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OVERVIEW OF A NEW NASA PROJECT FOCUSED ON PLANETARY DEFENSE

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ABSTRACT

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The National Aeronautics and Space Administration initiated a new project focused on Planetary Defense on October 1, 2014. The new project is funded by NASA's Near Earth Object Program (Lindley Johnson, Program Executive). This presentation describes the objectives, functions and plans of four tasks encompassed in the new project and their inter-relations. Additionally, this project provides for outreach to facilitate partnerships with other organizations to help meet the objectives of the planetary defense community.

The four tasks are (1) Characterization of Near Earth Asteroids, (2) Physics-Based Modeling of Meteor Entry and Breakup (3) Surface Impact Modeling and (4) Physics-Based Impact Risk Assessment. Task 1 is focused on building models of the physical properties of potentially hazardous asteroids (PHAs) with validation of the models based on astronomical observations and laboratory studies of meteoric collections. Additionally, physical characteristics of PHAs will be collected in a database to be maintained at NASA Ames. Task 2 will extend existing NASA physics-based entry technology codes so they can reliably predict environments for meteor entries (up to ~ 20 km/sec entry speeds and much higher stagnation pressures ~ 100 MPa). Task 2 also seeks improved understanding of fundamental processes that occur during airbursts. Task 3 is focused on predicting the near field effects caused by airbursts (including land and water - tsunami formation and propagation). Task 4 has the requirement to specify the minimum size PHAs that require mitigation action that must be taken and the

associated lead-time required for their detection. Alternatively, the requirement for Task 4 is to determine the maximum size of a PHA whose effects could be mitigated by civil defense measures such as shelter or evacuation.

The physical models and entry state models from Task 1 are required inputs for the entry and breakup simulations carried out in Task 2. Physics-based predictions of airburst properties from Task 2 will be used as inputs from Task 3 to predict water and land impact effects as a function of PHA properties and entry state conditions. Task 4 embodies a "sensitivity to uncertainty" approach to risk assessment that has been applied to several NASA projects such as the Orion Multi-Purpose Crew Exploration Vehicle. The results of the sensitivity studies help guide optimal efforts for Tasks 1 and 2. Upgrades to NASA's entry technology codes to enable simulations of meteor entries will require many months of effort. In the interim, simulations of airburst properties will be provided at Ames by use of Department of Energy codes.

The new effort at NASA Ames will provide information on the physical properties of PHAs needed to model the effects of mitigation approaches involving kinetic means. Reliable predictions of anticipated damage can be used by decision makers to specify the appropriate levels of mitigation effort when faced with a pending PHA strike.

Finally, this presentation will set the stage for several companion papers from the above-described task areas being submitted by NASA Ames to the 2015 Planetary Defense Conference.

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