WINDSAT

The Coriolis Mission

December 15 2002

Welcome

The launch of the Navy's Windsat radiometer on the Coriolis mission opens the door to a new future in metrological observations and forecasting in support of civil and military weather science. This also, is an important mission for the Space and Naval Warfare Systems Command and our Meteorological Systems Program Office. We are please to be teamed with the Air Force Space Test Program for the Coriolis mission placing Windsat into orbit in late 2002 and the 2006 mission launching the Indian Ocean Meteorological Observer.

Like the launch of the Navy's Geosat Follow-On from Vandenberg AFB in 1998, the Windsat radiometer will help meteorologists develop an understanding of our cyclic weather patterns on a global scale. With a revisit rate of eight days, scientists will be able to gather seasonal data globally while obtaining operational wind speed and direction in near real time over large areas of the earth's surface. Designed to measure wind speed and direction near the ocean's surface from an altitude of 830 kilometers, the sensor may also provide sea surface temperature, soil moisture, rain rates ice and snow characteristics, and water vapor data – data of use to both meteorologists and climatologists.

Built by the Naval Research Lab, the instrument with its large 1.9 meter reflector will help Meteorologists to explore the science and enhance our understanding of space-based polarimetric radiometry. The Windsat payload provides the National Polar-orbiting Operational Environmental Satellite System Integrated Program Office a concept demonstration and risk reduction that they will use in the development of the Conical Microwave Imager Sounder.

Windsat will support a broad range of Naval missions including ship movement and positioning, aircraft carrier operations, aircraft deployment, effective weapons use, underway replenishment, and littoral operations. Windsat will also aid with forecasting short-term weather phenomenon for issuing timely weather warnings, and gathering general climate data.

The U.S. Navy absolutely depends on time - critical meteorological information in support of the warfighter deployed Forward and engaging forces with Sea Power - 21. Our team members are actively working to bring timely and historical meteorological and oceanographic data to our military and civilian users that will enhance the quality of our lives, improve safety, and assist our government in the development of commerce and trade.

Robert Louis Clark, CAPT USN
Program Manager, Navy Meteorological Programs
SPAWAR PMW-155, San Diego CA

The launch of the Coriolis mission marks several important milestones for Air Force and Navy space programs – including joint missions and operations and teaming on future space programs. In the post Space Commission era, this launch will provide Air Force and Navy space systems professionals with opportunities to build the new relationships that will be vital to our future mission success.

While the Air Force and Navy have worked together on space launch and satellite programs in the past, the Coriolis mission brings together a diverse team of government and industry partners dedicated to a successful meteorological support mission. The Air Force Space and Missile Systems Center operates a Detachment in Albuquerque New Mexico whose mission is to fly experimental test payloads. We use a variety of launch vehicles in support of these missions. For Coriolis, we are using a refurbished Titan II ICBM for the lift to orbit. Our spacecraft is a commercial off the shelf bus supplied by Spectrum Astro of Gilbert, Arizona. Spectrum Astro is also the integrator of the payloads and the launch vehicle.

With about three quarters of the Earth's surface covered with water, the U.S. Navy is a heavy user of space systems. From communications to weather, the Navy requires accurate and reliable systems to provide time critical information to the forward deployed warfighter. We are happy to be carrying the Navy's Windsat radiometer aboard the Coriolis mission. Built by the Naval Research Laboratory and managed by the Space and Naval Warfare Systems Command, the Windsat radiometer provides risk reduction opportunities for next generation polar orbiting weather satellites through both the technology demonstration and operation of the payload.

In addition, the Air Force Research Laboratory has provided a new tool for the prediction of space weather – a Solar Mass Ejection Imager. This tool is designed to improve our ability to observe the sun's magnetic and particle storms earlier than we can today. Early warning of these coronal mass ejections will enable communications and power transmission companies to take precautions well before the storm reaches its peak. For warfighters, early warning can help us prepare for communications outages and protect our troops in the field through mitigation efforts.

The Space Test Program is pleased to be the provider of both the lift to orbit and the spacecraft that serves as a home for both payloads during the scheduled three-year mission. We look forward to many future Joint operations with the Navy and SPAWAR.

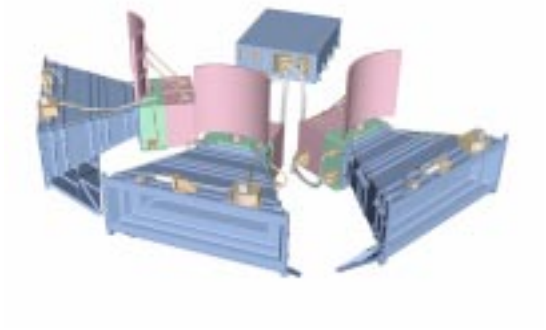
Richard W. White Jr., Col, USAF
Director, DoD Space Test Program
SMC Det 12, Kirtland AFB, NM

Coriolis / Windsat / SMEI Mission Snapshot

The Air Force Coriolis mission will fly the Navy Windsat microwave polarimetric radiometer and Air Force Solar Mass Ejection Imager in a low Earth, sun synchronous orbit. The Windsat radiometer will provide important meteorological information on wind speed and direction at or near the surface of the ocean and the Solar Mass Ejection Imager will provide valuable early warning of coronal mass ejections that affect communications and power distribution systems here on earth.

