Have Starship, Will Travel

The Newsletter of the Tennessee Valley Interstellar Workshop

Issue 12
July 2017

The Tennessee Valley Interstellar Workshop (TVIW) is pleased to bring you this summer 2017 newsletter. Issue 12 of Have Starship, Will Travel (HSWT) highlights the fast approaching Fall symposium: Step by Step: Building a Ladder to the Stars. Early registration for the symposium is open until July 15 with a reduced price for those that have not yet registered.

This year's symposium will feature many distinguished presentations, including: Dr. Pete Worden, Chairman for the Breakthrough Prize Foundation; Dr. Andrew Siemion, Director of the UC Berkley Center for SETI Research; and Dr. Slava Turyshev, Physicist at the NASA Jet Propulsion Laboratory. A particularly special event will be the VIP Panel with participants such as Congressman John Culberson, NASA Marshall Space Flight Center Associate Director Paul McConnaughey, and Dr. Pete Worden.

In addition to presentations, participants have the opportunity to contribute to interactive sessions such as Sagan Meetings – which is a new format for this year's TVIW symposium that is inviting more presenters – and Working Tracks.

TVIW also has the pleasure to announce the three recipients of the 2017 student scholarships, with the support of Baen Books and Digital Oilfield Solutions.

Newsletter Contents

STEP BY STEP: BUILDING A LADDER TO THE STARS

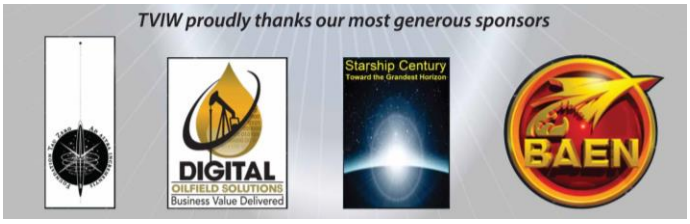
UPDATES ON THE 2017 TVIW SYMPOSIUM THIS COMING OCTOBER

The TVIW 2017 Symposium, with the theme of 'Step by Step: Building a Ladder to the Stars', will be held Oct. 4-6, 2017, at the Embassy Suites in Huntsville, Alabama. This symposium is being presented by the Tennessee Valley Interstellar Workshop, in collaboration with Starship Century and Tau Zero Foundation.

Issue 11 of Have Starship, Will Travel (HSWT), released in April of this year, highlighted the Breakthrough Starshot presentations organized by Starship Century and the presentations organized by the Tau Zero Foundation on the first two days of the symposium respectively. It can be found at https://tviw.us/newsletters/. This issue of HSWT provides updates to those presentations in addition to the presentations organized by TVIW on Day 3 of the symposium. Additionally, the Sagan Meetings and working tracks are detailed.

On the next page, you will find the schedule for this year's symposium, starting with the pre-symposium seminars on October 3 and following through the three exciting days of the symposium, October 4-6. This year's symposium includes distinguished scientists, experienced engineers, illustrious military personnel, and eminent politicians.

Early registration prices are available until **July 15**, so register soon for this lively and stimulating symposium. Registration and further information can be found at tviw.us/2017-symposium.



