



# BIS International Space Forum

Saturday 1st June 2024 09:30 - 17:00 BST

In-Person at:

**British Interplanetary Society**

*Arthur C. Clarke House, 27-29 South Lambeth Rd, London, SW8 1SZ*

and

**Online on Zoom**

## Overview

The **BIS International Space Forum** is a meeting place for discussing and reporting on all international space activities, exploring the latest insights, critical issues and historic perspectives within the space domain from across the globe. The Forum aims to report, discuss and track the progress and heritage of international efforts to advance astronautics, highlighting areas of interdependence between different space programmes, and the opportunities/challenges in how and where the global space community can or should be working together.

## Programme

09:00 - 09:30	<b>Arrival and Registration (In Person Attendees)</b>	
09:30 - 09:40	<b>Event Start</b> (Zoom Open Online) - <b>Welcome Address</b> - <b>Introduction</b> - Aims of International Space Forum 2024	Alistair Scott (AS) Simon Feast (SF)
09:40 – 10:10 10:10 – 10:40	Morning Session <b>A 25-Year Journey of World Space Week for Enhanced Public Engagement</b> <b>The San Marco Project: from 0 to orbit in 3 (5) years</b>	<b>Alma Okpalefe</b> (online) <b>Fabrizio Bernardini</b> (online)
10:40 – 11:00	Coffee Break [20min]	
11:00 – 11:30 11:30 – 12:00	<b>Soviet Spaceflight in 1924</b> <b>China's New "Smart" satellite production line, the TianMu 天目 constellation and the new ground stations</b>	<b>Kenelm England</b> <b>Andrew Thomas</b> (online)
12:00 – 12:30	Discussion: <b>Methods for the Mitigation of Environmental Impact of End-of-Life Disposal of Satellites by De-Orbiting</b>	<b>Griffith Ingram</b>
12:30 – 13:30	<b>Lunch</b>	
13:30 – 14:00 14:00 – 14:30 14:30 – 15:00	Afternoon Session <b>Contamination of Mars (ethical concerns on contamination and terraforming)</b> <b>The Impact of Space-Based Resources on Existing World Markets</b> <b>Scorpion: Benchmarking History</b>	<b>Nina Kojima</b> <b>Philip Baldock</b> <b>Mark Hempzell</b>
15:00 – 15:20	Coffee Break [20min]	
15:20 – 15:50 15:50 – 16:20 16:20 – 16:50	<b>Stellar Powered Interstellar Accelerator</b> <b>Island Zero: A practical gateway to large-scale space habitats</b> Discussion: <b>Open Discussion</b>	<b>John Anderson</b> <b>Jerry Stone</b>
16:50 – 17:00	<b>Closing Remarks</b> [10min] <ul style="list-style-type: none"><li>• Feedback from the day</li><li>• Future format and direction of the Forum</li><li>• Other ideas topics for additional Forums / Open Suggestions</li></ul>	Chair: AS / SF
17:00	ISF 2024 Programme Close	
17:00 – 18:00	Social in Building (In-person attendees)	BIS HQ Building
18:00 – 20:00	Supper at local Pub (Optional – At Own Expense)	TBD

## **Abstracts - Morning Session 09:40 - 12:30**

### **0940: A 25-Year Journey of World Space Week for Enhanced Public Engagement**

**Alma Okpalefe, Ilayda Edali (Online)**

Twenty-five years ago, the declaration of World Space Week marked the beginning of an annual global festivity celebrating space between October 4th and 10th. This period has since evolved into the largest space event worldwide, coordinating events across the globe. World Space Week transcends geographical and cultural boundaries, embodying a diverse tapestry of meanings to various audiences. At its core, it serves as an essential platform for public engagement, a highlight for space exploration, and a catalyst for sparking the passions of future space enthusiasts.

