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SAMPLING MECHANISMS FOR ASTEROID SAMPLE RETURN MISSIONS

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There is a unique challenge in developing sample collectors for low-gravity bodies such as asteroids. Traditional devices rely mostly on gravity for sample collection which is inappropriate in the case of asteroids. The NEAR Shoemaker has shown that we can design spacecrafts that can maneuver very closely to asteroids and provide us with a wealth of valuable data. However, a sample collector that can return samples to the Earth has yet to be fully developed. During the Near-Earth Sample Return Workshop held in Los Angeles in July 2002, the scientific requirements and engineering constraints of sample return collectors were discussed. It was proposed that the touch-and-go-sampler is to be preferred for the first missions. The collector should be as simple as possible, with the minimum of moving parts to reduce cost and prevent damage to the sampler during the collection process as well as minimize surface disturbance on the asteroid. However, the collection procedure must meet certain conditions in order for a complete assessment of the samples. The collection process should not change the composition (molecular, elemental, or isotopic), physical properties, mineral and phase proportions, or grain size distribution. Our answer to these challenges is an adhesive tray collector. The adhesive tray touch-and-go-sampler would include a thirty centimeter in diameter tray bound to a boom. The boom would allow the spacecraft to collect samples with a minimum amount of disturbance from the one to two second encounter with the surface of the asteroid with the adhesive tray. The adhesive tray would be able to sample surface regolith including one to two centimeter clasts in a diverse number of scientifically valuable sites. Once the sample has been collected, the boom will retract and place the adhesive sample tray into a sample return canister.

Progress in the development of this collector and preliminary results of testing under microgravity and space conditions will be reported at the meeting.