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Impact hazard communication case study: 2011 AG5

Introduction

Asteroid 2011 AG5 was discovered by the Catalina Sky Survey on January 8, 2011.

Astronomers were able to track 2011 AG5 for several months before it became unobservable for a time. Based on this early work – 213 observations spanning 316.77 days – JPL's NEO Program Office initially calculated a 1-in-625 (0.2 percent) chance of Earth impact in 2040.

Observers recovered the asteroid in October 2012, collecting enough data to enable JPL to eliminate the risk of Earth impact. JPL announced the retirement of this risk in December 2012.

The story

On 29 November 2011, the Association of Space Explorers (ASE) Committee on NEOs published a report authored by Rusty Schweickart, *2011 AG5 Deflection and Decision Analysis*.

On 13 February 2012, Schweickart, representing the ASE's NEO committee, gave a briefing on this report to the 49th session of COPUOS/STSC, in which he claimed:

- "AG5 is an impact threat; low, but significant." (Emphasis in original.)
- "The primary challenge presented by AG5 is not (currently) its impact probability, but rather the time required to prevent impact, if indeed it is headed for the 2023 keyhole."
- "Decision date for a keyhole deflection is very soon, if not now." (Emphasis in original.)
- "AT-14 should use the AG5 situation to accelerate and emphasize the immediate need for an operational NEO impact decision structure. Other AG5s are coming, and we should be ready to deal with them."

A NEOShield study conducted by DEIMOS Space, "Kinetic impact mitigation options for Asteroid 2011 AG5," dated 13 February 2012, was also presented to COPUOS/STSC, reporting:

- “At the start of 2011 a new NEO was discovered and subsequently named 2011 AG5. The asteroid has been visible to Earth telescopes from that moment until the end of September 2011. Data has been gathered for up to 256 days. Such has enabled the derivation of an impact probability with Earth in 2040 of 1/625.
- Additionally, it has been determined that a close pass by Earth in 2023 triggers such risk due to the current lack of precise knowledge on the asteroid orbit parameters and its physical characteristics. The possibility that the asteroid passes through the related keyhole in 2023 would thus direct the asteroid for collision in 2040....
- This document is aimed at providing technical support, in the context of the NEOShield study, to the evaluation of the feasibility of a kinetic impactor mitigation mission to deflect asteroid 2011 AG5... The current study has as [its] objective the provision of back-up calculations to the results presented by astronomer R.L. Schweickart in [*2011 AG5 Deflection and Decision Analysis*].”

On 27 February 2012, space.com reported on discussions of 2011 AG5 at COPUOS/STSC. Fox News re-reported the story online under the headline, “Big asteroid could pose threat to Earth in 2040.”

(<http://www.foxnews.com/scitech/2012/02/27/big-asteroid-could-pose-threat-to-earth-in-2040/>)

On 28 February 2012, JPL public affairs officer D.C. Agle posted a story on JPL’s “latest news” page, “Asteroid 2011 AG5 - A Reality Check” (the story was reposted 29 February on physorg.com and March 1 on spacedaily.com):

“Asteroid 2011 AG5 has been receiving a lot of attention lately because of a very unlikely scenario which would place it on an Earth-interception course 28 years from now. Here is a scientific reality check of this relatively nondescript space rock which is currently ranked a ‘1’ on the 1 to 10 Torino Impact Hazard Scale.

As of Feb. 26, 2012, asteroid 2011 AG5 is one of 8,744 near-Earth objects that have been discovered. It is approximately 460 feet (140 meters) in size and its orbit carries it as far out as beyond Mars’ orbit and as close to the sun as halfway between Earth and Venus.

Due to its current location in the daytime sky, observations of 2011 AG5 cannot be made by Earth-based telescopes, so its orbit has not yet been determined to a level where scientists can confidently project its location decades into the future. But that day is coming.

‘In September 2013, we have the opportunity to make additional observations of 2011 AG5 when it comes within 91 million miles (147 million kilometers) of Earth,’ said Don Yeomans, manager of NASA’s Near-Earth Object Program Office at the Jet Propulsion Laboratory in Pasadena, Calif.”

On 28 February 2012, ABC News (U.S.) reported on JPL's news item. In a story titled "Asteroid threat in 2040? Scientists watch 2011 AG5," ABC told viewers:

"Don't quit your job and sell your house just yet. Astronomers, who have been tracking the asteroid since January 2011, say it is in an elliptical orbit that could bring it somewhere near Earth in 2040. Earth is about 8,000 miles in diameter; the asteroid appears to be about 450 feet across. The problem is that having watched it for only about half an orbit around the Sun, the scientists cannot say for certain where it will be 28 years from now.... In the meantime, [2011 AG5] was a subject of discussion at a meeting in Vienna of the Scientific and Technical Subcommittee of the United Nations Committee on the Peaceful Uses of Outer Space...."

