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**Selected Publications on TIROS Satellites and
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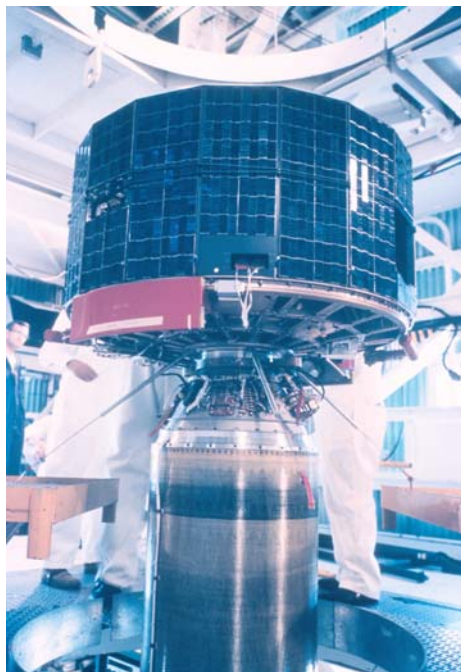


Photo: NOAA Photo Library

TIROS satellite attached to rocket for launching

Prepared by Anna Fiolek

U. S. Department of Commerce
National Oceanic and Atmospheric Administration
National Environmental Satellite, Data, and Information Service
National Oceanographic Data Center
NOAA Central Library

April 17, 2000, Rev. January 2007

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Preface to the 2007 revision

The original *Bibliography* was prepared to mark the 40th anniversary of the launch of TIROS I, the world's first weather satellite, in April 2000. This *Bibliography*, revised and enlarged as of January 2007, includes selected, unique, printed and online resources on TIROS, other meteorological satellites, and satellite meteorology from NOAA Central Library's collection. This revised document also provides full-text access to some of the listed items and has been enhanced with the addition of a section of Internet resources. It is published online under LISD Current Reference Series 2006-2.

Publications listed in this *Bibliography* may be requested through your local library's Interlibrary Loan (ILL) service. For more information on this consult NOAA Central Library's ILL home page at: <http://www.lib.noaa.gov/docs/ill.html>

This publication is available online for downloading in HTML and PDF formats at:
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<http://www.lib.noaa.gov/edocs/TIROSbib.pdf>

This *Bibliography* would not have been possible without the assistance of many individuals at the NOAA Central Library: Janice Beattie, Director, and Doria Grimes, Chief of Contract Operations Branch for their help and support for this project; Albert E. "Skip" Theberge for his assistance with the selection of historical documents; and Librarian Liselle Drake for her editorial assistance and advice.

Anna Fiolek, M.A., M.L.S.
NOAA Central Library
Silver Spring, MD
e-mail: Anna.Fiolek@noaa.gov

January 2007

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I. Introduction

TIROS I - Television Infrared Observation Satellite I was launched on April 1, 1960 from Cape Canaveral, Florida. The main objective of the TIROS program was to demonstrate the feasibility and capability of observing the Earth's cloud cover and weather patterns from space. Although the program was experimental, this first space-borne system demonstrated the capability to acquire information which meteorologists could use immediately in an operational setting.

TIROS I was the world's first weather satellite to test the experimental television techniques leading to a world-wide meteorological satellite information system. It also was the first satellite to test sun angle and horizon sensor systems for spacecraft orientation. There were several participating agencies in the test, including: NASA, the US ARMY Signal Research and Development Lab, the US Weather Bureau, RCA, and the US Naval Photographic Interpretation Center.

