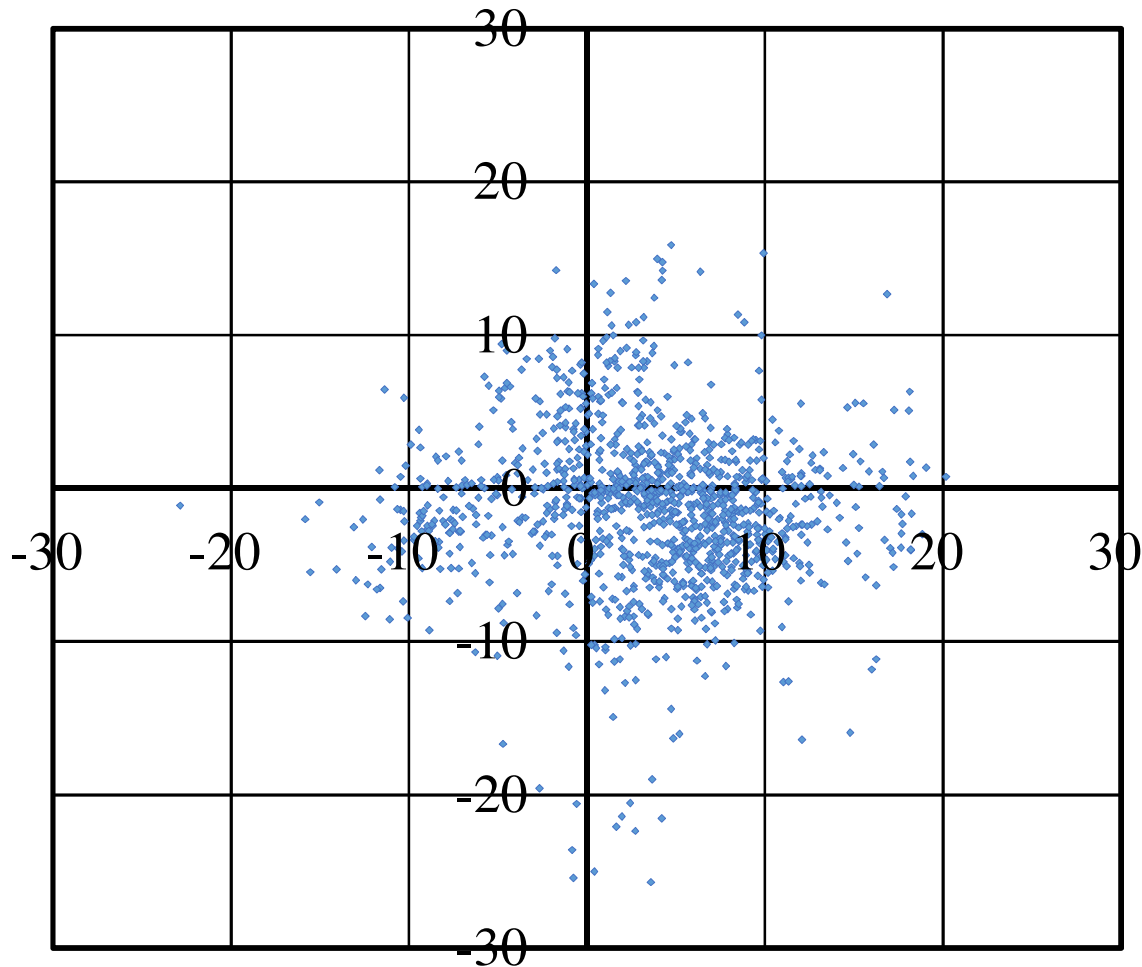
## Position Gaps between GPS Compass



# Position Accuracy

2drms (2 distance root mean squared): 95%

2drms(iPhone)=16.1m (N=1204)