Over its quarter-century journey, World Space Week has unfolded into a narrative of growth, innovation, and learning. This paper aims to shed light on the key successes and hurdles encountered throughout its evolution. It seeks to chart a course for leveraging World Space Week as a dynamic tool for public outreach and engagement, offering strategic insights for engaging the world's interest in the vast expanse beyond our planet. Through reflective analysis and forward-looking recommendations, this discussion contributes to the ongoing dialogue on how best to utilize this global platform to inspire, educate, and connect the public with the wonders of space in the years ahead.

**Keywords:** World Space Week, Public Engagement, Space Exploration, Global Coordination, Outreach Strategies, Educational Impact, Global Platform, Space Awareness

#### **Bio:**

Alma Okpalefe currently holds the position of Executive Director at the World Space Week Association, the global coordinators behind the "biggest space event on Earth." With nearly two decades of legal expertise in the satellite industry, Alma's journey in the space sector began with Nigerian Communications Satellite (NIGCOMSAT) Ltd, where she served as Legal Counsel and Company Secretary. In this role, she not only managed Legal Services, Corporate Strategy, and International Cooperation but also contributed significantly to various communication satellite initiatives across Africa. Beyond her legal pursuits, Alma is deeply involved in humanitarian efforts. As the Chair and Co-founder of Isaiah's Hope Foundation, her focus lies in utilizing technology to improve healthcare access, particularly among underserved communities, including internally displaced persons. Further demonstrating her commitment to championing innovative solutions, Alma serves as an Advisor for healthtech company One2One Healthcare/RingMD.

### **1010: The San Marco Project: from 0 to orbit in 3 (5) years**

**Fabrizio Bernardini (Online)**

In this talk a brief overview of the history of the Italian San Marco Project will highlight how such a complex programme was accomplished in just a few years. Despite all the innovations, and inherent difficulties, the Project accomplished all its objectives opening also new frontiers for astronautics and science.

#### **Bio:**

Fabrizio Bernardini is a freelance system engineer specialising mainly in spacecraft avionics system, and is the operations manager of the SHARAD instrument on-board Mars Reconnaissance Orbiter. With a mixed hardware and software background, he participates also in projects which apply different technologies to science, cultural heritage, geodesy and aviation. As a Fellow and Council Member of the British Interplanetary Society, he manages education and outreach activities in the space sector.

### 1100: Soviet Spaceflight in 1924

#### Kenelm England (In-person)

After a general introduction to the topic of spaceflight at the time, the presentation covers some of the events and personalities relating to spaceflight and space exploration, which occurred in the Soviet Union in 1924.

#### **Bio:**

Kenelm England is a retired teacher and amateur astronomer, with a particular interest in the history of astronomy and space. He is a member of the BAA, BIS and RAS and has attended the International Forums since the late 1980s. He has published a number of articles on astronomical history in The Observatory magazine.

### 1130: China's New "Smart" satellite production line, the TianMu 天目 constellation and the new ground stations

#### Andrew Thomas (Online)

Announced by China Aerospace at the IAC in Baku last October were three significant satellite innovations that interact.

The first is the new "Smart" satellite production line. Built in Wuhan, Hebei province, this produces constellations of small (less than 1 ton) satellites, at a rate of 240 per annum. A short video taken from the exhibitor's stall shows this facility in operation.

The second development is the use of this facility to produce the constellation Tian Mu 天目, which is a constellation of weather satellites with an innovative network that will be discussed.

Thirdly, through a Hong Kong limited company with worldwide branches, China has opened a satellite ground station and control centre in Azerbaijan, and has the technology to add satellite stations anywhere in the world with its new product line of 1.8 metre portable satellite dishes.

This presentation relies on public information given freely to IAC conference participants, but all inferences are made by the author, who is not a representative.

#### **Bio:**

Andrew Thomas shares his name with many other famous people including the Australian astronaut! He is a Fellow of the BIS, a radio "ham", and he wrote his MA and M Phil theses about the popular culture and conversation about space in both Russia and China.

