

Idaho Incubation Fund Program

Final Report Form

Proposal No. IF18-006
Name: Sin Ming Loo
Name of Institution: Boise State University
Project Title: Infrasound Detector for Localizing Gun Shot

Information to be reported in your final report is as follows:

1. Provide a summary of overall project accomplishments to include goals/milestones met, any barriers encountered, and how the barriers were overcome:
 - Successfully deployed detection array in Little Cottonwood Canyon near Salt Lake City, Utah, along highway that accesses Snowbird and Alta ski resorts as part of an avalanche detection study. Natural occurrences of snow avalanches were recorded. The system also recorded avalanche control shots by the Utah Department of Transportation. This deployment is part of Utah DOT study looking for ways to upgrade and expand the present avalanche detection systems being used.
 - Redesigned and deployed two versions of microphone sensor enclosure to improve environmental stability and reduce wind noise level.
 - Developed and prototyped watertight control motherboard enclosure for ease of system deployment and data collection.
 - Deployed a battery system + photovoltaic solar panel to ensure continuous operation.
 - Built a second system for deployment and testing. The system was deployed on the roof of the Micron Engineering Center building to collect data on infrasound sensitivity and internal sensor noise levels.
 - The system was also deployed to record infrasound generated by explosives. WMDTech staff set off various explosives. The infrasound system was able to record the explosions and calculated direction of sounds.
 - Successfully upgraded the motherboard with WiFi transceiver. The WiFi firmware and detection software were also completed and improved.
 - Submitted a grant to Idaho Department of Commerce IGEM. The proposal has been funded at \$368k.

2. Describe the current state of the technology and related product/service:

- The current state of technology lack a cost effective infrasound solution. It is the goal of this project to reach a product for natural occurrence events and gunshot detection. The system will be portable and easy to setup. The incubation fund was able to help us in making this product possible.

3. List the number of faculty and student participants as a result of funding:

- Primary Investigator Prof. S. M. Loo
- Graduate/Undergraduate Study Employees: Mark Laverty, Austin Davis, Grady Anderson, Ashton Durrant, and Chris Larsen

4. What are the potential economic benefits:

- The product development continues with Commerce IGEM funding. The potential economic benefits hasn't been fully realized until the development is completed.

5. Description future plans for project continuation or expansion:

- The collaboration with WMDTech has worked out well for this project. With their help, we will able to successfully obtained the Idaho Commerce IGEM grant.
- Successfully obtained an Idaho Department of Commerce IGEM grant at the amount of \$368K to continue to take this idea to market in 2 years.

6. Please provide a final expenditure report (attached) and include any comments here:

- Enclosed

7. List invention disclosures, patent, copyright and PVP applications filed, technology licenses/options signed, start-up businesses created, and industry involvement:

- None at this writing, the development of this system will continue with the new Idaho Commerce IGEM Grant

8. Any other pertinent information:

- This incubation grant allowed us to improve the systems and completed more field tests. The improved infrasound system successfully competed at the Idaho Department of Commerce IGEM program. We have been granted \$368K to take this system to market in two years.
- WMDTech has hired Austin Davis (Electrical Engineering Major, Class of 2017-2018) as Electrical Engineer to design electrical subsystem and firmware.

