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Word from the Editor

NASA Makes Progress on Shuttle Tank

(NASA) Engineers are moving closer to resolving the problem of large foam insulation falling off space shuttle external fuel tanks during launch. A “tiger team” is making recommendations addressing the factors that may have contributed to foam loss when the space shuttle Discovery (STS-114) was launched in July.

The next shuttle mission is also on Discovery. It will be the second test flight in the Return to Flight sequence. At a recent news conference at NASA’s Johnson Space Center, Houston, space shuttle managers emphasized they have not set a specific launch date. NASA is using the May 3 to 23, 2006, launch window as a target for work to prepare Discovery for the mission.

Shuttle workers will likely replace and modify areas of insulation on the external tank where foam came loose during the July launch. Space Shuttle Program Manager Wayne Hale said a series of tests over the next several weeks would help further clarify the tank issues. “I think we’re beginning to have our hands well around the technical problems we have and we are defining the fixes necessary to fly again,” he said.

Factors contributing to the decision to target the May launch window include outstanding tank work and the effect on the NASA workforce by Hurricane Katrina. NASA’s Michoud Assembly Facility near New Orleans and the Stennis Space Center in Mississippi were in the storm’s path. Much of their workforce has been displaced by the storm.

Since external tanks are manufactured at Michoud, work there is crucial. Approximately 25 percent of the workforce is back on the job. If improvements to transportation and infrastructure go as planned, the full staff should be back at work by early December.

“Workers at Michoud have just done a phenomenal job,” said Associate Administrator for Space Operations Bill Gerstenmaier. “They’ve shown tremendous dedication and a tremendous desire to show up to work to help us out.”

Rick Gilbrech is head of the NASA tiger team. He said the team had identified several possible factors contributing to the foam loss. The team recently completed an interim report to NASA management. The report identifies several technical recommendations and “lessons learned,” including advising NASA to implement additional engineering rigor to further reduce schedule pressure in decision-making.

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Cassini Views Dione, a Frigid Ice World

(NASA/JPL) Sitting in the tranquility of space is the pale moon Dione, looking as if it’s posing for a painter (cover and right). The moon is set against the stunning backdrop of Saturn, adorned in gold and draped with hues of blue.

Breathtaking views and a movie of the icy world are now available at http://saturn.jpl.nasa.gov and http://www.nasa.gov/cassini.

During the Cassini spacecraft’s only close flyby of the grayish moon, on Oct. 11, 2005, the spacecraft came within 500 kilometers (310 miles) of the surface. Like most of its counterparts in the Saturnian system, Dione shows a heavily cratered surface. It has a signature style all its own that includes streaky terrains dominating one whole side of the moon. The fine latitudinal streaks appear to crosscut everything and appear to be the youngest feature type in this region of Dione. These striking cracks and fractures are caused by tectonic activity.

“Dione seems to be an older sibling of Enceladus,” said Dr. Bonnie Buratti, scientist on the Cassini visual and infrared mapping spectrometer team at NASA’s Jet Propulsion Laboratory, Pasadena, Calif. “We think that the cracked features of Dione may be the older version of the tiger stripes on Enceladus. Enceladus is the up-and-coming moon, complete with a recently active history, while Dione is the older, more mature moon.”

The Cassini infrared spectrometer team is working on compositional maps of the moon’s surface.

As it departed its encounter with Saturn’s moon Dione, Cassini sailed above an unreal landscape blasted by impacts (opposite). The rising Sun throws craters into sharp contrast and reveals steep crater walls. Multiple generations of fractures are visible on Dione. Numerous fine, roughly parallel grooves run across the terrain and are interrupted by the larger, irregular, bright fractures. In several places, fractures postdate some deposits in the bottoms of craters.

The Cassini ultraviolet imaging spectrograph team reports the detection of water ice on the surface of Dione and also finds striking brightness variations across the surface. This could be the result of cracks and fractures in the ice. “The ice in the fractures appears to be different than in the surrounding terrain. This may be due to the grain size variations,” said Dr. Amanda Hendrix, Cassini scientist at JPL.

