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The design of the multipurpose Lusi drone. When technology can access harsh environments.

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Extreme and inaccessible environments are a new frontier that unmanned and remotely operated vehicles can today safely access and monitor. The Lusi mud eruption (NE Java Island, Indonesia) represents one of these harsh environments that are totally unreachable with traditional techniques. Here boiling mud is constantly spewed tens of meters in height and tall gas clouds surround the 100 meters wide active crater. The crater is surrounded by a 600 meters circular zone of hot mud that prevents any approach to investigate and sample the eruption site.

In the framework of the Lusi Lab project (ERC grant n° 308126) we assembled and designed a multipurpose drone to survey the eruption site. The Lusi drone is equipped with numerous airborne devices suitable for use on board of other multicopters.

During the missions three cameras can complete 1) video survey, 2) high resolution photogrammetry of desired and preselected polygons, and 3) thermal photogrammetry surveys with infra-red camera to locate hot fluids seepage areas or faulted zones.

Crater sampling and monitoring operations can be pre-planned with a flight software, and the pilot is required only for take-off and landing. An automatic winch allows the deployment of gas, mud and water samplers and contact thermometers to be operated with no risk for the aircraft. During the winch operations (that can be performed automatically) the aircraft hovers at a safety height until the tasks are completed while being controlled by the winch embedded processor. The drone is also equipped with a GPS connected CO₂ and CH₄ sensors. Gridded surveys using these devices allowed obtaining 2D maps of the concentration and distribution of various gasses over the area covered by the flight path.