

# Report of JAXA Space Education Center

On Its Activities in FY 2006-2007



# REPORT OF JAXA SPACE EDUCATION CENTER ON ITS ACTIVITIES IN FY 2006 AND 2007

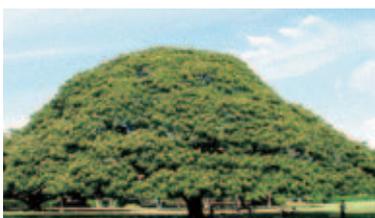
(Information as of March 2008)

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## I. INTRODUCTION



In a short time period following its establishment in May 2005, Space Education Center of Japan Aerospace Exploration Agency (JAXA) rapidly expanded its activities to reach out to more children, to stimulate their embedded curiosity toward the nature, life and universe and inspire them to aim for higher goals in their lives. Recognizing “space” as the unique source of interest, imagination and inspiration, the Center has continued to promote the effective use of space subject, materials and resources to stimulate interest in the minds of young people in not only science and technology but also many other aspects of human activities.

During its first year, the Space Education Center spent much of its efforts in turning ideal goals into practical actions as well as defining and informing others of its principles and objectives while responding to requests for support in education and outreach activities. The second year, from 2006 to 2007, could be marked as the year for strategic development and consolidation of major activities, in accordance with the articulated goals and principles.

This report reflects the results of the efforts made by the Space Education Center during its second year, from 2006 to 2007, and indicates directions to be pursued in the coming year.

## II. BASIC FACTS OF THE CENTER

### A. Establishment of the Center



Sagamihara Campus



Opening of the Space Education Center

The Space Education Center was established on 1 May 2005 by an executive decision by its President and was officially opened on 19 May 2005 at Sagamihara Campus of JAXA.

Educational activities of JAXA had long been carried out as part of the public relations and outreach activities. Those activities focused on increasing public awareness and understanding of the work of JAXA, highlighting societal benefits yielded by space activities, with the aim of increasing public support for space activities as a whole.

The growing recognition of the fundamental difference between public outreach and education resulted in the establishment of a separate group dedicated to space education activities. Originally placed within the Public Affairs Department, the space education group carried out those activities that would have positive impact on the growing-up process of children with the use of attractive space materials to stimulate their interest in science and other subjects relating to their daily lives. The space education group served as a predecessor to the Space Education Center and, to some extent, laid the foundation for the work of the Center.

### B. Goals and principles

Space subjects, resources and materials inherently have unique power to attract young people's attention, encourage them to take on challenges and aim for higher goals. While the Space Education Center aims to expand the pool of future space scientists and engineers by getting more young people interested in space subjects and pursuing career options in space-related areas, the Center considers it as its unique, key mission to use space materials to have positive impact on young people's minds in their development process, to expand their potential and help them become socially responsible individuals.

There are a few principles that the Space Education Center follows in its activities for young people to achieve its goals.

## MISSION STATEMENT



The Center places importance on having the young people understand the thinking process behind what is acquired as knowledge. The Center aims to take advantage of children's simple curiosity embedded in their minds toward the nature, life and environment that surrounds them and offers opportunities to experience the joy of discovering and solving mysteries by themselves. In this process, the Center also aims to increase young people's appreciation of science and technology and their capacity for logical thinking.

“Preciousness of life”, or “dignity of life”, is the most important message that the Center endeavours to convey to young people.

The abundance of goods and services that meet various needs of people in Japan might indicate the richness of the society. However, that may not necessarily be true if the minds of people, especially young people, are taken into consideration. An increasing number of young people in Japan have been observed to have little motivation to do anything, to be pessimistic about their own future and even to treat people's lives lightly and get involved in serious crimes. The people involved in the establishment of the Space Education Center became deeply concerned about those young people, and they wanted to do something about it.

Space subjects and materials were found to offer an excellent tool to inspire and motivate young people, to start gaining self-confidence and aiming for higher goals in their lives. After learning that there had been a lengthy chain of relays of one life to another before a certain life was born and that the lives on the Earth today had come a long way from pieces of galaxies and stars, many of the young people who participated in education activities organized by JAXA started to think deeply about the origin and evolution of lives.

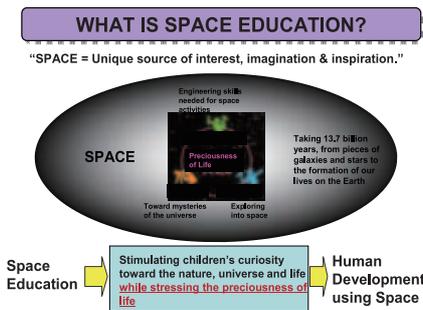
By letting young people learn about the origin and evolution of the universe and life and showing how long we have been searching for Earth-like planets, the Center aims to increase their appreciation of all forms of lives on the Earth.

The spirit of “Never Give Up” is another important message that the Center always emphasizes in its activities, as it is considered essential for anybody who wants to achieve something significant in this challenging world. The history of space exploration is full of exam-

ples that show how important this spirit is.

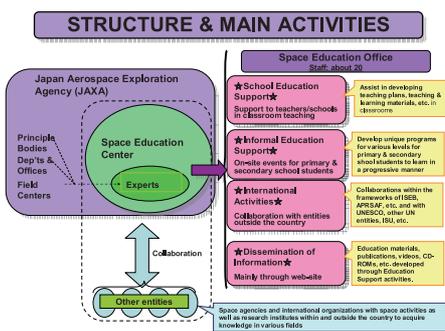
Through its activities, the Center also guides young people to understand how important and how rewarding it is to be part of the society to build a better future together. No individual can carry out space activities by themselves, but together, a large number of people with various backgrounds can even build global systems that could benefit large populations. The Center aims to increase young people's appreciation of the importance and the power of collective efforts made toward common goals.

With the above goals and principles, the Center carries out its activities to help young people become full of curiosity, adventurous spirit and craftsmanship, always aiming for the best in whatever they do.



