Title:

Joint NASA / Lifeboat Foundation Prizes to Encourage Participation in Space Research and Development

Abstract:

We propose offering prizes for space research and development that can be implemented at the level of the traditional garage-scale inventor. The Lifeboat Foundation is an eclectic group of futurists concerned with encouraging scientific progress while avoiding risks associated with that progress. Prestigious prizes encourage innovative activity out of proportion to their dollar amount. We might usefully partner with NASA in offering prizes for innovative achievements in space development, and in associated fields of education and science and technology. Lifeboat has already offered dozens of prizes, and we have plans for more. NASA / Lifeboat prizes would carry more weight because of the value of the NASA name. Lifeboat can function as an innovative think tank to propose and sponsor prizes, with advice from NASA and partnership in those prizes that appropriately address NASA goals.

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A. Title of proposed activity(ies).

Joint NASA / Lifeboat Foundation Prizes to Encourage Participation in Space Research and Development

B. Description of proposed activity(ies).

We propose that NASA and the Lifeboat Foundation partner to offer prizes for research and development activities that are within the capacities of garage-scale inventors, Hackerspace members, and teams of students and faculty advisors. We propose to stretch and challenge those capacities.

Prestigious prizes encourage innovative activity way out of proportion to their dollar amount. Lifeboat has already offered dozens of prizes, and we have plans for more. NASA / Lifeboat prizes would carry more weight because of the value of the NASA name. We suggest a creative process wherein prizes are crafted to meet the goals of both NASA and Lifeboat. Lifeboat can function as an innovative think tank to propose and sponsor prizes. NASA can assist with this planning and can choose to associate with only those prizes that best fit their mission. Indeed, Lifeboat does not own the idea of offering prizes. We encourage NASA to use this idea whether or not they associate with us.

Most of the prizes Lifeboat has offered have been small scale, for example autographed books donated by our authors. On a larger scale, we offer our "A-Prize" of $30,000 for creation of a synthetic organism (which must execute at least one synthetic nonbiological operation to complete its life cycle) while using proper safety precautions. Recently, our first Lifeboat-to-the-Stars Award for a science fiction story that encourages star travel ($1,000) was presented at the Campbell Conference.

We offer this prize because science fiction has leverage. It inspired our first steps into space. However, science fiction has become dystopian lately. We hope to change that. See Appendix B, our invocation to the Campbell Conference. (This does not exceed the 10-page limit.) This prize was suggested by Lifeboat members Frederik Pohl and James Gunn, and was one of the 45 awards we proposed in our 100-Year-Starship proposal.

Our 100-Year-Starship proposal was not accepted, but we are implementing some of its components. A list of its proposed activities and prizes is attached here as Appendix A. It is attached here to illustrate the diversity of the prizes we can propose and the activities we can sponsor.

Good examples, worth expansion here, are the prizes we intended to offer through the Hackerspace community (we now hope to offer some of them to a larger community as well) for 1) a simulated experiment to be deployed at the Mars Society's simulated Mars base, and 2) the best test that demonstrates or improves or disproves an innovative space drive. An innovative space drive could be anything that is not a chemical rocket, allowing ion engines, mass drivers, solar sails, etc, or it could be focused on things that are more speculative. Several Lifeboat physicists are working on speculative space drives, but they are not easy to test. Another prize that would stimulate space industrialization would be a prize for a 3D printer using regolith. See the Metzger citation below. We feel that prizes of this nature will "actively engage public participation" by the class of innovative garage inventors that included the Wright Brothers. Some projects are of too large a scale for garage inventors, but some (such as the airplane) are not. The appropriate scale is not apparent in advance. Some early aeronautical experiments had impressive funding, but didn't work. Garage inventors thrive on challenge, and may surprise us. Addressing those challenges also encourages study of the underlying

math and science. If we make enough of a splash, we may make those subjects "cool" again. King Hussein of Jordan was an avid ham radio operator, encouraging that pastime among Jordanian youth. Many Jordanians who were ham radio operators as kids are now engineers.

C. Mission, Vision, and/or Values: Summary of how the Respondents mission, vision, and/or values complements NASA's mission, vision, and /or strategic goals.

The Lifeboat Foundation is an eclectic group of futurists concerned with encouraging positive singularities while avoiding negative singularities. A singularity is a time when some form of technology grows exponentially in a positive or a negative direction, producing amazing new tools, products, and enhancements to life, or amazing new dangers, that change almost everything. The Lifeboat Foundation has advisory boards comprising over 2,000 members, including four Nobel Prize winners, twelve Hugo-Award winning science fiction authors, and many authors of important books and publications. Our website is at: http://lifeboat.com .

