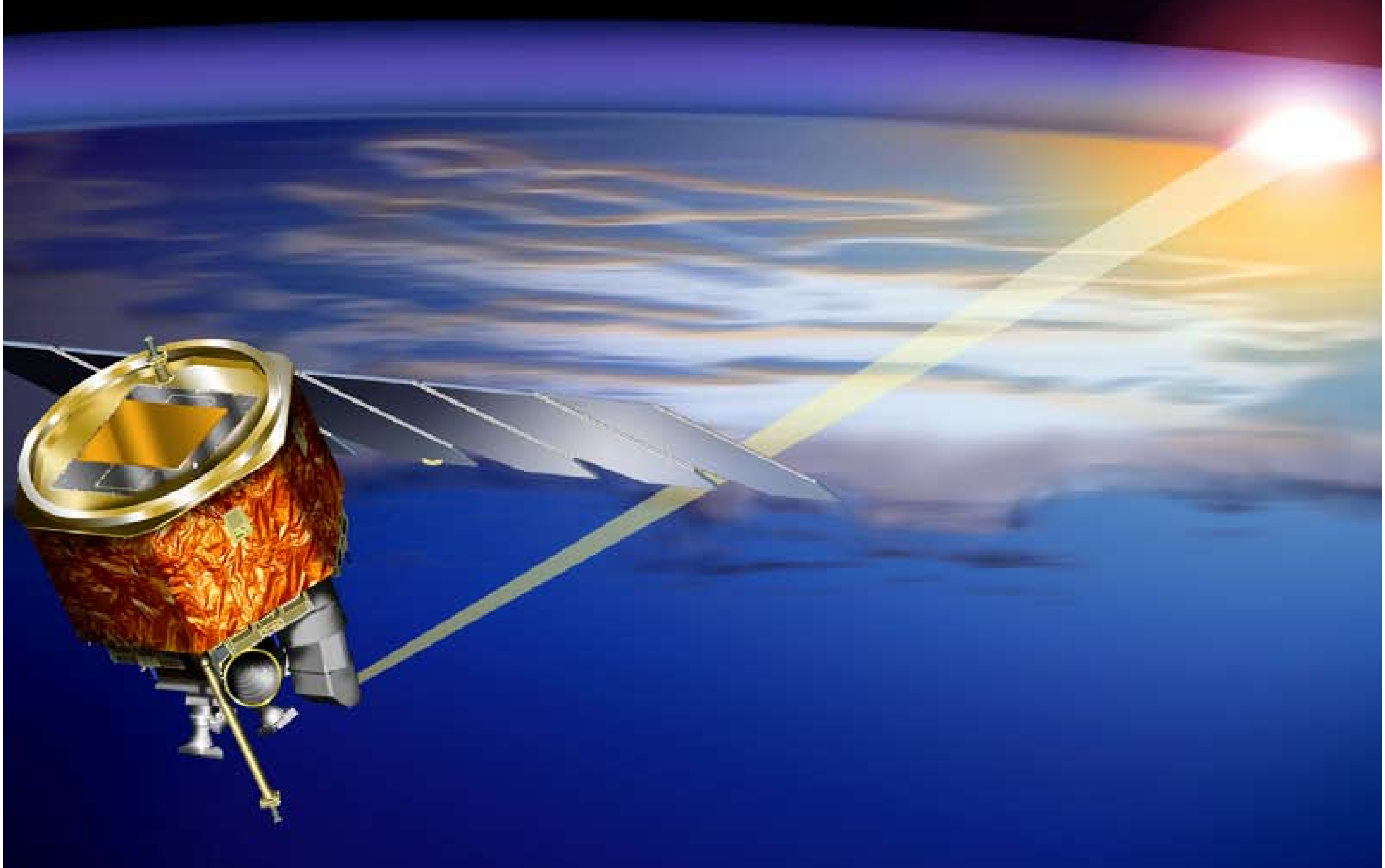
National Aeronautics and Space Administration



AIM press kit

www.nasa.gov

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AIM Launch Time: AIM is scheduled to launch at 4:26:49 p.m. EDT (1:26:49 p.m. PDT) on April 25, 2007. The Stargazer aircraft that will carry the Pegasus rocket will take off at 3:25 p.m. EDT (12:25 p.m. PDT) from Vandenberg Airfield at Vandenberg Air Force Base, Calif.

NASA News Center/AIM Status Reports

The NASA AIM News Center at Vandenberg Air Force Base KSC will open on L-2 days and reached at 805-605-3051. Recorded status reports will be available beginning on L-5 days which may be dialed at 805-734-2693.

Launch Media Credentials for Vandenberg Air Force Base

Accreditation requests to cover the prelaunch press conference and the launch of AIM may be made through the 30th Space Wing Public Affairs Office at 805-606-3595.

NASA Television Information

The prelaunch press conference and mission science briefing will begin at 1 p.m. PDT (4 p.m. EDT) on April 24. Launch coverage will begin at noon PDT (3 p.m. EDT) on April 25.

In the continental United States, NASA Television is carried by an MPEG-2 digital C-band signal on AMC-6, at 72 degrees west longitude, Transponder 17C, 4040 MHz, vertical polarization. In Alaska and Hawaii programming is on an MPEG-2 digital C-band signal accessed via satellite AMC-7, transponder 18C, 137 degrees west longitude, 4060 MHz, vertical polarization.

A Digital Video Broadcast compliant Integrated Receiver Decoder is required for reception. Analog NASA TV is no longer available.

NASA TV audio of AIM events will be available on the “V” circuits that may be reached by dialing: 321-867-1220, -1240, -1260, - 7135.

For NASA TV information and schedules, visit: http://www.nasa.gov/ntv

Internet Information

More information on NASA’s AIM mission, including an electronic copy of this press kit, press releases, fact sheets, status reports, animations, and photos can be found at:
http://www.nasa.gov/AIM

Pre-launch L-14 Media Briefing: held by Telecon on April 11.

Pre-launch L-1 Media Briefing: A prelaunch press conference and mission briefing, to be carried live on NASA Television, will begin at 1 p.m. PDT (4 p.m. EDT) on April 24 in the conference room of the NASA-KSC Resident Office at Vandenberg Air Force Base.

Participating in the prelaunch press conference will be:

- Vicki Elsbernd, AIM Program Executive, NASA Headquarters, Washington
- Omar Baez, NASA Launch Director/NASA Launch Manager, Kennedy Space Center, Fla.
- Bryan Baldwin, Pegasus Launch Vehicle Program Director, Orbital Sciences Corporation, McClean, Va.
- Mike McGrath, AIM Project Manager, Laboratory for Atmospheric and Space Physics, University of Colorado-Boulder, Co.
- Captain Damon Vorhees, Launch Weather Officer, U.S. Air Force 30th Weather Squadron, Vandenberg Air Force Base, Calif.

Mission Science Briefing: will immediately follow the L-1 Pre-Launch briefing. Panelists may include:

- Mary Mellott, AIM Program Scientist, NASA Headquarters, Washington
- James Russell III, AIM Principal Investigator, Hampton University, Hampton, Va
- Scott Bailey, AIM Deputy Principal Investigator, Virginia Tech, Blacksburg, Va.

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Headquarters, Washington
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April 11, 2007

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RELEASE: 07-084

NASA AIMS TO CLEAR UP MYSTERY OF ELUSIVE CLOUDS AT EDGE OF SPACE

WASHINGTON - NASA is preparing to launch the Aeronomy of Ice in the Mesosphere (AIM) spacecraft, the first mission dedicated to exploration of mysterious ice clouds that dot the edge of space in Earth's polar regions. These clouds have grown brighter and more prevalent in recent years and some scientists suggest that changes in these clouds may be the result of climate change.

The first opportunity for launch is on Wednesday, April 25 from Vandenberg Air Force Base, Calif., aboard a Pegasus launch vehicle.

AIM will conduct the first detailed probe of this unusual phenomenon typically observed approximately 50 miles above the Earth's surface in the mesosphere. The mesosphere is the region just above the stratosphere. Researchers know very little about how these polar mesospheric clouds form, why they are being seen at lower latitudes than ever before or why they have recently grown brighter and more frequent.

"These clouds are indicators of conditions in the upper reaches of the Earth's atmosphere, and are an important link in the chain of processes that result in the deposition of solar energy into Earth's atmosphere," said Mary Mellott, AIM program scientist, NASA Headquarters, Washington. "AIM will provide an understanding of how and why these clouds form, an important contribution toward the NASA goals of understanding the fundamental physical processes of our space environment and how the habitability of planets is affected by the interaction of planetary magnetic fields and atmospheres with solar variability."

