Strategic Mars exploration: Orbiter and EDL demonstration mission for space weather, climate, and aquatic environment

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This presentation will report on outline of the strategic Mars exploration with an orbiter and EDL technology demonstration to investigate the space weather, climate, and aqua-environment at Mars, which is to be submitted to the Master Plan 2020 of the Science Council of Japan. The research project was previously proposed from Society of Geomagnetism and Earth, Planetary and Space Sciences (SGEPSS) as “Exploration of the space weather and climate at Mars,” which is listed in the Master Plan 2017 of the Science Council of Japan as the large scientific research project number 79, category number 24-2. The project has been developed since then through discussions over larger related academic communities including the planetary science. Here we propose the renewed project as a joint proposal between SGEPSS and the Japanese Society for Planetary Sciences.
In the roadmap of the solar system exploration in coming 20 years, understanding of the formation and evolution of the habitable environment is regarded as an essential goal of the planetary science. Among various targets, Mars is an idealtarget for comparative planetology and astrobiological researches, since it once had a habitable environment with an abundant water on its surface. Mars sample return mission with international collaborations is under planning for the 2030’s. In order for Japan to play a leading role there,implementation of our original strategic Mars exploration missions in 2020’s is under vital demands from both the scientific and technological points of view.
As an important step in the Japanese strategic Mars exploration to strengthen our ability to contribute the future Martian exploration scenario by ISECG (international space exploration coordination group), this project combines the orbiter and EDL (entry, descending, and landing) technology demonstration, focusing on the responses of Martian environment to extreme solar variations and its co-evolution with subsurface aquatic environment.The mission will elucidate influence of the active sun on the habitable environment and provide the basis for our future landing exploration in 2030’s. In particular, by investigating the instantaneous response to extreme solar variations, which can be usual conditions in ancient sun, we will obtain the key knowledge to understand how atmospheric escape to space contributes to the loss of habitable environment from ancient Mars. The project will also provide knowledge about Martian radiation environment and will achieve demonstration of key technologies for the future landing exploration as well as important information of possible landing sites.In order to achieve the goal, we identified three observational requirements and 11 model payloads for the mission. In the presentation, details of these items will be also introduced.

Keywords: Mars, Exploration, Master Plan, space weather, space climate, Water

