Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

MSD004-01 Room:301A Time:May 27 14:15-14:30

World's First Flight of Solar Power Sail by IKAROS

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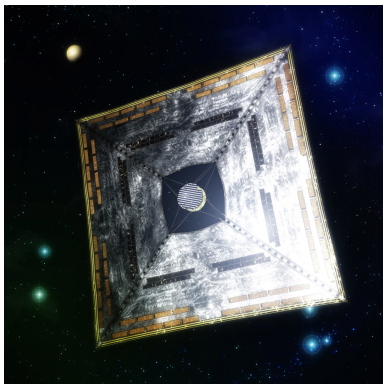
A Solar Sail is a space yacht that gathers energy for propulsion from sunlight pressure by means of a membrane. A solar sail can move forward without consuming propellant as long as it can generate enough energy from sunlight. This idea of a solar sail was born about 100 years ago and we often find it in science fiction novels. The solar sail missions are studied in the world. However it was not realized before IKAROS flight.

A Solar Power Sail is a Japanese original concept that gets electricity from thin film solar cells on the membrane in addition to acceleration by solar radiation. A solar power sail craft can save the fuel using a solar sail and it can also gain the necessary electric power using a vast area of thin film solar cells on the membrane even when it is away from the sun. It can be a hybrid propulsion system with a solar sail by activating the ultra-high specific impulse ion engines with the power generated by thin film solar cells.

The authors have studied an Extended Solar Power Sail mission toward Jupiter and Trojan asteroids via hybrid electric photon propulsion. The mission proposal passed the Mission Definition Review and now is eligible to go into the pre-project phase (Phase-A).

In addition, we applied first for the small technology demonstrator mission, IKAROS as a Front-Loading of new key technical issues of extended solar power sail craft. The proposal was endorsed in fall, 2007. IKAROS (Interplanetary Kite-craft Accelerated by Radiation Of the Sun) demonstrates the membrane deployment and thin film power generation. It is also the world's first actual solar sail flying an interplanetary voyage.

In this paper, the development of hub bus and mission portions of IKAROS is presented and the summary of IKAROS operation is introduced.



Keywords: Solar Sail, Solar Power Sail, Thin Film Solar Cell, Membrane, Deployment

Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

MSD004-02 Room:301A Time:May 27 14:30-14:45

Report on Solar Power Sail Deployment Mission of IKAROS

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Japan Aerospace Exploration Agency (JAXA) launched the solar power sail orbiter IKAROS, on May 21th, 2010. IKAROS demonstrates a new propulsion technology of utilizing photons from the sun, and an electrical power generation using solar cell film, for deep space exploration, which is called the Solar Power Sail technology.

The IKAROS is a small demonstrator of the solar power sail technology, as a front-loading demonstration for risk reduction of a future solar power sail mission. IKAROS is a spin type orbiter that deploys a large solar power sail utilizing centrifugal force, in an interplanetary orbit.

IKAROS will conduct the following missions,

1)Expand the solar power sail that diameter is 20 meter class, and obtain the characteristic of a sail dynamics.

2)Generate electric power using the very thin flexible solar arrays attached on the sail, and evaluate their performance and depletion.

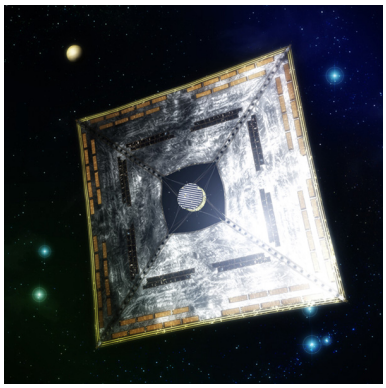
3)Demonstrate the navigation technology utilizing acceleration arisen by photon pressure on the sail.

4)Estimate a length and direction of acceleration vector of photon pressure.

We developed the new mechanical system to deploy a lager solar power sail for IKAROS that realizes a two phase deployment method we proposed. The deployment method is composed of two sequences, that is, quasi-static deployment sequence ”First stage deployment” and a dynamical deployment sequence ”Second stage deployment”.

IKAROS succeeds to deploy the solar power sail on June 9th, 2010, the first in the world. We detect and valuate dynamics of the sail using rate gyros (RG), acceleration sensor attached to tip of the sail, and monitor camera system. IKAROS can demonstrate the new deployment method and the deployment mechanism.