The clouds are noctilucent, meaning they can be seen from the ground only at night, when they are illuminated by sunlight no longer visible from the Earth's surface. The brightest of these clouds are now known to be primarily composed of water ice. Their seasonal lifecycle is controlled by complex interactions between temperature, water vapor, solar activity, atmospheric chemistry and small particles on which the cloud crystals form. Human-induced factors such as carbon dioxide cause a warming in the lower atmosphere but a cooling in the mesosphere.

The clouds form in the coldest part of the Earth's atmosphere at the summer season in the polar regions. In the northern hemisphere they begin appearing in mid-May and last through mid-August, in the southern hemisphere beginning mid-November and lasting through mid-March.

“The occurrence of these clouds at the edge of space and what causes them to vary is not understood,” said AIM principal investigator James Russell III, Hampton University, Hampton, Va. “One theory is that the cloud particles grow on ‘seeds’ of meteoric dust or dust lofted up from below. AIM will provide the comprehensive data needed to test current theories for cloud formation or develop new ones, and allow researchers to build tools to predict how they will change in the future.”

AIM will be comprised of three instruments: the Solar Occultation for Ice Experiment; the Cloud Imaging and Particle Size Experiment; and the Cosmic Dust Experiment. The satellite will simultaneously measure air pressure and temperature, moisture content and cloud dimensions, providing data needed to determine the role of polar mesospheric clouds as an important indicator of the planet’s changing climate.

The clouds appear to be a relatively recent phenomenon, first reported in the late 19th century shortly after the volcanic eruption on the Indonesian island of Krakatoa. The first daytime observations of the clouds were made by satellite in 1969. Regular space-based observations began in 1982 with NASA’s Solar Mesosphere Explorer using instruments primarily designed for other purposes.

“This Small Explorer mission is a good example of the huge science returns we can get for a relatively small cost investment,” said Vicki Elsbernd, program executive for the AIM mission, NASA Headquarters.

For more information about NASA and the AIM mission, visit:

http://www.nasa.gov/aim

-end-

AIM Quick Facts

NASA's Aeronomy of Ice in the Mesosphere is led by Hampton University, Hampton, Va. AIM is a two-year mission to study Polar Mesospheric Clouds (PMC's), the highest clouds in our atmosphere that form an icy layer 50 miles above the Earth's surface at the edge of space.

Launch Date/Time: April 25 at 4:26:49 p.m. EDT (1:26:49 p.m. PDT)
Launch Window: 4:23:34 p.m. - 4:30:03 p.m. EDT, 1:23:34 p.m. - 1:30:03 p.m. PDT
For a 24-hour launch slip the, launch time/launch window remains the same.

Aircraft/Take-off time: April 25 at 3:38:49 p.m. EDT (12:28:49 p.m. PDT)
Take-off Window: 3:25:34 p.m. – 3:32:03 p.m. EDT, 12:25:34 p.m. – 12:32:03 p.m. PDT

Launch sequence of events

Launch + 5 seconds	Stage 1 ignition
Launch + 1:32 minutes	Stage 2 ignition
Launch + 2:07 minutes	Fairing separation
Launch + 7:04 minutes	Stage 3 ignition
Launch + 10:11 minutes	Payload separation; automatic sequence started to acquire TDRS communication, stabilize spacecraft, deploy solar array
Launch + 76 minutes	First ground station contact, Svalbard Norway
Launch + 85 minutes	Spacecraft declared to be nominal

Mass of Instruments	64Kg
Mass of Spacecraft and Instruments	197 Kg
Average Power Consumption of Spacecraft	216 Watts
Communication Subsystem	S band
• Command Uplink Rate at	2 kbs
• Two Down Link Rates	8 Kbs TDRSS low rate; 2Mbs normal operations
Command Data & Handling Subsystem	
• Radiation Hardened RAD 6K Processor Running at	16.5 Mhz
Attitude Control Subsystem	3 Axis Stabilized
Propulsion Fuel	No Propulsion on S/C

Science Instruments

- **Solar Occultation For Ice Experiment (SOFIE):** built by Space Dynamics Laboratory (SDL) at Utah State University
- **Cloud Imaging and Particle Size (CIPS):** built by the Laboratory for Atmospheric and Space Physics (LASP) at the University of Colorado-Boulder
- **Cosmic Dust Experiment (CDE):** built by the Laboratory for Atmospheric and Space Physics (LASP) at the University of Colorado-Boulder

Science Data Volume: ~1.3 Gbits per day; 50 hours worth of storage in PMC season

Orbit Configurations: near circular sun-synchronous orbit; orbit inclination of 97.772°± 0.25°; orbit altitude of 600km

Spacecraft Bus: LEOStar-2; Orbital Sciences Corporation, Dulles, Va.

Launch Vehicle: Pegasus XL, Orbital Sciences Corporation, Dulles, Va.

- **Mission Specific Items:**
  - » SoftRide Isolation system
  - » 38" separation system
  - » Clampband radial retraction system
  - » Two 42-pin electrical connectors
  - » Thermal paint applied to forward ring and brackets
  - » Quick-disconnect GN2 battery cooling and instrument purge
  - » Standard fairing access door for payload
  - » Connector covers for payload side of separation system

Aircraft: Stargazer L-1011; Orbital Sciences Corporation, Dulles, Va.

In-orbit Check-out period: approximately 30 Days

Mission Lifetime: 2 years

Mission Operations Center: Laboratory for Atmospheric and Space Physics (LASP) at the University of Colorado-Boulder

Project Data Center: Department of Atmospheric and Planetary Sciences at Hampton University

Mission Management: AIM is a NASA mission managed by the Explorers Program Office at NASA's Goddard Space Flight Center, Greenbelt, Md. The Principal Investigator is Dr. James M. Russell of the Center for Atmospheric Sciences at Hampton University, Hampton, Va.

Cost: approximately $140M including the launch vehicle

Related Web sites:
http://www.nasa.gov/aim
http://aim.hamptonu.edu/
http://www.orbital.com
http://lasp.colorado.edu/
http://www.gats-inc.com

AIM Launch Day Events

Unlike other rocket launches, the Pegasus XL launch vehicle is carried aloft by an L-1011 carrier aircraft and released from the plane's underbelly at a designated "drop" point and time. For Pegasus launches, launch time is considered the "drop" time, or the time when the Pegasus is released from the aircraft.

Several key countdown events will occur during the launch countdown.

Approximately two hours before takeoff of the L-1011 carrier aircraft and its payload, the ground communications and power are disconnected between the aircraft and the "hot pad" portion of the runway.

About half an hour later, if tower clearance has been granted, the L-1011 rolls to the end of the runway and the chase planes are notified.

