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**PLANETARY DEFENSE GROUND ZERO: MASCOT'S VIEW ON THE ROCKS –
AN UPDATE BETWEEN FIRST IMAGES AND SAMPLE RETURN**

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ABSTRACT

At 01:57:20 UTC on October 3rd, 2018, after 3½ years of cruise aboard the JAXA spacecraft HAYABUSA2 and about 3 months in the vicinity of its target, the MASCOT lander was separated successfully by from an altitude of 41 m. After a free-fall of only ≈5^m51^s MASCOT made first contact with C-type near-Earth and potentially hazardous asteroid (162173) Ryugu, by hitting a big boulder. MASCOT then bounced for ≈11^m3^s, in the process already gathering valuable information on mechanical properties of the surface before it came to rest. It was able to perform science measurements at 3 different locations on the surface of Ryugu and took many images of its spectacular pitch-black landscape. MASCOT's payload suite was designed to investigate the fine-scale structure, multispectral reflectance, thermal characteristics and magnetic properties of the surface. Somewhat unexpectedly, MASCOT encountered very rugged terrain littered with large surface boulders. Observing in-situ, it confirmed the absence of fine particles and dust as already implied by the remote sensing instruments aboard the HAYABUSA2 spacecraft. After some 17^h of operations, MASCOT's mission ended with the last communication contact as it followed Ryugu's rotation beyond the horizon as seen from HAYABUSA2. Soon after, its primary battery was depleted. We present a broad overview of the recent scientific results of the MASCOT mission from separation through descent, landing and in-situ investigations on Ryugu until the end of its operation and relate them to the needs of planetary defense interactions with asteroids. We also recall the agile, responsive and sometimes serendipitous creation of MASCOT, the two-year rush of building and delivering it to JAXA's HAYABUSA2 spacecraft in time for launch, and the four years of in-flight operations and on-ground testing to make the most of the brief on-surface mission.

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