



Oak Ridge, Tennessee
09-12 November, 2014

"We are the universe trying to understand itself."

Delenn, from the television series *Babylon 5*.

"The heavens declare the glory of God." Psalm 19:1

The Tennessee Valley Interstellar Workshop is about taking humanity to the stars. This is a dream that may not become a reality for another millennium. Why, then, should some of the most visionary and intelligent people in the ~~Tennessee Valley United States~~ World (!!) gather at a hotel in Oak Ridge, Tennessee, to discuss the challenges and opportunities of interstellar travel? *Because we must*. We are compelled by our nature to think positively about the future of humanity in a beautiful yet extremely hostile universe. Life on Earth is wonderful and we should do what we can to protect and preserve it here, and yet...

...there is more. Among the billions of galaxies, with their billions of stars and billions of planets, we sense a call to explore. A call to disperse ourselves and settle a multitude of worlds in order to preserve and protect what must be very rare indeed: a bipedal species of intelligent tool users who dare to dream, to love, to create and to aspire for more than mere survival. To survive and thrive we must push the boundaries and, well, we must go. And it isn't too soon to prepare. There are many challenges and some of them will take generations to overcome.

Here, in the valley of a great river in the southern region of a great nation, gather visionaries from many great nations to take up the challenge. I challenge each of you to make this week more than just a few days of interesting talks, thought-provoking workshops, and entertaining side discussions. Make connections with other attendees. Find a project that you can start and work on together. Meet that person you've never met and help them solve a technical or social challenge related to interstellar flight with which they've been wrestling. Let's make these ***precious*** few days count. Be an active participant. Make *Long-Term Thinking -- Present-Day Action* more than just a workshop theme and let's go to the stars!

Les Johnson – Chairman, Tennessee Valley Interstellar Workshop

Program for 3rd Tennessee Valley Interstellar Workshop
"Long-Term Thinking -- Present-Day Action!"

Sunday, 09 November 2014 –seminars will be held at the Doubletree Hotel

9:00 am - 12:00 pm - "Terraforming 101" taught by **Ken Roy** PE, Board Room

1:00 – 4:00 pm - "Space Propulsion 101" taught by **Les Johnson**, Board Room

5:00 – 9:00 pm – **Reception** sponsored by **Baen Books** and the **Ultimax Group Inc.**
at the home of **Barbara and Robert**, 209 Whippoorwill Drive, Oak Ridge, Tennessee

Monday, 10 November 2014 – all events will be held at the Doubletree Hotel

7:00 – 8:00 am – continental breakfast outside of the Full Ballroom

7:30 am – registration opens

8:00 am – *Introduction and Orientation* by general chair Mr. **Les Johnson**

8:15 am - **keynote speaker**: "*The Search for Earth 2.0*" (Dr. **Sara Seagar**/MIT)

9:00 am – "*Key Issues for Sailships*" (Dr. **Jim Benford**/Microwave Sciences)

9:30 am – "*Nothing Like a Little (Biomedical) Science... in Space!*" (Dr. **Robt. Hampson**/Wake Forest)

10:00 am – "*Challenges to Man's Existence Beyond the Earth: I. Gravity Concerns in Long Duration Human Spaceflight*" (Dr. **Fred Sloop**/Oak Ridge National Laboratory)

10:30 am – "*Technological Capabilities and Interstellar Travel: Can an Individual Build a Starship One Day?*" (**Andreas Hein**/I4IS; Technische Universitaet München)

11:00 am – "*Frontiers of Radio Astronomy & SETI*" (Dr. **H. Paul Shuch**/SETI League & Dr. **David Fields**/Tamke-Allan Observatory)

11:30 am – "*Lacking Tools, Information, and Hope: Results of First Attempts in Colonization and Exploration in La Florida and Later Improvements*" (Dr. **Robert Lightfoot**/So.Georgia College)

12:00 – 1:00 pm – **Buffet Lunch** served in hall, eat in Full Ballroom

1:00 – 1:30 pm – "*Revisiting the Physics of Inertial Frames – A Space Drive Prerequisite*" (**Marc Millis**/Tau Zero Foundation)

1:30 – 2:00 pm – "*A Construction Scenario for O'Neill Cylinder Space Settlement Habitats*" (Dr. **Gordon Woodcock**/L5 Society)

2:00 – 4:00 pm – walls close; **parallel workshop tracks** commence

"A-for-Aero/Astro" *Systems and Software Safety / Security Engineering for Interstellar Missions*
(co-leaders: **Donna Dulo**, JD/Navy Postgraduate School & Mr. **Michel Lamontagne**, P.Eng./Icarus) Ballroom A

