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Results from the Short-Period (SP) Seismometers on the Insight Mission: From Launch to Sol 120

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The Interior Exploration using Seismic Investigations, Geodesy and Heat Transport (InSight) mission landed successfully on Mars on 26 November, 2018 at 4.51°N, 135.97°E in Elysium Planitia. InSight's seismic payload, SEIS, includes the short-period (SP) sensors optimized to investigate the martian seismic signal above a few Hz [1, 2]. In particular, the three axes of the short-period (SP) sensor contained within the SEIS payload have survived the rigors of launch, cruise, EDL (entry descent and landing) and, finally, the pyrotechnic shocks during the deployment of the assembly into its final configuration as a seismic station on Mars.

The SPs operated for a total of 210 hours from landing to sol 40. The first data was acquired on Sol 4, with six additional sols of on-deck observations. SEIS was deployed on to the surface of Mars on Sol 24. Further SP data was recorded on the ground, with the very-broad-band sensor (VBB) joining SP operations after SEIS levelling on sol 35. The SP has generally operated whenever thermal constraints have allowed, usually in the second half of each sol, after system observations confirmed that the UHF-induced currents in the tether did not pose an operational risk. In doing so, the sensor has satisfied its performance, thermal and shock requirements for the mission [2].

Prior to landing, the two horizontal SPs acquired data during the cruise to Mars on 16 and 19 July and 29-30 August with the free-fall environment allowing the performance of the sensors to be determined and validating their noise requirements. Moreover, the sensor has operated on the InSight lander deck from sol 4 of the mission, owing to its ability to function over a wide range of tilts [1]. This has enabled the dynamical characterization of the lander up to 40Hz with a sensitivity below 10 nm/s2/rtHz [3]. Off the deck, the ground motion response is modified only by the LVL mount [4] and the direct coupling of environmental sources [5]. These observations have allowed the characterization of the environmental injections from around noon to 22:00 LTST, showing noisy and quiet regimes. The analysis of the on and off deck observations, therefore, determines the propagation of lander generated and atmospheric sources to the sensor assembly. This is essential for the comprehension of the recorded seismograms [3, 4].

We will present a summary of the SP's initial results on and off the deck.

[1] Pike et al. Proc. IEEE MEMS, (2018)
[2] Lognonné et al., in press, Space Science review, 2019.
[3] Murdoch et al. Space Sci Rev (2017) 211: 457.
[4] Knapmeyer-Endrun et al. Space Sci Rev (2018) 214: 94
[5] Mimoun et al. Space Sci Rev (2017) 211: 383.