### C. Organizational structure and major activities

The Space Education Center consists of the Space Education Office, which serves as the implementing body of the Center, and a group of experts who administratively belong to other offices and departments but have been appointed as technical advisers to assist in the planning of the Center's activities on a frequent basis. As of March 2008, the Space Education Office consists of about 20 staff members, including 6 regular staff and 12 invited or contracted staff.



The Center carries out the following four major activities:

- i) school education support, to assist teachers and schools in carrying out classrooms activities using space materials as part of formal education;
- ii) informal education support, to organize various educational events to offer opportunities to learn about space subjects and to participate in hands-on activities; this includes providing support to space activities by university and graduate students in Japan
- iii) international activities, to promote and support space education activities outside Japan through collaborations with other countries and international organizations; including programs to send university and graduate students to participate in international meetings and education programs abroad in space areas;
- iv) information dissemination, to distribute publications, edu-

cation materials and other products of the Center and to inform the public of its activities mainly through Internet-based services.

## D. Collaborations for space education

Other offices and departments of JAXA have also been carrying out activities that have educational elements, and the Space Education Center collaborates with them.

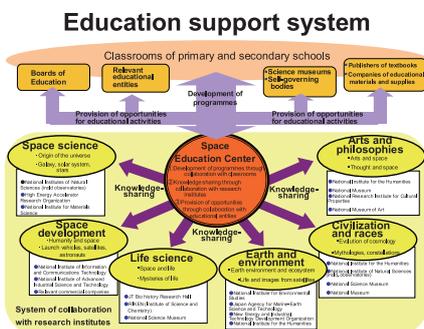
For example, the Center works in cooperation with the planning and outreach group of the Public Affairs Department, which sends JAXA staff to give talks on various space topics at schools particularly during the one-month period celebrating Space Day in Japan, on 12 September.

The Space Education Center also works in cooperation with the Space Environment Utilization Center, which carries out education-related activities in association with Space Shuttle flights and the use of the International Space Station.

The Satellite Applications and Promotion Center produces useful information materials with images taken by JAXA-operated satellites for distribution to the public. The Space Education Center works in collaboration with the Satellite Applications and Promotion Center in carrying out educational activities using images taken by JAXA satellites.

The Space Education Center seeks for collaborations with various entities outside JAXA that are engaged in education. Close collaborations with teachers and schools are considered most essential. The Center has continued to explore opportunities for collaborations with associations of teachers, education boards as well as publishers of textbooks and companies of educational materials, in its efforts to better integrate space subjects and materials into the existing curricula for formal education and to produce education materials that better meet needs of schools and teachers.

In pursuing collaborations to expand space education activities, the Center takes a comprehensive approach. The Center seeks for collaborations not only with those entities that are involved in space



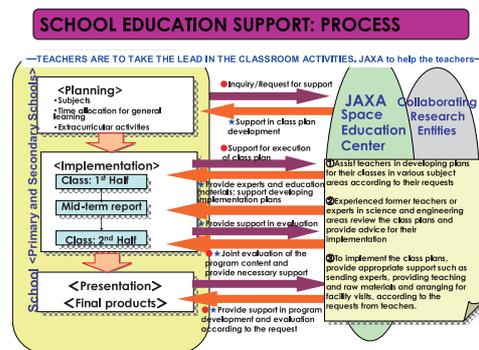
science and technology and their applications, life science and Earth science, which have clear links with space activities, but also with others that are engaged in studies on humanities and civilizations as well as arts and philosophies.

### III. SUPPORT FOR SCHOOL EDUCATION

#### A. Objectives and strategies

The Space Education Center provides customized support to the teachers who have contacted the Center with specific requests for support to address space-related subjects in their classroom activities.

After the initial contact, staff of the Center hold numerous consultations with those teachers to articulate their needs and interest, identify goals and develop plans for activities for their classes. Once the plan has been developed with the teacher, appropriate experts from space science and technology fields as well as pedagogy are identified and called upon to provide knowledge and expertise to develop teaching and learning materials. When the teacher carries out classroom activities according to the plan, the Center sends its staff and appropriate experts to provide on-site support to the teacher. Upon request by the teacher, the Center assists the teacher in evaluating the results of the activities as much as the circumstances allow.



Throughout the entire process of providing support to the teachers, the Center ensures that the teachers take initiatives in articulating needs and interest of their students and that its staff and experts remain in a supportive role.

The scope of school education support also expanded in the reporting period. From 2007, the Center began to respond to requests from kindergartens, to provide support in integrating space subjects in their activities for kindergarten pupils together with their parents.

In view of the introduction of measures in 2008 to make it mandatory for the primary and secondary school teachers to training courses

for their teaching license renewal, the center has strengthened its efforts to have space education included in the mandatory teachers training courses for license renewal.

## B. Achievements

### 1. Reaching out to schools across the country

Providing customized support to teachers and schools consumes a large amount of staff time and efforts. A classroom activity plan consists of normally more than one classes, and the period required to implement the plan could last for one full academic year, requiring at least a several visits by the Center’s staff and experts. The Center has, nonetheless, continued this labour-intensive approach in supporting school education with the team of 4 to 5 staff members.

The number of schools that received customized support from the Center increased from 20 in the first fiscal year, from May 2005 to March 2006, to 42 schools in the third fiscal year, from April 2007 to March 2008, increasing the number of young people who benefited from the center’s support from 1,543 to 4,044.

<Number of schools supported by the Center and their participants>

	FY 17		FY 18		FY 19	
	Schools	participants	Schools	participants	Schools	participants
Kindergartens	0	0	1	112	1	94
Elementary Schools	1	30	8	337	18	1,634
Junior High Schools	5	1,158	3	457	6	817
High Schools	14	355	15	898	17	1,499
<b>TOTAL</b>	<b>20</b>	<b>1543</b>	<b>27</b>	<b>1804</b>	<b>42</b>	<b>4,044</b>

NOTE: FY 17 = Fiscal Year 17, from April 2005 to March 2006; FY 18 = Fiscal Year 18, from April 2006 to March 2007; FY 19 = Fiscal Year 19, from April 2007 to March 2008.

