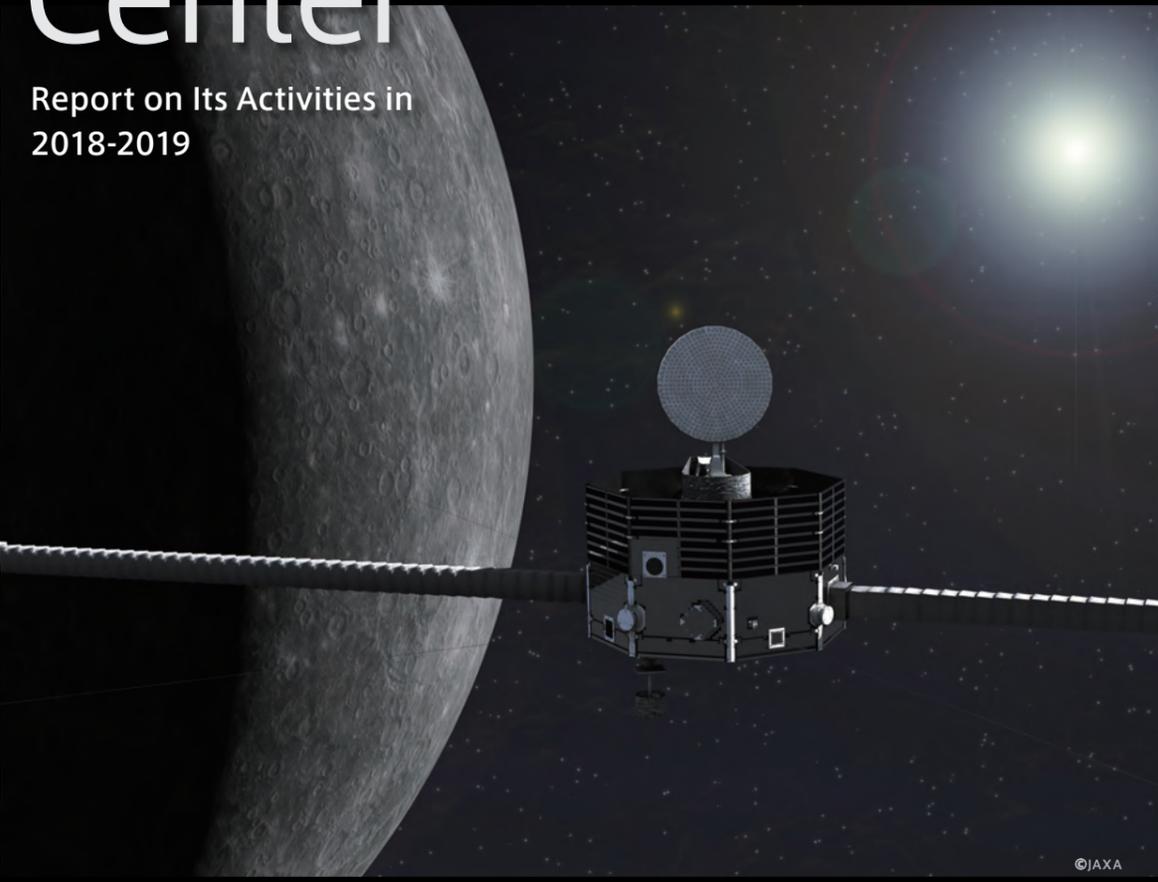




JAXA Space Education Center

Report on Its Activities in
2018-2019



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Report of JAXA Space Education Center

On Its Activities in 2018-2019
(Information as of March 2019)

CONTENTS

FROM THE DIRECTOR 01

THE YEAR IN REVIEW 02

WHO WE ARE

The History of JAXA Space Education Center 14

Our Goals & Principles 14

WHAT WE DO

Formal Education Support 15

Informal Education Support 16

Experience-Based Learning Opportunities 16

International Engagement 17

Content Publishing 18

Establishing Strategic Partnership 19

From the Director

Our philosophy in space education is maximized in a society of co-creation

Children's enthusiasm for objects and phenomena, motivation for experience and learning, struggle toward achievement, joy of success, and discovery of new horizons – JAXA aims to assist in such learning as well as physical and emotional growth and development, by considering space education as one of the pillar tasks of JAXA. The activities of the Center take advantage of diverse achievements in the fields of space and aeronautics, as one of its lead projects and carrying out projects in collaboration with teachers, who are directly involved in the education of children.