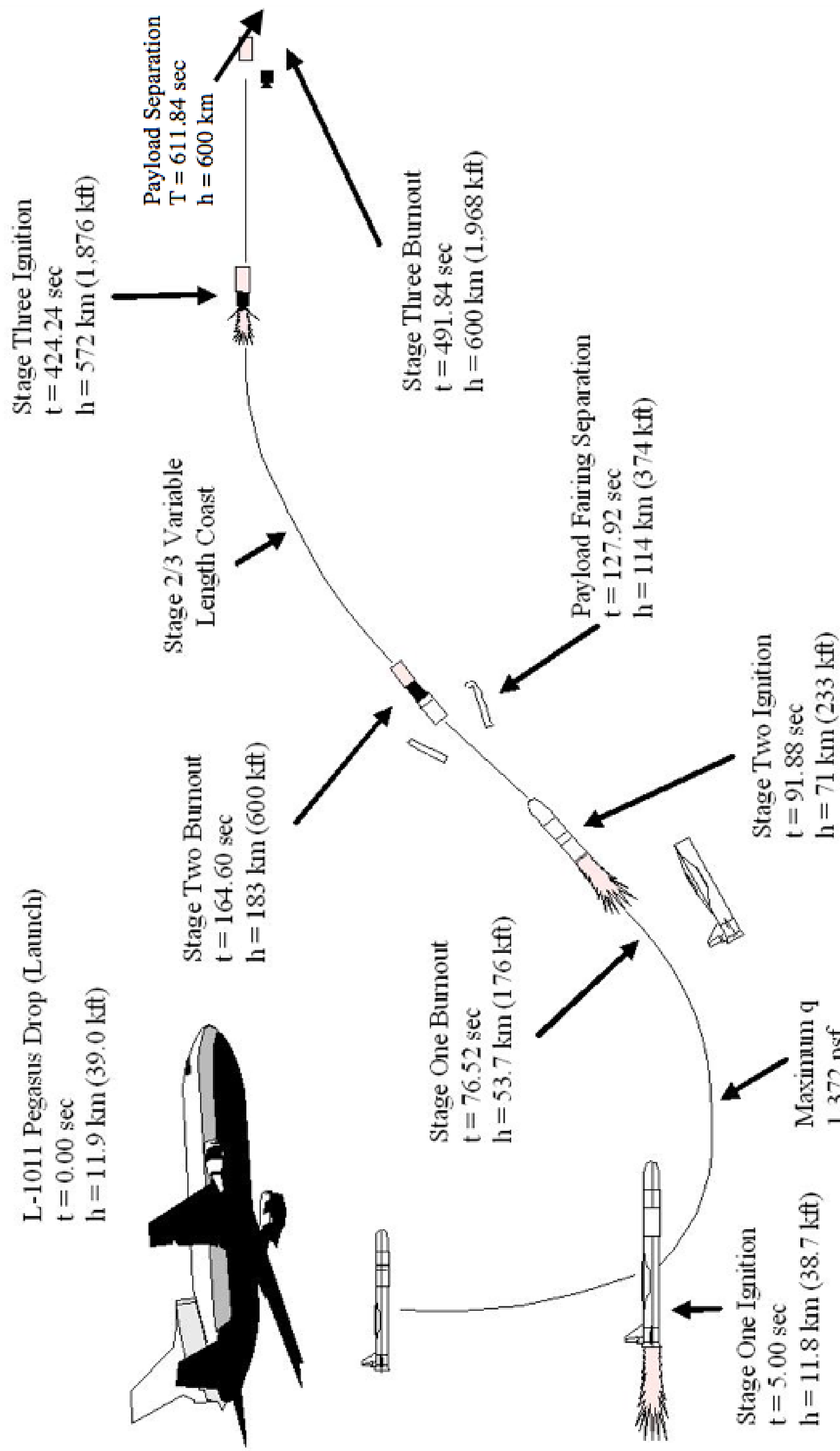
At L-1:03 hours, the Ground Launch Team is polled to determine if the L-1011 is ready for takeoff. If all team members report a "go," the aircraft takes off minutes later.

Thirty-six minutes before the drop, the carrier aircraft begins a turn, flying under the drop point. About ten minutes later, the L-1011 pilot reports any turbulence, winds or clouds.

The final weather briefing takes place about eight minutes before the drop. Three minutes later, the launch team is polled to determine final launch readiness. The terminal count begins one minute later, at L-4 minutes.

In the final 90 seconds before Pegasus performs the drop, the pilot acquires the necessary launch heading and the Pegasus' fin battery is activated at L-45 seconds.

Ten seconds before the drop, the launch conductor gives the official "go" for launch. When the clock ticks down to T-0, the Pegasus is released from the L-1011 aircraft.


L-1011 Pegasus Drop (Launch)
t = 0.00 sec
h = 11.9 km (39.0 kft)
Stage One Ignition
t = 5.00 sec
h = 11.8 km (38.7 kft)
Maximum q
1,372 psf
Stage One Burnout
t = 76.52 sec
h = 53.7 km (176 kft)
Stage Two Ignition
t = 91.88 sec
h = 71 km (233 kft)
Stage Two Burnout
t = 164.60 sec
h = 183 km (600 kft)
Payload Fairing Separation
t = 127.92 sec
h = 114 km (374 kft)
Stage 2/3 Variable
Length Coast
Stage Three Ignition
t = 424.24 sec
h = 572 km (1,876 kft)
Stage Three Burnout
t = 491.84 sec
h = 600 km (1,968 kft)
Payload Separation
T = 611.84 sec
h = 600 km

National Aeronautics and Space Administration

NASAfacts

AIM For The Clouds

AIM is a two-year mission to study Polar Mesospheric Clouds (PMCs), the Earth's highest clouds, which form an icy membrane 50 miles (80.4 km) above the surface at the edge of space.

These clouds, which are visible from the ground with the naked eye, form in the late spring and summer at high latitudes and have been seen for over a century, reflecting the Sun's light in the twilight sky. While one and the same phenomenon, they are called Noctilucent Clouds (NLCs) when observed from the ground at twilight and PMCs when viewed from space platforms with instruments that can sense their presence at any time of the night or day. Previous satellites have inferred the presence of PMCs but were not designed to determine their properties.

The PMCs, believed to be made of frozen ice crystals, form in the summer polar region in the coldest place in the atmosphere 50 miles (80.4 km) above the Earth's surface. Noctilucent Clouds were first observed in 1885 by an amateur astronomer and have been becoming brighter, more frequent and appear to be moving to lower latitudes in recent years.

The primary goal of the AIM mission is to explain why PMCs form in the first place and what is causing the mysterious changes in their behavior.

The AIM satellite carries three state-of-the-art instruments: Cloud Imaging and Particle Size (CIPS), Solar Occultation For Ice Experiment (SOFIE) and the Cosmic Dust Experiment (CDE). Each will take precise measurements of NLCs and related parameters in the Earth's upper atmosphere.

CIPS has four cameras positioned at different angles, allowing scientists a 2-D look at the clouds as the satellite passes and looks back at them. Multiple views of the clouds from different angles allow a determination of the sizes of the ice particles that make up the cloud. The cameras will provide panoramic PMC images of the polar cap daily.

SOFIE will use solar occultation to measure cloud particles, temperature and atmospheric gases involved in forming the clouds. The instrument observes chemicals that are involved in PMC formation. It will provide the most accurate and comprehensive simultaneous look to date of ice particles and chemicals within the clouds as well as of the environment in which the clouds form.

CDE records the amount of space dust that enters the atmosphere from the cosmos. It will allow scientists to determine the role the particles have in PMC formation.

By observing the PMCs, chemicals and small dust particles for at least two years, the AIM mission is designed to answer the most important questions about the origin of these mysterious clouds.

AIM is 55 inches tall and 43 inches wide and weighs 430 pounds. Once in orbit, solar arrays will deploy to power the satellite. The satellite will be launched from Vandenberg Air Force Base, Calif., on a Pegasus-XL launch vehicle to its orbit 373 miles (600 km) above Earth.

AIM is a NASA-funded SMall EXplorers (SMEX) mission managed by the Explorers Program Office at Goddard Space Flight Center, Md. The mission is led by the Principal Investigator from the Center for Atmospheric Sciences at Hampton University in Va. The Laboratory for Atmospheric and Space Physics (LASP), University of Colorado – Boulder, is building the CIPS and CDE instruments. LASP also provides technical management for the AIM mission and will control the satellite after launch. The Space Dynamics Laboratory, Utah State University, is building the SOFIE instrument. Other research institutions involved include Virginia Polytechnic Institute and State University, Blacksburg, Va; University of Colorado-Boulder, Boulder, Colo.; Utah State University, North Logan, Utah; Gats, Inc., Newport News, Va; the Naval Research Laboratory, Wash, DC; George Mason University, Fairfax, Va.; and the British Antarctic Survey, Cambridge UK. Orbital Sciences Corporation, Dulles, Va, designed, manufactured and tested the AIM spacecraft. Orbital will also provide the Pegasus launch vehicle.

For additional information, visit:
http://www.nasa.gov/aim
http://aim.hamptonu.edu/

Q What is AIM?

A AIM is an acronym for Aeronomy of Ice in the Mesosphere. Aeronomy is a science that deals with the physics and chemistry of the upper atmosphere of planets.

Q What is NASA's AIM Mission?

A AIM is a two-year mission to study Polar Mesospheric Clouds (PMC's), the highest clouds in our atmosphere, that form an icy layer 50 miles above the Earth's surface at the edge of space. Over the course of its two-year mission, AIM will collect the data needed to address the fundamental question of why these clouds form and vary. The mission will document for the first time, the entire complex life cycle of these clouds. With this information, scientists will be able to resolve many of the mysteries about how these clouds form and be better able to predict how they will change in the future.

Q What are the mission science goals?

A The goal of the AIM mission is to determine why PMCs form and vary.

Q What is unique about this mission?

A AIM is the first satellite mission dedicated to the study of Polar Mesospheric Clouds (PMCs). These clouds are important because it is believed that they may be indicators of climate change in the upper atmosphere. They usually exist at high latitudes in the summer near 83 km (50 miles) above the Earth surface. They are special because they are visible in the night sky after sunset. Prior to 1885, these clouds had never been observed. Today they are a common phenomenon in many locations and they are changing; they are becoming more frequent, they are brighter and they are being observed at lower latitudes than ever before. We need to understand what is causing these changes and allowing these clouds to become more commonplace. In order to do that we need to understand why these clouds form in the first place. There are many mysteries about PMC formation. The atmosphere at the formation altitude is 100,000 times dryer than the Sahara desert. It is a hostile environment for clouds. AIM will measure the relevant environmental conditions of the upper atmosphere as well as microphysical properties of the clouds to answer why PMCs form and why they vary.

