Have Starship, Will Travel
The Newsletter of the Interstellar Research Group
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First European Interstellar Symposium

The Interstellar Research Group continues to grow! Please join us in Luxembourg December 2 – 5, 2014 for our first European Interstellar Symposium. Co- sponsored by the University of Luxembourg, the Luxembourg Space Agency, and our friends at the Initiative for Interstellar Studies (I4IS), we are gathering an (inter)stellar line up of plenary speakers for the lectures, our usual slate of short courses that may be taken for continuing education credits, an array of science fiction authors as part of our public outreach, and, for the first time since our event in Huntsville, Alabama, an art show. Registration for the symposium will soon be online.

For more information, visit: https://irg.space/first-european-interstellar-symposium/

We hope to see you in beautiful Luxembourg!

2025 IRG Scholarship Announcement

The non-profit Interstellar Research Group (formerly the Tennessee Valley Interstellar Workshop) is proud to present its 2025 Scholarship Program, to provide one undergraduate scholarship, Tim Bolgeo Memorial Scholarship ($2,500), and one master's level graduate scholarship ($2,500), and one doctoral level scholarship ($2,500) for qualifying students.

The scholarships (including the Tim Bolgeo Memorial Scholarship) are sponsored by IRG supporters Baen Books and Rob and Ruann Hampson are merit-based and require applicants to complete an essay with their application forms. Applications will be available online on September 15, 2025. The deadline for all applications is December 15, 2024, 5 pm EST.

Applicants for the undergraduate scholarships must be high school seniors or present undergraduates in the United States and its territories who plan to pursue their first undergraduate degree in any related field related to interstellar travel missions and establishing successful civilizations at any accredited, four-year American college or university. Applicants for the graduate scholarship must be full-time college or university students majoring in field related to interstellar travel missions and seeking a graduate degree (e.g. MS, EngD, JD, non-exclusive) from an accredited college or university in the United States.

For more information about the new scholarships, including application guidelines, visit:

https://irg.space/2025-scholarships/

To learn more about IRG scholarship sponsors, visit: http://www.baen.com

2024 IRG Scholarship Essays

The Interstellar Research Group "was created to foster and assist the study, research and experimentation necessary to make human interstellar travel a reality, with untold benefits to life on Earth," said IRG President Emeritus John Preston. "We can imagine no better way to demonstrate that goal than the creation of these scholarships, helping new generations of thinkers, builders and explorers to set their sights on the stars."

In this issue, we feature essays from two of the 2024 scholarship winners:

Sadie Cullings is the undergraduate winner of the Tim Bolgeo Memorial Scholarship. Sadie is pursuing a degree in Aerospace engineering & Astronautics at Arizona State University, and her winning essay is "Achieving Interstellar Travel".

Katlynn Vicuña is the winner of the Master's Scholarship; she is pursuing a degree in Space Systems Engineering at Johns Hopkins University. Her winning essay is about her contributions to the "… collective endeavor of advancing our capabilities in interstellar travel and exploration."

Achieving Interstellar Travel
Sadie Cullings

Achieving interstellar travel would open so many windows of opportunity for scientists to better understand the universe we live in and why reality is the way that it is. To achieve interstellar travel, one must consider the requirements needed to travel great distances within a given time scale. Once dark matter is better understood, it could potentially be harnessed as a means of interstellar spacecraft propulsion at much higher speeds than have currently been achieved using modern systems.

One possibility is by utilizing dark matter as a form of propulsion, and by locating and better understanding how traversable wormholes work, society could successfully achieve interstellar travel, reaching the other side of the galaxy or universe in a significantly reduced amount of time. Now, this all hinges on the existence of traversable wormholes, which has yet to have been proven. Because of this uncertainty about the existence of traversable wormholes in the space-time continuum, I decided to work on a research project as an ASU/NASA Space Grant Intern, with the goal of identifying potential ways that the existence of traversable wormholes could be proven. I approached my research project by creating a Newtonian analogue of a spherically symmetric traversable wormhole, which allowed me to better understand the interactions a wormhole might exhibit with other astrophysical bodies. The analogue I created allowed me to determine that traversable wormholes would exhibit a specific gravitational wave signature that could differentiate a wormhole from, say, a black hole - black hole merger. Current technologies, like the Laser Interferometer Gravitational-wave Observatory (LIGO), allow for the detection of gravitational waves, hence the significance of my research project. My hope is that my research project will allow for the very first detection of a wormhole in the space-time continuum, proving their existence beyond just theory.

