



Project name

Glia Foreign Office – 2018

Fellow(s)

Tarek Loubani

Short description

The Foreign office has been established. Stable operational costs remain the most difficult item to gain funding for, and so we will continue funding the office's operational costs through the Shuttleworth Foundation grant.

Objective(s)

- Maintain the operational costs of the Glia foreign office so that it may continue its goal to research, create, maintain and manufacture high quality open access medical devices in the foreign country
- Permeate the broader values of local design and manufacture in the area

The Foreign team will:

- Be a centre of excellence for 3D printing and rapid prototyping
- Be a centre of excellence for Free/Open Source Software and Hardware in the Foreign country
- Disseminate 3D printing culture in schools, universities and businesses
- Produce medical devices for local hospitals and the Ministry of Health
- Train hospital biomedical engineering departments on use of 3D printing
- Establish centres for 3D printing and device development in Terre des Hommes, and the Emaar Centre for Rehabilitation and Development



Link to scope of fellowship(s)

The fellowship scope is to both create medical devices and to create the conditions for open source medical devices to thrive. The Foreign country serves as a live test for these devices, and an office is necessary to coordinate this work.

Context

Over the past year, we have established an office in the Foreign region that has been more successful than we initially imagined. This project will allow the engineers in the Foreign office to continue their work full-time with Glia, and to have equipment that makes it possible to work efficiently and effectively.

There continues to be active work on addressing the medical device shortage in the Foreign region. However, other projects to address the medical device shortage due to the blockade focus on importing devices and designing political and legal mechanisms to ensure transit. These projects require large expenditures of political and financial capital, and so tend to be reserved for big-ticket items or times of extreme deprivation.

The unique geopolitical context also means that duplication is an essential component of any project, since any one location may be bombed at any time or the participants arrested or assassinated. A goal of the office will be to continue the creation of a network of printing and production centres over time.

Intended beneficiaries

- Ministry of Health (Foreign country) – creation of needed medical devices
- Work Without Borders (Foreign country) – continuing training and support of their 3D modeling team
- University College of Science and Technology (Khan Younis) – continuing training and support of biomedical devices division
- Terre des Hommes – continuing training and support of their mobile fablab
- Emaar Centre for Rehabilitation and Development – continuing training and support of their fablab

Strategic partners

- Ministry of Health (Foreign)



- Work Without Borders (Foreign)
- University College of Science and Technology (Khan Younis)
- Terre des Hommes
- Emaar Centre for Rehabilitation and Development
- Tashkeel 3D
- Glia Inc

Boundary players

Boundary players are listed below in order of disruption as a function of ability and likelihood.

- Coordination of Government Activities in the Territories (COGAT) – Israeli unit responsible for blockade
 - Might deny project members entry to Gaza
 - Might deny equipment entry into Gaza
- Ministry of Interior (Israel)
 - Might deny project members visas to enter Israel
- Israel Security Agency (aka Shin Bet aka Shabak)
 - Might declare project members as terrorists
- Canadian Security Intelligence Service / Royal Canadian Mounted Police (CSIS/RCMP)
 - Might define work in Gaza as falling within Bill C51 (The Antiterrorism Act)
 - Might order confiscation of laptops / electronics
- Health Canada
 - Licensing barriers might create down-time in projects in Gaza

Methodology and activities

Manufacturing

The Foreign office is presently co-located with Tashkeel 3D, a 3D printing, CNC and PCB-manufacturing facility currently based in a 3-room shared workshop. Glia will cover \$300 of



the \$400 rent, and Tashkeel 3D will pay for the remainder. All of Tashkeel 3D's equipment (CNC, tools, etc) will be available to Glia. See below in "Sustainability strategy" for the rationale on keeping Tashkeel 3D alive.

This year, one of our goals will be the development of small-scale injection molding to allow for the more rapid mass manufacture of simple plastic parts.

Research and development

Research and development was planned between the Glia office as well as the UCST-KY college and other public institutions. However, in November and December of 2017, control of public institutions passed partially to the Fatah political party, which has not proven capable of operating them. As such, these institutions have failed to contribute as we hoped a year ago.

As an independent group, Glia has been able to continue to perform research and development work on several of our devices and manufacturing technologies.

Personnel

The office has three paid personnel, two engineers (Mohammed Abu Matar and Shaker Shaheen) and a helper. Because the office represents a real-life work opportunity, unpaid interns seconded from public universities will be leveraged as well.



Outputs and deliverables

Medical device manufacturing

The primary task of the team will be to create and distribute medical devices. The primary goal for 2018 will be the manufacture and distribution of tourniquets. Using a graded model of distribution and continuous improvement, 100 stethoscopes will be delivered in the first 3 months of 2018, followed by approximately 100 units per week in the 6 months thereafter with a goal of 10,000 units by the end of the year, depending on when the group's injection molding capability comes online.

