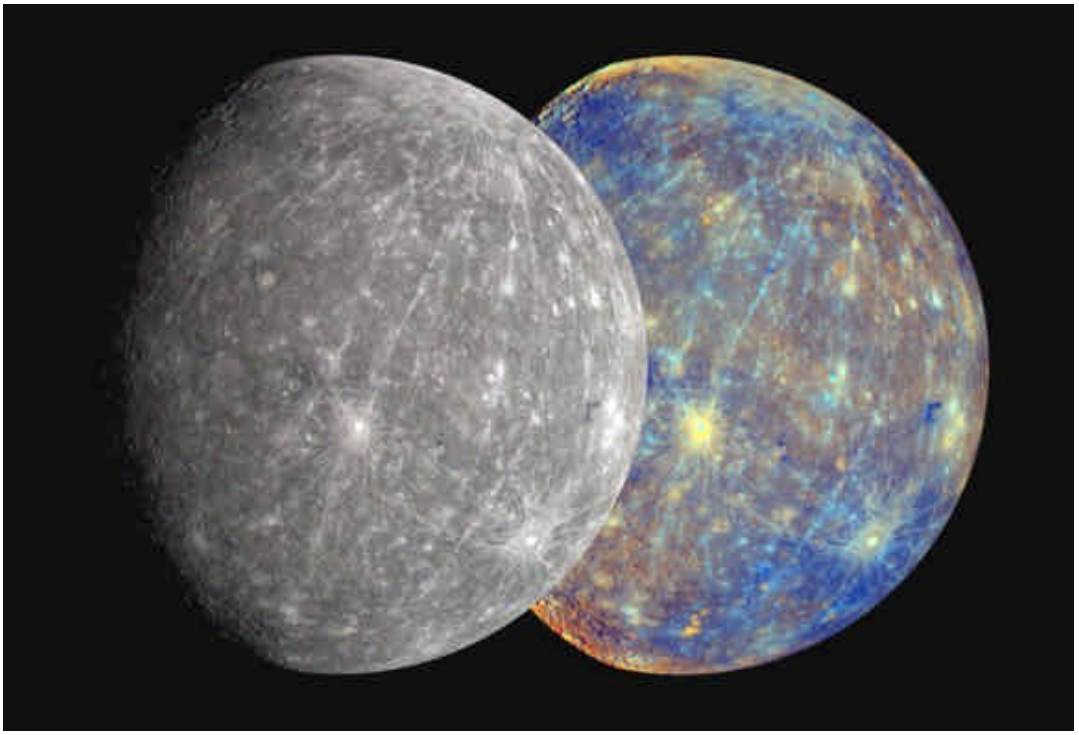
TRANSIT

The Newsletter of

Cleveland & Darlington Astronomical Society

05 November 2008



A coloured Mercury - Messenger fly-by 06 October 2008

Front Page Image - By eye, Mercury is a relatively uniform grey with splotches of variation in brightness. But spacecraft MESSENGER's sensitive cameras have filters on them which isolate different colors, and when put together and enhanced they show subtle colour changes on the planet's face. These colours are almost certainly due to changes in the composition of the rocks on the surface…

In this close-up view, younger terrain on the left is yellow, while older features appear blue. We know the area on the left is young because it's smooth; it hasn't been around long enough to get bombarded from space by comet and asteroid impacts. On the right, the material that appears blue may have been ejected by the impact that formed the crater on the right. - NASA

Last meeting : 10 October 2008. "A Deep Look into your Telescope" by Dr Jurgen Schmoll of Durham University and CaDAS/DAS

Next meeting : 14 November 2008. "The Extremely Large Telescope" by Dr. Mark Swinbank of Durham University

Letter to the Editor

From John Crowther

Re last month's Transit. How wet is WETI? Does it exist, is it a wind-up? When I read that WETI is a new alternative to SETI I felt as though it was the First of April.

So, is there a connection between those who believe that Aliens visit us in Flying Saucers and the members of WETI?

Is it that, for the moment, Aliens land and visit scientists, if so then WETI's waiting is done. The WETI disciplines listed get less and less scientific, with the first three being relevant and the others less so. We have astrophysics, biology, neurology, psychology and philosophy, how about adding theology to the list? Astronomy can't be needed as those who wait don't need to be associated with those who seek as SETI does.

The article from Phil Plait "Trans-cosmic flow" broadens our horizon, it certainly broadened mine, it blew it away.

To pass on such information must mean that Phil Plait isn't The Bad Astronomer his title pretends.

The final sentence says “Everything else will have sailed below the horizon, so we better look around while we can”. So, how many billions and billions of years are left before all that is left visible in the night sky is our local cluster of galaxies? Will it all slowly emerge and be again if the universe begins to contract into the Big Crunch?

So, is the universe like a black hole with an event horizon?

Wanted – ***Would any member be interested in providing a regular “Whats up in the Night Sky This Month” article for Transit? - Editor***

CaDAS Has its Third Astromind Champion!