Our mission coincides with the mission of NASA because expansion into space is a positive singularity. According to John Lewis, there is enough material in the asteroid belt alone to build O'Neill habitats for 10,000 trillion people, a positive singularity indeed. NASA physicist (and Lifeboat Advisory Board Member) Dr. Philip Metzger shows how this might be done in [Metzger et al, "Affordable, Rapid Bootstrapping of Space Industry and Solar System Civilization," Journal of Aerospace Engineering, April 2012]. Expanding into space also addresses negative singularities and existential risks by providing a "Lifeboat," a backup for Earth.

D. Communication Priorities and Goals: Summary of how the Respondents proposed activities will incorporate NASA's communications priorities and goals.

A. Alignment with NASA's missions, vision, and strategic goals

Lifeboat's focus on positive singularities aligns with NASA's goals. See "C" above.

B. Alignment with NASA's communication priorities:

1. Conduct valuable research on the Space Station

We could offer prizes that result in low-mass experiments to be conducted on the space station. These might be self funding, in the same way that the cube satellite specification allows dozens of inexpensive experiments to piggyback on launches that have surplus lift capacity. Cube satellite experiments can pay their own way at a price that is within reach of university departments and even amateur inventors.

2. Work to better understand and protect our home planet Earth.

Lifeboat focuses on existential risks with the goal of protecting Earth.

3. Explore Mars

One of our proposed Hackerspace prizes was a simulated Mars experiment.

4. Explore our solar system and beyond

If prize recipients succeed at improving space drives or other forms of space hardware, this would make space exploration more practical.

C. Alignment with NASA's Communications Goals:

1. Expand outreach to new audiences and venues to disseminate information on NASA's mission, robust programs and activities

Garage inventors are a new audience. Their work sometimes makes news and reaches larger audiences.

2. Create greater opportunities for employees and the public to tell NASA's story

Prizes are newsworthy and carry messages. For an example, see Appendix B, a message for attendees at the Campbell Conference at which our Lifeboat-to-the-Stars prize was awarded. NASA Communications could help us do something similar with NASA / Lifeboat prizes.

3. Inspire and educate the public by demonstrating NASA's relevance and benefits to key audiences.

Garage inventors are a key audience. The expense of current space experiments makes these experiments seem beyond their level of contribution. We mean to change that.

E. Assets and Resources:

1. Description (including type and level) of NASA resources Respondent proposes to use. For example, the number of civil servant labor hours, and how often and for what purpose any NASA facility would be used.

Lifeboat intends to raise funds to fund prizes. We have funds on hand to fund some. We do not intend to use NASA resources for this purpose.

The main NASA resource to be used is collaboration of NASA personnel in the design of prizes. Lifeboat could operate with none of that resource. However, we conjecture that the opportunity will be motivating for NASA personnel, and that they will contribute well beyond the parameters of their job descriptions. There is no easy way to estimate the number of hours they will contribute, or the number of hours they will charge. We think that high involvement of NASA personnel, if it occurs, will be because they will be doing their jobs and appropriately determine that the benefits to NASA outweigh the costs. We hope for large benefits.

Another NASA resource is knowledge of ITAR. Prizes would be announced in media available to foreign citizens, and Hackerspaces are located in many countries. We would count on NASA to make sure that collaborative prize specifications do not contain proscribed information.

There are program risks. Lifeboat comprises a diverse group. Some members have unconventional ideas. A new Senator Proxmire could see some of our ideas as worthy of his Golden Fleece Award. Also, unconventional ideas often don't work. A benefit is the fact that unconventional ideas are the precise components of Kuhn's scientific revolutions. Acceptance of ideas from diverse sources also helps make garage inventors feel that they are not completely outclassed. We think they can be a valuable resource if used appropriately, and facilitating significant contributions from them can contribute substantially to a public sense that ordinary members of the public can participate.

2. Description of the management team proposed to implement the Respondents responsibilities.

Eric Klien, President of the Lifeboat Foundation, is principally responsible. The current lead for this project is James Blodgett, Chair of Lifeboat's Grantsmanship Committee and primary author of this proposal. His biography is listed at http://lifeboat.com/ex/bios.james.blodgett . However, our major management asset is our large set of advisory boards.

