

# Taiwan University activities related to NIPWG work



Shwu-Jing CHANG, NIPWG7

# NTOU (National Taiwan Ocean University)

- 7 colleges: 22 under., 27 master, 20 Ph.D. programs
  - Maritime Science and Management
    - Merchant Marine, Marine Engineering, Shipping and Transportation Management... (**Dept. of Navigation & Institute of Maritime Technology**)
  - Life Science
    - Aquaculture, Marine Biotechnology...
  - Ocean Science and Resource
    - Fisheries Science, Geosciences, Marine Affairs and Resource Management...
  - Engineering
    - Harbor and River Engineering, Mechatronic, Materials, Systems Engineering and Naval Architecture...
  - **Electrical Engineering and Computer Science**
    - EE, CS, Optoelectronics, **Communications, Navigation & Control Engineering**
  - Humanities and Social Science
    - Oceanic Culture, Education,....
  - Ocean Law and Policy
    - Ocean Law and Policy, Ocean Tourism Management,...



# ENC Center, NTOU

<http://enc.ntou.edu.tw/ENCCenter/>



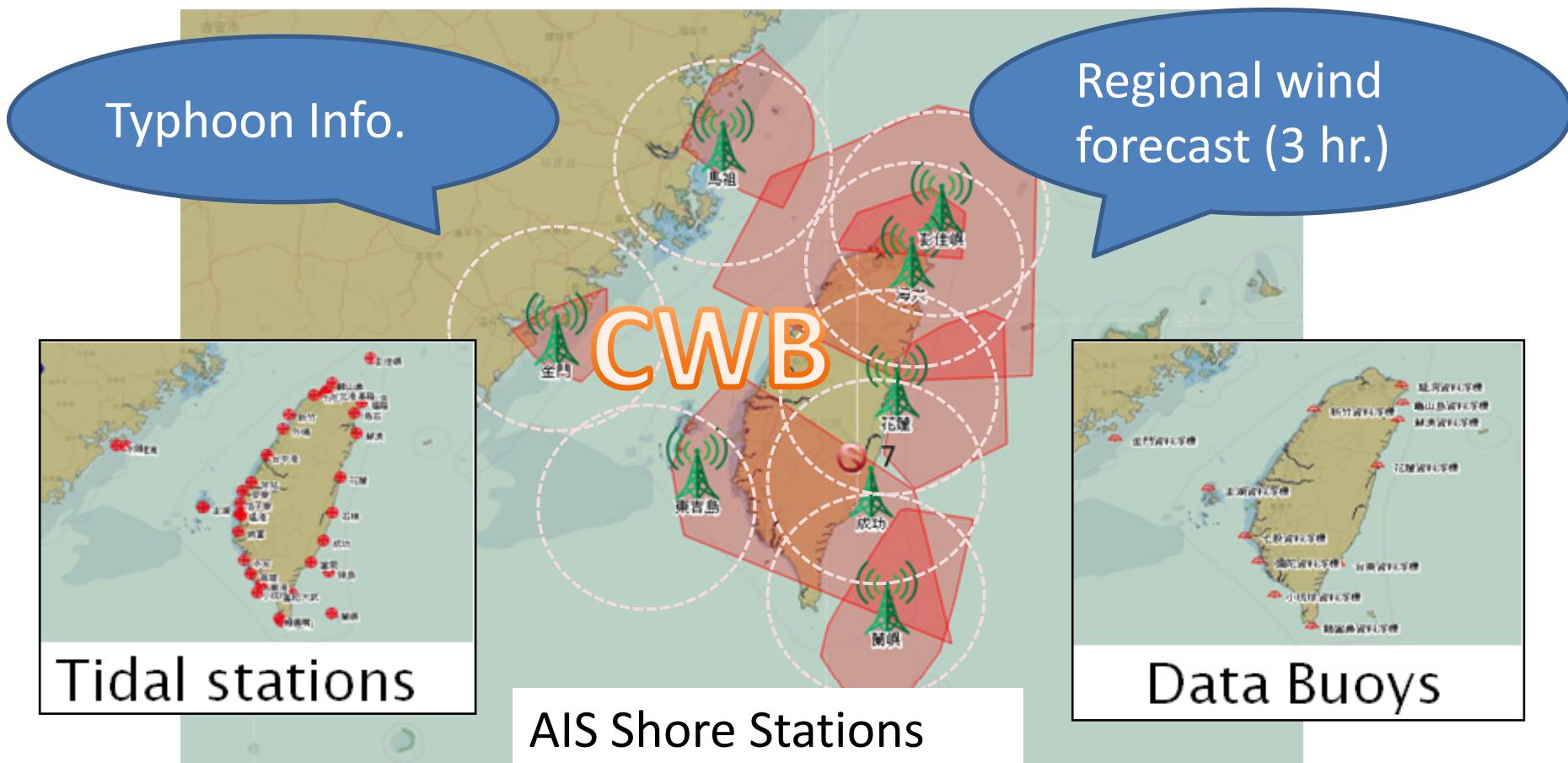
- To enhance navigation safety and efficiency, by promoting e-navigation, advanced maritime management and intelligent marine transportation system, with ENC as the basis.

# Background- Projects/Activities

| GMOs  | Projects/Activities   |
|---|---|
| MOTC (Ministry of Transportation & Comm.)<br>IHMT, Port Authorities<br>Maritime & Port Bureau | ENC, beacon-DGPS and AIS pilot projects (1997-2000, 2002-2003)<br>ENC Services and Data Protection (2005-2008)<br>Maritime ITS, Green Routing & Smart Piloting (2009-2012, 2013-2016)<br>VTS, LRIT, Coastal AIS network, DGNSS, MEOSAR(Cospas-Sarsat) |
| Fishery Administration /Overseas Fishery Development Council                                  | Fishing Vessel Monitoring System (since 2000, software & ENCs &boundaries, distant-water & coastal)<br>e-logbook/ catch reporting (Inmarsat-C, Argos, Iridium, FBB)<br>Applications of AIS in fisheries management (ship & shore)                     |
| Central Weather Bureau  | AIS (ASM)-based marine meteorological information service and weather observation reporting (since 2012, ship & shore two-way fully automated system)   |
| MOEA(Economic Affairs)<br>Bureau of Energy/ITRI   | Offshore Wind Farm (OWF) related navigation safety & fishery issues (since 2012, spatial planning, impact/risk assessment & management)   |
| MOI (Ministry of the Interior)  | ENC related technology and management services<br>Taiwan ENC Center ( <a href="https://ocean.moi.gov.tw/TENCC">https://ocean.moi.gov.tw/TENCC</a> )   |

# AIS weather Information Service

- 8 AIS shore stations (setup by NTOU for CWB)
  - Quality controlled sensor data + forecast & warning



# Start with International AIS ASM

| FI | Message Name                         | Data Source   |
|----|--------------------------------------|---|
| 31 | Meteorological and hydrographic data | Buoys(wind, wave and current..)                           |
| 26 | Environmental                        | Tidal(observation and prediction)                         |
| 21 | Weather observation report from ship | Shipboard weather instrument (automatic and manual entry) |



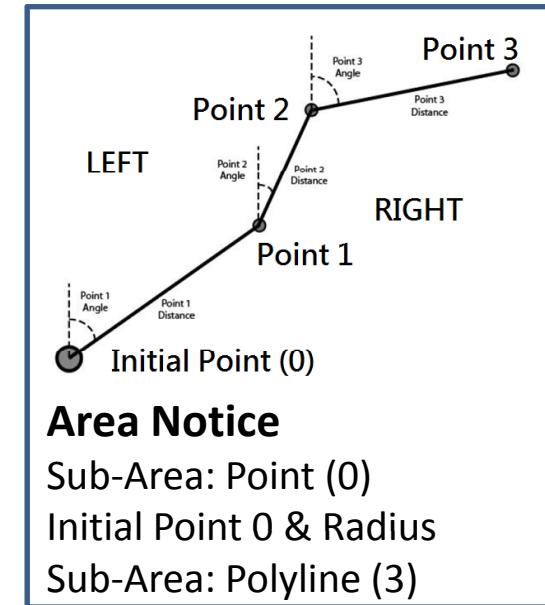
# Regional ASM- Wind Forecast

- A 2-slot message with FI=34 & DAC=416
  - Each message delivers 8 grid data of wind force vectors.
  - Feature extraction and broadcast scheduling are designed for ships to receive data of the whole area as soon as possible, then incrementally increase the data density.

