

UPDATE ON NASA'S PLANETARY AEOLIAN LABORATORY. D. A. Williams¹, ¹School of Earth and Space Exploration, Arizona State University, Tempe, Arizona 85287-1404 (David.Williams@asu.edu).

Introduction: NASA's Planetary Aeolian Laboratory (PAL) is a facility funded by NASA's Planetary Science Division (PSD) that includes the Mars Wind Tunnel (MARSWIT) and the Titan Wind Tunnel (TWT) located at the Ames Research Center (ARC) at Moffett Field, CA. The purpose of this abstract is to update the planetary aeolian community on the operational status of the PAL and inform them of the critical need for more proposals to conduct work in the PAL.

Background: The PAL was founded at NASA ARC in 1976 by Dr. Ronald Greeley of Arizona State University (1939-2011) as a facility to conduct controlled experiments in aeolian processes. Funded by NASA's Planetary Geology and Geophysics Program, the PAL initially included the Mars wind tunnel (1976-present) and a Venus wind tunnel (1981-1994), which was remodeled as a Titan Wind Tunnel and became operational in June 2012. The MARSWIT is used to investigate the physics of particle entrainment by the wind under terrestrial and Martian conditions, to conduct flow-field modeling experiments to assess wind erosion and deposition on scales ranging from small rocks to landforms (scaled) such as craters, and to test spacecraft instruments and other components under Martian atmospheric conditions. MARSWIT is a 13-m long open-circuit boundary-layer wind tunnel within a large environmental chamber that operates at atmospheric pressures ranging from 1 bar to 5 millibars, with maximum speeds of 10.5 m/sec at 1 bar and 100 m/sec at 5 millibars. The wind tunnel is an open-circuit design, but sits on the floor of a large pressure chamber with an inside height of 30 m and an interior volume of 13,000 cubic meters. For low-pressure wind tunnel runs, the chamber is sealed and pumped down, and the open-circuit wind tunnel inside is operated within the low-pressure environment. PAL can be evacuated to Mars analog pressure (4 torr) in about 45 minutes. Due to the high cost to operate the vacuum system an agreement was struck in which PAL draws its vacuum almost exclusively only as a ride-along with other NASA-Ames projects/facilities that sponsor the activities of the NASA-Ames steam plant. This arrangement is highly cost-effective, but requires advance scheduling of low-pressure runs (requiring pump-downs) well in advance. Aside from this agreement, reserved vacuum service is available, provided sufficient funding is presented and there are no scheduling conflicts.

The TWT is a closed-circuit, pressurizable (to 20 bars) wind tunnel with an overall dimension of 6-m by 2.3-m. Included in the remodel were upgrades to a

newer, higher performance motor, advanced motor controls, and new instrumentation. Overall tunnel pressure is determined by visual observation of a calibrated gauge (manufactured by Wika Instrument Corp., + or - 1psig) attached to the front of the tunnel instrument panel. Differential pressure is measured (for flow velocity calculation) by a custom designed sensor (manufactured by Tavis Corp.). This sensor is connected to a stack valve that determines which pitot tube is being "read" (traversing or fixed). The voltage from the sensor is sent to a data acquisition module (manufactured by Measurement Computing Corp.) and processed for interpretation by TracerDAQ software installed on a laptop computer. A test section is designed to allow the substitution of test plates. A test plate specifically designed for boundary layer profile work already exists and can be installed should the need arise.

Also available to the aeolian community (but not a part of the PAL) is the ambient pressure/temperature wind tunnel (ASUWIT) and the vortex (dust devil) generator (ASUVG) on the Tempe campus of Arizona State University (ASU), which is part of the ASU School of Earth and Space Exploration (SESE) and the Ronald Greeley Center for Planetary Studies. These facilities exist as a "recharge center" as part of ASU, and are available for anyone's use at a cost of \$500/day, plus cost of consumables or special equipment.

PAL Status: At the time of this writing (February 2015) the PAL is funded through July 2015. Because there are two currently funded NASA PSD projects requiring use of the PAL facilities in 2015 and 2016, I have recommended to NASA that they grant a 1-year augmentation to the existing grant at the current funding level to continue operating the PAL through July 2016, pending arrangements for a facility review. No decisions have been made on this recommendation.

If the PAL is to continue as a NASA-funded facility, it is imperative that there is an increase in usage by the planetary community, either through an increase in funded proposals to conduct experiments in the PAL, or by requests from funded instrument teams for upcoming missions to test their components in the PAL. Thus, **I encourage members of the aeolian community, who have been thinking about proposing wind tunnel work, to submit your proposals this year under ROSES-2015!!**

Where to Propose to Use the PAL? The PAL was previously funded by the NASA Planetary Geology and Geophysics (PG&G) program, and as of 2014 is

now incorporated into the “Solar System Workings” Program, where Announcements of Opportunity to Propose (AO) are released annually as part of NASA’s Research Opportunities in Space and Earth Science (ROSES), typically available in February of each year. This should be the primary R&A program to submit proposals to conduct laboratory studies with PAL facilities. Funding to use the PAL facilities could also be included in instrument development proposals or proposals to develop instruments for future missions.

Proposers’ Information: In ROSES look for information on the PAL in Section C.1. I have made a *PAL Guidebook to Proposers*, which is available as a PDF through a link in ROSES section C.1. This document contains details on the technical capabilities of the PAL wind tunnels and necessary proposal and budgetary information. Feel free to email me at David.Williams@asu.edu for a copy of this document, or download from this webpage: <http://rpif.asu.edu/pal/>. For technical feasibility assessments on proposed PAL projects, feel free to contact the PAL Engineer James “Ken” Smith at James.K.Smith@asu.edu