SPACE TECHNOLOGIES: EXPANDING HORIZONS AND SPARKING THE EXODUS

Outer space is an incredibly fascinating area to research as it is beyond what we know here on Earth, with endless possibilities allow our imagination to wander and our innovated minds to turn in what we could learn and develop from its vast knowledge and space, especially with NIAC, or the NASA Innovative Advanced Concepts program. While incredibly fascinating it is also one of the most incredible conundrums as it's endless and vastness present countless problems with both exploration and colonization. Exploring space allows us to discover new possibilities and with these new possibilities we may be able to collect resources and even colonize parts of space for human life and advancement.

To begin exploring vast and unlimited outer space, exploratory technologies are necessary to design, create, and alter as new information is discovered through the current exploratory technology. This technology is used to find new or additional resources that we need here on Earth, possibly to one day find a habitable planet, and overall assist in finding new discoveries that could be helpful both in space and here on Earth.

As you can imagine these types of technologies are not only very difficult and time consuming to research and develop, but are also extraordinarily expensive to design and create. While there are new technologies being developed both within levels of government and the private sector, the main concentration is on the experts who pioneered and took the lead on space exploration, NASA. While previously exploring space wasn't just time consuming and expensive, it was also incredibly dangerous. These new technologies are helping to substantially

decrease the risk of life threatening failures, while also allowing us to see space like never before.

NASA has recently been awarded substantial amounts of money to begin research on these new technologies, with the first phase being planning and partially engineering phase. This first phase is awarded up to $500,000 per device. These devices are aimed to making space travel easier, cheaper, more efficient, and ultimately much safer.

BREEZE, a new technology that stands for bioinspired ray for extreme environments and zonal exploration. This technology is designed to explore Venus' atmosphere in an incredibly efficient manner. The craft uses inflatable structures with advanced bioinspired kinematics that will surf Venus' atmosphere at 50km and uses advanced solar panels to stay powered (Bayandor. 2019). Due to its unique design, it can also surf through the wind, allowing it to stay operational for much longer without needing solar power to recharge. To put in simpler terms, it's essentially a glider designed to operate in both space and Venus' atmosphere.

THE MOST, another technology with a unique acronym, stands for the high Étendue multiple object spectrographic telescope. A very revolutionary technology because it sought to solve many problems that NASA had with previous astronomical telescopes in space. Telescopes generally aim to see a narrow space, with a narrow field of view, requiring large sizes for better results, with poor resolution and high costs (Ditto. 2019). THE MOST solves all these problems and allows it all to be done in space. This is revolutionary because a technology like this has be sought after for decades and to not fix just one, but many issues makes it very remarkable.

SPEAR, standing for swarm-probe enabled ATEG reactor probe. Powered by NEP, nuclear electric propulsion systems that provides a secondary power source to solar in a very efficient manner. At its current design it would require the unit to be very large and thus mostly

used only on major missions, however, research continues to make this unit a smaller size to provide its use in smaller missions and possibly help revamp other technologies with its power source alone (Howe. 2019). One major mission the SPEAR is being sought for is to explore one of Jupiter's moons, Europa. This moon very likely contains existence of extraterrestrial life which could obviously open a vast door of possibilities for research and life as we know it. The SPEAR is just one more step in reducing the size in NEP powered devices, while not without its challenges such as reduced power for propulsion due to its reduced size, the SPEAR is just one small step in the giant leap we are making in space.

Self-Guided Beamed Propulsion for Breakthrough Interstellar Missions, a new and revolutionary propulsion system that has been needed to undertake some of the most challenging and long-distance missions for NASA. It boasts being able to travel at 10% the speed of light and its architecture dramatically increases distance in which the spacecraft is accelerated while also reducing the beam diameter (Limbach. 2019). While the advancements in this new technology are best explained with very specific terminology and having previous knowledge in the field, it is essentially allowing us to explore space like never before. It focuses on being more efficient than any current space exploration technology while also being faster and allowing it to achieve distances that previously were never thought we could possibly reach.

An honorable mention, power for interstellar fly-bys is a technology that will allow ultra-miniature probes that are flying by using laser-pushed sails to get the necessary power for observations and communications by harvesting power from the motion of the spacecraft as it passes through its target environment (Landis. 2019).