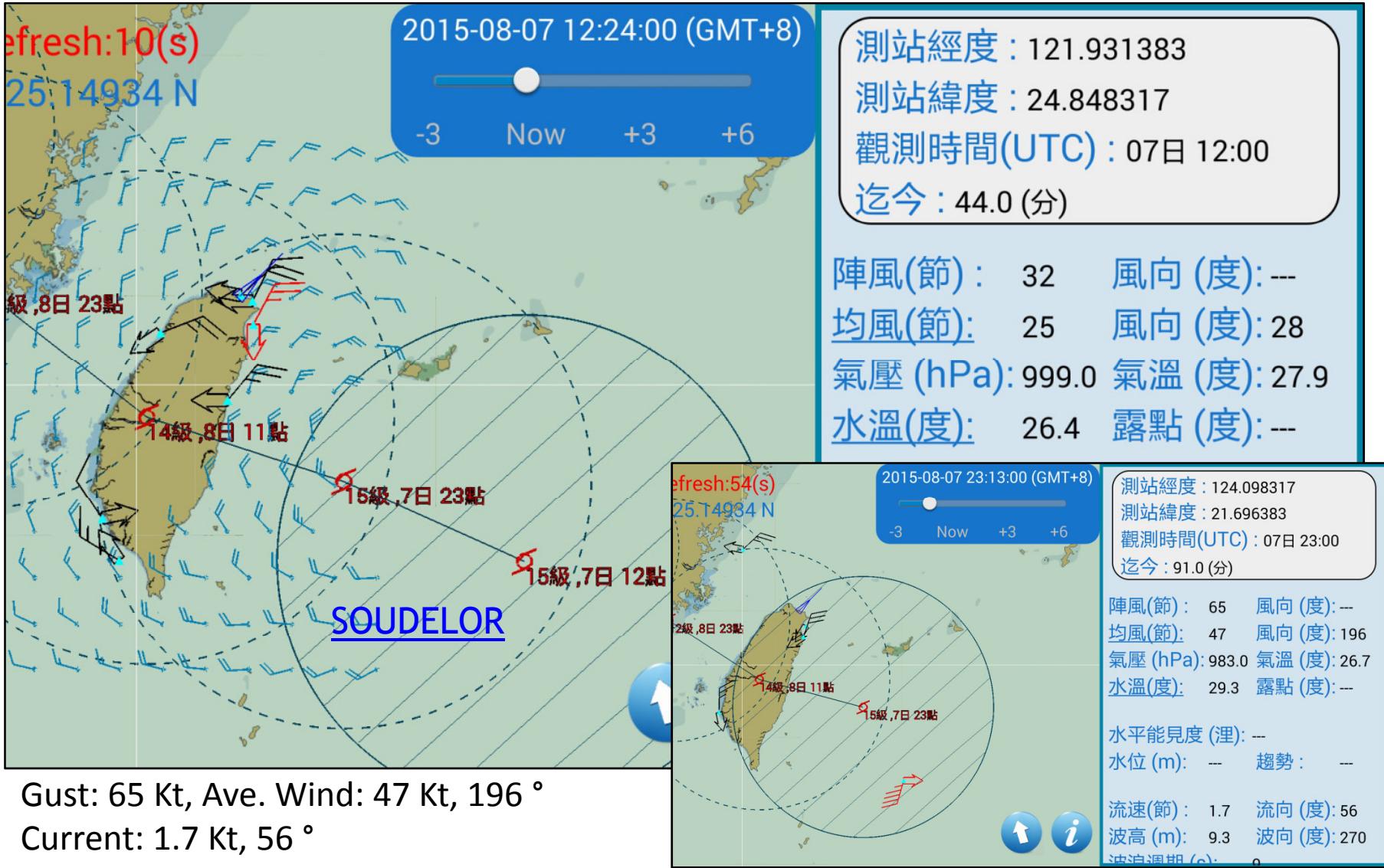


# AIS ASM for Typhoon Warning

- Designed according to CWB's warning sheet:
  - current position, radius and wind force of the typhoon;
  - forecast position, radius and wind force of the typhoon in 12h, 24h, 36h, and 48h.
- A two-slot regional ASM
  - FI 22 "Area Notice"
    - dynamic geospatial info.
  - FI 29 "Text Description"
    - the wind force values
  - When received by the AIS-Weather APP
  - link this pair to present typhoon warning

