NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SAGEIII/SOLVE II Mission

Media Kit
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Contacts

David Steitz Headquarters, Washington, D.C.	Policy/Program Management	202-358-1730
Elvia Thompson Headquarters, Washington, D.C.	Policy/Program Management	202-358-1696
Cynthia M. O'Carroll Goddard Space Flight Center, Greenbelt, MD	Public Affairs Office	301-614-5563

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NASA BEGINS NEW YEAR WITH INTERNATIONAL ARCTIC OZONE STUDY

NASA researchers, and more than 350 scientists from the United States, European Union, Canada, Iceland, Japan, Norway, Poland, Russia and Switzerland, are working together this winter to measure ozone and other atmospheric gases. The scientists will use aircraft, large and small balloons, ground-based instruments and satellites.

The DC-8 phase of the Arctic campaign runs from Jan. 8 through Feb. 6, 2003. Flights of large balloons will augment the aircraft campaign, extending the measurement period to late March 2003.

This second SAGE III Ozone Loss and Validation Experiment (SOLVE II) campaign will be conducted in close collaboration with the European Commission. It is sponsored by the
VINTERSOL (Validation of International Satellites & Study of Ozone Loss) campaign. (SAGE III stands for the third Stratospheric Aerosol & Gas Experiment.) SOLVE takes place in Kiruna, Sweden, the site of the first winter (1999-2000) international effort (SOLVE I).

NASA's SAGE III satellite instrument is being used to quantitatively assess ozone loss in the higher latitudes. SAGE III was launched onboard a Russian Meteor-3M spacecraft
on December 10, 2001. The validation of the SAGE III observations is a principal goal of SOLVE II. SOLVE II is sponsored by NASA's Earth Science Enterprise, dedicated to
better understanding and protecting our home planet.

"The primary goals of the joint SOLVE II-VINTERSOL campaign are to further understanding of ozone loss processes in the Arctic, and provide coincident observations between the airborne and SAGE III measurements. This comparison will enable the satellite scientists to critically and quantitatively assess the in-space performance of their
instruments to measure profiles of ozone, aerosols, and water vapor over the Earth," said Michael Kurylo, SOLVE II co-Program Scientist at NASA Headquarters, Washington.

Ozone studies are important, because the ozone layer prevents the sun's harmful ultraviolet radiation from reaching the Earth's surface. Ultraviolet radiation is a primary cause of skin cancer. Without protective upper-level ozone, there would be no life on Earth.

During the campaign of 1999-2000, record ozone losses of 70 percent were observed at altitudes around 18 kilometers (11 miles), and a great deal was learned about the processes leading to the rapid ozone loss in the Arctic. The

SOLVE II campaign will add to that body of knowledge.

During the coming winter, scientists in SOLVE II-VINTERSOL will work toward verifying the accuracy of measurements from current Earth observing satellites. The in situ and remote sensing measurements taken aboard these aircraft will provide a unique data set for comparison with the SAGE III instruments and other satellite instruments. Teams from the Centre National d'Etudes Spatiales (France's National Center for Space Studies) and NASA will launch research balloons carrying payloads weighing up to several hundred pounds from Kiruna. A network of over 30 stations of ground-based instruments will take atmospheric readings over a wide area to show how the chemical composition of Arctic stratosphere evolves through the whole winter.

VINTERSOL is a pan-European campaign involving researchers supported by the European Commission and national research agencies.

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Media Services information

Newsroom operations will not be conducted in Kiruna. Journalists interested in interviewing the scientists in Kiruna or by telephone should contact Ms. Cynthia O'Carroll, NASA Goddard Space Flight Center, 301-614-5563.

