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English only

Committee on the Peaceful Uses of Outer Space

International cooperation in the peaceful uses of outer space: activities of Member States

Note by the Secretariat

Contents

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I. Introduction

1. At its fifty-fifth session in 2018, the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space recommended that the Secretariat continue to invite Member States to submit annual reports on their space activities (A/AC.105/1167, para. 44).

2. In a note verbale dated 29 August 2018, the Office for Outer Space Affairs of the Secretariat invited Member States to submit their reports by 5 November 2018. The present conference room paper was prepared by the Secretariat on the basis of replies received in response to that invitation.

II. Replies received from Member States

Canada

[Original: English]
[8 January 2019]

International Space Activities 2018

Summary

Canada engaged in a diverse range of space activities in 2018, highlights include: the flight of Canadian astronaut, David Saint-Jacques, to the International Space Station (ISS) for his first mission; the completion of the assembly, integration, and testing of our RADARSAT Constellation Mission (RCM); the arrival of the OSIRIS-Rex spacecraft, with Canada's laser Altimeter (OLA), on asteroid Bennu, the kick-off of the Canadian Cubesat Project for university students, and milestone anniversaries for some of Canada's key space assets, including Dextre and SCISAT. In 2018, Canada also assumed Chairmanship of the International Student Education Board and handed over its two-year Chairmanship of the Committee on the Peaceful Uses of Outer Space to Mexico.

The International Space Station (ISS)

Canada's contribution to the ISS, the Mobile Servicing System (comprised of Canadarm2, Dextre and the Mobile Base System), demonstrated its importance as a critical robotics system by performing resupply, maintenance, and service tasks essential to ISS operations. Canadarm2 was used to capture, manoeuvre, unload, and release various cargo vehicles including SpaceX's Dragon, Orbital ATK's Cygnus and Japan's H-II Transfer Vehicle. Canadarm2 also underwent some maintenance on its Latching End Effector (LEE), which was replaced in January 2018. As well, Dextre celebrated its 10th anniversary in March 2018. Over the past decade, Dextre has performed important maintenance operations and experiment deployments, and saved astronauts from over 25 spacewalks.

Human health and medical science remain Canadian priorities for the utilization of the ISS. Canada is developing new multipurpose medical and research platforms to address risks associated with human space flight, such as the Life Science Research System (LSRS), which reached completion in 2018 and will be deployed on the ISS in 2019. Canada also initiated the development of a novel and breakthrough biological sample preparation technology for the ISS, MicroPrep and pursued five scientific studies related to health on the ISS: T-Bone, Marrow, At Home in Space, Vascular Echo and RADI-N2.

Human Space Flight

Throughout 2018, Dr. David Saint-Jacques continued to prepare for his mission as a member of ISS Expedition 58/59, which launched on 03 December 2018 on a Soyuz vehicle from Baikonur, Kazakhstan. This is his first mission, the 17th Canadian

spaceflight and 3rd Canadian long duration Expedition mission. During his assignment, Dr. Saint-Jacques will conduct a series of Canadian and International health life science experiments, robotic tasks, and act as crew medical officer. He is also qualified to perform extravehicular activities (EVAs).

Space Atmospheric Sciences

The Canadian Space Agency (CSA) continues to support Canada's SCISAT satellite, which celebrated its fifteenth anniversary in August 2018. SCISAT's two instruments, ACE-FTS and MAESTRO, continue to produce high-quality data to better understand the depletion of the ozone layer. SCISAT remains an essential data source for climate scientists and an important asset to international environmental policy-making and implementation of international treaties, such as the Montreal Protocol. SCISAT's data has been cited by over 1400 scientists worldwide, in hundreds of publications.

The CSA also continues to support Canada's Optical Spectrograph and InfraRed Imaging System (OSIRIS) instrument onboard the Swedish Odin satellite, measuring atmospheric composition. The data quality of OSIRIS has become internationally recognized, is highlighted in United Nations Ozone Assessment Reports, and is also used to monitor the impact of the United Nations Montreal Protocol.

