Morning session

UNOOSA and Space 4 healthy life and global well-being

Mr. Niklas Hedman Chief, CPLA	UNOOSA	Intergovernmental activities
Mr. Hedman introduced the work of the Working Group on Space and Global Health which falls under the Scientific and Technical Subcommittee of COPUOS and which started working in 2019 with a mandate until 2022. The WG established a questionnaire to gather a comprehensive picture on state of affairs in using space to support global health. One of the aims of WG is to identify possible existing gaps in capacities at all levels. STSC reviewed a limited number of responses with documentation available on OOSA website. WG is encouraging more entries. The purpose of the questionnaire is also to compile the existing agreements and coordination between various sectors, including medical, space and other communities as well as collect the existing and planned practices and initiatives in the use of space for global health. In the coming years, it is important to bring in the medical community much more into this coordination effort – so far cooperation and coordination has been very well fostered.		
Mr. Jorge del Rio Vera Programme Officer, SAS	UNOOSA	SAS
Mr. del Rio Vera explained that space is one of the many solutions that can be applied to address global challenges including health. Fundamental research is important to advance any field, and this is true for space. In this regard, microgravity offers a unique way of research health-related issues and development of medicines and vaccines. UNOOSA cooperates with China Manned Space Agency and the Center of Applied Space Technology and Microgravity (ZARM) to provide such unique experiment conditions to teams from across the world and the available opportunities were described. Also, he touched upon how astronauts deal with health issues in space – as examples, astronauts receive basic medical training on human body as well as equipment and can use tele-health to communicate with the ground. The role of Global Navigation Satellite Systems (GNSS) in the current COVID-19 pandemic was also elaborated. This includes contact tracing, locating the positively tested, identifying risky locations, helping in the adoption of policies by understanding mobility, and monitoring the environmental factors of the lockdown measures and spread of the disease.		
Mr. Shirish Ravan Programme Officer	UNOOSA	UN-SPIDER
Mr. Ravan talked about the benefits of space-based information on the spread of the virus, especially geospatial data to demarcate hot spots or the daily use of GIS to control the outbreak. He also explained the role of the dedicated disaster management programme of UNOOSA, the UN-SPIDER, which is at the forefront of disaster management. UN-SPIDER is teaching people how to use space tools and technologies for disaster management - the most important contribution of UNOOSA to this situation. A dedicated page on the UN-SPIDER Knowledge portal on COVID-19 where examples and best-practices on the use of space are collected was also introduced. As the result of the crisis, disaster management authorities have been activated around the world and he also explained the role of UNOOSA in the International Charter Space and Major Disasters. The role of UNOOSA's Regional Support Offices, with the mission to help countries access and develop space capacities to support disaster management cycle, was also described.		

Space for emergencies and health

Ms. Annalaura Di Federico, Ms. Lucia Luzietti	e-Geos	Copernicus Emergency Monitoring Service for COVID-19
Ms. Luzietti explained the role of geo-information products, such as maps, in supporting civil protection and humanitarian affairs, including prevention, preparedness and reaction to human-caused and natural disasters. The most important task is to provide information based on satellite imagery during emergency 24/7 service. One of the examples used was the detailed cartography products that can provide updated views of a city and its evolution in a short time allowing users to apply accurate measurements to estimate maximum capacity of places. Users can integrate maps with additional geo layers to plan activities correctly. Another example used was on mobile infrastructure where continuous census of installed infrastructure and its merger with population data tells us about the level of usage and allow modeling of expected use and better design for the phases of economy re-opening. Ms. Luzietti also talked about the implications of lockdowns on cross-border travel and supply chains and the use of satellites help alleviate the situation by monitoring vehicles in almost real time. She also dedicated the time to describe past uses of Copernicus such as monitoring the Ebola epidemic West Africa or the phytosanitary emergency in Italy where monitoring plants affected by the bacteria helped to stop the spread.		
Mr. Abhineet Jain Global Industry Business Development (Civil Government & Environment)	MAXAR, Singapore	Imagery & Earth Intelligence for Crisis Response
Mr. Jain introduced the work of MAXAR and its satellites out of which some provide critical communications to governments, TV, radios, first responders, as well as enable tele-medicine and tele-work as one of the unique applications of SatComs. Maxar also has 4 very high-resolution imaging with future next generation constellation WorldView Legion with even better resolution. The new constellations will be able to provide imagery on 5 million km^2 every day. Mr. Jain argued that the current pandemic has further underlined the value of global transparency and that Maxar has helped in improving it by monitoring rapid construction of hospitals, movement of cruise ships or the work of the businesses around the world. He also explained how satellites can help locate remote populations and understand their growth and development, reach them, understand how they are affected by crisis or disasters and how resilient they are. Satellites can be very well used in emergencies and are also great for mapping human landscape. Open data is an integral part of the global response to emergencies such as the COVID-19 crisis. In the interest of public/private cooperation, Maxar has been releasing data of affected areas to help the response – imagery of 19 cities was released and the link is available in the Presentation.		
Mr. Giriraj Amarnath Research Group Leader: Water Risks and Development Resilience	International Water Management Institute (IWMI), Sri Lanka	EO to monitor the impact of COVID-19 situation on agriculture and food security
Mr. Amarnath used his time to elaborate on the use of space for monitoring the impact of COVID-19 on food security and water risks. The implications of the crisis on the sector are very significant as agriculture itself as well as its supply chains have been disrupted across the globe. One of the most important use is the understanding of the crop land areas telling farmers what and when is ready to harvest as the best means to try to avoid		