This year's prestigious Yorkshire Astromind competition was hosted by Sheffield A.S. on 18 October. As has become traditional in the last few years, I set the questions and chaired the quiz.

Darran Summerfield, who has represented CaDAS for the last few years, and has won the trophy once, was unable to compete this year, due to a clashing engagement - so Rob Peeling bravely volunteered to give it a go.

And guess what... Rob won, at his first time of trying!

It was an incredibly close contest this time, with only a single point separating the first three places! On the points total, Rob was tied for first place with Gary Gawthrope of Mexborough and Swinton A.S.; he was declared the winner by virtue of having fewer passes in the speed round. The defending champion and multiple winner, Marcus Armitage of Huddersfield A.S., was beaten into third place by one point. – **Neil Haggath**

Buzz Aldrin: "We Should Build a Settlement on Mars."

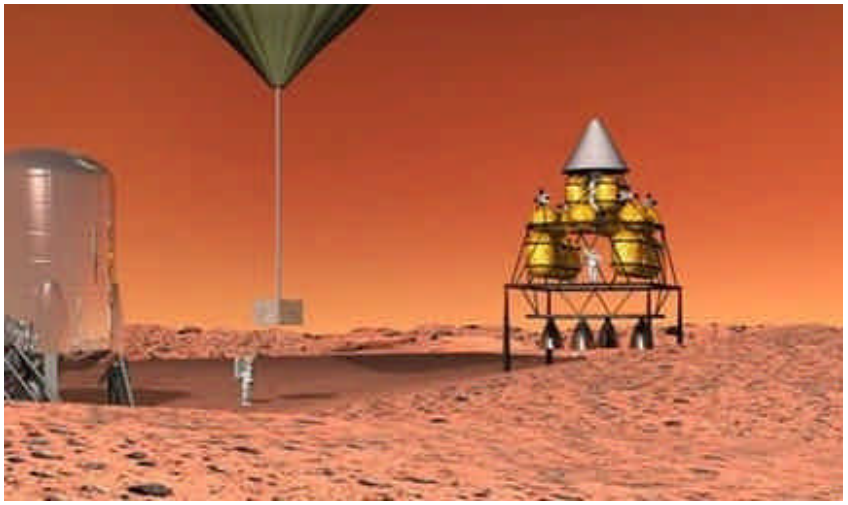
Posted by Josh Hill.

He was the second man to walk on the moon behind Neil Armstrong, and has since become the cultural icon that the reclusive Armstrong never wanted to be. And now, speaking in Paris on Tuesday, Buzz Aldrin believes that the first to visit Mars should settle there.

Aldrin compares humanities desire to visit Mars to our travel from Europe to the Americas. Those original pioneers knew that they would probably never return to their homes, but set out regardless.

"They need to go there more with the psychology of knowing that you are a pioneering settler and you don't look forward to go back home again after a couple a years," he said. "At age 30, they are given an opportunity. If they accept, then we train them, at age 35, we send them. At age 65, who knows what advances have taken place. They can retire there, or maybe we can bring them back."

Mars has been the focus of much attention this year given the successes and challenges facing first, the Mars Exploration Rovers Spirit and Opportunity, and later the Phoenix Mars Lander. Add to that the three orbiting spacecraft, Mars Odyssey, Mars Express, and Mars Reconnaissance Orbiter, and Mars is definitely on the agenda.



Buzz Aldrin referred to the “nearer terrestrial conditions” that exist on Mars compared to “the Moon and any other place.” Given recent discoveries of the existence – whether it is past or present – of water on the planet, and the geological similarities to Earth, astronomers and scientists from all across the planet hope to eventually send astronauts to the Red Planet.
"If we are going to put a few people down there and ensure their appropriate safety, would you then go through all that trouble and then bring them back immediately, after a year, a year and a half?” said Aldrin.

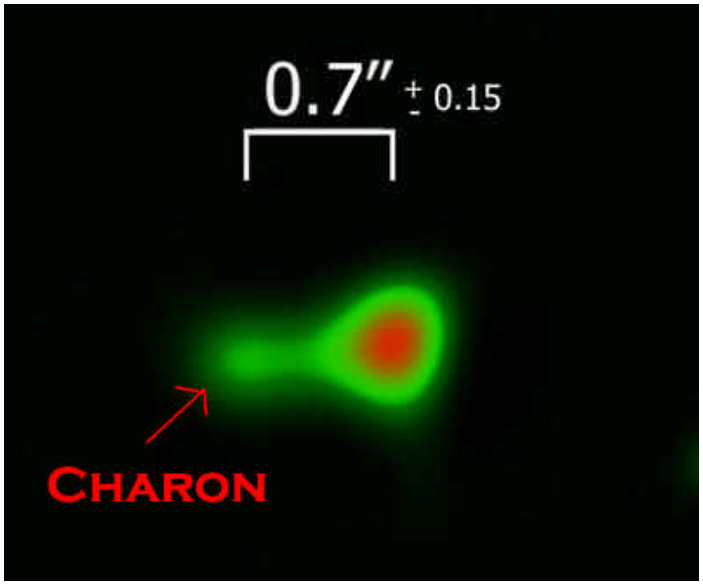
Visits to Mars are already on drawing boards at NASA and other space agencies worldwide. But the cost to send even an unmanned explorer with materials for future human visitors are bring many to hesitate about the wisdom of such actions; let alone sending the humans. Many critics of sending humans believe that sending unmanned probes and explorers offer just as much in the way of scientific discovery, without the exorbitant cost.