We report that result of verification of the function of deployment mechanism and a 20m class solar power sail dynamics in inter-planetary orbit, in this paper.



Keywords: IKAROS, Solar Power Sail, Exploration

Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

MSD004-03 Room:301A Time:May 27 14:45-15:00

Next-generation International Scientific Observation Satellite Project

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Professor Shinichi Nakasuka of the University of Tokyo is now leading a small satellite development activity within the scope of a Japanese FIRST (Funding Program for World-Leading Innovative R&D on Science and Technology) program. In this program at least five micro-satellites are going to be developed including one scientific satellite under international cooperation, which is the second one of the series. Tohoku University is in charge of project management of this satellite and is playing the central role in inviting and selecting international scientific instruments from all over the world, designing the satellite bus system, and arranging the total project management activities.

The above mentioned scientific micro-satellite is a 50-kg class one dedicated to scientific research by different types of scientific instruments mainly focusing on Earth observation. The invitation process of the international instruments has already been started and indeed our group officially gave an announcement of Call for Letter of Intent inviting scientific instruments for this micro-satellite at the International Astronautical Congress held in Prague in September/October 2010. In this Call, it is also mentioned that we strongly encourage the participation by inexperienced groups in developing countries and for these groups we plan to start a capacity building course in space-instrument fabrication at Japanese universities. Though the time schedule was tight, as the deadline of this Call was the end of October, we were successful in receiving more than 10 LOI's from worldwide academic/research institutions. Some institutions submitted even more than one LOI's. Within these proposed instruments, we have some radiation measuring instruments of different types of radiation sources, a CMOS/CCD camera system, a thermal luminescence detector, an electro-dynamic tether and so forth, which are of our great interest.

The selection of scientific instruments will be completed by the end of the Japanese fiscal year 2010, namely, by the end of March 2011. The engineering models of selected instruments are planned to be delivered by the end of second quarter of the fiscal year 2011, and flight models in one year later from that point, so that the engineering model of the satellite system can be developed by the end of the fiscal year 2011, and the flight model by the end of the fiscal year 2012 (ready for launch). For the instruments selection, we take into account their scientific values, the feasibilities of their development schedules in terms of the above mentioned satellite development master schedule, the heritages and capabilities of the candidate institutions, and the regional arrangement. We are interested in accommodating as many instruments as feasible.

The satellite bus system is designed in the way that the observation capabilities of the scientific instruments can be dramatically improved than recent general micro-satellites in terms of observation time duration, attitude control pointing accuracy, and amount of data. Also a great attention is paid to the system's reliability and operability.

In the presentation the results of instruments selection, the instruments themselves and their mission objectives, satellite system design and its operational scenario will be described in detail.

Keywords: Micro-satellite, International Scientific Mission

Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

MSD004-04 Room:301A Time:May 27 15:00-15:15

Scientific objectives and current status of the SPRINT-A/EXCEED mission

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The EXCEED (EXtreme ultraviolet spectrosCope for ExosphEric Dynamics) mission is an Earth-orbiting extreme ultraviolet (EUV) spectroscopic mission and the first in the SPRINT series being developed by ISAS/JAXA. EUV spectroscopy is suitable for observing tenuous gases and plasmas around planets in the solar system (e.g., Mercury, Venus, Mars, Jupiter, and Saturn). The aim of the SPRINT-A/EXCEED mission is to investigate the plasma and energy transport processes in the inner and outer planets.

This mission has two primary scientific targets. The Jovian magnetosphere is known to be dominated by the plasma flow co-rotating around the planet. Co-rotating regions are common in the magnetospheres of magnetized bodies. Although the terrestrial magnetosphere also has a co-rotation region in the inner magnetosphere, it is strongly affected by the solar wind. Because Jupiter's co-rotation electric field is orders of magnitude higher that the solar wind electric field, plasmas in the inner magnetosphere inside a radial distance of 10-20 planetary radii are co-rotating with the planet. Jupiter provides us with good opportunities to study energy and plasma transport processes in the co-rotation region itself.

Another primary objective is to investigate an unresolved problem concerning the escape of the atmosphere to space. Although there have been some in-situ observations by orbiters, our knowledge is still limited. This mission plans to make imaging observations of plasmas around the planets to determine the amounts of escaping atmosphere. The instrument's field of view (FOV) is so wide that we can get an image from the interaction region between the solar wind and planetary plasmas down to the tail region at one time. This will provide us with information about outward-flowing plasmas, e.g., their composition, rate, and dependence on solar activity.

