Publicising a Science Discovery: It's All in the Timing — Two Case Studies

Ray Villard
Space Telescope Science Institute
E-mail: villard@stsci.edu

Key Words

Written Science Communication
Press Office Best Practices

Summary

Many factors are involved in deciding when a scientific result is ready to be presented to the news media and public. The most newsworthy science is often cutting-edge science and can inherently contain disagreement and controversy among scientists. Even results from peer-refereed papers are not free from criticism if scientists feel that the findings have been too widely publicised and lack caveats. How does a public information office balance these factors to ensure that newsworthy science is reported in a timely manner? This article presents two case studies from the research areas of exoplanets and astrobiology.

The common refrain from kids on a car trip is: "Are we there yet?"

Public Information Officers (PIOs) are sometimes viewed as being just as annoying when they ask a researcher, "Are we there yet?", when it comes to publicising a major scientific result.

The process of science publication is at odds with the process of news reporting. Research typically takes years of meticulous step-by-step analysis and advancement. The science news process is fuelled by stories that are exciting, relevant, colourful and succinct. The superlatives "biggest", "farthest" and "first" are the easiest to sell to news editors who are commonly uninterested in science, if not averse to it.

Truly profound discoveries that resonate with the public are few and far between. When one does come along it typically becomes a lightning rod for peer scrutiny. Over one hundred years ago the American author Mark Twain wrote: "The scientist will never show any kindness for a theory which he did not start himself."

The PIO, whose duty it is to serve as an agent for meeting the needs of the media and public for a good story and, in parallel, the needs of scientists to be properly acknowledged without antagonising their peers with suspicions of hype and self-promotion, is caught in the middle. It's a fine line to walk.

All PIOs fear that a major discovery could leak out without their parent institutions being involved. They don't want their directors learning about a discovery made by their observatory by reading about it in the newspaper.

Frequently this inner conflict is further aggravated by the final popular news reporting of a discovery that, simply because of limited word space, leaves out qualifiers, full acknowledgement and details. For example, we recently reported on a discovery by the *Hubble Space Telescope* and the *Spitzer Space Telescope* of one of the most distant galaxies ever seen. An exasperated Associated Press reporter told me he had to tell the story in 200 words.

Of course neither the scientist nor the PIO has any control over how a story is reported and is put into a social and cultural context for the readers, no matter how detailed or thorough the press release is.

In all sciences the road to Ultimate Truth is littered with results that were initially reported with great flourish, only to be proven wrong later. This is particularly true in reports on the search for exoplanets and will almost certainly be the case again as astrobiology experiments and observations are realised.

What's frequently lost in the debate about when a result should be reported is the simple fact that science is messy. Great discoveries in astronomy are often on the fringe of what a telescope can detect, whether it

Figure 1. NASA planetary scientist David McKay, at right, unveils the Martian meteorite ALH84001 as NASA Associate Administrator Wesley Huntress looks on during an August 1996 news conference at NASA Headquarters. Credit: NASA.

is the feeble trace of an exoplanet, the faint spectroscopic signature of extraterrestrial life, or a galaxy near the visible horizon of the Universe.

It is simplistic to assert, as some science and journalism critics do, that a result cannot be publicised until it is absolutely correct. Scientific research is a process of infinite midcourse corrections, so it should come as no surprise when the results are later modified or even retracted. The irony is that some critics have asserted that PIOs only issue results, but never describe the process of science. What could be more informative to the public than to discuss openly and honestly why a result was misinterpreted and what new information was learned from more recent data?

Occasionally new observations may come to light that are contrary to the results in a refereed paper about to be published and publicised in a press release. This presents an ethical dilemma for the PIO. Is it legitimate to publicise a refereed paper knowing that it will be challenged by research that will shortly be published?

The dilemma is that it is "double jeopardy" for a researcher to have work that has been accepted, and then "re-peer reviewed" by other scientists who may be serving in an advisory role to a news office. Also, it is not the job of a Public Affairs Office (PAO) to decide what is right or wrong in a story, but simply to report on the published work and its significance clearly and succinctly and in a timely manner. However, the institutions that PIOs serve, whether NASA facilities, universities, or research institutes, also worry about institutional embarrassment if a misleading story is issued.

It is specious to assert that doing a press release or press conference makes the science result "more real". Science journalists are flooded with astronomy press releases every day. They are astute enough to prioritise and, when needed, to separate the signal from the noise.