During its first year, the Center received request for support mainly from special high schools that were designated by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) as “Super Science High Schools” (SSH), which were supported by MEXT to yield concrete results in enhancing science and math edu-

cation, or that were selected by MEXT to implement “Science Partnership Programs” (SSP), which aim to provide more opportunities to stimulate interest of students in science through collaborations with universities and research institutes. Over the past few years, the Center has received an increasing number of requests from other schools as well.

## **2. Reaching out to kindergartens: Ohshuh Wakayanagki Kindergarten**



In February 2007, the Space Education Center began to provide support to kindergartens to carry out space education activities. In response to the request received from Wakayanagi Kindergarten, a public kindergarten of the City of Ohshuh, Iwate Prefecture, the Center supported the 90-minute class of the kindergarten by giving a talk on rockets, using images of rocket launches by JAXA, and organizing a hands-on session to make and launch rockets from disposable plastic bags commonly used in Japan to carry wet umbrellas inside buildings on rainy days. The class was attended by 56 pairs of kindergarten pupils and their parents.

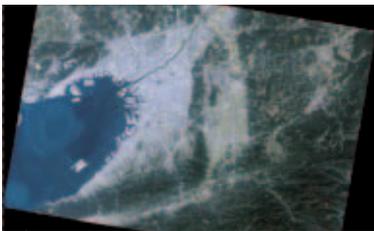


The success of this first attempt resulted in four classes organized at this kindergarten from July 2007 to February 2008, for kindergarten pupils and their parents to watch the night sky, make flying objects from styrene paper, make and fly hot-air balloons and make constellations using star-shaped sand, or remnants of *Baclogypsina spaherulata*.



## **3. Caring for our environment: Kokubunji Fourth Elementary School**

Reflecting the increasing interest among schools in the issue of climate change and global environment, the Space Education Center supported classroom activities that involved discussions among students on the protection of environment. At the Fourth Elementary School of the City of Kokubunji, Tokyo, the Center supported a series of classroom activities as part of “integrated studies” for the fifth-grade students over the period of two months that addressed environmental problems at global scale.



Through lectures given by JAXA expert, using images taken by Earth observing satellites, and the group discussions and presenta-

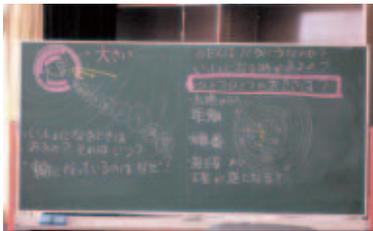


tions that followed, the participating students learned about the status of the Earth, examined the status of local environment, considered how human activities could have impact on the environment and presented their findings to younger students. The lectures apparently increased awareness of the students of the preciousness and uniqueness of the planet Earth and motivated them to do something they can do locally to protect its environment.

#### **4. Thinking about links between our daily lives and space activities: Shimosuwa Yashiro Junior High School**

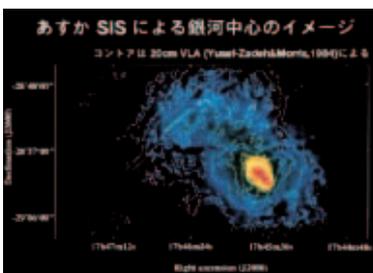


Having carried out “Yashiro Space Project” for four years up to December 2006 as part of “integrated learning” activities, Shimosuwa Yashiro Junior High School of the Town of Shimosuwa, Nagano Prefecture, had served as a catalyst in promoting space education for other local schools. The Project consisted of close to 30 class meetings from May to December each year and was open for participation by any interested students regardless of their school years. The Project encouraged the students to think about various links between our modern society and space activities, not only from scientific and engineering point of view but also from other perspectives involving literature, arts, history and religion.



The successful collaborations between Shimosuwa Yashiro Junior High School and the Space Education Center have resulted in firm support by the education board of the local government to integrate space subjects into classroom teaching. By 2007, the Center supported classroom activities of another junior high school that addressed environment with the use of space materials and assisted two elementary schools that jointly organized hands-on sessions to learn about science of flight.

#### **5. Enhancing scientific thinking through minds-on activities: Saibi High School**



Saibi High School of Ehime Prefecture launched a project in 2006 as part of extracurricular activities to give the students with opportunities to grasp an overview of natural sciences, covering from the origin of the universe to life science. Under the theme “Space Science ? Universe, Earth and Life”, 12 one-day to three-day sessions and 35 one-day sessions were organized over the academic year in 2006 and 2007, respectively, consisting of lectures on such diverse sub-



jects as the history of the universe, Earth environment, life science as well as science and technology, and group research activities.



During the course of the Project, the participating students received practical training on identifying and articulating problems to investigate, collecting useful information for research, improving analytical research skills as well as presenting research results to the public. While the Project aimed to stimulate interest of the students in various disciplinary areas of natural sciences, it provided the students with opportunities to acquire practical, fundamental skills that are necessary to conduct research in general.

## 6. Expanding collaborations to support teachers training



What started in 2005 as support, together with other research and scientific entities, to the training programme for 10 teachers selected by the education board of Kanagawa Prefecture had expanded by the end of 2007 to the collaborations with seven prefectural and municipal education boards, education centers and education research groups to train more than 240 primary and secondary school teachers to integrate space subjects and materials in their classroom teaching. The typical training programme consists of sharing the principles and concept of space education, sharing space resources and materials available from JAXA and providing hands-on training in using those resources and materials in classroom teaching.



<Teachers training>



In 2007, the Center collaborated with Nagasaki University in the training programme for 156 university students of pedagogy who would be future school teachers. Under the theme “Children’s future and education”, the programme provided the participating students with opportunities to think about the history of the universe and the place of our planet Earth in the vastness of the universe and how to effectively use space subjects and materials in the classroom teaching to make the school students become aware of the vantage point offered by space.



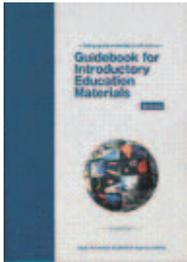
<Training for future school teachers>

## 7. Products: Introductory Education Materials

In order to support many school teachers who are too occupied with teaching requirements dictated by the existing curricula as well as



fulfilling administrative requirements and are unable to set aside time to address space subjects as additional activities, the Space Education Center developed materials that could be used to integrate space subjects into teaching per existing curricula. Introductory education materials are designed for use by the teachers at the beginning of a curriculum unit to stimulate interest of the students in learning more about the subject matters covered in that unit.