By better understanding the very nature of dark matter and its properties, the design of a warp drive could be researched, developed, and potentially created to aid in humanity's ability to perform interstellar travel missions. This would revolutionize the space industry and the future of space exploration, by expanding the scope of missions to other star systems and creating a means of much faster space travel. This would have significant implications for becoming an interplanetary species, by allowing us new pathways to arrive at other potentially hospitable planets within the lifetime of a human. If traversable wormholes are also proven to exist, the travel time

could potentially be cut even shorter if scientists and engineers learn how to harness the wormhole without destroying the spacecraft and potential astronauts onboard. By combining a warp drive with traveling through a wormhole to the far reaches of our galaxy, humanity would likely be able to better sustain living in space and space travel, expanding our sphere of influence, and exploring uncharted territories.

Enough about the logistics of achieving interstellar travel; it's just as important to discuss the importance of interstellar travel and how it could impact society and our current understanding of the universe as we know it. Interstellar missions would allow us to better understand other star systems and learn more about the far reaches of our galaxy, beyond just what limited information can be determined from modern telescopes located on Earth or in space today. With a much larger network accessible through interstellar travel, more research and tests can be used to find extraterrestrial life on various potentially hospitable planets NASA has identified. If the existence of extraterrestrial life is proven on a far-off planet or moon in another star system, that would be a landmark discovery of a lifetime for all of humanity, due to the impact it would have on our perception and understanding of life and evolution, compared to our current understanding. With the new wealth of knowledge gained from interstellar missions, technology would continue to advance, in a new era of innovation and exploration. A successful interstellar mission would also signify a huge step forward in the advancement of our species and our current civilization, as our bounds of influence would be greater than ever before. It is important to consider the ramifications that interstellar travel may have on both the current state of society here on Earth and on potential extraterrestrial environments/landscapes and species that might be encountered on such a journey. If extraterrestrial life is found, ethical considerations must be considered when trying to learn more about the extraterrestrial species found or while exploring the habitats and environments that host such life. The preservation of extraterrestrial species is extremely important, and careful consideration will need to go into mission planning if such a situation arises to prevent contamination or waste being exposed to the otherworldly environment.

Interstellar travel is a topic that is often brought up in science fiction novels and movies, highlighting the endless potential of what the universe holds in store. Unfortunately, interstellar travel and exploration is easily dismissed as purely science fiction in today's society, with no real, solid efforts to make it a reality. This is probably due to the lack of capabilities for interstellar travel with current technologies, and the cost to research, design, and build new, innovative technologies capable of such travel can be quite extensive. However, I believe with advancements in our understanding of dark matter and wormholes, interstellar travel is within the realm of possibility with enough ingenuity and excitement for exploring new star systems further into our galaxy or universe than ever before. Interstellar travel is an extraordinary concept that if successfully implemented and achieved, will change the world as we know it forever. Humanity has always been prone to exploration and discovery, so the ability to successfully achieve interstellar travel would likely lead to worldwide celebrations and excitement and help unite countries on Earth by giving a bigger perspective on life and the reality that we create. Overall, interstellar travel and research also have the potential to bring people together from all walks of life under a common goal of the exploration and discovery of our place in the universe, which highlights the importance of interstellar travel

CONTRIBUTING TO INTERSTELLAR TRAVEL
Katlynn Vicuña

Embarking on a professional journey that many can only dream of, I have been exceptionally fortunate to contribute to groundbreaking projects such as Mars Base Camp, Inflatable Habitat testing, and the Transporter, a Cislunar gas station. My career has been marked by an unwavering commitment to advancing space exploration, and pushing the boundaries of human achievement. As someone deeply passionate about the cosmos, I aspire to take the next giant leap by becoming an astronaut, driven by the insatiable curiosity to explore uncharted realms and contribute to the evolution of humanity's presence beyond Earth. The experiences gained from working on these innovative space initiatives serve as a launching pad for my future goals, propelling me toward the infinite possibilities that lie ahead in the vast expanse of the cosmos.