As on other Saturnian moons, rockslides on Dione may reveal cleaner ice, while the darker materials accumulate in areas of lower topography, such as crater floors and the bases of scarps.

Scientists on the Cassini fields and particles instruments note that early results do not support the presence of an atmosphere.
Dione orbits Saturn within the broad, tenuous E-ring. Hence, scientists will be looking to see if Dione, like Enceladus, is a source of material in the E-ring. They also seek to learn whether the E-ring is affecting Dione’s surface. Over the coming months, scientists will begin to piece together a more detailed story of Dione.

Following the rendezvous with Dione, Cassini captured its best views ever of the tiny moon Telesto (below). “Telesto was too small in Voyager images to see detail on the surface. Cassini has given us the best views of the potato-shaped chunk of ice,” said Dr. Candice Hansen, Cassini scientist at JPL. Early results indicate the entire moon, roughly 24 kilometers across (15 miles), is ice.

**A Mission to Study the History of Water on Mars**

(NASA/JPL) NASA’s Mars Reconnaissance Orbiter, launched on August 12, 2005, is on a search for evidence that water persisted on the surface of Mars for a long period of time. While other Mars missions have shown that water flowed across the surface in Mars’ history, it remains a mystery whether water was ever around long enough to provide a habitat for life.

After a seven-month cruise to Mars and six months of aerobraking to reach its science orbit, Mars Reconnaissance Orbiter will seek to find out about the history of water on Mars with its science instruments. They will zoom
in for extreme close-up photography of the martian surface, analyze minerals, look for subsurface water, trace how much dust and water are distributed in the atmosphere, and monitor daily global weather.

These studies will help determine if there are deposits of minerals that form in water over long periods of time, detect any shorelines of ancient seas and lakes, and analyze deposits placed in layers over time by flowing water. It will also be able to tell if the underground martian ice discovered by the Mars Odyssey orbiter is the top layer of a deep ice deposit or whether it is a shallow layer in equilibrium with the current atmosphere and its seasonal cycle of water vapor.

In its survey of the red planet, Mars Reconnaissance will increase tenfold the number of spots surveyed close-up. One of the Mars Reconnaissance Orbiter’s cameras is the largest ever flown on a planetary mission. While previous cameras on other Mars orbiters could identify objects no smaller than a school bus, this camera will be able to spot something as small as a dinner table. That capability will also allow the orbiter to identify obstacles like large rocks that could jeopardize the safety of future landers and rovers. Its imaging spectrometer will also be able to look at small-scale areas about five times smaller than a football field, at a scale perfect for identifying any hot springs or other small water features.

The orbiter’s telecommunications systems will also establish a crucial service for future spacecraft, becoming the first link in a communications bridge back to Earth, an “interplanetary Internet” that can be used by numerous international spacecraft in coming years. Testing the use of a radio frequency called Ka-band, Mars Reconnaissance Orbiter may demonstrate the potential for greater performance in communications using significantly less power.

The orbiter also carries an experimental navigation camera. If it performs well, similar cameras placed on orbiters of the future would be able to serve as high-precision interplanetary “eyes” to guide incoming landers to precise landings on Mars, opening up exciting, but otherwise dangerous, areas of the planet to exploration.

The orbiter’s primary mission ends about five-and-a-half years after launch, on December 31, 2010.

Hubble Looks For Possible Moon Resources

(NASA/STScI) NASA is using the unique capabilities of the Hubble Space Telescope for a new class of scientific observations of the Earth’s moon.

Hubble’s resolution and sensitivity to ultraviolet light have allowed the telescope to search for important oxygen-bearing minerals on the moon. Since the moon does not have a breathable atmosphere, minerals, such as ilmenite (titanium and iron oxide), may be critical for a sustained human lunar presence. Ilmenite is a potential source of oxygen for breathing or to power rockets.

The new Hubble observations are the first high-resolution, ultraviolet images ever acquired of the moon. The images provide scientists with a new tool to study mineral
adjacent Schrotter’s Valley. *Hubble* also photographed the Apollo 15 and Apollo 17 landing sites, where astronauts collected rock and soil samples in 1971 and 1972.

