PDC2015
Frascati, Roma, Italy

☐ **Planetary Defense – Recent Progress & Plans**
☒ **NEO Discovery**
☐ **NEO Characterization**
☐ **Mitigation Techniques & Missions**
☐ **Impact Effects that Inform Warning, Mitigation & Costs**
☐ **Consequence Management & Education**

IAA-PDC-15-P-15

Results of the Asteroid Tracker algorithm challenge

Rinat Sergeev[(1)], Ben Kerschberg[(2)], Jin Paik[(1)], Karim Lakhani[(1)], Barry Geldzahler[(3)] and Jason Soloff[(3)]
[(1)]*Crowd Innovation Lab at Harvard University, 617 495 0995,*
[(2)]*Appirio,*
[(3)] *NASA Lyndon B. Johnson Space Center,*

Keywords: *Algorithm, NEO Tracking, Radar Array*

ABSTRACT

We are pleased to present the results from NASA's Asteroid Tracker Challenge, which was part of the Asteroid Grand Challenge Series. The series consisted of Appirio/TopCoder challenges to spur both (i) the understanding of threats to Earth, and (ii) development of possible solutions.

NASA's Ka-Band Object Optimization and Monitoring ("Ka-BOOM") competition tasked Appirio's crowdsourcing community with optimizing the implementation of high-resolution, high-powered 12-meter Ka-band radar dishes to more effectively track and characterize (*e.g.*, size, shape, spin, surface composition) Near Earth Objects such as asteroids and comets, as well as orbital debris as small as 5 centimeters in diameter. In addition, one of the challenges NASA faced was how to determine the optimal selection of individual antennas within a wide array of them. This challenge required complex analysis and its results go directly to the development of the concepts of operations and operations costs, as measured in terms of maintenance and total capacity required.

Based on these parameters, joint teams from NASA and Harvard framed the problem such that the winning solution had to (i) effectively design the necessary subarray allocation required to track all objects in a particular data set, (ii) automatically adjust to changes in radar build-in parameters and configuration of the dishes. A solution's minimization of the radars' operational costs was also judged.

The Appirio platform attracted 43 highly-rated competitors from a community of more than 700,000 expert developers worldwide. The competitors submitted 299 attempted

solutions collectively. Algorithms were automatically evaluated with the highest optimal metrics awarded prizes and the top five selected for further analysis.

Final analysis of the contest framework and live testing of the contest output was performed by the Crowd Innovation Lab at Harvard University. The Lab confirmed the highest outputs for two algorithms, which it recommended for implementation on actual NASA antenna arrays.

****