National Aeronautics and
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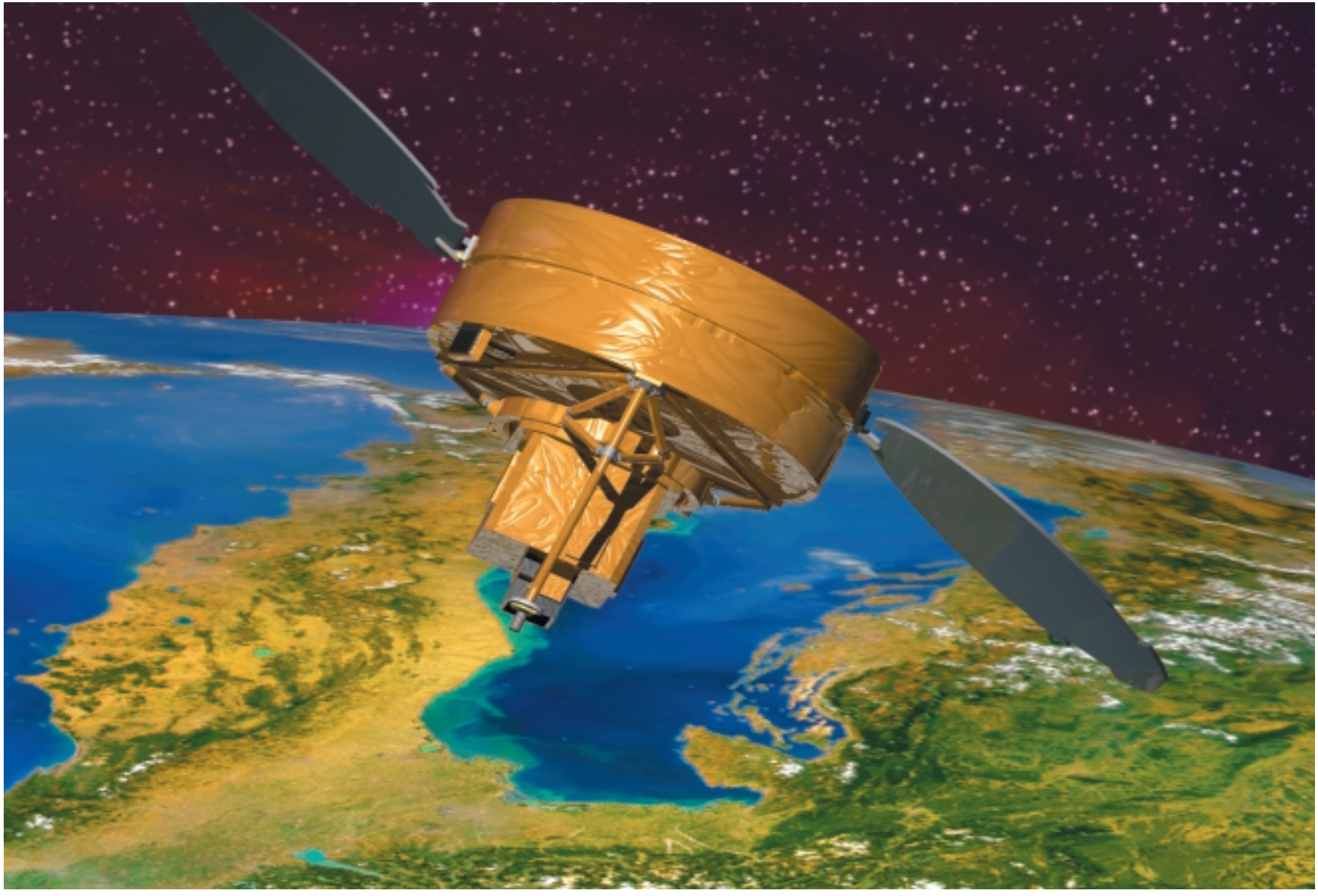
Goddard Space Flight Center

QuikTOMS - Quick Total Ozone Mapping Spectrometer



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QuikTOMS - Quick Total Ozone Mapping Spectrometer

In July 1999, NASA selected Orbital Sciences Corporation to build, launch and operate the Quick Total Ozone Mapping Spectrometer (QuikTOMS), so named because it entailed the construction and launch of a spacecraft in less that two years as compared to traditional missions which take from three to five years. QuikTOMS was procured by NASA's Goddard Space Flight Center's (GSFC) Rapid Spacecraft Development Office and is managed by the GSFC QuikTOMS Project Office.

QuikTOMS is a free-flying spacecraft with its own orbit adjustment subsystem. As soon as the spacecraft separates from the launch vehicle, a preprogrammed sequence of commands will be initiated to deploy the solar arrays and transition the spacecraft to safe mode. It will then use a series of orbit-adjustment burns to obtain an operational Sun-synchronous orbit of 500 miles (800km).