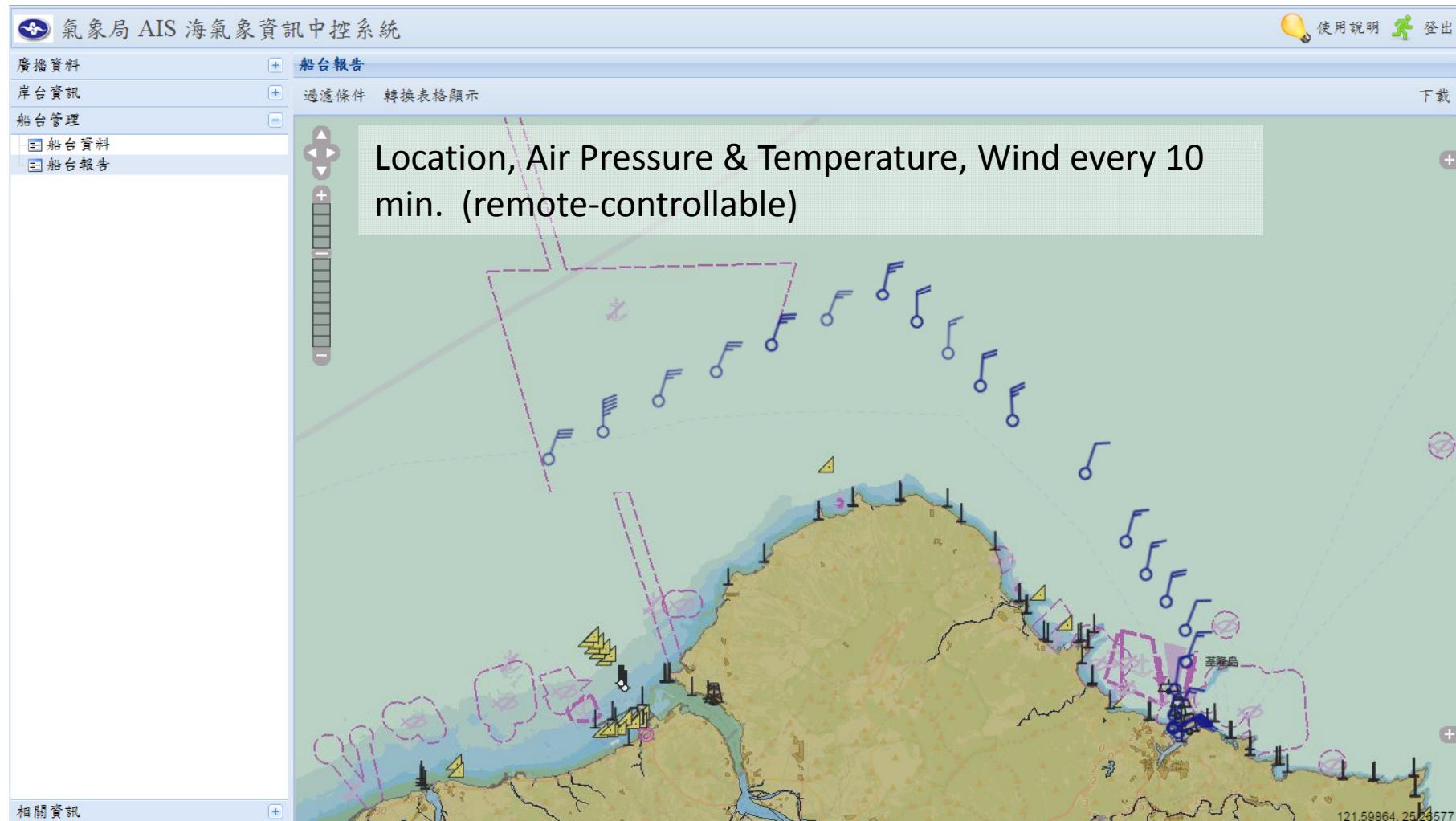


# Wind forecast /Typhoon/Data Buoys



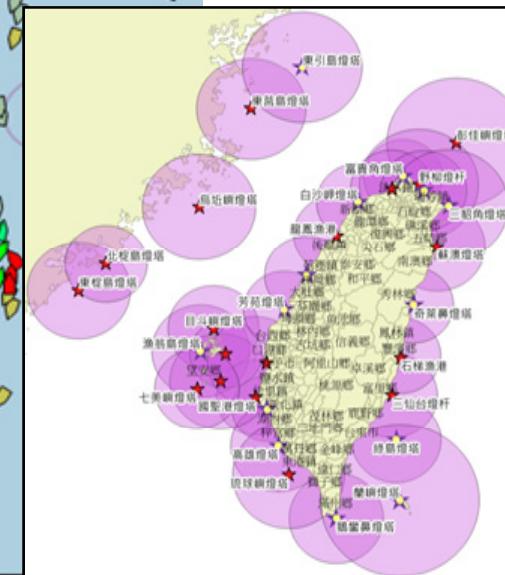
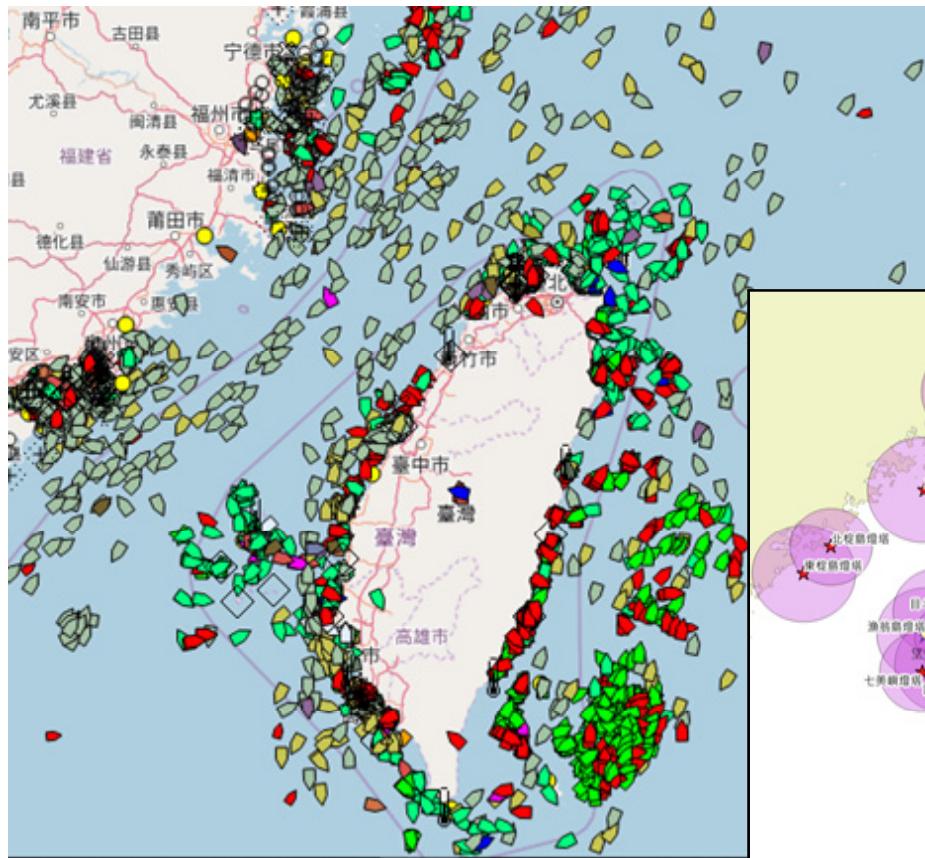
# Weather Observations from Ships

Participation: Round Island Tankers, Cross-Taiwan-Strait Passenger Ships  
Research vessels, Offshore Wind Farm Service Vessels



# Weather Info. Service & Shipboard Observation Reports

“AIS Weather Service” being extended with the coastal AIS network of 14 Base Station & 19 ATONs (MPB) – starting with safety messages (texts) & the collection of weather observation reports from ships

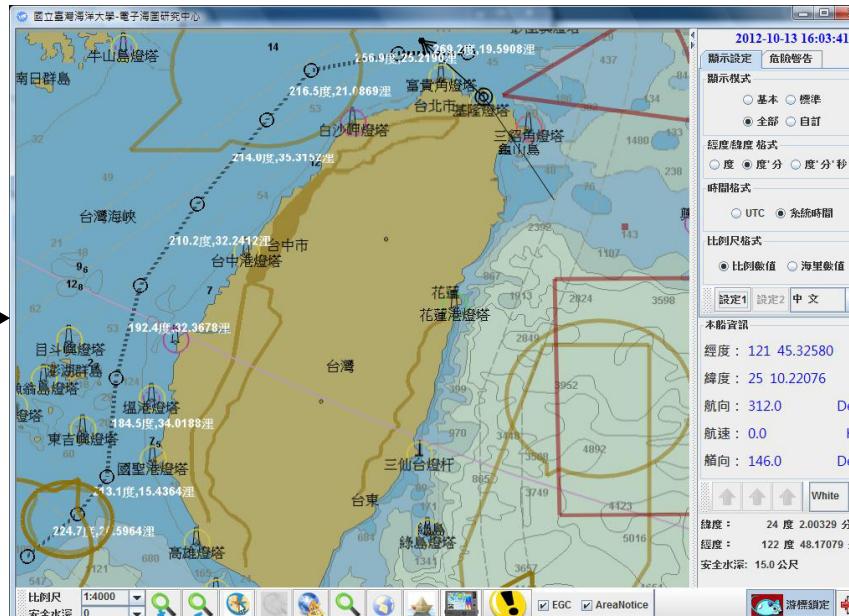
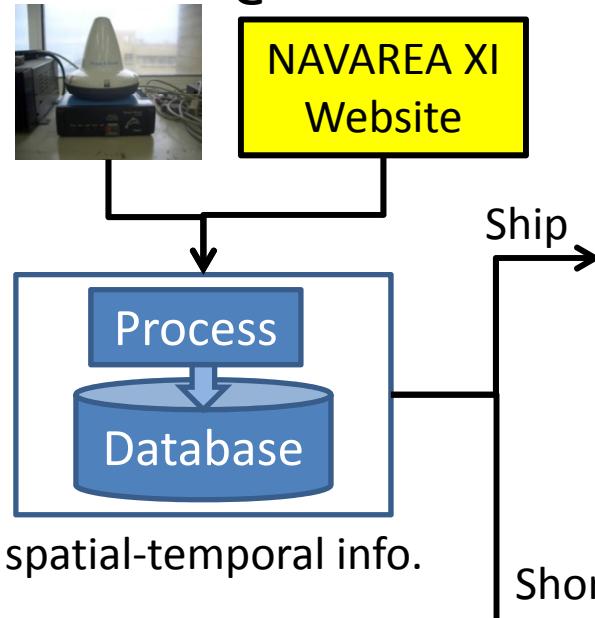


2018/8/23 Kaohsiung Port  
Strong wind (tropical depression)  
→ 7 groundings

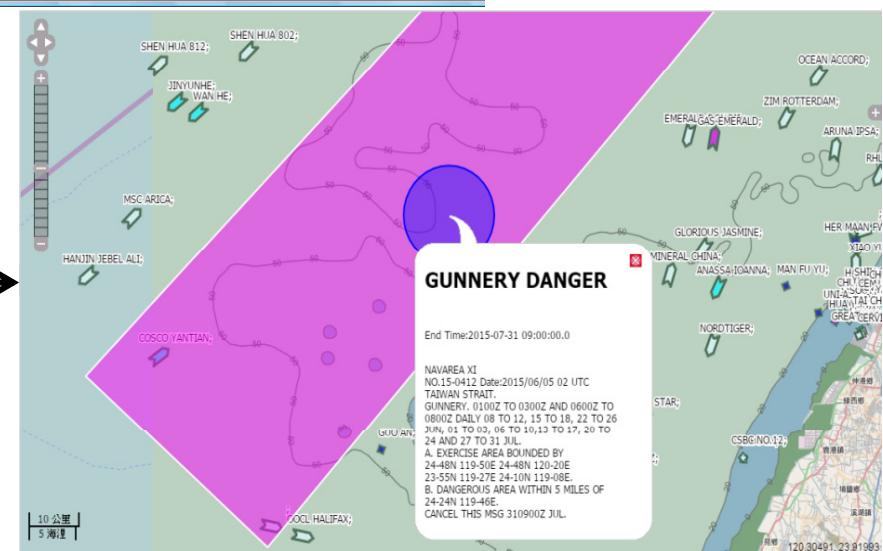
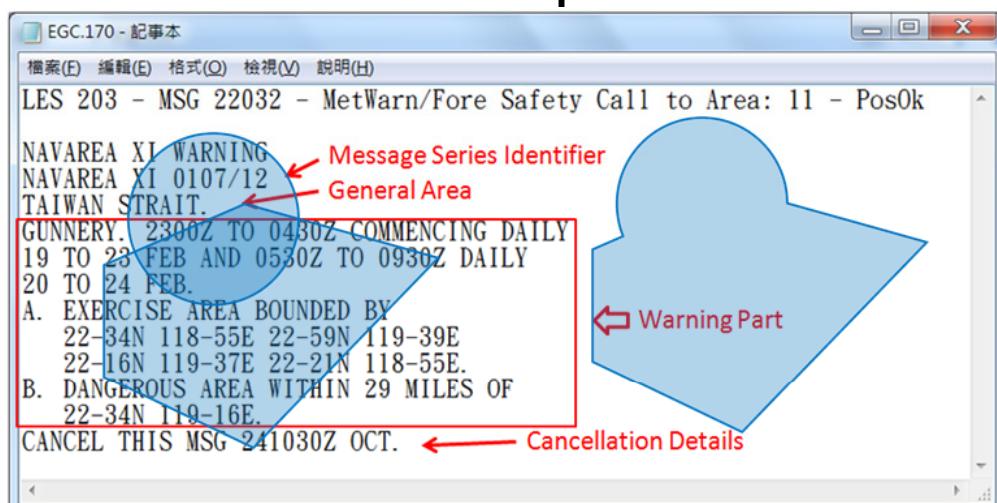


