National Aeronautics And Space Administration Press Kit

QuikTOMS Mission

September 2001

Public Affairs Contacts

Gary Caruso	Headquarters Policy. Program Office	202-358-1705
Cynthia M. O'Carroll	QuikTOMS GSFC PAO	301-614-5563
Bruce Buckingham	KSC Launch Operations PAO	321-867-2468
Barry Beneski	Orbital Sciences Corporation	703-406-5528

Table of Contents **Page**

Press Release to be inserted once it is approved

Media Services Information

<u>NASA Launch Coverage</u>
Live commentary and coverage of the QuikTOMS launch will be available on NASA TV beginning five minutes before the launch, at approximately 2:44 p.m. EDT (11:44 a.m. PDT). This coverage will be broadcast on NASA TV on G-2, transponder 9C, located at 85 degrees west longitude.

Orbital will provide live commentary and launch coverage via a commercial satellite beginning at 1:45 p.m. EDT (10: 45 a.m. PDT). This coverage will be broadcast on: **TBD**

A live webcast of the launch will be available at Orbital Sciences Corporation's web site: www.orbital.com

<u>Briefings</u>
A pre-launch briefing is scheduled for L-1 at 3:00 p.m. EDT (12:00 p.m. PDT) on September 20 at the Pacific Coast Club at VAFB to discuss the details of the launch vehicle, spacecraft and the weather for launch day. The briefing will be will be taped by Orbital and an edited version will be shown on the day of the launch as part of the launch commentary.

<u>News Center/Status Reports</u>
NASA Public Affairs will staff the News Center at VAFB beginning on L-2 and continuing about two hours after a successful launch. Recorded status reports also will be available beginning two days before launch by dialing **805-734-2693** or **301-286-NEWS**.

<u>Media Credentials</u>
Media seeking launch accreditation should contact the Resident Office at Vandenberg AFB, Calif., by close of business two days before the launch at 805-606-3595, fax:805-606-8303, or e-mail: Rebecca.Bonilla@Vandenberg.AF.mil
Requests <u>must be</u> submitted on the letterhead of the news organization and specify the editor making the assignment to cover the launch

Internet Information
Detailed information about the QuikTOMS mission and the TOMS instrument can be found at the following web sites:
http://quiktoms.gsfc.nasa.gov
http://toms.gsfc.nasa.gov
http://www.orbital.com

QuikTOMS Quick Facts

Spacecraft Dimensions:
Size: 112 cm x 117 cm (44 in. x 46 in.) stowed
Weight: 168 kg (370 lb.)
Lifetime: 1 year with a goal of 3 years
Orbit: 800 km (497 mi.) Sun synchronous, 10:30 am descending mode

Instrument
Instantaneous Field of View: 3° square (42 km at nadir)
Mass: ~32 kg
Max. Scan Angle: ±54°
Radiation: 20 krad (total dose)
Resonant Freq.: >120 Hz
Scan Cycle Time: 6.3 sec.
Scan Steps: 37
Wavelengths Used
- Band 1 360.0 ± 0.2 nm
- Band 2 331.2 ± 0.1 nm
- Band 3 322.3 ± 0.1 nm
- Band 4 317.5 ± 0.1 nm
- Band 5 312.5 ± 0.1 nm
- Band 6 308.6 ± 0.1 nm

Launch
Launch Vehicle: Taurus
Payload: QuikTOMS is the secondary payload for this launch. The primary payload Orbview-4/Warfighter-1, built by Orbital will provide high resolution panchromatic, multispectral and hyperspectral imagery to commercial and military customers.

Subsystems:
Communications: combine science and spacecraft S-Band Data Rate – 400 Kbs
Propulsion: Fuel – Hydrazine
Attitude Control: 3-axis stabilized, nadir pointing
Thermal: primarily passive, augmented with heaters
Solar Array Power Output at end of life: 239 watts
Instruments: Total Ozone Mapping Spectrometer

Mission Lifetime: 1 year with a goal of 3 years
Launch Site: Western range, Launch pad 576E, Vandenberg Air Force Base
Launch Window: 2:49 p.m. – 3:06 p.m. EDT (11:49 a.m. – 12:06 p.m. PDT)
Spacecraft separation: 3:02 p.m. EDT (L+14:01 minutes)
Solar Array Deployment: 3:02:30 p.m. EDT (L+14:06 minutes)
First Signal Acquisition: 3:17 p.m. at McMurdo (L+29:01 minutes)
On-orbit Checkout: L+3 days through 30 days
Launch Vehicle Provider: OSC Space Systems Group

Launch Operations: OSC Orbital Launch Services Group
Spacecraft Operations: Orbital Sciences Mission Control Center, Dulles, VA
Mission Management: NASA Goddard Space Flight Center, Greenbelt, MD
Mission Cost: Total mission costs are approximately $52.6 million. This includes all costs associated with data processing of distribution as well as five years of mission operations.

