Michael Thomas Ratcliffe
63 Ayrefield rd
Robymill
Upholland
Lancashire
WN8 0QP

Ms. Emma Boulton
British Council
10 Spring Gardens
London
SW1A 2BN
United Kingdom

February 25th 2018

Dear All,

I would like to confirm my interest for participation in the 2018 Living Research programme made available thru the collaboration of The British Council and the Arts & Humanities Research Council. With having participated in a similar exchange, experience of living in China and being part of the maker movement I am confident I can utilize these skills and contacts to promote the learnings and aims of this china exchange program and assist in building upon the excellent reputation of the collaborating organisers.

After briefly living in Beijing China during 2014/2015 I have been following closely the development of China's food sector and their involvement with modern farming techniques. This program would offer the opportunity to return to China once more with a group of high calibre makers and academics to personally witness China as it pushes for better agricultural and environmental practises. It will also allow further assess the potential for a makerspace orientated distribution and knowledge hubs that turn delivering open source project into profits.

I am part of Aquaponicslab a startup that was initially hosted by the FabLab Manchester Makerspace we have since grown in size and machine needs, purchased our own rapid prototyping equipment, but continue with the makerspace mentality of clean concise project sharing that can be replicated in any makerspace. We mainly develop easy to use Open Source automation and educational material for farming systems, generating profit from providing support and commercial automation. Our achievements have led to multiple industrial and maker space partnerships along with strong ties with academic institutes conducting research in similar areas:

- Farnell
- Fab Lab Manchester, GreenLab London
- Equilibrium Co-op Brazil
- AVF [Association Vertical Farming]
- Lancaster University
- EdgeHill University
- Liverpool University
- Manchester University

Although not requested I have enclosed within this application:

- Curriculum vitae
- References and Examples of Makerspace Work

In 2017 Nuffield Farming Scholarships Trust awarded mentoring, connections and funding for a Ten week Global Focus Programme and a further Ten week personal study travel on the subject of technology in farming, this gave the opportunity to visit and better understand the needs of small and urban farmers at a global level, gave experience of government bodies, NGOs and opportunity to develop personally from mentoring and networking with peers. The China Program you are facilitating sounds very interesting for better understanding the asian maker movements ability to generate cash flow, deliver knowledge and develop personally from networking with high calibre peers.

I look forward to meet with you to discuss the program in more detail. Please feel free to contact me or my referees for further information.

Yours sincerely,

Michael Ratcliffe
Mobile: +44 (0)7510530073
Mike@AquaponicsLab.org

References

Short Testimonials

Association for Vertical Farming

Henry Gordon -Board Member

“Michael Ratcliffe's Project Portfolio is the Ideal Response to the Needs of Growers Around the World"

BAQUA

Alice Archer -Founder

“As part of our check in with what’s been happening in the Aquaponics Scene we are delighted to have Mike Ratcliffe of Aquaponics Lab (in the UK) join us. Aquaponics Lab has been the source of many great shareable resources and within the BAQUA team we love their open source, commons oriented ethos! "

Element14

Charles Gantt -Maker and PR

“A Great Example of How to Organize, Document, and Illustrate the Progress of Your Projects "

AquaponicsLab

Aquaponics Lab

Mr. Paulo Marini
Collaborative Commons Lab Ltd
Ewood Lane
Todmorden, OL14 7DF

February 20th 2018

Dear Sir/Madam,

I am writing to recommend Mr. Michael Ratcliffe to the Living Research 2018 programme. His performance and dedication as one of our core collaborators in the capacity of systems engineer and maker mentor indicate that he would be a valuable asset for this research trip. I would highly endorse Mr. Ratcliffe for his experience with the Maker movement in the UK.

I have known him for around two year in my capacity of director at the Aquaponics Lab, a startup company working with open source food system which was born inside the FabLab Manchester. He is an intelligent and creative individual with good analytical and communication skills. He has worked on various maker projects as a consultant and developer.

In our weekly makerspace workshops, open for the wider public, he acts as a mentor for newcomers, and support the dissemination of the technologies and know-how our organisation curates. As a Nuffield foundation fellow he has previous experience of travelling, meeting new cultures and establishing fruitful relationship with international hosts. I believe his skills and practical knowledge about the maker culture in the UK would make him highly suitable for the role of delegate for this research trip.