Canada also continues to support the Measurement of Pollution in the Troposphere (MOPITT) instrument onboard the NASA Terra satellite. Since 1999, MOPITT has been continuously scanning the Earth's atmosphere to make long-term measurements of carbon monoxide concentrations. It is the longest-running pollution monitor in space today.

Planetary Exploration

Canada provided the OSIRIS-REx Laser Altimeter (OLA) on NASA's asteroid-sampling mission OSIRIS-Rex, which arrived at asteroid Bennu in December 2018. OLA is a sophisticated laser-based mapping system which will be used to create 3D maps of Bennu to help the mission team select a sample collection site.

Space-Based Astronomy

Canada continues to support the James Webb Telescope project, a partnership between NASA, ESA, and the CSA. The partners are working towards a 2021 launch date. Canada has provided the Fine Guidance Sensor (FGS), a critical element of the mission used for extremely precise pointing of the telescope, and the Near-Infrared Imager and Slitless Spectrograph (NIRISS).

The CSA continued its collaboration with the Indian Space Research Organisation (ISRO) on ASTROSAT. Canadian astronomers are now eligible to obtain data from ASTROSAT thanks to the provision of Canadian detectors for UVIT, the twin UV and visible imaging telescopes, on India's ASTROSAT.

Canada is a partner in the BRITE Constellation with Austria (University of Vienna and Graz University of Technology) and Poland (Copernicus Astronomical Center). The constellation observes the most luminous stars, including massive blue stars. As of 2018, five of the six BRITE satellites are operational.

In addition, Canada joined the science team for JAXA's X-Ray Imaging and Spectroscopy Mission (XRISM) mission. The CSA is collaborating with NASA to test and calibrate one of XRISM's instruments at the Canadian Light Source in Saskatchewan in exchange for eligibility to compete for observation time.

Space Weather

Space weather science requires world-wide ground and space-based observations to develop models that will ultimately contribute to the detection and mitigation of risks. Given Canada's northern location, it is highly impacted by the

effects of space weather, but also has a front row seat to observe the near-Earth space environment (geospace) where space weather occurs.

Canada's Geospace Observatory initiative observes geospace using arrays of ground-based instruments deployed across Canada and the data acquired is openly available to scientists worldwide.

Canada also continues to operate ground imagers and magnetometers across Canada, through the support of the University of Calgary and the University of Alberta, to contribute to the NASA THEMIS mission.

Canada is a partner in the European Space Agency's (ESA) Swarm mission (launched in 2013), designed to measure the magnetic fields generated by the Earth. ESA procured a Canadian Electric Field Instruments (EFI) for each of the three satellites. The University of Calgary, supported by the CSA, uses measurements from the EFIs to learn about the influence of space weather on the space environment.

Finally, Canada continues to lead the Committee on the Peaceful Uses of Outer Space Expert Group on space weather. In line with recommendations of the Expert Group, Canada has initiated a socioeconomic study to assess the impacts of space weather on Canadian infrastructure and aims to share its conclusions with the Committee on the Peaceful Uses of Outer Space in 2019.

Space Situational Awareness (SSA)

Canada's Department of National Defense continues to operate Sapphire, an operational space-based SSA sensor. Sapphire currently contributes 2000–3000 metric observations/day on deep-space objects to the larger US-led Space Surveillance Network, contributing to the safety of space objects in Earth's orbits. Sapphire will likely continue to be operated beyond its designed lifespan of 2018.

Since 2013, the Near-Earth Object Surveillance Satellite (NEOSSat) provides continuous tracking of man-made objects and near Earth asteroids for advanced R&D purposes. The spacecraft has suffered from two major anomalies in 2016, it was since fully recovered in 2017 and continues its mission. It now provides data to the Minor Planet Center on Near Earth Asteroids and exoplanets.

The CSA's Conjunction Risk Assessment and Mitigation System (CRAMS) continues to provide invaluable analysis for protecting space assets against space debris. Following additional requests from Canadian industry, academia and international partners, CRAMS continues its activities and now supports a total of 73 space assets both from LEO and GEO missions

Finally, several Canadian universities are collaborating with international colleagues in "all-sky camera networks", collecting observations on incoming debris/meteorites for logging and recovery purposes.