The QuikTOMS Mission

The QuikTOMS satellite carries NASA’s fifth Total Ozone Monitoring Sensor (TOMS-5). Managed by the Goddard Space Flight Center’s Earth Explorer’s Program, the main Objectives of the TOMS program are:

1. To determine long term changes in global total ozone levels
2. To understand the processes related to the "ozone hole" formation in the polar regions and local anomalies across the entire globe
3. To improve understanding of processes that govern the generation, depletion, and distribution of global total ozone

The TOMS instrument provides data to derive daily global measurements of Ozone, Aerosols, Erythemal UV exposure, and Reflectivity. TOMS data products are made available to scientists throughout NASA, the US government and the international science community to better understand the relationship between the atmospheric ozone distribution and the factors that alter it.

TOMS Sensor: The TOMS instrument, the fourth built for NASA by Orbital Sciences Corporation, is a cross-track scanning, grating spectrometer designed to measure sunlight backscattered from the Earth's atmosphere at six different ultraviolet wavelengths. For accurate long-term measurements, it employs a diffuser assembly to measure the solar flux, a reflectance calibration lamp for monitoring the reflectivity of the diffuser surfaces, and a wavelength monitor.

Spacecraft: The QuikTOMS spacecraft is a derivative of Orbital Sciences Corporation’s MicroStar bus, one of the most widely flown and most reliable LEO space platforms. Originally developed to support the ORBCOMM global communications system, the lightweight design is optimized for shared payload missions. The QuikTOMS spacecraft consists of two rings stacked together; a core ring carrying all spacecraft and payload support systems, and a second carrying four propulsion tanks and two solar arrays.

Taurus Launch Vehicle: The Taurus launch vehicle is a ground-launched variant of Orbital’s air-launched Pegasus rocket capable of launching up to 3,000 pounds to low Earth orbit. Taurus has achieved a 100% success rate with five successful launches that have delivered 9 satellites into orbit.

Quick Total Ozone Mapping Spectrometer -- QuikTOMS

The Total Ozone Mapping Spectrometer (TOMS) is the primary instrument for studying atmospheric ozone on a global scale. National Aeronautics and Space Administration (NASA) scientists use the TOMS instrument to continuously monitor changes of the Antarctic ozone hole, local ozone levels, and global ozone. TOMS also measures sulfur dioxide and ash from large volcanic eruptions, smoke from forest fires and from forest clearing in the tropical rain forests, airborne dust from large sand storm events, and the flux of ultraviolet radiation reaching the Earth's surface. The U.S. Federal Aviation Administration (FAA) is using these measurements to prevent aircraft from flying through volcanic ash clouds.

In July 1999, NASA selected Orbital Sciences Corporation (Orbital) to build, launch and operate the Quick Total Ozone Mapping Spectrometer (QuikTOMS), so named since the QuikTOMS effort entailed the construction and launch of a spacecraft in less than 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 (RSDO) and is managed by the GSFC QuikTOMS Project Office.

Ozone Research

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

Ozone data must be collected over an extended time period in order to separate human-forced changes from natural atmospheric variations and to help quantify the individual 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 central challenges of stratospheric research today.

Atmospheric ozone is controlled by a combination of radiative, chemical and dynamical processes. Ozone plays an important role in these of processes, coupling them in a complex set of feedback mechanisms. Among the factors that affect ozone amounts are variations induced by: (1) atmospheric dynamics (stratospheric weather); (2) solar variations; (3) human produced gases such as chlorofluorocarbons (CFCs) and halons; and (4) volcanic eruptions.

Total Ozone Mapping Spectrometer and Data

TOMS is a second-generation, ozone-sounding instrument derived from the Backscatter Ultraviolet (BUV) Spectrometer flown aboard NASA's Nimbus-4 satellite in 1970. The first TOMS instrument was launched aboard Nimbus 7 in 1978. The Nimbus-7 TOMS operated almost continuously since its launch until its failure in 1993, providing more than 15 years of global, daily maps of total ozone. The Meteor-3 TOMS, ADEOS TOMS and the Earth Probe TOMS followed the Nimbus-7 TOMS. The current operational instrument, Earth Probe TOMS, has been in orbit for five years and QuikTOMS will replace this aging satellite.