# NTOU MSI Integration R&D (2012-2016)

Inmarsat-C @NTOU



NTOU ECS  
integration with  
EGC SafetyNET  
&  
AIS Area Notice

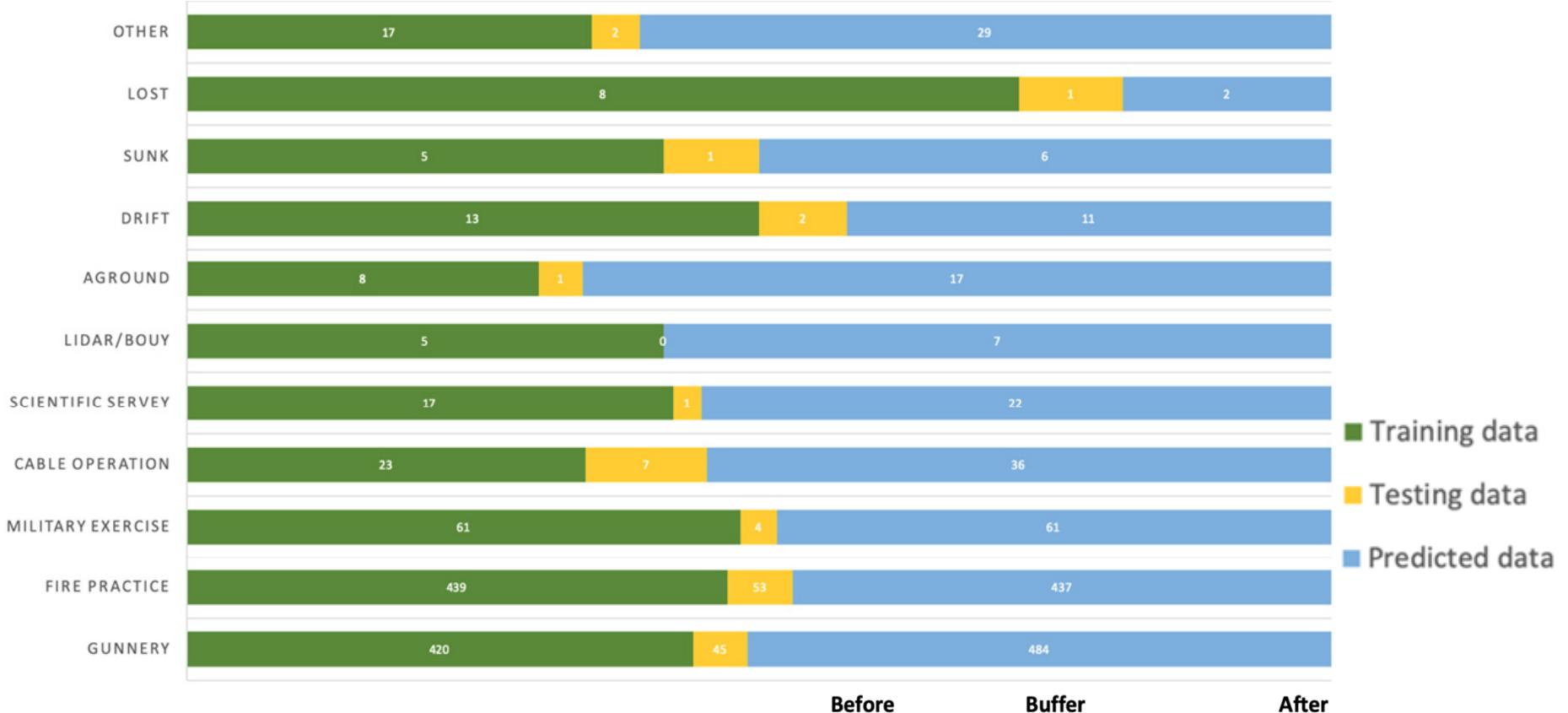


Web-based Integrated Ship Monitoring

# Preliminary Work on NAVTEX vs. S-124

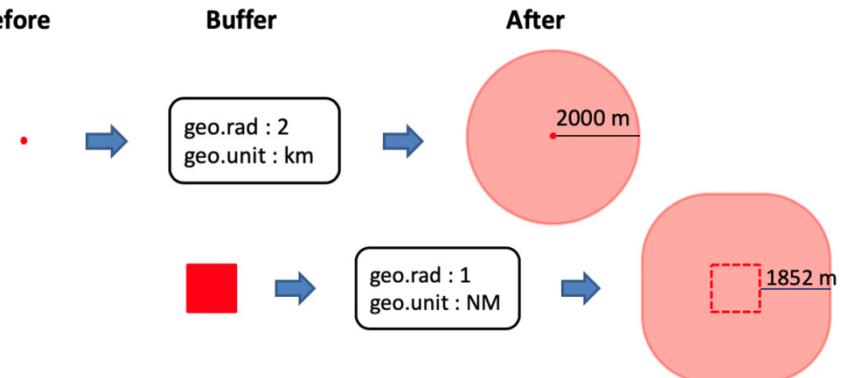
- Master thesis of Mr. Ying-Jui Chu, NTOU, Jul. 2019
  - “Design and Trial of S-124 Navigational Warning Data Service Provision”
  - Advisor: Shwu-Jing Chang ;
  - Data: Keelung Radio’s 2245 NAVTEX messages (2015~2019)
    - Design and experiment the two-way analytical conversion between traditional NAVTEX navigational warning messages and the draft S-124 data exchange standard.
    - The research analyzes the NAVTEX navigational warning message structure by natural language processing and deep learning method, and builds the XML file of the S-124 data standard & visualized GIS file through algorithms that automatically extract relevant text types.
    - Then experiments are performed to assess the accuracy of converting NAVTEX data to S-124 standard format data and the applicability of using S-124 standard data to generate NAVTEX navigational warning message

# NAVTEX Data: Subject & Geometry



|            | Training data | Testing data | Predicted data |
|------------|---------------|--------------|----------------|
| POINT      | 41            | 6            | 52             |
| LINESTRING | 13            | 3            | 22             |
| POLYGON    | 1202          | 120          | 1269           |

Buffering operation ? Units ?



