Oceanographic Calibration Facilities from RMIC/AP

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Dec.15, 2021

Oceanographic Calibration Facilities from RMIC/AP

中华人民共和国
法定计量检定机构
计量授权证书

The People's Republic of China
Certificate of Metrological Authorization
to the Legal Metrological Verification Institution

（国）法计（2021）00008号

国家海洋计量站：

根据《中华人民共和国计量法》、《中华人民共和国计量法实施细则》和《法定计量检定机构监督管理办法》、《计量授权管理办法》的有关规定，在核定项目范围内，你单位经考核评定合格，现授权准予进行计量检定、校准和检测工作，特发此证（授权区域和项目见附件）。

This is to certify that your organization has been examined and deemed to be qualified within the authorized items in accordance with the provisions of the Law on Metrology of the People's Republic of China, the Rules for the Implementation of the Law on Metrology of the People's Republic of China, and the Measures on Supervision and Administration of the Legal Metrological Verification Institution, as well as Administrative Measures on Metrological Authorization. Your organization is hereby authorized as a legal metrological verification institution to carry out metrological verification, calibration and test (for authorized regions and items shown in the annex).

批准人签
Approved by:

发证机关：国家市场监督管理总局
Issued by:
发证日期：2021年06月05日
Issued on:
有效期至：2026年06月05日
Valid to:

ilac-MRA CNAS

China National Accreditation Service for Conformity Assessment

LABORATORY ACCREDITATION CERTIFICATE

(Registration No. CNAS L3365)

National Center of Ocean Standard and Metrology

No.219, Jieyuan West Road, Nankai District, Tianjin, China

is accredited in accordance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories(CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence to undertake the service described in the schedule attached to this certificate.

The scope of accreditation is detailed in the attached schedule bearing the same registration number as above. The schedule form an integral part of this certificate.

Date of Issue：2017-05-02
Date of Expiry：2023-05-01
Date of Initial Accreditation：2008-02-22

Signed on behalf of China National Accreditation Service for Conformity Assessment

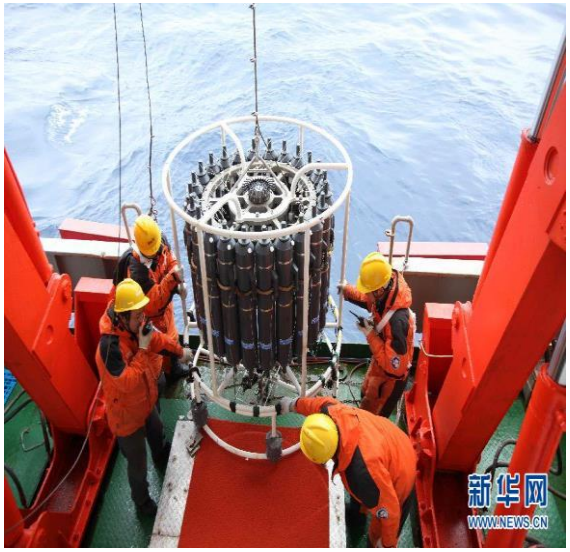
China National Accreditation Service for Conformity Assessment(CNAS) is authorized by Certification and Accreditation Administration of the People's Republic of China (CNCA) to operate the national accreditation schemes for conformity assessment. CNAS is a signatory of the International Laboratory Accreditation Cooperation Mutual Recognition Arrangement (ILAC MRA) and the Asia Pacific Laboratory Accreditation Cooperation Mutual Recognition Arrangement (APLAC MRA).
The validity of the certificate can be checked on CNAS website at http://www.cnas.org.cn/english/findanaccreditedbody/index.shtml

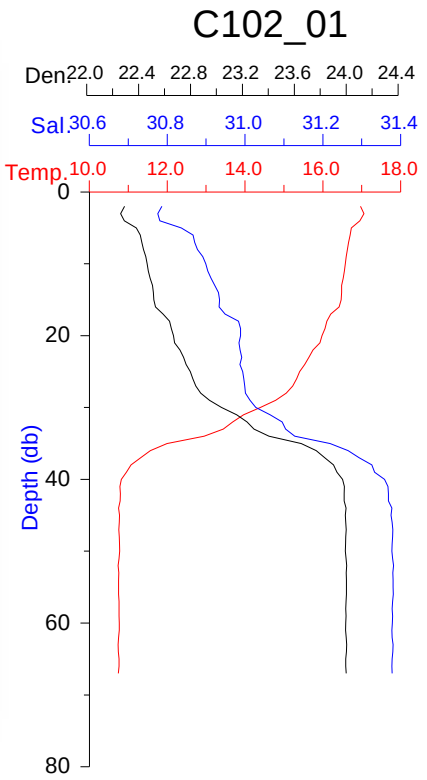
Oceanographic Calibration Facilities from RMIC/AP

- **1. Conductivity, Temperature and Depth (CTD) instruments & Bio-chemical sensors**
- 2. Reference Material (Standard Seawater, seawater-based pH, PO_4^{3-}-P)
- 3. Wave Buoy
- 4. Tide Gauge
- 5. Meteorological Instruments
- 6. Environmental Test
- 7. Performance evaluation of domestic R&D marine instruments

1. Conductivity, Temperature and Depth (CTD) instruments & Bio-chemical sensors

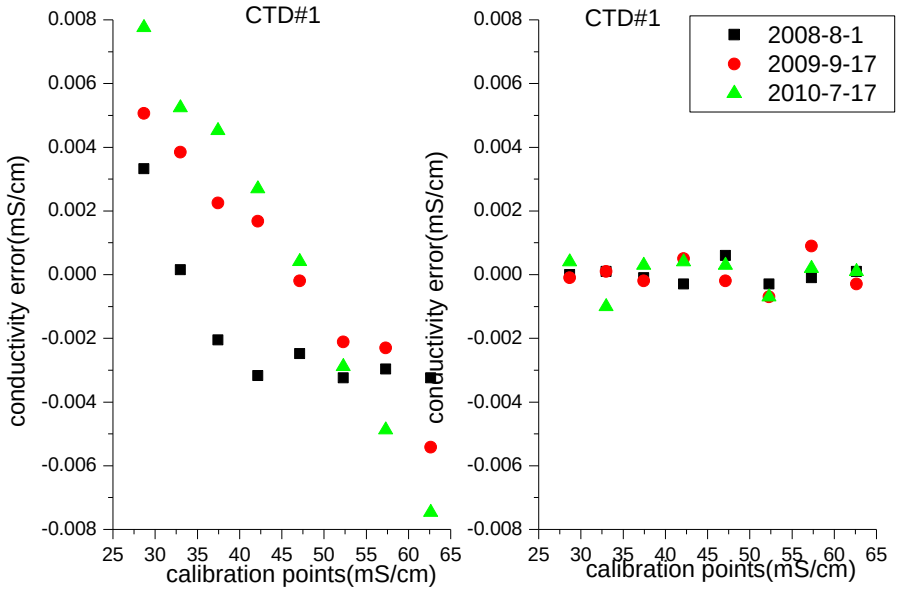
- CTD instruments are the prime tool used by scientists for marine measurements.