If Mr Ratcliffe's performance in our organisation is any indication, I trust he will add a significant contribution to the personnel skills set of the delegation, and that his blend of skills and experience will ensure his work will result in valuable networking and a high quality documentation of the trip.

Should you require any further information, please do not hesitate to contact me.

Yours faithfully,

Mr. Paulo Marini
Director
paulo@aquaponicslab.org
+44 (0) 774 100 2517
www.aquaponicslab.org

Association for Vertical Farming

16/01/2016

Re:Michael Thomas Ratcliffe

Dear Sir/Madam,

It is my pleasure to recommend Michael,

I came to know Mike in my capacity as UK Regional Manager of the Association for Vertical Farming. The AVF provided funding and equipment to form a competition between some of the world's brightest and most motivated electrical engineers, to overcome the challenging task of optimising vertical growing systems. After following his documentation of work and meeting him in person on the farm, I can confidently vouch for his commitment and passion for his work.

Mike distinguished himself by consistently submitting exceptionally well-researched and well-documented control system implementations, an ideal response to the needs of growers around the world. The information he offers through various means of sensors, automation, and nutrient delivery contribute notably to the vertical farming dialogue. This work secured him a podium position after the competition drew to a close.

Due to the understanding, insight and performance he showed in this project, I would be happy to recommend Michael for any funding or position in relation to Aquaponics, Farming or System Engineering either personally or in his role at the AquaponicsLab.

If I can be of any further assistance, or provide you with any further information, please do get in touch.

Yours faithfully,

Mark Horler
Association for Vertical Farming – UK Regional Manager
Regrowth – Founder

mh@vertical-farming.net

Curriculum vitae

Michael Thomas Ratcliffe

63 Ayrefield rd, Robymill, Upholland Lancashire, WN8 0QP

Email: mike@michaelratcliffe.com

Tel: 01257 252441 *Mobile*: +44 (0)7510530073

UK National with full, clean driving licence

Mechanical and Electrical Engineer with strong foundations and experience in automation, control, and computational mathematical modelling/simulation of real world systems. Currently employing these Skills in the Open Source automation, optimisation and public relations of Urban and Peri Urban farms.

Education and Qualifications

2016- 2018 **Nuffield Farming Trust Fellowship**
NSch Fellowship By research
Funded by the Richard Lawes Foundation

Overview: Nuffield Farming Scholarships Trust awarded mentoring, connections and funding for a Ten week Global Focus Programme and a further Ten week personal study travel. The GFP involved a round the world knowledge exchange trip with 8 high calibre agricultural farmers and leaders, 10 countries and hundreds of farm visits. The Personal Study is centred around soilless agriculture, Hydroponics and Aquaponics, its current use in urban agriculture and its potential application for regeneration of arid areas and the opportunities for open source solutions. Presenting the learnings to policy makers, government organisations and urban farming practitioners.

2012- 2014 **Lancaster University, Lancaster**
MSc by Research Mechanical Engineering
Funded by the Sir John Fisher Foundation

Research Project and Publication: "BLDC Motor Power Control Techniques, A novel current control technique" This research project summarised the current state-of-the-art with respect to digital motor commutation techniques, progressed to propose and simulate a novel current control technique aimed at increasing efficiency under part load conditions. Heavily based around simulation, leading to a good base knowledge about how simulations are performed and implemented and provided a great opportunity to network with leading researchers from around the world. Work was presented and published at IEEE POWERENG international conference [Istanbul, Turkey].

2009- 2012 **Lancaster University, Lancaster**
BEng (Hons) Mechanical Engineering (**2.1**)
(**Accredited** by the IMECHE)

Primary Project: "ARTEMIS PROJECT": A novel air-siphon power generation & environmental regeneration solution using lake Grevelingen (Holland) as a case study" Involves researching and assessing the viability of air siphon technology in a maritime environment.

2007 – 2009 **Wigan & Leigh College**
National Diploma in Mechanical Engineering treble grade: **DISTINCTION-DISTINCTION- MERIT**
National Certificate in Mechanical Engineering double grade: **MERIT- MERIT**

Abraham Guest High School
Usual cluster of subjects, with grade's consisting of **A**'s and **B**'s.

