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A LOW-COST EARTH-OBSERVATION CAMERA WITH HIGH IMAGE PROCESSING CAPABILITY USING COTS TECHNOLOGIES

Abstract

In recent years, the advances in remote sensing technology for Earth-observation satellites have been remarkable, and satellite-acquired images find widespread use in scientific research and commercially. Previously, national projects were the primary application of Earth-observation satellites; however, with advancements in remote sensing technologies, commercial applications of the satellites are emerging. Nevertheless, the satellite-acquired images are still expensive, which is one of the major barriers discouraging the generation of new ideas for applications of the satellites in the private sector. The high cost of images is due to the high development cost of the satellites, but it is expected that development costs of Earth-observation satellites will be reduced. Therefore, we rapidly developed a low-cost camera system to minimize the expenditure involved, based on our COTS-monitoring camera technologies, which utilize IKAROS. We used COTS technologies such as an FPGA, imager utilized in digital cameras, and open-source operating system. Based on this concept, the system was extended to capture high-resolution images using a high-resolution image sensor, a long focal-length optical system, and a high-performance processor. We term this system as CANAL-1 and plan to demonstrate its performance on the Earth and the Astronomical Observation Technology Demonstration Satellite, TSUBEME, which is planned to be launched at the end of 2012. During the demonstration using TSUBAME, we also plan to conduct a high-speed serial shooting mission that obtains images to simulate frame-by-frame video by performing serial shooting with CMG high-speed attitude control. The camera system is expected to capture images in ground sample distance of 9.2 m at 500 km, and the size of optical and processing units are 177 75 77.5 mm and 110 60 37 mm, respectively. We adapted Virtex4 to FPGA and used a PowerPC 405, operating at 400 MHz. In addition, we increased the RAM capacity to 256 MB while serial shooting, and we increased the image data capacity and Linux area for image processing. Furthermore, CANAL-1

uses a 2 GB NAND Flash for the main storage and 2 GB SD micro SD cards for sub storage. In this paper, we will introduce the basic concept of a low-cost Earth-observation camera and report the results of qualification tests.