The QuikTOMS instrument will continue these measurements of total ozone. These measurements will allow scientists to separate changes of global ozone caused by natural processes from trends due to 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 requires 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 will be to study changes of biologically active UV radiation that accompany changes in global ozone. The TOMS measurements are used to determine the flux of ultraviolet sunlight at each point on 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.

Although the TOMS data will be used primarily to study ozone, the information gained from TOMS will also contribute to volcanic studies. Volcanoes generate sulfur dioxide (SO2) in the Earth's atmosphere and TOMS can map this gas. This gas is rapidly transformed into sulfate aerosols, which may persist in the stratosphere for months to years. Its effects in the stratosphere include the red sunsets that follow major volcanic eruptions, and these effects may be associated with climate change. TOMS data on volcanic eruptions will make valuable contributions to studies in several disciplines, including volcanology, meteorology and atmospheric chemistry.
The TOMS data has many other applications. The total ozone pattern measured by TOMS can be used in studies of severe storms to infer the circulation patterns of the jet stream that strongly affect our weather. TOMS can also observe smoke after it has been lofted to 3-4km altitude. Unlike other instruments, TOMS can distinguish between smoke (or dust) and clouds, and can be used to track the transport of smoke or dust over long distances. TOMS ozone data can also be used for comparison with ground stations, atmospheric correction of ocean color measurements of pigment concentrations, studies of the UV reflectivity of Earth's surface, and development of cloud climatology.

Program History
The first TOMS instrument was launched in October 1978 as part of the package of the Solar Backscattered Ultraviolet and Total Ozone Mapping Spectrometer (SBUV/TOMS) on Nimbus-7, and operated until May 1993. The engineering model of Nimbus-7 TOMS was refurbished and flown aboard Meteor-3 in August 1991. Meteor-3/TOMS provided critical scientific data until December 1994.

A new series of TOMS instruments was developed to monitor the long-term trend of global total ozone and to continue the study of ozone loss and the Antarctic ozone hole. The first of these, Earth Probe TOMS, was launched aboard Earth Probe (EP) in July 1996, and is still operating. A TOMS instrument was also launched aboard the Japanese ADEOS satellite, in August 1996: and operated until June 1997 when the satellite's solar array failed.

On June 17, 1992, the United States and the Russian Federation signed an agreement concerning cooperation in the exploration and use of outer space for peaceful purposes. In December 1994, NASA and the Russian Space Agency (RSA) signed an agreement to fly a TOMS aboard a Russian Meteor-3M spacecraft. However, because of delays, NASA and RSA agreed to halt cooperation on the mission. In order to meet the critical science window, the primary science objectives of NASA, and the environmental information needs of the international community, QuikTOMS was conceived.

Science Objectives

The primary science objective of NASA's TOMS 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 to assist the U.S. Federal Aviation Administration (FAA).

QuikTOMS Management

NASA Headquarters' Office of Earth Science (OES) manages the overall Earth Explorer and TOMS programs. The Earth Explorers Program Office is responsible for the management of all Earth Explorers Projects assigned to Goddard, which includes the QuikTOMS Project. The QuikTOMS Project Office is responsible for the management of the QuikTOMS mission through definition, development, and integration and test, launch and on-orbit checkout.

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.

Mission Operations

QuikTOMS is a free-flying spacecraft with its own orbit adjust subsystem. It will be launched into an intermediate parking orbit, from which it will be raised by a series of orbit-adjust burns, to its operational Sun-synchronous orbit of 500 miles (800km). 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.

Ground coverage for communications and tracking for the on-orbit phase of the mission will be provided by the Universal Space Network. The NASA Earth Observing System Polar Ground Network will be used for the launch, checkout and orbit raising phases of the mission. Flight Dynamics and the NASA Integrated Services Network are supplied by the Space Operations Management Organization to support QuikTOMS. They support the launch and on-orbit checkout phase. Orbital Sciences Corporation provides the Mission Control Center, which is located in Dulles, Virginia, and is responsible for the Flight Operations Team that provides spacecraft operations (telemetry, command, and control. The TOMS Science Operations Center, located at the Goddard Space Flight Center in Greenbelt, Md., generates instrument operations plans. The flight operations team integrates instrument plans into the spacecraft operations, captures science data from the mission control center and forwards them to the science center for data processing and generation of data products.

