GOSAT

Greenhouse Gases Observing Satellite “IBUKI” and its contribution to improve our understanding of global warming

United Nations Committee on the Peaceful Use of Outer Space
UN COPUOS
Scientific and Technical Subcommittee, 46 session

Vienna, 9-20 February 2009

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## GOSAT Satellite and Launcher

<table>
<thead>
<tr>
<th>Size</th>
<th>Main body</th>
<th>1.5 x 2 x 3.2 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass</td>
<td>Total</td>
<td>1750kg</td>
</tr>
<tr>
<td>Power</td>
<td>Total</td>
<td>4400W</td>
</tr>
<tr>
<td>Life</td>
<td></td>
<td>5 years</td>
</tr>
<tr>
<td>Orbit</td>
<td>Sun Synchronous Orbit</td>
<td></td>
</tr>
<tr>
<td>Local time</td>
<td></td>
<td>12:54</td>
</tr>
<tr>
<td>Altitude</td>
<td></td>
<td>666km</td>
</tr>
<tr>
<td>Inclination</td>
<td></td>
<td>98deg</td>
</tr>
<tr>
<td>Re-visit</td>
<td></td>
<td>3 days</td>
</tr>
<tr>
<td>Launch</td>
<td>Vehicle</td>
<td>H-IIA</td>
</tr>
<tr>
<td>Date</td>
<td></td>
<td>23rd Jan. 2009</td>
</tr>
</tbody>
</table>
JAXA contribution to GEO

To develop and operate an Earth Observation System for GEOSS

GEOSS
The nine ‘Social Benefit Areas’

Health

Energy

Ecosystems

Water

Climate

Disasters

Weather

Agriculture

Biodiversity

A plan of advanced low Earth orbit satellites

Water SBA

- Dual-frequency Precipitation Radar (GPM) [2012] (With NASA)

- AMSR2 (GCOM-W) [2011] (With NASA)

- Cloud Profiling Radar (EarthCARE) [2012] (With ESA)

- SGLI (GCOM-C) [2013]

Climate SBA

- Greenhouse Gases Observation Sensor (GOSAT) [2009]

Disaster SBA

- SAR (ALOS, disaster monitoring satellites), Optical Sensor (ALOS, Geo-stationary EO satellite) [2006(ALOS)]

SBA : Societal Benefit Area

18th Sept 5
Introduction

GOSAT is

- the Greenhouse gases Observing SATellite.
- the satellite to monitor the global distribution of Green House Gases (GHG).
- the joint project of
  - Japan Aerospace Exploration Agency (JAXA),
  - Ministry of Environment (MOE), and
  - National Institute for Environmental Studies (NIES).
Organization

**ORGANIZATION**

GOSAT is the joint project of JAXA, MOE (Ministry of Environment) and NIES (National Institute for Environmental Studies).

- **MOE**
  - Sensor development (Funding Support)
  - Date use for Policy development

- **JAXA**
  - Sensor development
  - Satellite development
  - H-IIBA launch
  - Satellite operation
  - Data acquisition
  - Calibration

- **NIES**
  - Algorithms development
  - Data use for science
  - Validation
Mission Objectives

GOSAT has two major mission objectives;

(1) To contribute to the environmental policy development.
   - by monitoring the global distribution of GHG (CO₂ and CH₄)
   - by estimating the emission and absorption of GHG at sub-continental scale.

(2) To contribute to the advancement of earth observation technologies.
   - by developing Short Wave and Thermal Infrared Fourier Transform Spectrometer
   - by developing highly reliable and robust satellite system
Mission Priority

(1) Primary mission
- Short Wave Infrared observation
- CO$_2$ and CH$_4$ column density (day time)

(2) Secondary mission
- Thermal Infrared observation
- CO$_2$ and CH$_4$ altitude profile
- CO$_2$ and CH$_4$ column density (night time)
- Other gases (O$_3$, etc)
- Other products (Temperature profile, Earth radiation)
# Sensor Characteristics

<table>
<thead>
<tr>
<th></th>
<th>Greenhouse Gases Observing Sensor</th>
<th>Clouds and Aerosol Sensor</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Size</strong></td>
<td>1.2<em>1.1</em>0.7m</td>
<td>0.5<em>0.4</em>0.5m</td>
</tr>
<tr>
<td><strong>Mass</strong></td>
<td>250kg</td>
<td>40kg</td>
</tr>
<tr>
<td><strong>Power</strong></td>
<td>310W</td>
<td>100W</td>
</tr>
<tr>
<td><strong>FOV</strong></td>
<td>1000km (mechanical scan)</td>
<td>1000km</td>
</tr>
<tr>
<td><strong>IFOV</strong></td>
<td>10km</td>
<td>0.5km-1km</td>
</tr>
<tr>
<td><strong>Resolution</strong></td>
<td>0.2-0.5 (Band1) cm-1</td>
<td>20-130 nm</td>
</tr>
<tr>
<td><strong>SNR</strong></td>
<td>300</td>
<td>200</td>
</tr>
<tr>
<td><strong>Channel</strong></td>
<td>ch1:0.75-0.78μm/ ch2: 1.56-1.72μm</td>
<td>ch1:0.38μm/ ch2:0.67μm</td>
</tr>
<tr>
<td></td>
<td>ch3:1.92-2.08μm/ ch4:5.5-14.3μm</td>
<td>ch3:0.87μm/ ch4:1.61μm</td>
</tr>
</tbody>
</table>
**Operation of FTS**

- **Solar Irradiance Cal.**
- **Lunar Cal**
- **FTS SWIR**
- **Solar Flux**
- **FTS TIR**

**Observations:**
- **Nominal observation** (dayside land, nightside)
- **Sunglint observation** (dayside ocean)
- **Special point observation** (calibration, validation, pipeline)
Footprint
FTS IFOV=10.5 km
CAI IFOV=0.5, 1.5 km

Cross-track pattern  Distance bet. points (at 30deg in latitude)  Exposure (sec)
1  790 km  4x3
3  260 km  4x3
5  160 km  4
7  110 km  2
9  88 km  1

Along Track
Cross Track
TANSO-CAI SWATH=900km
Near Infrared

Spectral coverage:
- 2.0 μm band (4,800 ~ 5,200 cm⁻¹)
- 1.6 μm band (5,800 ~ 6,400 cm⁻¹)
- 0.76 μm band (12,900 ~ 13,200 cm⁻¹)

Resolution: 0.2 cm⁻¹
Apodization: Norton-Beer (Moderate)
GHG Observing Points

Ground Stations (current)

- 274 ground stations in the world.
- The observing data from these stations is distributed from WDCGG of WMO
- The number of stations is limited, and they exist unevenly in the world.

WDCGG: World Data Center for Greenhouse Gases
WMO: World Meteorological Organization

From Space (GOSAT)

- Over 100,000 points per 3 days
- Global and frequent observation with a single instrument
Annual Flux Estimation

Annual Flux (GtC/yr) of CO₂ in Sub-continental Scale

Current Estimation Error: 0.54 GtC/yr
Small longitudinal gradient of CO2

A: Columner CO2 (in ppm)

Calculated CO2 column concentration in March (the correction is made for the surface altitude)

Water column distribution (Observed by AMSR-E, Aug.-Oct. in 2007)
Conclusion

- GOSAT launched on 23rd February by H-IIA
- Mission checkout is underway for 3 months
- CAL/VAL starts April to August
- L1 non validated data provision for PI’s starts April
- Another users, L1 from October, L2 from next January
- 2nd RA will be in April
For more secure
and prosperous society

Japan Aerospace Exploration Agency

END OF PRESENTATION