Space News Update
— August 12, 2014 —

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1. New Commercial Eye in the Sky Launching Wednesday

The world's most capable commercial Earth-imaging satellite will be launched into space Wednesday atop an Atlas rocket from Vandenberg Air Force Base in California.

Liftoff is scheduled for 11:30 a.m. local time (2:30 p.m. EDT; 1830 GMT) at the opening of a 15-minute launch window from pad 3-East on South Base.

"It's kind of like your kid going off to kindergarten and college for the first day at the same time," said Jeff Dierks, the program manager at satellite builder Ball Aerospace. "It's been something we've been working on for four years and it's coming to an end, but once they're launched we get to follow what they do for years and years. It's pretty cool."

Designed to see objects as small as 1-foot-wide (31 cm) from 383 miles (617 km) in space, the WorldView 3 spacecraft will be the latest in a series of commercial eyes in the sky operated by DigitalGlobe of Longmont, Colorado.

The market for imagery varies from the U.S. government to agriculture, oil and gas, scientific researchers and land developers.
"As they are getting the licenses to get (better and better) resolution, that's really getting into the realm of aerial imagery from airplanes," Dierks said.

But with the new resolution of WorldView 3 and the amount of imagery it can collect a day far outweighs imagery from planes.

"They view it as a large market to move in to."

The DigitalGlobe constellation:

- Ikonos: 82 cm resolution
- QuickBird: 61 cm
- WorldView 1: 50 cm
- WorldView 2: 46 cm
- GeoEye 1: 41 cm

WorldView 3's capacity is 263,000 square miles (680,000 km²) per day.

Built by Ball Aerospace & Technologies Corp., the 6,200-pound satellite stands 18.7 feet tall and 23 feet across with its power-generating solar panels deployed. WorldView 3 carries an Exelis-built 1.1 meter aperture telescope. The craft has a design life of 7 years and expected service life of 10-12 years.

"(Google Earth) is probably the use most people are familiar with. If you've looked up your house on Google Earth, the image taken from space on there was probably taken with one of the WorldView spacecraft," Dierks said.

"Every time I see DigitalGlobe (logo) on the news, it makes me feel proud," said Dierks, who also led earlier spacecraft developments for the company.

The satellite's sensors are part of the first multi-payload, super-spectral, high-resolution spacecraft in the commercial field. It can image in black and white and color, plus short-wave infrared to see through smoke and haze for disaster response and has an atmospheric sounder for enhanced color calibration.

"Having that calibration helps them better, for example, ascertain crop health," Dierks said. "Is it really taking an image of the true color on the ground? Is that Ferrari we just took a picture of a true Ferrari Red or some other red?"

WorldView 3 collects 31 cm panchromatic resolution, 1.24 m multispectral, 3.7 m short-wave infrared (SWIR) and 30 m Cloud, Aerosol, Water Vapor, Ice, Snow (CAVIS).

Riding atop a 189-foot-tall Atlas 5 rocket, United Launch Alliance will deliver WorldView 3 into orbit under an arrangement with Lockheed Martin Commercial Launch Services. It is the 10th commercial Atlas 5 launch.

A single firing of the Centaur upper stage will be needed to heave the payload into its sun-synchronous polar orbit. Deployment occurs 19 minutes after liftoff.

The launch is the 630th for an Atlas vehicle, the 196th Atlas-Centaur, the 48th Atlas 5 rocket and the 24th to fly in the 401 configuration with a four-meter fairing, no solids and a single-engine Centaur. For United Launch Alliance, it is the company's 87th launch overall since 2006 and the 10th just this year.

Source: Spaceflight Now
2. Gaia: ‘Go’ for Science

Following extensive in-orbit commissioning and several unexpected challenges, ESA’s billion-star surveyor, Gaia, is now ready to begin its science mission.

The satellite was launched on 19 December 2013, and is orbiting a virtual location in space 1.5 million kilometres from Earth.

Gaia’s goal is to create the most accurate map yet of the Milky Way. It will make extremely accurate measurements of the positions and motions of about 1% of the total population of roughly 100 billion stars in our home Galaxy to help answer questions about its origin and evolution.

Repeatedly scanning the sky, Gaia will observe each of its billion stars an average of 70 times each over five years. Small apparent motions in the positions of the stars will allow astronomers to determine their distances and movements through the Milky Way.

In addition, Gaia will also measure key physical properties of each star, including its brightness, temperature and chemical composition.

