Public Invention Q1 Report, 2024

-- Robert L. Read (Rob), May 18th, 2023

Executive Summary

We received a $50,000 gift from an anonymous donor. We received a $175,000 gift from an anonymous donor to support the Global Distributed Tracking project of GOSQAS, which we fiscally sponsor, but is a separate organization headed by Rob, Victoria Jaqua and Christina Cole.

Rob and Victoria work weekly with the GDT team, which is largely composed of women. GDT is designed to fight global counterfeiting and assure quality by “Trust through Transparency”

NASA has approximately $60K for us to continue/complete the work which was canceled due to a NASA-wide cutback. This contract will probably be executed before June 1st.

Because we got paid by NASA, we had an extra $60K even before these gifts. We now have approximately $100K in assets. We purchased some CDs, since we will not be able to spend this money quickly, both for Public Invention and as stewards of the GOSQAS money.

In April we traveled to Colorado Mesa University and delivered to them one of our two extant PolyVent ventilators.

A graduate student at Penn who is going to Galapagos islands has asked to use our Moonrat Portable Incubator—discussions of that are underway.

Every month in 2023 we held a third-Thursday event known as our Inventors’ Gathering. These had between 7-15 people attend on average. They had a very positive vibe and were often very interesting. We have continued these into 2024.

Products

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

Megan has created a storefront for these products, but nobody has bought anything yet.

Projects

NASA Ceramic Oxygen Generator Project

We received $100,000 from NASA and spent all of it on equipment and to the paid engineers (not Rob) working on the project. This was a failure, in that Rob worked many hours on this project and Public Invention gained no funds from it.

We will soon execute a $60K contract with NASA for additional work to be completed by September 15th, which will be challenging. This is also likely to be a break-even work. However, working with NASA has probably usefully increased the prestige of Public Invention.

PolyVent

Rice University asked for a sample invoice and negotiated a low price for a PolyVent, but then never got back to us.

In April we traveled to Colorado Mesa University and delivered to them one of our two extant PolyVent ventilators. They will attempt to build one in the fall as part of a classroom exercise. They have already used it to drive a lung model (two balloons in a tank of saline water) as part of their work in Electrical Impedance Tomography (EIT).

We failed to obtain the NSF POSE grant, with the main criticism being that we did not have a big enough user community. The fact that Colorado Mesa is now actively using the PolyVent should be a major boost to our efforts. I do not intend to apply in 2024, but hopefully in 2025 we can make a strong application based on continued use.

During my trip there, I gave several lectures to ~25 individuals each, including a live demo of the ventilator.

Moonrat

A team composed of three graduate students at Cinvestav University in Guadalajara, lead by Melanie LaPorte with mentorship from Lee “El Ejecutor” Erickson, is designing a new and improved version of the GPAD. Melanie and Lee designed a PCB assembly. The Guadalajara

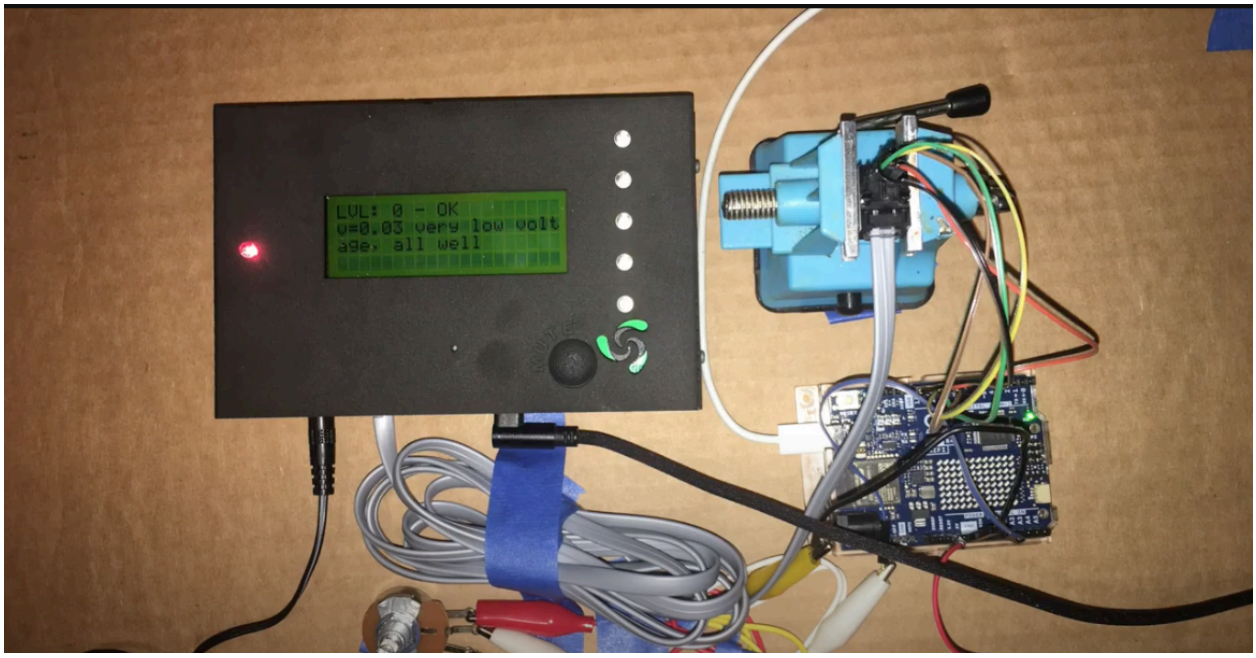
team is designing the enclosures and have improved the software. They have implemented a fuzzy logic controller, in addition to the functioning PID controller.