Today's society is characterized by changes in the environment that surrounds us, including innovations in information technology and shifts in the economic balance, which make it difficult to have a long-term outlook. Under such circumstances, the perspective required for children's education is also evolving. In order to foster the ability to identify and solve problems, merely having rich knowledge and high individual performance is not sufficient. Rather, it requires abilities such as in collaboration, co-creation, and continuous learning, which also pose a major challenge on the part of educators. We take advantage of the synergy generated through networking with diverse parties concerned, not only government institutions that play a role in the fields of space and education but also industries and non-profit organizations, in the hope of achieving our ideal space education.

JAXA's activities are based on its missions to realize a world where JAXA's achievements are utilized by society, through which they become well-established, to pursue challenging research and development that opens up a new world, thereby leading the country and the world, and to actively invite new partners and adopt new technologies, and so create innovations. Similarly in the field of education through space, we strive toward growth of the children who will lead the next generation and evolution of the global community, and from a more advanced perspective, the space community.



2019
Kaori Sasaki
Director,
JAXA Space Education Center

THE YEAR IN REVIEW

April

4

Cosmic College and Space School for Families

Cosmic College and Space School for Families start their new year every April, and are held year-round on weekends and school holidays across the country. Every year, many children participate in these programs as an opportunity that opens new doors for their intellectual curiosity.

Cosmic College is an interactive science education program hosted by local communities across the country. Recently, the program has been increasingly held at libraries by taking advantage of the functions of libraries, such as introducing books related to the theme of the program.

In Space School for Families, students and their families learn together through schooling and at-home learning using familiar materials. For instance, in the schooling part of Space School for Families held in Abashiri City, Hokkaido, drift ice was used in the program "Let's try ice fishing." The programs are designed to incorporate the uniqueness of each community, in order to not only offer scientific learning but also to kindle participants' interest in their hometown.



July

7

Classroom Partnership: Asa Senior High School, Yamaguchi Prefecture

Classroom Partnership supports schools' unique activities. At Asa Senior High School, students and teachers collaborate with a local company to develop space food. This year, they worked on improving the freeze-dried croquette that they developed last year, in terms of nutrition and shelf life. This involved consideration of many factors including nutrients required in space and the extent of oxidation, which was a big challenge. Improving different aspects resulted in a delicious croquette. We hope that they continue their efforts so that one day their product may be adopted as real space food.

Space Education Regional Forum

The Space Education Regional Forum was held on July 4 in Okayama Prefecture, one of our partners, and on December 11 in Kakuda City, Miyagi Prefecture, also our partner. This was our first trial of this kind, and is intended for our space education partners and those engaged in educational activities in nearby communities, with the aim of exchanging information on different learning support activities and building a network of educators.

Open Campus at JAXA Sagamihara

As part of the JAXA Sagamihara Open Campus on Friday, July 27, the Space Education Center held an interactive event titled "Experience the mystery of light!"

In the event, approximately 500 visitors experienced mirror writing, where the world becomes upside-down and left-right reversed resulting in difficulty writing; a pinhole viewer, where the image through the box appears upside-down; a pinhole viewer with a lens; and ambigrams, where a word appears as a different word when viewed upside-down.

July-August

7.8

KIMISSION (Making Your Own Space Mission)

Eighteen high school students gathered at the Institute of Space and Astronautical Science (ISAS) to participate in a five-day intensive program. With the guidance of ISAS graduate students and faculty, the students formed three groups and investigated original space missions, such as space travel, search for evidence of extraterrestrial life, and sample return from Solar System Objects.

The 18 students, who met each other for the first time in this program, were engaged in face-to-face discussions to share their ideas with peers, through which they successfully designed their own space missions.