At the IAC in Baku he presented an interactive presentation and paper: "A European Space Policy Bridge with Chinese Characteristics" and following a paper in JBIS he is invited to Cospar in Busan this July to talk about "Radio Communications and Navigation on Mars without artificial satellites".

### 1200: Methods for the Mitigation of Environmental Impact of End-of-Life Disposal of Satellites by De-Orbiting

#### Griffith Ingram (In-person)

The removal from orbit of satellites at the end of their useful life is highly desirable in order to avoid contributing to the potential for a "Kessler Syndrome" catastrophe. Whilst the potential exists, via new technologies currently coming on-line from such companies as Astroscale and Clearspace, to re-fuel satellites to extend their operational lifespan, the fact remains that the end-of-life provision for many satellites is for de-orbiting. There is currently concern as to the environmental effects of re-entering satellites.

When a satellite undergoes atmospheric re-entry, the effects may vary from complete vapourisation to fragmentation. Approximately 10% of stratospheric aerosol particles contain metals (chiefly aluminium) from such satellites, having effects on ozone depletion and the absorption and scattering of solar radiation.

However, it is also vitally necessary to deal with the problem of “orbital crowding”. Satellite licensing regulations in the United Kingdom require an end-of-life plan which, as a minimum, will result in the satellite being de-orbited inside 25 years, in accordance with the Inter-Agency Space Debris Coordination Committee Space Debris Mitigation Guidelines. The only end-of-life options available at present are removal to a so-called “graveyard orbit” or de-orbiting; it is becoming apparent that “graveyard orbits” are not as stable as has previously been thought. To quote C. R Longstaff, M Hempzell, and S Alexandra, “A Study into the Sustainable Disposal of End of Life Satellites”, *Journal of the British Interplanetary Society*, Volume 69 (2016), pp.429-438), “debris density in the ‘graveyard orbits’ grows each year and will eventually reach the point where the collision risk reaches an unacceptable level, given that debris created by any collision at graveyard altitudes will reach the geostationary arc.”

It is proposed that a study project be undertaken to:

- (i) Evaluate the magnitude of the atmospheric pollution due to the anticipated re-entry of satellites;
- (ii) Report on the operational requirements for the implementation of the “Orbital Necropolis” proposal of Longstaff, Hempzell, and Alexandra [\*C];
- (iii) Prepare proposals for:
  - (a) An initial proposal for the intact return of satellites to Earth for refurbishment/recycling using Astroscale or Clearspace vehicles (or developments thereof), as “space tugs” to capture satellites at end-of-life and rendezvous with Space Forge vehicles (or, again, developments thereof) to return them to the surface of the Earth, possibly for refurbishment and re-use;
  - (b) A secondary proposal for the use of a Space Forge vehicle as an “orbital smelter” to reduce satellites to their constituent materials and return the resulting materials to Earth, for sale as scrap;
  - (c) A tertiary proposal for an “Orbital Recycling Centre” which will either refurbish satellites on-orbit for re-use, dismantle them for salvage, or recycle them for their scrap value.

It is considered that this Study Project will have the twin benefits of producing proposals for dealing with a growing problem, and presenting the BIS in a favourable light from the point of view of environmental responsibility.

**Bio:**

Griffith Ingram works part-time as a BIS Staff Member, and is also an enthusiastic volunteer for the Society. He has been a space enthusiast since the age of five, when he saw an episode of Fireball XL5. Griffith has extensive experience in the aircraft industry, as a draughtsperson, drawing checker, and mass properties engineer. He is also a valued member of the Society’s publications team.

## **Abstracts – Afternoon Session 13:30 - 17:00**

### **1330: Contamination of Mars (ethical concerns on contamination and terraforming)**

**Nina Kojima (In-Person)**

The potential for contamination of Mars is a critical issue in contemporary space exploration and astrobiology. I am examining the implications of introducing Earth-originated biological and chemical entities to Mars, particularly in light of possible extant Martian ecosystems beneath its icy crusts. Scientific missions, such as those involving rovers, have raised concerns about the inadvertent contamination of Mars. This discussion becomes even more complex when considering the ethical ramifications of deliberate actions like terraforming.