"B-for-Bio" *Evolution's Pace in Very Small Ecosystems like the ISU Worldship* (co-leaders:
Ms. **Cassidy Cobbs**/Vanderbilt, Dr. **Chris Welch**/Int'l Space Univ. & Dr. **Robert Hampson**) Board Room B

"C-for-Commo" *Language as Reality: Near-Term Roadmap for Exploiting Opportunities & Natural Experiments Here on Terra Firma to Inform *C*ETI* (co-leaders: Dr. **Robert Lightfoot** & Dr. **H. Paul Shuch**) Ballroom C

"D-for-Design" *Near-Term and Far-Term Concepts for Travelling at Interstellar Ranges: A Parallel Design Workshop* (co-leaders: Mr. **Andreas Hein**/I4IS & Mr. **Rob Swinney**, CEng/I4IS) Ballroom D

4:00 pm – walls open; **plenary talks** resume

4:00 – 4:30 pm – "*Ground-To-Orbit Fusion Propulsion System for Achieving Commercial Interplanetary Space Travel*" (Dr. **Michael Minovitch**/formerly of JPL)

4:30 – 5:00 pm – "*Wormholes: From Einstein-Rosen to Heinlein to Thorne*" (Dr. **Al Jackson**/NASA JSC)

5:00 – 8:00 pm – **Buffet Dinner** at indoor poolside, sponsored by **Digital Oilfield Solutions**

8:00 – 11:00 pm – walls close; **parallel birds-of-a-feather (BoF) sessions**

"A-for-Aero/Astro" BoF (Dulo/Lamontagne)	Ballroom A
"B-for-Bio" (Cobbs/ Welch/Hampson)	Board Room B
"C-for-Commo" (Lightfoot/Shuch)	Ballroom C
"D-for-Design" (Hein/Swinney)	Ballroom D

Tuesday, 11 November 2014 – all events will be held at the Doubletree Hotel

7:00 – 8:00 am – continental breakfast outside of the Full Ballroom

8:00 am - "*Space Solar Power: A (Mostly) Commercial Path to the Stars*" (**John Mankins/Artemis**)

8:30 am - "*Starfleet Deferred: Project Orion in USAF Space Plan 1962*" (Maj. Dr. **Brent Ziarnick**, USAF)

9:00 – 11:00 am – walls close; **parallel workshop tracks** resume

"A-for-Aero/Astro" BoF (Dulo/Lamontagne)	Ballroom A
"B-for-Bio" (Cobbs/ Welch/Hampson)	Board Room B
"C-for-Commo" (Lightfoot/Shuch)	Ballroom C
"D-for-Design" (Hein/Swinney)	Ballroom D

11:00 am – walls open; **plenary talks** resume

11:00 am – "*Vision of Space and NASA in 2050 and 2100*" (Ms. **Amy Sivak**/NASA MSFC)

11:30 am – "*Project Icarus, an Update*" (Mr. **Rob Swinney**/I4IS)

12:00 – 1:00 pm – **Buffet Lunch** served in hall, eat in Full Ballroom

1:00 – 1:30 pm – "*Ultra Lightweight Probes to Catalyze Major Interstellar Progress*" (Dr. **John Rather**/Rather Creative Innovation Group)

1:30 – 2:00 pm – "*Laser Sail Propulsion Beyond the Solar System – Extrapolation from Current High Energy Laser Technology*" (**Edward Montgomery**)

2:00 – 3:00 pm – walls close; **parallel workshop tracks** resume

"A-for-Aero/Astro" BoF (Dulo/Lamontagne)	Ballroom A
"B-for-Bio" (Cobbs/ Welch/Hampson)	Board Room B
"C-for-Commo" (Lightfoot/Shuch)	Ballroom C
"D-for-Design" (Hein/Swinney)	Ballroom D

3:00 – 4:00 pm – walls open for **reporting out** of parallel **workshop tracks** to full audience

4:00 – 4:30 pm – "*Firefly Icarus: An Unmanned Interstellar Probe Utilizing Z-Pinch Propulsion*" (Mr. **Robert Freeland**/Icarus)

4:30 – 5:00 pm – "*An Interstellar Sail Before 2020*" & *Closing Remarks* (**Les Johnson**/general chair)

5:00 – 7:00 pm – **Dinner** on your own

7:00 - 11:00 pm – **Science Fiction Authors & Publishers Panel** for the **Public & the Press**
(**Tony Daniel, Sarah Hoyt, Dan Hoyt, Paul Gilster, Les Johnson, Toni Weiskopf**)

sponsored by **Baen Books**; book fair and book-signing provided by **Barnes & Noble**

TVIW 2014 officially adjourns

Wednesday, 12 November 2014 – offsite plant tour of **Oak Ridge National Laboratory** all morning

8:30 am – depart Doubletree for carpools to Oak Ridge Nat'l Lab (must be previously signed up)

9:00 am – noon – tour of ORNL's **Spallation Neutron Source & Graphite Reactor**; return by 1 PM

3:00 pm – some of us will catch the matinee of "Interstellar" at Tinseltown Theatre (5-10 min walk)

6:00 pm – "dead dog" session in the Consuite

VISION AND PURPOSE OF THE WORKSHOP TRACKS

Welcome to the Third Tennessee Valley Interstellar Workshop and to Oak Ridge, Tennessee, aka “Atomic City, USA”! So what’s with these funny “workshop tracks”?