Scientists are comparing the properties of the rock and soil samples from the *Apollo* sites with the new *Hubble* images, and the Aristarchus region, which neither humans nor robotic spacecraft have visited. The *Hubble* observations of Aristarchus crater and Schrotter’s Valley will help refine researchers’ understanding of the diverse, scientifically interesting materials in the region and to unravel their full resource potential.

“Our initial findings support the potential existence of some unique varieties of oxygen-rich glassy soils in both the Aristarchus and *Apollo* 17 regions. They could be well-suited for visits by robots and human explorers in efforts to learn how to live off the land on the moon,” said Jim Garvin, chief scientist at NASA’s Goddard Space Flight Center, Greenbelt, Md. Garvin is principal investigator for the project.

“While it will require many months before fully quantitative results can be developed, we
Garvin said.

Hubble’s lunar observation analysis team included colleagues from Goddard and Cornell University, Ithaca, N.Y.; Brown University, Providence, R.I.; Northwestern University, Evanston, Ill.; the University of Pittsburgh.; and the University of Hawaii, Manoa.

The Hubble Space Telescope is a project of international cooperation between NASA and the European Space Agency. The Space Telescope Science Institute in Baltimore conducts Hubble science operations. It is operated for NASA by the Association of Universities for Research in Astronomy, Inc., Washington, under contract with Goddard. 

"Big Baby" Galaxies in the Newborn Universe

(NASA/STScI) Two of NASA’s Great Observatories, the Spitzer and Hubble Space Telescopes, have teamed up to “weigh” the stars in several very distant galaxies. One of these galaxies, among the most distant ever seen, appears to be unusually massive and mature for its place in the young universe. This comes as a surprise to astronomers because the earliest galaxies in the universe are commonly thought to have been much smaller agglomerations of stars that gradually merged together to build large majestic galaxies like our Milky Way.

“This galaxy appears to have ‘bulked up’ amazingly quickly, within the first few hundred million years after the Big Bang,” says Bahram Mobasher of the Space Telescope Science Institute and the European Space Agency, a member of the team which discovered the galaxy. “It made about eight times more mass in stars than are found in our own Milky Way today, and then, just as suddenly, it stopped forming new stars. It appears to have grown old prematurely.”

The Astronomical Society of Nevada

The ASN normally meets on the 2nd Tuesday of each month at 6:30 pm at the Fleischmann Planetarium. Call 775-324-4814 for information.

http://www.astronomynv.org/

The ASN has a Las Vegas Chapter. For information see:

http://www.astronomynv.org/vegas/
The galaxy was pinpointed among approximately 10,000 others in a small patch of sky called the Hubble Ultra Deep Field. Thanks to the Hubble Space Telescope, this area is captured in the deepest images of the universe ever made by humankind at optical and near-infrared wavelengths. It is also within the deepest survey from the Spitzer Space Telescope, the Great Observatories Origins Deep Survey (GOODS). The galaxy is believed to be about as far away as the most distant galaxies and quasars now known. The light reaching us today began its journey when the universe was only about 800 million years old.

Scientists studying the Ultra Deep Field found this galaxy in Hubble’s infrared images and expected it to be a very young “baby” galaxy, like others known at similar distances. Instead, they found a “teenager,” much bigger than other galaxies known from this young cosmic era, and already quite mature.”

Hubble’s Advanced Camera for Surveys (ACS) does not see the galaxy at all, despite the fact that the Ultra Deep Field is the deepest image ever taken in optical light. This indicates that the galaxy’s blue light has been absorbed by traveling billions of light-years through intervening hydrogen gas (imagine trying to see the bottom of a silt-laden pond).
Spitzer’s IRAC is sensitive to the light from older, redder stars which should make up most of the mass in a galaxy, and the brightness of the galaxy suggests that it is quite massive indeed. “This would be quite a big galaxy even today,” says Mark Dickinson of the National Optical Astronomy Observatory (NOAO). “At a time when the universe was only 800 million years old, it’s positively gigantic.”

