Hackerspace Space Program (HSP)

Volume I: Technical and Management Proposal

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Name of Lead Organization:	Hackerspace Space Program (HSP)
Type of Business:	Nonprofit
Organization Members:	Sean Auriti, Alex Cureton-Griffiths, Min Lin Hsieh, Jerry Isdale, Cole Santos, Ricky Ng-Adam, Paul Szymkowiak, Huei Ming Tan
BAA Technical Thrust Area Addressed:	3. Advanced Space Systems and its sub-mission thrusts: 3.a Resilience in Space Operations 3.b Assured Space Access 3.c Stability
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Disclaimer: This proposing organization and individual team members are NOT providing scientific, engineering, and technical assistance (SETA) or similar support to any DARPA technical office(s) through an active contract or subcontract.

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"*The Earth is the cradle of humanity, but mankind cannot stay in the cradle forever.*"

- Konstantin Tsiolkovsky -

Summary

1. Innovation

We propose a HSP organization based around the coordination of Hackerspaces (HS) worldwide. This organization will enable scalable grassroots community units collaborating with each other and with interested partners around the world to carry out activities dedicated to the enhancement of humanity's survivability. This is accomplished through the Hackerspaces serving as local hubs for community education, innovation and self-sufficiency, whereas HSP will encourage, support and coordinate activities that could not be accomplished by any one or few Hackerspaces such as expanding humanity's reach and presence beyond Earth orbit.

2. Results

We will create an important platform for local communities, young people and the general public to get engaged with space travel and exploration. We're in a unique position to engage wide interest, support broad involvement and apply an extensive set of problem-solving

skills and capabilities.

This platform will be one step in pushing mankind's limits to help us survive and thrive in space, as well as improving our chances here on Earth by spurring the innovation needed to solve global challenges, resource constraints and the need to get along in an increasingly crowded environment.

3. Technical Rationale

The development of HSP as an organization enables tighter coordination and closer collaboration between participating Hackerspaces. By rallying around what some would call 'humanity's adventurous, stubborn, mad and glorious aspiration to reach the stars' while maintaining our home planet's habitability, the HSP organization aims to inspire and galvanize more Hackerspaces to be better organized at contributing to the great challenges facing humanity today. At the same time, participating Hackerspaces benefit from the institutional support and networks in enhancing their own adaptability and ability to function as a community education and innovation platform.

As an actor on the global stage composed of an international membership and partners, HSP is committed to the promotion of responsible, peaceful and safe use of space. As an umbrella of multiple crowdsourced local platforms that facilitates the creation of an engaged and responsible global citizenry, HSP contributes a unique approach in aligning with and fulfilling related guiding principles as laid out in the 2010 National Space Policy and 2011 National Security Space Policy.

In attempting to achieve major endeavors, such as the first flight to the moon, mankind has pushed the boundaries of what's possible technically. In addition to yielding a long-term impact, it typically has very real near-term benefits. Space programs and related investments to date has resulted in benefits as far flung as improving water purification processes to better data communication protocols to enhancing breast cancer detection. We contend that the approach and technologies developed as this undertaking will have very direct impact to humanity here on earth, and that ancillary consequences will also benefit the Department of Defense and to NASA.

4. Technical Approach

Our approach is to support and fund Hackerspaces to function as local community hubs, carry out research and public engagement activities, conduct long term strategic foresight and planning to coordinate large scale international projects with the local hubs and lastly, to identify and expand areas of mutual relevance between terrestrial and space activities.

5. Experience

Participating hackerspaces are already working on projects related to growing food in self-contained environments, interstellar propulsion, lunar rovers and sustainable habitats. Individual members of the hackerspaces have experience in starting and supporting hackerspaces, fostering long-term organisations, project generation, research, engineering, mentoring, finding partners, marketing and education. Specific skills to date include product lifecycle management, hardware/software development, microfluidic engineering, low cost Scanning Tunneling Microscope setup, aerospace and Arduino.

6. Cost
Cost for the first two years of operation will be 500,000 USD at 250,000 USD per year, covering organisation setup, coordination, staff and funds for selected hackerspaces working on projects relevant to the mission. We foresee raising additional funds through sponsorship, fundraising, crowdfunding and (in the longer term) commercial spin-offs.

A. Statement of Work (SOW)

1. Objectives

We propose a HSP organization based around the coordination of Hackerspaces (HS) worldwide. This organization will enable scalable grassroots community units collaborating with each other and with interested partners around the world to carry out activities dedicated to the enhancement of humanity's survivability. This is accomplished through the Hackerspaces serving as local hubs for community education, innovation and self-sufficiency, whereas HSP will encourage, support and coordinate activities that could not be accomplished by any one or few Hackerspaces such as expanding humanity's reach and presence beyond Earth orbit. These Hackerspaces will inspire others to do the same through the successes of projects. One of the great strengths of hackerspaces is unfettered autonomy, so to augment this an advisory board will provide a centralised body to help support interaction between Hackerspaces within the HSP and between the HSP and external organisations. HSP community members with prominent, credible profiles in space-related research and development will be approached and encouraged to help build and strengthen relationships related to the program.
For many, space exploration is still seen as being too difficult a challenge to be doable, too distant to relate to on a personal level, too immense to contemplate its infinite resources or too slow to realize any tangible payoffs. The HSP organization aims to dispel this way of thinking, and convince the public to shift away form this paradigm.
We propose the HSP vision as *to enhance humanity's survivability and enabling long-distance manned spaceflight for the purpose of space exploration and settlement.*
The HSP mission is to:

