ShadowCam instrument (top) with a focused view of the electronics and radiator (right).

ShadowCam Seeing in the Shadows

ShadowCam is a NASA-funded instrument hosted onboard the Korean Aerospace Research Institute (KARI) Korean Pathfinder Lunar Orbiter (KPLO) satellite. By collecting high-resolution images of the Moon's permanently shadowed regions (PSRs), ShadowCam will provide critical information about the distribution and accessibility of water ice and other volatiles at spatial scales (1.7 m/pixel) required to mitigate risks and maximize the results of future exploration activities.

The Moon's PSRs never see direct sunlight and are illuminated only by light reflected from nearby topographic highs. This secondary illumination is very dim. To see details within the PSRs, ShadowCam was designed to be over 200 times more sensitive than previous imagers, like the Lunar Reconnaissance Orbiter Camera Narrow Angle Camera (LROC NAC). As a result, ShadowCam images will allow for unprecedented views into the shadows but will saturate while imaging sunlit terrain.

Science Objectives

1. Map albedo patterns in PSRs and interpret their nature: ShadowCam will search for frost, ice, and lag deposits by mapping reflectance with resolution and signal-to-noise ratios comparable to LROC NAC images of illuminated terrain.

2. Investigate the origin of anomalous radar signatures associated with some polar craters: ShadowCam will determine whether high-purity ice or rocky deposits are present inside PSRs.

3. Document and interpret temporal changes of PSR albedo units: ShadowCam will search for seasonal changes in volatile abundance in PSRs by acquiring monthly observations.

4. Provide hazard and trafficability information within PSRs for future landed elements: ShadowCam will provide optimal terrain information necessary for polar exploration.

5. Map the morphology of PSRs to search for and characterize landforms that may be indicative of permafrost-like processes: ShadowCam will provide unprecedented images of PSR geomorphology at scales that enable detailed comparisons with terrain anywhere on the Moon.

For more information, news, and images, about ShadowCam, visit online at shadowcam.sese.asu.edu. For more information about the KPLO satellite and KARI, visit www.kari.re.kr/eng/sub03_07_01.do

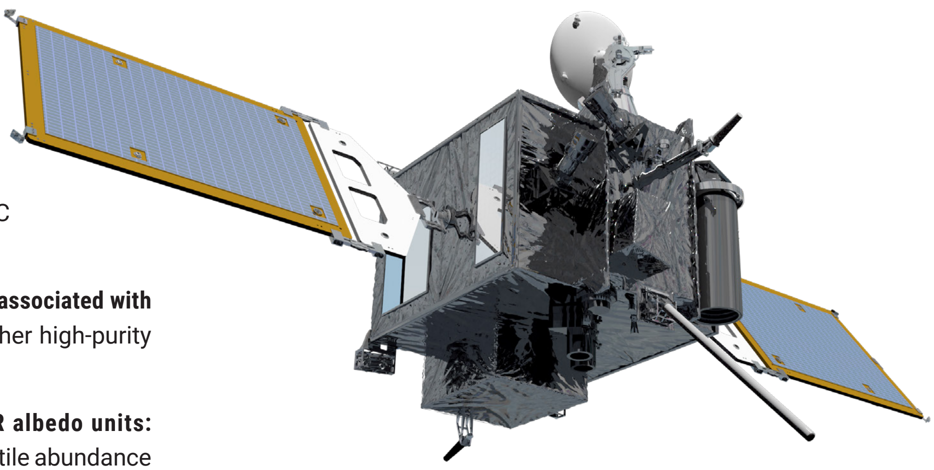
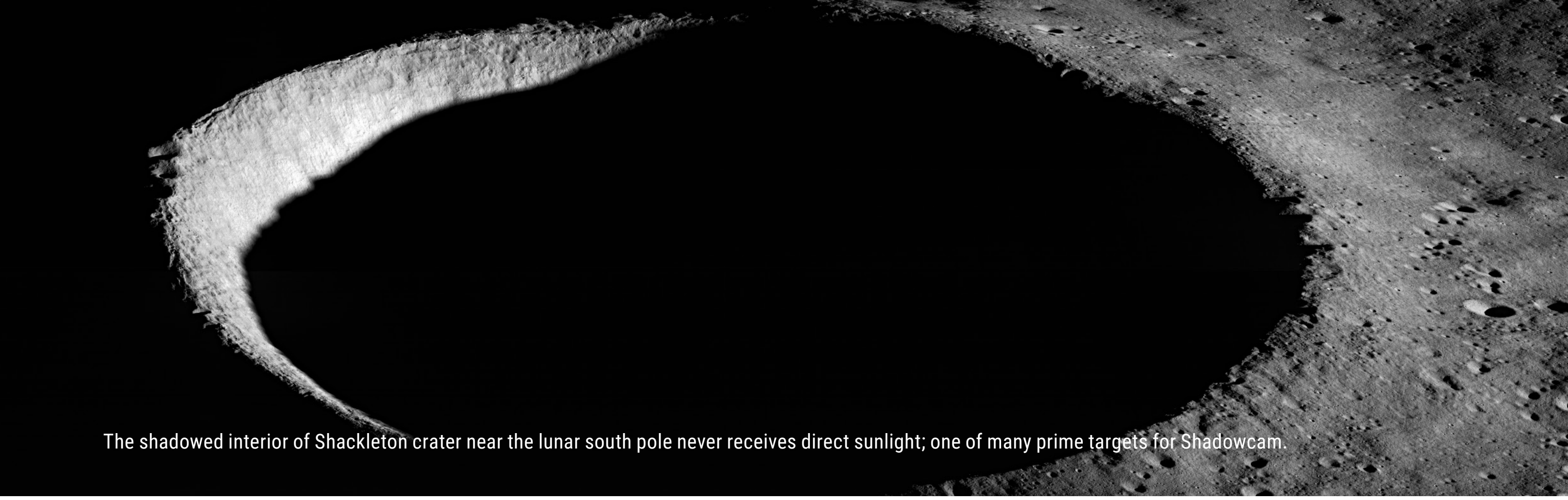