A Penn State student traveling to the Galapagos Islands has inquired about the Moonrat. We intend to loan them one—discussions are still underway about this.

General Purpose Alarm Device (GPAD) / Krake

The next version of the General Purpose Alarm Device is being designed by Nagham Kheir in Lebanon. She is being mentored by Lee Erickson. The new version is codenamed the “Krake”, and intentional misspelling of a Lebanese waterfowl.

The Krake will be WiFi enabled and capable of reproducing recorded sounds, such as spoken English like “A Hose is Disconnected.”



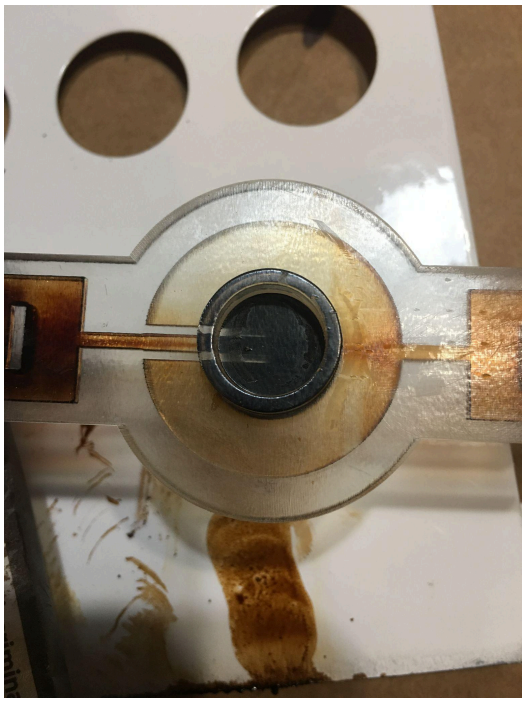
Passive Ferrofluid Check Valve (PFCV)

Joe Hershberger has joined the team this time. Lisa Kotowski has dropped out, after spurring us to significant theoretical efforts.

Joe and I have made several versions of the valve and have made progress improving it. We can now hold a pressure of 200 cm H2O (about 3 psi) with a relatively low cracking pressure of about 6 cm H2O. We have new untested versions which may work even better.

Creating an operating theory of the PFCV has been intellectually difficult, but I believe I am making some progress on it.

A new volunteer, Tripti Pandey, has recently joined the project.



Ferrofluid Pump

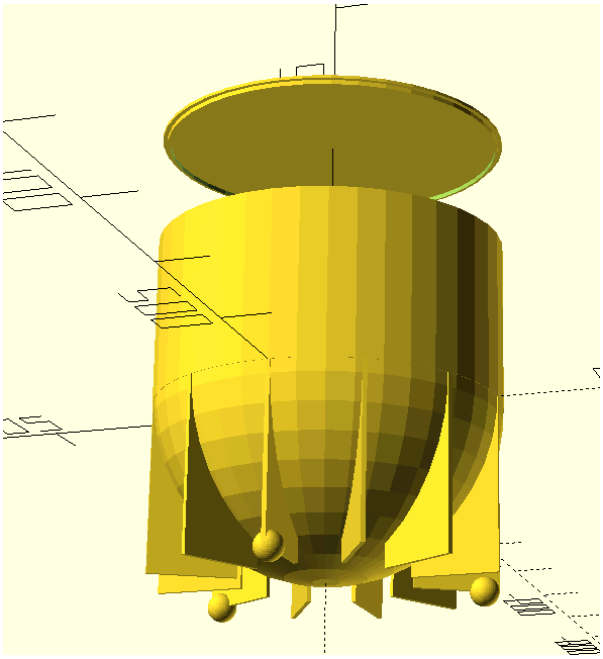
Joe Hershberger is also working on a different idea, the 7-circle ferrofluid pump. Additionally, a new student, Asmi Shirsat, will be exploring a different project to make a pump, based on the idea of making a ferrofluid squirt gun.

