Search for Large Asteroids Nears Completion, Experts Ponder Gaps in Program

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SYDNEY, Australia -- A stated goal of finding 90 percent of all large Near Earth Asteroids (NEAs) by 2008 is more or less on target, leading experts said last week at the General Assembly of the International Astronomy Union (IAU) in Sydney, Australia.

The goal, originally outlined by NASA and mandated by the U.S. Congress, is designed to insure that space rocks in the vicinity of Earth's orbit, and larger than 1 kilometer (0.62 miles), are found and tracked. An object of this size could cause global destruction if one were to hit Earth.

An international affiliation of groups, collectively called Spaceguard, carries out the search and follow-up observations needed to purse the targets. NASA funds much of the work.

No asteroids are presently known to be heading toward the planet.

The global experts gathered here reiterated a common concern among asteroid scientists: When the current goal is reached, there will still be many unfound smaller objects that are easily capable of destroying a large city.

Yet present technology is somewhat limited in its ability to find the thousands and perhaps millions of smaller asteroids that could potentially threaten the planet.

The search for Earth-threatening asteroids was described by three international experts at a public forum Thursday: David Morrison from NASA's Ames Research Center; Alan Harris of the Space Science Institute in Colorado, and Andrea Milani from the University Pisa, Italy.

Bigger, better telescopes are on the drawing board for finding these smaller asteroids, the scientists said. Meanwhile, images of the sky taken by current programs could be crucial to future attempts to find and track small asteroids using the new telescopes. Determining an asteroids exact trajectory and potential future danger requires observations across time, so the object's movement can be plotted.

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Importantly, there are no large telescopes devoted to the task of hunting asteroids from the Southern Hemisphere. A major search program down under would help in this task, the panelists said.

The forum, "The danger from space: Are Near Earth Objects a catastrophe waiting to happen?" was moderated by Australian science celebrity Karl Kruszelnicki.

NASA's Morrison described the consequences of an asteroid colliding with Earth. The larger NEAs, bigger than a half mile (1 km), would cause global environmental disaster, he said. Smaller objects are still a danger to cities and regions and Spaceguard will eventually be expanded to cover these smaller objects.

Harris, from the Space Science Institute, showed the progress made with Spaceguard and described new telescopes that, within the next decade, could be used for detecting and tracking NEAs. He cautioned, however, that these new telescopes would have competing demands and most would be devoted to Spaceguard on a part-time basis.

Harris said the lack of a major asteroid search program in the Southern Hemisphere was limiting the pace of new discoveries.

A specialized Schmidt 1.2-meter (4-foot) telescope at Siding Spring in Australia is under-utilized and could be upgraded to search for near-Earth asteroids, he said. This would involve replacing a large photographic plate holder with a modern CCD camera (like those in video cameras).

With new technology involving multiple CCDs, the Siding Spring telescope could be better at searching for asteroids than any current Spaceguard telescopes, Harris said. Australian astronomer Duncan Steel pointed this out in a science paper written in 1995, shortly before the Australian Spaceguard program was terminated as government funding was dropped.

Milani, from the University Pisa, described the computations necessary to establish an asteroid's orbit around the Sun and to calculate whether it would hit the Earth in the future.

He suggested that it was not very useful searching for new near-Earth asteroids if the extra work was not also done to check whether there was a risk of a collision. This usually involves alerting astronomers around the world to conduct follow-up observations. Much of the asteroid tracking effort involves amateurs who volunteer their time.

Asteroids are sometimes initially found to have remote risks of hitting Earth. The additional observations are included in revised computations that, so far, have resulted in an impact risk being downgraded to zero in all cases that have been studied over time.

Milani and his colleagues recently developed computer programs to generate numerous possible paths for a newly discovered asteroid. If any of these "virtual impactors" is found, by computation, to be on a collision course, then mathematicians can describe its predicted orbit and astronomers can carefully check whether the actual asteroid is on the same path.

Just as important in this process is the checking of old sky images. The mathematicians can run a predicted orbit back in time and old images can be checked for signs of the object.

Harris explained that *not* finding an object in old images could be used to eliminate the possibility an impact. The approach illustrates the importance of archiving astronomical observations -- a blank area on a picture could be just as important as a small white dot.

It is also a good reason to immediately start taking images of southern skies, researchers say.

After the public forum a discussion ensued about ways to deflect an incoming asteroid.

The work by Milani and others has demonstrated that, if an asteroid is determined to be on a collision course, the most likely scenario is that over several decades it will perform multiple close approaches to the Earth before the impact. During these close encounters the asteroid must pass through a window, or "keyhole" in space if it is to continue on its collision course.

In these cases it only takes a deflection of a few hundred kilometers (miles) to force a rock to miss the keyhole and therefore avoid Earth impact in a subsequent orbit.

This compares with an object heading directly for an impact that must be deflected by thousands of kilometres (miles) so that it misses the Earth. Because they pass close to the planet on several occasions before impact, it should be possible to detect quite small keyhole asteroids with current telescope technology -- but only if scientists are effectively looking for them.

A keyhole deflection is only possible if the threatening asteroid can be detected decades ahead of the impact and if sufficient sightings have been made to pin down its orbit. This was cited as another good reason for stepping up the Spaceguard effort and adding a southern sky search.

On July 25, the Australian Minor Planet Workshop will take up discussion of how to jump-start asteroid searches in Australia and New Zealand.

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