- Produce medical devices in Gaza:
 - Tourniquets – new production
 - Stethoscopes – continued production
 - Pulse oximeters – new production
 - Otoscope – new production
- Train hospital biomedical engineering departments on use of 3D printing for replacement parts like gears

Medical device development

The team is currently working on expanding manufacturing capacity to allow us to realize mass manufacture of the devices that have been developed. The stethoscope and tourniquet projects are the main targets of this effort. Over the coming year, this effort will expand to include pulse oximetry as well

Personnel development

Two engineers have been working extensively on 3D printing and its cultural dissemination in Gaza. They are Mohammed Abu Matar and Shaker Shaheen. Through this project, they will be given 1 day a week (5 day work week) to work on independent projects as they see fit to help them develop their skills and interests.

External training for 3D printing

Terre des Hommes is an international NGO with a centre in Gaza that is developing a mobile fablab. For this project to succeed, they will need 3D printers and other equipment, which our team will provide. As well, they will need training for their mobile team.

Emaar Centre for Rehabilitation and Development is in a similar position, looking for support for their fixed fablab in the southern region.



Time frame

One year, renewable. Start date is effective immediately.

Resources and budget

Table 1. Capital costs

Item	Description	Quantity	Unit cost	Total cost
Filament extruder	Gaza made model	1	1270	\$1,270.00
Filament winder	Gaza made model	1	300	\$300.00
Stepper drivers for 3D printers	4 per printer	200	5	\$1,000.00
Motors for 3D printers	5 per printer	40	25	\$1,000.00
3D printer parts	RAMPS control boards, heaters, extruders, heated beds, lead screws, belts, gears, bearings, fans, etc.	1	4930	\$4,930.00
Solar panels		1	1200	\$1,200.00
Additional solar energy system	Inverter, batteries	1	1000	\$1,000.00
Shelving, Enclosures		1	150	\$150.00
Safety Equipment		1	350	\$350.00
Hazardous fume ventilation		1	190	\$190.00
Total				\$11,390.00

Table 2. Material costs



Item	Description	Quantity	Unit cost	Total cost
3D printer construction materials	Wood, glue, paint	1	120	\$120.00
Plastic pellets	Chi Mei Polylac PA-757 ABS (25kg)	24	80	\$1,920.00
Stethoscope packaging		500	0.1	\$50.00
Tourniquet packaging		1000	0.1	\$100.00
international purchases (supplies)	bed sheets, teflon tube, temperature tape, NTC sensors, cnc bits	1	450	\$450.00
Total				\$2,640.00

Table 3. Monthly recurring costs

Item		Quantity	Monthly unit cost	Total annual cost
Engineering salary		2	1000	\$24,000.00
Support staff salary		1	500	\$6,000.00
Short term staff salary		1	500	\$1,500.00
Social media ads/expenses		1	5	\$60.00
Maintenance		1	100	\$1,200.00
Transportation		1	50	\$600.00
Rent		1	300	\$3,600.00
Promotional video	One time fee	1	600	\$600.00
Manikin labour cost	One time fee	1	100	\$100.00
Other labour costs	One time fee	1	300	\$300.00
Total				\$37,960.00



Table 4. Total costs

Capital costs	\$11,390.00
Material costs	\$2,640.00
Monthly recurring costs	\$37,960.00
Total	\$51,990.00



Measures of success

What changes in behaviour do you expect to see?

1. Independence of the engineers in Gaza to create, research and manufacture devices
2. Ability of TdH, Emaar, UCST-KY and WWB to 3D print with competence

What changes in behaviour would you like to see?

We have gained some hardcore credibility through our ability to be on the field and in the academic ivory tower. However, people have looked curiously at us, rather than jumping in. After a year of visible successes, we hope others will be convinced that the use of open source works and that what we are doing is possible.

What changes in behaviour would you love to see?

Complete independence and collaboration between all teams.

Communication strategy

Intra-group communication will be done using Mattermost, Kanboard, email and in-person meetings.

External communication will be via twitter, facebook, instagram and public talks in Gaza and internationally.

Sustainability strategy

Sustainability of this project will depend on three main strategies.

For our partners, the innate advantage of cooperating in the project will hopefully be worth contributions from both via future grants or internal funding pools.

For the development component, we will continue to apply for and obtain academic grant funding, hopefully even a major grant via the Canadian science research system (Natural Sciences and Engineering Research Council, NSERC; or Canadian Institutes of Health Research, CIHR).

The third strategy is to attempt to create a high-impact revenue stream by transferring some legitimacy and capability from this project to Tashkeel 3D, which should be in a position to



take over Glia's funding needs by using commercial contracts to fund the office after the completion of the granting period.

Risks

The main risks for this office and its personnel are:

1. Personnel gaining status and taking higher paid jobs elsewhere
2. Personnel being targeted by Israeli authorities for perceived anti-Israeli activities
3. Personnel being targeted by Palestinian authorities for perceived anti-Palestinian activities
4. Theft, confiscation or destruction of office and equipment by Israeli or Palestinian forces
5. Theft of equipment by domestic competitors or idiots
6. Engagement of office personnel in non-medical activities of 3D printing, such as commercial or military uses.