Launch

The QuikTOMS mission will be launched from Vandenberg Air Force Base, Calif., on a commercial Taurus launch vehicle. QuikTOMS is a secondary payload to be flown with the OrbView-4 spacecraft, which is the primary payload. The QuikTOMS secondary payload services are obtained by NASA Kennedy Space Center, Fla., via a contract with Orbital Launch Systems Group. The launch vehicle will deploy the spacecraft in an injection orbit of 292 miles (470-km) circular, 97.3 inclination, and at a 10:30 a.m. equator crossing (descending node). Orbital Space Systems Group will provide the spacecraft, which is a Microstar bus, adapted for the TOMS-5 instrument. The TOMS instrument, provided by Orbital Science Corporations Sensor Systems Division integrated with the spacecraft, is designated the QuikTOMS observatory.

The mission orbit will be a sun-synchronous, 500 miles (800 km) circular orbit, with a 10:30 a.m. Equator crossing. The spacecraft is designed for a 3-year minimum on-orbit mission lifetime, with sufficient consumables to support a 5-year mission.

The Future

To ensure that ozone data will be available throughout the next decade, NASA will fly an advanced ozone-imaging instrument built by the Dutch called Ozone Monitoring Instrument on the Earth Observing System AURA spacecraft, scheduled for launch in 2003.

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

FACTS ABOUT OZONE

Ozone (O_3) is a relatively unstable molecule made up of three atoms of oxygen (O). Although it represents only a tiny fraction of the atmosphere, ozone is crucial for life on Earth. Depending on where ozone resides, it can protect or harm life on Earth. Most ozone resides in the stratosphere (a layer of the atmosphere between 10 and 40 km above us), where it acts as a shield to protect Earth's surface from the sun's harmful ultraviolet radiation. With a weakening of this shield, we would be more susceptible to skin cancer, cataracts, and impaired immune systems. Closer to Earth in the troposphere (the atmospheric layer from the surface up to about 10 km), ozone is a harmful pollutant that causes damage to lung tissue, plants, and materials.

The amounts of "good" stratospheric and "bad" tropospheric ozone in the atmosphere depend on a balance between processes that create ozone and those that destroy it. An upset in the ozone balance can have serious consequences for life on Earth. Scientists are finding evidence that changes are occurring in ozone levels–the "bad" tropospheric ozone is increasing in the air we breathe, and the "good" stratospheric ozone is decreasing in our protective ozone layer. This article describes processes that regulate "good" ozone levels.

Ozone Balance in the Stratosphere

In the stratosphere, ozone is created primarily by ultraviolet radiation. When high-energy ultraviolet rays strike ordinary oxygen molecules (O_2), they split the molecule into two single oxygen atoms, known as atomic oxygen. A freed oxygen atom then combines with another oxygen molecule to form a molecule of ozone There is so much oxygen in our atmosphere, that these high-energy ultraviolet rays are completely absorbed in the stratosphere.

Ozone is extremely valuable since it absorbs a range of ultraviolet energy. When an ozone molecule absorbs even low-energy ultraviolet radiation, it splits into an ordinary oxygen molecule and a free oxygen atom. Usually this free oxygen atom quickly re-joins with an oxygen molecule to form another ozone molecule. Because of this "ozone-oxygen cycle," harmful ultraviolet radiation is continuously converted into heat.

Natural reactions other than the "ozone-oxygen cycle" described above also affect the concentration of ozone in the stratosphere. Because ozone and free oxygen atoms are highly unstable, they react very easily with nitrogen (N), hydrogen (H), chlorine (Cl), and bromine (B) compounds that are found naturally in Earth's atmosphere (released from both land and ocean sources). For example, single chlorine atoms can convert ozone into oxygen molecules and this ozone loss offsets some of the production of ozone by high-energy ultraviolet rays striking oxygen molecules.

In addition to the natural ozone balance, scientists have found that ozone levels change periodically as part of regular natural cycles such as the changing seasons, winds, and long time scale sun variations. Moreover, volcanic eruptions may inject materials into the stratosphere that can lead to increased destruction of ozone.

Over the Earth's lifetime, natural processes have regulated the balance of ozone in the stratosphere. A simple way to understand the ozone balance is to think of a leaky bucket. As long as water is poured into the bucket at the same rate that water is leaking out, the amount or level of water in the bucket will remain the same. Likewise, as long as ozone is being created at the same rate that it is being destroyed, the total amount of ozone will remain the same.

