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A new facility for low-velocity experimental studies of wet target impacts at Centro de Astrobiología, Spain.

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Impact cratering is a fundamental geological process in the Solar System and may greatly influence the evolution of life by both extinction and creation of habitats. The crater geology may also reflect the target environment allowing paleoenvironmental reconstructions. At the Centro de Astrobiología, Spain, the new Facility for Experimental Impact Cratering (FEIC) complements observational data from natural impact craters and numerical 2-D simulations (iSALE) with the objective to understand how impact craters can reveal information on environments of importance for life. Thus, the FEIC is especially designed to allow the studies of wet-target impacts. It has a box-shaped small test bed (1.2x1.2m) and a funnel-shaped, circular large test bed (7m in diameter) with the capacity also for half-space experiments. The shape and size of the large test bed decrease disturbance from reflected surface waves at wet target experiments. The projectile launcher for the small test bed is a modified 17.5mm caliber paintball gun, and for the large test bed it is a compressed gas (200bar, N2 or He) gun (CGG) with 20.5mm caliber of our own design. Both guns can fire at any angle, into various targets, and with various projectile compositions and, for the CGG, with various diameters (with sabots if needed). Projectile velocities are currently estimated by combining frame rate of the high-speed camera used to document the tests, and the projectile travel distance. For the paintball gun the average projectile velocity is about 50 m/s (5.7g, glass) and 100 m/s (3g, paintball), and for the CGG 341 m/s (20mm, 16.3g Al2O3, N2) and 468 m/s (20mm, 5.7g delrin, N2). Further improvements to the CGG are planned to reach an impact velocity 50-100% higher than the current average velocity for the same projectile types. The velocities are below those at crater-forming events on planetary surfaces and therefore preclude study of the effects of melting and vaporization of the target, which, however, generally involve a relatively small fraction of the crater volume. A primary advantage of FEIC is that its large scale allows for detailed study of the dynamics of cratering motions through the phase of crater growth and subsequent collapse, especially in wet targets. These observations provide valuable benchmark data for numerical simulations and for comparison with field studies (Ormö et al, 2010, GSA SP 465).