

# Idaho Incubation Fund Program

## Progress Report Form

Proposal No. IF17-002  
Name: Peter Mullner  
Name of Institution: Boise State University  
Project Title: Solid State Positioning Device  
Reporting Period: July 1, 2016 to June 15, 2017

Information to be reported in your progress report is as follows (attach additional information as needed):

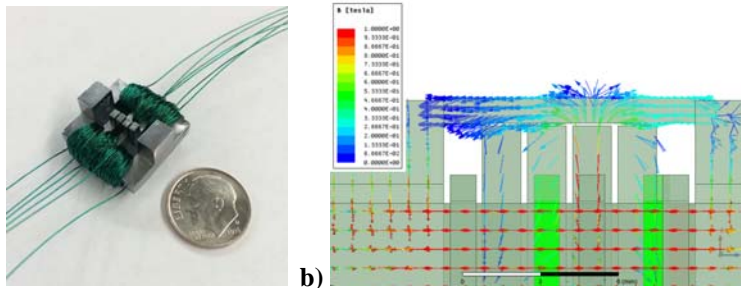
1. Summary of project accomplishments for the period just completed and plans for the coming reporting period:

### Summary of accomplishments

We designed and built a magnetic circuit with four pole pieces separated by 0.25 mm air gaps (*Fig. 1a*). These pole pieces were energized with a set of six individually controlled electrical coils. A small permanent magnet biased the magnetic circuit. By energizing two coils with opposite current, one pole turned active. When placing an MSM element over the pole pieces, the active pole created a twinned pocket in the element, which is the key

mechanism of the MSM-micropump.

*Fig. 1b* shows a finite element computer



**Fig. 1:** Solid State Drive System. (a) The SSDS prototype consists of a 3D soft-magnetic core-yoke-pole system (metallic gray), six hand-wound coils (green), and a permanent magnet (hidden by one of the coils). (b) Graphical representation of a numerical simulation of the actuation of the second pole (from right).

simulation of the activation of the second pole from right.

We submitted for publication a manuscript on an earlier stage of the drive system and a second manuscript on the current drive system (*Fig. 1*) is in preparation.

## Plans for coming reporting period

We submitted a funding request to HERC for the next reporting period and if funded plan to implement the SSDS in an MSM micropump for applications specified by our primary industry partner SMT. The project objectives for the next twelve months are:

- a. To double the length of the SSDS and the number of active poles.
- b. To implement the SSDS in an MSM micropump and operate the MSM-micropump. \
- c. To build a prototype solid state driven micropump to industry specifications at technology readiness level (TRL) 9 for medical or bio-molecular applications.

### 2. Summary of budget expenditures for the period just completed (include project burn rate):

Expense category	Amount
Salary regular	\$ 15,524.84
Student salary	\$ 35,601.53
Fringe	\$ 5,591.34
Other expense	\$ 10,524.79
Capital	\$7,757.50
<b>Total</b>	<b>\$ 75,000</b>

### 3. Numbers of faculty and student participation resulting from the funding, including internships:

Faculty (3)  
Students: (1 graduate student,

### 4. List patents, copyrights, plant variety protection certificates received or pending: In addition to the patents listed in section 6, we currently prepare another patent on an invention developed during the last six months.

### 5. List technology licenses signed and start-up businesses created: Details on technology licenses signed and start-up businesses created are listed in section 6.

### 6. Status of private/industry partnerships (include enough information to judge level of engagement):

DATE	ACTION
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DATE	ACTION
January 20, 2015	<b>Shaw Mountain Technology LLC</b> registered with State of Idaho
July 1, 2015	<b>Shaw Mountain Technology LLC</b> hires Dr. Aaron Smith
March 17, 2015	Collaboration established with <b>Acutus Medical Inc.</b> [6]
November 19, 2015	<b>Shaw Mountain Technology LLC</b> licenses Boise State University's inventions "Apparatus for Multi-axial Actuation" (BSU file 90), "Micropump for Biomedical Diagnostic" (BSU file 96), and "Actuation method and apparatus, micropump, and PCR enhancement method" (BSU file 122), and US Patent No. 9,091,251.
December 11, 2015	<b>Shaw Mountain Technology LLC</b> (PI) and Boise State University (Co-PI) submit an STTR Phase I proposal "MSM $\mu$ Pump: Precision Dosing for Laboratory Research to the National Science Foundation.
February 25, 2016	<b>Shaw Mountain Technology LLC</b> and Boise State University establish an Option Agreement "Actuation via Magnetic Torque Driven Deformation" (BSU file 144), "Self-Resetting Power Breaker" (BSU file 174) and U.S. Patent Applications Serial Nos. 15/068,237 and 15/266,449, respectively.
March 11, 2016	Boise State University files conversion of provisional patent 61/968,863 (BSU files 144 and 174).
March 31, 2016	Boise State University files patent application for BSU file 188, given U.S. Patent App. Serial No. 15/086,610.
July 1, 2016	<b>Shaw Mountain Technology LLC</b> and Boise State University obtain STTR Phase I funding "MSM $\mu$ Pump: Precision Dosing from the NSF.
July 14, 2016	<b>Shaw Mountain Technology LLC</b> and Boise State University execute a License Agreement on "Electrically driven magnetic shape memory apparatus" (BSU file 158) and "Permanent-magnet-assisted electrically driven magnetic shape memory apparatus" (BSU file 188, as CIP to 158).
March 30, 2017	<b>Shaw Mountain Technology LLC</b> wins the Prototyping Grant worth \$50,000 sponsored by uFluidix.
Spring 2017	<b>Shaw Mountain Technology LLC</b> negotiates collaborative work with two German companies (HNP-M and ETO MAGNETIC) for developing a micropump for the Lab-on-a-Chip.
May 2017	<b>AceCo Precision Manufacturing</b> expresses interest in exploring opportunities towards the commercialization of MSM micro-pumps in collaboration with Boise State University and Shaw Mountain Technology LLC.

- Any other pertinent information that will indicate to the council that the project is meeting satisfactory progress.