Introduction: Asteroids are key objects to understand the earlier evolutional process of planetesimal to main planets. However, the greatness in number and diversity of the asteroids makes difficult for us to understand the whole picture. The best way at present stage is to assign, to each taxonomic type of asteroids, the correct materials and, if exist, meteorite species. Hence acquisition from samples from a representative asteroid selected from each fundamental taxonomic type asteroids are of great importance. Through this approach we can understand the gross material distribution over the whole asteroid belt based on the classification of spectral type obtained by ground-based observation. Toward this goal sample returns to several asteroids each of which belongs to differing taxonomic class are required. As a first step we are going to send the world first sample return-mission MUSES-C to one of near-earth asteroids.

Mission scenario: MUSES-C is a near-earth asteroid sample-return engineering mission whose main purpose is to develop the technologies requisite for the future advanced sample return mission such as ion propulsion system, guidance and navigation technique, sampling technique, and reentry technique. The plan including the targeted asteroid has been recently changed from the former one [1] because of the launching failure of an astronomical satellite in last February. The new mission plan is as follows. The spacecraft is launched by the MV-5 rocket from Kagoshima in Nov. to Dec. 2002. After swing-by the earth in May 2003, it approaches a small near-earth asteroid 1998SF36 with the aid of ion engines (Details of this object is presented later). It arrives near the targeted asteroid in September 2005 and hovers at about 20km above the asteroid. During about three months’ stay near the asteroid it determines the asteroid mass and makes topographical, mineralogical, and chemical abundance maps based on the data presented by a camera(AMICA), a laser ranging altimeter(LIDAR), a near-infrared spectrometer(NIRS), and X-ray spectrometer(XRS) boarded on the spacecraft. Further a microrover provided by NASA/JPL- is dropped onto the asteroid surface which has a camera and an infrared spectrometer. After the reconnaisance observations the spacecraft approaches toward the asteroid surface for sampling. Sampling is carried out by shooting a small projectile onto the asteroid surface and catches the ejecta of asteroid material. After finish of these observation and sampling the spacecraft leaves the asteroid and cruises toward the earth again with the assist of the ion engines, and arrives near the earth in June 2007. The reentry capsule, inside which the sample is contained, removed from the main spacecraft directly plunges into the atmosphere from the interplanetary trajectory at velocity as high as 12.5km/sec. During the descent of the capsule the container is removed from the ablator shell and finally retrieved on the ground. The highest temperature of the sample will be expected at most less than 100degC.

Spacecraft and scientific instruments: The spacecraft is three-axis stabilized and its dry weight is 390kg. Weight for the scientific instruments is 12kg, including AMICA, LIDAR, NIRS, XRS. NIRS is a spectrometer using InGaAs array of 0.85-2.1 micron wave length. XRS using CCD detects fluorescent X-ray from the asteroid surface in energy range of 0.7-10keV. The microrover weighs 2.7 kg and can move and jump on the asteroid surface with its four wheels. An InGaAs spectrometer is also boarded on the microrover. Until now the protomodels of the spacecraft and scientific instruments were integrated and vibration, acousti,c, vacuum, and thermal tests were successfully performed.

The sampling mechanism (SAMPLER) is the most important scientific instrument in this mission. It is attached on the basement of the spacecraft, and consists of three parts: a funnel-shaped horn, a canister, a transfer mechanism, and projectors. After launch of the spacecraft the initially folded horn is stretched out to the full size. Immediately after the bottom of the horn touches on the asteroid surface a projectile of mass 5g is shot by the projector onto the asteroid surface. Impact of the projectile produces asteroid ejecta, which are concentrated through the horn toward the canister which capture the sample finally. The canister is transferred to the capsule and tightly sealed. Until now sampling efficiency of the protomodel device has been investigated by tests in reduced gravity utilizing the parabolic flight and free falling facility. Expected amount of the sample is about 1g although it depends on the material and properties of the asteroid surface.

1998SF36: The orbital elements of targeted asteroid 1998SF36 are a=1.32AU, e=0.28, i=1.63, but require more accuracy for determining the final strict mission scenario. The rotational period and spectral type have not been determined. The absolute magnitude is 18.8mag and assuming probable albedos the size is guessed to be about 1 km or so. The good opportunity for the observation comes toward the end of this year to middle of the next year. Especially in March next year the object approaches within 0.01AU distance from the earth, and apparent magnitude will be about 15mag.. Extensive observations are desired during this period not only for navigation and control of the spacecraft but for good science product.

Sample analysis: The curatorial and initial analysis of the returned sample will be carried out in several key facilities in Japan for a period less than a year, and after this period the announcement of opportunity for detailed analysis will be released to all over the world.