

NASA Heliophysics BARREL Balloon Campaign To Observe Atmospheric Electron Precipitation, Launches this Month

NASA Heliophysics Mission Page: <https://www.nasa.gov/mission-pages/rbsp/barrel/overview>

Project Website: <http://www.dartmouth.edu/~barrel/>



Image of the 1st BARREL Balloon, preparing for launch from Sweden on 13 August 2016. Credit: Gar Bering

Radiation trapped in the Earth's radiation belts 6,000-24,000 miles above the surface can, under some circumstances, precipitate into the atmosphere over the poles. It is known that the trapped radiation in the belts can be disruptive to many of our communications and GPS systems and harmful to our missions and astronauts in space. It is also understood that the amount of radiation (energetic particles) can wax and wane, but the precise circumstances that cause the changes are still under investigation. The NASA Heliophysics Division is trying to better understand these particles and the changes, and this month, that quest will be supported by a campaign. The [Balloon Array for Radiation belt Relativistic Electron Losses \(BARREL\) Campaign](#) launched its fourth campaign, the second from Sweden, last weekend. BARREL hopes to stagger eight balloon launches to allow data to be collected in a more continuous fashion over a longer period of time. The campaign hopes the balloons will collect data in the 30-35 km range above Earth's surface, which is an ideal altitude for observing and tracking the entry of charged particles from the radiation belts into our atmosphere through precipitation. BARREL supplements research done on this topic by the [NASA Heliophysics Van Allen Probes Mission](#), which flies at higher altitudes through the belts themselves.

The three previous BARREL campaigns have already made significant scientific contributions. BARREL observations helped link [EMIC waves to electron loss](#) from the radiation belts through precipitation on the dusk side of the magnetosphere. [BARREL observations](#) also linked electron precipitation to [chorus waves](#) on the dawn side of the magnetosphere. Both processes contribute to the emptying of the radiation belts. As an unexpected bonus, BARREL is also tuned to solar energetic protons (SEPs) and scientists were able to show in a [paper published in May this year](#), how they can trace the motion of Earth's magnetic boundary using precipitation caused by SEPs.

This new campaign will provide higher resolution x-ray data than seen on previous launches. All balloons will carry data loggers to record data on board that can be analyzed when the payloads are recovered, and then 10ms data can be provided in 14 channels. This is unprecedented resolution that can provide evidence that may have been hidden before. On Saturday, August 13th, the first BARREL balloon of the final campaign was launched and it immediately observed precipitation. The launch campaign was carefully planned to release balloons that would fly underneath one or another of the Van Allen Probes satellites. If the satellite observes chorus waves and BARREL reports precipitation then this supports the theory that chorus caused the precipitation. Conjunctions are also planned with [NASA Heliophysics MMS](#) and [THEMIS](#) missions as well as a few CubeSat missions, in the six more launches planned in the next few weeks. The combination of the higher resolution data and more conjunctions will likely make this the most successful campaign of all.



Image of the scientific payload, surrounded by reindeer. Credit: BARREL

Follow the campaign on their blog: <http://barrelscience.blogspot.com/>