Lost in Space: the Terebey Planet

Between 1963 and 2005 (before the discovery of 51 Pegasi, the first bona fide exoplanet around a normal star), there were at least 15 reported discoveries of exoplanets that were later retracted. But probably no false detection of an exoplanet has been so criticised as the *Hubble* image of a suspected exoplanet that was later found to be a background star.

Entitled "Dangers of Publication by Press Conference", a lead editorial in the 4 June 1998 issue of *Nature* magazine criticised NASA for making "preliminary results by press release" official policy.

The editorial was prompted by a press conference on 28 May 1998 at which NASA released a *Hubble* photograph, obtained by Susan Terebey and her team at the Extrasolar Research Corporation in Pasadena, California, showing what they believed to be the first visible light from a planet outside our Solar System.

The paper had not been submitted for peer review in a journal, but Terebey was going to present the result at the 25–28 May meeting of the American Astronomical Society (AAS). NASA officials were alerted to this result and decided that it was so important they should call a press conference prior to the AAS meeting.

Over the years there have been a number of significant news announcements from the AAS, and they have all been presented as "works in progress". Very few science findings announced at the AAS are at the stage where a paper has been written and peer reviewed. In the context of the conference, this is acceptable among scientists and journalists.

Nature missed this point in criticising NASA for what normally transpires at the AAS meeting. "Unfortunately for those interested in the scientific details, there is only the abstract of a conference submission to turn to," they wrote. Such a sketchy presentation of new results, *Nature* argued, invokes the danger of adding to the pressures on journalists, which could leave them "with insufficient time to do much more than turn a press release into something comprehensible and sparkling, possibly excessively so".

In the rush to publicise, NASA had taken the unusual step of having selected scientists informally "peer-review" Terebey's work. NASA had undertaken an in-house review of the data reported at the 31 May press conference. "We had five PhD astronomers sit down with Susan and literally grill her...," said a leading NASA official.

At the televised press conference, Terebey reported that she thought the object, called TMR-C1, was a hot protoplanet that had been expelled from its star system and was hurtling into interstellar space. She and guest science experts at the press conference cautioned that astronomers needed to make further observations to confirm her theory.

On 29 April 1998 the *New York Times* dutifully reported this story with qualifiers: "The astronomers who participated in the meeting yesterday said a very small chance existed that the object in the picture was not a planet but was merely a background star almost directly behind the binary-star system called TMR-1. To rule out this possibility, Dr. Terebey said, her group must wait until the constellation Taurus rises in the sky in August. Then the astronomers will begin measuring the outward movement of the planet and will analyse its light spectrum with the big Keck II telescope in Hawaii."

Just as she had cautioned, in a paper published in the May 1999 *Astronomical Journal*, Terebey reported: "The new data do not lend weight to the protoplanet interpretation and the results remain consistent with the explanation that TMR-1C may be a background star."

Figure 2. Dr Susan Terebey during a NASA Headquarters televised press conference on 28 May 1998 where she presented a Hubble *image of a suspected exoplanet that was later shown to be simply a background star. Credit: NASA.*

One inconsistency in the criticism of how the Terebey planet was publicised is that other tentative planet-hunting results have been accepted with appropriate qualifiers. For example, the European Southern Observatory reported a planet-detection story just like Terebey's in September 2004, and it was repeated by US investigators at the AAS meeting in January 2005. *Hubble* and the VLT telescopes had imaged a substellar companion object to the brown dwarf 2M1207.

The news articles that were written about that discovery were every bit as tentative as the Terebey planet story. The magazine, *Sky & Telescope*, in its 15 September 2005 is-

sue, reported, "Astronomers have unveiled the best candidate yet for the first direct image of an extrasolar planet. If confirmed, the object will also be the first planet-mass body found orbiting a brown dwarf rather than a true star."

In January 2006, *Space.Com* wrote: "The planet – still just a candidate, actually – is an odd duck in many respects. It does not orbit a normal star, and it is much more massive than the largest planets in our Solar System. Still, if confirmed, it represents a landmark in astronomy along the road to the ultimate goal of finding and photographing Earth-like planets around other stars."

What's been completely forgotten is that Terebey's paper was successfully refereed and was published in *Astrophysical Journal Letters* in August 1998 with the title, "A Candidate Protoplanet in the Taurus Star Forming Region".