Earth Observation

Canada's RADARSAT Constellation Mission (RCM) has completed assembly, integration, and testing of the three-satellite constellation and is awaiting launch in early 2019. RCM represents an evolution of the RADARSAT Program and will ensure C-Band SAR data and provide new applications enabled by the constellation approach.

The CSA continues to support a large number of R&D activities using RADARSAT-2 data both nationally and internationally through various CSA Earth observation applications development initiatives. RADARSAT-2 continues to support the Government of Canada in its mandates to monitor the impacts of climate change, protect our environment and foster sustainable development, manage natural resources, and support disaster relief.

STEM

The CSA awarded grants to 15 post-secondary institutions, through the Canadian CubeSat Project (CCP), as part of a challenge to design, build, launch, and operate their own CubeSat for a three-year period starting in 2018. The main objective of the CCP is to provide professors in post-secondary institutions with an opportunity to engage their students in a real space mission. Once tested and ready for space, the CubeSats will be launched to and deployed from the ISS. The teams will then operate their satellites and conduct science according to their mission objectives, which could last up to 12 months.

This year, the CSA assumed the Chairmanship of the International Space Education Board (ISEB). In its role of ISEB Chair, the CSA led the organization of several activities during the International Astronautical Congress (IAC) 2018 and sponsored the participation of ten Canadian students.

Capacity Building

The CSA continued to support initiatives and activities related to space science and technology development to attract, sustain and enhance a critical mass of Canadian space specialists; reduce technological unknowns; foster space innovation and know-how; preserve Canada's space-related capabilities; and increase commercial potential. In particular, the CSA invested over $31M for the development and maturation of over 50 space technologies and over $6M to support space related research in Canadian post-secondary institutions. The CSA also carried out pre-mission research and technology activities and supported various pre-space capability demonstration opportunities to raise the space readiness of Canadian science and technology, while training post-secondary students in the field of space science and technology. Finally, the CSA continued to implement the Canada-European Space Agency (ESA) Cooperation Agreement, while participating in negotiations for the renewal of the agreement in 2019.

Support to Global Challenges

The CSA and the Public Health Agency of Canada (PHAC) continue to apply Earth observation satellite data and derived geospatial information to advance research efforts and risk assessments within the Canadian public health domain. Efforts have been focused on six priority areas: mosquitos borne diseases, Lyme disease, air-borne diseases, water borne disease, vulnerable human population, and on pandemic and major outbreaks.

With its large landmass, Canada counts on its longstanding use of satellite imagery and collaborative work with national and international partners to support the global data challenge for the Sustainable Development Goals. Canada participated in a side event to the High-Level Political Forum of 2018, reaching out to decision makers to showcase what Earth Observations can help them achieve, and monitor progress, towards the SDGs.

The CSA has been working closely with international partners as part of disaster relief programs, making our Earth observation data available in times of crisis, helping to assess impact and mitigate risk for natural disasters.

Socioeconomic Benefits of Space Utilization

In 2018, the CSA commissioned a study to better measure the socioeconomic value of space utilization that benefits Canadians, both of a quantitative and qualitative nature, across three key domains: satellite communication, satellite navigation, and Earth observation (EO). A series of metrics and indicators were developed to provide data on six key topic areas: Disaster Management, Agriculture, Air Traffic Management, Environmental Monitoring, Rural/Remote Communities, and Transport/Logistics/Internet of Things.

