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ROSETTA AWAKENS

Ken Tapping, 28th January, 2014

Comets have always been seen as messengers. In mediaeval times, a comet in the sky was regarded as a harbinger of disaster. A mediaeval woodcut depicts a comet in the sky as a great sword. In 1996, comet Hyakutake looked exactly like that: a huge sword blade crossing the sky. It is easy to see why our ancestors were scared.

Today we see comets as messengers of a very different kind. They bring us information from the distant outer reaches of the Solar System. Out there, far from the Sun, there is an enormous amount of left-over material from the birth of the Solar System, some 4.5 billion years ago. It is a mixture of dust, ice and organic chemicals, some important for life. A comet is a lump of this material, that a collision or some other accident has deflected into a new orbit, one bringing into our neighbourhood, the inner Solar System. This makes comets not only messengers from the outer reaches of the Solar System, but also messengers from our distant past. That is why we have such a great interest in them. In 1986 the Giotto spacecraft flew by the head of Halley's Comet. Now we are on the threshold of getting the best look at a comet we've ever had.

Ten years ago, in March 2004, an Ariane 5 rocket lifted off from the European Space Agency's launch site at Kourou, in French Guiana. On board was Rosetta, a roughly 2m box-shaped spacecraft. Its mission is to rendezvous with Comet 67P/Churyumov-Gerasimenko as it heads inward for its next visit to the inner Solar System. It will then stay close to the comet as it flies by the Sun, and also land a 100kg probe, called Philae, on the surface of the comet. This is a very different process from landing a spacecraft on a larger body, like the Moon, where gravity pulls strongly downwards and retrorockets are used to slow the descent. Comets are typically only a few kilometres in size, and their gravity is scarcely strong enough to hold them together. Therefore Philae will just drift slowly to the comet, and when

it lands it will fire a spike into the comet to hold itself down. To stop the recoil from firing the spike pushing the probe off into space again, a small jet has to fire, to hold it down!

The logical way to do a space mission like this is to launch, drift to the comet and then rendezvous. However, that is beyond even the largest launch vehicles we have at the moment. So, to get to the right place, at the right time and at the right velocity involved circling the Sun four times, using close encounters with the Earth and Mars to boost its speed and to steer the spacecraft. This ten-year mission required Rosetta to be put into hibernation for most of the trip. It is now approaching its destination, and on 20 January the delicate task of waking the spacecraft was carried out. At 18:17 Universal Time, the ESA satellite tracking facility at Darmstadt, Germany picked up Rosetta's signal, confirming she is awake and functioning.

When Rosetta arrives at the comet, things will be pretty quiet. However, as the comet, together with Rosetta and Philae, speeds into the inner Solar System, the increasing solar heat will start to evaporate the comet's material, so that great jets of gas and dust will blast out of the lump, forming the glowing tails we associate with comets. This will enable us to determine not only what is in and near the comet, but also what's inside. In addition, we will have our first on-the-spot view of what happens when a comet passes close to the Sun.

The spacecraft is called Rosetta because we hope it will produce revelations regarding comets and our origins the way the Rosetta Stone changed our understanding of history. We are accustomed to space missions yielding spectacular results, and this one is likely to live up to our expectations.

Venus rises about 6am. Jupiter dominates the sky overnight, Mars rises around 1am and Saturn at 3am. The Moon will be New on the 30th.

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