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The Art of Science

Astronaut Photography from the International Space Station by William Stefanov · October 18, 2005

Astronauts on board the International Space Station (ISS) have many tasks, but a consistent favorite is taking photographs of Earth. The ISS astronauts don't just take digital images randomly. The photos they shoot are part of a well-defined program of data collection coordinated through the Crew Earth Observations team at Johnson Space Center. Current research targets include glaciers, deltas, urban areas, coral reefs, megafans (inland deltas), and long-term ecological monitoring sites. Dynamic events such as hurricanes, dust storms, volcanic eruptions, and fires are also imaged when possible. The database of [astronaut photography](#) is freely accessible via the Internet. ▶ 2

The Crew Earth Observations team selects science targets and uploads them to the ISS crew daily based on the current orbital position of the ISS, local sun angle, predicted local weather conditions, and the task schedule. Satellites, such as Landsat and Terra, that are in polar (pole-to-pole) orbits pass over the same location on the globe at approximately the same time every day. The inclined (angled), equatorial orbit of the ISS and having a "human in the loop" to point the camera allow for a wide variety of local sun angles and ground resolutions (levels of detail) for science targets. These unique characteristics of astronaut photography provide a dataset that includes both scientific and aesthetic, or artistic, value. This duality is expressed in ISS Expedition 10 Commander Leroy Chiao's ten favorite photos (see also [Expedition 10 Earth Observation Photos](#); and [Shooting for the Heart: Astronaut Finds Passion for Photography in Space](#)).



Snow cover shows the boundaries between built-up (gray) areas versus vegetated and open space (white) within the large city of Beijing (Peking), China. The Forbidden City is visible in image center. Astronaut photograph ISS010-E-18196 was acquired February 18, 2005, with a Kodak 760C digital camera with a 400 mm lens.

[High-resolution image](#) (1.9 MB JPEG)
NASA photograph courtesy JSC Gateway to Astronaut Photography of Earth.

Two of the world's great cities, New York and Beijing, were among those imaged by Leroy Chiao during Expedition 10. Large urban centers such as these serve as global economic, social, and cultural centers. The establishment and growth of cities also alters local and sometimes regional climate patterns, hydrology, and ecology. Replacement of existing soil and vegetation by asphalt and concrete fosters the creation of urban "heat islands," increases surface water runoff, decreases groundwater recharge, and fragments pre-existing ecosystems.



Manhattan Island and its easily recognizable Central Park (center left) are featured in this image. Some of the other New York City boroughs (including parts of Queens and Brooklyn) are also shown, as are two small sections of the New Jersey side of the Hudson River (lower left and lower right). Astronaut photograph ISS010-E-21487 was acquired March 26, 2005, with a Kodak 760C digital camera with an 800 mm lens.

[High-resolution image](#) (1.7MB)
NASA photograph courtesy JSC
Gateway to Astronaut
Photography of Earth.

While cities represent people's most visible alteration of Earth's surface, numerous other regions of the planet are also directly or indirectly impacted by human activities. Photography of glaciers, deserts, coastal regions, and lakes provide data for tracking changes. Astronauts document the advance and retreat of glacial ice due to climate change; location and structure of dune fields related to desertification; changes to coastlines and deltas following hurricanes or human development; and changes to lakes and rivers related to land cover and land use change. Digital astronaut photographs only record data in the visible red, green, and blue wavelengths of light (not infrared, for example), but the variety of acquisition times and spatial resolutions make these data useful additions to more traditional multispectral and hyperspectral datasets from satellites and other remote-sensing platforms like aircraft.



A portion of the Himalaya range and several glaciers are featured in this image. Astronaut photograph ISS010-E-15457 was acquired February 1, 2005, with a Kodak 760C digital camera with a 400 mm lens.

[High-resolution image \(1.0 MB JPEG\)](#)
NASA photograph courtesy JSC Gateway to Astronaut Photography of Earth.



The northernmost parts of the Cape Cod National Seashore, Massachusetts, are featured in this image. Wave refraction patterns are present near the edge of the Cape (bottom), and coastal dune fields are visible at image center. Astronaut photograph ISS010-E-21965 was acquired March 30, 2005, with a Kodak 760C digital camera with an 800 mm lens.

[High-resolution image \(1.4 MB JPEG\)](#)
NASA photograph courtesy JSC Gateway to Astronaut Photography of Earth.



This image captures a portion of the Grand Erg Oriental (Eastern Sand Sea) in Algeria. Astronaut photograph [ISS010-E-10124](#) was acquired December 11, 2004, with a Kodak 760C digital camera with a 400 mm lens.