Philippines

[Original: English]
[26 November 2018]

Space Activities of the Philippines

After the release of its first microsatellite, Diwata-i, the Philippines has been continuously pushing its way further into space with the launch of its cube satellite (CubeSat), Maya-i, and its next microsatellite, Diwata-2. These satellites were funded by the Department of Science and Technology (DOST) and were developed through the partnership of the DOST-Advanced Science and Technology Institute (ASTI) and the University of the Philippines- Diliman with Japanese universities: Tohoku University, Hokkaido University and Kyushu Institute of Technology. Diwata-i, the Philippines' first foray into space, has been operating for more than two (2) years now. It has since captured more than 14,500 multispectral images of the Philippines. Images from Diwata-i have proven indispensable for evaluation of the effects of typhoons. For example Haima (local name Lawin, 2016) and Mangkhut (local name Ompong, 2018). Furthermore, images were used to derive vegetation indices (NDVI, GNDVI), land cover and classification maps, including assessment of water quality in Laguna de Bay in Luzon Island. In general, data from Diwata-i are utilized for environmental studies and disaster-related management.

More than two years after the release of Diwata-i, its successor Diwata-2 was launched on October 29, 2018 via the Rh-A F4o rocket from Tanegashima Space Center in Japan. The microsatellite was released to a sun-synchronous orbit at an initial altitude of 620 kms. Diwata-2 derives its heritage from Diwata-i and the Rising-2 bus and mission systems. As such, the microsatellite carries similar payloads, namely the High-Precision Telescope (HPT), Space-borne Multispectral Imager (SMI) with Liquid Crystal Tunable Filter (LCTF), Wide-Field Camera (WFC) and a Middle-Field Camera (MFC).

Improvements in Diwata-2 include deployable solar array panels (DSAP), experimental attitude determination and sensing module, experimental amateur radio module, and an Enhanced Resolution Camera (ERC). The amateur radio module is envisioned to complemen6t amateur radio terrestrial operations, especially for emergency response. The addition of ERC aids in increasing the spatial resolution of images captured by the SMI. The experimental attitude determination module and amateur radio module are locally designed and manufactured, done in cooperation with Philippine-based industrial partners. These efforts will hopefully lead to the growth of collaboration among the government, academe, and industry in producing space-based materials and devices that positively impact society.

Images taken by Diwata-i and Diwata-2 are received in the multi-mission ground station facility called Philippine Earth Data Resource and Observation (PEDRO) Center, established in 2015, at the ASTI Building, Diliman, Quezon City. Command uplink and satellite maintenance operations are also performed in the PEDRO Center. For redundancy, there are ongoing activities to establish a new ground receiving station in Davao City, located in the Southern Philippines, which will serve as an additional infrastructure to support satellite operations. Aside from the Diwata constellation, PEDRO receives data from other satellites for increased coverage, robust and responsive observation over the country.

On the applications sphere, the Remote Sensing and Data Science (DATOS) Help Desk uses these satellite data to produce and communicate relevant disaster information to agencies and key end-users to complement the current efforts of existing government agencies and initiatives. DATOS builds on and integrates past and ongoing DOST supported projects and different Geographic Information System (GIS), Remote Sensing (RS) and other Data Science techniques. PEDRO and DATOS also provides actionable information, not only for disaster-related activities, but for many other application spaces such as agriculture and project monitoring through

DBM's DIME project. As support infrastructure, the Computing and Archiving Research Environment (COARE)—high performance computing facility—and the Philippine Research, Education and Government Information Network (PREGINET)—the country's only national research and education network that provides high capacity interconnectivity—provide ample support for the space ecosystem. Other data sources also support the space endeavour such as the sensor data from the Hydromet and other relevant projects of DOST-ASTI which provide complimenting ground-based information. DOST-ASTJ is also set to add to its fleet of observation satellites with the planned capacity acquisition from a Synthetic Aperture Radar satellite with complimenting Automatic Identification System (AIS) for ship monitoring and identification. Such capability bodes well for an archipelagic country to proactively monitor maritime activities in its exclusive economic zone on top of innovative terrestrial monitoring.

In addition to the aforementioned microsatellites, the iC CubeSat maya-i was developed and released from the International Space Station on August 10, 2018. Maya-i is part of the three CubeSat constellation of the BIRDS-2 project, a cross-border interdisciplinary CubeSat development venture primarily for capacity building/education of students from Japan, Bhutan, Malaysia and the Philippines. The goals of the BIRDS projects is to provide hands-on experience to students from non-spacefaring nations on the overall satellite development process. Maya-i carries an amateur radio that supports message digipeating (APRS-Digipeater) and remote data collection through a store-and-forward communication technique, a commercial grade GPS receiver for technology demonstration, cameras, a magnetometer and a mechanism for mitigating and to count radiation effect on onboard electronics. The constellation is operated by a global network of ground stations established in the BIRDS-i and -2 participating countries.