TVIW 2017 *Schedule of Events*

	Tuesday 3-Oct-2017 TVIW	Wednesday 4-Oct-2017 Starship Century	Thursday 5-Oct-2017 Tau Zero Foundation	Friday 6-Oct-2017 TVIW	Saturday 7-Oct-2017 TVIW
	Seminars & Tours	***Breakthrough Star Shot***	***Pioneering Interstellar Flight***	***First Step on the Journey***	***Recovering & Planning***
7:00 AM	**Breakfast** (on your own)	**Breakfast** (provided for room guests)	**Breakfast** (provided for room guests)	**Breakfast** (provided for room guests)	TVIW/TZ/SC **Breakfast**
7:30 AM					
8:00 AM		Welcome: **Les Johnson**, General Chair Welcome: **Jim Benford**, Starship Century	Welcome: **Les Johnson**, General Chair	Welcome: **Les Johnson**, General Chair	TVIW/TZ/SC **Forward Planning**
8:30 AM	**Seminar Registration**	**Pete Worden** - Are We Alone?	**Marc Millis** - About the Grant	**VIP Panel:** Breakthrough Star Shot Executive Director Pete Worden (Chair) Congressman John Culberson NASA MSFC Assoc. Director Paul McConnaughey Lt. General Steven Kwast	
9:00 AM	**Morning Seminar** Conflict in Space / **Morning Seminar** Laser Propulsion	**Kevin Parkin** - Breakthrough Star Shot System Model and Trade Studies	**Bernard Kutter** - Transportation Supporting a Self-Sustaining Space Economy		
9:30 AM			**Jeff Greason** - Plasma Magnet Sails for Interstellar Flight and Precursor Missions	**Pontus Brandt** - Interstellar Precursors	
10:00 AM		**Coffee Break**	**Coffee Break**	**Coffee Break**	**Space & Rocket Center Tour** (on your own)
10:30 AM	**Coffee Break**	**Robert Fugate** - Star Shot Laser Driver	**Marc Weber** - Trapping Charged Particles	**Slava Turyshev** - Direct Exoplanet Imaging via Solar Gravity Lens	
11:00 AM			**Gerald Jackson** - Antimatter Fuel Production	**Geoffrey Landis** - Solar Gravity Lens Critique	
11:30 AM		**Jim Benford** - Our First Starships	**Hathaway** - Measurements and Methods	**Philip Lubin** - Enabling Interstellar Missions	
12:00 PM	**Lunch**	**David Messerschmitt -** Data Return from Star Shot Probes	**Lunch** (provided, in hotel dining area)	**Lunch** (on your own)	
12:30 PM		**Lunch** (provided, in hotel dining area)			
1:00 PM	**Afternoon Seminar** Humans in Space / **ULA Tour** (pre-registered guests only)		**Pauli Laine** Fission Fragment / **Brent Ziarnick** Nuclear Lessons	**Angelle Tanner** Exoplanets / **Jason Cassibry** Pulsed Magnetic Nozzle	
1:30 PM		**Al Jackson**: Wafersat Trajectories / **Benjamin Diedrich** NEA Guidance	**Gary Pajer** Direct Fusion Drive / **Ore** Worldship Conflict	**Sandy Montgomery** Space Tow Sails / **Angelo Genovese** Laser Electric Prop.	
2:00 PM		**R. London & J. Early:** Dust Impact Hazard / **Ken Roy** Problem of Alien Life	**Danny Jones** Fission-Fusion Rocket / **Cameron Smith** Adaptive Strategies	**Swartzlander** Diffractive Sails / **Nikki Werkheiser** In-Space Manufacture	
2:30 PM	**Coffee Break**	**Coffee Break**	**Coffee Break**	**James Schwartz** Worldship Ethics 101 / **Kelly Smith** METI	
3:00 PM		**Working Tracks**: First Contact/SETI *Security & Intel in Space* Step by Step to the Stars / **Sagan Meeting:** Biosignature Detection / **Discussion Groups**	**Working Tracks**: First Contact/SETI *Security & Intel in Space* Step by Step to the Stars / **Sagan Meeting:** Flyby or Deceleration? / **Discussion Groups**	**Coffee Break**	
3:30 PM				**Working Tracks**: First Contact/SETI *Security & Intel in Space* Step by Step to the Stars / **Sagan Meeting:** 550 AU FOCAL / **Discussion Groups**	
4:00 PM	**Free Time**				
4:30 PM					
5:00 PM	**Conference Registration**			**Paul Gilster** - Meeting Summary & Closure	
5:30 PM	**Break**	**Break**	**Break**		
6:00 PM	**Baen Reception** Hotel Ballroom **(dinner included)**	**Art Show & Reception** Hotel Ballroom **(dinner included)**	**Symposium Event** US Space & Rocket Center Biergarten **(dinner on your own)**	**Informal Social** in Hospitality Suite **(dinner on your own)**	
6:30 PM					
7:00 PM					
7:30 PM			7:30 - **Andrew Siemion** on SETI		

TVIW 2017: NEWLY ADDED FEATURED PRESENTATIONS FOR DAY 1 AND DAY 2

NEW ADDITION TO DAY 1 (OCT 4)

Are We Alone?

