AARSE

African Association of Remote Sensing of the Environment
Association Africaine de Télédétection de l'Environnement

NEWSLETTER • JUNE 2019

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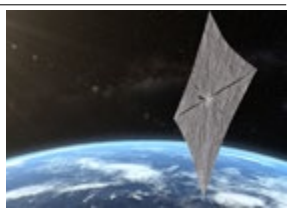

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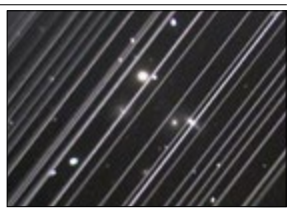

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From the Editor

Soon we will see thousands of satellites taking to the sky. Where we previously only had a hundred odd launched every year this figure will increase more than ten fold over the next few years, all in the name of providing broadband internet access to everyone on Earth.

While private companies are trying to outdo each other in yet another ground-breaking satellite-launch announcement it seems that no one has an idea of the big picture. Where are we going with all of this?

No wonder more and more voices of concern are being heard. We know that there are literally hundreds of thousands of pieces of space debris in low-Earth orbit. Incidents of satellites or objects colliding in space are reported regularly. The fear is that by adding thousands more satellites into this seemingly overcrowded space it would increase the probability of collisions.

Some theorists suggest that we're on the brink of kickstarting the Kessler syndrome which states that when two colliding objects in space scatter fragments it could cause even more collisions in an ever growing cascade. This could make low-Earth orbit a dangerous zone and seriously hamper space exploration.

The latest voice of concern which we report on in this issue comes from no less than the International Astronomical Union (IAU) which represents astronomers in more than 100 countries worldwide. Their main concern has more to do with polluting the night sky with light and interfering with radio frequencies which could affect astronomical observations and even potentially nocturnal life on Earth.

They also make a very valid point in that we have entered uncharted territory and do not yet understand the effect that satellite constellations might have and therefore suggests a regulatory framework to control space exploration worldwide.

It seems that the IAU's suggestion that, "all stakeholders in this new and largely unregulated frontier of space utilization work collaboratively to their mutual advantage" should be taken seriously..

Anthony Penderis
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10 Reasons why you should become an AARSE member

1. You can make a bigger impact on remote sensing in Africa through the Association;

2. You are joining a dynamic and respectable organization founded in 1994 which has received the recognition and support of numerous international organizations;

3. By being a member of AARSE, you can get reduction in membership fees to many organizations and direct access to their publications;

4. AARSE strives to address remote sensing policies and research directions in Africa. By being a member, you can be a part of this important voice;

5. You can attend biennial AARSE Conferences at a reduced rate (or even sponsored in some cases) and also participate in the planning of AARSE events;

6. By becoming a member, you might be able to get the AARSE-IEEE/GRSS Travel Fellowship Award to attend their conferences;

7. If you are an expert in technical remote sensing topics you can join our Technical Program Committee and assist with workshops and training activities;

8. You can utilize the resources provided by AARSE (on remote sensing, GIS and ICT education and training) offered through the courtesy of its partner organizations;

9. Quite often, AARSE suggests and promotes individual members as well as national/ regional members to sit in, or collaborate with, international fora;

10. Other benefits of AARSE Membership include subsidized subscription to the future AARSE Journal of Geoinformation and journals of its partner organisations.

See more at http://www.africanremotesensing.org/Why-Join-AARSE

Sign Up Now for AARSE Membership

You can select your membership level from one of the following: **Student Membership; Regular Membership A (residing inside Africa); Regular Membership B (residing outside Africa); SMME Membership; SMME with ARSGC; Corporate Membership; Corporate with ARSGC Membership**

See selection and payment options at the following links:

http://www.africanremotesensing.org/page-1512797

http://www.africanremotesensing.org/Membership-Payment-Options

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The AARSE Newsletter is an official publication of the African Association of Remote Sensing of the Environment. During the year 2019 it will be published at least six times starting February 2019 and thereafter every second month until December 2019.

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Message from the President

Dear Readers

With the editorial team, I am pleased to once again invite you to learn about some developments in the world of scientific activity and remote sensing in Africa and around the world in this June 2019 edition of the AARSE Newsletter.

This past month I had the privilege to attend the third convention of the African Space Stakeholders Dialogue held in Dakar, Senegal. It was a gathering of heads of African national space agencies, representatives of regional economic communities and experts from the academia and private sector convened by the African Union Commission.

It was the third series of annual space dialogues convened by the Commission to steer intra-African engagements among institutions, and update the community on the milestones of implementing the African Union's Space Policy and Strategy. It has emerged as an important convention to facilitate a harmonized African position in the global space arena.

High up on the agenda was of course the programmatic initiatives that the African Space Agency should prioritize as an organ of the African Union and to be hosted by Egypt. This Agency is destined to become a critical institutional arrangement for an inclusive architecture of an African outer-space program to implement the AU's Space Policy and Strategy.

All in all it was reassuring to hear the Director of HRST at AUC, Dr. Mahama Ouedraogo's opening remarks that we as Africans should all embrace the common goal of ensuring that space services are utilized to improve the lives of the African citizens. Dr. Ouedraogo also noted that as we move forward, some processes may take time because they are inclusive, and the commission endeavors not to leave anyone behind. He further encouraged all stakeholders to work in tandem to reach the final goal of ensuring that the continent is technologically competent.

It is indeed a privilege to be part of a greater movement with the ultimate goal of improving the lives of others.

Good Reading

Prof. Kamal Labbassi
AARSE President
2018 - 2022

Members of AARSE Council (2018 - 2022)

Name	Role	Term of office
Prof. Kamal Labbassi	President	2018 - 2022
Mahamadou Keita	Secretary General	2018 - 2020
Dr. Abel Ramoelo	Treasurer	2018 - 2022
Dr. Souleye Wade	Communications	2018 - 2022
Mahamadou Keita	Counsellor for West Africa	2016 - 2020
Prof. Islam Abou El-Magd	Counsellor for North Africa	2018 - 2022
Dr. Yazidhi Bamutaze	Counsellor for East Africa	2016 - 2020
Dr. Aboubakar Mambimba Ndjoungui	Counsellor for Central Africa	2018 - 2022
Dr. Solomon Tesfamicael	Counsellor for South Africa	2018 - 2022
Prof. Olajide Kufoniyi	Immediate Past President	2018 - 2022

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Dr. Sias Mostert	Trustee and Bank signatory
Prof. Peter Zeil	Trustee

African Space Industry Report 2019 now available

Space in Africa, the agency for news, data, and market analysis for the African space industry, has just released the African Space Industry Report– 2019 Edition. The report covers Africa's journey in space from 1998 through May 2019 and explains how the industry has already reached over USD 7 billion of annual revenues and is projected to grow at a 7.3% compound annual growth rate to exceed USD 10 billion by 2024.