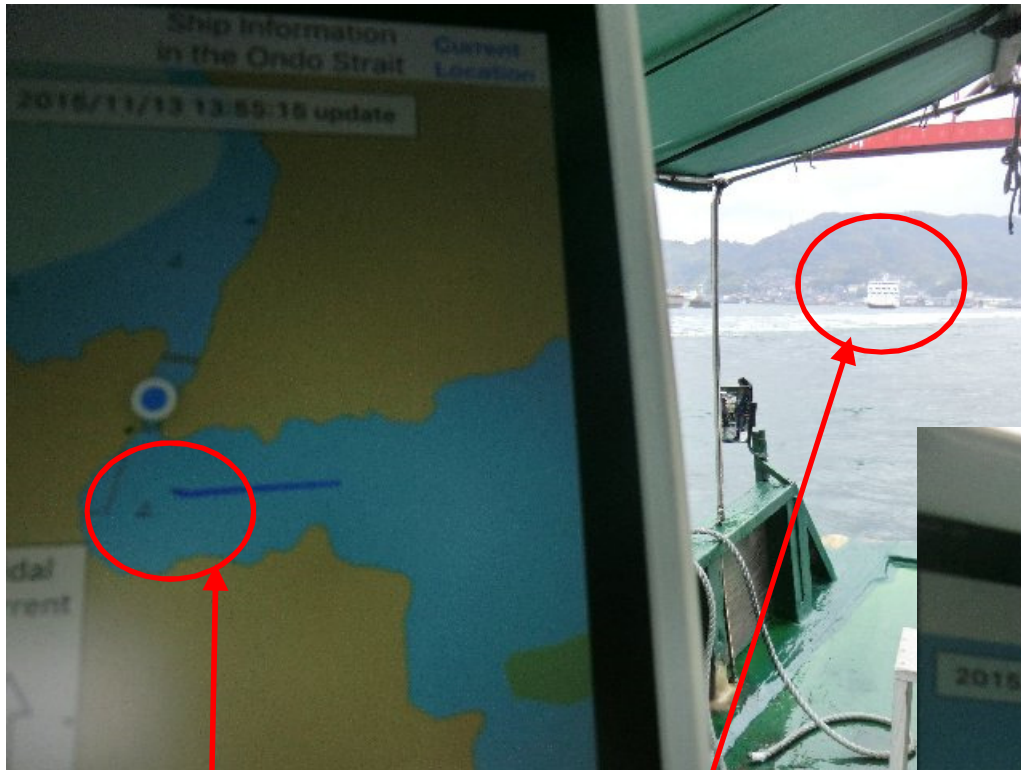


	2drms
iPhone	16.1m
iPad	17.2m
Zenfone	23.7m
Lenovo	16.3m



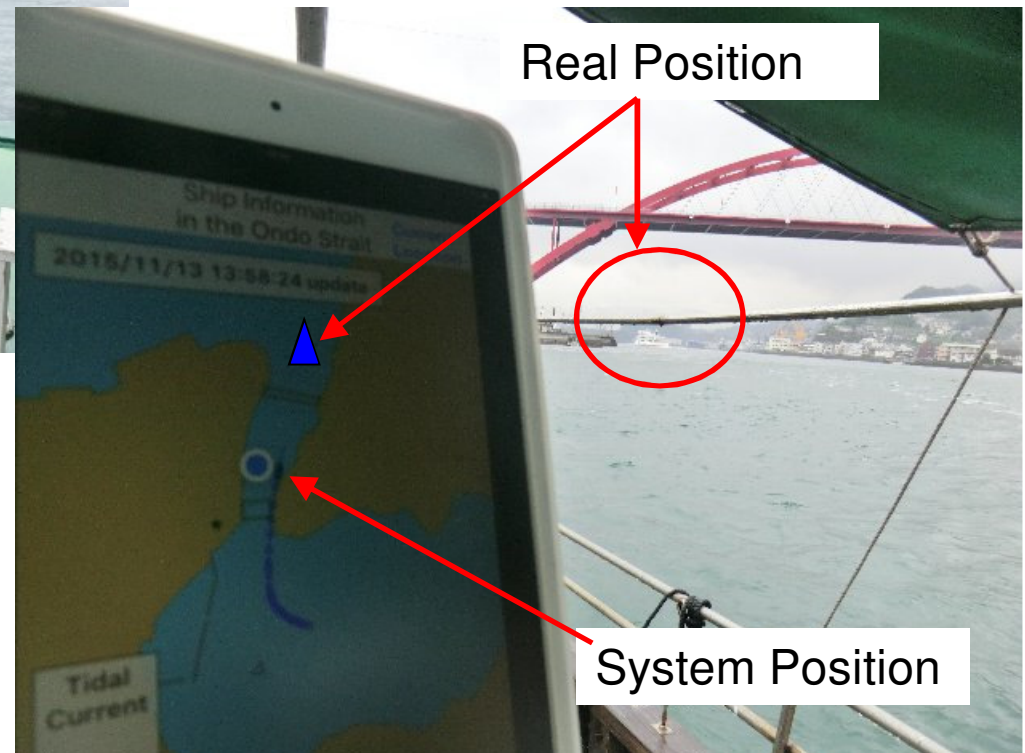
# Time Delay

(Time interval: over 60 seconds)



