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WHY AND HOW SMALL SATELLITES CAN BE RELEVANT TOOLS FOR SCIENTIFIC
RESEARCH?

Abstract

With the advent of 21st century, technology miniaturization has been taking place at a rapid pace. Space has been one of the biggest beneficiaries of technology miniaturization and this has opened up an altogether a new direction for space exploration by giving rise to small satellites, which also have turned out to be the drivers of technology miniaturization.

Ever since the advent of small satellites, many universities across the world have been showing interest in building them either solely or with international collaboration. In countries where there is not a definite space programme, these small satellites have helped them establish and pursue the dreams of space exploration. These small satellites are being built at a fraction of the cost that the huge satellites cost by not only using the commercially-off-the-shelf (COTS) items but are also serving as the test bed for these COTS items, consuming less resources including time and manpower and in-turn helping for a faster access to space.

Though small satellites are very attractive, they have their own limitations. On-board power available, size and volume, especially of the optical payloads and the communications are very important for the mission definition. Because small satellites consume fewer resources, even with the limitations they have been used widely especially used for technology demonstration.

This paper exposes some of the past and present successful small satellite missions that have been used for technology demonstration and the impact created both in terms of tangible and intangible benefits along with the future concepts of scientific research with small satellites. This paper also throws light on the optical payloads that are being hugely customized by being directly influenced by the overall size and mass of the satellite along with the essential technologies that are being developed or to be developed to enhance the capabilities of small satellites. A comparison of power and communications capability available on-board of these small satellites with the mass and volume of the spacecraft with focus on how these small satellites can help in technology transfer to developing countries for scientific research has also been provided in this paper. For the purpose of easy understanding, in this paper, we have classified all the satellites weighing less than 200 Kg as small satellites, which in-turn classified as Pico-satellites, weighing less than 1Kg; Nano-satellites, weighing between 1-10Kg; Micro-satellites, weighing between 10-100Kg; Mini-satellites, weighing between 100-200Kg.