

Idaho Incubation Fund Program

Progress Report Form

Proposal No. IGEM16-02
Name: Kurtis Cantley
Name of Institution: Boise State University
Project Title: Enhancing Capabilities in Microfabrication at Boise State
Reporting Period: July 1, 2016 to January 1, 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:

Since the last report submitted at the end of June 2016, we have continued work on facility infrastructure improvements, installation of new equipment, and upgrades and critical maintenance on existing equipment. A list of specific project objectives and related outcomes during this period is given below.

- As outlined in the previous report, purchase and setup of the Fuji Dimatix materials inkjet printer originally scheduled for year 3 was moved forward. This system is now fully operational, being used heavily by two different faculty research groups, and is the central tool enabling submission of multiple grant proposals by these faculty.
- In place of the ion mill end point detector (which was declared infeasible), we have moved forward with critical maintenance and upgrades to the Oxford PlasmaLab 180 Inductively Coupled Plasma (ICP) etching system. One of these upgrades is the addition of Argon gas line to effectively allow the tool to run as another ion mill. The other is the addition of an Ocean Optics USB3000 optical endpoint detector with control software integration for tight process control during etching.
- Major facility projects include continued upgrades to air handling equipment and HVAC to ensure the clean room areas stay at positive pressure relative to outside. We have also committed to share \$25k cost on a significant chilled water upgrade project being led by Boise State Facilities Operations and Maintenance.
- Supplies and safety purchases have included a corrosive chemical storage cabinet for the base chemical processing station purchased last year. Also, we moved forward with the purchase of new clean room garments that are safer for users and also ensure better cleanliness of the environment compared to the very old suits being used previously.
- Finally, we moved the purchase of a new ashing/reactive ion etching system from year 3 into year 2, due to the lower than expected expenditure rate of the new faculty startup. It was also decided to purchase a more powerful and cheaper PVA TePLA Ion 40 system over the originally proposed Samco 1-C.

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

As of December 31st 2016, 87% (or \$435,000) of the \$500,000 year 2 budget has been encumbered (including remaining salaries) or spent. This corresponds to a **burn rate (excluding remaining salaries) of approximately \$51,000/month** over the 6 months (July through December). Major purchases and expenditures include:

- \$44,720 for the new asher/reactive ion etching system
- Approximately \$100,000 in salary and benefits for technical support engineering Travis Gabel (for the year)
- Approximately \$115,000 in salary and benefits for ECE faculty Dr. Harish Subbaraman (for the year)
- Graduate student stipends and benefits totaling approximately \$62,000 for the year
- \$25,000 for endpoint detection and Argon gas upgrades to the Oxford PlasmaLab ICP etcher
- \$25,000 dedicated to lab chilled water supply upgrade (joint project with Boise State Facilities Operations and Maintenance)
- \$65,000 in total for supplies, and facility and equipment upgrades and installation

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

Currently, there is one full-time PhD candidate (Sumedha Gandharava) and one master's student (Binay Joshi) supported by the project. The new ECE faculty (Harish Subbaraman) and technical support engineer (Travis Gabel) are also supported with salary and fringe benefits. Funds provided through the grant include \$100,000 in research start-up needs to Dr. Subbaraman, which will be split between years 2 and 3.

4. List patents, copyrights, plant variety protection certificates received or pending:

None at the current time.

5. List technology licenses signed and start-up businesses created:

At this time there are no start-up businesses created as a result of the funding. However, memristor (resistive memory) technology developed by Prof. Kris Campbell in the ECE department has been licensed by Knowm, Inc. and M. Alexander Nugent Consulting (MANC) of Santa Fe, NM. If their projects proceed as expected, use of the IML by MANC could generated up to \$100,000 in revenue.

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

Several new agreements with Idaho businesses have been put in place since the start of the project to use the IML and new equipment and processes contained in it. These include:

- American Semiconductor, Inc. (Boise, ID) has heavily used the new Bruker stylus profilometer and presented results at multiple conferences and workshops with credit to the IML at Boise State. They are also working to expand contract usage with lithography and chemical processing.
 - Fiberguide, Inc. (Caldwell, ID) was previously using the old wet bench for process development and anticipates heavy use of the new benches in the coming months.
 - Collaborative use of the Bruker stylus profilometer for a joint project with Idaho National Laboratory (INL), with additional use planned for the future.
 - A new non-disclosure agreement (NDA) has been put in place between Boise State and PakSense, Inc. to initiate and protect collaborative research, particularly with the new ECE faculty member, Dr. Harish Subbaraman.
7. Any other pertinent information that will indicate to the council that the project is meeting satisfactory progress.