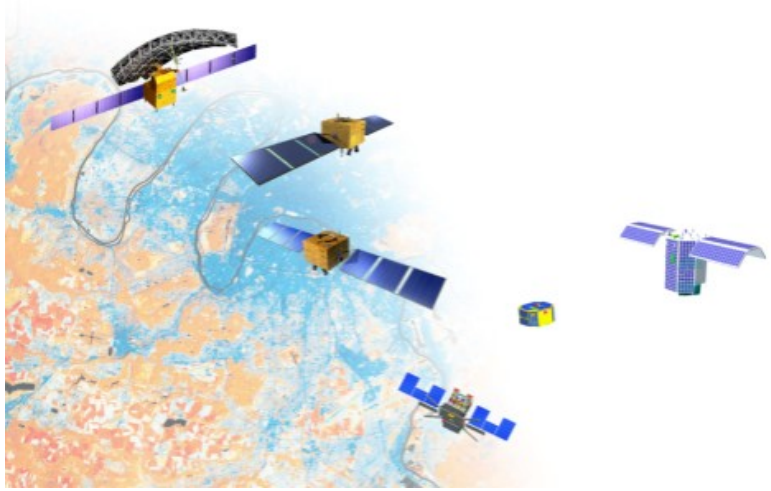
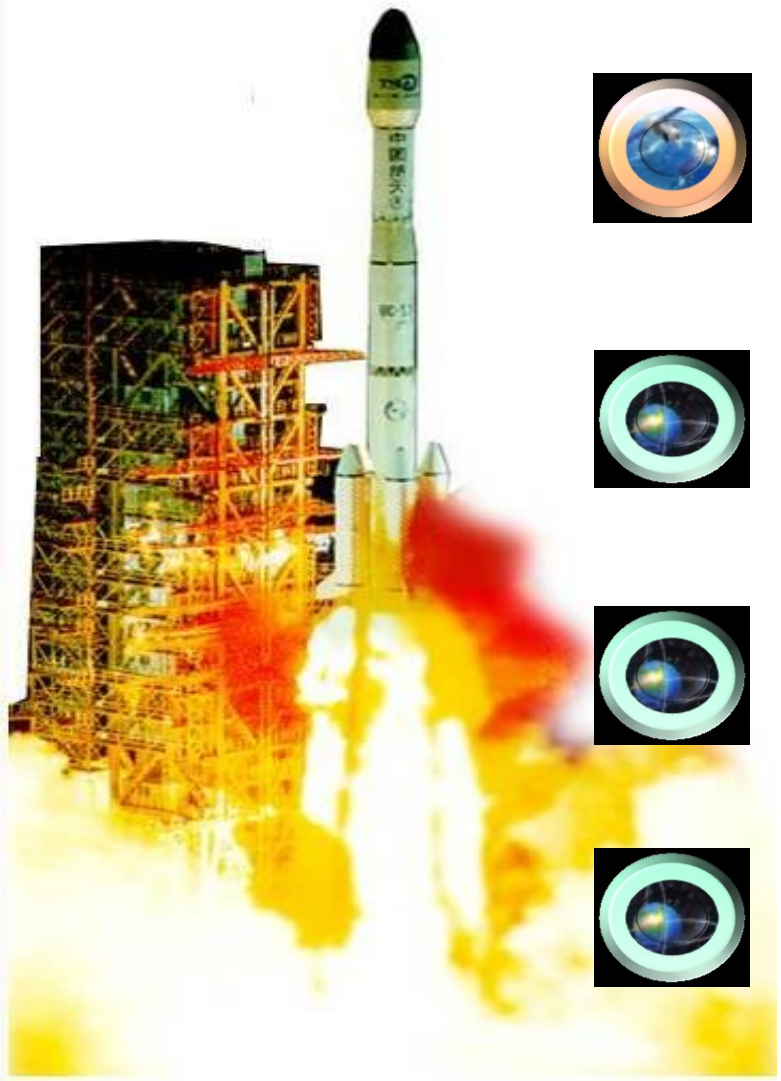
The Development and Application of Remote Sensing Micro-satellite



