

# A Joint Italian-Kenyan Postgraduate Course as a Tool for Capacity Building in Aerospace

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SAPIENZA  
UNIVERSITÀ DI ROMA

Committee On the Peaceful Uses of Outer Space  
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# Sustainable Development Goals directly addressed



## Capacity for the 2030 Agenda

“To develop capacities to enhance global decision-making and to support country level action for shaping a better future.”

(UN Institute for Training And Research)



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“A Joint Italian-Kenyan Postgraduate Course as a Tool for Capacity Building in Aerospace”

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COPUOS, Sixty-first session, 28 June 2018

# The objective: Building capacity in Kenya in space mission design and management

- Skills in space mission design and management can effectively be gained in a “learning by doing” perspective, using “hands-on” education.
- The traditional approach to capacity building in developing countries is mainly based on fellowships granted to single selected students, to attend Courses and/or obtain a Degree in industrialized countries
- In this way the gained know-how is dispersed in several “isolated” skilled individuals
- The real challenge:

How do we set up a process locally, so that the capacity is maintained and kept at an Institutional level and not merely at the individuals level.



# The main Tool: A joint Postgraduate Course

Bearing in mind the question on how we can set up a process to build capacity locally, we decided to establish a **joint Postgraduate Course in “Space Mission Design and Management”**, with these main objectives:

- **Make the process Institutional, not individual**
- **Make the process “active” locally**
- **Not just “transfer” know-how, but “build” know-how locally**

**To achieve these goals, not only students, but Professors at University of Nairobi and experts form Kenya Space Agency are directly involved in designing and setting a higher education program together with professors from Sapienza University of ROME and experts form ASI.**

**This course is “tailor-made” in the spirit of the Italy-Kenya Agreement, but this experience has the potential to be extended to other countries**



# Course Organization and target students

The course is organized in a time frame of ONE YEAR.

- **SIX MONTHS lectures and university laboratory activity**
  - THREE MONTHS at Sapienza University of Rome
  - THREE MONTHS at University of Nairobi
- **SIX MONTHS internship** in a space agency or space company
  - ASI offers internships for Kenyan students at the Broglio Space Center
  - Italian companies offer internship in their facilities in Italy

In this form of collaboration:

- **Students MUST attend at least 30% of the credits in the partner university**
- **Professors in both Universities are active in making decisions and giving classes**

The Course organization and the approach of the teaching methodology, makes the **Course well suited for students with a BSc Degree or higher**



# The application tool: desing, build, and deploy a “real” space mission in ONE YEAR – The Cubesat

## Learning the space mission process, not the details

(international organization, technical and managerial aspects of space mission, timeline of events, implementation of space standards)

## The right tool for this is the UNIVERSITY SATELLITE concept

- It is a **funcional spacecraft**, rather than a payload instrument or component. it **must operate in space with its own independent means of communications and command**.
- **Untrained personnel** (i.e. students) performed a significant fraction of key design decisions, integration & testing, and flight operations.
- **The training of these people was as important as** (if not more important) **the nominal “mission”** of the spacecraft itself.

Bob Twiggs, Stanford University, 1996



# Small satellites for space education and capacity building in aerospace

Practical Training of **Whole Cycle of Space Mission Development**  
**Know what is important and what is not**

- Mission conceptualization, satellite design, fabrication, ground test, modification launch and operation,

- **Synthesis** (Not Analysis) of an effective system

- Feedback from the real world to evaluate design, test, etc.

*Education and experience of Project Management*

- Four Managements: **time, human resources, cost and risk**

- **Team work**, conflict resolution

- Effective discussion, **documentation**

- **International cooperation**, negotiation, mutual understanding

*Shinichi Nakasuka, Department of Aeronautics and Astronautics, University of Tokyo*

**These fundamental concepts are complemented with:**

- **interdisciplinary approach, with a view on applications**
- **basic regulatory aspects of space law and space economics**



# Space Mission Design and Management

## First edition of the Postgraduate Course - 2016/17

- The First edition of the Course was attended by 4 Kenyan and 2 Italian students
- One of the main activities was the development of the Cubesat 1KUNS-PF
- In the spirit of “hands-on” education (“learning by doing”), students participated in all of the professional technical meetings, with complete access to the documentation and directly interacting with the involved institutions (Space Agencies, companies, hardware developers )



Laboratorio di Sistemi Spaziali at  
the Galileo Galilei Institute



Meeting with JAXA in  
preparation for satellite launch



Lecture at the Laboratorio di microscopia  
"Pietro M. Motta"

