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**Committee on the Peaceful Uses of Outer Space**

# Thematic priority 5. Strengthened space cooperation for global health

## Note by the Secretariat

## I. Introduction

1. In its resolution 71/90, the General Assembly, emphasizing the fiftieth anniversary of the United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE+50), to be commemorated in 2018, which will be an opportunity to consider the current status and chart the future of the contribution of the Committee on the Peaceful Uses of Outer Space to global governance of outer space activities, noted with satisfaction that the Committee, at its fifty-ninth session, agreed on seven thematic priorities of UNISPACE+50, including their objectives and mechanisms (see A/71/20, para. 296).

2. The time frame associated with the outcomes of UNISPACE+50 is oriented towards 2030. It coincides with global efforts undertaken under the 2030 Agenda for Sustainable Development, the Sendai Framework for Disaster Risk Reduction 2015–2030 and the Paris Agreement on climate change. Thematic priority 5 of UNISPACE+50, on strengthened space cooperation for global health, is closely linked to global agreements, in particular the relevant targets under Sustainable Development Goal 3 ("Good health and well-being"). It is also linked to the Sustainable Development Goals addressing water, sanitation, climate change and resilience.

3. The present note has been prepared by the Expert Group on Space and Global Health of the Scientific and Technical Subcommittee of the Committee, with substantive support provided by the Office for Outer Space Affairs of the Secretariat, in accordance with the mechanism endorsed for thematic priority 5 (see A/71/20, para. 296). The present note outlines possible ways to strengthen future work in promoting the use of space science, technology and applications in the global health domain. It is structured in line with the objectives set out for thematic priority 5, namely:

(a) Improve the use of space technologies and space-based information and systems in the global health domain;

(b) Promote enhanced cooperation and sharing of information in emergencies, epidemics and early warning events, as well as on environmental parameters;

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(c) Enhance the capability to integrate health data into disaster management plans;

(d) Strengthen capacity-building in advancing space technologies in global health efforts;

(e) Identify governance and cooperation mechanisms to support these objectives.

# II. Background

4. The first United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE), held in Vienna from 14 to 27 August 1968, served as a platform for the exchange of information and for consultations regarding practical applications of space technology. The Conference comprised 10 sessions. Its fifth thematic session, dedicated to biology and medicine, confirmed that: (a) biology and medicine played a leading role in cosmic research, particularly in connection with manned cosmic flight; and (b) the results of cosmic research and of the general development of cosmic science produced a considerable influence on the progress of biology and medicine as disciplinary sciences, as well as on their general practical aspects.

5. The Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE II), held in Vienna from 9 to 21 August 1982, noted that, since UNISPACE, space science and technology had developed extremely rapidly. The Conference highlighted the immense immediate and future benefits of outer space. Outer space provided an environment that could not easily be reproduced on Earth: micro-gravity, access to the cosmic spectrum of radiations and a virtually infinite source of near-vacuum. UNISPACE II noted that, as those factors had not been encountered by living organisms throughout their terrestrial existence and evolution, and living organisms displayed varying degrees of tolerance of each factor, space represented a new and powerful research environment for biology and medicine.

6. In its resolution 39/96, the General Assembly endorsed the recommendation of the Committee that the Scientific and Technical Subcommittee, at its twenty-second session, in 1985, should consider, on a priority basis, the implementation of the recommendations of UNISPACE II, and that it was particularly urgent to implement, inter alia, the recommendation that all countries should have the opportunity to use the techniques resulting from medical studies in space. Pursuant to General Assembly resolution 40/162, adopted in 1985, the Subcommittee started its consideration of the agenda item on life sciences, including space medicine. The item remained on the agenda of the Subcommittee until 1999, when the structure of the agenda was reviewed in preparation for UNISPACE III.

7. The Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III) was held in Vienna from 19 to 30 July 1999. The Conference culminated in the resolution entitled “The Space Millennium: Vienna Declaration on Space and Human Development”, in which the participants, recognizing the importance of space science and space applications for the fundamental knowledge of health and other areas, and the major contribution that space science and technology made to the well-being of humanity and specifically to economic, social and cultural development, declared that action should be taken to improve public health services by expanding and coordinating space-based services for telemedicine and for controlling infectious diseases.

8. To follow up on the recommendations of UNISPACE III, the Action Team on Public Health of the Committee on the Peaceful Uses of Outer Space (action team 6) was officially created in 2001. Initially, from 2001 to 2006, the Action Team was chaired by Canada, with the Space Generation Advisory Council acting as secretariat. In its preliminary report (A/59/174, annex V, appendix IV), the Action Team found

that there was a legitimate need for space-based services for telemedicine and other applications relating to, for example: the identification, monitoring and mitigation of specific diseases, including infectious ones; the maintenance and dissemination of data on best medical practices; and the use of space-based technologies for continuing education of medical professionals and the general public. The report contained a set of recommendations for further action, including: the establishment of a network for the management of knowledge about cardiovascular disease; the holding of a global conference on telemedicine; and the compilation of a report on the status and potential of telemedicine worldwide. In its final report (A/AC.105/C.1/L.305), the Action Team agreed that, in order to benefit from activities of the Office for Outer Space Affairs in the fields of tele-health and telemedicine, the Action Team would schedule its consultations and regional activities to coincide with the Office's activities.

9. In 2012, building on its work thus far, the Action Team set up an initiative led by the University of Koblenz-Landau in Germany and known as the action team 6 follow-up initiative. Under that initiative, over the three following years, a series of workshops were held with the support of the Office for Outer Space Affairs, and work was done to promote the creation of an open community approach to tele-health and telemedicine, the use of space technology in spatial epidemiology and spatial ecotoxicology issues, and the application of spatial methods in order to address targeted health issues in the world.

