Earth-Affecting Solar Causes Observatory (EASCO): Results of the Mission Concept Study

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Coronal mass ejections (CMEs) corotating interaction regions (CIRs) are two large-scale structures that originate from the Sun and affect the heliosphere in general and Earth in particular. While CIRs are generally detected by in-situ plasma signatures, CMEs are remote-sensed when they are still close to the Sun. The current understanding of CMEs primarily come from the SOHO and STEREO missions. In spite of the enormous progress made, there are some serious deficiencies in these missions. For example, these missions did not carry all the necessary instruments (STEREO did not have a magnetograph; SOHO did not have in-situ magnetometer). From the Sun-Earth line, SOHO was not well-suited for observing Earth-directed CMEs because of the occulting disk. STEREO's angle with the Sun-Earth line is changing constantly, so only a limited number of Earth-directed CMEs were observed in profile. In order to overcome these difficulties, we proposed a news L5 mission concept known as the Earth-Affecting Solar Causes Observatory (EASCO). The mission concept was recently studied at the Mission Design Laboratory (MDL), NASA Goddard Space Flight Center. The aim of the MDL study was to see how the scientific payload consisting of ten instruments can be accommodated in the spacecraft bus, what propulsion system can transfer the payload to the Sun-Earth L5, and what launch vehicles are appropriate. The study found that all the ten instruments can be readily accommodated and can be launched using an intermediate size vehicle such as Taurus II with enhanced faring. The study also found that a hybrid propulsion system consisting of an ion thruster (using ~55 kg of Xenon) and hydrazine (~10 kg) is adequate to place the payload at L5. The transfer will take about 2 years and the science mission will last for 4 years around the next solar maximum in 2025. The mission can be readily extended for another solar cycle to get a solar-cycle worth of data on Earth-affecting CMEs and CIRs. This paper provides a highlight of the MDL study results.