Interesting facts that emerge from the report are inter alia that 35 African satellites were launched since 1998. From 1998 through May 2019, 32 satellites were launched into orbit by eight African countries: Algeria, Angola, Egypt, Ghana, Kenya, Morocco, Nigeria, and South Africa. In addition to the 32 national satellites, African institutions jointly funded three other satellite projects – RASCOM-QAF1, RASCOM-QAF1R, and New Dawn – for regional operations. Some 15 out of the 35 satellites were launched in the last four years, indicating the skyward growth rate at which Africa is embracing space technologies to power the continent's growth and improve the lives of its people. The diverse satellite programmes include 14 Earth observation satellites, 10 communications satellites, 8 technology demonstration satellites, a satellite for scientific experiments, an educational project satellite, and a military radar satellite.

Increasing private sector activity had over 8,500 people employed in the African space industry while the new African Space Agency will complement national space programmes while implementing the continental space policy stipulated under the African Union Agenda 2063. This policy looks to grow the industry with a combination of expertise and products from outside of Africa alongside the expansion of African capabilities to grow the industry for the good of all parties.

The report is available on www.africanews.space/report. For information on the report or more information on the African space industry, email info@africanews.space or call their Lagos bureau at +234-906-836-9665.

Competition offers sustainable solution opportunities for Africa's challenges

African entrepreneurs, scholars, companies and startups have a fabulous opportunity to create sustainable solutions for the continent's numerous challenges in the arena of climate, water, food security, maritime issues, forestry and urban planning through the Copernicus Masters 2019 Competition still open for submissions.

As the UN Sustainable Development Goals for these challenges can only be achieved with reliable, up-to-date information this mostly comes from satellites. The fact that all these data available from the ESA's Copernicus fleet of Sentinel satellites are not only reliable but also completely free of charge gives companies, entrepreneurs and startups many opportunities to create sustainable business concepts.

The Copernicus Masters 2019 is structured as a competition searching for outstanding applications, solutions, and business concepts from future-oriented SMEs, startups, universities and individuals in the fields of business, research, and higher education.

Together with cash prizes, challenge winners will receive access to an international network of leading Earth observation organizations, substantial satellite data quotas, and business development support worth more than EUR 450,000 in total. The Overall Winner will receive an additional cash prize of EUR 10,000.

Participants can demonstrate their innovative use of Earth observation data across a wide variety of challenge topics, including the fields of future EO, Artificial Intelligence (AI), machine learning, energy, health, sustainable living, smart farming, and digital transportation, as well as maritime, defence & security.

"Since 2011, the Copernicus Masters competition has evolved into the leading innovation platform for promoting user uptake of Earth observation data in a commercial, societal and sustainable context. Each year, it showcases new solutions and trends, serving as an integral part of an international EO innovation network," says Thorsten Rudolph, Managing Director of AZO, the competition organiser.

Participants in the Copernicus Masters 2019 can submit their innovative EO solutions to 7 challenges offered by the following list of partners in the competition: European Space Agency (ESA), the German Aerospace Center (DLR), Planet, BayWa, Airbus-sobloo and the German Federal Ministry of Transport and Digital Infrastructure (BMVI).

Below follows a short summary of the requirements for each section in this competiion.

ESA Copernicus 4.0 Challenge
ESA is looking for solutions that reflect the upcoming "golden era" in Earth Observation by demonstrating how new trends in EO can work together with the traditional EO satellites.

DLR Environment, Enery & Health Challenge
DLR is looking for innovative ideas that use EO data to drive the sustainable management of our limited natural resources and foster human well-being.

Planet 'See Change, Change the World' Challenge
Planet is looking for new solutions that solve important sustainable development challenges faced by today's population.

BayWa Smart Farming Challenge
BayWa is looking for innovative solutions that use new technologies, ideas and products to support sustainable agriculture.

Airbus-sobloo Multi-Data Challenge
Airbus and sobloo are looking for solutions that use both Sentinel and Airbus EO data to deliver value-added services for specific communities and markets.

BMVI Digital Transport Challenge
BMVI is looking for solutions that use Copernicus data to solve major challenges faced by transport systems today.

Social Entrepreneurship Challenge
The Copernicus Masters Social Entrepreneurship Challenge is looking for solutions using Copernicus data that solve social, cultural, or environmental issues and generate a positive return to society.

The deadline for submissions this year is 30 June 2019. For more information and registration to take part visit their website at https://www.copernicus-masters.com.

Winners Copernicus 2018
On 4 December 2018, the "Space Oscars 2018" – the festive Awards Ceremony of the Copernicus Masters – took place in front of an international audience during the EU Space Week 2018 in Marseille, France. A total of 16 business cases and Challenge winners were recognized during the Awards Ceremony by high-ranking industry and institutional representatives. Image www.copernicus-masters.com

International Space Conference Diary 2019

We have assembled the details of the most important international and African conferences in the arena of remote sensing, satellites and geotechnical applications scheduled during the next few months. Please visit their individual website for more information on submission criteria for papers, deadlines for registration, etc.

Satellite 2019
July 18- 19, 2019;
Valencia, Spain
http://satellite.alliedacademies.com

This conference creates a platform for the globalization of research through dialogue between industries and academic organizations on how to transfer knowledge from research to industry. Events include hot topics presentations from all over the world and professional networking with industries, leading working groups and panels.

SA GeoTech Conference
July 22 – 23, 2019; Ekurhuleni, South Africa
www.ee.co.za

The conference and exhibition will bring together leading thinkers and doers around the theme 'Geo-tech to drive new business opportunities and economic growth.' It seeks to promote geospatial solutions and professionals.

Small Satellite Conference
August 3 - 8, 2019; Logan, Utah
www.smallsat.org

The 33rd AIAA/USU Conference on Small Satellites aims to explore the technical issues, development considerations, and new opportunities that result from an ever-growing trend toward missions using small satellites. Mr. Greg Wyler OneWeb founder will be the keynote speaker.

RCMRD International Conference
August 14 – 16, 2019; Nairobi, Kenya
rcmrd.org/ric2019

The 3rd RCMRD International Conference will have the theme 'Earth Observation for Evidence-Based Decision Making'. Their mission is to promote sustainable development in the member states through geo-information technologies.

