

The role of national regulations in RPAS-based mapping projects in the monitoring of natural hazards that could involve infrastructures: the example of the Val Venosta Railway (Northern Italy – Bolzano).

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Italy has adopted National Regulations for the use of RPAS in its country's airspace in December 2013, issued by the Italian Civil Aviation Authority (ENAC). Despite the issued regulations, over the past months an increasing number of unauthorized and unsafe operations have been performed and the attention to safety is growing quickly in the public opinion. For this reason “Critical Operations” is permitted only to those RPAS Operators which have received special authorization by ENAC after a very demanding Aeronautical procedure. According to the Regulations, the flight close to-over urban areas, industrial plants, highways and railways, implies that only authorized RPAS Operators may perform such activities.

An example of a “Critical” operation were the RPAS flights performed along the Venosta railway line to evaluate the current situation of two areas affected by geological instability and laid the basis for a future high accurate monitoring.

The Venosta Valley is located in the western part of South Tyrol (Northern Italy). The valley possesses some unique features compared to the entire Alps, the particularly dry climate and the presence of huge alluvial fans, which give rise to different levels of altitude in the valley. From geological point of view, the Venosta Valley is characterized by the presence of the Austroalpine domain. In particular, there are two different geological units in this area: (i) the crystalline schists of the basement, which includes paragneiss, gneiss, granitoid pegmatites, garnet micaschists, quartzites and phyllites. (ii) The Mesozoic coverage divided into various complexes with successions of phyllites, volcanics and magmatiti.

The railway line that runs through the Venosta Valley (Merano - Malles) unfolds along a path of 59,8 kilometers and covers an altitude difference of about 700 meters. In particular, three tunnels characterized the first section, including the M. Giuseppe tunnel, which required extensive consolidations both inside and outside.

The mission's scope was to achieve high precision photogrammetry data to reconstruct sub-centimetric 3D models of the retaining wall and the unstable rock mass. Flights have been performed with two different RPAS, a multicopter and an helicopter, controlled by a crew composed by three members: two pilots (Command and Backup Pilot) operating redundant data links for flight control and a payload operator and Aeronautical Flight procedures have been applied. The payload operated the camera to achieve the best images for the data acquisition and 3D model reconstruction. The flights have been conducted with manual piloting flight procedures because of the RPAS on board GPS is significantly affected by the mountain slope proximity. For this reason, for the georeferencing procedure, ground control points have been acquired by using an high precision GPS.

Finally, using RPAS data it has been possible to assess the lateral earth pressure on the retaining wall of the railway embankment, while in the second case the aim was to accurately reconstruct the volumes of an unstable rock mass.