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Development and Assembly of a MEMS Based High-Sensitivity Relative Gravimeter for Multi-Pixel Imaging Applications

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The manufacture and production of a high-sensitivity cost-effective gravimeter has the potential to change the methodology and efficiency of gravity measurements. Currently, the most common method to conduct a survey is by using a single gravimeter, usually costing tens of thousands of Dollars, with measurements taken at multiple locations to obtain the required data. The availability of a cost-effective gravimeter however would allow the user to install multiple gravimeters, at the same cost of a single gravimeter, to increase the efficiency of surveys and long-term monitoring.

Since the previous reporting on a low-drift relative MEMS gravimeter for multi-pixel imaging applications (Prasad, A. et al, EGU2020-18528), significant progress has been made in the development and assembly of the previously reported system. Field prototypes have been manufactured and undergone significant testing to investigate the stability and robustness of the system in preparation for the deployment of multiple devices as part of the gravity imager on Mount Etna. The device, known as Wee-g, has several key features which makes it an attractive prospect in the field of gravimetry. Examples of these features are that the Wee-g is small and portable with the ability to connect to the device remotely, can be powered through a mains connected power supply, or through portable batteries, weighs under 4kg, has a low power consumption during normal use of 5W, correct for tilt through manual adjustments or remotely through integrated stepper motors with a total tilt correction range of 5 degrees, the ability to read out tilt of the device through an inclinometer for either alignment or long term monitoring and numerous temperature sensors and heater servos to control the temperature of the MEMS to <1mK.

This presentation aims to report on the progress that has been achieved in the development and manufacturing of the prototype devices, various testing of the devices under various laboratory conditions (such as the measurements of the Earth tides, and a relative measurement

of gravity at various floor levels), as well as additional applications that are to be explored in 2021.