losses. In rural areas, the harvesting period has been impacted heavily by the lockdowns causing local scale impacts on economy as well as food security. Innovation in space technology provides a good way to bridge the gap between end-users and challenges that COVID-19 crisis is causing. He argued that we need to do today is not only look at the current emergency as a threat but also as an opportunity for new investments and proactive enabling policies. Satellites have helped to make harvesting more efficient and served as a monitoring tool for policy reach. The analysis contributes to climate action as in the coming months the rich data can help the authorities to provide farmers with best-practices and advice on cultivation and climate information, as well as to provide insurance and financial instruments. Thanks to use of space infrastructure the value chain companies are also better able to reach farmers to procure goods, ensuring that perishable products will not get lost. Mr. Amarnath also spoke about the recommendations for managing climate disasters concurrently with COVID-19. There is a strong need for data to be available and utilized as widely as possible and hence he called for more interaction.

Ms. Astrid-Christina Koch Senior Expert	European Commission	Copernicus Services Initiatives for COVID-19

Ms. Koch presented the operational products developed through the Copernicus Atmosphere Monitoring Service (CAMS) and the Climate Change Service (C3S) for making informed decisions. Copernicus Sentinel data and services provide free and open data policy for all. There has been an increased interest in monitoring air-quality due to the COVID-19 crisis. E.g., a recent visual product shows daily forecast on NO2 under the business-as-usual as compared to the current restriction situation due to COVID-19 crisis allowing comparisons between the two scenarios. CAMS currently contributes to a number of epidemiological studies, which aim to identify the link between air pollution and COVID-19. She also explained the use of the dedicated website with the available data and touched upon the correct use of the data. The C3S helps understanding the effects of temperature and humidity on the virus spread coupled to the mortality data. The products of CAMS are getting integrated with C3S to combine the different layers and achieve a better understanding of the links between the pollution and disease outbreak.

Mr. Aravind Ravichandran Senior Consultant, PwC Space Practice	PwC	Leveraging Data from Space for Impact Assessments and Policy Making during

Mr. Ravichandran talked about space for crisis management, economic impact assessment and space for crisis recovery and policymaking. Leveraging on data from satellites combined with other sources of data is relevant for managing COVID-19 crisis, around the world but especially in developing countries. He also described some specific uses of space infrastructure and its application to the current exceptional situation. Satellites help us identify human settlements and their density, which is particularly useful in places where this has not been documented sufficiently in the past. Segregated data tells us a lot about where to go to carry out testing, send help and medical equipment, or first responders. From space, we can also monitor industries to assess the economic impact – e.g. in aviation thanks to GNSS you can understand, among other indicators, how many jets are in the air and where they are heading. Geolocation and EO can help in lockdown easing – those measures can be planned and monitored continuously.

