

News Feature: The i4is Technical Team

Dan Fries

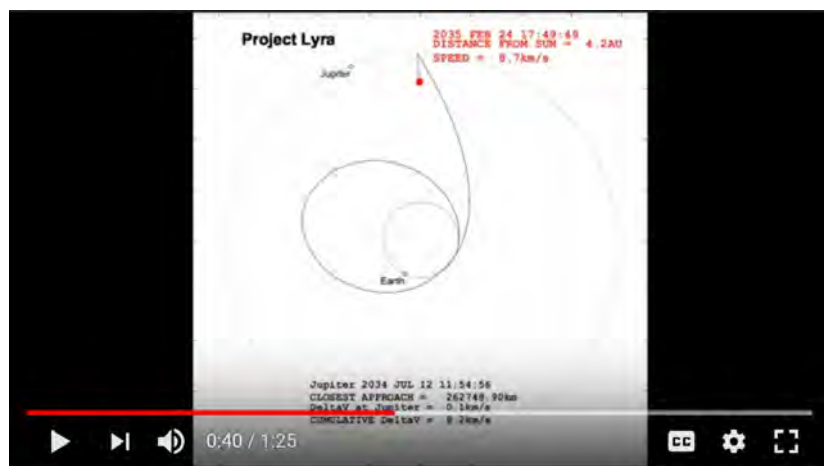
If we are to achieve our interstellar objectives then we must research both the universe we wish to explore, and ultimately populate, and the technologies we need to reach first the nearest stars and thence beyond them. This requires major advancements both in scientific knowledge and in engineering innovation and development. This is the purpose of our technical team.

Dr Dan Fries has been at the heart of i4is technical work since our founding in 2012. Here he explains how the technical team works, introduces some of the key contributors and suggests some of the key qualities you will need to contribute to our work.

The technical committee consists of a loose group of people from different career paths and with different levels of engagement at different times. A common denominator is that members usually have some sort of technical or scientific education or career. Age does not play a role and neither does the current status of one's professional career. Everybody is free to make suggestions and pursue topics they find interesting, with the general support of the committee. If other people find a project interesting, they will join in or suggest people outside of i4is that might be interested in helping out. People that are looking for support with their own ideas and project, but are not members of i4is, are also encouraged to contact us and many fruitful collaborations have been established this way in the past. We try to publicize and discuss the technical committee's work through media and in-person events, and usually we mentor at least a couple of students at the International Space University each year, for their Master's projects. On a regular basis we are proposing projects to funding agencies, such as ESA or NASA, with the goal to pursue rigorous scientific and technical studies directed at the establishment of human presence and utilization within our solar system and at interstellar distances.

Recently, we had the privilege to contribute mission architecture ideas to visit the first interstellar objects detected in our solar system (Project Lyra). We have been working hard to push the idea of visiting interstellar objects, when detected in our vicinity, in general, through different technological approaches, and we have been considering new missions to the upper clouds layers of Venus, in the search for potential signs of life.

Other recent projects include reviews for deceleration of interstellar missions, interstellar Bussard ramjets, and the exploration of the design space for near-term self-replicating space probes. A long-term goal of the technical committee has been the realization of laser sail propulsion systems for interstellar missions. One component of such a system could be chip-sized spacecraft, for which we acquired funding and started a collaboration with University students developing such a proof-of-concept ChipSat. Of course, all these efforts would be impossible without the people that actually drive them. An article naming every single person would probably take up the entire Principium issue, so I will put a spotlight on only a few of them, and hope I will be forgiven for such an incomplete list.



Project Lyra: OITS Simulation

Here a proposed ISO interceptor probe has just rounded Jupiter, resulting in a trajectory towards a close encounter with the Sun and an Oberth manoeuvre to overtake 1I/ʻOumuamua.

drive.google.com/file/d/1Pgcdl4kuz7rxSJ30PDkafvohbg2G63P8/view

Credit: Adam Hibberd/i4is

I, myself, recently completed my PhD in Aerospace Engineering at the Georgia Institute of Technology and now work as a Post-Doctoral fellow at the University of Texas at Austin. My research focus is on experimental high-speed, high-temperature flows and I am currently involved in a project to increase the fidelity of plasma simulations combining numerical and experimental results. I am originally from Germany, where I studied at the University of Stuttgart and led multiple project teams tackling space system engineering challenges. I started getting involved with i4is in 2012, initially on a fusion propulsion concept but then shifting to a larger scale project to engage university students in the development of beamed laser sail propulsion system architectures. Since then I have worked on a number of projects including proof-of-concept missions for laser sails, asteroid mining, ChipSat planetary reentry, and exploration of interstellar objects in our solar system. One of the main reasons I have stayed engaged with i4is is that the variety of projects within i4is is enormous and working with knowledgeable people willing to share their knowledge is very enjoyable. It is an entirely volunteer based organization, so seeing people come together to tackle various aspects of interstellar exploration is very inspiring, too. I also enjoy the educational opportunities a lot, where we mentor and work with students at the International Space University or hold lectures on a variety of subjects (eg ChipSat development or propulsion concepts based on the General Theory of Relativity).