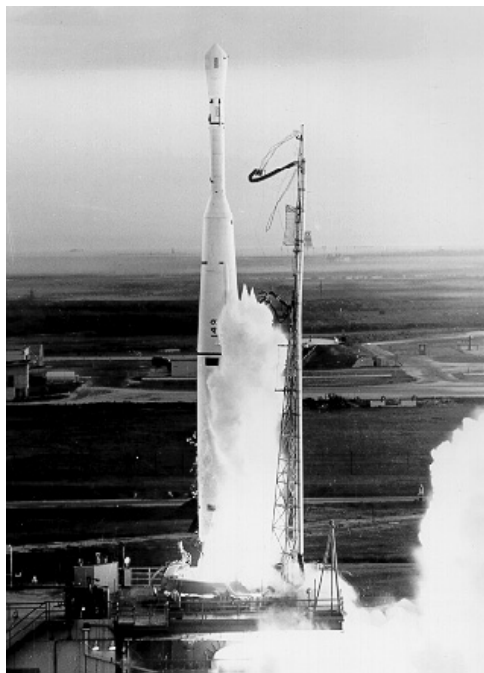


Photo: NOAAASIS home page

TIROS I launch at Cape Canaveral

The spacecraft was 42 inches in diameter, 19 inches high and weighed 270 pounds. The craft was made of aluminum alloy and stainless steel covered by 9200 solar cells. The solar cells served to charge the nickel-cadmium (nicad) batteries. Three pairs of solid-propellant spin rockets were mounted on the base plate. Two television cameras were housed in the craft, one low resolution and one high resolution. A magnetic tape recorder for each camera was supplied for storing photographs while the satellite was out of range of the ground station network. The antennas consisted of four rods from the base plate to serve as transmitters and one vertical rod from the center of the top plate to serve as a receiver. The craft was spin-stabilized and space oriented (not Earth-oriented). Therefore,

the cameras were only operated while they were pointing at the Earth when that portion of the Earth was in sunlight. The video systems relayed thousands of pictures containing cloud-cover views of the Earth. Early photographs provided information concerning the structure of large-scale cloud regimes.

TIROS I was operational for only 78 days, but proved that satellites could be a useful tool for surveying global weather conditions from space. It was followed by nine more test satellites launched between November 23, 1960 (TIROS II) and July 2, 1965 (TIROS X) to provide routine, daily weather observations. For more information on TIROS satellites, please consult the TIROS satellite index page developed by the Dept. of Meteorology, Florida State University. [1]

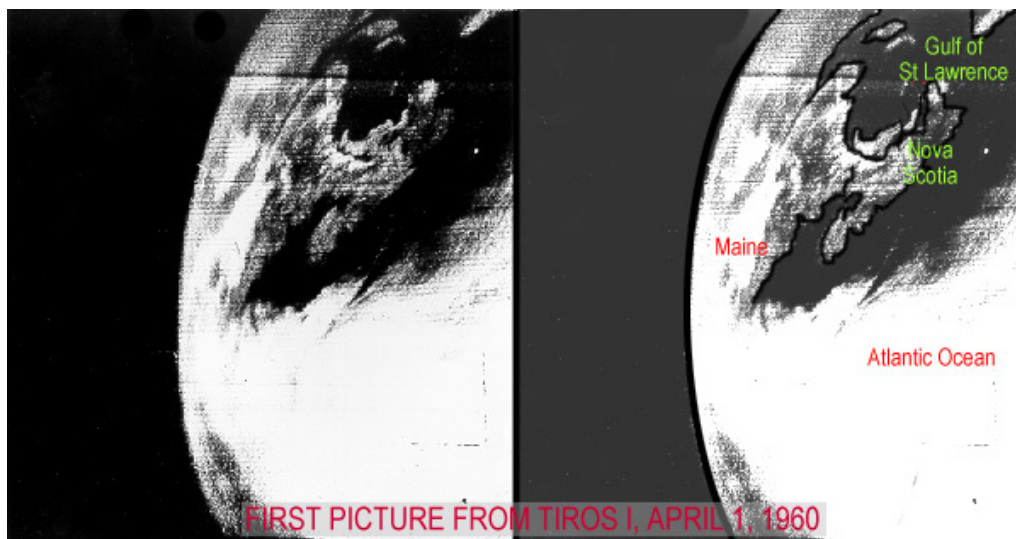


Photo: NOAA/SIS home page

First picture from Space - TIROS I satellite, April 1, 1960

“Since those first exciting days, satellite systems have become an intrinsic part of weather forecasting, oceanography, terrestrial mapping, and hazard detection. NESDIS and its ancestor organizations have processed, interpreted, and archived millions of satellite images that were acquired by those early systems and the thirty or so NOAA owned and operated satellites that have done so much to protect and warn the citizens of the United States.” [2]

To view the a pictorial history of TIROS and other NOAA satellites consult the NOAA in Space album of images at: <http://www.photolib.noaa.gov/space/index.html>

