KAGUYA (SELENE) / TERRAIN CAMERA INITIAL RESULTS AND PERSPECTIVES. J. Haruyama[1], M. Ohtake[1], T. Matsunaga[2], T. Morota[1], C. Honda[1], M. Torii[1], Y. Yokota[1], Y. Ogawa[2], M.Abe[1], S. Hara[3], K. Hioki[3] and LISM working group. [1].Japan Aerospace Exploration Agency, Institute of Space Astronautical Science, Yoshinodai 3-1, Sagamihara City, Kanagawa 229-8510, Japan. [2] National Institute for Environmental Studies, 16-2 Onogawa, Tsukuba City, Ibaraki 305-8506, Japan. [3] Central Computer Services Co., Ltd. 1-42-20 Kameido, Koto-ku, Tokyo 136-0071, Japan.

Introduction: On 14 September 2007, the Japanese Moon explorer KAGUYA (SELENE) was successfully launched by an H-IIA rocket from the Tanegashima Space Center. KAGUYA reached the Moon after about a one-month cruise and became the first Japanese lunar orbiter. It has an inclination of 90° and acquires data for studying the lunar origin and evolution and the possibility of future human activities on the Moon.[1,2] KAGUYA carries three optical mission instruments: the Terrain Camera (TC), the Multi-band Imager (MI), and the Spectral Profiler (SP).[3,4] These three instruments share structures and electric circuits to reduce mission resource consumption and are collectively called the Lunar Imager/Spectrometer (LISM).[4] The LISM acquired the first data on November 3, 2007, in the initial checkout operation period of KAGUYA. We processed the data, and confirmed that LISM had not been damaged during launch and the cruising phase and was functioning properly in orbit around the Moon. The three LISM instruments transitioned to the normal operation phase with 12 other mission instruments on December 21, 2007 after completion of the initial checkout phase. In this presentation, we introduce the LISM/TC initial results and perspectives.

TC instrument on KAGUYA: The TC is a push-broom stereoscopic imager with forward-looking and aft-looking optical heads with slant angles of +/- 15 degrees from the nadir vector.[5, 6, 7, 8] The spatial resolution of TC is 10m/pixel from the KAGUYA nominal altitude of 100km. The exposure time will be chosen from three levels: 6.5ms (long), 3.25ms (middle), and 1.675ms (short). The saturation levels (10bit or 1023 DN) of the TC are radiance factors defined in Hapke[9] of 8%, 16%, and 32% for long, middle, and short exposure times. To reduce the data volume, DCT compression with compression tables chosen from 32 patterns by commands can be executed on board. The TC will provide (1) global/local high-contrast mosaicked maps and (2) DTMs for the Moon's entirety with relative height resolution of a few tens of meters or better and ultimately a DEM with absolute height information.[4, 8] The TC products will complement lunar high-resolution topographic maps and contribute to the lunar sciences together with data acquired by past explorers such as Apollo, Luna, Clementine, and Smart-1 as well as future lunar explorers.

TC first light: The TC first initial checkout was conducted on November 3, 2007, sharing time with MI's checkout in three revolutions along longitudes of about 60E on the lunar night side and about 240E on the lunar day side as planned. One of the first-light images presented in Fig. 1 depicts an area around the lunar south-pole that was in early summer. The faint crescent feature in the lower section of this image is Shackelton crater's rim. This image was taken in the non-compression mode and low-exposure time mode. The detailed structure is clearly discernible, indicating that the TC will be able to provide data even in dark conditions such as at high latitude areas or in low beta (sun-moon-spacecraft) angle periods. From image data acquired in the checkout on November 3, digital terrain models (DTMs) were produced to check the digital terrain model production system installed in the SELENE Operation and Analysis Center in the Institute of Space and Astronautical Science (ISAS). An anaglyph image from a TC DTM and an ortho-image produced in the ISAS are presented in Fig. 2 for a region of nearly 64N and 240E. A large sculptured structure a few kilometers wide and several hundreds of meters in depth as well as detailed features are well reproduced.

TC operation plan: TC and MI operate at different times to conserve spacecraft resources of total data volume, data rate, and power.4 The default plan of LISM operation are 1) TC stereo mapping in three Moon cycles, 2) TC mono-telescope mapping under illumination conditions of eastward and westward lower solar elevation angles for 60N to 60S in two Moon cycles, and 3) MI visible and near-infrared mapping in six Moon cycles. SP will acquire data in the daytime. Figure 3 depicts the current nominal operation plan for TC and MI.

References: [1] Maejima H., et al. (2005) *Space Resource Roundtable VII*, *Proc. of LEAG Conference on Lunar Exploration*, No. 1287, p.62. [2] Kato M., et al. (2006) *LPS XXXVII*, Abstract #1233. [3] Haruyama J., et al. (2007), *LPS XXXVIII*, Abstract #1565. [4] Haruyama J., et al. (2007) *Earth Planets Space*, in press. [5] Haruyama J., et al. (2003) *23rd ISTS proc*., 1992-1996. [6] Haruyama J., et al. (2005) *24th ISTS proc.*, 857-862. [7] Haruyama J., et al. (2006) *LPS XXXVII*, Abstract #1132. [8] Haruyama J., et al. (2006) *Adv. in Geosciences. 2005*, 228-236. 4151, 32-39. [9] Hapke, B., Theory of Reflectance and Emittance Spectroscopy, 262, Cambridge Univ. Press, 1993.