Future unmanned missions to Mars include the Mars Science Laboratory which is set to launch in 2009, and is essentially the older, smarter brother of the Mars Rovers. The Phobos-Grunt will be visiting Mars' largest moon Phobos, and missions being headed by Finland, Russia, NASA and the ESA are all set to launch between now and 2020. Needless to say, by the time we ever consider launching humans to Mars, we'll have enough info to get us there safely.

Aldrin also commented on what he believed were the disappointing Space Shuttle program and the International Space Station. The shuttle "has not lived up to its expectations, neither has the space station," said Aldrin.

"Amateur" astronomers capture Charon

The definition of a professional astronomer is one who gets paid to do it. But the difference between that and an amateur, who technically does it for fun, is getting hard to tell.
Take this image of Pluto and its moon Charon taken by so-called amateur astronomers Antonello Medugno and Daniele Gasparri from Italy:

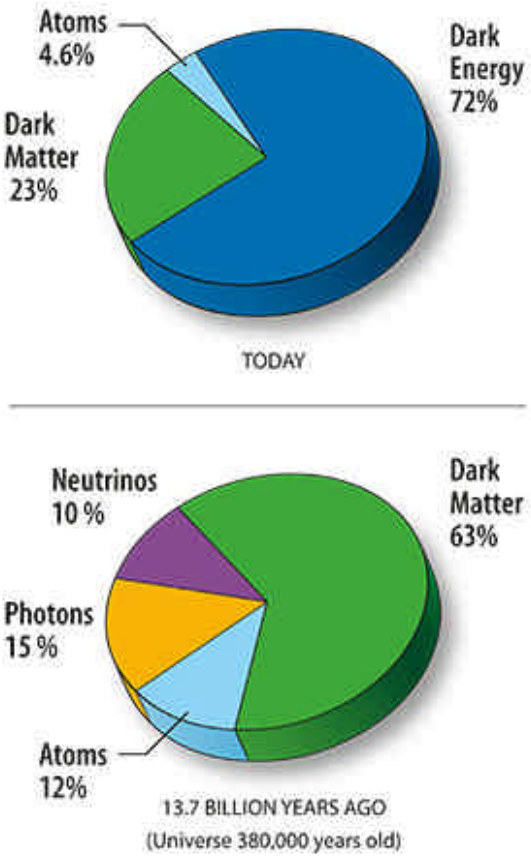


The bright blob on the right is Pluto, and Charon is on the left. The separation is 0.7 arcseconds, an incredible feat (the Moon is 2500 times wider than this in the sky). This is definitely Charon; it's at the correct position, separation, and brightness. They nailed it.

Mind you, Charon wasn't even discovered until 1978 by a pro, using a 61 inch telescope! The image above was using a 14? telescope, and is in fact much better than the discovery image. In 30 years of progress, a much smaller commercial telescope can do better than a professional set up could.

Dark Energy Science

From the NASA Joint Dark Energy Mission



Two competing teams of astronomers announced the accelerating universe in 1998. The groups, known as the Supernova Cosmology Project and the High-Z Supernova Search team, used the same method. They observed distant star explosions known as Type Ia supernovae. These cataclysms occur when dense stars known as white dwarfs blow themselves to smithereens. Type Ia supernovae are special because they all explode with nearly the same luminosity, so astronomers can use them as "standard candles." Measuring the apparent brightness of a Type Ia supernova gives astronomers a direct measure of its distance.

By painstakingly observing Type Ia supernovae at different distances from Earth, and by seeing how their light has been "stretched out" by cosmic expansion, the teams calculated how the universe's expansion has changed over time. The two teams made most of their observations with ground-based telescopes. They also used NASA's Hubble Space Telescope (HST) to improve the accuracy of their measurements. Since 1998, completely independent studies with NASA's

Chandra X-ray Observatory and Wilkinson Microwave Anisotropy Probe (WMAP) have confirmed the initial findings: we live in a universe whose expansion is accelerating.

Whatever it is, modern astronomical measurements show that about 72% of the total energy in the universe is dark energy. The rest consists of dark matter (23%) and the familiar atomic matter that makes up our bodies (4.6%). Not knowing the nature of dark energy would be akin to an alien scientist trying to understand Earth's surface without knowing the nature of water. Scientists cannot claim to understand the universe at its deepest level if they can't explain its dominant form of energy. Unlocking the mysteries of dark energy will have profound implications for both physics and astronomy.

