The sound velocity of liquid Fe-S is an important physical property to understand the Earth’s and lunar outer cores. We measured P-wave velocity ($V_P$) of liquid Fe$_{84}$S$_{16}$, Fe$_{60}$S$_{40}$, and Fe$_{50}$S$_{50}$ up to 5.4 GPa and 1550 °C using ultrasonic method combined with synchrotron X-ray technique. The derived $V_P$ of liquid Fe-S shows very little change with temperature. The $V_P$ of liquid Fe-S decreases linearly with increasing S content at 2.5 GPa and 1300 °C. The $V_P$ of liquid Fe$_{60}$S$_{40}$ increases almost linearly. The expected $V_P$ of the lunar outer core range 3840-4250 m/s assuming the lunar core consists of liquid Fe-FeS outer core and solid Fe inner core. Although the $V_P$ of liquid Fe$_{60}$S$_{40}$ is slower than that of pure liquid Fe up to 5.4 GPa, the $V_P$ of liquid Fe$_{60}$S$_{40}$ should be exceed that of liquid Fe over 7 GPa because the pressure derivative of $V_P$ of liquid Fe$_{60}$S$_{40}$ is larger than that of liquid Fe. This result suggests S is effective in increasing the $V_P$ of liquid Fe over 7 GPa. Therefore, S is considered to be a possible light element of the Earth’s outer core.

Keywords: high pressure, sound velocity, core, liquid, Fe-S