1. Conductivity, Temperature and Depth (CTD) instruments & Bio-chemical sensors

Temperature errors before & after calibrated



Conductivity errors before & after calibrated

1. Conductivity, Temperature and Depth (CTD) instruments & Bio-chemical sensors

社会公用计量标准证书

Certificate of Measurement Standard for Public Service

[1988] 国 社量标 海洋 证字 第 021 号

根据《中华人民共和国计量法》第六条的规定，批准你单位建立的计量标准作为社会公用计量标准。

This is to certify that the measurement standard set up in your unit is authorized to be used for public service in accordance with article 6 of the Law on Metrology of the People's Republic of China.

建标单位 国家海洋计量站

Possessor of the measurement standard

计量标准名称 海洋测温仪器检定装置 代码 57110006

Name of measurement standard Code

测量范围 （-2~40）℃

Measuring range

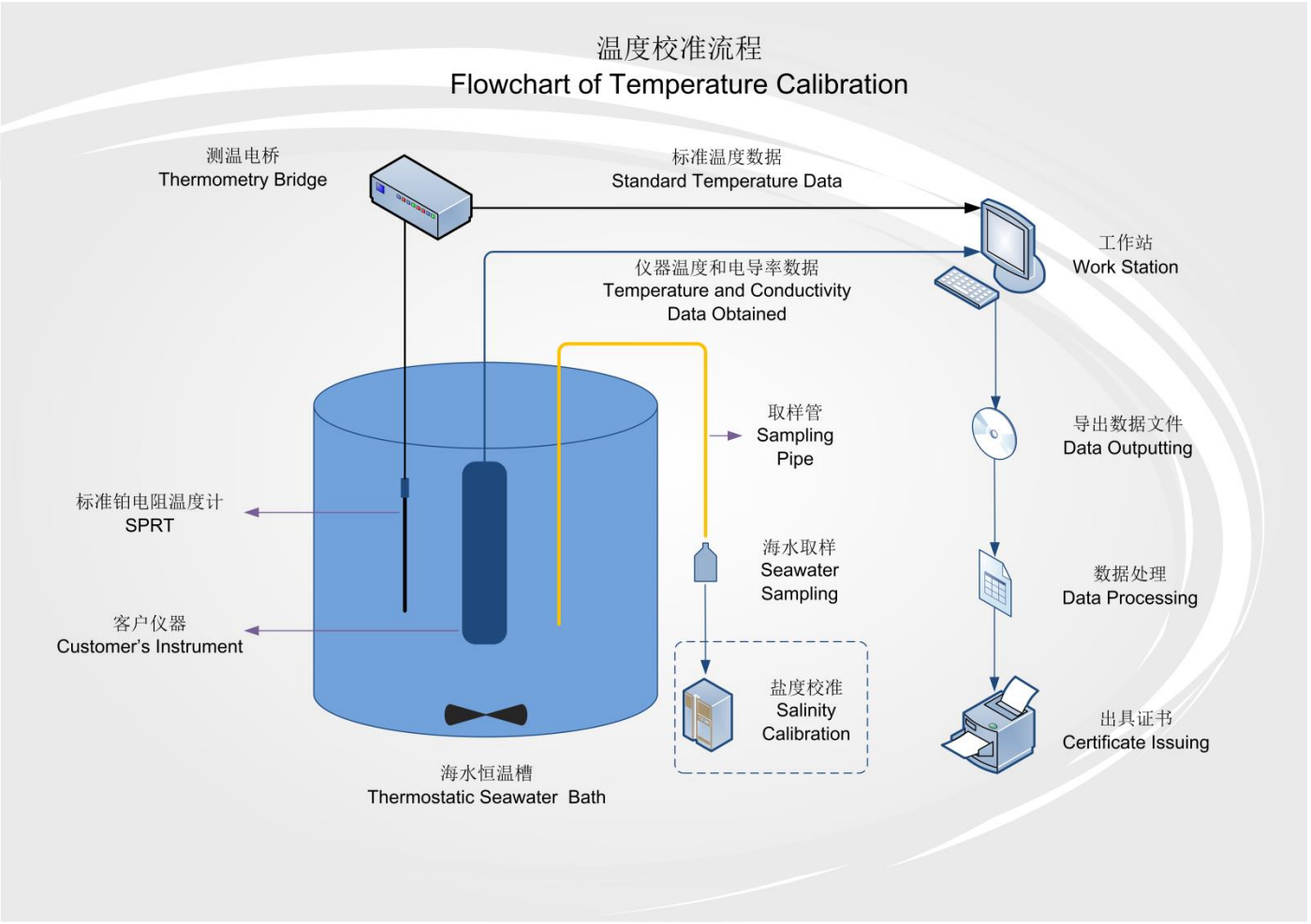
不确定度或准确度等级 或最大允许误差 MPE：±0.003℃

Uncertainty/accuracy class/ maximum permissible error

Name of Measurement Standard	Measuring Range	Uncertainty/ Maximum Permissible Error
Temperature	(-2~40)℃	±0.0015℃
Salinity	2~42 PSU	±0.001 PSU
Pressure (depth)	(0.05~100) MPa	±0.005%

- JJG763-2019 *CTD Measuring Instruments*
- JJF1059 *Evaluation and Expression of Uncertainty of Measurement*

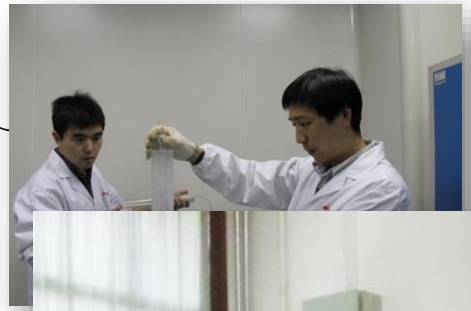
1. Conductivity, Temperature and Depth (CTD) instruments & Bio-chemical sensors



1. Conductivity, Temperature and Depth (CTD) instruments & Bio-chemical sensors

- Measuring instruments for **temperature** calibration

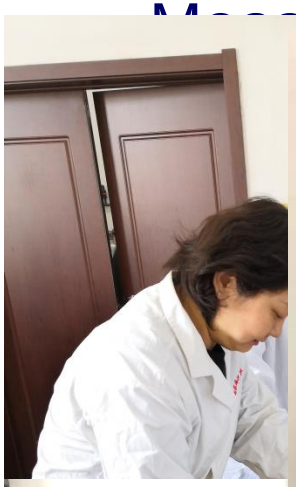
- 1) standard platinum resistance thermometer(SPRT)
  - Measurement range:（-38.8344～156.5985）℃



- 2) Water Triple Point
- 3) The Gallium Melt Point
- 4) AC Bridge
- 5) Comparison Seawater Bath

1. Conductivity, Temperature and Depth (CTD) instruments & Bio-chemical sensors

- Measuring instruments
- ratio
- istanc
- -38.83
- nt
- r Bath



1. Conductivity, Temperature and Depth (CTD) instruments & Bio-chemical sensors

- Measuring instruments for **Conductivity** calibration
- 1) Chinese Primary SSW
  - Salinity: S=35
  - Uncertainty: *U*=0.001 (*k*=2)
- 2) Laboratory Salinometer
  - PSU：2～40
  - Resolution：0.0002

Inter-Comparison of seawater salinity Measurements

- In 2014, we organized the ***JCOMM Inter-comparison Pilot project for seawater salinity Measurements .***
- 25 labs from 17 countries participated in.
- The final report has been published on JCOMM website.