10. From 2000 to 2013, the Subcommittee and its Working Group of the Whole considered issues related to the work of the Action Team and to its follow-up initiative under the agenda item on the implementation of the recommendations of UNISPACE III. In 2013, the Subcommittee agreed to the agenda item on UNISPACE III being renamed to connect more closely with the United Nations Conference on Sustainable Development and with what was to become the 2030 Agenda for Sustainable Development, taking into account the work on sustainable development done by the Committee. Based on a proposal by the delegation of Canada, the topic of global health was included as an ongoing subject under the agenda item related to sustainable development.

11. In 2014, the Subcommittee agreed on the establishment of a focused expert group on space and global health to consider issues related to the use of space technology for public health, noting that no Secretariat services would be required for that expert group. The Expert Group on Space and Global Health held its first meeting on 5 February 2015 under the chairmanship of Canada, at which the final report was presented on the activities held under the action team 6 follow-up initiative. At that first meeting, the Expert Group set out its vision (see A/AC.105/C.1/2015/CRP.29). The Expert Group also developed its mandate and its three-year workplan (see A/AC.105/1088, annex I, para. 7), which were endorsed by the Subcommittee.

12. At its second meeting, held on 18 and 19 February 2016, the Expert Group continued to review activities and approaches to strengthen the efforts of the space community to bring tangible support to sustainable development. Also, it elected Switzerland as its co-chair (see A/AC.105/C.1/2016/CRP.21). At its third meeting, held on 2 and 3 February 2017, the Expert Group established a road map towards formulating recommendations to the Subcommittee in support of thematic priority 5 (see A/AC.105/C.1/2017/CRP.28). As part of that road map, the Expert Group agreed to support the preparation of a global conference on space and global health, to be held in Geneva.

13. The United Nations/World Health Organization (WHO)/Switzerland Conference on Strengthening Space Cooperation for Global Health was organized jointly by the Office for Outer Space Affairs, WHO and the Government of Switzerland, with the support of the European Space Agency (ESA). It was held in Geneva from 23 to 25 August 2017 as a flagship conference on thematic priority 5 (see A/AC.105/1161). The aim of the Conference was to foster a dialogue about improving the utilization of space-based technologies and data in support of global health, and to showcase selected global health initiatives and their various uses of

space technologies, data access, data provision services and information-sharing, with a focus on resiliency and interoperability. The outcomes and recommendations of the Conference constitute key input to the present note.

# III. Strengthening space cooperation for global health

## A. Improving the use of space technologies and space-based information and systems in the global health domain

14. In 1971, in its resolution 2776 (XXVI), the General Assembly recommended that the Committee continue and develop the programme for promoting the practical applications of space technology, taking into account the needs of the developing countries. The United Nations Programme on Space Applications, implemented by the Office for Outer Space Affairs, assists Member States with the building of capacity in the use of space science, space technology and space applications in support of sustainable development. Since its inception, the Office has organized several hundred training courses, conferences, seminars and meetings for the benefit of Member States, including in areas related to health. A number of such activities were organized in support of the Action Team on Public Health.

15. In 2005, from 19 to 23 September, the United Nations/ESA/Argentina Workshop on the Use of Space Technology for Human Health for the Benefit of the Countries in Latin America was held in Córdoba, Argentina, to discuss applications of satellite technology for human health, tele-health and telemedicine programmes, and projects, and landscape epidemiology (see A/AC.105/860). At the Workshop, participants agreed to establish a network forum; identify national and regional health-related projects; build relevant capacities; and implement a regional initiative that included such components as formal training, a satellite imagery database, risk maps and health early warning systems and responses for each disease.

16. Also in 2005, from 5 to 9 December, The United Nations/Economic and Social Commission for Asia and the Pacific (ESCAP)/China Workshop on Tele-Health Development in Asia and the Pacific was held in Guangzhou, China (see A/AC.105/868). Workshop participants discussed issues, concerns and approaches relating to developing tele-health for the region; participated in a real-time telemedicine demonstration at a hospital in Guangzhou; and recommended for implementation projects in the following domains: development of a methodology for early warning of avian influenza using geospatial data and space technologies; telehealth training; assessment of specifications for communication system network configurations for various applications of tele-health; and a comprehensive needs assessment for the implementation of a national tele-health programme.

17. In 2007, the Office for Outer Space Affairs and ESCAP organized the Regional Expert Meeting on Using Space Technology for Monitoring and Early Warning of Infectious Diseases, Including Avian Influenza, held in Asia, in Bangkok from 1 to 3 August in support of the Action Team. In view of the prevailing concern in Asia about the hazards of avian influenza, the Meeting established a project on the use of space technologies to provide decision-supporting tools for identifying risks and possible spread routes, and to provide early warning and preventive measures to the region.

18. In 2008, the United Nations/Burkina Faso/WHO/ESA/Centre national d'études spatiales (CNES) Workshop on the Use of Space Technology in Telehealth to Benefit Africa was held in Ouagadougou from 5 to 9 May (see A/AC.105/915). At the Workshop, participants examined current tele-health practices in Africa and discussed issues, concerns and approaches related to the development of tele-health for the region, such as the use of space-based technology to provide medical services and health education for the prevention and treatment of infectious diseases such as malaria and avian influenza, with a view to establishing a network to support the Action Team. The discussions resulted in the identification of 11 actions and projects.

