Kepler Mission: K2 spacecraft operation tests continue

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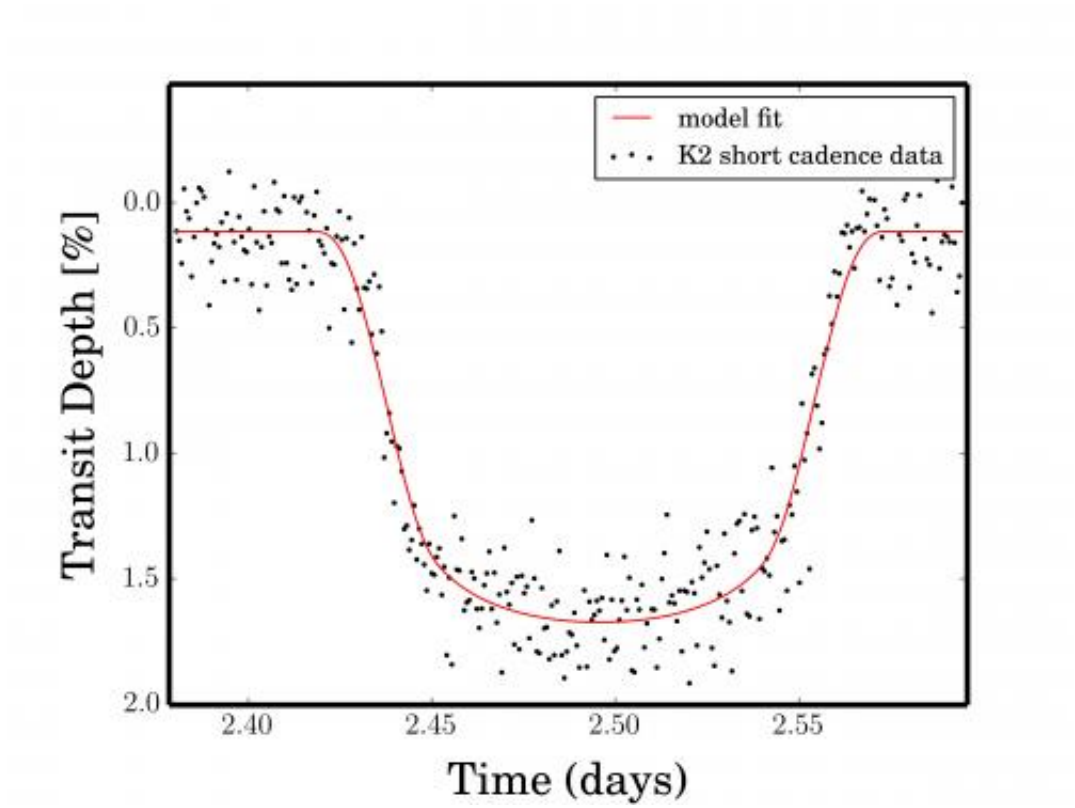

During a spacecraft operation performance test in Jan. 2014, one transit of the previous known exoplanet WASP-28b was captured. The data were obtained at 1 min intervals. The observation proves the repurposed spacecraft can still detect planets. Credit: NASA Ames/T. Barclay

On Jan. 30, in response to an invitation from NASA Headquarters, the Kepler team submitted a proposal to the 2014 Astrophysics Senior

Review of Operating Missions to continue scientific observations with the Kepler spacecraft in this new two-wheel mode of operation. The team is very excited about the science opportunities the new K2 mission could enable. We continue to run demonstration tests to learn the nuances of operating the spacecraft, and progress has been good.

The K2 mission definition continues to mature. The mission can explicitly address continued exoplanet discovery, but perhaps of greater interest is that it can find planets around bright and nearby stars. Continuing additions to the exoplanet catalog give us more targets for follow-up observations and will inform future missions to better characterize the nature of these planets, including their atmospheres. The K2 mission also would open a window on well-known star-forming regions and stellar clusters of varying ages, providing insight into stellar evolution. Observations of other galaxies, supernovae and even gravitational microlensing events, are also exciting new opportunities with K2.

During one of the demonstration tests, the known planet-hosting star WASP-28 was observed while in K2's field of view. Three days of data were collected and a transit was captured of WASP-28b, a Jupiter-sized planet orbiting its star every three and a half days. The observation proves the repurposed spacecraft can still detect planets!

Another very good sign from spacecraft operations is that we've been able to demonstrate that we can use the fine guidance sensors mounted on the focal plane to control the spacecraft pointing. While this doesn't improve the pointing stability to the quality we had before the failure of reaction wheels #2 and #4, it does ensure that the pointing is controlled by sensors that are adjacent to the science detectors. This will ensure we have no significant misalignment issues during science data collection.

Star trackers mounted toward the back of the spacecraft, well-separated

from the focal plane, are the alterative to control spacecraft pointing. As Kepler orbits around the sun, the solar illumination changes. As a result a differential expansion of the structures on the spacecraft occurs, and during science data collection, the alignment of the star trackers changes slightly. The effect is about a hundredth of a degree, but 40 times worse than needed for pointing control. This effect must be removed through careful calibration.

By using the fine guidance sensors, the additional calibration step is eliminated entirely. We are prepared to operate either way, but the successful demonstration of this fine guiding capability is a welcome development.

The new mission concept, first unveiled at the Kepler Science Conference II, was further detailed at the 223rd AAS Meeting in January, where a preliminary set of observing fields were distributed for public comment and initial targets were solicited. We are currently reviewing the target requests from 126 proposals and will begin our first science verification observations in March. The first science observation run will be called "Campaign 0." The primary purpose of this campaign will be to calibrate the star tracker alignment, but we will be collecting science data as we do.

Also at the AAS meeting, the team reported on four years of ground-based follow-up observations targeting Kepler's exoplanet systems. These observations confirm the numerous Kepler discoveries are indeed planets and yield mass measurements of the ubiquitous and enigmatic worlds that vary in size between Earth and Neptune. As a result, scientists confirmed 41 of the planet candidates discovered by Kepler and determined the masses of 16.

On March 6, 2009 at 10:49 p.m. EST, Kepler lifted off on a Delta II rocket from Cape Canaveral Air Force Station in Florida in search of

new worlds. To celebrate and reflect on the contributions the mission has made so far, we are preparing activities to properly mark the 5-year anniversary milestone. Please watch Facebook and Twitter for more details.

Meanwhile, the team continues to sift through four years of data collected during Kepler's prime mission. More than a year of that data remains to be fully searched and analyzed.

Provided by NASA