In fact, it was cited by reviewers as bold and innovative research. The NASA PAO would have dutifully reported the result in the same manner in August 1998. Never mind, said the critics, the press conference jumped the gun. It propelled a questionable result into the news stratosphere via the televised NASA press event.

What's specious about this argument is that journalists have the same responsibility to assess and report a science new story accurately regardless of the venue, be it press release, press conference, or astronomical society presentation. Mainstream journalists do not have time to read the original science papers, much less find outside experts that have read the paper.

One major irony is that the first widely publicised exoplanet story also fell on its face despite being peer-reviewed and published in *Nature*. The 5 August 1991 issue of *Time Magazine* eagerly reported: "Now a team of three astronomers in Britain claims to have spotted solid evidence of a faraway world. Writing in the British journal *Nature*, Andrew Lyne and colleagues at the University of Manchester's Jodrell Bank radio observatory report an object between 10 and 15 times the mass of the Earth, orbiting a special kind of star called a pulsar that lies some 25 000 light-years away."

Numerous publications had reported that Lyne and his team had unequivocally discovered the first planet outside the Solar System. But the University of Manchester radio astronomer had changed his planned talk in the days before his scheduled slot at the American Astronomical Society meeting in Atlanta in 1992.

The 24 January 1992 issue of *Science* magazine reported: "Instead of telling a tale of triumph, he shocked the audience of several hundred with an anguished confession: The planet was a mistake. 'It was an artefact of the Earth's motion around the sun,' Lyne told the audience. His peers reacted sympathetically to his retraction, and even applauded. And, it did not sour them on the idea of pulsar planets — as their favourable reception of another talk, about a new crop of pulsar planets, showed."

Some theorists initially suspected that Lyne had been misled by some effect of the Earth's orbit, because the period of his pulsar planet was almost exactly six months I asked one of the referees if he had ever been suspicious about the six-month periodicity of the exoplanet. "No, I assumed they had done their math correctly," he shrugged.

Invaders from Mars?

The Terebey press criticism pales in comparison to the ongoing debate over NASA's decision to publicise the Mars meteorite findings in August 1996. A potato-shaped meteorite, labelled ALH 84001, found in Antarctica was suspected of containing fossilised Martian bacteria and other biotracers.

A science team from NASA'S Johnson Spaceflight Center (JSC) reported that "lines of evidence" pointed to the likelihood that a primitive form of microscopic life that flourished on the red planet three billion years ago had been found on board a meteorite that fell to Earth 13 000 years ago.

I have seen NASA endlessly lambasted for putting this out in a standing-room-only press conference at NASA Headquarters on 7 August 1996. Critics say that the announcement was premature. NASA should have waited until the finding had been fully vetted by the science community before making any public statement.

NASA was aware of the meteorite result months before the paper was to be published in *Science*. NASA PIOs knew it was only a matter of time before the results would leak out because the finding was so extraordinary. As a stopgap, the JSC scientists were told not to talk to reporters. But the NASA PAO knew that astute reporters would put the pieces together and build a coherent story.

Once the meteorite paper was successfully peer-reviewed, the NASA PAO asked *Science* to speed up publication for fear of a news leak. NASA Administrator Dan Goldin was even in direct communication with *Science* editors to facilitate an early publication date. The *Science* editors did not see the urgency or seem worried about news leaks.

In the meantime the NASA PAO put together a "Pearl Harbour" plan in case the story leaked to the news media. The press release and television graphics were prepared well in advance. NASA PAO had the JSC scientists on call to hop a plane on short notice and fly to NASA Headquarters in Washington DC, for a hastily called press conference.