# Verification: Accuracy & Fail Case

| Items                 | Accurate | Samples | Accuracy (%) |
|-----------------------|----------|---------|--------------|
| Geometry              | 99       | 103     | 96.11%       |
| fixedDateRange        | 97       | 103     | 94.17%       |
| Entire NAVTEX Message | 95       | 105     | 90.47%       |

Reception Errors  
 → Requires data cleaning

```
--- 518kHz NAVTEX MESSAGE ---
ZCZC PA61
160230UTC FEB 2019
TAIWAN NAVTEX N.W.NR0047/2019
FIRE PRACTICES
(1)2300UTC-2400UTC
    DAILY 17,24 FEB
    0000UTC-0830UTC
    2300UTC-2400UTC
    DAILY 18 TO 22,2*,26 FEB
* 0000UTC-0830U*C* DAILY
23,27 FEB
    AREA BOUNDED BY
    24-48N 11*90E
    2*-4*N 120-*0*
* 2*-55N 119-27E* *WRAQP N
*KU*AI*I
(2**3*0UTC-2400UTC
    *AI*Y*17,24 FEB
    0000UTC-0500UTC
    0600UTC-0900UTC
    2300UTC-2400UTC
*DAILY 18 TO 22,25,26 FEB
```

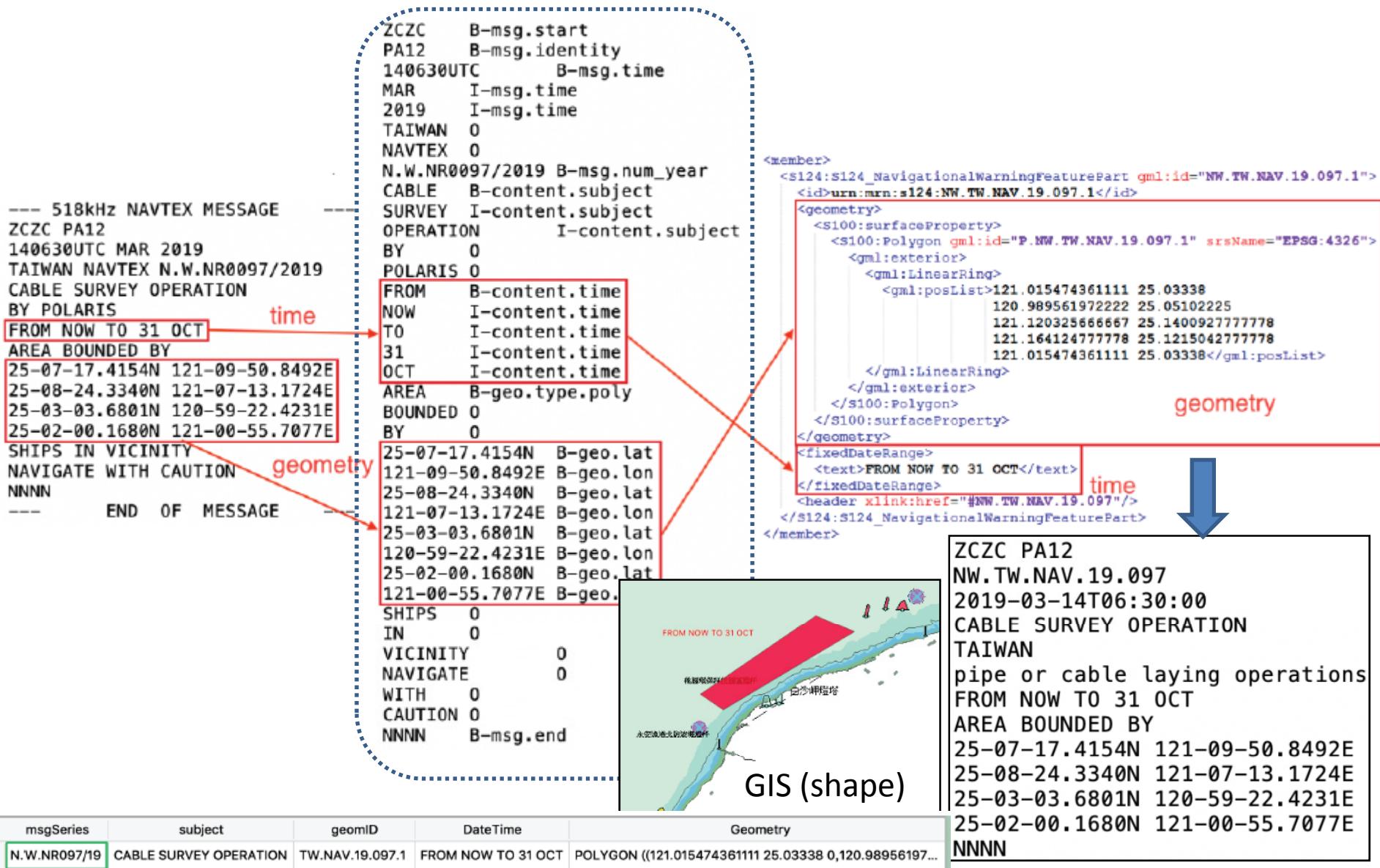
```
--- 518kHz NAVTEX MESSAGE ---
ZCZC PA22
240230UTC DEC 2016
TAIWAN NAVTEX N.W.NR0659/2016

RIP-RAP OPERATION BY
JOSEPH PLATEAU
DURATION:15 DEC 2016 TO 1 MAR
2017
OPERATION AREA:
13MILES NORTHWEST OF ANPING PORT
SHIPS IN VICINITY NAVIGATE WITH
CAUTION
NNNN
--- END OF MESSAGE ---
```

Geometry ?

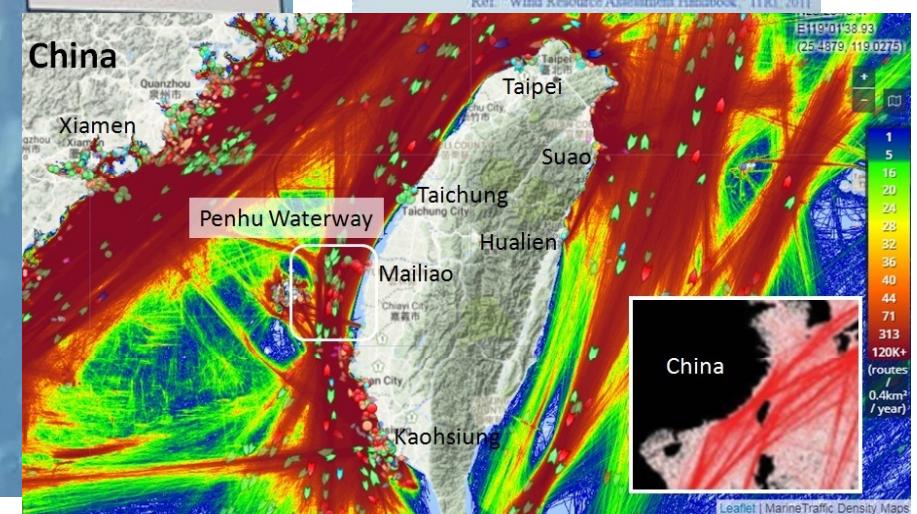
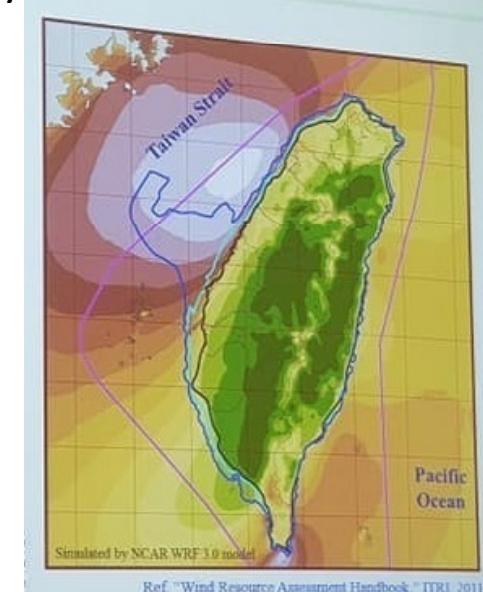
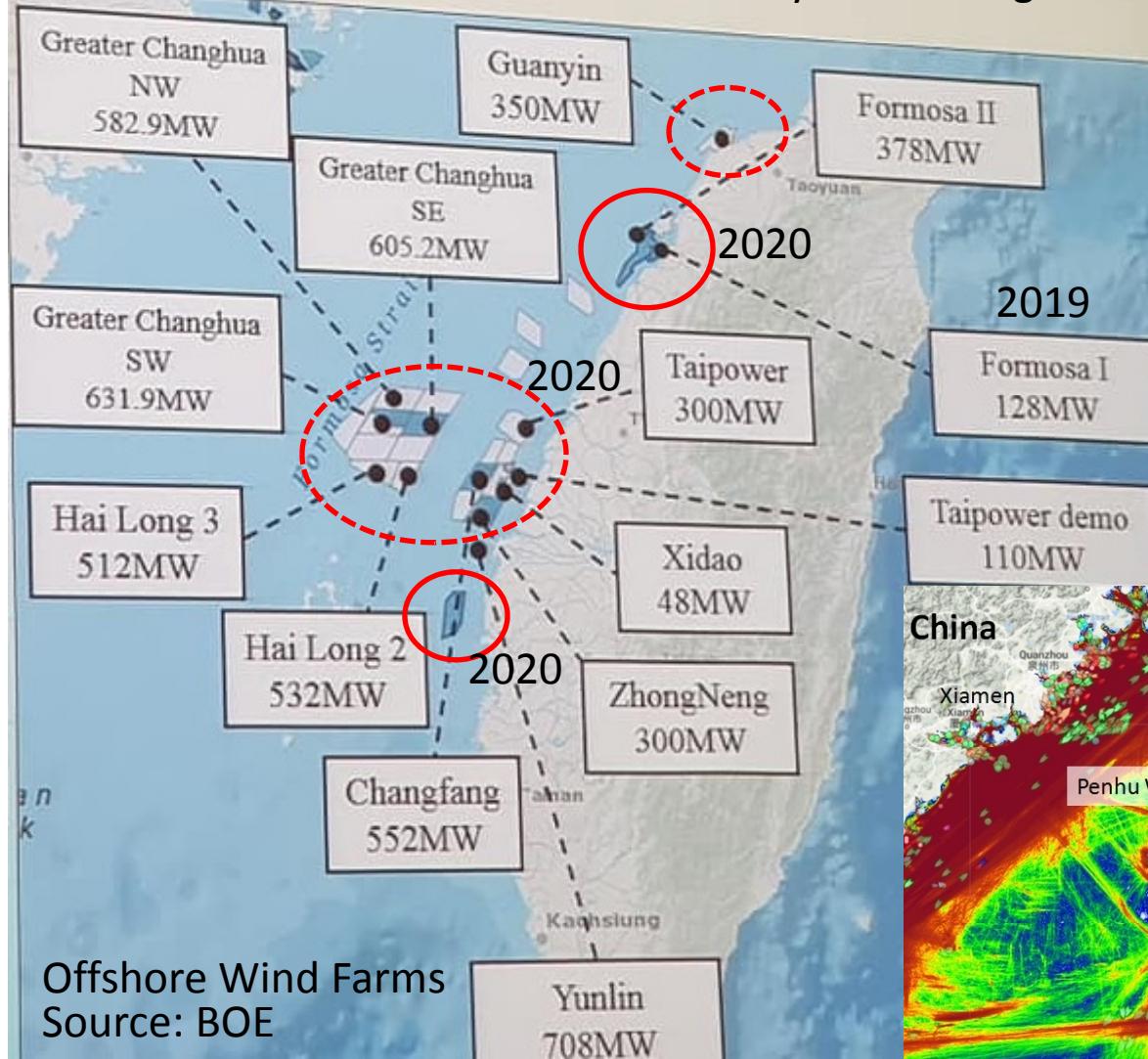
```
ZCZC     B-msg.start
PA22     B-msg.identity
240230UTC      B-msg.time
DEC      I-msg.time
2016    I-msg.time
TAIWAN   0
NAVTEX   0
N.W.NR0659/2016 B-msg.num_year
RIP-RAP  B-content.subject
OPERATION    I-content.subject
BY       0
JOSEPH   0
PLATEAU   0
DURATION   B-content.time
15        I-content.time
DEC       I-content.time
2016     I-content.time
TO        I-content.time
1         I-content.time
MAR      I-content.time
2017     I-content.time
OPERATION   0
AREA      B-geo.type.poly
13MILES   0
NORTHWEST 0
OF        0
ANPING    0
PORT      0
SHIPS     0
IN        0
VICINITY   0
NAVIGATE   0
WITH      0
CAUTION   0
NNNN     B-msg.end
```