A small group consisting of space scientists and engineers, primary and secondary school teachers as well as professors of pedagogy examined all textbooks of science for primary and secondary schools. They identified sections of the textbooks where space activities could be mentioned or space-derived images could be shown in conjunction with the subjects to be taught. Their final product was the publication entitled “Guidebook of Introductory Education Materials: Science” in 2006. Each of the ten materials presented in that Guidebook was provided with: i) background information of the relevant space activities; ii) explanatory notes on teaching guidelines per relevant formal curriculum; iii) sample uses of the material and sample questions to be addressed in the classroom; and iv) a list of relevant chapters and sections of existing textbooks. This Guidebook was made available also in English.

Following the publication of the Guidebook for Science, the Center revised its content and re-produced the compilation of introductory education materials in the leaflet format in the following year. The compilation of introductory education materials using space materials is now available in the leaflet format not only for science course but also for the courses of homemaking, social science and Japanese as language.

<Introductory education materials>

## IV. SUPPORT FOR INFORMAL EDUCATION

### A. Objectives and strategies



Supporting informal education is another pillar of the activities of the Space Education Center. Using unique programmes and materials that it has developed, the Center supports informal education carried out by other entities rather than schools outside the formal education curricula.



Most of the hands-on education and training activities that the Center supports are being carried out as part of “Cosmic College”. The Cosmic College aims to achieve the following objectives: i) to increase interest of young people in science and technology; ii) to help establish voluntary groups of young people that are fond of science and technology; iii) to motivate young people to raise questions, think and find solutions by themselves; iv) to encourage collaborations with others; v) to lead young people to appreciate the importance of life.



In convening Cosmic College courses across the country, the Center shifted its strategy over the past few years. During its initial year, the Center took the lead in planning and organizing the courses with local communities as its partners. From 2006, the Center began to let local communities take the lead in organizing the courses while the Center plays only a supportive role. With the belief that the local communities should be held responsible for nurturing their children, the Center gradually succeeded in identifying those local communities that could serve as the main organizers for such courses.



<Various courses of Cosmic College>

In supporting the organization of Cosmic College courses, the Center has continued to work closely with the Young Astronaut Club (YAC)-Japan, an incorporated foundation with about 120 branches across the country and 3,000 members to carry out educational activities addressing space and science.

## **B. Programmes for young people: from kindergarten to high-school students**

### **1. Cosmic College: Kids Course**



“Kids Course” of Cosmic College is organized for young children that are younger than the second year elementary school students to participate with their parents. The programme is for one day and aims to increase interest of the participating children in and their familiarity of the surrounding nature. Through hands-on experience with scientific observations, experiments and handicraft, the programme also aims to cultivate young children’s scientific thinking and to build the basis for logical thinking process.



<Kids courses>

### **2. Cosmic College: Fundamental Course**



The target audience for the Fundamental Course of Cosmic College are the school students who are between the third-year of elementary school and the third-year of junior high school. The programme is in principle for one day, and it encourages the participating students to find interest in the surrounding natural objects and phenomena. Through hands-on activities involving scientific observations, experiments and handicraft designed for the study of the nature, the participating students are guided to improve their scientific and logical thinking capabilities.



< Fundamental Courses>



### 3. Cosmic College: Advanced Course

The programme for Advance Course of Cosmic College is designed for the school students who are between the sixth-year of elementary school and the third-year of junior high school. The programme normally lasts for five to six days. Through hands-on experience with scientific observations, experiments and handicraft, the participating students are encouraged to come up with solutions for the questions and issues of interest that they have identified. They also receive hands-on, minds-on training to deepen their understanding of natural phenomena and to acquire better scientific and logical thinking capabilities.



<Lecture and hands-on session during Advance Courses>

### 4. Cosmic College: High School Course

The High School Course of Cosmic College is designed for high school students to acquire advanced knowledge and understanding of space science and technology and their applications through lectures by leading space experts and hands-on training, such as building model rockets. The programme normally lasts for a few days



<Activities during High School Courses>

## 5. Other programmes for high school students



<Activities during Science Camps>

Besides the Cosmic College courses, the Space Education Center supported Science Camps organized by research centers of JAXA, such as Tsukuba Space Center. The Science Camps are mainly for high school students to experience hands-on training at research facilities in the three-day programme.



<Activities during “Kimission”>

At Sagamihara Campus, the Space Education Center also organized the five-day training programme for high school students to learn how to design scientific missions through team work and to experience questions and answers on the evaluation of mission planning. This programme is known as Space Mission High School, or “Kimission”, which is a combination of “Kimi”, or “you” in Japanese, and “mission”.

## C. Programmes for educators and instructors of space education

### 1. Cosmic College: Educators Course



<Hands-on sessions during Educators Courses>

The Cosmic College offers “Educators Course” for school teachers and leaders of groups that carry out activities for young people. The primary objective of this course is to train future instructors for Cosmic College courses for young people. Through the one-day or three-day programme, the participants learn about the methods and materials that the Center has developed for Cosmic College courses and take part in hands-on activities that are included in Cosmic College courses.

## 2. Leaders Seminar



<Lectures and hands-on sessions during Leaders Seminars>

For those people who have already been engaged in, or interested in carrying out, space education or informal education activities, the Space Education Center organizes Leaders Seminars with the programme for one to two days. The programme aims to transfer basic knowledge and skills that are required for instructors of space education activities. Such knowledge and skills taken up in the programme concern goals of space education, role of leaders and understanding children's needs, development of activity plans as well as crisis management and safety measures.

The Center issues certificates of completion for those individuals who have participated in the Leaders Seminar. The holders of those certificates could then attend training seminars to become space education instructors. Successful participants of those seminars would then be invited as instructors to support Leaders Seminars organized in their communities. They are also encouraged to plan and implement space education activities for their communities. Following the review of the results of a written examination and presentation at the end of the training seminar as well as space education activities organized in the past year in the local community and contributions to the Leaders Seminars as instructor, the Center issues a license for the Space Education Conductor (SEC).

