THE HAYABUSA ASTEROID SAMPLE RETURN MISSION. H. Yano, Dept. of Planetary Science, Japan Aerospace Exploration Agency (JAXA)/Institute of Space and Astronautical Science (ISAS) 3-1-1 Yoshinodai, Sagamihara, Kanagawa, 229-8510, JAPAN (yano.hajime@jaxa.jp).

Introduction: On 9th May 2003, the Japanese spacecraft MUSES-C was successfully launched from Uchinoura. The spacecraft was directly inserted into an interplanetary trajectory and renamed as "Hayabusa", or "Falcon", to be the first sample return spacecraft to visit a near-Earth asteroid (NEA) [1]. The target is NEA (25143)Itokawa (formerly known as 1998SF36). Its size is 490 (±100) x 250 (±55) x 180 (±50) m with a ~12-hour rotation period [2]. It has a red-sloped S(IV)-type spectrum with strong 1- and 2-micron absorption bands, analogous to ordinary LL chondrites exhibiting possible space weathering effect [3]. The asteroid could be olivine rich compared to typical S asteroids. Assuming a bulk density of ordinary chondrites, the surface gravity of Itokawa is on the order of 10 micro-G, with an escape velocity = ~20 cm/s.

Mission Sequences: At present, the spacecraft operates with three ion propulsion engine systems. In June 2005, the spacecraft will be inserted into an orbit which is nearly identical to the orbit of the target asteroid itself. As it draws nearer the asteroid, the spacecraft will conduct global mapping with an multi-color optical camera, near-infrared spectrometer, X-ray fluorescence spectrometer, and LIDAR for up to three months

Sample Return Strategy: After completing global mapping, the first descent for touch-and-go sampling will be conducted. Before touching the surface, however, one of three target markers will be dropped to track its passage by autonomous navigation. Also a hopping rover called MINERVA will be deployed. Since the actual surface conditions of Itokawa are unknown, HAYABUSA employs a sampling mechanism that should work for a diverse heterogeneity of target surfaces, from hard metal-silicate surfaces to fluffy regoliths [4]. Within 0.3 seconds after the tip of the sampler horn touches on the asteroid surface, a Ta projectile of 5-g mass is shot at 300 m/sec by a small projector onto the asteroidal surface. Impact of the projectile produces surface ejecta, which is concentrated through a conical capture horn toward the sample catcher. The catcher is transferred into the reentry capsule, which is hermetically sealed. During testing, the mass of samples recovered ranged from several hundred mg to several g per shot. The majority of recovered samples were fine-grained (sub-mm size) particles, rather than large chips. The sampling will occur at as many as three locations in November 2005.

Preliminary Sample Analysis: In July of 2007 the samples will be returned to Earth within the hermetically-sealed capsule, and flown to a new dedicated curation/preliminary examination lab in Sagamihara for ~1 year of preliminary investigation in Japan. During this time investigations of the vestigations of the samples will be made by largely Japanese teams, though with some foreign participation. These teams are being chosen through competitions. A maximum of 15 mass% could be consumed to characterize representative samples during this 1-year long preliminary examination phase. Following the initial analysis period an international announcement of opportunity for detailed analyses of another 15 mass% of the samples will be released. Another 10 mass% will be transferred to NASA's Johnson Space Center.

References: [1] J. Kawaguchi et al. (2000) *Prof. 22nd ISTS*, 2000-o-3-06v. [2] M. Kaasalainen et al. (2002) *Proc. ACM 2002*, ESA SP-500. [3] R.P. Binzel et al. (2001) *Meteoritics & Planet. Sci.*, **36**. [4] J. Veverka et al. (2001) *Science*, Vol. **292**, 484-488.