Lifeboat has over 2,000 Advisory Board members in 39 boards. Lifeboat Advisory Board members include: Dr. Stephen Wolfram (Mathematica); Ray Kurzweil (Singularities); Dr. Miguel Alcubierre (Physicist, Alcubierre Drive); Keith Henson (Cofounder, L5 Society); Baroness Dr. Susan Greenfield (Physiology); Dr. Stuart Armstrong (Anthropic Probability); Dr. Aubrey de Grey (Life Extension); Dr. Paul Werbos (Intelligent systems, NSF); Dr. Ben Goertzel (Artificial Intelligence); Dr. Jack Sarfatti (Physicist); Dr. Philip Metzger (Physicist, NASA); Dr. Willard Wells (Physicist); Eliezer Yudkowsky (Artificial Intelligence); Dr. Otto Rössler (Rössler Attractor); and Dr. C.S. Holling (Ecological Economics).

Nobel Laureates on our boards include: Dr. Eric Maskin (Economics), Akinwande Oluwole Soyinka (Literature), Dr. Daniel Kahneman (Economics), and Sir Dr. Richard Roberts (Medicine).

Nobel Laureate Sir Dr. Clive Granger (Economics) was on our board until his death in 2009. As an example of our diversity, our Dr. Rouslan Krechetnikov won an Ig-Nobel prize.

Science fiction writers on our boards who have won Hugo awards include: Frederik Pohl, Dr. David Brin, James Gunn, Greg Bear, Allen Steele, Joe Haldeman, Elizabeth Bear, Nancy Kress, Dr. Gregory Benford, Dr. Ben Bova, Robert J. Sawyer, and science fiction artist Rick Sternbach.

A list of boards, their members, and biographies of all 2,000+ advisory board members are listed at: http://lifeboat.com/ex/boards .

F. National Scale Audience: Description of how the collaboration will leverage NASA's resources to achieve the widest reach of the proposed targeted audience and reach new or broader audiences for NASA across a national scale.

The proposed primary target audience is garage inventors, Hackerspace hackers, and student apprentices. We hope to reach a fair percentage of them. The secondary audience is the entire pubic, who may be interested in the activities of garage inventors.

G. Broadening Participation: Description of how Respondents proposed activity will incorporate the NASA program areas (science, human exploration, aeronautics, space technology, and education).

We hope to craft prizes that address all of these areas.

H. Submission Approach: Description of the Respondents ability to:

1. Create and implement a successful project, activity, or event to engage the target audience described in the Submission.

We have already offered similar prizes. We have also conducted activities at conferences that were attended by Lifeboat members. The current project lead was involved in organizing many conferences, training programs, and presentations, and has taught ten college courses.

2. Work with NASA to deliver a promotional campaign through various multimedia, including, but not limited to print, radio, television and the digital methods (web, social, mobile), to inform about missions and recent accomplishments, and to facilitate encouragement of the public, especially young Americans to enter scientific, mathematical and engineering fields.

Lifeboat has not done large multimedia campaigns. However, our Media and Arts Board has 189 members, many published authors and artists. We recently published our first book. We were able to choose cover graphics from among several member contributions. We have used Media and Arts people for other projects as well. Space projects historically have benefited from graphics that made proposals seem real.

As for encouraging the public and young Americans to enter scientific, mathematical, and engineering fields, we feel that that happens when those fields provide outlets for creative projects and embryonic skills. King Hussain, mentioned above, was able to accomplish this via ham radio. We think that creatively-specified prizes tailored for appropriate audiences can accomplish the same objective.

I. Timeline: Describe the realistic timeline(s) and/or schedule(s) with milestones, including data collection and metrics evaluation, for accomplishing proposed activities.

Prizes are publicized on a timescale of a year or more. Hackerspace prizes can be publicized on a timescale of months.

Informal metrics will be the number of prize entries submitted, their quality, and the amount of press coverage. If desired, we could do a national sample survey to determine the percent of the population who are aware of our efforts. An expensive version of this does not seem cost-effective.

J. Technical Capabilities: Describe the level of brand equity for your organization.

The Lifeboat Foundation has been gaining worldwide attention with publicity from ABC, the BBC, CBS, CNN, *The New York Times*, NPR, *Popular Science*, *USA Today*, *The Wall Street Journal*, and *Wired*. With greater web traffic than the National Space Society, the Lifeboat Foundation site is becoming a “go to” site for those who care about our future.

Appendix A

Activities and prizes in the Lifeboat Foundation entry for the DARPA/NASA 100-Year-Starship grant:

A) The Lifeboat Foundation will subcontract to provide the following projects. Letters of agreement with all subcontractors are attached. All letters of agreement specify the work to be done, and specify a completion date that is within DARPA's period of performance. In all cases a principal performer who will be responsible for the activity is identified, however, in some cases team members have yet to be selected or specified.

