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On the 4th of July, 2005, a NASA spacecraft called “Deep Impact” released an impactor which struck a comet known as “Tempel 1.” This artist’s impression depicts how that encounter may have appeared. Image credit: Pat Rawlings, U. Md., JPL, NASA. Click on the image for a much-better view.

From a rooftop observatory in the city of Danzig (now Gdansk), Johannes Hevelius used his astronomical instruments to search the sky.

With items like a 150-foot refractor (extending over several houses) and an azimuth quadrant (fixing the location of his observations), Hevelius discovered the comets of 1652 and 1661. In 1668, he published Cometographia which, among other things, illustrates various comet forms.

Also in 1668, Stanislaus Lubienietzki published his lavishly illustrated Theatrum Cometicum (“The Theatre of Comets”). Among its many pictures is a woodcut showing the perceived destructive influence of a fourth-century comet. His entire book is available at the National Digital Library of Poland. (Although that site goes offline occasionally, we encourage you to view its amazing contents.)

Artists created drawings of other seventeenth-century comets:

- The Great Comet of 1680 (discovered by Gottfried Kirch) was featured in Germany with captions like: “New Miracles - A Large Comet-Star.”
- In 1682, Halley’s Comet (although not-yet called by that name) appeared in the European sky. One artist made it seem like the comet was extremely close to Earth.

In fact, comets are in orbit far above Earth. But ... what if it were possible to send a probe directly into a comet’s orbit? What if that probe could take pictures of the comet’s nucleus? What if the probe actually impacted the comet’s surface?

Those questions, and answers, are no longer speculative. Less than a thousand years after Halley’s Comet seemed like a bad omen in Britain—939 years to be exact—NASA launched an unmanned mission, called “Deep Impact,” to a comet, called Tempel 1, for an “up close and personal” look.

What was the plan?

Send a spacecraft (called the “FLYBY”) to launch a smaller spacecraft (called the “IMPACTOR”) directly into the path of Tempel 1 (a comet about the size of Manhattan Island), causing a collision between the two. FLYBY

(repositioned safely out-of-the-way) would standby to observe and record what happened, transmitting electronic images to Earth.

Although many things could have gone wrong, *FLYBY* (after traveling 268 million miles, or 431 million kilometers) delivered IMPACTOR (battery-operated, thruster-equipped and made mostly of copper) which smacked into Tempel 1 at speeds of 23,000 miles per hour. NASA's animated recreation depicts those events of 3 July 2005.

After successfully completing its "Deep Impact" mission, beginning the science of cometary geology, *FLYBY* went into sleep mode. NASA officials will "awaken it," as needed, for other possible investigations.

Meanwhile, two other NASA vehicles have been hard at work ... on Mars.

See Alignments to State and Common Core standards for this story online at:

<http://www.awesomestories.com/asset/AcademicAlignment/FROM-OMENS-TO-IMPACT-Exploring-Space-Images-from-NASA>

See Learning Tasks for this story online at:

<http://www.awesomestories.com/asset/AcademicActivities/FROM-OMENS-TO-IMPACT-Exploring-Space-Images-from-NASA>

Media Stream



Johannes Hevelius

Image online, via Amazing Space website.

View this asset at: <http://www.awesomestories.com/asset/view/Johannes-Hevelius>



Hevelius Observatory in Danzig (Gdansk), circa 1640

Image online via Museum of the History of Science at Oxford University.

View this asset at:

<http://www.awesomestories.com/asset/view/Hevelius-Observatory-in-Danzig-Gdansk-circa-1640>



Hevelius with His Sextant and Wife Elizabeth

Image online, via University of Montreal.

PD

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<http://www.awesomestories.com/asset/view/Hevelius-with-His-Sextant-and-Wife-Elizabeth>



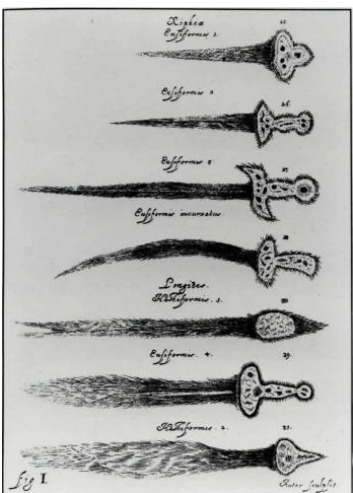
Cometographia - Study of Comets by Hevelius

Image, described above, online via Sotheby's.