More than building and launching satellites, the Philippines is also committed to starting a healthy and sustainable local ecosystem for space technology. Building on the results and lessons from the implementation of the Development of Philippine Scientific Earth Observation Microsatellite (PH L-Microsat) Program, which launched Diwata-i, Diwata-2 and Maya-i, it is succeeded by the Space Technology and Applications Mastery, Innovation and Advancement Program (STAMINMSpace). The STAMINA4Space Program aims to build a local industrial base and enhance local space science and engineering expertise, which will ultimately prepare the country in the establishment of the Philippine Space Agency. Further, the country aspires to continuously contribute to the international space community by fostering partnerships and collaboration.

Thailand

[Original: English]
[11 January 2019]

Thailand Space Activities Report 2018

In 2018, Thailand has conducted many activities based on conceptual and long-term strategies of the National Space Master Plan (2017–2036). These activities are fit in
4 pillars of the Office for Outer Space Affair's Space2030 agenda as follows.

Space Society (Evolution of society and societal benefits stemming from space-related activities)

(a) Thailand developed a draft of National Space Act with a purpose to fulfil national space legislation to comply with international space law. At the same time, Thailand also made a draft of Landing Rights and Marketing Access Policy with a purpose to regulate authorization given to satellite operator to enter a national market to provide communication services. These legal instruments are Thailand's initial

policy guidelines on satellite industry. it is also the first time Thailand will have a space policy that benefits both the public and private sectors which utilize the satellite network and support the public and commercial markets. As such, the space policy would cover the areas of geostationary-satellite orbit (GSO) and non-GSO with the aim of setting criteria for satellite service providers in the country.

(b) Thailand started to develop Thailand Earth Observation System Phase 2 (THEOS-2). THEOS-2 will be a major milestone in the development of national geo-information system. According to its outline, Thai engineers are going to be involved in manufacture two Earth Observation satellites: an optical satellite system delivering 0.5-metre ground resolution imagery and indigenous 100-kg satellite. In addition to manufacturing satellites, Thai engineers will develop an innovative end-to-end geo-information platform: Action Intelligent Policy Platform (AIP). This platform will become an important tool for area-based management and decision-making to users. It will improve the quality of the dynamic map, Geo-Intelligences and Intelligence propriety geographic for human service and will reform decision system and spatial management.

AIP will also build a nationwide professional network of data expertise. Executive leaders and state governments can use these integrated data systems to better develop and evaluate their programs. Thailand expects that well designed and integrated data systems are a key to determining how to improve economic mobility for sustainable development in the country.

Space Diplomacy (Partnerships and strengthening international cooperation in space activities)

(a) United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP)'s Asia-Pacific Plan of Action on space applications for sustainable development (2018–2030) was developed under the chairmanship of Thailand. This initiative is a regionally coordinated Plan of Action that harnesses space applications and digital innovations to help countries of Asia and the Pacific, particularly those with special needs, to achieve the 2030 sustainable development goals. The Plan of Action was endorsed by the third Ministerial Conference on Space Applications for Sustainable Development in Asia and the Pacific on 10 October 2018 in Bangkok, Thailand. The current Plan of Action in ESCAP's Regional Road Map for implementing the 2030 Agenda for Sustainable Development in Asia and the Pacific, addresses the following thematic areas: 1) disaster risk management, 2) natural resource management, 3) connectivity, 4) social development, 5) energy and 6) climate change. The implementation modalities are through: 1) research and knowledge sharing, 2) capacity building and technical support, and 3) intergovernmental discussions and regional practices. This Plan of Action is one of the latest outstanding cooperation in the region.

