Feature

- Built - in hyperspectral water quality monitoring, liquid level monitoring, scene video forensics functions;
- Remote sensing monitoring, without contact with the water surface;
- Maintenance-free, no chemical reagents required;
- Support a number of water quality indicators: chlorophyll, total nitrogen, total phosphorus, transparency, etc;
- Spectral range: 400-1000 nm
- Spectral resolution 1nm
- Deviation of water quality accuracy < 20%
- The fastest monitoring speed can reach the second level;
- Monitoring height is 8m;
- Water level monitoring technology: 80 GHz millimeter wave radar;
- Accuracy error of water level is less than 5mm;
- Not affected by wind and rain, fog, high temperature and other environmental climate;
- Support the maximum 2560×1440@30fps HD video output.

Application

- Real-time online monitoring of river water quality
- On-line monitoring of lake and ocean water quality
- On-line monitoring of aquaculture water quality

Description

ATE7000 remote sensing hyperspectral water quality monitoring system is a real-time online remote sensing monitoring product launched for river course, lake, ocean, water source area and other application fields. ATE7000 is a combination of **hyperspectral water quality monitoring, water level monitoring, on-site video forensics** of a new form of products.

ATE7000 adopt international leading water quality hyperspectral remote sensing technology, it built the high development and production of high-performance spectrum analyzer, the joint Chinese Academy of Sciences, invest a lot of cost, the depth of the joint development of training learning inversion algorithm, and tens of thousands of times of water samples in field experiments, thus successfully developed the water quality of multi-parameter monitor in real time.

The ATE7000 can provide real-time in-situ multi-parameter water quality parameters and liquid level information, timely alarm for abnormal conditions, and record field visible light video/pictures.

The ATE7000 monitoring data and field images can also be uploaded to the cloud platform for real-time multi-point information collection, threshold alarm setting for each point, and historical information review and global trend judgment for the region.

Optosky also jointly developed the industry standard "Technical guidelines for spectral on-line water quality monitoring system" with its peers, which was promulgated and passed in 2020.

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2. Principle of hyperspectral water quality monitoring

In addition to water molecules, the optical components of water which affect the reflectivity of water separation mainly include phytoplankton, non-algal suspended matter and colored soluble organic matter (Also known as the yellow substance, CDOM). The phytoplankton pigment in natural water is mainly chlorophyll a, and the scattering of chlorophyll a belongs to Mie scattering, that is, there is no difference in the scattering intensity at all wavelengths. The absorption is stronger in red and blue wavelengths, but weaker in green wavelengths. Therefore, the water with more chlorophyll is green. The scattering of non-algae particles also belongs to Mie scattering, and the absorption intensity decreases negatively exponentially with the increase of wavelength. Therefore, in the water with enough concentration of yellow substances, the water will be yellowish brown. However, in most natural water bodies, there is not a single substance or a dominant substance in the water body component, but several substances acting together to form the optical characteristics of water bodies, which makes the relationship between water body color and water body component complicated. Hyperspectral analyzer can be very sensitive to detect subtle changes in water color, so as to reverse the contamination of water quality.
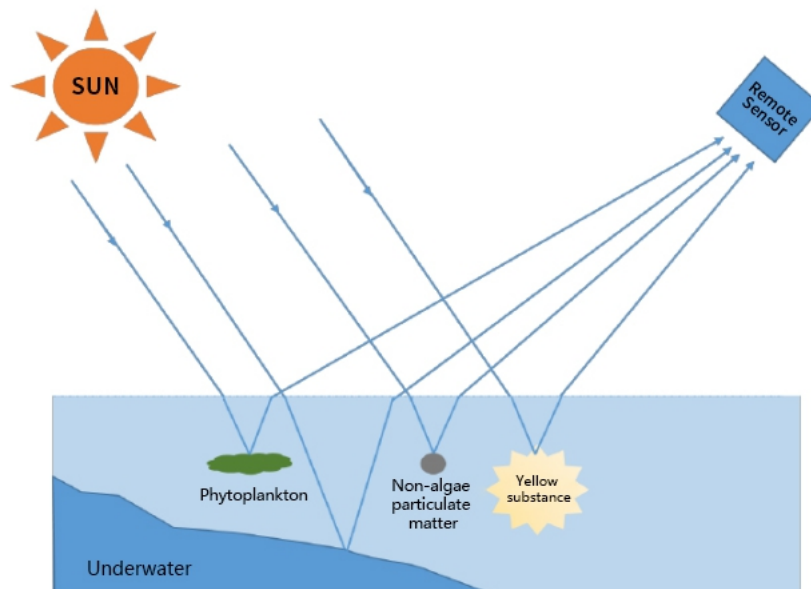

