



Small Satellite Technology as an Emerging Technology in Mauritius

United Nations / South Africa
Symposium on Basic Space Technology
“Small satellite missions for scientific and technological advancement”

11-14 December 2017



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Mauritius Research Council

Mauritius Research Council

- Set up in May 1992
- Apex body advising Government on all matters concerning scientific, technological, research and innovation issues.
- Also act as the national research and innovation agency and focal point for the promotion and coordination of research, development and innovation responding to the social and economic needs of the country.
- It helps to facilitate the creation of knowledge through research and innovation in all fields of science - including the social sciences - and technology, and thereby contribute to the improvement of the quality of life.
- Provide research grants, incubators

Overview of MRC

Vision

- *“Shaping up the Mauritius of tomorrow through research, technology and innovation”*

Mission

- *"Promoting and pioneering research for sustainable development to enhance the quality of life of the people of Mauritius"*

ISO 9001:2008 Certified since July 2016

MRC Objectives

- *Foster, promote and co-ordinate research and development in all spheres of scientific, technological, social and economic activities;*
- *Advise the government on all matters concerning scientific and technological policies;*
- *Lay guidelines for, and initiate the formulation of research and development policies on a national basis; and*
- *Encourage commercial utilisation of research and development results in the national interest.*



STRATEGIC AREAS FOR RESEARCH & INNOVATION

- Renewable Energy
- Ocean Technology, Ocean Resources and Ocean Services
- ICT/BPO/Telecommunications
- Life Sciences (Health, Medical & Pharmaceutical)
- Manufacturing
- Traffic Management
- Social Issues
- Agro-industry
- Emerging Technologies (e.g Robotics, IoT, **NanoSatellites**, etc...)



Emerging Technologies in Mauritius

- Era where accelerated technological advancement
- New technologies important for innovation
- Great importance for the Government of Mauritius
- Climb up the innovation ladder
- Adopt new technologies to tackle national challenges, accelerating the economic development of the country.
- Enhance competitiveness of the economy.

