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Geotechnical investigations at Matjiesfontein Space Geodesy Observatory for the emplacement of geodetic and geoscience instruments

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The donation of a 1 m Cassegrain telescope by France to HartRAO facilitated the development of a combined Satellite and Lunar Laser Ranger (S/LLR). The S/LLR will be located at Matjiesfontein, South Africa and will be collocated with a gravimeter, seismograph and a Global Navigation Satellite Systems (GNSS) receiver. In addition to the mentioned instruments, the site could be considered for the installation of two 34 m dishes as part of the NASA Deep Space Tracking Network. These dishes may be suitable for International Celestial Reference Frame VLBI experiments. The possible future installation of a DORIS system will further enhance satellite tracking and orbit calculations.

Geotechnical properties of the terrain at Matjiesfontein are of crucial importance for the stability of these instruments as they should be anchored to firm bedrock. This will allow the measurement of the Earth's crust and allow precise orbit and range determination. The LLR is designed to achieve sub-cm accuracy ranges from Earth to the retro-reflectors placed on the lunar surface during the Apollo and Lunokhod era. Geotechnical work undertaken at the designated Matjiesfontein site includes measurements of the strength of materials, slope stability, road design and excavation depth. An accurate 3D model (within 10 cm) of the terrain is also being created through the collection of high density height measurements with the use of GPS instruments.

Investigations also include appropriate placement of administrative buildings, sewerage tank placement and installation and distribution of services such as access, water, electricity and potential future communication lines such as fibre-optic cable. The access road to the site is severely eroded and an appropriate design inclusive of low level river crossings will be done based on predicted future use. An environmental impact assessment is currently underway and should be completed by the year end. Here we report on the progress to date and provide an outline of future work to be done.

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