Figure 1 Working principle of multi-parameter monitoring water quality by hyperspectral remote sensing

High spectral analysis technique has got a lot of research in the field of hydrology and applications, such as in water resources utilization, water quality monitoring and Marine science research Gui in areas such as application, he can analyze the great river, the source of the river, and the characteristics of water flow, sediment, rivers change situation, such as flood disaster monitoring, investigation and assessment,

prediction and assessment, flood management, It also studies the law and process of evolution of rivers, lakes, and reservoirs using remote sensing images from different years. Hyperspectral remote sensing can understand from the perspective of imaging spectral resolution for the spectral resolution of remote sensing, it is mainly in the electromagnetic spectrum for many continuous spectrum width is very narrow and the technology of image data, hyperspectral remote sensing data because of its small imaging band sampling interval, number and sampling band correlation, high spatial resolution, etc. Therefore, the image data has a large amount of information and can reflect the subtle features of the target object, which makes the quantitative or qualitative analysis of the target object from a distance become a reality. At the same time, compared with panchromatic and multispectral remote sensing, the spectral resolution is improved, and the spectral reflectance reconstruction method can be used to obtain rich and continuous spectral information of the target object. By using data mining, neural network and other flexible classification methods, the recognition degree of object elements and the amount of information of remote sensing data can be increased, which makes the remote sensing application more stable and extensive. Water color is the result of the interaction between sunlight and substances in water, and is closely related to the absorption and scattering of chlorophyll, suspended matter and CDOM, each component of water color.
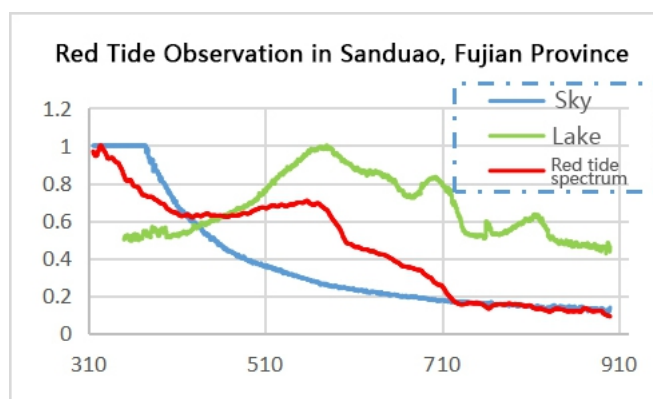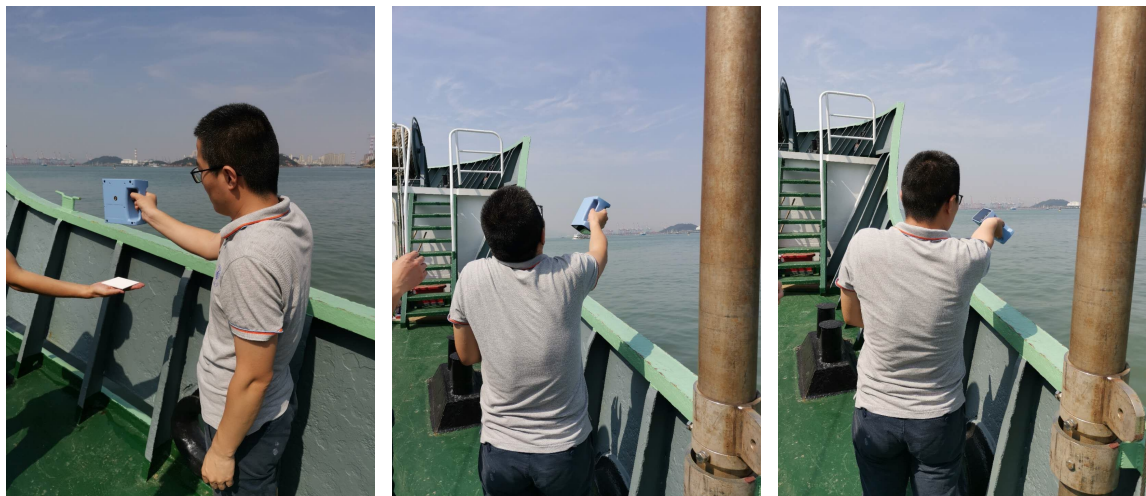

