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Moon Exploration - Part 1 (2A)

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# AMALIA MISSION: THE ITALIAN ANSWER TO THE GOOGLE LUNAR X PRIZE CHALLENGE

**Abstract**

According to the Google Lunar X Prize a robot – to be sent on the Moon surface within 2012 – is asked to cover at least 500 m reporting through both videos and images its walk on the surface. The whole mission must be only privately funded. Currently sixteen official teams are competing for the prize: eight from US, five supported by international consortia, three strictly national; four consortia exploiting collaboration between private industries and well-known Universities. Italy is answering to this call with the AMALIA mission (Ascensio Machinae Ad Lunam Italica Arte): the team, completely Italian, is composed by major Italian Aerospace and Engineering Universities in the country supported by three large systems integrators and developers among Italian aerospace industries: Politecnico di Milano, Politecnico di Torino, Università di Roma "La Sapienza", Università di Napoli "Federico II", for the academic participation and Thales Alenia Space-Italia SpA, Carlo Gavazzi Space SpA and TechnoSystem Development SpA for the industrial side. The International Association for the Aerospace Culture coordinates the team. These entities have already an impressive track record in contributing to and developing space exploration and planetary missions for the Italian and the European Space Agencies. The AMALIA mission baseline sees a lander vehicle releasing a wheeled rover on the Moon surface; the lander vehicle plays the cargo role for the Earth-Moon transfer too. The alternatives of either 'only rover active' or 'rover plus lander active' on the surface are still considered. The vehicles design is driven by the mass minimization: therefore the two vehicles subsystems sharing maximization is aimed; miniaturized hardware components are exploited; redundancy is avoided, as far as the mission reliability is preserved. The VEGA launcher is considered as the baseline, assuming the DNEPR as a back up solution. Some tight constraints imposed by VEGA are strongly pushing for identifying a very smart design to significantly reduce the launch mass. Chemical propulsion units control the transfer trajectory; the same units guide the landing leg with an almost continuous thrusting profile. The selected landing site is equatorial. A four wheels rover with specifically designed suspensions will be released on the surface; navigation will be accomplished by merging classic and visual odometry supported by three cameras mounted on a mast; those cameras will also supply data required to answer challenge official requirements. On board autonomy is limited, leaving the authority to Ground. Deeper details on the Team Italia project state of the art are offered in the paper.