Public Invention Q3 Report, 2022

-- Robert L. Read (Rob), October 10th, 2022

This the Q3 quarterly report of Public Invention for 2022.

REMINDER: Board meeting on Sunday, October 9th, at 2:00 pm Central.

Introduction

This quarter saw a different rhythm. In July, we got a short-term contract with NASA which consumed almost all of my time. In August I went to Tanzania with my local Engineeers Without Borders chapter, where I successfully tested the Moonrat project. On my return, I got COVID. After this, my wife and I took a planned 3-week vacation to Greece. I seem to have recovered fully from COVID, because as John Gibbons has said, I always had a little brain fog to begin with.

In yet another action, our relationship with Sustainable Progress and Equality Collective (SPEC) is going well. Lee Erickson and Lawrence Kincheloe have built a useful hardware device, the General Purpose Alarm Device (GPAD):

https://github.com/PubInv/general-alarm-device

We have 15 functional GPAD boards. I suspect we will someday need a new version, as is typical, but this is great progress. My hope is that this will be useful for the PolyVent. Additionally, I hope that we can sell this as an actual product, because it has wide utility. This is new territory for Public Invention, but an important growth step: we may need to build and sell devices to have more impact than the mere academic papers and open-source designs that we produce. I expect our relationship with SPEC to be mutually beneficial as they use this project for the Research Associates.

In other news, I took the "Moonrat" portable incubator to Tanzania, where it performed well. That was a crazy and wonderful trip for Engineers Without Borders. This kind of work helps us to "keep it real" --- a village in rural Tanzania is a very gritty, real place. I would like to do a "short run" production of Moonrat, but this is a low priority for me.

When I return, the priorities for the final quarter of 2022 will be:

1. Making the Prometheus project a success, and getting paid for it.
2. Testing the PolyVent Educational Platform and making it a successful educational module.

3. Running a symposium on third-party open-source quality assurance, of which Victoria Jaqua and OSMS will be co-partners.
4. Complete my book (currently 72 pages): https://github.com/PubInv/intro-public-invention/blob/main/intro-pubinv.pdf and find a publisher for it.
5. Write a technical paper for the VentOS (with Dr. Schulz and Ben Coombs)
6. Write a technical paper for the PolyVent system (with Dr. Suturin, Nathaniel, and Antal.)

Basically, I am going to devote the last quarter of the year to doing only writing and marketing activities. Other projects, such as the ferrofluid pump and valve, will have to wait. Megan and I are discussing making a YouTube show/podcast. The monthly "happy hours" we have had have been pretty successful, with about a dozen people at each.

The NSF POSE Grant

Public Invention paid $5,000 to professional grantwriters to prepare a grant for the “Pathways to Opens Source Ecosystems” around our Freespireco concept (which predated the grant opportunity by years.)

Sadly, we did not win this grant. All of the 20 awardees were Universities. Although we seemed to receive very good review marks, we were not selected. The awardees appear superficially to be similar (but in different domains) to our own proposal.

The reviewers misunderstood two aspects of our proposal: They seemed to fault us for not addressing the process of FDA approval even though we were not going to manufacture any medical devices, and they seemed to penalize us for the fact that I draw no salary, thinking of that as a negative instead of a positive.

This was a very disappointing result; but I am encouraged and believe that if they open the same system in the future we stand a good chance of winning.

