Alexandria
Mission Statement

[INTERNAL USE ONLY]

Cosmic Lee Public Statement

To sustain six crewmembers on a long-duration flight to the Outer Planets of the Solar System: Saturn and its moons (including a long stay at Titan), Uranus and its moons, Neptune and its moons, Pluto and its moon Charon, and potentially deeper into the Oort Cloud. This initial flight will test and evaluate a number of significant new technologies needed for extended-duration spaceflight and colonization across the entire Solar System.

Internal Cosmic Lee Only Statement [Politically Sensitive: Do Not Share]

To sustain six crewmembers on a long-duration flight to Proxima Centauri B, so that they may establish and grow a thriving human colony outside the Earth's Solar System. It is expected that this colony must be entirely self-sufficient from the beginning. Should Proxima Centauri B be unsuitable for colonization, the ship and crew must be capable of reaching a second candidate star system within the lifetime of ship systems.

Ship Systems

Alexandria is a unique ship design, a state-of-the-art ship backed by tested and proven hardware and software.

Power and Propulsion

Power is provided by two Tang Dragon fusion reactors, with failover and additional capacity, allowing one reactor to be taken offline for maintenance as the second powers the ship. Additionally, these reactors can be disassembled, so that one of them can be ferried down and reassembled to supply the initial power needs of a new colony. There is a sufficient supply of cometary ices containing deuterium to power both reactors for one hundred years.

Propulsion comes from an array of twelve Zhang-Liu Celestial engines, which should be capable of accelerating the *Alexandria* to nearly 0.5c, also using ionic and chemical propellants distilled from cometary ices. While capable of selectively applying high thrust levels for short durations in case of emergency, the engines are primarily designed for lower levels of thrust over extended periods, for consistent acceleration and deceleration.

It is unclear if the experimental drive currently being installed aboard the *Alexandria* will be able to assist in reaching peak acceleration. While the mathematics of this drive suggest that it might be possible to exceed the speed of light, the current Cosmic Lee engineering staff are doubtful of this claim. Further and careful experimentation is needed prior to launch.

Artificial Intelligence

Systems are controlled by the latest generation Cosmic Lee Artificial Intelligence. This AI is completely integrated into shipwide systems and sensors, so that normal ship operations are mostly controlled automatically, with a limited need for crew control. The AI has several specific extensions and remote units capable of operating anywhere in or on the ship, for repairs and maintenance.

The AI has substantial additional capacity for learning and storage, sufficient for unmodified operations in excess of one hundred years. The computer systems are enhanced by significant archives of human knowledge and experience, which allow the AI to answer questions on nearly any topic. Furthermore, these archives contain patterns and instructions for crafting devices, pharmaceuticals, and other necessary objects on one of the 3D matter printers carried aboard the ship. While one is installed aboard the ship, several are in storage for use at the ship's eventual destination of Proxima Centauri B.

Crew Ecosystem

The *Alexandria* is equipped and capable of sustaining a crew of six humans for an extended duration. All crew habitation spaces rotate to provide a simulated Earth pull of gravity, mitigating the debilitating effects of long-term zero gravity exposure. These areas, and other important storage areas of the ship are shielded from radiation exposure through several layers of technology, from superconductor-imposed magnetic deflection mechanisms, dense but lightweight ceramic shielding, and other means of protection.

The *Alexandria* carries an extensive set of hydroponic farming modules, also within the rotating spaces. These hydroponic modules are separated into several sections for redundancy, and make up three important components of the *Alexandria* ecosystem. First, they generate oxygen and recycle carbon dioxide, which is essential to the health of the crew. Second, they grow the food that will be eaten by the crew, renewably, with additional capacity to allow an extended duration mission, should it be necessary. Third, they provide a mechanism for recycling old or broken organic systems, helping to maintain the closed-loop ecosystem necessary for a long voyage.

Closed-loop ecosystem controls beyond the hydroponic systems regulate atmospheric pressure, oxygen levels, water supplies, and recycle waste byproducts. These controls are enhanced versions of Lunar and Martian systems and protocols developed for long-term habitation away from additional supplies. They can, of course, be restocked and enhanced from in-system resources, when the *Alexandria* reaches its destination.

Crew Medical Systems

The *Alexandria* carries the best medical systems commercially available. There is a complete suite of diagnostic and surgical tools, Compact X-ray, CAT, and MRI scanners are available for use in diagnosis and treatment. Powerful microscopy and analysis tools are capable of identifying foreign or unusual substances that may be involved in an illness, especially on a colony world. A specialized 3D matter printer capable of producing pharmaceuticals is part of the medbay, eliminating the need to store bulk medications. There is a small, fully stocked surgery as part of the medbay, which is designed to function even in zero gravity.

All medical equipment is backed by 3D patterns in the medical archives, so that any hardware problems can be fixed during flight, and so that the medical suite can be reproduced on the surface of the colony planet, as often as needed.