PD

View this asset at:

<http://www.awesomestories.com/asset/view/Cometographia-Study-of-Comets-by-Hevelius>



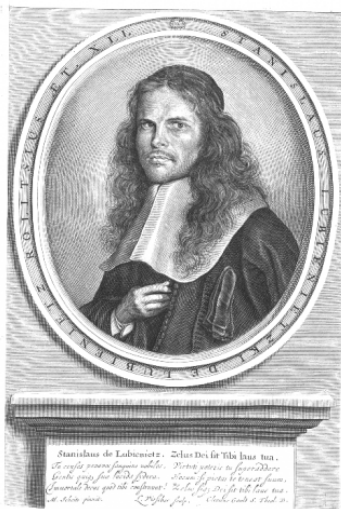
Comet Drawings from Cometographia

Image, described above, reprinted in Don Yeomans' *Comets: A Chronological History of Observation, Science, Myth and Folklore*. Illustration online via NASA.

PD

View this asset at:

<http://www.awesomestories.com/asset/view/Comet-Drawings-from-Cometographia>



Stanislaus Lubienietzki

Image maintained by the National Library of Poland.

Online, courtesy Wikimedia Commons.

View this asset at: <http://www.awesomestories.com/asset/view/Stanislaus-Lubienietzki>

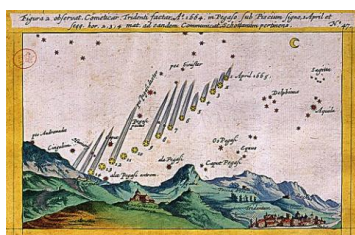


Illustration from Theatre of Comets

Image online via the BnF, from "Theatrum Cometicum," published in Amsterdam between 1667-68.

View this asset at:

<http://www.awesomestories.com/asset/view/Illustration-from-Theatre-of-Comets>



Colorized Drawing from Theatrum Cometicum

Image, described above, from "Theatrum Cometicum," originally published in Amsterdam between 1667-68. Online via NASA.

View this asset at:

<http://www.awesomestories.com/asset/view/Colorized-Drawing-from-Theatrum-Cometicum>



Illustrating the Destructive Influence of Comets

Illustration from Lubienietzki's "Theatrum Cometicum," Amsterdam (1668).

Image online via NASA.

View this asset at:

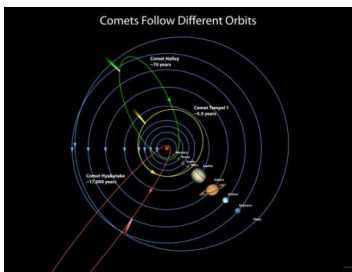
<http://www.awesomestories.com/asset/view/Illustrating-the-Destructive-Influence-of-Comets>



Gottfried Kirch

Image online, courtesy SPACETEC, a German-Language website.

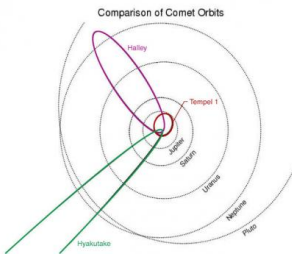
View this asset at: <http://www.awesomestories.com/asset/view/Gottfried-Kirch>



Comparison of Comet Orbits

Illustration, by Tony Farnham, online via NASA and [University of Maryland](#).

View this asset at: <http://www.awesomestories.com/asset/view/Comparison-of-Comet-Orbits>



Orbit of Comet Tempel 1

Illustration, by Tony Farnham, online via NASA and [University of Maryland](#).

View this asset at: <http://www.awesomestories.com/asset/view/Orbit-of-Comet-Tempel-1>

FLYBY Spacecraft - Comet Tempel 1

The unmanned "Deep Impact" mission to Tempel 1 (a comet) included a flyby spacecraft and an on-board impactor.

The mission's impactor crashed, spectacularly, into Tempel 1. The purpose of the impact was to study the make-up of this particular comet and, hopefully, to draw conclusions about other comets.

What about the other significant piece of hardware which was part of the mission:

- How does NASA define a "flyby spacecraft?"
- What are some of the more-famous examples of flybys?

[NASA answers those questions](#) for us:

Flyby spacecraft conducted the initial reconnaissance phase of solar system exploration. They follow a continuous solar orbit or escape trajectory, never to be captured into a planetary orbit. They must have the capability of using their instruments to observe targets they pass. Ideally, their optical instruments can pan to compensate for the target's apparent motion in the instruments' field of view.

They must downlink data to Earth, storing data onboard during the periods when their antennas are off Earthpoint. They must be able to survive long periods of interplanetary cruise. Flyby spacecraft may be designed to be stabilized in 3 axes using thrusters or reaction wheels, or to spin continuously for stabilization.