World Meteorological Organization

United Nations Educational, Scientific and Cultural Organization

Intergovernmental Oceanographic Commission

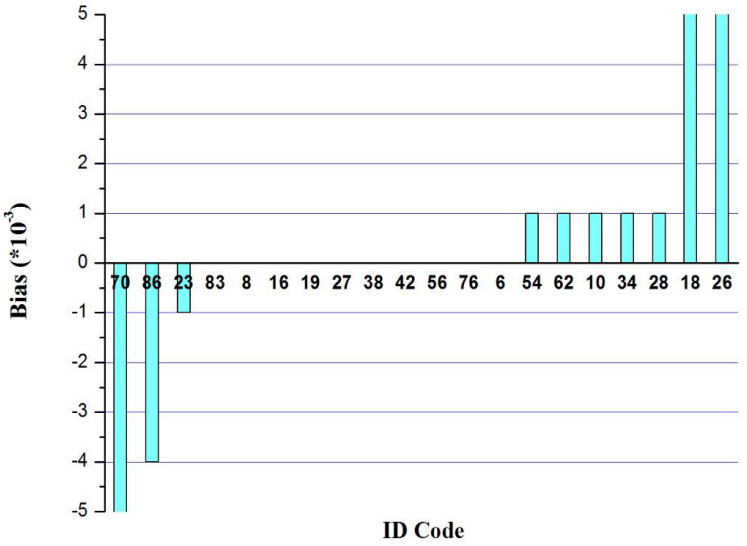
WORLD METEOROLOGICAL ORGANIZATION

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION (OF UNESCO)

FINAL REPORT, JCOMM PILOT INTERCOMPARISON PROJECT FOR SEAWATER SALINITY MEASUREMENTS

2015

JCOMM Technical Report No. 84

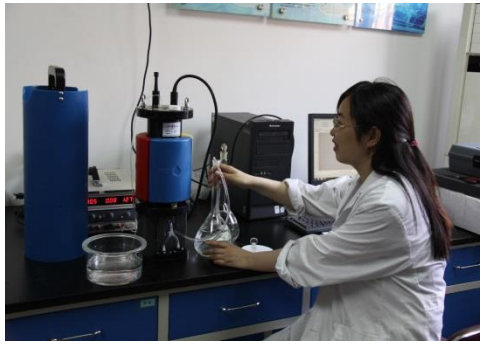


1. Conductivity, Temperature and Depth (CTD) instruments & Bio-chemical sensors

- Measuring instruments for **Pressure (Depth)** calibration
- 1) Piston pressure gauge
  - （0.05～10）MPa
  - MPE：±0.005%

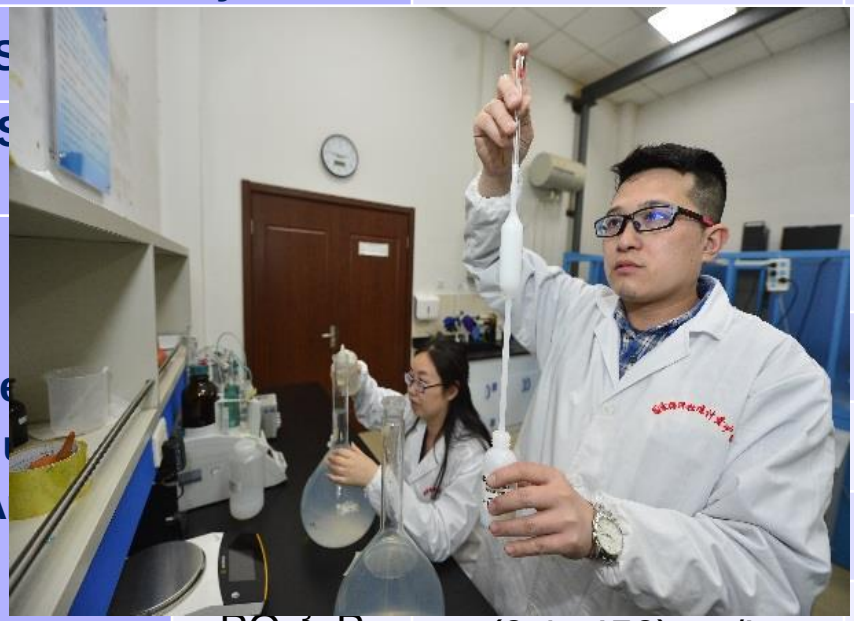
1. Conductivity, Temperature and Depth (CTD) instruments & Bio-chemical sensors

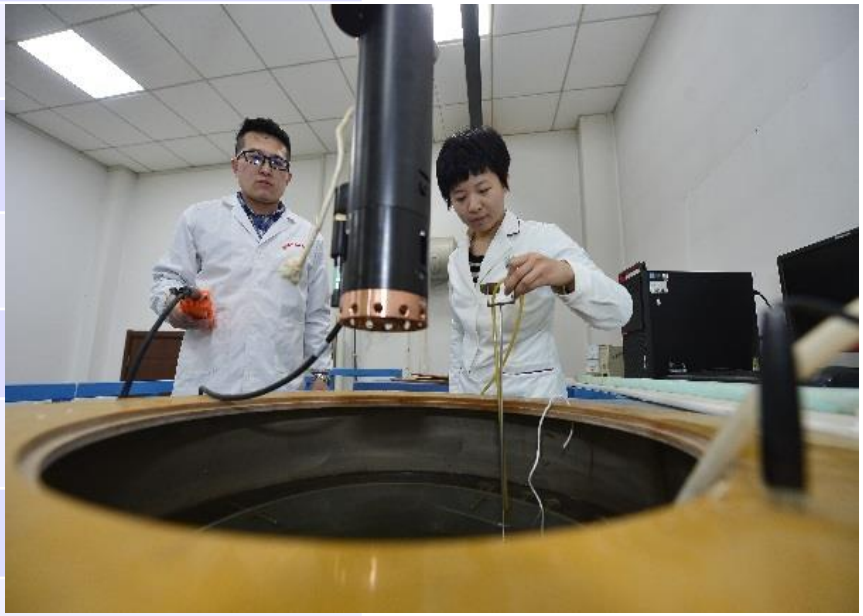
Calibration Device		Measuring Range	MPE/Uncertainty
Seawater DO Analyzer		（0~20）mg/L	±0.5mg/L
Seawater pH-meter		（0~14）	U= 0.01, k= 2
Seawater Turbidity Analyzer		（0~1000）NTU	U_{rel}= 2.6%, k= 2
Seawater Nutrients Analyzer	NO_2^--N	(0.1~200) μg/L	U_{rel}= 1.7%, k= 2
	NO_3^--N	(0.1~500) μg/L	U_{rel}= 2.1%, k= 2
	NH_4^+-N	(0.1~600) μg/L	U_{rel}= 2.2%, k= 2
	SiO_3^--Si	(0.1~400) μg/L	U_{rel}= 2.3%, k= 2
	PO_4^{3-}-P	(0.1~450) μg/L	U_{rel}= 2.2%, k= 2