19. Also in 2008, the United Nations/India/ESA Regional Workshop on the Use of Space Technology in Tele-epidemiology to Benefit Asia and the Pacific was held in Lucknow, India, from 21 to 24 October (see A/AC.105/935). The Workshop focused on the use of space technology for public health surveillance and tropical diseases health care. Participants initiated actions to pursue future projects on topics relating to mobile health systems, to capacity-building, training and education, and to data collection, repository and sharing. They also discussed supporting the activities of the Action Team. As a follow-up to that Workshop, hospitals of excellence in India were connected with reference hospitals in Bhutan in the framework of the South Asian Association for Regional Cooperation. In Nepal, a telemedicine node was installed at Patan Hospital in Kathmandu. Telenursing education was the first application implemented.

20. In 2009, at the sixth European Congress on Tropical Medicine and International Health, held in Verona, Italy, from 6 to 10 September, the Office for Outer Space Affairs held a workshop on the contribution of space technology to infection surveillance and the health-related Millennium Development Goals. The principal goal of the workshop was to raise awareness among the medical community of the potential of satellite technology for monitoring and predicting the spread of infectious diseases. Information was provided to the 1,200 participants in the Congress on the outcomes of specific pilot projects using satellite data implemented in Asia and the Pacific, Europe and Latin America and the Caribbean.

21. In 2011, the United Nations/Canada Workshop on the Contribution of Tele-epidemiology to Public Health in the Context of Climate Change Adaptation was held in Montreal, Canada, from 19 to 21 June. It was aimed at fostering new cross-disciplinary initiatives and promoting the functional integration of space technologies within public health organizations around the world. The two key objectives of the Workshop, held under the auspices of the Action Team, were to put forth the latest research, programmes, approaches and policies that capitalized on innovative partnerships to deal with satellite technology, climate change and public health, as well as to provide networking and knowledge-based opportunities for those with an interest in surveillance and risk assessment methods aimed at better addressing health conditions arising from a rapidly changing environment.

22. In 2011, the United Nations/Islamic Republic of Iran Regional Workshop on the Use of Space Technology for Human Health Improvement was held in Tehran from 23 to 26 October (see A/AC.105/1021). The Workshop was organized to raise awareness of the use of space technology with regard to health care and to review the benefits of applications such as tele-health and telemedicine, mobile health, tele-epidemiology and distance learning. Recommendations of the workshop included the establishment of a regional telemedicine research centre in Asia; possible development of e-health or telemedicine strategies and projects; the establishment of a national body comprising of experts from ministries of health and telecommunications, medical institutions, and space agency; the development of training courses in tele-epidemiology and geographical information systems (GIS), and access to remote sensing data for human health improvement.

23. In 2012, in support of the action team 6 follow-up initiative, the University of Koblenz-Landau, with technical advisory assistance from the Office, held an international expert meeting on the theme “Improving public health through space technology applications: an open-community approach”. The expert meeting was held in Bonn, Germany, from 30 July to 1 August. Further to the expert meeting, a strategy meeting was held in 2013 on the margins of the Subcommittee session to discuss a follow-up initiative for an open community approach to tele-health and telemedicine and the use of space technology in spatial epidemiology and spatial ecotoxicology issues. On 28 and 29 October 2013, the University of Koblenz-Landau and the National Institute of Health of El Salvador, with the support of the Office, held a virtual meeting on improving public health through low-cost technology and Global Positioning System-tailored access to risk assessment and resources.

24. Also in 2012, the United Nations Expert Meeting on the International Space Station (ISS) Benefits for Humanity was held in Vienna on 11 and 12 June as part of the Human Space Technology Initiative of the Office (see A/AC.105/1024). The Meeting focused on facilitating dialogue on potential synergies between the ISS partner agencies and United Nations bodies in the areas of Earth observation and disaster response, health and education. In preparation of the Meeting, 14 concept notes were drafted. Two of those were related to health. The concepts of space-proven telemedicine devices and services for underserved populations were included so as to identify and transfer telemedicine applications that were space-proven on board ISS for use on Earth to benefit underserved populations.

25. In 2014, another United Nations Expert Meeting on the ISS Benefits for Health was held in Vienna, on 19 and 20 February (see A/AC.105/1069). The Meeting had been co-organized by the Office for Outer Space Affairs, WHO and five ISS partner agencies. At the Meeting, information was exchanged on the space agencies' health-related activities and potential areas of collaboration were identified in which the needs and requirements of the health sector could be met with the use of space-proven technologies developed for ISS. The potential areas of collaboration included the provision of medical care in the physical absence of health-care professionals and in remote and isolated locations; supporting the supply of clean water, telemedicine, and research on therapies for non-communicable diseases, pharmaceuticals, diagnostics and ageing. In that context, ISS partner agencies highlighted spin-offs of space-based technology that could offer solutions for those areas.

26. In February 2014, on the margins of the Subcommittee, Japan and WHO hosted a seminar on the theme "Space and sustainable development: space technology and research for global health". The seminar facilitated the exchange of views and information on how data obtained by satellite and space medicine would contribute to improving global health. It highlighted the expectation that space technology and research would be further utilized in fields such as telemedicine, tele-epidemiology and food security.

27. Also in February 2014, the European Space Policy Institute (ESPI) published its report "Humanitarian telemedicine: potential telemedicine applications to assist developing countries in primary and secondary care", which explored the potential of humanitarian telemedicine applications, in particular in the field of primary care. In the report, ESPI defined humanitarian telemedicine as the provision of telemedicine, both by the primary health-care provider and/or the secondary care professional, to developing countries in times of immediate and/or permanent medical need with the aim of improving personal health.

28. The twenty-fourth United Nations/International Astronautical Federation (IAF) Workshop on Space Technology for Socioeconomic Benefits was held in Toronto, Canada, from 26 to 28 September 2014 (see A/AC.105/1081). The programme included four technical sessions, two of which addressed space technology for global health and space applications for tele-epidemiology.