Qin Yuan
China

Sep. 2018

OUTLINE

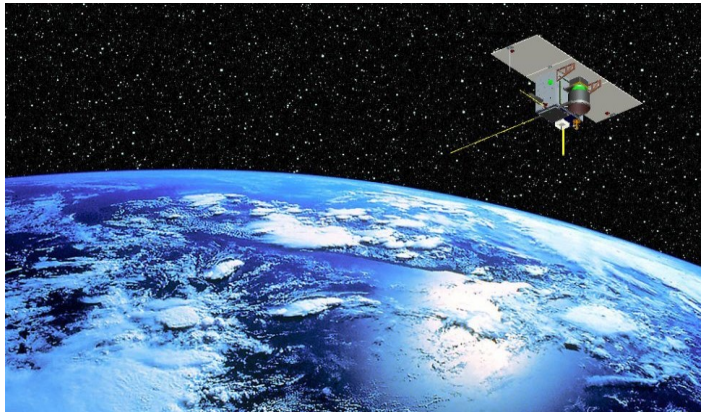


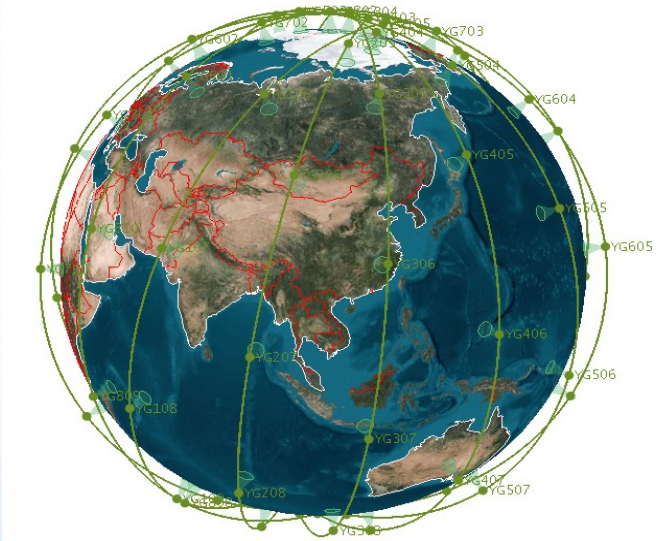
- The Development
- Application and Analysis
- Company Introduction
- MV-1 Constellation

1. The Development

What's micro satellite?

Micro-satellites have characteristics of short development time, low cost and fast update. When deploying and applying on a large scale the small satellites can exert huge potential.

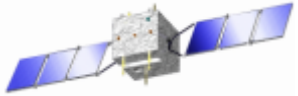




Micro-satellite Constellation

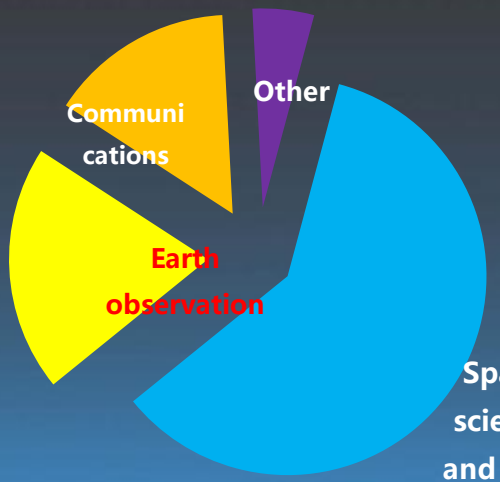
Characteristics

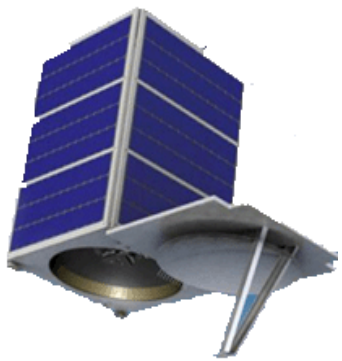
- **Economy** (Low Cost and Market Competitiveness)
- **Highly Integrated** (Application of New Technology)
- **Short-Cycle Manufacturing** (Quickly Enter the Market)
- **Construct Satellite Formation or Constellation** (Use Bulk)
- **Reliability** (In the Period of Life)
- **Highly Autonomous** (Intelligent)



1. The Development

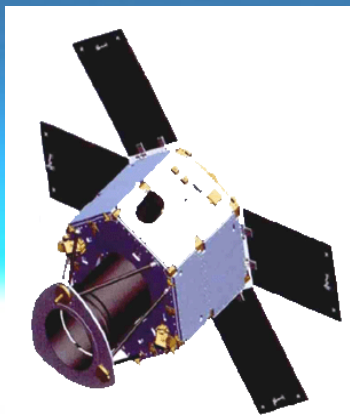
Before 2012, the micro satellites had kept increasing sustainably and stably . From 2013, micro satellites were explosively growing around the world. In 2014, about 150 satellites had been launched. Micro satellites technology have evolved from experiment to military applications and business operations, which have been widely used in earth observation, communications and broadcasting fields etc.