The EcoPot Project

Two years ago I mentored a team at Rice University that produced a cooking pot that showed (in at least one situation) a 42% reduction in fuel usage necessary to boil water. Since one billion people still cook on open fires in the world and have to labor hard to gather firewood, this project has tremendous potential.

I have begun working with a Ghanaian engineer named Cledden Obeng-Poku Kwanin to design an improved pot based on our own theories that will be testable.

We are considering running an international hackathon around the design of these pots. Ideally, we would have the ability to do a computational fluid dynamics simulation of these pots as a



complement to ordering them 3D printed in metal in miniature. We believe the free software OpenFOAM is capable of this, but have not yet had the resource to fully investigate it.

Embedded Botanical Electrical Impedance Monitoring

Volunteer Bene Skirde has been using a NanoVNA Vector network analyzer in an attempt to build a sensor for vascular plants that uses electrical impedance to measure moisture and sugar content within the plant. I greatly underestimated the complexity of this project, but Bene and I have been learning together with help from Lawrence Kincheloe.

Nano Cap Table

We recently began a project to allow a very light weight tracking of a “cap table” for volunteer open source projects with Prajwal Shah. Christina Cole may become the invention coach for this project.

Financial Position and Fundraising

Please see our financial statement in the appendices.

We have about $100,000 in assets, We are holding about $145K additional funds for GOSQAS. These funds will be transferred to that organization when it obtains its 501c3 status.

Our gala raised $3,508 in pledges (all but $1033 received). When fully received, Rob will match $1754, for a total of $5,262.

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We did not get the Freespireco grant. The reviews were similar to last year. The fundamental problem reported was that we do not have a large enough user community. With the expanded use of the PolyVent, we are making progress on this weakness to improve for potential grant applications in the future.

Switch to Fund Accounting and Other Accounting Improvements

With the help of Christina Cole, an accountant who does the accounting for other nonprofits (e.g., REAP center, OSMS), we have moved to “fund-based accounting”. This will make it a little easier for us to show how we spend money on projects.

Although I have always kept receipts, we are now storing them directly in Quickbooks. This should create less drama if we need to open our books to a potential funder who wants to examine them.

We have also submitted our 990EZ tax form in a timely manner.

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 16 monthly Inventor Gatherings 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 EventBrite for it and join us for future events! This has been recognized by some as a major thought-leadership event. I believe this is slowly building momentum.

Speaker	Topic	Date	Number of participants	ink
Gavin Taylor	The Institute for Globally Distributed Open Research and Education (IGDORE) and Open Science	5/16/2024	**8**	https://youtu.be/Lr-sMsRigHc
Prof. Michelle Mellenthin and Talles Santos	The Polyvent Ventilator and Electrical Impedance Tomography	4/18/2024	**7**	https://youtu.be/JRtxTfWx-Go?si=63u3YOv90PPZLyJQ
Dale Dougherty	2024 Gala and Fundraising	3/21/2024	**24**	https://youtu.be/6iFIMFUCaXM?si=lpKTrUM9gSdW49lu
Robert L. Read	The Gadgeteer Super Hero Trope Made Real	2/15/2024	**11**	https://youtu.be/MGi0Rt5fd7U?si=il_Rv7zBBvK-Norw
Robert L. Read	Supply Chain as a Humanitarian Responsibility	1/18/2024	**12**	https://youtu.be/hxK4HIY9-mc?si=OM_jAecj00WdpjSL
Melanie Laporte Forrest Lee Erickson	Moonrat Portable Incubator Presentation	12/21/2023	**6**	https://youtu.be/yTW_BcTsaGw?si=ZSbDD5JhDmQJuaT3
Robert L. Read	What Public Invention has done for NASA	11/16/2023	**6**	
Robert L. Read	Public Infrastructure	10/19/2023	**7**	
Robert L. Read	Public Infrastructure Service Work Session	9/21/2023	**5**	
Alex Barton		8/17/2023	**4**	
Victoria Jaqua	Use of the phrase "Public Infrastructure"	7/20/2023	**9**	
Robert L. Read	Artists connecting with Open Source Projects	6/15/2023	**12**	
(SPEC) Joe Torreggiani		5/18/2023	**12**	
Robert L. Read		5/16/2	**4**	