Perhaps more important, dark energy controls the fate of the universe. In some theories, dark energy will cause the universe to accelerate forever, eventually spreading out galaxies so thinly that our cosmos will be a dark, cold, and lonely realm. In other theories, dark energy could reverse its properties in the distant future, causing the universe to collapse back upon itself in a "big crunch."

Unlike some mysteries, where nobody has any idea how to solve it, the problem with dark energy is that scientists have developed too many possible solutions. It's possible that one of their ideas is correct, but so far the scientific community has not settled on a single explanation. Here are three of the leading contenders:

1 The Energy of Empty Space
Scientists have known for decades that even supposedly "empty" space could have energy. The energy contained in this vacuum, known as the cosmological constant, could be providing the oomph that is pushing galaxies apart from one another at an ever-faster rate.

2 Modified Gravity
Our theory of gravity, based on the laws of Newton and Einstein, is very well tested on the scale of the solar system. But perhaps over very large distances, such as those between galaxies, our understanding breaks down. A new law of gravity may naturally explain why cosmic expansion is speeding up.

3 A Dynamical Energy Field

Some theorists think that an invisible energy field known as quintessence pervades our universe, and that the nature of this field varies with time. At the moment, quintessence is causing cosmic acceleration. But in the future, it may reverse itself, leading to a big crunch.

Hawking to Retire, But Not Quit

Written by Nancy Atkinson

Cosmologist Stephen Hawking will retire from his post at Cambridge University next year, but he still intends to continue his exploration of time and space. University policy is that officeholders must retire at the end of the academic year in which they become 67. Hawking will reach that age on Jan. 8, 2009. Hawking is the Lucasian Professor of Mathematics at the university, a title once held Isaac Newton. The university said on Friday that he would step down at the end of the academic year in September, but would continue working as Emeritus Lucasian Professor of Mathematics. Hawking became a scientific celebrity through his theories on black holes and the nature of time, work that he carried on despite becoming severely disabled by amyotrophic lateral sclerosis, or ALS.

Hawking was born on January 8, 1942 (300 years after the death of Galileo) in Oxford, England. He attended University College in Oxford, and wanted to study mathematics, but it wasn't available as a major, so he chose Physics instead. After three years and "not very much work," Hawking said, he was awarded a first class honours degree in Natural Science. He then went to Cambridge to do research in Cosmology, since no one was working in that area in Oxford at the time.

After getting his Ph.D. he became first a Research Fellow, and later on a Professorial Fellow at Gonville and Caius College. 1973 Stephen came to the

Department of Applied Mathematics and Theoretical Physics, and since 1979 has held the post of Lucasian Professor of Mathematics.
Hawking first earned recognition for his theoretical work on black holes.

Disproving the belief that black holes are so dense that nothing could escape their gravitational pull, he showed that black holes leak a tiny bit of light and other types of radiation, now known as "Hawking radiation."
His 1988 book, "A Brief History of Time," was an international best-seller; in 2001 he published "The Universe in a Nutshell," and a children's book, "George's Secret Key to the Universe," was published in 2007, which was co-authored with his daughter Lucy.

To celebrate his 65th birthday in 2007, he took a zero-gravity flight. In part, he went on the flight to bring public attention to space travel. "I think the human race has no future if it doesn't go into space. I therefore want to encourage public interest in space," he said.

Microsoft vs. Google: The New Space Race?

Posted by Casey Kazan.

Are Microsoft and Google in a space race? We think they are. Their rivalry is also, we believe, a precursor to the next great post-Internet technology boom: space exploration and development.

Microsoft released its new Worldwide Telescope this spring, which will access images from NASA's great fleet of space-born telescopes and earth-bound observatories such as the future Large Synoptic Survey Telescope, partially funded by Microsoft founder Bill Gates, which is projected for 'first light' in 2014 in Chile's Atacama Desert -the world's Southern Hemisphere space-observatory mecca.

The 8.4-meter telescope will be able to survey the entire visible sky deeply in multiple colors every week with its 3-billion pixel digital camera. The telescope will probe the mysteries of dark matter and dark energy, and it will open a movie-like window on objects that change or move rapidly: exploding supernovae, potentially hazardous near-Earth asteroids and distant Kuiper Belt objects.

LSST is truly an Internet telescope, which will put terabytes of data each night into the hands of anyone that wants to explore it. The 8.4-metre LSST telescope and the 3-gigapixel camera are thus a shared resource for all humanity — the ultimate network peripheral device to explore the universe.
Not to be outdone, Google early this spring joined MIT scientists who are designing a satellite-based observatory -the Transiting Exoplanet Survey Satellite (TESS)- that they say could for the first time provide a sensitive survey of the entire sky to search for earth-like planets outside the solar system that appear to cross in front of bright stars. Google will fund development of the wide-field digital cameras needed for the satellite.

"When starships transporting colonists first depart the solar system, they may well be headed toward a TESS-discovered planet as their new home," says George R. Ricker, senior research scientist at the Kavli Institute for Astrophysics and Space Research at MIT.
Microsoft's new free software application called WorldWide Telescope allows everyone from space novices to astronomy professionals to easily explore galaxies, star systems and distant planets.