Pete Worden
Brig. Gen., USAF, Ret., PhD
Chairman for the Breakthrough Prize Foundation

Dr. Worden will lead a talk on the work the Breakthrough Foundation is doing to help humanity investigate the possibility of life forms on other planets, and how scientists can get involved.

The Star Shot initiative—a plan to send a spacecraft to another star system in the next 25 years—will be the main topic of the presentation. Dr. Worden will also discuss the foundation's other major initiatives: Listen and Watch. *Listen* is the search for extraterrestrial intelligence using RF (1 GHz to 30Ghz) and visible light. *Watch* is the search for earth-sized planets in the habitable zone of nearby stars.

SPEAKER BIO: Brig. Gen. Worden is the chairman for the Breakthrough Prize Foundation, where he runs the Breakthrough Initiatives. Previously, he has been Director of NASA's Ames Research Center at Moffett Field, California, has held several positions in the United States Air Force and was research professor of astronomy at the University of Arizona, Tucson. He is a recognized expert on space issues – both civil and military. Worden has authored or co-authored more than 150 scientific papers in astrophysics, space sciences, and strategic studies. He served as a scientific co-investigator for two NASA space science missions, and received the NASA Outstanding Leadership Medal for the 1994 Clementine mission. He was named the 2009 Federal Laboratory Consortium Laboratory Director of the Year.

NEW ADDITION TO DAY 2 (OCT 5)

The Search for Ourselves Among the Stars

Andrew Siemion, PhD
UC Berkley Center for SETI Research

Siemion, who teaches and conducts research at the University of California-Berkeley, will discuss the current state of interstellar research and exploration in his public address, "The Search for Ourselves Among the Stars," Oct. 5 at 7:30 p.m. CDT. Highlighting recent discoveries in astrobiology, which guide and motivate the search for intelligent life beyond Earth, Siemion's presentation will be held the Space & Rocket Center as a part of its "Pass the Torch" lecture series featuring high-profile scientists, engineers and space experts.

SPEAKER BIO: As director of the UC Berkeley Center for SETI Research, Dr. Siemion is jointly affiliated with The Netherlands Institute for Radio Astronomy at Radboud University in Nijmegen, Netherlands and with the SETI Institute in Mountain View, California. He is one of the leaders of the "Breakthrough Listen Initiative," a 10-year, $100-million effort sponsored by Yuri Milner's Breakthrough Prize Foundation, which is conducting the most sensitive search ever made for advanced extraterrestrial life.

Dr. Siemion was the recipient of numerous accolades during his studies. He is an elected member of the International Union of Radio Science and committee secretary for the International Academy of Astronautics' SETI Permanent Committee. He serves on the Science@Cal advisory board, co-chairs the Cradle of Life Science Working Group for the forthcoming Square Kilometer Array telescope, and sits on the board of directors of the Foundation for Investing in Research on SETI Science and Technology (FIRSST).

TVIW 2017 DAY 3 (6 OCT): FEATURED PRESENTATIONS PROVIDED BY TVIW

Washington Perspectives on Interstellar Research

Congressman John Culberson
R-TX

Mr. Culberson will participate in a VIP Panel on Day 3 alongside NASA MSFC Associate Director Paul McConnaughey and Breakthrough Star Shot Executive Director Dr. Pete Worden.

SPEAKER BIO: As Chair of the House Commerce, Justice, Science, and Related Agencies (CJS) Appropriations Subcommittee, which funds NASA, the Congressman is focused on ensuring that NASA receives the funding and guidance necessary to maintain US leadership in space. He supports additional funding for NASA and believes it is crucial for the agency to have a clear vision that is driven by science and inspires our young people to study science and mathematics. The Space Launch System heavy-lift rocket and Orion multi-purpose crew vehicle will be critical components of our capability to return to the moon or lunar orbit, to reach Mars, and to go beyond. He authored the Space Leadership Preservation Act to make NASA more professional and less political by establishing a long-term NASA Administrator who overlaps presidential administrations, creating a board to drive the vision for NASA exploration, and allowing NASA to develop spacecraft using long-term contracts.