Key Skills and Competencies

Computational skills
Along with being computer literate with respect to the usual Microsoft office programs, also proficient in the use of:

- Solid-Works/Autocad
- MATLAB SimuLink
- C++
- Linux
- Arduino IDE
- Integrating MCU's and HTML

Technical skills and Competences

A busy personal life and strong academic achievements have strengthened many technical skills and competences, some noteworthy ones can summarised as such:

- Computational Simulation
- Automation, sensing and control
- Energy conservation/ process refinement
- Technical writing and presentation
- Electrical and Mechanical principles
- Mathematical practices and theory

Teamwork, Leadership and Communication

Culturally sensitive and internationally travelled. Ability to identify attributes and strong personal traits suited to tasks and putting personal ego aside for the benefit of the team, taking the lead when necessary to give the team motivation, direction and conflict management. International research collaboration and professional leadership training honed the ability to present complex ideas and developed concise, technical writing skills and communicate well through written reports and publications.

Projects

Some examples of past projects can be seen below, many were successful some failed and none exploded:

- Non contact Hydropower
- BLDC motor control
- Aquaponics automation
- Quadcopter noise reduction
- Feedback tuning
- Vision based sensing and control
- Renewable energy integration
- Weather measurement

Career History

Nuffield Farming Scholar [Global]
2016–Current

- Assessment of technology use in Urban and Peri Urban farming operations.

Collaborator and Control Systems Engineer [Aquaponics-Lab, UK]
2015 –Current

- System automation and optimisation of Open Source Aquaponic systems.

English Tutor [Beijing, People's Republic of China]
2014-2015

- Worked with students on a one to one basis, mainly to develop communication skills.

Lab Assistant and Demonstrator [Lancaster University]
2012- 2013

- Lab assistant for modules of interest, working with students building knowledge and understanding needed to implement tasks presented in practical labs.

Memberships

Elemet14's Member of The Month September 2015: For exceptional projects and documentation.

- IMECHE
- IET
- AVF
- AquaponicsLab
- Element14
- HackADay

Hobbies and Interests

Problem solving, Automation and Control System Optimisation, Electronics, Farming, Aquaponics, Travel, DIY and Automotive Maintenance, along with Reading, Teaching and PingPong.

References

Examples of work, academic and professional references available upon request.

Examples of Work and Collaboration

Early Work

Growing up on a small family farm helping my grandfather who was a engineer solve problems on the farm with as few specialised tools as possible was a very good way to learn hands on skills that I use as a Maker. Following a degree in mechanical engineering and a postgraduate by research in electrical engineering I returned to farming.

After finishing the Undergraduate degree me and some friends built up a overland jeep to travel a bit of the sahara desert over the summer break. Noticing that the sahara desert surprisingly has shallow water wells and good transport networks, coupled with the sun intensity this is everything a productive farm needs apart from soil. This is how my interest in Aquaponics got started.

While working on my postgrad research I built a medium sized aquaponics unit to test it out for myself, turns out it was a hard system to manage so I started to automate the system using a limited budget. Farnell Later noticed this work and sponsored me to document the progress on their website element14:

https://www.element14.com/community/community/design-challenges/vertical-farming/blog/2015/09/13/automated-green-house-blogs-main-page

So as a side gig, I was working with basic,cheap, easy to replicate automation for controlled growing environments. One of the projects turned out to be very useful to growers, I still receive weekly emails from people replicating all over the world 3 years later:

https://www.element14.com/community/community/design-challenges/vertical-farming/blog/2015/09/03/automated-green-house-blog9--three-dollar-ec-ppm-meter-for-mcu

Video blogs turned out to be much easier time wise and talking on camera aided public speaking abilities in general:

https://www.youtube.com/watch?v=wHKHTTbyTrI&t=2s

AquaponicsLab

Aquaponics Lab's Mission is to implement community food systems capable of producing of local, healthy and affordable food using the best available technology. I.e. actually do it. This is really exciting in a world where academia tends to be out of touch with real world needs. We use the research of academic institutes and a makerspace environment to create reproducible solutions to the needs of farmers, releasing the information on social platforms to better engage the final audience.

Teach food production techniques enabling communities to feed themselves and creating business opportunities.