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# Sapienza University and University of Nairobi Students' and Professors' joint Activities

A joint team of students and professors from both Sapienza University of Rome and University of Nairobi participated in the ground station activities in the Sapienza University Satellite Control Center for the satellite URSA-MAIOR (QB-50 mission). First contact 23th June 2017, 10:37 am

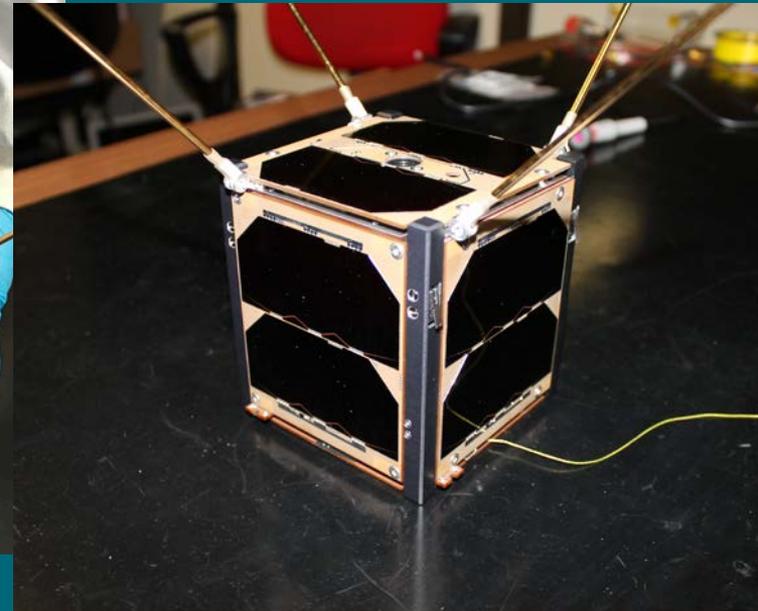
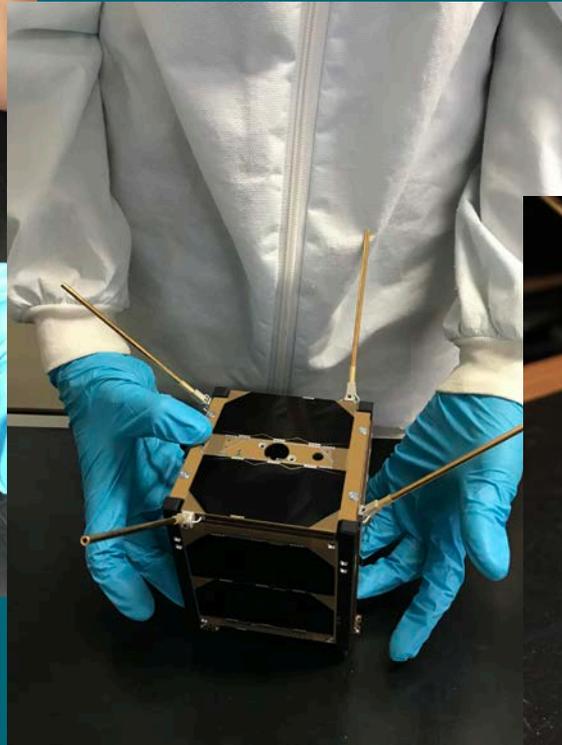
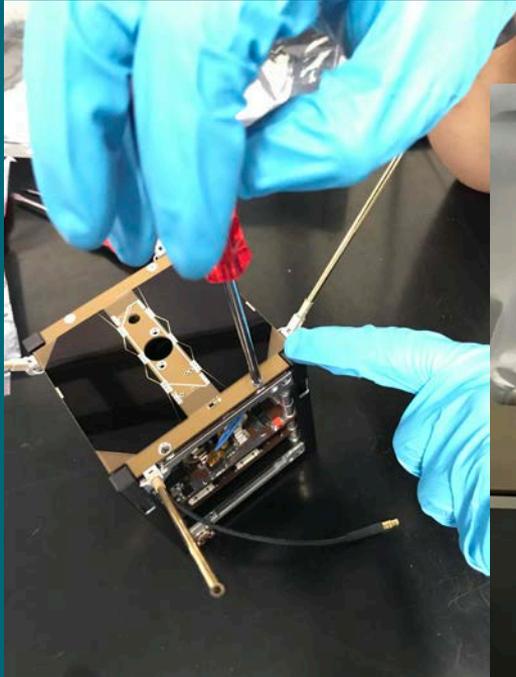