1. Enable Hackerspaces as local community hubs to carry out research and public engagement activities (such as leadership and technical workshops for youth) to support the HSP vision in concert with external partners
2. Apply principles from strategic foresight and planning for the central leadership to coordinate large scale international projects with the local hubs and project partners
3. Identify and expand areas of mutual relevance between terrestrial and space activities

Initial goals within the first five years of operation are:

1. Realistic short and medium term research and engineering projects that build upon larger goals of the HSP organization and Hackerspace self-sufficiency,

2. Widened engagement with youth through leadership and educational programs while building a multigenerational knowledge base and mentors,
3. Organization of annual public symposiums to facilitate cooperation and communication between participating hackerspaces, partner organisations and the wider community.
4. Working to build strong collaboration with other groups, such as Project Icarus, Hackerspace Global Grid, etc

Our immediate 2-5 year plan would be to channel a portion of the grant funds into a variety of realistic short and medium term projects that fit into the larger plan and use the successes to solicit crowd-funding, partnerships and productization. This will give the opportunity to space enthusiasts to move beyond part-time endeavors while equipping further Hackerspaces with the tools they need to build space technologies. We will also be funding projects with a humanitarian focus to obtain design and field experience in generating low cost, reliable and environmentally sustainable sustenance, health and hygiene solutions to rural communities and disaster stricken areas. These projects will be crucial in widening youth engagement with space and establishing a multigenerational knowledge base for youth to learn from or projects for them to improve on. The key here is to aid in generating demand for the nascent private spaceflight industry and enthusiast organizations to provide cheap alternatives to accessing Earth orbit.

An open-source/creative commons knowledge base will be created to explore technologies and expertise regarding space exploration, with a focus on practical “how to” elements. As a by-product we will look into the history of human exploration to search for more lessons; survey the major players in the space community to examine areas of mutual interest; and track relevant trends that could disproportionately affect the trajectory of the HSP organization. At the same time, local hubs will carry out outreach and education programs as well as explore academic/industrial partnerships. A major effort will also be in using a portion of the grant money to organize a follow up HSP Symposium in 2013. By 2016, it is envisioned that education programs and crowdsourced product design and manufacturing will form the basis of Hackerspace revenue streams supplemented by fundraising activities.

From 2016 to 2021 the HSP organization will oversee the completion and commercial implementation (i.e. spin-off companies from the originating hackerspace) of its engineering programs as well as encouraging project proposals from hackerspaces that intend to address sustainability issues, such as providing for a significant portion of the food, water and energy needs of its community (which ensures project longevity and has implications for self-sufficiency in space). This will be followed up by more advanced projects between 2021 and 2031, focusing on the expansion of human presence into Earth orbit and beyond. Similar hackerspace projects to date include participants in the Google X Prize and the hacker satellite network to develop an alternative internet infrastructure. Depending on the prevailing economic, social and technology trends, the HSP organization will be planning and executing the next spiral of engineering programs targeted towards the exploration of the outer Solar System and aiding settlement of the inner Solar System for completion by 2061. Another

roadmap will begin its planning phase in 2051 for implementation in 2061 to chart the HSP course in the second half of the century time frame as it becomes clearer if, for example, Kurzweil's singularity trends has bought significant progress to use commercial hardware to assemble and launch a kilogram sized probe containing an uploaded human consciousness as a reconnaissance mission to Alpha Centauri.

2. Technical Approach

Our approach is to support and fund Hackerspaces to function as local community hubs, carry out research and public engagement activities, conduct long term strategic foresight and planning to coordinate large scale international projects with the local hubs and lastly, to identify and expand areas of mutual relevance between terrestrial and space activities.

3. Deliverables

A kick-off meeting will be held in Arlington, Virginia immediately upon award and shall submit an annual report at 12 and 24 months, containing a balance sheet, cashflow statement, and list of specific investments/projects carried out by the HSP organisation. The report will also be available via a publicly-accessible website throughout the existence of the HSP organization. The organization will provide to DARPA, at minimum, Government Purpose Rights to the annual reports with contents as described above, submitted by the organization to the agency in accordance with FAR 27.404-3 (a) paragraphs (3), (4) and (5). The HSP organization anticipates that any intellectual property developed by the organization would be published under an open source intellectual property licence.