# NAVTEX → S-124/XML/SHP → NAVTEX ?



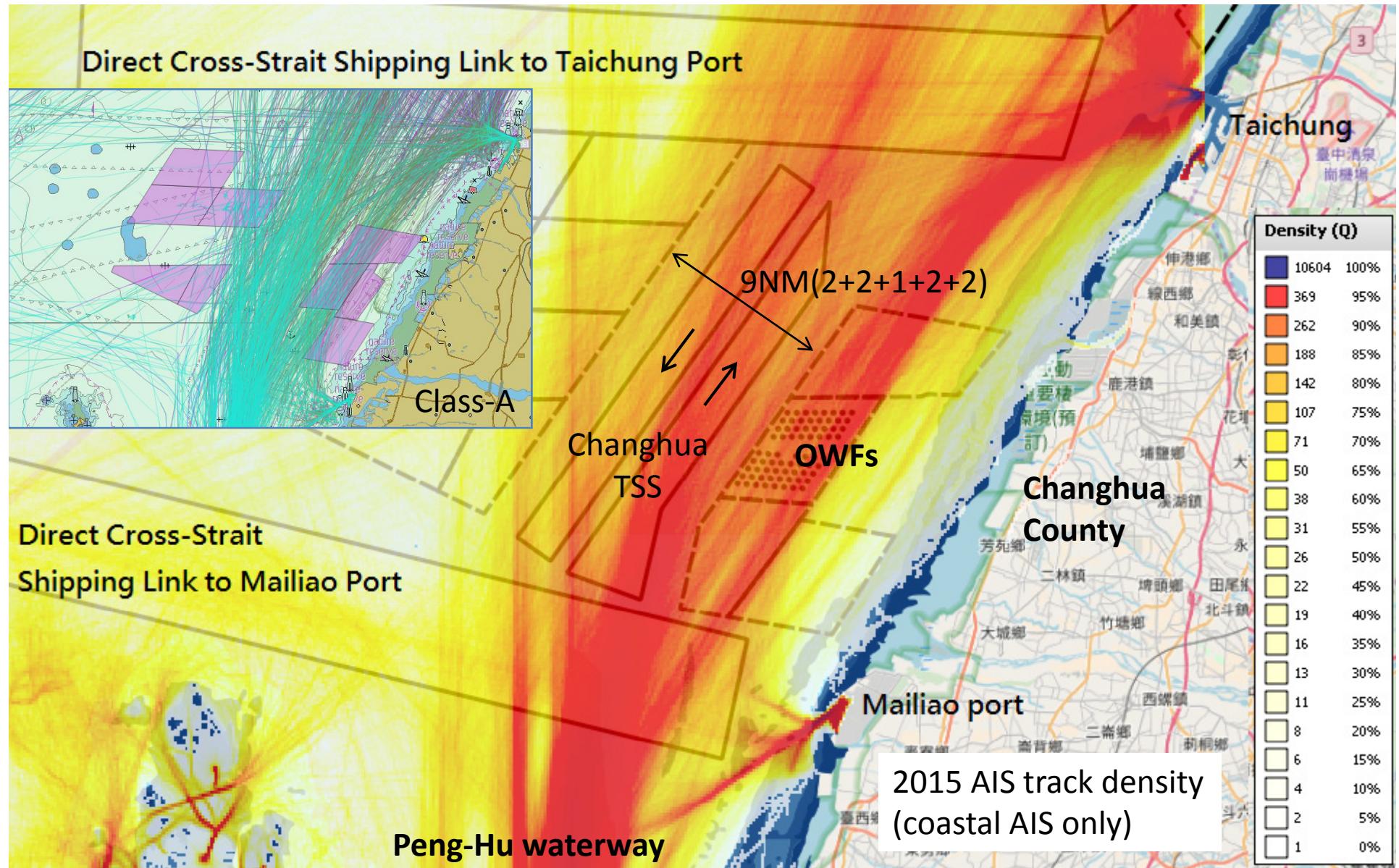
# Wind Power & Traffic in the Taiwan Strait

Northeast monsoon from Oct. to Mar. may make navigation very difficult for some vessels.