Most Important Projects

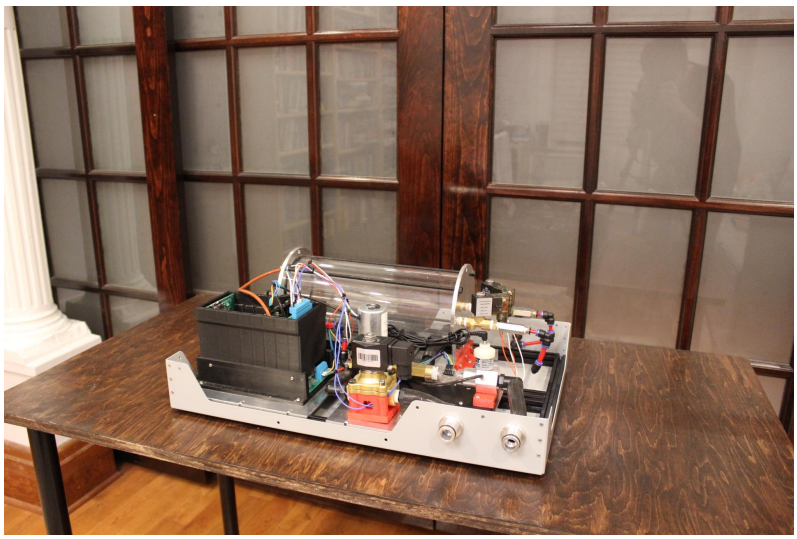
PolyVent

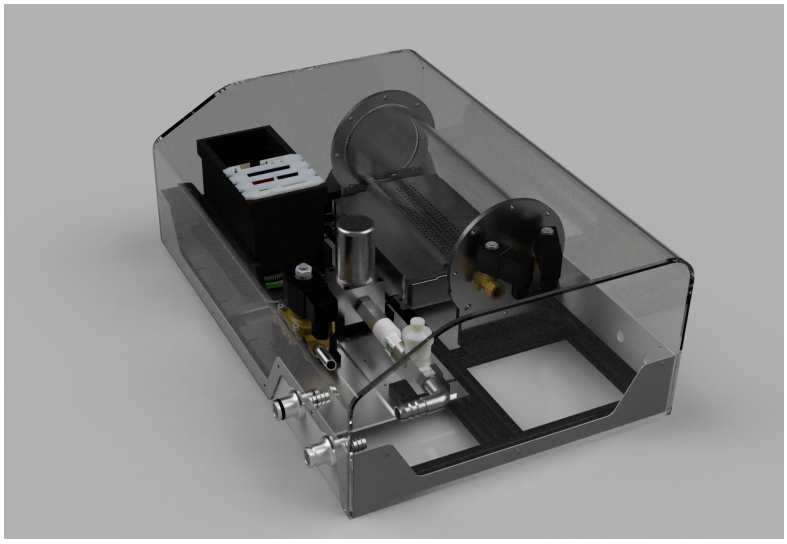
Rob received the PolyVent open source ventilator from Nathaniel Bechard. Unfortunately, it was damaged in shipping, but we are repairing it and learning how to ship it better. Nathaniel is now

in college and basically is done working on this project; he did a great job and we will support his career in any way possible. We now need to protect him by not asking too much of him. There remains some software integration with VentOS that Rob will do; but since this model is largely unchanged electrically, we think this is low risk.

Our goal is to use it in October or November in a classroom setting at Rice University in a course taught by Dr. Sabia Abidi. Our new volunteer Uday has made some nice PolyVent documentation for us; his contributions have already made the PolyVent more usable.

After it is tested at Rice, I will lead the writing of a paper for HardwareX. Victor Suturin will likely be the lead author on this paper, as he is the invention coach of this project, but I have written for HardwareX before. The PolyVent is one of the few pandemic-inspired ventilator projects still operating, and is the by far the most modular, most open, and best documented.

