University of Nairobi



Kenya's Venture into Outer Space Exploration 1st Kenya University Nano Satellite Precursor Flight (1KUNS-PF)

The Launch of a Space Science Program for Kenya Mwangi Mbuthia, University of Nairobi, Kenya

> United Nations Expert Meeting on Human Space Technology 5 December, 2018 VIC, Vienna, Austria



Kenya's participation in the utilization of space has a long history starting in 1962 when an agreement between the University of Nairobi (Formally Royal Technical College) and University of Rome, Sapienza was signed for using Kenyan territorial waters at Malindi to build the San Marco satellite launch platform and base camp for ground stations.





- Between 1962 and 1987, 27 satellites were successfully placed in orbit. The ground stations at the Malindi base camp (renamed Broglio Space Centre) are currently operated by Italian Space Agency (ASI)
- In an MOU dated 20 June 2002 the University of Nairobi and University of Rome, Sapienza, established a Memorandum of Understanding (MOU) to collaborate in education and research activities of common interest, including cooperation in the utilization of space resources and exchange of both students and faculty staff.

- However, during the life of these agreements, there has been limited progress in using these agreements to build local capacity and skills for Kenyans to fully participate in harnessing space resources.
- To start addressing this gap, the University of Nairobi renewed the partnership with University of Rome in July 2015, with a new focus on cooperation to build local capacity and skills to design and operate space missions for peaceful utilization of space resources.



Outer Space Exploration Learning Tool: Design, Build, Deploy a "Real" Space Mission - Cubesat

- University of Nairobi Nano Satellite building program was established in September 2015, in a partnership between University of Nairobi and University of Rome (Sapienza), with the main goal of designing, building and launching a student-built 6U (20cm X 30cm) Cubesat in three years.
- The opportunity to have a precursor flight for the program became available in early 2016 when UNOOSA announced a launch opportunity for a 1U (10cm X 10cm) Cubesat from the ISS using the Japanese Experimental Module (JEM) "KIBO".

Space Science For Peaceful Utilization of Outer Space Resources

- The 1KUNS-PF team responded to the announcement of the UNOOSA launch opportunity of a 1U Cubesat from the JEM KIBO deployed on ISS by Japan Aerospace Exploration Agency (JAXA)
- The 1KUNS-PF team nanosat design and mission goals was the winner of a competitive global selection process and the building of the 1U Cubesat commenced.



JEM Module "Kibo" Deployed on ISS

Peaceful Utilization of Outer Space Resources – Capacity Building





2nd ASI-Sapienza Capacity Building Meeting with Kenyan Universities held at the University of Nairobi



Sapienza and University of Nairobi Students Working on Cubesat Components at a University of Nairobi Laboratory

Peaceful Utilization of Outer Space Resources – 1KUNS-PF Mission



The Payload Consists of:

- Two commercial cameras located on opposite axis of the satellite that will take low resolution pictures of the Earth
- Audio upload and satellite broadcast receiver based on a mobile phone application.

Peaceful Utilization of Outer Space Resources – 1KUNS-PF Handover



- On January 16, 2018 at JAXA headquarters, Tsukuba Space Centre in Tokyo, Japan, the University of Nairobi team handed over the First Nano Satellite a IU Cubesat (1KUNS – PF). This is the first satellite operated by a Kenyan University.
- IKUNS-PF is also the first outer space object registered by Kenya and the first Kenyan satellite to go into orbit.

Utilization of Outer Space Resources – 1KUNS-PF Deployment

The Successful Deployment from Kibo/ISS 1KUNS-PF, Kenyan First Satellite University of Nairobi Selected for First Round of UNOOSA-JAX Action 1995

PRESENTED TO IKUNS-PF PROJECT TEAM ON THE OCCASION OF YOUR FIRST SATELLITE DEPLOYMENT FROM KIBO/ISS FROM JAPAN AEROSPACE EXPLORATION AGENCY

> SHIHO OGAWA DIRECTOR OF JEM UTILIZATION CENTER, HUMAN SPACEFLIGHT TECHNOLOGY DIRECTORAT MAY 11, 2018

On 2nd April 2018, 1KUNS-PF was successfully delivered to ISS by a Falcon_9 SpaceX Rocket launched from for Kennedy Space Centre in Florida, USA as the CRS14 SpaceX resupply mission to ISS.

On 11th May 2018, 1KUNS-PF was successfully deployed from the ISS. By using KIBO, 1KUNS-PF mission goal has been achieved.

Utilization of Outer Space Resources – 1KUNS-PF Benefits

The Successful development of 1KUNS-PF and the achievement of the stringent standards required by JAXA for a satellite launch from ISS has given the University of Nairobi an opportunity to lead in the development of an outer space program for Kenya to harness science and explore peaceful utilization of the space resources for the benefit of all. The of 1KUNS-PF mission has success generated great excitement within Kenya and created the environment for local support of a space science program.



Utilization of Outer Space Resources – 1KUNS-PF Operation









Images Taken by the Low Resolution Camera on Board 1KUNS-PF in Orbit The training of human resource and development of space technologies has in the past been one of the leading catalysts for the development of microelectronic devices and telecommunications that we all depend on in our lives today.

- ➤ The advances in space science made by the space faring nations has contributed to the leadership that these nations have maintained in the area of microelectronics and telecommunications and the growth of their manufacturing sector
- Kenya now has an opportunity to inspire the next generation of scientists and engineers through space science by building on the success of 1KUNS-PF.

- Building the human capital and a satellite development capacity requires a long term commitment to a space science program.
- ➤The 1KUNS-PF project has created the opportunity for the University of Nairobi to work with JAXA as the satellite launch partner, Sapienza and Kyushu Institute of Technology of Japan as the technology partners for human resource development in satellite design, manufacture and testing to meet the quality standards set by JAXA for nanosats launch from ISS using JEM KIBO.

- The University of Nairobi will build on the success of 1KUNS–PF and we have started a 5 year program of advancing outer space science in Kenya and developing satellite based services by building and launching the following satellites: -
- 2018 1KUNS-PF 1X1U Nanosat in low earth orbit Launched in May 2018
- 2020 ILOSS_1 1X3U Nanosat for providing designated services
- 2023 ILOSS_2 4X3U Nanosats for providing designated services



- Depending on the mission goals for each year of the space program, the cost of design, manufacture, launch per nanosat and gradual setting up of the requisite laboratories requires substantial financial commitments
- The satellite development activities in each year will incorporate new mission goals. Every year, M.Sc. and Ph.D. students who show a great passion for space science will be recruited to join the satellite design, manufacturing, launch and mission operations teams.

- Some of the payloads that we shall
- select for the Cubesats include;
- Earth Imaging and Surveillance Applications in Agriculture
- Transport and Food Security
- Disaster Management
- **Coastline Monitoring**
- **Field Communication**
- Education and Space Research
- **Outer Space Observations**
- Land Use Monitoring
- Environmental, Livestock and Wildlife Management



Agricultural Efficiency



Air Quality



Climate



Disaster Management



Ecological Forecasting



Public Health







Weather

- The University of Nairobi has identified the Kenya Government and a short list of collaborators who will be our partners/sponsors and work with us to execute this very important program that will yield enormous benefits for Kenya.
- To attract the resources required to design, manufacture and deploy the nanosats, we shall work with our government and collaborators to agree on the final mission goals for the cubesats.



