Public Invention Q1 Report, 2023

-- Robert L. Read (Rob), May the Sixth, 2023

NASA Ceramic Oxygen Generator Project

Perhaps our most important project and highest responsibility (after the advancement of our young volunteers) is the successful completion of the new \$50,000 contract with NASA to build an Oxygen Engine Digital Control System (OEDICOS). This project is well underway, though the schedule is tight at this writing. The contract ends June 15th.

We are developing a physical electronic control system in an enclosure which was made under contract by Public Inventor Forrest "Lee" Erickson. The wiring of this box is not yet complete, but the DC and AC power components have been tested.



Additionally, Geoff Mulligan has done significant work designing an formal "experiment" format which will allow us to define a temperature and power regime to run remotely. Additionally, he has developed a WiFi integration with data logging. The upshot of all of this work is that at the end we should have a completely remotely-controllable oxygen engine, which should be a tremendous benefit to NASA.

There is some discussion about yet another contract to build a larger system that moves from laboratory to a field deployable oxygen generation system.

When this technology is finally deployed, it will significantly improve the supply of therapeutic oxygen around the world. Public Invention is proud to be part of this work.

PolyVent

The flagship project of Public Invention is the <u>PolyVent Educational Platform</u>. The PolyVent may be the most sophisticated fully open source medical device ever produced and documented with fully open licenses, despite the fact that we have no immediate intention of seeking FDA approval. The PolyVent is not for use on human patients. But nonetheless, if a new pandemic forces us as a planet once again to rush to build ventilators, I claim that the PolyVent would be the best starting point for this effort. Public Invention has been in the center of the open source respiration device effort spurred by the pandemic, and we know of no other ventilator which is as fully open.

Public Invention recently attended the 2023 <u>Open Source Hardware Association (OSHWA)</u> <u>summit</u>, where we demonstrated the PolyVent with the new VentMon T0.5 and the <u>General</u> <u>Purpose Alarm Device (GPAD</u>) 0.2. Here is a picture of Lee Erickson demoing the PolyVent in combination with the GPAD and the VentMon.



We shared our table space with the <u>Sustainable Progressive and Equality Collective (SPEC)</u>, which co-developed the GPAD with Public Invention.

Here's a photo of Lawrence and Lee in Times Square (this was the first time they had been to NYC):



A critical goal of Public Invention is to sell five PolyVents at \$4,000 USD to institutions of higher learning and teaching hospitals. This is not to make money (this would be a little more than our costs) but would create a community of practice that will keep the technology alive. We can offer a discount to purchasers in low- and middle-income countries.

Rice University has expressed interest in purchasing two PolyVents by the end of the calendar year. We of course intend to spare no effort in making sure they are successful in this.

We are pleased to announce that our description of the classroom experience at Rice University using the PolyVent has been accepted to the <u>Association for Engineering Education conference</u> in Baltimore June 25th-29th, where Dr. Sabia Abidi and I will present it with our co-authors Nathaniel Bechard and Dr. Victor Suturin (though possibly only I will actually do the talking.)

General Purpose Alarm Device (GPAD)

The GPAD project is moving along rapidly. This semester Lawrence Kincheloe, with some help from Lee Erickson and myself, mentored two teams at Oklahoma University, which successfully explored a sound system to have the GPAD make pre-recorded spoken voice announcements and WiFi enablement. These two features will require a major redesign, but will make the GPAD widely usable.

Independently of this, we made the 0.2 version, which we successfully demoed connected to the PolyVent at OSHWA.



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

VentMon T0.5

Mr. Ben Coombs designed VentMon T0.5, and sent me two of them, which we successfully used for demos at OSHWA. The T0.5 is very small and a significantly improved design. Ben is going to make 13 more and send them to me. Our plan is to make a product offering of this as an IoT spirometer on our website. The photographs below show the T0.5 (on the left) compared to the T0.4 (on the right), showing how much smaller Ben has made it.



The VentMon, the GPAD, and the PolyVent are all essential parts of the Freespireco idea—the idea of create a Free-libre respiration ecosystem of cooperating components.