Contamination can alter or destroy nascent extraterrestrial life forms, which may have profound scientific and philosophical implications. The presence of an ecosystem beneath the Martian ice would add another layer of complexity to our understanding of life's resilience and the planetary processes that support it. The irreversible nature of contamination and its potential to permanently alter any existing Martian biosphere calls for a cautious approach to space exploration.

The ethical debate intensifies when discussing terraforming Mars—deliberately altering its environment to suit human needs. Philosophers and ethicists, including Milligan and Sparrow, argue against such interventions. They suggest that the inherent value of an untouched Mars, possibly hosting primitive life forms, should preclude any human interference that alters its natural state. The ethical stance is primarily one of non-interference and preservation, advocating for Mars as a scientific preserve rather than a new frontier for human colonization.

I will be exploring these ethical considerations by juxtaposing scientific ambitions to explore and possibly colonize Mars against ethical theories advocating for the preservation of extraterrestrial environments. It assesses the arguments for and against human activities on Mars, including the potential scientific benefits of studying an unaltered Martian ecosystem versus the ethical imperatives to avoid harm to any possible Martian life.

Ultimately, this analysis aims to illuminate the ethical dimensions of Mars exploration and the broader implications for our treatment of other celestial bodies. The philosophical perspective that emerges is one of caution and respect for potential extraterrestrial life, advocating for strict protocols to minimize contamination and a re-evaluation of the objectives of human space exploration in light of ethical considerations. This discussion contributes to the ongoing debate on the balance between scientific discovery and ethical responsibility in our interactions with the cosmos.

#### **Bio:**

Nina Kojima is a dynamic and multifaceted scholar currently pursuing her thesis on Ethics in Extraterrestrial Nanotechnology at the University of Glasgow. Her academic journey is marked by an impressive array of achievements, including three Master of Arts degrees in Philosophy, Sociology, and Film Directing. This diverse educational background has uniquely positioned her to explore the complex intersections of ethics, technology, and the future of humanity in space.

In addition to her academic pursuits, Kojima has made significant contributions to the world of cinema. Her films, which span a variety of genres and themes, are available on numerous platforms such as Amazon, Kanopy, Xumo, Fox, and Apple. Her work in film is distinguished by a keen eye for detail and a profound ability to engage audiences with thought-provoking narratives.

Kojima's professional career is equally distinguished by her extensive experience in journalism and broadcasting. She has served as the 10 Downing Street correspondent for TV Slovenia, where her insightful reporting and keen analysis earned her a place in the prestigious 10 Downing Street Press Lobby. Her journalism career has been defined by a commitment to uncovering the truth and delivering impactful stories to the public.

A passionate advocate for humanity's future in space, Nina Kojima is a dedicated member of the Mars Society. She firmly believes that human settlement on Mars will become a reality within her lifetime. This belief fuels her advocacy and research, as she works tirelessly to address the ethical implications of extraterrestrial living and the technological advancements that will make it possible.

Nina Kojima's diverse expertise and unwavering commitment to exploring the frontiers of human knowledge make her a leading voice in the discourse on extraterrestrial ethics and the future of human civilization in space.

## 1400: The Impact of Space-Based Resources on Existing World Markets

### Philip Baldock (In-Person)

With SpaceX Starship now all but functional the prospects for obtaining large quantities of products manufactured in space are now much more promising than even a few years ago. While cheap transport to (and importantly also from) space is a recent development, techniques for manufacturing that have the potential to be much more viable in space have existed for decades, for example vapour deposition, contact welding, zone refining etc. Delicate supply chains on Earth at the international level may well be disrupted by these changes.