29. In 2015, a meeting on the applications of space science and technology for public health, organized by WHO and the Office, was held on 15 and 16 June (see A/AC.105/1099). The aim of the meeting was to assess the status of space technology-related contributions to addressing health issues; identify relevant technologies and applications that were not yet being employed by the health sector; identify barriers and potential solutions for implementing space technology-related health applications; and consider opportunities for aligning relevant space-related activities, such as research activities on ISS, ongoing activities within the Group on Earth Observations (GEO) and other frameworks relevant to the priorities of WHO.

30. In 2016, the workshop "ESA innovation exchange: when space meets health" was held in Noordwijk, Netherlands, on 8 November. Aimed at raising awareness among stakeholders in the health area, it enabled participants to explore opportunities for developing partnerships. ESA has created a dedicated online portal entitled "Space

for health" (www.esa.int/health), which puts the emphasis on ESA activities directly linked to health. Those include: activities relating to telemedicine and tele-health technologies and capabilities; the provision of operational Earth observation data on environmental factors of importance to health; epidemic intelligence; health emergencies; benefits of space science to public health; and research projects on health topics conducted in the human spaceflight programme, using ISS and ground- and flight-based analogues. A number of additional mechanisms exist to enable the transfer of technology and knowledge to the broader user community, along with partnership schemes. Furthermore, a publically accessible online catalogue shows how ESA programmes and activities relate to the Sustainable Development Goals. The catalogue facilitates collaboration towards the objectives under the Goals. The portal groups all ESA news items linked to the Sustainable Development Goals (www.esa.int/SDG).

31. Finally, in 2017, the United Nations/WHO/Switzerland Conference on Strengthening Space Cooperation for Global Health, held in Geneva in August (see para. 13), recognized the application and potential of space-based assets, data and technologies to support global health. The Conference highlighted the importance of dealing with pressing issues related to water, climate change, major epidemics, the location of health facilities and access to health services, pollution-related diseases and non-communicable diseases. The Conference also recognized that space technology could play a significant role in supporting logistical and operational needs specific to key functions of public health, including surveillance, emergency preparedness and field response.

32. The applications of space-based technologies in global health considered by key stakeholders at these important international and regional events can be grouped into three main areas:

(a) Earth observation and remote sensing: collecting valuable data on a local, regional and global scale, collecting information that can support national and subnational public health decision-making, including for disease surveillance, outbreak containment and resource planning for the well-being of the population, and studying and monitoring vector-borne diseases (tele-epidemiology);

(b) Telecommunication, and positioning and tracking: supporting tele-health and telemedicine applications for appropriate health interventions to and from rural or isolated areas with limited access to adequate medical support;

(c) Space-based research (for example, on board ISS) and technology transfer: studying human physiology and identifying potential interventions and treatments in the event of a major disease outbreak, and for water purification, ultrasound applications and vaccine development.

## B. Promoting enhanced cooperation and sharing of information in emergencies, epidemics and early warning events, as well as on environmental parameters

33. An important aspect of global health is the transnational impact that globalization exerts on the social, economic and cultural factors that determine good or bad health (known as health determinants) and health problems, something that is beyond the control of individual States. Global health emergencies, epidemics and early warning events can become threats to the stability of the international community. Issues related to environmental and climate change, such as air pollution and water quality, which are essential for human health and well-being, are also intrinsically transboundary. Space technology, supported by in situ observations, can provide important data for environmental, epidemiological and molecular models for disease risk forecasting and the formulation of policies to monitor environment, prevent outbreaks or contain epidemics. It is therefore important to promote enhanced cooperation and the exchange of information in this area.

34. In 2007, the United Nations/Russian Federation/ESA Workshop on the Use of Microsatellite Technologies for Monitoring the Environment and Its Impact on Human Health was held in Tarusa, Russian Federation, from 3 to 7 September (see A/AC.105/903). The Workshop focused on the use of microsatellite technologies in detecting potentially dangerous phenomena on the Earth's surface and in the atmosphere, ionosphere and magnetosphere, and applications of microsatellites to improve livelihoods on Earth. The Workshop addressed biomedical and biological issues and the use of microsatellites for education in space technologies, environmental monitoring, climate change and human health services.

35. In 2011, the United Nations/Canada Workshop on the Contribution of Tele-epidemiology to Public Health in the Context of Climate Change Adaptation (see para. 21) discussed issues related to the contribution of tele-health and tele-epidemiology to public health in the context of climate change adaptation. It focused, inter alia, on leveraging space technologies for public health in the context of climate change for monitoring air-level pollutants and climate change-induced variations in concentrations of aerosols in the air, and on modelling extreme weather scenarios and the distribution of climate sensitive vector-borne diseases, in order to better prepare for public health crises.

36. In June 2017, a workshop entitled "One Earth, one health" was held in Montreal, Canada. The title referred to the interconnection between the health of humans, animals and ecosystems. The objective of the workshop, which had been co-organized by the Canadian Space Agency and the Public Health Agency of Canada, was to gain a better understanding of the links between the environment, the climate, society and public health in the context of Earth observation. Participants demonstrated the relevance of existing applications derived from the analysis of Earth observation data, identified existing or potential Earth observation data, indicators and methods in support of public health and defined key themes, namely mosquito-borne diseases, tick-borne diseases, airborne diseases, waterborne diseases, vulnerable human populations, and pandemics and major outbreaks.

37. The United Nations/WHO/Switzerland Conference on Strengthening Space Cooperation for Global Health, held in Geneva in August 2017 (see para. 13) recognized that, as global environmental changes directly and indirectly affected the health of all populations, there was a strong connection and interdependence between the state of the environment and the health of humans, animals and the planet. The Conference further recognized the need to better connect health information systems with remotely sensed Earth observation data and information in order to increase operational use and maximize impact.