(b) Thailand cooperated with United Nations Office for Outer Space Affairs (UNOOSA) to draft a project outline for the establishment of a Regional Liaison Office (RLO) in Bangkok. This office will support the development of UN's new initiatives to offer a full range of space-based solution in the Asia Pacific region.

(c) Thailand has participated in Asia Pacific Regional Space Agency Forum (APRSAF) in various working groups and initiatives such as Space Environment Utilization Working Group for space experiment and exploration activities, Space Application Working Group and Sentinel Asia which is a web-based disaster management service for Asia-Pacific region, and Space Applications for Environment Working Group which focus to utilize space technology for environment issues.

(d) Thailand has joined to contribute THEOS-1 data on the Small Multi-Mission Satellite (SMMS) Constellation Program of *Asia-Pacific Space Cooperation Organization* (APSCO). This program aims to improve space capacity building and data sharing service among 8 countries of APSCO's member states (Bangladesh, China, Iran, Mongolia, Pakistan, Peru, Thailand, Turkey)

(e) Thailand cooperated with Asia Pacific Space Cooperation Organization (APSCO) to held the first workshop on Radiometric Calibration of Satellite Sensors Project during 25–27 December 2018 in Bangkok, Thailand. This workshop is a part of the cooperation of Radiometric Calibration Project started in 2017. The project aims to establish APSCO Satellite Sensors Calibration Center of Excellent for sharing data, techniques, and know-how of satellite sensor calibration among 8 countries of APSCO's member states.

(f) Thai students have participated in the Student Small Satellite (SSS) project of Asia-Pacific Space Cooperation Organization (APSCO). This project aims to train the students from the Member States of APSCO to study space technology and satellite engineering through a practical design of satellites until the flight model is made. From 2017–2018, Thai students were participated in the summer camp to undertake small satellite design and development.

Space Accessibility (Communities using and benefiting from space technology and applications)

(a) Thailand conducted a space education research project “Thai Durian to space” with a purpose to raise space exploration awareness in Thailand. On 18 July 2018, Blue Origin’s New Shepard space vehicle was success to carry a six-kilograms payload to an altitude of 100 kilometres above Earth's sea level for several minutes and returned to the ground. A bake durian is among several vacuum-sealed foods in the payload that contains experiments from several universities and space agencies from Thailand.

Durian is Thailand's famous fruit. This project aims to study effects of zero gravity to its texture, taste and smell and findings way to develop techniques for preparing food to be consumed in space.

Not only several vacuum-sealed foods, the payload also carried the bleeding prevention device from Thailand. This device was designed to prevent profuse bleeding in their patients on Earth. The purpose is to test the effects of microgravity exposure on the device. Profuse bleeding is an issue that space scientists are concerned with, as profuse bleeding is amplified in the weightless environment of space. Not only the microgravity environment can interfere with healing of the wound, but it also can cause the kind of problems associated with fluids flying around in a spacecraft. This topic is an important area of research for human space traveller in the future.

(b) Thailand‘s first entirely Thai-built satellite, the 1U CubeSat KNACKSAT (KMUTNB Academic Challenge of Knowledge SATellite), was deployed from the lower free flyer of SpaceX 's SSO-A on 3 December 2018. This 1.3 kg satellite was developed and entirely built by the team of King Mongkut’s University of Technology North Bangkok (KMUTNB), Thailand. The satellite uses amateur radio frequencies for the communication between the satellite station and the ground station. The main missions of KNACKSAT are including: (1) developing a communication system using amateur radio frequencies, (2) taking images from space (3) testing 3-axis attitude control algorithms by using magnetic torquers, (4) verifying a deorbit technology by a magnetic torque and (5) confirming the uses of Commercial Off-The-Shelf (COTS) components in space.

Space Economy (Development of space-derived economic benefits)

Thailand has been developing infrastructure to facilitate space research and entrepreneur at Space Krenovation Park (SKP). SKP is located at Sri Racha, Chonburi, Thailand which is in the same area with Thailand Earth Observation Satellite Ground Receiving Station. Currently, there are Space Learning Center, Geo-informatics Center, GNSS Innovation Center at SKP. Since it was founded in 2012, SKP becomes a centre for space innovation projects such as VERSATILE Operational System for Satellite Control and Administration: VOSSCA, Wise

Antenna of Transmission Execution and Receiving system: WATER and a flight dynamic software development: EMERALD.