“Today, the nation's environmental satellites are operated by NOAA's National Environmental Satellite, Data, and Information Service in Suitland, MD. NOAA's environmental satellite system is composed of two types of satellites: geostationary operational environmental satellites for national, regional, short-range warning and now-casting; and polar-orbiting environmental satellites for global, long-term forecasting and environmental monitoring. Both GOES and POES are necessary for providing a complete

global weather monitoring system. Both also carry search and rescue instruments to relay signals from aviators and mariners in distress.”[3]



Photo: National Air and Space Museum, 7B31915

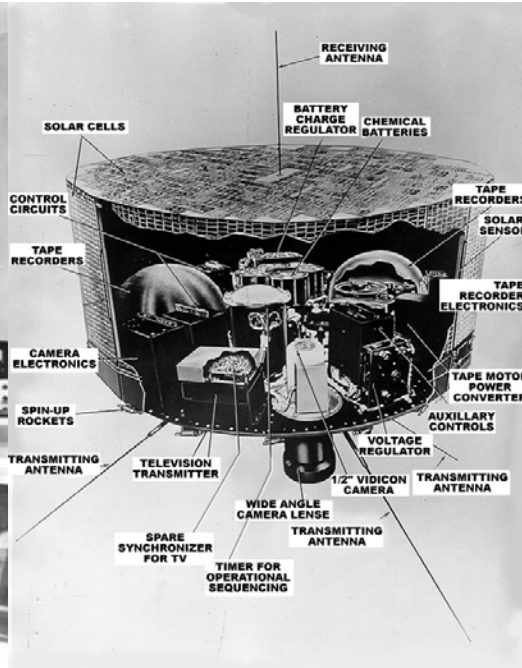


Photo: NOAA home page

TIROS I during preliminary test stage

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Abstract: Contains description of the instruments on the NOAA POES series from TIROS-N through NOAA-14, the level 1b data format that NOAA uses to distribute raw data to users, and derived data products including TOVS soundings, sea surface temperature (SST), mapped GAC, and radiation budget; it also describes the various products derived from NOAA POES data to monitor global vegetation growth and distribution.

Online access: <http://www2.ncdc.noaa.gov/docs/podug/> (Polar orbiter data user's guide. Updated November 1998 version); <http://www2.ncdc.noaa.gov/docs/gviug/> (Global vegetation index user's guide)

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Weather satellites : economies available by converging government meteorological satellites : report to Congressional committees and subcommittees. Washington, D.C. : U. S. General Accounting Office., [1987]

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World Ocean Circulation Experiment satellite data CD-ROM. World Ocean Circulation Experiment, Florida State University, NASA, Physical Oceanography DAAC. Southampton, U.K. : WOCE International Project Office, Data Information Unit ; Silver Spring, Md. : Available from the U.S. National Oceanographic Data Center, 1998-
GC228.5 .W45 1998 CD-ROM (disc 13)

World Weather Watch global observing system; satellite sub-system : information on meteorological and other environmental satellites. 2nd ed. Geneva, Switzerland : Secretariat of the World Meteorological Organization, 1989. WMO (Series) ; no. 411.
QC851 .W6445 no.411