The TVIW is a demonstration of what a few committed individuals amplified by technology can accomplish. It serves as both a *colloquium* to present papers of interest to colleagues, as well as a **workshop** to **get things done**. This is no small subject we are dealing with; it is as big as they come. The purpose of the parallel tracks in the daytime, and the nighttime birds-of-a-feather (“BoFs”) sessions is to figure out what, in the face of the profound challenge and sheer scale of interstellar distance, are the things we (the human race) need to do next, and what can we (the Workshop) practically contribute? People say creativity can’t be forced, but the conditions to foster creativity certainly can be—so we intend to engineer the conditions to nurture those things that need doing, provide a venue for discourse, and promote progress in our field.

In regard to interstellar studies in general and SETI in particular, there have been three truly seminal conferences in history, all of them highly interdisciplinary: the 1961 meeting at Green Bank organized by Frank Drake himself, the 1971 “CETI” conference at Byurakan Observatory in old Soviet Armenia jointly organized by the American and Soviet Academies of Science, and 1983’s “Interstellar Migration” workshop at Los Alamos. The latter two generated quite remarkable proceedings, one edited by Carl Sagan (*Communication with Extraterrestrial Intelligence*, 1973), the other by Finney & Jones (*Interstellar Migration and the Human Experience*, 1985). Not as much of equal substance or importance seems to have transpired since. The topics in 1971 were covered in the same order as their appearance in the Drake Equation itself:

$$N = R_* f_p n_e f_l f_i f_c L$$

A few salient quotes from these meetings have been inspirational to us at the TVIW:

“the form of the discussions was ... an *initial presentation of a subtopic by a discussion leader and then an often lively and vigorous range of comments, criticism, and free association.*” (Sagan, ‘71)

“before we are able to solve the problem of communicating with extraterrestrial intelligence, it might be a good thing for there to be *communication on the subject among nations*” (Shklovsky)

“One contribution the social science community can make ... is to develop *programs of research* into this question of time-binding and how we *can develop institutions that have a longer life span* than those currently conceived.” (Lee, after Sagan & Kardashev in ‘71)

“We need to learn a little humility and at least to become aware of our *unexamined assumptions*. ... leave to the rocket men their equations; but what the social scientists could contribute is the designing of ... a *closed-system, multigenerational, human experiment.*” (Lee again in ‘83)

Four-plus decades later, we aspire to tackle to a similar breadth of topics. Thus in the words of those others, most of them long dead, we have the rationale for our workshop-track approach to interstellar communication, exploration, and travel. “A-for-Aero/Astro” is identify opportunities in the physical sciences, “B-for-Bio” in the life sciences, “C-for-Commo” in the social sciences, while “D-for-Demo/Design” is just a pure engineering romp. In some cases (“B” and “C” for sure, but maybe all?) the work will continue after you leave here. So pick one, work hard, and enjoy the ride.

Robert G Kennedy III, PE, co-founder, Oak Ridge, Tennessee

PRESENTERS (in alphabetical order)

Jim Benford, Ph.D., is an American physicist, and president of Microwave Sciences, Inc., in Lafayette, California, which does contracting and consulting in High Power Microwaves (HPM). His interests include HPM systems from conceptual design to hardware, microwave source physics, electromagnetic power beaming for space propulsion, and experimental intense particle beams. He earned his PhD in Physics at UC San Diego. He is an IEEE Fellow and an EMP Fellow. He has taught 25 courses in HPM in nine countries. He has written seven books. In 2007, he co-authored *High Power Microwaves*, 2nd ed., a textbook in general use and is now working on the 3rd edition. In 2013, he co-edited *Starship Century*, an anthology of fact & fiction dealing with the prospect of star travel. See www.jamesbenford.com.

Cassidy C. Cobbs, is a mycologist and life sciences researcher at Vanderbilt University Department of Biological Sciences; before that, undergraduate research assistant at NCSU College of Veterinary Medicine Department of Molecular Biomedical Sciences with 7 years' experience in molecular and computational biology research techniques. She has a keen interest in "the biology of science fiction" and a mission to encourage and prepare the next generation of young women to enter the hard sciences. She is creator/co-presenter of science-track convention programming for 4 years, inc.: Hypericon (Nashville, TN), LibertyCon (Chattanooga, TN) & ConGlomeration (Lexington, KY).

Donna Dulo, JD, is a senior mathematician, computer scientist, and systems engineer for the US Department of Defense where she has worked in military and civilian capacities for 26 years. She is currently at the US Naval Postgraduate School, performing research in aviation software systems focusing on aviation software safety, reliability, and resilience. She is a systems and safety engineer at Icarus Interstellar where she focuses on spacecraft systems safety and unmanned spacecraft systems software. Donna is an astronomer at the Monterey Institute for Research in Astronomy where she has worked for over 17 years. Donna is also an adjunct faculty member at Embry-Riddle Aeronautical University where she teaches in the area of computer and systems security. She did her undergraduate work in Economics at the US Coast Guard Academy. She holds a Doctor of Jurisprudence from the Monterey College of Law, an MS in Systems Engineering from Johns Hopkins University, an MS in Computer Science from the US Naval Postgraduate School, an MA in National Security and Strategic Studies from the US Naval War College, an MAS in Aeronautics and Aviation/Aerospace Safety from Embry-Riddle Aeronautical University, an MS in Computer Information Systems from the University of Phoenix, and an MBA in Engineering Management from City University. She is a graduate of both the Marine Corps Command and Staff College and the College of Naval Command and Staff, and has a certificate in Computer Security from Stanford University and three certificates in Software Engineering from the Air Force Institute of Technology. Donna is a PhD candidate in Software Engineering at the US Naval Postgraduate School focusing on Aerospace Software Safety. She is currently the editor and contributing author of the American Bar Association's book on unmanned aircraft law and technology.

David Fields, Ph.D., is an experimental physicist, formerly of ORNL, founder/president of ORION, Director of Tamke-Allan Observatory, private pilot, and gentleman farmer. At the 1st TVIW in 2011, he discussed a new radio astronomy band and a novel approach to SETI. He worked with Ken Roy & Robert Kennedy on geoengineering concepts, coined the moniker, "Dyson Dots" and is helping design/build RASDR, a software-defined-radio for radio astronomy.

Robert Freeland, is a Director for Icarus Interstellar who is passionate about their core mission to explore nearby stars by 2100. He also serves as Deputy Project Leader and Core Designer for their flagship Project Icarus, specifically focused on an unmanned probe using fusion-based propulsion. Within Project Icarus, he is lead Designer for the "Firefly" variant using Z-pinch propulsion.

Noah Frere, a world traveler, linguist, and astronomy student at Pellissippi State Community College, is a co-winner of the essay contest.

Robert Hampson, Ph.D., is Associate Professor of Physiology & Pharmacology at Wake Forest School of Medicine in North Carolina. As a neuroscientist, he worked on the development of "neural prosthetics" – euphemistically called "Replacement Parts for the Brain." Dr. Hampson's research on the neural encoding of memory in rats, monkeys and humans has contributed to development of a hippocampal prosthesis for restoration of memory, which will be tested in humans within the next few years. His dedication to science advocacy and brain awareness has led him to pursue these interests as an advisor to science fiction authors and to represent neuroscience and biology via science fiction conventions throughout the southeastern U.S. Under the *nom de plume* of "Tedd Roberts" he creates fiction, science-fact blogs and articles directed to science fiction writers and readers alike. He has participated in more than 20 international meetings and seminars, and held a Professor of Research position at the University of Aberdeen (Scotland) from 2004 to 2011. With over 100 peer-reviewed articles, 20 book chapters, two patents, and 30 years of presentations and teaching, he is equally dedicated to continued innovative research and brain science education.

Andreas Hein, is a German space systems engineer, currently Deputy Director of the Initiative for Interstellar Studies (I4IS) as well as Director Technical Programs. He received his master's degree in aerospace engineering at the Technische Universitaet München. He is now working on a PhD at TUM's Institute of Astronautics, focusing on application of heritage technologies to space systems. He completed a research stay at the Massachusetts Institute of Technology (MIT) System Architecture Lab under supervision of Professor Ed Crawley, focusing on architecture and heritage use for X-ray astronomy missions. He spent a semester abroad at Institut Supérieur de l'Aéronautique et de l'Espace in Toulouse, working on numerical simulation of hypervelocity impact of space dust on spacecraft antennas. He also worked at the European Space Agency Strategy and Architecture Office on stakeholder analysis for future manned space exploration. In his free time Andreas founded and leads Icarus Interstellar's Project Hyperion: A design study on manned interstellar flight. He is also a Core Designer and Module Lead of Project Icarus. Andreas is active in the Scientific Workgroup for Rocketry and Astronautics (WARR) at his home university where he founded the space elevator and interstellar flight group. He is a member of the International Honor Society for Systems Engineering – Omega Alpha Association, a Fellow of the British Interplanetary Society, and a member of INCOSE. He has published numerous articles on the topic of interstellar travel in *Centauri Dreams* as well as *JBIS*, and is the author of over 30 journal and conference publications dealing with advanced space system concepts, systems engineering, and innovation.

Albert Allen "Al" Jackson IV, Ph.D., earned his doctorate in relativistic astrophysics from UT-Austin in 1975. At NASA's Johnson Space Center (JSC), Houston, he performed: flight crew training, mission planning software, orbital debris modeling, and engineering simulation. Dr. Jackson has published articles in planetary physics, astrodynamics of interplanetary dust and Earth orbital debris and interstellar flight, and has research experience in astrodynamics, astronautics, and planetary

astrophysics. He is a permanent visiting scientist at the Lunar and Planetary Institute in Houston, Texas. At present, he still consults for the Engineering Division of JSC.

Les Johnson is a husband (of Carol), proud father of Carl and Leslie, physicist, author (co-editor of *Going Interstellar* from Baen Books) and in his day job serves as the Senior Technical Advisor for NASA's Advanced Concepts at the Marshall Spaceflight Center. He has spent much of his career working on advanced space propulsion technologies such as solar sails and electrodynamic tethers and was the featured "Interstellar Explorer" in *National Geographic's* 125th Anniversary Issue devoted to exploration (January 2013). Together with his frequent co-author Greg Matloff, Ph.D., and collaborator Robert Kennedy, he co-founded the Tennessee Valley Interstellar Workshop in a hotel in the Italian Alps during the 7th IAA Symposium in Aosta, Italy in July 2011.

Andrew "Dru" Kirkpatrick, is a brand new engineer (double major Chemical and Biomolecular Engineering, with a minor in chemistry) who graduated from the University of Tennessee, Knoxville. Dru is the other co-winner of this year's essay contest.

Michel Lamontagne, P.Eng., is a Canadian professional engineer specializing in HVAC, who has worked on everything from water treatment to kitchen design, food storage, power supplies, emergency lighting and power, as well as some semi autonomous facilities for up to 1200 workers in the Canadian North. He has been designing spacecraft for science fiction and illustrative purposes for about 35 years. He has not had very many opportunities to discuss these interests until the last two years, via the internet, and will enjoy meeting others with the same interests. He has been giving workshops on his web site for about five years, and is an invited speaker for a course at the Polytechnic University in Montreal, Quebec. Biography: <http://www.icarusinterstellar.org/team/michel-lamontagne/> .

Robert "Sam" Lightfoot, Ph.D., is an anthropologist, criminologist, and associate professor at South Georgia State College. He received his Ph.D. in Criminal Justice from FSU in 2007. An active researcher in the fields of sociology and criminal justice, he includes research on solar and extra-solar exploration and social consequences as a necessary area for our preparation. He is also a research and consulting archaeologist, European contact with native cultures being the major focus. He also teaches and practices Judo, Jujitsu, and European Sword.

John Mankins' 25-year career at NASA and CalTech's JPL ranged from flight projects and space mission operations, to systems level innovation and advanced technology research & development management. While at NASA, he lead critical studies of space solar power, highly reusable space transportation, affordable human exploration approaches, and other topics. In recognition of his accomplishments, he has received numerous awards and honors, including the prestigious NASA Exceptional Technology Achievement Medal. Mr. Mankins has authored or co-authored more than 80 published papers, reports and other technical documents. He has testified before Congress on several occasions, and has been consulted on R&D management and space issues with organizations in the U.S. and internationally.

Marc G. Millis, the co-founder of the Tau Zero Foundation, is a physicist who earned a BS in Physics from Georgia Tech (1982), a MS in Physics Entrepreneurship from Case Western Reserve University (2006), and is an alumnus of the International Space University Summer Session (1998). He led NASA's "Breakthrough Propulsion Physics" project investigations relevant to the ultimate goals of

non-rocket "space drives" and faster-than-light-travel. In 2009, he and his colleagues published the first-ever scholarly book on that topic: *Frontiers of Propulsion Science* (AIAA, 2009). After 31 years with NASA, he retired in 2010 to devote full time to the Tau Zero Foundation, a nonprofit for incremental advances toward practical star flight and sharing that progress to the public. He is also now serving as an Adjunct Faculty Researcher for the USAF Institute of Technology.