Internet Sites
The following web sites provide additional information about the mission:

http://www.gsfc.nasa.gov/topstory/20020930solve.html
http://svs.gsfc.nasa.gov/stories/solve/

For information about SOLVE I Mission:
http://cloud1.arc.nasa.gov/solve/index.html

For information about the SOLVE II Mission:
http://cloud1.arc.nasa.gov/solveII/index.html

For information about SAGE III:
http://www-sage3.larc.nasa.gov/

For information about the VINTERSOL program:
http://www.ozone-sec.ch.cam.ac.uk

Mission Overview

During the winter of 2002-2003, NASA researchers will join scientists from around the world to measure ozone and other atmospheric gases in the Arctic using aircraft, large and small balloons, ground-based instruments, small payload rockets, and satellites.

The second SAGE III Ozone Loss and Validation Experiment (SOLVE II) is an international field campaign designed to examine the processes controlling ozone levels at mid- to high latitudes and to acquire data needed to validate the third Stratospheric Aerosol and Gas Experiment (SAGE III) satellite measurements that will be used to quantitatively assess high-latitude ozone loss. Measurements will be made in the Arctic high-latitude region in winter using the NASA DC-8 aircraft, as well as balloon platforms and ground-based instruments. This campaign will be conducted in close collaboration with the VINTERSOL (Validation of International Satellites and study of Ozone Loss) campaign sponsored by the European Commission and national agencies. More than 350 scientists from the United States, the European Union, Canada, Iceland, Japan, Norway, Poland, Russia, and Switzerland will participate in this joint effort. The research will take place in Kiruna, Sweden, the site of the first international effort, SOLVE I and the Third European Stratospheric Experiment on Ozone (THESEO 2000), during the winter of 1999-2000.

During the coming winter, scientists in SOLVE II - VINTERSOL will also work toward ensuring that measurements from other current Earth-observing satellites are accurate. Scientists will take measurements of the stratosphere using a large suite of instruments aboard three aircraft: NASA's DC-8, the European M55 Geophysica, and the German DLR Falcon. A temperature-profiling instrument from NASA's Jet Propulsion Laboratory will also fly on the M55 Geophysica. These aircraft will all be based in Kiruna, Sweden.

The DC-8 phase of this Arctic campaign will run from January 8 through February 6, 2003. Flights of large balloons will augment the aircraft campaign, extending the measurement period from late November 2002 to late March 2003.

Mission Goals

The joint SOLVE II – VINTERSOL campaign will further the understanding of the process of ozone loss in the Arctic and verify that satellite observations of the ozone layer are accurate from space. The satellite observations are the primary measurements used by the international scientific community to follow and understand changing stratospheric ozone levels.

This international field campaign is designed to acquire data needed to validate the Meteor-3M/ SAGE III satellite mission, atmospheric chemistry instruments onboard the National Space Development Agency of Japan’s Advanced Earth Observing Satellite (ADEOS-II), and the European Space Agency’s environmental satellite (ENVISAT) missions. These additional satellite observations both enhance comparisons and improve ozone loss studies. Measurements will be made in the Arctic in winter using the NASA DC-8 aircraft, balloon platforms, and ground-based instruments.

European and NASA Research balloons, carrying payloads weighing up to several hundred pounds will be launched by teams from the French space agency Centre National d'Etudes Spatial. An internationally based network of over 30 stations of ground-based instruments will take atmospheric readings over a wide area that will show how the chemical composition of Arctic stratosphere evolves through the whole winter.

SOLVE-II will take place in close collaboration with the VINTERSOL campaign that includes the German Falcon and Geophysica M55 aircraft, other balloon platforms and ground-based instruments. VINTERSOL is a pan-European campaign involving researchers supported by the European Commission and national research agencies.

Science Objectives

The first SOLVE campaign was conducted during the winter of 1999-2000. Both the observations from that campaign and research over the last few years have improved our understanding of Arctic ozone losses, but have also revealed new areas of concern. During SOLVE-II the NASA DC-8 aircraft will be used to pursue five basic science objectives. These objectives are:

2002 *The SAGE III instrument validation.* Ozone, aerosol, water vapor, and nitrogen dioxide measurements from the DC-8 will be compared to SAGE III measurements in order to prove the quality of satellite observations. The satellite observations are key components of the international effort to determine the current state of the ozone layer, and in order to determine how it will evolve into the future.

