

Canada's input into UN Office for Outer Space Affairs  
Questionnaire on the use of space science and technology for global health  
November 22, 2019

1. Please describe existing or planned formal cooperative agreements and other institutional arrangements (memorandums of understanding, letters of agreement, frameworks of collaboration, etc.) between the health sector and other sectors directly involved in space activities at the national level.
  - **A New Space Strategy for Canada** (<http://www.asc-csa.gc.ca/pdf/eng/publications/space-strategy-for-canada.pdf>) was launched in March 2019. This strategy outlines the Health-related priorities of:
    - Harnessing space to solve everyday challenges for Canadians, such as improving remote medicine and health care; and
    - Ensuring Canada's leadership in acquiring and using space-based data to support science excellence, innovation and economic growth. Under this priority, unique data collected from Canada's 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 allow Canada to remain key partners in global security and defence networks.
  - **Health and Life Sciences:**
    - The Canadian Space Agency (CSA) has a Memorandum of Understanding (MOU) with the Canadian Institutes of Health Research- Institute of Aging (CIHR-IA) to collaborate on a space analogue study that uses inactivity (prolonged bedrest) as a model for weightlessness in space. The CIHR-IA will support the research projects associated with the study, as inactivity is a recognized health risk among the aged.
    - Space is recognized a model to study accelerated aging in the CIHR-IA strategic plan "Living Longer, Living Better" .
    - Through an umbrella MOU with supporting letters of agreement, CSA is collaborating through a cost-sharing mechanism with the National Research Council of Canada to develop an in situ sample-to-answer device for space. This device will allow in-situ bioanalysis that will accelerate and facilitate life sciences research since it will allow the sampling of biological samples in space that would otherwise require transport to Earth for analysis or be too fragile for study.
  - Canada is planning to look at food security and production for space and is 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 - GRIP) and Public Health Agency of Canada* to improve knowledge on determinants of health through satellite Earth observation (EO). Its focus is to provide evidence-based data to support risk modelling and mapping, primarily around development of environmental determinant indicators linked to risk factors for Lyme disease and mosquito-borne disease.
  - In 2017, the CSA supported a consortium of researchers (University of Montreal, Université du Québec à Montréal, Public Health Agency of Canada (PHAC), City of Montreal) via its Science and Applications Research (SOAR) program 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 would be exposed to high heat, air pollution or infectious diseases (viruses) transmitted by mosquitoes. The data gathered by RADARSAT-2

can help detect vulnerable zones based on 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 EO sensors, various databases and field data. These diverse datasets 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 is proven, it could be applied in other Canadian cities facing similar public health issues. Information: <https://www.asc-csa.gc.ca/eng/blog/2017/05/19/using-satellites-to-identify-potential-health-risks-in-cities.asp>

2. *Please provide recommendations regarding the establishment of a dedicated platform for effective coordination among United Nations entities, other international organizations and relevant actors on space and global health issues.*
  - **Establishment of a “UN Collaboration Centre on Space and Global Health” could serve as a means to bridge the UNOOSA and the World Health Organization. The WHO Collaboration Centres should be considered by these two UN agencies as a possible model under which to work collaboratively.**
  - **UNOOSA should also consider other existing platforms such as the Geo Health Community of Practice (<http://www.geohealthcop.org/>), which is currently supported by UNOOSA.**
3. *Please describe existing or planned policy-enabled environmental and governance mechanisms for removing barriers to the effective use of space-based technologies in support of global health.*
  - **Environmental governance to remove barriers is addressed under UNOOSA’s Science and Technology Subcommittee. The Subcommittee should continue to foster leadership and effective governance mechanisms in that zone.**
  - **When appropriate, the World Health Assembly should be engaged in adopting and/or leveraging space for broad global health goals of the SDG.**
4. *Please describe existing or planned policies on open data-sharing and participatory approaches to developing and improving access to geospatial information relevant to global health.*
  - **Since 2014, the Government of Canada has had a Directive on Open Government whose objective is to maximize the release of government information and data of business value to support transparency, accountability, citizen engagement, and socio-economic benefits through reuse, subject to applicable restrictions associated with privacy, confidentiality, and security. All data resources of business value held by Government of Canada departments are to be open by default and released as open data unless subject to valid exceptions, such as ownership, security, privacy, and confidentiality, as determined by the department. Such data, including geospatial data produced by the Canadian Space Agency is housed on the Open Data platform <https://open.canada.ca/en/open-data>**
5. *Please describe existing or planned efforts related to the geotagging of all assets relevant to health systems, including health information systems.*
  - **There is no known systematic geotagging of health assets at a national or subnational level countrywide.**

6. Please describe existing or planned intersectoral coordination and cooperation for effective international, regional, national and subnational capacity-building activities relevant to the application of space science and technology in the field of global health.