The WorldWide Telescope links together 12 terabytes -- the data equivalent of 2.6 billion pages of text -- of pictures from sources including the Hubble Space Telescope, the Chandra X-Ray Observatory Center and the Spitzer Space Telescope.

The experience is similar to playing a video game, allowing users to zoom in and out of galaxies that are thousands of light years away. It allows seamless viewing of far-away star systems and rarely-seen space dust in breathtaking clarity.

Microsoft said it will release the WorldWide Telescope free of charge as a tribute to Jim Gray, a Microsoft researcher who went missing off the coast of California while sailing last year. Gray worked on projects with astronomers to organize the vast amounts of data and images being pulled from satellites.
Google has a similar offering called Google Sky, a companion to its Google Earth program.

Features of WorldWide Telescope include virtual tours of different parts of space, led by expert educators and astronomers. People will be able to use the Microsoft program to create their own space tours, to share with their friends. The program is also notable for its high level of detail, its large volume of data

and the ability to fine-tune the views, said Curtis Wong, principal researcher in Microsoft's Next Media Research Group. "I expect that there are going to be a lot of people learning so much more about the sky, because we've taken away the limitations of light pollution and smog and bad weather," Wong said. "Those of us in Seattle, it's our chance to finally see the sky."

The program runs on the PC desktop but pulls data and images from the Internet. Google Sky can run in a standard Web browser or in the downloadable Google Earth program. But the system requirements for Microsoft's WorldWide Telescope program come with a catch: It works only in Windows XP or Windows Vista.

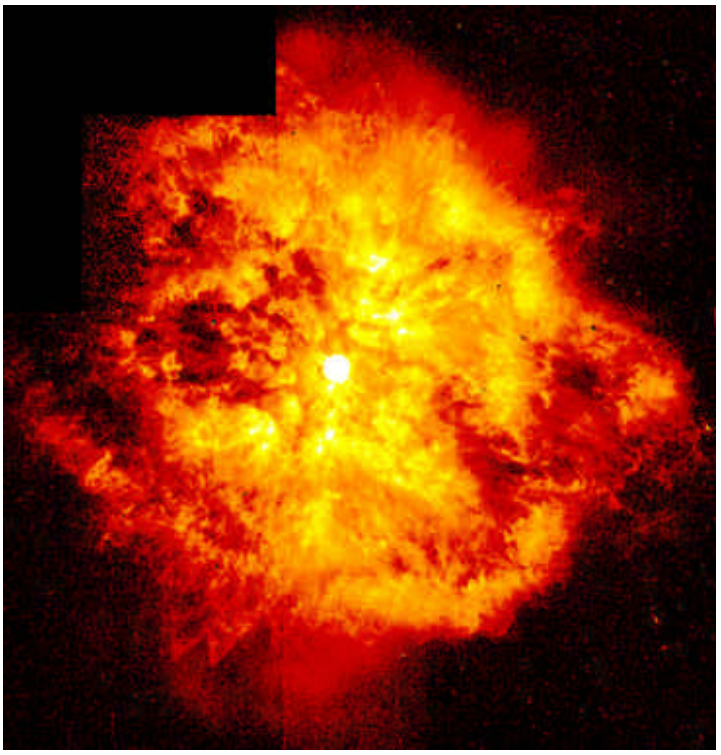
A test version of the software is available for download at

http://www.worldwidetelescope.org.

Neil Haggath with Fred Haise at the recent Pontefract talk given by this Apollo 13 Astronaut

Is a Death Star Aimed at Earth?

Posted by Luke McKinney.



Australian astronomers have been studying an intergalactic assassin poised to wipe out life on Earth. Maybe. Observations indicate that cosmological curiosity WR104 may be a killer - and we might be the victim.

The pretty pinwheel that makes the system so distinctive is now know to be a combination of two stars - a blue star orbiting the Wolf-Rayet 104. Note that the "Wolf-Rayet" name is the astronomical equivalent of a beeping red LCD countdown reading "0:01" - it's a swollen star getting ready for final supernova detonation. At the moment its fusion reactions are blasting its own photosphere off into space, where the blue companion orbits and illuminates the material, creating a seriously impressive spiral over twice the size of our solar system.

We have a perfect view of this pinwheel pattern, since the spiral is at right angles to us, in the same way a man being held at gunpoint has a perfect view of the little hole the bullets come out of. And the gun is over twenty-five times the size of the sun. When a binary system collapses into a black hole, which astronomers call 'coalescence' (a euphemism which makes 'heated debate' a valid description of World War II), it can release a gigantic burst of gamma rays. Gamma rays are the ultimate high energy electromagnetic radiation, and while the burst lasts less than two minutes it can contain more energy than the entire

mass of the sun converted into energy by E = m c^2. You'll notice that the mass of the sun and the speed of light, c, are extremely large numbers.

