



LOW-COST TECHNOLOGY COMBINATIONS FOR PLANETARY DEFENSE MISSIONS INVOLVING RECONNAISSANCE AND MITIGATIVE ACTIONS

Paul Graham(1), Nathan Going(2), Nancy Wolfson(3), James Harris(4), Debi-Lee Wilkinson(5), and Ashani Dissanayake(6) (1)(2)(4)(5)(6) Kepler Shipyards, 6805 Crystalbrook Dr. Austin, TX, 78724-3420 – United States, 248.274.0177, Paul@keplershipyards.com (corresponding author); Nate@keplershipyards.com; JHarris@keplershipyards.com; Debi-Lee@keplershipyards.com; adiss010@uottawa.ca (3) Vice Chair of the IAFTC on NEOs, Washington DC - United States, 202.213.2898, jessonsbynancy@gmail.com

Premise:

Handling planetary defense threats will be much easier, cheaper, and faster with a pre-existing, robust presence in space.

Assumptions:

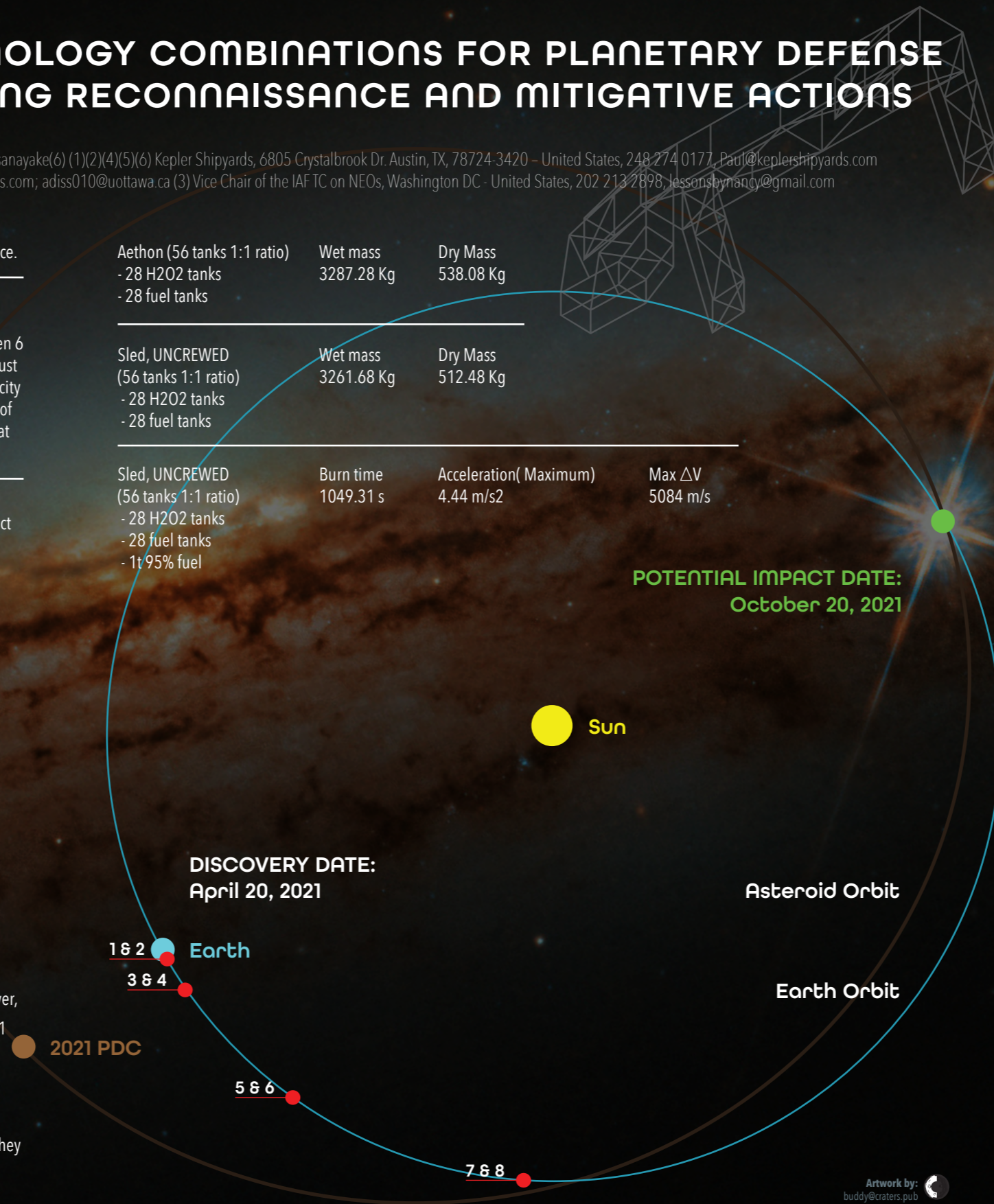
The mission we propose to assist with the conference scenario makes the following assumption; OpenLuna's second generation outpost has been completed. This includes, Five habitation modules, a crew of up to 30 personnel, between 6 and 14 operational aquaponics modules, significantly self-sufficient water, food, fuel, and power infrastructures, a robust communication and data infrastructure both locally, on the lunar surface, to earth, and to deep space, a moderate capacity for limited manufacturing, and reconfiguration of material required to support the local infrastructure, a combination of up to six "Aethon" or "Sled" class space vehicles, with several auxiliary cargo modules. At least one full bay tanker, and at least one full bay service module cargo containers.