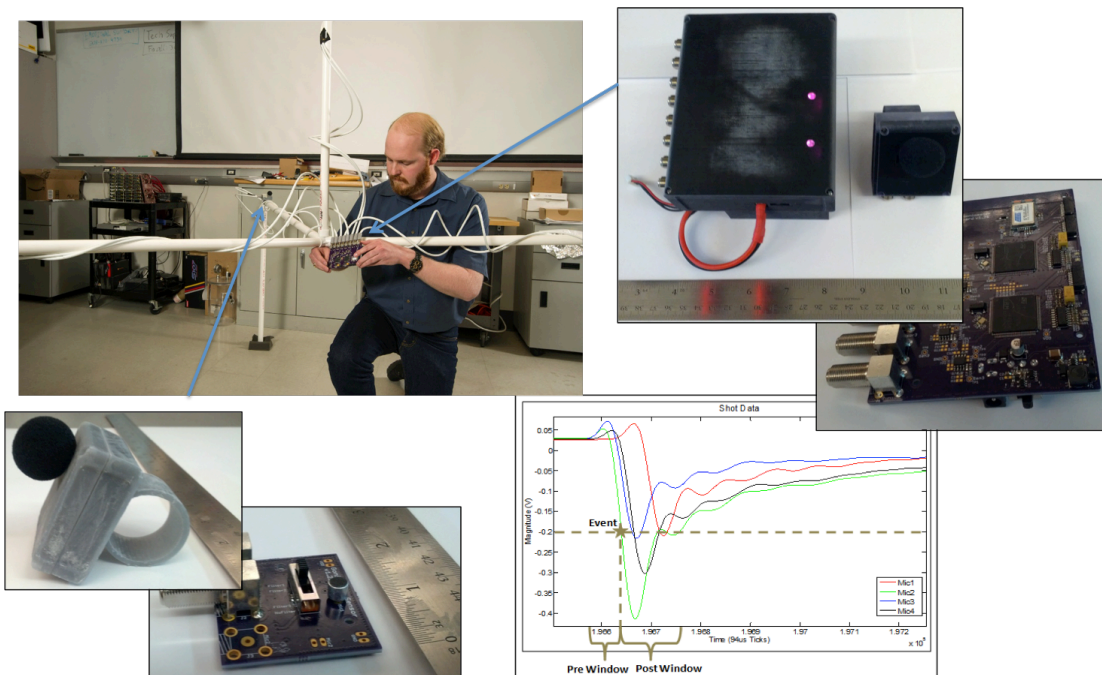
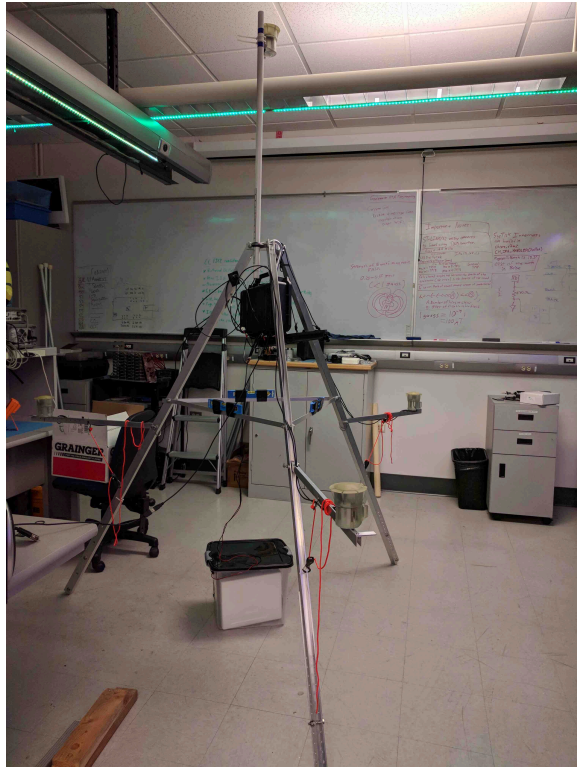


Figure 1: The prototype prior to HERC IF grant.



(a)



(b)

Figure 2: With HERC IF grant, we built prototype (a) and (b). Our latest prototype is shown in (b). A much portable and sturdy prototype.

FINAL EXPENDITURE REPORT

A. FACULTY AND STAFF		
Name/Title	\$ Amount Requested	Actual \$ Spent
Sin Ming Loo/Professor	\$12,466.00	\$12,452.33
B. VISITING PROFESSORS		
Name/Title	\$ Amount Requested	Actual \$ Spent
C. POST DOCTORAL ASSOCIATES/OTHER PROFESSIONALS		
Name/Title	\$ Amount Requested	Actual \$ Spent
D. GRADUATE/UNDERGRADUATE STUDENTS		
Name/Title	\$ Amount Requested	Actual \$ Spent
Graduate/Undergraduate Budget	\$47,054.00	
Grady Anderson/Undergraduate		\$8,838.00
Austin Davis/Undergraduate		\$12,945.00
Ashton Durrant/Undergraduate		\$4,271.41
Chris Larsen/Undergraduate		\$1,176.00
Mark Lavery/Graduate		\$17,325.00
E. FRINGE BENEFITS		
Rate of Fringe (%)	\$ Amount Requested	Actual \$ Spent
Fringe Budget	\$8,160.85	
Sin Ming Loo (24%)		\$3,054.98
Grady Anderson (3%)		\$282.55
Austin Davis (1%)		\$216.22
Ashton Durrant (7%)		\$301.00
Chris Larsen (1%)		\$7.27
Mark Lavery (6%)		\$959.28
PERSONNEL SUBTOTAL:	\$67,680.85	\$61,829.04
F. EQUIPMENT: (List each item with a cost in excess of \$1000)		
Item/Description	\$ Amount Requested	Actual \$ Spent
1.		
2.		
EQUIPMENT SUBTOTAL:		\$0.00
G. TRAVEL		
Description	\$ Amount Requested	Actual \$ Spent
1.		
2.		
3. TRAVEL SUBTOTAL:		

H. PARTICIPANT SUPPORT COSTS:			
Description		\$ Amount Requested	Actual \$ Spent
1.			
2.			
3			
PARTICIPANT SUPPORT COSTS SUBTOTAL:			
I. OTHER DIRECT COSTS:			
Description		\$ Amount Requested	Actual \$ Spent
1. Materials and Supplies Budget		\$6,919.15	
2. Educational Supplies			\$828.54
3. Medical & Lab Supplies			\$4,266.79
4. Other Supplies			\$1,993.48
OTHER DIRECT COSTS SUBTOTAL:		\$6,919.15	\$7,088.81
TOTAL COSTS (Add Subtotals):			\$68,917.85
TOTAL AMOUNT REQUESTED:			\$74,600.00
TOTAL AMOUNT SPENT:			\$68,917.85