On the upside we'll never see it coming. The EM-burst travels the speed of light so the only warning we'd have is dying - which most people will accept is a little too late. The dinosaurs certainly did (some scientists believe historical mass extinctions were caused by similar intergalactic "life reset button" gamma bursts). Even better, this Earthicidal explosion may have already happened with the lethal radiation already speeding its way right at us. On the other hand, the big boom might not happen for hundreds of thousands of years - and might do so without a peep of gamma radiation.

The combination of science and philosophy is a challenging field that many don't bother with, but this is a strong motivation to start. If you could die tomorrow, how would you like to live today?

18 Year Old Rocket Motor Found in Australian Outback

Written by Nancy Atkinson

Picture by Michael White : A solid rocket motor casing from a commercial U.S. Delta 2 launch vehicle was found in Australia, nearly 18 years after it reentered.

This just in from 'The Sky is Falling' Department: NASA's Orbital Debris Newsletter reports that a launch vehicle rocket motor casing was found by ranchers in the Australian Outback during a cattle round-up on a three million-acre pasture property.

It was first spotted by Mr. Arthur Taylor who was flying a Cessna aircraft to look for stray cattle. The casing appeared in relatively good condition (see picture above) and did not seem to be very old. Mr. Michael White forwarded numerous photos of the object to the NASA Orbital Debris Program Office, including one with a clear serial number next to the nozzle attachment point. Using the serial number, NASA Kennedy Space Center personnel were able to trace the motor

casing to a a specific mission.

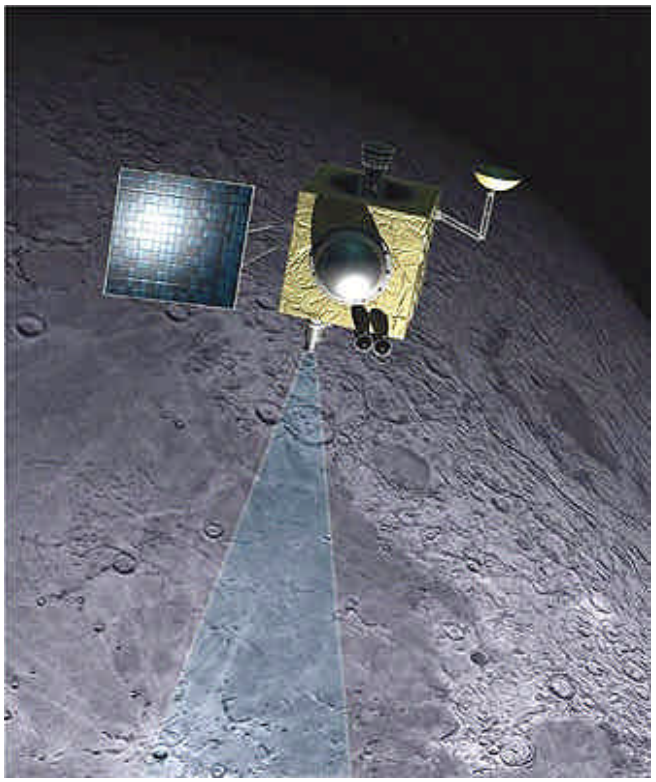
The casing came from a Delta 2 rocket used on June 2, 1990 to launch the Indian INSAT-1D geosynchronous spacecraft from the Cape Canaveral Air Force Station, Florida. This solid rocket motor served as the launch vehicle's third stage which carried the payload from a low altitude parking orbit into a geosynchronous transfer orbit. (If you want to trace it yourself, here are the particulars: U.S. Satellite Number 20645, International Designator 1990-051C), Reentry of the stage occurred a few months later.

This isn't the first time rocket casings have been found in Australia, and this object joins similar solid rocket motor casings found in Saudi Arabia, Thailand, and Argentina during the past several years.

Yikes!

India's Chandrayaan-1 On Its Way to the Moon

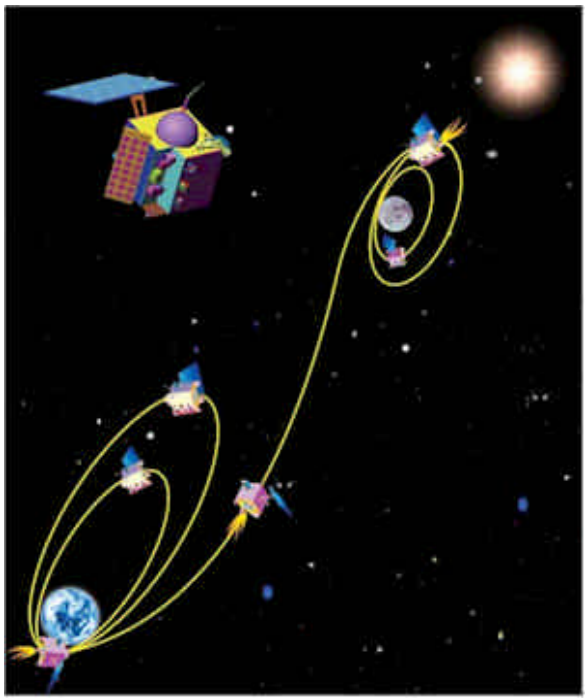
Written by Nancy Atkinson



Artists rendition of Chandrayaan-1 in lunar orbit. Credit: ESA

Chandrayaan-1, India's first mission to the Moon, was successfully launched October 22 from the Satish Dhawan Space Centre (SHAR) in Sriharikota, India.