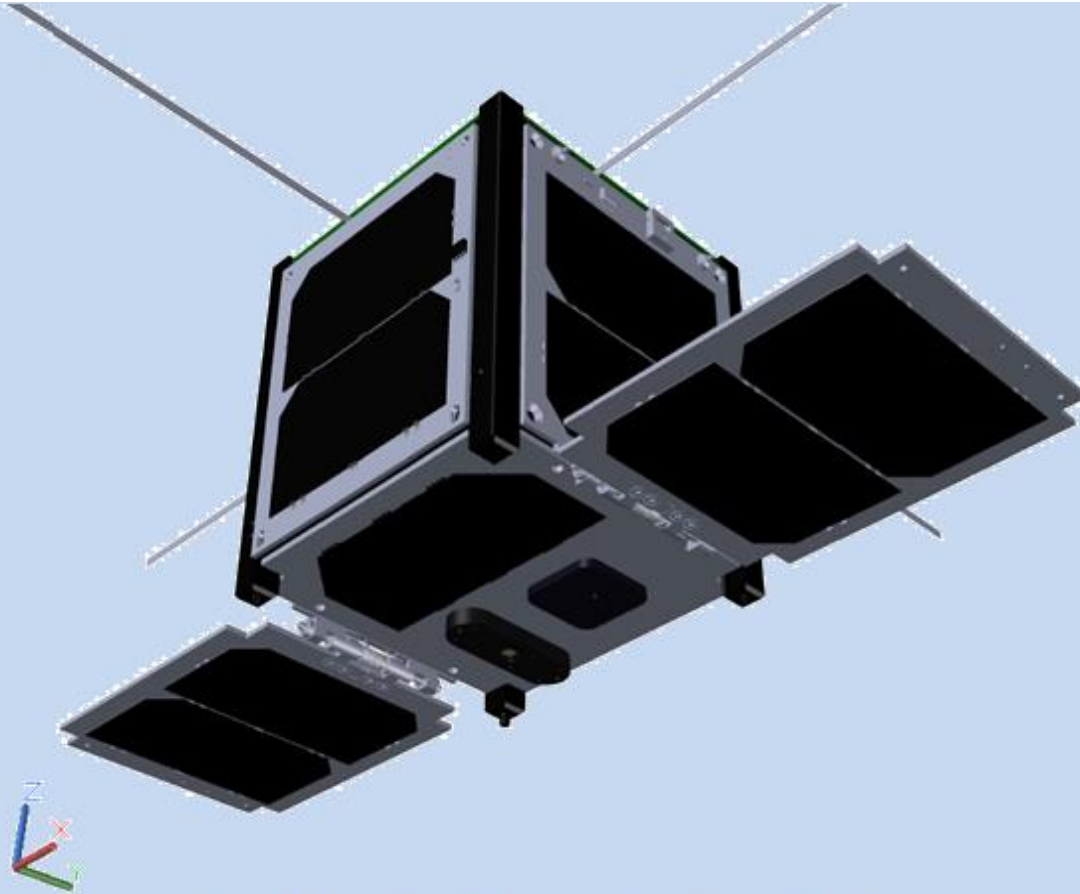
MRC – Emerging Sector - NanoSats

- Emerging Sector - New
- NanoSatellite technology
- Advanced technology, smartphones, small electronic devices, powerful microprocessors
- Building satellites has become more affordable
- Its small size makes use of wasted space
- More efficient and capability of bigger older satellites
- Launching into LEO is also becoming more affordable
- Can be used for capacity building
- For research purposes and solve key problems of the country

CubeSats as a solution to current issues

- Mauritius net food importer with 22.1% of total imports accounting for food.
- Limited agricultural land and continually decreasing at average rate of 750 Ha annually.
- Around 30% of food wasted or lost to pest, diseases and improper storage.
- Rising concern of food safety with excessive dosage of agro chemicals.
- Large EEZ, no fish tracking problems, illegal fishing, ocean surveillance also a rising concern
- Remote islands with very few inhabitants and islets with conservation and leisure activities. However, no internet connectivity.

1st Mauritian Satellite in Space?



MIRT-SAT1

1ST MAURITIAN INFRARED AND TELECOMMUNICATIONS SATELLITE

The first Mauritian satellite

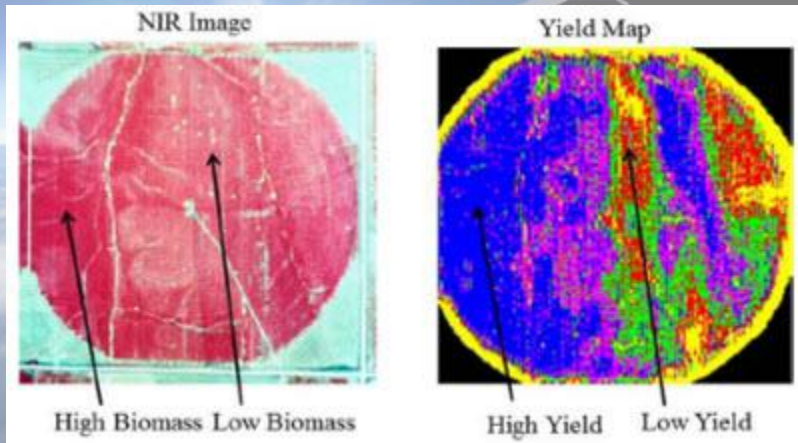
- A first time in the Country
- MRC proposed the idea to local stakeholders
- To gauge the needs for a first Mauritian NanoSat in space
- To share interest, collaborate and agree on a mission statement
- Benefits of such a project are found to be significant
- This project will promote and accelerate interest in small satellites technology in the country.
- For the 50th anniversary of Mauritius, big step, shows strong commitment towards innovation.