This talk will pose and attempt to answer the following questions:

- Which materials are likely to be viable for production in space and economical as exports to Earth in the near future and how might this work?
- Which industries might these most directly influence or disrupt?
- Of the present World economic interests who is most likely to be affected and what might be done to remedy any negative consequences of such activities?

#### **Bio:**

Philip Baldock is the Technical Projects Lead at the NextGen Network. Graduating from Birmingham as a Physicist, he went on to work there as a postgraduate researcher in structural nuclear materials (silicon carbide fibre composites for fusion power applications). His interests are in fluid dynamics, astrodynamics, nuclear/chemical engineering, and manufacturing, about which he is presently writing a book detailing the newest technological innovations towards human colonisation of the Inner Solar System.

## 1430: Scorpion: Benchmarking History

### Mark Hempell

The last 50 years after Apollo have seen many exciting advances in astronautics, but also stagnation, particularly in human spaceflight. It is argued that stagnation is not due to technical constraints. The Scorpion is a feasibility design that is restricted to technologies that can be traced back to around 1970.

It is shown that high thrust nuclear propulsion with treble the specific impulse of the best chemical engines, was conceived in the early seventies and all but one of the key technologies were already under development. The one technical exception are lightweight high performance heat exchangers of the type later developed for the HOTOL/Skylon engines. Real world constraints of the nuclear engine mean the Scorpion also requires a non-nuclear secondary propulsion. This LOX/LH engine significantly out performs current chemical engines, but is based on the design proven by experimental Advanced Space Engine made by Rocketdyne in the 1970's.

The life support and other habitability systems required for missions of several weeks were proven on the 1970's space stations and later the Space Shuttle, although more modern systems are an improvement and these were incorporated on the Scorpion. The same argument is made for the data handling, communications and navigation systems.

The objective of the study was to emphasise the missed opportunities of the past half century, and that the current status of human spaceflight was the result of humanities' collective indolence and not any shortfall in technical ability or vision as to what would be possible. This is an important lesson, as after two generations the perception that human spaceflight is inherently difficult, dangerous, expensive and hence must move at snail's pace has become the industry "group think" and a self-fulfilling prophecy.

Mark's long career in astronautics started at British Aerospace Space and Communications Division working as a systems engineer on communications satellites and infrastructure systems. In 1991 he

joined the University of Bristol and became the Senior Lecturer in Astronautics. In 2008 he launched his own company, Hempzell Astronautics Ltd.

## **Bio**

Mark joined the Society in 1971 and was elected to Fellow in 1984. He is a twice Past President (1997-2000 & 2015-2018) and a past Editor of the Journal. He Chairs the Book Publishing Committee and the Constitution Committee and serves on the Technical Committee. He is particularly keen to keep the balance between the academic and the popularising roles of the Society to ensure they continue to invigorate each other.

### **1520: Stellar Powered Interstellar Accelerator**

#### **John Anderson (In-Person)**

All the technology for manned interstellar travel has now been invented, with two minor exceptions, both of which involve the development of materials on existing lines. No advances in physics are required. Since a journey of more than four light years is necessary to reach even the nearest star, a starship must be accelerated to at least a tenth of the speed of light,  $c$ . The energy,  $E$ , needed for this is very high. Since that energy  $E = mc^2$ , the mass of the starship,  $m$ , must be minimised, and should not include fuel for the acceleration of the starship. Such a starship should be accelerated by a beam supplied by an external source. A star is a good source of large amounts of energy.

It was long thought, but found to be impossible to prove, that light from an area or volume source could not be focussed onto a small spot. UK Patent, GB 2,305,516 B, showed how it is possible to direct electromagnetic energy from an area or volume source using one or more pairs of reflections. Three such pairs will focus light onto a spot smaller than that from a laser. Section 6.19.0 of that patent examined the fallacies which gave rise to the misconception that area or volume focussing is impossible. And a computer aided design system, EMCAD, has been used to show that both area and volume focussing are feasible.