Direct Multipixel Imaging of an Exo-Earth with a Solar Gravitational Lens Telescope

Slava Turyshev, PhD
NASA Jet Propulsion Laboratory

Nature has presented us with a very powerful "instrument" that we have yet to explore and learn to use. This instrument is the Solar Gravitational Lens (SGL), which results from the ability of the gravity field of the Sun to focus light from faint, distant targets. In the near future, a modest telescope could operate on the focal line of the SGL and, using the enormous magnification power of the Lens,

could provide high-resolution images and spectroscopy of a habitable exoplanet. We discuss the imaging properties of the SGL, when the image occupies many pixels in the region near the optical axis. We discuss a mission to the SGL focal region that could provide us with direct, multi-pixel, high-resolution images and spectroscopy of a potentially habitable Earth-like exoplanet. Based on our initial studies, we find that such a mission could produce (1,000×1,000) pixels images of "Earth 2.0" at distances up to 30pc with spatial resolution of ~10 km on its surface, enough to see its surface features. We address some aspects of mission design and spacecraft requirements, as well as capabilities needed to fly this mission in the next two decades.

SPEAKER BIO: Dr. Turyshev is a physicist at the NASA Jet Propulsion Laboratory, California Institute of Technology, whose areas of research include gravitational and fundamental physics, research in astronomy, astrophysics and planetary science. He is an expert in spacecraft navigation, solar system dynamics, satellite and lunar laser ranging, planetary research and related technology efforts spanning detectors, instruments and data analysis. Dr. Turyshev has made a number of significant accomplishments: i) successful resolution of the Pioneer anomaly; ii) development of new methods to describe performance of the long-baseline optical interferometers; iii) major improvements in the tests of general relativity; Developed several new missions and experiments to test general relativity; iv) proposed new method to describe relativistic dynamics of N-body system and spacecraft observables; v) developed new instruments and methods for lunar laser ranging including new design of a hollow laser corner-cube retroreflector instrument and new LLR techniques; v) developed a new wave-theoretical treatment of the Solar Gravitational Lens (SGL) and proposed a new mission concept of direct megapixel imaging and spectroscopy of an exoplanet from the focal area of the SGL. Dr. Turyshev has published over 175 research papers and 2 books. Over the years, he actively participated in organization of and contribution to technical meetings, symposia, committees, industry and NASA review panels. He has organized major international conferences; edited their proceedings. Since 2012 he is an Adjunct Professor at the UCLA's Department of Physics and Astronomy. In 2016 Dr. Turyshev was elected a corresponding member of the International Academy of Astronautics.

TVIW 2017: SAGAN MEETINGS

Sagan Meetings are new for TVIW 2017. Carl Sagan famously employed this format for his 1971 conference at the Byurakan Observatory in old Soviet Armenia, which dealt with the Drake Equation. Sagan solicited short presentations from top scientists (e.g. – Freeman Dyson) on each factor in the Equation, followed by a healthy debate and a drive to consensus.

TVIW 2017 will have three separate 2-hour Sagan Meetings, each dealing with a separate topic. Four 15-minute presentations will be accepted for each Sagan Meeting, after which presenters will sit on a panel to engage in a lively discussion and debate with the general audience. The conversations will be recorded and documented for inclusion into the conference proceeding and possible journal publication.

The deadline for application to present at one of the three Sagan Meeting is July 31. If you would like to share your ideas on one of these topics during the Sagan Meetings, then please submit a short abstract, no more than 400 words, identifying which Sagan Meeting you would like to join, and what your position is on that meeting's topic at tviw.us/submissions/Sagan-Meetings.

The topics for TVIW 2017 are as follows.

Biosignature Detection

Day 1 (Wed)

In honor of this format's origins, the first TVIW Sagan Meeting will deal with a variation on the Drake Equation put forth by astronomer Sara Seager. This equation describes the probability of detecting life on alien planets, specifically with a bent toward the detection of biogenic gases in alien atmospheres. This is a considerably less ambitious equation than Drake's, because it doesn't attempt to predict the probabilities of alien intelligence, or the behavior of such intelligent lifeforms. It is nevertheless particularly relevant in today's environment of rapid exoplanet discovery and our impending ability to determine these planet's atmospheric contents. How likely are we to detect biosignatures in the spectra of exoplanets?