B. Technical Rationale

Why the HSP? Why Hackerspaces?
There are several advantages of relying on Hackerspaces for generating a grassroots movement for HSP:

- The philosophy is one of openness, sharing, collaboration and communities which is essential for humanity to building the knowledge and expertise to reach the stars.
- Hackerspaces are best suited to attract space enthusiasts with technical skills without completely alienating interested individuals from other specialties.
- Hackerspaces are created and managed by stakeholders in their local communities, ensuring they are inherently agile and adaptable to their local environments
- Hackerspaces are long-lived, due to influx of new members and ongoing knowledge/expertise transmission from experts to novices. This allows long-term planning and projects.

- Hackerspaces are self-sufficient, relying on assistance from member volunteers and revenue from projects built in the community.
- Hackerspaces connect to nearby organisations in schools, universities, companies and the wider community through their members.
- On an international level, multiple Hackerspaces will be able to function as swarm intelligence in completing large-scale complex projects

Due to the importance of Hackerspaces as building blocks to our HSP proposal, we provide a working description of Hackerspaces:

> *Hackerspaces are community-operated physical spaces which have been in existence for many years in various places around the world largely independent from government sponsorship. Each Hackerspace is an autonomous entity, but they all share the same philosophy of having fun building things together.*
>
> *A core feature is to provide an open participation environment where people of all ages and from various disciplines learn hands on in a collaborative, fun manner by making prototypes and tinkering with devices, participate in international competitions or do ambitious projects from flying machines to biology hacking. Hackerspaces typically use OpenSource and OpenHardware technologies# and generally have a consensus-based, democratic or even anarchic approach with a focus on action. Examples of activities and projects in Hackerspaces include a wide variety of inter-disciplinary projects in mechanical, electrical, software engineering disciplines, arts and/or design with a focus on teaching each other how to make things and how to make them work.*

Hackerspaces themselves are part of a large family of organizations variously called FabLabs, TechShops, Makerspaces, etc, that exist all around the world. When we use the term Hackerspaces in this document, we are inclusive of this family of organizations.

The HSP mission is to enable Hackerspaces to function as local community hubs and thus:

- Carry out research and public engagement activities to support the HSP vision in concert with external partners
- Conduct long term strategic foresight and planning to coordinate large scale international projects with local hubs
- Identify and expand areas of mutual relevance between terrestrial and space activities

We aim to accomplish the above by funding and supported selected projects relevant to the mission of the HSP, in addition to coordinating disparate projects to work towards a common goal.
As an example of global collaboration on space activities, five Hackerspaces from Australia, Maui, New York, San Francisco and Shanghai submitted a joint response to DARPA's BAA-11-13 Request for Information exercise. Some of them already have space projects in their portfolio, such as Noisebridge in San Francisco with its SpaceBridge program.

Technical Rationale for HSP Projects

We will initially be starting small, since public data on commercial-grade software/hardware is currently lacking. Our initial focus will be building technical capabilities, facilities and expertise across the hackerspace community. Our ultimate goals are nothing short of supporting missions matching the prestige and complexity that national space agencies, the military and private "newspace" corporations are beginning to today. When individual hackerspaces submit projects for funding consideration from the HSP, the organization will look to help support those projects by coordinating between hackerspaces and allocating funding to best support as many viable projects as possible. Where possible, the HSP will look at opportunities for hackerspaces to collaborate on mutual projects and problem solving. We foresee initial projects (in the first 12-24 months) as an open solicitation for hackerspace led projects. Project proposals will focus on target achivable goals in open-source/open-hardware development of small satellites (picosats, balloon sats, suborbital etc.), sensing equipment for space technologies (e.g. spatial sensors, environmental sensor modules, telemetry systems, and remote viewing capabilities), and proof of concept hacks (e.g. lab meat, low mass aeroponics, space resource utilization, space manufacturing, etc.)

Modalities of investment/research

Where possible, the HSP will support continuous selection of project proposals on specific themes. Those themes will be submitted by the global Hackerspace community, and selection is facilitated through a board of directors, with one director per Hackerspace supporting the HSP organization. The actual selection mechanics will be evolved over time.

Selected entries are then provided with funding to be distributed to sustain small teams at each physical space with very specific goals and deliverables in a short time-frame of 3 to 6 months. For the first two years, a new project is selected every 3 months and receives support from two full-time HSP staff, including on-site visits where helpful. Having HSP staff on-site will help communication within the community and externally, and documentation and retention of results.

A third of the funds are expected to go to the community itself (education, space, common tools), a third dedicated to acquiring project specific parts and tools and a third to financially supporting one or more contributors with the goal of having the contributor(s) work full-time for the time period during which the selected project is initiated.

Each individual Hackerspace project will be building on previous designs of the entire organization via an OpenSource and OpenHardware community approach. Progress is reported to the global community with online access to technical documents, blogs and video reports; continued funding is predicated on these reports being produced.

Areas of investment/research

There are three investment areas we want to focus on in the first decade: education, space economy and biospheres.