Crew Morale Systems

Even accelerating to 0.5c, the trip to Proxima Centauri B will take more than ten years. For a crew of six, constrained by the relatively small habitable volume of the *Alexandria*, this will be unprecedented in human spaceflight. Long-duration experiments in close proximity have shown the need for morale systems, in order to avoid significant (and potentially fatal) problems after years in flight. Limitations on human interaction and movement are psychologically damaging and can feel like torture.

To mitigate these psychological challenges, the AI has an anthropomorphic interface, so that it is capable of conversing and interacting with the crew as the crew's seventh member. There are extensive psychological modules available to the crew for alleviating expected stresses on a long-duration voyage. There are two virtual reality (VR) units that can be programmed for specific or general purposes by the crew, all under the watchful control of the AI. The VR system is designed to address the effects of loneliness and claustrophobia, simulating human relationships and open spaces, with a community of virtual beings. It is theorized that some individuals will be perfectly happy living with mostly simulated social interactions in simulated spaces. These VR units also come with an extensive library of entertainment and educational experiences.

Additionally, the educational systems are available outside the VR environment. While less immersive and "hands-on," these packages are necessary to cross-train the small crew in other specialties. There is a small probability of a fatal accident or illness affecting one of the crew; others must be capable of stepping in to replace that crewmember. Thus, the AI will encourage all crewmembers to spend time cross-training throughout the mission. Furthermore, those with training in an area will be encouraged to develop their training and experience to greater levels, based on the educational packages in the archives. Additionally, these crewmembers will be asked to enhance the training curriculum for their own areas of expertise, enhancing the archival materials.

There is a small gym with equipment capable of letting a crewmember work off stress and excess energy. The AI carries a detailed set of exercise algorithms capable of challenging a crew member's limits, in a safe manner.

There are some small habitable volumes that are outside of the rotating section of the ship, such as the seed bank and gene bank storage areas, where gravity is not necessary. It is expected that the crew will train and play in these areas, for more novel experiences.

Communication Systems

Alexandria has two primary means of communication beyond the ship. The standard Zhao-L1000 laser communication system provides transmission and reception of typical Solar System laser signals used throughout the UEC. Targeting and amplification of signals grows more difficult with distance; this system is rated for reliable communications within 12 light hours of the receiver. (Neptune is 4 light-hours distant, so this should be usable well into trans-Plutonian space.)

The *Alexandria* is equipped with a full set of laser relay circuits, which will allow it to be used as a moderate-capacity geosynchronous laser relay station once it arrives at its destination. Colonists on the ground with the appropriate laser communication base station should have reliable high-capacity data transmission links suitable for colony exploration teams.

The companion Zhao-R2550 radio communication system, paired with the Zhao-AE25 dish antenna mounted along the midline of the *Alexandria*, is capable of radio transmission and reception at much greater distances. Theoretically, this should be capable of detecting, amplifying, and processing of faint radio signals from carefully targeted sources several light years away, although this capacity has never been tested. There is a limit to transmission power from the *Alexandria*, which makes the transmitted signal range much shorter. It may be possible for a radio signal sent from Proxima Centauri B to be captured and processed by UEC observatories, including the Larsen Telescope Array on the Lunar Farside, although this has also never been tested. (Thus, the *Alexandria* may be able to hear messages from Earth for much longer than they could expect a reply to be received.)

The *Alexandria* is also equipped with a full set of radio relay circuits, which will allow it to be used as a high-capacity geosynchronous radio relay station once it arrives at its destination. Colonists on the ground with simple radio equipment should have reliable radio communications with others in space or on the ground. This is ideal for providing the cheap communication infrastructure that a growing colony will need. This system can be enhanced by the creation of small radio relay satellites based on 3D-printable patterns stored in *Alexandria's* computer archives.

Astronomical Sensors

The UEC has catalogued thousands of potential exoplanets through astronomical observation. The keys to this are “potential” and “observation.” The most efficient way of detecting and

cataloguing worlds around distant stars remains watching the patterns and spectra of light that are emitted by that star. The presence of a potential exoplanet, or a system filled with them, can be calculated based on the dips in the light intensity and the Doppler shifts in that light. This has remained the case since the earliest days of exoplanet discovery using the Kepler, TESS, and Webb orbital observatories.

The *Alexandria* carries a small but powerful set of telescopic sensors that can be trained on a small set of target star destinations for a period of time, over a wide range of wavelengths. These observations can be used with traditional algorithms to refine information about known, catalogued potential destinations.

These telescopic sensors will be even more valuable as the *Alexandria* enters its destination system, to provide greater detail about the planets, moons, asteroids, comets, and other elements of that system.

These telescopes can also supply observational data to the meteorological algorithm package aboard the *Alexandria*, providing high quality weather predictions for the colony.

System Protocols

Alexandria has a number of standing protocols, for emergencies and other important events. These include:

Alpha Protocol: Begin accelerating away from Earth at moderate speeds, on a course for Proxima Centauri B. Broadcast a set of livestream transmissions detailing the event for posterity, providing a press release of the significance of the mission to Earth as a whole.