1. Conductivity, Temperature and Depth (CTD) instruments & Bio-chemical sensors

Calibration Device	Measuring Range	MPE/Uncertainty
Seawater DO Analyzer	（0~20）mg/L	±0.5mg/L
S		
S		
Se Nu A		
	PO_4^{3-}-P	(0.1~450) μg/L	U_{rel}= 2.2%, k= 2





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2. Reference Material (Standard Seawater)

◆ Classification

Reference Materials

- S=35,P-series
- S=5,A-series
- S=20,B-series
- S=30,C-series
- S=35,D-series
- S=40,E-series

2. Reference Material (Standard Seawater)

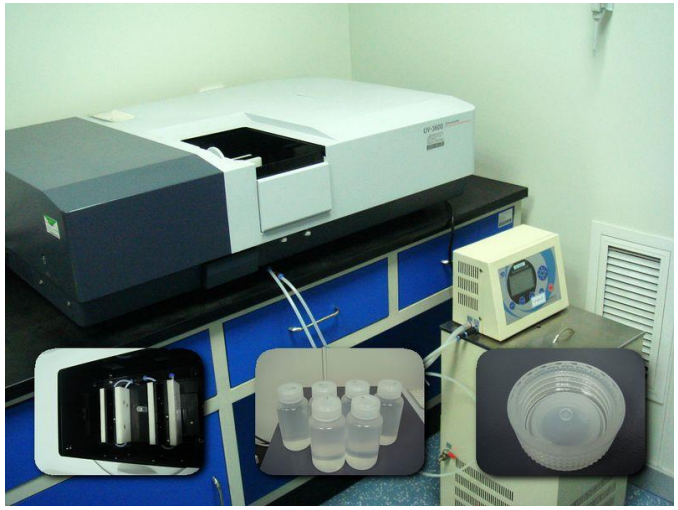
- Chinese Primary SSW
  - Salinity: S=35
  - Uncertainty: *U*=0.001 (*k*=2)
- China Serial Standard Seawater
  - Salinity: S=5, 20, 30, 35, 40
  - Uncertainty: *U*=0.003 (*k*=2)

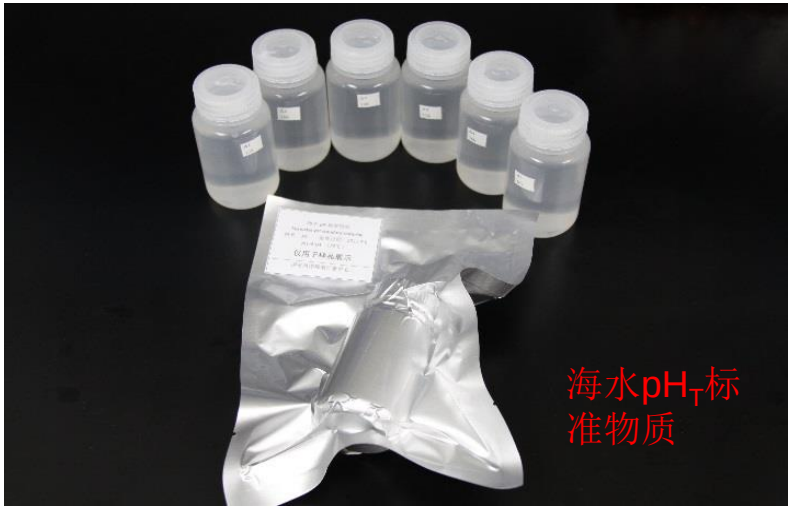
The same level with IAPSO SSW

Standard Seawater	China Primary Standard Seawater	IAPSO Standard Seawater
Batch	P_{10}	P_{155}
Measurements	20.0833	20.0835
	20.0835	20.0837
	20.0835	20.0835
	20.0837	20.0835
	20.0837	20.0837
	20.0833	20.0835
Average	20.0835	20.0836
Error	0.0001	
Results	＜0.0014	
In this test, the same sample was measured with 8400B salinometer calibrated by China Primary Standard Seawater and IAPSO Standard Seawater, respectively.		

2. Seawater-based pHT Reference Material

- Seawater-based pHT Reference Material (salinity=25);
- Seawater-based pHT Reference Material (salinity=35)





- **pH value is determined by spectrophotometry;**
- **The homogeneity and stability is carried out by *F* test and *t* test method.**

2. Seawater-based PO_4^{3-}-P Reference Material

- 0.5 μmol/L；
- 1.0 μmol/L；
- 2.0 μmol/L；
- 4.0 μmol/L

二、海水活性磷酸盐标准物质

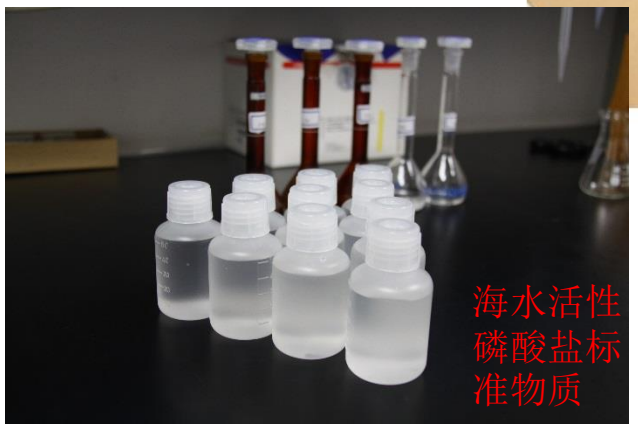
制备流程主要分为四个步骤：

1）大洋海水过滤杀菌；

2）添加磷酸盐试剂；

3）高温蒸汽灭菌；

4）分装保存。



海水活性磷酸盐标准物质

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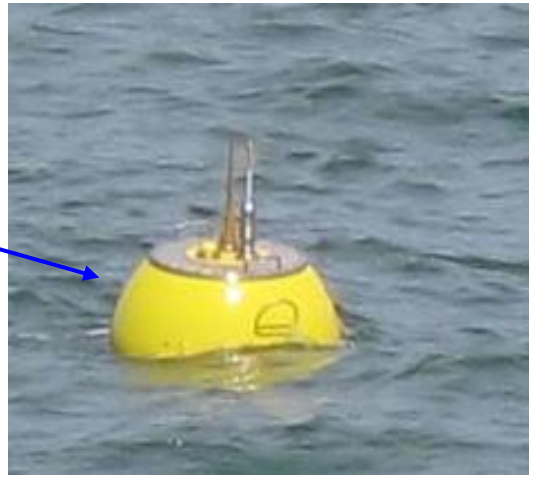
3.Wave Buoy

- **The Gravitational Acceleration Wave Buoys** are used widely for wave information.
- They measures near surface waves, and are often taken as the **measurement standards (reference instruments)** to assess the performance of other types of wave measuring instruments.



3. Wave Buoy

社会公用计量标准证书

Certificate of Measurement Standard for Public Service

[2005] 国 社量标 海洋 证字 第 069 号

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建标单位 国家海洋计量站

Possessor of the measurement standard

计量标准名称 波浪浮标检定装置 代码 57110010

Name of measurement standard Code

测量范围 波高：（1～6）m
Measuring range 波周期：（2～40）s

不确定度或准确度等级或最大允许误差 波高误差：±0.2%F.S 周期误差：±0.2s

Uncertainty/accuracy class/ maximum permissible error

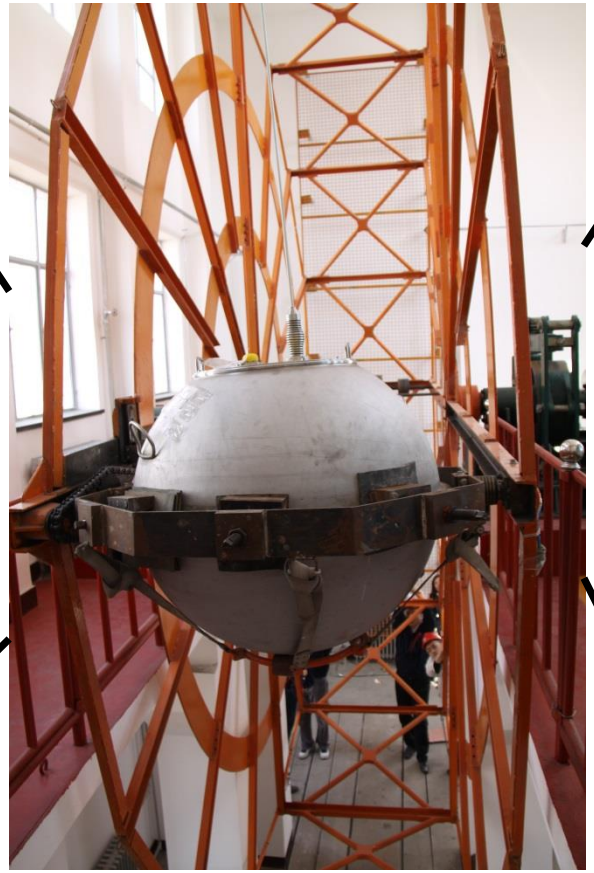
Measurement Standard	Measuring Range	Maximum Permissible Error
Wave Height	(1～6) m	MPE:±0.2%F.S
Wave Period	(2～40) s	MPE:± 0.2 s

- JJG 1144-2017*The Gravitational Acceleration Wave Buoy*

3.Wave Buoy & wave sensors

- **The Calibration Device of Wave Buoy was developed by RMIC/AP.**
- **Maximum Loading Weight: 180 kg, measurable diameter of buoys: (0.5～1.0) m.**

Double-round truss



Driving and braking system

Data acquisition and control system

Frequency speed control and power supply system

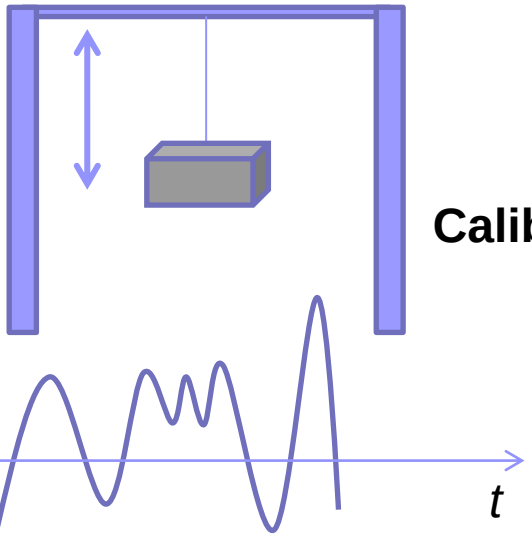
In-situ calibration of GPS wave buoy

1. in-situ calibration device for GPS wave buoy

Measurement standard: wave spectrum calculating module

Transmit GNSS signals(Doppler shift)