Skysat

DMC3

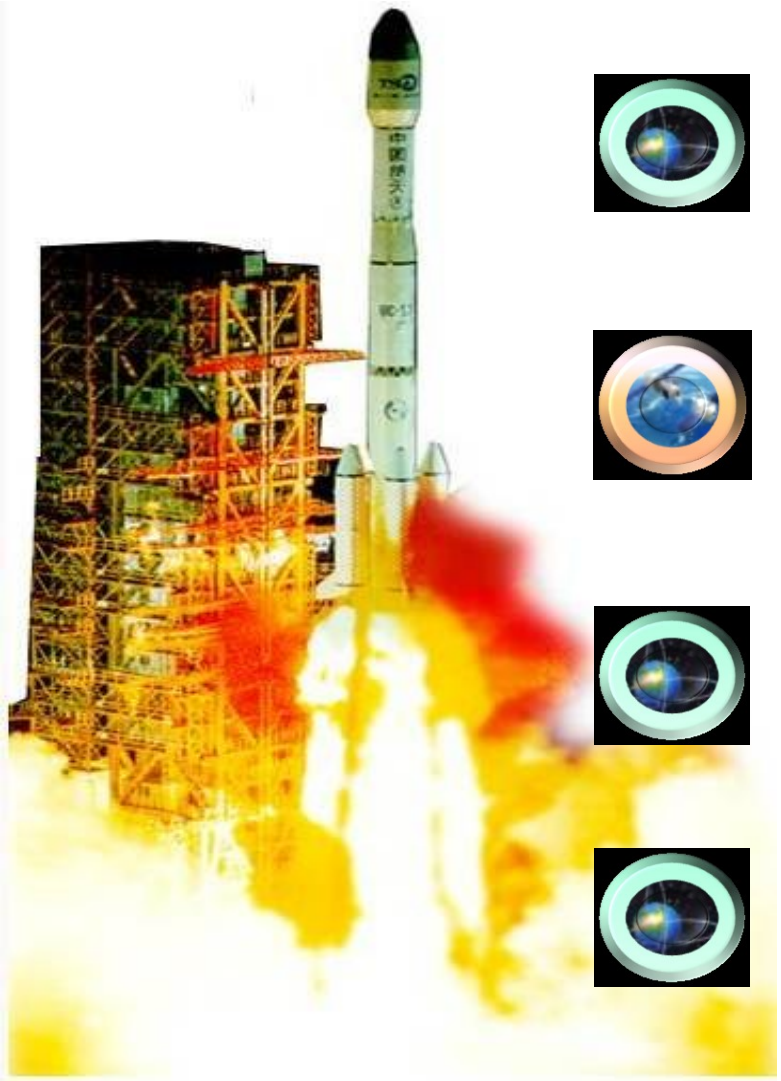


DubaiSat

Flock

FM

OUTLINE



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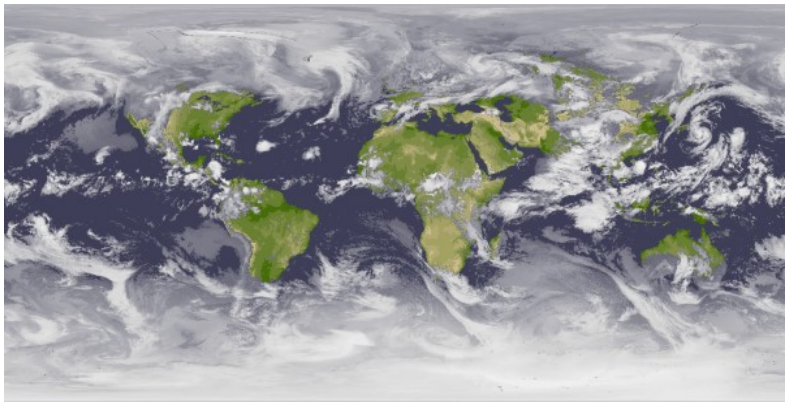
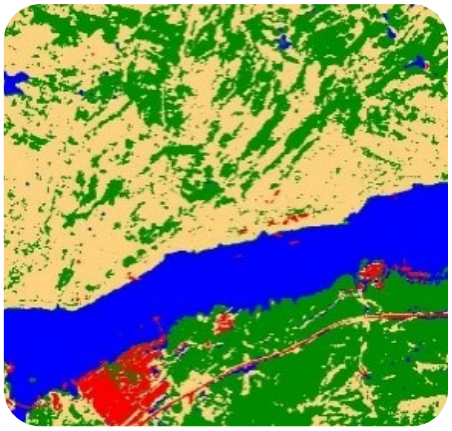
2. Application and Analysis

What's satellite remote sensing ?

The science and art of acquiring information (spectral, spatial, temporal) about material objects, area, or phenomenon, without physical contact with the objects.



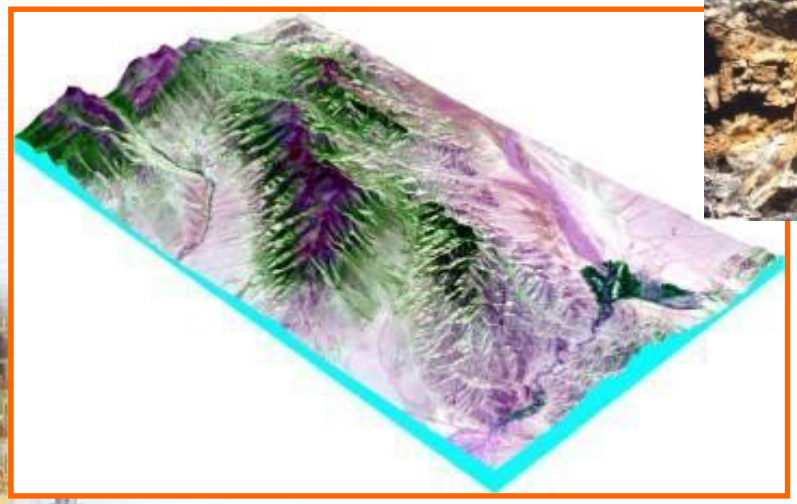


Earth observation

2. Application and Analysis

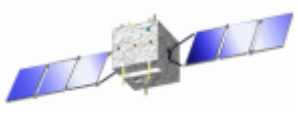
Why we use remote sensing ?

Remote sensing provide many clues at the earth's surface



Stereo image of Qinghai province

It's difficult for survey at transportation inconvenience areas due to serious weather, mountain, altiplano, rain or snow.