A Star Paths Committee will list many paths to the stars suggested by science and science fiction. The committee will explore the technology required to implement each path, and the plausibility of that technology. Frederik Pohl, Hugo winning science fiction writer and one of several Lifeboat Advisory Board Members who suggested this idea, will be honorary chair, and hopes to contribute. In order to demonstrate the value of Lifeboat's mostly volunteer model, this project will be budgeted at zero.

The Mars Society will conduct an expedition to a Mars simulation station in the Arctic. They will deploy the experiment that wins our 100YSS Mars Hack prize, which will be offered through the Hackerspace community. The commander of the expedition will be Joseph E. Palaia IV.

Biologist and author Athena Andreadis will write a popular book titled "Distant Campfires" about biological adaptations to star travel. As a demonstration of Lifeboat concern about sustaining revenue for promotion of star travel after DARPA funding runs out, Lifeboat will receive 5% of the royalties on sales of this book.

Leeward Space Foundation will use seed money to explore space–and-star-travel-based utilization of Hanger 1 at Ames, an historic and structurally interesting building that is one of the largest buildings in the world, is owned by NASA, and is currently vacant. Leeward will propose an International Space Development Hub. (ISDHuB) Amalie Sinclair is in charge of development for this. Leeward will also explore other projects for space infrastructure.

The Voyager group, which includes several Lifeboat Advisory Board members, will propose architecture and life support design for an asteroid used as a star ship. The Voyager group consists of the following individuals: Dirk Schulze-Makuch, Joe Miller, Giorgio Gaviraghi, Edward Guinan, Jose Cordeiro, Michael Smith, and Piergiovanni Marzocca.

Physicist and music composer Fiorella Terenzi will produce two panel discussions on star travel as part of the Space and Astronomy Lecture Series offered by Brevard Community College.

Dr. Joseph Pelton, who has had many academic and private-sector positions related to space utilization, has written over 30 relevant books, and has served as Founder, President, Director, and Chair of various professional societies, will conduct a study of methods of repositioning to L5 lunar orbit and reusing the International Space Station after the end of its currently projected useful life.

Black Holes BV, a consultancy company of Lawyer Prof. Dr. Frans von der Dunk, will conduct a study of existing world law as it applies to star travel, with recommendations for modifications that could help to facilitate star travel.

Sister Ilia Delio, who has PhDs in both science (pharmacology) and theology, will work on a book and conduct a collaborative study that explores Teilhard de Chardin's idea of how technical progress enhances the human spirit, an idea that motivates travel to the stars.

21st Century Medicine Inc. will open-source publish three papers on suspended animation, and three papers on preserving the mammalian brain, enabling technology for several paths to star travel. Much of the work has already been done. Dr. Gregory Fahy, Chief Scientific Officer, is responsible for this work.

Bios of key people who will assist with these projects include:

http://lifeboat.com/ex/bios.frederik.pohl
http://lifeboat.com/ex/bios.joseph.e.palaia.iv
http://lifeboat.com/ex/bios.athena.andreadis
http://lifeboat.com/ex/bios.amalie.sinclair
http://lifeboat.com/ex/bios.dirk.schulze-makuch
http://lifeboat.com/ex/bios.joseph.d.miller
http://lifeboat.com/ex/bios.giorgio.gaviraghi
http://lifeboat.com/ex/bios.edward.f.guinan
http://lifeboat.com/ex/bios.jose.luis.cordeiro
http://lifeboat.com/ex/bios.pier.marzocca
http://lifeboat.com/ex/bios.fiorella.terenzi
http://lifeboat.com/ex/bios.joseph.n.pelton
http://lifeboat.com/ex/bios.frans.von.der.dunk
http://lifeboat.com/ex/bios.ilia.delio
http://lifeboat.com/ex/bios.gregory.m.fahy

B) The Lifeboat foundation will award the following prizes. These prizes will be awarded within DARPA's period of performance.

Thirty $1,000 100YSS writing expense prizes will be awarded, for book projects that best contribute to the goal of keeping the idea of star travel alive.

Ten $5,000 100YSS seed money prizes will be awarded, for the best ideas for promoting star travel that require development and further fundraising.

Two $5,000 100YSS prizes will be awarded for the science fiction story that best promotes the idea of star travel. We will ask two of our science fiction writers to present the prize at two yearly science fiction conventions. Our science fiction writers include Catherine Asaro, Elizabeth Bear, Greg Bear, Gregory Benford, Ben Bova, David Brin, Brenda Cooper, Bill DeSmedt, Alan Dean Foster, David Gerrold, James Gunn, Joe Haldeman, Sarah Hoyt, Nancy Kress, Frederik Pohl, Jerry Pournelle, John Ringo, Nick Sagan, Robert Sawyer, Allen Steele, and Daniel H. Wilson.

