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The Student-Led Design and Testing of an Imaging CubeSat Payload

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Volcanic ash presents a challenge for the aviation industry. 3D information is needed to be able to back-calculate dose – this is a key parameter in managing airspace. To recreate the ash cloud, multiangle observations are required – deal to perform visual and infrared observations. Other mission objectives using the can also be realised, for example, as volcanic ash clouds are the primary target, there is the possibility to map new magma extrusions, lava and pyroclastic flow movements. Thermal infrared data has also previously been used to observe volcanic cycles and better understand their behaviour. The visual images required for 3D construction of ash clouds can be used to create digital elevation models of terrain around volcanos which have application in disaster management and planning, and forest fires may also be included as targets of opportunity.

A CubeSat mission - Pointable Radiometer for Observing Volcanic Emissions (PROVE) Pathfinder - is proposed to monitor the ash cloud using both thermal infrared and visual cameras. The resulting 2U payload consists of a thermal infrared camera (FLIR Tau 2 with a 50mm lens) and a visual camera (a narrow field of view Basler ace ac5472-5gc with a Kowa LM75HC lens). Alongside this, a payload computer to communicate with the cameras and store data was selected (the BeagleBone Black Enhanced Industrial) with a custom PCB providing connections to the instruments and bus. The software to operate the payload takes the form of a custom scheduler for an imaging pass, sending commands to the camera systems (and to the bus) to take the required multiangle images for ash cloud reconstruction.

The engineering model of the payload is currently being tested at the European Space Agency's CubeSat Support Facility with the support of the Education Office of the European Space Agency under the educational Fly Your Satellite! Test Opportunities programme. The team are undertaking a month of environmental testing including vibration and thermal vacuum tests. The aim of the testing campaign is to qualify the payload for launch.

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