

# University of Nairobi (UoN) NanoSatellite Journey

Towards 3U CubeSat Launch using Vega C

*Prof. Mwangi Muthia & Dr. Mutugi Kiruki*

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**University of Nairobi**

*10<sup>th</sup> Feb 2023*

# Introduction: University of Nairobi (UoN)



## ❖ University of Nairobi

- Oldest and largest in Kenya
- Student Population: > 40,000



## ❖ 11 Faculties

- Engineering
- Health Sciences
- Science and Technology
- Social Sciences
- Education
- Agriculture
- Arts
- Built Environment & Design
- Business & Management Sciences
- Law
- Veterinary Medicine





# Nanosatellite Projects at UoN

## ❖ Project 1: 1KUNS Project (2016 – 2019)

- 1<sup>st</sup> Kenyan University Nano Satellite (1KUNS)
- Collaboration: UoN & University of Rome, Sapienza
  - P.Is: Prof. Mwangi Muthia, Prof. Fabio Santoni
- 1<sup>st</sup> Beneficiary of Japanese KiboCUBE Launch Opportunity
- Deployed from ISS in May 2018



# Nanosatellite Projects at UoN

## ❖ Project 2: NaSPUoN (Sept. 2020 – Nov. 2021)

- Kenya Space Agency Grant Call
  - NanoSatellite Research Chair at Public Universities
  - USD 50,000 (5 universities @ USD 10,000)

### ○ NaSPUoN – NanoSatellite Platform for the University of Nairobi

- Project Kickoff – Oct 2020
- Principal Investigator – Prof. Mbuthia
- Project Manager – Dr. Kiruki

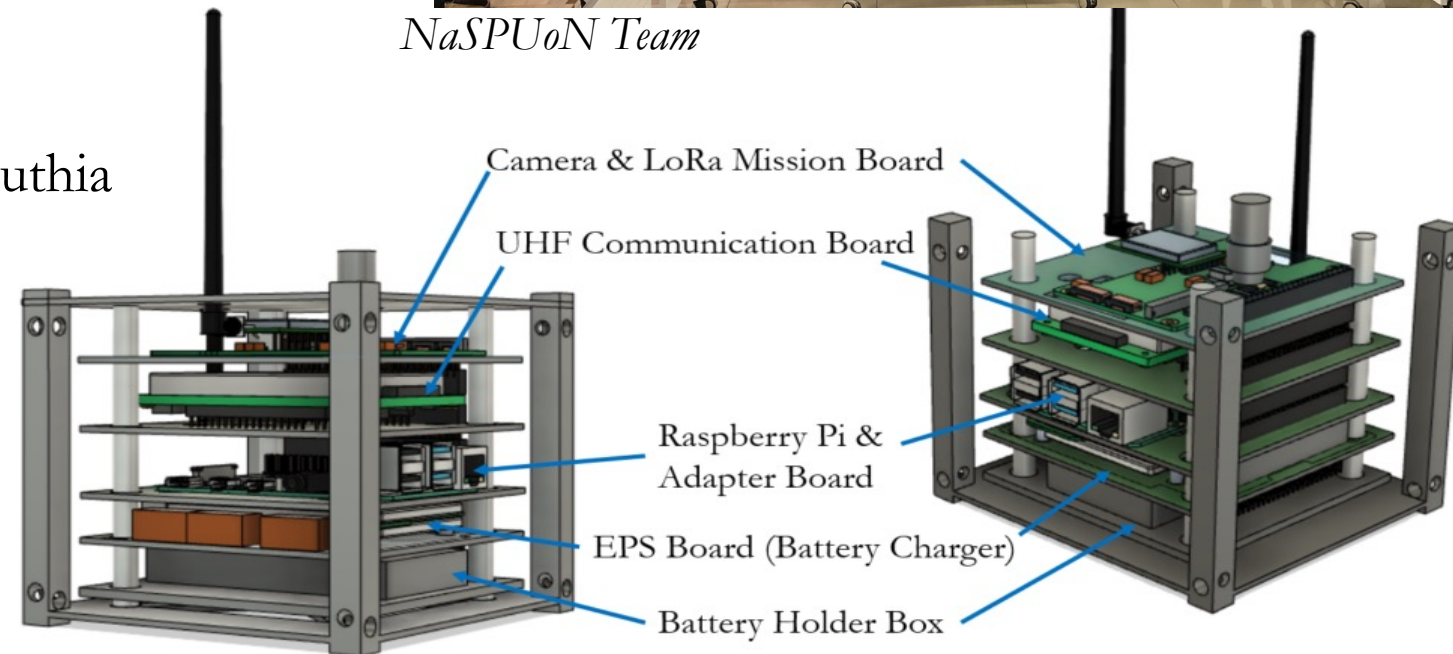
## ❖ 1U Bench Model (Not space-grade)