The mission:

Once 2021 PDC is first sighted, and determined to be a possible threat, highest priority needs to be to establish its exact orbit, composition, and true threat risk.

- As such, a Tanker Aethon will immediately be dispatched via remote control to the Sled in best position, probably the closest. This Sled's crew will unload and cargo in its cargo bay, and once the tanker arrives, refill the sled, adding more fuel tanks if possible. The crew, and any cargo possible will return with the tanker.
- The Sled will, again under remote control, immediately accelerate as fast as possible towards 2021 PDC predicted location, in order to get more precise observations as to the exact orbit of 2021 PDC. This Sled will be considered disposable, and no immediate effort will be made to recover it. If deemed useful, it could even be used as an impactor. This launch could potentially take place within hours of the initial discovery. Total flight time will depend on several factors, but this initial Sled could arrive close enough to make precise observations within 8 days.
- While this is going on, two aquaponics modules will be separated from the larger farm, along with a sled service module, any available mining explosives and tools as reasonable, and as many extra propellant tanks as prudent, along with two volunteer crew members, via several Aethon trips, to an orbital rendezvous with a fresh Sled.
- The Sled based deep space transport is assembled, the "Exploration crew", (EC) is placed, and the entire craft is launched towards a rendezvous with 2021 PDC. This orbital rendezvous will be planned in such a way that the crew will expend as much fuel as required for a quick rendezvous, but allowing for a slow return.
- During this orbital transfer, the initial sled should have passed by 2021 PDC and we will have precisely determined the orbit and made some best guest estimates of its composition. If the orbit of 2021 PDC is determined to be completely safe, the exploration team will be recalled. If there is any chance of impact however,
- The EC continues on to 2021 PDC, upon arrival, the crew will do testing to determine exact composition of 2021 PDC, and working with earth-based support, determine if they have the tools and materials to do anything to mitigate possible impact or damage threats. If so, they will do whatever they can with the tools and materials available to mitigate the danger.
- Once finished, the EC will return back to the Moon, taking as much time is required with the little bit of fuel remaining in their tanks. With the advantage of the aquaponics systems strapped to the outside of their sled, they will have effectively unlimited life support for an extended return trip. If required, the crew can burn most of their Earth return fuel to get on site faster. Then, all they need to do is get far enough away from 2021 PDC for safety, and wait for a remotely piloted tanker sled to bring them enough fuel to get home.
- If they were unable to do anything, It is believed that the information that both missions gain will dramatically improve the effectiveness of other earth-based damage mitigation strategies.