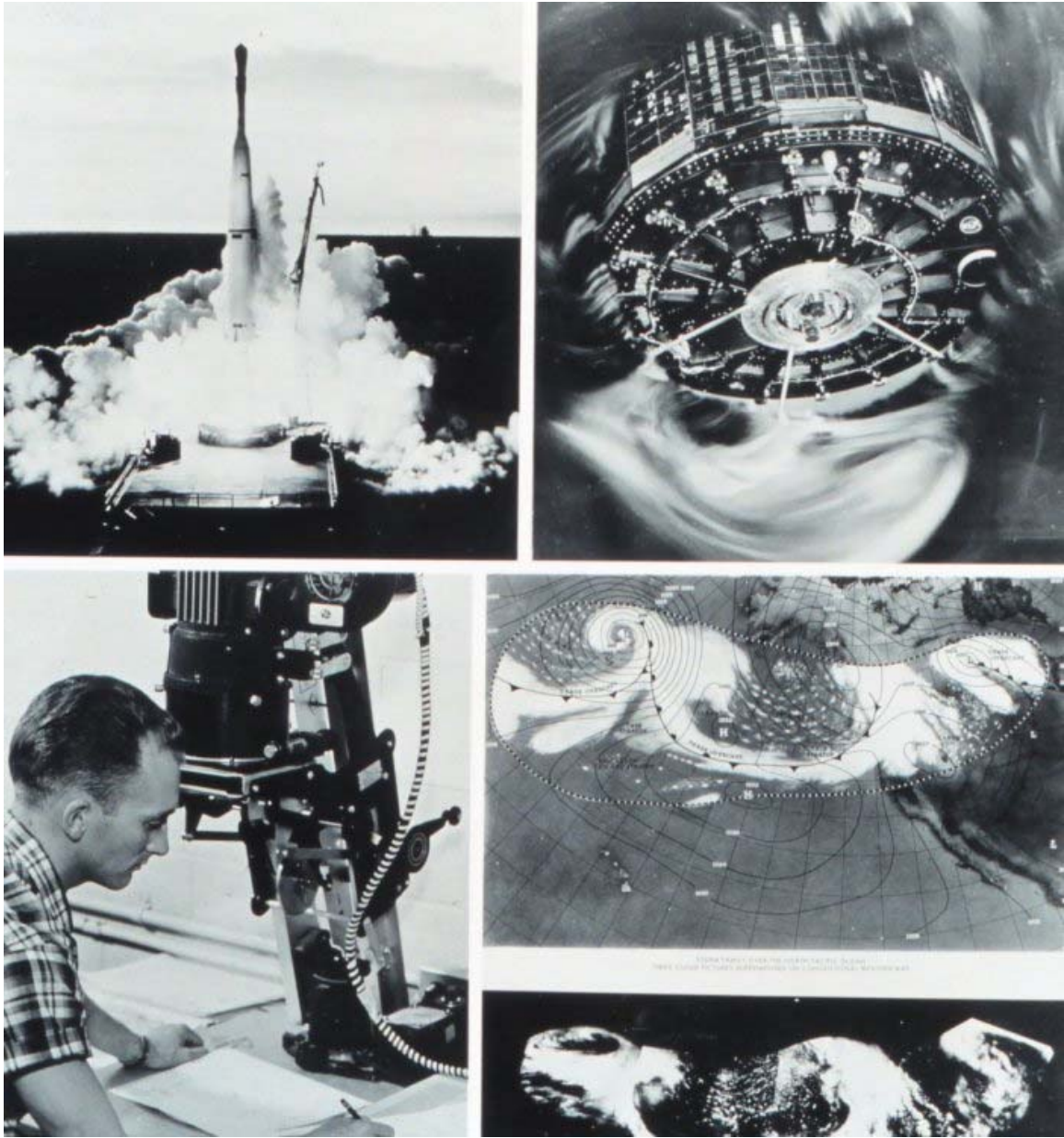


Photo: NOAA Photo Library

TIROS I images of North Pacific storm system on May 19-20, 1960. TIROS I launch on upper left; TIROS I satellite on upper right; processing images on lower left.

III. Internet Resources on TIROS, other Meteorological Satellites, and Satellite Meteorology

[The entries bellow are listed in alphabetical order by the website title. The URL addresses were viewed for their accuracy between August 2006 and January 2007]

The advanced very high resolution radiometer (AVHRR) : a brief reference guide / David A. Hastings. U.S. Dept. of Commerce, National Oceanic and Atmospheric Administration, National Geophysical Data Center. In: Journal Photogrammetric Engineering and Remote Sensing, v. 58, no. 8, August 1992, pp. 1183-1188.
http://www.ngdc.noaa.gov/seg/cdroms/AVHRR97_d1/avhrr2.htm

American Institute of Aeronautics and Astronautics home page. American Institute of Aeronautics and Astronautics, Inc., 2007 <http://www.aiaa.org/index.cfm>

Automatic Weather Stations Project and Antarctic Meteorological Research Center. Space Science and Engineering Center, University of Wisconsin-Madison, 2007?
<http://amrc.ssec.wisc.edu/index.html>