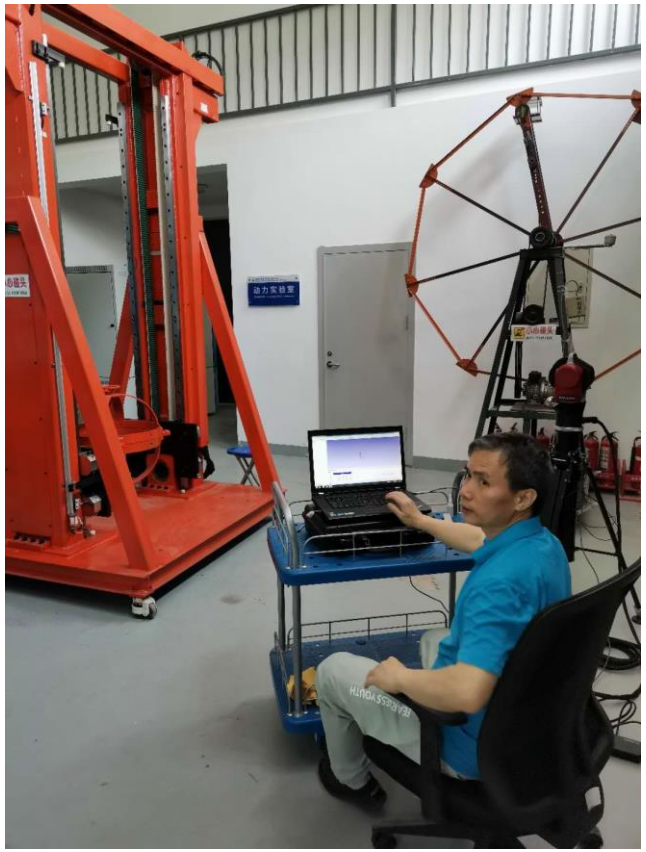
traceability

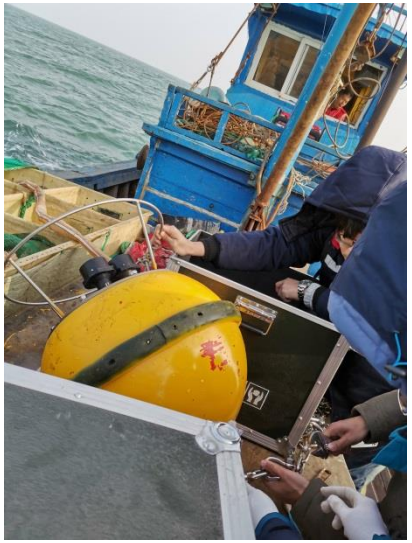


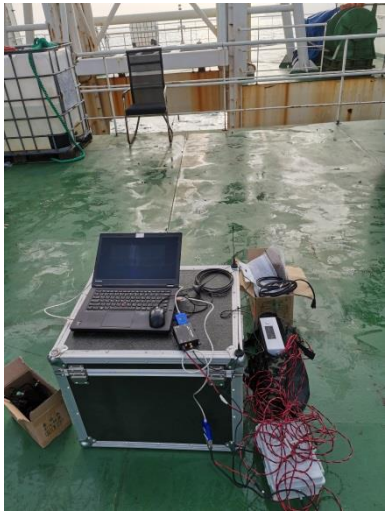
Calibration device

2. GPS wave buoy prototype (with calibration port)

In-situ calibration of GPS wave buoy







Wave height MPE:1.2 mm
U=0.1 mm（*k*=2)

Deployed in-situ calibration at Bohai Sea China

In-situ calibration of GPS wave buoy

	wave spectrum calculating module	GPS wave buoy prototype	Measurement error
Wave height(m)	0.411	0.442	0.031
	0.468	0.503	0.035
	0.466	0.501	0.035
	0.516	0.555	0.039
Calibration coefficient= GPS wave buoy/ wave spectrum calculating module=0.92			
Wave height(m)	0.504	0.509	0.005
	0.551	0.557	0.006
	0.435	0.440	0.005
	0.406	0.411	0.005
	0.408	0.412	0.004
	0.411	0.416	0.005

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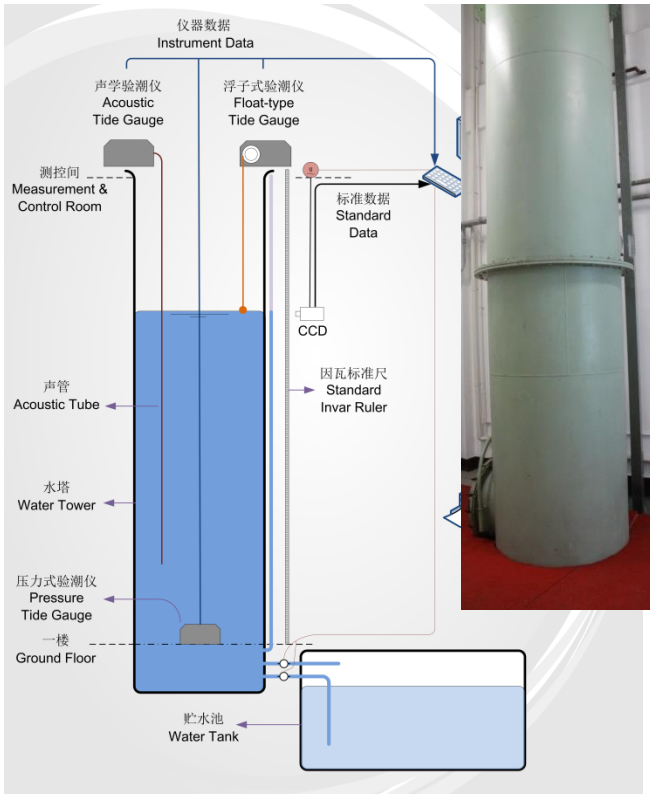
4. Tide Gauge

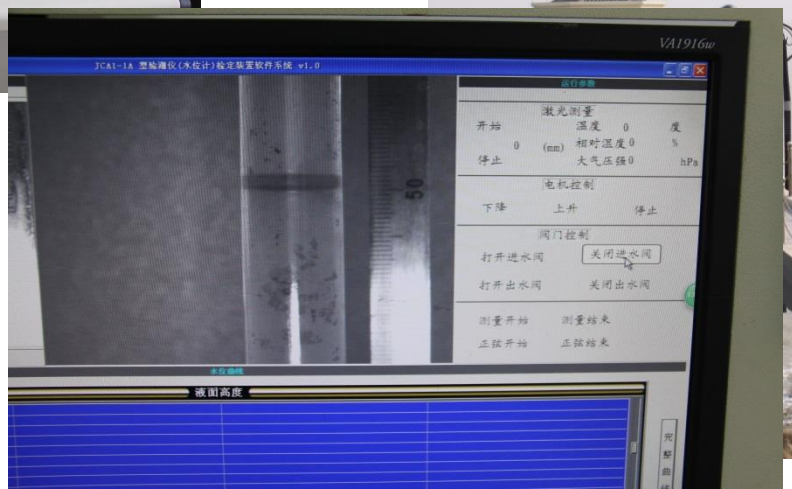
- **Tide gauges** are playing an important role in tide (sea level) measurement and predicting.