Figure 2 The ATP9100　produced by Optosky was used to monitor red tides on the ship Jiageng of Xiamen University, location: Aohai District, Santu, Ningde, Fujian Province, May 11-16, 2020
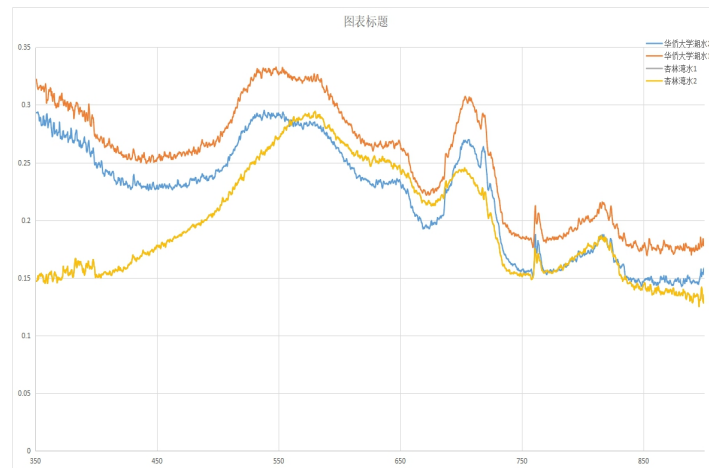
Figure 3 The application of ATP9100 field spectroradiometer produced by Optosky in the analysis of lake water color

In clean shallow water, underwater reflection is also an important component of out-of-water radiation. Such sunlight can be transmitted to the bottom, and the water body whose underwater reflection affects out-of-water radiation is called optically shallow water. Conversely, water body whose sunlight cannot reach the bottom is called optically deep water. Generally speaking, water quality parameters that can be monitored by remote sensing include suspended particulate matter concentration, chlorophyll a (Chl-a) concentration, water transparency, turbidity, dissolved organic matter, vertical attenuation coefficient of incoming and incoming light in water, and some comprehensive pollution indicators such as nutrient state index. In addition, in view of the other water quality indicators have corresponding research, such as soluble organic carbon, dissolved oxygen, 5 chemical oxygen demand (cod), biochemical oxygen demand (cod), total phosphorus, total nitrogen, etc., but these indicators are difficult to obtained directly from the spectral characteristics, general is the use of different materials the relationship between remote sensing analysis, indirectly, the levels of these substances. Remote sensing inversion of water quality parameters not only has high requirements for spatial resolution, spectral resolution, band setting and radiation resolution of sensors, but also brings great challenges and difficulties to establish accurate and strong applicability of water quality parameter inversion algorithm and atmospheric correction algorithm.

ATE7000 remote sensing hyperspectral water quality multi-parameter monitoring system, using the

world's leading hyperspectral water quality remote sensing technology, it is built in the high performance hyperspectral analyzer developed and produced by Optosky, and the Chinese Academy of Sciences, invested a lot of cost, jointly developed and trained deep learning inversion algorithm, and then experienced tens of thousands of field water sample experiments.

Therefore, the water quality multi-parameter real-time detector can be successfully developed, which can be installed on the shore to carry out real-time online monitoring of water samples and obtain more accurate monitoring data.

3. Specification

Parameter \ Model		ATE7000 Hyperspectral Water Quality Analyzer
Hyperspectral	Detector Model	Single point spectrometer
	Spectral Range	400-1000nm
	Spectral Resolution	1 nm
	Water Quality Measurement Index	Chlorophyll, total nitrogen TN, total phosphorus TP, transparency, COD, turbidity, ammonia nitrogen NH3-N, suspended solids concentration, etc.
	Precision Deviation Index	± 20%　(TN,TP,NH3-N ±30%)
	Installation Height	2～8 m
Radarcargo Level Indicator	Measuring Range	8m
	Measured Deviation	± 5mm
	Measuring Frequency	W Band(80GHZ)
	Beam Angle	8°
VIS Camera	Detector Model	1/1.8 " progressive scan CMOS
	Min. Illumination	Color: 0.005 Lux @(F1.3, AGC ON); Black：0.001 Lux @(F1.3, AGC ON); 0Lux with IR
	Focal	2.8~12mm，4 times the optics
	FOV	107.4~39.8° (wide angle)
	Max Aperture	F1.3
	Cloud Platform - Level	Level angle 360°
	Cloud Platform - Vertical	-5°~90°
	Min. Image Size	2560×1440
	IR View Distance	50m
	Prevent Overexposure Of Filling Light	Yes
Whole	Power	<50W
	Power Support	DC12V, 5A

Weight	8KG
Installation Condition	The water depth of the monitoring place is more than 1 m (the bottom material cannot be directly seen); the surrounding environment is open to avoid the object's solar shadow falling on the monitor or the monitoring area below.