One of the first projects I had the privilege of being a part of was Mars Base Camp (MBC). Mars Base Camp (MBC) will be unveiling the frontiers of interplanetary exploration with Nuclear Thermal Propulsion (NTP) In the dynamic realm of space exploration, the Mars Base Camp project stands as a beacon of innovation, poised to unlock the future of interplanetary exploration through the application of Nuclear Thermal Propulsion (NTP) technology. Having had the privilege to work closely with Lockheed Martin Space on Mars Base Camp, I have witnessed firsthand the evolution of this visionary concept. As humanity embarks on the Artemis era of space exploration, MBC represents a pivotal stride towards sustained lunar missions and the development of capabilities essential for future Mars exploration. During my tenure as an intern, I had the invaluable opportunity to actively contribute to and play a pivotal role in the multifaceted aspects of our mission. Specifically, I engaged in the dynamic realm of simulations, where my responsibilities included not only participating in the execution of simulated scenarios but also aiding in their intricate design and orbital analysis. Additionally, I was actively involved in the rigorous design phase, collaborating with the team to ensure the reliability, efficiency, and resilience of various mission-critical components. Beyond this phase, my role extended to the hands-on implementation of key elements, allowing me to witness firsthand the seamless integration of carefully developed solutions into the overarching framework of the mission. This multifaceted involvement not only broadened my understanding of the mission's intricacies but also provided me with a comprehensive experiential foundation in the practical aspects of aerospace engineering and mission execution.

Evolution of Mars Base Camp since its inception in 2016, has undergone a transformative journey. Initially conceived as a chemically propelled Mars transit vehicle, the project has now embraced the revolutionary potential of NTP technology. This paradigm shift has expanded the horizons of Mars exploration, introducing numerous advantages over traditional propulsion methods. NTP not only promises faster transit times but also enhances crew safety through abort possibilities, all while seamlessly integrating with lunar in-situ resource utilization (ISRU).

My contributions to abort trajectories are as follows. In the intricate web of Mars mission capabilities, one of the crucial aspects is the development of optimized trajectories and abort scenarios. Having been intimately involved in the Mars Base Camp project, I had the unique opportunity to contribute to the design and analysis of abort trajectories. This involved exploring scenarios where the high thrust and efficiency of NTP could be harnessed to ensure crew safety during the outbound leg of the mission. Utilizing Systems Tool Kit (STK), an industry-standard I was able to help determine the most optimal conditions during transit to perform abort maneuvers, how much delta-v was needed, and the amount of fuel consumption. This was determined as early as one week into the mission up until one week prior to arrival at Mars. These simulations helped to determine the feasibility of a safe return of the involved crew members. The inclusion of NTP technology marks a turning point in Mars mission capabilities. The combination of high efficiency and thrust not only ensures safer crewed flights but also facilitates faster conjunction-style transits from Earth to Mars. The capability for abort during the outbound leg of the mission adds an extra layer of security, demonstrating the matured and integrated nature of NTP technology within the Mars Base Camp framework. An additional highlight of this experience includes my contribution to co-authoring my inaugural published paper and collaborating with this exceptional team.

In the realm of interstellar travel, the accommodation and functionality of living spaces become critical considerations for human well-being. Unlike traditional housing on Earth or the potential structures on other planets, innovative solutions must be devised to address the unique challenges posed by extended space journeys. In this context, inflatable habitats emerge as exceptionally versatile options. By opting for inflatable structures, the need to transport massive, rigid frameworks into space is mitigated, offering a more compact, lightweight, and potentially more durable alternative. The significance of adaptable infrastructure for scientists and astronauts cannot be overstated, playing a pivotal role in ensuring the success of interstellar missions. Within the Mars Base Camp (MBC) project, adaptive infrastructure stands as a cornerstone, evolving dynamically to meet the escalating demands of increasingly intricate missions. The phased development of supporting infrastructure initiates with minimal prerequisites for initial missions and progressively integrates advanced components. This comprehensive approach includes the incorporation of a lander equipped with rovers, inflatable habitats, power sources, and sets the stage for further Mars research endeavors. The adaptability inherent in the MBC project's infrastructure positions it as a flexible and robust platform. Unlike traditional models that necessitate preplaced infrastructure for initial mission success, MBC's dynamic approach anticipates and accommodates the evolving requirements of extended interstellar exploration. In essence, the MBC project sets a precedent for future missions by demonstrating the efficacy of adaptable infrastructure in creating a sustainable and functional living environment for scientists and astronauts venturing into the uncharted realms of interstellar space.

