P78-10072

NASA News

National Aeronautics and
Space Administration

Washington, D.C. 20546
AC 202 755-8370

For Release IMMEDIATE

Press Kit

Project Joint American-Soviet Particle Intercalibration Project

RELEASE NO: 78-71

Contents

(NASA-News-Release-78-71) SOVIET SHIP ARRIVES NEXT MONTH FOR JOINT ROCKET TESTS (National Aeronautics and Space Administration) 10 p

N78-76094

Unclas
00/46 17465

Mailed:
May 15, 1978

NASA News

National Aeronautics and
Space Administration

Washington, D.C. 20546
AC 202 755-8370

For Release

IMMEDIATE

Nicholas Panagakos
Headquarters, Washington, D.C.
(Phone: 202/755-3680)

Kenn Morris
Headquarters, Washington, D.C.
(Phone: 202/755-3897)

Joyce Milliner
Wallops Flight Center, Wallops Island, Va.
(Phone: 804/824-3411)

RELEASE NO: 78-71

SOVIET SHIP ARRIVES NEXT MONTH FOR JOINT ROCKET TESTS

A Soviet research ship will arrive off the Virginia coast near NASA's Wallops Flight Center, Wallops Island, Va., about June 1 to participate in a series of rocket tests designed to investigate ionization sources in the upper atmosphere.

Launches will be conducted before, during and after a solar flare or intense magnetic storm.

-more-

Ionization is the process by which neutral atoms or groups of atoms become electrically charged, either positively or negatively, by the loss or gain of electrons.

Objective of the Joint American-Soviet Particle Intercalibration (JASPIC) Project is to compare the techniques used by both countries over the years to deduce the intensity of energetic electrons and protons coming down into the lower ionosphere. The project is designed to gather experimental evidence concerning the role of these particles in creating ionization in the lower ionosphere at night at midlatitudes.

The particles are thought to cause high latitude auroras, and sunlight is believed to be the principal source of ionization everywhere in the daytime.

The research ship, Professor Vize, will operate offshore and serve as the Soviet launch platform. Comparison tests will be made on the basis of four sounding rocket launches from Wallops Island and five Soviet MF-12 rocket launches from the ship. One of the Wallops-launched rockets will carry a chemical cloud release which may be visible to East Coast residents.

Each organization will be responsible for conducting countdown and launch operations for their respective launches.

A similar project involving U.S./U.S.S.R. intercomparison of meteorological sounding rockets was conducted jointly last August from the Wallops Island range and the Soviet ship, Akademik Korolev, located offshore. In that project, 22 pairs of meteorological rockets were launched during a two-week period.

In the past there have been disparate instrument measurements of energetic particles in the ionosphere. At a meeting of the International Union of Geodesy and Geophysics in Grenoble, France, in 1975, U.S. and Soviet scientists agreed that the first question to be resolved was instrument credibility. A joint measurement of the intensity of energetic electrons and protons at the same time and place is a first step in understanding the apparently conflicting results reported in the scientific literature.

(END OF GENERAL RELEASE. BACKGROUND INFORMATION FOLLOWS

BACKGROUND INFORMATION

Many discussions supporting and rejecting the existence of a midlatitude nighttime particle (electrons and/or protons) ionization source have been made by scientific researchers.

There have been reported direct measurements by satellite and rocket instrumentation which measured insignificant fluxes of energetic particles in the precipitation loss cones for midlatitudes and reports of optical observations which placed low upper limits on the possible precipitating fluxes. There are also many reports of rocket measurements of plasma densities from which large particle fluxes have been inferred, several rocket flights in which significant fluxes of particles were measured directly, and several more rocket flights in which particle fluxes were inferred from the background counts in instruments designed for other purposes.

Theorists have proposed alternative mechanisms to explain excess plasma densities and, of course, various experimenters have proposed various mechanisms which would lead to incorrect flux measurements. Several of the investigators in this project have been involved in these earlier efforts made at different times and different locations.

At a meeting of the International Union of Geodesy and Geophysics in Grenoble in 1975, U.S. and Soviet scientists agreed that the first question to be resolved was instrument credibility. Therefore, a joint measurement of the fluxes at the same time and place was the first step necessary to understand the apparently conflicting results in the scientific literature. Future steps could involve identification of location and conditions leading to precipitation and identification of mechanisms to be tested.