HEASA 2019
August 28 –30, 2019;
Swakopmund, Nambia
https://fskbhe1.puk.ac.za

Hosted by the University of Namibia the goal of this conference to bring together scientists from the southern African region, the African continent, and around the world with an interest in high-energy astrophysical phenomena. The deadline for registration and abstract submission is on August 4, 2019.

Copernicus Hackleton
October 11-13, 2019; Bari, Italy
https://hackathons.copernicus.eu

The Humans To Mars Summit (H2M) is to advance humanity to the Martian surface by the 2030s. Keynote speakers will include NASA Administrator Jim Bridestine and the 'Second Man on the Moon' Buzz Aldrin.

IAC 2019
October 21-25, 2019;
Washington DC, USA
http://www.iafastro.org

Hosted by the American Institute of Aeronautics and Astronautics this 70th International Astronautical Congress is possibly the largest gathering of space professionals. It promises an intense week with to discuss the advancement and progress of space and celebrate 50th anniversary of the moon landing.

Africa Geospatial Data/Internet Conference
October 21 – 25, 2019; Accra, Ghana
www.afrigeocon.org

The Conference serves to bring people together from various stakeholder groups as equals and to facilitate a common understanding of how to maximize geospatial and Internet opportunities in Africa and address risks and challenges.

AfricaGIS 2019
November 18 - 22, 2019; Kigali, Rwanda
www.eis.africa/africagis-2019

The largest Geospatial, Science and Technology conference on the African Continent held every two years. It explores the role of innovations in geospatial information and its implication in addressing the 17 targets of the Sustainable Development Goals for Africa.

Report back GMES & Africa Continental Workshop 1 on Water and Natural Resources, 6-10 May 2019, Dakar, Senegal

By Dr Souleye Wade (CEO African Institute of Geomatics, Senegal and AARSE Communications Manager)

The Africa Union Commission had convened the first workshop on Water and Natural Resources from 6-10 May 2019 in Dakar, Senegal. All the consortia leading the implementation of the GMES & Africa Water and Natural Resources service were invited, together with partners, Regional Economic Communities and organizations, and European Technical Institutions among others.

The objectives of this particular workshop were :

1. To discuss and provide solutions on the technical issues on the four pillars of GMES & Africa:

a) Infrastructure and Data
b) Products and Services
c) Training and Capacity Development
d) Outreach, Awareness and Engagement

2. To identify cross-fertilization mechanisms among the consortia.

Participants in the workshop came from:

1. Representatives from the 9 Consortia in charge of the implementation of the water and natural resources Service
2. Representatives of the 5 RECs
3. The African regional organizations AfDB, Africa-Connect, AARSE, etc.
4. International organizations UN Agencies, World Bank, USAID, WRI, etc.
5. GMES & Africa Project Management Unit and AUC Departments
6. European Partners DG-GROW, ESA, EUMETSAT, JRC, etc.
7. EU Delegations

Attending the workshop, from right to left: Dr Souleye Wade (CEO African Institute of Geomatics, Senegal and AARSE Communications Manager), Dr Jane Bemigisha (Executive Director, ESIPPS International Ltd, Uganda), and Dr Charles Paradzayi (Managing Director at GISkonsult Plc, Zimbabwe).

The workshop was a success.
In their in-depth and fruitful discussions, participants were able to provide relevant answers to key questions relating to (i) Infrastructure and data ; (ii) Services; (iii) Training and capacity development ; and (iv) Outreach and engagement.
Now consortia are expected to run un-interruptible services and reach the objectives of the project.

There are currently 9 Consortia implementing GMES & Africa Water and Natural Resources Services as illustrated in this diagram.

NO.	CONSORTIA	THEME	*APPLICATIONS*
1.	RCMRD	Water and Natural resources	*Land degradation monitoring and assessment*
			Wetlands Monitoring and Assessment
			Open Geographical Regional Reference Vector Database (~1:1M scale) for water and agro-ecological zonings
2.	CICOS	Water and Natural Resources	*Water level monitoring for river navigation*
			Monitoring the hydrological balance of the sub-basins of the Central Africa region
			Monitoring of the dynamics of the flooded areas under forests of the Central Cuvette
3.	CSC	Natural Resources	*Riverine Floods Monitoring and Assessment*
			Pasture Seasonal Monitoring, Early Warning and Assessment
			Wildfires Seasonal Monitoring, Early Warning and Assessment
			Agriculture Seasonal Monitoring, Early Warning and Assessment
4.	ICPAC	Natural Resources	*Natural Habitats Monitoring and Assessment*
			Tropical Forest Surveillance, Monitoring and Assessment
			Agriculture Seasonal Monitoring, Early Warning and Assessment
			Rangeland Seasonal Monitoring, Early Warning and Assessment
5.	SASSCAL	Water	*Wetland Monitoring and Assessment*
6.	CSSTE	Water	*Riverine Flood Monitoring and Assessment*
7.	AGEOS	Natural Resources	*Forest Monitoring and Assessment*
8.	OSS	Water	*Water Abstraction Surveillance, Monitoring and Assessment in Irrigated Areas*
			Water Abstraction Surveillance, Monitoring and Assessment in Irrigated Areas
			Water Abstraction Surveillance, Monitoring and Assessment in Irrigated Areas
9.	CSE	Water	*Water Resources Monitoring and Assessment*

REGIONAL CENTRE FOR MAPPING OF RESOURCES FOR DEVELOPMENT

In our series Discovery of an African Space Institution in this issue we focus on the Regional Centre for Mapping of Resources for Development (RCMRD) based in Nairobi, Kenya.

Discovery of an African Space Institution

By Dorah Nesoba: Communications and Outreach Expert (RCMRD)

The need for a regional cartographic centre was first mooted at the first United Nations Cartographic Conference held in 1963 in Nairobi, Kenya. The eighth session of United Nations Economic Commission for Africa (UNECA) held in Addis Ababa in 1964 called for the creation of regional centres for training in photogrammetry, photo interpretation and airborne geographical surveys.

GC Chair Ms. Elizabeth Bonolo Khumotaka PS Min of Land Management, Water and Sanitation Services doing a tree planting ceremony at the new complex construction site.