With the above system for issuing certificates and SEC licenses, the Center aims to expand the basis of collaborators to further increase space education activities to reach out to all children in the country while giving proper recognition of the knowledge, skills and actual contributions of those collaborators. From April 2008, the Leaders Seminar would be renamed to be "Space Education Instructors Seminar".

## D. Achievements

### 1. Increasing community bases for space education activities around the country



With the belief that the local communities should be in charge of nurturing their children, the Center began to establish a system that respects the central role of local communities in planning and implementing space education events according to their needs and interests without much intervention by the Center. Through the training seminars for space education leaders and instructors, the Center supports those local communities by making more instructors and lecturers available for their space education events.

This system allowed for a sharp increase in the number of hands-on education activities organized around the country for young people while the level of resources provided by the Center remained the same.

<Number of cosmic college courses organized and their participants>

	FY 17		FY 18		FY 19	
	Events	Participants	Events	Participants	Events	Participants
Kids Course	6	600	14	1,318	26	3,068
Fundamental Course	10	565	10	505	34	2,278
Advanced Course	1	65	1	61	2	63
High School Course	1	43	1	35	0	0
<b>TOTAL</b>	<b>18</b>	<b>1,273</b>	<b>26</b>	<b>1,919</b>	<b>62</b>	<b>5,409</b>

NOTE: FY 17 = Fiscal Year 17, from April 2005 to March 2006; FY 18 = Fiscal Year 18, from April 2006 to March 2007; FY 19 = Fiscal Year 19, from April 2007 to March 2008.

The number of educators and volunteers who have received training each year to carry out space education activities also increased by close to 40 per cent in two years.

<Number of participants of Educators Courses and Leaders Seminars>

	FY 17	FY 18	FY 19
Cosmic College: Educators Course	349	192	174
Leaders Seminar	213	233	600
<b>TOTAL</b>	<b>562</b>	<b>425</b>	<b>774</b>

NOTE: FY 17 = Fiscal Year 17, from April 2005 to March 2006; FY 18 = Fiscal Year 18, from April 2006 to March 2007; FY 19 = Fiscal Year 19, from April 2007 to March 2008.

## 2. Products: teaching guides and home-learning materials

**<Teaching Guides: "Science of Flight">**  
 ⇒ 2-page, 1-sheet leaflets, each with: i) background information; ii) objectives; iii) step-by-step activity descriptions; iv) teaching points  
 ⇒ 10 exercise units:  
 ① Making flying objects from styrene paper;  
 ② Observing the flight of plant seeds in the small wind tunnel;  
 ③ Flying hot-air balloons made from vinyl bags  
 ④ Flying big hot-air balloons from vinyl bags  
 ⑤ Making and flying "straw" rockets  
 ⑥ Making and flying "syringe" rockets  
 ⑦ Flying paper aircraft  
 ⑧ Making and flying umbrella-bag rockets  
 ⑨ Flying "film-case" rockets using bubble-making bath tablets  
 ⑩ Flying "film-case" rockets using alcohol rockets

To help those people who are interested in organizing space education activities but are not able to afford time to participate in the courses and seminars organized by the Space Education Center, the Center is producing sets of teaching guides on typical hands-on activities that are included in Cosmic College courses. These teaching guides are being compiled per study subject. Following the set of teaching guides for "Science of Flight", consisting of 10 exercise units, the Center is preparing a set for "Science of Light".

The Center continues its efforts to support parents that are interested in addressing space subjects and using space materials in their interactions with children at home. Through the support provided by a group of school teachers, the Center has developed 5 sets of home-learning scientific materials in leaflet form to address "Flight", "Earth and Sand", "Atmosphere", "Light" and "The Sun and Its Companions".

<Sample teaching guides of "Science of Flight">



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<Samples of home-learning materials>



## V. SUPPORT FOR UNIVERSITY AND GRADUATE STUDENTS

### A. Background and strategies



(Photograph: Courtesy of ISU)

While the Space Education Center focuses on supporting primary and secondary schools teachers and students, it continues to provide some support to university and graduate students to the extent possible within the limitation of resources. Following the establishment of the Center in May 2005, the functions to support the space activities of the University Space Engineering Consortium (UNISEC) as well as to send university and graduate students to participate in the International Astronautical Congress (IAC) and education programmes offered by the International Space University (ISU) were transferred to the Center.

While the importance of providing support to university and graduate students and contributing to the training of future space scientists and engineers to support space activities in the coming years is well recognized within JAXA, the discussions are underway to identify a best organizational structure to provide such support. Until such concrete organizational structure is put into place, the Space Education Center would continue its support for university and graduate students that would also help achieve objectives pursued in its school education support and informal education support.

### B. Supporting space activities in Japan for university and graduate students



<CanSat flyback competition>



<CanSat>



<ARLISS>

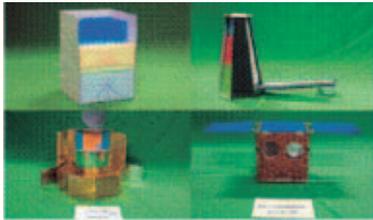
The Space Education Center provides financial and in-kind support to the University Space Engineering Consortium (UNISEC), a non-profit organization to support practical space activities carried out by universities and colleges. UNISEC consists of more than 420 student members, representing 47 laboratories of 36 universities and colleges, and 160 supporting members.

UNISEC pursues human resource development in space engineering and technological development for future space applications. Some of the activities of UNISEC include fund-raising to support small satellite and hybrid rocket projects by universities and colleges, analysis of launch safety, frequency of satellite communication, search for piggy-back launch opportunities and search for opportunities for collaborations with governmental entities and commercial companies.



<Award ceremony of the Satellite Design Contest>

Some of the activities supported by the Space Education Center include the organization of the annual Noshiro Space Event, consisting of CanSat flyback and rover competitions, participation of Japanese students in the annual event known as “A Rocket Launch for International Student Satellites” (ARLISS) held in Nevada, United States, organization of space development workshops for students and the hybrid rocket launch experiments in Taiki, Hokkaido.



