**Intact Capture, Aerogel, SOCCER, STARDUST & LIFE** Peter Tsou, Sample Exploration System, P. O. Box 831 La Canada CA 91012, tsou.peter@gmail.com

**Intact Capture:** In order to determine if comets brought the Earth's ocean water and early life seedlings, we needed to bring samples of comets to terrestrial laboratories for detailed analyses. The concept of landing on a comet, excavating the surface, then returning the samples back to Earth (Comet Nucleus Sample Return) has been studied for decades, but unimplemented due to lack of necessary technologies and very high cost. Comets, however, expel their surface material as they approach the Sun, making conceivable a low cost flyby sample return missions. There was a catch, though - flybys are at hypervelocity encounter speeds that atomize the samples, destroying the sample morphology and causing fractionations and losing astrobiological value. To solve this problem, an "intact capture" technology was developed in 1984, utilizing a technique that captures and preserves intact a portion of the sample at hypervelocity flyby speeds.

**SOCCER NEARER STARDUST:** With intact capture technology and the adaptation of transparent silica aerogel as a capture medium, in 1987 NASA/ISAS began to develop a comet coma sample return mission, Figure 1. 1992 a joint NASA/ISAS SOCCER mission concept was proposed, Figure 2. The final outcome was a NASA STARDUST Discovery mission and a NEARER (later Hayabusa) mission both of 1994. Detailed analyses of samples from comet Wild 2 have revolutionized our understanding of comets, revealing for the first time elements formed at the formation of our Solar System. Comets have principally a Solar composition, containing both fire (Solar core material) and ice (Kuiper belt and beyond accretions).

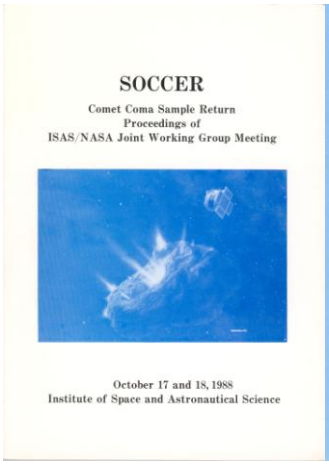


Figure 1 SOCCER

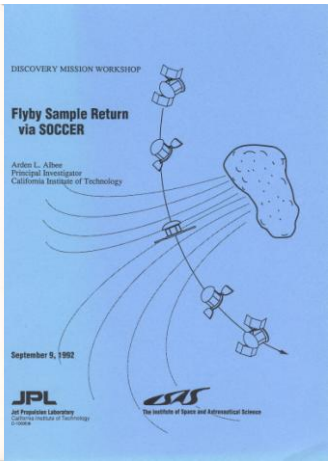


Figure 2 Joint NASA/ISAS Proposal

**LIFE:** In 2005, Cassini discovered that water being jetted from the south pole of Enceladus. Its instruments returned data showed that Enceladus is habitable; that is, it has liquid water, a heat source to maintain water as a liquid, organic nutrients and nitrogen. These discoveries make Enceladus the second Solar System body with a proven existence of these factors (besides Earth). Everywhere there is water on Earth, there is life. Enceladus can help us determine if we are alone in the Solar System. To answer this question, we need to return intact samples from Enceladus to terrestrial laboratories for detailed analyses to determine if it once had life and if not at what stage of development of life. LIFE (Life Investigation For Enceladus) proposes once again a joint NASA/JAXA-ISAS mission to acquire and return the first samples from Enceladus. The 1st joint LIFE Workshop was held in Los Angeles 2013 Figure 3

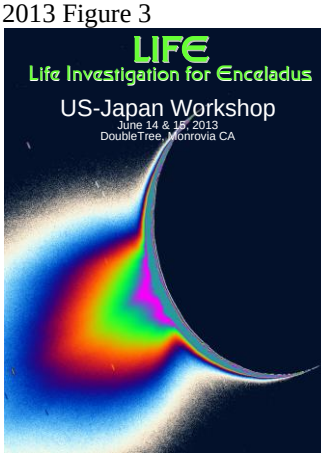


Figure 3. First Joint LIFE Workshop was held in June 2013.