The Centres are: The Regional Centre for Training in Aerospace Surveys (RECTAS) now African Regional Institute for Geospatial Science and Technology (ARIGST) established in 1972 in Nigeria for West Africa; the Regional Centre for Services in Surveying, Mapping and Remote Sensing (RCSSMRS) now The Regional Centre for Mapping of Resources for Development (RCMRD); established in 1975 housed in Kenya for Eastern and Southern Africa and in North Africa is the African Regional Centre for Spatial Sciences and Technologies (CRASTE: Centre RÈgional Africain des Sciences et Technologies de liEspace), (MAGHREB countries) established in 1998 and based in Morocco.

The Regional Centre for Services in Surveying, Mapping and Remote Sensing (RCSSMRS) was established in 1975 in Kenya under the auspices of UNECA and the then Organisation of African Unity (OAU) now African Union (AU). The founding members were Uganda, Kenya, Somalia, Tanzania and Malawi.

In 1987 RCSSMRS became The Regional Centre for Mapping of Resources for Development (RCMRD) with 14 contracting members States (Botswana, Comoros, Ethiopia, Kenya, Lesotho, Malawi, Mauritius, Namibia, Somalia, Sudan, Swaziland, Tanzania, Uganda, Seychelles and Zambia). RCMRD is an inter-governmental organization and currently has 20 contracting member states in the Eastern and Southern Africa Regions; Botswana, Burundi, Comoros, Eswatini, Ethiopia, Kenya, Lesotho, Malawi, Mauritius, Namibia, Rwanda, Seychelles, Somali, South Africa, South Sudan, Sudan, Tanzania, Uganda, Zambia and Zimbabwe. The affiliated non-contracting member states are: Angola, Djibouti, Democratic Republic of Congo (DRC), Eritrea, Mozambique and Madagascar.

The main objectives of the Centre are: surveying and mapping including aerial photographs, photogrammetry, photo-interpretation, geodesy, remote sensing, calibration and maintenance of surveying and mapping equipment. Its mission was extended to the promotion of development, application and dissemination of geo-information for sustainable development in Africa. In 2018, the mission was revised to strengthen the member states and stakeholders capacity through Generation, Application and Dissemination of Geo-information and Allied Technologies for sustainable development."

This Centre whose mission has emerged and adapted to reach: resource mapping and environmental management, engineering services, human resources development and management continues to be a great African Centre involved in the African Geodetic Reference Frame (AFREF) as forefront of its implementation. It carries more than 18 projects in many domains (spatial data, GIS application, Environmental Impact Assessment (EIA) among others).

The recent programs approved based on 2020 vision are being reformulated as follow: Resource Mapping, Remote Sensing and Environmental Management, Engineering Services, Human Resources Development and management.

This year (2019), the AfriGEO Secretariat moved from South Africa to Kenya and is now hosted by the Regional Centre for Mapping of Resources for Development (RCMRD) in Nairobi, Kenya. Formerly known as AfriGEOSS, the initiative has been rebranded as AfriGEO to better reflect the initiative's role as the regional GEO community in Africa. The move followed a recommendation of the fourth AfriGEO Steering Committee meeting, held in Gabon in June 2018.

RCMRD, established in Nairobi in 1975, is an intergovernmental organization with

member States in Eastern and Southern Africa. Its programs focus on sustainable applications in the management of natural resources, infrastructure and the environment using Earth Observations technologies, making it an appropriate host for the AfriGEO Secretariat.

AfriGEO is the Group on Earth Observations (GEO) regional initiative in Africa. The Pan-African initiative serves as a framework for coordinating and strengthening partnerships within Africa, and as a gateway to Africa for international partners. AfriGEO contributors include 27 Member governments and nine Participating Organizations, while GEO as a whole has 105 member governments and 127 Participating Organizations. RCMRD is one of the nine Participating Organizations.

The new AfriGEO Secretariat will aim to strengthen connections with GEO's global partners, and expand regional engagement. The Secretariat will play an important role in ensuring increased awareness and use of Earth observation data in Africa, promoting long-term capacity development, and driving contributions to global, regional and African priorities including the Sustainable Development Goals and the African Union Agenda 2063.

Allocated funding under AfriGEO will support Earth observation applications, ensuring access to data and developing capacity. Priority will be given to supporting collaborative projects that improve food security and agriculture, sustainable urban development, water resource management, sustainable forest management, climate services and adaptation, the coordination of data infrastructure initiatives in Africa, and the mobilization of financial and in-kind resources.

GC Chair Ms. Elizabeth Bonolo Khumotaka PS Min of Land Management, Water and Sanitation Services visits the RCMRD new complex construction site.

Communication and outreach will raise awareness on the many uses of Earth observations, networking and resource mobilisation opportunities, and calling for proposals that addresses critical gaps in priority areas.

The Secretariat will keep an updated database of national and regional institutions with Earth observation activities, and work to increase national and international collaboration in AfriGEO. This will include the development of applied and experimental technology and training initiatives in the region, with a particular focus on youth, women and small, medium and micro-enterprises. The Secretariat is also responsible for the annual AfriGEO Symposium. This year, RCMRD will host the third RCMRD International Conference (#RIC2019) alongside the fourth AfriGEOSS symposium under the theme Earth Observation for Evidence-Based Decision Making from August 13 to 16, 2019. (http://ric2019.rcmrd.org/).

Besides offering satellite-based services, RCMRD provides training to its member states on the following space-related disciplines; Remote Sensing (RS) & Satellite Image Processing/Interpretation; Geographic Information Systems (GIS) & Global Positioning/Navigation Systems (GPS); Geo-spatial Database Development and Management; Integrated Water Resources Management and Land Information Management Systems.

RCMRD through one of her long running projects SERVIR-ESA (http://servir.rcmrd.org/) introduced an activity dubbed RCMRD Space Challenge targeting primary and secondary schools to enlighten and equip children in Kenya and RCMRD member States on some of the causes and drivers of climate change. This challenge leverages on a partnership between RCMRD, GLOBE Program [Kenya], the Kenya Space Agency 4HKenya and support from the Ministry of Education. The program is used to promote STEM and introduce students to practical Earth Science at an early age.

The Hon Kefentse C. Mzwinila RCMRD Conference of Ministers Chairperson and Minister Ministry of Land Management, Water and Sanitation Service Republic of Botswana (R) and RCMRD Director General Dr. Emmanuel Nkurunziza (L)

Morocco's Geo Observateur call for papers

The Royal Centre for Remote Sensing in Morocco (CRTS) annually publishes a scientific and technical review Geo Observateur which aims to concentrate useful information in the many fields of activities concerned by the remote sensing and geographical information systems and to promote it among managers, scientists and users.

The publication serves the remote sensing community with scientific and technical results on theory, experiments, and applications of remote sensing and geographic information systems. Brief papers reporting new observations, preliminary results, and experimental techniques are welcomed.

