**CETUS working group: Rise of the HERATICs**

(Community Extreme Tonnage User Service)

(High pressure Experimental Research Apparatus Technical Implementation Conference)

A proposal to COMPRES for a small meeting in January 2017, partnering with the Lunar and Planetary Institute (LPI)

Introduction

Large sample volume 5000 ton multi-anvil presses have contributed to the exploration of deep Earth and planetary interiors, synthesis of ultra-hard and other novel materials, and serve as a sample complement to pressure and temperature regimes already attainable by diamond anvil cell experiments. However, no such facility exists on the North American continent. A large press has a number of potential benefits to expanding high pressure research, as outlined by the COMPRES community at meetings over the past year. The large sample volume in an experiment would reduce sample-capsule boundary interaction effects, but alternatively could be used as a template to study surface interactions at multiple simultaneous interfaces and/or along an imposed thermal gradient. Additionally, a large sample volume at lower mantle conditions would provide opportunities to study minor phases in the mantle, particularly volatile-rich phases. It could also contribute to greater understanding of the thermal conductivity of planetary interiors via experiments with complex mixtures of materials. Finally, a key need identified by COMPRES community members is synthesis of phases at significant quantities to share among researchers and/or for use in multiple applications, a task feasible only with a large volume press.

Motivation

After the Large Multi-Anvil Press COMPRES workshop in July 2015, work began in earnest by the CETUS development team to establish a large multi-anvil press facility in the United States. The development team members are Lisa Danielson1, David Draper2, Kai Landskron3, Kurt Leinenweber4, Francis McCubbin2, and Kevin Righter2. 1Jacobs JETS, NASA JSC, 2NASA JSC, 3Lehigh University, 4Arizona State University.

A number of milestones have been reached in 2016:

* A Planetary Major Equipment proposal was submitted to the NASA Emerging Worlds solicitation for the full cost of the press and partial FTE for development team members. (6/3/16)
* A full sub-award proposal was submitted to COMPRES for 2 FTE research and technical staff to run the CETUS facility. (8/15/16)
* A sub-award was submitted to COMPRES for experimental cell assembly development. (8/15/16)
* The PI, Lisa Danielson, is attending the European High Pressure Research Group International Meeting on High Pressure Science and Technology, Bayreuth, Germany, 9/5/16-9/9/16, and conducting site visits to Bayreuth Geoinstitut and the Voggenreiter factory, which is the preferred vendor for the 5000 ton press.

The development team is seeking more active input and participation from the community as the project moves forward.

Expected Outcomes

We wish to conduct a working group meeting that will address the following issues and outline a plan of action for CETUS development for 2017:

* What are the themes and science goals for the facility? Specifically, how do these address NASA and NSF programs and objectives?
* What are the innovation, process, and/or technical development goals for the facility? How will this facility differ from others (GRC and BGI)? What design considerations are there that will address our user base (also see below, users and funding)?
* Who is our initial user base? How might the user base and their experimental needs change over time? How will we engage this base for any additional development or operations funding?
* What are the initial and long term funding sources? What are additional strategies will be implemented to secure CETUS funding?
* What community service projects should this facility fulfill? What user logistical concerns remain, and how will these be addressed?
* What are development or operational hurdles and pitfalls, and how will these be addressed?

Agenda and Meeting Participants

The CETUS HERATIC working group will be comprised of ~20 attendees; the original development team, invitees from BGI and GRC, invitees from researchers who’ve contributed letters of support, and additional interested community members.

Arrive Sunday, January 22, 2017

Informal Gathering 6-9 pm

Monday, January 23, Lunar and Planetary Institute

Morning: Outline meeting goals, brief presentations by invited speakers, followed by contributed talks (if any)

Afternoon: Break into sub-groups to address topics

End of day: summary reports of sub-groups

Tuesday, January 24

Morning: Reshuffle sub-groups (if productive), submit final written reports

Afternoon: optional tour of JSC facilities

Adjourn

Budget

The LPI will contribute meeting space, web hosting, and ancillary logistical services related to running a workshop. The LPI will also fund travel for early career scientist participation. We are requesting that COMPRES fund travel for domestic and international invitees and participants, as well as some meeting refreshments. The table below provides estimates of costs and the total requested from COMPRES.

Itemized budget

15 participants

Candlewood Suites 100 per night, 2 nights

domestic airfare 500

transportation 100

2 participants

Candlewood Suites 100 per night, 2 nights

international airfare 2000

transportation 100

total travel 16600

Jason's Deli Breakfast wrap tray w fruit and coffee

7.99 per person, 2 days, 20 people

49.96 coffee and cookies

45 veggie tray

115 sandwich trays

65 fruit and cheese tray

total w 8.25% tax 643.61

**Total requested 17243.61**