Link: KAGUYA home page site (English): http://www.selene.jaxa.jp/en/index.htm

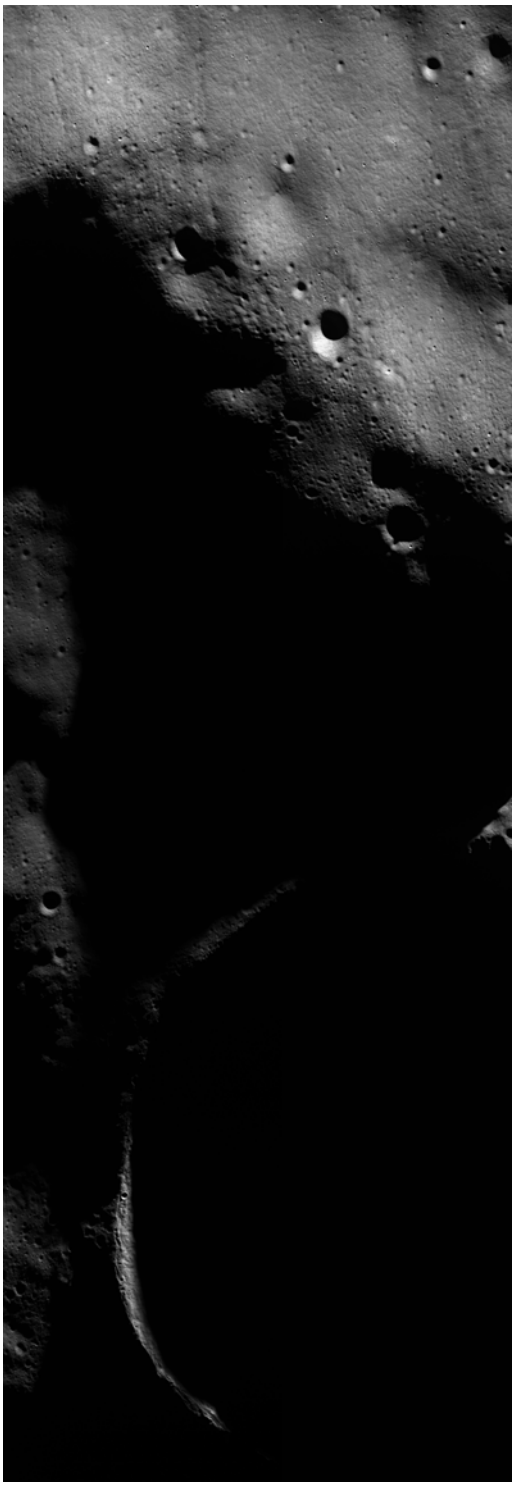


Fig.1. First (raw) image of TC near the lunar south-pole taken on November 3, 2007. The swath is about 16km. The upper side is north. The crater near the bottom is the Shackelton crater.

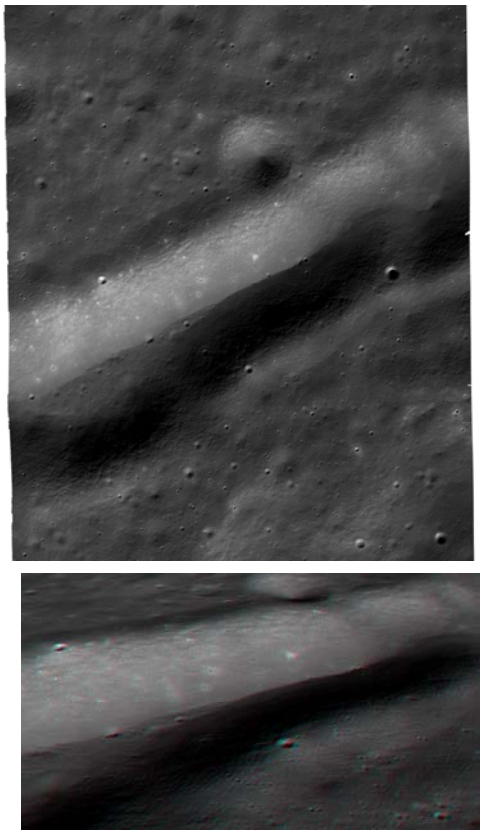
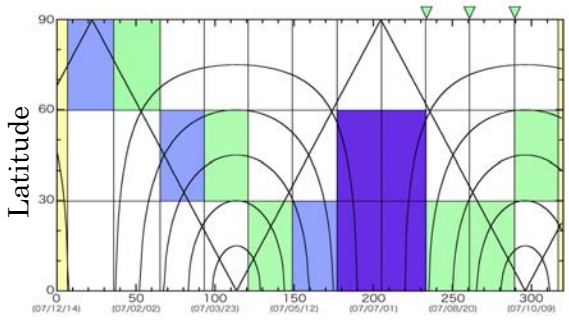


Fig. 2. TC ortho-image of an area around 64N and 240E (upper) and its anaglyph image (lower) produced in ISAS. This area's 3D movies produced from TC DTMs and ortho images have been released on http://www.selene.jaxa.jp/en/index.htm



Date (from Dec.14, 2007)

Fig. 3. TC/MI operation plan. The horizontal line indicates days from Dec. 14, 2007. The vertical line indicates the observation latitude. Sky blue areas indicate TC stereoscopic observation, dark blue areas indicate TC mono telescope observation, and green areas indicate MI observation. Half circuits indicate the same solar elevation angles in 15° intervals increasing to the center. Straight lines starting from about 70° latitude at Dec. 14, 2007, indicate beta (sun-moon-spacecraft) angles. Three orbital plane changes are planned (indicated by green triangles in this figure) so as to ensure MI's global observation coverage.