<Award winning designs>

Besides its support to UNISEC, the Space Education Center also collaborates with other organizations to convene the annual Satellite Design Contest for university and graduate students. The participating students compete for creativity in developing mission and design concepts.

### C. Providing education and training opportunities outside Japan



In cooperation with the International Space University (ISU), the Space Education Center continues to provide scholarships for Japanese university and graduate students to participate in the Space Studies Program (SSP), nine-week course held between June and August by ISU at a different location each year around the globe, and the degree programs for Master of Science in Space Studies and Master of Science in Space Management (MSS/MSM), one-year course held at ISU main campus in Strasbourg, France. With more than 2,400 alumni worldwide and several hundred faculty and lecturers drawn from around the world, ISU offers unique programmes that are international, interdisciplinary and inter-cultural in nature.



<SSP 2007 in Beijing, China>  
(Photographs: Courtesy of ISU)



<Central Campus of ISU, Strasbourg, France>

Based on the Memorandum of Understanding concluded between JAXA and ISU in December 2003, JAXA supports activities of ISU by receiving MSS/MSM students as interns at JAXA research facilities, sending JAXA staff as lecturers for SSP and MSM/MSM and participating in the Board of Trustees of ISU.



<Water rocket workshops organized  
by JAXA students during IAC  
Valencia in 2006>

Starting from the year 1999, JAXA and its predecessor, National Space Development Agency of Japan (NASDA), have been sending a group of Japanese university and graduate students to the annual International Astronautical Congress. Originally started in cooperation with the European Space Agency (ESA), this program provides opportunities for the participating students to learn about the latest developments in various space-related fields, network with space experts, programme managers and policy makers and interact with other students with various academic and cultural backgrounds.



<International Student Zone>

Following its establishment, the Space Education Center has been responsible for supporting the participation of Japanese students in this IAC Student Program, which is now being carried out jointly by five space agencies within the framework of the International Space Education Board (ISEB). (See details of the activities of ISEB below.)



<CanSat demonstration during IAC  
Valencia>

## VI. INTERNATIONAL ACTIVITIES

### A. Objectives and strategies



The Space Education Center is expanding collaborations to entities of other countries and international organizations to promote space education activities. In pursuing collaborations, the Center uses as much as possible the existing frameworks for cooperation in space activities.

In carrying out international activities, the Center places emphasis on promoting activities for the benefit of primary and secondary school teachers and children, particularly in the region of Asia and the Pacific. This reflects the focus of the Center's activities in space education as well as the emphasis placed by JAXA as a whole on collaborations with countries in Asia and the Pacific in enhancing international cooperation in space activities. The space education initiatives taken within the framework of the Asia-Pacific Regional Space Agency Forum (APRSAF), therefore, are given high priority.

While recognizing benefits of introducing programs and materials developed by other space agencies with established education and training programs for use and participation by Japanese teachers and schools, the Center makes efforts to share its space education concepts, principles and approaches particularly with developing countries that are increasingly interested in and capable of carrying out space activities. Efforts are also made to make teaching and learning materials of the Center available for developing countries in their languages when sufficient interest is expressed.

As for developing countries in other regions, the Center supports their space education activities through initiatives taken by the United Nations Educational, Scientific and Cultural Organization (UNESCO) and other entities of the United Nations system as well as development agencies, such as Japan International Cooperation Agency (JICA).

Cooperation with space-faring nations in space education activities is pursued mainly through the framework for cooperation provided by the International Space Education Board (ISEB).

## B. Strengthening cooperation with space-faring nations through International Space Education Board



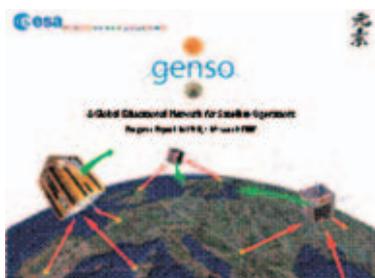
<Establishment of ISEB>

The Space Education Center collaborates with the members of the International Space Education Board (ISEB) in carrying space education activities and represents JAXA in ISEB. ISEB was established in October 2005 by the Canadian Space Agency (CSA), the European Space Agency (ESA), the National Aeronautics and Space Administration of the United States (NASA) and JAXA as its Founding Members. The French Space Agency, Centre National d'Etudes Spatiales (CNES), joined ISEB in October 2006.



<Heads of Education Session with Students during IAC Hyderabad, 2007>

The objectives of ISEB are: i) to increase science, technology, engineering and mathematics literacy achievement in connection with space; and ii) to support the future workforce needs of space programs. While ISEB meets once a year with the participation of heads of education of its member agencies during the annual IAC, the activities of ISEB are being carried out and coordinated by its Representative Working Group, consisting of one officer each from the ISEB member agencies. The membership is open to any public organization carrying out space activities and pursuing education programmes.



<Concept of GENSO Project>

The following projects are being carried out within the framework of ISEB: i) international student programs at the annual IAC and the biennial assembly of the Committee on Space Research (COSPAR); ii) international student participation in NASA Academy; iii) “Global Educational Network for Satellite Operations” (GENSO) project; v) CanSat activities; vi) Delta Researcher School project.



<CanSat Workshop in Tokyo, February 2007>

The term of the chairmanship is one year, and it rotates among the Founding Members. Following its successful initial year under the chairmanship of ESA, ISEB was chaired by NASA from October 2006, and has been chaired by CSA since September 2007.

The Space Education Center has continued to support the work of ISEB by, for example, participating in the organization of IAC and COSPAR Student Programs, supporting the participation of Japanese graduate students in GENSO project and by organizing the International CanSat workshop at Tokyo in February 2007.

## C. Focusing on children in Asia: Asia-Pacific Regional Space Agency Forum



<APRSAF-12 Water Rocket Event,  
Kitakyushu, Japan, 2005>



<APRSAF-13 Water Rocket Event,  
Jakarta, Indonesia, 2006>



<APRSAF-14 Water Rocket Event,  
Bangalore, India, 2007>

The Space Education Center has supported educational activities of Asia-Pacific Regional Space Agency Forum (APRSAF) since 2005. From the year 2006, the Center has served as the Secretariat of APRSAF Space Education and Awareness Working Group. Currently consisting of members representing 16 countries and 3 international organizations, the Working Group has become increasingly active in the past few years in promoting space education activities in the region.