This review publishes articles which present results of thematic application or a specific study or a state of the knowledge in the use of remote sensing and geographical information systems in the area of Africa and Middle East.

Recommendations and guidelines for authors plus all abstracts of articles from past issues of the review are available on the website of www.crts.gov.ma. Please confirm your intention of publication layachi@crts.gov.ma. The next issue No 24 of Geo Observateur will be published in September 2019. Deadline for submissions is 31 July 2019.

Royal Centre for Remote Sensing in Morocco (CRTS)

Satellite Engineering Course for Managers offered in Cape Town

A two-week training course is on offer in Cape Town, South Africa for managers who want to successfully execute a space program or develop the space knowledge of their team by Africa's biggest private space company, Space Commercial Services (SCS).

The course also caters for engineers who want to understand the basic concepts of the space industry and anyone who has been out of the space industry for a while and needs a refresher.

The first week of the course covers compulsory modules in satellite mission, analysis and design; satellite systems design; as well as assembly, integration and testing. During week two there is an option to focus on electrical, software or mechanical aspects of small satellites.

SCS consists of two companies namely the Space Advisory Company (SAC) (www.spaceadvisory.com) which provides satellite programme and systems products, engineering consultancy and training solutions as well as SCS Space (www.scs-space.com) which provides satellite mission solutions and satellite systems.

For further information about the training programme contact Turcia Busakwe at turcia@spaceadvisory.com or +27 (0)21 300 0060.

Turcia Busakwe

One of the world's two fastest supercomputers to be based in Africa

Engineering design work has been completed on two supercomputers, one to be based in Cape Town, South Africa and the other in Perth, Western Australia to make up the Science Data Processor (SPD) of the Square Kilometre Project (SKA), the world's largest radio telescope. Designed to process the enormous amount of data produced by the SKA's telescopes they will distribute enough data per year to fill more than a million laptops.

"We estimate SDP's total compute power to be around 250 PFlops – that's 25% faster than IBM's Summit, the current fastest supercomputer in the world," said Maurizio Miccolis, SDP's Project Manager for the SKA Organisation in a statement.

An international consortium, led by the University of Cambridge in the UK, has designed the elements that will together form the "brain of the SKA". In total, close to 40 institutions in 11 countries took part in this 5 year project. SDP is the second stage of processing for the masses of digitised astronomical signals collected by the telescope's receivers, following the correlation and beamforming that takes place in the Central Signal Processor (CSP).

"It's been a real pleasure to work with such an international team of experts, from radio astronomy but also the High-Performance Computing industry" said Maurizio. "We've worked with almost every SKA country to make this happen, which goes to show how hard what we're trying to do is."

The role of the consortium was to design the computing hardware platforms, software, and algorithms needed to process science data from CSP into science data products.

"SDP is where data becomes information" said Rosie Bolton, Data Centre Scientist for the SKA Organisation "This is where we start making sense of the data and produce detailed astronomical images of the sky."

To do this, SDP will need to ingest the data and move it through data reduction pipelines at staggering speeds, to then form data packages that will be copied and distributed to a global network of regional centres where it will be accessed by scientists around the world.

Prof. Paul Alexander, Consortium Lead at the University of Cambridge concluded "I'd like to thank everyone involved in the consortium for their hard work over the years. Designing this supercomputer wouldn't have been possible without such an international collaboration behind it."

The Square Kilometre Array (SKA) project is an international effort to build the world's largest radio telescope, led by the SKA Organisation based at the Jodrell Bank Observatory near Manchester, UK. The SKA will conduct transformational science to improve our understanding of the Universe and the laws of fundamental physics, monitoring the sky in unprecedented detail and mapping it hundreds of times faster than any current facility.

Former Minister of Science and Technology Mmamoloko Kubayi-Ngubane, Deputy President David Mabuza and former Northern Cape Premier Sylvia Lucas at the MeerKAT launch on the Losberg site in the Northern Cape Province of South Africa on 13 July 2018. Image: SKA South Africa

The SKA is not a single telescope, but a collection of telescopes, called an array, to be spread over long distances. The SKA will be constructed in Australia and South Africa; with a later expansion in both countries and into other African countries.

Already supported by 13 countries – Australia, Canada, China, France, Germany, India, Italy, the Netherlands, New Zealand, South Africa, Spain, Sweden and the United Kingdom – the SKA Organisation has brought together some of the world's finest scientists, engineers and policy makers and more than 100 companies and research institutions in the design and development of the telescope.

Source:
www.skatelescope.org
https://www.ska.ac.za

The MeerKAT radio telescope completed last year consists of an array of 64 antennas on the SKA Losberg site in the Northern Cape of South Africa. MeerKat is a precursor to the full Square Kilometre Array (SKa) which will add another 133 dishes bringing the total up to 197 when completed. Image: SKA South Africa

Cameroon's Ngaoundéré becomes a 'Smart City'

Ngaoundéré the capital of the Adamawa Region in Cameroon has just acquired the status of a 'Smart City' with free access to data to promote resilience and adaptation to climate change.

Michel Tchotsoua is a full Professor of Geography/Geomatics at the University of Ngaoundéré in Cameroon. He is also the Head of the Geomatics Laboratory and Team Manager for the e-learning Professional Master: http://gager-undere.auf-foad.org/login/index.php. He is a member of the Cameroon Academy of Sciences and President of the Association for Mapping, Planning and Resources Management (AMPRM) www.acager.org, and Editor-in-Chief of an online Scientific Journal http://acager.org/index.php/revue-scientifique.

"In collaboration with the World Bank's Open Cities Project we covered for eight months the urban area of Ngaoundéré with a group of students and young researchers to collect data concerned with infrastructures, land use, flooding and rock fall risk," says the project leader Michel Tchotsoua, a Professor of Geography/Geomatics at the University of Ngaoundéré in Cameroon.

"This participatory approach involved a wide range of specialists including topographers, geometricians and operators of aerial photography using UAV. We have also been supplied with the necessary precision mapping tools by our World Bank partners whom we sincerely thank for their support," says Prof Tchotsoua.

Building on the success of the Open Cities project in South Asia, the global Open Data for Resilience Initiative, and GFDRR's Code for Resilience, Open Cities Africa is carried out in 11 cities in Sub-Saharan Africa, to engage local government, civil society, and the private sector to develop the information infrastructures necessary to meet 21st century urban resilience challenges.