4. Calibration of Tide Gauges

- 1) Float-type Tide Gauges

Measuring Range	Measurements Uncertainty (*k=2*)
(0-8) m	*U*=2 mm

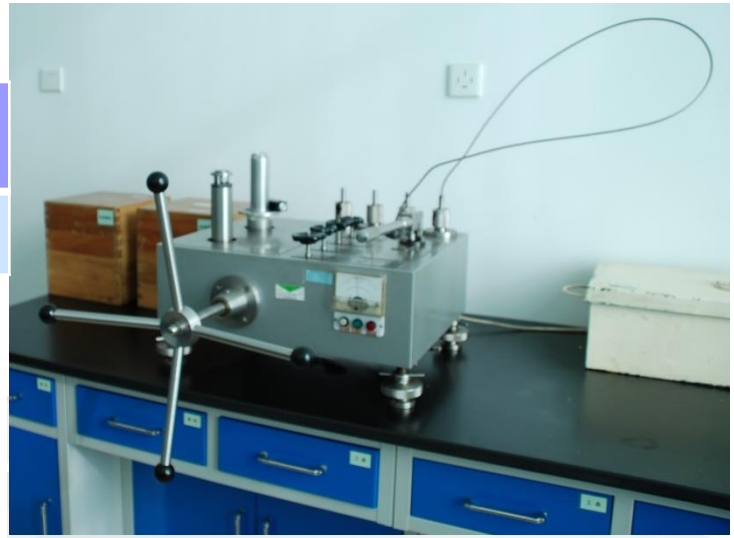


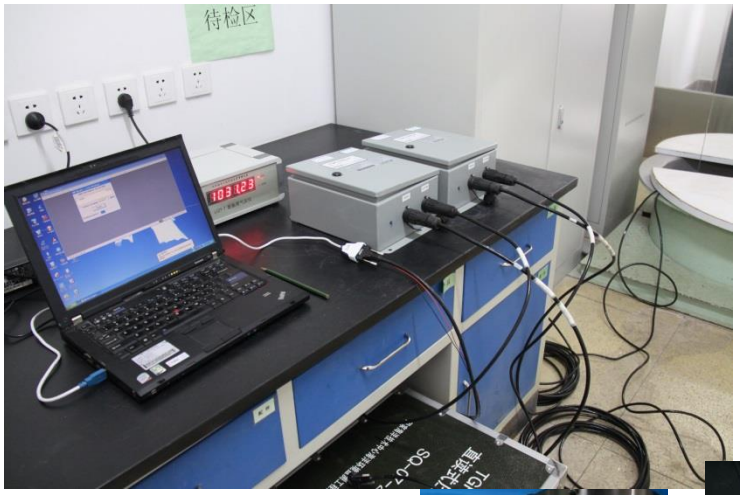


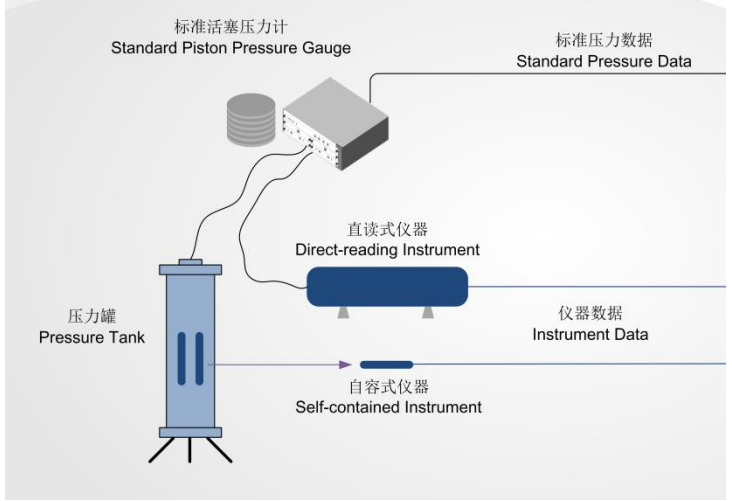
4. Calibration of Tide Gauges

- 2) Pressure Tide Gauges

Measuring Range	Measurements Uncertainty ($k=2$)
(0-600) m	U=0.02%







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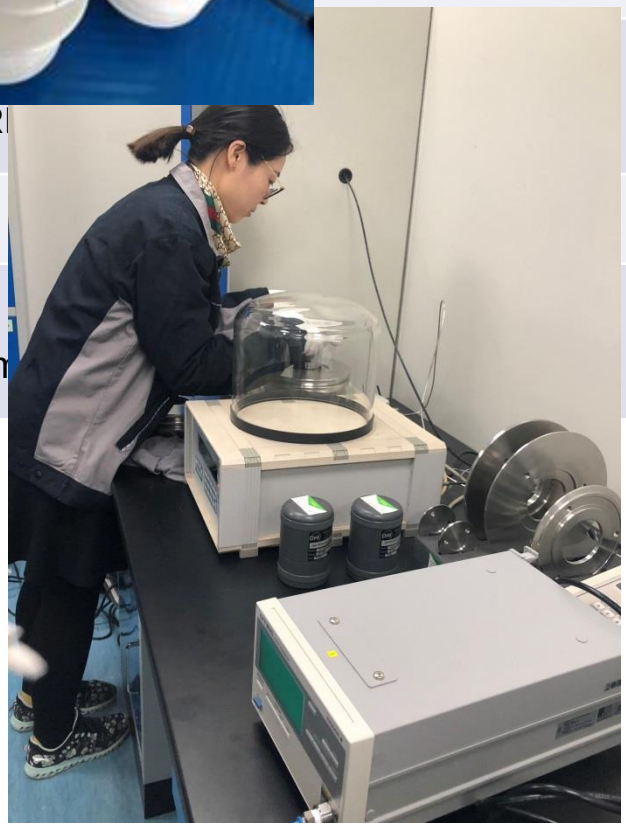
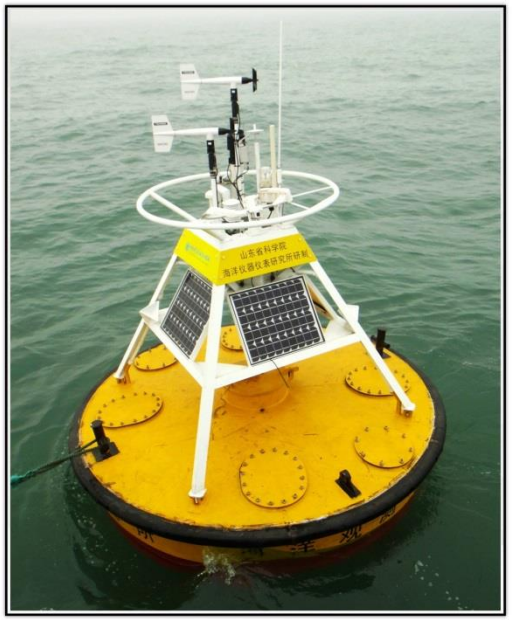
5. Meteorological Instruments

Meas	inty/ Accuracy mum Permissible Error
Veri	04 ℃（*k*=2）
Verificatio ther	4 ℃（*k*=2）； 2 %RH（*k*=2）
V	（5～95）%R
V	0）kPa
	～10）mm （0～4）mm/m

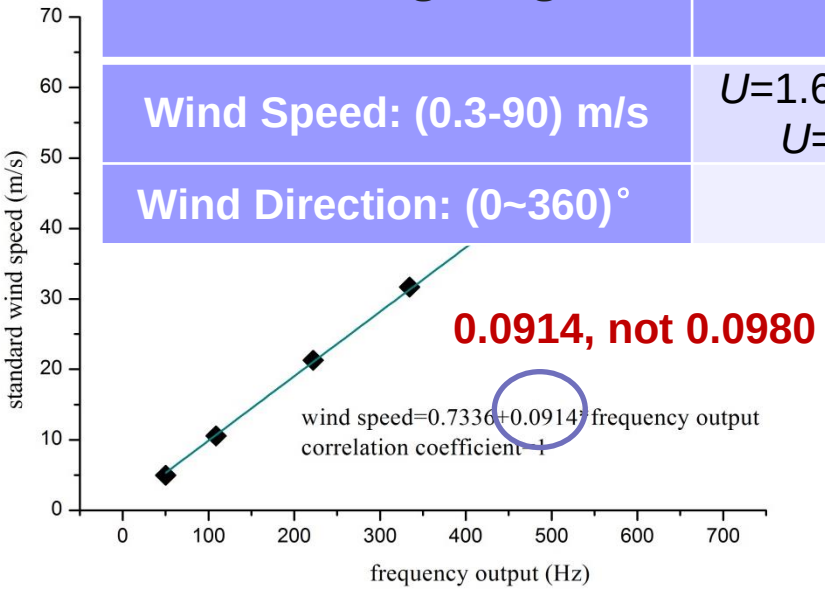


Calibration of the Meteorological Instruments

- We built a **wind tunnel** to calibrate wind sensors in our lab.