2003 *Understanding polar ozone loss rate in early to mid-winter*. Observations during the first SOLVE campaign showed a larger than expected loss of ozone during the January-February period. During SOLVE-II DC-8 flights and balloon observations will be designed to measure ozone losses during January 2003.

2004 *Improving our understanding of polar stratospheric clouds.* Observations during the first SOLVE campaign revealed the unexpected presence of very thin polar stratospheric clouds composed of large particles in the high Arctic region. These large particles were shown to be composed of nitric acid and water and contribute to ozone depletion. However, the formation of these large particles is not understood.

2005 *Improving our understanding of the chemistry of ozone loss.* Stratospheric ozone is destroyed by chlorine and bromine gases that primarily come from human-produced compounds. Measurements of these compounds in the Arctic during the first SOLVE campaign showed that the observed decrease of ozone was in reasonable agreement with the observed levels of chlorine and bromine. During the SOLVE-II campaign we will also be testing our observed ozone losses against these chlorine and bromine levels.

2006 *Meteorological impacts on polar ozone levels.* Over the course of the winter, ozone typically increases in the polar region as ozone rich air at higher altitudes in the mid-latitudes and higher altitudes is carried poleward and downward by the winds. This motion also acts to warm the polar region. Because meteorological conditions vary widely between winters, this transport of ozone rich air must be carefully identified during this winter’s campaign.

Program/Project Management

1	SOLVE II Program Scientists	Michael Kurylo and Phil DeCola
2	SOLVE II DC-8 Project Scientists	Mark Schoeberl and Paul Newman
3	SOVLE II Project Managers	Michael Craig and Steve Hipskind
4	SOLVE II Balloon Project Scientist	Jim Margitan
5	SAGE III Project Scientists	Charles Trepte and Lamont Poole
6	SOLVE II DC-8 Mission Manager	Chris Miller

A more complete listing of all those involved in the mission can be found at: http://cloud1.arc.nasa.gov/solveII/people.html

SOLVE is co-sponsored by the Upper Atmosphere Research Program, Atmospheric Chemistry Modeling and Analysis Program, and Earth Observing System of NASA's Earth Science Enterprise as part of the validation program for the SAGE III instrument.

SOLVE II is sponsored by NASA's Earth Science Enterprise, dedicated to better understanding and protecting our home planet.

Quick Facts

SAGE III Instrument
The SAGE III instrument is a grating spectrometer that measures ultraviolet/visible energy. It relies upon the flight-proven design used in the Stratospheric Aerosol Measurement (SAM I) and SAGE I and II instruments.

The new SAGE III design incorporates state-of-the-art detectors and computer hardware. Combined, these devices allow for wavelength calibration, a self-consistent determination of the viewing geometry, lunar occultation measurements, and expanded wavelength coverage. This new-generation instrument will provide ozone observations of much greater accuracy and precision.

SAGE III sensor assembly consists of pointing and imaging subsystems and an UV/visible spectrometer. The pointing and imaging systems are employed to acquire light
from either the Sun or Moon by vertically scanning across the object.

The SAGE III instrument was developed and managed by NASA Langley Research Center, Hampton, Virginia.

SAGE III Specifications:

Weight:	76 kg, 167 pounds
Power:	80 W on-orbit average Data Rate 115 Kbit/s
Dimensions:	73 cm x 45 cm x 93 cm, 29 inches x 18 inches x 37 inches.
Built by:	Ball Aerospace in Boulder, Colorado
Launch date:	December 10, 2001
Launch site:	Baikonur Cosmodrome, Kazakhstan
Launch vehicle:	Meteror-3M

DC-8 AIRCRAFT
The DC-8 is a modified airliner that is capable of extended range and very large payload. The aircraft is a medium altitude, moderate to high speed aircraft flying up to 41,000 feet above sea level between 425 and 490 knots True Air Speed (TAS). The DC-8 is capable of precise flight line navigation by means of an integrated inertial and GPS navigation systems from which line guidance is provided to the pilots. The aircraft and its complement of on-board sensors provide a readily deployable remote sensing platform that supports scientific research throughout the conterminous United States, Alaska and Hawaii. The aircraft has been deployed in support of research in Australia, Bermuda, France, Germany, Austria, Italy, South America, and Africa.