Professor Tchotsoua explains the significance of making ground control points for the preparation of the drone cover. © ACAGER, Petnga

Ngaoundéré was chosen with ten other cities on the continent in this Open Cities Africa project. These were Kinshasa (DRC), Kampala (Uganda), Accra (Ghana), Monrovia (Liberia), Pointe Noire (Congo), Saint-Louise (Senegal), Antananarivo (Senegal), Brazzaville (Congo), Seychelles and Zanzibar City (Tanzania).

The city of Ngaoundéré is facing recurring challenges related to urban floods, which are increasing as its uncontrolled urbanization continues. Urbanization has been largely spontaneous, resulting from the increasing occupation of many flood or wetlands and mountain slopes without adequate land management. To improve the management of its territory, the Ngaoundéré City Council (NCC), in collaboration with the Inclusive and Resilient Cities Development Project (IRCDP) financed by the World Bank via the Ministry of Housing and Urban Development (MINHUD), have updated their open access spatial data to capture built space and critical infrastructure located in areas at risk of floods on the major beds of the main rivers.

From the cartographic data compiled in a Geographic Information System, the Open Cities Africa Project:

• made available to the city of Ngaoundéré decision support tools for the prevention and implementation of disaster action plans;

• strengthened the capacities of local populations in the perception and management of risks of flooding and bouldering in the city of Ngaoundéré; and

• forged new partnerships between different stakeholders.

From the data generated through the Open Cities project Ngaoundéré will enable municipal and local authorities to better plan urban growth, land use, urban development and the various interventions in the city as far as the event of floods and landslides are concerned. The city dwellers of Ngaoundéré will then

live in a protected and better environment. In the long term, the city will be able to serve as an example of success for its neighboring localities, in urban planning and computer-aided management of natural resources. According to Prof Tchotsoua the duplication of this project in at least all the main African cities in their first phase is strongly recommended.

Source:
https://opencitiesafrica.course.tc
https://opencitiesproject.org
http://gager-undere.auf-foad.org
https://opendri.org
https://acager.org

Launch of the drone to collect data during the Ngaoundéré Open City project. SO-GEO has also allowed ACAGER members to learn how to use their equipment. © ACAGER, Petnga

Focus on an African Personality in Space Science and Technology

Professor Tsehaie Woldai

In the arena of geosciences, remote sensing and space sciences there are few who could match the magnitude and range of experience of Professor Tsehaie Woldai. This article covers but a bit of what he has achieved in a lifetime of dedication to his profession - Editor

Prof Tsehaie Woldai is currently a professor at the School of Geosciences at the University of Witwatersrand in Johannesburg, South Africa as well as a visiting professor at the State Key Laboratory of Information Engineering in Surveying Mapping and Remote Sensing (LIESMARS), Wuhan University, Wuhan, China.

He holds a B Sc degree from the H.S.I. University, Addis Ababa, Ethiopia (1971), an MSc degree from the International Institute for Aerospace Survey and Earth Sciences (ITC), Enschede, The Netherlands (1977) and a PhD degree of the Open University, Milton Keynes, England (1994). He is a Fellow of the African Academy of Sciences (AAS); the Geological Society of Africa (GSAF); the IEEE-Geoscience & Remote Sensing Society (GRSS); and the Environmental System Africa (EIS-Africa). He is also the founder and Past President of the African Association of Remote Sensing of the Environment (AARSE).

His key expertise and experience are mainly in the following fields:

- Remote Sensing, Radar theory and applications, Interferometric SAR (InSAR), Hyperspectral, Digital Image Processing, Geographic Information System (GIS), geo-environmental modelling;
- Geology, Structural Geology;
- Environmental Geology: geological hazard (neo-tectonics and earthquake hazard, volcanic hazard, mining impact on the environment, desertification); and
- Education, Research, Management

As an invited of keynote speaker for the period 2006 - 2017 he was inter alia a member of the Scientific Committees in many international Conferences and chaired over 52 international conferences and seminars (e.g. UN Regional Conferences in Africa, Asia and Latin America; European Union; and World Bank workshops and seminars). From 1997 – 2017 he has given more than 50 invited keynote speeches on various topics and in various national or international conferences/symposia or meetings.

As a teacher and lecturer he has given M.Sc and Post-Graduate courses in Remote Sensing, Geoinformatics and Earth Sciences and have supervised over 120 students with their MSc and PhD thesis throughout his career at ITC. He has also reviewed the research thesis of about 20 PhD students studying in various other universities in countries such as Egypt, Ethiopia, South Africa and Mongolia.

Prof Woldai has published, co-authored or delivered a total of 166 papers, publications and conference papers.

Prof Woldai has published, co-authored or delivered a total of 166 papers, publications and conference papers. He has peer-reviewed over 200 manuscripts for highly rated journals such as:

- Remote Sensing of Environment
- ISPRS Journal of Photogrammetry and Remote Sensing
- EEE Transactions on Geoscience and Remote Sensing
- Applied Earth Observation and Geoinformation
- Remote Sensing
- Photogrammetric Engineering and Remote Sensing
- International Journal of Remote Sensing
- Canadian Journal of Remote Sensing
- The Photogrammetric Record
- IEEE Geoscience and Remote Sensing Magazine
- Journal of Metamorphic Geology
- Journal of Structural Geology
- Journal of African Earth Sciences
- Ore Geology Reviews
- Arabian Journal of Geosciences
- The Egyptian Journal of Remote Sensing and Space Sciences
- Natural Resources Research (NARR)

In the arena of management and organization he has been responsible for symposiums, conferences, worshops and seminars in numerous African countries, Europe and China.

Amongst his some 15 awards, honours and fellowships count inter alia an Outstanding African Visionary1996 (Department of State, United States of America); Outstanding Lecturer of the year 2006 (ITC, The Netherlands); Making a Difference in Africa 2012 (Environmental Systems Research Institute ESRI); The Schermerhorn Award of the International Society of Photogrammetry & Remote Sensing 2000 (ISPRS).

Apart from his mother tongue Tigrigna Prof Woldai is proficient in six other languages which are English, Amharic, Dutch, Spanish, Italian and French.