Deceleration vs. Flyby

Day 2 (Thurs)

Flyby or Deceleration? Can worthwhile science be accomplished by a flyby interstellar mission? Or conversely, can enough worthwhile science be performed by a fully-decelerated interstellar mission to justify increase in cost and time? If BOTH approaches have merit, then what should be the optimal role of each? This has particular relevance in light of recently-published work promoting each.

550 AU FOCAL

Day 3 (Fri)

General relativity describes how spacetime warps around massive bodies, such that even light "bends" around those bodies. There exists a region at some distance from any star where the light from an object on the exact opposite side of the star bends symmetrically around it, creating a tremendously powerful lensing effect. In the case of our Sun, this gravitational lensing is only complete at 550+ AU from Sol. Proposals have been made to launch probes to Sol's 550 AU regions opposite nearby stars, thereby allowing direct imaging of exoplanets in those systems, as well as amplified SETI listening. Are 550 AU FOCAL missions worthwhile? Are they even technically feasible?

TVIW 2017: WORKING TRACKS

The working tracks for the 2017 TVIW symposium have been announced and may be selected upon registration. The working track deliberations will occur at the same time as the Sagan Meetings, so attendance at both a working track and the Sagan Meetings won't be possible. Since the Sagan Meetings will not be deliberative, we will assume selection of a working track to take priority over Sagan Meeting selections.

Working tracks are collaborative, small group discussions around a set of interdisciplinary questions on an interstellar subject. Topics in previous years have included: spaceship design; life-systems design; propulsion systems; target (planetary and stellar) selection; prerequisite technology development; and human factors necessary for interstellar exploration and colonization.

Working Tracks will be allocated 2-hour blocks each day for in-depth conversation between participants, led by a Track Moderator. The descriptions of the selected working tracks are outlined below.

Step by Step to the Stars

This working track will investigate ways to influence society in general to ensure long-term, continuing support for the interstellar effort. Even before determining who will go, and what they will need to take, there are industrial and financial capabilities are needed, both on and off earth, to make interstellar exploration feasible.

In order for interstellar exploration to begin (and continue), there must be deep, long-lasting support from at least a significant portion of terrestrial society, along with the ability to construct and support the vessels needed, and the infrastructure to operate them and their ancillary requirements (communication, consumables, etc.). This working track will consider how this support can be engendered, expanded, and (possibly) institutionalized. Output of the working track will include recommendations on how to start building the infrastructure for societal motivation, mission support, and mission decisions (such as targets, crew & cargo selection).

Planning for First Contact/SETI – Starting Now!

This working track will discuss the framework for a traveling science exhibition with the working title Extraterrestrial Life & Civilizations: Science and Speculation. The exhibition's conceptual framework might be built around a quote attributed to Arthur Clarke: "Either we are alone in the Universe or we are not. Both are equally terrifying."

The proposed "first contact" scenario is that you are in deep space, beyond ready communication with Earth and therefore have only your immediate resources at hand. You encounter an artificial object of unknown (though not of human) origin… what do you do? What is the plan? How do you avoid starting a conflict, how do you protect humanity's interests? What can you do to establish communication? Earth-based SETI and METI will also be considered.

The outcome of the workshop would be an exhibition flow diagram outlining the topics, documentation of key messages, diagrams of the interpretive organization, conceptual sketches, and, afterwards, a concept proposal. The proposed exhibition would put visitors into the shoes of scientists, engineers, economists, politicians, and aliens to explore question about cosmology, life, civilization, spaceflight, communication technologies, and the scale of space‐time.

The Evolving Role of Security & Intel in Space – Turning Paranoia into Preparation

This working track will discuss the evolving role of Security and Intelligence in interplanetary and interstellar exploration and colonization. The emphasis will be on "evolving," in other words, how does S&I become thoroughly integrated with exploration goals and missions and not simply become "red shirts" to be expended at whim.

It will also discuss the needs of an interstellar colonization mission, both the composition of the group of colonists, the consumables needed during the voyage, and the materials both biological and industrial needed to construct a viable colony upon arrival in the target star system.

Building a starship is only part of the problem of interstellar colonization. This working track will act as the "S-2" and "S-4" for the mission, determining what the mission needs and how to make it available.