Q What are the primary objectives of the mission?

A PMC Microphysics: What is the global morphology of PMC particle size, occurrence frequency and dependence upon H2O and temperature?

Gravity Wave Effects: Do gravity waves (GWs) enhance PMC formation by perturbing the required temperature for condensation and nucleation?

Temperature Variability: How does dynamical variability control the length of the cold summer mesopause season, its latitudinal extent and possible interhemispheric asymmetry?

Hydrogen Chemistry: What are the relative roles of gas phase chemistry, surface chemistry, condensation/sublimation and dynamics in determining the variability of water vapor in the polar mesosphere?

PMC Nucleation Environment: Is PMC formation controlled solely by changes in the frost point or do extraterrestrial forcings such as cosmic dust influx or ionization sources play a role?

Long-Term Mesospheric Change: What is needed to establish a physical basis for the study of mesospheric climate change and its relationship to global change?

Q What are Noctilucent Clouds?

A Noctilucent clouds are the highest clouds in our atmosphere, occrring 50 miles above the surface, mostly in polar regions in the spring and summer of each hemisphere. In recent years, they have been observed as low as 40 degrees North which is the approximate latitude of Utah and Colorado. They are referred to as 'night shining' since they are visible from the ground when illuminated by sunlight from below the horizon while lower layers of the atmosphere and Earth surface are in the Earth's shadow.

Q What are some theories that AIM will address concerning Polar Mesospheric Clouds?

A There are several theories about PMCs that will be addressed by AIM. For example a leading idea is that cosmic dust is key to PMC formation. AIM will address this theory with cosmic dust measurements made by a dust impact measuring devise on the top of the satellite and by cosmic dust observations made in the altitude region where the clouds exist. Another theory is that cold temperatures and water vapor are the driving forces for cloud formation but the relative importance of these variables is unknown. Still another theory is that gravity waves must play a major role in PMC existence because these waves appear to be reflected in the characteristics of the clouds, but the mechanisms and importance of these waves relative to other formation causes is unknown.

Q What are the instruments on this satellite and how do they contribute to the overall mission?

A The AIM satellite carries three state-of-the-art instruments: Cloud Imaging and Particle Size (CIPS), Solar Occultation For Ice Experiment (SOFIE) and the Cosmic Dust Experiment (CDE). Each will take precise measurements of NLCs and related parameters in the Earth's upper atmosphere.

CIPS has four cameras positioned at different angles, allowing scientists a 2-D look at the clouds as the satellite passes and looks forward, back and to the sides at them. Multiple views of the clouds from different angles allows a determination to be made of the sizes of the ice particles that make up the cloud. The cameras will provide panoramic PMC images of the polar cap daily.

SOFIE will use solar occultation to measure cloud particles, temperature and atmospheric gases involved in forming the clouds. The instrument will reveal the recipe of chemicals believed to be involved in PMCs' formation. It will provide the most accurate and comprehensive look to date of ice particles and chemicals within the clouds as well as of the environment in which the clouds form.

CDE records the amount of space dust that enters the atmosphere from the cosmos. It will allow scientists to assess the role the particles have in PMC formation.

By observing the PMCs, chemicals and small dust particles for at least two years, the AIM mission is designed to answer the most important questions about the origin of these mysterious clouds.

Q Do researchers believe that there is a connection between PMC's and Global Change?

A Scientists have pointed out a possible connection with global change because the clouds are becoming brighter, occurring more frequently with time and they are being observed at lower latitudes than ever before. One plausible explanation is that temperatures where the clouds form have become colder with time due to the build up in the lower atmosphere of greenhouse gases from human activities. High in the atmosphere, the greenhouse-gas buildup results in cooling.

AIM will test this hypothesis by providing a clearer understanding of why polar mesospheric clouds form and how they respond to short-term environmental changes. The comprehensive data from the mission will allow scientists to build computer simulations that reproduce the observed changes in these clouds. With these tools in hand, scientists will be able to predict future changes in the clouds and see to what extent they are an indicator of global climate change.

Q If one of the instruments were to fail could you still accomplish the mission?

A The three AIM instruments were selected because of their ability to provide important data required to address the six science objectives. Some redundancy is included in the measurements both for cross checks between instruments and to provide additional measurement coverage should data from an instrument be lost. CIPS and SOFIE for example both measure PMC particle size while SOFIE and CDE both measure cosmic dust in different forms. The prime mission requires that data from SOFIE and CIPS be collected.

Q What new technologies are used on the spacecraft?

A SOFIE uses a science enabling silicon carbide detector technology for ozone measurements that has high sensitivity at low ultraviolet wavelengths while at the same time has the ability to reject longer wavelength light that would otherwise render the measurement virtually impossible.

Q What will be going on with the spacecraft between orbital insertion and when the spacecraft begins its primary mission?

A The spacecraft transmitter is turned on immediately after payload separation from the third stage of the Pegasus rocket and telemetry signals start immediately being sent to the NASA Tracking and Data Relay Satellite System (TDRSS). About a minute after separation primary and redundant commands are issued sequentially to deploy the solar panels to power the spacecraft. During this time, the magnetic torquer bars and spacecraft reaction wheels will null out any residual motion caused by rocket motions and the separation event. Approximately 82 minutes after separation, the attitude control system transitions to the sun pointing safe hold condition signaling start of a six day spacecraft commissioning activity to verify satisfactory performance of all spacecraft subsystems.

Q How long after launch will the spacecraft begin science operations?

A SOFIE instrument turn-on and checkout will occur from L+7 to L+14 at which time it will begin science operations. Similar activities will occur for CIPS between L+11 to L+15 and for CDE from L+15 to L+17.

Q What is the orbit of the satellite and how is it relevant to collecting the appropriate science?

A AIM will be placed in a 600km sun synchronous noon/midnight orbit. This orbit will concentrate the SOFIE measurements of atmospheric limb absorption of sunlight in the polar regions where most PMCs form. The orbit is also well suited for PMC data collection using the sub-satellite viewing CIPS high spatial resolution cameras.

Q Who provided the spacecraft bus and the launch vehicle?

A Orbital Sciences Corporation, Dulles Va., provided the AIM spacecraft bus, and performed instrument integration, satellite environmental testing and launch operations. AIM will be the fifth satellite built using Orbital's LeoStar-2 bus design. The launch vehicle is an Orbital Pegasus XL rocket which will be dropped from the Stargazer aircraft (Lockheed Tristar L-1011) at a pre-determined location off the California coast.

Q How will the AIM science benefit society?

A It is clear that PMCs are changing; they are becoming more frequent, brighter and they are being seen at lower latitudes than ever before. This is science that the public can see and the changes are raising questions about human influences on our atmosphere. All these changes are signs that a distant and rarified part of our atmosphere is being altered and we do not understand how, why or what it means. These observations suggest a connection with global change in the lower atmosphere and could represent an early warning that our Earth environment is being altered.

Q Does the water vapor deposited into the atmosphere from Space Shuttle exhaust contribute to the formation of NLCs?

A There is clear evidence that water vapor from shuttle exhaust can be transported to the polar regions and then lead to the formation of NLCs. What is unclear is the relative importance of Shuttle effects versus other causes of NLC formation. The effect cannot be dominant because the number of shuttle flights in northern summer are sparse over the history of the Shuttle program since its start in 1981 and the variation in the number of flights does not correlate with the variation in PMC frequency of occurrence. AIM will measure the amount of ice present over the polar regions each day and from this, the enhancement of ice in response to shuttle launches can be determined. Thus AIM will quantify the role of shuttle exhaust in NLC formation.

Q Do noctilucent clouds form on other planets?

A Noctilucent clouds have been observed several times in the atmosphere of Mars. The clouds have a somewhat similar appearance and are visible in the night sky because of their high altitude, just as on Earth. The primary difference is that on Earth the noctilucent clouds are composed of water ice. On Mars the clouds are composed of ice made from CO_2 ice.

Q Who owns the AIM spacecraft? Is it best described as a Hampton University satellite or a NASA satellite?

A The Explorers Program Office at Goddard Space Flight Center funded the AIM mission that is led by the Principal Investigator, James Russell of Hampton University. It is a NASA satellite but Hampton University is the prime contractor.