Local applications

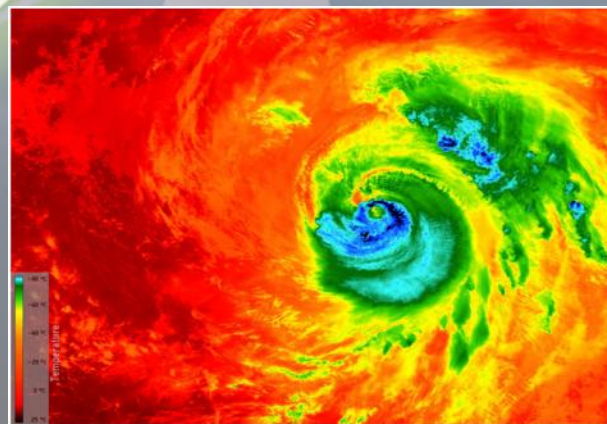
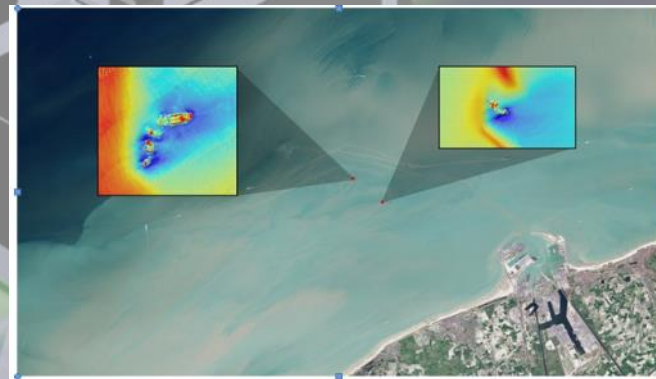
- Aim to tackle issues pertinent to the sustainable development goals.
- Food Security (SDG 2)
- Promote awareness to youth on small satellite technologies (SDG 4)
- Promote innovation (SDG 9)
- Marine life (SDG 14)
- Agriculture (SDG 15)
- Seeking international collaboration in this field in terms of access to new technologies, knowledge enhancement and capacity building (SDG 17)

Local applications

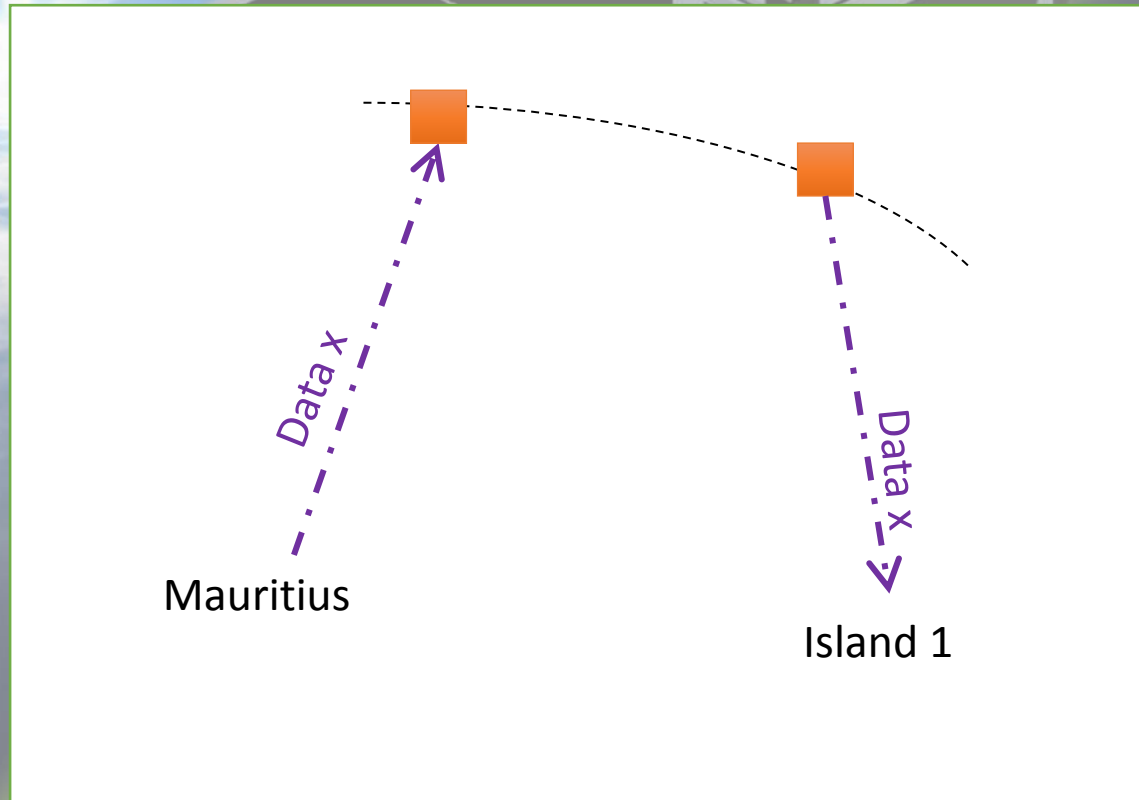
- Food Crop Management
- Thermal infrared images from satellites can help in monitoring & managing crop vegetation, irrigation scheduling, plant disease and pathogen detection and crop yield estimation and forecasting.
- Soil properties such as salinity
- Agroclimatic and crop suitability maps
- Fire detection in crops.
- Improved food security, early warning system
- Provide access to updated and regular maps on sea surface temperature (SST) to aid in research in oceanography.
- Seasonal change in SST determines fish migratory patterns.
- Existing datasets can be updated and enhanced with new data such as updated landuse map or fish migration map.