August

8

Aerospace School

Aerospace School was held at Tanegashima Space Center, in addition to Taiki Aerospace Research Field, Kakuda Space Center, Tsukuba Space Center, Chofu Aerospace Center, and Nagoya Flight Research Center, with 124 high school students participating from across the country. Themes were set according to the characteristics of each center: space science experiments (Taiki), rocket engines (Kakuda), space environment utilization (Tsukuba), aeronautical technology research (Chofu), aerospace engineering (Nagoya), and launch site development (Tanegashima). These themes were addressed through tours of the facilities along with intense discussions.



September-October 9-10

International Space Education Board (ISEB) Student Program and annual meeting in Bremen, Germany

Under the ISEB international cooperative framework, 73 undergraduate and graduate students were sent from around the world to participate in a seven-day special space education program, consisting of activities such as a cross-cultural awareness workshop, a Question and Answer session with the heads of space agencies, lunchtime sessions, space education outreach to local junior high school students, and participation in the annual International Astronautical Congress (IAC), through which they deepened mutual understanding. The ten JAXA-sponsored students also visited the Japanese School of Bremen to give four special interactive space education classes for local children.

At the ISEB annual meeting, the United Arab Emirates newly joined the ISEB as a member, together constituting an international cooperative framework of ten institutions and organizations. The members engaged in active discussions about future collaborative activities.



International Space Education Board



October

10

Publication of educational materials on computer programming

We published educational materials on programming intended for children in grades four through six. Through programming experience and learning designed for beginners, children can also learn about aspects of space science (features of satellites and analysis of imagery from earth observation satellites). Currently offered themes include battery, energy, fishery, agriculture, and weather, and new themes will be added. The texts can be downloaded from the Center's website with a search tool for space education materials. The texts are currently offered only in Japanese, and English versions will be developed by the end of 2019.

<http://edu.jaxa.jp/en/materialDB/>



November

11

The 25th Session of the Asia-Pacific Regional Space Agency Forum (APRSF-25) in Singapore

At the APRSAF Space Education Working Group annual session, more than 60 participants from 13 countries gave a total of 18 presentations. During the session devoted to the innovative space education program, participants from Japan, Indonesia, and the Philippines gave four presentations, which shared the latest space education methods and materials including programming education materials, robots, and CanSats, which are small simulated satellites. After the annual session, JAXA staff members also visited the Japanese School Singapore to give a special space education class for approximately 120 junior high school students.



APRSF Water Rocket Event

Prior to the APRSAF annual session, the APRSAF Water Rocket Event, which began in 2005, was held in Singapore for the 14th year. This year, 58 junior high and high school students from 12 Asia-Pacific countries along with 22 teachers and educators gathered for three days of substantial international exchange. A student from Sri Lanka won the water rocket launching competition. The teachers and educators from each country shared their space education efforts through the workshop.



November
11

APRSAF Poster Contest

Under the theme of "My Home in Space," 34 excellent posters were entered from 12 Asia-Pacific countries, and a student from China received the highest award through votes by APRSAF-25 participants. A 2019 calendar featuring all exhibited works can be downloaded from the following link.

http://www.aprsaf.org/working_groups/se/



APRSAF Space Education Seminar for Educators in Dehradun, India

Shortly after the closing of APRSAF plenary meeting, a space education seminar for teachers and educators from Asia-Pacific countries was held jointly by JAXA and the Indian Space Research Organization (ISRO). The two-day seminar offered a lecture on the latest space exploration and hands-on sessions on water rockets and vacuum experiments by JAXA, along with lectures on remote sensing and astronomical objects by the ISRO, for 76 participants from countries such as India and Nepal. A number of requests were received for a similar seminar to be held on a regular basis.



December

12

Partnership Agreement Signed with Kuwana City, Mie Prefecture

We have signed a partnership agreement with Kuwana City in Mie Prefecture on December 13, 2018. Kuwana City actively encourages initiatives involving citizens through collaboration with Kounotori Kuwana, a voluntary organization of school teachers and citizens.