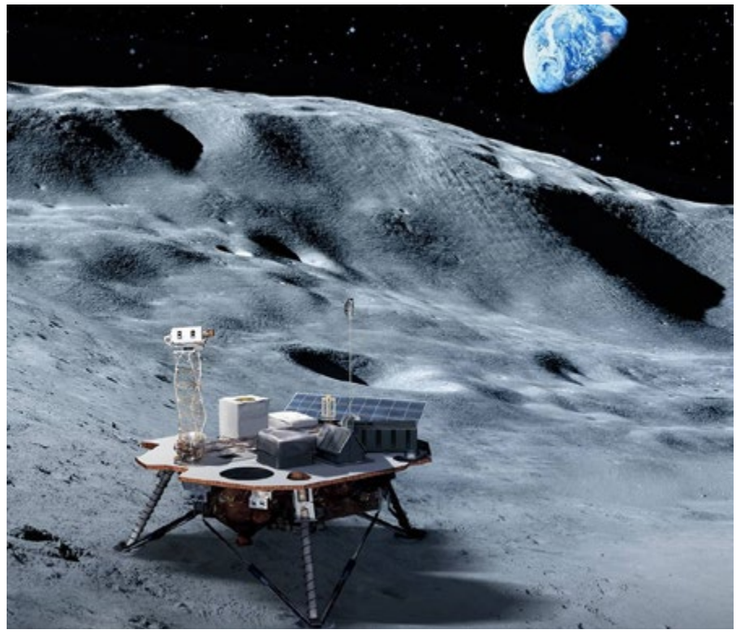
Space Alphabet

The space industry is not called burgeoning for nothing. There is so much happening that it's difficult to keep track of all the new developments all the time. In this issue we bring you once again a number of the most recent announcements in alphabetical order.

Armetis Programme

NASA has selected three commercial Moon landing service providers that will deliver science and technology payloads under Commercial Lunar Payload Services (CLPS) as part of the Artemis program. Three small businesses received separate contracts worth potentially $253.5M combined to help NASA send payloads to the lunar surface under the two-phase Artemis program. The agency awarded $97M to Orbit Beyond to carry up to four Commercial Lunar Payload Services cargo to the moon's Mare Imbrium lava plain; $79.5M to Astrobotic to send a maximum of 14 payloads to the moon's Lacus Mortis crater; and $77M to Intuitive Machines to deliver up to five payloads to the moon's Oceanus Procellarum area. NASA expects Orbit Beyond to finish contract work in September 2020. Astrorobotic and Intuitive Machines are expected to complete services by July 2021.

Source:
https://www.nasa.gov
https://www.enca.com



Armetis Programme
NASA has selected three companies to deliver some 24 science and technology payloads to the lunar service in preparation for the 2024 human Moon landing. Image: NASA

BeiDou

This is the 45th satellite of the Chinese Beidou Navigation Satellite System (BDS) family launched on Friday, 17 May 2019. BDS is named after the Chinese term for Big Dipper and are all positioned in geostationary earth orbit. The latest satellite will be connected to the BDS family of satellites to enhance reliability and stability of the constellation which has improved positioning accuracy from 10 meters to 6 meters so far. Another six to eight BDS satellites will be sent into space this year while two to four BDS-3 satellites will be launched in 2020 to complete their global network.

Source:
https://www.satellites.einnews.com

Blue Moon

A concept for a lunar lander proposed by Amazon's Jeff Bezos to support NASA's goal of land astronauts on the lunar surface by 2024. Companies such as Lockheed Martin and SpaceX have proposed different concepts. NASA will soon be seeking proposals from U.S. industry for the development of a functional human landing system on the Moon to meet their industry requirements. This will include proposals from industry in support of rapid development of an integrated human lunar landing system, including elements such as a descent element, ascent element, and transfer vehicle.

Source:
https://www.nasa.gov
https://www.geekwire.com

DART

This first-ever attack on an asteroid to test technology that could save Earth from a dangerous collision is embodied by a NASA mission called Double Asteroid Redirection Test (DART) being prepared to launch in June 2021. The satellite will reach the binary asteroid Didymos with its own moon Didymoon around October 2022 and slam into the asteroid in an attempt to change its course. The exercise will be complemented by the European Space Agency's Hera satellite which will be observe the collision from a safe distance as part of the larger Asteroid Impact and Deflection Assessment (AIDA) mission.

Source:
https://www.space.com
https://www.space.com

Kessler Syndrome

The NASA scientist Donald J. Kessler proposed a theory in 1978 now known as the Kessler Syndrome which states that if two objects collide in say Low Earth Orbit it would increase the likelihood of further collisions in an ever increasing cascade that would make space activities impossible in that specific orbital range. According to a recent MIT Techonology Review the planned Starlink mega-contestellation by SpaceX's of more than 7,000 internet satellites could trigger potentially 67 000 collisions in outer space. According to Scientific American this could trap humans on earth and make space exploration impossible..

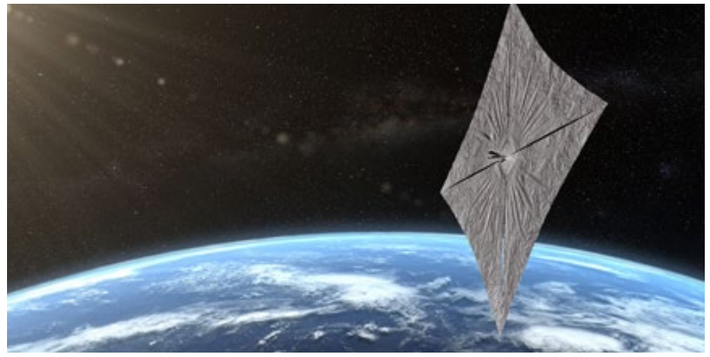
Source: http://www.satnews.com

Lego Lunar Lander

The Danish Lego Group started in 1949 and famous for its interlocking toy bricks to build just about anything has release a 1,087-piece Apollo 11 lunar lander model with astronauts included. This model recreates the Eagle lunar module used by humans to set foot for the first time on another heavenly body on 20 July 1969. This model could be a very useful tool in space awareness workshops amongst school children all over the world.

Source:
https://www.geekwire.com

Lego Lunar Lander
This 1,087-piece Apollo 11 lunar lander model has just been released by Lego to recreate the Eagle lunar module used by humans to set foot on the moon. It can be ordered online at the Lego Shop website.



Lightsail

LightSail 2 will fly to an orbit 720 kilometers high, where the acceleration from sunlight overcomes atmospheric drag. It will unfold a sail of around 32 square meters which will then utilize solar photons to lift the satellite to a higher orbit measurable after one month. This will possibly demonstrate the ability of using solar power to make spaceflight more affordable.

If successful, LightSail 2 will become the first spacecraft to raise its orbit around the Earth using sunlight. While light has no mass, it has momentum that can be transferred to other objects. A solar sail harnesses this momentum for propulsion. It will demonstrate the application of solar sailing for CubeSats, the small, standardized spacecraft that have made spaceflight more affordable for academics, government organizations, and private institutions.

