IMAGING FROM THE INSIGHT LANDER, J. Maki[1], A. Trebi-Ollennu[1], B. Banerdt[1], C. Sorice[1], P. Bailey[1], O. Khan[1], W. Kim[1], K. Ali[1], G. Lim[1], R. Deen[1], H. Abarca[1], N. Ruoff[1], G. Hollins[1], P. Andres[1], J. Hall[1], and the InSight Operations Team[1], [1]Jet Propulsion Laboratory, California Institute of Technology (4800 Oak Grove Drive, Pasadena, CA 91109, Justin.N.Maki@jpl.nasa.gov).

Introduction: After landing in Elysium Planitia, Mars on November 26th, 2018, the InSight mission [1] began returning image data from two color cameras: the Instrument Context Camera (ICC), mounted on the lander body underneath the top deck, and the Instrument Deployment Camera (IDC) mounted on the robotic arm (Figure 1, [2], and [3]). Images from these color cameras have helped the mission meet several key objectives, including: 1) documentation of the state of the lander, robotic arm, and surrounding terrain, 2) terrain assessment for the selection of the SEIS [4] and HP3 [5] instrument deployment locations, 3) facilitation and documention of deployment activities, 4) monitoring of the state of the instruments post-deployment, and 5) monitoring of atmospheric dust opacity. The cameras are also providing information about the geologic history and physical properties of the terrain around the lander [6,7,8,9].

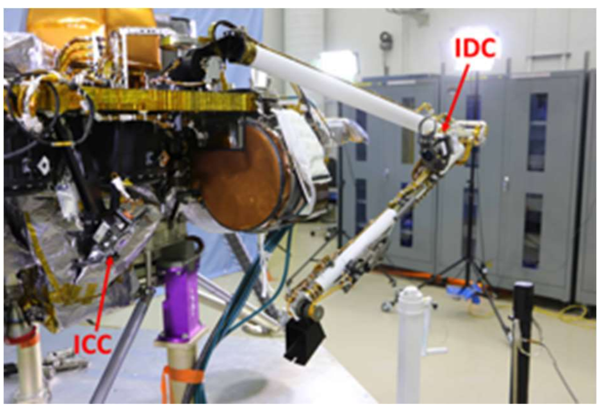

Figure 1: Locations of the IDC and ICC on the InSight lander. The IDC is located on the robotic arm and the ICC is mounted directly to the lander body.

Instrument Description: Both InSight cameras are flight spare units from MSL [10], which flew build-to-print copies of the Mars Exploration Rover (MER) cameras [11]. The InSight project converted the MSL cameras from grey-scale to color by replacing the MSL detectors with a Bayer color filter array (CFA) version of the same type of frame transfer charge-coupled devices (CCDs). The camera electronics and optical assemblies are otherwise unchanged from MSL. Both cameras use identical camera heads and readout electronics, differing only in the type of lens mounted to the camera head. Table 1 gives a summary of the key camera characteristics. For a more detailed description of the InSight cameras, see [2].

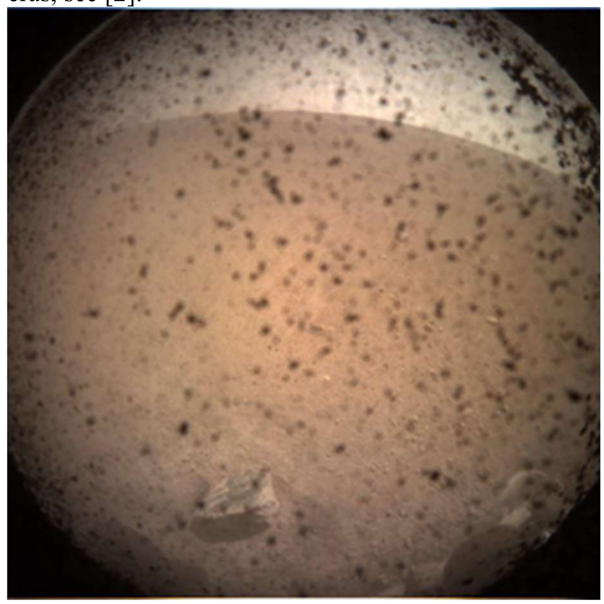

Figure 2. First image acquired by the ICC. The transparent dust cover was in the closed position when this image was acquired.

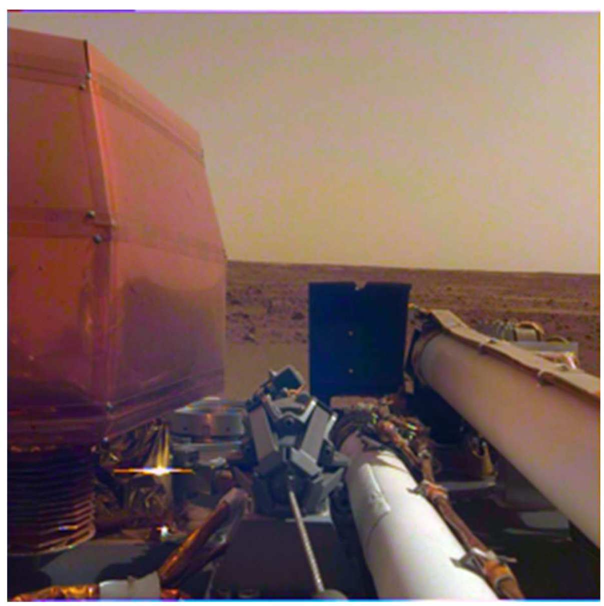

Figure 3. First image acquired by the IDC, showing the SEIS (left), robotic arm (right), and Martian terrain. The transparent dust cover was in the closed position when this image was acquired.