Just started the turn

Already turned



Real Position

System Position

# Time Delay

(Time interval: 5 - 10 seconds)



# Throughput on Board

- Ookla Speedtest

- Fujitsu Arrows

F-10D (4G) Mbps

	DOWN	UP
A	18.0	10.2
B	62.4	23.3
C	32.5	12.2

- iPhone 4S(3G)

	DOWN	UP
A	5.97	1.28
B	5.49	3.56
C	1.74	1.58



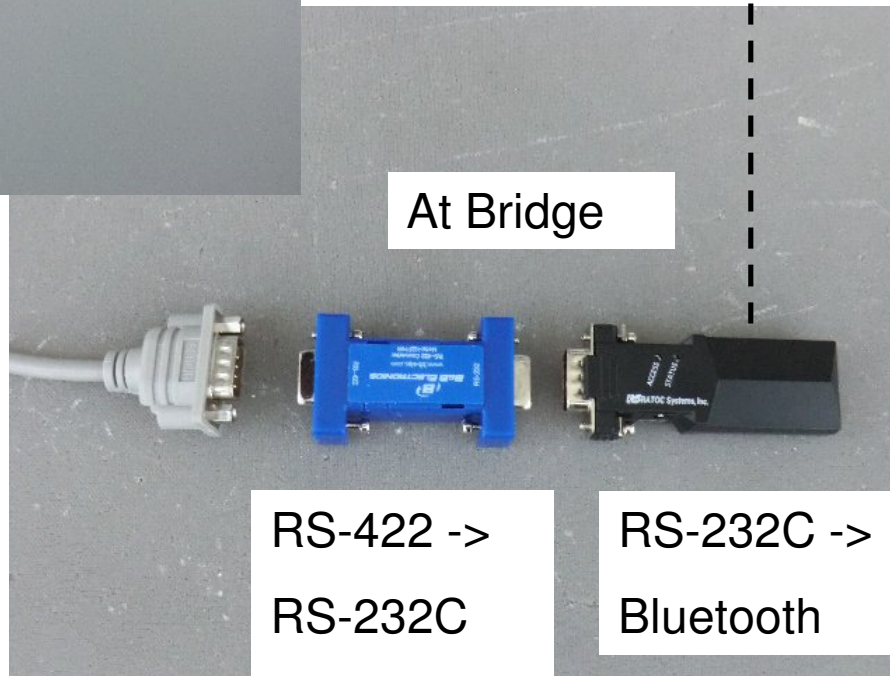
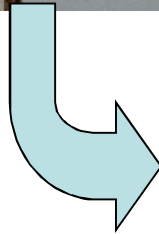
# If the GPS signal is weak in environment



# If the GPS signal is weak in environment



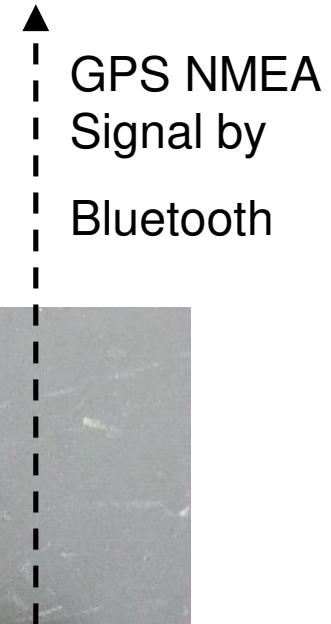
GPS  
NMEA  
Signal  
RS-422



RS-422 ->  
RS-232C  
Converter

RS-232C ->  
Bluetooth

Smartphones/Tablets



# Summary/Conclusion

- Developed Small Sea Area Ship information System
  - Using Maritime Cloud
  - Using smartphones/tablets for non-AIS ships' position
- Carried out field test
  - Position accuracy of smartphones/tablets  
2drms(95%) 15-25m
  - Data interval time 5-10 seconds -> Good results
  - Measured enough throughput on board
- This system would be helpful for safe navigation.

# Acknowledgements

- Most part of this work was carried out as the research project of Japan Ship Technology Research Association (JSTRA).
- This project was supported by the Nippon Foundation.
- Field test was supported by JCGA (Japan Coast Guard Academy), and also Oshima College (formerly Oshima National College of Maritime Technology).



- A part of this work was supported by JSPS KAKENHI Grant Numbers 26289342.