2. Application and Analysis

Remote sensing satellite can be used in many kinds of aspects:

- **Agriculture investigation** : Growth monitoring and production forecast
- **Urban Planning**: Urban road survey and dynamic monitoring of urban construction
- **Environment Protection**: Pollution monitoring and environmental protection
- **Land and resources survey**: national land resource survey, planning and government decision-making, Distinction and investigation of lake, soil and mineral
- **Defense**: detect airports and important port information
- **Mapping**
- **Maritime Monitoring**

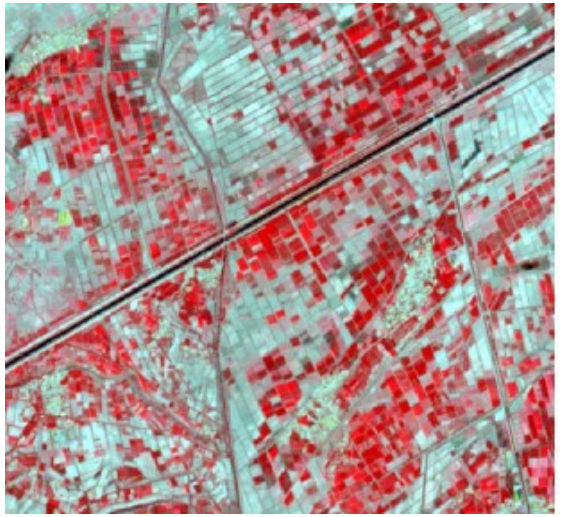
2. Application and Analysis

APPLICATION

Agriculture investigation

Based on the satellite data system, the collection of a wide range of agricultural data acquisition, storage, analysis and visualization module for the agricultural field shall bring a stable and efficient data services. Government department can assess crop output with image data , in order to make wise and reasonable decision.

GSD 5m



Multispectral image(8 m)

2. Application and Analysis

APPLICATION

Urban Planning

With image data, we can get urban road survey and dynamic monitoring of urban construction. Also they help us gain urban population and construction density surveillance.

GSD 5m

Pan image(4 m)

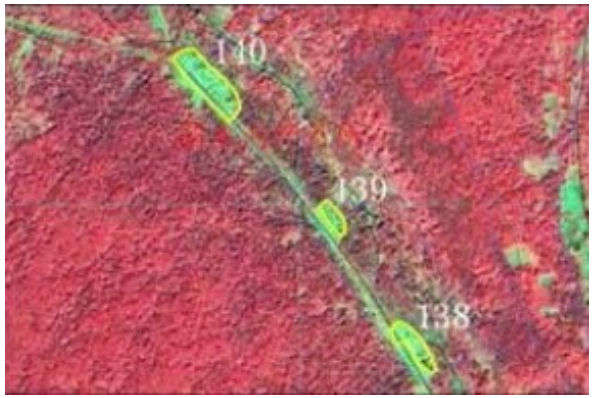
2. Application and Analysis

APPLICATION

Land and Resources Survey

Satellite remote sensing technology shall be beneficial for land and resources census, land use status survey and analysis. Also image data can identify the country's urban and rural areas within the use of land resources and ownership status, and access land and resources management special data. It can also used to investigate the mineral.