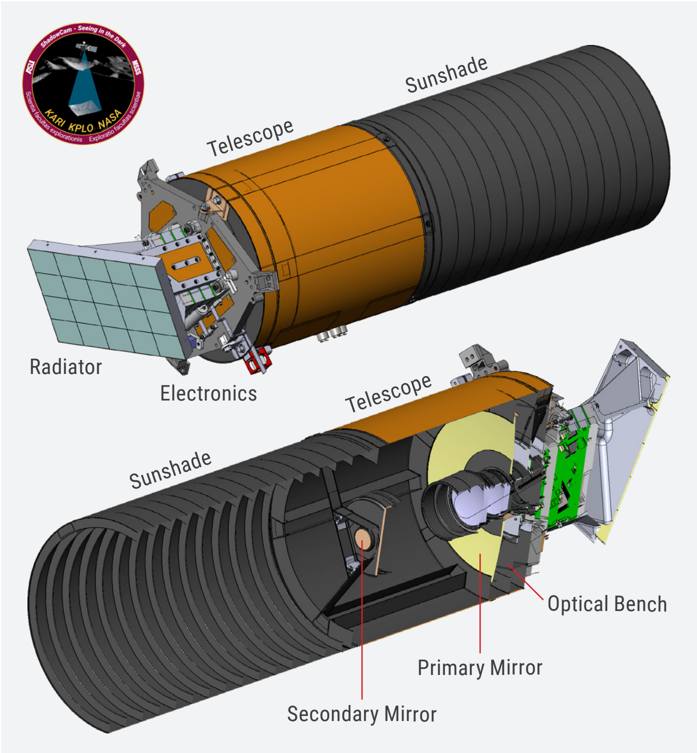
Illustration of KPLO satellite (courtesy of KARI).



The shadowed interior of Shackleton crater near the lunar south pole never receives direct sunlight; one of many prime targets for Shadowcam.

ShadowCam Characteristics

Camera Design	Time Delay Integration pushbroom
FOV (cross track)	2.86°
Image Scale	1.7 m/pix
Signal-to-Noise Ratio	>90
Pixel Size	12 µm
Instantaneous FOV	17.1 µrad
Image Size	3144 (3072 sensing pixels; cross track)
Image Footprint Max	5 km × ~140 km
Optics	f/3.6 Cassegrain (Ritchey-Chretien)
Focal Length	700 mm
Primary Mirror Diameter	195 mm
MTF (@Nyquist)	>0.2
Aperture	194.4 mm
Effective TDI Lines	32
Sensitivity	>200× the LROC NAC sensitivity
Mass	8.753 kg
Volume	118 × 27 cm (w/radiator)
Peak, Standby Power	9.3, 4.5 W
Average Power	6.4 W



CAD model of the ShadowCam instrument (top) and cross-section (bottom) showing the internal optics and sunshade baffling.

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*Key LROC personnel leveraged to build, operate, and analyze observations.