4. ATE7000 Physical Map

Figure 4 The test site of ATE7000 hyperspectral water quality monitor in Jiulong River, Zhangzhou, Fujian (without the liquid level monitoring module)

Figure 5 ATE7000 hyperspectral water quality analyzer tests at Fujian Minjiang

5. ATE7000 Drawing Picture
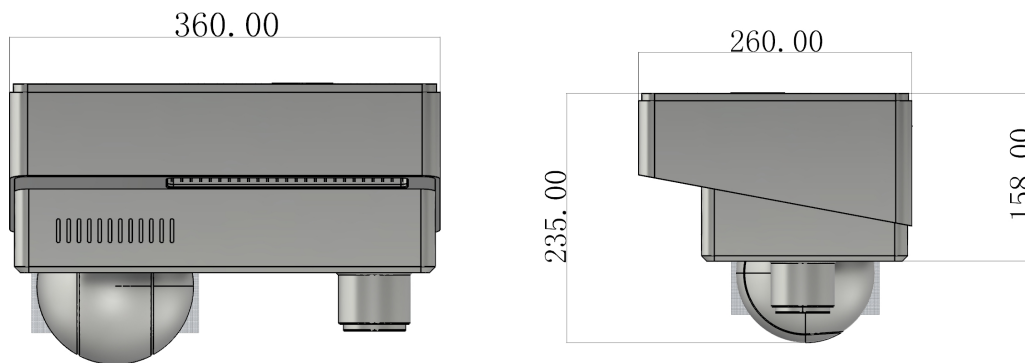
Figure 6 ATE7000 hyperspectral water quality drawing picture

