PDC2023
Vienna, Austria

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EVACUATION AND SHELTER PLANS FOR ASTEROID IMPACTS

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Keywords: *asteroid, impact, evacuation, shelter, risk*

ABSTRACT

Asteroid impact risk is currently often quantified using estimates of expected casualties if the impact occurred without warning. With modern telescopes and better capabilities coming online soon it is becoming much more likely that an asteroid big enough to cause significant ground damage will be detected at least a few days before impact. This will hopefully be sufficient time to complete necessary evacuations, so fatalities and injuries should be minimal. Useful metrics, in future, may therefore include the number of evacuees and the cost of damage to infrastructure which cannot be moved out of the danger zone. This can be weighed against the cost of in-space mitigation if warning time allows.

This presentation will cover how evacuations and shelters are managed for hurricanes in the USA. It will then consider nuclear explosion blast effects on buildings and the reduction in risk provided by shelters that could be built. Finally it will apply these lessons to estimate the evacuees for asteroid impacts.

Hurricane forecasters run 1000 simulations a day to predict the track of a hurricane which can vary considerably. Emergency managers compare the expected arrival time of tropical storm force winds to the time required to prepare for and to complete evacuations. The public may get detailed information on probabilities and risks, or may simply heed watches, warnings, and evacuation orders. People typically do not need to evacuate far, just out of flood zones and to buildings designed to withstand the maximum expected winds. The percentage of people evacuating an area varies from almost 100% for a category 5 storm, to almost no-one for a tropical storm. The result is a fatality rate of about 1 in a million regardless of storm strength.

Nuclear explosions show that a blast wave with over 10 psi overpressure is required to level most reinforced concrete buildings, but 5 psi overpressure will level most houses. At 1 psi, doors and windows will be blown out, and there will be flying debris, but few houses will collapse and shelters built in the basement should be sufficient to reduce risk to 1 in a million.

The 2021 PDC asteroid impact scenario showed significant uncertainty on the impact energy, even just before impact. If the impact were to occur by surprise, the expected fatalities would be approximately 100 000 people. To meet the 1 in a million fatality rate, everyone within the mean 1.3 psi blast radius (55 km) needs to evacuate, which is 770 000 people. Everyone within the mean 0.44 psi radius (190 km = 14.4 million people) needs to either evacuate or find an appropriate shelter or build one. This varies from the basement of a reinforced concrete building or basement/underground shelter close to 55 km, to simply being in the basement at 190 km. Outside of 190 km people just need to stay away from windows to the limit of window breakage at 450 km (mean 0.2 psi).

Application to the 2023 PDC scenario will be done when it is released.

Comments:
Alternative session such as “Impact Effects and Consequences” also acceptable.
No preference on timeslot.
Oral presentation preferred.

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The abstract length should be between 250 and 500 words. It must contain the paper title, the author names, their corresponding affiliations, postal and e-mail addresses. The abstract shall be prepared using the following format:

- Paper: standard A4 paper (21.0x29.7 cm)
- Margins: 2.54 cm (all sides)
- Title: 12 pt bold, Arial, centered, all capital letters
- Author names: 12 pt bold, Arial, centered
- Affiliation: 12 pt italic, Arial, centered
- Abstract body: 12 pt, Arial, justified with single line spacing
- Equations, figures, literature may be included with references in the body text

Abstracts must be written in English and should be submitted to the IAA as Microsoft Word files (.doc, .docx) or PDF files (.pdf) within the deadline. All abstracts must be submitted online via https://atpi.eventsair.com/23a01---8th-planetary-defense-conference/abstractsubmission. It is recommended to proofread the abstract before submission.

Notification about the review process is planned according to the dates given in the Call for Papers, which is available at https://iaaspace.org/pdc . Please note that the presenting author of each accepted abstract has to register to the conference.

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Comments:

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