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**SCOUT: SHORT-ARC ORBIT ANALYSIS AND HAZARD ASSESSMENT FOR
NEWLY DISCOVERED ASTEROIDS**

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ABSTRACT

It typically takes a few days for a newly discovered asteroid to be officially recognized as a real object. This time is needed to collect additional data and make sure the observations belong to an actual asteroid rather than being an artifact or corresponding to an artificial object. However, asteroids could experience an Earth close approach or even an impact only a few days or less after the discovery observations, as in the cases of 2008 TC3 and 2014 AA, i.e., the only two asteroids discovered before an Earth impact. In such cases, a rapid identification of the close approach or impact dramatically improves the chances of securing the asteroid's trajectory with additional observations prior to impact. Scout is a JPL automated system that provides an orbital and hazard assessment for new potential asteroid discoveries within minutes after the observations are available. Since the time interval covered by the observations is generally short, perhaps only a few hours or even less, there are severe degeneracies in the orbit estimation process. To overcome these degeneracies Scout relies on systematic ranging, a technique that scans the poorly constrained space of topocentric range and range rate, while the plane-of-sky position and motion are directly tied to the recorded observations. This

scan allows us to identify the possible orbits and the regions corresponding to collision solutions, as well as potential impact times and locations. From the probability distribution of the observation errors, Scout derives a probability distribution in the orbital space and in turn estimates several metrics of interest, e.g., probability of an Earth impact, of a close approach to Earth, and of being a mission-accessible target. The information computed by Scout is made available to observers and other users on the JPL Center for NEO Studies website together with an ephemeris tool to support follow-up efforts.