Andreas Hein is the current i4is executive director and chairman of the Technical Research Committee. He received his PhD at the Technical University of Munich in the area of space systems engineering, focusing on the application of heritage technologies to space systems and doing part of his research at the Massachusetts Institute of Technology (MIT) System Architecture Lab. He also worked at the European Space Agency Strategy and Architecture Office on stakeholder analysis for future crewed space exploration. Currently he is working as an assistant professor of systems engineering at CentraleSupélec – Université Paris-Saclay.



Andreas Hein



Left to right: Robert Kennedy, Dan Fries, Ariel Ekblaw (Founder of the MIT Space Exploration Initiative)

Robert Kennedy is the president of the Institute for Interstellar Studies, our US organisation. When he is not pouring his heart into i4is, he is currently employed as a senior systems engineer at Tetra Tech. He studied mechanical engineering at California Polytechnic, with emphases in robotics, machine design, and optical physics. Fresh out of school, he designed industrial robotics systems at the Douglas Aircraft Company in Los Angeles, and pursued research in artificial intelligence at Oak Ridge National Laboratory. Robert’s interests go far beyond the purely technical and he is a published commercial artist and author (nonfiction). He has written about space-based solar power, shell worlds, climate change, linguistics, energy parks, biofuels, and energy security. He also was a technical consultant on the movie “Deep Impact”.

Another essential member of the Tech Committee is Adam Hibberd. Adam lived in the East African country of Tanzania, where his father worked at the University of Dar Es Salaam, up to the age of four. The family then returned to the UK and Adam attended the University of Keele, gaining a joint honours degree in physics and mathematics. In the ‘90s, he worked as a software engineer on the on-board flight program for the European Ariane 4 launch vehicle; including the production, maintenance, real-time testing and post-flight analysis, his expertise being the guidance algorithm. He developed his Optimum Interplanetary Trajectory Software (OITS) in 2017 as a personal challenge to learn the MATLAB programming environment and language, then using it to investigate missions to the first known interstellar object, 1I/’Oumuamua. He contacted i4is with his results and his involvement with i4is started from there. His work on missions to interstellar objects has been published in Acta Astronautica and he has worked on two other papers on similar subjects since then.



Adam Hibberd

Nikolaos Perakis is currently working towards his PhD at the Chair of Turbomachinery and Flight Propulsion of the Technical University of Munich, focusing on the combustion modeling of green propellants for space propulsion applications and specifically the combination of methane and oxygen. His involvement with interstellar travel began within Project Icarus (follow-up study to Project Daedalus) and continued with i4is' Dragonfly Project (Lasersails). His work on the Dragonfly project resulted in a novel method of combining magnetic and electric sails for deceleration in interstellar missions.

Nikolaos Perakis

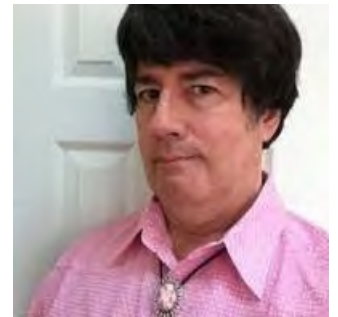


Olivia Borgue

Olivia Borgue is a PhD student at Chalmers University in Sweden in the division of Product Development. She is working on the introduction of new technologies in already established industries aimed at promoting innovation. For example, the introduction of additive manufacturing in the space industry. Recently, she led a project to explore the design space of self-replicating space probes and come up with a minimum feasible design.

Marshall Eubanks

Marshall Eubanks has been instrumental in many i4is proposals and research papers. He is a physicist with extensive experience in experimental General Relativity, geophysics and planetary physics, and radio interferometry. A graduate student under Professor Irwin Shapiro at MIT, Marshall was the technical lead of Very Long Baseline Interferometry programs at both the Jet Propulsion Laboratory and the U.S. Naval Observatory, creating measurement systems essential for navigation of spacecraft and the operation of the Global Positioning System satellites. In 2018, he co-founded Space Initiatives Inc and is currently Chief Scientist there, where he has been working on low cost communication, positioning and instrumental arrays on the Moon, and also on the problems of exploring Interstellar Objects passing through the Solar System. He is also a member of the "Roadmap to Ocean Worlds" committee, which is advising NASA on its new initiative to search for life in the ice-covered oceans being found in the outer Solar System.



Manasvi Lingam

Manasvi Lingam is an Assistant Professor of Astrobiology, Aerospace, Physics and Space Sciences at the Florida Institute of Technology. Coming from Mumbai, India, he obtained his PhD at the University of Texas at Austin. Afterwards, he undertook postdoctoral stints at Princeton University, Harvard University and the Harvard-Smithsonian Center for Astrophysics. His current research interests are situated mostly within plasma physics and astrobiology. This includes exploring the multiple factors that regulate the habitability of planets and identifying potential signatures of extraterrestrial life. Manasvi has worked with the i4is technical team on a number of projects.

Angelo Genovese received a Master's Degree in Aerospace Engineering (specialising in Space Propulsion) at the University of Pisa, Italy, in 1992. He started to work as Electric Propulsion Engineer in the Italian space propulsion research centre "Centrosazio" in Pisa, developing Field Emission Electric Propulsion (FEEP) ion thrusters for ultra-precise positioning of scientific spacecraft. In 2000 he contributed to the development of an Indium FEEP micro-propulsion system for the ESA mission LISA Pathfinder. Within i4is, Angelo has made many valuable contributions relating to electric propulsion development and laser sail experiments.



Angelo Genovese