CIMSS real-time GOES page. CIMSS is the Cooperative Institute for Meteorological Satellite Studies formed through a Memorandum of Understanding between the [University of Wisconsin-Madison](#) (UW-Madison), the [National Oceanic and Atmospheric Administration](#) (NOAA) and the [National Aeronautics and Space Administration](#) (NASA). CIMSS scientists conduct research using passive remote sensing systems for meteorological and surface-based applications.
<http://cimss.ssec.wisc.edu/goes/realtime/realtime.html>

CIMSS GOES real-time derived products. Cooperative Institute for Meteorological Satellite Studies, 2007. This website contains various GOES derived product images (DPI) as well as composite displays made routinely at CIMSS, usually every hour, using current GOES multi-spectral sounding data. <http://cimss.ssec.wisc.edu/goes/rt/>

CIMSS tropical cyclones. Cooperative Institute for Meteorological Satellite Studies, 2007. <http://cimss.ssec.wisc.edu/tropic/tropic.html>

CIRA : Cooperative Institute for Research in the Atmosphere. Cooperative Institute for Research in the Atmosphere, Colorado State University. Fort Collins, CO, 2006.
<http://www.cira.colostate.edu/>

CIRS's AMSU website. Cooperative Institute for Research in the Atmosphere, Colorado State University. Fort Collins, CO, 2006. AMSU stands for Advanced Microwave Sounding Unit. It is derived from the Microwave Sounding Unit (MSU) which began service in 1978 on TIROS-N and continued on the NOAA 6 through 14 satellites.
<http://amsu.cira.colostate.edu/>

NASM space artifacts : civilian space applications : TIROS. Washington, D.C. : Smithsonian, National Air and Space Museum, Space History Division, 1999.
<http://www.nasm.si.edu/research/dsh/artifacts/CS-TIROS.htm>

COMET : Cooperative Program for Operational Meteorology, Education and Training. University Corporation for Atmospheric Research, National Center for Atmospheric Research. <http://www.comet.ucar.edu/>

Comprehensive Large Array-data Stewardship System (CLASS). Silver Spring, MD: NOAA, National Environmental Satellites, Data, and Information Service (NESDIS). The Comprehensive Large Array-data Stewardship System (CLASS) is an electronic library of NOAA environmental data. This web site provides capabilities for finding and obtaining those data. CLASS is NOAA's premiere on-line facility for the distribution of NOAA and US Department of Defense (DoD) Polar-orbiting Operational Environmental Satellite (POES) data, NOAA's Geostationary Operational Environmental Satellite (GOES) data, and derived data. <http://www.class.noaa.gov/nsaa/products/welcome>

Cooperative Institute for Meteorological Satellite Studies. University Wisconsin-Madison, Space Science and Engineering Center, 2006. <http://cimss.ssec.wisc.edu/>

Destination Earth : 40+ years of Earth Science : Television Infrared Observation Satellite (TIROS). National Aeronautics and Space Administration (NASA). Washington, D.C., 2004. <http://www.earth.nasa.gov/history/TIROS/TIROS.html>

Destination Earth : 40+ years of Earth Science : NOAA Program. National Aeronautics and Space Administration (NASA). Washington, D.C., 2004. <http://www.earth.nasa.gov/history/noaa/noaa.html>

EUMETSAT home. European Organisation for the Exploitation of Meteorological Satellites. In English and French.
<http://www.eumetsat.int/Home/Head/FAQ/index.htm?l=en> (English version)
<http://www.eumetsat.int/Home/index.htm?l=fr> (French version)

Earth Observing System Data Gateway. National Aeronautics and Space Administration (NASA). Washington, D.C., 2007. Science data products from NASA. <http://redhook.gsfc.nasa.gov/~imswww/pub/imswelcome/plain.html>

Global Climate Observing System (GCOS) home page. The Global Climate Observing System (GCOS) was established in 1992 to ensure that the observations and information needed to address climate-related issues are obtained and made available to all potential users. It is co-sponsored by the World Meteorological Organization ([WMO](#)), the Intergovernmental Oceanographic Commission ([IOC](#)) of UNESCO, the United Nations Environment Programme ([UNEP](#)) and the International Council for Science ([ICSU](#)).
<http://www.wmo.ch/web/gcos/gcoshome.html>

Goddard Library : Goddard's projects directory. NASA Goddard Space Flight Center, 2006. <http://library01.gsfc.nasa.gov/cgi-bin/gdprojs/searchform.pl>. [Search database on: "TIROS"]