**Over the past decade, the coordination, cooperation and collaboration between PHAC and CSA has developed into a successful partnership to advance the application of space technologies (EO data) and geospatial data in the public health domain. Both organizations actively participated in international committees and a series of domestic research and development projects focusing on the prevention and control of infectious diseases. There are several outstanding examples to illustrate these joint activities:**

- **Collaborative project work among PHAC, CSA and other Canadian government departments includes risk assessment for microbial contamination of recreational waters using satellite imagery. Joint projects with industry partners focused on the use of RADARSAT data in support of One Health initiatives; these concentrate on water detection and monitoring of wetlands and lake extent in an effort to curb water-borne and mosquito-borne diseases. Joint activities with academia concentrated on health-related projects in urban environments; research into public health threats such as heat, air pollution and mosquitos borne diseases took into account the impact on vulnerable human populations. The projects were supported through the CSA Government Related Initiatives Program (GRIP), the Earth Observation Applications Development Program (EOADP) and the Science and Operational Applications Research (SOAR).**
- **At the international level, PHAC and CSA participated from 2006 to 2015 in the United Nations Convention on the Peaceful Use of Outer Space (UN-COPUOS) Action Team 6 on Public Health. The mandate of the Action Team involved the implementation of *telehealth* plans and activities to improve health services in developing countries by facilitating the application of space technologies in early warning of infectious diseases.**
- **Since 2015, PHAC and CSA are participating 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 to propose tangible and long-lasting solutions regarding the contribution of space to the global health agenda. The PHAC and CSA contributions have been documented in part in several reports of the United Nations. They include a 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 (UN Document: A/AC.105/1091, 30 April 2015); a 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 (UN Document: A/AC.105/1099, 29 October 2015), and a Report on the United Nations Expert Meeting on the International Space Station Benefits for Health (UN Document: A/AC.105/1069, 10 September 2014).**
- **The Canadian Space Agency has supported a special study on tele-epidemiology in close collaboration with PHAC to better understand this emerging EO sector.**
- **In addition to their contributions at the United Nations, PHAC and CSA have co-lead international conference sessions and workshops (ex: European Space Agency Living Planet Symposium – Special Session on Tele-epidemiology, Prague 2016; EO Summit – One Earth, One Health, Montreal, 2017) supporting the application of tele-epidemiology in the public health domain. One of the main goals was to develop and maintain a community of practice, with focus on public health and Earth observation and guided by a number of activities. These include the following: to convene leaders and experts in EO and public health to explore, discuss, establish or strengthen collaborations and partnerships on novel EO applications,**

products and services to support public health; to better understand the links between environment, climate, society and public health that can be elucidated using EO data; to identify existing public health applications derived from EO data; to identify existing or potential future EO data, indicators, methods and technologies that may be developed to support 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 emphasis on EO technology, applications and methods. The main goals aligned with those set by the UN Sustainable development goals on *Public Health and the Sustainable Development* that aims to ensure healthy lives and promote well-being for all ages (<https://sustainabledevelopment.un.org/?menu=1300>; <http://www.earthobservations.org/sbas.php>).
- The CSA and PHAC are co-leading and collaborating to the development of a report titled “The Potential for Earth Observation to contribute to public health practice: current activities, challenges and opportunities”. This report identifies EO and public health applications areas: (1) mosquitoes borne-diseases; (2) tick-borne diseases; (3) air quality & heat; (4) water-borne disease; (5) vulnerable populations. This is an example of intersectoral (health, space, environment, epidemiology, etc.) cooperation activities among multiple international organizations (CSA, PHAC, NASA, NOAA, CNES, etc.). The draft report is presently under review with the international partners and will be publish in 2020.

7. Please describe existing or planned mechanisms to engage educational institutions and other capacity-building mechanisms in motivating young health professionals to acquire skills and abilities required to efficiently use advantages provided by space technology, science and applications at an early stage in their careers.