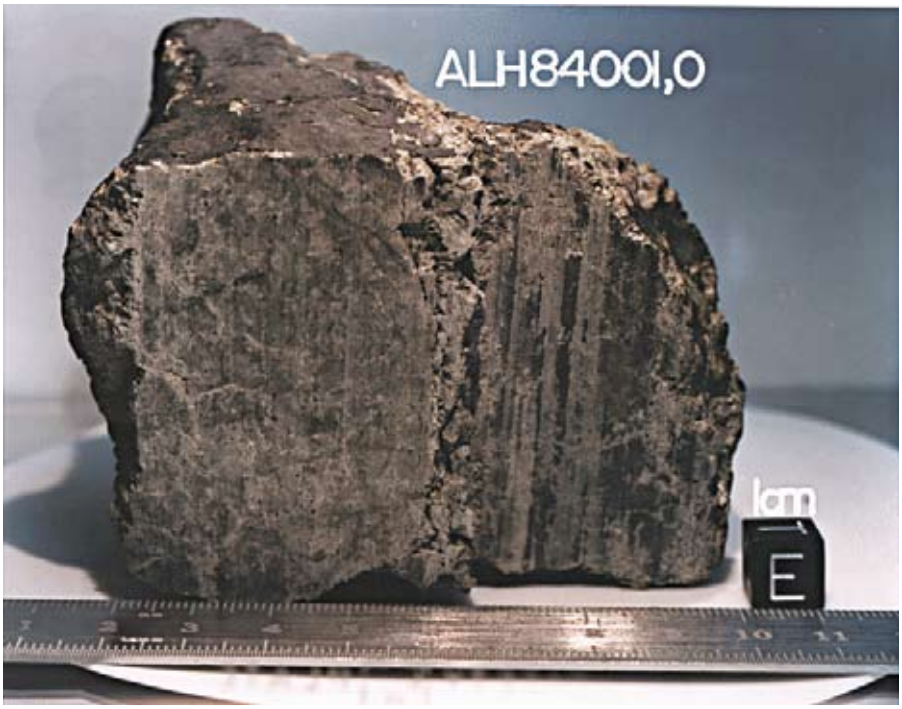

Figure 3. The most infamous rock in NASA history is the Mars meteorite ALH84001. It caught the attention of the US President and made headlines around the world in 1996 when scientists announced that it might contain evidence for Martian bacteria — a claim that remains highly disputed even today. Credit: NASA.

Veteran aerospace reporter Leonard David picked up the Mars meteorite story at a science conference in Houston and published it in *Space News* a few days ahead of the embargo.

Two days before the 7 August NASA press conference, Leonard David told CNN: "Well, you know, I think the actual story's been evolving for a while, and there were certain indications even a year ago that something exciting had been found, but the clam doors of NASA kind of shut down on it, and rightly so, just to make sure that they believe that they have the correct evidence that they believe shows that this particular meteorite has biological indicators of life. I think we're at a point, too, where sort of a kind of an ounce of caution is worth about five pounds of Mars rocks, right now. You've got to be a little careful."

Veteran science reporter K. C. Cole of the *Los Angeles Times* picked up on the furore. "The team led by researchers from NASA's Johnson Space Center in Houston found what they say could be fossils of tiny extraterrestrial organisms stuck to the surfaces. They describe the findings in a paper to be published next week in the journal *Science*. But by Tuesday, word had spread around the world. Harried NASA officials have scheduled a news conference for today. 'NASA has made a startling discovery,' said NASA Administrator Dan Goldin. He called the evidence 'exciting, even compelling, but not conclusive'."

The debate over the nature of the meteorite will go on for years. In a meeting at NASA's Johnson Space Center in 2004, one participant said the presence of biotracers in the meteorite is a "definite maybe".

The bottom line, some researchers assert, is that the years of debate have been beneficial. Identifying what kinds of signatures of life are real and can be depended upon is crucial, particularly when spacecraft missions return the first Mars samples, or in trying to make on-the-spot judgments via instruments on the planet.

"A lot of people have done some exquisite work. This is going to be really useful to the community. This is all valuable stuff. In terms of being better prepared for handling Mars return samples in the future, it's a win-win situation for science," said Everett Gibson of the JSC Mars meteorite team. "This is an argument that's difficult for the person on the street to sort out, science is not accepted quickly."

Steven Kahn of the Kavli Institute for Particle Astrophysics and Cosmology at Stanford University believes that cultivating public interest and support for big astronomy programmes goes beyond simply listing science goals. "My belief is that a new transition will be required — a transition to beyond science. We must couple our field to goals that the public can viscerally attach themselves to, whether or not they understand the scientific measurements and analyses that will be performed."

This is more than hypothesis. The controversial 1996 report of biotracers in a Mars meteorite prompted US President Bill Clinton to reiterate US support for space exploration: "...the fact that something of this magnitude is being explored is another vindication of America's space programme and our continuing support for it, even in these tough financial times."

The "messy science" of exploration and discovery will be even more of a challenge in the coming decades. The diffusion of news across the internet in continuous news cycles, proliferation of blogs, and immediate scientist-to-scientist communication via publication sites like astro-ph will antiquate the practice of embargoed news and formal press conferences.