January

1

JAXA-hosted Teacher Training at Kushiro Children's Museum

Beginning in last year, the JAXA Space Education Center has actively hosted training for teachers recruited by JAXA. This year, on a pilot basis, we collaborated with an external institution and limited the type of schools from which teachers participated. As an example, we held a training session for kindergarten teachers and child daycare staff in collaboration with one of our partners, Kushiro Children's Museum. This program is designed for teachers to learn the core concepts of space education and experience the educational materials just like students do, thereby deepening their understanding of space education. Although we could not fully reach kindergarten teachers and daycare staff as targets for this training program, this year's program demonstrated that teachers at these school types are very suitable to be involved in space education. JAXA will continue to work on spreading space education to diverse targets.



JSora no Tobira (Portal to Space) and Soratobi Science Pocketbook

The 46th issue of Sora no Tobira (Portal to Space) and the Soratobi Science Pocketbook were released. This issue gives a detailed introduction to the asteroid "Ryugu" explored by Hayabusa 2. The Pocketbook compiles all kinds of information useful for science education, including astronomy, space environment utilization, space science, and aerospace research and development. Both of these are also available online at

<http://edu.jaxa.jp/soratobi/> (Japanese only)



February

2

Workshop for incorporating space in education: Space Exploration Educators Conference (SEEC)

Every year, JAXA sends school teachers to the SEEC held at Space Center Houston, Texas, USA. At the conference, participating teachers presented teaching methods featuring space that are adopted in the classrooms in Japan, along with case examples. A daycare staff member demonstrated teaching material for learning dispersion of forces through playing with a balloon trampoline. Other demonstrations included koinobori (carp streamer) and balloon popping, and the presentation ended with participants balancing on balloons. The experience of balancing on many balloons was unimaginable, and the presentation was very successful.

An elementary school teacher gave a presentation on learning about the mechanism of sound production by incorporating gagaku, Japanese ancient court music and dance. Participants learned about the connection between gagaku and space, and built a structure for producing specific musical notes using a straw. At the end of the presentation, all participants joined to play their favorite original straw in concert and together experienced space. (Photo: lecture by elementary school teacher using a straw flute)



March

3

Space Education Symposium

The Space Education Symposium is an opportunity for its participants to cultivate a shared understanding of the core concepts of space education and to exchange cases in practice for the purpose of sharing information, discussion, and further development. In 2019, under the theme of "Space Education Leads Children's Future," the symposium offered, for the first time, poster sessions by educators involved in space education and an exhibition of their original space education teaching materials, followed by a workshop for participants to further speculate on the significance of space education and engage in active discussions.

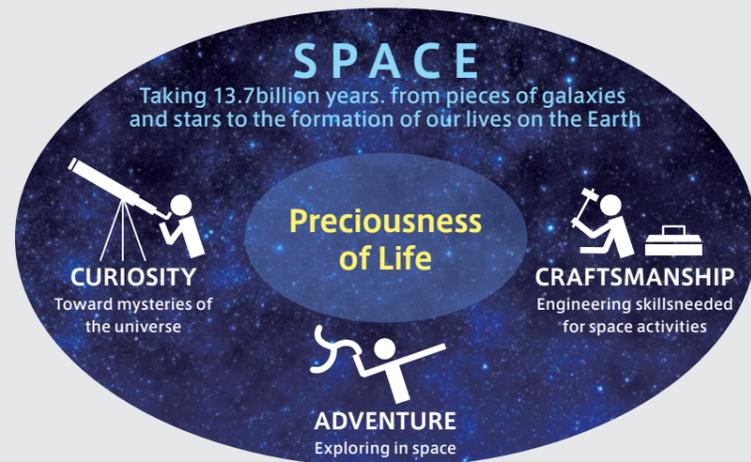


Who we are

Space is a unique source of interest and inspiration, and gives flight to the imagination. The Space Education Center of the Japan Aerospace Exploration Agency (JAXA) works with children and young people to nurture their inherent curiosity about the natural world, the universe, and all living things. Over the past 13 years, we have increased and expanded our program, bringing space-related topics and materials into schools and homes across the nation and around the globe. Our mission is to stimulate interest in not only science and technology, but also in human behavior.