		023		
Brianna Jonhs GOSH	(GOSH) Gathering for Open Science Hardware	4/20/2023	**4**	
Robert L. Read	2023 Gala and Fundraising	2/16/2023	**15**	
Robert L. Read	A Free Software Happening for Geotagging in Ukraine	5/18/2022	**19**	

Grant Writing

We applied to the (Presidential Awards for Excellence in Science, Mathematics and Engineering Mentoring) PAESMEM award for $10,000. We did not get it. The reviews suggest they want a very formulaic model "collect statistics about who you help and your impact." I refuse to do this. Often our society fetishes statistics. Our mentorship advances the careers of real human beings, and cannot be reduced to statistics.

Peer-reviewed Publications and Submissions

In our co-work with Project Data, Rob was an author of:

https://link.springer.com/article/10.1007/s43069-024-00303-1

Villar, A., Abowitz, S., Read, R. *et al.* Maximizing Supply Chain Resilience: Viability of a Distributed Manufacturing Network Platform Using the Open Knowledge Resilience Framework. *Oper. Res. Forum* **5**, 26 (2024). https://doi.org/10.1007/s43069-024-00303-1

Last year we submitted a paper to HardwareX on the General Purpose Alarm Device. This paper has been conditionally accepted with a request to improve the photos and make other changes. That work is currently underway.

We are finalizing a different submission to HardwareX on the PolyVent.

Peer-reviewed Talks

We gave no talks in the quarter, but are applying (today!) to an IEEE conference in Global Humanitarian Engineering.

Partnerships and Cooperation

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 Helpful Engineering, 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.

Taken as a whole our current volunteers are a strong team as of Feb. 4th. They are:

1. Robert L. Read (oversees all projects)
2. Lawrence Kincheloe (NASA, Embedded Botanical Sensors)
3. Lee Erickson (NASA, Moonrat, Krake)
4. From Cinvestav University, Guadalajara (Moonrat):
    a. Silvia Casillas
    b. Luis Enrique Ruiz Fernandez
    c. Horacio Garcia
5. Benedetto Skirde - Embedded Botanical Sensors
6. Melanie Laporte - Moonrat and fundraising
7. Joe Hershberger - Ferrofluid Check Valve and Ferrofluid pump
8. Tripti Pandey - Ferrofluid Check Valve
9. Nagham Kheir - Krake
10. Geoff Mulligan - (NASA)
11. Prajwal Shah - Nano Cap Table
12. Cledden Obeng-Poku Kwanin – EcoPot
13. Asmi Shirsat – Ferrofluid Squirt Gun/Pump
14. Mairin O'Grady - technical writing assistance.

Public Invention is a major part of the GOSQAS/GDT effort, which meets weekly, and includes:

1. Victoria Jaqua
2. Christina Cole
3. Harry Pierson
4. Anusha Shringi (high school)
5. Nora Moor (high school)
6. Katie Pryal
7. Judith Weng
8. Coco Cheng

9. Hira Taqueer

The three outputs of Public Invention are Inventions, Papers, and Experienced Volunteers. We trust and hope that most of these volunteers obtain something of value. We clearly have more volunteers than ever right now, especially if you count the 8 volunteers for the GDT effort.

2023 Goals Checklist

Here were our previous priorities for 2023:

1. Making the new NASA contract successful, which is one building block of a revolutionizing therapeutic oxygen delivery in low- and middle-income countries. - SUCCESS SO FAR
2. Selling five of the PolyVent Educational Platforms around the world and building a community of practice. - Failure, but 1 in use
3. “Productizing” the GPAD 0.2. - DONE, but no sales
4. “Productizing” the VentMon T0.5 - DONE, but no sales
5. Completing my book (currently 72 pages): https://github.com/PubInv/intro-public-invention/blob/main/intro-pubinv.pdf and finding a publisher for it. FAILURE
6. Writing a technical paper for VentOS (with Dr. Schulz and Ben Coombs) - NOT DONE
7. Writing a technical paper for the PolyVent system (with Dr. Suturin, Nathaniel, and Antal.) - Almost complete
8. Creating a second version of the General Purpose Alarm Device (GPAD) and productizing it. - UNDERWAY
9. Make serious research progress on the ferrofluid inventions (valve and pump). - PARTIAL

General Strategies for 2024

Public Invention is making a difference. It is in that sense a success. Compared to other nonprofits in this space, we get a lot done. We are publishing good open source software, hardware, and inventions. We are providing many people a valuable learning experience they may not be able to find at Universities.