Our prime example of the flyby spacecraft category is the pair of Voyager spacecraft, which conducted encounters in the Jupiter, Saturn, Uranus, and Neptune systems...

Other examples of flyby spacecraft include:

- [Stardust Cometary Sample Return](#)
- [Mariner 2 to Venus](#)
- [Mariner 4 to Mars](#)
- [Mariner 5 to Venus](#)
- [Mariner 6 and Mariner 7 to Mars](#)
- [Mariner 10 to Mercury](#)
- [Pioneers 10 and 11 to Jupiter and Saturn](#)
- [New Horizons Pluto-Kuiper Belt Mission](#)

This artist's illustration depicts the Flyby Spacecraft used in the Tempel 1 "Deep Impact" mission. [NASA describes it with these words:](#)

The flyby spacecraft for the Deep Impact Mission. The spacecraft carries a solar panel (right), a high-gain antenna (top), a 370-kilogram self-guided impactor (not visible), a debris shield (left), and science instruments for high and medium resolution imaging, infrared spectroscopy, and optical navigation (yellow box and cylinder, lower left).

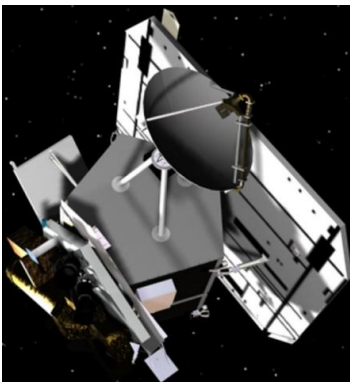
The spacecraft is about 3.3 meters long, 1.7 meters wide, and 2.3 high, and has a total payload mass of 1020 kilograms.

Click on it for a better view.

Artist's illustration by Ball Aerospace & Technologies Corp; online, via NASA, JPL, University of Maryland and Ball Aerospace & Technologies Corp.

View this asset at:

<http://www.awesomestories.com/asset/view/FLYBY-Spacecraft-Comet-Tempel-1>



FLYBY Launches Probe - Comet Tempel 1

On the 4th of July, 2005, NASA's "Deep Impact" flyby spacecraft launched its impactor for a dramatic encounter with a comet known as "Tempel 1."

This artist's interpretation depicts the likely scene as the flyby spacecraft releases the heading-for-the-comet impactor about 24 hours before its collision with Tempel 1.

We learn more about the drawing from NASA:

This is an artist's rendition of the flyby spacecraft releasing the impactor, 24 hours before the impact event.

Pictured from left to right are comet Tempel 1, the impactor, and the flyby spacecraft.

The impactor is a 370-kilogram mass with an onboard guidance system.

The flyby spacecraft includes a solar panel (right), a high-gain antenna (top), a debris shield (left, background), and science instruments for high and medium resolution imaging, infrared spectroscopy, and optical navigation (yellow box and cylinder, lower left).

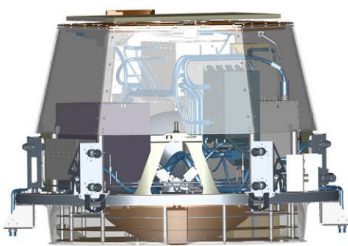
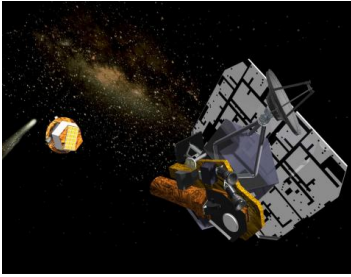
The fly spacecraft is about 3.2 meters long, 1.7 meters wide, and 2.3 meters high. The launch payload has a mass of 1020 kilograms.

Click on the image for a better view.

Artist's illustration by Ball Aerospace & Technologies Corp; online, via NASA, JPL, University of Maryland and Ball Aerospace & Technologies Corp.

View this asset at:

<http://www.awesomestories.com/asset/view/FLYBY-Launches-Probe-Comet-Tempel-1>



Impactor - Comet Tempel 1

Artist's illustration by Ball Aerospace & Technologies Corp; online, via NASA, JPL, University of Maryland and Ball Aerospace & Technologies Corp.

View this asset at: <http://www.awesomestories.com/asset/view/Impactor-Comet-Tempel-1>



Deep Impact - First Look Inside a Comet

NASA drawing by Ball Aerospace and Tim Cline. Online, courtesy the University of Maryland website.

View this asset at:

<http://www.awesomestories.com/asset/view/Deep-Impact-First-Look-Inside-a-Comet>



FROM OMENS TO IMPACT

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