DATE: **February 15th, 2021**

TO: **Dr. Deirdre Hunter**

FROM: **Sindhuja Darisipudi, Nora Han, Joseph Urso, Michael Tang, Jason Ye**

**Team Moonrats (**[**5moonrats@gmail.com**](mailto:5moonrats@gmail.com)**)**

SUBJECT: **Water Assessment Incubator Problem Statement and Team Structure**

**The Water Sanitation Crisis and the Need for a New Water Assessment Incubator**

Water sanitation is a crisis affecting 780 million people around the world, many of whom live in underprivileged and remote areas. This problem is exacerbated because not all water potability tests (i.e. tests that indicate if water is drinkable) are practical in such settings, as many rely on access to laboratories.

Public Invention is an Austin based startup whose mission is to “invent in the public, for the public”. As a part of this mission, they have partnered with Engineers without Borders Austin in order to bring water quality testing to remote areas (including but not limited to Latin America and Central Asia) to address this very problem.

Our client is utilizing 3M Petrifilms for E.coli detection, a culture-based method for the detection of microbial contaminants. However, these films require a temperature-stable incubation environment in order to reliably detect microbial contaminants of concern in drinking water. By applying water samples to these Petrifilms and incubating them for 24-48 hours, field scientists who are in various remote areas can visually inspect for E. coli contamination. Currently, they have identified several problems with their existing incubator (“The Armadillo Incubator”) and have asked us to create an improved, low-cost and portable incubator for these Petrifilms that is suitable for water sanitation testing research in remote areas that lack lab resources.

**Water Assessment Incubator Problem Statement and Limitations in the Existing Solution**

1. **Problem Statement:**

Our task is to build an incubator for the Petrifilms that is suitable for water sanitation tests in these remote areas. Design criteria that we will keep in mind, as elaborated in item number 3 include small size, ease of use, and data logging capabilities. Our device will be:

* *Designed for*: Public Invention, as a part of an initiative to help monitor water quality in remote settings.
* *Used by*: On the ground experts in remote and low resource settings

1. **Limitations of existing solution**

In order to monitor water quality in remote & low resource settings, a portable incubator is needed to be transportable, as on the ground workers will often be going from location to location

The existing solution (“The Armadillo Incubator”) has the limitations of:

i. not providing enough information about the inside temperature to monitor the growing environment of the microorganisms.

ii. not being small enough

1. **Potential design solution features**

A portable (< 38cm×24.5cm×19cm (dimensions of existing design))\*, low-cost (under $500) incubator to hold 20 small petri film (3x4 inches) which has:

**i.**  the ability to provide a constant elevated temperature between 30ºC and 42ºC, as this is the ideal incubation temperature for the petrifilms

**ii.** a data tracking and digital readout of temperature

**iii.** rechargeable primary cells that could last the duration of one incubation cycle (up to 48 hours) per one charging

**iv.** be able to work with minimal repairs (be able to be easily repaired by a researcher with components that could be ordered online or found in hardware shops) for upwards of 3 years

If possible, we would like to have the following features:

**i.**  A warning mechanism to indicate if the system has failed, the battery is low, or if the temperature has fluctuated out of range.

**iii.** humidity control inside of the incubator

*\*client wants it to fit in a backpack.*

**Team Structures and Activities**

Over the course of the Spring 2021 semester (beginning January 25th, 2021 and ending May 14th, 2021), Team Moonrats will produce a prototype, 9 technical memos, and a final design accompanying the final prototype. Table 1 outlines the authors of each technical memo, and the date by which we plan to finish them. Table 2 outlines other major deliverables and an estimate of when we would like to finish them by.

We will produce our deliverables within a $500 budget that has been allocated to our team. In order to meet our goals within the given time frame, we will meet weekly on Tuesdays from 7:00pm - 8:00pm. Below, Table 3 and Table 4 list the contact information of the members and affiliates of Team Moonrats.

**Table 1: Tech Memo Author Table**

| **Tech Memo** | **Finish By** | **Authors** |
| --- | --- | --- |
| TM1: Problem Statement | 02/08/2021 | All team members |
| TM 2: Need-to-Know List and Bibliography | 02/15/2021 | Michael & Joseph |
| TM 3: Design Criteria | 02/19/2021 | Jason & Nora |
| TM 4: Brainstorming of design solutions | 02/22/2021 | Sindhuja & Michael |
| SM 10: Team Pit Stop Reflection | 02/22/2021 | Everyone individually |
| TM 5: Evaluation of Design Solution | 03/02/2021 | Joseph & Jason |
| TM 6: Design Plan | 03/08/2021 | Nora & Sindhuja |
| TM 7: Gantt Chart | 03/22/2021 | Michael & Joseph |
| SM 11: Identity Reflection | 03/29/2021 | Everyone individually |
| TM 8: Testing Plan | 04/12/2021 | Jason & Nora |
| TM 9: Design Solution | 05/05/2021 | All team members |
| SM 12: Team Post Mortem Reflection | 05/07/2021 | Everyone individually |

**Table 2: Major Deliverables and Planned Completion Dates**

| **Task** | **Planned Completion Date** |
| --- | --- |
| Design Proposal Presentation | 03/09/2021 |
| Prototype Evaluation #1 | 03/23/2021 |
| Prototype Evaluation #2 | 04/13/2021 |
| Prototype Design & Demo Presentation | 04/29/2021 |
| Prototype Evaluation #3 | End of the Course |

**Table 3: Team Members and Contact Information**

| **Team Moonrats** | | |
| --- | --- | --- |
| **Name** | **Email** | **Phone Number** |
| Joseph Urso | [jru1@rice.edu](mailto:jru1@rice.edu) | +1 (832) 496-4116 |
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**Table 4: Clients, Sponsors, and Other Affiliates and Contact Information**

| **Name** | **Role** | **Email** |
| --- | --- | --- |
| Dr. Christopher Ferguson | Client | [cfergu11@gmail.com](mailto:cfergu11@gmail.com) |
| Dr. Ashley Taylor | Faculty Mentor | [art6@rice.edu](mailto:art6@rice.edu) |
| Scott Lin | Design Mentor | [sl105@rice.edu](mailto:sl105@rice.edu) |
| Cat Grasso | Writing Mentor | [cg39@rice.edu](mailto:cg39@rice.edu) |

**Works Cited**

“Global WASH Fast Facts.” *Global Water, Sanitation, & Hygiene (WASH)*, Center for Disease Control and Prevention, 11 April 2016, https://www.cdc.gov/healthywater/global/wash\_statistics.html. Accessed 5 February 2021.

Mistry, Pratibha, and Jessica A. Lawson. “Testing water quality: When labs don’t work.” *World Bank Blogs*, World Bank Group, 24 January 2017, https://blogs.worldbank.org/water/when-labs-don-t-work. Accessed 7 February 2021.

Schertenleib, A., Sigrist, J., Friedrich, M. N. D., Ebi, C., Hammes, F., Marks, S. J. Construction of a Low-cost Mobile Incubator for Field and Laboratory Use. J. Vis. Exp. (145), e58443, doi:10.3791/58443 (2019). Accessed 7 February 2021.