The Coriolis mission is being assembled and launched by the Air Force Space and Missile Systems Center's Detachment 12 Space Test Program Office at Kirtland Air Force Base in Albuquerque, New Mexico using a refurbished Lockheed Martin Titan II booster and a Spectrum Astro spacecraft bus. Spectrum Astro is integrating the spacecraft bus and payloads with the Titan II for launch from Vandenberg Air Force Base in California.

Coriolis mission operations will be conducted by Detachment 12's, Vehicle Operations Directorate, Research, Development, Test & Evaluation Support Complex at Kirtland Air Force Base. After the first year, the Naval Satellite Operations Center at Point Mugu will conduct joint flight operations with Blossom Point for the remainder of the mission.



The Navy's Space and Naval Warfare Systems Command is providing the Naval Research Lab built Windsat polarimetric microwave radiometer. This radiometer is an important step in reducing risks associated with the National Polar-orbiting Operational Environmental Satellite System by proving the concept of using a space-based radiometer for measuring ocean surface wind speed and direction. Windsat will demonstrate the viability of using polarimetry to measure the wind vector from space and provide operationally usable tactical information to Navy units. The payload provides risk reduction data that the NPOESS Integrated Program Office (NOAA / NASA / Air Force / Navy) will use in the development of the Conical Microwave Imager Sounder (CMIS). Windsat is the primary payload on the Coriolis mission and is funded by the Navy and NPOESS IPO.

The Air Force Research Lab at Hanscom AFB, Mass., is providing the Solar Mass Ejection Imager that will improve space weather forecasts by monitoring and warning of impending geomagnetic storms solar plasma and magnetic fields. A geomagnetic storm can cause a wide variety of damaging effects to military and civilian spacecraft, ground-based communications and power distribution systems, degraded satellite communication and surveillance systems, increased drag and deterioration of satellite altitude control. Coronal Mass Ejections, known as CMEs, consist of solar plasma and embedded magnetic fields traveling at speeds of up to 1,000 km/second (2,236,936 miles/hour). Advanced warning of such storms would permit initiation of preventive measures to mitigate these effects. At present, prediction of even moderate geomagnetic storms is difficult. SMEI should provide advanced warning of one to three days of impending geomagnetic storms by tracking CMEs from the Sun to near-Earth space.

SMEI's all-sky images will also greatly aid astronomers and astrophysicists in understanding solar processes and detecting astronomical phenomena. SMEI will be able to observe near-earth objects and extra-solar planetary transits.

Vandenberg Air Force Base is headquarters for the 30th Space Wing. The 30th is home to the Western Range and manages Department of Defense space and missile testing, and placing satellites into near-polar orbit from the West Coast, using expendable boosters (Delta II, Atlas, Titan II and Titan IVB.) Wing personnel also support the service's Minuteman III and Peacekeeper Intercontinental Ballistic Missile Follow-on Operational Test and Evaluation Launch program. The Western Range begins at the coastal boundaries of Vandenberg and extends westward from the California coast to the western Pacific including sites in Hawaii.

The launch window is 15 minutes. Should the launch not occur Sunday morning, an additional launch attempt is scheduled 24-hours later (Monday morning). Spacecraft separation is scheduled to occur almost one hour after liftoff. The initial orbit is scheduled to be 827 kilometers by 278 kilometers with a 98.7 degree inclination.

Titan II Space Launch Vehicle Profile

The Titan II space launch vehicle is a modified Titan II Intercontinental Ballistic Missile that can lift approximately 4,200 pounds into low-Earth polar orbit. The rocket consists of two liquid-propellant stages, a payload adapter and payload fairing. The Air Force and Lockheed Martin have successfully launched 11 Titan II Space Launch Vehicles from Vandenberg Air Force Base, Calif.

Lockheed Martin built more than 140 Titan ICBMs, once the vanguard of America's nuclear deterrent force, for the Air Force. Ten manned and two unmanned Titan IIs also were flown as space launch vehicles in NASA's Gemini program in the mid-1960s. Deactivation of the Titan II ICBM system began in July 1982. The last missile was taken from its silo at Little Rock Air Force Base, Ark., June 23, 1987. Deactivated missiles are in storage at Davis-Monthan Air Force Base in Tucson, Ariz.

Lockheed Martin Space Systems Company's Astronautics Operations has modified 14 Air Force Titan II ICBMs under contract to the Air Force Space & Missile Systems Center for use as space launch vehicles. This includes modifying the forward structure of the second stage to accommodate a 10-foot diameter payload fairing with variable lengths; manufacturing the new fairings plus payload adapters; refurbishing the Titans' liquid rocket engines; upgrading the inertial guidance systems; developing command, destruct and telemetry systems; performing payload integration; and modifying Space Launch Complex 4W at Vandenberg Air Force Base, Calif., to conduct the launches.