An area focussing directed energy device looks like a representation of a human eye, and is therefore known as an "eye mirror". UK Patent, GB 2,520,386 B, described a "Stellar powered interstellar accelerator". As the light from the photosphere of a star spreads out and becomes less strong with the distance from that photosphere, it is desirable to place an eye mirror as close to that photosphere as possible. The sun is relatively cool just above its photosphere and it is feasible to suspend an eye mirror in that region.

The stellar powered interstellar accelerator provides the perfect solution for accelerating a starship to relativistic velocities, and is unlikely to be surpassed. It is therefore not entirely surprising that the Jain Agamas, which possibly record the oldest of ancient legends, include a detailed description of this device, along with a great deal of information about the galaxy. The theme of the proposed presentation is that the earliest civilizations on this planet possessed knowledge that must have come from an extraterrestrial source.

## **Bio:**

I have had an interest in space travel from a very early age and was a founder member of the school rocketry society. I was asked in 1975 to write a " Three dimensional space game ". After considering how best to achieve interstellar travel, I invented the Stellar Powered Interstellar Accelerator. One of my wife's relations drew my attention to the popular books relevant to the subject. After much research I discovered that this accelerator was described in the Aupapatika Sutra as Ishatpragbhara, literally impelling forward mass, and was known as Siva's Eye.

I have been granted nine patents for the accelerator, the Leaved Eye Mirror Starship, and the Beam Launch to Space Facility. I have also published a book entitled Space Powered Interstellar Accelerator.

## 1550: Island Zero: A practical gateway to large-scale space habitats

### Jerry Stone (In-Person)

In the early 1970s, Gerard O'Neill developed plans for large habitats to be constructed in free space that could house 10,000 people or more. The first level of design was known as "Island One". Larger designs were designated "Island Two" and "Island Three".

He deliberately restricted the design to the technology of the time, so that no-one could suggest that it was fantasy due to requiring materials that had not yet been invented.

Due to improvements in materials and technology over the next 40 years, I ran a project at the BIS to re-examine and update the original studies.

Various such designs all assume the structure would rotate to produce 1g. An initial question that I put to the project was whether they needed 1g. Why not 0.9g, 0.8g or lower? This would mean less stress on the structure, so less material required for its construction. It would also mean less stress on the inhabitants and they would not have to carry out two hours of exercise every day, as on the ISS. Also, construction would not begin with Island One; a much smaller structure would be needed first, as living and working space for the construction personnel. Importantly, it would rotate to provide simulated gravity. The associated question is how much the gravity can be reduced before it becomes a problem rather than a benefit.

An initial version could carry out the medical research necessary at different gravity levels simultaneously in order to determine the g-level to be used in larger space habitats.

This small unit has been designated as "Island Zero".

Modules could also be used for commercial space activities and space tourism.

Inflatable units have already been launched, and others are undergoing testing. This means that with approval to go ahead this could be constructed now and be launched within 2 or 3 years.

### **Bio:**

I am a Freelance Space Presenter; I give presentations on astronomy and space exploration all over the UK, and have given space talks for over 50 years.

I have spoken about space at the British Science Festival, the Edinburgh Festival, the Palace of Westminster, the Royal Institution, the World Science Fiction Convention ... and a rock festival! I also give presentations online.

I'm often interviewed on radio and TV. I was on Sky News covering Tim Peake's mission on the International Space Station, and was on both Sky and BBC News when Neil Armstrong died.

I am a space author. My book, "One Small Step" commemorates the Moon landings and was described by Sir Patrick Moore as "Marvellous!", and my latest book is "Find Out - Space Travel". Both are described as "suitable for 8-year-olds of all ages"!

I have a space-related Blue Peter badge, from when I was interviewed about how rockets work. I am also a space poet, as a poem that I wrote is on the MAVEN spacecraft in orbit around Mars.