EXCEED has two mission instruments: the EUV spectrograph and a target guide camera that is sensitive to visible light. The EXCEED spectrograph is designed to have a wavelength range of 55-145 nm with minimum spectral resolution of 0.4 nm. Three spectrograph slits have a field of view of 400 x 10, 400 x 60, and 400 x 140 arc-seconds. The 10 arc-sec slit will be used to achieve the best spectral resolution of 0.4 nm. The target guide camera will be used to capture the target and guide the observation area of interest to the slit. Emissions from outside the slit's FOV will be reflected by the front of the slit and guided to the target guide camera. The image is taken every 5 seconds and sent to a mission data processor (MDP), which calculates the centroid of the image. During an observation, the bus system controls the attitude to keep the centroid position with an accuracy of 10 arc-seconds.

The SPRINT-A/EXCEED mission is now under development and plans to launch in 2013.

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Small Satellite Program ERG

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In order to investigate acceleration mechanisms of relativistic particles of the radiation belts and dynamics of geospace during space storms, the ERG (Energization and Radiation in Geospace) project has been proposed. The small satellite SPRINT-B/ERG will be launched around 2014-2015 in which many space storms tend to occur. The planned apogee altitude is about 4 Re, which is essential to measure the heart of the outer radiation belt, and the mission life will be longer than 1 year. The SPRINT-B/ERG satellite is currently designed to have a comprehensive set of plasma/particle sensor as well as field and wave instruments. These sensors can cover wide energy ranges of plasma/particles and frequency ranges of waves, which are important to understand the cross-energy coupling to generate relativistic electrons. The project consists of satellite observation team, ground-network observation team, and simulation/integrated studies team. There are also science coordination team and project science center in the ERG project. In this presentation, we will talk about the current status of the project.

Keywords: small satellite, geospace

Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

MSD004-06 Room:301A Time:May 27 15:30-15:45

Space-borne imaging observation of the Ionosphere, mesosphere, upper atmosphere, and plasmasphere

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ISS-IMAP (Ionosphere, Mesosphere, upper Atmosphere, and Plasmasphere mapping) mission is a space-borne imaging missions to observe the Earth's upper atmosphere, the mesosphere, the ionosphere, the thermosphere and the plasmasphere. It is a scientific mission that installs two imaging instruments on the Exposed Facility of Japanese Experiment Module on the International Space Station, Kibo (EF of ISS-JEM), . The observation is planed to be started in 2011 fiscal year. It will make imaging observation of the Earth's upper atmosphere with visible-light and infrared spectrum imager (VISI) and extra ultraviolet imager (EUVI). The objective of this mission is to clarify the physical mechanism of the following three processes: (1) energy transport process by the atmospheric structures whose horizontal scale is 50-500km in the upper atmosphere (2) process of the plasma transport up to 20,000km altitude (3) effect of the upper atmosphere on the space-borne engineering system. ISS-IMAP will measure the following three parameters in the lower latitude region than 50 degrees: (1) distribution of the atmospheric gravity wave in the mesopause (87km), the ionospheric E-region (95km), and the ionospheric F-region (250km) (2) distribution of the ionized atmosphere in the ionospheric F-region (3) distribution of O+ and He+ ions in the ionosphere and plasmasphere. VISI will observe the airglow of 730nm (OH, Alt. 85km), 762nm (O2, Alt 95km), 630nm(O, Alt.250km) in the Nadir direction. EUVI will measure the resonant scattering of 30.4nm [He+] and 83.4nm [O+]. Its field-of-view is 15 degrees, and points the limb of the Earth to observe the vertical distribution of the ions. The scientific objectives and current status of the ISS-IMAP mission will be introduced in the presentation.

