Marco Polo: International Sample Return Mission to the Most Primitive Bodies of the Solar System

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http://planetb.sci.isas.jaxa.jp/flab/

Established in 2004, the Minor Body Exploration Working Group has studied a concept of next generation minor body exploration mission in the post-Hayabusa era. In the JAXA long term vision in 2006, a concept of the Primitive Body Exploration Program (Yoshikawa et al., this meeting) has been formulated to aim sample return series of primitive bodies to the 'further, smaller, and more primitive' direction, from S-type asteroids by Hayabusa, C-type asteroids by Hayabusa-2 and even more primitive types like D/P-type asteroids and CAT(comet-asteroid transition) objects in next decades.

In 2006, European and Japanese scientists gathered and agreed to work together on a join proposal of a primitive body sample return mission in the Hayabusa Mk-II period (i.e., in mid-2010's) by combining successful expertise of short-period comet explorations in Europe and Near Earth Object sample return mission in Japan. Thus the Hayabusa Mk-II concept was evolved into the 'Marco Polo' mission that would employ the mothership inherited from Hayabusa with two complementary sampling devices as well as in-situ scientific instruments from both parties as well as a large lander inherited from Rosetta/Philae with a surface science package as a baseline configuration.

In November 2007, this proposal was selected as one of 4 medium-class Cosmic Vision mission candidates to be launched after 2017 by ESA and the joint assessment study between Japan, as the senior partner, and Europe has started. The down selection by ESA will be made by the end of 2009 and the final selection by 2012.

The baseline scenario was chosen as the most difficult among other options to go to the CAT object Wilson-Harrington in the launch of 2018. The mothership will utilize a cluster of improved ion engines to reach the target and extendible boom for touch-and-go sampling of both surface and sub-surface materials of the dormant comet nuclei. After several months of the stay at the target in 2022, the spacecraft will return to the Earth in 2026 with the earth reentry capsule at the speed of ˜14 km/s.

This presentation describes scientific objectives, baseline mission design, possible spacecraft configuration, straw man payloads, sampling technology, new engineering challenges as well as status report of the on-going assessment study of this joint mission.