Near infrared (NIR) aerial image and yield map show similar spatial patterns. Images taken by Cornerstone Mapping and courtesy of USDA-ARS



- Inter Island communication of the Rep. of Mauritius where Internet barely exists.



Project Mission Statement

- To enhance access to space application tools for sustainable development in Mauritius through capacity building in basic satellite technology and creation of a collaborative network with renowned international space related agencies
- Allow Mauritian authorities to get acquainted with the legal and regulatory considerations and responsibilities related to satellite projects
- Use the development of the first ever Mauritian satellite as a platform to promote space technology in Mauritius and to encourage the development of more sophisticated satellites in the future to support the needs of Small Island Developing States (SIDS) and of the African continent.

Mission Objectives

- Verify the performance of the on-board subsystems – if all operational
- Establish communication to and from the satellite
- Broadcast an update from the internet to an islet of the Republic of Mauritius using the on-board communication subsystem
- Ensure that the on-board payload is operational
- Collect thermal infrared images of Mauritius and surrounding regions in the Mauritian EEZ

Design

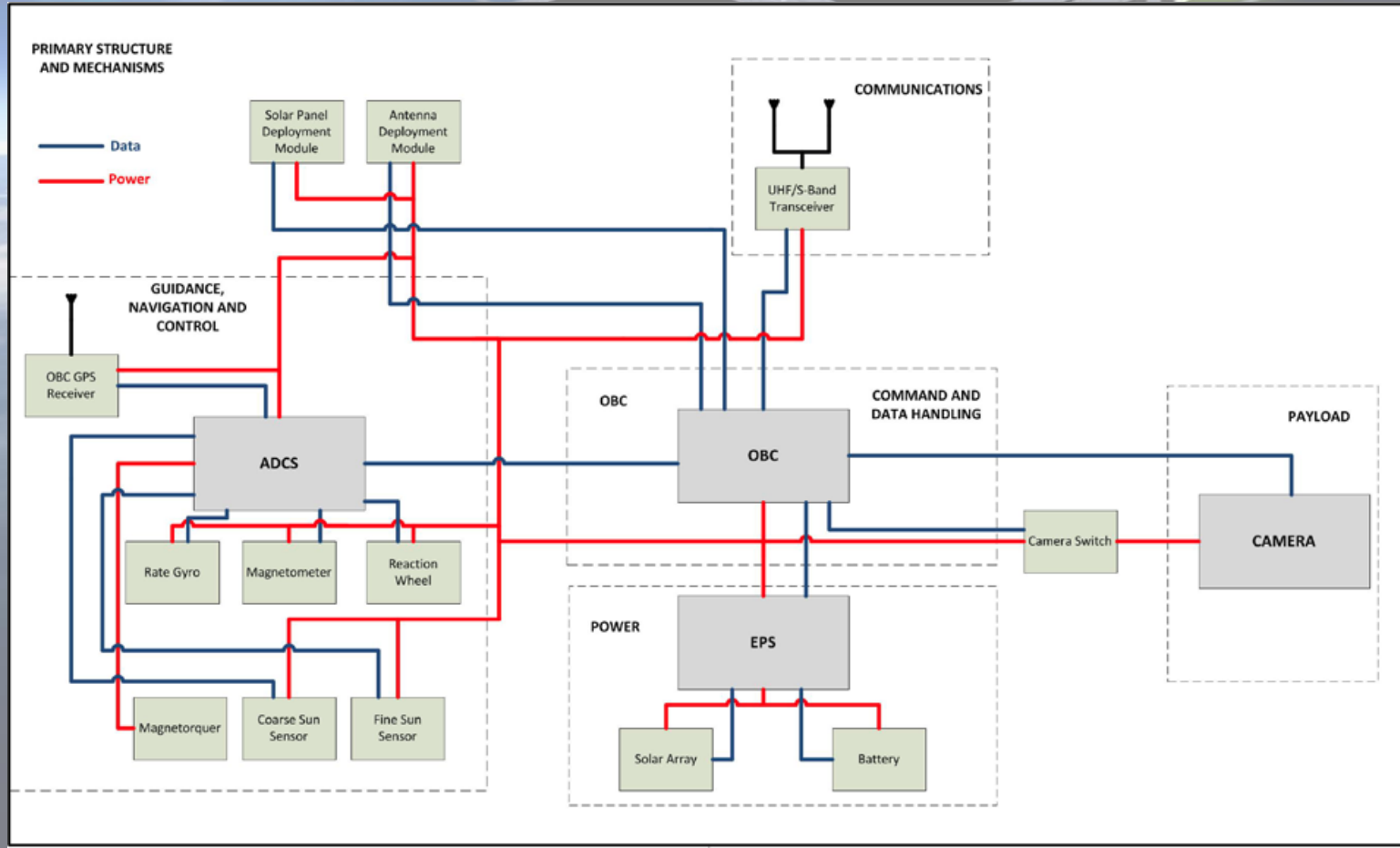
For more information regarding the design,
please contact Mr Faraaz Shamutally as follows:

