Geophysical Research Abstracts,
Vol. 10, EGU2008-A-01483, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-01483
EGU General Assembly 2008

EUROX (Europa Explorer)

An astrobiology mission concept to the jovian icy moon Europa

J.P.P. de Vera (1), S. Bartlett (2), B. Baticle (3), M. Bodendorfer (4), P. Byrne (5), O. Doule (6), T.A. Heydenreich (1), A. Johnsson (7), I. Magiopoulos (8), R.M. Martinez-Arnaiz (9), M. Sampl (10), S. Siljeström (11), A.M. Trofaier (12), P. von Paris (13), Team Tutor: U.G. Jorgensen (14)

(1) Heinrich-Heine-University, Institute of Botany, Universitätsstr. 1, D-40225 Düsseldorf, Germany (deVera@uni-duesseldorf.de, phone: +49-211-81-1342), (2) The Open University, Planetary and Space Science Research Institute, Walton Hall, Milton Keynes, MK7 6AA UK, (3) ESTACA, 34 rue Victor Hugo, F-92300 Levallois-Perret, France, (4) University of Bern, Siedlerstrasse 5, CH-3012 Bern, Switzerland, (5) Trinity College Dublin, College Green, Dublin 2, Ireland, (6) Czech Technical University, Faculty of Architecture, Thakurova 7, 16624 Prague 6, (7)Earth Science Centre Göteborg University Guldhedsgatan 5A, SE-41320 Göteborg, Sweden, (8) University of Crete, Department of Materials Science and Technology, P.O.BOX 2208, 71003 Heraklion, Crete, Greece, (9) Universidad Complutense de Madrid, Avenida Complutense s/n, E-28040 Madrid, Spain, (10) Graz University of Technology, Institute of Communications Networks and Satellite Communications, Inffeldgasse12, A-8010 Graz, Austria, (11) Stockholm University, Department of Geology and Geochemistry, SE-10691 Stockholm, Sweden, (12) University of Edinburgh, School of Physics, James Clerk Maxwell Building, The Kings Building, Mayfield Road, Edinburgh EH9 3JZ, UK (13) Technische Universität Berlin, Zentrum für Astronomie und Astrophysik, Sekr. PN 8-1, Hardenbergstraße 36, D-10623 Berlin, (14) Copenhagen University, Niels Bohr Institute, Juliane Maries Vej 30, DK-2100 Copenhagen O

The discovery of so-called extremophiles indicates how robust life is. That microbial life can resist extreme and harsh environmental conditions as e.g. very high and cold temperatures, desiccation, acidity, salinity and wide ranges of radiation spectra including UV and X-rays, suggests that micro organisms are capable of surviving

and maintaining essential living functions, or often thriving, in conditions previously thought impossible. Recently it seems that only liquid water and an energy source are the core prerequisites for the development of life, greatly expanding the range of potential habitats for life both on Earth and in the solar system. In light of these discoveries, the definition of the “Habitable Zone” as the region where liquid water can exist at a planetary surface may need revision. Energy in the form of heat may be found on several volcanic worlds in our solar system, and subsurface liquid water may exist there, too. One likely candidate for such a reserve of water is the jovian icy moon Europa. Imaged by the Voyager and Galileo probes, this icy body appears to have a geologically young outer surface. Spectroscopic studies from Earth have confirmed that the European crust is composed of water ice. Long cracks across its surface may be suggestive of huge ice blocks rafting upon an underlying liquid layer. Darker non ice material also covers much of the surface and is spatially associated with the cracks. Recent modeling suggests that tidal forces imparted upon the moon by Jupiter may cause heating in the depth – raising the possibility of a liquid water ocean beneath Europa’s icy crust. Further on it is supposed that a weak induced magnetic field is present on the moon. This classifies Europa as an object of great scientific interest, warranting investigation for habitability and even the presence of life within the supposed ocean of the moon. The Europa Explorer (EUROX) mission complements other proposed missions to study Europa. EUROX will characterize the habitability potential of Europa, with the aim of understanding whether life could exist there or not. The mission will address the following key questions: (i) existence or non- existence of a liquid ocean beneath the surface, (ii) the nature of the non icy material visible upon the surface cracks, (iii) the physical characteristics of the ice crust, (iv) effects by local radiation on the surface chemistry, (v) the depth of radiation penetration in the ice and probably shielding effects by a magnetic field and (vi) the presence of organic compounds on or in the Europan ice crust. Our proposed mission will operate as a fully European and further on international mission, with the aim of providing the initial information required for later, larger missions to visit Europa. EUROX will involve both remote-sensing and in-situ research. Its mission architecture sees a single space craft deployed to Europa, launched by an Ariane 5. This vehicle will use conventional propulsion and a Venus-Earth-Earth flight path to travel to the jovian system in six years. Upon arrival at Europa, the space craft will commence remote observations of the icy moon, to determine the physical nature of the ice crust, and to investigate the presence of a subsurface liquid ocean. The orbiter will carry two independent vehicles (two penetrators) that will then separate, de-orbit, and penetrate the crust nearby or in the cracks to a depth of several meters. A suite of compact instruments will address the physical and chemical properties of the crust, as well as seeking organic compounds and pre-biotic material in the ice. The use of a laser communication system removes the need for a relay spacecraft in orbit around Jupiter, decreasing overall mission cost. Expected orbiter mission duration is on the order of two months, with each penetrator functioning for approximately 24 hours.