38. GEO is working with the health community to improve the flow of user-friendly environmental data. Comprehensive data sets support prevention, early warning, research, health-care planning and delivery, and timely public alerts. Gathered and distributed through the Global Earth Observation System of Systems, those Earth observation data contribute to improving our understanding of how the environment affects human health and well-being. Key variables include airborne, marine, and water pollutants; stratospheric ozone depletion; land-use change; persistent organic pollutants; food security and nutrition; noise levels; weather-related stresses and disease vectors; and many others.

39. A noteworthy example within the context of tele-epidemiology and the Ebola outbreak of 2013–2016 relates to the *Protocol for Assessing National Surveillance and Response Capacities for the International Health Regulations (IHR) (2005) in Accordance with Annex 1 of the IHR: A Guide for Assessment Teams*, published by WHO in December 2010. The *Protocol* includes an item on GIS. The Global Alert and Response Team manages an integrated global alert and response system for epidemics and other public health emergencies based on strong national public health systems and capacity and an effective international system for coordinated response. Using GIS in combination with space-based information as part of its response to the

recent Ebola crisis, the Team presents surveillance information on maps using the web (http://www.who.int/csr/disease/ebola/maps/en/).

40. The above activities confirmed the need for enhanced cooperation and information-sharing in emergencies, epidemics and early warning events, as well as on environmental parameters. The key observations can be summarized as follows:

(a) Tele-epidemiology, a transdisciplinary area in which space-based systems such as Earth observation, satellite navigation and satellite communication systems are used in epidemiological studies and public health surveillance, is well suited to play a key role in public health. Earth observation makes it possible to gather high-resolution information on a broad scale, and provides and improves opportunities to analyse and predict infectious and environment-related diseases. For example, remote-sensing observation of air, land and ocean parameters can now be used to predict outbreaks of or trends in diseases such as meningitis, malaria and cholera;

(b) Environmental changes resulting from climate change, population growth, deforestation, urbanization, agricultural intensification, globalization and increased trade, affect human health in a variety of ways. In that context, long-term data records, and global information and data sets are important for monitoring historical changes, assessing trends and predicting changes in the future;

(c) Consistent and standardized in situ and satellite-derived data along with products and tools capable of providing end users with the information required for decision-making are needed for the effective application of tele-epidemiology in the field of public health;

(d) Global health will depend more and more on global e-health, telemedicine, biosurveillance and health informatics, and it will expand as issues around the world grow increasingly complex. A transdisciplinary approach and partnering are required. To successfully address these key challenges, it will be critical to involve all stakeholders, such as specialists in health, space, disaster management, the environment and biodiversity.

## C. Enhancing capability in integrating health data into disaster management plans

41. In its resolution 61/110 of 14 December 2006, the General Assembly established the United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER) with a mandate to provide universal access to all types of space-based information and services relevant to disaster management to support the full disaster management cycle by being a gateway to space information for disaster management support, serving as a bridge to connect the disaster management and space communities and being a facilitator of capacity-building and institutional strengthening, in particular for developing countries. The programme is implemented by the Office for Outer Space Affairs and has an open network of providers of space-based solutions to support disaster management activities. It currently comprises 21 regional support offices.

42. Disaster risk reduction and the work of UN-SPIDER are at the centre of UNISPACE+50 thematic priority 6, on international cooperation towards low-emission and resilient societies, which is strongly interconnected with the objective of enhancing the capability to integrate health data in disaster management plans. The international framework for promoting resilience and disaster risk reduction is provided by the Sendai Framework for Disaster Risk Reduction. Resilience is also a pillar in the 2030 Agenda for Sustainable Development. In the 2030 Agenda it is recognized that global health threats, more frequent and intense natural disasters and other factors threaten to reverse much of the development progress made in recent decades.

43. The Sendai Framework for Disaster Risk Reduction 2015-2030 was adopted in Sendai, Japan, on 18 March 2015, at the Third United Nations World Conference for Disaster Risk Reduction. The Sendai Framework strongly emphasizes disaster risk management as opposed to disaster management. It defines seven global targets and sets as an aim the substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries. Health resilience is strongly promoted throughout the document.

44. The Sendai Framework stresses the importance of enhancing the resilience of national health systems, including by integrating disaster risk management into primary, secondary and tertiary health care, especially at the local level; developing the capacity of health workers in understanding disaster risk and applying and implementing disaster risk reduction approaches in health work; promoting and enhancing the training capacities in the field of disaster medicine; and supporting and training community health groups in ways to approach disaster risk reduction in health programmes in collaboration with other sectors, as well as in the implementation of the IHR. The Sendai Framework also stresses the importance of enhancing cooperation between health authorities and other relevant stakeholders at the global and regional levels.

45. To assist countries in developing resilient health systems, the Government of Thailand, the United Nations Office for Disaster Risk Reduction and WHO hosted the International Conference on the Implementation of the Health Aspects of the Sendai Framework for Disaster Risk Reduction 2015-2030 in Bangkok on 10 and 11 March 2016. The Conference highlighted the importance of putting health resilience at the heart of disaster risk management in the face of crises such as the Zika virus outbreak. The outcome of the Conference comprises seven recommendations, known as the Bangkok Principles for the implementation of the health aspects of the Sendai Framework, which help to place health at the heart of disaster risk management.

46. To integrate health data into disaster management plans, it is crucial to enhance cooperation between health authorities and other stakeholders at all levels of government, encourage technology and solution-driven research, increase awareness of the benefits provided by space-derived data, technology and applications for health and disaster risk management, and enhance multi-hazard early warning systems. It is important to promote the integration of knowledge bases, encourage innovation across sectors and increase the understanding among stakeholders of the role that tele-epidemiology, tele-health, science and technology innovations — such as mobile medical platforms, satellite technologies, telecommunications and Earth observation — play in informing the decision-making process and the support those technologies lend to the implementation of the Sendai Framework.

