



SearchLites

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The Quarterly Newsletter of The SETI League, Inc.

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The Drake Equation: All in the Family

by Nadia Drake

(a blog entry from *Science News*, used by permission)

On November 1, 2011, the formula for estimating the abundance of extraterrestrial life in our galaxy celebrated its 50th birthday. It's known as the Drake equation for its creator, Frank Drake, who is also my father.

The equation grew out of my dad's need to organize a meeting he'd convened at the Green Bank Observatory, in West Virginia. Then 31, he had been thinking for a while about the materials needed to build communicating, extraterrestrial life. He ended up crafting a formula that calculates the number of detectable, intelligent civilizations in the Milky Way galaxy. That equation is now found in most astronomy textbooks.

"It was just something that had been in my mind for months. It wasn't 'ah-hah,' it was just - to me - obvious," he recalled during a recent interview with me. [Subscribers to *Science News* can read the complete Q&A on the *Science News* website. It is also available in the November 7 issue of *Science News Prime*, the tablet version of *Science News* available on the iPad.]

To that meeting in Green Bank, my dad invited "everybody in the world" he could think of with a scientific interest in extraterrestrial intelligence - all 12 people. Carl Sagan was there. Otto Struve was there. Melvin Calvin was there.

At the time, looking for aliens still sat on the fringes of science. But in the intervening five decades, searching for extraterrestrial intelligence has moved inside, even taking up residence in people's homes. As radio telescopes turned a hopeful ear to the stars and optical telescopes kept their eyes peeled for an illuminated alien pulse, a cavalry of citizens armed with personal computers sorted through jumbles of data. A new branch of science - astrobiology - even grew up and dedicated itself to the scientific search for little green men - or at least microbes - and the places they might call home...

But even though the Search for Extraterrestrial Intelligence still runs into roadblocks, I think it's fair to say that many people eagerly await the tell-tale message hailing us from across the interstellar sea, the signal that will tell us that Earth isn't an isolated inhabited island alone amidst endlessly quiet worlds.

The equation describing the number of potential callers has remained unchanged in the half century since it was written, but some of its seven terms have evolved slightly different definitions. My dad and I spoke about these more puzzling pieces of the equation, like the vexing "L" - the amount of time for which a civilization is detectable - and " n_c " or the fraction of habitable planets. Wait - planets, or any kind of habitable, celestial body? What about moons like Europa?

"When we talk about the number of habitable planets, what we really mean is the number of habitable bodies. There may be systems where there are more habitable moons than planets," Dad said during our interview.

Now, each new dispatch from exoplanet hunters sends me tiptoeing closer to an answer, as its next-door factor " f_p " - the fraction of stars with planets - has already done.

Maybe in another 50 years, we'll know how to fill in the values for each of the equation's terms. And maybe, during those 50 years, we'll even hear a whisper - or a shout - from across the galaxy.



Event Horizon

SearchLites readers are apprised of the following conferences and meetings at which SETI-related information will be presented. League members are invited to check our World Wide Web site (www.setileague.org) under *Event Horizon*, or email to us at info@setileague.org, to obtain further details. Members are also encouraged to send in information about upcoming events of which we may be unaware.

March 10, 2012: 37th *Trenton Computer Festival*, The College of New Jersey, Ewing, NJ.

March 30 - April 1, 2012: *Contact 2012*, Sunnyvale, CA.

April 21, 2012, 0000 UTC - 2359 UTC: Thirteenth annual SETI League *Ham Radio QSO Party*: 3.551, 7.0309, 7.2039, 14.084, 14.204, 21.306, and 28.408 MHz.

April 22, 2012: Eighteenth SETI League *Annual Membership Meeting*, Little Ferry NJ.

May 22 - 24, 2012: IAA *Global Space Exploration Conference*, Washington, DC.

May 25 - 28, 2012: *Balticon 46*, Hunt Valley, MD.

July 26 - 28, 2012: *Central States VHF Conference*, Cedar Rapids, IA.

August 30 - September 3, 2012: *Chicon 7*, 70th World Science Fiction Convention, Chicago IL.