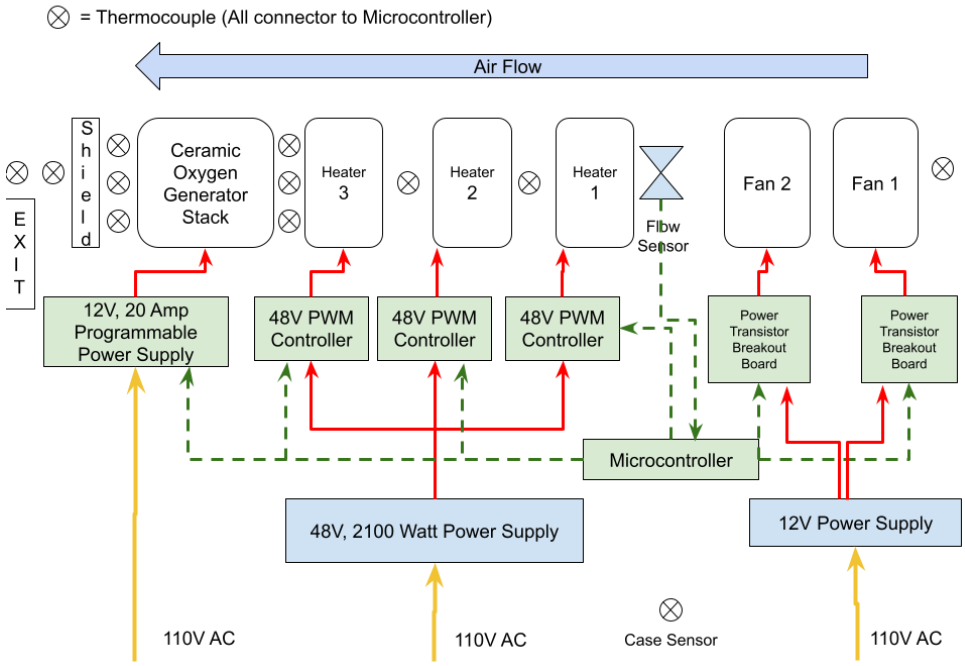




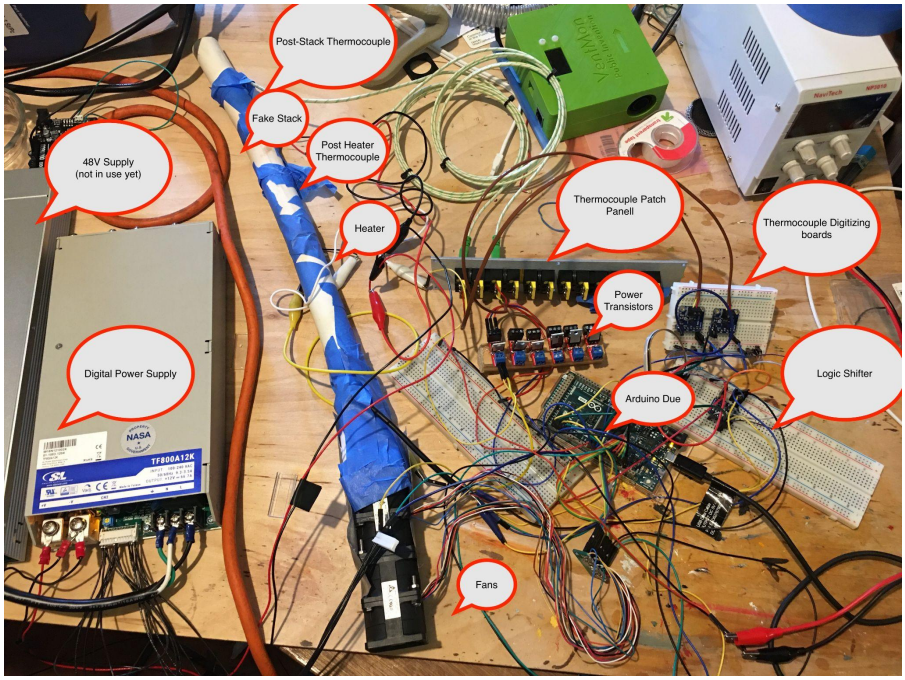
Since Nathaniel is now in college, it is our duty not to rely on him except for things that can absolutely only be done by him.

NASA Ceramic Oxygen Generator Project

Public Invention, with the assistance of Geoff Mulligan, successfully completed a 160-hour contract with NASA (for $140/hour) to write a report on recommendations for a digital control system for a startling technology they have developed. American Oxygen, a firm supported by NASA, has developed a ceramic wafer that can extract pure oxygen from air and other gases when a voltage is applied to it at more than 700C. This is essentially a solid-electrode fuel cell operated in reverse. This technology is a huge improvement of pressure-swing adsorption in that it is immune to fouling due to moisture and dust, which plague clinics in the developing world. While potentially equivalent to cryogenic oxygen separation, cryogenic separation is only done at very large scale; this requires large investment, trucks to ship cylinders, and good roads. The NASA technology could make small-scale oxygen production for a 4-bed clinic that does not have air-conditioning extremely practical. This technology could have a huge impact on the 700,000 kids that die due to childhood pneumonia every year. Possibly our work here will help commercialize this faster.



Of course, we didn't just write a report. We constructed a desk-top prototype of the control system to remove risk in our approach, and wrote a complete Arduino-based control system for it. This code is a fork of Ben Coomb's "the Ox" oxygen system, which is in turn a fork of the Helpful Engineering VentOS system (which was mostly written by Robert L. Read and Ben Coombs.)



NASA wants to extend our contract. It is our goal to do this while also supporting global health in this way.

Marc Jones has pointed out that this action will require us to get professional tax help for the 2022 tax year, since it is possible this “other business income” will be taxed. In general, we would prefer to receive “grants” rather than “contracts”, but our primary goal is to assist this technology coming to market. Dr. John Graf has mentioned the possibility of seeking grants (outside of NASA) for this technology from a global health point of view; we are happy to participate in that.

General Purpose Alarm Device (GPAD)

I am pleased to say that our collaboration with the Sustainable Progress and Equality Collective (SPEC) has produced in short order an important “invention” (although light on research and heavy on engineering.) Lee Erickson and Lawrence Kincheloe did a great job designing the below printed circuit board, which was received just recently and is ready for software testing (by me.)