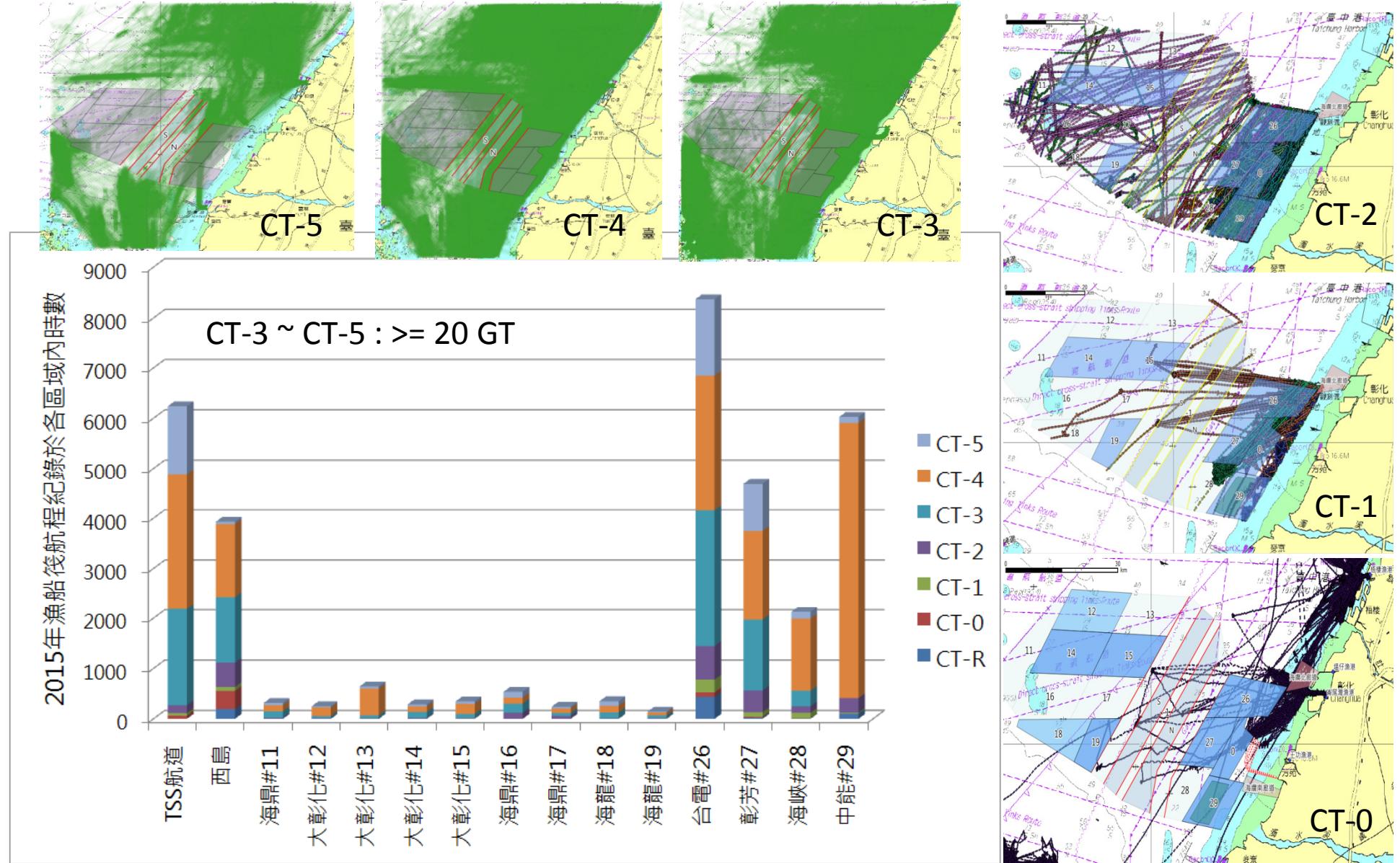


# Require Major Reorganization of the Traffic

Target : offshore wind power 520MW by 2020, 3GW by 2025

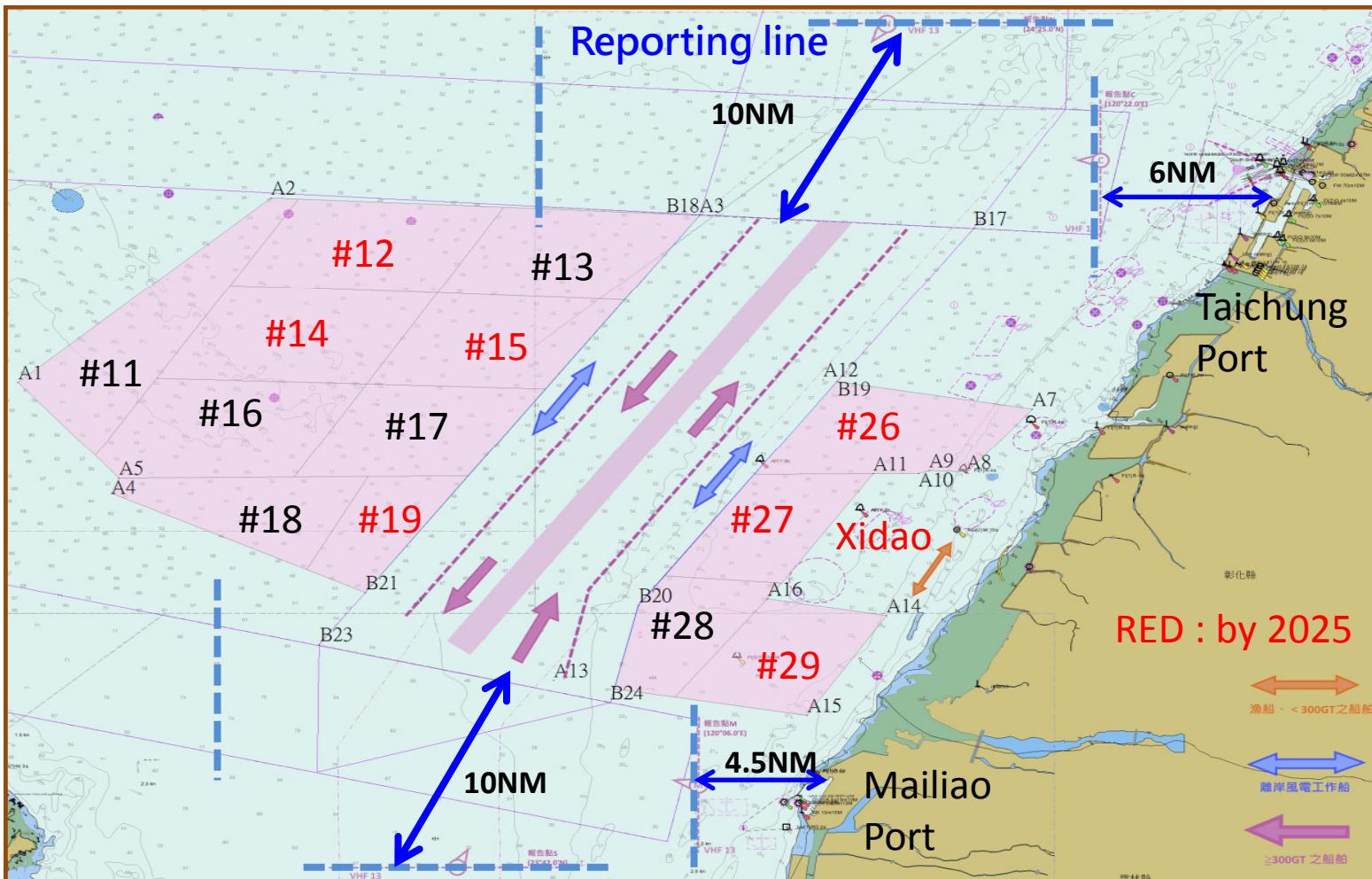


# Fishing Activities (hr/yr) - VDR



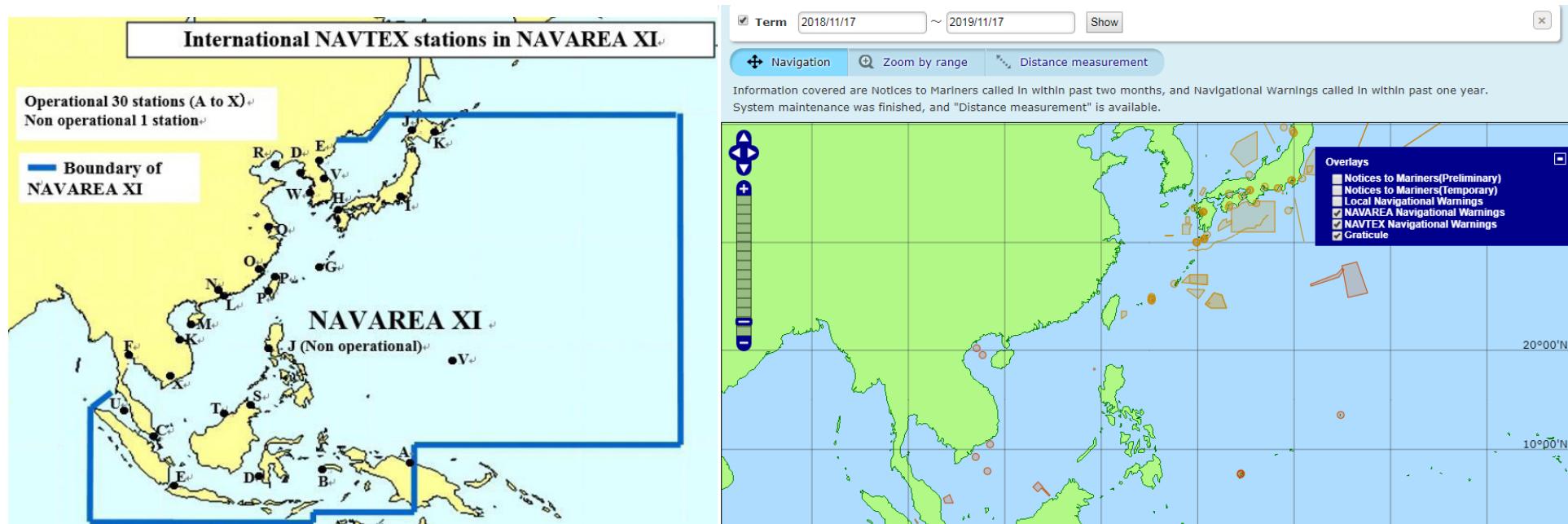
# Traffic Management ?