September 2012 (dates TBA): *Sixth International Congress for Radio Astronomy*, Medicina, Italy.

September 25 - 28, 2012: *Fourth IAA Symposium on Searching for Life Signatures*, Republic of San Marino.

October 1 - 5, 2012: *63rd International Astronautical Congress*, Naples, Italy.

October 12 - 14, 2012 (tentative): *AMSAT Space Symposium*, Orlando, FL.

April 20, 2013, 0000 UTC - 2359 UTC: Fourteenth annual SETI League *Ham Radio QSO Party*: 3.551, 7.0309, 7.2039, 14.084, 14.204, 21.306, and 28.408 MHz.

April 21, 2013: Nineteenth SETI League *Annual Membership Meeting*, Little Ferry NJ.

August 29 - September 2, 2013: *Lonestarcon 3*, 71st World Science Fiction Convention, San Antonio TX.

September 23 - 27, 2013: *64th International Astronautical Congress*, Beijing, China.

April 19, 2014, 0000 UTC - 2359 UTC: Fifteenth annual SETI League *Ham Radio QSO Party*: 3.551, 7.0309, 7.2039, 14.084, 14.204, 21.306, and 28.408 MHz.

April 20, 2014: Twentieth SETI League *Annual Membership Meeting*, Little Ferry NJ.



Annual Meeting Notice

In accordance with Article IV, Section 1 of our duly approved Bylaws, the Trustees of The SETI League, Inc. hereby schedule our Eighteenth Annual Membership Meeting for 1 PM Eastern time on Sunday, April 22, 2012, at SETI League Headquarters, 433 Liberty Street, Little Ferry NJ 07643. Our office is located just two blocks north of Route 46 and one mile east of the Teterboro Airport, on the northwest corner of Liberty and Kinzley Streets.

We recommend that out-of-town members and guests flying in commercially use the Newark International Airport (EWR), which is about twenty minutes South of our office. There is a wide variety of hotels available at the Newark Airport. A rental car is recommended. From Newark, drive North on the New Jersey Turnpike to US Route 46 Westbound, cross over the Hackensack River, and two long blocks after the traffic circle, turn right onto Liberty Street.

Our members and guests using General Aviation are invited to use the Teterboro Airport (there *is* a landing fee). Of the half-dozen Fixed Base Operators offering transient parking, we recommend Atlantic Aviation (ask Ground Control for parking in the Atlantic Midfield). They should be able to assist you with ground transportation. Please coordinate your schedules and needs in advance through our secretary, Heather Wood.

As attendance by one percent of the League's membership constitutes a quorum, all members in good standing are encouraged to attend. The preliminary agenda for this meeting, per Bylaws Article XII, appears below.

Per Article IV, Section 3 our Bylaws, written or electronic notice of this Meeting is being provided to all members in good standing, not less than ten days nor more than ninety days prior to the meeting date. Members are encouraged to submit additional Old Business and New Business items for inclusion in the Agenda. Please email your agenda items to n6tx@setileague.org, not later than April 1, 2012.

The annual Board of Trustees Meeting required per Bylaws Article V, Section 3 will immediately follow the Membership Meeting. All SETI League members in good standing are welcome to attend.

Preliminary Agenda

- Call to Order
- Minutes of 2011 Membership Meeting
- Financial Report
- Committee Reports
- Old Business
- New Business
- Good and Welfare
- Adjournment



SETI League 2011 Program Service Accomplishments

(a) Science Programs:

- Supported 147 Project Argus radio telescopes built by members in 27 countries on all seven continents. Coordinated their SETI and astrophysical observations. Argus stations analyzed and cataloged several new candidate signals during 2011.
- Members' stations continued to monitor telemetry signals and science beacons from several NASA and ESA interplanetary space probes.
- Provided Committee leadership (as co-chairman) to the SETI Permanent Study Group of the International Academy of Astronautics.
- SETI League members continue to lend computer support to the SETI@home distributed computing experiment, through the Berkeley Open Infrastructure for Networked Computing (BOINC).

(b) Technology Programs:

- Assisted three members in bringing new Project Argus stations online.
- Coordinated and archived four closed technical email lists.