DC-8 Specifications:

Crew:	Two Pilots, Flight Engineer, Navigator
Length:	157 feet
Wingspan:	148 feet
Engine:	Four CFM56-2-C1 High Bypass Turbofan Jet

Altitude: 1,000 - 41,000 feet
Range: 5,400 Nautical miles
Duration: 12 hours
Speed: 425 - 490 knots True Air Speed (cruise)
Payload: 30,000 lb.
Base: Dryden Flight Research Center, Edwards, Calif.

SOLVE II Instruments

Instruments scheduled to fly onboard the DC-8:

1 Aerosol Lidar
2 DIAL - Differential Absorbtion Lidar
3 AROTAL - Airborne Raman Ozone, Temperature & Aerosol Lidar
4 MTP - Microwave Temperature Profiler
5 FCAS II - Focused Cavity Aerosol Spectrometer II
6 N-MASS - Nucleation-Mode Aerosol Size Spectrometer
7 DIAPER – Aerosol observations
8 FASTOZ - High Resolution In-Situ Ozone DACOM/DLH - Differential Absorbtion CO Measurement/Diode Laser Hygrometer
9 PANTHER – PAN (peroxyacetyl nitrate) and Trace Hydrohalocarbon ExpeRiment
10 DIAS - Direct Beam Solar Irradiance Spectroradiometer
1 AATS - Ames Airborne Tracking Sunphotometers
2 GAMS/LAABS - Gas & Aerosol Monitoring System/ Langley Airborne A Band Spectrometer

Instruments scheduled to fly onboard Balloons:

1 BBFPH - Balloon Borne Frost-Point Hygrometer
2 ECC - ECC Ozone Sonde
3 MkIV - MkIV Balloon Interferometer
4 CN - Condensation Nuclei
5 OPC - Optical Particle Counter

Ground Based Instruments:

1 Ozone Sondes
2 Super Loki rockets with falling sphere temperature measurements
3 Lidar - Multi Wavelength Stratospheric Ozone & Aerosol Lidar
4 Lidar - Tropospheric Raman Lidar
5 RAM - Microwave Radiometer for Atmospheric Measurements
6 FTS - Fourier Transform Spectrometer
7 UV-vis Spectrometers
8 Photometer

Forecast Models will also be used during this mission. For more specific information about each of these instruments go to: http://cloud1.arc.nasa.gov/solveII/instruments.html

Acronyms

ADEOS-II National Space Development Agency of Japan's Advanced Earth Observing Satellite
ENVISAT European Space Agency's environmental satellite
RASA Russian Aviation and Space Agency
SAGE III third Stratospheric Aerosol and Gas Experiment
SAM I Stratospheric Aerosol Measurement
SOLVE II second SAGE III Ozone Loss and Validation Experiment
THESEO 2000 Third European Stratospheric Experiment on Ozone in 2000
VINTERSOL Validation of International Satellites and Study of Ozone Loss

Video Listing

The following NASA video files may be of interest to the media. You may obtain further information about them and request copies of them by calling NASA Goddard Space Flight Center Television, Ms. Katie Stofer, 301-286-5687, or from the following web site:
http://pao.gsfc.nasa.gov/gtv.html

1 Tape #G02-090 -- **SOLVE II** – will be on NASA TV at various times during the mission. You can obtain the schedule from the following web site:
http://www.nasa.gov/ntv/

NASA TV is broadcast on GE-2, transponder 9C, C-Band, located at 85 degrees West longitude. The frequency is 3880.0 MHz. Polarization is vertical and audio is monaural at 6.8 MHz.