Michael Minovitch, Ph.D. is an American mathematician and the discoverer of the first numerical solution to the famous unsolved Three-Body Problems in Celestial Mechanics. He used this solution to invent gravity-propelled interplanetary space travel (popularly known as "gravity-assist trajectories"). This was the invention that made possible all of NASA's high energy deep-space multiplanetary missions, such as the Voyagers and the Pioneers. He is the Chairman, chief physicist, and CTO of Breakthrough Technologies Corporation, as well as the Chairman, of Phaser Telepropulsion Inc.

Edward Montgomery, has over 35 years experience in the aerospace industry, much of it relating to advanced space concept analysis and new technology development. After working 10 years in the aerospace industry in Huntsville, AL, he was employed 18 years at the NASA Marshall Space Flight Center. While there he was a technology area manager over solar sails and flight project manager for the NanoSail-D missions. He is currently the Manager of the High Energy Laser Laboratory at the U.S. Army Space and Missile Defense Command / Army Forces Strategic Command. Mr. Montgomery has authored over three dozen professional technical presentations published by SPIE, AIAA, ASME, and the Directed Energy Professional Society.

John Rather, Ph.D., obtained his B.S. in Physics from UTK and his Ph.D. in Astronomy from UC Berkeley. He worked at three National Laboratories, was VP of an aerospace company, and served in the U.S. Senior Executive Service as Assistant Director for Technology Development at NASA HQ. His scientific background includes astrophysics, plasma physics, space technology, medical technology, and intelligence applications. He has published over one hundred papers including several on interstellar communication and travel. In 2006, he returned to Oak Ridge to found his small company, Rather Creative Innovations Group Inc. (RCIG, www.rciginc.com), to motivate technology breakthroughs for industries & the government.

Sara Seagar, Ph.D., is a planetary scientist and astrophysicist. She has been a pioneer in the vast and unknown world of exoplanets (planets that orbit stars other than our sun). Her ground-breaking research ranges from the detection of exoplanet atmospheres to innovative theories about life on other worlds to development of novel space mission concepts. Now, dubbed an "astronomical Indiana Jones", she is on a quest after the field's holy grail, the discovery of a true Earth twin. Dr. Seager earned her PhD from Harvard University and is now the Class of 1941 Professor of Planetary Science and Professor of Physics at the MIT. Professor Seager is a 2013 MacArthur Fellow and was named in Time Magazine's 25 Most Influential in Space in 2012.

H. Paul Shuch, Ph.D., (rhymes with "luck") is an American microwave engineer and the inventor of home satellite TV, founder and director *emeritus* of the SETI League, and past president of the Society of Amateur Radio-astronomers (SARA). He earned a B.S. in industrial technology from San Jose State University and a Ph.D. in engineering from the University of California, Berkeley. He is a Vietnam-era Air Force veteran and active instrument-flight-rules (IFR) instructor. Upon completion of military service, he worked as an engineer for several Silicon Valley aerospace companies before

commencing his academic career. He founded Microcomm Consulting in 1975, where in 1978 he designed and produced a commercial home satellite TV receiver. He has taught physics, astronomy, and engineering on various campuses for over three decades. When the NASA SETI program was cancelled by the US Congress in 1993, New Jersey industrialist Richard Factor established the nonprofit, membership-supported SETI League, which he invited Shuch to head. Shuch became the organization's first Executive Director, a position he now holds on an emeritus basis. He designed the hardware and protocols for, and remains Principal Investigator on, the SETI League's Project Argus all-sky survey. Shuch is principal investigator for the Invitation to ETI, a web-based SETI experiment initiated by his colleague, Allen Tough. Along with Ivan Almar of the Konkoly Observatory, Budapest, Shuch developed the San Marino Scale, an analytical tool for quantifying the significance of transmissions from Earth into Space.

Amy Sivak, earned a Bachelor's in Physics and a Master of Science in Aerospace Engineering, and is currently working towards her Ph.D. in Aerospace Engineering. After working at Orbital Sciences as the Thruster Lead for commercial and government satellites, she moved Huntsville, AL, to work at NASA as the RCS Thruster Lead for Ares I rocket. She had a brief stop in Thrust Vector Control for SLS, but her heart was in Propulsion Research and Advancing Technologies. She worked in Electric Propulsion and Nuclear Propulsion in the Propulsion Research and Technologies Applications Branch until recently, when she took a position with Marshall's Chief Technologist.

Frederick V. Sloop Jr., has worked as a research scientist at the Oak Ridge National Laboratory for the past 30 years and is a frequent contributor to ORION. His interest in human endeavors in space dates back to the days of his youth, standing under the evening skies of October watching a small dot of light called Sputnik passing over his hometown. He is the proud father of two gifted daughters, Katie - an environmental consultant to the energy industry and Elizabeth - currently an undergraduate at the University of Tennessee. He attended and presented at both previous TVIW's. His lives in Oak Ridge, TN, with his wife Betty, the family cat, and a number of beehives filled with honeybees.

