SCIENCE OBJECTIVES OF JAPANESE ATMOSPHERIC ESCAPE MISSION TO MARS (HEIR OF NOZOMI): ROLE OF ATMOSPHERIC ESCAPE IN EVOLUTION OF MARTIAN ENVIRONMENT.

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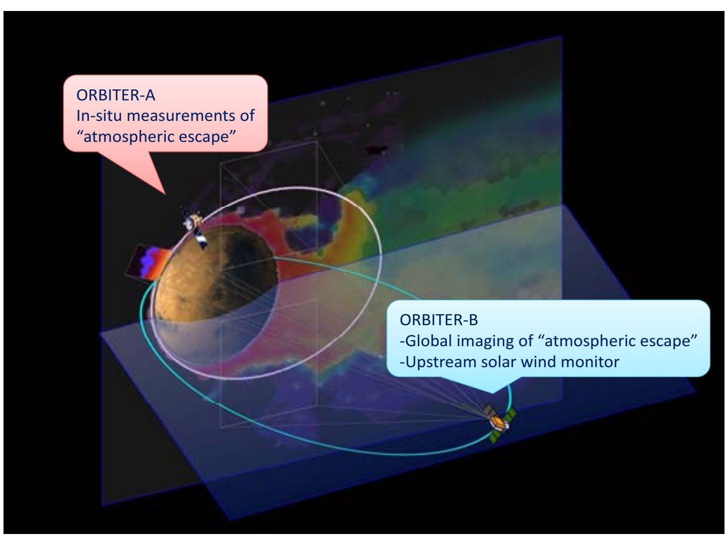
Backgrounds: The cumulative effect of the atmospheric erosion due to the external forcing is regarded as one of the plausible candidates of the drastic climate change from warm and wet to cold and dry environment, which Mars is believed to have undergone in the past. Our target is to elucidate non-thermal escape processes, in particular, solar wind-induced escape processes, which are pointed out to involve substantial uncertainties by previous measurements and theoretical studies. This target was one of the main scientific objectives of Nozomi (launched in 1998), the Japanese first mission to Mars. Recent progress made by MGS and Mars Express has given us partial view of current atmospheric escape, and the motivation is now taken over by the upcoming MAVEN mission of NASA. MAVEN is planning to carry out a comprehensive in-situ observation of the atmospheric escape, which will unveil the current state of upper atmosphere and its escape.

Scientific Objectives and Mission Strategy: The Martian atmospheric escape mission working group at ISAS/JAXA has studied possibility of two-orbiter mission in order to deepen our understanding of escape processes and their response to the solar variations to the level of an extendable one to the past to discuss atmospheric evolution, which cannot be achieved by one satellite. We consider that the following combination of remote sensing and in-situ measurements from two orbiters is essential to get key information. Simultaneous observations from the "high-altitude orbiter", which will grasp a global (planet-wide) structure of escaping ions and neutrals by UV/EUV/VIS imaging, and from the "low-altitude orbiter", which will investigate the escape processes by in-situ measurements, enable us to identify many essential escape processes. In addition, the imaging as well as the high-mass-resolution in-situ particle measurements can identify ion and neutral compositions of escaping atmosphere related to CO_2. Thus it will be possible to study how and how much the greenhouse gas has escaped from Mars. The "high-altitude orbiter" provides another key observation: solar wind monitoring. The solar wind monitoring is crucial to precisely understand present escape processes/fluxes as well as their dependences on the external conditions of the solar activity, which are necessary to reconstruct the evolutional history of atmospheric escape with geological timescale.



Schematic drawing of atmospheric escape mission to Mars (heir of NOZOMI)