The object is also well detected with Spitzer’s Multiband Imaging Photometer (MIPS) which covers wavelengths fifteen times longer than those of the Hubble, making it sensitive to energetic processes in galaxies. This observation is consistent with the object hosting a supermassive black hole at its center, if indeed it is this massive and was formed at this early stage in the history of the universe.

The GOODS Spitzer observations have previously revealed evidence for mature stars in more ordinary, less massive galaxies at similar distances. Lawrence Eyles from the University of Exeter and collaborators, and Haojing Yan of the Spitzer Science Center, working with other members of the GOODS team, have published joint Spitzer and Hubble analyses that identify other galaxies nearly as massive as the Milky Way, seen when the universe was less than one billion years old. The new observations by Mobasher and his colleagues dramatically extend this notion of surprisingly mature “baby galaxies” to an object which is perhaps ten times more massive, and which seemed to form its stars even earlier in the history of the universe.

Mobasher and his collaborators estimated the distance to this galaxy by combining the information provided by the Hubble, Spitzer, and VLT observations. Together, these observatories cover a wide swath of the electromagnetic spectrum, from visible to mid-infrared wavelengths (0.4 to 24 microns). The relative brightness of the galaxy at different wavelengths is influenced by the expanding universe, and allows astronomers to estimate its distance. At the same time, they can also get an idea of the make-up of the galaxy in terms of the mass and age of its stars. The team has tried to confirm the distance estimate with spectroscopic measurements from the largest ground-based telescopes, the VLT, Keck, and Gemini observatories, but the object has proven to be too faint for such observations. However, thanks to the many wavelengths at which the galaxy has been observed, the color signature appears to be unique, and the estimates of the distance and mass seem robust. “While we cannot completely discard other scenarios, this appears to be the most plausible interpretation, given the available data,” says Henry C. Ferguson, a member of the team.

Astronomers generally believe most galaxies were built up piecewise by mergers of smaller galaxies. However, the discovery of this object suggests that at least a few galaxies formed quickly and in their entirety, long ago, as some older theories of “monolithic” galaxy formation have suggested. For such a large galaxy, this would have been a tremendously explosive event, and the energy from the quick emergence of those stars would have helped reheat the universe very shortly after it cooled following the Big Bang. This early epoch (the first 5 percent of the universe’s age) is fertile ground awaiting the James Webb Space Telescope (JWST), which will have the infrared sensitivity to possibly look all the way back to the very first stars that ignited after the Big Bang.

Planned for launch in 2013, the JWST will have the light collecting power not only to see more distant objects, but to measure their spectral fingerprints as well, yielding even more reliable distances and chemical composition information.

The Mobasher findings will be published in the December 20, 2005 issue of the Astrophysical Journal. Additional findings with Spitzer by Yan was published in the November 2005 issue of the journal. ❖
Black Hole in Search of a Home

(NASA/STScI/ESA) The detection of a super massive black hole without a massive host galaxy is the surprising result from a large Hubble and VLT study of quasars. This is the first convincing discovery of such an object. One intriguing explanation is that the host galaxy may be made almost exclusively of dark matter.

A team of European astronomers has used two of the most powerful astronomical facilities available, the NASA/ESA Hubble Space Telescope and the ESO Very Large Telescope (VLT) at Cerro Paranal, to confidently claim the discovery of a bright quasar without a massive host galaxy. Quasars are powerful and typically very distant source of prodigious amounts of radiation. They are commonly associated with galaxies containing an active central black hole.

The team conducted a detailed study of 20 relatively nearby quasars. For 19 of them, they found, as expected, that these super massive black holes are surrounded by a host galaxy. But when they studied the bright quasar HE0450-2958, located some 5 billion light-years away, they could not find evidence for a host galaxy. This, the astronomers suggest, may indicate a rare case of a collision between a seemingly normal spiral galaxy and an exotic object harbouring a very massive black hole.

With masses up to hundreds of millions that of the Sun, super massive black holes are commonly found in the centers of the most massive galaxies, including our own Milky Way. These black holes sometimes dramatically manifest themselves by devouring matter that they gravitationally swallow from their surroundings. The best fed of these shine as quasars (the name quasar is a contraction of quasi-stellar object, as they had initially been confused with stars).