(c) Public Education Programs:

- Executive Director Emeritus delivered five public SETI lectures in the US and South Africa.
- Members participated in the 2011 Green Bank Technical Conference of the Society of Amateur Radio Astronomers (SARA), a SETI League affiliate, as well as SARA's regional conferences in Tennessee and California, presenting papers and conducting workshops.
- Executive Director Emeritus published five technical articles in scholarly journals, Conference proceedings, and the popular press, served as a manuscript reviewer for the International Academy of Astronautics, and as a member of the British Interplanetary Society's editorial board.
- The SETI League provided webmastering and website hosting services to the International Academy of Astronautics SETI Permanent Committee.
- Distributed CD copies of "The SETI League Technical Manual" and "Tune In The Universe!", a radio amateur's guide to the Search for Extra-Terrestrial Intelligence.
- Officers and volunteer Regional Coordinators answered numerous email queries from around

the world on technical and societal aspects of SETI.

- Distributed numerous print and CD copies of various SETI League Conference Proceedings.

(d) Media and Outreach Programs:

- Published four issues of SearchLites, the quarterly newsletter of The SETI League, Inc.
- Coordinated and archived two open public email lists.
- Distributed three Press Releases and twelve Editorials to over 700 media outlets worldwide.
- Filed 52 weekly updates to The SETI League's extensive website.
- Mailed out dozens of membership brochures to email requesters.
- Several of our 60 volunteer Regional Coordinators in 46 countries conducted print and broadcast media briefings and interviews.
- Executive Director Emeritus granted interviews to print media and broadcast outlets in New Jersey, Pennsylvania, New York, the United Kingdom, Brazil, Germany, and South Africa.
- Awards Committee chairman designated recipients for the sixteenth annual Giordano Bruno Memorial Award, the ninth Orville Greene Service Award, and twelve SETI SuperStar Awards. ❖

Ask Dr. SETI®

ATA Dish Design

Dear Dr. SETI:

Thanks for sending along the latest SearchLites. I found the article about the Allen Telescope Array interesting. I wonder if you could explain the ATA dish design. I've seen pictures of the array, and find the design intriguing.

Doc, North Dakota

The Doctor Responds:

I'm glad you're enjoying *SearchLites*, Doc. The ATA dishes are Gregorian antennas. They use a ~6 meter offset-fed primary mirror, which reflects incoming signals onto a ~2 meter secondary reflector which is mounted *outside* of the focal point. The secondary mirror in turn reflects the signals to a broadband log-periodic feed, which contains a cryogenically cooled combination balun (balanced-to-unbalanced transformer) and an extremely broadband, ultra-low-noise preamplifier. All very high efficiency, very complicated, and *very* expensive! ❖

Guest Editorials:

National Parks on the Moon?

by Seth Shostak

Senior Astronomer, SETI Institute

From *Huffington Post*, used by permission.

I've often fantasized about visiting the Bahamian beach where Columbus first stumbled ashore in 1492. Sadly, no one knows where that beach is. In fact, no one's even sure which island Columbus first encountered (there are three candidates).

It's a pity, a disappointment, and a lost revenue source for the Bahamians.

Now, more than a half-millennium later, there are some new beachheads to mark and preserve. NASA's Office of Commercial Exploration has been concerned about protecting the landing zones where humans first walked on the Moon, and one of my colleagues, ecologist Margaret Race, has been part of their deliberations. For those too young to remember, there were six lunar missions between 1969 and 1972, and among these, the touchdown sites of Apollo 11 (the first) and Apollo 17 (the last) are particularly resonant. Unlike most stories churned out in the daily news, what happened in these small bits of dusty real estate will interest every generation that follows us.

So what's the problem? You might assume that these small parcels are safely ensconced on a pock-marked, airless, and uninhabited world a quarter of a million miles away. Not a lot of worry there.

But the Moon's splendid isolation is bound to be temporary. The era during which only governments could put hardware on the Moon is coming to an end. There are 26 private teams competing for the \$30 million Google Lunar X-Prize -- to be awarded for sending a robotic spacecraft to this nearby world that can roam at least 500 meters, and send back data such as a photo. There's also a \$5 million bonus for documenting an historic, lunar landing site.