Rob Swinney, CEng., is a British astronomer and military engineer. He is the Deputy Director of I4IS as well as the Finance Director. In the 1980s Rob completed his Bachelor of Science degree in Astronomy and Astrophysics at the University of Newcastle Upon Tyne, and his Master of Science degree in Radio Astronomy at the University of Manchester (Jodrell Bank – thesis 'Kinematics of the Radio Flare star Cygnus X-3'). After several successful years working as a teacher of Craft, Design and Technology at Sherborne Boys School in Dorset he returned to his studies and graduated from Cranfield University with a further Master of Science degree in Avionics and Flight Control Systems (thesis 'Graphical Interface for a hybrid Flight Simulator'). After Cranfield, he undertook a challenging and rewarding career in the Royal Air Force as an Aerosystems Engineering Officer and he completed his RAF Commission in 2006 having attained the rank of Squadron Leader. He is a Chartered Engineer registered with the UK's Engineering Council and a Member of the Institute of Engineering and Technology (previously known as the Institute of Electrical Engineers), and, of course, a Fellow of the British Interplanetary Society. Rob has been published in *Nature* and the *Journal of the British Interplanetary Society* and recently returned to the world of academia and research.

Chris Welch, Ph.D., is a British physicist-turned-engineer, Resident Faculty professor of Spacecraft Engineering at the International Space University (ISU) in Strasbourg, France, as well as Visiting Lecturer in Spacecraft Propulsion at Cranfield University, UK. Dr Welch is a frequent commentator on space and astronautics and has made more than 200 television and radio broadcasts. He is interested in all aspects of space, from science/engineering to education/outreach to space art and has written what he believes to be the first ever paper on the design of extraterrestrial gardens. Chris is a Fellow and Vice-President of the British Interplanetary Society and an Associate Fellow of the American Institute of Aeronautics and Astronautics. He is Chair of the International Astronautical Federation Space Education and Outreach Committee, board member of the World Space Week Association, Spacelink Learning Foundation, Initiative for Interstellar Studies, and the Space Generation Advisory Council. A Chartered Physicist and a Chartered Scientist, in 2009 he was awarded the Sir Arthur Clarke Award for Space Education.

Excerpted from the National Space Society/HAL5 award, "For A Lifetime of Service to the Space Community": This Space Pioneer award is given to honor Dr. **Gordon Woodcock** for his many contributions to the advancement of space technology, concepts, and advocacy in a great variety of areas. After getting his engineering degree from Oregon State in 1954 and starting the same year with Boeing, his 57-year aerospace career is still continuing as a consultant for several companies. He worked on Saturn V first stage (S1-C) development and various other projects in Huntsville. Then he helped with Space Shuttle's initial design, and was Principal Investigator for Boeing's Solar Power Satellite Study of 1977-1980. At Boeing he was involved with the space station proposal team, space transportation concepts and architectures. He served as President of L5 (1984-86) and also as an NSS Director and Chairman of the NSS Executive Committee and is currently serving as a member of the NSS Policy Committee. After he retired from Boeing in 1996, he has continued his full participation in this field, with the publication of over 100 books and articles, with current books and AIAA papers coming out on space mission architectures for beyond Low Earth Orbit.

Brent D. Ziarnick, Ph.D./MAJ USAF (Reserve), is currently a student at Air Command and Staff College, Maxwell AFB, Alabama. In the military he has served as a GPS operator, engineer, and tactician as well as a space control officer deployed in the Middle East and Korea. His last assignment was as a space power instructor at the National Security Space Institute, Peterson AFB, Colorado. As a civilian, he was a launch operations engineer at Spaceport America, New Mexico. MAJ Ziarnick holds a doctorate in economic development from New Mexico State University, a master's degree in space systems engineering from the University of Colorado at Colorado Springs, and a bachelor's degree in space operations from the USAF Academy. His long-term interest is in military space power and space industrial development, and near-term interest is doing classified research into the Air Force's role in developing Project Orion.

SCI-FI AUTHORS & PUBLISHERS PANEL (in alphabetical order)

Tony Daniel is an editor at Baen Books where he works with authors such as Les Johnson, Ben Bova, David Weber, John Ringo, Larry Correia, Lois Bujold, Wen Spencer, Brad R. Torgersen, and many others. He is the author of ten science fiction novels himself, the latest of which is *Guardian of Night*, as well as an award-winning short story collection, *The Robot's Twilight Companion*. He's the coauthor of two books with David Drake in the long-running General series, *The Heretic and The Savior*, as well as the author of original series Star Trek novels *Devil's Bargain* and *Savage Trade*.

