SDGSAT-1: A Frontier Technology of TFM for Sustainable Development Goals

Huadong Guo

February 10, 2022  Beijing, China
SDGs Challenge

Sustainable Development
UN SDGs

Measuring Status & Progress

17 Goals
169 Targets
230+ Indicators

Tier I
supported by both methods and data
53%

Tier II
have methods but lack data
46%

Tier III
have neither standard methods nor data
1%
Technology Facilitation Mechanism (TFM)

UNITED NATIONS INTERAGENCY TASK TEAM ON STI FOR THE SDGS (IATT)

10-MEMBER GROUP TO SUPPORT THE TECHNOLOGY FACILITATION MECHANISM

MULTI-STAKEHOLDER FORUM ON SCIENCE, TECHNOLOGY AND INNOVATION FOR THE SDGS (STI FORUM)

ONLINE PLATFORM (2030 Connect) - GATEWAY FOR INFORMATION ON EXISTING STI INITIATIVES, MECHANISMS AND PROGRAMS
On Oct 25 2021, UN General Assembly Adopted the “Space2030” Agenda: space as a driver of sustainable development.

62 countries Sponsor the “Space2030” Agenda.

Four pillars: space economy, space society, space accessibility and space diplomacy.
SDGSAT-1: The World’s first Science Satellite for SDGs

SDGSAT-1 satellite was launched on Nov. 5, 2021

- Thermal infrared + nighttime-light + multi-spectral
- Wide scale (300 km)
- High-resolution (10 m)

- Explore new methods to sense Earth’s environment
- Provide datasets for SDGs that representing interaction between human activities and natural environment
Scientific Objectives

- Study/characterize the correlation and coupling of SDGs indicators representing the interaction between human activities and natural environment;
- Convert the Earth surface object parameters into SDGs application information (digital transformation);
- Monitor, evaluate and study of SDGs indicators introduced by human activities;
- Explore new methods and approaches to detect surface environmental elements under low-light conditions such as night light or moonlight.
Monitor, evaluate and study of SDGs indicators that representing the interaction between human activities and natural environment

Requirements Analysis
- Artificial construction coverage status
- Consumption of Energy and power
- Urban functional area identifying
- Temperature field distribution
- Human settlement pattern
- Intensity and concentration of human activities
- Water quality status
- Coastal ecosystems monitor
- Glacier changes and land creatures
- Offshore Water quality evaluation
- Port economic activity intensity
- Urban pollution at night
- Snow and ice detection in polar night

Observing Parameters
- Night light intensity
- Night light distribution
- Night light index
- Thermal radiation intensity
- Water temperature
- Industrial heat source
- Heat source identifying
- Land cover/change
- Artificial construction
- Sediment concentration
- COD, Total P/N
- Blue algae, red tide

Technical Demand
- High spacial resolution
- High dynamic range
- Quantitatively detection
- Wide coverage

Night light detection—
Glimmer Imager
Thermal radiation detection—
Thermal Infrared Spectrometer
Earth surface/water detection—
Multispectral Imager

Requirements-Driven Design
Innovational design

- Integrated design of satellite platform and payload systems;
- High sensitivity integrated design and high precision multi-mode control;
- Single solar panel wing with fixed angle of 30°;
- Multi-mode design of Glimmer/Multispectral Imager sharing optical path and switching imaging between night/day, ensuring synergetic observations in 24h.
Technical Specifications

- Orbit altitude: 505 km;
- Orbit inclination angle: 97.5°
- Spacial Resolution: 10 m for Glimmer/Multispectral, 30 m for Thermal Infrared.
- Data collect mode: Thermal Infrared + Glimmer (night); Thermal Infrared + Multispectral (day), and single sensor.
- Calibration Model: Moon, black body, LED lamp, etc., ensuring accurate quantitative detection.