The teams competing for the X-Prize -- well aware of the cultural importance of these places -- have asked for guidelines on how to explore them. So these groups are not likely to cause any damage. But in another century, there might be a permanent human presence up there. Going to the Moon may be something that tourists do, tourists whose parents were not even alive when the first men landed in the Sea of Tranquility. These sites will no longer be safe merely because they're remote.

Admittedly, it would take industrial-grade chutzpah and a massive dose of malevolence for anyone to

bulldoze the spot where Neil Armstrong stepped off the Eagle lander. But even innocent visits could be damaging.

"The biggest concern is rocket exhaust," says Race, "because landing spacecraft could sandblast everything as the engine stirs up the Moon's surface." Another problem is accidents -- an incoming rocket could inadvertently crash. This has led to specifying a restricted "air space" above the most important places.

Rovers -- rolling in for a close-up view -- could also cause problems, particularly as the lower gravity (and lack of air) mean that abrasive dust kicked up by the wheels goes high and moves fast.

"You may have to restrict the speed at which rovers could approach the site," Race says.

Not to mention the obliteration of boot prints, the taking of souvenirs, etc.

Sure, for people of good will, there's little cause for concern. But what about future visitors whose will is not so good, or who are simply indifferent or oblivious? Race argues that we should fill in some gaps in the legal structure governing cosmic exploration. That's the provenance of the Outer Space Treaty, which dates to 1967 and has been ratified by over 100 countries. According to the OST, the Moon cannot be claimed by any country -- it belongs to all humankind, in the way that Antarctica does. On the other hand, the spacecraft and other paraphernalia now placidly parked on its surface are the property of the governments that built them.

"So there's clearly a problem," says Race. "I mean, some people will point to a site and say, 'You don't own the real estate, so who are you to draw restrictive circles around your hardware?'"

Solving this and the other problems of preservation is probably not too difficult right now, since the whole issue is both new and -- to many people -- almost amusingly arcane. But Race believes strongly that we should do something soon. Otherwise, it's likely that we'll succumb to our historic modes of exploration: just barrel ahead, and damn the consequences.

It will be like settling the Americas, Race says. "Just do it, and then people will figure out what was done wrong later."

This cowboy approach is easy and, to some, even appealing. But a little proactive work might lead to outcomes that future generations will come to appreciate.

Think about it this way. You can't visit Columbus' landing spot. We don't know where Balboa first tasted

the waters off the Darian coast to prove they were salty, or where the Pilgrims first stepped ashore in Massachusetts (it wasn't on that rock).

It's history without artifacts. But it needn't be. We can ensure that our descendants in the 23rd century -- most of whom will not know much about the wars or politics of our time -- will at least be able to gaze in awe at where their ancestors first made a big step for mankind.

The National Parks have been touted as "America's best idea." Perhaps it's time to craft a similarly enlightened idea at the international level -- to show appreciation of the truly promethean things that our species has done, and to safely bequeath them to those who follow. ❖

Let the Search Continue

by Paul Gilster
Centauri Dreams

Most people think that SETI is worth doing, whether or not they actually believe there are other technological civilizations in the galaxy. Ben Zuckerman, a professor of astronomy at UCLA, is certainly in the skeptics' camp, thinking there are no technological ETs in the Milky Way, but he's quoted in a story from QUEST (KQED San Francisco) as calling for more SETI. "Given that the costs are not very high," says Zuckerman, "why not continue the search?" Zuckerman, who once worked with Carl Sagan in graduate school, no longer thinks we live in a crowded galaxy, but a potential discovery of this magnitude justifies the relatively modest expenditure.

It's not surprising to find Jill Tarter echoing Zuckerman. The recent funding problems of the Allen Telescope Array have not daunted the woman who more than anyone else has come to represent the search for other intelligent life. And although she believes we may one day come to the 'extraordinary conclusion' that we really are alone, the time for drawing that conclusion is hardly near. We have hundreds of billions of stars to choose from in the Milky Way and hundreds of billions of galaxies beyond our own, and in those terms, we've barely begun to search.