My contributions to inflatable habitat are as follows. As stated by Lockheed Martin “At Lockheed's cutting-edge facility in Denver, Colorado, a pivotal test unfolded on June 14, 2023, utilizing the very test stand that once supported the renowned Titan rocket. The focal point of this experiment was an inflatable module, its pressure reaching an astonishing 253 psi, a magnitude six times beyond its designated operating threshold.” This trial represented a crucial juncture, demanding meticulous consideration and analysis of various weaving techniques before their integration into the comprehensive habitat structure. In the lead-up to the explosive burst test, a comprehensive exploration of weaving methods was imperative. I actively contributed to this phase, delving into the assessment of these techniques and conducting tension tests to discern the strength and optimal characteristics of each weave. This hands-on involvement allowed us to discern the weaves with superior resilience, separating them from those deemed less suitable for further testing and refinement. The comprehensive approach to weaving exploration not only enriched our understanding of the module's structural dynamics but also paved the way for more informed decisions in the habitat's development process. This odyssey through the realms of Mars Base Camp, fortified by the revolutionary force of Nuclear Thermal Propulsion, underscores a pivotal juncture in space exploration. The exploration of NTP capabilities not only heralds a transformative chapter but also unveils the potential for an era marked by unprecedented interplanetary endeavors. Peering into the future, the Mars Base Camp project emerges as a beacon of promise, fusing adaptability and the integration of cutting-edge technologies into a seamless framework poised for sustained and viable long-term Mars exploration.

My contributions to the mission, spanning simulations, testing, and implementation of key components, echo the collaborative spirit of this endeavor. The intricacies of Mars mission capabilities, from actively participating in the development and analysis of optimized trajectories and abort scenarios, to my involvement in the burst test of the inflatable habitat module illuminated the intricacy of weaving techniques, contributing to the module's structural dynamics and informing decisions crucial to its development. As we stand on the verge of the 2030s, with the prospect of the first crewed Mars mission looming, the Mars Base Camp project symbolizes the culmination of years of meticulous planning, innovative technology integration, and collaborative efforts. Personally invested in this evolving mission, I eagerly anticipate the extraordinary discoveries that await humanity in the uncharted territories of the Red Planet. The fusion of adaptability, cutting-edge technologies, and the revolutionary capabilities of nuclear thermal propulsion propels (pun intended) Mars Base Camp into the forefront of interplanetary exploration, marking a thrilling and transformative era in our relentless pursuit of knowledge beyond the confines of Earth.

Venturing closer to home, I've had the privilege of engaging in a collaborative effort between Lockheed Martin and Blue Origin, contributing to a project known as "The Transporter." This ambitious mission is geared towards transporting propellant from low Earth orbit to the near-rectilinear halo orbit around the moon, where a versatile lander is strategically positioned. The primary objective is to facilitate the refueling of the lander, designed for deployment in multiple missions, effectively establishing a

Cislunar gas station in orbit. This groundbreaking initiative aims to reduce the propellant requirements of launch vehicles, enabling them to carry more supplies and alleviating the burden of excessive propellant weight.

My involvement in this mission spans several critical facets. I have been entrusted with assisting in the design of the propulsion system and evaluating the practicality of the orbit transfer around the moon. This project stands out as the most advanced endeavor I have had the opportunity to contribute to, surrounded by a team of seasoned experts in propulsion and orbital optimizations. In collaboration with Blue Origin, our focus on the propulsion side involves integrating engines into a meticulously designed propulsion system. Currently, the project entails extensive simulations and trade studies to determine the most optimal configuration, ensuring alignment with the mission's success criteria. The learning curve has been steep, but the exposure to cutting-edge technology and the collaborative spirit of the team have provided invaluable insights into the intricacies of advanced space exploration projects.

Moreover, this experience has provided me with exposure to industry standards for propulsion simulation programs, enhanced my proficiency in Systems Tool Kit (STK) through continued learning, and familiarized me with modeling software integral to the project. Additionally, I've had the opportunity to delve into project management by coordinating meetings with different personnel on the team. These interactions have been instrumental in gathering accurate information, fostering collaboration, and ensuring that all team members are on the same page. This multifaceted exposure not only enriches my skill set but also underscores the importance of seamless coordination and effective communication in the successful execution of complex aerospace projects.