GSD 5m



Forest resources survey

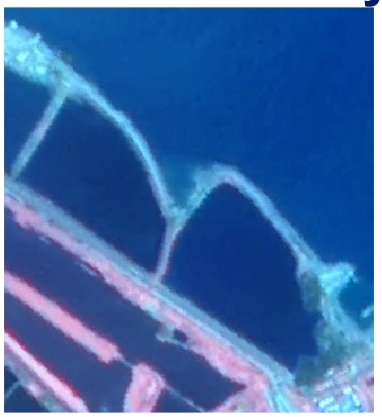
Wetland monitoring

2. Application and Analysis

APPLICATION

Ocean Resources Survey

Reclaimation



Cultivation ponds

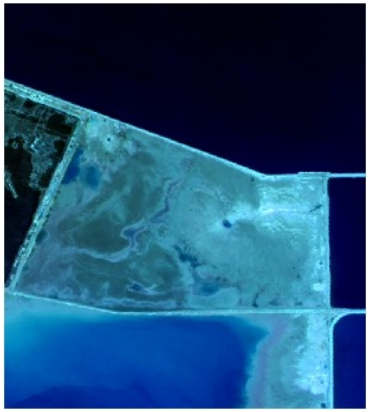
Saltern

Enclosed water to be used

Sea filling

Urban construction land

Port land

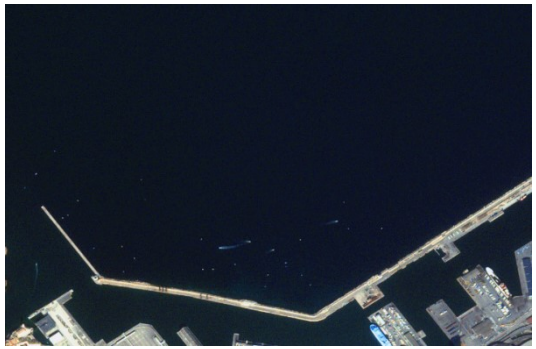


Others

2. Application and Analysis

APPLICATION

Maritime Monitoring



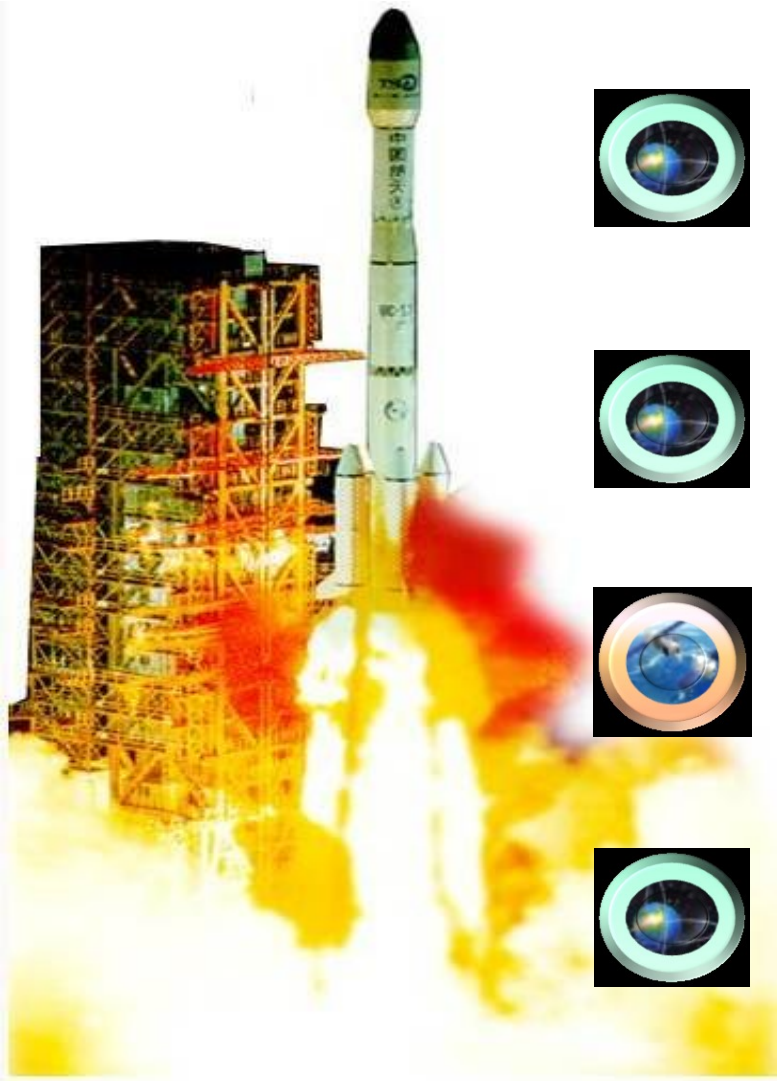
2. Application and Analysis

APPLICATION

Video

The video satellite is suitable for tracking environmental dynamic monitoring and moving targets. There are the specific application in the airplane rising and falling, the train running, factory smoke emission, urban stereoscopic imaging and so on. In the commercial field, it can monitor supply chain, infer economic indicators and master operating conditions of the company.

OUTLINE



- The Development
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- **Company Introduction**
- MV-1 Constellation

3. Company Introduction

Shenzhen DFH HIT

The company belongs to the china Academy of Space Technology(CAST)

- Adjacent to Hong Kong
- One of the most successful Special Economic Zones
- One of the fastest-growing cities in the world
- The largest producer of electric products in China
- Open environment in business and advantages in human resources

3. Company Introduction

Located in High-tech Park, Nanshan District, Shenzhen, 46400m2,17 floors.

Micro/Mini Satellites Manufacture

Micro/Mini Satellite Appliance

Micro/Mini Satellite Industrialization Base

3. Company Introduction

Our capabilities

- 60 years of space technology development
- Over 200 spacecrafts by CAST
- Integrated quality assurance system

Total solution of Micro-Satellites (Space qualified)

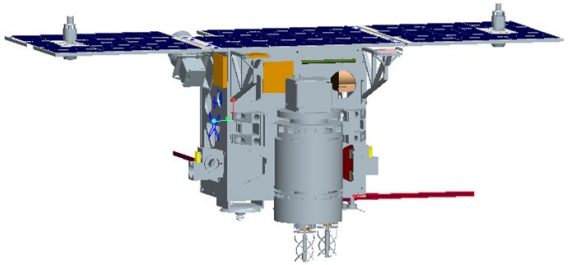
- system design
- satellite manufacturing
- environmental test
- in orbit operation
- ground supporting system
- training service

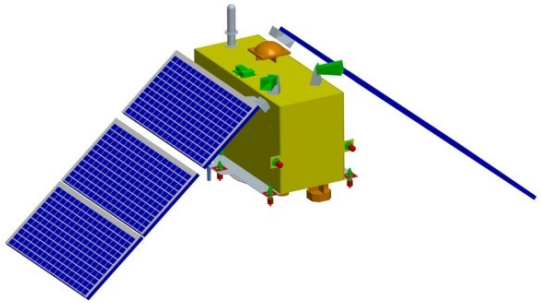
3. Company Introduction

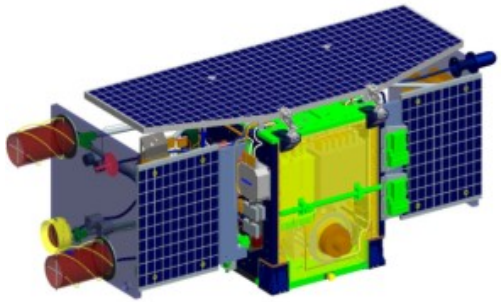
Micro-Satellite Buses

We have three micro-satellite buses, at present, each has its accommodate field.

- **Micro-Satellite Buses**
  - **CAST-5**: Flexible integrated electronic system and high functional density for micro-satellite platform
  - **CAST-10**: Mid/High performance for formation flying applications
  - **CAST-20**: Routine piggy-back launch mode, new technology demonstration



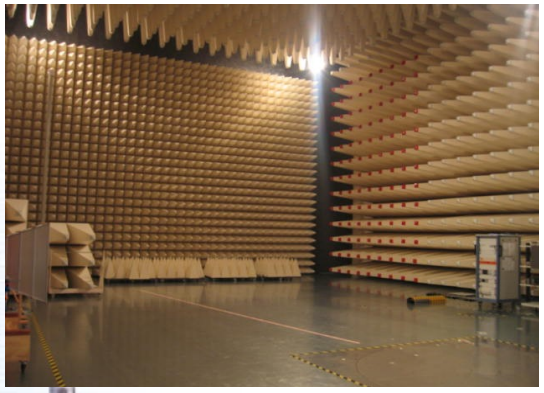




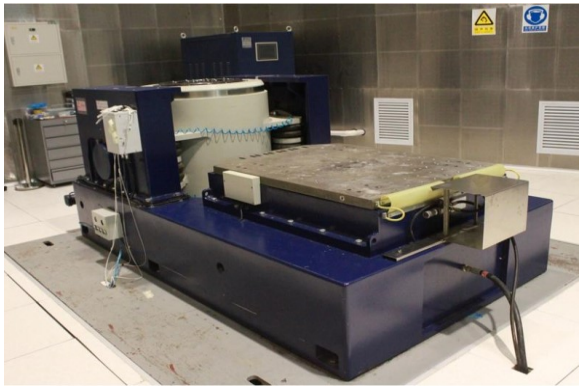
3. Company Introduction

Micro-Satellite Testing System

Shenzhen DFH has built the following laboratories, owning the capabilities of system development, design and analysis, and integrated simulation for micro-satellites and constellations.



3 meters semi-anechoic chamber



10T Vibration Test System

Φ3.6m×5m Thermal Vacuum Environmental Test Facility

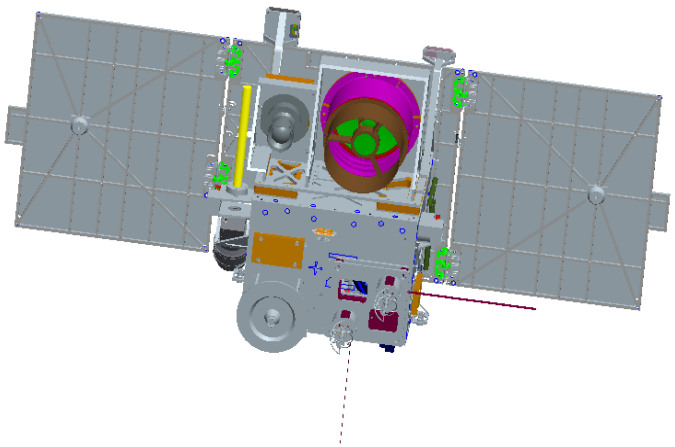
3-Axis Turntable

Φ1.2m×1.5m Thermal Vacuum System

3. Company Introduction

BNU-1 Satellite

BNU-1 satellite is a remote sensing micro satellite designed for polar region observation. The satellite is equipped with two cameras and AIS. The cameras can take images of the important area and AIS payload can receive the data from ships, which is helpful for polar ship navigation.



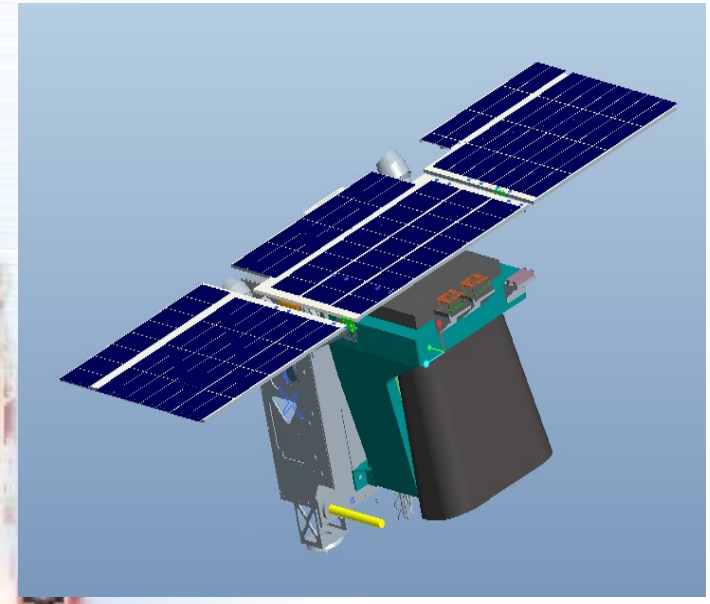
Main Parameters

Satellite Mass	≤16kg
Payload	Two cameras & AIS Push-broom camera GSD: 77.8m Area array camera GSD:8.6@778km
Orbital Parameters	Sun Synchronous Orbit Altitude: 778km
Pointing Accuracy	0.2°
Pointing Stability	0.01°/s
Design Life	1 year