The first area is creating new generations of makers and researchers who can research and implement the necessary technologies. This will be in the form of an open source education

program, with both self-education and group-education components, designed to teach successive generations the basics of Maker/ Tinker/ Hacker thinking and encourage continual innovation and improvement of the program itself. We also want to inspire an interest in space development through providing opportunities for applied sciences and engineering.

Second, investments in projects to create a viable Near-Earth space economy:

- Space prospecting and mining: Focusing on automated small body electronics: robotics, remote sensing, navigation.
- Space power station: Providing energy to the Near-Earth space facilities. Solar panels, microwave power transmission
- Space manufacturing: Once provided with power and material, it is possible to start manufacturing in space. To scale up production, research into self-replicating 3D printing machines and fully automated manufacturing.

Finally, efforts to make it possible to live autonomously in space and other planets of the solar system through the creation of self-encapsulated biospheres with improvements in hydroponics and waste recycling.

The specific topics and projects in the second and third investment areas will be determined by the interests of the Hackerspace community and the projects that are submitted for funding consideration, however they are likely to relate to the topics outlined here.

C. Results

We propose the HSP vision as *to enhance humanity's survivability and enabling long-distance manned spaceflight for the purpose of space exploration and settlement.*
The HSP mission is to:

1. Enable Hackerspaces as local community hubs to carry out research and public engagement activities (such as leadership and technical workshops for youth) to support the HSP vision in concert with external partners.
2. Apply principles from strategic foresight and planning for the central leadership to coordinate large scale international projects with the local hubs and project partner.
3. Identify and expand areas of mutual relevance between terrestrial and space activities.
4. Consolidate the deliverables and outcomes - in the first instance in terms of IP, but ultimately products and services too - into a shared base of knowledge and resources.

The Organisation

When established the organisation will be a 501(c)(3) non-profit organisation providing grants

to hackerspaces worldwide, to focus on projects that help accomplish the HSP mission objectives. The HSP organisation also shares several areas of mutual interest with the US National Space Policy, including energizing and fostering new industries, expanding international cooperation on space activities and strengthening stability in space.

The results of the hackerspace space program will be a variety of innovative technologies developed by hackerspaces around the world, many with applications both terrestrial and extra-terrestrial, with military and civilian applications. Examples of projects currently being worked on include nano-satellite testing equipment, food production, interstellar farming, propulsion, extraterrestrial habitats and industrial systems. As funding begins and more hackerspaces sign up, we foresee a greater number of more advanced projects, all of which will be open-source and open hardware (i.e. non-proprietary).

D. Experience

Participating hackerspaces are already working on projects related to growing food in self-contained environments, interstellar propulsion, lunar rovers and sustainable habitats. Individual members of the hackerspaces have experience in starting and supporting hackerspaces, fostering long-term organisations, project generation, research, engineering, mentoring, finding partners, marketing and education. Specific skills to date include product lifecycle management, hardware/software development, microfluidic engineering, low cost Scanning Tunneling Microscope setup, aerospace and Arduino.
A diverse range of projects are being carried out by other hackerspaces around the world (who may be potential candidates for funding in future) including 3D printers, small-scale local surveillance via GSP, agricultural robotics, open source mill routers, mesh networks, laser cutters, solar power, open source GSM networks, web connected gadgets and many more. With such a varied range of technologies being worked on, cross-fertilisation, adaptation and alternative use cases will bring new ideas and tools to the HSP.

E. Facilities

The main facilities used for the HSP are hackerspaces, which are located worldwide and self-sustaining. They will be responsible for project generation, proposal application, project development, etc. Tyical equipment includes 3D printers, CNC routers, laser cutters, metalworking tools, etc

F. Organization

Ownership

Organizational ownership of HSP is a question of participation and control. Any individual or organizational entity can choose to be a participating member of HSP, but the HSP organization

is controlled by individuals who have accumulated sweat equity. In other words, membership of the HSP organization is open to all individuals and organizations who choose to join, but strategic decision making (i.e. dealing with issues that impact the entire organization) is carried out by a group of Hackerspace representatives who are acknowledged by their peers to possess leadership qualities needed in the HSP organization (e.g. personal integrity, competence in a technical field or organizational ability and inclusivity) and have made significant contributions to their Hackerspace and/or HSP organization. Each Hackerspace carries a single vote in deciding HSP strategic decisions and these decisions will be made by distributed leadership with consultative input from the overall HSP membership whenever possible, and half of the leadership group will be put up for reconsideration every five years. This is intended to balance the need for maximum accessibility and flexibility in participating and gaining access to HSP activities, knowledge base and facilities while providing consistent strategic direction through a stable and frequently refreshed leadership within the organization.

For its intellectual properties, an open source cloud based knowledge base for the entire HSP organization is planned for, but it is anticipated that the Hackerspaces would duplicate the knowledge base on a smaller scale as a local knowledge hub. By embracing the open source philosophy, all knowledge is open to all. However, innovators and skilled participants retain an advantage with their supporting infrastructure. A two tiered approach is similarly envisioned for acquisitions, physical assets and financial holdings. Conversely, any responsibilities incurred by liabilities to a Hackerspace are to be diluted and shared by nearby participating Hackerspaces and supplemented by insurance coverage depending on the nature of the liability.