Global Open Source Quality Assurance System (GOSQAS) alliance formed

In October, Pubic Invention and Open Source Medical Supplies (OSMS) led a symposium attended by about 15 thought leaders around the problem of assuring quality in rapidly manufactured emergency and medical devices based on free-libre open designs. There was broad agreement that this is a serious problem and most of the attendees agreed to create a <u>Global Open Source Quality Assurance System (GOSQAS)</u> alliance. Robert L. Read of Public Invention and Victoria Jaqua (board member of Public Invention and OSMS) and Christina Cole of OSMS are leading this effort.

Our initial approach is to develop a completely open provenance tracking system.

Participants in the GOSQAS alliance include:

- Public Invention
- Open Source Medical Supplies (OSMS)
- University Health Network Advanced Perioperative Imaging Lab (APIL)
- Every Breath Counts Coalition (EBCC)
- Helpful (Helpful Engineering)
- IoPA (Internet of Production Alliance)
- UBORA
- OSHWA (Open Source Hardware Alliance)

At this time, we are negotiating with a commercial firm to "white label" their product to perform open provenance tracking for rapidly manufactured devices. This will accomplish our purpose much more quickly than any technology we could build ourselves.

Glia Tourniquet Project

Public Invention has been acting as a fiscal sponsor for GLIA, a Canadian firm that makes an <u>open source tourniquet</u>, which is particularly in demand in Ukraine. We have raised over \$37,000 in partnership with them (included in our donations), which have already been transferred to their team. They have also given us quarterly reports in writing as we have requested.

Based on their Q1 reporting, I've written a <u>blog post</u> describing their current status. They have developed an open injection mold for desktop injection molding equipment. A small team in Poland is planning to produce 1000 of these tourniquets for Ukraine directly.

Passive Ferrofluid Check Valve

Veronica Stuckey, the public inventor behind the Ferrofluid project, published her team's original paper at <u>Engineering ArXiv</u>. Rob, the Invention Coach, 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.

A new volunteer, Lisa Kotowski, is now working on the passive ferrofluid check valve, attempting to perform a theoretical analysis and possibly program a simulation.

The Unscrew Propeller

A new volunteer, Matthew McCartney, has been doing a computational fluid dynamics simulation of the <u>unscrew propeller</u> invention. The initial analysis suggests that it does not work. Despite the apparent success of the video, it is possible that this is explainable by some other effect. However, this is a tricky situation to analyze, and he is still working with Rob.

Financial Position

We have about \$10,000 in cash, considering our accounts payable.

Outreach

Miriam Castillo continues to recruit volunteers. We have improved the presentation of projects at our website, although we are still updating our active projects accordingly. Miriam has learned to use Google Ads effectively for us. (Google gives non-profits \$500 / month in free advertising.)

Monthly Inventor Gatherings on the Third Thursday

We have now held about 6 monthly <u>Inventor Gatherings</u> in a row, on the third Thursday of every month. These have been attended by between 2 and 20 people. We invite all readers of this report to register at <u>EventBrite</u> for it and join us for future events!

Gala and Awards

This quarter we held a virtual Awards Gala. It was attended by about 20 people, who donated \$2000, matched by \$1000 from Rob. We are extremely grateful for these donations. The annual <u>awards</u> can be found at our website, but are included here as an Appendix due to their importance!

Peer-reviewed Publication Submissions

Rob and Megan Cadena submitted their work "<u>The Plane Tangent to Three Spheres Touching</u>" to <u>Journal of Geometry and Graphics</u>.

Talks

Rob and Marc Jones traveled to Brussels for FOSDEM. Rob gave two talks. The first was <u>on the</u> <u>PolyVent</u>, where we were pleased to have Victor Suturin of Germany and Antal Zuiderwijk of the Netherlands present in the audience. Victor is the leader of the PolyVent Project, and Anatal did much of the physical CAD design.

The <u>second talk was videoed</u> and is a presentation of the ideas of GOSQAS, coauthored by Public Invention board member Victoria Jaqua and Christina Cole of Open Source Medical Supplies (OSMS).

The PolyVent was demoed at OSHWA.

Upcoming Talks

Rob will speak on a panel virtually at <u>XIX Biennial IASC</u> (International Association for the Study of the Commons) Conference in June.

Partnerships and Cooperation

As well, our work with SPEC has been particularly fruitful. The <u>GOSQAS</u> alliance is actively trying to improve QA across the open source world.