THE HISTORY OF JAXA SPACE EDUCATION CENTER

Space education has long been a part of the Japanese space program's mission. The early years were marked by the Public Affairs Department's efforts to increase general awareness of space and gain the public's understanding of how society could benefit from space-related activities. One team involved in this outreach specialized in working with children and young people, using compelling, space-related educational materials to connect science to everyday life; the hope was that a greater interest in science would positively influence their intellectual growth. With the creation of JAXA in October 2003, it was increasingly recognized that education is fundamentally distinct from public relations. Combined with the foundation already laid by the student outreach team, this led to the establishment of the Space Education Center on May 1, 2005, by executive order of the then-president of JAXA. Since then, the Center has been a vibrant presence on JAXA's Sagami-hara Campus.



OUR GOALS & PRINCIPLES

Children love the natural world, and look at life with wonder. In particular, the mysteries of space tug on their curiosity and fire the imagination. Space exploration calls to their spirit of adventure. But alongside the spirit of **curiosity** and **adventure** is another spirit, just as important. Without hands-on perseverance to match the adventurousness, there can be no reaching what you seek. This is the spirit of creativity—**craftsmanship**.

To ignite these three spirits within children is the core philosophy of the Center. Children will then grow their own knowledge and experience, driven by the joy of learning.

With space as an effective educational material and the preciousness of life as underlying message, we aim to use the wealth of knowledge and technology gained from space development to nurture young minds.

The spirit of curiosity, adventure, and craftsmanship. By learning "with space" rather than learning "about space," children develop the capacity to learn continuously. That, we believe, is the key to raising people capable of creating knowledge and techniques on their own, and all their lives.

What we do

The Cosmic College is an interactive program focused on fostering inspiration through firsthand experiences such as crafting and experiments featuring space. The program is designed to kindle children's curiosity and spirit of inquiry through the experience of the fun and mystery of science, to help children grow up spiritually rich. The program is hosted by local teachers for children in the region in order to ensure sustainable learning, and the JAXA Space Education Center continues to support such local initiatives.



FORMAL EDUCATION SUPPORT PROFESSIONAL DEVELOPMENT & CLASSROOM PARTNERSHIP

Space is a great fit for classrooms, and not just in science, technology, engineering and mathematics (STEM) courses. The possibilities for application are many: social studies, language learning, art, ethics, even life skills. From lesson plans to educational materials, the Space Education Center is there to support teachers.

Teaching is a demanding profession, and flexibility is the cornerstone of our **professional development programs**. We work with education boards and other groups to organize lectures and workshops targeting educators for all age levels throughout their career: preschool and kindergarten, primary, middle, and high schools, education majors and seasoned teachers.

Number of sessions and participants of professional development programs

	FY2014		FY2015		FY2016		FY2017		FY2018	
	Sessions	Students/Teachers								
For candidates for teachers	1	200	4	350	2	265	1	204	1	220
For teachers	28	1,200	35	1,929	34	1,550	50	1,545	29	1,413
TOTAL	29	1,200	39	2,279	36	1,815	51	1,749	30	1,633

NOTE: The Japanese fiscal year runs from April 1 to March 31.

By bringing space into the classroom, we change perspectives and encourage observation. The classroom partnership program consists of thematic lesson activity, information about space-related educational materials, and lesson planning advice. In one example, students in a life skills class conducted a taste test of two instant curries, one for astronauts and one from the supermarket, discussing the noticed differences in ingredients and properties to build their analytical thinking skills.

Number of schools supported by the Center and students who have benefited from the program

	FY2014		FY2015		FY2016		FY2017		FY2018	
	Schools	Students								
Kindergartens	5	264	3	207	4	284	3	188	3	245
Elementary Schools	69	7,180	74	6,669	69	5,400	75	6,194	79	6,253
Junior High Schools	25	4,663	24	5,714	31	6,549	31	3,278	34	3,118
High Schools	18	1,273	17	1,450	13	1,084	17	1,499	18	1,176
TOTAL	117	13,380	118	14,040	117	13,317	126	11,159	134	10,792

What we do

INFORMAL EDUCATION SUPPORT

EXTRACURRICULAR AND HOME ACTIVITIES

Weekends and holidays offer a wonderful opportunity for informal space education. The Space Education Center has a raft of cohort-specific programs that children of all ages, their parents and even grandparents can participate in.