47. A model for promoting country-level cooperation can be derived from the technical advisory support provided by UN-SPIDER at the national level as one of its prime activities. UN-SPIDER assists countries by, inter alia, facilitating technical advisory missions involving experts from space and disaster management agencies from other countries, and from international and regional organizations and institutions; providing technical advice to national institutions; facilitating direct cooperation between national institutions and providers of space-based information and solutions; and supporting countries in accessing space-based information to support emergency response operations.

48. The recommendations made by the technical advisory missions cover various issues related to policy and coordination, data access, data availability, data-sharing, capacity-building and institutional strengthening. Following most technical advisory missions, countries request additional support from UN-SPIDER to implement those recommendations. The recommendations can cover needs regarding capacity-building, institutional strengthening or the development of partnerships to build the required data infrastructure or the analytical tools for the development of basic information for disaster risk reduction or emergency response operations.

## D. Strengthening capacity-building in advancing space technologies in global health efforts

49. The objective of strengthening capacity-building in advancing space technologies in global health efforts is closely linked to UNISPACE+50 thematic priority 7, on capacity-building for the twenty-first century. Thematic priority 7 is a cross-cutting priority aimed at defining new approaches to overall capacity-building; strengthening comprehensive capacity-building and outreach activities of the Office for Outer Space Affairs; developing infrastructure for cross-sectoral and integrated applications, with combined scientific, technical, legal and policy outputs; strengthening partnerships to deliver targeted capacity-building and technical advisory activities based on needs assessments; and promoting efforts to encourage science, technology, engineering and mathematics education, especially for women in developing countries.

50. The capacity-building efforts should be aimed at enhancing the capacities of Member States and other stakeholders at the national, regional and international levels to harness benefits offered by outer space for global health. Capacity-building activities could benefit from comprehensive, long-term engagement with Governments, the private sector, civil society, the scientific community, academia, philanthropic institutions, foundations, volunteers and others. Modalities should include interventions on the individual, organizational and institutional levels and the promotion of an environment that enables the effective application of space-based science and technology for global health.

51. Interventions aimed at institutional strengthening and the building of an enabling environment have the most significant impact on countries' development. They are aimed at enhancing governance, policies, laws, regulations, guidelines, institutional linkages, coordination, cooperation and partnerships, and require synergies across all of those. Successful interventions also require the agreement of all parties to share information and to act in cooperative ways that further the system capacity-building objectives.

52. Capacity-building at the organizational level is intended to facilitate and accelerate within a given country the development of sustainable, effective and efficient organizations involved in public health. It may consist of trainings and technical assistance to develop standard operating procedures, documents, tools, curriculums and laboratories, and it may be aimed at improving the ability of organizations to design, implement and monitor programmes, their agility in adapting to emerging, rapidly changing and complex situations, and strengthening existing networks and building new ones.

53. At the individual level, capacity-building assistance may take the form of facilitating professional networking or awarding fellowships intended mainly to enable practitioners to increase their professional and technical knowledge and operational experience. Upon the completion of the fellowship they can apply that knowledge and experience to solve concrete problems. Fellowships may be awarded for short-term or medium-term academic studies or hands-on learning. Fellowships are normally granted to government officials at the request of their Governments.

54. The United Nations/WHO/Switzerland Conference on Strengthening Space Cooperation for Global Health, held in Geneva in August 2017 (see para. 13), was instrumental in providing direction and fostering a dialogue aimed at strengthening capacity-building efforts and cooperation in the global health domain with a view to integrating space technologies and data at the organizational and institutional levels. The Conference identified specific areas in which capacity needed to be built in using space-derived data and information for global health. It also identified the barriers to accessing and processing the data and ways to overcome those barriers, as well as solutions that would strengthen the building of capacity in the use of space-derived data and tools for global health. Challenges is this area could be resolved with clear policies, donor cooperation and regular training and retraining of staff in relevant

institutions. Having open data and opening up access to key data will become of critical importance in the future.

55. With regard to systems interoperability, organizational interoperability and technical cooperation, discussions focused on the following topics: mechanisms to better integrate, harmonize and share space-derived data and information into decision-making processes related to global health; intersectoral cooperation in the use of space-derived data and information; strengthening interoperability and technical cooperation in the use of space-derived data and tools; and the need for clear custodianship of data at all levels. It was acknowledged that many needs of ministries of health were already well documented, that donors could provide more concrete support in their development assistance, and that user feedback at the local level and from government users was crucial to improving trust and cooperation.

56. At the organizational level, capacity-building assistance can be provided by raising awareness among global health policymakers and decision makers of the benefits of space tools and by helping to integrate those tools into standard operating procedures and decision-making processes. Under UNISPACE+50 thematic priority 7, on capacity-building for the twenty-first century, the Office is developing a compendium of space solutions. The compendium is to include searchable information on specific space applications, relevant observations and recommendations, best practices, contact information of space experts and example programmes, projects across all areas of sustainable development and other topics. The health-related component of the compendium can benefit from the review compiled by the Expert Group on Space and Global Health of the relationship between space activities and global health applications (see A/AC.105/C.1/2015/CRP.29, annex) and the ESA catalogue (see para. 30). Its development can help to boost national and local capacities in this area.