Particularly by organizing the APRSAF Water Rocket Event with the regional water rocket launch competition in conjunction with the annual session of APRSAF and encouraging participating countries to organize national water rocket competitions to select participants for the Event each year, the Working Group contributed to increasing awareness of space education activities. Following the first Water Rocket Event held in Kitakyushu, Japan, in October 2005, and the second Event, held in Jakarta, Indonesia, in December 2006, the third APRSAF Water Rocket Event was attended by 24 students from 11 countries between 12 and 18 years old. The Event has been attended by 40-50 students and accompanying teachers from between 10 and 13 countries each year.



<Making water rockets, Jakarta>



<Launch competition, Jakarta>



<Launch site, Jakarta>



<Launching the rocket, Bangalore>



<APRSAF-13 Poster Contest, Jakarta, 2006>

For younger children, between 8 and 11 years old, the Working Group began to organize APRSAF Poster Contest from 2006 under a selected theme each year. The first Contest was held under “Importance of Space” and received 12 entries from four countries. The number of participating countries doubled in the following year, in 2007, when the Contest was held under the same theme as the one for the World Space Week that year, i.e. “50 Years in Space”, and received 23 entries from 8 countries.



<APRSAF-14 Poster Contest, Bangalore, 2007>



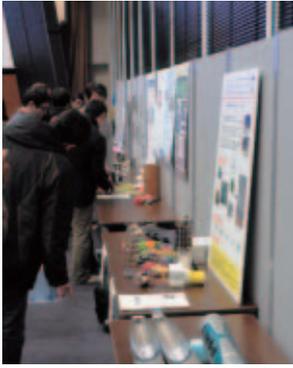
<Space Education Forum, Ha Noi, 2006>

APRSAF Space Education and Awareness Working Group also organizes space education forums, to provide school teachers and students with opportunities to learn about various space-related subjects, and space education seminars, to provide training opportunities for school teachers to use space materials and resources in the classroom activities to stimulate interest of students in the subjects to learn. In organizing those activities, efforts are made to create synergies with the space education initiatives taken by UNESCO, in introducing and promoting space education in developing countries.



<Space Education Seminar, Jakarta, Indonesia, 2006>

The Space Education Forum in Ha Noi, Vietnam, in March 2006 was jointly held by APRSAF and UNESCO with local support by the Vietnamese Academy of Science and Technology (VAST). In December 2006, the Space Education Center also collaborated with UNESCO in organizing the Space Education Seminar for teachers in Jakarta, Indonesia, immediately following the conclusion of the thirteenth session of APRSAF.



<Displays of CanSats>



<Demonstration of rover>



<Discussions during the Workshop>



<CanSat presentations by high school students>

Following its agreement reached in 2006, APRSAF Space Education and Awareness Working Group began to consider education and training activities for secondary to tertiary school students. In this connection, the Working Group began to exchange information on CanSat activities.

CanSat is a nano-scale satellite model with all basic functions of a satellite fitted into a soda can of 350-ml or a little more. It could perform various experiments such as attitude control, image capture and downlink as well as differential GPS measurement. Because of this, CanSat is considered to provide excellent training opportunities for those who wish to learn about and gain hands-on experience with satellite design, fabrication and operation.

In Japan, more than a few university teams actively participate in the annual CanSat comeback competition. One has to make a CanSat with a certain control mechanism, such as parafoil, to reach a predetermined target point without human intervention after a release from a captive balloon at a high altitude or following the launch by an amateur rocket.

In order to introduce CanSat activities in Asia and the Pacific, the Space Education Center organized, within the framework of APRSAF, the International CanSat Workshop in Tokyo in February 2007, in cooperation with UNISEC. This Workshop was also held within the framework of ISEB and enjoyed participation of about 150 university and graduate students, educators and space experts involved in educational activities from 15 countries, with 10 from Asia and the Pacific.

Following the Workshop, some countries in Asia, such as Malaysia and Thailand, began to carry out CanSat activities at home. In the case of Malaysia, the National Space Agency of Malaysia organized a CanSat competition with the participation of several university teams.

## D. Pursuing cooperation with developing countries outside Asia

### 1. Working with UNESCO



<Medellin, Colombia>

Upon invitation by UNESCO, the Space Education Center participated in workshops organized by UNESCO for the first time when they were held in multiple cities of Colombia in November and December 2005. During the workshops held in Medellin and Bogota, the Center introduced water rockets as educational activities and supported hands-on sessions for school children to build and launch water rockets.



<Hue, Vietnam>

Following those workshops in Colombia, the Center provided similar support to the UNESCO space education workshops held in Hue and Ho Chi Minh, Vietnam, in March 2006, as well as the workshops in Quito, Cuenca and Guayaquil, Ecuador, in May 2007. The Center continues to respond to requests for information, advice or materials relating to water rockets that it receives from those educators and teachers who participated in the UNESCO workshops.



<Cuenca, Ecuador>

As of March 2008, the Center plans to support the workshops to be held in Dar-es-Salaam and Arusha, Tanzania, and a regional space camp for teachers and students from Latin American countries to be held in Ibarra, Ecuador, both in May 2008.

The partnership with UNESCO has turned out to be effective in promoting water rocket activities for educational purposes, using the materials provided by the Space Education Center. It has opened the door for collaborations with those other developing countries with emerging space capabilities with willingness and communication channels to reach out to a large number of school teachers. As part of such collaborations, the Center provided support to water rocket events in conjunction with the celebration of the World Space Week in 2007 as well as associated teachers seminar held in Argentina, Brazil, Colombia, Ecuador, Nigeria, Philippines and Vietnam.



