An Overview of the Los Alamos Program on Asteroid Mitigation. R. P. Weaver[1] and Catherine S. Plesko[1], Galen R. Gisler[1,2] and Jim M. Ferguson[1] [1]MS T087, Los Alamos National Laboratory, Los Alamos, NM, 87544 USA [2]University of Oslo, Norway, galen.gisler@fys.uio.no.

Introduction: Los Alamos National Laboratory (LANL) is starting a new project to address the mitigation of a potentially hazardous object (PHO). A series of efforts at Los Alamos have been working this problem for the last few years in an ad-hoc fashion. We now have an approved project to dedicate time to this important mission. Our tasking for this project includes studying both non-nuclear (e.g. kinetic impactors) as well as nuclear explosive options to have a database of options available to the world leadership should a PHO Earth crossing object be found and considered a significant threat. If the lead-time after discovery is sufficiently long, then kinetic impactors or gravity tractors provide a credible mitigation technique. However, if the lead-time is short, the general consensus among this community is that a nuclear option would be more effective and cause significantly less collateral damage. Initial results from a variety of studies managed under this project will be shown at this conference. This paper summarizes the Los Alamos project.

Ongoing Mitigation Modeling at LANL. 1) For a kinetic impactor mission, our team is developing a deeper understanding of the beta-momentum enhancement factor. Gisler is leading this effort and an overview of the current work will be shown. 2) For nuclear explosive standoff mission options, our team is studying a variety of detailed physics issues related to the coupling of energy and momentum from the nuclear explosive to the potentially hazardous object (PHO), an asteroid or a comet. The whole team is studying details of the x-ray deposition. Cathy Plesko and Jim Ferguson are working details of the neutron deposition. Cathy Plesko is working on understanding how to produce a better equation-of-state (EOS) for PHO hydro simulations. Once energy has been transferred to the PHO, Bob Weaver and Cathy Plesko are studying the propagation of shocks through aspherical objects. Working with NASA Goddard and Iowa State, Bob Weaver s performing detailed radiation hydro simulations relevant to the HAIV/NIAC mission concept. Preliminary results will be given here.

Methodology: The two main simulation capabilities we employ are the MNCP code for neutron transport and deposition and the RAGE code for detailed radiation hydrodynamic simulations in 1D, 2D and sometimes 3D. A short summary of these code capabilities will be shown.

POSTER SESSION preferred.

References: [1] Gittings M. L. et al., Comp. Sci. Disc 1, 2008. [2] Lyon, S. P., Johnson, LAUR-92-3407, LANL, 1992. [3] Brown, F. B., Trans. Am. Nuc. Soc. 87, 2002. [4] Plesko, C. S. Thesis, UCSC, 2009. [5] Weaver, R. P., et al. Acta Astron. 2014. [6] Howley, K. et al., Acta Astron., 2014.

Fig. 1 (left): Ejecta v< 1m/s at t=0.1s, 64 cm impactor at 20 km/s into a 500 m solid quartz sphere.

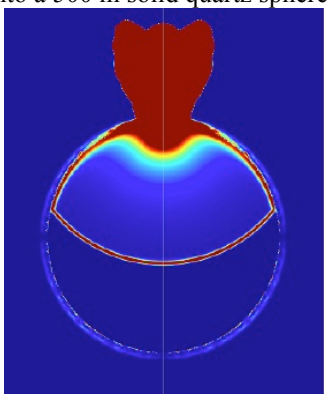

Fig. 2 (below, middle): 1 Mt X-ray energy burst deposited into a 1 km x 0.5 km aggregate of spherical basalt boulders.

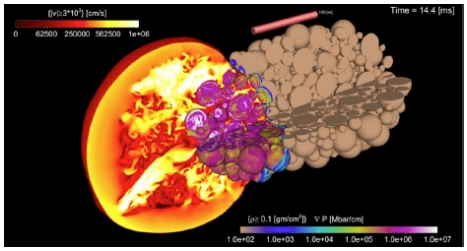

Fig. 3 (bottom): MCNP model of neutron deposition into CI Chondrite, mean free path 2.9 cm.