f.Shamutally@mrc.intent.mu

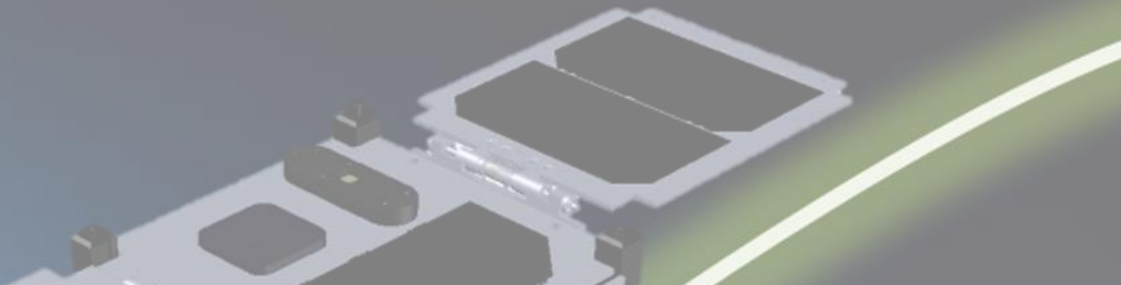
Tel: +230 465 1235

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Design



Orbit Design



ContactLocator1

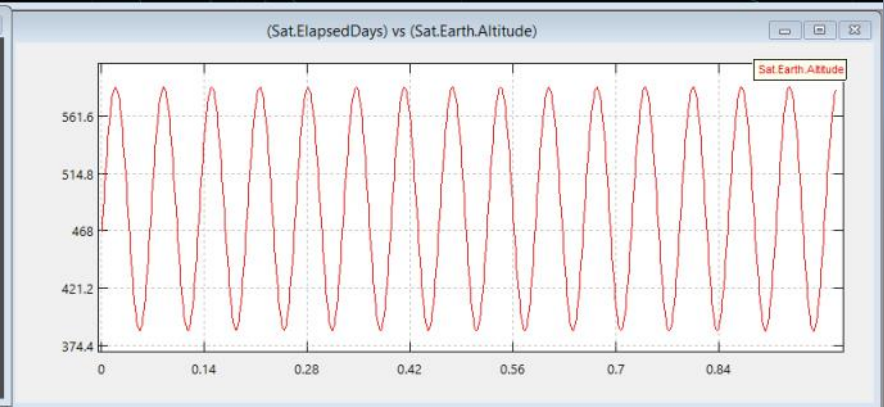
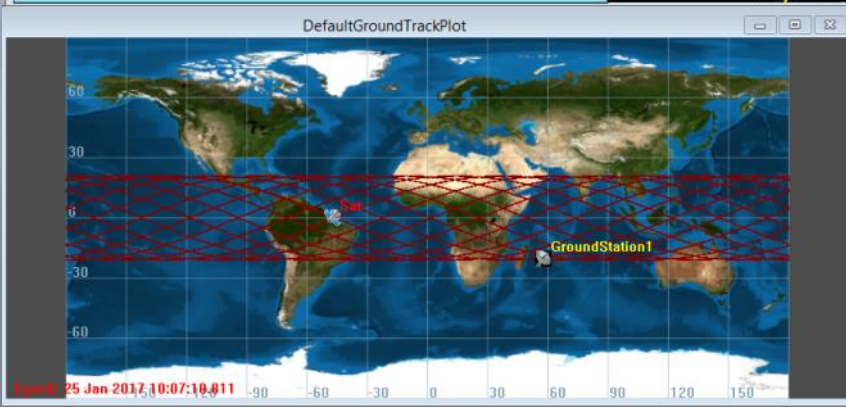
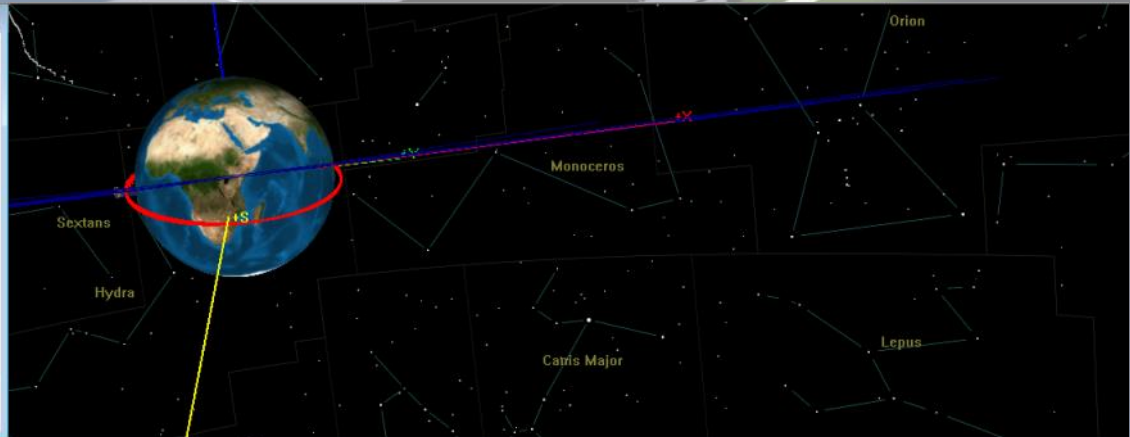
Target: Sat

Observer: GroundStation1

Start Time (UTC)	Stop Time (UTC)	Duration (s)
24 Jan 2017 10:59:44.902	24 Jan 2017 11:07:59.696	494.79474756
24 Jan 2017 12:40:30.381	24 Jan 2017 12:47:44.299	433.91859635
24 Jan 2017 14:22:46.191	24 Jan 2017 14:25:36.635	170.44441566
25 Jan 2017 03:52:53.636	25 Jan 2017 03:57:22.000	268.36434414
25 Jan 2017 05:30:56.532	25 Jan 2017 05:39:46.739	530.20675562
25 Jan 2017 07:10:57.608	25 Jan 2017 07:20:24.333	566.72527422
25 Jan 2017 08:51:37.200	25 Jan 2017 09:00:39.528	542.32751504