Two $5,000 100YSS exotic science hack prizes, to be offered through the Hackerspace community, will be awarded for the best test of an exotic space drive or energy source. (Hackerspaces are rooms filled with machine tools that members can use. http://hackerspaces.org lists 500 of them.) These will be awarded in each of the two years of the period of performance, in order to start an annual tradition.

A 100YSS Mars hack prize will be awarded for an experiment that will be deployed by the Mars Society in their Mars simulation station in the Arctic. This prize will be approximately $2,000.

Economic considerations driving aspects of some of these prizes, and an extended discussion of their rationale, are presented in the cost section, section 8.

Appendix B (An example to support D. C. 2. above)

A Campbell Conference invocation to science fiction writers:

Write stories that explore existential opportunities in space and inspire us to go there

James Blodgett, Lifeboat Foundation

In the ancient temple, Indiana Jones finds a magic idol. The ancients knew its value. They guarded it with death traps. Indiana Jones evades each trap by a hairbreadth to win his way out of the temple, only to be confronted by cannibals. He escapes them by leaping on the rescue airplane at the last second as it takes off, living to save the world against incredible odds. Could you make this into a science fiction story? Some see our future as dull. I contend that our future looks like this.

Singularity folks see our future as inevitable, as productivity increasing in a smooth exponential curve. The temple was quiet before the death traps sprung. Arthur Clark and Gerard O'Neill, writing forty years ago, foresaw amazing space infrastructure by now. Instead we get global warming. As we peer to the bottom of the global warming trap, we see that it just might run away and make Earth like Venus, a terrifying death trap indeed. If that doesn't get us, there are other traps waiting. Willard Wells finds human-caused existential risks most threatening because we have not been exposed to them for a long time and know that they happen infrequently. [Willard Wells, Apocalypse When? Calculating How Long the Human Race Will Survive, 2009]

Our future in space is contingent, not inevitable. It is really hard to get to the stars, or (as recent history demonstrates) even to get into space on a large scale. However, with luck and skill we still might get it right. This hairbreadth contingency is exciting, or should be. Travel to the stars seems to have lost its promise and its excitement. But there are worlds at stake. Our difficulties are not dull.

It is a stereotype to say that science fiction needs thriller action. Sometimes the action is intellectual. Our present difficulties can evoke plenty of that.

Space development can be a form of singularity, of technology increasing exponentially to incredible heights. Singularities are not inevitable. Exponential growth can hit limits, as space development has demonstrated. Also, singularities are not always good. The tangent line goes to infinity in both positive and negative directions. Science fiction paints dystopian pictures of negative singularities.

It can seem impossible to get to the stars, but that impossibility is not yet demonstrated. I like the idea of many tiny (egg sized?) seeder ships [Google that to see its science fiction etymology] stuffed with artificial intelligence, nanotech, the DNA of many species, and the smarts to modify that DNA and nanotech to fit local conditions. When a seed ship arrives in a star system it terraforms and builds infrastructure, introducing Earth species including humans. Seed ships require advanced technology, but no new physics. There are other ways to get to the stars without new physics. O'Neill's vision could make construction of generation ships easy. Simply nudge an O'Neill habitat into a trajectory around a planet that throws the habitat out of the solar system. I see the problem with O'Neill's vision as being construction of his incredible habitats, but Philip Metzger, a NASA physicist, sees a way to do that, starting with a few tons of machinery shipped to the moon: mining equipment and 3D printers and teleoperated robots that could build machines with lunar material, crude at first and requiring Earth components, but improving and expanding exponentially to create an industrial revolution in space. [Metzger et al, "Affordable, Rapid Bootstrapping of Space Industry and Solar System Civilization," Journal of Aerospace Engineering, April 2012]

The potential for good is greater than the potential for bad. Space is more than just backup. If we destroy the world, we lose seven billion humans. An O'Neill group estimated that the asteroid belt alone had enough material to support 10-100 trillion (not billion) humans. [Johnson & Holbrow, "Space Settlements: a Design Study," NASA SP-413, NASA, 1977] A more recent estimate is 10,000 trillion. [John Lewis, Mining the Sky, 1997, p. 194] The galaxy could support many many more than that. Our actions now could enable those lives. A decision theorist would multiply projected population by probability to calculate expected value. The probability of various futures is highly subjective, but any reasonable probability of enabling trillions of humans gives an enormous expected value in terms of human life, greater even than the negative expected value of destroying Earth. Years ago, science fiction inspired our first steps into space. We need it to do that again.