(<http://abcnews.go.com/Technology/asteroid-threat-2011-ag5-close-earth-2040-scientists/story?id=15809386#.T1TKRpirU-Z>)

On 1 March 2012, ABC News posted a story online based on the JPL news item, under the headline, "Asteroid anxiety: in worst-case scenario, asteroid 2011 AG5 will hit Earth sometime in year 2040."

(<http://www.abcactionnews.com/news/science-and-technology/asteroid-anxiety-in-a-worst-case-scenario-asteroid-2011-ag5-will-hit-earth-sometime-in-year-2040-wfts1330638324947>)

On 2 March 2012, the (U.K.) *Register* reported: "Asteroid could SMASH INTO EARTH in 2040: UN boffins bang heads to knock rock off-course."

On 4 March 2012, under the headline, "Could giant asteroid 2011 AG5 hit Earth in 2040?", the online news site examiner.com reported:

"Is Earth in the cross hairs of a huge asteroid? That is a question that astronomers all over the world area attempting to answer right now upon news of an announcement that an asteroid called 2011 AG5 has a 1 in 625 chance of hitting the earth on February 5, 2040. Obviously, 1 in 625 odds are not good and the asteroid itself isn't large enough to cause a mass extinction event (like the one that killed the dinosaurs) but, on the other hand, the fact that scientists *can't* yet rule out an impact is making some people very, very nervous...." (<http://www.examiner.com/space-news-in-national/could-giant-asteroid-2011-ag5-hit-earth-2040>)

On 7 March 2012, "Bad Astronomy" blogger Phil Plait reported on 2011 AG5, calling it "a football-stadium-sized rock to watch carefully."

(<http://blogs.discovermagazine.com/badastronomy/2012/03/06/asteroid-2011-ag5-a-football-stadium-sized-rock-to-watch-carefully/>)

Meanwhile, on 3 March 2012 Schweickart had appealed to NASA Administrator Charlie Bolden for action on 2011 AG5. Bolden responded to Schweickart: "2011 AG5 is high on NASA's list of NEOs to monitor for impact hazard potential.... A

transponder mission is not warranted at this time because of the opportunities for highly accurate ground-based observations in the near future.... Even the 2015 apparition occurs seven years prior to the close 'keyhole' passage."

Schweickart responded with an 8 March 2012 proposal "for NASA consideration re exploration options for 2011 AG5." He asked NASA to hold a workshop "to explore a series of scenarios for AG5 in order to better understand the response options available."

On 12 March 2012, space.com (Leonard David) reported on Schweickart's concerns about 2011 AG5:

"A massive asteroid that may be on a collision course with Earth should be studied in more detail, according to a former Apollo astronaut who specializes in monitoring potentially hazardous space rocks. Asteroid 2011 AG5...is on NASA's impact hazards list, but more definitive tracking of the object is still needed, scientists say. In fact, some near-Earth object (NEO) experts say it's time to start hammering out a plan in case the asteroid needs to be deflected. Former Apollo astronaut Russell Schweickart is calling upon NASA to undertake a detailed engineering and mission planning analysis of 2011 AG5. In a March 3 open letter to NASA administrator Charles Bolden, Schweickart spotlighted what he sees as the potential deflection challenges posed by asteroid 2011 AG5, should the object happen to be headed for a so-called keyhole in 2023, setting."

On 13 March 2012, the *Huffington Post* re-posted space.com's story on 2011 AG5, under the headline "Asteroid Risk Posed By 'Space Rock' 2011 AG5 Unclear And Requires More Study, Apollo Astronaut Says."

(http://www.huffingtonpost.com/2012/03/13/asteroid-2011-ag5-risk-unclear_n_1341355.html)

It is worth noting that space.com functions as a product marketing site for a business called Purch, a self-described "digital content and services company that helps millions of people make smarter purchases." Purch claims it drives more than \$1 billion in commerce transaction annually in more than 1,000 product categories. Space.com is one of several "brands" owned by Purch.

On 29 May 2012, NASA's Near Earth Object Observations Program held a workshop on 2011 AG5, where Schweickart reiterated his concerns and where JPL reported on the results of an analysis conducted from 26 March-26 2012, *Report on Asteroid 2011 AG5 Hazard Assessment and Contingency Planning*.

([http://neo.jpl.nasa.gov/neo/2011 AG5 Deflection Study report 13.pdf](http://neo.jpl.nasa.gov/neo/2011%20AG5%20Deflection%20Study%20report%2013.pdf))

According to JPL's report:

“Extensive analysis of the current orbit parameters of 2011 AG5 indicates that the asteroid...currently has a 1-in-500 (0.2 percent) chance of impacting the Earth on February 5, 2040.... The most likely trajectory of 2011 AG5 as currently understood does not indicate that the asteroid will pass through [the] keyhole in 2023.... It is important to note that the current extent of uncertainty embedded in these predictions is large... In the unlikely event that observations made in September 2013 show a significant increase in the chance of Earth impact, there would still be sufficient time to plan and carry out a successful deflection campaign.”