Starting in the early 1970's, however, scientists found evidence that human activities are disrupting the ozone balance. Human production of chlorine-containing chemicals such as chlorofluorocarbons (CFCs) has added an additional factor that destroys ozone. CFCs are compounds made up of chlorine, fluorine and carbon bound together. Because they are extremely stable molecules, CFCs do not react easily with other chemicals in the lower atmosphere. One of the few forces that can break up CFC molecules is ultraviolet radiation. In the lower atmosphere, CFCs are protected from ultraviolet radiation by the ozone layer itself. CFC molecules thus are able to migrate intact up into the stratosphere. Although the CFC molecules are heavier than air, the air currents and mixing processes of the atmosphere carry them into the stratosphere.

Once in the stratosphere, the CFC molecules are no longer shielded from ultraviolet radiation by the ozone layer. Bombarded by the sun's ultraviolet energy, CFC molecules break up and release chlorine atoms. Free chlorine atoms then react with ozone molecules, taking one oxygen atom to form chlorine monoxide and leaving an ordinary oxygen molecule.

If each chlorine atom released from a CFC molecule destroyed only one ozone molecule, CFCs would pose very little threat to the ozone layer. However, when a chlorine monoxide molecule encounters a free atom of oxygen, the oxygen atom breaks up the chlorine monoxide, stealing the oxygen atom and releasing the chlorine atom back into the stratosphere to destroy more ozone. This reaction happens over and over again, allowing a single atom of chlorine to act as a catalyst, destroying many molecules of ozone.

Fortunately, chlorine atoms do not remain in the stratosphere forever. When a free chlorine atom reacts with gases such as methane (CH_4), it is bound up into a molecule of hydrogen chloride (HCl), which can be carried downward from the stratosphere into the troposphere, where it can be washed away by rain. Therefore, if humans stop putting CFCs and other ozone-destroying chemicals into the stratosphere, the ozone layer eventually may repair itself.

Ozone Depletion

The term "ozone depletion" means more than just the natural destruction of ozone, it means that ozone loss is exceeding ozone creation. Think again of the "leaky bucket." Putting additional ozone-destroying compounds such as CFCs into the atmosphere is like increasing the size of the holes in our “bucket” of ozone. The larger holes cause ozone to leak out at a faster rate than ozone is being created. Consequently, the level of ozone protecting us from ultraviolet radiation decreases.

During the last 15 years, an additional mechanism was found in the areas over the Antarctic and Arctic that rapidly destroys ozone. Over the Earth’s poles during their respective winters, the stratosphere cools to very cold temperatures and polar stratospheric clouds (PSCs) form. In the polar stratosphere, nearly all of the chlorine is in the form of inactive or “reservoir” gases such as hydrogen chloride (HCl) and chlorine nitrate ($ClONO_2$) that do not react with ozone or each other. However, chemical reactions of these “reservoir” chlorine gases can occur on the polar stratospheric cloud particle surfaces, converting the chlorine “reservoir” gases into very reactive forms that rapidly destroy ozone. This “polar chemistry” on the stratospheric cloud particles has caused very large decreases in ozone concentrations over Antarctica and the Arctic. In fact, ozone levels drop so low in spring over Antarctica that scientists describe this loss as the “Antarctic Ozone Hole.”

Monitoring Ozone from Space

Since the 1920’s, ozone has been measured by ground-based instruments. Scientists place instruments at locations around the globe to measure the amount of ultraviolet radiation getting through the atmosphere at each site. From these measurements, they calculate the concentration of ozone in the atmosphere above that location. These data, although useful in learning about ozone, are not able to provide an adequate picture of global ozone concentrations.

The amount and distribution of ozone molecules in the stratosphere varies greatly over the globe. Ozone molecules are transported around the stratosphere much as water clouds are transported in the troposphere. Therefore, scientists observing ozone fluctuations over just one spot could not know whether a change in local ozone levels meant an alteration in global ozone levels, or simply a fluctuation in the concentration over that particular spot. Satellites have given scientists the ability to overcome this problem because they provide a picture of what is happening daily over the entire Earth. The United States satellite measurement program for ozone, run jointly by NASA and the National Oceanic and Atmospheric Administration (NOAA), has measured ozone distribution by season, latitude, and longitude, and has observed long-term changes over more than 20 years using a variety of satellite instruments. The instruments in use today will be replaced over the next five to ten years by a new generation of improved, more sophisticated instruments.