6. Environmental Monitoring Products
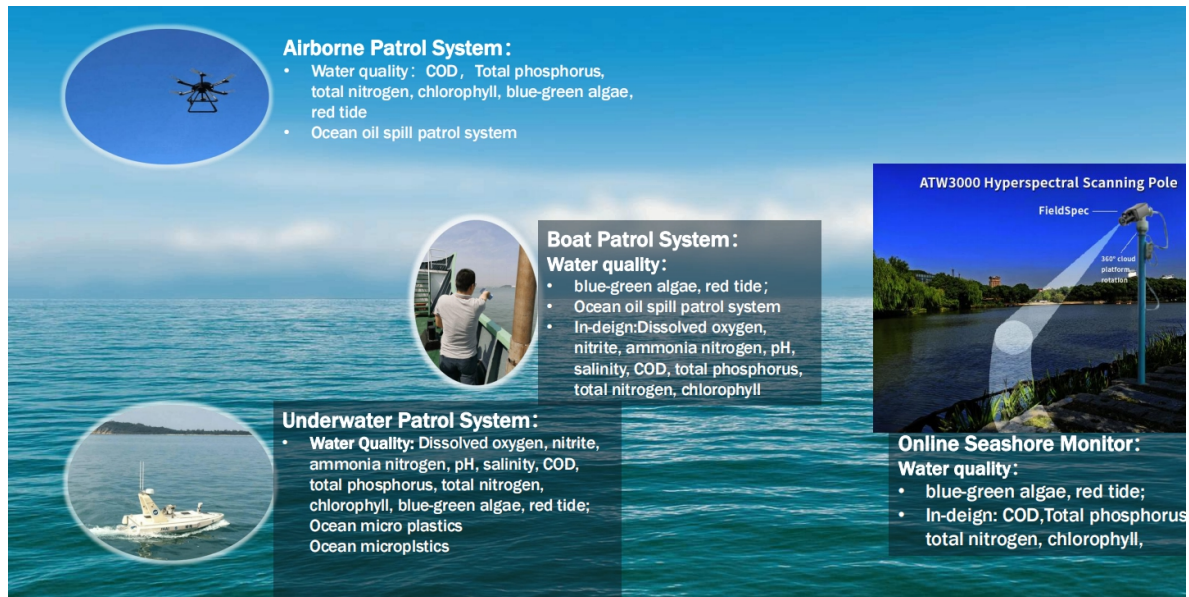
Figure 7 Water quality monitoring products produced by Optosky (as of December 2020)
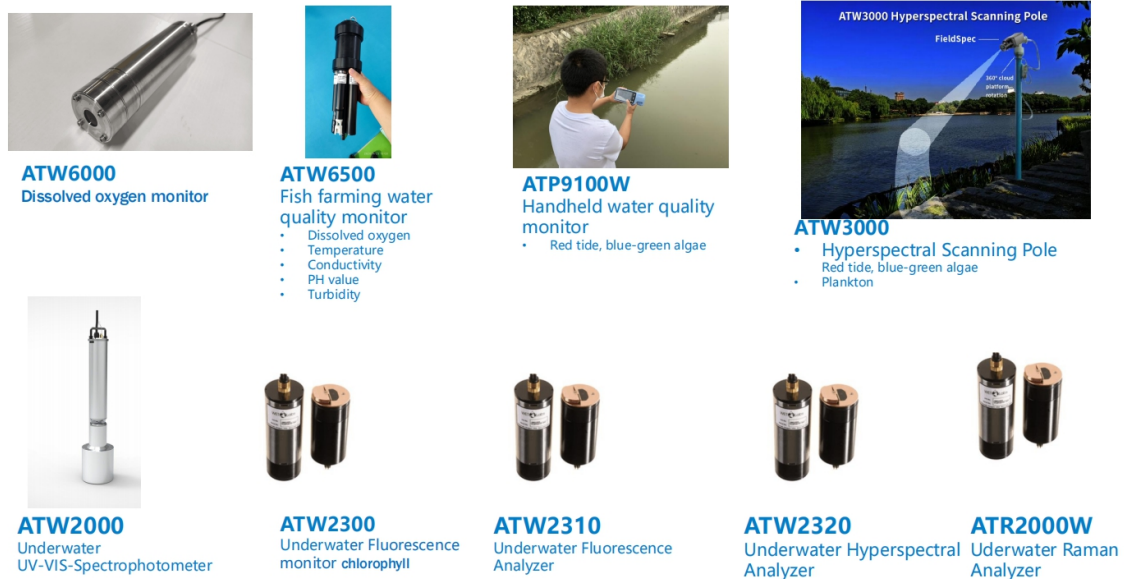
Figure 8 Water quality monitoring products produced by Optosky (as of December 2020)

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ATH9012W
Airborne Water Quality Remote Sensing Monitor

ATE2000
Reagent-free multi-parameter water quality analyzer

ATE3000
Portable multi-parameter water quality analyzer

Figure 9 ATH9012W Airborne Water Quality Remote Sensing Monitor, ATE2000 Reagent-free multi-parameter water quality analyzer, ATE3000 Portable multi-parameter water quality analyzer (as of December 2020)

ATE5000YW
Airborne Fluorescence Imaging Oil Polution Remote Sensing System

Work Day & Night

ATF25000NL
Online Oil Polution Monitor River cross-section

ATF2500
Handheld Fluorescence Oil Polution Monitor
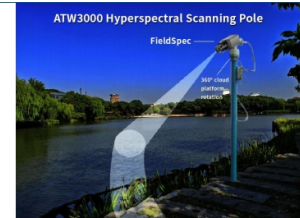
Figure 10 ATE5000YW Airborne Fluorescence Imaging Oil Polution Remote Sensing System, ATF2500ONL Online Oil Polution Monitor River cross-section, ATF2500 Handheld Fluorescence Oil Polution Monitor
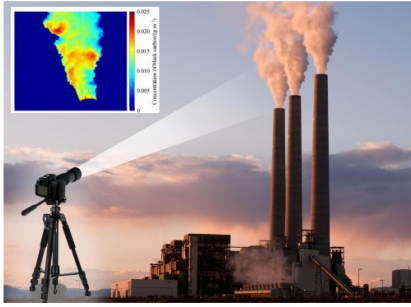
GF300
Chimney Vent Remote Sensing System
(SO2, NO2, Carbon Black)

GF300HH   GF300OL   GF300PT

GF320
Methane and VOCs leak Monitor
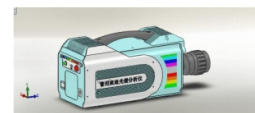
GF3200L   GF320PT

Figure 11 GF300 chimney vent emission remote sensing monitoring system, GF320 methane and VOCs leak monitor produced by Optosky

7. Company Profile

Optosky company is an first-class spectroscopy solution provider, with the headquarter locates in the 7th floor of the research institute of the Chinese Academic of Science at an area of 2500 square meter in Xiamen city where successfully held the international 9th BRICK summit in 2017.The subsidiary company locates in Wuhu city with an area of 2035 square meter.