# Sapienza University and University of Nairobi Student's Joint Activities at University of Nairobi

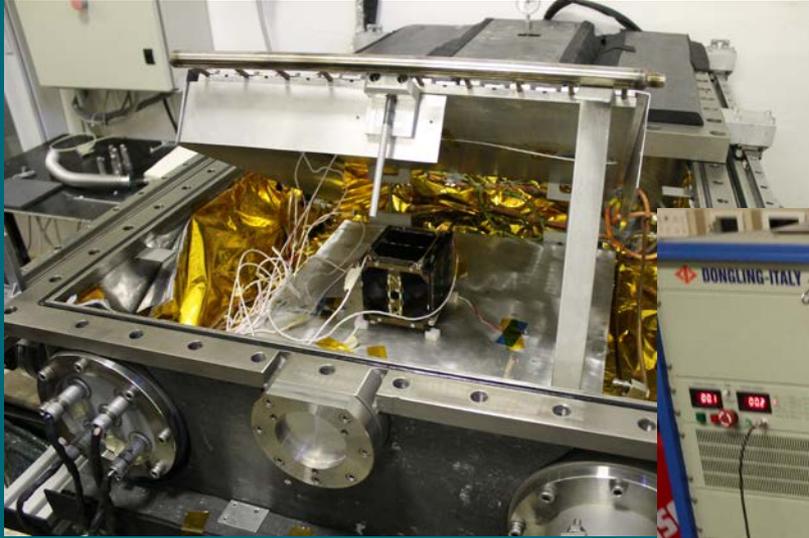
- Radio Amateur Ground Station Installed at University of Nairobi
- Solar panel assembled at University of Nairobi
- Electronic boards manufactured at University of Nairobi
- Professors at University of Nairobi teaching classes



# Satellite integration



# Environmental Testing

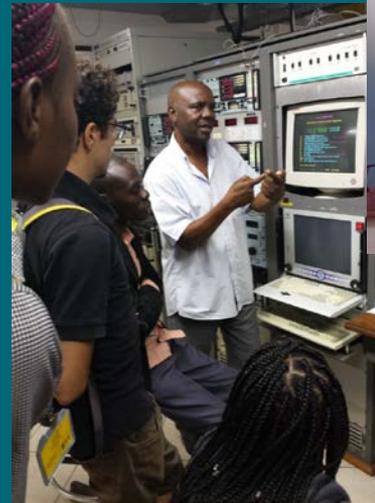


# Lectures and internships at ASI

- The Italian Space Agency contributes directly to education activities with lectures and internships at the Broglio Space Center



Lectures at the Italian Space Agency  
in Rome



Lectures and internship at the Broglio Space Center, Malindi



# The second edition (2017/18)

- The second edition of the Course (2017/18) is ongoing
- The students participate in the IKUNS mission, known as LEDSAT

Visit at the ThalesAlenia Space clean room in Rome



Regular classes at Sapienza University of Rome



# A view of the future

- More focus on **capacity building and technology transfer methodologies**
- Postgraduate Course in “**Capacity Building in Astronautics**”, from **2018/19**
- Involve students not only with degree from many disciplines, not only in Engineering, fostering space **applications**
- **Student payloads in hyperspectral imaging remote sensing and telemedicine in discussion**
- University satellites built together by Italian and Kenyan students:
  - 2017: 1KUNS**
  - 2018: 2KUNS**
  - :**
  - 20nn: nnKUNS**
- **Exploit the capacity developed locally**, obtaining technical support by the Postgraduate Course Alumni, as the mentors for younger students
- **Foster involvement of Companies from Kenya** (existing or to come....)



# Conclusions

- The Italy-Kenya cooperation in aerospace has proven to be mutually beneficial
- A joint International Postgraduate Course seems the right tool to pursue this cooperation further, for what concerns **capacity building** and joint research and education programs
- We are looking forward to **seeing more satellites in orbit soon**, commanded by students of the Postgraduate Course in the ground stations in Kenya
- Involving students in practical activities and **giving them responsibilities in a real program foster their interest and make the capacity building and technology transfer process fast and effective**
- The experience of the Italian-kenyan joint postgraduate course has the full potential to be extended to other contexts in other countries



# Thank you for your attention

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<https://www.uniroma1.it/it/offerta-formativa/master/2018/space-mission-design-and-management-internazionale>