For example, the spectroscopic measurement of an Earth-like exoplanet with an atmosphere in disequilibrium will very probably see a replay of the Mars meteorite debate. There will be no consensus among scientists when the news of a planet with a possible biosphere is announced.

This news will be so extraordinary that it will be close to impossible to keep it secret for very long. There will very probably be allegations in the press of more NASA hype (since the result will likely come from an advanced NASA space observatory). But for the public it will be a tantalising "what if" that could at least open our society to thinking about the implications of finding life off-Earth. It could lead a future US president to make a public statement about the historic and cultural significance of the finding and to reiterate national support for the importance of astronomical research.

In summary, here is some conventional wisdom to be applied to the "Are we there yet?" question of when to publish a significant science result:

1. Big science stories can have a strong element of uncertainty and stand a reasonable chance of being significantly modified later or even proven wrong through subsequent observations.
2. Even if a result is later proven wrong, it can serve as a catalyst for further scientific investigation and enhanced public interest.
3. It is impossible for a major finding to be kept under wraps until it has been vetted to every scientist's satisfaction. Reporters will pick it up as "work in progress" from conference presentations, posters and general internet chitchat.
4. The question of whether to go public with a research finding without prior publication in a peer-reviewed journal is a judgement to be made on a case-by-case basis. There is much that scientists might say about their work that falls outside the scope of a refereed journal.
5. There will always be some discoveries that are clearly suited to immediate public disclosure, with or without full technical details. The 1994 *Shoemaker–Levy* comet impacts on Jupiter, or the ongoing exploration by rover vehicles on Mars, are just two examples.
6. By the time a science result is fully vetted it may be old news, because it has been surpassed by even more advanced findings.
7. It will take years or even decades for certain controversial scientific findings to be settled, especially when it comes to the emerging frontier of astrobiology. For example, the theory of plate tectonics was debated for nearly 50 years.
8. A science news story will find its proper buoyancy in the marketplace of daily news activities. The success of a news story is influenced more by the competing news of the day rather that what venue it was presented in, whether televised press conference or news release.
9. The public is largely understanding and forgiving if a science result is later retracted in the light of new information. Errors only have potentially serious consequences for the public in medical reporting and related health

Biography

Ray Villard is News Director for the Space Telescope Science Institute in Baltimore Maryland. For the past 35 years he has communicated astronomy to the public through popular articles, planetarium programmes and public seminars and courses. A 22-year veteran of the Hubble Space Telescope Project, he has received several NASA service awards for his contribution. His latest book, *Infinite Worlds*, is an illustrated survey of extrasolar planets.

Case studies have rarely been used in undergraduate science teaching exÂ cept as occasional stories told by an inÂ structor, perhaps as historical footÂ notes, to general lectures. James B. Conant of Harvard was apparently the first science educator to try and orgaÂ-nize an entire course around this mode of teaching (Conant 1949).Â â– As part of two general education "Great Discoveries" courses where three paradigms are discussed in the form of cases in the classical sense of a historicalstory as envisionedby Conant. â– As an occasional case used in the laboratories and lecture of a large biÂ ology course. We draw several conclusions from these experiences. It is to be noted that the Indus Valley script remains undeciphered and there are very little surviving fragments of its writing, thus any inference about scientific discoveries in the region must be made based only on archaeological digs. Mathematics[edit]. Numbers, measurement and arithmetic[edit]. Around 3000 BC: Units of measurement are developed in the major Bronze Age civilisations: Egypt, Mesopotamia, Elam and the Indus Valley. The Indus Valley may have been the major innovator on this, as the first measurement devices (rulers, protractors, weighing scales) were invented in Lothal in Gu Scientific discoveries, achievements, and inventions are made all the time. Throughout the year, papers are published and patents are filed for any number.Â The fascinating discovery indicates that the ancient version of GK-PID did not behave in the same way it does currently. The only reason it became capable of working like a genetic carabiner is due to a single mutation that copied itself, suggesting that multicellular life is the result of a single, identifiable mutation. 9New Prime Number Discovered. Mathematicians discovered a new prime number in January via the Great Internet Mersenne Prime Search. The new prime number is 2^74,207,281 â€“ 1. You might be asking why there is a project to determine such a number.