However, we have not accomplished the mission of creating a world-wide movement toward Public Invention. We have not created a sustainable funding base. We have (probably) not saved any lives yet.

In 2024, we plan to:

1. Apply for grants from more second-tier (regional) foundations.
2. Recruit more Invention coaches, possibly by absorbing and supporting other projects.
3. Finish the publication of our existing projects.
4. Hold some in person events.

Specific Project-based Goals for 2024

At Public Invention, the projects are the point. Our project specific goals are:

- Make sure the NASA contract is a success.
- Finish the GPAD HardwareX paper.
- Submit the PolyVent Paper.
- Make sure Colorado Mesa's use of PolyVent is a success.
- Make GDT a usable project with 100 users by the end of 2024.
- Submit a paper on the PFCV.
- Make progress on other projects (sensor, pump, squirt gun, nano cap table.)

Appendix: 2023 End-of-year Financial Reports

Largest Programs by Expenditure

Largest Programs by Expenditure Totals
Public Invention 2023

	Program	Expenses
1	NASA-COG	$(106,290.32)
2	GOSQAS	$ (12,717.63)
3	PolyVent	$ (10,161.88)
4	MoonRat	$ (4,038.33)
5	VentMon	$ (3,811.36)

Statement of Financial Position

Public Invention
Statement of Financial Position
As of December 31, 2023

	Total
ASSETS	
Current Assets	
Bank Accounts	
Fidelity Z40323246	65.82
Wells Fargo Simple Business Checking (7066)	76,202.55
Ferrofluid Check Valve	-849.07
General Alarm Module	-1,695.36
GOSQAS	-12,717.63
Mentoring Expenses	-228.42
MoonRat	-4,130.29
NASA-COG	-13,677.32
PayPal	2,026.67
PolyVent	-10,186.47
Public Invention	-17,666.36
Tetrobot	-105.94
VentMon	-4,505.83
WetPoo	-27.55
Total Wells Fargo Simple Business Checking (7066)	**$ 12,438.98**
Total Bank Accounts	**$ 12,504.80**
Other Current Assets	
Petty Cash	-0.90
Total Other Current Assets	**-$ 0.90**
Total Current Assets	**$ 12,503.90**
TOTAL ASSETS	**$ 12,503.90**
LIABILITIES AND EQUITY	
Liabilities	
Current Liabilities	
Other Current Liabilities	
Robs personal contributions	0.00
Total Other Current Liabilities	**$ 0.00**
Total Current Liabilities	**$ 0.00**
Total Liabilities	**$ 0.00**
Equity	
Opening Balance Equity	-1,421.08
Retained Earnings	14,417.36
Net Revenue	-492.38
Total Equity	**$ 12,503.90**
TOTAL LIABILITIES AND EQUITY	**$ 12,503.90**

Profit and Loss

Public Invention
Statement of Activity
January - December 2023

		Total
Revenue		
Donations		66,471.36
Investment Income		26.37
Contracts		100,483.77
Total Revenue	**$**	**166,981.50**
Gross Profit	**$**	**166,981.50**
Expenditures		
Advertising & Marketing		2,744.02
Bank Charges & Fees		73.86
Books		583.88
Charitable Contributions		172.50
Conference Fees		3,952.19
Contractors		127,835.84
Equipment		17,912.50
Job Supplies		658.68
Legal & Professional Services		3,851.25
Meals & Entertainment		2,212.57
NASA-COG (deleted)		-28.53
Office Supplies & Software		2,334.60
PolyVent (deleted)		-2,706.39
Research		61.58
Shipping		525.83
Tools		323.62
Travel		6,501.15
Uncategorized Expense		758.58
Total Expenditures	**$**	**167,767.73**
Net Operating Revenue	**-$**	**786.23**
Other Expenditures		
Reconciliation Discrepancies		-293.85
Total Other Expenditures	**-$**	**293.85**
Net Other Revenue	**$**	**293.85**
Net Revenue	**-$**	**492.38**