TVIW 2017: PRE-SYMPOSIUM SEMINARS (OCT 3)

As provided in the last newsletter, there are three pre-symposium seminars will be offered on Tuesday, October 3 on a single subject, providing an in-depth look at that subject. These are separate from TVIW 2017 Symposium, and you can sign up for one or two seminars without attending the Symposium. More information can be found at tviw.us/2017-symposium/pre-symposium_events.

Conflict in Space

Presented by **Major Brent D. Ziarnick,** *USAFR*

This seminar will survey the state of conflict in space today, including the players (focusing on the United States, Russia, and China) as well as the technologies and concepts that exist now or are expected in the near future. The state of space weapons in policy and strategy will be discussed, as well as the possible goals of each player in the space environment. This seminar will not discuss science fiction or historical concepts but will arm attendees with the latest unclassified and open-source understanding of the state of the militaries of the great space powers. Those who attend this seminar will be well-prepared to assess international space news and separate the real from the ignorant – and the realistic from the sensational – in modern debates about space conflict.

Laser Propulsion: An Introduction to Laser Propulsion and Assessment of Relevant Current Technologies

Presented by **Edward. E. (Sandy) Montgomery**

This Seminar will address both Earth-to-Orbit and In-Space applications of lasers to propel space vehicles. Its particular relevance to interstellar travel is often noted in reference to advanced conceptualizations such as StarWisp by Robert Forward. The fundamental mission concepts, system mechanizations, trajectories, and key performance parametrics will be presented for Laser thermal rocketry, Laser photon momentum exchange, and Laser ignited fusion/fission.

A summary of the historical perspective on the development of high power lasers and advanced beam directors will be provided. Current on-going technology development initiatives in the United States and Australia will be described. Some questions to be addressed include: Is a gigawatt laser needed? How could it be constructed? Where will the power for the laser come from? How far can a laser be projected? What laser propulsion systems have been designed and built? What do they look like? How does the cost of laser propulsion compare to conventional propulsion technologies? How does its cost compare with other future propulsion technologies? Can laser propulsion enable us meet and maybe exceed the goals of Breakthrough Star Shot?

Human Life in Space: Separating Reality from Wishful Thinking

Presented by **Dr. Robert E. Hampson** *(aka Speaker to Lab Animals), neurophysiologist and SF writer.*

Most fiction, even hard science fiction, glosses over the problems that humans will have adapting to environments other than Earth. Good Science Fiction addresses a few of the problems, such as the body's adaptations to zero-G or microgravity, but there are so many issues that a body evolved in a constant 1-G field, with plentiful air and water will have adapting to space, that no one story can address them all. So we guess, and we invoke wishful thinking that all of the problems will somehow be solved by the time we get there.

This seminar will examine many of the real medical and physiological problems encountered by the few humans who have spent more than a handful of days in space. From fluid balance to vertigo, from radiation to immune deficiencies, Dr. Hampson will lead participants in discussions of the real problems facing humans as we move out into space and potentially other planets.

ANNOUNCING OUR 2017 STUDENT SCHOLARSHIP RECIPIENTS

TVIW is very excited to announce the winners of the new scholarship programs. Following a competitive process with many high-quality applicants with intriguing essays, three students were chosen as the recipients of the 2017 scholarships.

Margaret Horton (Graduate)

Margaret attended Tulane University for her undergraduate degree in Spanish, but her interest has turned to public health. She has worked with the Texas Department of State Health Services, and provided services for the Consulate General of Mexico in Austin, Texas. She will be starting at Emory University in the fall in public health, with the goal of working at the CDC in Atlanta.

Emily Kerns (Undergraduate)

Emily is a student at the University of North Florida, majoring in Biology, concentrating in Coastal Biology. She has been working in field research with Dr. Matthew Gilg, University of North Florida ecological geneticist. She aspires to be a university professor, to pass on her love for teaching.

Rohan Varshney (Undergraduate)

After attending Stanton College Preparatory School in Jacksonville, FL, as a National Merit Finalist, Rohan has chosen to attend Georgia Institute of Technology in Engineering and possibly Computer Science.

With the support of Baen Books and Digital Oilfield Solutions, TVIW will award these deserving students, two undergraduate scholarships and one graduate scholarship, on a merit-basis in the amount of $2500 per recipient.