57. Another illustration of how capacity-building assistance can be provided at the organizational level is the United Nations/Mexico/Pan American Health Organization Training Course on Satellite Technology for Tele-health, held in Mexico City in June 2007. It was organized in cooperation with the National Centre for Health Technology Excellence of the Ministry of Health of Mexico. The Course was aimed at assisting the countries of Latin America and the Caribbean in evaluating existing and emerging technologies related to tele-health and integrating efforts in the public health institutions in the region, so that tele-health programmes could be shared and exploited by the whole region, thus enhancing their impact on global health.

58. A further example is promotion of education by developing a curriculum to support the application of space-based science and technologies for global health so as to increase the availability of professionals able to provide the relevant services at the national level. Such a curriculum will serve as a tool to be used by educational institutions and in training initiatives. It may help to streamline educational programmes and facilitate teaching the necessary skills and knowledge through academia. The curriculum may build on the Office's expertise and follow the format the Office developed for earlier curriculums on satellite meteorology and global climate; satellite communications; space and atmospheric science; remote sensing and GIS; global navigation satellite systems (GNSS); and space law.

59. An excellent example of capacity-building assistance at the individual level is the United Nations/Argentina fellowship programme for advanced training in landscape epidemiology that was jointly established, in 2007, by the Office and the National Commission for Space Activities of Argentina. The fellowship programme was a follow-up to the 2005 United Nations/ESA/Argentina Workshop on the Use of Space Technology for Human Health for the Benefit of the Countries in Latin America (see para. 15). The fellowship covered participation in an annual six-week training course held at the Mario Gulich Institute for Higher Space Studies in Córdoba, Argentina. Its objectives were to build capacity at the regional level and to promote the utilization of space technology in epidemiological issues through specific project

applications. It was aimed at providing the necessary critical mass in tele-epidemiology applications for Latin America and the Caribbean.

60. Those who participated in that training event initiated the following regional projects: (a) spatial-temporal evaluation of epidemiological patterns of dengue outbreaks in Santa Cruz de la Sierra, Plurinational State of Bolivia; (b) landscape characterization of triatominides, vectors of Chagas disease, using remote sensing in the Valparaíso Region of Chile; (c) an analysis of potential *Triatoma infestans* re-infestation in the Ybycui district of Paraguay using remote sensing; (d) identification of environmental risk factors of malaria between 2002 and 2006 in Colombia using remote sensing; (e) malaria and its spatial-temporal relationship with a lake in Paraguay between 2002 and 2006; (f) characterization of habitats of *Phlebotominae* in north-western Argentina using remote sensing; (g) geographical distribution and incidence of tegumentary leishmaniasis in the Bolivarian Republic of Venezuela and its relationship with environmental factors estimated by remote sensing over the period 1999–2006; (h) analysis of malaria using geostatistics and remote sensing in high-risk areas in Loreto, Peru; and (i) spatial-temporal spread of hepatitis B in eastern Ecuador.

61. It is important to mainstream a gender perspective in all types of activities, regardless of the level at which they are undertaken, as part of a solid capacity-building strategy for advancing the use of space technologies in global health efforts. Gender mainstreaming is not an end in itself but rather a means to achieve the goal of gender equality. It requires assessing the implications for women and men of any planned action and ensuring that gender perspectives and attention to the goal of gender equality are central to all activities under thematic priority 7: policy development, research, advocacy and dialogue, legislation, resource allocation, and planning, implementation and monitoring.

## E. Identifying governance and cooperation mechanisms to support the strengthening of space cooperation for global health

62. The Committee on the Peaceful Uses of Outer Space is the central intergovernmental forum for promoting peaceful uses of outer space. The Committee is a natural platform for identifying a coordination mechanism to assist countries in harnessing benefits of space for global health and to ensure that all countries and, in particular, developing countries, benefit from applications of space science and technology for advancing health-related aspects of sustainable development agenda.

63. The Expert Group on Space and Global Health has been established under the Scientific and Technical Subcommittee of the Committee. The mandate of the Expert Group includes the review and analysis of current uses of space (technology, applications, practices and initiatives) in support of global health needs in order to identify gaps, propose recommendations and provide orientation for the future work of the Subcommittee.

64. The working sessions of the Expert Group, held on the margins of the sessions of the Subcommittee, are a forum for Member States, intergovernmental organizations, non-governmental organizations and their respective experts to share needs, opportunities, best practices and expertise and thus to actively contribute to the use of technology, applications, practices, capacity-building and initiatives making it possible to use space for global health purposes. The Expert Group reports to the Subcommittee through its Working Group of the Whole. In doing so, it raises awareness among Member States, increases their engagement and promotes collaborative and direct actions by Member States in the area of space and global health.

65. The Office for Outer Space Affairs is the coordinating authority within the United Nations mandated with bringing the benefits of space to humankind and promoting international space-related cooperation. The Office serves as the secretariat to the Committee, its Subcommittees and Working Groups. It also

discharges the responsibilities of the Secretary-General under the United Nations treaties and principles on outer space, and provides technical advisory services and capacity-building activities in areas such as remote sensing, satellite meteorology, navigation, disaster risk reduction, tele-education, health, space law and policy and basic space sciences for the benefit of developing States.

66. WHO is the coordinating authority for health within the United Nations system and is responsible for providing leadership on global health issues. Its goal is to build a better, healthier future for people all over the world. Acting through offices in more than 150 countries, WHO staff work side by side with Governments and other partners to ensure the highest attainable level of health for all people.

67. Within the United Nations system, the Office for Outer Space Affairs leads the activities of the Inter-Agency Meeting on Outer Space Activities (UN-Space), the formal mechanism for inter-agency coordination and cooperation in space-related activities. In 2015, UN-Space issued its special report entitled "Space for global health" (A/AC.105/1091), which provides an overview of selected areas in which United Nations entities use space science and technology for public health and offers recommendations for further consideration by the Committee of future work in this domain under UNISPACE+50 (see para. 100 of that special report).