GOES Project science. NASA, NOAA, 2007. <http://goes.gsfc.nasa.gov/>

GOES soundings : GOES sounder temperature and moisture products. U.S. Dept. Of Commerce, National Oceanic and Atmospheric Administration, National Environmental Satellite, Data, and Information Service. Silver Spring, MD, 2006. <http://www.orbit.nesdis.noaa.gov/smcd/opdb/goes/soundings/index.html>

GOES-East satellite products from the Global Hydrology and Climate Center. NASA, 2007. The GHCC obtains GOES East (GOES-12) real-time satellite data from a roof-top antenna. Data from both the Imager and Sounder instruments on-board the GOES satellite are ingested and are used to monitor developing weather conditions and to develop a number of useful products. The Imager provides high spatial resolution images (1 km visible and 4 km infrared) of the CONTinental United States (CONUS) up to 4 times an hour for 5 spectral channels. The Sounder provides 10 km resolution data of the CONUS once an hour for 19 spectral channels. <http://www.ghcc.msfc.nasa.gov/goesprod/>

Hurricanes. U.S. Dept. Of Commerce, National Oceanic and Atmospheric Administration. Silver Spring, MD, 2006. <http://hurricanes.noaa.gov/>

International Satellite Cloud Climatology Project (ISCCP) : catalog of data and products / compiled and edited by Katherine B. Kidwell and Daniel R. Poltar. Ashville, N.C. : National Oceanic and Atmospheric Administration (NOAA), National Environmental Satellites, Data, and Information Services (NESDIS), National Climatic Data Center (NCDC), 1998. (September 1998) Online access: <http://www2.ncdc.noaa.gov/docs/isccp/cover.htm>

Jonathan McDowell. **Jonathan's Space home page.** 2006. Jonathan McDowell, astrophysicist working at the [Harvard-Smithsonian Center for Astrophysics](http://www.harvard.edu/~smc). <http://www.planet4589.org/space/>

Landsat satellites. U. S. Dept. of Interior, U.S. Geological Survey, 2007. <http://landsat7.usgs.gov/>

Manual of synoptic satellite meteorology conceptual models and case studies. Version 6.0. Contributed by DHMZ, FMI, KNMI, ZAMG; supported by EUMETSAT. <http://www.zamg.ac.at/docu/Manual/>

MetEd : satellite meteorology. University Corporation for Atmospheric Research, National Center for Atmospheric Research. http://meted.ucar.edu/topics_satellite.php

Meteorological satellites. U.S. Centennial of Flight Commission. <http://www.centennialofflight.gov/essay/SPACEFLIGHT/metsats/SP35.htm>

Monitoring stratospheric ozone. Australian Government, Bureau of Meteorology, 2007. The Bureau monitors ozone so that it can have data for the initialization and verification of global modeling and analysis products, so that we can detect long term trends and in order to resolve questions about the dynamics of the stratosphere and the ozone layer. The Bureau's network is a part of the WMO's Global Atmosphere Watch.
<http://www.bom.gov.au/inside/oeb/atmoswatch/aboutozone.shtml>

NASA Earth Observatory home page. National Aeronautics and Space Administration. Washington, D.C., 2007? The purpose of NASA's Earth Observatory is to provide a freely-accessible publication on the Internet where the public can obtain new satellite imagery and scientific information about our home planet. The focus is on Earth's climate and environmental change. In particular, we hope our site is useful to public media and educators. Any and all materials published on the Earth Observatory are freely available for re-publication or re-use, except where copyright is indicated.
<http://earthobservatory.nasa.gov/>

NASA home page. National Aeronautics and Space Administration. Washington, D.C., 2007. <http://www.nasa.gov/>

NASA History Division home page. National Aeronautics and Space Administration. Washington, D.C., 2006. <http://history.nasa.gov/>

National Aeronautics and Space Agency photographs. The Dwight D. Eisenhower Presidential Library and Museum. Abilene, KS.
http://www.eisenhower.archives.gov/avwebsite/selectlistofphotographs/19531961/space/Space_Related_Photos.html