- Disseminate open source technologies which enable communities to install and build food systems to ensure their well-being and resilience in a sustainable manner.
- To advance the state of the art of collaborative common technologies through:
    - Research techniques and systems;
    - Develop open farming techniques & technologies;
    - Curate open farming technologies;

The lab's values are to:

- Create long term mutual beneficial partnerships instead of one off relationships;
- Utilize for our operation the best, most cost effective and reliable resources available favoring open technologies;
- Protect the universal access to our technologies by releasing them as open source;
- Nourish the collaborative commons towards a resource based economy.
- Ensure that our work in any specific situation is acceptable in light of our values.

In short there are three barriers to entry a urban or peri urban farmer will face in developing countries:

- Educational Barriers
- Financial Barriers
- Access to quality agricultural inputs

To reduce Financial Barriers the majority of our relevant work is released open source and made from commodity components or parts manufacturable in a makerspace environment. We also release educational material aimed at newcomers and more detailed material for practitioners and host weekly knowledge groups at the local hackerspace.

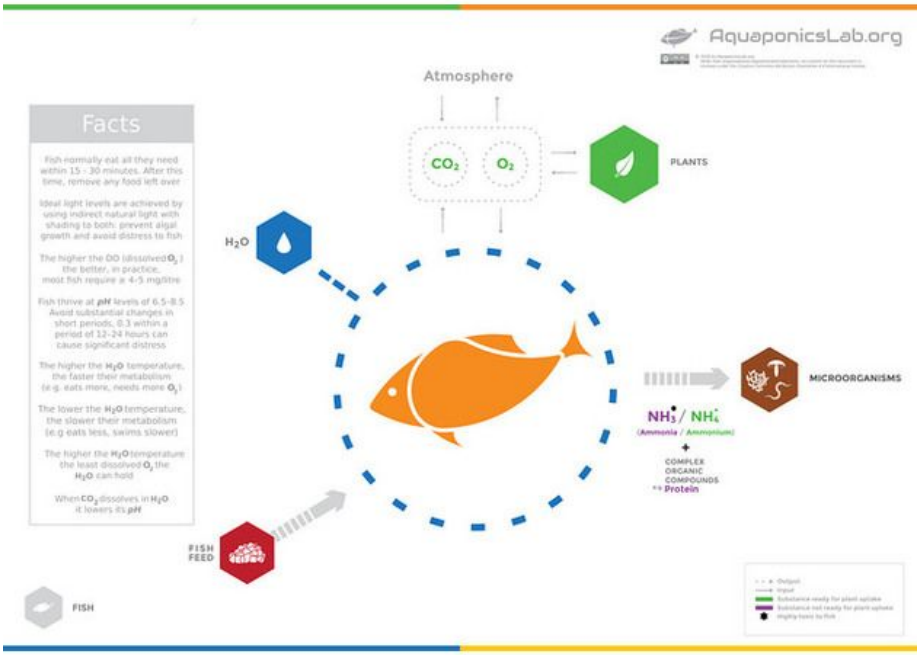
These public engagements and project sharing has raised our profile at a global level and made us the go to people for aquaponics projects both personal and commercial. This was a unforeseen side effect of the open source development and benefits the commercial side of the organisation.