3. Company Introduction

HN-1(01) Satellite

HN-1(01), a 50kg level remote sensing satellite, carrying a Dual-band Line-scan Wide-swath Camera and AIS payload. HN-1(01) satellite build specially for Map Survey Land & Sea Cover Investigation, and Ship Identification of Hainan province and the South China Sea.



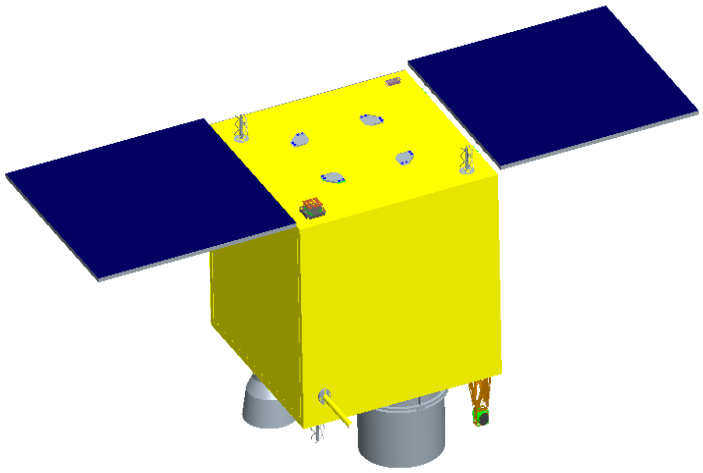
Main Parameters

Mass	35kg
Payloads	■ Wide-swath imager 5m GSD with 110km swath ■ AIS receiver with frequency 161.975MHz,162.025MHz 156.775MHz,156.825MHz
Orbital Parameters	Inc: 30°, Alt: 500km
Attitude Parameters	Pointing Accuracy 0.2° Pointing Stability 0.01º/s
Design Life	3 year

3. Company Introduction

HN-1(02) Satellite

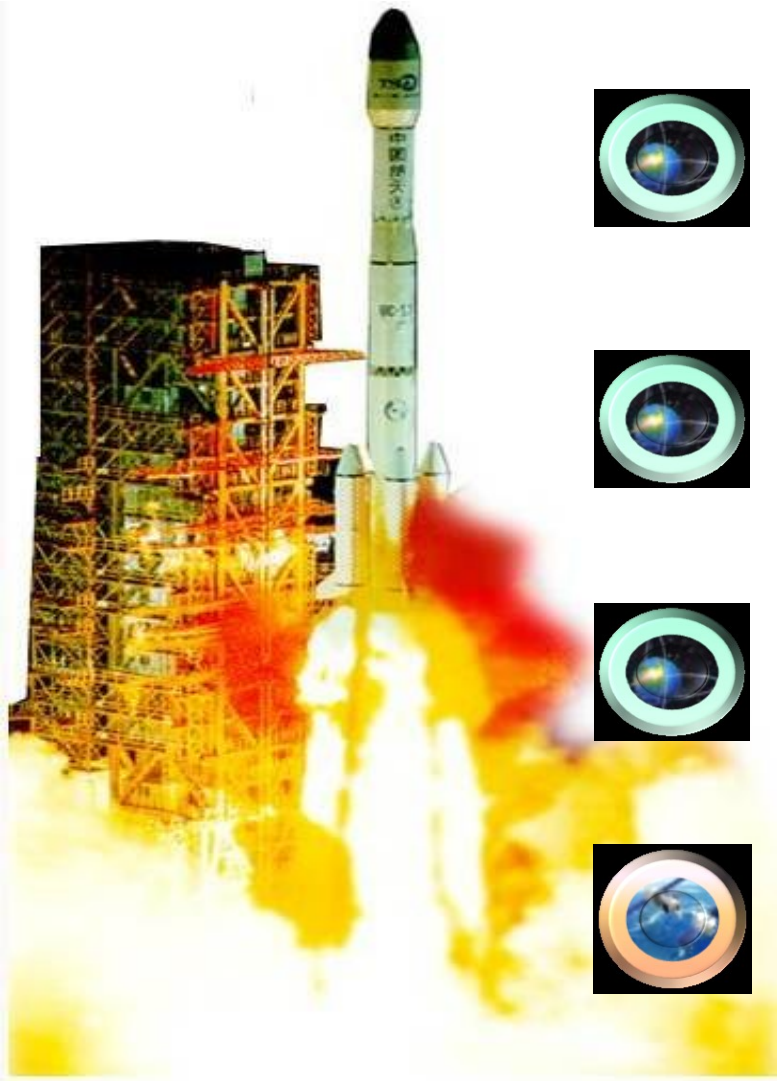
HN-1(02), **a 50kg level remote sensing satellite, carrying a High Resolution Camera and AIS payload. Similar to HN-1(01), HN-1(02) satellite build specially for Map Survey, Land & Sea Cover Investigation, and Ship Identification of Hainan province and the South China Sea, as well.**