<Northern region of Argentina>



<Teachers training in Brazil>



<Baranquilla, Colombia>



<Bogota, Colombia>

## **2. Pursuing inter-regional cooperation: supporting Space Conference of the Americas**

Recognizing the effectiveness of working with those entities that serve as focal points for regional cooperation in space activities, the Space Education Center responded to the invitation by the organizers and participated in the Fifth Space Conference of the Americas (V CEA), held in Quito, Ecuador, in July 2006, as well as its Preparatory Conference, held in Santiago de Chile, in March 2006. At those meetings, the Center introduced its concept, principles approaches taken for space education activities and introduced water rocket activities as one example of effective hands-on education for young people. The Center continues to support the work of the Pro Tempore Secretariat of V CEA by, among other things, providing them with water rocket education materials and supporting them in the organization of the first regional space camp, planned in May 2008.

### **3. Pursuing collaborations with development agencies: supporting Japan International Cooperation Agency (JICA) teachers training programme**

The Space Education Center has begun to take a step forward in pursuing collaborations with African countries. Japan International Cooperation Agency (JICA) provided opportunities for the Center to receive groups of African science teachers in September 2006 and September 2007 to introduce space education. The Center provided short hands-on sessions for those teachers to use space materials and resources to stimulate interest of students in science classes. In total, the Center provided such opportunities to 17 science teachers from 8 African countries, i.e. Kenya, Gambia, Ghana, Malawi, Namibia, South Africa, Tanzania and Uganda.



<Receiving science teachers from African countries for the first time, 2006>

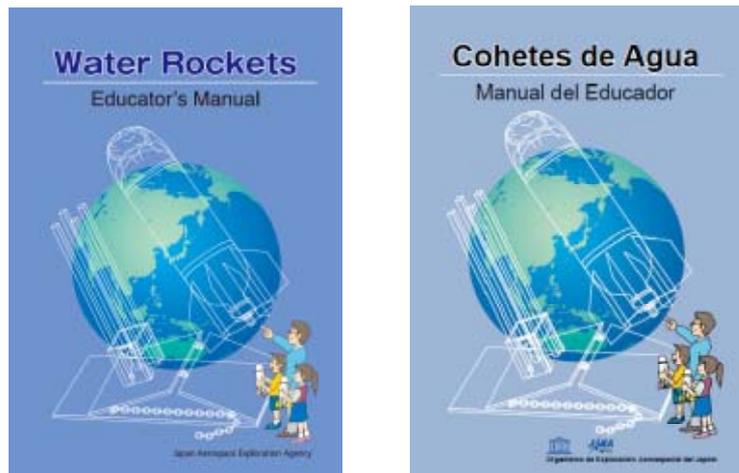


<Welcoming the new group of science teachers from African countries, 2007>

## E. Achievements: education materials resulting from international collaborations

Through international activities, the Space Education Center makes available some of its selected teaching and learning materials in other languages than the original one, Japanese, with the aim of disseminating its education materials outside the country to further promote space education. In selecting those materials, the Center places importance on the feedback that it receives from educators and teachers in other countries on the education activities that the Center introduces.

One of the successful examples for taking the above approach is the production of the Water Rocket Educator's Manual and its accompanying DVD. The English version of the Manual and DVD was prepared first for distribution to APRSAF Space Education and Awareness Working Group and to the participants of APRSAF Water Rocket Event in 2006. In view of the positive feedback that the Center received from many teachers and educators not only from Asian countries but also from Latin American countries, the Center worked with UNESCO to produce the Spanish version.



<English and Spanish versions of the Water Rocket Educator's Manual>

## VII. DISSMINATION OF INFORMATION

The Space Education Center uses Internet-based services and publications as the main tools to disseminate information.



<Home page of the  
Space Education Center>

As for the Internet-based services, the Center provides information on its activities, including announcements for upcoming opportunities and reports on the past activities, and distributes and revises online education materials and programs, mainly through its web site. Its web site continues to be upgraded, and it now contains movie files and video clips. The web site of the Center (<http://www.edu.jaxa.jp>) aims to achieve the following three objectives: i) to serve as the focal point to disseminate information on space education activities and to provide a forum for exchanging ideas and information among educators; ii) to provide education materials, images and pictures that can be easily downloaded for use by educators in classroom teaching; iii) to make available immediately the teaching and learning materials developed through school education support as well as reports on school support.

In addition, the Center issues short journals via electronic mail, or “Mail Magazine”, once or twice a month, taking up a space-related topic that may be of interest to young people and disseminating the latest news on the Center’s activities. As of March 2008, 25 issues have been disseminated since the first issue in June 2006. The number of subscribers increased 30-fold in almost two years, from 30 to close to 1,000.



<News letter>

The Center disseminates paper-based publications on a regular basis. The Center has been distributing news letters to about 15,000 elementary and junior high schools in the country. For “Science for Kids”, a monthly journal for children, the Center is contributing articles on its activities. Starting from August 2007, the Center is issuing the quarterly journal, “Door to the Space (Sky)” for children. By March 2008, three issues have been published, to disseminate articles on space-related subjects and activities of the Center.



<Quarterly magazine,  
“Door to Space (Sky)”>

## VIII. CONCLUDING REMARKS

To some extent, we in our Space Education Center are trying to establish a network of space education efforts at various levels, through various cooperation frameworks and through not only organizations but also individuals who share our goals and principles. As far as the space education is concerned, we value what each individual can do to have positive impact on the minds of young people.

In our efforts to highlight the importance of space activities for the society, we have stressed the benefits of space science and technology and their applications to enhance safety, security, predictability, responsiveness, stability and convenience at the societal level, aiming for the enrichment of the society as a whole. While these efforts should continue, we could pay a little more attention to individual needs particularly those of young people.

What JAXA Space Education Center is doing now is perhaps the reflection of the lessons that we learned in the Japanese society. In the excessive pursuit of material richness, efficiency and productivity, we might have forgotten something important in the pursuit of happiness as human beings.

Our attempt to establish a network of space education efforts is an attempt to create a coalition of forces around the world who want our children to lead lives full of happiness and joy of living. Through our interactions particularly with teachers and educators in developing countries, we have gained confidence that what we are doing will eventually bear fruits in the future.

It is our believe that the enhancement of human development at individual level through space education will contribute to the establishment of a solid foundation for global peace, so that one day, when human beings eventually start living in space, there will be no human sorrows and tragedies that we have observed too often on the Earth.

