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CHOOSING NEO MISSION TARGETS: CURRENT KNOWLEDGE AND FUTURE EARTH-BASED OBSERVATION OPPORTUNITIES.

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Abstract

NEOShield is a consortium of 13 research institutes, universities and industrial partners from 6 countries. The aim of the project is to explore mitigation options in the event that a NEO is found to be on a potential collision course with Earth, and to pave the way for demonstration missions to test proposed mitigation techniques. Finding an accessible and appropriate target NEO for a demonstration mission is an important aspect of mission design. Targets for NEOShield and other potential missions require both a firm orbit and physical characterization. With > 900 NEOs discovered per year, it is important to continuously assess our knowledge of potential mission targets, and what future possibilities exist for refining that knowledge.

We have created a web-based tool to aid the provision of NEO mission targets. either for orbit improvement or for physical studies. It currently resides at http://star.pst.qub.ac.uk/~af/lowdv_neos/ . Its primary purposes are to act as initial guidance for NEO mission target selection, and to aid future Earth-based observations and reconnaissance of those targets.

NEOs are listed depending on their fly-by or rendezvous delta-v (dv) as calculated using the formalism of Shoemaker & Helin (NASA CP-2053, p245,1978), and colour-coded based on the current sky-plane positional uncertainty given in the ASTORB database (Bowell 2013). Lists are ordered by name/provisional designation or as a function of dv, for all NEOs and for those in size ranges most suitable for mitigation

test missions. For each NEO, a plot of its observability from Earth for a 4-year period can be viewed and downloaded; an example is shown in figure 1. Physical parameters where already known are taken from the European Asteroid Research Node compilations (Hahn and Mottola 2013). If a physical parameter can be estimated from other measurements, those values are listed *e.g.* where a spectral type has been observed, the albedo can be inferred using the nominal values given by Mainzer et al. (AJ 741, p90, 2011).The data in these tables are updated at least once a week to maintain their relevance for planning Earth-based observations, and further enhancement of this service will take place during the NEOShield Project.

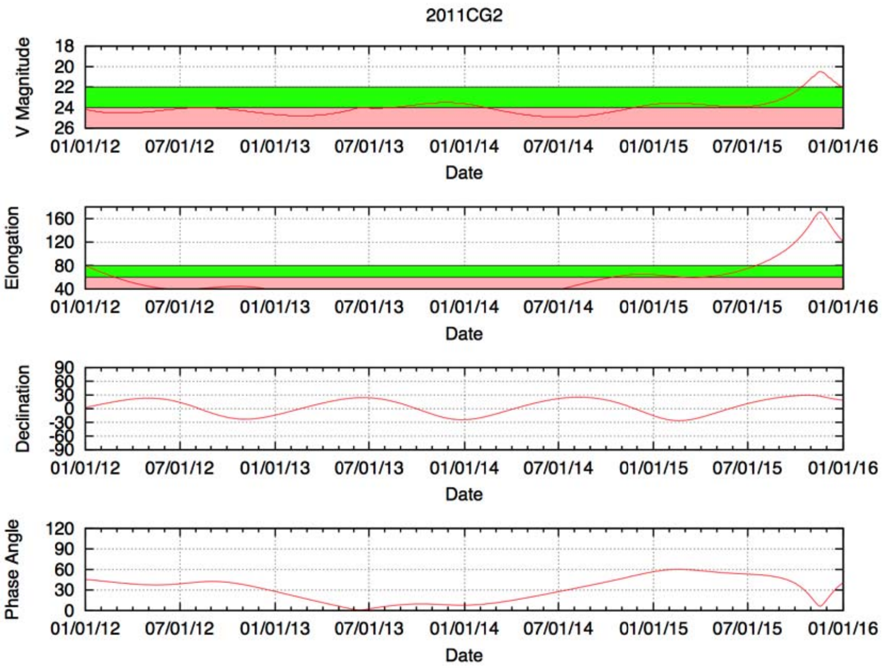

Figure 1: Future observability chart for low delta-v NEO 2011 CG2.

The creation of this service has revealed some interesting statistics about potential mission targets. For example, 51 NEOs were discovered in 2011 with probable diameters $50\text{m} \leqq D \leqq 300\text{m}$ and a rendezvous $dv \leqq 6$ km/sec. By early January 2013, 20 already had a sky–plane uncertainty of between 30 and 300 arcsec, and another 22 were effectively lost. On the positive side, some recent discoveries with low delta-v will be observable in the relatively near future. One example is 2011 CG2 with $H_V = 21.4$ and a very low $dv = 4.3$ km/sec, whose orbital uncertainty will allow an easy recovery and some physical studies when it reaches magnitude 21 in late 2015. Hence it is clear from this study that targetted follow-up observations of low-dv NEOs both during their discovery apparition and at later epochs could greatly increase the pot of potential targets from which to choose a mission target.

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