68. GEO is coordinating with health organizations, global philanthropic institutions and partnerships to provide Earth observation and remote sensing data under the "one health" concept. The GEO health community of practice is led by the National Oceanic and Atmospheric Administration and the National Aeronautics and Space Administration, both in the United States of America, with contributions from other entities. It helps to coordinate the "one health" approach through the global public health community.

69. Continued and effective intersectoral collaboration at the international, national and subnational levels engaging multiple stakeholders can enhance existing cooperation mechanisms and maximize the return of public investment on space-based assets. The added value of an international coordinating body in undertaking such an intersectoral initiative needs to be considered, as do efforts to break down silos by improving communication and better aligning interests. Working together, the Office for Outer Space Affairs, WHO and other international entities, such as the World Meteorological Organization, the Operational Satellite Applications Programme of the United Nations Institute for Training and Research, the United Nations Office for Disaster Risk Reduction, the International Telecommunication Union, GEO, the European Union and ESA, will be the key enablers supporting efforts to attain Sustainable Development Goal 3 ("Good health and well-being") and other Goals relevant to it.

70. There are examples of international frameworks for cooperation and coordination in the space field that could be studied further. The Office for Outer Space Affairs, for instance, acts as the executive secretariat of the International Committee on Global Navigation Satellite Systems (ICG) and as the permanent secretariat for the Space Mission Planning Advisory Group (SMPAG), which ensures the structured and sustained implementation of activities of those bodies. Both ICG and SMPAG have evolved from the UNISPACE III action teams, in particular the Action Team on GNSS (action team 10) and the Action Team on Near-Earth Objects (action team 14).

71. ICG, which promotes voluntary cooperation on GNSS, is open to States Members of the United Nations, international organizations and international entities that are responsible for GNSS and GNSS augmentations. The ICG Providers' Forum, a body comprising Member States with expertise as current or future providers of GNSS, gives policy guidance to ICG. The Office, as the executive secretariat of ICG, substantively supports the implementation of the activities of ICG.

72. The establishment of SMPAG was formally endorsed by the Committee and, subsequently, the General Assembly in 2013. Membership is open to all national space

agencies and governmental or intergovernmental entities involved in activities related to near-Earth objects. SMPAG consists of a plenary group of delegates nominated by its members, guided by a steering committee with a rotating Chair.

# IV. Recommendations

73. It is recommended that a new item dedicated to space and global health be put on the agenda of the Scientific and Technical Subcommittee under a multi-year workplan, and that a working group be established that is to be tasked with considering and proposing actions, with the scope of its work to be further determined, relating to the future uses of space (technology, applications, practices and initiatives) in support of global health needs in the wider context of sustainable development on Earth, including the contribution of space science and technology and their applications to the achievement of the Sustainable Development Goals, and taking into account the concerns and interests of all countries, in particular those of developing countries.

74. It is recommended to further pursue and elaborate the recommendations contained in the final report of the Action Team on Public Health on the use of space technology to improve public health (A/AC.105/C.1/L.305), with particular attention to governance and cooperation mechanisms, taking the following action:

(a) Encourage formal cooperative agreements between health authorities and space authorities at the national level;

(b) Establish a dedicated platform for effective coordination among United Nations entities, other international organizations and relevant actors, on space and global health issues;

(c) Encourage United Nations entities, intergovernmental organizations and national Governments to pursue effective coordination in all key space activities relevant to global health (telecommunications, GNSS, remote sensing and GIS, and space life science and technology development).

75. There should be strengthened institutional arrangements between the Office for Outer Space Affairs and WHO for effective collaboration.

76. WHO should establish a dedicated high-level focal point for space-related affairs to advance the use of space science and technology in global health.

77. The key role of the Office for Outer Space Affairs in providing technical support to United Nations entities and intergovernmental organizations on interdisciplinary and cross-sectorial space-related matters should be reinforced. Further attention should be given to promoting a "one health, one planet" perspective.

78. WHO should be actively engaged in some of the activities of the Office for Outer Space Affairs that are relevant to global health, including, but not limited to, UN-SPIDER technical advisory missions. The Office should also be more closely involved in activities of WHO on a reciprocal basis, as appropriate.

79. The United Nations system should support the wider application of space solutions for global health. This could be achieved by encouraging the implementation of a broader range of space solutions for sustainable development, and could include public-private partnerships.

80. Building on the foregoing, the following specific cross-cutting recommendations are made:

(a) United Nations entities and intergovernmental organizations should develop appropriate tools to enable Member States to address their public health needs related to space technology;

(b) Member States are encouraged to establish policy-enabled environment and governance mechanisms, with due consideration of legal and ethical issues, for removing barriers to the effective use of space-based technologies, including telemedicine solutions;

(c) Member States are strongly encouraged to promote open data-sharing policies and participatory approaches to developing and improving access to all geospatial information relevant to global health, whenever possible;

(d) Member States and participating entities are encouraged to advance their efforts related to the geotagging of all assets relevant to health systems, including health information systems, and make them available to further the attainment of health goals;

(e) Intersectoral coordination and cooperation should be enhanced 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. Actors engaging in such activities should consider follow-up mechanisms aimed at strengthening the sustainability of the activities;

(f) Member States are encouraged to engage learning institutions and other capacity-building mechanisms in motivating young health professionals, at an early stage, to acquire space-related skills and abilities;

(g) Member States are encouraged to enable organizational and technical interoperability to facilitate the development and implementation of space-based science and technology in the health sector;

(h) Member States are encouraged to conduct appropriate drills and exercises to benchmark their operational preparedness and response capacities and capabilities for appropriate use of space technologies in responding to global health events.