A consensus report on the 29 May workshop, dated 1 June and made public on 15 June, stated:

- “Using observations from Fall 2013 to improve 2011 AG5’s orbit has a 95% chance of eliminating the 2040 impact scenario, while further observations in 2015-2016 could drive that to ~99% eliminated.
- On the other hand, in the very unlikely case where the asteroid is actually on an Earth impacting trajectory, the 2013 observations could find the computed impact chance rising to 10%-15%, and the observations in 2015 – 2016 could find it rising further, to ~70%.
- Only additional observations in 2013 and 2015 will increase the accuracy of these predictions.”

On 15 June, NASA issued a press release about the workshop: “NASA Releases Workshop Data and Findings on Asteroid 2011 AG5 – Researchers anticipate that asteroid 2011 AG5, discovered in January 2011, will fly safely past and not impact Earth in 2040.”

The *Huffington Post*, *space.com*, and many other news outlets reported out this message. The following headlines are representative of media coverage:

- “Asteroid 2011 AG5 Won't Hit Earth In 2040, NASA Astronomers Say” (*Huffington Post*, 18 June, 2012).
- “Earth Safe From Giant Asteroid in 2040, Scientists Say” (*space.com*, reposted on *mashable.com*).
- “Well, that’s a relief! NASA says asteroid won’t hit us in 2040” (*Daily Mail* (U.K.), 18 June 2012).

On 20 June 2012, ESA’s Space Situational Awareness Program posted a report on the workshop on its web site:

“ESA, NASA and international researchers met last week to assess the latest data on asteroid 2011 AG5, discovered in January 2011. The workshop consensus finding is that the object will most likely fly safely past Earth in 2040.”

http://www.esa.int/Our_Activities/Operations/Space_Situational_Awareness/Global_workshop_assesses_asteroid_2011_AG5

In October 2012, David Tholen and colleagues at the University of Hawaii's Institute for Astronomy recovered 2011 AG5 and resumed observations.

On 21 December 2012, the JPL NEO Program Office reported: "All clear given on potential 2040 impact of asteroid 2011 AG5." Tholen and colleagues had provided NASA their new data on 2011 AG5, and "an analysis of the new data conducted by NASA's Near-Earth Object Program Office at the Jet Propulsion Laboratory in Pasadena, California, shows that the risk of collision in 2040 has been eliminated," JPL reported in a news release. (<http://neo.jpl.nasa.gov/news/news176.html>, <http://www.ifa.hawaii.edu/info/press-releases/allclear2011AG5.shtml>)

What follows is a sampling of the media response to this announcement:

- "Deadly asteroid will not collide with Earth in 20-40, NASA says" (*Latinos Post*, 22 December 2012).
- "Apocalypse never: huge asteroid will miss Earth in 2040" (*Discovery News*, 23 December 2012).
- "In 2040, asteroid '2011 AG5' will miss Earth, NASA now says definitively" (*Huffington Post*, 24 December 2012).
- "Good news confirmed: asteroid won't hit Earth in 2040" (NBC News, 26 December 2012).
- "Don't mark your doomsday calendars: 2040 asteroid won't hit Earth" (*Los Angeles Times*, 24 December 2012).
- "No collision between Earth and asteroid 2011 AG5 in 2040: NASA" (the *French Tribune*, 25 December 2012).

Conclusions

From January 2011 when 2011 AG5 was discovered through December 2012 when the risk of Earth impact in 2040 was eliminated, NEO scientists and government officials – such as Detlef Koschny/ESA, Lindley Johnson/NASA, and Donald Yeomans/JPL – stayed on message. They reported what they knew, made clear what they didn't know, and explained what they needed to know and when they expected to know it. The media quoted them often, by and large accurately.

However, during the period when 2011 AG5 was deemed to pose a risk of Earth impact in 2040 (January 2011-December 2012), the media tended to downplay uncertainties – a common practice, as journalists construct their credibility on the basis of reporting "facts" and "truth." The "doomsday" scenario was more "newsy," and most media reports on 2011 AG5 during this period led off with the risk of impact in 2040.

In contrast to official sources, contrary voices – in particular the ASE and its astronaut spokespeople, in particular Rusty Schweickart – drew media attention due to their "underdog" status (disagreement with NASA, the official source) and "astronaut" cachet. (Schweickart signed his 3 March 2012 letter to NASA Administrator Bolden, "Rusty Schweickart, Apollo 9 astronaut.")