Aethon (56 tanks 1:1 ratio) - 28 H2O2 tanks - 28 fuel tanks	Wet mass 3287.28 Kg	Dry Mass 538.08 Kg	
Sled, UNCREWED (56 tanks 1:1 ratio) - 28 H2O2 tanks - 28 fuel tanks	Wet mass 3261.68 Kg	Dry Mass 512.48 Kg	
Sled, UNCREWED (56 tanks 1:1 ratio) - 28 H2O2 tanks - 28 fuel tanks - 1t 95% fuel	Burn time 1049.31 s	Acceleration(Maximum) 4.44 m/s ²	Max ΔV 5084 m/s



Spacecraft involved

Aethon class cis-lunar transport:

The spacecraft is designed to be built on the lunar surface from the parts of three to four disassembled "Speck" class lunar landers, and a small conversation kit.

It is designed to be the backbone and workhorse of a small, lightweight, extremely modular cis-lunar spacecraft fleet. It can be remote piloted, or have a crew of up to two. Although it can carry very little by itself, it's strength and versatility come from it's very large (although the width is unbounded, the rest of the bay is 6 meter long, 2 meter tall) modular cargo bay, that is designed to carry several different cargo container modules, including a tanker, open cargo bay, pressurized and unpressurized Crew transport, and service bay, among others. All of these modules are shared with the Sled.

It's dry mass is 540 Kg, and it's empty, wet mass is 3300 Kg.

It's total propellant mass is 2800 Kg, which can be burned through 8 900N engines in the rear, and lifted by one "downward" facing 450N engine on each corner.

RCS thrusters use the same fuel, burned through a catalyst matrix for self ignition.

It has a horizontal Delta V of 4971 m/s.

Aethons are intended for operation in empty space or in proximity with gravity wells no more than 1/6G. It can be crewed by one or two people or operated remotely.

Sled class of Space transport:

The "Sled" is virtually identical to the Aethon with one major exception. Once assembled and launched, it is designed to never touch any surface. It is purely a space-based transfer craft. As such, all landing gear, landing gear supports, and the 450 N engines are not included in this craft. This provides a significant mass savings.

The Sled can use all Aethon cargo modules, and a service module is designed especially for this Sled, and it's special mission of servicing other spacecraft and satellites.

It's dry mass is 520 kg,

It's total propellant mass is 2800 Kg, which can be burned through 8 900N engines in the rear.

RCS thrusters use the same fuel, burned through a catalyst matrix for self ignition.

It has a Delta V of 5084 m/s.

Cargo modules:

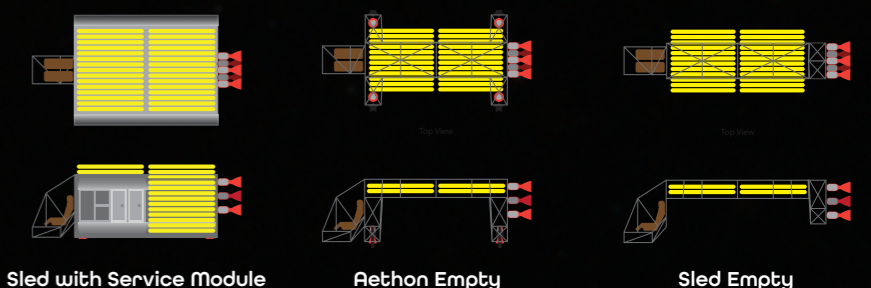
There are two cargo modules that would be used in this mission.

Tanker. The tanker module is nothing more than a bundle of extra tanks from the Speck class lunar Landers plumbed in such a way that is easy to load and unload fuel. It should be noted that because of this plumbing, they could also be used as extra long range tanks for extended operational range.

Service module. The service module is designed to support the crew while on orbit servicing satellites or dealing with space debris, and is divided into three sections.

Small two-person crew quarters consisting of nothing more than two microgravity sleeping bags, a small galley, communication and data terminal, and hygiene facilities.

A tool rack, and storage lockers for common consumables and parts, and smaller cargo storage. An open storage bay with elastic mesh tie downs to move larger arbitrary shaped cargo. A small manipulator arm or half tanker may be added as well if the mission demands it.



Artwork by:
buddy@craters.pub



Rudentes Fortuna Avast: "Fortune favors the bold"