Keywords: Ionosphere, Mesosphere, Plasamasphere, Thermosphere, International Space Station, Kibo

Japan Geoscience Union Meeting 2011
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MSD004-07 Room:301A Time:May 27 15:45-16:00

Current Status of JEM-GLIMS onboard ISS and Expected Science Outputs

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In order to study the generation mechanism and occurrence condition of Transient Luminous Events (TLEs), global occurrence rates and distributions of lightning and TLEs, and the relationship between lightning, TLEs and Terrestrial Gamma-ray Flashes (TGFs), we will carry out the lightning and TLE observation at Exposed Facility of Japanese Experiment Module (JEM-EF) of International Space Station (ISS). In this mission named JEM-GLIMS (Global Lightning and sprIte MeasurementS on JEM-EF) two kinds of optical instruments and two sets of radio receivers will be integrated into the Multi mission Consolidated Equipment (MCE) which is the bus system and will be installed at JEM-EF finally. The optical instruments consist of two wide FOV CMOS cameras (LSI) and six-channel spectrophotometer (PH), and all these optical instruments are pointed to the nadir direction. LSI uses a STAR-250 CMOS device as a detector, which has 512x512 pixels and 25x25 um pixel size, and has 28.3x28.3 deg. FOV. LSI-1 equips a wide band optical filter (730-830 nm) and mainly measures lightning emission, while LSI-2 equips a narrowband optical filter (766+/-6 nm) and mainly measures TLE emission. Five of six PH channels have 42.7 deg. FOV and use photomultiplier tube (PMT) as a photon detector. They equip band-pass filters (150-280 nm, 316+/-5 nm, 337+/-5 nm, 392+/-5 nm, and 762+/-5 nm) for the absolute intensity measurement of the TLE emission. One of six photometers equips a wide-band filter (600-900 nm) to detect lightning occurring within 86.8 deg. FOV. These output signals will be recorded with the sampling frequency of 20 kHz with a 12-bit resolution. In order to detect whistler wave in the VLF range excited by lightning discharges, one VLF receiver (VLFR) is installed. VLFR consists of one VLF receiver that can record waveform data with a sampling frequency of 100kHz with 14-bit resolution and of 15cm monopole antenna that is directing nadir direction and is attached at the base plate of MCE. In addition to this, VHF interferometer (VITF) which measures VHF pulses emitted by lightning discharges is installed. VITF consists of two patch-type antennas installed at the base plate of MCE and separated by 1.5m and of one receiver which records pulse data with a sampling frequency of 200MHz with 8-bit resolution. JEM-GIMS will be launched by H-IIB F3 on 20 January 2012. We have finished the fabrication of GLIMS instruments and all the environmental tests (EMC, vibration, and thermal vacuum) and have delivered GLIMS instruments to the system side. All functional and environmental tests of MCE carried by system side will be finished and be delivered it to the launch site in this summer. We will present the status of the JEM-GLISM mission and discuss the expected science outputs derived from this mission more in detail.

Keywords: lightning, sprite, International Space Station

Japan Geoscience Union Meeting 2011
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MSD004-08 Room:301A Time:May 27 16:00-16:15

Progress Report of the Development of microsatellite RISING-2 for cumulonimbus and sprite observation by multi-spectrum

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[1]Tohoku University, [2]Hokkaido University

The development of 50-kg microsatellite RISING-2 started in July, 2009 by Tohoku University and Hokkaido University. The primary mission is earth observation with a resolution of about 5 meters, and the design method of RISING (SPRITE-SAT) launched in January, 2009 is inherited. In this presentation, a summary of mission and system design is reported.

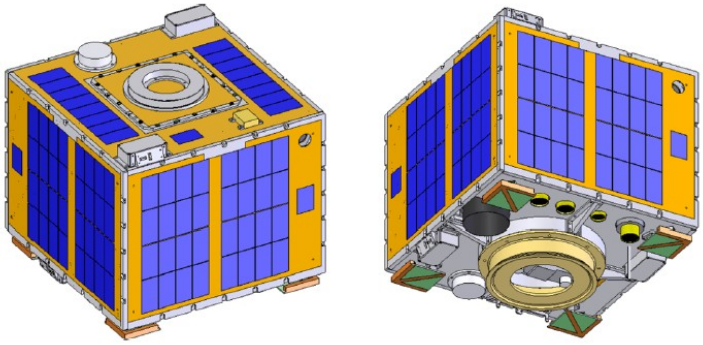
The RISING-2 is the microsatellite which mass is about 50kg and the size is about 500x500x500mm. The orbit is sun synchronous and the altitude of circular orbit is planned from 600 to 800 km. The launch rocket and date is not decided, but the development will be finished until March, 2011, and the launch opportunity after April, 2011 is scheduled.