Gaia spins slowly once every six hours, sweeping its two telescopes across the sky and focusing the light from their separate fields simultaneously onto a single focal plane – the largest digital camera ever flown in space, with nearly a billion pixels. As the stars drift across the camera, the relative positions of all detected stars are measured and downlinked to Earth. Over time, a complete network of positions of stars covering the whole sky is built up, before being analysed to yield a highly accurate 3D map.

The accuracy required is astonishing: Gaia must be able to measure positions to a level equivalent to the width of a human hair seen at 2000 km. In turn, these measurements demand a very rigorous calibration of the satellite and its instruments, a painstaking procedure that has taken the first part of the year to complete.

Gaia is now ready to begin its five-year science phase, but the commissioning also uncovered some unexpected anomalies.

One problem detected early in the commissioning was associated with water freezing on some parts of the optics, causing a temporary reduction in transmission of the telescopes.

This water was likely trapped in the spacecraft before launch and emerged once it was in a vacuum. Heating the affected optics to remove the ice has now largely solved this problem, but it is likely that one or two more ‘decontamination’ cycles will be required during the mission to keep it in check.

Another problem is associated with ‘stray light’ reaching Gaia’s focal plane at a level higher than predicted before launch. This appears to be a mixture of light from the Sun finding its way past Gaia’s 10 m-diameter sunshield and light from other astronomical objects, both making their way to the focal plane as a diffuse background.
The effect on Gaia’s performance is negligible for brighter objects at magnitude 15 and above, and a slight degradation in the positional accuracy is seen for fainter stars, reaching 50% for stars at Gaia’s nominal faint limit of magnitude 20.

There is also some effect on the accuracy to which stellar brightnesses will be measured. The impact of the stray light should, in principle, be more significant for faint stars seen by Gaia’s Radial Velocity Spectrometer (RVS).

“However, we are optimising the on-board software to mitigate as much as possible the impact caused by these higher background levels of light, and we are confident that we will not be far off our initial and somewhat conservative estimate of studying 150 million stars with RVS, as planned,” says Giuseppe Sarri, ESA’s Gaia Project Manager.

“We will still be able to analyse one billion – if not more – stars with the astrometry and photometry instruments, measuring each star’s position and motion up to 100 times more accurately than Gaia’s predecessor Hipparcos and for a far larger number of stars.”

Further tests made during commissioning have shown that it may be possible to extend Gaia’s reach to stars even fainter than magnitude 20, while at the other end, software changes enable Gaia to measure almost all of the brightest stars in the sky, previously ruled out as being too bright for such a sensitive system. Both of these extensions will need further analysis before being implemented.

Finally, Gaia also contains a laser device called the ‘basic angle monitor’, designed to measure the angle of separation between Gaia’s two telescopes to an extremely high level of accuracy. This is necessary in order to correct for expected periodic variations in the separation angle caused by thermal changes in the payload as Gaia spins.

Although this system is working, the detected variations in the basic angle are larger than expected. Further efforts are being made to measure and accurately calibrate the variations, with the aim of largely eliminating them during the overall data analysis.

The commissioning has not only focused on the spacecraft performance, but also on the flow of data on the ground, testing procedures that will be used to process and analyse the vast amount of data that will be transmitted to Earth on a daily basis for the next five years.

Thus, after extensive testing and analysis of systems both in space and on the ground, Gaia is now in a position to begin routine operations. “The commissioning phase has been challenging, and although some activities are ongoing, all in all Gaia is in good shape to fulfil its promise – all of the core scientific goals are still achievable, as hoped,” says Timo Prusti, ESA’s Project Scientist for Gaia. “Given the somewhat longer-than-expected commissioning and taking into account the time needed to develop some new software, we anticipate that the first intermediate catalogue of science data will be released to scientists and the public in summer 2016.”

Source: ESA

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NASA Carbon Counter Reaches Final Orbit, Returns Data

Just over a month after launch, the Orbiting Carbon Observatory-2 (OCO-2) -- NASA’s first spacecraft dedicated to studying atmospheric carbon dioxide -- has maneuvered into its final operating orbit and produced its first science data, confirming the health of its science instrument.

Atmospheric carbon dioxide is the leading human-produced greenhouse gas responsible for warming our world. It is a critical natural component of Earth’s carbon cycle. OCO-2 will produce the most detailed picture to date of sources of carbon dioxide, as well as their natural “sinks” -- places on Earth’s surface where carbon dioxide is removed from the atmosphere. The observatory will study how these sources and sinks are distributed around the globe and how they change over time.