2 Tape # G00-A035 -- **SOLVE I** – video file from the first SOLVE mission

3 Tape # G01-069 -- **Arctic Ozone Trigger** -- long planetary waves affect Arctic temps and thus ozone

4 Tape # G02-016 – **Northern Ozone "Hole" May form After Large Volcanic Eruptions.**

5 Tape #GO2-076 – **Seeing Double: Unusual Weather Splits 2002 Antarctic Ozone Hole**

Mission Background

SOLVE I Campaign

NASA scientists and researchers from Europe, Russia, and Japan mounted the largest field measurement campaign ever, SOLVE I, to measure ozone amounts and changes in the Arctic upper atmosphere during the winter of 1999-2000.

This NASA-sponsored campaign was conducted jointly with the European Commission sponsored THESEO 2000 campaign. These collaborative campaigns obtained measurements of ozone and other atmospheric gases using satellites, airplanes, heavy-lift and small balloons, and ground-based instruments. Researchers examined the processes that control ozone amounts at mid to high latitudes during the Arctic winter.

The SOLVE/THESEO-2000 campaign represented a new level of active cooperation between U.S., European, Russian, and other national research scientists. Such scientific collaboration has been encouraged under the 1998 European Union/United States Science and Technology Cooperation Agreement. More than 350 scientists, technicians and support workers were involved in the SOLVE/THESEO-2000 experiment.

The SOLVE II campaign will add to the body of knowledge gained during the campaign of 1999-2000, when record ozone losses of 70 percent were observed at altitudes around 18km (11 miles) and more was learned about the processes leading to the fast ozone loss in the Arctic.

Meteor-3M Mission

SAGE III was successfully launched onboard a Meteor-3M spacecraft on December 10, 2001, from the Baikonur Cosmodrome in Kazakhstan. The satellite is in a sun-synchronous orbit with an ascending node time of about 9 AM.

The SAGE III/Meteor-3M satellite mission is a joint partnership between NASA and the Russian Aviation and Space Agency (RASA). It was initiated in 1994 and extends a long-term working relationship between the United States and Russia to understand Earth's environment.