The company founder Dr.Hongfei,Liu graduated Docter degree from Chinese Academic of Science and postdoctral degree from Xiamen University, by integrating both of top Universities' spectroscopy technology background into Optosky company aiming at developing the leading spectroscopy equipment in the world.

The company bases on unique technologies of Optomechatronics, Spectroscopy Analysis, Process Weak Optical and Electrical Signals, Cloud Computing, and have been developed wide products line of the competitive Raman spectroscopy instruments, micro spectrometer, hyperspectral imager, field spectroradiometer, fluorescence spectroscopy, LIBS etc. Driven by advanced technologies and products, Optosky brand has been well-known to customers all over the world.

Optosky company base on technologies innovation, market driven direction, customer first, provides first-class products and services, and one-stop solutions to many fortune 500 companies in

many industries. The company received praise from different industries companies, as well as many innovative intellectual property, software copyright, qualification certification, and winner awards over hundred numbers.

Optosky receives top class A introduced high-tech company to international Xiamen city, the national high-tech and new innovative technology company award. The founder Dr.Hongfei Liu receives the innovation talent award by ministry of science and technology.

The company is currently conducting the exclusive project of major industrialization national oceanic administration with a total fund of five million us dollar. The company in charge of drafting national industry standard of VNIR and SWNIR Field Spectroradiometer, and six national standard drafter, including China National Standard Drafter for Hazmat detector based on Raman spectroscopy, China National Standard Drafter for Buoy-type Monitor eco-environment, China National Standard Drafter for water quality monitor in unmanned boat, China National Standards drafter for online water quality monitor by spectroscopy, China National Standard Drafter for UV-absorbent measure fabrics.

The company has over 70 IPs and over 20 innovative patents.

The company received ISO9001:2015 certification, CE certification, Police Administration Certification, FDA approval compliant, IQOQPQ compliant.