Engaging in an unexpected but highly relevant project within the realm of the aforementioned cislunar endeavor, I delved into research on lunar dust. While it might initially appear as a minor concern, lunar dust stands as one of the most formidable challenges in developing infrastructure on the moon. Until the mastery of wireless electricity transmission becomes a reality for our species, the necessity persists for the implementation of wires, connectors, and various electrical components. Lunar dust, comprising extremely fine particulates with magnetic or ferrous and silicate-based properties, poses a significant threat. These particles readily acquire an electric static charge, complicating matters further. The primary issue arises from the minute size of these particles, which not only adhere stubbornly to metal surfaces but clings tenaciously to any object due to the static electricity. This inherent stickiness makes removing lunar dust from components nearly impossible, as it inherently seeks to adhere to everything it encounters.

The second challenge stems from the absence of an atmosphere on the Moon. While the lack of wind eliminates the risk of these particles dispersing uncontrollably, it also means that the particles retain their sharp, rigid nature. This characteristic renders lunar dust extremely hazardous, posing risks to lunar rovers, equipment, and, most critically, to any humans who might inadvertently inhale these particles. Thus, addressing the intricacies of lunar dust becomes a vital component in ensuring the safety and functionality of lunar infrastructure.

My involvement with this project is as follows. I was tasked to reach out to existing electrical connector companies, meticulously gathering and consolidating the wealth of information and research they had previously conducted. My objective was to discern not only the most optimal companies for collaboration but also to differentiate between those actively engaged in practical research and testing, and those primarily existing in the theoretical realm. Ultimately to figure out there is a lot of work that needs to be done.

During our lunar exploration, one of the initial projects I had the privilege to contribute to was the Lunar Mobility Vehicle, a collaborative effort between General Motors and Lockheed Martin. The aim was to develop a human-operated lander-vehicle combination designed to explore various regions of the lunar surface. My involvement began in the project's preliminary phase, where ensuring the safety of the drivers emerged as a paramount concern. It was imperative to establish a foolproof method to prevent the vehicle from tipping over, regardless of the landing orientation.

My involvement with this project is as follows. I was assigned the task of creating a ⅓ scaled model. This model served as a crucial element in our simulations, replicating the lunar environment and allowing us to explore different landing configurations, from craters to large boulders. With the absence of external assistance for astronauts in the event of an incorrect landing, meticulous attention was dedicated to ensuring the vehicle's stability under all circumstances. The goal was to eliminate any potential issues, emphasizing the importance of a flawless design for the safety of those navigating the lunar surface.

My involvement in the realm of interstellar travel, though not initially otherworldly, has laid a foundation upon which I can build in the years to come. My journey began as a nontraditional student, having spent a decade as an automotive technician before making the significant transition to aerospace engineering. This prior experience equipped me with hands-on skills and honed my technical troubleshooting abilities, fostering a mindset that thinks creatively and perseveres in the face of challenges.
The shift from my automotive career to academia marked a pivotal moment where my technical aptitude seamlessly translated into technical writing and the development of lab experiments for an open-source textbook and corresponding CubeSat kit. This initial foray opened doors to various projects, including participation in CubeSat endeavors, First Nations Launch Rocket competitions, Rover robotics teams, NASA competitions, and more. Each undertaking served as a stepping stone, contributing to a cumulative reservoir of skills and knowledge in my mental database.

As part of this continuous progression, one of my next steps involves obtaining my private pilot's license, a pursuit that I believe will further prepare me for the ultimate goal of applying to become an astronaut. Unlike being a mere degree holder, I see myself as an individual with practical experience, the ability to perform under pressure, and a knack for improvisation in problem-solving situations. While I may not be an interstellar traveler within my lifetime, I aspire to play a role in paving the way for those who will embark on such journeys in the future. I envision myself not only as a candidate but as an excellent one, offering a unique blend of real-world experience and a deep understanding of the multifaceted challenges inherent in space exploration. My journey is not just about personal aspirations; it's about contributing to the collective endeavor of advancing our capabilities in interstellar travel and exploration.