ROLIS, A Close-up Look at the Surface of 67P. S. Mottola[1], H. Michaelis[1], W. Bresch[1], R. Jaumann[1], G. Arnold[1], H.- G. Grothues[2], G. Neukum[3], I. Pelivan[1], S. Schröder[1], J.-P. Bibring[4], T. Behnke[1], A. Lichopoj[1], R. Schrödter, M. Tschentscher[1], [1]DLR, Institute of Planetary Research, Berlin, Germany, DLR, [2]Space Management, Space Science, DLR, Bonn, Germany, [3]Free University, Department of Earth Sciences, Berlin, Germany, [4]Institute of Space Astrophysics, Orsay, France

Introduction: ROLIS (Rosetta Lander Imaging System) is a multispectral imager onboard the Rosetta Lander Philae. From its location on the instruments balcony and a down-looking orientation, ROLIS will acquire images during the descent onto 67P /Churyumov-Gerasimenko and after landing. The aim of the experiment is to contribute to the understanding of the physical properties of the surface, as its texture, photometric properties, degree of heterogeneity, as well as the processes at work, as erosion by sublimation and collisions that reshape the nucleus over time. The measurements by ROLIS will also provide context to the Philae in-situ analyzers, while the landing acquisition sequence will contribute to an accurate determination of the landing location.

Figure 1. ROLIS camera head

Instrument Description: The instrument has been developed by a team of scientists and engineers at DLR's Institute of Planetary Research in Berlin, Germany in cooperation with engineers from Jena Optronik. ROLIS components were built by Jena Optronik and Tecnotron, and integrated and tested at DLR [1] . It consists of a compact imager with a 1k x 1k CCD detector and a near-field illumination device with four color channels. With its FOV of about 58° it will image comet 67P/Churyumov-Gerasimenko with a sampling ranging from about 20 cm/pix to 1 cm/pix during descent, and of 0.3 mm/pix after landing. The first optical element of the f/5 objective lens can be shifted in and out of the optical path by a motor-driven mechanism. With the front lens in the optical path, the objective is focused for objects at distances ranging from 1.4 m to infinity. With the lens off the path, the camera is focused at an object distance of 30 cm with a depth of field of approximately (+10; −8) cm. During surface operations, the front lens also serves as a cover by closing between different exposure series and therefore protecting the close-up optics.

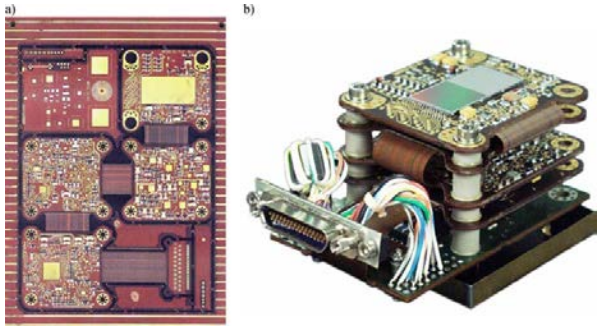

Figure 2. The ROLIS PCB stack in unfolded (a) and folded (b) configuration

The ROLIS instrument consists of two main units: the Camera Head (CH) and the Imaging Main Electronics (IME). The first comprises the detector and the front-end electronics, the illumination device, the optics and the front lens mechanism and drive. The IME comprises the data processing unit, the mass memory and the interfaces to the spacecraft and to the instrument CIVA [2]. The IME is responsible for the instrument commanding, data processing and storage. While the IME is located inside the lander in a thermally conditioned compartment, the CH is located on lander balcony, and is therefore exposed to the harsh environment conditions of the comet. The limited mass and power resources available on the lander, as well as the demanding contamination, thermal and radiation environment, have been the drivers for the development of the instrument. A compact shape format for the camera head was achieved by using unpackaged components and a stacked PCD layout, based on rigid-flex technology [3].

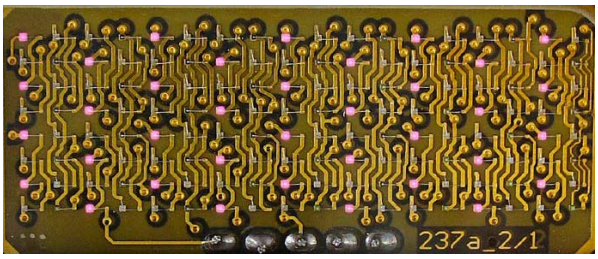

Figure 3. ROLIS LED illumination device

The ROLIS CH accommodates an innovative LED illumination device designed to illuminate the near field in 4 spectral bands. It consists of an array of 144 LEDs arranged in 36 quadruplets each containing a blue, green, red and near-infrared diode. The diodes are soldered as a dye (without encapsulation) on the 38×18mm2 printed circuit board, and are protected on the front side by a 2 mm radiation-hard quartz window.

In Mar 2014 ROLIS has undergone successful post-hibernation commissioning after the Rosetta wake-up and is fully operational for the landing and on-comet operations in Nov 2014. The ROLIS experiment is an important contribution to the Philae payload. Because of its ability to image the cometary soil at high resolution, ROLIS will provide insight into the small-scale structure of the surface, about its physical properties,
and its spectral diversity. Furthermore it will provide context to the measurements of the APXS and of the drill sample analyzers, thereby contributing to the Rosetta Mission goal of helping us to understand the origin and evolution of the Solar System.

[1] Mottola et al. (2007), *SSR, 128, 241-255.* [2] Bibring et al. (2007), *SSR, 128, 397-412.* [3] Michaelis et al. (1999), *proc. SPIE 3794, 115-121.*