The primary mission is the earth observation with a resolution of 5 meters by using a Cassegrain reflector telescope which diameter is about 10 cm and the focus distance is about 1 meter. The visible infrared and multi spectral images of cumulonimbus clouds can be observed by using a liquid crystal tunable filter (LCTF) as well as usual color images. Continuously observing the cloud images with an interval of about 10ms, the detail structure of cumulonimbus clouds in multi spectrum can be constructed. This resolution is higher than images obtained by conventional satellites such as TRMM, which have 2-km resolution, and ground radar observatories. These observations are expected to solve a mechanism of guerilla heavy rain and contribute to the establishment of basic technology for weather forecasting.

In the RISING (SPRITE-SAT) project, the primary mission was the observation of sprite, which is one of lightning discharge phenomena in the upper atmosphere discovered in 1989. Unfortunately, the trouble in bus instruments was happened on 12 days after launch, and the telemetry data are not being received in ground stations until now.

The RISING-2 carries the same instruments and tries to observe the sprite phenomena again. The instruments consist of two spectrum CMOS cameras, which FOV is 29 degrees each, and one wide-view CCD camera. The horizontal structure is solved by simultaneously observing sprites and lightning discharge phenomena. In the same years, several similar missions such as TARANIS, ASIM, and JEM-GLIMS are scheduled. The multiple observations in several missions will have the marvelous influence on the science of atmospheric electricity in the meteorology, the space and terrestrial physics, and the gamma-ray astronomy.

The RISING-2 can observe the designated position around the earth by using the three-axis attitude control system which consists of reaction wheels, star sensors and gyro sensors. The almost instruments of attitude control system including a central control unit, attitude sensors and wheels are newly developed in this project. The angular velocity just after the entry into orbit will be about 2 deg/s, and this tumbling motion is dumped into less than 0.2 deg/s by magnetic torquers and magnetometers. In the sunshine, the coarse earth-pointing control is carried out every time by magnetic torquers, magnetometers, and sun sensors. The fine pointing control using wheels, gyro, and star sensors is carried out for 15 minutes in sunshine and 15 minutes in eclipse each. In the coarse control mode, the almost instruments about attitude control and earth observation are powered off to save the average power consumption.



Keywords: microsatellite, Cassegrain reflector telescope, liquid crystal tunable filter, cumulonimbus clouds, sprite

Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

MSD004-09 Room:301A Time:May 27 16:30-16:45

Tanpopo: Astrobiology Exposure and Micrometeoroid Capture Experiments

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Terrestrial microbes may be ejected to outer space by natural events such as volcanic eruption, meteorite impact and electrostatic interactions. Microbes have been collected at high altitude up to several tens km using balloons and aircrafts. Some of the sampled microbes showed the high UV-resistance. To test the possible interplanetary migration of terrestrial life, we propose the microbe sampling experiments on International Space Station (ISS) at low Earth orbit (400 km). Ultra low-density aerogel will be exposed to space to capture micro-particles. After the curation of tracks and particles on the aerogel, the samples will be distributed to scientists to examine mineralogical, organo-chemical and microbiological characteristic of the particles. For the microbiological analysis, samples will be stained with DNA-specific fluorescence-pigment, and will be inspected with a fluorescence microscope. The fluorescent particles will be used for PCR amplification of the rRNA sequence followed by cloning and DNA sequencing. The sequence will be used to estimate the origin and properties of the captured microbes.

Keywords: microbe, IPD, organic compounds, Panspermia hyphothesis, space debris

Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

MSD004-10 Room:301A Time:May 27 16:45-17:00

HDTV observation from International Space Station

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A high resolution camera (HDTV) as an instrument of ISS/JEM/MCE has been developed from COTS high vision camera. This camera will launched by HTV-3 and will operate on the ISS in Jan. 2012. This paper will introduce the development of MCE/HDTV and its observation plan.

Keywords: HDTV, ISS

Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

MSD004-11 Room:301A Time:May 27 17:00-17:15

TARANIS Micro-Satellite: Science Objective and Current Status

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In the past 20 years, various new phenomena associated with lightning discharges were discovered. One of these phenomena is transient luminous events (TLEs), such as sprites, elves and blue jets. These transient optical flashes are generate by the strong cloud-to-ground discharges whose charge moment or peak current is extremely large. The other is terrestrial gamma-ray flashes (TLFs), which are first discovered by BATSE onboard the CGRO satellite in 1994. The most likely models for the generation of TGFs involve the production of runaway electron beams accelerated in an avalanche process by thundercloud associated with strong electric fields. However, fundamental issues regarding the association of TLEs or lightning with TGFs and the nature of the source of penetrating radiation itself remain a mystery.