Source: NASA
3. NASA’s Mars Spacecraft Maneuver to Prepare for Close Comet Flyby

This graphic depicts the orbit of comet C/2013 A1 Siding Spring as it swings around the sun in 2014. On Oct. 19, the comet will have a very close pass at Mars. Its nucleus will miss Mars by about 82,000 miles (132,000 kilometers). Image Credit: NASA/JPL-Caltech

NASA is taking steps to protect its Mars orbiters, while preserving opportunities to gather valuable scientific data, as Comet C/2013 A1 Siding Spring heads toward a close flyby of Mars on Oct. 19.

The comet’s nucleus will miss Mars by about 82,000 miles (132,000 kilometers), shedding material hurtling at about 35 miles (56 kilometers) per second, relative to Mars and Mars-orbiting spacecraft. At that velocity, even the smallest particle -- estimated to be about one-fiftieth of an inch (half a millimeter) across -- could cause significant damage to a spacecraft.

NASA currently operates two Mars orbiters, with a third on its way and expected to arrive in Martian orbit just a month before the comet flyby. Teams operating the orbiters plan to have all spacecraft positioned on the opposite side of the Red Planet when the comet is most likely to pass by.
"Three expert teams have modeled this comet for NASA and provided forecasts for its flyby of Mars," explained Rich Zurek, chief scientist for the Mars Exploration Program at NASA's Jet Propulsion Laboratory (JPL) in Pasadena, California. "The hazard is not an impact of the comet nucleus, but the trail of debris coming from it. Using constraints provided by Earth-based observations, the modeling results indicate that the hazard is not as great as first anticipated. Mars will be right at the edge of the debris cloud, so it might encounter some of the particles -- or it might not."

During the day's events, the smallest distance between Siding Spring's nucleus and Mars will be less than one-tenth the distance of any known previous Earthly comet flyby. The period of greatest risk to orbiting spacecraft will start about 90 minutes later and last about 20 minutes, when Mars will come closest to the center of the widening dust trail from the nucleus.

NASA's Mars Reconnaissance Orbiter (MRO) made one orbit-adjustment maneuver on July 2 as part of the process of repositioning the spacecraft for the Oct. 19 event. An additional maneuver is planned for Aug. 27. The team operating NASA's Mars Odyssey orbiter is planning a similar maneuver on Aug. 5 to put that spacecraft on track to be in the right place at the right time, as well.

NASA's Mars Atmosphere and Volatile Evolution (MAVEN) spacecraft is on its way to the Red Planet and will enter orbit on Sept. 21. The MAVEN team is planning to conduct a precautionary maneuver on Oct. 9, prior to the start of the mission's main science phase in early November.

In the days before and after the comet's flyby, NASA will study the comet by taking advantage of how close it comes to Mars. Researchers plan to use several instruments on the Mars orbiters to study the nucleus, the coma surrounding the nucleus, and the tail of Siding Spring, as well as the possible effects on the Martian atmosphere. This particular comet has never before entered the inner solar system, so it will provide a fresh source of clues to our solar system's earliest days.

MAVEN will study gases coming off the comet's nucleus into its coma as it is warmed by the sun. MAVEN also will look for effects the comet flyby may have on the planet's upper atmosphere and observe the comet as it travels through the solar wind.

Odyssey will study thermal and spectral properties of the comet's coma and tail. MRO will monitor Mars' atmosphere for possible temperature increases and cloud formation, as well as changes in electron density at high altitudes. The MRO team also plans to study gases in the comet's coma. Along with other MRO observations, the team anticipates this event will yield detailed views of the comet's nucleus and potentially reveal its rotation rate and surface features.

Mars' atmosphere, though much thinner than Earth's, is thick enough that NASA does not anticipate any hazard to the Opportunity and Curiosity rovers on the planet's surface, even if dust particles from the comet hit the atmosphere and form into meteors. Rover cameras may be used to observe the comet before the flyby, and to monitor the atmosphere for meteors while the comet's dust trail is closest to the planet.

Observations from Earth-based and space telescopes provided data used for modeling to make predictions about Siding Spring's Mars flyby, which were in turn used for planning protective maneuvers. The three modeling teams were headed by researchers at the University of Maryland in College Park, the Planetary Science Institute in Tucson, Arizona, and JPL.

Source: NASA
The Night Sky

Tuesday, August 12
- Peak Perseid meteor night late tonight. But the Moon, just two days after full, compromises the view. See our article, Perseids vs. Moonlight: Which Will Prevail?

Wednesday, August 13
- The waning gibbous Moon rises in the east just about at the end of twilight. Look above the Moon (or above where it's just about to rise) for the Great Square of Pegasus, larger than your fist at arm's length and standing on one corner.