For the youngest learners, **Space School for Families** represents an opportunity to not only gain early exposure to science but also grow a stronger family unit and a more close-knit local community. Co-organized with the NPO Kodomo Uchu Mirai Association (KU-MA), the program consists of hands-on group sessions with “homework” in between and a final presentation by each family; to date, the Center has developed 107 homework texts in various subjects.

Number of Courses and Participants of Space Schools for Families

	FY2014	FY2015	FY2016	FY2017	FY2018
Courses	51	53	54	56	52
Participants	4,987	4,799	4,701	4,989	5,144

The **Cosmic College** is an interactive program focused on fostering inspiration through hands-on experiences such as crafting and experiments featuring space. The program is designed to kindle children’s curiosity and spirit of inquiry through the experience of the fun and mystery of science, to help children grow up spiritually rich. The program is hosted by local teachers for children in the region in order to ensure sustainable learning, and the JAXA Space Education Center continues to support such local initiatives.

Number of Courses and Participants of Cosmic Collenges

	FY2014	FY2015	FY2016	FY2017	FY2018
Courses	280	328	405	481	525
Participants	18,598	18,326	27,046	27,876	24,701

EXPERIENCE-BASED LEARNING OPPORTUNITIES

PROVIDING OPPOTUNITIES

The Space Education Center supports and creates learning opportunities for students and educators both domestically and internationally.

In JAXA’s **Aerospace School** program, high schoolers live and work as a team for several days in space center facilities across Japan. The program brings students into direct contact with working members of the Japanese space program, state- of-the-art research facilities and spacecrafts, and authentic experiences that emerge from working with other teens that share their passion.

Number of Courses and Participants of Aerospace Schools

	FY2014	FY2015	FY2016	FY2017	FY2018
Courses	7	7	5	5	6
Participants	104	142	98	100	124

Making Your Own Space Mission (Kimission) is another program for high school students. They team up and plan space missions from the ground up under the supervision of graduate students of the Institute of Space and Astronautical Science. The young mission planners spend five full days in JAXA Sagami-hara campus, exploring their own ideas along with space. Their missions are presented to the audience of JAXA professionals on the last day, and the teams have the option to develop their mission further and give presentation at the annual meeting of the Astronomical Society of Japan.

The Center also provides learning opportunities for students, teachers and educators that cross borders. In the **APRSAF*1 Water Rocket Event**, junior high and high school students across Asia-Pacific Region gather and share skills and knowledge of Water Rocket. Cultural exchange is also an important element of the event. The **APRSAF Space Education Seminar** and the **Educator Workshop** are valuable opportunities for teachers and educators to trade experiences, insights and achievements from their own space education activities. The aim of these educator programs is to enhance the quality of teaching in order to nurture the next-generation talent capable of true innovation.

ISEB*2 Student Program provides opportunity for university and graduate school students to attend IAC sessions, present their research, network with space professionals and fellow students, and conduct outreach for local students. The Center sponsors Japanese students to attend the program every year.

INTERNATIONAL ENGAGEMENT

INVESTMENT IN A SHARED FUTURE

With the aim of contributing human resource development for next generation, the Space Education Center has been actively collaborating with international partners under global and regional frameworks.

The **International Space Education Board (ISEB)*2** was founded by CSA, ESA, JAXA and NASA in October 2005. It now brings together nine space agencies (AEM, CSA, CNES, ESA, JAXA, KARI, NASA, SANSA and UAESA) and one space education entity (VSSEC). Every year, the Heads of Education of the ISEB member agencies discuss cooperative space educational projects face-to-face. Once action plans are agreed upon by the ISEB HoE, working group representatives implement the plans throughout the year.

Now the largest space conference in the Asia-Pacific, **the Asia-Pacific Regional Space Agency Forum (APRSAF)*1** draws attendees from public, private, academic, and non- governmental sectors from more than 40 countries and regions. The APRSAF Space Education Working Group (SEWG), formerly known as the Space Education and Awareness Working Group, was established in 2001 for promoting space education activities including space topics and providing opportunities for space education. The Space Education Center serves as co-chair of the APRSAF Space Education Working group and assists in organizing the water rocket event, the themed poster contest and educator seminars.