Official stories – ESA and NASA statements, from officials on web sites, and in press releases – were clear, concise, and correct. Official sources were sufficiently transparent and readily available. The media (mainstream and social) predictably sensationalized the risk of impact. In much of the media coverage of 2011 AG5 from January 2011 to December 2012, sensational headlines led into stories that accurately explained knowledge about 2011 AG5.

Overall, media coverage of 2011 AG5 can be characterized as true to journalistic practice – including the habits of pack journalism and reliance on other media (made even easier in recent years due to the continuing consolidation of mass-media ownership and the expansion of social media), deciding what's news according to a standard set of news values (such as danger and conflict), and adherence to professional conventions (such as objectivity, balance and fairness).

No one, to my knowledge, is doing audience research on the effects of misleading headlines about potentially hazardous asteroids. Audience research is difficult and expensive to do, as every reader/listener/viewer interprets messages uniquely. Consequently, we do not – and may not ever – know how news reports that the NEO community may interpret as misleading actually affect public knowledge and understanding of asteroid impact risks.

Nonetheless, the NEO community can, and by my assessment should, continue to collaborate on communication strategy (approach) and tactics (messaging), always aiming for timeliness, clarity, consistency, completeness, and transparency.

Postscript

One news report on 2011 AG5 that is currently available online was published by *Berliner-Zeitung* on 8 January 2014. I make note of this story because it blames the Voice of Russia for propagating a doomsday message about the asteroid.

According to the headline of this story, “Die Welt geht am 5. February 2040 unter” (the world is ending on 5 February 2040). The story begins: “Die Welt ist bedroht. Am 4. February 2040 könnte ein Asteroid die Erde treffen und möglicherweise Millionen Menschen vernichten, behauptet ein staatlicher russischer Radiosender. Doch es gibt einige Zweifel an dieser Nachricht.” (The world is threatened. On 4 February 2040 an asteroid could hit the Earth and possibly destroy millions of people, claimed a Russian state radio station. But there are some doubts about this message.)

Berliner-Zeitung reported that the source of this doomsday prediction was the Voice of Russia, a Russian radio station:

“Immer wieder gibt es Warnungen vor einem drohenden Weltuntergang. Dieses Mal ist es der Sender „Stimme Russlands“, dessen Meldung gerade durch die Internetwelt geistert. Nasa-Forscher hätten erklärt, dass die Erde in 26 Jahren mit

dem Asteroiden 2011 AG5 kollidieren könnte, berichtet der Sender, immerhin der staatliche russische Rundfunk-Auslandsdienst. „Die Katastrophe wird sich am 5. February 2040 mit einer recht großen Wahrscheinlichkeit von 1 zu 625 ereignen“, heißt es weiter.“

(There are always warnings of an impending apocalypse. This time it is the station "Voice of Russia," [and] the message just haunts the Internet world. NASA researchers have stated that the Earth could collide with the asteroid 2011 AG5 in 26 years, reports the transmitter, the Russian state-owned broadcasting service abroad. "The disaster will occur on February 5, 2040 with a very large probability of 1 to 625," it said.)

“Dennoch gab es einige Aufregung um einen möglichen bevorstehenden Weltuntergang. Vor allem in den Medien wurde über eine Kollision spekuliert. Die Astronomen selbst erkannten aber schnell, dass die Gefahr gering ist. Auf der Turiner Risikokala von 0 bis 10 landete der Asteroid auf Stufe 1. Diese steht für „routinemäßige Neuentdeckung, für die ein Vorbeiflug vorhergesagt wird, der keine ungewöhnliche Gefahr darstellt“. Erst Stufe 10 wäre „eine sicher eintretende Kollision“, die die Zivilisation ernsthaft bedroht.“

(...there was some excitement about a possible impending doom, especially in the media, which has been speculating about a collision. The astronomers themselves soon realized, however, that the risk is low. At the Turin risk scale from 0 to 10, the asteroid landed at level 1. This stands for "routine discovery, for a flyby is predicted, which is not an unusual danger.")

This story concludes:

“Doch was ist nun mit dem von der „Stimme Russlands“ erwähnten Asteroiden 2011 AG5? Könnte dieser die Erde wirklich treffen? Bereits am 21. Dezember 2012 hatten Astronomen eines Teleskops auf Mauna Kea Entwarnung gegeben. Der Asteroid wird die Erde am 4. February 2040 voraussichtlich in einer Entfernung von gut einer Million Kilometern passieren. In kosmischen Dimensionen bedeutet das „fast gestreift“. Nach irdischen Maßstäben liegen jedoch ganze Welten zwischen uns und dem Asteroiden. Der Weltuntergang findet also auch dieses Mal nicht statt.“

(But what about the "Voice of Russia" report on Asteroid 2011 AG5? Could this really hit the Earth? Already on 21 December 2012 [astronomers] had given the all-clear.... The asteroid is expected to pass the Earth on 4 February 2040 at a distance of just over one million kilometers.... So the end of the world does not take place this time.)