Colonizing space is not only the most arduous challenge that humans have ever pondered, but it could possibly be the most important and rewarding undertaking in history and new

technologies geared towards the colonization of space could make it possible to provide energy across great distances, have rugged and advanced, self-correcting PPEs, collect valuable or new resources, provide innovative, space-age strategies for protection of new and old human settlements, which could create the possibility of a human colony in a formerly inhabitable place, like terraforming Mars, or utilizing an Earth-like planet, like Kepler 438b, which has an Earth Similarity Index of 88% (Norton. 2015).

One such concept that is meant to generate power in extreme environments, Venus in this case, is power beaming. It is where one vehicle collects energy in a safer place, then wirelessly transfer energy, in the form of microwaves, that can maneuver through a thick carbon dioxide atmosphere to an antennae connected to the high temperature rechargeable batteries of the lander, which stores the energy and therefore makes it capable of being recharged far from Earth and able to complete multiple missions unaided (Brandon. 2019). This concept could be optimized to use light or laser-based for much faster transmission, if there was no existence of thick atmospheric conditions to work around.

Another device that can be used to collect energy are Diffractive LightSails, which are solar panels that seek the best angle of the sun and bend light accordingly and are propelled because of continuous acceleration with use of diffraction instead of reflection to allow navigation without forfeiting solar power on the sail (Swartzlander. 2019). These Lightsails will be made for missions of inner solar orbit and checking out faraway stars, while passing space weathering testing, such as: surviving harsh UV exposure, electron and proton fluxes.

Next on the list is the SmartSuit, which is a spacesuit made for mars missions and is more advanced, mobile, and safe, with numerous sensors to monitor its own data along with the environments. As for spacesuits right now, Diaz Artiles, designer of the SmartSuit says that a big

antagonist of astronaut fatigue is that, “The spacesuit is like a big balloon. When you try to bend your leg it has this tendency to come back to the natural position, so you’re fighting against the suit every time you try to make a move” (McHarg. 2019). The solution to the problem? A soft-robotic layer in the suit that allows many things, like the computer assisted moving that would augment performance, improve mobility, increase range of motion and enhance environmental interactions. Another allowance is the self-healing outer layer that provides protection and collects data about the suit and outside environment through sensors in the membrane. An additional perk of this suit is that it can provide continuous mechanical counterpressure, which would permit astronauts to physically ‘feel’ the rocks they are inspecting, while also possibly shortening the decompression protocols from 4 hours to just 90 minutes, since the suit would be able to apply specific counter pressures prior to starting depressurization (Artiles. 2019).

Protection human civilizations, on Earth or in space, is a job for the CHARON, Crosscutting High Apogee Refueling Orbital Navigator, which will eliminate space debris and be self-fueling by having the ability to collect the needed oxygen and nitrogen molecules. In low orbit on Earth, there are 8,100 tons of space debris accumulated, which could lead to the “Kessler Syndrome”, where debris can make getting to space more dangerous, difficult, or render access to space impossible (Slough. 2019). Self-fueling is accomplished by scooping up and loading the low density N2 and oxygen in low altitudes. CHARON can operate on stored fuel in a many of configurations, depending on what is available on that particular mission. In 10 years, One CHARON can process 5,500 kg of propellant, enough to transport 80 spacecraft, all with one spacecraft launch and no supplemental fuel (Slough. 2019).

Last but not least, two new techniques for mining in space could be a valuable technology in reference to being used for collecting precious and possibly new resources or terraforming an

alien planet so a colony can be built. The goal of the Lunar Polar Gas-Dynamic Mining Outpost, LGMO, is to decrease the cost of exploration and industrial development of the Moon by being built at a high altitude of roughly 100 miles tall, which is still lightweight because of low lunar gravity, which gives it the ability of being perpetually powered by constantly harnessing sunlight. The method of mining is called Radiant Gas Dynamic, RGD, mining uses microwaves, infrared radiation, and radio frequencies to vaporize the permafrost or ice and collect the available water vapors in cryotraps, which could yield between 40 to 500 tons of water (Sercel. 2019). The other methodology is Thermal mining, which has the same goals of being solar powered and made for water collection, but this method differs from RGD mining because it redirects sunlight, like a huge magnifying glass, to cut out the ice for harvesting (Sowers. 2019).

Endless possibilities and rewards loom and with the innovative program of NASA, the NIAC program, and could change what we know about the world and how we all live for the better.

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