Predicting Ozone Levels

Stratospheric ozone is being depleted worldwide–partly due to human activities. Scientists now know that the large polar ozone losses are a direct result of the effects from human-produced chemicals. However, scientists still do not know how much of the mid-latitude loss is the result of human activity, and how much is the result of fluctuations in natural cycles.

Measurements and research are being used to improve models for predicting ozone levels. In fact, early model predictions have already aided policy makers in determining solutions to the ozone depletion problem. Faced with the strong possibility that CFCs could cause serious ozone depletion, policy makers from around the world signed the Montreal Protocol treaty in 1987, limiting CFC production and usage. By 1992, the growing scientific evidence of ozone loss prompted diplomats to strengthen the Montreal Protocol. The revised treaty called for a complete phase out of CFC production in developed countries by 1996. As a result, most CFC concentrations are slowly decreasing around the globe.

Much remains to be learned about the processes that affect ozone. To create accurate models, scientists must study simultaneously all of the factors affecting ozone creation and destruction. Moreover, they must study these factors from space continuously, over many years, and over the entire globe.

NASA's Earth Observing System (EOS) will allow scientists to study ozone in just this way. The EOS series of satellites will carry a sophisticated group of instruments that will measure the interactions within the atmosphere that affect ozone. Building on the many years of data gathered by previous NASA and NOAA missions, these measurements will increase dramatically our knowledge of the chemistry and dynamics of the upper atmosphere and our understanding of how human activities are affecting Earth's protective ozone layer.

Related Web sites:
Internet TOMS (Total Ozone Mapping Spectrometer)
http://toms.gsfc.nasa.gov
EOS Aura Project Homepage
http://aura.gsfc.nasa.gov
Ozone Dance
http://asd-www.larc.nasa.gov/edu_act/
ozone_dance.html
NASA's Earth Observatory - Ozone
http://earthobservatory.nasa.gov/Library/Ozone/
Atmospheric Chemistry Data & Resources
http://daac.gsfc.nasa.gov/CAMPAIGN_DOCS/
ATM_CHEM/ac_outline.html
Studying Earth's Environment from Space
Stratospheric Ozone
http://see.gsfc.nasa.gov/edu/SEES/strat/strat.htm
Related NASA Web sites

PROGRAM MANAGEMENT

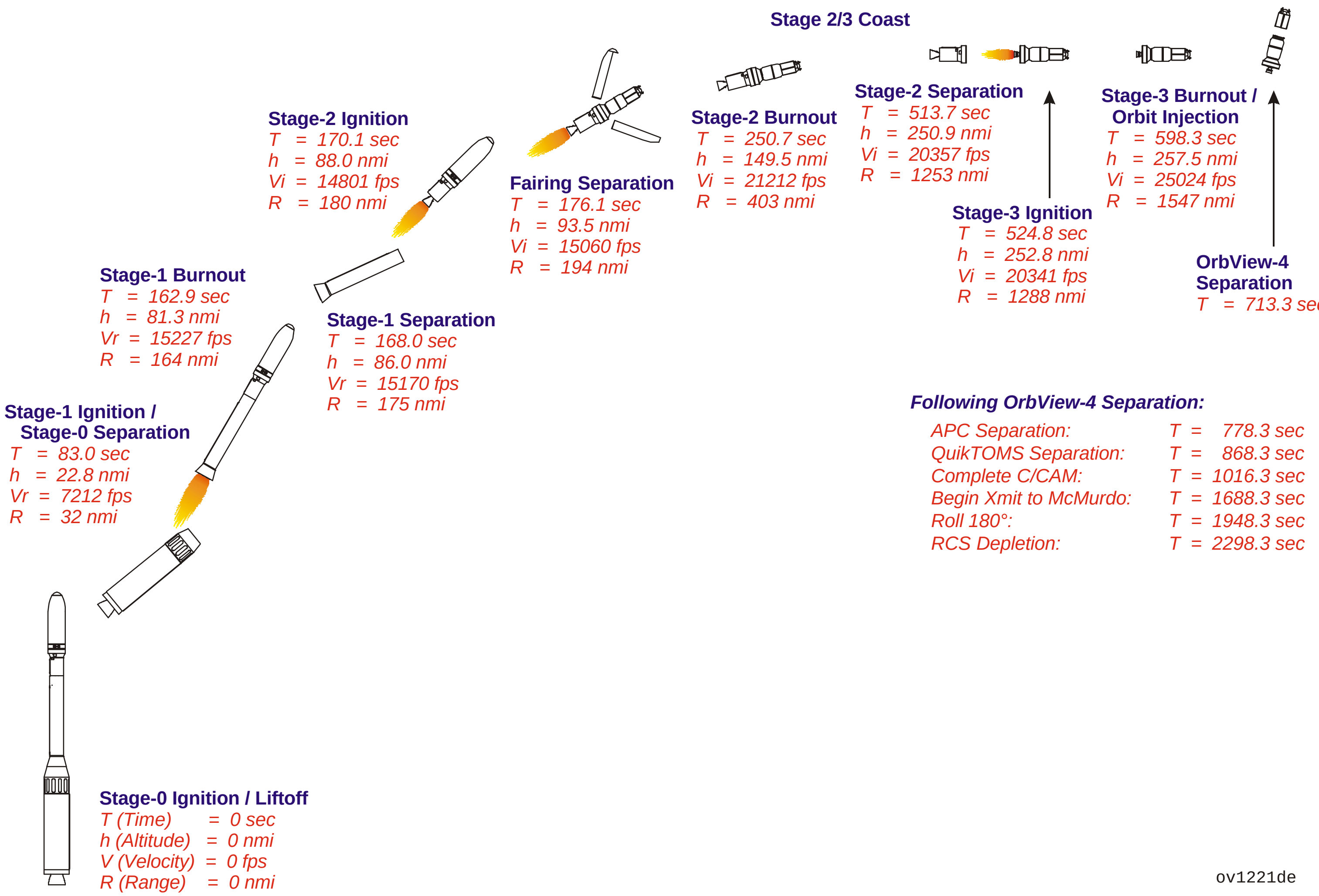
NASA Headquarters' Office of Earth Science (OES) manages the overall Earth Explorer and TOMS programs. The Earth Explorers Program Office is responsible for the management of all Earth Explorers Projects assigned to Goddard, which includes the QuikTOMS Project. The QuikTOMS Project Office is responsible for the management of the QuikTOMS mission through definition, development, and integration and test, launch and on-orbit checkout