Ownership issues when dealing with HSP and Hackerspace partners will be decided by the lead partner, or a separate entity may be formed to deal with matters pertaining to an equal, joint project.

Organization legal form

A non-profit 501(c)(3) entity will be registered in the U.S. This entity will house the core nexus of the HSP effort and its membership with participating Hackerspaces to retain its existing organization and a significant amount of autonomy. 501(c) entities creation and management are well-understood in addition to providing opportunities for tax-deductible donations to further the existence of the organization beyond the first 24 months covered by the grant. A constitution for the organization will be created by the founding members prior to the incorporation of the 501(c)(3) in line with the organizational principles outlined above.

501(c)(3) exemptions apply to corporations, and any community chest, fund, cooperating association or foundation, organized and operated exclusively for religious, charitable, scientific, testing for public safety, literary, or educational purposes, to foster national or international amateur sports competition, to promote the arts, or for the prevention of cruelty to children or animals. These bodies are often referred to in shorthand form as "Friends of" organizations.

America is still the premier superpower, the world's largest economy for at least the next 15

years and arguably still the most successful country at space exploration, so it is important to establish the initial organization in the USA for ease of partnerships with domestic USA partners.

Ownership structure

The HSP organization favors openness and inclusiveness with a focus on quickly building up participation and partnerships with existing organizations from around the world to reach its long-term goal. Due to the tremendous mismatch between the funds made available through the grant versus the funds required to eventually achieve the goals of the HSP, there is a need to ensure that an independent, autonomous collection of self-sustainable communities is created around the world.

The HSP will provide international Hackerspaces with an overarching goal to bring them together and a central nexus leadership to connect the disparate efforts. By having a board of directors made up of one representative by participating Hackerspaces, we ensure that a wide variety of viewpoints and needs are represented.

As local communities, Hackerspaces are adaptive to their environment and their local societies. Some are privately incorporated, some are non-profits, some are part of universities and schools, some are funded by individuals, some are sponsored by corporations or governments and some are cooperatives. This diversity in the organizational forms of Hackerspaces ensures that they are likely to allow for long-term adaptability in the HSP organization.

Management & Organizational Structure

Structure of the HSP organization

The HSP will take the lead in addressing the challenges of interstellar travel. It will manage memberships, receive and distribute the grant from DARPA and other participating organizations, organize international development, and promote the goals of individual participating Hackerspaces. The international hierarchy is designed to be flat in a decentralized, scale-free network similar to the internet, but with significant local autonomy and control consolidated into a local Hackerspace's leadership. Each local Hackerspace will decide on the focus and portfolio of their contributions by consensus, taking into account their members' passions, areas of interest and capability. In the near term, individual contributors at the local Hackerspace level are expected to be students, interns, researchers, professional engineers on sabbaticals and hobbyists. This will build up into a community of experts, budding enthusiasts and interested learners in a self-sufficient enclave which also conducts public outreach activities. Where possible, a master-apprentice system is established to ensure a continuous transfer of leadership and technical skills and knowledge to younger stakeholders.