Recently, the Thai government has specified 10 new industries to serve as the key drivers for establishing the Eastern Economic Corridor (EEC) in the three eastern provinces (Chachoengsao, Chonburi, and Rayong). The aerospace industry is the one of 10 new industries. According to the EEC scheme, SKP was also selected as a facilitating site for the aerospace industry. In SKP, there is also a site of GISTDA's Aerospace Laboratory of Excellence and Innovation (GALAXI), which the main responsibilities are to efficiently drive the aerospace industry development. In additions, Thailand was in the process of exploring the possibility to establish Thailand aerospace association in order to support new start-ups and to ensure sustainability and innovativeness of the aerospace sectors.

Turkey

[Original: English]
[12 December 2018]

Turkey's Recent Activities in Space (2018)

Turkey's space activities have gradually increased in recent years. Activities and capabilities in satellite development, satellite testing and production have been expanding. In addition to these, various joint projects are being carried out with other countries in order to benefit from space for peaceful and scientific purposes. Observation and analysis activities relevant to the possibility of collision with space objects are carried out for operated satellites and related projects.

Activities Coordinated by the Directorate General of Aeronautics and Space Technologies

The production and ground tests of the UBAK-USAT Experimental Communication Satellite have been completed in cooperation with Istanbul Technical University and Japan Kyushu Institute of Technology, under the coordination of the General Directorate of Aeronautics and Space Technologies and its satellite frequencies were registered by the ITU. On 11 May 2018, UBAK-USAT Experimental Communication Satellites were successfully sent from the International Space Station to its orbit in space.

Space endurance tests of the materials to be used in satellite technologies developed in Turkey were conducted in coordination with the Japan Aerospace Exploration Agency (JAXA), under the coordination of the General Directorate of Aeronautics and Space Technologies. The test process started in April 2017 in the open space environment in the KIBO Experiment Module of the International Space Station. The tests which took one year have been completed. The materials will be brought to Turkey within this year. In the same scope, nanocomposite materials which can be used in our satellites and as part of space technologies and which can repair itself in multiple directions have been delivered to the International Space Station KIBO Experiment Module in order to be subjected to space radiation tests in the open space environment. The test process started in the open space environment on 23 May 2018.

Activities Coordinated by TURKSAT

Project of the Development and Production of TURKSAT 6A Domestic Communication Satellite

It is of great importance to have the capability of space and satellite technologies and develop them in Turkey, rather than acquiring them from abroad. In order to gain the capability and technologies of production and development of domestic communication satellite production and to produce national communication satellites

through local facilities, “TURKSAT 6A National Communication Satellite Project Contract” and its “Additional Protocol” were signed between the Ministry of Transport and Infrastructure of the Republic of Turkey, TUBITAK (Scientific and Technological Research Council of Turkey) and TURKSAT on 15 December 2014, in a ceremony held with the attendance of Republic of Turkey’s President Recep Tayyip ERDOĞAN. With the signing of these documents, the project has officially started.

It is aimed that TUBITAK UZAY, TUSAŞ, ASELSAN and CTECH companies will develop a unique national communication satellite by using their current technological capabilities and put it into service in geostationary orbit located at 42 degrees East.

TURKSAT engineers, who have gained knowledge and experience in technological transfer programs of the satellites TURKSAT 3A in France and TURKSAT 4A&4B in Japan, take role in the work packages compatible with their specialization areas.

As the Customer Organisation, The Ministry of Transport and Infrastructure and TURKSAT follow up TURKSAT 6A project in line with the Customer Organisation requirements and project calendar.

Integration and test of our domestic communication satellite TURKSAT 6A will be held in the Space Systems Integration and Test Center, which was opened on 21 May 2015 in order to manufacture domestic satellite, in cooperation with SSB (Presidency of Defense Industries), TUSAŞ and TURKSAT.

