

15th SYMPOSIUM ON SMALL SATELLITE MISSIONS (B4)  
Hitchhiking to the Moon (8)

Author: Dr. Rene Laufer  
Baylor University, United States, rene\_laufer@baylor.edu

Dr. Glenn Lightsey  
The University of Texas at Austin, United States, lightsey@mail.utexas.edu  
Mr. Ralf Srama  
Max-Planck-Institute for Nuclear Physics, Germany, ralf.srama@mpi-hd.mpg.de  
Dr. Georg Herdrich  
Germany, herdrich@irs.uni-stuttgart.de  
Mr. Wilfried Tost  
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR), Germany, wilfried.tost@dlr.de  
Dr. Carsten Wiedemann  
Technical University of Braunschweig, Germany, c.wiedemann@tu-braunschweig.de  
Dr. Ed Chester  
CTAE - Aerospace Research and Technology Centre, Spain, (*email is not specified*)  
Dr. Hugh Hill  
International Space University (ISU), France, hill@isu.isunet.edu  
Mr. Gregory Earle  
University of Texas at Dallas, United States, earle@utdallas.edu  
Mr. Troy Henderson  
Virginia Polytechnic Institute and State University, United States, henderson@vt.edu  
Dr. Rainer Sandau  
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR), Germany, rainer.sandau@dlr.de  
Prof. Hans-Peter Roeser  
University of Stuttgart, Germany, roeser@irs.uni-stuttgart.de  
Dr. Lorin Matthews  
Baylor University, United States, Lorin\_Matthews@baylor.edu  
Mr. Truell Hyde  
Baylor University, United States, Truell\_Hyde@baylor.edu

ARMADILLO – A DEMONSTRATION FOR A CIS-LUNAR EXPLORATION MISSION TO THE  
KORDYLEWSKI CLOUDS

**Abstract**

ARMADILLO (Attitude Related Maneuvers And Debris Instrument in Low Orbit) is a low Earth orbit small satellite mission under development by the University of Texas at Austin in collaboration with the Center for Astrophysics, Space Physics and Engineering Research (CASPER) of Baylor University and the Institute of Space Systems, Stuttgart. The project was recently selected to participate in the University Nanosatellite Program to be designed and built in the 2011-2013 timeframe with the goal to target a 2014 launch opportunity.

The 3-unit cubesat will demonstrate the combination of precise attitude control for nanosatellites, a cold-gas micro-propulsion system and a miniaturized dust/debris detector. The ACS consists of GNC

computer, IMU, GPS receiver, sun sensors, magnetometer, reactions wheel, magnetorquers and low-cost optical navigation with the goal of achieving 0.1 degree 3-axis attitude control. The cold gas propulsion system is based on an Aerospace Corporation design and will provide approximately 50 m/s impulsive capacity and a delta-v resolution of around 0.1 m/s – during the ARMADILLO mission used for the end-of-mission de-orbit. The Piezo Dust Detector (PDD) is a miniaturized in-situ measurement instrument of around 0.5 kg to detect dust and debris particles of up to 1 mm size. The detector is a joint development of CASPER (Baylor University) and the Institute of Space Systems (University of Stuttgart) in partnership with the Cosmic Dust Group at the Max-Planck- Institute for Nuclear Physics, Heidelberg based on the experience from preparation and tests of the Mercury Dust Monitor for the European BepiColombo mission.

ARMADILLO will demonstrate the capabilities necessary for a mission to verify the Kordylewski clouds, proposed dust clouds at the Earth-Moon libration points L4/L5. Such an investigation was first proposed in 2005 within the Stuttgart small moon orbiter project “Lunar Mission BW1”. At least one – preferred is a constellation of two – ARMADILLO-like spacecraft would travel piggyback with a carrier probe like the Lunar Mission BW1, separating at some point in cis-lunar space. Using its own chemical or electrical micro-propulsion system for final trajectory adjustment, the nanosatellite(s) would fly through the Kordylewski clouds performing in-situ dust measurements for several hours to investigate these regions of the Earth-Moon system for the first time. The paper will present briefly the ARMADILLO satellite and the PDD instrument design, and then the required adjustments for a mission beyond low earth orbit (e.g. AOCS subsystem) as well as the scientific results expected from that mission.