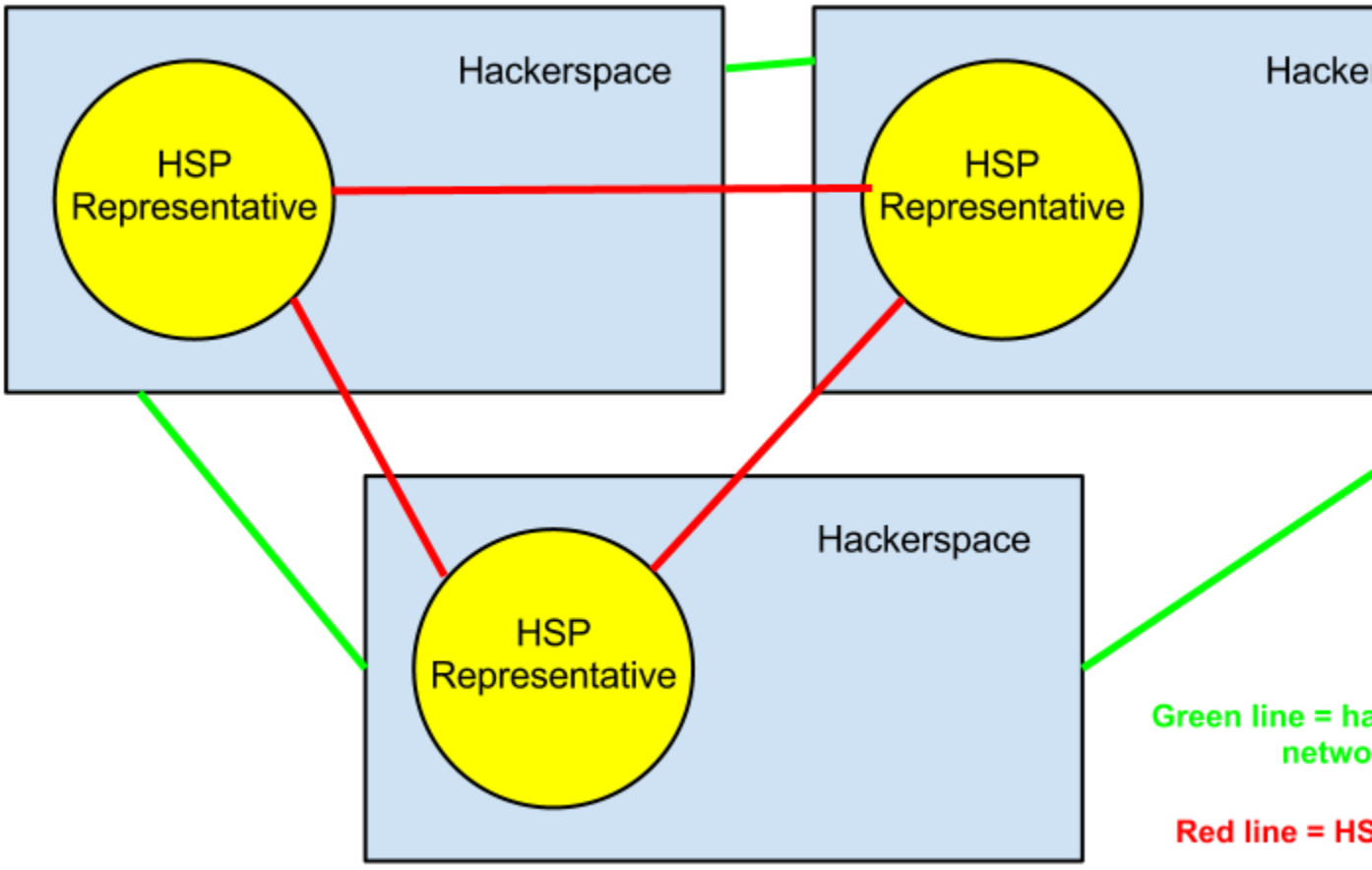
While each Hackerspace maintains its own individual bylaws and organizational structure, the

HSP organization, designs, directions, and bylaws are decided by a majority vote of all participating Hackerspaces on the basis of one Hackerspace, one vote. New Hackerspaces join by being voted in by majority. Voting, discussion and communication will take place via web based social networking software dedicated to organization governance, or as new forms of virtual collaboration become available.

An annual or biannual international event will be organized to demonstrate progress, hold design discussions, set objectives/key results for the following year and hear research talks from scientists and technical talks by engineers. This event will be modeled and/or be part of the annual Maker Faire or similar events, with more frequent regional events to facilitate knowledge sharing and collaboration between Hackerspaces in neighboring countries.