In addition to their well-rounded accomplishments, each student submitted an essay on a riveting interstellar topic: the rationale for humanity to become an interstellar species; a near-term plan (within 20 years) for building advocacy toward interstellar space exploration; what the student can do to help further humanity's expansion into space; or why space development is important.

For more details, visit the website: tviw.us/scholarships.

NEWS FROM OUR SISTER ORGANIZATIONS

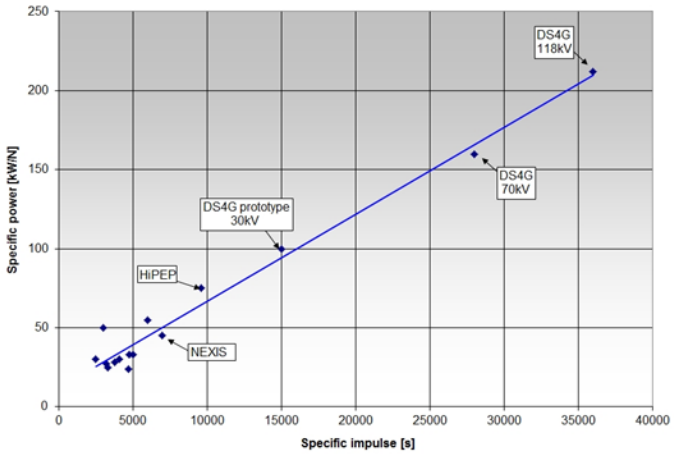
Initiative for Interstellar Studies (I4IS)

Issue 17 of Principium features a Guest Introduction by Dr. Angelo Genovese, a guest presenter at TVIW 2017 who is a propulsion engineer with many years of experience in ion propulsion systems. These high specific-impulse reaction propulsion systems will be familiar to most readers of the TVIW newsletter. Angelo has perhaps some of the most detailed engineering understanding of them and here gives us a survey of the subject and some of his own thinking on where they may take us on the way to the stars. Angelo is Director of Experimental Programmes at the Initiative for Interstellar Studies. He has worked space propulsion systems in his native Italy, in Austria, and in Germany, where he is now Senior Electric Propulsion Engineer at Thales Deutschland - a German branch of a French company.

In the near term, solar electric propulsion with a modest sun-ward excursion to 0.7 AU can yield a velocity of 30.5 km/sec in just over two years, with radioisotope power providing additional delta V of 8 km/sec over 10 years. Flight times of 27.5 years or 23.7 years, with Jupiter Gravity Assist, take us to 200 AU.

Nuclear electric propulsion is a little further away technically but yields higher velocities. The major issue is the mass/power ratio of the reactor. For example, 1 MWe with a specific mass of 12.5 kg/kWe and thrusters of around 10,000 seconds specific impulse can reach 1000 AU.

Laser electric propulsion, still further in the future, allows a power source which need not be carried in the craft so the mass ratio in Tsiolkovsky's "tyrannical" equation and the resultant delta V is much improved.



Angelo concludes that electric propulsion is a major candidate for the propulsion system of near and longer-term interstellar precursor missions. The following image compares each of these propulsion systems. Read his article in Principium 17.

Also in this issue, Tishtrya Mehta asks "Is the Alcubierre Drive the answer to Interstellar Travel?". This has been asked many times and Tishtrya contributes a new analysis. Her conclusion is that it is unlikely humanity will develop a warp drive in the manner initially suggested by Alcubierre but that it can help us to understand and question the nature of the universe.

Principium 17 also publishes the first of three parts of a study of the massive prospect of Interstellar Engineering "Engineering New Worlds: Creating the Future" by Dmitry Novoseltsev of the Siberian Mechanical Engineering Partnership. Dmitry is a regular contributor to the Space Colonization Journal (jour.space).

Wider culture is represented in reviews of Alex Storer's recent album Infinity of Space by that longest-established of space artists, David Hardy, and of TVIW Founder Greg Matloff's book Starlight, Starbright: Are Stars Conscious? Greg is a pioneer of interstellar studies but here he takes a leap beyond interstellar engineering to ideas first expressed by Olaf Stapledon.