The past decade of observations, largely with the Hubble telescope, has shown that quasars

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Shows available for all grade levels are offered Monday thru Friday at both the Fleischmann Planetarium and the CCSN Planetarium. For information, call 702-651-4505 in Las Vegas or 775-784-4812 in Reno.
are normally associated with massive host galaxies. However, observing the host galaxy of a quasar is challenging work because the quasar completely outshines the host and masks the galaxy’s underlying structure.

To overcome this problem, the astronomers devised a new and highly efficient strategy. Combining Hubble’s ultra sharp images and spectroscopy from ESO’s VLT they observed their sample of 20 quasars at the same time as a reference star. The star served as a reference pinpoint light source that was used to disentangle the quasar light from any possible light from an underlying galaxy.

Despite the innovative techniques used, no host galaxy was seen around HE0450-2958. This shows that if any host galaxy exists, it must either be at least six times fainter than typical host galaxies, or have a radius smaller than about 300 light-years, i.e. 20 to 170 times smaller than typical quasar host galaxies (which normally have radii ranging from about 6,000 to 50,000 light-years).

“The with the powerful combination of Hubble and the VLT we are confident that we would have been able to detect a normal host galaxy”, says Pierre Magain (Université de Liège, Belgium), member of the team of astronomers who conducted the study. “We must therefore conclude that, contrary to our expectations, this bright quasar is not surrounded by a massive galaxy”.

The astronomers did however detect an interesting smaller cloud of gas about 2,500 light-years wide, which they call “the blob”, just next to the quasar. VLT observations show this cloud to be glowing because it is bathed in the intense radiation coming from the quasar, and not from stars inside the cloud. Most likely, it is the gas from this cloud that feeds the super massive black hole, thereby allowing it to become a quasar.

In the Hubble image, a strongly disturbed galaxy, showing all the signs of a recent collision, is seen near the quasar. The VLT observations show it to be forming stars at a frantic rate. “The absence of a massive host galaxy, combined with the existence of the blob and the star-forming galaxy, lead us to believe that we have uncovered a really exotic quasar”, says team member Frédéric Courbin (Ecole Polytechnique Federale de Lausanne, Switzerland). “There is little doubt that an increase in the formation of stars in the companion galaxy and the quasar itself have been ignited by a collision that must have taken place about 100 million years ago. What happened to the putative quasar host remains unknown.”

HE0450-2958 constitutes a challenging case. The astronomers propose several possible explanations. Has the host galaxy been completely disrupted as a result of the collision? It is hard to imagine how that could happen. Has an isolated black hole captured gas while crossing the disk of a spiral galaxy? This would require very special conditions and would probably not have caused such a tremendous disturbance of the neighboring galaxy as is observed. Further studies will hopefully clarify the situation.

Another intriguing hypothesis is that the galaxy harbouring the black hole was almost exclusively made of dark matter. It may be that what is observed is a normal phase in the formation of a massive galaxy, which in this case has taken place several billion years later than in most others.

The paper on HE0450-2958 is published in the September 15, 2005 issue of the journal Nature.
Give a Star

A popular service of The CCSN Planetarium lets you dedicate a star to a loved one. For a donation of $35, we will provide an attractive certificate that proclaims your dedication of the star of your choice to any other person. The certificate will have a chart of the constellation containing the star and complete information about the star. Accompanying the certificate will be The Sky Challenger, which contains a series of adjustable charts of the sky as seen from North America to help you find your star. A donation of $100 will give you an exclusive dedication. Call 651-4138 or 651-4505 for further information.
Sky Calendar

All times are Pacific Standard Time. Rise and set times are for the astronomical horizon at Las Vegas or Reno as noted.

The Planets

Mercury. Mercury is low in the east before sunrise for most of the month. Greatest Western Elongation (21°) occurs on December 12. Inferior conjunction on the near side of the sun occurred on November 24.

Venus. Venus is visible in the evening sky setting about three hours after the sun. It is brighter than every other object in the sky other than the sun and moon. It will remain in the evening sky for the rest of the year. Greatest Eastern Elongation occurred on November 3 (47°).