Q What are NASA's Strategic Goals for Heliophysics and how are they related to AIM science?

A Understand Our Home in Space – Discover and understand the response of the Earth and near-Earth space to solar variability; Discover the origins of the Polar Mesospheric Clouds (PMCs); Determine the response of PMCs to climate change in the mesosphere. AIM bridges the disciplines of planetary, space and Earth sciences: Planetary sciences because high altitude noctilucent clouds have been observed in the Martian atmosphere and understanding their formation in Earth's atmosphere will help in understanding their existence in the Martian atmosphere; space science because PMCs occur literally on the edge of space in Earth's atmosphere and cosmic dust is a leading theory for the source of nucleation particles needed for their formation; and Earth science because the lower atmosphere is the primary source of water vapor needed for cloud formation in the high atmosphere and global changes in the lower atmosphere are likely connected with PMC changes observed in recent years.

Q How does AIM science fit into NASA's research?

A NASA is building a Great Heliophysics Observatory composed of a distributed system of environmental science missions from the Sun to Earth's upper atmosphere, beginning at the mesosphere extending out to the edge of the local interstellar medium. AIM, which is scheduled for launch this month, will determine why PMCs are found at such high altitudes, ~50 miles, and will provide data needed to assess the impact of climate change on their behavior. AIM also provides a new data source that is scientifically synergistic with the data from the TIMED satellite that has been operating in orbit since January 2002. Together these satellites provide a bridge between past and future missions.

Great Observatory measurements will provide information on changes in factors affecting mesospheric climate as well as ionizing radiation that may cause the formation of condensation center. AIM and the Great Observatory usher in a new era for NASA's Heliophysics Program and its efforts to understand how the sun influences the upper atmosphere.

Q How will the AIM mission contribute to the International Polar year that began in March 2007 and continues through February 2009?

A The AIM mission coincides with the two-year worldwide scientific community's International Polar Year (IPY) and the mission is expected to make unique contributions to IPY's objective of advancing polar research. AIM will observe two complete polar mesospheric cloud seasons over both poles, documenting for the first time the entire complex life cycle of PMCs.

AIM will conduct the first detailed exploration of Earth's unique and elusive clouds that are literally on the "edge of space." Very little is known about how these clouds form over the poles, why they are being seen at lower latitudes than ever before, or why they have been growing brighter and more frequent. Some scientists have suggested that these polar mesospheric clouds may be the direct result of human-induced climate change. AIM is another example of NASA's pioneering work to create cutting-edge technologies for exploring the poles that reveal a more complete view of these remote regions than has ever been possible.

Q How is the AIM mission managed?

AIM is the nineth Small Explorers mission under NASA's Explorer Program. The program provides frequent flight opportunities for world-class scientific investigations from space within heliophysics and astrophysics. The Explorers Program Office at Goddard Space Flight Center, Greenbelt, Md., manages this NASA-funded mission.

The Principal Investigator for this mission is James M. Russell III, who is a professor and Co-Director of the Center for Atmospheric Sciences at Hampton University, Hampton, Va. Russell is assisted in his responsibilities by Professor Scott Bailey, AIM Deputy Principal Investigator at Virginia Tech in Blacksburg, Va. The Laboratory for Atmospheric and Space Physics at the University of Colorado, Boulder, built two of the spacecraft's three instruments, manages the mission and will control the satellite after launch. The Space Dynamics Laboratory of Utah State University, Logan, built the third instrument. Orbital Sciences Corporation, Dulles, Va., designed, manufactured and tested the AIM spacecraft.

Q Why was Hampton University selected for this mission?

A In 1996, Hampton University formed its Center for Atmospheric Sciences (CAS). The Center is led by two scientists, Drs. James M. Russell III and M. Patrick McCormick both formerly of NASA, with a long history of leadership in remote sensing and scientific study of the Earth's atmosphere. Russell is the Principal Investigator for AIM and his previous experiments have provided the observations upon which much of our knowledge of the altitude regions where PMCs form is based. AIM is a logical step in a very successful progression of exploration of the Earth's atmosphere. Russell assembled a world-class science team to address the AIM objectives, forming key partnerships with institutions around the world to develop the spacecraft and instrumentation.

Q What is Hampton University's role in the mission?

A Hampton University proposed the mission to NASA, is leading the AIM mission, is the prime contractor for NASA and is partnering with other organizations to provide the three instruments and the spacecraft, activities to interface with the launch vehicle, data processing, data dissemination to the scientific community and data archival after the mission ends. Dr. James Russell of Hampton University will lead an international science team to analyze the data and publish the results in conjunction with NASA. Hampton University will also house the AIM Project Data Center, which will serve as an archival center for the data and provide links to all other AIM data for scientists worldwide.

Q What is the role of Hampton University students in AIM?

A Hampton University, a Historically Black College and University (HBCU), is the first HBCU to have Principal Investigator and total Mission lead responsibility for a NASA Satellite mission. Founded in 1868 to educate freed people, HU has grown into a dynamic, progressive institution of higher education that is privately -endowed, non-profit, non-sectarian and co-educational. With the University's long history of educating youth and preparing them for the world in which we live, AIM is just another step in this tradition by providing the opportunity for significant HU student training in carrying out satellite missions. HU students will assist a team of experts in the design and implementation of the science data system, information retrieval from remote sensing instruments, instrument ground test data evaluation, in-orbit performance trending studies and operation of the AIM Project Data Center at HU.

Q Where is the Mission Operations Center for AIM located?

A The AIM Mission Operations Center (MOC) is located within the Laboratory for Atmospheric and Space Physics (LASP), a research institution at the University of Colorado at Boulder. The LASP facility, the operational systems within it, and the flight team personnel meet the same stringent security standards that apply to NASA's own satellite operations centers at GSFC and the Jet Propulsion Laboratory.

Q What is the role of the University of Colorado Laboratory for Atmospheric and Space Physics in the AIM mission?

A The Laboratory for Atmospheric and Space Sciences (LASP), Boulder, Colorado, is responsible for the project management, development of two flight instruments and flight operation of the AIM observatory. LASP will use its existing multi-mission satellite operations facility and the hardware, software, procedures, and personnel that are already in place for operating the QuikSCAT, ICESat, and SORCE satellites to operate AIM.

Q What is Utah State University's involvement in the AIM mission?

A Utah State University's Space Dynamics Laboratory designed, fabricated, tested and integrated the SOFIE (Solar Occultation for Ice Experiment) instrument, one of three AIM instruments being used to study polar mesospheric clouds. SOFIE will use solar occultation to measure atmospheric temperature, water vapor carbon dioxide, methane, nitric oxide, ozone and aerosols.

Q How does GATS support the AIM mission?

A GATS, Inc. continues their long history of supporting NASA satellite missions by contributing to nearly every facet of the AIM mission. Larry Gordley, the founder of GATS, is the Principal Investigator for the SOFIE instrument and Mark Hervig is the Deputy Principal Investigator. Working in collaboration with Hampton University, LASP and SDL, GATS oversaw the SOFIE instrument design, development and calibration. GATS will operate SOFIE in orbit and process the data.

The flight operations team will command SOFIE from the GATS Payload Operations Center. The flight ops team developed the software for monitoring SOFIE's health and performance, and used this software for ground testing and calibration. They made important contributions to mission requirements, interface designs and science data processing.

The SOFIE Data Processing Center at GATS will process, analyze and turn raw data from the experiment into the physical parameters needed by the science community. Scientists and programmers at GATS are writing the complex retrieval algorithms that will perform these operations. The data, once processed, will be available through the AIM Project Data Center to researchers via interactive web-based visualization tools developed at GATS.

With the heritage of six major NASA remote sensing missions behind them, GATS brings a wealth of experience to the AIM mission. In fact, GATS has collaborated with Hampton University and most of the AIM participants before on several other successful NASA missions. Together they form a well-seasoned and efficient team.

Q Who are the other partners on this mission and what are their roles before launch and after launch?

A There are sixteen science investigators, listed below, who are responsible for the analysis of data from the three flight instruments.