Shipping traffic (cargo/tanker), Fishing vessels, OWF construction/service vessels  
Port VTS (Taichung, Mailiao), VTS (Marine Coordination) of each OWFs  
Changhua TSS (22NM long) and its VTS to be implemented



# Missing Links in the MSI Service

- Taiwan is located in NAVAREA XI
  - MSI Self Assessment NAVAREA XI @ WWNWS11 : 30 NAVTEX stations indicated in the figure, but only 28 mentioned in the text.
  - WiKi list marks those 2 stations(P) in Taiwan as not active.
  - Only one MSI found in NAVAREA XI in the year 2019  
[https://www1.kaiho.mlit.go.jp/TUHO/keiho/navarea11\\_en.html](https://www1.kaiho.mlit.go.jp/TUHO/keiho/navarea11_en.html)



# The only Taiwan MSI found in NAVAREA XI (2018/11~2019/11)

- Different from the NAVTEX (the one closest in time and space) broadcast by Keelung Radio (Taiwan)
- Much more : Gunnery, OWF construction/survey & submarine cable....

ZCZC PA77  
160230UTC NOV 2019  
TAIWAN NAVTEX N.W.NR0640/2019  
FIRE PRACTICES  
2300UTC-2400UTC 17 NOV  
0000UTC-0900UTC 2300UTC-2400UTC  
DAILY 18 TO 21 NOV  
0000UTC-0900UTC 22 NOV  
AREA BOUNDED BY  
(1)22-34N 118-55E  
22-59N 119-39E  
22-16N 119-37E  
22-21N 118-55E  
(2)23-43N 122-05E  
23-43N 122-38E  
23-20N 122-38E  
23-00N 122-05E  
NNNN

NAVTEX (Taiwan)  
By Keelung Radio

[Print] X

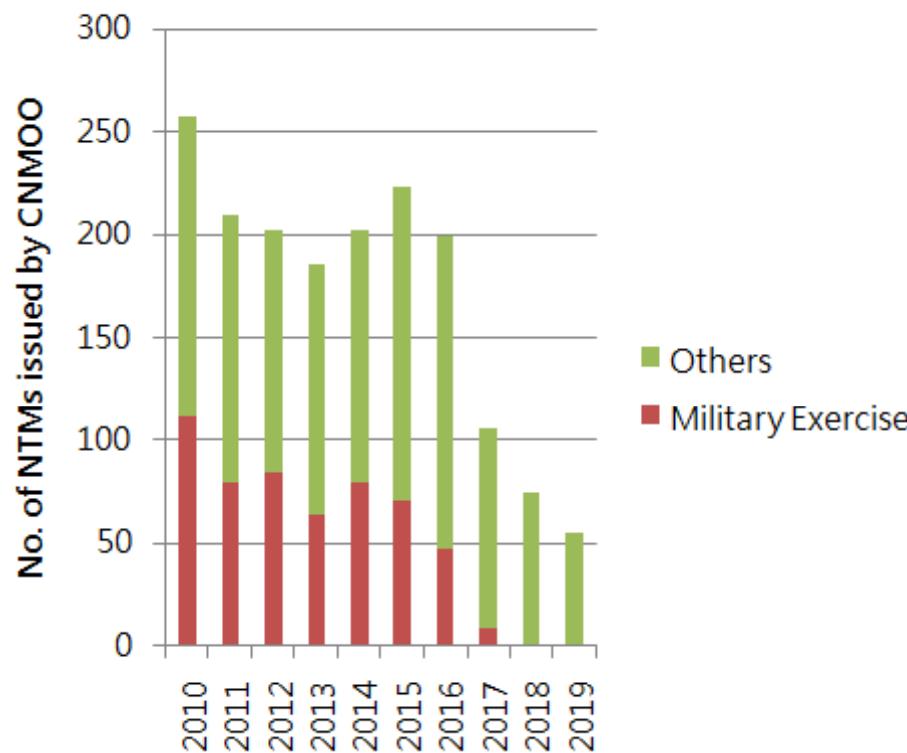
[NAVTEX Navigational Warnings]  
TAIWAN  
NO.19-2166 Date:2019/10/27 05 UTC  
TAIWAN, EASTWARD.  
GUNNERY. 2300Z TO 0900Z COMMENCING DAILY  
31 OCT, 03 TO 07, 10, 11, 17 TO 21 AND  
24 TO 28 NOV. AREA BOUNDED BY  
23-43N 122-05E 23-43N 122-38E  
23-20N 122-38E 23-00N 122-05E.

Accessed @2019/11/17

# Missing Links in the MSI Service & The Risk

## (Observed Situation Change in Taiwan)

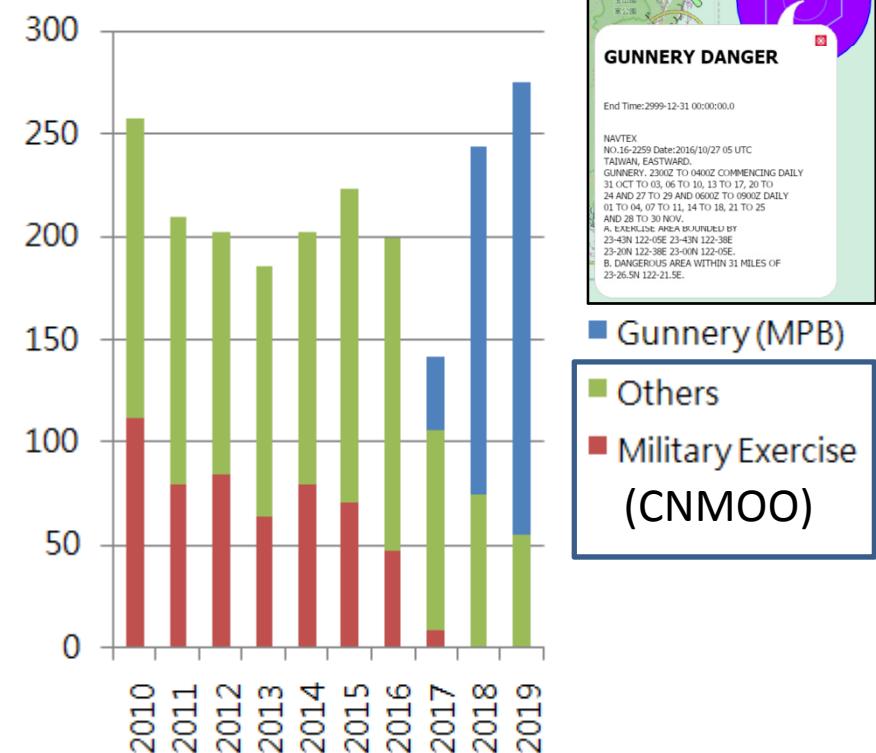
- CNMOO's NTMs
  - paper chart corrections only
  - no more Nav. Warnings
- MPB's NTMs (national coordinator?)
  - posted on website, searchable
  - Chinese only, PDF, no standard format



### Construction of 1<sup>st</sup> OWF

(started in May, completed in Nov. )

1. Nav. Warnings on MPB's website
2. CNMOO's NTM: Cables only
3. NAVTEX (Taiwan): none
4. SafetyNET: none



# How do we manage the change & risk ?

- How to implement this Changhua TSS (mandatory) ?
- How to disseminate MSI, especially during the simultaneous construction phases of the OWFs ?
  - NtMs can take very long time (months) to reach mariners from local source to other chart producers, and may be interpreted wrongly.
  - ENC weekly updating is a more efficient way
  - In WWNWS, only NAVTEX is accessible to Taiwan
    - There are missing links, domestic and international
- NTOU is working hard for the solutions, and the work of NIPWG/IHO plays a very important role.