Europa Seismic Package: Measuring the structure and activity of Europa with a flight-proven seismic system

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A mature and capable microseismometer with broadband sensitivity is required for determination of the activity and subsurface structure of Europa within the significant resource constraints of any landed mission on the icy ocean world. The InSight SP seismometer (e.g. Lognonné et al., 2019), now flight-proven after having operated on Mars successfully since November, 2018, can be readily adapted to function in Europa conditions. The sensor head requires updating for Europa gravity, while the proximity and feedback electronics require straightforward updates for radiation-hardening. The backed electronics require a complete redesign from that used in InSight in order to simultaneously meet environmental requirements and meet mass and power limitations. By completion of the project, ESP will be at TRL 5 for Europa with demonstration of all key subsystems. Overall performance requirements are also discussed, with overall seismicity levels of Europa estimated in advance by scaling by tidal dissipation energy from observed activity on Earth's moon (Panning et al., 2018). Likely seismic signals at frequencies below 1 Hz can be simulated using seismic wave propagation modeling (Stähler et al., 2018) through thermodynamically self-consistent interior models (Vance et al., 2018). Possible signals at higher frequencies can be estimated through comparison with terrestrial analogs, such as comparing field studies on the Ross Ice Shelf in Antarctica, where a 1-km fractured ice layer overlaying a shallow water layer has geometry similar to that proposed for lenses of water formed beneath lenticulae and chaos (e.g., Schmidt et al., 2011).