## ❖ Emerged Overall Winners – Nov 2021

- Out of 5 public universities



*NaSPUoN Team*



# Nanosatellite Projects at UoN

## ❖ Project 3: TafiTi (Jan 2022 – Present)

- Kenya Space Agency Grant
  - Successor of the 1U Nanosatellite grant
  - Consortium of 4 Kenyan Public Universities
  - Grant of ~ USD 30,000
  - Principal Investigator – Prof. Mwangi Mbutia
- 3U Engineering Model CubeSat
  - Main Payload: multispectral camera (RGGB Bayer)
  - Building on 1U CubeSat project





# Project 4 (Avio Launch Opportunity)

## ❖ NaSPUoN Zero Gravity Peace Mission 2030 (NaSPUoN-0GPM2030)

- Tri-partite Cooperation: UoN, UofA, Space Trust



University of Nairobi



- MoU Agreement of Cooperation signed March 2021

- Supported by Kenya Space Agency



## ❖ Key Missions

- Zero-G Peace Mission 2030
  - Championed by Space Trust
- Enhanced NaSPUoN & Tafi Mission
  - Camera Mission
  - LoRa Mission
- High-Gain Antenna



# NaSPUoN - 0GPM2030 Team

## ❖ UoN Team



**Prof. Mwangi Mbutia**  
Principal Investigator  
**NaSPUoN -  
0GPM2030 Mission**



**Dr. Mutugi Kiruki**  
Assistant Principal  
Investigator

- Faculty of Engineering,  
University of Nairobi

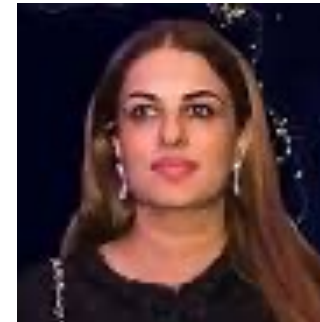
## ❖ University of Arizona



**Prof. Laretta Dante**

- Professor, University of Arizona's  
Lunar and Planetary Laboratory
- Principal Investigator of NASA's OSIRIS-  
Rex Asteroid Sample Return mission

## ❖ Space Trust



**Namira Salim**

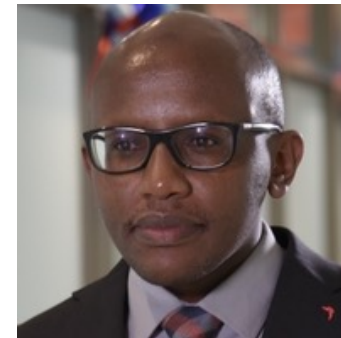
- Founder and Chairperson, Space Trust
- Advocates space as new frontier for peace

## ❖ Kenya Space Agency



**Lt. Col. Andrew Nyawade**

- Ag. Director, Space Regulation,  
Exploration and Utilization

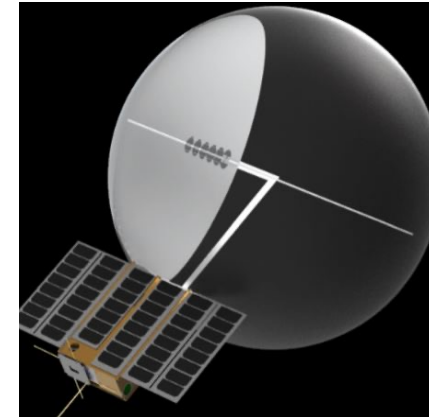


**Charles Mwangi**

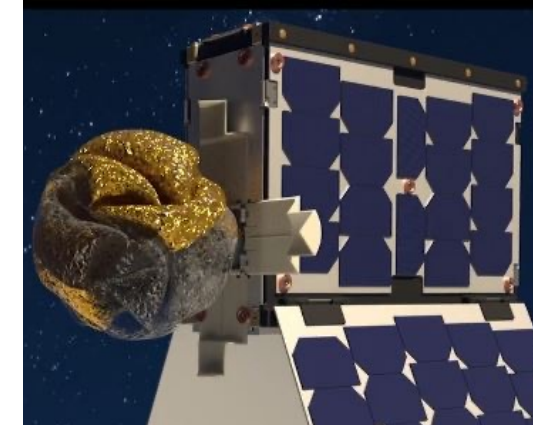
- Ag. Director, Space Sector & Technology  
Development

## ❖ Feeder Projects

- Build on past satellite experiences
  - 1KUNS
  - CatSat (UofA)
    - 6U Inflatable Antenna technology demonstration mission
  - NaSPUoN
  - TafiTi
  - UNReLo
    - LoRa ground network
    - Sponsored by KENET



