China’s Earth Observation Development

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11 May, 2015    Berlin, Germany
“White Paper” on Space Activities

China's Space Activities in 2000

China's Space Activities in 2006

China's Space Activities in 2011

Information Office of the State Council
The People's Republic of China

Source: CNSA
Short Term Goals

- Build a long term Earth observation system
- Set up an independent satellite telecommunications network
- Establish a satellite navigation system
- Provide commercial launch services
- Set up a remote sensing system
- Study space science such as microgravity, life science, etc
- Exploration of the Moon
Objective of EO

• Construct the advanced earth observation systems with multi-mode and different resolution.

• Achieve all-weather, all-day and global coverage EO data acquiring capability.

• Provide global application service in the fields of agriculture, disaster, resource and environment, etc.

• Promote international cooperation.
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<th>Satellite Type</th>
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<td>Beidou-1</td>
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In order to improve the comprehensive capabilities of China's earth observation system, in 2010, the Chinese government approved to implement CHEOS.

CHEOS will be completely activated by 2020, which is compositing by

- Space-based System
- Near Space and Airborne System
- Ground System
- Application System
High Resolution EO Satellites

GF-1
- one 2m panchromatic/8m multi-spectral camera
- one 16m multi-spectral medium-resolution and wide-view camera
- into orbit on 26th April 2013

GF-2
- one 1m panchromatic/4m multi-spectral camera
- designed lifespan of over 5 years
- into orbit on 19th August 2014

GF-3
- multi-polarized C-band SAR at meter-level resolution
- designed lifespan of 8 years.

GF-4
- 50m staring camera, operating on the geo-synchronous orbit
- capacity for high temporal resolution remote sensing monitor at minute-level

GF-5
- visible and short-wave infraed hyper-spectral camera,
- spectral imager, greenhouse gas detector, atmospheric environment infrared detector

Source: CNSA
China’s first satellite for global CO₂ monitoring, and scheduled for launch in 2015.

Payload of the satellite: High spectra of CO₂ detector.

“Scientific Satellite for Global CO₂ Monitoring and Application Demonstration” launched by the National High-Tech Program.

Source: MOST
# Global Change Information Products

- 30 categories of products including land, ocean, atmosphere, urban construction;
- Spatial and temporal scale: long-time series in global and regional scales.

## Land
- Photosynthesis fluorescence
- Chlorophyll content
- fPAR
- Vegetation phenology
- Forest vegetation height
- Vegetation category
- Vegetation coverage
- Inland water color
- Ice-sheet freeze-thaw in polar regions
- Water equivalent of snow

## Ocean
- Sea surface temperature
- Sea surface rainfall
- Sea surface height anomaly
- Offshore chlorophyll A
- Sea surface salinity

## Atmosphere
- Atmospheric CO₂ concentration change
- Near surface air temperature
- Aerosol

## Urban construction
- RS products of urbanization rate
- Land expansion for urban construction
- Surface settlement
- RS image data of world heritage

![Global FPAR](image1.png)  
![Carbon cycle of global ecological system](image2.png)
Earth Observation Monitoring for Global Ecosystem and Environment

Total six EO data products to support global change research.

- Growth Conditions of Global Terrestrial Vegetation
- Terrestrial Surface Water Areas
- Supply Situation of Maize, Rice, Wheat, Soybean
- Urban and Rural Resident Land Cover Distribution
- Large Wetlands of International Importance
- Africa Land Cover Mapping
UN Big Data Climate Challenge winners show how big data can drive climate action

2 September 2014 (NEW YORK) – The United Nations today announced the winners of the “Big Data Climate Challenge” as part of the buildup to the UN Secretary-General’s Climate Summit on 23 September at UN Headquarters in New York.

RADI’s Research Team of Big Earth Observation Data for Global Change is one of them in the list.
Earth Observation for Belt and Road
# Proposal of Global Change Scientific Satellites

<table>
<thead>
<tr>
<th>Satellite</th>
<th>Observed variables</th>
<th>Payloads</th>
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</thead>
<tbody>
<tr>
<td>Atmospheric carbon satellite</td>
<td>CO₂</td>
<td>Grating spectrometer</td>
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<tr>
<td>Forest biomass satellite</td>
<td>Forest biomass</td>
<td>P-band SAR</td>
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<td>LiDAR</td>
<td>LiDAR</td>
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<td>Night light satellite</td>
<td>Night light</td>
<td>Multi-spectral low-light VNIR and TIR imaging sensor</td>
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<td>Aerosol satellite</td>
<td>Aerosol, water vapor</td>
<td>Aerosol multispectral imager</td>
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<tr>
<td>Glacier satellite</td>
<td>Glacial change, digital terrain model</td>
<td>L-band SAR</td>
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<tr>
<td>Ocean salinity satellite</td>
<td>Ocean salinity</td>
<td>L-band microwave radiometer</td>
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</tbody>
</table>
Proposal of a Moon-based EO Platform

The advantages of the Moon as an Earth observation platform compared with satellite:

- Capability of long-term and successive observation
- Large, variable viewing angle
- Long life
- Clean environment
- High stability

Microscopic scientific objectives:
- Large scale and Earth surface change
- Large scale land-atmosphere interaction
- Large scale ocean-atmosphere interaction
- Large scale ocean-land interaction
Space S&T in China: A Roadmap to 2050
Mainly making use of domestic application satellite data and foreign satellite data, while making use of a small quantity of earth science satellite data.

Achieving systematic breakthroughs in deep space flight, autonomous navigation, and positioning.

Making use of domestic application satellite data and foreign satellite data, and the proportion of earth science satellite data increases sharply.

Establishing Digital Earth Scientific Platform; initiation of some interdisciplinary research and case studies.

Establishing an integrated space science research system; launching 2-3 science satellites per year.

Making use of domestic application satellite data and foreign satellite data and earth science satellite data, and making use of foreign satellite data only as a supplement.


Mainly making use of domestic application satellite data and foreign satellite data, while making use of a small quantity of earth science satellite data.

Launching planetary scientific laboratory; Mars landing exploration.

Most optical and other payloads for space and earth observation payload being at the advanced level of the world.

Some optical and other payloads for space and earth observation payload being at the leading level of the world.

Space communication data rate and key platform technologies at the advanced level of the world, capable of meeting most application needs.

Space communication data rate and key platform technologies at the advanced level of the world, capable of meeting most application needs.

Deep space flight, autonomous navigation, and positioning at the advanced level of the world.

Deep space flight, autonomous navigation, and positioning at the leading level of the world, capable of meeting almost all application needs.

Space communication data rate and key platform technologies at the leading level of the world, capable of meeting most application needs.
Thanks!

Institute of Remote Sensing and Digital Earth
Chinese Academy of Sciences

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