Number of Agencies and students who attended the ISEB program

	2014	2015	2016	2017	2018
Host Country	Canada	Israel	Mexico	Australia	Germany
Agencies/institutions	8	4	7	6	7
Students	59	19	52	54	73

Number of Countries/Regions attended APRSAF Space Education Working Group programs

	2014	2015	2016	2017	2018
Host Country	Japan	Indonesia	Philippines	India	Singapore
Water Rocket Event	17	14	13	12	12
SEWG meeting	15	13	13	13	13

What we do

CONTENT PUBLISHING

INFORMATION AND EDUCATIONAL MATERIALS IN PRINT AND ONLINE

Curating information about space, science, and our own activities is also a major part of the Space Education Center's mission. We use a variety of media to deliver knowledge and learning to people of all ages.

A quarterly print magazine geared to children, **Sora no Tobira (Portal to Space)** is also available in PDF format. Young readers can find news about space development, interviews with astronauts and technologists, and information about space education activity in which they can participate, across Japan. Copies are available in school libraries, science museums, and online. (<http://edu.jaxa.jp/soratobi>)

The Space Education Center shares information about its events on **Twitter**. This is also a great way to stay in touch after one of our many international outreaches. Heart us, retweet us, and share your own pictures of events! (@jaxa_education)

Developing educational materials is an essential support for space education. Utilizing images and videos linked to JAXA's R&D achievements, we develop material and tools that work with a variety of space education programs in collaboration with outside experts. The results are released online for anyone engaged in space education to use in their own learning activity. (<http://edu.jaxa.jp/en/materialDB/>)

The Center's series of **educational materials designed for the classroom** are linked to subjects mandated by the official curriculum, for easy implementation in classes such as social studies, science, and even ethics.

The **workbooks for Space School for Families** are designed to be provided in sets (of 30 over one year) for home learning. Around 107 workbooks have been created to date, and we have been seeing expanding use of individual workbooks, and beyond the setting of family homes at that. Of these workbooks, we have translated 43 of them into English to date.