National Air and Space Museum home page. Smithsonian Institution. Washington, D.C., 2007. The Smithsonian Institution's National Air and Space Museum maintains the largest collection of historic air and spacecraft in the world. It is also a vital center for research into the history, science, and technology of aviation and space flight, as well as planetary science and terrestrial geology and geophysics.
<http://www.nasm.si.edu/museum/>

National Hurricane Center/Tropical Prediction Center home page. National Oceanic and Atmospheric Administration, National Weather Service, National Hurricane Center/Tropical Prediction Center. Miami, FL, 2007.
<http://www.nhc.noaa.gov/index.shtml>

NESDIS/StAR/CoRP/RAMMB comprehensive publications list. NOAA, National Environmental Satellites, Data, and Information Service (NESDIS). Silver Spring, MD, 2006. <http://rammb.cira.colostate.edu/resources/publications.asp>

NOAA CoastWatch. U.S. Dept. Of Commerce, National Oceanic and Atmospheric Administration, National Environmental Satellite, Data, and Information Service,

Satellite Services Division. Silver Spring, MD, 2006.

http://coastwatch.noaa.gov/cw_index.html

NOAA Data and Applications. Australian Government, Bureau of Meteorology, 2007.

<http://www.bom.gov.au/weather/satellite/paper1NOAA.shtml>

NOAA Photo Library : NOAA in space. Prepared by Albert E. Theberge Jr. Silver Spring, MD: NOAA Central Library.

<http://www.photolib.noaa.gov/space/index.html>

<http://www.photolib.noaa.gov/space/spind2.htm> (Catalog of images)

NOAA Satellite and Information Service : National Environmental Satellites, Data, and Information Service (NESDIS). U.S. Dept. Of Commerce, National Oceanic and Atmospheric Administration, National Environmental Satellite, Data, and Information Service. Silver Spring, MD, 2007. NESDIS home page provides timely access to global environmental data from satellites and other sources to promote, protect, and enhance the Nation's economy, security, environment, and quality of life.

<http://www.nesdis.noaa.gov/>

NOAAWatch : NOAA's all hazard monitor. Silver Spring, Md. : U.S. National Oceanic and Atmospheric Administration, 2006-present.

Web portal offering information about ongoing environmental events, and explains the role of NOAA in prediction, monitoring, and recovery from environmental hazards. It provides public access to current information on a number of environmental threats ranging from oil spills, to hurricanes and tsunamis, to space weather. NOAAWatch integrates NOAA data, products, observations, satellite images, and other information pertaining to environmental hazards. It pulls many of NOAA's Web offerings together so that web visitors can get all NOAA information related to a storm or event on one site.

<http://www.noaawatch.gov/>

NPOESS : National Polar-orbiting Operational Environmental Satellite System.

U.S. Dept. Of Commerce, National Oceanic and Atmospheric Administration, National Environmental Satellite, Data, and Information Service (NESDIS). Silver Spring, MD, 2007. NPOESS home page provides timely information and data from the NPOESS satellite system. The National Polar-orbiting Operational Environmental Satellite System (NPOESS) is a satellite system used to monitor global environmental conditions, and collect and disseminate data related to: weather, atmosphere, oceans, land and near-space environment. <http://www.ipo.noaa.gov/>

Other satellites. Australian Government, Bureau of Meteorology, 2007.

<http://www.bom.gov.au/weather/satellite/paper1Other.shtml>

PO.DAC home. NASA, Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, 1999-2007. <http://podaac.jpl.nasa.gov/>

Polar Orbiting Satellite Data Archive. Australian Government, Bureau of Meteorology, 2007. The Bureau of Meteorology receives polar orbiter data (i.e. data from satellites whose orbit cross the north and south poles) from two satellites, USA's NOAA satellite, and China's [FY-1D satellite](#).

http://www.bom.gov.au/sat/archive_new/orbsat.shtml

Polar-orbiting weather satellites. Developed by Don Hillger and Gary Toth, Colorado State University, 2001-2007. The home page serves as a checklists of polar-orbiting weather satellites, launch dates, and images of the satellites.

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Mockup of TIROS-1 on display at the [National Air and Space Museum](#)

Prepared by:
Anna Fiolek, Librarian
NOAA Central Library
Silver Spring, Maryland 20910
tel. 301-713-2607, ext. 147
e-mail: Anna.Fiolek@noaa.gov