Institution	Investigator	Role pre-launch	Role post-launch
Hampton University	Jim Russell	PI, Science Planning, Mission Design and Oversight	Coordinate all Science Investigations, SOFIE data analysis

US Partners			
Institution	**Investigator**	**Role pre-launch**	**Role post-launch**
Virginia Tech	Scott Bailey	Deputy PI, Science Planning, Mission Outreach	Deputy PI, science planning, CIPS data analysis, mission outreach
University of Colorado – LASP	Mihály Horányi	CDE PI, Science Planning	CDE coordination & analysis, nucleation studies
	Cora Randall	Science Planning	PMC Microphysics Studies, data product validation
	David Rusch	CIPS PI, Science Planning	CIPS PI, CIPS data analysis, data product validation
	Gary Thomas	Science Planning	Data analysis
	Bill McClintock	CIPS instrument design and calibration	CIPS on-orbit calibration and data analysis

US Partners			
Institution	**Investigator**	**Role pre-launch**	**Role post-launch**
GATS, Inc.	Larry Gordley	SOFIE PI, Science Planning	SOFIE PI, SOFIE data analysis, data product validation
	Mark Hervig	SOFIE Deputy PI, retrievals, dust studies	SOFIE Deputy PI, data analysis, data product validation
George Mason University	Mike Summers	Science Planning	Hydrogen Chemistry Studies, data product validation
Utah State University	Mike Taylor	Science Planning	Gravity wave studies, CIPS data analysis
Naval Research Lab	Steve Eckermann	Science Planning	Gravity wave studies
	Chris Englert	Science Planning	Retrieval algorithm studies, PMC properties
	David Siskind	Science Planning	Temperature variability studies, effects on PMCs, data product validation
	Mike Stevens	Science Planning	Nucleation studies, data product validation

International Partners			
Institution	**Co-I**	**Role pre-launch**	**Role post-launch**
British Antarctic Survey	Pat Espy	Science Planning	Data product validation, studies of nucleation & PMC properties

The Aeronomy of Ice in the Mesosphere (AIM) mission is the first detailed exploration of Earth's unique and elusive clouds that are literally on the "edge of space." Other space-based and ground-based measurements have probed some aspects of this unusual phenomenon in Earth's mesosphere (the region just above the stratosphere), but very little is known about how these clouds form over the poles, why they are being seen at lower latitudes than ever before, or why they have been growing brighter and more frequent. Some scientists have suggested that these polar mesospheric clouds may be the direct result of human-induced climate change.

Over the course of its two-year mission, AIM will help answer these questions by documenting for the first time the entire complex life cycle of these clouds. With this information, scientists will be able to resolve many of the mysteries about how these clouds form and be better able to predict how they will change in the future.

Quick Facts

- Polar mesospheric clouds form over both poles only during each hemisphere's summer, which starts in mid-May in the north and November in the south. The number of clouds and their brightness is highest toward the poles. Clouds are both more frequent and brighter in the Northern Hemisphere than in the Southern Hemisphere. They are normally observed at altitudes of 83-84 kilometers (50 miles).
- Polar mesospheric clouds, as they are known to those who study them from satellite observations, are also often called "noctilucent," or night shining, clouds. This is because they are visible from the ground when illuminated by sunlight from below the horizon while lower layers of the atmosphere are in the Earth's shadow.
- The first public report of noctilucent clouds was made in 1885 by an amateur astronomer. The first observations of the clouds in the daytime were made by a satellite in 1969. Regular space-based observations began in 1982 with NASA's Solar Mesosphere Explorer. Space-based observations to date were made serendipitously by instruments designed for other purposes.
- AIM will observe two complete polar mesospheric cloud seasons over both poles.

Deciphering the Recipe for Polar Mesospheric Clouds

The formation of polar mesospheric clouds at such high altitudes does not follow conventional meteorological concepts of how clouds form lower in the atmosphere. One theory is that the cloud particles grow on "seeds" of volcanic or meteoric dust. These clouds appear to be a relatively recent phenomenon, being first reported in the late 19th century shortly after the volcanic eruption at Krakatoa. The brightest clouds are now known to be primarily composed of water ice, and their seasonal lifecycle is controlled by complex interactions between temperature, water vapor, solar activity, atmospheric chemistry and small particles on which the cloud crystals form.

AIM will make simultaneous measurements of the main ingredients needed to unravel the role of natural factors such as the solar cycle and meteorology in the formation of these clouds from the possible role of anthropogenic factors such as carbon dioxide, which causes a warming in the lower atmosphere but a cooling in this region of the atmosphere. Ultimately, this research will provide the data needed to determine the role of polar mesospheric clouds as an important indicator of our planet's changing climate.

Solar Cycle

Polar mesospheric clouds occur in the region where the sun first interacts with Earth's atmosphere, causing chemical and thermal changes. Solar radiation at this altitude can break apart water vapor molecules, thus reducing the amount of water ice available to form ice crystals in the clouds. The solar ultraviolet radiation at work in this process is known to vary with the 11-year solar cycle.

Satellite observations have shown a pattern of increasing solar ultraviolet radiation followed by declining brightness and frequency of these clouds over two solar cycles. But the change in solar activity occurs nearly a year before changes are seen in the clouds, indicating that the relationship is not a simple matter of direct cause and effect. It is not known why the two are so far out of sync with each other.

Water Vapor and Temperature

Three things are needed in order for these high-altitude clouds to form: cold temperatures, water vapor and small particles that provide surfaces for water to condense. Two of the leading suspects behind the recent changes in polar mesospheric clouds are an increase of water vapor in the region and colder temperatures. Climate models predict that the result of increasing greenhouse gases in the atmosphere would be warmer temperatures in the lower atmosphere, where emitted radiation is "trapped" by the air above, but colder temperatures in the mesosphere where the radiation is lost to space. Colder temperatures would allow more icy cloud particles to form. Alternately, a buildup of water vapor in the upper atmosphere could cause the same increase in polar mesospheric clouds. By measuring water vapor, temperature and the presence of clouds at the same time, AIM will allow scientists to isolate which of these factors is the key driver of cloud formation.

Understanding the processes that control water vapor in the summer polar mesosphere will provide a basis for understanding the formation and evolution of these clouds. Water vapor is transported upward into the polar summer mesosphere from the lower atmosphere. It is also produced by the photochemical destruction of methane in the stratosphere and mesosphere.

There are few direct measurements of water abundance along with polar mesospheric cloud properties in the region where these clouds form. AIM will measure a comprehensive data set of water vapor and key chemicals that lead to water formation and that can be used as tracers of the general atmospheric motion. These combined observations will yield a detailed view of the movement and formation of water vapor in this region of the atmosphere.

One unusual source of mesospheric water vapor – exhaust from rocket engines – was recently shown to be the cause of an increase in Arctic polar mesospheric clouds (Geophysical Research Letters, M. H. Stevens et al., July 6, 2005). The exhaust plume from an August 1997 space shuttle launch moved northward to form a burst of clouds a week after launch. Water vapor from rockets, however, is not thought to be a major contributor to the long-term increase in these clouds.

Cosmic Dust Particles

Like clouds in other parts of the atmosphere, one element required for polar mesopheric clouds to form is tiny particles on which water vapor can accumulate and grow into ice crystals. Nearer to Earth's surface clouds form from "cloud condensation nuclei" that can be sea salt spray, desert dust, or other materials lofted from the surface. In the mesosphere it is thought that cosmic dust particles falling into the Earth's atmosphere might serve this same purpose, although this has not been confirmed. AIM will be able to identify how important the daily influx of cosmic dust particles is in the lifecycle of these clouds by measuring the amount and changes of dust in low-Earth orbit. The dust particles disintegrate as they enter the atmosphere below the spacecraft and reform into minute smoke particles that might serve as nuclei for water condensation.

Instruments on the AIM spacecraft will measure the incoming dust, and this data will be used to estimate the average number of condensation nuclei available in the mesosphere for cloud formation. Comparisons will be made between the overall influx of cosmic dust and the occurrence and brightness of clouds in the same area to see if this “cosmic seeding” is more or less important for cloud formation than temperature, water vapor or other factors.

A “Canary in the Coal Mine” for Global Change?

AIM will examine the relative contributions of solar and human-induced effects that cause change in the upper atmosphere. Scientists have pointed out a possible connection with global change because the clouds are becoming brighter and occurring more frequently with time and they are being observed at lower latitudes than ever before. One plausible explanation is that temperatures where the clouds form have become colder with time due to the build up in the lower atmosphere of greenhouse gases from human activities. High in the atmosphere, the greenhouse-gas buildup results in cooling.

AIM will test this hypothesis by providing a clearer understanding of why polar mesospheric clouds form and how they respond to short-term environmental changes. The comprehensive data from the mission will allow scientists to build computer simulations that reproduce the observed changes in these clouds. With these tools in hand, scientists will be able to predict future changes in the clouds and see to what extent they are an indicator of global climate change.