The KQED story takes note of the new element in SETI research, which has to do with the Kepler mission. With the discovery of more than a thousand planets orbiting stars in its field of view, Kepler may well have found the first true Earth analogues - we'll know as its data continue to be analyzed. The Kepler findings give us a targeted list of stars that should be high priority for the SETI hunt. "This," says Kepler

team member Dimitar Sasselov, "is where we should be looking for the signals coming from other civilizations."

Just a month after the hibernation of the Allen Telescope Array due to money problems, the Green Bank radio telescope facility in West Virginia announced its own effort to study 86 of the stars chosen from the Kepler list, scanning an 800 MHz range of frequencies simultaneously (that's 300 times the range available at Arecibo). Among the 86 stars Green Bank will be studying are 54 candidate systems identified by Kepler as potentially having a planet in the habitable zone. Thus the largest steerable radio telescope in the world picks up on the Kepler work, another case of SETI soldiering on when resources are scarce.

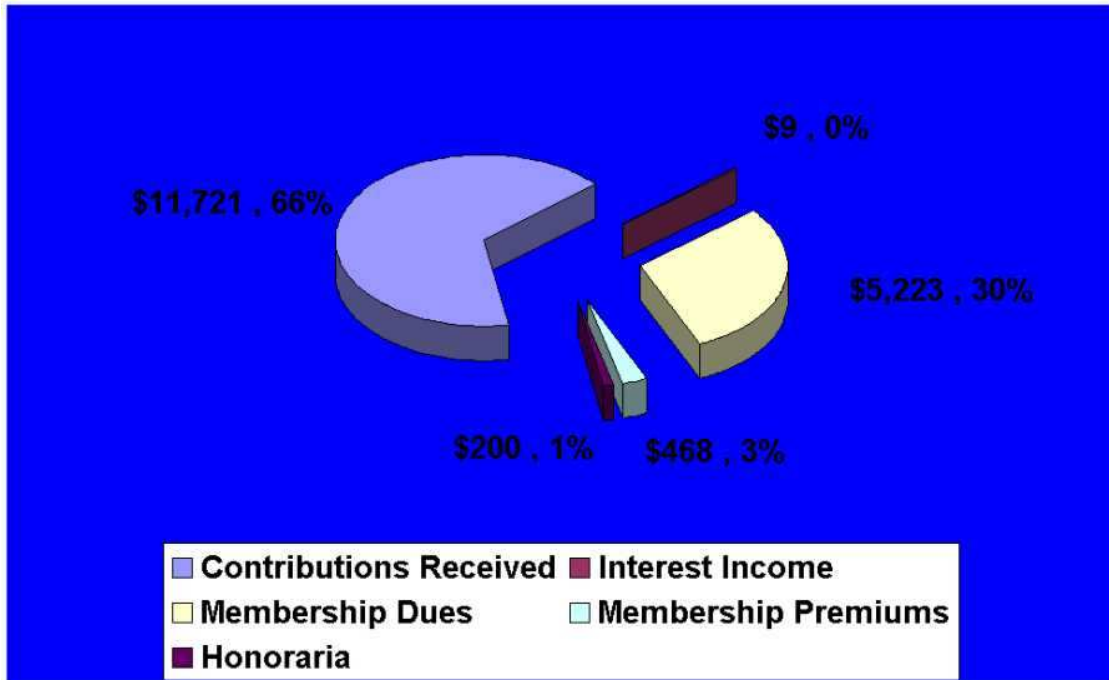
And fortunately, the Allen Telescope Array itself is back in business, thanks to more than \$200,000 in donations from some 2400 donors and an infusion of money from the U.S. Air Force, which should keep the project running for the next several months. In the longer term, the ATA needs \$2.5 million per year to keep operational, so fund-raising will doubtless become a permanent fixture of the facility's operations. The SETI Institute's page supporting a search of the Kepler candidates using the ATA continues to gather donations, a reminder that while SETI may be for now a relatively low-key project, it's one that generates wide public interest.

