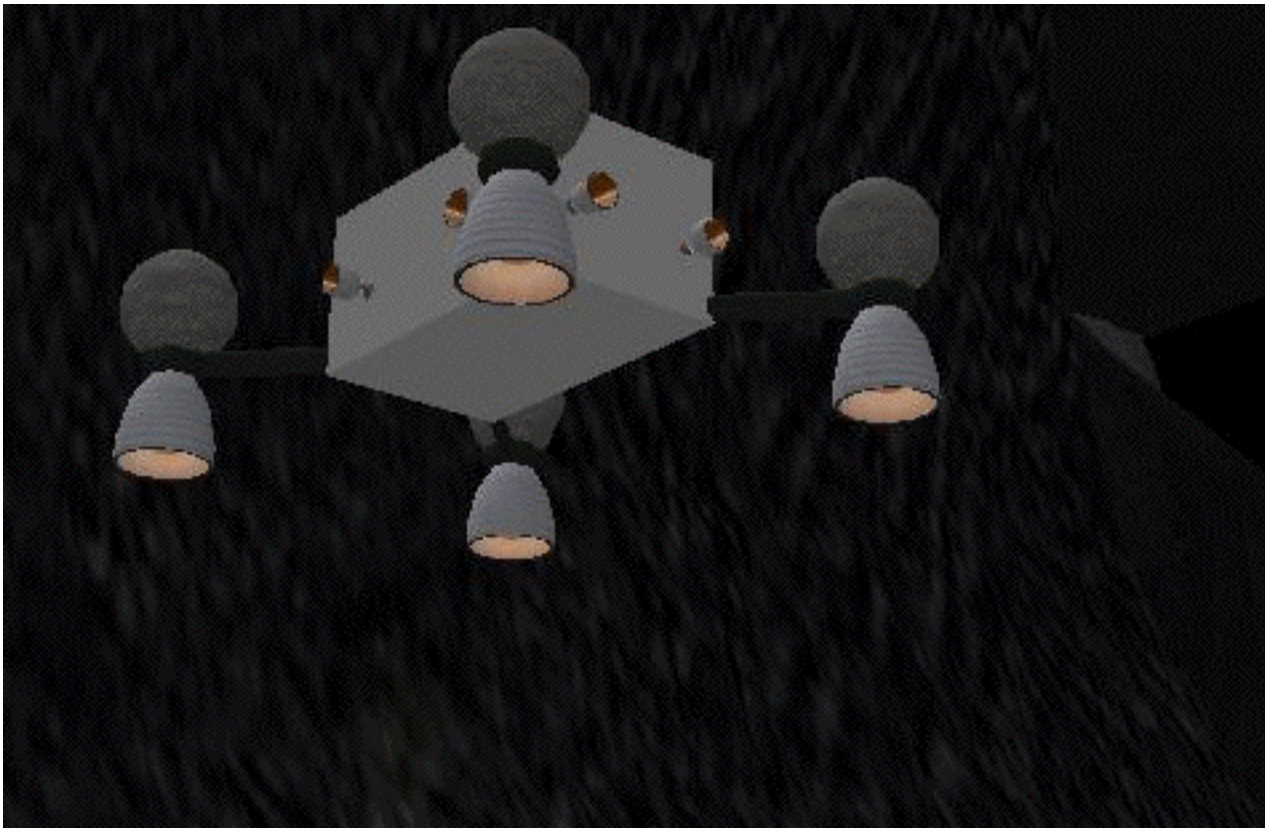
Exploring with MoonBats, from the Caverns of the Moon to Saturn's Rings. T.L. Billings[1] and M. Runyan[2], [1]Oregon L5 Society, 5131 SW 38th Place Ptld., OR 97221, itsd1@comcast.net , [2]Oregon L5 Society , marcus.runyan@gmail.com .

Introduction:

Recent images of the surfaces of the Moon and Mars confirmed that entrances to very large lava tube caves exist that will allow exploitation of these in situ resources.[1] Rough and boulder-strewn floors of lava tubes require a flying vehicle to perform a fast economical survey of these caverns.

Such "MoonBats" will be small, scalable exploration vehicles that can be delivered next to cave entrances by small landers with data storage and transmission capabilities. Designing in modules will allow optimizing between different gravity, endurance, and data requirements. A MoonBat will fly from a lander into the cave, trailing a fiber optic cable in order to transmit data reliably through the lava tube at high rates back to the lander for radio transmission to Earth. Later generations of MoonBats may use in situ propellant and tankage resources in previous outposts for both MoonBat and its lander. These can then scale to larger sizes and longer endurance while obtaining lower mission costs for each cave examined.



The MoonBat concept is already being modeled in the virtual world called Second Life, by the Oregon L5 Society Research Team. The Team has proposed to NIAC a Phase 1 study to demonstrate the needed autonomy of a flying vehicle in Earth lava tubes with a rotary-winged quadrocopter.

We believe that first generation MoonBats can be developed for planetary missions before the end of this decade. This will promote the exploration of caves throughout the Solar System. In smaller asteroids, or even Ceres, MoonBat rates of propellant consumption will drop. Sensor payloads can then expand, yielding greater scientific and operational returns. Here, the potential caves will be a result of the volatile outgassing expected of many such bodies.

Even farther from Earth, among the moons of the gas giant systems, we already see geological activities involving volatiles that have great potential for generating caves. While Titan's atmosphere will allow winged explorers, the rest will probably require the MoonBat system of rocket propulsion and autonomous flight. Lower-gravity moons will again allow larger sensor payloads and longer mission times.

Even when we have manned missions, using vehicles like the proposed Nautilus-X, the ability to approach moons and smaller ring bodies will be limited by the magnetospheres and radiation belts of the Gas Giants. The autonomy of a MoonBat system will still be crucial when the inner moons that orbit within the radiation belts are to be explored. Approaching these moons closely enough to use teleoperations will require more massive radiation shielding than a simple planetary transit, for the entire crewed mission system.

We will need a MoonBat sooner rather than later, so we are starting now.

[1] Haruyama J. et al. , (2009) GRL, 36, L21206, 5 PP. doi:10.1029/2009GL040635