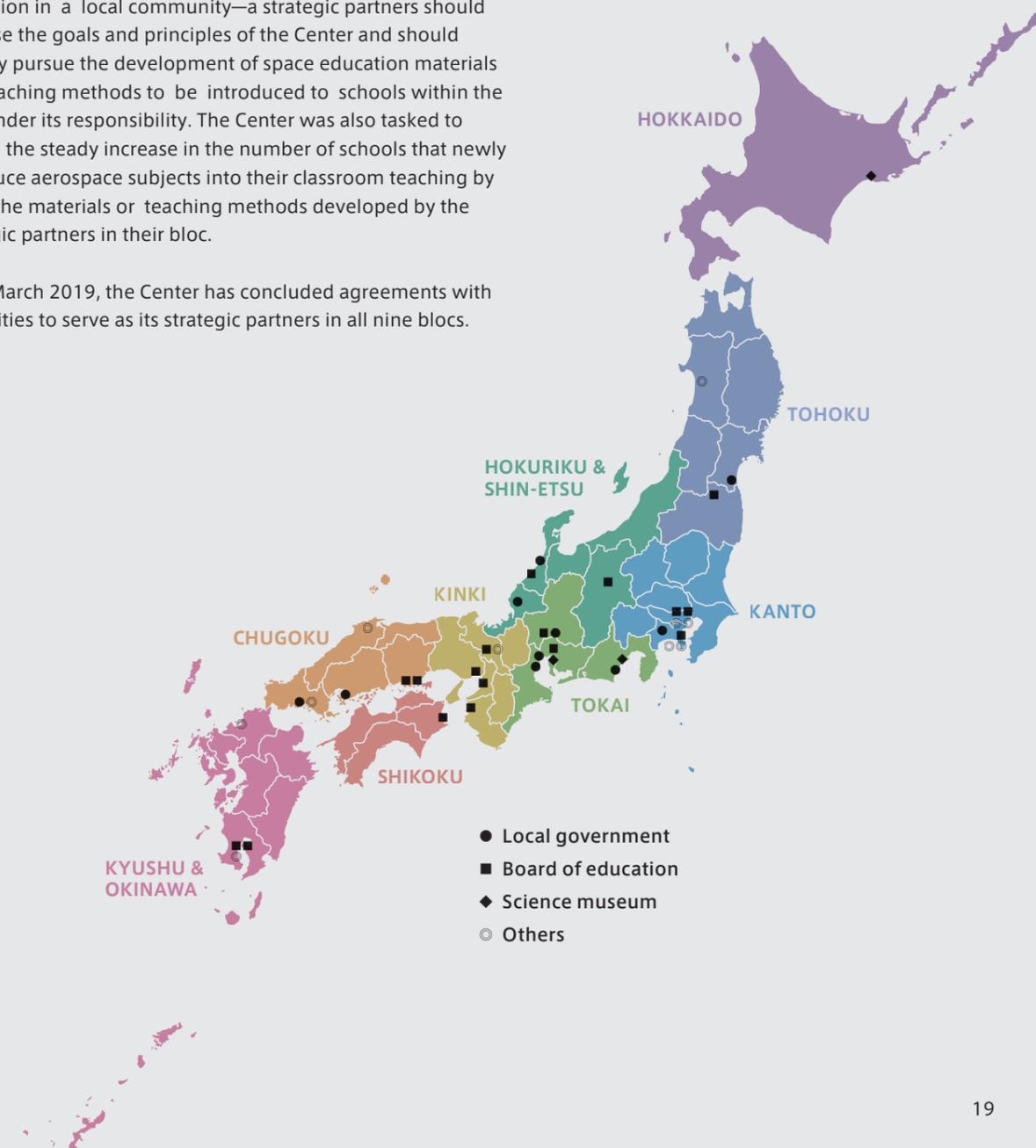
On a related note, our educational materials extend to recordings of simple **experiments conducted in the Kibo module** by JAXA astronauts during their multi-month stay on the International Space Station. The contrast with earthbound iterations of the same experiment brings home the mystery and allure of space.

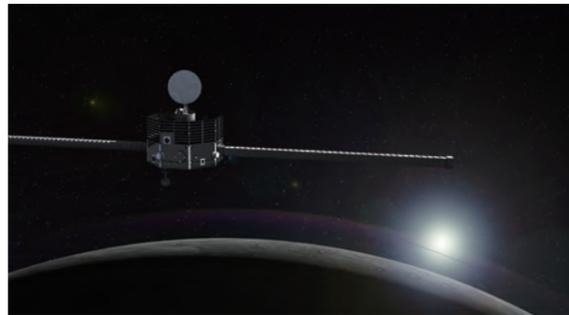


ESTABLISHING STRATEGIC PARTNERSHIP

As part of the executive directions set by the management of JAXA, the Space Education Center has been tasked since the fiscal year 2008 to establish strategic partnerships in all nine regional blocs of Japan, i.e. Hokkaido, Tohoku, Kanto, Hokuriku and Shinetsu, Tokai, Kinki, Chugoku, Shikoku, Kyushu and Okinawa. This is to ensure that the kind of classroom support provided by the Center continues to be expanded and further enhanced in an effective manner to benefit each of the primary and secondary schools without requiring direct and intense support by the Center itself. While it does not need to be a school, and it could well be a science museum or a board of education in a local community—a strategic partners should endorse the goals and principles of the Center and should actively pursue the development of space education materials and teaching methods to be introduced to schools within the bloc under its responsibility. The Center was also tasked to ensure the steady increase in the number of schools that newly introduce aerospace subjects into their classroom teaching by using the materials or teaching methods developed by the strategic partners in their bloc.

As of March 2019, the Center has concluded agreements with 37 entities to serve as its strategic partners in all nine blocs.





Mercury Magnetospheric Orbiter MIO ©JAXA

Report of JAXA Space Education Center
On Its Activities in 2018-2019

Space Education Center
Japan Aerospace Exploration Agency (JAXA)