My own views on SETI parallel those of Ben Zuckerman. I doubt intelligent life is widespread in the galaxy, but the whole point of science is to extend our knowledge. By all means, let's keep SETI in business, and maybe we skeptics will be proven wrong. And just letting the imagination run, it's fascinating to ponder the world we might live in if one of the Kepler planets turns out to be leaking some kind of artificial radiation. Remember that Kepler is looking out along the Milky Way's Orion arm, in an area where fewer than one percent of the stars the mission examines are closer than 600 light years. If we were to detect a transmission, it would take 1200 years to receive any return to our potential response. I suspect a detected signal, after revolutionizing our view of ourselves in the cosmos, would probably remain unrepeatable and untranslatable, a mystery for our time, an enigma speaking of all we have yet to learn. ❖

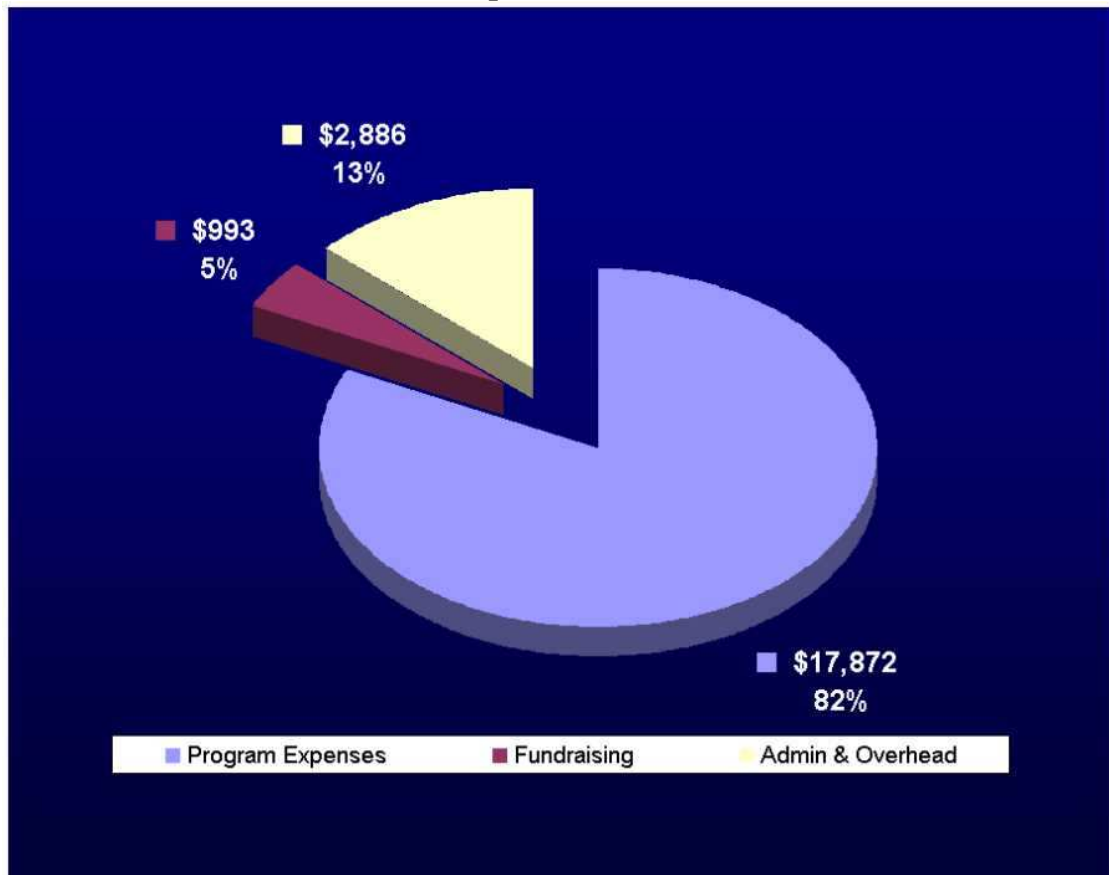
Disclaimer: The opinions expressed in editorials are those of the individual authors, and do not necessarily reflect the position of The SETI League, Inc., its Trustees, officers, Advisory Board, members, donors, or commercial sponsors.