### Technical specifications of SDGSAT-1

<table>
<thead>
<tr>
<th>Type</th>
<th>Index</th>
<th>specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Orbit</strong></td>
<td>Type</td>
<td>sun-synchronous</td>
</tr>
<tr>
<td></td>
<td>Altitude</td>
<td>505 km</td>
</tr>
<tr>
<td></td>
<td>Inclination</td>
<td>97.5°</td>
</tr>
<tr>
<td><strong>Thermal Infrared Spectrometer</strong></td>
<td>Swath Width</td>
<td>300 km</td>
</tr>
<tr>
<td></td>
<td>Bands</td>
<td>8～10.5 μm, 10.3～11.3 μm, 11.5～12.5 μm</td>
</tr>
<tr>
<td></td>
<td>Spatial Resolution</td>
<td>30 m</td>
</tr>
<tr>
<td><strong>Glimmer/Multispectral Imager</strong></td>
<td>Swath Width</td>
<td>300 km</td>
</tr>
<tr>
<td></td>
<td>Bands/Glimmer</td>
<td>P: 450～900 nm, B: 430～520 nm, G: 520～615 nm, R: 615～690 nm</td>
</tr>
<tr>
<td></td>
<td>Resolution/Glimmer</td>
<td>P:10 m, RGB: 40 m</td>
</tr>
<tr>
<td></td>
<td>Bands /Multispectral</td>
<td>B1: 380nm～420 nm, B2: 420nm～460 nm, B3: 460nm～520 nm, B4: 520nm～600 nm, B5: 630nm～690 nm, B6: 765nm～805 nm, B7: 805nm～900 nm</td>
</tr>
<tr>
<td></td>
<td>Resolution/Multispectral</td>
<td>10 m</td>
</tr>
</tbody>
</table>
Test in Satellite Launch Site
First set of images Released on Dec. 20th, 2021

Colored Glimmer image of Beijing/ 40m

Urban layout, road network, building, true color scene at night can be clearly displayed;

Water Cube(blue), neon light(red), road light(yellow) can be clearly identified.
Olympic Winter Games
Beijing 2022: Zhangjiakou Zone

Panchromatic Glimmer Image of Beijing/10m
Fused Colored Glimmer image of Charles de Gaulle Airport

Pairs /10m
Multispectral image of JiaoZhou Bay, Qingdao.

Multispectral image of entry of Yellow River/10m
CBAS: International Research Center of Big Data for SDGs

Inauguration Ceremony of the International Research Center of Big Data for Sustainable Development Goals
& Opening Ceremony of the International Forum on Big Data for Sustainable Development Goals

2021年9月6日 中国 北京
September 6, 2021 Beijing, China
President Xi and UN SG’s Congratulatory Letter to CBAS’s Launch

The sci-tech innovation and application of big data will help the international community to overcome difficulties and implement the UN 2030 Agenda globally.

-- President Xi’s congratulatory letter

This Research Centre will work side-by-side with the Regional Hub for Big Data to support the UN Global Platform. Together, we can do more to end poverty, protect the planet and promote peace.

-- UN Secretary-General António Guterres’ video message
Congratulations on International Research Center of Big Data for SDGs

Liu Zhenmin
UN Under-Secretary-General for UN DESA

Inger Andersen
UN Under-Secretary-General and Executive Director of UNEP

Ibrahim Thiaw
UN Under-Secretary-General and Executive Secretary of UNCCD

可持续发展大数据国际论坛
International Forum on Big Data for Sustainable Development Goals
A research team with extensive capacity

33 CAS Institute

96 Participating Organization

>1200 Scientist
The Center provides a range of services essential for addressing the most challenging problems such as lack of data and technology barriers in the implementation of the SDGs, including data sharing, technology solutions, decision-making support, as well as capacity building for developing countries.
CBAS Key Missions

- Develop SDG data infrastructure and information products
- Provide new knowledges for SDG monitoring and evaluations
- Develop and launch a series of SDG Satellites
- Establish a think tank for STI to promote SDGs
- Capacity development for SDGs in developing countries
The Reports on SDGs

Chinese government released reports at the 74th, 75th and 76th UN GA
Achieve SDGs with the Key of Big Data Together
THANKS

No.9 Dengzhuang South Road, Haidian District, Beijing 100094, China
Tel: +86-10-82178985
Fax: +86-10-82178980