Daniel was a Hugo finalist for his short story "Life on the Moon," which also won the Asimov's Reader's Choice Award. In the 1990s, he founded and directed the Automatic Vaudeville audiodrama group in New York City on WBAI. He's also co-written the screenplays for several horror movies, *Flu Birds* for the SyFy channel and the Larry Fessenden-directed *Beneath*, for Chiller. During the early 2000s, Daniel was the writer and sometimes director of numerous radio plays and audio dramas for SCI-FI.COM's Seeing Ear Theatre. Daniel has a Masters in English from Washington University in St. Louis. He attended the USC Film School graduate program for one year before dropping out (and moving to Seattle!) to write. Born in Alabama, Daniel has lived in St. Louis, Los Angeles, Seattle, Prague, New York City, Dallas, and Raleigh, North Carolina, where he currently resides with his wife Rika, and children Cokie and Hans.

Paul Gilster is a fulltime journalist and author residing in Raleigh, NC, who focuses on space technology and its implications. He is one of the founders of the Tau Zero Foundation and now serves as its lead journalist. Created by Marc Millis, this organization grew out of work begun in NASA's Breakthrough Propulsion Physics program, and now seeks philanthropic funding to support research into advanced propulsion concepts for deep space missions. He tracks developments in interstellar research from propulsion to exoplanet studies on his Centauri Dreams Web site (www.centauri-dreams.org). Gilster is the author of seven books, notably among them, *Centauri Dreams: Imagining and Planning for Interstellar Flight* (Copernicus, 2004), a study of the technologies that may one day make it possible to send a probe to the nearest star.

At age eight, **Sarah A. Hoyt** wanted to live in Denver and be a professional writer. Mind you, at the time she thought Denver was by the sea, but that is a minor detail. She eventually grew up to acquire a degree in languages and literature, get married and rather to her own surprise she now lives within spitting distance of Denver, CO, with her husband, two sons and a varying clowder of cats. She has published over a hundred short stories and two dozen novels, in fields from fantasy to science fiction to mystery. Her novel *Darkship Thieves* won the Prometheus Award in 2011.

Dan Hoyt makes his living as a systems architect for rocket trajectory software, when not writing, editing or managing the royalty financials for multiple publishers. Since his first sale to *Analog*, in which he discovered with a shock that it's possible to get paid to lie (without getting arrested), Dan has sold several stories to other magazines and anthologies, such as Esther Friesner's suburban fantasy anthologies (*Witch Way to the Mall*, *Strip Mauled*, and *Fangs for the Mammaries*), and to Mike Brotherton's groundbreaking NSF-funded online anthology, *Diamonds in the Sky*. Dan has even crossed over to the dark side of anthology editing with *Fate Fantastic* (DAW) and the *Better Off Undead* (DAW). Catch up with him at <http://www.danielmhoyt.com> .

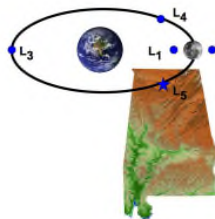
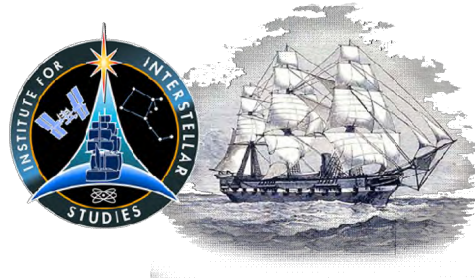
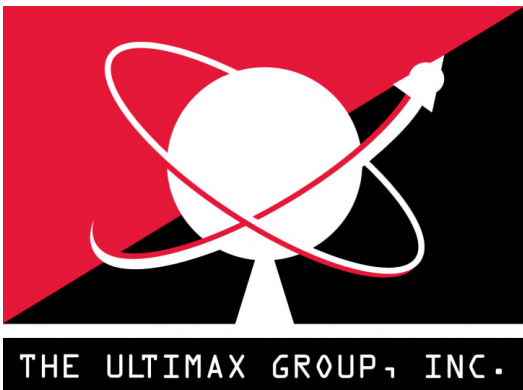
Toni Weiskopf is an American science fiction editor and the publisher of Baen Books. She is an alumna of Oberlin College, from which she graduated in 1987, and was immediately employed by Baen Books, where she served as executive editor until the death of founder Jim Baen in 2006, at which point she took over as publisher. She has edited a number of their anthologies under the name T.K.F. Weiskopf, and won the Phoenix Award in 1994 for excellence in science fiction, the Rebel Award in 2000 for lifetime achievement in Southern Science Fiction Fandom. Weiskopf was the editor guest of honor for the 2010 North American Science Fiction Convention, ReConStruction, and twice been nominated for a Hugo Award for Best Editor, Long Form.

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