

THE SCIENTIFIC AND PUBLIC OUTREACH VALUE OF LOW RESOLUTION VISUAL MONITORING CAMERAS ON PLANETARY PROBES (VMC)

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ABSTRACT

Several space vehicles and space transportation systems launched in the recent years were equipped with so-called visual monitoring cameras (VMC), sometimes also referred to as “visual telemetry”. These cameras are comparatively inexpensive, low resolution units of webcam quality, that provide engineers with visual feedback on the deployment of structures, vehicles, stage separations and other complex processes. Once these activities have been performed, these cameras are no longer used and remain mostly inactive.

Experience with the VMC installed on the Mars Express spacecraft, as well as comparable units on the REGINA and MIRIAM sounding rocket experiments, has shown however that despite their low resolution, such cameras have unique capabilities. These can enhance a mission’s worth scientifically, operationally and from a public outreach point of view.

Amongst the key advantages are their inexpensive procurement, the minimal use of on-board resources and the ease of operations and data processing. The low resolution, typically on the order of 640 by 480 pixels, with an 8 bit encoding and a Bayer filter, produce images of moderate data volume, that can be easily transmitted across the solar system even with low performance telemetry subsystems on top of other data. On Mars Express, the additional data generated by VMC operations never caused any data downlink shortages for data acquired during routine mission operations. If on-board image compression is added, entire series of images and even movies can be generated and transmitted with minimal effort. The cameras also produce data that can be directly imported into standard image processing software and the simplicity of the unit itself demands only a minimal support from mission operations.

In this paper we will present the VMC on Mars Express, the YACE camera on board AMSAT’s P3D satellite, as well as the camera subsystems of the REGINA and MIRIAM sounding rocket flights. Recent scientific observations made with these systems are discussed, to demonstrate the value such cameras can add to scientific data analysis. Examples of the ESA Mars Express VMC educational and public outreach campaign further showcase the tremendous public interest that a space mission can generate with such a system.

Based on these results, the value of such units for planetary probe missions is outlined and proposals for suitable VMC units on future planetary probes are made, along with suggested improvements and lessons learned.