Omega Protocol: Assume UEC hostile action against *Alexandria*. Accelerate away from Earth at maximum speed, intending to target Proxima Centauri B, using the best vector to avoid interception by UEC assets. Shut down all nonessential transmissions and radiative sources to avoid triggering UEC detection and homing systems. Be prepared to actively jam UEC weapon systems.

Colonization Systems

Alexandria is designed to carry its crew to a viable destination planet, where it can be used as the base for bootstrapping a robust human colony outside of the Solar System. There are several key systems and cargoes aboard for this purpose, to be activated on arrival.

The use of the *Alexandria* as a geosynchronous laser and radio relay station, as well as a base for weather sensing and prediction have been mentioned in previous sections. The *Alexandria* will be a vital component in the colonization effort.

Shuttlecraft

The *Alexandria* carries two identical Zhang-Liu multipurpose Tiger shuttles, designed for atmospheric flight to and from orbit. These shuttles can also be used solely in space, for capturing needed volatiles and ices to restock *Alexandria* systems. They will provide the necessary cargo capacity for bringing colonization equipment from the *Alexandria* to the colony site. Since much of the equipment will be created on site, using the 3D matter printers, their cargo capacity should be sufficient. They can be easily refueled using materials available on planet or in space.

Seed Bank

The *Alexandria* carries an extensive collection of seeds from Earth, for growing the necessary food supplies at the destination. This presumes an atmosphere, water and temperature range similar enough to the Earth for these seeds to grow. There are sufficient seeds to support a small, growing colony for several years as is. The offspring from these plants should continue to support a colony for decades to come, given a viable terrestrial-like ecology.

The *Alexandria* also carries DNA and genetic samples of the seeds in the seed bank, and more. Should the ecology be outside normal terrestrial limits, it may be possible for someone to use the genetic samples and the geneticist algorithm package to adapt these samples so that they can survive in a different or more hostile environment. This package is not capable of any significant terraforming efforts, despite recent advances from Martian and Venusian researchers.

Gene Bank

Several early studies determined that any human colony must have at least ten to forty thousand (10,000 - 40,000) different genetic sources for it to be viable and sustainable for at least ten generations. The *Alexandria* is designed to carry nearly one hundred thousand human genetic samples, protected from danger and radiation, from Earth to the colony destination. This collection provides the genetic diversity needed for the colony to survive. As with the seed bank samples, the geneticist package has some capacity for small adaptations to the samples, in order to make them more suited to the environment. This package is not designed for large scale adaptations across all samples; the target destination must be reasonably suitable for base human stock, as is.

Gestational Units

While a medical crewmember and the medical algorithm packages provide enough expertise for someone to conceive (or implant) a fertilized egg, manage a pregnancy, and then raise a child (within ecosystem constraints if entirely aboard the *Alexandria*), it is impractical and unsafe to expect the original colonists to bear enough children to form a stable first generation of the colony. For this reason, the *Alexandria* carries several reusable Nguyen Corporation Gestational Units (NCGU), as well the 3D patterns needed to construct more.

These NCGU, when connected to the appropriate nutrient supplies, are capable of taking a fertilized ovum through every gestational stage until the fetus is ready for birth. The NCGU monitor the entire process, supplying the necessary nutrients, hormones, and external stimulation needed for a healthy child.

It is expected that the emerging colony will build its initial population in waves, through these gestational units, using the genetic diversity in the gene bank to produce the widest possible genetic foundation. A small group of children, raised by the original crew, will, in turn, be used as caregivers to raise the next, larger group of children, and so on, until there is a viable population. This may require sociocultural rules outside of Earth norms, as children from these early generations should have no genetic connection to the parents who raise them. The *Alexandria* geneticist package is capable of creating a fertilized ovum using the DNA of any two parents, of any gender, so that as the colony reaches a stable, mature, robust, genetically diverse state, every couple that desires a child of their own can have one.

In the event of a crew death during the mission, it is feasible to create a replacement while in flight. The *Alexandria* is prepared for this contingency. The child could be raised onboard, taking advantage of all of the educational materials available through the AI. The novelty of a new crewmember might boost the morale of all aboard. This child would grow to consume the ecosystem requirements of the deceased crew member; while there would be some additional buffer during the early life of the child, it is impossible to support and sustain any additional crew beyond six. This, in fact, would risk the stability and capacity of the ecosystem for everyone - adding a seventh human would likely be fatal to most, if not all.

Educational Systems

The wealth of information, educational materials, and the *Alexandria* AI's capability for multitasking means that the emerging colony will have access to everything they need to raise an educated society in an efficient manner. The 3D matter printers can produce the necessary hardware for each student, to let them learn what is needed as it is needed, as well as keeping them in communication with the colony and each other. Information about their new world can be added quickly to the system, distributing it widely as soon as it is learned.