Source: http://www.spacedaily.com
http://www.planetary.org

Image: John Sprading/Planetary Society

Mars 2020

NASA will launch its next rover Mars 2020 in Florida during July 2020 to land seven months later at the Jerezo Crater on the Red Planet. It will be fitted with a new generation of instruments capable of sample-caching to return to Earth on later missions. The planned mission duration will be at least on Mars year which is about 687 Earth days.

Source: http://www.marsdaily.com

Space Traffic Regulations

Space traffic regulations are needed to ensure that orbital debris becomes manageable in future has been suggested by Iridium CEO Matt Desch. He also supports the proposal by the US Federal Communications Commission (FCC) that satellites which fly higher than the International Space Station's orbit at 400km to carry on-board propulsion. Currently there is no service to grab and dispose of dead satellites in low Earth orbit.

Source: https://www.spaceintelreport.com

Iridium CEO
Iridium CEO Matt Desch believes it is time to be outspoken about orbital debris and tighten up regulations for debris mitigation.

Another voice added to growing concern about space pollution - A regulatory framework for space exploration needed ? -

The International Astronomical Union (IAU) which represents some 13,500 astronomers in more than 100 countries around the globe has expressed its concern about private companies intending to launch thousands of internet satellites in low earth orbit over the next few years.

It also urges for 'appropriate agencies to devise a regulatory framework to mitigate or eliminate the detrimental impacts on scientific exploration as soon as practical' in a statement published earlier this month.

The IAU fears that large satellite networks or constellations risk interfering with radio frequencies and astronomical observations and the statement also said: "Satellite constellations can pose a significant or debilitating threat to important existing and future astronomical infrastructures, and we urge their designers and deployers as well as policy-makers to work with the astronomical community in a concerted effort to analyse and understand the impact of satellite constellations.

"The organisation, in general, embraces the principle of a dark and radio-quiet sky as not only essential to advancing our understanding of the Universe of which we are a part, but also as a resource for all humanity and for the protection of nocturnal wildlife.

"We do not yet understand the impact of thousands of these visible satellites scattered across the night sky and despite their good intentions, these satellite constellations may threaten both," the statement said.

This comes in the wake of announcements by SpaceX, Iridium, Amazon, Boeing, OneWeb and Facebook who together will launch tens of thousands of broadband satellites into Low Earth Orbit to tap into the lucrative market to provide internet access to everyone on Earth even in the remotest parts of the planet. The IAU states that these satellite constellations will soon outnumber all previously launched satellites.

"The IAU is a science and technology organisation, stimulating and safeguarding advances in those areas. Although significant effort has been put into mitigating the problems with the different satellite constellations, we strongly recommend that all stakeholders in this new and largely unregulated frontier of space utilisation work collaboratively to their mutual advantage.

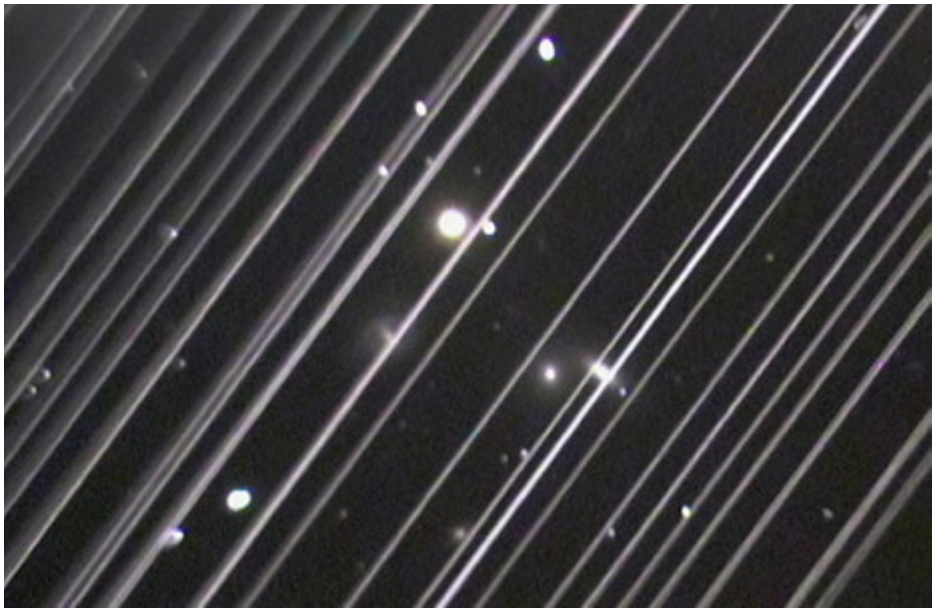
SpaceX CEO Elon Musk who plans to launch some 12 000 Starlink satellites denies that it will have any impact on advancements in astronomy. Image: wallpaperaccess.com

"Satellite constellations can pose a significant or debilitating threat to important existing and future astronomical infrastructures, and we urge their designers and deployers as well as policy-makers to work with the astronomical community in a concerted effort to analyse and understand the impact of satellite constellations. We also urge appropriate agencies to devise a regulatory framework to mitigate or eliminate the detrimental impacts on scientific exploration as soon as practical,' the statement said.

SpaceX CEO Elon Musk who plans to launch some 12 000 Starlink satellites has dismissed concerns regarding such a high number of satellites above Earth and wrote on Twitter: "There are already 4,900 satellites in orbit, which people notice zero percent of the time. Starlink won't be seen by anyone unless looking very carefully and will have zero percent impact on advancements in astronomy. We need to move telescopes to orbit anyway. Atmospheric attenuation is terrible."

Apart from potential visual space pollution and radio interference there is also serious concern that these thousands of satellites can trigger the so-called Kessler syndrome where collisions between satellites can trigger debris that cause more collisions in an ever growing cascade until Low Earth Orbit becomes impregnable and trap us on Earth.

Source:
https://www.express.co.uk/latest/space
https://www.iau.org



An image of the NGC 5353/4 galaxy group made with a telescope at Lowell Observatory in Arizona, USA on the night of Saturday 25 May 2019. The diagonal lines running across the image are trails of reflected light left by more than 25 of the 60 recently launched Starlink satellites as they passed through the telescope's field of view. The density of these satellites is significantly higher in the days after launch (as seen here) and will diminish in brightness as they reach their final orbital altitude.

Credit: Victoria Girgis/Lowell Observatory