[UofA 6U CatSat](#)



[FreeFall Aerospace Antenna](#)

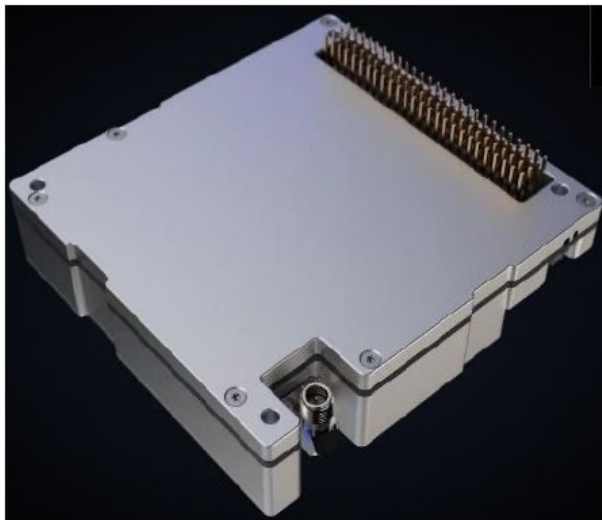
## ❖ Missions

- Peace Mission (Primary)
  - Transmission of Peace Messages
  - Use of High-gain Antenna for Downlink of HD Videos and Camera Mission Images
- NaSPUoN & TafiTi Missions (Secondary)
  - Camera Mission
  - LoRa Mission



## ❖ Transmission of Peace Messages

- In form of HD Videos & audio from world leaders
- Space Trust responsible for collection of messages
- Need of High-Gain Antenna for downlink
  - To be built/provided by UofA
  - Necessary for messages and images downlink
- Need of X-band Antenna



Endurosat Transmitter

- Max. data rate 150Mbps
- Internal memory 32GB

# Ground stations (Kenya)

## 1. Broglio Space Centre, Malindi

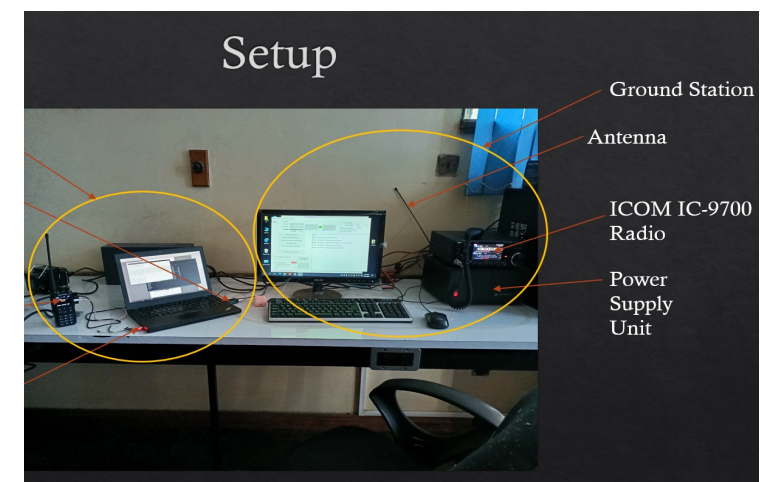


*UHF, VHF, S-band, X-band*

## 2. University of Nairobi



*UHF, VHF*



## 3. Kenya Space Agency



KSA Ground Station, Nairobi

- Under construction, to be commissioned this year
- UHF, VHF, X-band

## ❖ Dissemination of Peace Messages

- Website
  - Platform to get messages to wider audience (streaming)
  - Real-time tracking of satellite
  - Couple messages with images from the camera mission

## Accessing Space with Vega-C



- Submitted application for UNOOSA - Avio CubeSat Launch Opportunity – April 2021
- Announced inaugural awardee – Feb 2023

## News

- The winner of the 1st round of Vega-C will be announced SOON!

“This is a great opportunity for the University of Nairobi (UoN) to continue its nanosatellite capacity building, which is a huge positive for the nascent space sector in Kenya. As a consortium, we are very grateful to UNOOSA and Avio S.p.A. for granting us the opportunity to launch a 3U CubeSat, free of charge. This will go a long way in enhancing spacecraft engineering and satellite operation capacity not only at UoN, but in Kenya in general. The NaSPUoN-0GPM2030 nanosatellite will herald a new level of space utilization by Kenya and will include an earth observation mission to demonstrate and serve diverse local earth imagery needs. This opportunity cements the great impact of UoN collaboration with the Kenya Space Agency, University of Arizona and Space Trust and we shall work together to realize the NaSPUoN-0GPM2030 mission”