Thursday, August 14
- Vega is almost overhead after dark. The brightest star in the southeast is Altair, nearly as bright. Altair is flagged by little Tarazed (3rd magnitude) a finger-width above it: an orange giant far in Altair's background. Low in the dawn, bright Venus and Jupiter are drawing toward their very close August 18th conjunction.

Friday, August 15
- For the next several mornings, look low in the east-northeast about 45 to 30 minutes before sunrise for Venus and Jupiter very close together. On Saturday morning, these two brightest planets are still 1.8° apart. They'll be closest on Monday morning the 18th: just 0.2° apart at the time of dawn for Europe, 0.3° by the time dawn reaches the Americas.

Perseids vs. Moonlight: Which Will Prevail?

Well, it's happening again. This time the Moon will be two days past full on the peak Perseid night, August 12–13. So it won't be quite as bright as when it's full, but it will illuminate the sky all night, especially from midnight to dawn when the shower's radiant in Perseus is high and the meteors should be most numerous.

On their peak night, the Perseids typically produce about 100 meteors per hour when the radiant is near the zenith (directly overhead) and the sky is very dark. The peak rate typically runs for about 12 hours centered on the predicted time, which this year is 0h Universal Time on August 13th (near nightfall on August 12th in North American time zones).

Next year's peak Perseid nights will be moonless and ideal.

Source: Sky and Telescope
ISS Sighting Opportunities (from Denver)

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Sighting information for other cities can be found at [NASA’s Satellite Sighting Information](https://www.nasa.gov/).  

**NASA-TV Highlights**  
(All times Eastern Time Zone)

**Tuesday, August 12**  
8 a.m. - Docking of the European Space Agency’s "Georges Lemaitre" to the ISS (all channels)

**Thursday, August 14**  
12 p.m. - ISS Mission Control On-Console Interview with the Digital Learning Network (all channels)

**Friday, August 15**  
6:15 a.m., - Coverage of the Release of the Orbital Sciences’ Cygnus Cargo Craft from the ISS (all channels)

Watch NASA TV online by going to the [NASA website](https://www.nasa.gov/).  

[Image of ESA Automated Transfer Vehicle]
Space Calendar

- Aug 12 - Perseids Meteor Shower Peak
- Aug 12 - Comet 296P/Garradd At Opposition (1.391 AU)
- Aug 12 - Asteroid 398188 (2010 LE15) Near-Earth Flyby (0.040 AU)
- Aug 12 - Asteroid 277475 (2005 WK4) Near-Earth Flyby (0.072 AU)
- Aug 12 - Asteroid 9769 Nautilus Closest Approach To Earth (1.422 AU)
- Aug 12 - Asteroid 1001 Gaussia Closest Approach To Earth (2.124 AU)
- Aug 12 - Asteroid 306367 Nut Closest Approach To Earth (3.400 AU)
- Aug 13 - Worldview-3 Atlas 5 Launch
- Aug 13 - Cassini, Distant Flyby of Titan
- Aug 13 - Asteroid 2011 EW4 Near-Earth Flyby (0.078 AU)
- Aug 14 - Mars Orbiter Mission (MOM), Trajectory Correction Maneuver #3 (TCM-3)
- Aug 14 - Moon Occults Uranus
- Aug 14 - Comet 305P/Skiff At Opposition (0.843 AU)
- Aug 14 - Asteroid 4536 Drewpinsky Closest Approach To Earth (1.299 AU)
- Aug 14 - 15th Anniversary (1999), Galileo, Callisto 22 Flyby
- Aug 15 - Cygnus Spacecraft Reenters Earth's Atmosphere (International Space Station)
- Aug 15 - Comet 196P/Tichy Closest Approach To Earth (2.136 AU)
- Aug 15 - Comet 212P/NEAT At Opposition (4.220 AU)
- Aug 15 - Asteroid 54509 YORP Closest Approach To Earth (0.490 AU)
- Aug 15 - Asteroid 18132 Spector Closest Approach To Earth (1.173 AU)
- Aug 15 - Asteroid 5335 Damocles At Opposition (20.712 AU)
- Aug 15 - 25th Anniversary (1989), Sixiangkou Meteorite Fall (Hit House in China)
- Aug 16 - Comet C/2014 M3 (Catalina) Closest Approach To Earth (1.550 AU)
- Aug 16 - Comet 2P/Encke At Opposition (2.183 AU)
- Aug 16 - Comet C/2013 TW5 (Spacewatch) Perihelion (5.831 AU)
- Aug 16 - Asteroid 2014 MP5 Near-Earth Flyby (0.045 AU)
- Aug 16 - Asteroid 2014 OG300 Near-Earth Flyby (0.055 AU)
- Aug 16 - Asteroid 3356 Resnik Closest Approach To Earth (1.045 AU)
- Aug 16 - Asteroid 117329 Spencer Closest Approach To Earth (1.782 AU)

Source: JPL Space Calendar
Food for Thought

How Did Supermassive Black Holes Get So Big So Fast?