Design, manufacturing, developing and test activities with regards to the project are in progress.

Project for the procurement of TURKSAT 5A&5B Satellites

TURKSAT 5A&5B Satellites Procurement Project was signed on November 2017 to increase worldwide coverage and market share as required by TURKSAT Inc.’s mission, in order to gain rights on newly opened frequency bands, to protect its rights regarding the previously-owned frequency bands, to provide reserve capacity for existing satellites, to increase the limited Ka-Band data communication, to create capacity for new markets such as Iran, West Africa and South Africa, and to increase the current capacity in Europe, Turkey, the Middle East and North Africa.

The Project Monitoring Team was established in line with the approval of TURKSAT’s Board of Directors. As the Customer Organisation, TURKSAT conduct the follow-up process through the Project Monitoring team in line with requirements specified in the contract and according to the project schedule.

Design, production, development and testing activities related to the project are still ongoing.

Current Studies Conducted On the Issues Relating to the Space Debris, Safety of the Space Crafts, Collusion with Space Debris, Nuclear Power Sources

Measures Taken Within the Framework of Design Activities

As it is known, we have TURKSAT 3A, TURKSAT 4A which are operating on meridian 42 degrees and TURKSAT 4B which is operating on meridian 50 degrees East Communication Satellites within the scope of fundamental function of TURKSAT Inc. These satellites, positioned at “Geostationary Orbit”, rotate simultaneously with the earth. Our current communication satellites are operated within the framework of the communication constraints determined by the International Telecommunication Union (ITU), so as not to obstruct other satellites. Physically, the customers within the coverage of the satellite can benefit from the service thanks to the fact that the satellites are kept in their control window reserved for them. The satellites are kept in the control window with the manoeuvre activities periodically conducted by the Directorate of Satellite Control under TURKSAT. The purpose of these activities is to not only provide satellite coverage requirements but

also prevent the possible collision scenarios by providing the approach boundary values to other satellites.

Additionally, following its expiration, the satellite is transferred to a circular orbit which is defined as a graveyard orbit and is located at least 350 kilometres away from its current orbit, in order to prevent the formation of space debris and not to harm operational satellites. The design is made accordingly by calculating the propellant budget for the orbit raising manoeuvre activities to be conducted.

As for the use of nuclear power sources in space, designs are being made for our satellites not to carry any equipment/part containing radioactive materials.

Additional Measures

Apart from design measures, a number of additional measures are taken through the below stated methods developed by TURKSAT.

Approach of Unidentified Objects

The possible collision of satellites are checked and observed by TURKSAT Inc. Directorate of Satellite Control with objects existing in space being periodically checked. The approaches towards our currently operated satellites are analysed by means of using the published Two Line Element (TLE) data of space objects categorized by NORAD. These analyses that are carried out by utilizing advanced programs are evaluated by relevant orbit control engineers and it is ensured that the required measures are taken. Thus, the possible collision scenarios are estimated in advance and necessary activities are carried out while at the same time other foreign satellite operators are warned by establishing contact with them.

Project of Tracking Space Objects

The first objective of the project of tracking space objects that is carried out within the scope of R&D projects, is to develop additional methods to ensure the safety of our satellites. After the successful completion of the project, it is planned to make it available also for different purposes.

Considering the developing satellite fleet of TURKSAT Inc., it is required to use the orbit detection methods for safety purposes through an optical observation and to calculate the risk of collision. For this purpose, it is aimed to develop a Space Objects Tracking and Warning System based on the optical surveillance data for TURKSAT satellites by processing visual data received from the existing TURKSAT Observatory. The trajectory parameters of all satellites and other space objects in the earth orbit are measured by the US Space Tracking Network, with the help of radars and telescopes and are published as NORAD TLE (Two Line Element). It is planned to put the system into effect in order to identify the trajectory parameters of other controlled or uncontrolled objects which are getting close to our satellites, independent from this system and more accurately, and also to monitor them, and to foresee potential threats. The infrastructure to be established and the methods to be developed within the scope of this project will improve the safety of TURKSAT satellites which are of vital importance for Turkey.