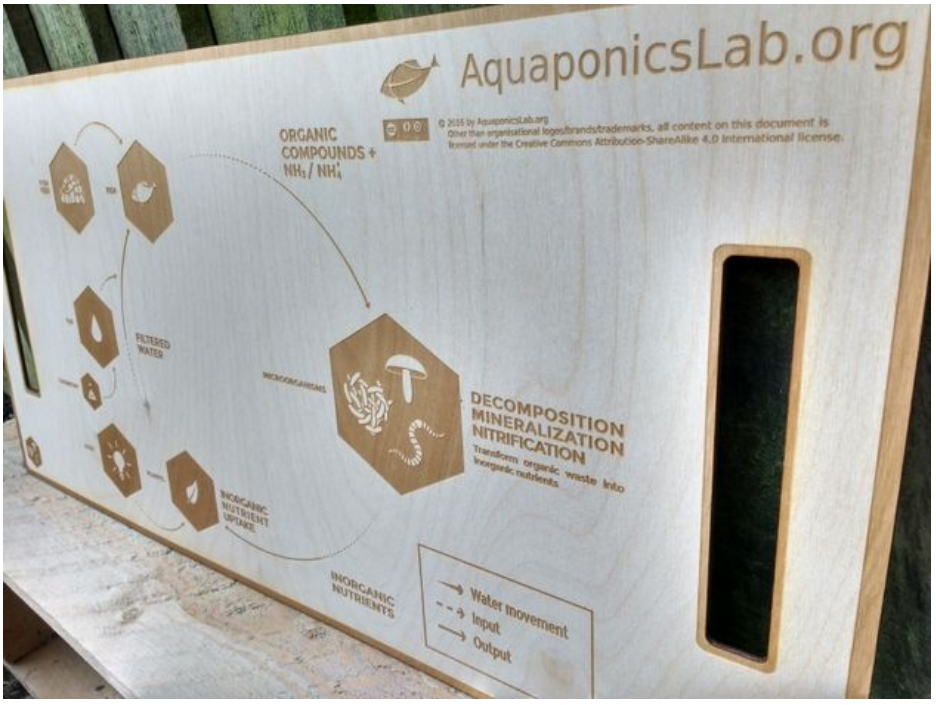
Educational

As an Example of the more basic educational material we produce:

https://www.thingiverse.com/thing:1930671

Other members of the team work on the information itself, I work on the final product and production side. For example these infographics are available in a printable or laser cuttable format for the more durable requirements.





Automation

Aquaponics is a relatively hard system to manage, for the smaller practitioner we need open source plug and play automated control system, no knowledge required, before we see the rapid adoption of this farming technique. “In developing countries there is a major need for cheap sustainable local food production, we have to adapt a hacker’s mindset to work with what little resources are available to achieve the result we need.

To keep the financial barriers low and knowledge level low, we create automation from commodity components, cheap parts smart software and an easy to use GUI. Using my background as an engineer these controllers are reliable and repeatable, as part of this quality control we are currently working with a group of beta testers for a 6 month period prior to open release.

So in Short, quality automation that includes:

- Hardware https://www.thingiverse.com/thing:2590723.html
- Software https://github.com/MTRatcliffe/Beta-Testers-Fish-Feeder
- Easy access GUI and Data Logs https://mtratcliffe.github.io/AquaponicsLabGUI/index.html

Opportunity

Although the majority of our products are OpenSource and are used by many, we have received a lot of paid work to install and deliver the automation controllers for commercial clients. These clients are willing to pay for the product support and knowledge that is common for commercial products.

Whilst we deal with many international clients, such as brazil and posting the product is possible, it is challenging to offer a competitive installation charge and support in the local dialect. During the higher level meetings at the AquaponicsLab we have been discussing the possibility to utilize Makerspaces to replicate the controllers and deliver them to the local community in a similar manner to how we operate now. That is free workshop days for those wanting to replicate themselves or need knowledge, whilst making a profit from selling the units to larger operations with the backup of the main hub in england.

MakerSpaces

The AquaponicsLab was initially hosted by the Makerspace FabLab Manchester, Although we have since grow and expanded to our own machinery we still collaborate closely with makerspaces. We host weekly makerspace workshops in and around Manchester on the topic of food production. Because the majority of our work is being reproduced at makerspaces, we always keep upto date and visit spaces when travelling for other work. For example Brazil, London,Netherlands.