The PSLV-C11 rocket lifted off at 02:52 Central European Summer Time (CEST). About 20 minutes later the spacecraft was , injected into a highly elongated orbit around the Earth. The spacecraft will reach the moon in about two weeks. It will take several days for the Chandrayaan-1 to reach its lunar transfer orbit, and then it will take about 5 days to reach the moon. Once the spacecraft is orbiting the moon, it will progressively lower its altitude through propulsive maneuvers to reach its final 100 km-high circular orbit.



Chandrayaan-1 mission profile.
Credit: ESA

Chandrayaan-1 is a truly international mission, with payloads from Europe as well as the United States. NASA's contribution includes the Moon Mineralogy Mapper, designed to look for lunar mineral resources, and an instrument known as Mini-SAR, which will look for ice deposits in the moon's polar regions. Engineers from the Jet Propulsion Laboratory are also providing backup navigation assistance to the Indian Space Agency in Bangalore, India.

At the earliest opportunity, the spacecraft will eject the 'Moon Impact Probe' to provide information about the lunar surface. The mission will then continue from orbit, with remote-sensing studies carried out by its 11 scientific instruments. Three of these instruments were provided by Europe (UK, Germany, Sweden) through ESA.

CERN Releases Preliminary Failure Analysis

The mammoth Large Hadron Collider is offline after a pretty big malfunction during testing. CERN, the agency in charge of the LHC, has released its preliminary findings of what happened.

The current flow in the LHC depends critically on it being a superconductor. That means the electricity flows with almost no resistance (think of it like water flowing in a pipe that has no friction). For some reason — why it happened is still unknown — a small patch of resistance developed in the circuit. If left alone, something like this can cause massive damage; for example electricity flow can generate a vast amount of heat in such a patch. However, the LHC automatic safeguards kicked in, and appeared to work as designed.

However again, an electric arc was triggered, and we're not talking about a little spark. It was big enough to punch a hole in the dewars containing the liquid helium needed to cool the magnets down to superconducting temperatures. The helium leaked out, and started to fill a region of the LHC which is supposed to be kept in vacuum. It also leaked out into the tunnel holding the LHC itself, causing some damage to the structure, including partially tearing the 1 ton magnets out of their brackets holding them down.

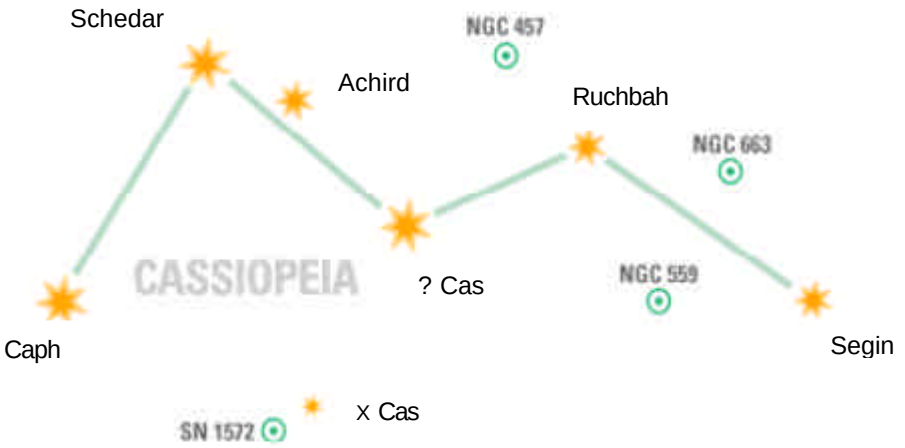
So there is some mechanical damage, but it's limited to where the problem occurred (other magnets appear to be fine). About 30 magnets were damaged, and they lost about six tons of helium, which needs to be replaced. The repair will take some time, as will figuring out exactly what happened, and, more importantly, why.

They're being cautious about this, as you might expect:

> "Although the cause of the initial growth of connection resistance has not yet been established, and knowing that a similar event has not occurred in the test of all other sectors and of their thousands of connections, it has nonetheless been decided that additional measurements to generate early warnings and interlocks, improvements in pressure relief devices and in external anchoring of the quadrupole [magnet] cryostats with vacuum barrier will be implemented before any further powering of the LHC circuits at high current".

So they will proceed carefully, but I'm guessing they will have it up and running in a few months time, certainly sometime next year. This is a major setback for the program, of course, and will cost them time, money, and some PR, no doubt. But they *will* get it back up to speed, and soon they'll be back in the business of science, poking and prodding the Universe on a quantum scale

Constellation - Cassiopeia



Cassiopeia was the vain and boastful wife of King Cepheus of Ethiopia, whose constellation lies next to her in the sky. This is one of the easiest constellations to spot during the autumn and winter months; its big "W" (or "M") shape rotates overhead each night. Apart from being a generally pretty area to scan in binoculars, there are some terrific sights to pick out.