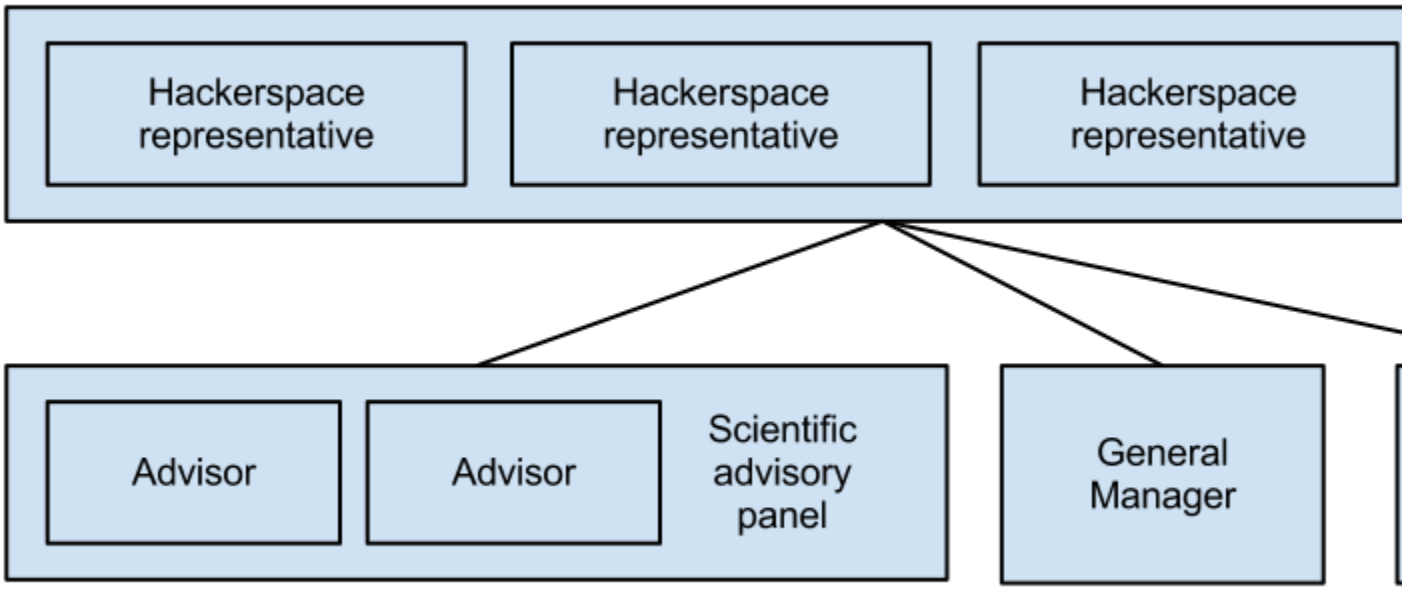
HSP Network Structure Diagram

This is a simplified version of the network structure of the HSP organisation. Every hackerspace that joins will be part of the network of participating hackerspaces, and each hackerspace will elect a member to represent them on the HSP board. For the sake of simplicity, the diagram below shows only three hackerspaces.



Organisation Chart

The HSP organisation has a relatively flat structure, with a board made of representatives of participating hackerspaces, who manage policy and select the scientific advisory panel, general manager and community manager.



Staff roles

Both community and general managers are staff members of the HSP organization. These are full-time volunteer positions created and financially supported for the first two years to facilitate the initial startup phase of the organization. Staff will be voted in by participating Hackerspaces and renewed or changed every 3 to 6 months (with the duration of each term to be extended to 5 years). These roles will be filled by the end of 2013.
Staff members will operate out of Hackerspaces across the world and are committed to implementing the Statement Of Work detailed in this document.

The two roles are:
Community manager: in charge of leading vision and coordination, project generation and evaluation, documentation and evangelizing the HSP internationally. Responsible for reporting and covering efforts being done online while discussing, documenting and sharing a global vision for the HSP organization as chief evangelist.

General manager: in charge of planning, purchasing, finances, and marketing for both the central HSP organization and the projects funded by the HSP in Hackerspaces.

Scientific and engineering advisor

A scientific and engineering advisory board will be created with the purpose of providing technical expertise and advice in evaluating how effectively projects fit with the long-term goals. Advisers will be recruited from the hackerspace community wherever possible, based on their experience in science, engineering and space-related endeavors.

Hackerspace representative

Hackerspace representatives (board of directors) are individuals selected by consensus to represent their Hackerspace's vote on strategic decisions such as which projects to fund and when, staff roles, new Hackerspace members, etc.

Initial caretaker group and their biographies

This caretaker group will help get the project started and move the HSP organization towards a democratically elected staff by the participating Hackerspaces representatives.

Ricky Ng-Adam is a software engineer with over 10 years of experience. He left his job at Google as a Software Engineer in Test to join the local Hackerspace in Shanghai XinCheJian from June 2011 to March 2012. He's the "project generator" for XinCheJian and the person who initiated the original reply to the Request For Information for DARPA HSP. He was also an eager participant to the first HSP symposium, serving on the organization panel to discuss the role that Hackerspaces could take in a century long interstellar space program.

Min Lin Hsieh is a software engineer with experience in Product Lifecycle Management. She's currently responsible full-time for the events planning, trips planning, purchasing, marketing material and finances management of XinCheJian as a volunteer.

> Both Min Lin Hsieh and Ricky Ng-Adam have experience working together closely on these projects. As an example, they've started a autonomous robot submarine student club (http://sonia.etsmtl.ca) that is not only still in existence ten years later but has just finished first at the international robot submarine competition in the summer of 2011.

Jerry Isdale is a software engineer with a long career in a variety of leading edge software systems from early computer animation for film and TV to DARPA and other DoD funded research projects. He was the lead engineer for the DARPA PENCIL project in 1994-96, developing a pen notebook computer/email system providing interactive maps, forms and coordination applications for the US Army National Guard. He was a developer and research scientist on several other DARPA projects for ISX Corporation and HRL Laboratories LLC. He worked on Aerovironment's Global Observer Apple OSX based Ground Control Segment until 2009 when he left to start Maui Makers, a makerspace on the island of Maui, HI. He will be responsible for coordinating and participating in various engineering and educational projects for the organization.

Cole Santos is a conservation specialist with experience in water supply conservation practices, intergrated urban agriculture/aquaculture ,and **composites manufacturing**. He attended the

University of Hawaii in Philosophy and Aquaculture. He is responsible for idea synthesis and unusual part acquisition at Maui Makers. Cole will offer his skills to participating in various engineering and educational projects, promoting the HSP, and hacking stuff together.

Huei Ming Tan is a teaching staff at the National University of Singapore, having joined in 2010 upon completion of his bachelors degree in Engineering Science. His current responsibilities till June 2012 include mentoring students in engineering projects to construct microfluidic devices, a low cost Scanning Tunneling Microscope setup and Wi-Fi antennas as well as ancillary duties of lab management, product evaluation and acquisition of research equipment and project/lab consumables. A space geek, he has co-authored a HSP RFI submission with Eddie Choo and was an organizations panel member at the HSP Symposium together with Ricky. He is currently in discussions with potential partners and will be lead coordinator of HSP activities in Singapore, based at the upcoming Sustainable Living Lab, of which he is a founding member.

