DETECTION OF EARTH IMPACTING ASTEROIDS WITH THE NEXT GENERATION ALL-SKY SURVEYS. P. Vereš[1], R. Jedicke[1], L. Denneau[1], S. Chesley[2] and the Pan-STARRS team. [1]Institute for Astronomy, 2680 Woodlawn Drive, Honolulu, Hawaii 96822-1897, USA. jedicke@ifa.hawaii.edu. [2]Jet Propulsion Laboratory, Pasadena, CA.

Introduction: We will simulate the detection of Earth impacting asteroids by a large synoptic survey telescope system – the Pan-STARRS prototype telescope, PS1. The simulation will use the PS1 Moving Object Processing System (MOPS)[1] and 10006 realistic but synthetic Earth impactors[2]. We will determine the survey efficiency as a function of impactor size and orbit, measure the evolution of the minimum orbital impact distance (MOID) as new observations are acquired, determine the distribution of impact warning times and estimate the probability that the survey will detect an impactor.

Survey simulation: The pseudo-realistic 3.5 year survey simulation incorporates two survey regions, one large region covering ~4400 deg^2 near opposition and another pair of 'sweetspot' regions covering a total of ~1100 deg^2 60-90° from the Sun and within 15° of the ecliptic. The synthetic survey incorporates a realistic survey pattern, a crude weather simulation, and an estimate of the survey efficiency dropoff near the limiting magnitude. Synthetic impactors are designed to collide with the Earth at random locations and at random times in the time interval 1 Jan 2010 through 1 Jan 2110 – roughly one impactor every 2-3 days. We will run the simulation size six different times with all impactors set to the same diameters (20m, 50m, 100m, 200m, 500m, 1km). The MOPS simulates the detection of the objects through intra and inter-night linking, orbit derivation, and precovery & attribution.

Results and discussion (preliminary): Our preliminary simulations used 100m, 200m and 500m diameter impactors and only a 3 month survey (the desrign reference mission for the PS1 survey is 3.5 years). In the 3 month simulations MOPS identified 8 impactors of 100m diameter, 60 impactors of 100m diameter and 358 impactors of 500m diameter. A crude extrapolation to the full PS1 survey yields survey efficiencies of 1% (100m), 8% (200m) and 50% (500m). These results imply that the PS1 survey efficiency drops rapidly with impactor size. Figure 1 provides distributions of the orbital elements in a-e and a-i for the generated (top) and discovered (lower) impactor populations. Note that this survey strategy appears to be more efficient at finding impactors exterior to the Earth's orbit (objects that reach perihelion of ~1 AU) rather than those that orbit the Sun interior to the Earth's orbit (objects that reach aphelion of ~ 1 AU). When we present these results at ACM we will have incorporated a much more realistic survey strategy and also implemented a technique to model the loss of detections due to chip and cell gaps, as well as guide and dead cells, in the PS1 camera and streak removal implemented by the AFRL.

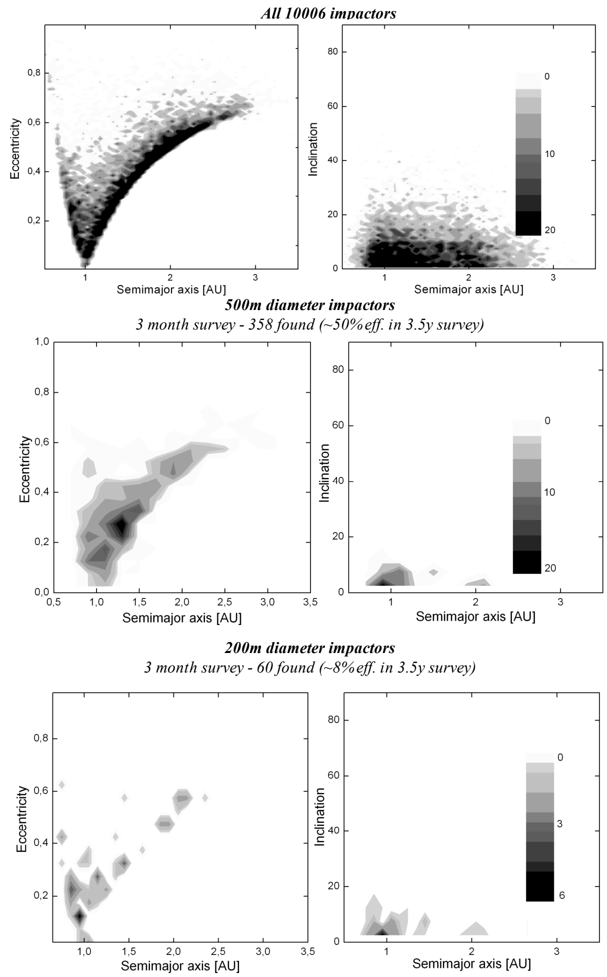

Figure 1: Impactor orbit element distribution in *a-e (left)* and *a-i (right)* for all synthetic objects (top) after a 3 month survey simulation for 500m diameter objects (middle) and 200m diameter objects (bottom).

References: [1] Jedicke R. et al. (2006) *proceedings of IAU Symposium No. 236*, Milani et al., eds. [2] Chesley S.R. and Spahr T.B. (2004)*, Cambridge U.P., p.22*.

Additional Information: This work was performed in collaboration with Spacewatch, LSSTC, CMU's AUTON lab, and Andrea Milani's NEODyS team and is supported by grants from the AFRL and the NASA NEOO program.