In order to study the occurrence condition and mechanisms of TLEs and the generation region and mechanism of TGFs, and in order to identify the relationship between TLEs and TGFs, simultaneous space measurements of lightning, TLEs and TGFs are essential. For these purposes a micro satellite mission named TARANIS (Tool for the Analysis of RAdiations from lightNIngs and Sprites) is under way. The scientific payload consists of two cameras, three photometers, one hard X-ray/gamma-ray detector, one energetic electron detector, and electric/magnetic field sensors. The orbit of the satellite will be polar sun-synchronous with an altitude of 700 km, and the local time of ascending node is required to be 22 LT with a slow drift of the order of 2 LT/year. Our group has joined the TARANIS mission as co-investigators, and started development of the photometers (MCP-PH: Micro Cameras and Photometers-PHotometer). MCP-PH consists of four channels: one wide-FOV (42.7 deg.) photometer with wide-band filter (150-280 nm) named as PH1, two wide-FOV (42.7 deg.) photometers with narrowband filter (337+/-5 nm, 762.5+/-5 nm) named as PH2 and PH3, and one wide-FOV (86.8 deg.) with wideband filter (600-800 nm) named as PH4. As the optical detector of these photometers, metal-package photomultiplier tubes (PMTs) will be used for PH1-PH3. For PH4 a photodiode with 10x10 mm2 size will be used. As the optics of the photometers, telecentric dioptrics system is adopted. The dimension (LxDxH) and mass of the photometers is 12x19x14 cm and 1.6 kg, respectively. We have developed breadboard model and finished the experiments for the performance check. Based on these results, we started designing of the engineering model (EM) of the photometers.

Current status of the TARANIS mission is just at the start line of Phase-C/D, which is the development of EM and fabrication of flight model (FM). Final deliver of FM is planned in 2014, and the launch of TARNIS is planned in 2015. At the presentation, we will discuss the science goal and current mission status more in detail.

Keywords: lightning, sprite, terrestrial gamma-ray flash

Japan Geoscience Union Meeting 2011
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MSD004-12 Room:301A Time:May 27 17:15-17:30

Proposal for atmosphere and plasmasphere observation from small satellite

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JAXA/ISAS has been leading satellite observation studies of ionosphere in Japan. Previous (before 2000) ISAS satellites were all 'small satellite', and INDEX satellite program showed that small satellite program is very effective in terms of science outcome for atmosphere/ionosphere research. AKEBONO satellite conducted in situ observation of ionosphere (its remote sensing instrument stopped shortly after the orbit operation). INDEX satellite made optical remote sensing of Aurora and limb air glow. Currently ISS/JEM/IMAP is under development (2012 January launch is scheduled) which will measure nadir airglow with high spectral resolution imager, GPS occultation (and reflection) is another technique for atmosphere/ionosphere research, which is not yet developed in Japan. This paper reports the status of Atmosphere-Plasmaspjere observation proposal by using in-situ measurement, optical remote sensing, and GPS techniques.

Keywords: ionosphere, atmosphere, remo sensing, in situ observation, small science satellite

Japan Geoscience Union Meeting 2011
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MSD004-13 Room:301A Time:May 27 17:30-17:45

Development of CP-SAR UAV for Microsatellite ground test

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Synthetic Aperture Radar (SAR) is a multi purpose sensor that can be operated in all-weather and day-night time. Recently, the SAR sensor is operated in linear polarization (HH, VV and its combination) with limited retrieved information. The characteristics of the conventional SAR sensor is bulky, high power, sensitive to Faraday rotation effect etc. Recently, we are developing the Circularly Polarized Synthetic Aperture Radar (CP-SAR) onboard microsatellite for Earth diagnosis. In this research, the CP-SAR sensor is developed to radiate and receive circularly polarized wave. The sensor is designed as a low cost, simple, light, strong, low power or safe energy, low profile configuration to transmit and receive left-handed circular polarization (LHCP) and right-handed circular polarization (RHCP), where the transmission and reception are both working in RHCP+LHCP, SAR image compression etc. Then these circularly polarized waves are employed to generate the axial ratio image (ARI). This sensor is not depending to the platform posture, and it is available to avoid the effect of Faraday rotation during the propagation in ionosphere. Therefore, the high precision and low noise image is expected to be obtained by the CP-SAR. For this purpose, we are developing the CP-SAR onboard unmanned aerial vehicle (UAV) for ground testing of this sensor.