Figure 12 Optosky (Xiamen) Photonics Inc. Company Headquarter

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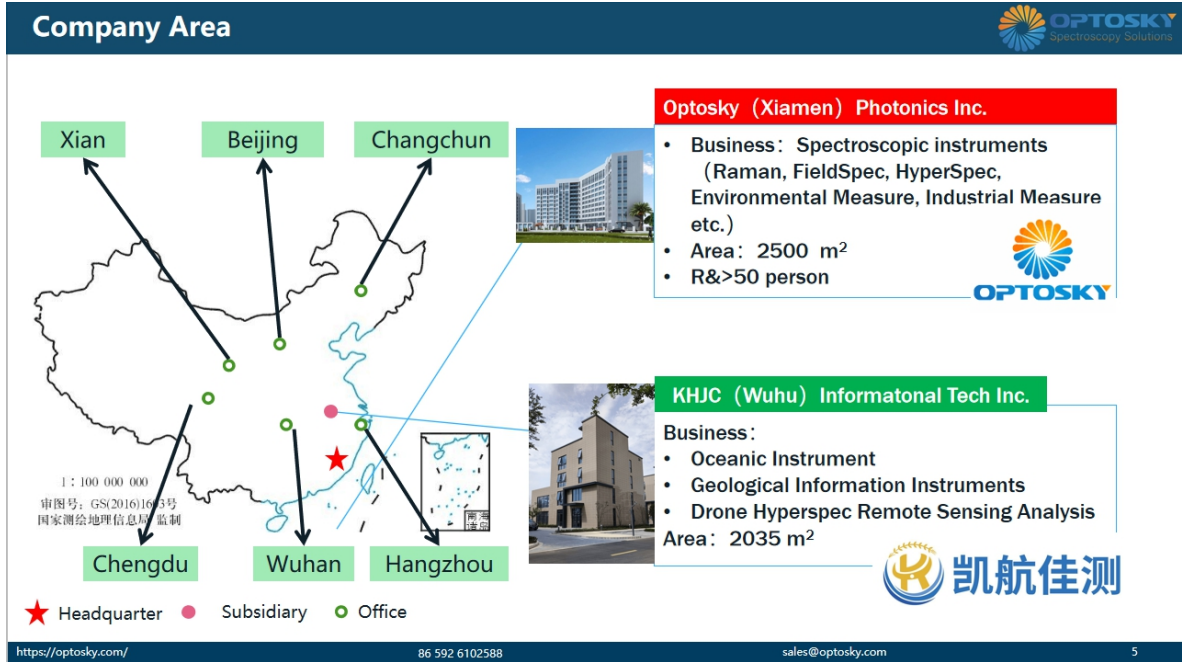
Figure 13 Optosky Company Area
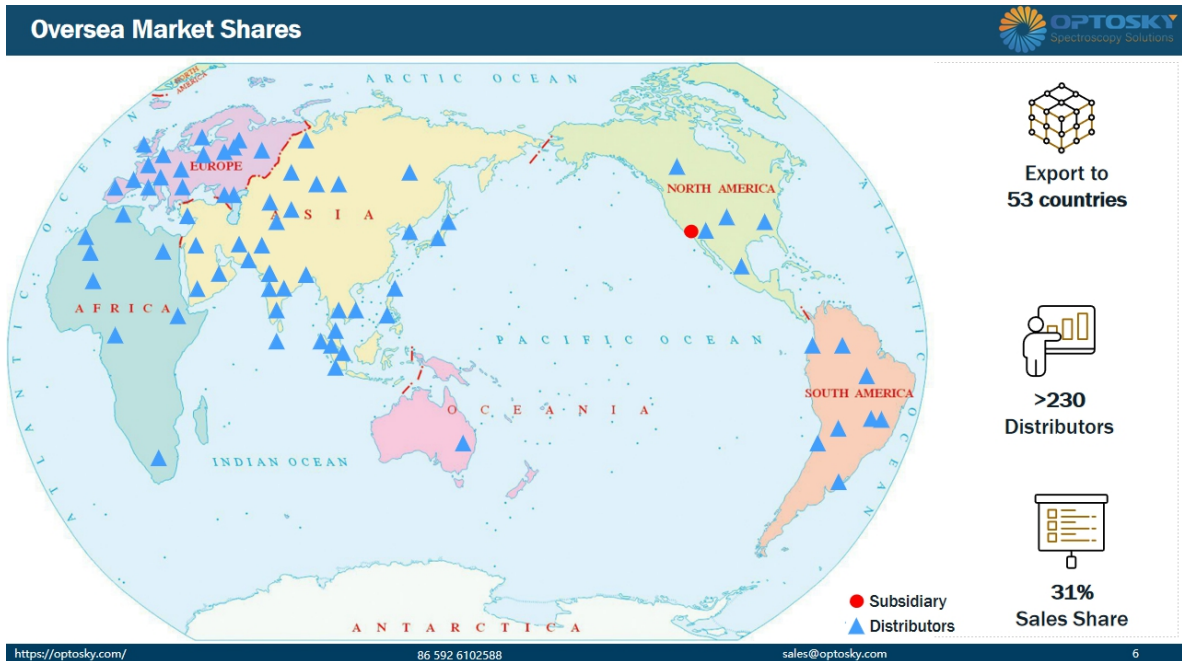
Figure 14 Oversea Market Shares

Figure 15 Optosky Chair and Draft National Standards Lists.

