

New Opportunities for a Historic Spacecraft

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On 10 August 2014, an extraordinary spacecraft will return to Earth after having been away for 30 years. Plans are emerging and actions are being taken to reactivate the International Sun-Earth Explorer 3 (ISEE 3, later renamed the International Cometary Explorer (ICE)) and enable it to gather new scientific data.

The NASA–European Space Agency ISEE pioneered the multipoint approach to studying solar-terrestrial connections. ISEE 1 and ISEE 2 were launched in 1977, and ISEE 3 was launched in 1978. These spacecraft were designed to explore the relationship between the incoming solar wind (sampled by ISEE 3) and Earth’s magnetosphere (sampled by ISEE 1 and ISEE 2).

ISEE 3 is notable for many space firsts. It was the first spacecraft in a “halo orbit” around the Sun–Earth L1 libration point. Later, it became the first spacecraft to intercept a comet when, after being renamed ICE, it was sent to comet Giacobini-Zinner in 1985. After a distant encounter with Halley’s comet in 1986, ISEE 3/ICE continued on its heliocentric orbit. In August 2014, this trajectory will bring the spacecraft on a close approach with Earth and will provide an opportunity to return it to active service.

The spacecraft carries 13 plasma, high-energy particle, field, and wave sensors, most of which were still functional as of 1999. The current health of these instruments needs to be evaluated, but a test in 2008 confirmed ISEE 3/ICE’s location and clearly detected the spacecraft carrier signal. The spacecraft has sufficient fuel (approximately 150 meters per second of change in velocity (ΔV) capability) to send it back to L1.

Much of the documentation from the initial mission programming was lost, but members of the original team are now working on rebuilding the commands necessary for spacecraft control and data acquisition. Once these commands are rebuilt, the Deep Space Network will be used to communicate with the spacecraft and determine instrument health. Demonstrating that we can communicate with the spacecraft and that it is sufficiently healthy is a crucial step toward a new mission in 2014.

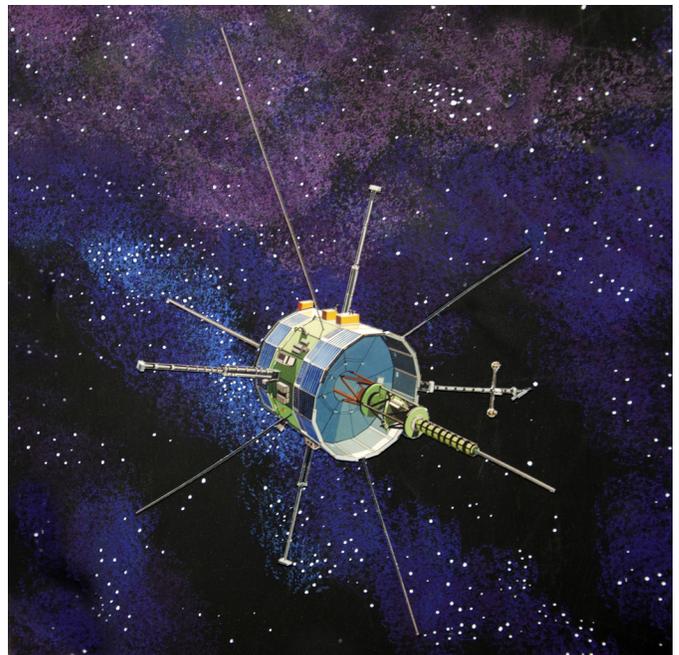


Figure 1. The return of ISEE 3/ICE in 2014 is an opportunity to broaden scientific understanding using data collected via this historic spacecraft. It can also serve to educate a new generation of scientists and engineers.

On what new adventures do we send our venerable explorer? One option is that it could return to the L1 halo orbit. Much more is known about space weather now than was known 30 years ago. Even so, multipoint space weather monitoring and research are more important than ever, and this spacecraft is an exceptional candidate to serve as a space weather monitor providing complementary and cost-effective measurements of the solar wind.

However, ISEE 3/ICE can serve many more purposes. Controlling this comparatively simple spacecraft, now well beyond warranty, would be an ideal training opportunity for young scientists and engineers. A single PC, for example,

could support the entire ground system, a prime example of NASA's ability to do "more with less."

For more information on ISEE 3, see <http://nssdc.gsfc.nasa.gov/nmc/spacecraftDisplay.do?id=1978-079A>.

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