THE NEW DANISH/ESA MARS SIMULATION WIND TUNNEL AT AARHUS UNIVERSITY. P. Nornberg, J.P. Merrison, H.P. Gunnlaugsson, Aarhus University, Mars Simulation Laboratory, Ny. Munkegade, build. 1520, DK-8000 Aarhus C, Denmark. (geopn@phys.au.dk).

Introduction: Study of processes in the Martian surface environment has since 2000 taken place at the Mars Simulation Laboratory, Aarhus University. Simulated Mars conditions, that are close to the conditions at the surface of the planet, has been created in a chamber for microbiological experiments, a small Mars wind tunnel and to day also a big Mars wind tunnel. In the Bio-chamber Martian pressure, temperature, gas composition and UV-VIS light conditions can be created. In the wind tunnels also the wind flow and dust environment on Mars can be reproduced. The smaller wind tunnel has existed as a Mars simulation facility since 2000 (Figure 1) [1].

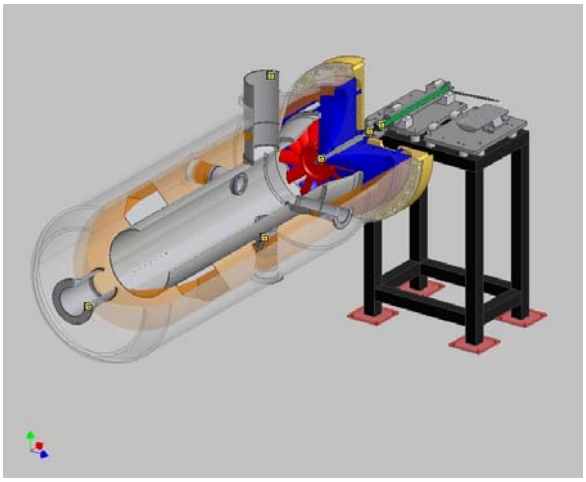

Figure 1: The wind tunnel is placed in a vacuum chamber. It is 400 mm in diameter, and 1500 mm long, and cooling performed with liquid nitrogen through the blue flange.

A wide range of applications have taken place, from development, test and calibration of instruments, over tests of solar panels, and aerodynamic studies of granular transport to studies of physical properties of dust materials such as grain electrification, aggregation and magnetic properties [2,3]. The Salten Skov I analogue [4] and other Martian regoliths and dust analogues have been used in the wind tunnel experiments. The bigger wind tunnel has a cross section of ~1 x 2 m and is placed in a tank 2.5 x 10 m.

New Mars Wind Tunnel: With the view to future research on Martian surface processes, instrument development and solar panel optimization a new ESA supported wind tunnel has been constructed at Aarhus University (Figure 2).

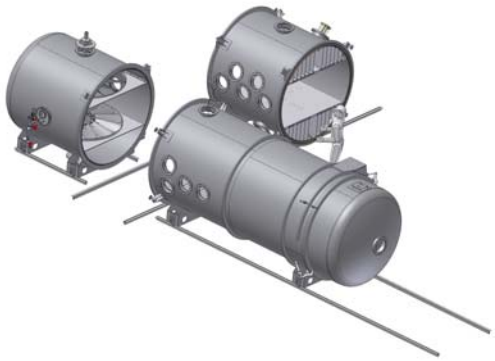

Figure 2: Main assembly of the three sections of the Mars Simulation Facility. In the fan section (left) two fans pulls the air out of the ~ 1 x 2 m wind tunnel measuring section (middle) and circulates it through the top and bottom return tubes. To the right the 5 m upwind flow stabilisation tube of the wind tunnel is seen.

Figure 3: Upper: Test section with cooling plates at top and bottom. In the middle of the lower plate the manipulation stage for samples will be mounted. The fans are seen in the section behind. Lower: The five metre long upstream section for stabilization of the wind flow.

The wind tunnel is installed in the laboratory (Figure 3), and currently (December 2009) close to being finally tested. Vacuum system, pressure and gas composition control, cooling down to Martian temperatures and dust suspension works. An example on cooling down the lower cooling plate in the test section is shown in Figure 4.

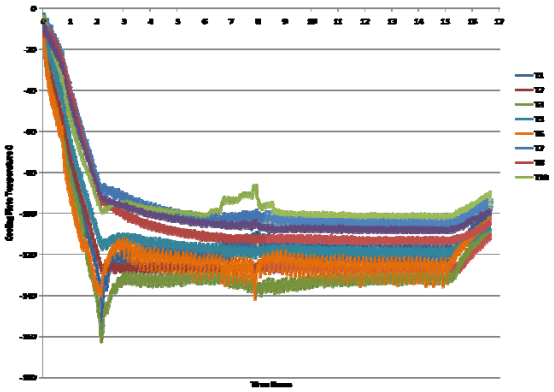

Figure 4: An example on temperature gradients upon cooling the lower cooling plate down with liquid nitrogen. As the graph shows the temperature drops to Martian level within the first two hours of the cooling cycle and stay stable until the experiment is stopped after 15 hours.

The wind flow still needs some adjustment, and we expect to reach a speed of close to 30 m/s under Martian pressure conditions and with samples cooled. Wind speed is measured by three different methods. A commercial Laser Doppler anemometer, a laser based time of flight instrument constructed for ExoMars and a conventional pitot tube.

ESA, ExoMars use of this facility will have priority. However, research projects in collaboration with external users will continue like in the former wind tunnel. Early 2010 access possibilities will be announced at the Mars Simulation Laboratory home page: www.marslab.dk.

References:

[1] Merrison, J., Bertelsen, P., Frandsen, C., Gunnlaugsson, H.P., Knudsen, J.M., Madsen, M.B., Mossin, L., Nielsen, J., Nornberg, P., Rasmussen, K.R., Uggerhøj, E. and Weyer, G. 2002: Simulation of the Martian Aerosol at Low Wind Speeds, **J. Geophysical Research Letters,** 107 (E12): Art. No. 5133.

[2] Merrison, J.P., Bechtold, H., Gunnlaugsson, H., Jensen, A., Kinch, K., Nornberg, P., Rasmussen, K. 2008: An environmental simulation wind tunnel for studying Aeolian transport on Mars. **Planetary and Space Science**, 56, 426-437.

[3] Merrison, J.P., Gunnlaugsson, H.P., Nornberg, P., Jensen, A.E., Rasmussen, K.R. 2007: Determination of the Wind Induced Detachment Threshold for Granular Material on Mars using Wind Tunnel Simulations. **Icarus,** 191, 568-580.

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