



ADDRESSING THE COMET AND ASTERIOD IMPACT THREAT: A NEXT STEP

AN AIAA INFORMATION PAPER

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July 2002

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INTRODUCTION

The threat posed to the U.S. and to the Earth in general by comet and asteroid impacts and their devastating consequences is no longer in question. Overwhelming evidence shows such impacts have occurred in the past and will certainly occur in the future. The recent near miss of a football-field-sized object (it passed within 75,000 miles or about 121,000 km, roughly one-third the distance to the Moon) that was not detected until after it passed the Earth is a stark reminder. What is unknown is when they will occur and whether we will be ready with a response. This paper addresses what AIAA feels are the next logical steps in dealing with this threat.

AIAA POSITION

In 1990, AIAA published a position paper titled: "Dealing with the Threat of an Asteroid Striking the Earth." It recommended convening a pair of workshops; the first to develop a plan to dramatically increase the rate of the detecting and cataloging of potentially threatening objects; and the second to address applicable technologies for threat mitigation strategies. The U.S. House of Representatives responded by directing NASA to convene both workshops. NASA briefed the House of Representatives on the results in March 1993.

AIAA published a second position paper in 1995 that urged the world's governments to address aggressively the threat issue. This paper suggested that an integrated, systematic, and multi-disciplinary approach was needed and that an interagency governmental body focused on planetary defense was likewise needed to successfully execute such an approach. The paper had very wide concurrence in the U.S. aerospace community and was specifically endorsed by the Aerospace and Electronics Systems Society of the Institute of Electrical and Electronic Engineers (IEEE), the International Council on Systems Engineering, and the Space Studies Institute.

In the decade since the original AIAA paper, there has been a nominal amount of attention paid to planetary defense, but only to certain aspects of the problem. In the U.S., NASA/Air Force cooperative telescopic search efforts have been discovering threat objects at a high rate, and are on the way toward meeting the goal of cataloging 90% of near Earth asteroids with diameters one kilometer or greater by 2008, a goal that Congress established following hearings in 1998. Also, several rendezvous missions have been planned, and NASA's Near Earth Asteroid Rendezvous mission (NEAR) has demonstrated the capability to operate in the vicinity of and land on an asteroid.

There has been progress, but many areas require increased attention. For example, within the U.S. Government there is no agreement on which department or agency speaks for the U.S. on matters of planetary defense. This is attributable to the inherent difficulty in organizing a response to a threat that requires the capabilities of and crosses the responsibility boundaries of many key governmental departments. However, internationally, the United Kingdom Task Group on Potentially Hazardous Near Earth Objects recently released its recommendation that the British government take an active

role in planetary defense. This would include the establishment of a National Center for Near Earth Objects (NEOs), along with the building of dedicated search telescopes, the development of spacecraft missions to NEOs, and the investigation of means of mitigating impact threats. In fact, the British National Space Center has established the UK Near Earth Object Information Center, an official government channel for encouraging an understanding by the general public of the near Earth object situation.

Our challenge is to create an integrated U.S. approach across the planetary defense disciplines. **As the next logical step, AIAA recommends the formation of a senior level interagency working group to examine all the pertinent planetary defense issues and advise the U.S. government on the proper course of action for achieving the following:**

- the creation or designation of an office of primary responsibility for U.S. planetary defense activity, charged with providing an assessment of U.S. planetary defense research and development options, coordinating NEO detection activities, and acting as the single point of contact for international activities,
- the coordination of those organizations that develop estimates of closest approach of potential impactors to effect both the rapid and accurate validation of Potentially Hazardous Object orbits, and an appropriate process for the release of that information to governments and the public.
- the coordination with non-U.S. organizations active in planetary defense, to ensure non-duplication of effort and to enhance the scope and competence of the U.S. activities identified above.

We recommend this be a multi-agency working group, co-chaired by Air Force Space Command (in its roles as the Department of Defense's newly designated Executive Agent for Space) and NASA (in its historical role as the Department of Defense's interface to the civilian community). It should include the appropriate representatives from across the U.S. Government who can provide expert knowledge of the consequences of an asteroid impact. It should also include experts capable of mapping out a plan leading to a mitigation strategy.

The asteroid and comet impact threat requires that we contend with both extreme effects and extreme probabilities. The likelihood of any one person being killed on any one day as a result of an impact, thankfully, is extremely low. However, the global, national, and even regional consequences of an asteroid or comet impact can be catastrophic on a scale unprecedented in recorded history. An impacting object 1 kilometer across would be expected to kill one quarter of the planet's population. A 250-meter diameter object would annihilate an area the size of Connecticut. If an object only 100 meters across were to impact at sea as far out as 1000 kilometers (620 miles) from shore, the result would be an on-shore wave moving several hundred miles an hour that could easily be over 10 stories high.

Dire consequences can be expected from even small objects. On January 18, 2000, a meteor with an estimated diameter of 6 to 10 meters entered the atmosphere over

Canada's Yukon Territory. It exploded at an altitude of 25 kilometers (15 _ miles) with the force of a 2-to-3 kiloton bomb¹. Events of this size are very common, occurring about once a year on average² as confirmed by satellite data. We must consider the consequences of such an event had it impacted in a heavily populated area such as a major U.S. city. Would the U.S. have understood that this was not an attack? What if it exploded over Moscow or Beijing? Can we predict with any certainty how Russia or China would react? Would they accept the explanation of the true nature of the incident and react with restraint? What if the incident took place over an Islamic capital?

Clearly, the consequences of inaction on the part of the US could be severe. **AIAA strongly recommends that the group suggested be convened, and empowered to enact the steps necessary to successfully deal with the threat.**

¹ Ron Baalke baalke@jpl.nasa.gov, "DoD Fireball Detection Over Yukon Territory, Canada," CCNet 07/2000, 20 January 2000 and Dr Peter Brown, Meteor Physics Lab, quoted by Martin E.B. France, "Planetary Defense: Eliminating the Giggle Factor," available online at <http://www.airpower.maxwell.af.mil/airchronicles/cc/france2.html>.

² Morrison, D., C. Chapman, and P. Slovic, *Hazards Due to Comets and Asteroids*. University of Arizona Press, 1994.. pg. 63.