Figure 16 Qualification

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Informationization & Industrilization Fusion Management System
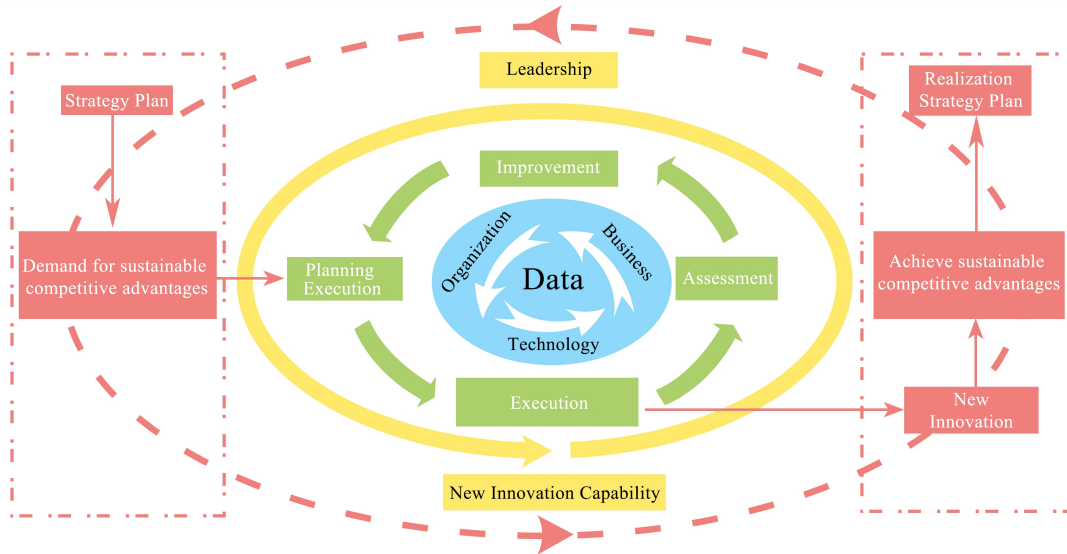
Figure 17 GB/T 23001_Informationization & Industrilization Fusion Management System

Figure 18 Optosky's Co-founder_Dr. Hongfei Liu

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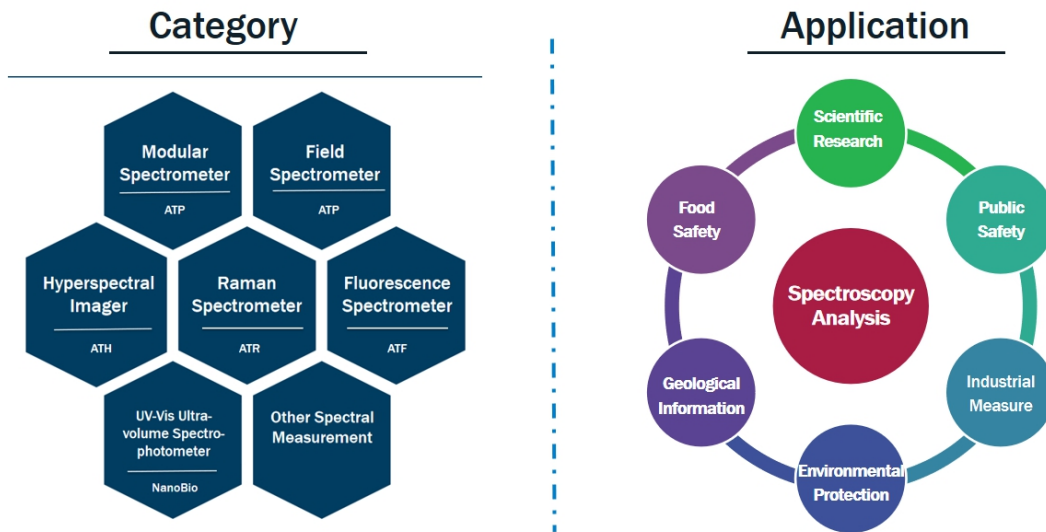
Category & Application

Category

Application

Figure 19 Category & Application

Model Name Rule

Model Name Rule:

- Prefix
- Category
- Model
- Suffix

AT R 3000 - 1064

Prefix

Category Model Suffix

Abbreviation OPTOSKY
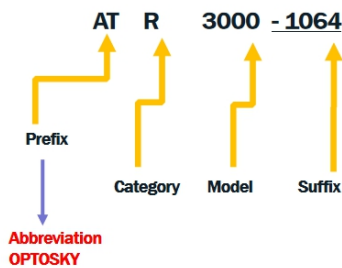
- **ATR** – **R**aman Spectrometer
- **ATP** – Micro **S**pectrometer
- **ATH** – **H**yperspectral Imager
- **ATF** – Micro **F**luorescence Spectrometer
- **ATL** – **L**IBS
- **ATW** – **W**ater
- **ATE** – **E**nvironment **P**rotect
- **ATFD** – **F**ood Safety
- **GA** – Public Safety (**G**ong **A**n)
- **GF** – Gas Monitor (**G**as **F**inder)
- **GY** – Industrial Monitor (**G**ong **Y**e)

eg:
- Raman Microscope：ATR8300MP-1064
- Hyperspectral Imager：ATH9500

Figure 20 Model Name Rule

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