Rob acted as a judge at the Rice360 global design project science fair for senior capstone teams worldwide. Rob is also an active board member at <u>Helpful Engineering</u>, a similar 501c3.

Volunteers

Nothing lasts forever. We have had some great volunteers who have finished their work or moved on. It is a major goal of Public Invention to leave every volunteer with a positive experience so that they refer new volunteers to us. I'm pleased to say that this has happened—Lauria Clarke has referred a new volunteer to us, who plans to start when her degree is over in June.

Taken as a whole our current volunteers are stronger than they have ever been. They are:

- 1. Lawrence Kincheloe
- 2. Lee Erickson
- 3. Lisa Kotowski
- 4. Matthew McCartney
- 5. Melanie Laporte
- 6. Nina Lahoti
- 7. Victor Suturin
- 8. Antal Zuiderwijk
- 9. Pio Lee
- 10. Ben Coombs
- 11. Sid Chou
- 12. Judith Weng
- 13. Geoff Mulligan

In fact, we represent the overall process of Public Invention, in the diagram below. The three outputs of Public Invention are Inventions, Papers, and Experienced Volunteers.



Productization

Public Invention is a non-profit. Nonetheless, we believe we can have a bigger impact by doing "short-run" productions of small numbers (less than 20) units of our inventions and offering them for sale to make it easier for people to evaluate our inventions, even though all of them are completely open source.

We now intend to productize and place on sale:

- The VentMon T0.5
- The General Purpose Alarm Device (GPAD) 0.2
- The PolyVent

Strategy for the Coming Year

Sadly we were not awarded the grant for Freespireco from the NSF. However, we will continue to work on the Freespireco concept. Public Invention continues to grow slowly. We have been successful in obtaining "gravitas, influence, and credibility" but have not created the army of volunteers that we are hoping to energize, though we probably have as many high-quality volunteers right now as ever.

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

The priorities for the full year of 2023 are:

- 1. Making the new NASA contract successful, which is one building block of a revolutionizing therapeutic oxygen delivery in low- and middle-income countries.
- 2. Selling five of the PolyVent Educational Platforms around the world and building a community of practice.
- 3. "Productizing" the GPAD 0.2.
- 4. "Productizing" the VentMon T0.5
- Completing my book (currently 72 pages): <u>https://github.com/PubInv/intro-public-invention/blob/main/intro-pubinv.pdf</u> and finding a publisher for it.
- 6. Writing a technical paper for VentOS (with Dr. Schulz and Ben Coombs)
- 7. Writing a technical paper for the PolyVent system (with Dr. Suturin, Nathaniel, and Antal.)
- 8. Creating a second version of the General Purpose Alarm Device (GPAD) and productizing it.

The 2022 Annual Awards

Public Invention does not ordinarily pay its volunteers, but our sincere thanks and acknowledgement is essential to motivating volunteers. To this end, we give out Annual Awards, commemorated by an engraved plaque on cherrywood. The 2022 winners are the following:

Annual Awards 2022

Forrest Lee Erickson Best Public Inventor, 2022 For the General Purpose Alarm Device

Lawrence Kincheloe

Best Invention Coach, 2nd Place, 2022 For the General Purpose Alarm Device

Victor Suturin Best Invention Coach, 2022 For the PolyVent Educational Platform

Nathaniel Bechard Best Public Inventor, 2nd Place, 2022 For the PolyVent Educational Platform

Megan Cadena Best Paid Staff Contribution, 2022 For Outreach Coordination

Miriam Castillo Best Volunteer Staff Contribution, 2022 For Volunteer Recruitment

Veronica Stuckey Best Academic Paper, 2022 For "Passive Ferrofluid One-way (Check) Valve"

Geoff Mulligan Best External Expertise, 2022 For NASA MCOG Extensions

Antal Zuiderwijk Best Mechanical CAD Design, 2022 For PolyVent

Avinash Baskaran Best External Ambassador, 2022 For creating the Auburn PIHE

Victoria Jaqua Most Active Board Member, 2022 For GOSQAS

Sabia Abidi Most Active Board Member, 2nd Place, 2022 For PolyVent Evaluation and University Relations