Space applications for health

Ms. Ana Cristina Galhego Rose Founder & CEO	DIPTERON UG	Space Application for Detecting Aedes Mosquito Risk Areas
Ms. Galhego Rose presented on the use of space applications for detecting Aedes mosquito risk areas - an application from a start-up established in 2017 as the incubation of ESA. Dipteron combines both satellite and ground data which can be used in combination with Artificial Intelligence to create prediction models about risky areas – in principle, serving as early warning system. This is due to the fact that mosquito breeding depends on climate and environment conditions. Mitigation actions can be taken more swiftly reducing costs and time. Satellites can provide advance localization of outbreaks, visualization of potential breeding sites and access the number of cases in certain areas. Dengue, Zika, Chikungunya represent 40% of diseases in the world and cause over 50 million infections a year. Today, there is an additional layer of difficulty as COVID-19 symptoms resemble those from Zika, making it harder to distinguish cases without testing. In Brazil, these diseases both culminate at the time, complicating response to the outbreak of the new coronavirus. Ms. Galhego Rose also highlighted the benefits of EO for Health, and benefits in when EO is combined with AI.		
Mr. Alberto Fernandez-Wyttenbach Market Segment Leader – Road Transportation & Automotive	European GNSS Agency (GSA)	Galileo Green Lane: reducing the impact of COVID-19 in the transport of critical goods across borders
Mr. Fernandez-Wyttenbach presented on the role of the EU's Galileo in reducing the impact of COVID-19 in the transportation of goods across borders. The EU is an organization bringing together 27 Member States with an open economy and free movement of goods, among other freedoms. Currently, these freedoms are limited due to Covid pandemic and this represents a challenge for the European economy. Galileo monitors 187 border crossings across the EU and an App Galileo Green Lane was created to monitor the green lanes created for facilitating cross-border travel. This solution was developed together with start-up Sixfold hence it is also directly supporting the development of European industry. The app has two interfaces. One interface is for border authorities to offer real time visualization of the overall border situation and make reports on waiting time and traffic flow, and to predict patterns. It was already successfully tested in two countries. The drivers interface allows drivers to update the map to validate the official reporting. Data from 80 different crossings in 15 countries has been collected so far. Everything in the application is crowdsourced which allows for visualization and consequent analytics of data.		
Mr. Jason Hatton *Science Coordinator for Biology and Environmental Monitoring Science*	European Space Agency (ESA)	ESA activities in support of Global Health
Mr. Hatton described in general the ESA's activities relating to Global Health touching upon several programmes across various directorates. Earth Observation data and products in ESA are widely used for supporting the achievement of the Sustainable Development Goals, helping in Official Development Assistance, environment monitoring and safeguard, as well as measuring and monitoring progress of SDGs. Among the most relevant focus areas in ESA are disaster management, climate change		

and determinants of health. He also talked about terrestrial application of human spaceflight research and technology together with Spin in and Spin out of human space exploration. Research on human body and physiology in space helps in the optimization of physical exercise, healthier diet and living overall. The technology development has led to many new/improved technologies such as water treatment and purification, tele-medicine and e-health, as well as air and water monitoring from space.		
Ms. Rita Rinaldo *Head of the Institutional Projects Section, Downstream Business Applications Department*	European Space Agency (ESA)	ESA activities in support of Global Health
Ms. Rinaldo presented how has ESA specifically supported the response to COVID-19 outbreak through stimulating the development of applications in a variety of sectors. Three Tender Actions were started by ESA Business Applications to demonstrate projects for healthcare or education. Over 130 proposals were submitted addressing a variety of topics such as distance learning, social care, support for medical operations, telemedicine, and epidemiology (full list available in the Presentation). She also explained the successful past project of ESA called the Biological Light Fieldable Laboratory for Emergencies (B-Life). Ms. Rinaldo also elaborated how ESA aims to help the society in the post-COVID-19 recovery period. Currently, a study is underway for issuance in June to identify how space can help mobility, transport, aviation and other affected sectors in the era of "new" normal. She invited stakeholders to get in touch and participate.		