Measuring Range	Measurements Uncertainty (k=2)
Wind Speed: (0.3-90) m/s	U=1.6% reading, (5~70)m/s, U=0.1m/s, (0.3~5)m/s
Wind Direction: (0~360)°	U=1.3°



- **Accuracy;**
- **Threshold velocity of propeller/vane**

Oceanographic Calibration Facilities from RMIC/AP

- 1. Conductivity, Temperature and Depth (CTD) instruments & Bio-chemical sensors
- **2.** Reference Material (Standard Seawater, seawater-based pH, PO_4^{3-}-P)
- 3. Wave Buoy
- 4. Tide Gauge
- 5. Meteorological Instruments
- **6. Environmental Test**
- 7. Performance evaluation of domestic R&D marine instruments

6. Environmental Test: water pressure

Up to 100MPa

The max design water pressure is 40MPa; but crushed at 34MPa

this deep sea glass sphere was crushed at 13MPa

- **water pressure test**







6. Environmental Test: water pressure

walk-in chamber
(temperature and humidity)

Inclinations and Swings Test Equipment

Salt mist test

Oceanographic Calibration Facilities from RMIC/AP

- 1. Conductivity, Temperature and Depth (CTD) instruments & Bio-chemical sensors
- **2.** Reference Material (Standard Seawater, seawater-based pH, PO_4^{3-}-P)
- 3. Wave Buoy
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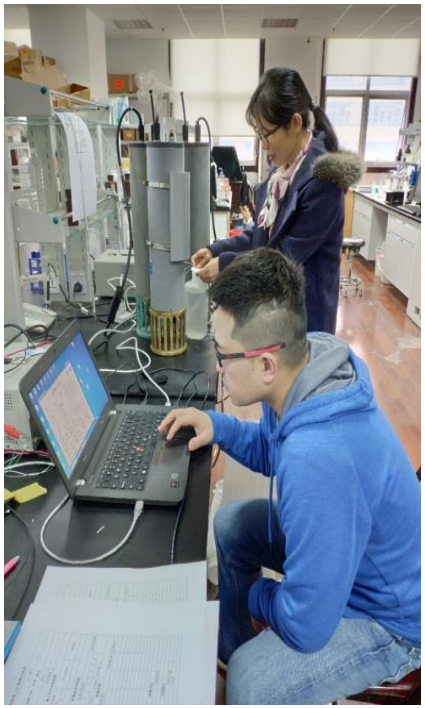
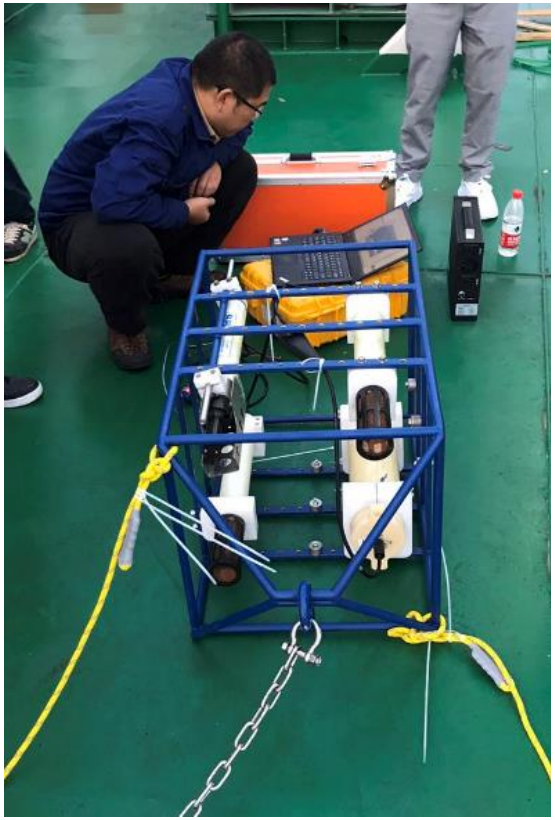
7. Performance evaluation of domestic R&D marine instruments

Third-party standardization sea trial for wave buoys

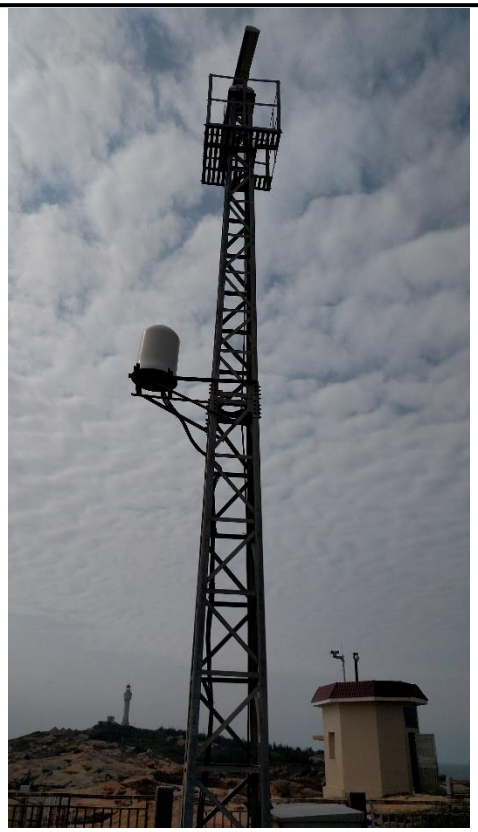


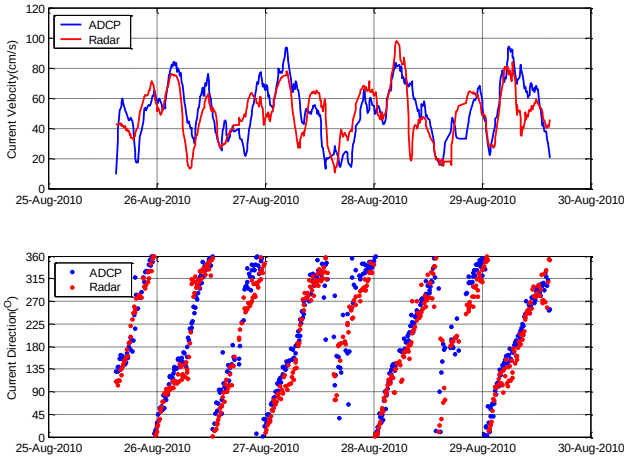
Third-party evaluation for seawater pH and COD measurement devices

7. Performance evaluation of domestic R&D marine instruments



Third-party evaluation for domestic R&D CTDs





Third-party evaluation for Wave band S radar

Thank you for your attention!

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