Mars. Mars is moving westward through Aries. Mars was at Opposition (directly opposite the sun) on November 7 after its closest approach to the earth on October 29. The waxing gibbous moon will be just above Mars on the evening of December 11.

Jupiter. Jupiter, in Libra, is low in the southeast before sunrise. At mid-month it is rising over 3 hours before the sun. On the morning of December 26, the waning crescent moon will rise about a half hour before Jupiter.

Saturn. Saturn, in Cancer, is rising in the early evening. It will be directly opposite the sun and rising at sunset in mid-January.

Uranus. Uranus, in Aquarius, is setting in the west in the late evening at mid-month. Uranus is visible only through a telescope exhibiting an angular size of 3.6 arc seconds*.

Neptune. Neptune, in Capricornus, is setting over an hour before Uranus at mid-month. Neptune is visible only through a telescope exhibiting an angular size of 2.2 arc seconds*.

Pluto. Pluto is in the constellation of Serpens Cauda. It is too close in direction to the sun to be seen at this time. Pluto will pass the far side of the sun on December 15. A telescope of at least 12” diameter from a dark sky environment is usually required to see this faint planet. It appears star-like in all but the very largest telescopes. 

* Note: The arc second is a small angle corresponding to 1/3600 of a degree. A feature on the moon that is only one mile across has an angular size

The Moon

Each day the moon rises about one hour later than the day before. The New Moon (not visible) is in the direction of the sun and rises and sets with the sun. The first quarter moon rises at about noon and sets near midnight. The full moon is opposite the sun in the sky and rises at sunset and sets at sunrise. The last quarter moon rises near midnight and sets near noon. Perigee is when the moon is closest to the earth and apogee is when it is farthest. The distance varies by ±6% from the average.

- New Moon Dec. 1 7:01 am pst
- First quarter Dec. 8 1:36 am
- Full Moon Dec. 15 8:15 am
- Last quarter Dec. 23 11:36 am
- New Moon Dec. 30 7:12 pm
- Apogee Nov. 22 10:19 pm
- Perigee Dec. 4 8:33 pm
- Apogee Dec. 20 6:50 pm
Winter Solstice

Winter officially begins with the Winter Solstice which will occur at 10:35 am PST on December 21.

The winter solstice is that moment when the apparent position of the sun, as the earth revolves around the sun, is at its southern most position. This occurs when the north pole of the earth is tipped away from the sun. This is the day with the least amount of daylight and the greatest amount of night. In Las Vegas, this is 9 hours of daylight and 14 hours of darkness. The noon time sun is at its lowest elevation for the year (about 30° for Las Vegas and 27° for Reno).

On this date, the energy gained by the ground in the daytime is a minimum and the energy lost by the ground at night is a maximum. This causes the average temperatures to fall at their greatest rate. The lowest temperatures normally occur about six weeks later when the energy gained and energy lost balances between day and night. This is why the coldest part of the year normally occurs in February.

Meteor Shower

The Geminid meteor shower is expected to reach its peak near midnight on the night of December 13/14. The meteors from this shower are caused by debris from an unnamed, comet. The asteroid 3200 Phæthon is traveling on virtually the same path as the particles from the stream and is thought to be the dead nucleus of the comet.

This shower is usually one of the best showers of the year producing nearly 100 meteors per hour at its peak. The nearly full moon will cause considerable interference with the shower this year.

Meteors are best seen after midnight where the sky is clear and dark. This means the observer must get away from city lights. For the typical metropolitan area, you need to get at least 30 miles away from the city.

Meteors from a shower can be seen anywhere in the sky. Because the particles causing the meteors are traveling on parallel paths, you can trace back the path of each meteor to a common place in the sky. This place is called the radiant for the shower. The radiant for the Geminids is near the star Castor in the constellation of Gemini.

The next major meteor shower will be in the first week of January. The Quadrantids are usually a very good shower. The moon will be near new phase and will not interfere with this shower. The Quadrantid meteor shower usually produces 50 to 100 meteors per hour.
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