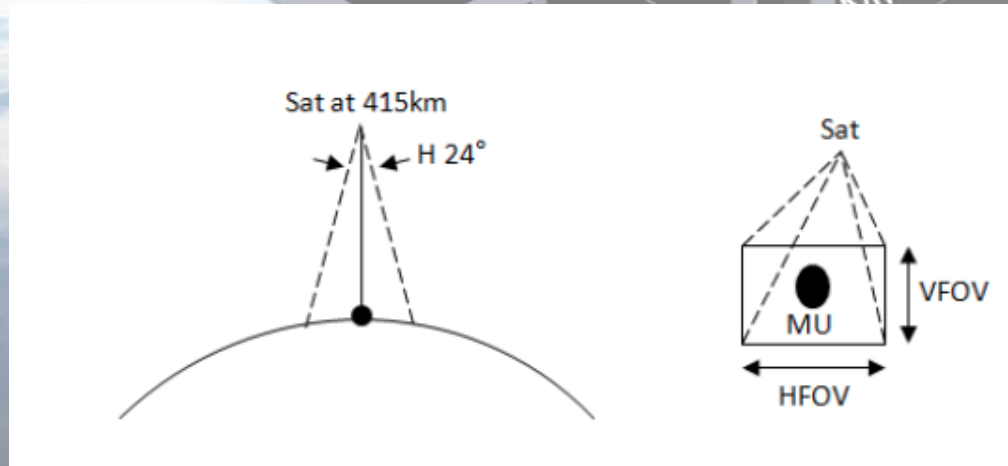
Number of events : 7

Close Help



Design

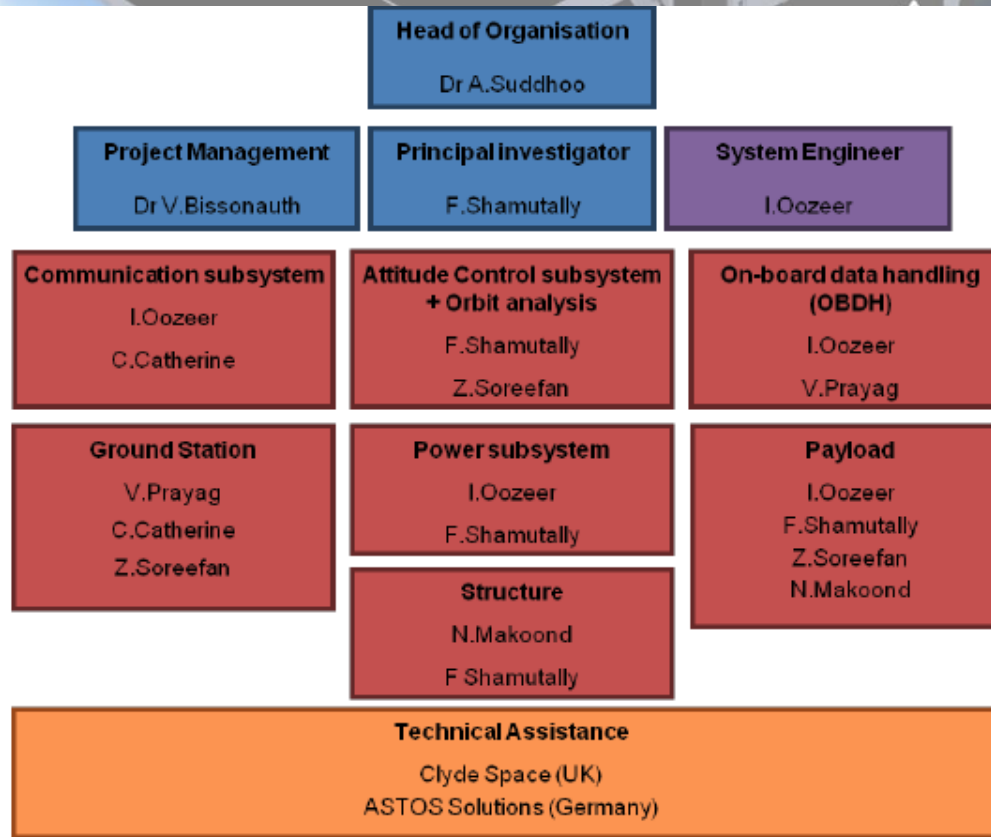
- Longwave IR Camera with theoretical resolution of roughly 550m x 550m.



UNOOSA/JAXA KiboCUBE Prog.

- The MIRT-SAT1 will contribute to developing human knowledge and capacity to undertake activities in the field of space science and technology in Mauritius.
- It will also contribute to enhancing research and development through the technological demonstration of deploying and operating the CubeSat in the country, which will be a first.
- This Programme offers opportunity to deploy the CubeSat from the ISS Kibo module.
- Proposal submitted under this programme during the KiboCUBE 2nd Round in March 2017
- Shortlisted among the high-quality proposals.

Our Team



International collaboration

- Clyde Space (Glasgow, UK) – assistance for design, integration and testing of the 1U CubeSat platform as well as dedicated nanosatellite training.
 - Submit proposal under the UKSA IPP as international partner to Clyde Space
- ASTOS Solutions (Germany) – assistance for mission analysis (orbit design, communication link budget and sunlight hours).

Future Work

- Explore more opportunities to launch the satellite
- Extend collaboration to more institutions local and international
- Investigate other applications for a possible 3U/6U CubeSat
- Develop a space industry in Mauritius
 - Meet with collaborators and stakeholders
 - Come up with a roadmap



Thank You!



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