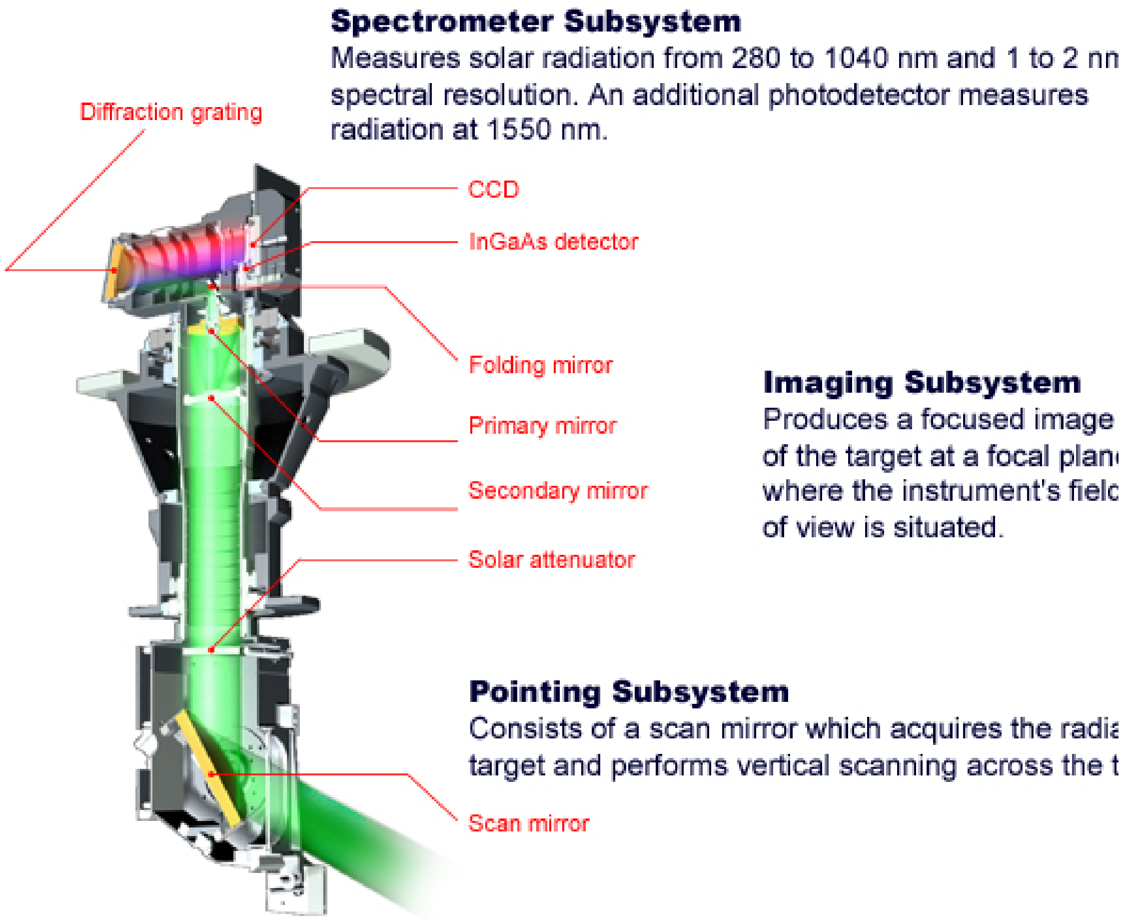
The Meteor-3M spacecraft is an advanced model of the Meteor spacecraft that was developed over 30 years ago. The payload includes SAGE III and other instruments designed to measure temperature and humidity profiles, clouds, surface properties, and high energy particles in the upper atmosphere.

The instrument is commanded and controlled by personnel at the SAGE III Mission Operations Center at NASA Langley Research Center, in Hampton, Va. Data are downlinked twice daily to the Wallops Flight Facility in Wallops Island, Va., and to a Russian receiving station. It is processed at the Langley Research Center's Atmospheric Sciences Data Center. Routine measurement operations began in March 2002.

Mission Timeline

December 12, 2002	- safety briefing
December 13	- first Experimenter test flight – 4 hours
December 17	- second Experimenter test flight – 4 hours
December 19	- third Experimenter test flight – 6 hours
December 20	- SOLVE II Principal Investigators depart for Holiday Break
January 2-7, 2003	- laser alignment and calibration
January 2	- SOLVE II Principal Investigators return
January 4	- back-up Experimenter test flight 8 hours
January 6	- cargo flight from Dryden Flight Research Center to Kiruna
January 8	- deploy to Kiruna
January 9	- arrive in Kiruna
January 12	- first science flight – 6 hours
January 14	- science flight – 6 hours
January 16	- science flight – 8 hours
January 18	- science flight – 10 hours
January 21	- science flight – 10 hours
January 23	- science flight – 10 hours
January 25	- science flight – 10 hours
January 27	- science flight – 10 hours
January 29	- science flight – 10 hours
January 30	- down day
February 1	- science flight – 10 hours
February 3	- last science flight – 10 hours
February 6	- DC-8 transit to Dryden Flight Research Center

Sage III Instrument Diagram



SAGE III Instrument

NASA DC-8 Aircraft

NASA Dryden Flight Research Center Photo Collection
http://www.dfrc.nasa.gov/gallery/photo/index.html
NASA Photo: EC99-44896-13 Date: February 1999 Photo by: Jim Ross

DC-8 Airborne Laboratory in flight during research mission - view from above