Timeline to Discovery

The three scientific instruments onboard AIM will begin to deliver images and data within a few months after launch, which is currently scheduled for April 2007. The first observations will be made of the Arctic polar mesospheric cloud season during the summer months in the Northern Hemisphere. Scientists will then begin to analyze the data with computer simulations of the mesosphere to better understand the many complex processes at work.

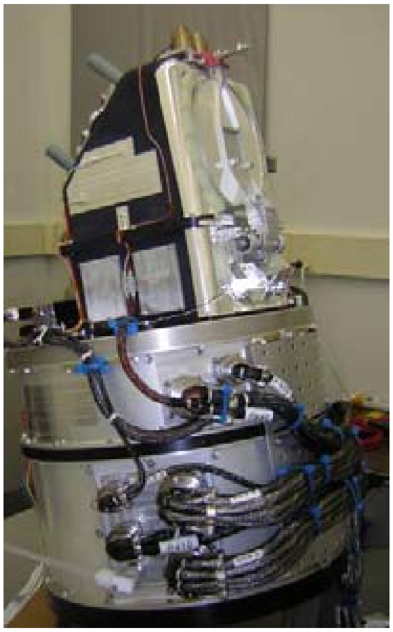
Further Reading

Gary E. Thomas, “Are noctilucent clouds harbingers of global change in the middle atmosphere?” Advances in Space Research, vol. 32, no. 9, 2003.

Matthew T. DeLand et al., “A quarter-century of satellite polar mesospheric cloud observations,” Journal of Atmospheric and Solar-Terrestrial Physics, Vol. 68, 2006.

This is the AIM spacecraft with the solar array fully deployed. There are six separate solar array panels, which are integrated into a single deployed wing. In this orientation the nadir deck is pointed up towards the ceiling, and the SOFIE and CIPS instruments are visible in the photo. The photograph was taken in the clean room at the Orbital Sciences Dulles, Va. facility.

Credit: Orbital Sciences Corporation

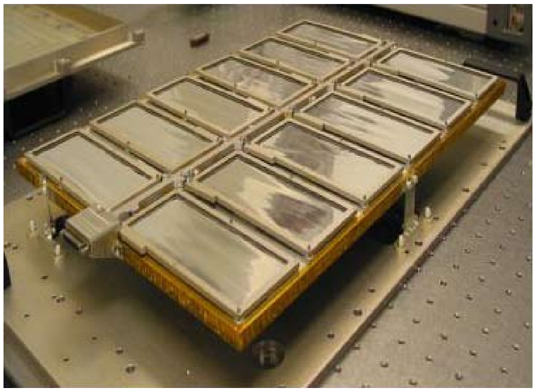


Solar Occultation For Ice Experiment (SOFIE)
SOFIE PI: Larry Gordley, GATS
Deputy SOFIE PI: Mark Hervig, GATS
Institutions: Built by Space Dynamics Laboratory (SDL) at Utah State University. GATS led the instrument design, and is providing the retrieval algorithms, payload operations and data management.

SOFIE is designed to measure polar mesospheric clouds (PMCs), temperature and gas concentrations in the upper atmosphere. PMCs are the highest of all clouds and occur only in polar regions during summer, where temperatures dip lower than anywhere else on Earth. These elusive clouds are showing hints of global climate change. SOFIE is the first satellite instrument targeting these clouds and their environment. The gases measured by SOFIE—water vapor, ozone, carbon dioxide, methane and nitric oxide—are the key species governing chemistry and cloud formation in this high-altitude region. In addition, SOFIE will collect the first data characterizing the cosmic smoke layer from meteoroids vaporized by the atmosphere.

Two essential techniques are used by SOFIE: “solar occultation” and “differential absorption radiometry”. “Solar occultation” refers to viewing the Sun’s light through the Earth’s atmosphere. As SOFIE orbits the Earth, it will watch the Sun rise and set through the limb of the atmosphere. “Differential absorption radiometry” uses pairs of channels tuned to different wavelengths. Differencing the signals from these channels gives the extraordinary sensitivity needed for sensing minute concentrations in the thin upper atmosphere.

Another “first” by SOFIE will be to use atmospheric refraction to accurately measure temperature. By measuring the amount the sun “flattens” near the horizon, the temperature profile can be extracted. This has been done with GPS satellites, but never before using solar occultation.



Cosmic Dust Experiment
CIPS PI: Mihaly Horanyi, LASP/CU
Institution: Built by the Laboratory for Atmospheric and Space Physics (LASP) at the University of Colorado-Boulder

The Cosmic Dust Experiment will monitor the variability of dust influx into our atmosphere.

This is an in situ experiment, meaning it measures what is happening at the location of the spacecraft, however the characteristic life time for an incoming micrometeorite from low Earth orbit until it burns up in the mesosphere is on the order of a minute. Hence, CDE observations of the temporal and spatial variability of the dust influx can be used to establish possible correlations with the observations of NLC brightness and coverage.

CDE is an impact dust detector based on thin permanently polarized foil sensors. Each dust particle impact on the films generates a science event, where the time, channel number and the impact charge are recorded, in addition to all relevant housekeeping data.. Using appropriate averages this can be turned into a time-dependent global map to show the possible spatial and temporal variability of the amount of cosmic dust entering the atmosphere.

Cloud Imaging and Particle Size Experiment (CIPS)
CIPS PI: Dave Rusch, LASP/CU
Instrument Scientist: Bill McClintock
Institution: Built by the Laboratory for Atmospheric and Space Physics (LASP) at the University of Colorado-Boulder

The Cloud Imaging and Particle Size (CIPS) instrument on AIM is a panoramic UV imager. CIPS will provide images of the atmosphere at a variety of scattering angles in order to determine cloud presence, provide the spatial morphology of the clouds and constrain the parameters of the cloud particle distribution. CIPS will provide:

- Panoramic imaging with a 120° x 80° field-of-view
- Scattered radiances from PMCs
- Rayleigh scattering information from 55 km altitude to measure atmospheric gravity wave activity and small scale variations in lower mesospheric ozone
- Multiple exposures of individual clouds to derive PMC scattering phase functions and detect spatial scales to approximately 2 km

The instrument consists of a 2x2 array of cameras operating with a 15 nm pass band centered at 265 nm, each with an overlapping FOV, and a resolution (looking downward) of 2 km. The total FOV is 80 deg x 120 deg, centered at the sub-satellite point, with the 120 deg axis along the orbit track.

CIPS will search for clouds from about 30 degrees latitude in the summer hemisphere over the pole and into the night hemisphere. The near-polar orbit of AIM and the cross-track FOV will cause the observation swaths to overlap at latitudes higher than about 70 deg, so that nearly the entire polar cap will be mapped with 15-orbit per day coverage. For the first time a morphology of PMC evolution throughout the entire season, and in both hemispheres, will be achieved.

Special Delivery: The Pegasus XL Rocket

The Pegasus XL was developed as an inexpensive way of launching small payloads into space. The rocket specializes in carrying satellites and experiments that weigh up to 1,000 pounds into low-Earth orbit. With the body of an oversize model rocket and tail of an airplane, the Pegasus has three solid-fuel rocket motors and a rather unique and economical way of lifting off.

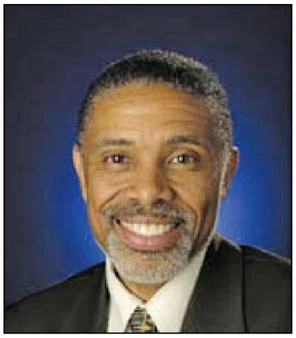
Pegasus' first leap into space is actually aboard Orbital Science's L-1011 "Stargazer" jet. The Pegasus starts its mission secured to the belly of the L-1011, where it's carried to the planned launch altitude. Using the Stargazer again and again saves money by eliminating the need for a stage motor to lift each Pegasus off of the ground.

The Stargazer began life as an Air Canada passenger jet before it was whisked off to Cambridge, England, for conversion into a flying launch pad. While in England, the jet's seats were removed, its wings reinforced and the Pegasus' launch systems installed.

One of Pegasus' greatest benefits is its ability to be launched from practically anywhere in the world. With a conventional rocket, the launch has to take place from wherever the assembly and launch facilities are located. However, in the case of Pegasus, the launch can take place from either its home base in Vandenberg, Calif., or from a number of other possible sites. If another location is desired, the rocket can be partially or completely assembled in California and flown to the launch site.