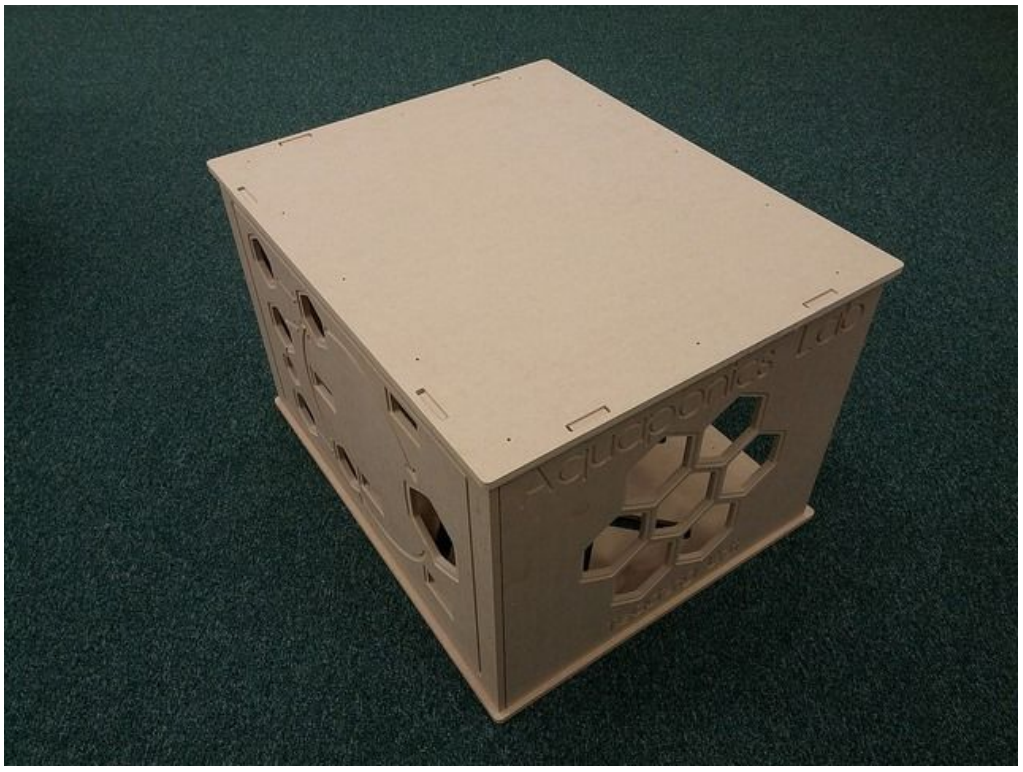
We use these workshop days to listen to problems of the members and visitors, offer mentoring on using the maker space to replicate our controllers and other open source solutions. We have also given many talks and conferences at makerspaces.

For example a recent talk at GreenLab London's maker space:

http://www.baqua.org.uk/open-source-aquaponics/

Pictures

Base For a Educational Display, Made on ShopBot CNC:

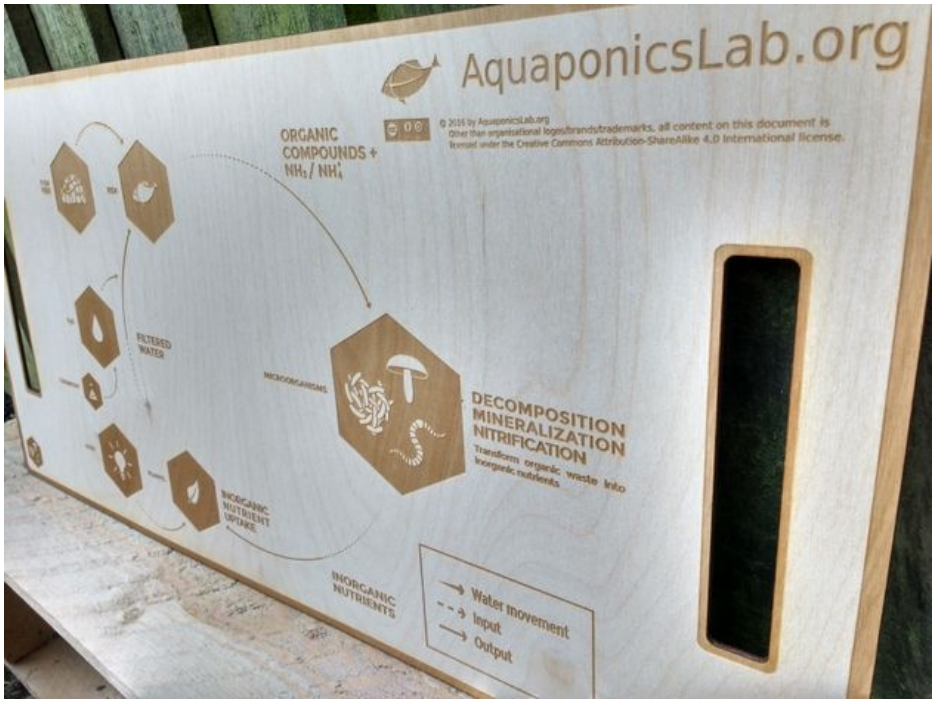


Airtight 3D printed water control Valve, Printed on Reprap i3:

Fish Feeder initial 3D printed prototype:

Getting Feedback for the second gen feeder from one of our Beta practitioner testers:

Laser Cut InfoGraphic:



Laser Cut Christmas Gift: