



# General Assembly

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**Committee on the Peaceful  
Uses of Outer Space  
Scientific and Technical Subcommittee  
Fifty-seventh session  
Vienna, 3–14 February 2020  
Item 16 of the provisional agenda\*  
Space and global health**

## **Responses to the set of questions regarding policies, experiences and practices in the use of space science and technology for global health**

**Note by the Secretariat**

### **I. Introduction**

1. At the fifty-sixth session of the Scientific and Technical Subcommittee, held in February 2019, the Working Group on Space and Global Health of the Subcommittee agreed on the questionnaire (A/AC.105/1202, annex III, appendix II), to be circulated by the Secretariat to States members of the Committee and international intergovernmental and non-governmental organizations in accordance with the Working Group's multi-year workplan (A/AC.105/1202, annex III, appendix I). Accordingly, on 18 July 2019, a communication was sent to member States inviting them to provide responses to a set of questions regarding policies, experiences and practices in the use of space science and technology for global health by 16 October 2019, so that the information could be made available to the Subcommittee at its fifty-seventh session.

2. The present document has been prepared by the Secretariat on the basis of information received from Canada.

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\* A/AC.105/C.1/L.383.



## II. Replies received from a Member State

### Canada

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#### Question 1

*Exploration, Imagination, Innovation: A New Space Strategy for Canada* ([www.asc-csa.gc.ca/pdf/eng/publications/space-strategy-for-canada.pdf](http://www.asc-csa.gc.ca/pdf/eng/publications/space-strategy-for-canada.pdf)) was launched in March 2019. The strategy outlines the health-related priorities of:

- Harnessing space to solve everyday challenges for Canadians, through, for example, improving remote medicine and health care.
- Ensuring leadership by Canada in the acquisition and use of space-based data to support scientific excellence, innovation and economic growth. As part of this priority, unique data collected from Canadian space assets will enable the Government of Canada to make evidence-based decisions that keep its citizens safe, monitor and protect the environment, support a range of economic sectors and maintain its position as a key partner in global security and defence networks.

#### Health and life sciences

- The Canadian Space Agency has signed a memorandum of understanding with the Institute of Aging of the Canadian Institutes of Health Research in order to collaborate on a space analogue study that uses inactivity (prolonged bed rest) as a model for weightlessness in space. The Institute will support the research projects associated with the study, as inactivity is a recognized health risk among the elderly.
- Space is recognized as a useful model for studying accelerated aging in the Institute's strategic plan, entitled "Living Longer, Living Better".
- Through an umbrella memorandum of understanding with supporting letters of agreement, the Canadian Space Agency is collaborating, by way of a cost-sharing mechanism, with the National Research Council of Canada to develop an in situ sample-to-answer device for space. The device will enable in situ bioanalysis that will accelerate and facilitate life sciences research, since it will allow the analysis in space of biological samples that would otherwise be too fragile or require transportation to Earth for study.

Canada is planning to investigate food security and production for space and is engaged in talks with federal agencies responsible for the well-being of Northern and remote communities. In November 2018, the Government of Canada created an interdepartmental memorandum of understanding between the Canadian Space Agency Government Related Initiatives Program and the Public Health Agency of Canada to improve knowledge of determinants of health through Earth observation. Its focus is to provide evidence-based data to support risk modelling and mapping, primarily relating to the development of environmental determinant indicators linked to risk factors for Lyme disease and mosquito-borne diseases.

In 2017, the Canadian Space Agency began supporting a consortium of researchers from the University of Montreal, the Université du Québec à Montréal, the Public Health Agency of Canada and the City of Montreal, through its Science and Operational Applications Research programme for the utilization of satellite Earth observation data to identify potential health risks in cities. The project aims to use RADARSAT-2 data to help find areas where vulnerable populations may be exposed to high temperatures, air pollution or infectious diseases (viruses) transmitted by mosquitoes. The data gathered by RADARSAT-2 can help detect vulnerable zones on the basis of urban patterns or land characteristics. The broader goal of the project

is to use the satellite data in combination with environmental information and risk factors from various sources. In addition to RADARSAT-2 images, the project will use information from other Earth observation sensors, various databases and field data. These diverse data sets will then be integrated into a single database for public health agencies so that prevention and control measures can be put in place. While the approach is being developed in Montreal, once it has been proved effective, it could be applied in other Canadian cities facing similar public health issues.

## Question 2

The establishment of a United Nations centre for collaboration on space and global health could create a bridge between the work of the Office for Outer Space Affairs and the World Health Organization (WHO). WHO collaboration centres should be considered by these two United Nations agencies as a possible model under which to work collaboratively.

The Office for Outer Space Affairs should also consider other existing platforms such as the GEO Health Community of Practice ([www.geohealthcop.org](http://www.geohealthcop.org)), which the Office currently supports.

## Question 3

Environmental governance to remove barriers is addressed by the Scientific and Technical Subcommittee. The Subcommittee should continue to foster leadership and effective governance mechanisms in that area.

When appropriate, the World Health Assembly should be engaged in adopting and/or leveraging space for the broad global health-related targets of the Sustainable Development Goals.

## Question 4

In 2014, the Government of Canada established the Directive on Open Government, the objective of which is to maximize the release of government information and data of business value to support transparency, accountability, citizen engagement and socioeconomic benefits through reuse, subject to the applicable restrictions associated with privacy, confidentiality and security. All data resources of business value held by Government departments are to be open by default and released as open data unless subject to valid exceptions, such as in the areas of ownership, security, privacy and confidentiality, as determined by the department. Such data, including geospatial data produced by the Canadian Space Agency, is stored on the open data platform at <https://open.canada.ca/en/open-data>.

## Question 5

There is no known systematic geotagging of health assets at the national or subnational levels.

## Question 6

Over the past decade, coordination, cooperation and collaboration between the Public Health Agency of Canada and the Canadian Space Agency have resulted in the development of a successful partnership through which to advance the application of space technologies (Earth observation data) and geospatial data in the public health domain. Both agencies have actively participated in international committees and a series of domestic research and development projects focusing on the prevention and control of infectious diseases. The following are key examples of those joint activities:

- Collaborative project work between the Public Health Agency of Canada, the Canadian Space Agency and other Government departments. That work has included assessment, using satellite imagery, of the risk of the microbial contamination of recreational waters. Joint projects with industry partners have focused on the use of RADARSAT data in support of One Health initiatives;

these concentrate on water detection and the monitoring of wetlands and lakes in an effort to curb water-borne and mosquito-borne diseases. Joint activities with academia have concentrated on health-related projects in urban environments; research into public health threats such as high temperatures, air pollution and mosquito-borne diseases have taken into account the impact on vulnerable human populations. The projects have been supported through the Canadian Space Agency's Government Related Initiatives Program, the Earth Observation Application Development Program and the Science and Operational Applications Research programme.

- At the international level, the Public Health Agency of Canada and the Canadian Space Agency participated, from 2006 to 2015, in the Committee on the Peaceful Use of Outer Space Action Team on Public Health. The mandate of the Action Team was to implement telehealth plans and activities to improve health services in developing countries by facilitating the application of space technologies in early warning mechanisms for infectious diseases.
- Since 2015, the Public Health Agency of Canada and the Canadian Space Agency have participated in the newly formed Expert Group on Space and Global Health. The Group is engaging Member States, international intergovernmental organizations and non-governmental organizations in collaborative projects and is tasked with developing tangible and long-lasting solutions that involve space in the context of the global health agenda. The contributions made by the Public Health Agency of Canada and the Canadian Space Agency have been partially documented in several United Nations reports. They include the special report of the Inter-Agency Meeting on Outer Space Activities on the use of space science and technology within the United Nations system for global health (A/AC.105/1091); the report on the meeting on the applications of space science and technology for public health organized by the World Health Organization and the Office for Outer Space Affairs (A/AC.105/1099); and the report on the United Nations Expert Meeting on the International Space Station Benefits for Health (A/AC.105/1069).
- The Canadian Space Agency has supported a special study on tele-epidemiology in close collaboration with the Public Health Agency of Canada to better understand this emerging Earth observation sector.
- In addition to their contributions at the United Nations, the Public Health Agency of Canada and the Canadian Space Agency have jointly led international conference sessions and workshops, including the European Space Agency Living Planet Symposium special session on tele-epidemiology, held in Prague in 2016, and the Earth Observation Summit One Earth – One Health workshop, held in Montreal in 2017, with a view to supporting the application of tele-epidemiology in the public health domain. One of the main goals has been to develop and maintain a community of practice, with a focus on public health and Earth observation, guided by a number of activities. These include the following: to convene leaders and experts in Earth observation and public health to explore, discuss, establish and strengthen collaboration and partnerships on novel Earth observation applications, products and services in support of public health; to better understand the links between the environment, climate, society and public health using Earth observation data; to identify existing public health applications derived from Earth observation data; and to identify existing or potential future Earth observation data, indicators, methods and technologies that may be developed in support of public health.
- The One Earth – One Health workshop provided a forum for scenario-based discussion and dialogue among recognized experts and authorities on key public health issues, with an emphasis on Earth observation technology, applications and methods. The main goals are aligned with Sustainable Development Goal 3, aimed at ensuring healthy lives and promoting well-being for all ages.

- The Canadian Space Agency and the Public Health Agency of Canada are jointly leading and collaborating on the development of a report entitled “The potential for Earth observation to contribute to public health practice: current activities, challenges and opportunities”. The report identifies the following areas of public health in which Earth observation could be applied: (a) mosquito-borne diseases; (b) tick-borne diseases; (c) air quality and heat; (d) water-borne diseases; and (e) vulnerable populations. This is an example of intersectoral cooperation between multiple international organizations, including the Canadian Space Agency, the Public Health Agency of Canada, the National Aeronautics and Space Administration, the National Oceanic and Atmospheric Administration and the National Centre for Space Studies, in areas such as health, space, epidemiology and the environment. The draft report is currently being reviewed by international partners and will be published in 2020.

### Question 7

The Canadian Space Agency is using space to engage young Canadians in science, technology, engineering and mathematics studies and careers and took advantage of the astronaut David Saint-Jacques’ six-month mission in space to invite young Canadians to participate in science, technology, engineering and mathematics activities.

As part of the participation by Canada in the Lunar Gateway, the Canadian Space Agency launched the Junior Astronauts campaign in 2019, with a view to encouraging young Canadians to consider a future career in the space field and to help them understand the role they could play in the country’s mission to the Moon. Online content and learning games were made available to all young Canadians. Structured activities in science and technology, fitness and nutrition, and teamwork and communications were also developed for schools and youth organizations. Qualified participants from across Canada will be chosen at random to take part in a summer camp in 2020, during which they will join astronauts, scientists and engineers for a week of space training.

The Public Health Agency of Canada has signed a memorandum of understanding with the University of Sherbrooke to conduct research activities on the risk of the microbial contamination of recreational lakes using remote sensing and geomatics tools. The Agency is also planning to work with Laval University to develop a method to improve the spatial scale (downscaling) of massive data in the estimation of microclimatic determinants and risk mapping of emerging vector diseases in Canada.

The Canadian Space Agency is currently working in close collaboration and cooperation with the University of Jena in Germany, the German Aerospace Centre and Canadian federal departments including Agriculture and Agri-Food Canada, Canadian Ice Services of Environment and Climate Change Canada, and Canada Centre for Earth Observation and Mapping of Natural Resources Canada, in order to develop an educational online course and material on Earth observation data and climate change applications relating to agriculture, coastal ice and floods. The material will be integrated into the European Space Agency massive open online course “Echoes in space”, designed for students and young professionals who wish to acquire skills related to the utilization of Earth observation data and the monitoring of environmental and population health.

### Question 8

Under the Innovative Solutions Canada initiative, the Public Health Agency of Canada has challenged private firms to develop efficient models and tools that make use of Earth observation data to inform decision makers. That data enable estimation of variables and indicators related to environmental determinants of health, such as land use, land cover, climate and microclimate. Further information is available at [www.ic.gc.ca/eic/site/101.nsf/eng/00029.html](http://www.ic.gc.ca/eic/site/101.nsf/eng/00029.html).

Environment and Climate Change Canada operates a high-performance computing platform for weather forecasting, air quality alerts and complex scientific modelling.

### Question 9

The Health Portfolio Operations Centre of the Public Health Agency of Canada provides an all-hazards integrated federal emergency response to public health events (potential or actual, natural or human-induced, accidental or intentional) of national interest. The Centre provides 24/7 monitoring and reporting, national-level situational awareness, warning products and integrated risk assessments, as well as national-level planning and whole-of-government response management. During an emergency response, maps and geomatics products can be generated by the broader Government Operations Centre. These products serve to enhance the Health Portfolio Operations Centre's capabilities in providing strategic coordination, analysis and advice.

### Question 10

The following text is drawn from *Exploration, Imagination, Innovation: A New Space Strategy for Canada*.

From strategy element 3, "Harness space to solve everyday challenges for Canadians":

- **Improving remote medicine and health care.** By leveraging Canada's health and medical research expertise, and emerging technologies such as artificial intelligence, Canada will advance autonomous medical systems to support astronaut health in space and health outcomes at home. Through the Lunar Gateway project and via new efforts on Earth, Canada will explore questions key to improving health care and quality of life for Canadians. Keeping astronauts healthy in deep space has many direct applications in health care today, especially for remote communities: monitoring vital signs, preventing illnesses, performing diagnostics and delivering medical care over great distances. Canada will work with health partners and northern communities to make sure that the advanced knowledge and technologies gained from the space program translate into concrete benefits for all Canadians.

From strategy element 5, "Space-based data to support science excellence, innovation and economic growth":

- **Prioritizing future Earth observation capabilities.** Canada will soon launch<sup>1</sup> a new "constellation" of satellites, the RADARSAT Constellation Mission (RCM), that will provide unprecedented near-real-time data to allow for important evidence-based decision making in response to the changing climate and security threats. For example, the effects of climate change are increasingly evident in Canada with the rising number of floods, droughts, wildfires, as well as melting polar ice caps and rising sea levels; the full scope of these catastrophic events will be observed and monitored by the RCM. Over its life, the RCM will help increase our knowledge of climate processes and their impacts, and thus properly target our responses. Canada will need to continue to benefit from high-quality EO data, such as those provided by the RCM. The CSA and other government departments are therefore planning for data continuity beyond the expected lifespan of the RCM by launching concept studies to examine options for a successor solution.

### Question 11

#### Tele-epidemiology and environmental health

- Satellites help us stay healthy in seven key ways: (a) by identifying urban areas where vulnerable populations are exposed to extreme heat; (b) by measuring air

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<sup>1</sup> Launched in 2019.

pollution and monitoring air quality; (c) by observing ozone depletion and ultraviolet radiation, which can cause cancer; (d) by monitoring water quality in recreational waters; (e) by identifying risk locations for diseases carried by mosquitoes and ticks; (f) by improving access to health care in remote regions via telemedicine; and (g) by providing timely responses and guiding group interventions during major epidemics such as Ebola.

- The Public Health Agency of Canada is currently conducting a research project to improve its knowledge of determinants of health by integrating Earth observation imagery and tele-epidemiology, geographical intelligence, risk modelling and epidemiological approaches in order to produce evidence-based data to support multi-scale and multi-temporal risk modelling and mapping for Lyme disease risk factors and environmental/remote-sensed early warning indicators for mosquito-borne diseases.
- While the Government is engaged in many practices in the areas of tele-epidemiology and environmental health, the never-ending pursuit of knowledge and innovation means that gaps will always remain. Canada is conducting the following types of activities to help address some of the key gaps:
  - Identifying key areas for further research and space science study
  - Collecting and accessing data on areas such as climate change, epidemiology and biodiversity
  - Supporting sustainable communities of practice such as a GEO community of practice
  - Developing knowledge, know-how and excellence in data analytics
  - Prioritizing future Earth observation capabilities and participating in Earth observation satellite mission development for monitoring diseases risks
  - Developing methods, tools and systems
  - Implementing technical infrastructure and technologies

### Space life sciences

- The Canadian priority for the utilization of the International Space Station is the Space Health and Life Sciences programme. The purpose of the programme is to identify, characterize and mitigate the health risks that astronauts encounter in space missions. Many of those risks have parallels with health risks on Earth. For example, the accelerated bone loss astronauts experience can be similar to the bone loss associated with aging or inactivity.
- Canada is addressing these risks through a combination of science studies and technological developments. The risks often have terrestrial parallels that mean that space health sciences and technology are relevant on Earth. Canada has carried out and continues to support science studies, including the Vascular Echo study, that address cardiovascular adaptation in space, which in some ways mimics changes on Earth. Two deployed Canadian payloads include a shirt that measures a variety of physiological and health-relevant parameters which could be equally easy and useful in isolated environments on Earth. The in situ bioanalysis hardware on the International Space Station now has a parallel terrestrial stream. A second piece of hardware will process a variety of biological samples and, in a second generation, process and analyse samples. This will be relevant both in space and on Earth.