FIRST STAGE
Length: 70 feet
Diameter: 10 feet
Engine Thrust: 474,000 pounds (vacuum)
ISP: 296 sec (vacuum)

SECOND STAGE
Length: 40 feet
Diameter: 10 feet
Engine Thrust: 100,000 pounds (vacuum)
ISP: 316 sec (vacuum)

LIQUID ROCKET ENGINES
Refurbished Titan II ICBM engines
Propellant: Nitrogen Tetroxide & Aerozine 50
Subcontractor: Aerojet

PAYLOAD FAIRING
Diameter: 10 feet
Lengths: 20 to 30 feet
Aluminum skin-stringer tri-sector design
Subcontractor: Boeing

GUIDANCE and NAVIGATION
Inertial Guidance System Consisting of Inertial Measurement Unit and Missile Guidance Computer
Subcontractor: Ensco

TITAN II SPACE LAUNCH VEHICLE FLIGHTS
Sept. 5, 1988 – Titan IIG-1 / SLC-4W / First Titan II SLV / Classified Payload
Sept. 5, 1989 – Titan IIG-2 / Classified Payload
April 25, 1992 – Titan IIG-3 / Classified Payload
Oct. 5, 1993 – Titan IIG-5 / NOAA LandSat 6
Jan. 25, 1994 – Titan IIG-11 / Deep Space Program Science Experiment 1 for the Missile Defense Agency. Clementine was the first U.S. moon mission in more than two decades.
April 4, 1997 – Titan IIG-6 / Defense Meteorological Satellite Program S-14 satellite
May 13, 1998 – Titan IIG-12 / Advanced TIROS-NPOES Meteorological Satellite (NOAA-K) National Aeronautics and Space Administration National Oceanic and Atmospheric Administration.
June 19, 1999 – Titan IIG-7 / QuikSCAT Scatterometer for NASA's Jet Propulsion Lab. (NASA/ Ball Aerospace & Technologies Corp. Ocean Winds monitoring spacecraft).
Dec. 12, 1999 – Titan IIG-8 / Defense Meteorological Satellite Program 15
Sept. 21, 2000 – Titan IIG-13 / Advanced TIROS-NPOES (NOAA-L) satellite.
June 24, 2002 - Titan IIG-14/ Advanced TIROS-NPOES (NOAA-M) satellite.

The Air Force Space and Missile Systems Center (Air Force Space Command) is the center of technical excellence for researching, developing and purchasing military space systems. SMC is also responsible for on-orbit check-out, testing, sustainment and maintenance of military satellite constellations and other Department of Defense space systems.

The Air Force Space and Missile Systems Center's Detachment 12 was established July 1, 1992 as the Space Test and Experimentation Program Office. Detachment 12's mission is to serve as the primary provider of launch capability, spaceflight, and on-orbit operations for the entire Defense Department space research, development, test, and evaluation community. Detachment 12 is located at Kirtland Air Force Base in Albuquerque, New Mexico.

Detachment 12's Space Test Program was chartered in 1965 by the Secretary of Defense to provide space flight for advanced Defense Department research and development experiments not able to fund their own flights. The Space Test Program has flown nearly 400 experiments, using Small Class Spacecraft, Medium Class Spacecraft, the Space Shuttle, and Piggyback on other spacecraft.

LOCKHEED MARTIN

Lockheed Martin Astronautics Operations is one of the operating elements of Lockheed Martin's Space Systems Company. Astronautics Operations designs, develops, tests, and manufactures a variety of advanced technology systems for space and defense. Chief products include planetary spacecraft and other space systems, space launch systems and ground systems.

SPECTRUMASTRO

Founded in 1988 as a single-employee research and development company, Spectrum Astro today provides a variety of space-technology products and services ranging from space electronics manufacturing to the leadership of best-in-class, multi-company teams in the design, integration, test, and on-orbit support of large, complex space systems.

Vandenberg Air Force Base is headquarters for the 30th Space Wing. The 30th is home to the Western Range and manages Department of Defense space and missile testing, and placing satellites into near-polar orbit from the West Coast, using expendable boosters (Delta II, Atlas, Titan II and Titan IV.) Wing personnel also support the Service's Minuteman III and Peacekeeper Intercontinental Ballistic Missile Follow-on Operational Test and Evaluation Launch program. The Western Range begins at the coastal boundaries of Vandenberg and extends westward from the California coast to the western Pacific including sites in Hawaii.

The Space and Naval Warfare Systems Command (SPAWAR) is one of the Department of the Navy's three major acquisition commands. Its mission is to enable knowledge superiority for the warfighter through the development, acquisition and life cycle support of effective, capable and integrated C4ISR (Command, Control, Communications, Computers Intelligence, Surveillance and Reconnaissance), IT (Information Technology), and Space Systems. We strive to deliver these systems as an integrated end-to-end operational capability for the fleet.

SPAWAR provides C4ISR, IT, and space infrastructure, applications and sensor system capabilities that are critical to the national interest. The demand for these capabilities is growing exponentially. SPAWAR supplies the Fleet and our other customers with integrated, adaptable and scalable systems that have high reliability and low maintenance requirements. More than ever, SPAWAR relies on Fleet customers to project their needs and provide input on ways to shape emerging technologies for future use.

www.spawar.navy.mil