Table 1. Instrument Summary

Item	IDC	ICC
Angular Resolution at the center of the FOV (mrad/pixel)	0.82	2.1
Focal Length (mm)	14.67	5.58
f/number (f/#)	12	15
Entrance Pupil Diameter (mm)	1.25	0.37
Field of View (h x v degrees)	45 x 45	124 x 124
Diagonal FOV (degrees)	67	180
Depth of Field	0.5 m – infinity	0.10 m – infinity
Best Focus (m)	1.0	0.5
Bandpass centers (nm, approximate)	R (600) G (550) B (500)	R (600) G (550) B (500)

Instrument Status and Operations Summary: Operation of the cameras has been ongoing since landing, with over 361 images returned as of Sol 42. The radiometric and geometric performance of the cameras have been nominal. While the dust covers from both cameras opened successfully, the ICC dust cover did not completely protect the camera from dust during/after the landing event. Thus ICC images show a noticeable mottled pattern caused by dust contamination on the lens (this impacts useability only slightly). The IDC front lens has remained dust-free by comparison.

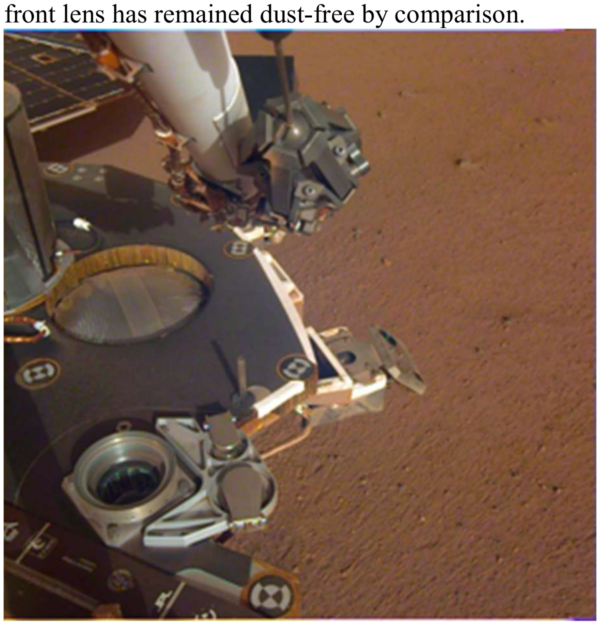

Figure 4. IDC image of the lander deck and nearby deployment area.

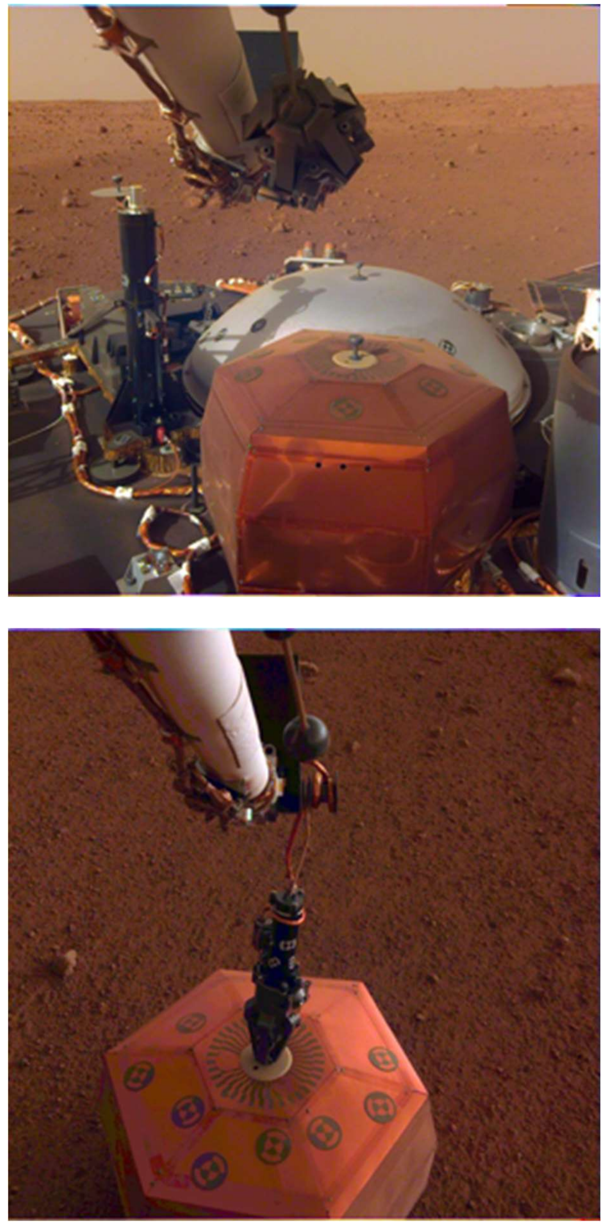

Figure 5. IDC image of SEIS on the lander deck (top) and on the Martian surface (bottom, acquired after Martian sunset).

References:

[1] Banerdt, et al. (2017) *LPSC 48*, 1896.
[2] Maki, et al. (2018) *Space Sci Rev 214*: 105.
[3] Trebi-Ollennu. et al. (2018) *Space Sci Rev 214*: 93.
[4] Longonne et al, (2018), *Space Sci. Rev.*, in review.
[5] Spohn, et al. (2018) *Space Sci Rev 214*: 96..
[6] Golombek et al. (2018) *Space Sci Rev 214*: 84.
[7] Weitz et al., (2019), *LPSC 50*
[8] Garvin et al., (2019), *LPSC 50*
[9] Grant et al., (2019), *LPSC 50*
[10] Maki, et al. (2011) *Space Sci. Rev., 170,* 77-93.
[11] Maki et al. (2003), *J. Geophys. Res*., *108*, 8071.