GEOLOGICAL AND GEOMORPHOLOGICAL MAP OF EXOMARS 2016 LANDING SITE. A. Pacifici[1], G. G. Ori[1], F. Cannarsa[1], A. Murana[1], A. Aboudan[1], S. Portigliotti[2], A. Marcer[2], L. Lorenzoni[3], [1] IRSPS, Universita' d'Annunzio, Viale Pindaro 42, 65127, Pescara, Italy (pacifici@irsps.unich.it), [2] Thales Alenia Space Italy (TAS-I), Strada Antica di Collegno 253, 10146, Torino (Italy), [3] ESA-European Space research and Technology Center (ESTEC), Netherlands.

Introduction: ExoMars 2016 is a joint endeavor between European Space Agency (ESA) and Russia Space Agency (Roscosmos). Part of the ExoMars 2016 mission, with Thales Alenia Space Italia (TAS-I) as prime contractor, is constituted by an entry, descent, landing demonstrator module (EDM), named Schiaparelli, carrying instruments payload for surface operations.

The target landing of ExoMars 2016 is an ellipse (110x25 km) in the Meridiani Planum area of Mars, partially overlapping the NASA mission MER Opportunity landing ellipse. The Meridiani Planum area has been deeply investigated in the past [1, 2]

A geological-geomorphological map of ExoMars 2016 landing ellipse has been realized to support the engineering constraints analysis. The map (scale about 1:100000) is, therefore, prepared based on the need to characterise the environment at the landing sites and define the landing hazard

Data and Methodology: Data utilized consist of low, to very high-resolution data, acquired by previous Martian missions. Low-resolution data consist of MOLA and THEMIS IR mosaic; high-resolution data consist of HRSC and CTX. Very high-resolution data consists of MOC-Na and HiRISE. Data have been processed using ISIS3 software, and then ingested in a GIS project. In order to mitigate the misalignments of data acquired from different spacecrafts, the entire dataset have been co-registered on the base of MOLA data, and following an increasing resolution order, similarly as proposed by [3]. The south-eastern portion of landing ellipse of ExoMars 2016 partially overlies the landing ellipse of NASA rover mission MER Opportunity, for which several very high-resolution images have been acquired by MGS and MRO NASA missions. As a consequence, south-eastern part of ExoMars 2016 landing site is densely and completely covered by very high-resolution images (MOC-Na and HiRISE). Moreover, MER Opportunity data of the Martian surface have been utilized in order to better distinguish and characterize geomorphological units of such area. In the other part of ExoMars 2016 landing site, very high-resolution images are discontinuous and sparse.

A novel image transformation procedure, that we called Multi-Scale Tonal Roughness (MSTR), has been developed in order to enhance and quickly map metric and decametric-scale features in high and very high-resolution images.

Geological-Geomorphological Map: The geological-geomorphological map has been realized in a GIS environment. The main problem during the mapping phase has been due to the different distribution of very high-resolution data on the landing site: HiRISE and MOC-Na. In order to characterize as best as possible the entire landing site we proceeded following these steps: i) principal geological and geomorphological facies have been distinguished trough HiRISE, HiRISE Multi-Scale Tonal Roughness data and MOC-Na images, allowing the determination of the principal geological and geomorphological units. ii) Geological-geomorphological units observed on the basis of HiRISE and MOC-Na images have been extended at the entire landing site trough lower resolution data (CTX, HRSC, THEMIS IR). The landing site area has been divided in five main units (Bedrock, North-West, South-East, Aeolian and Impact Crater) successively divided in sub-units.

Bedrock unit consists of a consolidated rock formation that crop-out at the surface (when soil or other superficial deposits were removed). The substratum probably consists of the rocks forming the Burns formation [2] covered by a veneer of deflation deposits consisting of coarse sand and granules with scattered pebbles and cobbles. Geological lineations, ranging from joints to fractures and varying in term of morphologies and dimensions, characterize larger part of this unit, and seem to be genetically connected to the processes of induration/consolidation of the substratum.

North-West unit locates to the north-western tip of the landing site ellipse. It is probably made by material forming (or related to) the ejecta of a large impact crater occurring NW of the Landing site.

South-East unit consists of rocks belonging to the Burns formation and surrounding the north-western part of Endeavor Crater. Part of this unit has been traversed by NASA MER Opportunity rover. As the Bedrock unit, it is characterized by occurrence of geological lineations.

Aeolian unit represents areas in which aeolian related morphologies appear dominant. These are formed by loose materials emplaced and arranged by aeolian processes. Shape and orientation of features forming this unit suggest that main winds acting in the landing site (now or at the time in which such aeolian bedforms formed) blow westward. Areas belonging to this unit could appear both bluish or brownish in HRSC color images, depending on the nature both of the loose material and the superficial dust. Aeolian sub-units illustrate the distribution of dunes and aeolian megaripples of different wavelengths.

Impact Crater unit collects all features and morphologies related to impact cratering processes. The landing site area is characterized by a large number of impact craters, ranging in size, morphology and stage of preservation. Only craters larger than 100 m in diameter are considered in the map, as smaller craters aren't representable at the map scale (1:100000). Furthermore, **s**maller craters are not clearly distinguishable in CTX images, which are the highest data in resolution among those covering the entire landing site. Anyway, where very high-resolution images occur, all the impact craters larger than 3 m in diameter have been mapped in order to support the ExoMars 2016 landing risk analysis.

References: [1] Christensen P. R., (2000) *Journal of Geophysical Research - Planets, 105 (E4), 9623 – 9642*. [2] Grotzinger J. P. et al. (2005) *Earth and Planetary Science Letters, 240. [3] Parker T. J. et al. (2012) XXXXIII LPSC, Abstract #2535.*