Ozone Research

Ozone absorbs virtually all of the Sun's radiation in the biologically harmful ultraviolet (UV) wavelength range of 200-310 nanometers. Ultraviolet radiation can cause sunburn, cataracts, and more seriously, skin cancer. It also causes damage to many other life forms. The decline in global ozone levels, and the discovery of the Antarctic ozone hole, have placed urgent emphasis on monitoring ozone change.

Ozone data must be collected over an extended time period in order to separate human induced changes from natural atmospheric variations and to help quantify the roles of these factors. Maintaining global, carefully calibrated ozone measurements over decades is critical for verifying ozone depletion and the expected ozone recovery. These tasks are the central challenges of stratospheric research today.

Total Ozone Mapping Spectrometer and Data

The Total Ozone Mapping Spectrometer (TOMS) is the primary instrument for studying atmospheric ozone on a global scale. NASA scientists use the TOMS instrument to continuously monitor changes of the Antarctic ozone hole, local ozone levels, and global ozone.

TOMS is a second-generation, ozone-sounding instrument derived from the Backscatter Ultraviolet Spectrometer flown aboard NASA's Nimbus-4 satellite in 1970. The first TOMS instrument was launched aboard Nimbus-7 in 1978. That TOMS operated almost continuously from its launch until its failure in 1993, providing more than 13 years of global, daily values of ozone levels. The Meteor-3 TOMS, ADEOS TOMS and the Earth Probe TOMS followed the Nimbus-7 TOMS. The current operational instrument, Earth Probe TOMS, is approaching its fifth year in orbit and QuikTOMS will replace this aging satellite.

The QuikTOMS instrument will continue measuring the total ozone. These measurements allow scientists to separate changes in global ozone caused by natural processes from trends due to chlorofluorocarbons (CFCs), halons, and other trace gases. For example, theory predicts that long-term variations of the UV output of the Sun will affect total ozone. However, identifying these variations require data extending over periods longer than a decade. With this information, scientists can begin to predict how human activity affects the environment.

Another important use of TOMS data is to study changes of biologically active UV radiation that accompany the decrease of global ozone. The TOMS measurements are used to determine the change in ultraviolet energy striking the Earth's surface at wavelengths that affect both plants and animals. TOMS provides the information necessary for estimating biologically active UV radiation at the Earth's surface as a function of location and time of year.

TOMS also measures sulfur dioxide and ash from large volcanic eruptions, smoke from forest fires and from forest clearing in the tropical rain forests.

Science Objectives

The primary science objective of NASA's QuikTOMS mission is to continue the ongoing measurements of the Earth's atmospheric ozone begun with Nimbus-7 in 1978 and currently being measured by the NASA Earth Probe (EP)/TOMS mission.

Secondary mission objectives are to measure ultraviolet absorbing tropospheric aerosols; detect and measure non-absorbing aerosol pollution plumes; estimate surface ultraviolet irradiance and reflectivity; and detect and measure volcanic emissions.

The Future

QuikTOMS satellite data, complemented by aircraft and ground data, provide a better understanding of natural environmental changes and to help us distinguish natural changes from human induced changes. These data, which NASA freely distributes, are essential for making informed decisions about our environment.

The TOMS program is managed by NASA's Goddard Space Flight Center, Greenbelt, and is part of NASA's Earth Science Enterprise, a coordinated research effort to study the Earth as a global environmental system.

More information on the QuikTOMS program is available on the QuikTOMS web site at: http://quiktoms.gsfc.nasa.gov

For the Classroom:

For this investigation, you are going to use images made from ozone data collected with the TOMS satellite. Go to the web site:
http://toms.gsfc.nasa.gov/ozone/ozone01.html

1. Go to the series of pull down menus. For "Choose output (format info)," select "Global image" from the pull down menu. Next, for "Select coverage satellite," choose Nimbus-7, a satellite from an early period. Next, on the "Date to be studied" menu, select Oct 1, 1979. Click on "Request." After a few seconds, an image will appear. Using the color key on the bottom of the image, determine the lowest value of ozone, in Dobson Units, over Antarctica. Record this number.

2. Click on the "BACK" button of your browser.

3. Leave the "Choose output" choice as "Global Image." Next, on the "Select coverage satellite," choose "Earth Probe", a satellite from a more recent time. On the "Date to be studied" menu, select Oct 1, 2000 and click on "Request." Using this new image, find the lowest value of ozone over Antarctica. Record this number.

4. Find the percentage change in ozone concentration from 1979 to 2000.

More information, as well as full global maps usually available within 24 hours, is located on the TOMS web site at: http://toms.gsfc.nasa.gov.

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