- The CSA is using space to engage young Canadians in science, technology, engineering and math (STEM) studies and careers and took advantage of the astronaut David Saint-Jacques’s six-month mission in space to invite young Canadians to participate in STEM activities.
- As part of Canada’s participation in the Lunar Gateway, the CSA launched the Junior Astronauts campaign in 2019 to engage young Canadians, get them excited about future careers in the space field, and help them understand how they can play a role in Canada’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 to be run in schools and youth-serving organizations. Qualified participants from across Canada will be chosen randomly to take part in a camp in summer 2020, during which they will join astronauts, scientists and engineers for a week of space training.
- PHAC has an MOU with the University of Sherbrooke for research activities on the risk assessment of microbial contamination of recreational lakes using remote sensing and geomatics tools. The Agency is also planning work with the University of Laval 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.
- CSA is presently working in close collaboration and cooperation with the University of Jena (Germany), DLR (German Space Agency) and Canadian Federal Departments (Agriculture and Agri-Food Canada, Environment and Climate Change Canada – Canadian Ice Services, Natural Resources Canada – Canada Centre for Earth Observation and Mapping) for the development of an educational on-line course and material on satellite EO data and climate change

applications (agriculture, coastal ice, floods). The material will be integrated into the European Space Agency Massive On-line Course (MOOC) “Echoes in Space” dedicated to students and young professional that wish to acquire skills and abilities related to the utilization of EO data and the monitoring of the health of the environment and its population.

8. Please describe existing or planned mechanisms to better integrate space-derived data and information into decision-making processes related to global health, and to harmonize and share such data.
  - **Under the Innovative Solutions Canada initiative, PHAC has launched a challenge to private firms to develop efficient models and tools that make use of EO data to inform decision-makers, by enabling estimation of variables and indicators related to environmental determinants of health (i.e. related to land use, land cover, climate and microclimate.**  
<https://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.**
9. Please describe how space technology and applications are integrated into health-related emergency planning and management and disaster management plans.
  - **The Health Portfolio Operations Centre (HPOC), housed at PHAC, 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. When activated, it 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 through the broader Government Operations Centre. These products serve to enhance the HPOC’s capabilities in providing strategic coordination, analysis and advice.**
10. Please describe key activities, reference documents and plans relevant to the topic “Space for global health”.

**From 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 [note: launched June 2019] 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.”

11. Please provide an overview of existing and planned practices and initiatives in the current uses of space (technology, applications, practices and initiatives) in support of global health and identify gaps, if any, in the following areas:
- Telemedicine and tele-health;
  - Tele-epidemiology and environmental health;



- The Public Health Agency of Canada is currently conducting a research project to improve its knowledge on determinants of health by integrating Earth observation (EO) imagery/tele-epidemiology, geographical intelligence, risk modeling 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 disease risk.
- While, there are many general ongoing practices conducted by the Government of Canada in the areas of tele-epidemiology and environmental health, the never-ending pursuit of knowledge and innovations means that gaps will always remain. Canada is conducting the following types activities to help address some of the key gaps:
  - Identification of key theme areas for further research and supporting space science study
  - Collecting and accessing data (climate change, epidemiology, biodiversity etc.)
  - Supporting a sustainable community of practices (such as GEOCoP)

- **Developing knowledge and know-how and excellence in data analytics**
- **Prioritizing future Earth Observation capabilities and participating in EO satellite mission development for monitoring diseases risks**
- **Developing methods, tools and systems**
- **Implementing technical infrastructures and technologies**

C. **Space life sciences;**

- **The Canadian priority for the utilization of the International Space Station (ISS) is the Space Health and Life Sciences (HLS) Program. The mandate of the HSL Program is the identification, characterization and mitigation of the health risks that astronauts encounter in space missions. Many of these 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 addresses these risks through a combination of science studies and technology developments. The risks often have terrestrial parallels that mean that space health sciences and technology are relevant on Earth. Canada has performed and continues to support science studies that address cardiovascular adaption in space (Vascular Echo) which in some ways mimic 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 ISS now also has a parallel terrestrial stream. A second hardware will process a variety of biological samples and in a second generation, will process and analyze samples. This will be relevant in space and on Earth.**

D. **Disaster and health emergency management;**

E. **Other.**