Afternoon session

UNOOSA and Space 4 healthy life and global well-being

Mr. Antoine Geissbühler Vice-rector, University of Geneva Director, division of eHealth and telemedicine, Geneva University Hospitals	Chair, STSC Working Group on Space and Global Health	Intergovernmental activities of the STSC Working Group on Space and Global Health
The Scientific and Technical Subcommittee of COPOUS has established a Working Group on Space and Global Health. The group is concerned with the domains of telemedicine, telehealth, disaster and health emergency management, and space life sciences to assess the question: How can space applications increase our ability to respond to global health issues? A multi-year workplan started last year, national points of contact have been established, and a questionnaire has been sent to collect information about the development of a global platform to share information, best practices, and capacity building resources in the area of space and global health. The group also has a wiki to gather information and open educational resources. Going forward, the group wants to have more engagement from public health and medical experts in the scientific and technical subcommittee and plans to develop a knowledge sharing platform to strengthen the links between the space and global health domains. In June, a virtual meeting will be held on space, global health, and lessons learned from the COVID-19 pandemic to also look forward to recovery efforts.		
Mr. Jorge del Rio Vera Programme Officer, SAS	UNOOSA	SAS
Space is one of many solutions that can be applied to address global challenges, including health. Fundamental research is important to advance any field, including space for health applications. Microgravity offers a unique environment to research health-related issues and to develop medicines and vaccines. UNOOSA cooperates with the China Manned Space Agency and the Center of Applied Space Technology and Microgravity to allow teams from across the world to conduct research in microgravity. Astronauts dealing with health issues in space also provides applicable lessons for Earth. For example, astronauts use tele-health technology to communicate with medical professionals on the ground. Additionally, Global Navigation Satellite Systems (GNSS) have a role in addressing in the current COVID-19 pandemic. Applications include contact tracing, locating those who have tested positive, identifying risky locations, helping in the adoption of policies by understanding mobility, and also monitoring the environmental factors of the lockdown measures and spread of the disease.		
Mr. Radu Botez	UNOOSA	UN-SPIDER
Space-based information has applications to address the spread of coronavirus. Of particular use are geospatial data to demarcate hot spots, and the daily use of GIS to track and control the outbreak. UN-SPIDER, the dedicated disaster management programme of UNOOSA, is at the forefront of disaster management. The core activities of UN-SPIDER are: technical advisory, capacity building, knowledge management, fostering cooperation. Currently, UN-SPIDER is focusing on knowledge management for COVID-19. The group has a		

portal with space-based information and technologies for responding to the pandemic. The portal has regular updates and background information about tools and techniques for using space-based information for health applications and is also accepting relevant submissions.

Space for emergencies and health

Ms. Annalaura Di Federico Ms. Lucia Luzietti	e-Geos	Copernicus Emergency Monitoring Service COVID-19
(see presentation from morning session)		
Mr. James Hagen Professor Emeritus, Saint Xavier University, Chicago Public Health and Emergency Management	St. Xavier College	Space-Related Aspects of Disease and Pandemics
Space technologies can be used to better understand and address infectious disease. There is linkage between climate change, environment, and the emergence of novel microorganisms. To understand the full picture, there is a need to have effective design and synthesis of information linking measurable aspects of disease, including its rise, progression, and resolution. This applies to COVID-19 – in many ways the current assessment of COVID-19 can be framed as a data and information problem. In order to analyze and understand the situation, we need to: track and measure infected individuals, track modes of travel, effect of lockdowns, population movements, where are cases and deaths, space technologies can help with these needs. Use of data will enable better understanding of this outbreak and future outbreaks. A major challenge is to integrate all the disparate datasets, and to rapidly identify hotspots. Technology will also be needed to track the use and effectiveness of treatments.		
Mr. Talbot Brooks Director and Professor of the Practice, Center for Interdisciplinary Geospatial Information Technologies, Delta State University	Delta State University	Know Your Audience: Presenting Geospatial Data and Cognitive Bias
Mr. Brooks discussed the need and usefulness of data standards, particularly as they relate to geospatial data. There are three areas of concern that impact decision makers and users of space-based data: • Standards development which enable access and distribution of data, • Communication processes which identify audiences and account for cognitive bias		

- Integrative processes which facilitate approaches to larger scale problems.

Data standards must cover exchange of data, completeness, quality, application area, and format of data. Standards should be driven by standards community and by participants using a consensus driven approach, standards should be registered, and should be advertised.

Cognitive and communication biases must be considered when developing maps and using geospatial data – different message can be unintentionally (or intentionally) emphasized when displaying data. Interdependencies of critical infrastructures can be understood through different data sources. This has implications for monitoring COVID-19 effects: how illness will affect food supply, transportation, energy, etc. It is useful to integrate all this information to tell a larger story.