Main Parameters

Mass	45kg
Payloads	■ Bayer RGB imager 1.55m GSD with 12km swath ■ AIS receiver with frequency 161.975MHz,162.025MHz 156.775MHz,156.825MHz
Orbital Parameters	Inc: 30°, Alt: 500km
Attitude Parameters	Pointing Accuracy 0.1° Pointing Stability 0.005º/s
Design Life	3 year

OUTLINE



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- **MV-1 Constellation**

4. MV-1 Constellation

The MV-1 constellation global service system consists of 80 microsatellites , which can provide hourly revisit, cost-effective, and high-quality remote sensing data in the global illumination area, and then provide remote sensing data services to global business users by building a sharing platform based on public cloud.

Business users

Public cloud services

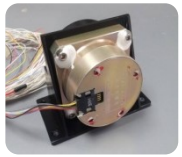
Data sharing platform

4. MV-1 Constellation

The MV-1 satellite is a cost-effective imaging micro-platform with characteristics of intelligent autonomous operation and management, using full color, multi-spectral and hyperspectral imaging with resolution 1m~5m.

Cost-effective micro-platform and payloads


Industrial camera


Fiber optic gyroscope

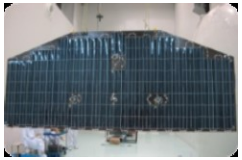

Magnetometer

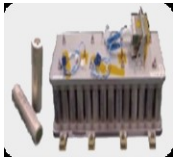

Spaceborne computer


Measurement and control module


Power module


GNSS module


Solar array


Battery pack


Magnetic torquer


Transmission module


Communication module

4. MV-1 Constellation

The MV-1 constellation system can flexibly expand and add payloads such as GNSS occultation receiver, AIS, ADS-B and DCS to provide global meteorological data, ship signals, civil aircraft signals, and short data collection services. The main application scenarios include urban planning, environmental monitoring, weather detection, space-based internet of things, vessel tracking, resource identification, and agroforestry monitoring.

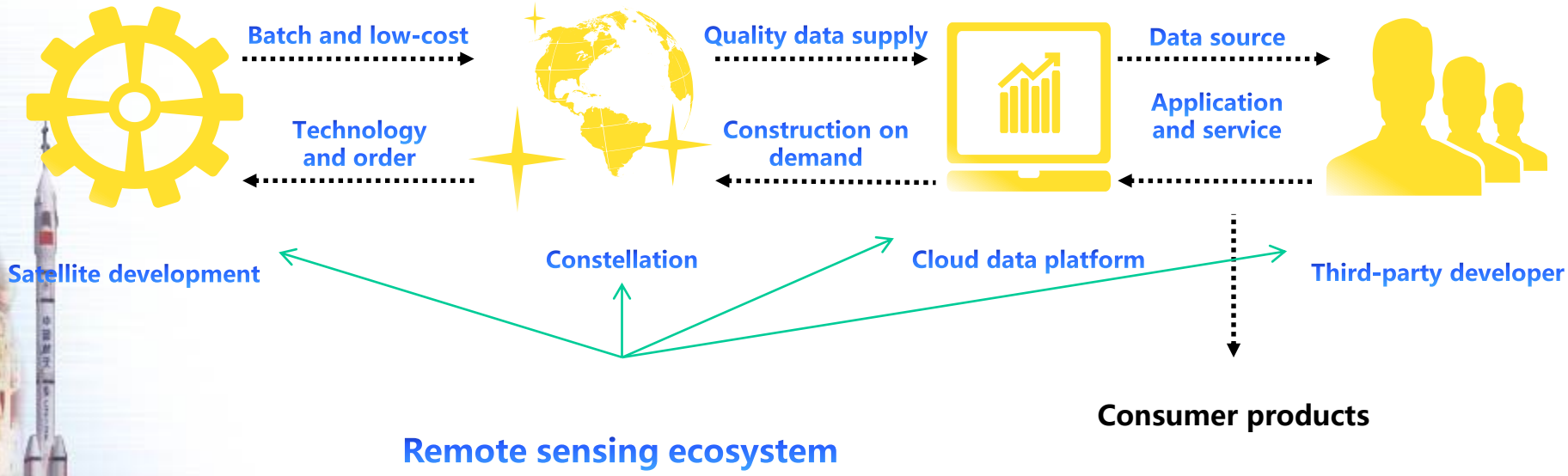
Urban planning

AIS vessel tracking

Space-based networking

4. MV-1 Constellation

The MV-1 cloud data sharing platform provide safer, reliable, and comprehensive data services for users using the multi-source remote sensing data fusion techniques. Third-party developers can not only obtain the remote sensing data resources provided by the platform, but also use various types of data processing analysis tools.



Thanks for your attention

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