Paul Szymkowiak is a software development consultant with 25 years of working in, managing, coaching and mentoring software development teams. He worked for 7.5 years with Rational Software (a company well-known for its involvement in Mil Aerospace projects), and is one of the authors of the Rational Unified Process development method (RUP). He is a "Buccaneer Scholar", self-educated since leaving high school, and has spent much of the past 3 years "learning by doing" as an active member of the Maker and Hacker communities. He a founding member of Connected Community Hackerspace (CCHS) based in Melbourne, Australia, and is activePaul will offer his skills toly involved in managing, promoting and educating about Hackerspaces. help establish the HSP organizational structure and program of works, and will work on an ongoing basis in establishing the underlying education program and managing various projects as part of the program.

Alex Cureton-Griffiths is a marketing consultant based in Shanghai, China, and regularly attends Xinchejian. With an interest in space from a young age, he wants to spread the HSP message and "bring about the tomorrow we were promised yesterday." He has experience in entrepreneurship and marketing and currently updates the HSP wiki. He is interested in promoting the HSP to hackerspaces, academia, sponsors and the general public, as well as building the HSP organisation and putting in place a focused, international effort to get hackerspaces into space.

Sean Auriti Sean's experience with electronics began at age two when he accidentally, on purpose, bit into an electrical wire. While earning his B.S. in Electronic Engineering at the New York Institute of Technology, Sean worked for his school diagnosing and repairing software, hardware and security problems.

Sean's professional career revolves around a variety of technology based services. In addition to his role as an exceptionally skilled Web Developer, Sean has also excelled as a Director of Technology and a System Administrator.

For the past year, Sean has been spending his after office time at Alpha One Labs, a community hackerspace in Brooklyn, where he collaborates with other members on unique projects including a tweeting Christmas Tree, laser controlled lights, a telepresent bot, 3D POV and multiple space related projects.

Hackerspaces interested in joining the HSP

This is a sample of existing Hackerspaces with at least some members having shown an interest in joining the HSP.

XinCheJian, Shanghai, China. (http://xinchejian.com)
Interstellar Farming (Ricky Ng-Adam, rngadam@xinchejian.com)
XinCheJian is the first Chinese Hackerspace with initial space of 100 m^2. The Hackerspace interest is in exploring how to grow food in self-contained environments with a variety of applications in modern urban farming. Our urban farming projects are in partnership with Susan Evans, a Tongji University M.A course Sustainable Design lecturer and founder of kplunk (http://kplunk.com), an organization committed to a sustainable future by creating demand and markets for sustainable living. Future projects include automated environmental monitoring and growing meat.
Alpha One Labs, Brooklyn, USA. (http://alphaonelabs.com)
(Multiple space related projects psytek@alphaonelabs.com)
Alpha One Labs Hackerspace was founded in July 2009. Promoting radical inclusivity, Alpha One Labs aims to provide a fun, tool rich space for users of all ages and interests to work on projects together. We meet every Tuesday from 7-10pm and it is open to all. Alpha One Labs is exploring multiple space related projects.

Connected Community Hackerspace (CCHS), Melbourne, Australia. (http://hackmelbourne.org)
(Main contacts: Andy Gelme, Luke Weston, Secondary contact: Paul Szymkowiak)
CCHS members have been undertaking space-related projects over the last couple of years as part of structured efforts such as the http://lunarnumbat.org build team and the Australian Space Research Institute (ASRI), in addition to working on less-structured amateur projects. Projects include: Lunar Numbat is a partner of WhiteLabelSpace who are competing in the Google Lunar X-Prize; Working on ASRI AusRoc 2.5 rocket engine control; and Amateur hobbyist rocket avionics, e.g. MobSenDat, for Linux Conference Australasia (LCA2011).
Maui Makers, Hawaii, USA. (http://mauimakers.com)
Extraterrestrial Habitats/Industrial Systems - (Cole Keaoulu Santos, cksantos85@gmail.com)
Engineering & Education - (Jerry Isdale, isdale@gmail.com)
Maui Makers was founded in 2010 as the first makerspace in Hawaii. Members have a wide range of interests and projects ranging from computer activities such as web development and microcontrollers to agricultural and sustainable habitats. We are working on state of the art aquaponics demonstration systems that incorporate microcontrollers and pressurized and gas

optimized grow chambers, as well as a network of low cost RF linked weather stations for monitoring microclimates of sparsely populated (island) locales. We also mentor the local high school robotics club.
Current and future projects include: atmospheric water farming (chillbox), pressurized and gas optimized grow chambers, SCADA environmental control systems for habitats, low cost wifi weather stations, one man closed cycle habitat, Biogas systems for LOX/Methane rockets, co2 agriculture enrichment and hydrogen sulfide ore leaching.