The GPAD device is designed to be used as a multi-purpose “alarm device”. It has bright LEDs on the right that can be programmed to show “alarm level”, and a built-in buzzer that can produce a variety of pitches. It has a “mute” button on the face and a large LCD display to show the cause of the panic condition.

We dream that someday this will be a product sold at Adafruit, for example, to hobbyists where it can be used for anything from a cat door to a burglar alarm to a solar installation monitor system. However, one immediate use is to provide medical alarms for the PolyVent (this is not yet integrated.) Every mechanical ventilator needs an alarm system. Very few of the emergency pandemic ventilators had one. In keeping with the PolyVent philosophy, this system is highly modular, and supports local manufacture.

Glia Tourniquet Project

Last week I had a meeting with GLIA where they gave me the full rundown of the Tourniquet project. They are under budget due to some in-kind gifts. It is a very impressive organization; I feel confident that the $37,000 funneled through Public Invention to them is being wisely spent. These tourniquets will eventually advance emergency care globally; this is one of the first fully open-source medical devices. I have written a blogpost about this, but am waiting for Carrie Waken and Victoria Jaqua to approve the details before I publicize it.

Part of our agreement with Glia to maintain our 501c3 status is quarterly written status updates; I’m happy to say they have produced an excellent report for this quarter.

Passive Ferrofluid Check Valve

Veronica published our original paper at Engineering ArXiv. Rob put significant work into building a pump using this valve, by hand winding iron semi-circles and programming power transistors. The initial use of this pump failed due to leaks. This project is well worth continuing, but was put on hold due to the NASA contract displacing it.
Freespireco is our largest project, with many components.

Standards and VentOS

VentOS is a project of Helpful Engineering. However, it utilizes data standards and software created by Public Invention for the VentMon, including VentDisplay, PIRDS and PIRCS. We recently expanded PIRCS based on input from Erich Schulz, MD. These standards continue to evolve.

VentMon

Mr. Ben Coombs is designing the VentMon T0.5. The design is nearly complete, and manufacturing of 15 units may begin soon.

Financial Position

We have about $15,000. We owe Geoff Mulligan $15,000, and have invoiced NASA for $22,400.

Projects (Non-Freespireco)
A majority of Public Invention's work is organized into projects; our main mission is to invent things that help all people. These are our most active Public Invention projects:

Partnerships

Public Invention continues to support other teams wherever possible. Rob is an active board member of Helpful Engineering. We have encouraged a network of non-profits, including EBCC, GOSH, Helpful, FieldReady, OSMS, OSHWA to apply (separately) to the NSF POSE grant and are advising them.

Outreach

Miriam Castillo continues to recruit volunteers. We have improved the presentation of projects at our website, although we need to add all of the project.

Megan Cadena, our paid contract assistant, has taken a full time job, which caused an interruption in her work, but she continues to work 5/hours per week.

Events

We are hosting a working symposium on October 13th with many other non-profits and some university researchers to attempt to solve the global problem of developing a process and culture for quality assurance of distributed manufacturing of open source designs for medical devices. Victoria Jaqua is co-hosting this, and it is attended by representatives from UBORA, EBCC, Helpful, Nation of Makers, Internet of Production Alliance, and many others. This event is an experiment, but demonstrates real leadership on the part of Public Invention.

Additionally, we held a number of monthly “happy hour” meetings, which had about 15 participants. These were a big success, especially Megan’s jeopardy game.

Peer-reviewed Publications

Other Publications

Talks

Rob presented a talk on Freespireco at the Southern California Linux Expo (Scale 19x). It was attended by about 20 people and well received.

Partnerships and Cooperation

Public Invention continues to actively cooperate with Rice University, Helpful Engineering, OSMS, JOGL, and the Every Breath Counts Coalition.

Rob is mentoring a Freshman Design team at Rice University.

Our work with SPEC has been particularly fruitful.

Social Media Growth

Because of our Social Media Coordinator and Admin Staffs’ efforts, our social media presence has grown by the following amounts in 2021:

1. Our YouTube channel now has 303 subscribers.
2. Our Twitter handle now has 257 followers.
3. Our Google Group now has 86 members.
4. Our LinkedIn page now has 322 followers.

This is about a 25% growth over the beginning of this year.

Strategy for the Coming Year

Sadly we were not awarded the grant for Freespireco from the NSF. However, we will continue to support this.

A long-term goal is to raise enough money to hire an executive director so that Rob can focus on being head invention coach.
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