The Drop Tower Experiments as a Tool for Asteroid Studies. Y. Takagi[1], [1]Aichi Toho University (3-11 Heiwagaoka, Meito-ku, Nagoya 465-1585, JAPAN, takagi@aichi-toho.ac.jp).

There are some methods to obtain as low gravity environment as that on small asteroids such as Itokawa: orbiting platforms (Space shuttle orbiter [STS] and the International Space Station [ISS]), parabolic flights of aircraft, and drop towers. The orbiting platforms provide stable and long-term microgravity environment. However, flight opportunities onboard STS or ISS are rare and there are many restrictions on experimental conditions. The use of parabolic flight aircraft is less expensive and easier to accommodate and lasts for ~20 seconds. We made performance tests of the impact sampling device of MUSES-C/Hayabusa mission onboard parabolic flights [1]. However, the quality of microgravity environment depended upon flight conditions and the best performance of reduced gravity level is about 10^{-2} G level, which is 2-3 orders of magnitude larger than that on small asteroids like Itokawa. Even in some cases, the negative gravity levels (upward acceleration) were applied to the sand target, which scrubbed the impact ejecta measuremenets.

On the other hand, the quality of microgravity environment in the drop capsule is stable in $10^{-4\sim-5}$ G level, which is equivalent to the small asteroid surface gravity, as explained later. We performed efficiency tests of the sampling device of MUSES-C/Hayabusa mission [2] and impact cratering experiments [3] using the Microgravity Drop Experiment Facility of Micro-Gravity Laboratory of Japan (MGLAB, http://www.mglab.co.jp/), Toki, Japan. The results showed that the facility is useful for asteroid geology studies despite the fact that the drop tower experiment only lasts several seconds in the microgravity environment condition. In the poster, major features of the drop tower as a tool for asteroid geology studies are summarized.

Using the MGLAB facility, we have performed over 50 drops tower tests on the course of the development of the sampling device of MUSES-C/Hayabusa mission [2] and 40 additional drops for impact cratering experiments simulating asteroid surfaces [3]. These experiments have proven that this facility is a useful tool for asteroid geology studies and for spacecraft design of small body explorations. This facility was also used for performance tests of a micro-rover and target markers onboard Hayabusa.

References: [1] Fujiwara, A. et al. (2000), Capture efficiency of impact-sampler in reduced gravity (in Japanese), Journal of the Japan Society of Microgravity Application 17, 178-182. [2] Yano, H. et al. (2006), Touchdown of the Hayabusa Spacecraft at the Muses Sea on Itokawa, Science 312, 1350-1353. [3] Takagi, Y. et al. (2008), Impact cratering experiments in microgravity environment, in preparation