Every Pegasus flight starts with the rocket locked to the underside of the Stargazer. The jet takes off and requires about one hour to fly to the rocket's launch altitude of 39,000 feet. At that height, the Pegasus is released and allowed to freefall for about five seconds. Then the first stage motor fires and accelerates the rocket to over 5,000 miles per hour. After 76 seconds, the first stage motor burns out and the vehicle briefly coasts before igniting its second stage rocket at the 97-second mark. Nearly 10 minutes later, the Pegasus has exhausted its stage two and three motors, reached a top speed of nearly 17,000 mph, and climbed to an altitude of 460 miles. Following the boost phase of the flight, the spacecraft separates from the Pegasus and glides off to begin its mission.

Charlie Plain
NASA's John F. Kennedy Space Center



Willis S. Jenkins, Jr., Explorer's Program Executive, NASA Headquarters

Willis Jenkins is a program executive in the Heliophysics Division of NASA's Science Mission Directorate. Within his role in the Explorer Program, Jenkins is responsible for projects from definition and formulation through funding and accomplishment of objectives. Jenkins began working at Goddard Space Flight Center in 1994 and became a HQs program executive in 2003.

Jenkins earned his Bachelor of Science degree in electrical engineering from Northeastern University in Boston, Mass. At age 15, Jenkins was accepted to a program called A Better Chance (ABC). The program placed talented inner city youth in schools with rigorous academic programs.

Jenkins has garnered many accolades for his work, including the NASA Medal for Exceptional Service. He was nominated Black Engineer of the Year in 2001. He also received the outstanding Professional Excellence in Federal Career Award, signed by Sen. Barbara Mikulski of Maryland.

Jenkins lives in Maryland with his wife of 22 years and their two teen daughters. In his spare time, he enjoys spending time with his family, restoring antique Buicks and mentoring children in the community.

Vicki Elsbernd, AIM Program Executive, NASA Headquarters

Vicki Elsbernd is the Solar Terrestrial Probes (STP) Program Executive in the Heliophysics Division in the NASA HQ Science Mission Directorate. She is responsible for providing strategic management and oversight for all projects in the STP Program including TIMED, STEREO, Solar-B, and Magnetospheric Multiscale. During her 16-year career with NASA, she has served as an International Program Manager on the Space Station Program and as Program Manager and Program Executive for various missions, including POES, GOES, SAGE III, ACRIM, SOLSTICE, and NPP. She holds a Bachelor of Science degree and a Master of Science degree in Engineering and has received numerous individual and group performance awards, including the Goddard Space Flight Center's Outstanding Leadership Award.

Chris Savinell, AIM Mission Manager

After earning a Bachelor of Science degree in Physics and a Master of Science degree in Measurement & Control from Carnegie Mellon University, Mr. Savinell spent more than 15 years designing and managing the development of precision instrumentation and equipment for a wide variety of applications for academia, private industry, and DOD contractors.

Since joining NASA in 1991, he has served as manager of several instruments for missions such as the Earth Observing System and the Tropical Measuring Rainfall Mission. As an Associate Division Chief for instrument development, Mr. Savinell supervised the Instrument Managers at GSFC. In addition to his work at GSFC, Mr. Savinell worked at NASA HQ as the Program Executive for Gravity Probe-B, Terrestrial Planet Finder, and RadioAstron.

Dr. Hans G. Mayr, AIM Project Scientist, Goddard Space Flight Center

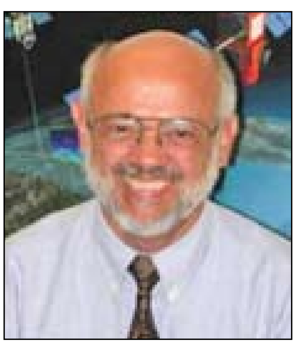
Dr. Mayr was the project scientist during the definition phase of the Thermosphere Ionosphere Mesosphere Energetics and Dynamics (TIMED) mission, launched 5 years ago, whose original scientific objectives included the study of polar mesospheric clouds. Thus he became involved with the fascinating and challenging scientific questions surrounding these clouds, which are now being investigated by the Aeronomy of Ice in the Mesosphere (AIM) mission. He was educated in Austria and received a PhD in Physics from the University of Graz where he spent a short tenure as a research assistant. Dr. Mayr came to Goddard in 1965 on a National Research Council fellowship. With the goal to understand space-born observations, he has been involved primarily in developing physical models that can describe the atmospheres of the planets and the Earth. In that capacity, he served as interdisciplinary principal investigator on TIMED and on the Dynamics Explorer mission. He likes to play tennis, dabbles in wiring, plumbing, and car servicing, and he enjoys listening to and reading about classical music.

James M. Russell III, AIM Principal Investigator, Hampton University

Dr. Russell's research has focused on atmospheric science, remote sensing and satellite data analysis to study properties and processes in Earth's atmosphere. He began his career in electrical engineering at the NASA Langley Research Center in Hampton, Virginia developing instrumentation and performing ground and rocket reentry tests of heat shield material used on the Gemini and Apollo capsules.

Dr. Russell also worked on instrumentation for characterizing the Martian atmosphere during entry. He has served as Co-PI on the Nimbus-7 LIMS experiment to study odd nitrogen effects on the ozone layer and PI for the HALOE experiment on the UARS satellite to study odd chlorine and odd nitrogen effects on ozone. He currently serves as PI for the SABER experiment on the TIMED satellite to study the chemistry, dynamics and energetics of the thermosphere and mesosphere and PI on the AIM mission to study noctilucent clouds.

Dr. Russell served as head of the Chemistry and Dynamics Branch and the Theoretical Studies Branch in the NASA Langley Atmospheric Sciences Division and currently is a Professor of Atmospheric and Planetary Sciences and Co-Director of the Center for Atmospheric Sciences at Hampton University in Virginia. He received the BSEE degree from Virginia Tech in 1962, the MSEE degree from the U. of Virginia in 1966 and the PhD in Aeronomy from the U. of Michigan in 1970. He is author or co-author of more than 350 papers in the scientific literature.



Dr. Leonard R. McMaster AIM Program Deputy, Hampton University

Dr. McMaster received a bachelor's degree in physics from the College of William and Mary in 1967 and a JD in law from the Marshall Wythe School of Law, College of William and Mary in 1976. He worked at the NASA Langley Research Center from 1967 to 2004 as a research engineer and manager for numerous space and atmospheric science programs, and was the Director of all Langley Atmospheric Sciences Research when he retired in 2004. While at NASA, he received numerous NASA awards including the Exceptional Service Medal in 1986, the Outstanding Leadership Medal in 2002, and the Presidential Rank, Meritorious Senior Executive Service award in 2003. McMaster has worked at Hampton University since 2004. He is the author or co-author of more than 50 publications and presentations, and holds one patent.

In addition to McMaster's science management career, he is an attorney and member of the Virginia Bar Association. He is also a licensed, instrument-rated private pilot, who owns his own plane and enjoys flying in his spare time.

Dr. Scott M. Bailey, Deputy PI for AIM,
Virginia Polytechnic Institute and State University

Dr. Bailey's research activities involve studies of the Sun's influence on the upper atmosphere including the formation and variability of polar mesospheric clouds. He is actively engaged in sounding rocket and satellite observations of both the Earth and Sun. He served as instrument scientist and later principal-investigator on the Student Nitric Oxide Explorer satellite. He is co-investigator on the Solar EUV Experiment and EUV Variability Experiment. He is deputy-principal investigator of NASA's Aeronomy of Ice in the Mesosphere mission. Dr. Bailey is currently an assistant professor in the Bradley Department of Electrical and Computer Engineering at Virginia Tech. He received his B.S. in Physics from Virginia Tech 1990. He received his M.S. in 1994 and his Ph.D. in 1995 from the University of Colorado. Before joining Virginia Tech, he was a faculty member in the Geophysical Institute and Department of Physics at the University of Alaska and he was a research assistant professor of physics in the Center for Atmospheric Science at Hampton University. In his spare time, Dr. Bailey enjoys the outdoors, especially bicycling and canoeing.

Mike McGrath, AIM Project Manager,
University of Colorado

Mr. McGrath is experienced in systems engineering and management of space-based instrumentation and spacecraft, with emphasis on NASA science missions. McGrath's career has encompassed detailed component design through project management. McGrath has knowledge and familiarity with instruments and investigations in X-ray, EUV, UV, Visible and IR wavelengths, and has experience at all levels of instrument and system design. McGrath has been the Engineering Director at LASP for the past 7 years. McGrath is a Professor Adjunct in the Aerospace Engineering Sciences department at the University of Colorado where he teaches the capstone design course in Spacecraft Design, as well as an introductory class in engineering projects.

McGrath's outside interests include traveling, dry fly stream fishing, building houses, and listening to flute and guitar music.

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