The stars in Cassiopeia are all less than second magnitude brightness, they are visible at northern latitudes for the whole night all year. The brightest, **Schedar**, is a multiple star, pale rose overall and slightly variable, from 2.2 to 2.8 magnitudes, while the second brightest , **Caph,** is a white star steady at 2.4 magnitudes.

When Caph is straight up towards the zenith from Polaris, it is celestial midnight, this star is a 24-hour clock hand and is a brilliant white binary, magnitudes 2 and 11.

? Cas is a remarkable blue-white variable known as a shell star, throwing off rings of gas apparently because its high-speed rotation makes it unstable. The eclipsing binary pair, **Ruchbah**,share one name from Arabic for "the knee".

9,000 light years away sits **NGC 457,** a 6th-mag open cluster known as the Owl Cluster.

NGC 559 a 9.5-mag open cluster is about 2.5° from **NGC 663** a 7th-mag open cluster seen in binoculars.

Cassiopeia is also the area of sky where Tycho's Star or Supernova **Sn 1572** appeared slightly to the west of Kappa Cassiopeiae, changing the appearance of the sky for six months and cementing Copernicus' 1543 rebuttal of Ptolemaic theory.

NASA'S Phoenix Mission Faces Survival Challenges

In a race against time and the elements, engineers with NASA's Phoenix Mars Lander mission hope to extend the lander's survival by gradually shutting down some of its instruments and heaters.

Provided by JPL, Pasadena, California

Originally scheduled to last 90 days, Phoenix has completed a fifth month of exploration in the Martian arctic. As expected, with the Martian northern hemisphere shifting from summer to fall, the lander is generating less power due to shorter days and fewer hours of sunlight reaching its solar panels. At the same time, the spacecraft requires more power to run several survival heaters that allow it to operate even as temperatures decline.

"If we did nothing, it wouldn't be long before the power needed to operate the spacecraft would exceed the amount of power it generates on a daily basis," said Phoenix Project Manager Barry Goldstein of NASA's Jet Propulsion Laboratory (JPL), Pasadena, California. "By turning off some heaters and instruments, we can extend the life of the lander by several weeks and still conduct some science."

Over the next several weeks, four survival heaters will be shut down, one at a time, in an effort to conserve power. The heaters keep the electronics within tested survivable limits. As each heater is disabled, some of the instruments are expected to cease operations as well. The energy saved will power the lander's main camera and meteorological instruments until the end of the mission.

On October 28, engineers sent commands to disable the first heater. That heater warms Phoenix's robotic arm, robotic-arm camera, and thermal and evolved-gas analyzer (TEGA), an instrument that bakes and sniffs Martian soil to assess volatile ingredients. Shutting down this heater is expected to save 250 watt-hours of power per martian day.

The Phoenix team has parked the robotic arm on a representative patch of martian soil. No additional soil samples will be gathered. The thermal and electrical-conductivity probe (TECP), located on the arm's wrist, has been inserted into the soil, and it will continue to measure soil temperature and conductivity, along with atmospheric humidity near the surface. The probe does not need a heater to operate and should continue to send back data for weeks.

Throughout the mission, the lander's robotic arm dug and scraped martian soil and delivered it to the onboard laboratories. "We turn off this workhorse with the knowledge that it has far exceeded expectations and conducted every operation asked of it," said Ray Arvidson, the robotic arm's co-investigator and professor at Washington University, St. Louis.

When power levels necessitate further action, Phoenix engineers will disable a second heater that serves the lander's pyrotechnic initiation unit. The unit hasn't been used since landing, and disabling its heater is expected to add 4 to 5 days to the mission's lifetime. Following that step, engineers would disable a third heater that warms Phoenix's main camera — the Surface Stereo Imager — and the meteorological suite of instruments. Electronics that operate the meteorological instruments should generate enough heat to keep most of those instruments and the camera functioning.

In the final step, Phoenix engineers may turn off a fourth heater — one of two survival heaters that warm the spacecraft and its batteries. This would leave one remaining survival heater to run on its own.

"At that point, Phoenix will be at the mercy of Mars," said Chris Lewicki, lead mission manger.

Engineers are also preparing for solar conjunction, when the sun is directly between Earth and Mars. Between November 28 and December 13, Mars and the Sun will be within 2° of each other as seen from Earth. This positioning will block radio transmission between the spacecraft and Earth. During that time, no commands will be sent to Phoenix, but daily downlinks from Phoenix will continue through NASA's Odyssey and Mars Reconnaissance orbiters. Controllers can't predict whether the fourth heater would be disabled before or after conjunction.

Articles : Please send contributions for the newsletter to Bob Mullen,

18 Chandlers Ridge, Nunthorpe, Middlesbrough, TS7 0JL, 01642 324939 (b2mullen@hotmail.com) Copy deadline date is the 20th of each month.).

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