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Author: Mr. Iliass TANOUTI
International Space University, France, iliass.tanouti@community.isunet.edu

Dr. Taiwo Raphael Tejumola
International Space University, France, taiwo.tejumola@isunet.edu

DEVELOPING AN EARTH OBSERVATION CUBESAT CONSTELLATION TO ADDRESS THE
SUSTAINABLE DEVELOPMENT GOALS IN AFRICA

Abstract

According to the Sustainable Development Goals (SDGs) 2019 progress report, most African countries will not be able to achieve the SDGs by 2030. Water scarcity, food insecurity, urban unsustainability, and climate risks are some of the challenges the continent faces. These challenges can be addressed using innovative solutions enabled by satellite Earth Observation. Designing, manufacturing, and launching CubeSats facilitates cheaper and faster access to space Earth Observation. Furthermore, they ease building indigenous capabilities, they foster innovation, and they establish the basis for easy transfer-of-knowledge mechanisms. In this study, we developed a need-driven Earth Observation CubeSat constellation that can adequately answer Africa's needs, and provide concrete solutions to them. This study defines the constellation requirements for spatial resolution and revisit rate as the thresholds set by the World Meteorology Organization (WMO) and the United Nations (UN) requirements for data used to inform the SDGs global indicators. The project defines the feasibility and practicality of combining different Earth Observation payloads in a single constellation. It considers detailed radiometric budgets and optimized coverage functions tailored to the needs of the different regions in Africa. Besides, we optimized the constellation for rapid implementation and minimum cost. The final concept consists of high resolution Visible and Near Infrared (VNIR) multispectral imagers and thermal infrared radiometers. The constellation can cover the whole continent daily, with revisit rates of up to four times for specific target sites. The performance simulations conducted show that the constellation can address many of the Earth Observation gaps in Africa. The mission concept, architecture, and estimated costs constitute an ideal baseline for a development inspired project to contribute towards the achievement of the SDG.