[High-resolution image](#) (1.3 MB JPEG)
NASA photograph courtesy JSC Gateway to Astronaut Photography of Earth.



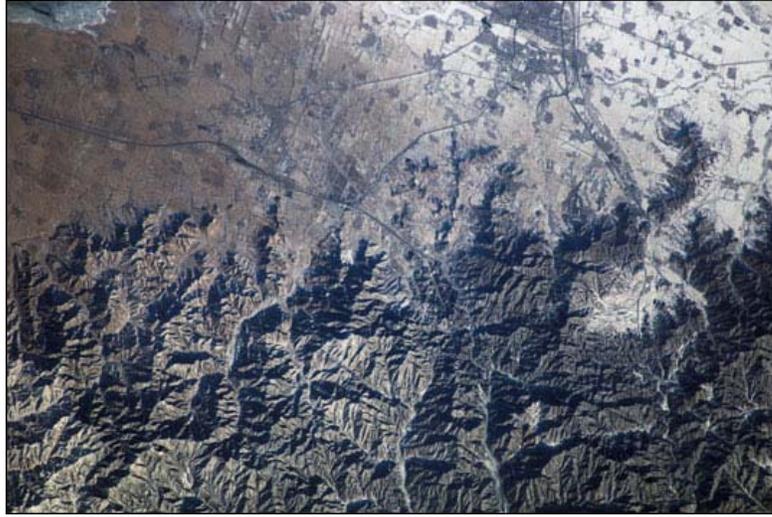
Egypt's Lake Nasser was created by completion of the Aswan High Dam in 1970. Sunglint (light reflected off the water surface) on the lake makes it easily visible. Astronaut photograph [ISS010-E-14618](#) was acquired January 23, 2005, with a Kodak 760C digital camera with a 400 mm lens.

[High-resolution image](#) (1.5 MB JPEG)
NASA photograph courtesy JSC Gateway to Astronaut Photography of Earth.

► [Special Interests](#)

Astronauts onboard the ISS also take striking images in addition to their designated science targets; hometowns, places of special interest, and spacecraft are typical subjects. Among Leroy Chiao's special interests were the Great Wall of China (see also [China's Wall Less Great in View from Space](#)) and spacecraft launch facilities. Crew Earth Observations scientists assisted him in capturing these targets by uploading detailed landscape descriptions, maps, and other remotely sensed imagery to the ISS. As Commander Chiao stated, "Photography in space helped bring out the artistic side in me. The beauty of the Earth was very inspiring, and I tried to find new ways to capture and express that beauty."





The Great Wall of China and Inner Mongolia are featured in this image. Snow cover and shadows helped to positively identify the position of the Great Wall. Astronaut photograph ISS010-E-18338 was acquired February 20, 2005, with a Kodak 760C digital camera with a 400 mm lens.

[High-resolution image](#) (1.8 MB JPEG)
NASA photograph courtesy JSC Gateway to Astronaut Photography of Earth.



The image depicts the spacecraft launch complex at Jiuquan, China. Astronaut photograph ISS010-E-14586 was acquired January 23, 2005, with a Kodak 760C digital camera with an 800 mm lens.

[High-resolution image](#) (1.2 MB JPEG)
NASA photograph courtesy JSC Gateway to Astronaut Photography of Earth.



Backdropped by the blackness of space and Earth's horizon, an unpiloted Russian Progress supply vehicle approaches the International Space Station. The Progress 17 supply craft docked to the aft port of the Zvezda Service Module as the Station flew 225 statute miles over the Equator west of Africa. Astronaut photograph ISS010-E-19144 was acquired March 2, 2005.

[High-resolution image](#) (466 KB JPEG)
NASA photograph courtesy JSC Gateway to Astronaut Photography of Earth.



A full moon is visible in this view above Earth's atmospheric limb. Astronaut photograph ISS010-E-18583 was acquired February 24, 2005, with a Kodak 760C digital camera with an 800 mm lens.

[High-resolution image](#) (555 KB JPEG)
NASA photograph courtesy JSC Gateway to Astronaut Photography of Earth.

Images are provided by the ISS Crew Earth Observations experiment and the Image Science & Analysis Group, Johnson Space Center. The [International Space Station Program](#) supports the laboratory to help astronauts take pictures of Earth that will be of the greatest value to scientists and the public, and to make those images freely available on the Internet. Additional images taken by astronauts and cosmonauts can be viewed at the NASA/JSC Gateway to Astronaut Photography of Earth.

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