NASA coordinates the launch of the spacecraft with Orbital Sciences Corporation and the U.S. Air Force. The NASA Earth Observing System Polar Ground Network will be used for the launch, checkout and orbit raising phases of the mission. Flight Dynamics and the NASA Integrated Services Network are supplied by the Space Operations Management Organization to support QuikTOMS. They support the launch and on-orbit checkout phase. Orbital Sciences Corporation provides the Mission Control Center, which is located in Dulles, Virginia, and is responsible for the Flight Operations Team that provides spacecraft operations (telemetry, command, and control. The TOMS Science Operations Center, located at the Goddard Space Flight Center in Greenbelt, Md., generates instrument operations plans. The flight operations team integrates instrument plans into the spacecraft operations, captures science data from the mission control center and forwards them to the science center for data processing and generation of data products.

NASA Program Management:
Headquarters
Dr. Ghassem Asrar, Associate Administrator of the Office of Earth Science
Dr. Michael J. Kurylo, HQ QuikTOMS Program Scientist

Goddard Space Flight Center
Kenneth Schwer, QuikTOMS Project Manager
Dr. P.K. Bhartia, QuikTOMS Project Scientist
Dr. Richard McPeters, QuikTOMS Principal Investigator

QuikTOMS Orbit Raising

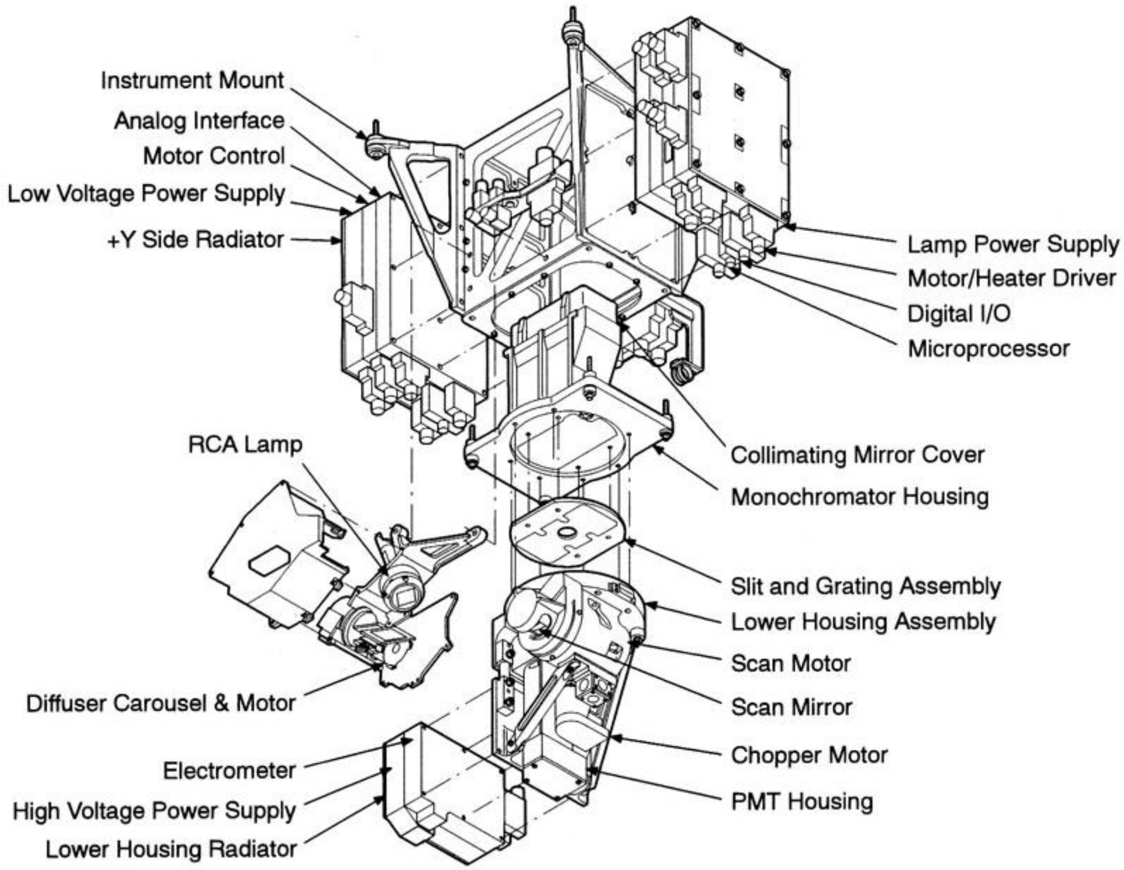


Following OrbView-4 Separation:

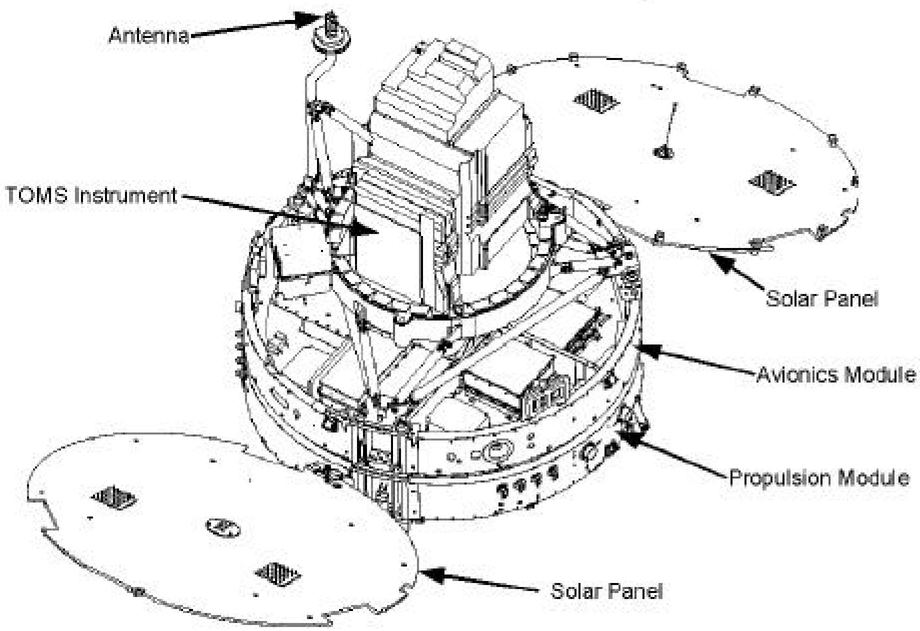
APC Separation:	*T = 778.3 sec*
QuikTOMS Separation:	*T = 868.3 sec*
Complete C/CAM:	*T = 1016.3 sec*
Begin Xmit to McMurdo:	*T = 1688.3 sec*
Roll 180°:	*T = 1948.3 sec*
RCS Depletion:	*T = 2298.3 sec*

ov1221de

QuikTOMS Line Drawing



QuikTOMS Observatory



Note: Thermal covers and insulation removed to show interior

QuikTOMS Animation