Keywords: microsatellite, synthetic aperture radar, unmanned aerial vehicle (UAV)

Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

MSD004-14 Room:301A Time:May 27 17:45-18:00

Lightning Observation from Geo-Stationary Orbit

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Lightning observation from Geo-Stationary orbit is proposed. The scientific goal of the mission is to provide unprecedented information on the thunderstorm in terms of electricity through continuous observation of lightning from geostationary orbit. The link between lightning activity and thunderstorm evolution allows us to use lightning information as a measure of convective intensity, a highly important characteristic of thunderstorm that cannot be measurable by current observing system. Since the proposed measurements have both the temporal and spatial resolution to continuously document the location, intensity, and duration of storm convection, this mission will greatly improve our understanding of the fast time scale elements of atmospheric convection. This information will improve diagnostic retrievals and predictive forecast models and will help in issuing severe weather warnings.

Based on the understanding, GOES-R Geostationary Lightning Mapper (GLM) was proposed in the US following the TRMM/LIS and is scheduled to be launched in the late of 2010's. On the other hand, GLIMS mission which is a project on the Japan Exposure Module in the ISS is scheduled to be launch in 2012 and will observe both lightning and TLEs by optical and electromagnetic wave sensors from low earth orbit. In this presentation, scientific and practical discussion on the lightning observation from geostationary orbit and the current status of the Japanese project will be given. And then a vision of the future in Japan in terms of lightning observation from geostationary orbit will be shared.

Keywords: Lightning, Satellite, Geo-Stationary Orbit

Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

MSD004-15 Room:301A Time:May 27 18:00-18:15

The present status of the small scientific satelite: ELMOS Constellation

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The ELMOS constellation is composed of 200kg-class small satellite and four or five microsatellites. All the satellites carry GPS occultation receiver, impedance probe and electron temperature probe. Its main objective is to observe time-space variation of physical values of the ionosphere-atmosphere region.

Keywords: small scientific satellite, ELMOS, constellation, GPS occultation, ionosphere, seismo-electoromagnetic

Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

MSD004-16 Room:301A Time:May 27 18:15-18:30

Feasibility study on the GPS occultation sensor based Next generation JAXA GPSR

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It is well recognized that the GPS occultation method is essential and most reliable measurement technique for the ionosphere and atmosphere. GPS occultation has been already applied to weather forecast system of major countries including Japan. GPS occultation, by its physical principle, is also strong research tool of ionosphere. GPS occultation sensors have been developed by NASA/JPL and ESA, since GPS occultation requires very high precision measurement (other than the differential GPS technique) not available from civilian GPS receiver system, such as car navigation systems. JAXA has already developed high precision space GPS receiver (JAXA-GPSR) in late 1990s, and it has been already applied to several earth observation satellites, such as ALOS ”Daichi”. It is already known in 1998, soon after the first report of GPS-Met experiment, that JAXA-GPSR can be modified easily to the GPS occultation sensor system (Suzuki et al. 2000). Currently JAXA is developing Next generation GPSR (NGPSR) which has much higher performance, capability, and potential expandability. This paper reports the status of feasibility study on the GPS occultation by using JAXA-NGPSR.

Another application of GPS system is GPS ocean surface reflection, which is useful for ionosphere (horizontal structure) and sea surface altitude variation measurement. This paper also reports the status of feasibility study of GPS reflection measurement in Japan.

Keywords: GPS Occultation, GPS Reflection

Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

MSD004-P01 Room:Convention Hall Time:May 27 10:30-13:00

Remore sensing of vegetation by using SWIR hyperspectral remote sensing

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Satellite remote sensing of vegetation is very effective tool in earth environment studies, eco-system sustainability, forest management, agriculture applications. NDVI (Normalized Vegetation Index) is derived simple algorithm only using 2ch data of NOAA AVHRR sensor, but it is well known to be very useful for various scientific studies. Recent years, there have been many trials to use high spectral resolution remote sensing (Hyper spectral Remote Sensing) to the vegetation monitoring. Ogawa et al (Okayama RIBS) have proposed feasibility of the 1,7 micron spectral region to the vegetation monitoring. This paper reports the status of feasibility study of hyper spectral remote sensing of vegetation by using 1.7 micron region from space.

Keywords: SWIR, vegetation, hyper spectral sensor