OVERVIEW OF JAPAN'S MELOS1 MARS MISSION: MARS EXPLORATION FOR LIFE/ORGANISM SEARCH. T. Satoh[1], T. Kubota, K. Fujita, T. Okada, T. Iwata, T. Imamura, A. Oyama, N. Ogawa, K. Yamada (Japan Aerospace Exploration Agency), H. Miyamoto (University of Tokyo), A. Yamagishi (Tokyo University of Life and Pharmacy), G. Komatsu (IRSPS), T. Usui (Tokyo Institute of Technology), G. L. Hashimoto (Okayama University), H. Demura (Aizu University), H. Senshu (Chiba Institute of Technology), S. Sasaki (Osaka University), and G. Ishigami (Keio University). [1]ISAS/JAXA, 3-1-1 Yoshinodai, Chuo-ku, Sagamihara, Kanagawa 252-5210, Japan (satoh@stp.isas.jaxa.jp).

Introduction: Mars is an attractive object for explorations (scientific, robotic, or human in coming decades). Japan had a Mars exploration mission, NOZOMI (launched 1998), of which primary scientific objectives was escaping atmosphere from Mars. NOZOMI was unsuccessful (sad to say) and we did not have a chance to visit the red planet since then. After having our first Venus mission, AKATSUKI (launched 2010), there have been planning activities for "next" Mars missions. Through intensive discussion among researches of various areas, we have recently reached a conclusion about the aim of our MELOS1 mission [1]. It is "Life/Organism Search" which can be compared to what Americans or Europeans will do in upcoming missions (ESA's ExoMars [2] or NASA's Mars2020 [3]). "MELOS" in MELOS1 is an acronym of "Mars Exploration for Life/Organism Search".

When and How: ESA will launch a series of ExoMars missions: an orbiter in 2016 and a rover in 2018. NASA, on the other hand, will search for signs of "past" lives with a rover, Mars 2020, build based on successful (in engineering aspects, at least) Curiosity rover [4]. Because the area of Mars is about the same as the earth's continents, too wide to cover with just a handful of landing probes, it is necessary that as many places as possible should be visited via international collaboration. Japan should play a role in this and the best way to do so is to send a rover equipped with a high-sensitivity life and organism detector. The timing should not be too far from ExoMars or Mars2020, of course.

We, therefore, propose a rover mission for early 2020's. The launch vehicle is assumed to be H-IIA 202. The entire system consists of an entry-descent-langind (EDL) module and a cruise stage, weighing some 800 kg or so. After departing from the earth, the cruise stager will generate necessary electric power with its solar-array panels. The power covers communication to the earth and data handling, the attitude control system, the heat-managing system, and the trajectory control maneuvers. When approaching Mars, the EDL module will be detached and enter the Mars atmosphere [5].

To efficiently search for life or organism, the probe should land on very specific place where remote observations strongly indicate there should be something. This requires a "high-precision" landing that can be done by active-guided descent under speed of supersonic or sub-sonic, an engineering challenge. The Martian atmosphere is sometimes saide to be "too thin to be useful but too thick to ignore". MELOS1's engineering team members are working hard to overcome this problem with high confidence.

The system is currently so designed that we can land a 60-kg rover on the Martian surface.

On Mars: The rover's nominal life time, though still TBD, may be 60 to 120 Martian days during which she performs life and organism detection experiments. The 60-kg rover will host 6 to 7 kg of science payload. The main instrument, of course, is Life Detection Microscope (LDM) [7]. To best utilize 8 sample containers of LDM, the rover will traverse for 5 to 6 days to a new location. At one place, the onboard instruments will be used to decide from where we pick up the sample (may take a few days for this). Then, scoop and test will be performed for one full day. This cycle requires up to 10 days per sample. During the mission's life time of 90 days, we can utilize all 8 sample containers.

More Future: It is imaginable that the entire world will be shocked and changed if ANY sign of life on Mars is discovered. After MELOS1, if successful, we should then plan missions that give us more detailed data to study what kind of lives they are on Mars and probably on othe worlds in the universe. This should be the dawn of "generalized" biology.

References:

[1] Satoh, T., et al.: MELOS1 Mars Landing Exploration Plan, Presented at JPGU2013 (May 2013).
[2] ExoMars: http://exploration.esa.int/mars/.
[3] Mars2020: http://mars.jpl.nasa.gov/mars2020/.
[4] Curiosity: http://mars.jpl.nasa.gov/msl/.
[5] Fujita, K., et al.: Design Study of Mars EDL Demonstrator for MELOS Mission, Presented at ISTS2013 (June 2013).
[6] Ishigami, G., et al.: 'Feasibility Study of a Small, Lightweight Rover for Mars Surface Exploration, Presented at ISTS2013 (June 2013).
[7] Yamagishi, A., et al: MELOS Life Search Plan: Search for Microbes on the Mars Surface with Special Interest in Methane-oxidizing Bacteria, Presented at ISTS2013 (June 2013).