SETI League Financial Report

2011 Revenues (unaudited)



2011 Expenses (unaudited)



Budget Tracking – 2011

990 Line	REVENUES:	2011 (Projected)	2011 (Actual)
1d	Dues, Grants & Contributions	20,000	17,612
4	Interest & Investments	19	9
12	Total Revenues:	20,019	17,621
	EXPENSES:		
13	Educ. and Scientific Programs	17,000	17,872
14	Management & General	4,600	2,886
15	Fundraising	1,400	993
17	Total Expenses:	22,000	21,751
18	Excess or (Deficit) for the year	-1,981	-4,130
	BALANCE SHEET:		
19	Beginning Net Assets	10,981	10,981
21	Ending Net Assets	9,000	6,851

Annual Budget - 2012

990 Line	REVENUES:	2012 (proposed)
1d	Dues, Grants & Contributions	18,000
4	Interest & Investments	5
12	Total Revenues:	18,005
	EXPENSES:	
13	Educ. and Scientific Programs	17,000
14	Management & General	3,000
15	Fundraising	1,000
17	Total Expenses:	21,000
18	Excess or (Deficit) for the year	(2,995)
	BALANCE SHEET:	
19	Beginning Net Assets	6,851
21	Ending Net Assets	3,856



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Annual Renewal: Is This Your Last *SearchLites*?
SETI League memberships are issued for the *Calendar Year*. Please check the expiration date indicated on your mailing label. If it reads December 2011 or earlier, you have already expired, and *must* renew your SETI League membership **now!** Please fill out and return this page along with your payment.

Please renew my membership in this category:

Full Member	\$50 / yr
Supporting Member (elderly, retired, or disabled)	\$35 / yr
Scholarship Member (full-time students only)	\$25 / yr
Household Member (same address as a Full Member)	\$15 / yr
Household Life Member (same address as a Life Member)	\$300
Life Member (until we make contact)	\$1,000
Sustaining Life Member – a generous <i>annual</i> pledge of:	\$1,000 / yr
Patron (priority use of The SETI League’s radio telescope)	\$10,000
Director (Patron membership plus seat on advisory board)	\$100,000
Benefactor (a major radio telescope named for you)	\$1,000,000

Annual memberships are issued for the calendar year. Those processed in January through April expire on 31 December of that year. Those processed in September through December expire on 31 December of the *following* year. Those members joining in May through August should remit half the annual dues indicated, and will expire on 31 December of the same year.

Order Your Membership Premiums:

	(u/c)*	(o)*
Pocket protectors	\$ 3	\$ 4
Mouse pads	\$ 5	\$ 7
<i>Tune In The Universe! (CD-ROM)</i>	\$25	\$30
<i>Proceedings of SETICon01</i>	\$20	\$27
<i>Proceedings of SETICon02</i>	\$20	\$27
<i>Proceedings of SETICon03 (CD)</i>	\$15	\$17
<i>Proceedings of EuroSETI04 (CD)</i>	\$15	\$17
<i>Proceedings of SETICon04(CD)</i>	\$15	\$17
<i>SARA Conference Proceedings:</i>		
2006, 2007, 2008, 2009 (specify)	\$20	\$27
<i>SETI League Technical Manual (CD)</i>	\$10	\$13
<i>Project Cyclops 2nd Edition</i>	\$20	\$30
<i>The Listeners</i> by James Gunn	\$15	\$21
<i>Sing a Song of SETI</i> (Songbook)	\$10	\$13
<i>Sing More Songs of SETI</i> (Songbook)	\$10	\$13
<i>Sing a Song of SETI</i> (music CD)	\$15	\$17
<i>Demented!</i> (music CD)	\$15	\$17
T-shirts, specify M, L, or XL	\$15	\$22
SETI Nerd Gift Set (one each Mouse Pad, Pocket Protector, <i>Project Cyclops</i> and <i>Tech Manual</i>) at 20% Savings to <u>Members Only</u> :	\$30	\$43

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The SETI League invites you to pay your membership dues and additional contributions via credit card, using the PayPal online payment system. Simply log on to www.paypal.com and specify that your payment be directed to paypal@setileague.org.

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