

# “Ready to Launch”: A’Hearn on Planetary Defense

## Joel Marks

Professor Emeritus of Philosophy, University of New Haven, West Haven CT 06516  
jmarks@newhaven.edu

### Professional Acquaintance

The information presented in this poster derives from my professional correspondence with Mike A’Hearn, whom I had contacted after watching his **testimony to the U.S. House Science, Space, and Technology Committee on March 19, 2013**. The hearing was called to discuss “Threats from Space” subsequent to the explosion of the meteor over Chelyabinsk. In anticipation of the hearing, I had contacted the office of Congressman Chris Stewart of Utah to suggest that he ask about comets. The Chelyabinsk event was being billed as a “wake-up call”; but it seemed to me that the response to that asteroidal airburst was oddly blinkered, given the discovery two months earlier of Comet Siding Spring (C/2013 A1), which was heading for a very close approach to Mars and capable of producing a far more energetic impact if it actually collided with a planet. Wasn’t that a wake-up call too? The Congressman obliged, and his exchange with A’Hearn is given at right.



Mars flyby of Comet Siding Spring (C/2013 A1)

Photo credit © Rolando Ligustri (used with permission)

### A’Hearn’s Testimony to Congress

Dr. A’HEARN. 15 to 25 kilometers per second is the right ballpark for the asteroids. It is one of the things you have to keep in mind, however, if you deal with the cometary impact hazard. Those come in at more like 30 to 70 kilometers per second. Now, they are very infrequent compared to the asteroids, but one of a given size will be much more damaging because of that high speed of entry compared to the asteroid.

Mr. STEWART. Yeah, okay. ... I know there was a recent comet that was discovered in January that was looking like it was going to have a near miss with Mars, and it would have been a devastating event for—had that, you know, impacted the Earth, a dinosaur killing type event. And as I recall, it was two years is what the, you know, estimated impact time would be. Of course, we know it is going to miss it now. If that had been directed toward Earth in two years, is there realistically anything we could have done? ... In two years from now, could we—are we technologically capable of launching something that could intercept it? Dr. A’Hearn, you seem to be shaking your head “no.”

Dr. A’HEARN. No. If we had spacecraft plans on the books already, that would take a year—I mean a typical small mission like a Discovery class mission takes four years from approval to start to launch. Okay. Now, a really accelerated military program would be faster than that but that is a couple of years still. ... And **you would have to have something ready to launch**, basically, if you wanted to do it on very short notice.

**Complete transcript available at**  
<https://www.govinfo.gov/content/pkg/CHRG-113hhrg80552/pdf/CHRG-113hhrg80552.pdf>

### Working Notes for a Paper

Below are excerpts from A’Hearn’s emails to me about comets and planetary defense. He expresses a keen interest in this topic, but was at first preoccupied with Rosetta, a science mission. However, by the time of his passing, A’Hearn had begun work on “a real paper for a refereed journal” (January 22, 1917).

*Please do not cite any of the following as authoritative, as obviously they were written on the fly. A’Hearn’s untimely passing precluded completion of the paper. Nevertheless, I feel these notes are an important legacy that should not be lost.*

**From:** Michael F. A’Hearn

**Sent:** Saturday, April 25, 2015 10:02 PM

There are a couple of points regarding comets as NEOs, but I haven’t written them up.

1. Asteroids dominate the hazard to a city, but Earth-approaching “newly discovered” comets tend to dominate the dinosaur killers
2. The fact that we don’t know what to do about newly discovered comets (likely discovered too late to mount a defense) does not mean we should ignore them
3. After the current surveys reach the congressionally mandated limits, comets will represent ballpark half the residual danger (Al Harris has presented graphs that show this)
4. The nearest Earth has come to total devastation in recorded history has been comet Lexell. This I have sort-of written up (presented to the NRC study Mitigation Panel) and I have attached a ppt.

NEOs are not my primary interest, I got into them only from chairing one of the subpanels of the NRC study. Thus I don’t have the time to pursue them in the detail they deserve. I am happy to interact or collaborate with others, but for the next year or two my effort will be dominated by the Rosetta mission.

**Sent:** Sunday, April 26, 2015 11:12 AM

FYI - The Deep Impact proposal devoted one short paragraph (I think only two sentences) out of the 25-page science section to planetary defense. It really was selected for the science, with planetary defense a side benefit.

**Sent:** Tuesday, May 12, 2015 11:02 AM

I happened to mention comets again to [a colleague] last week... and his response was the usual one -- let’s deal with the problem we know how to address first. Of course, I think we should, at least in the background, be trying to sort out how to deal with the problem that we don’t know how to address.

... I would argue [that 16% of the NEOs are cometary].

I note that there is yet another hazard from cometary NEOs - breakup into multiple NEOs. If you go to the JPL NEO web pages and look at the table of NECs, there are >20 pieces of Schwassmann-Wachmann 3 that qualify as PHOs, i.e., MOID < 0.05 (they range from 0.038 to 0.047, i.e. they will evolve independently in the future).

Among NEOs that are discoverable, there are significant differences between cometary ones and asteroidal ones.

1. They are darker - using the canonical 20% albedo, comets are typically >4 times darker therefore >2x larger (8x mass) than a typical asteroid of the same magnitude
  2. They are less dense (1/2x mass)
  3. They come in at higher speeds (2x vel, 4x kinetic energy) and with a much wider dispersion in speeds.
- The subset of comets that are inert, i.e., appear asteroidal, may be significant compared to the ones that are active - these are not yet well sampled.

**Sent:** Saturday, July 11, 2015 3:11 PM

It is the long-period comets that I worry about. Given our current knowledge of NEOs, they constitute <10%, maybe still about 1%, of the unpredictable deaths from impacts. But the 140m asteroid survey should remove most of the remaining risk from NEAs without affecting the risk from long-P comets. Thus they will become responsible for something like half the potential deaths - because they are big and fast and kill a lot more people than a 140m asteroid. And they can wipe out civilization. It won’t happen soon, if you have faith in statistics, but it CAN happen any day.

When I get some more time ... I might find the time to actually work on this, but for now I need to stay out of it to get things done on Rosetta.

**Sent:** Wednesday, June 1, 2016 5:51 PM

**Subject:** Fwd: 5th IAA Planetary Defense Conference, 15-19 May 2017, Tokyo, Japan

It might be a good time to present a talk on comets, e.g., the Marsden group, as PHOs. Or noting that most of the fragments of SW3 are almost PHOs and one is a PHO.

**Sent:** Sunday, January 22, 2017 3:22 PM

Finally a few moments to think about tasks for PDC talk/paper. As I indicated, I would like to turn this into a real paper for a refereed journal, with only the required 2-page extended abstract for PDC proceedings.

The real goal is to emphasize the need to consider comets when talking about planetary defense and to use specific examples.

I think the right outline is more or less as follows:

1. Why comets matter - including especially the philosophical issues about species extinctions
2. Large close approachers
3. Fragmenting comets
4. Properties relevant to deflection???
5. Summary

*Note:* The paper title in the preliminary program for PDC 2017 in Tokyo was “Returning to PHCs.” But A’Hearn became too ill to attend, and died 13 days after his scheduled talk. It is clear that the world lost a powerful voice for restoring comets to their proper place in planetary defense. May others carry on this important work.