Ms. Astrid-Christina Koch Senior Expert	European Commission	Copernicus Services Initiatives for COVID-19
(see presentation from morning session)		
Ms. Rhiannan Price	MAXAR	Imagery & Earth Intelligence for Crisis Response
(see presentation from morning session)		

Space applications for health

Mr. Alberto Fernandez-Wyttenbach Market Segment Leader – Road Transportation & Automotive	European GNSS Agency (GSA)	Galileo Green Lane: reducing the impact of COVID-19 in the transport of critical goods across borders
(see presentation from morning session)		
Mr. John Haynes Program Manager, Health and Air Quality Applications	NASA	Utilizing Earth Observations for Improved Air Quality and Health Decisions
NASA utilizes its fleet of 20+ satellites and sensors in low-Earth orbit to continuously monitor Earth's weather, climate, and environment for research and applications purposes. Data collected by these satellites are free and available globally. Three satellites and their instruments were discussed in Mr. Haynes' presentation:		

1. The MODIS instrument onboard NASA's Terra and Aqua satellites: MODIS is a spectroradiometer that observes the Earth in over 30 wavelengths of the electromagnetic spectrum. One of the instrument's products is aerosol optical depth, which can be used as a proxy to assess concentrations of PM 2.5.

2. The Ozone Monitoring Instrument (OMI) onboard NASA's Aura satellite: This instrument monitors global ozone, NOx, and SOx.

Aura/OMI and ESA TROPOMI instrument data revealed large decreases in NO_2 emissions in areas where COVID-19 mitigation measures were introduced. Ongoing observations of air quality have helped provide immediate examples of how Earth's systems are responding to these unprecedented changes in human behavior, including reduced transportation, manufacturing, and other forms of economic activity.

The NASA OMI team created a portal to provide scientists an easy way to compare 2020 satellite NO_2 observations to the 2015-2019 average for the same 14-day period: https://so2.gsfc.nasa.gov/no2/no2_index.html. In addition, NASA, JAXA, and ESA are developing a tri-lateral COVID-19 dashboard which will include pertinent environmental and socio-economic datasets. Mr. Haynes also discussed the upcoming launch of the TEMPO satellite to GEO in 2022, which will provide hourly observations of ozone, NO_2, and formaldehyde.

Ms. Helena Chapman Associate Program Manager, Health and Air Quality Applications	NASA	Using Earth Observations to Strengthen One Health Collaborations

Ms. Chapman discussed the One Health concept, which describes the interconnectedness between humans, animals, and the environment and promotes transdisciplinary collaborations to address complex global challenges. Using this holistic approach, scientists can strengthen communication across sectors, enhance disease surveillance programs, and develop innovative initiatives to mitigate risk to human, animal, and environmental health. One example is the use of Earth observations for public health applications to develop a malaria early warning system in the Peruvian Amazon region. In this project, NASA Land Data Assimilation System data sets were combined with public health data to identify malaria hot spots. As researchers developed and validated models to predict malaria outbreaks weeks ahead of time, this information can be used to help with coordinating and enacting public health responses and policy. This novel research application advances scientific discovery, bridging Earth and health science disciplines. Ms. Chapman described the Group on Earth Observations Health Community of Practice, as a global network of scientists, researchers, and practitioners who use Earth observation data to improve health decision-making. More recently, this group has leveraged expertise across sectors and geographies to share Earth observation data, tools, and knowledge to support the COVID-19 response.

Mr. Leon Alkalai	JPL	An Overview of the NASA/JPL Ventilator Design in response to the COVID-19 Pandemic

Mr. Alkalai's presentation discussed the VITAL ventilator project at JPL. Responding to the COVID-19 pandemic, JPL engineers worked to design a new ventilator that can be quickly built using fewer parts. This project was undertaken to address the predicted ventilator shortage, and disruptions in supply chains that would affect what kinds of

parts would be available. The ventilator that was designed by the team used only parts that could be found readily in the supply chain during the pandemic, and particularly those part which would be able to be obtained at hardware stores and non-specialized locations. The ventilator was tested in collaboration with hospitals in the United States and has now received FDA approval to be used.