This illustration depicts matter falling into a supermassive black hole, creating jets of material travelling almost at the speed of light. Credit: NASA/Goddard Space Center

Black holes may have grown incredibly rapidly in the newborn universe, perhaps helping explain why they appear so early in cosmic history, researchers say.

Black holes possess gravitational pulls so powerful that not even light can escape their clutches. They are generally believed to form after massive stars die in gargantuan explosions known as supernovas, which crush the remaining cores into incredibly dense objects.

Supermassive black holes millions to billions of times the mass of the sun occur at the center of most, if not all, galaxies. Such monstrously large black holes have existed since the infancy of the universe, some 800 million years or so after the Big Bang. However, it remains a mystery how these giants could have grown so big in the relatively short amount of time they had to form.

In modern black holes, features called accretion disks limit the speed of growth. These disks of gas and dust that swirl into black holes can prevent black holes from growing rapidly in two different ways, researchers say. First, as matter in an accretion disk gets close to a black hole, traffic jams occur that slow down any other infalling material. Second, as matter collides within these traffic jams, it heats up, generating energetic radiation that drives gas and dust away from the black hole.

"Black holes don't actively suck in matter — they are not like vacuum cleaners," said lead study author Tal Alexander, an astrophysicist at the Weizmann Institute of Science in Rehovot, Israel.
"A star or a gas stream can be on a stable orbit around a black hole, exactly as the Earth revolves around the sun, without falling into it," Alexander told Space.com. "It is actually quite a challenge to think of efficient ways to drive gas into the black hole at a high enough rate that can lead to rapid growth."

Alexander and his colleague Priyamvada Natarajan may have found a way in which early black holes could have grown to supermassive proportions — in part, by operating without the restrictions of accretion disks. The pair detailed their findings online today (Aug. 7) in the journal Science.

The scientists began with a model of a black hole 10 times the mass of the sun embedded in a cluster of thousands of stars. They fed the simulated black hole continuous flows of dense, cold, opaque gas.

"The early universe was much smaller and hence denser on average than it is today," Alexander said.

This cold, dense gas would have obscured a substantial amount of the energetic radiation given off by matter falling into the black hole. In addition, the gravitational pull of the many stars around the black hole "causes it to zigzag randomly, and this erratic motion prevents the formation of a slowly draining accretion disk," Alexander said. This means that matter falls into the black hole from all sides instead of getting forced into a disk around the black hole, from which it would swirl in far more slowly.

The "supra-exponential growth" observed in the model black hole suggests that a black hole 10 times the mass of the sun could have grown to more than 10 billion times the mass of the sun by just 1 billion years after the Big Bang, researchers said.

"This theoretical result shows a plausible route to the formation of supermassive black holes very soon after the Big Bang," Alexander said.

Future research could examine whether supra-exponential growth of black holes could occur in modern times as well. The high-density and high-mass cold flows seen in the ancient universe may exist "for short times in unstable, dense, star-forming clusters, or in dense accretion disks around already-existing supermassive black holes," Alexander said.

Source: Space.com

Spiral Galaxy NGC 6744
Source: NASA
Space Image of the Week

Rosetta's Rendezvous
Image Credit: ESA / Rosetta / MPS for OSIRIS Team; MPS/UPD/LAM/IAA/SSO/INTA/UPM/DASP/IDA

Explanation:
On August 3rd, the Rosetta spacecraft's narrow angle camera captured this stunning image of the nucleus of Comet 67P/Churyumov-Gerasimenko. After 10 years and 6.5 billion kilometers of travel along gravity assist trajectories looping through interplanetary space, Rosetta had approached to within 285 kilometers of its target.

The curious double-lobed shape of the nucleus is revealed in amazing detail at an image resolution of 5.3 meters per pixel. About 4 kilometers across, the comet nucleus is presently just over 400 million kilometers from Earth, between the orbits of Jupiter and Mars. Now the first spacecraft to achieve a delicate orbit around a comet, Rosetta will swing to within 50 kilometers and closer in the coming weeks, identifying candidate sites for landing its probe Philae later this year.

Source: NASA