- John I Davies (assisted by Angelo Genovese)

TVIW REPRESENTATIVES CONVENE IN CHATTANOOGA FOR LIBERTYCON 2017

TVIW Representation at the June 30-July 2, 2017 Libertycon was strong. TVIW President John Preston and Registrar Doug Loss sported the new TVIW patches, and conversations with TVIW representatives Robert Hampson (spkr. to animals), Dru Meyer (Presentations), Connie Trieber (Registration), John Trieber (AV), Joe Meany (Web), Doug Loss (Registrar), Fritz Fotovich (Art Coordination), Toni Weisskopf (Advisory Board/Sponsor), Jim Beall (Participant) were enjoyed by all. Some of the interesting presentations were these:

Stealth in Space Panel (Ross Hathaway)
Future of Cybersecurity and Cyber Warfare Panel (Doug Loss)
A CyberWar reference (Rick Boatright)
The Discoveries of Kepler-186f and Kepler-37b (Dr. Elisa Quintana and Dr. Tom Barclay)
Current Regulations on (Private) Space Activities (Laura Montgomery)
Search for Life in the Universe Panel (Dr. Elisa Quintana)
The Energy Smorgasbord Panel (Jim Beall)
Outer Space Treaties and Legal Barriers to Space Exploration (Laura Montgomery)
Future Illnesses (Robert Hampson)
Mad Scientist Round Table (Robert Hampson)
Creativity, Inventions and the Patent Process (Dr Hans Schantz)

TVIW President John Preston showcasing our new patches

UPCOMING INTERSTELLAR AND SPACE EVENTS

August 7-9 (Monterey, CA). Icarus Interstellar Starship Congress 2017. Website: http://www.icarusinterstellar.org/pages/starship-congress-2017

August 21 (Earth). Total Eclipse of 2017. Websites: eclipse2017.nasa.gov or www.greatamericaneclipse.com

September 15 (Saturn). NASA's Cassini will end remarkable mission by entering and burning up in Saturn's atmosphere.

September 22 (Earth). Northern hemisphere autumnal equinox. Southern hemisphere vernal equinox.

October 3-6 (Huntsville, AL). TVIW 2017 Symposium (TVIW5). Website: tviw.us/2017-symposium/

October 24-26 (Glasgow). 15th Reinventing Space Conference. Website: rispace.org

November (Moon). China to launch robotic mission to return samples from the lunar surface.

November 10-11 (Austin, TX). New Worlds 2017 Symposium. Website: newworlds2017.com

November 13 (Earth). Venus joins Jupiter

December (Earth). Launch of NASA's TESS (Transiting Exoplanet Survey Satellite) space telescope.

December (Earth). Launch of ESA's CHEOPS (CHaracterizing ExOPlanet Satellite).

December 5-7 (Houston, TX). SpaceCom. Space Commerce Conference and Exposition. Website: spacecomexpo.com

December 13 (Earth). Geminid Meteor Shower

USE AMAZONSMILE TO BENEFIT TVIW

An exciting opportunity to support the great work that TVIW is doing is to use the AmazonSmile program. Every dollar counts for non-profit groups. TVIW can benefit from each purchase you make at no additional charge to you. Amazon donates 0.5% of each purchase to the non-profit organizations of your choice and the TVIW is one of those organizations. This is a painless way to support us.

To participate, go to Smile.Amazon.com. Sign into your account and a "pop up" page will appear. On the right side of the page, at the bottom is a "search" window. Type in: Tennessee Valley Interstellar Workshop and click the search button. Click on the top one and you are done. Your donations will be automatic for any purchase within the Amazon Smile program (which is most merchandise). You can also use the following link.

https://smile.amazon.com/ch/46-4572727

A NOTE FROM THE EDITOR

The opportunity to gather the many great things that the members of TVIW are working on every day every day and to share them with the reader is a great privilege. As an organization, TVIW looks for each member to play her or his part in sharing the excitement of interstellar space travel and pushing our bounds as humanity to go beyond our pale blue dot. Each member of the team works hard every day to pull together unbelievable achievements. From the website committee that keeps us on the forefront of interstellar online presence to the symposium organizing committee that is shaping and expanding the bounds of what can be shared with and cultivated from the attendees of this year's TVIW symposium. I am proud to be a part of this team, and I cannot wait to share our interstellar enthusiasm with you in October.

- Abigail Sherriff, *Editor*