SCIENTIFIC CONSIDERATIONS AND COMPARISON CRITERIA

Objectives

The primary objective of this intercalibration experiment is to establish the credibility of the following U.S. and Soviet instruments and designs used in the past to directly determine the existence of particles (electrons and/or protons) which would be responsible for ionizing the lower regions of the ionosphere at night.

- Phosphor (a thermoluminescent dosimeter);
- Magnetic electron spectrometer;
- Solid state integral detectors;
- Electrostatic analyzer; and
- Geiger counters.

This objective will be attained by:

- Simultaneously measuring energetic particle fluxes which would be capable of causing ionization in the nighttime ionosphere between 100 and 180 kilometers (62 and 112 miles) with each of the instruments listed above;

- Making confirmatory measurements of the effects of these particles, i.e., ionization levels and optical emissions;

- Making a latitudinal survey of any optical emissions caused by particles;

- Making an all-sky survey for any "patchiness" in the emissions caused by nonuniform precipitation of the particles in the vicinity of Wallops Center;

- Measuring the ionization level at both Wallops Center and Arecibo, Puerto Rico, to determine the latitude variation of particle flux levels; and

- Determining the particle fluxes on the same L shells at higher altitudes by utilizing data from satellites. Satellite data may also provide a means to observe the fluxes and their latitudinal changes of pitch angle distributions which occur during the time the vertical probe (rocket) data is obtained. From satellite data the changes in particle populations before and after the rocket launches can also be followed. Additionally, the rockets will be launched over a two or three day interval to follow the time development at low altitudes not accessible to satellite.

Scientific Considerations

This project represents a coordinated effort to bring U.S. and Soviet scientists and techniques together which heretofore have made disparate measurements from several locations at separate times. This plan details the coordinated measurements required to overcome such deficiencies as:

- Instrument malfunctions or imprecise understanding of instrument behavior and calibrations;
- Geographic differences;
- Differences owing to changing conditions with time; and
- Lack of ancillary measurements to help analyze results obtained airglow which must accompany particle fluxes will be measured at Wallops Center and other locations in order to obtain an understanding of particle flux changes with latitude and their spatial uniformity.

Plasma densities will be measured along each of the rocket trajectories together with energetic particle fluxes. Ion densities will also be obtained between the E and F regions. The possibility that observed "excess" ionization is not the result of particle impact, but due to dynamics of the wind systems, will be determined by both the in-situ particle measurements and by observations of a trimethyl aluminum (TMA) trail.

This material reacts with atomic oxygen to create a chemiluminescence which can be seen at any time during a moonless, clear night. This trail deforms if wind shears are present. Knowledge of the deformation rate permits wind speeds to be calculated. These data are also vital to our understanding of the intermediate layer.

Each of the various particle instruments being flown was selected for its part in the historical record. Some designs have previously been on spacecraft, others have been rocket borne. The rocket carrying the TMA will also release barium at apogee, permitting electric field strengths to be determined.

Specific launch times will be determined after the ship arrives on site from a daily analysis of magnetometer data and ionosonde data. It is also expected that real time data from other locations will be available on occasion and they will also be used in the decision-making process as available.

The solar forecast center at Boulder will make data from its worldwide net of observation stations available in real time and will provide forecasts for the geomagnetic activity.

The scientific literature records a flux dependence on level of disturbance of the Earth's magnetic field resulting from solar flares. The forecast center will assist in selecting the period in June 1978 having the greatest likelihood of an intense magnetic storm and make the magnetic data available for the scientists to use in selecting the appropriate launch times.

Summarizing

Energetic particles will be measured directly. However, since these measurements can be spurious if contaminated by ambient dense plasma, ultraviolet light, insufficient outgassing of detectors, high voltage, intermittent breakdown or by the existence of large fluxes of particles at energies or charge not expected, different types of particle sensors having different susceptibilities to masking by supurious effects will be used. The atmospheric effects produced by particles will also be measured with a variety of techniques in flight and from the ground.

Comparison Criteria

A total of nine sounding rockets will be launched during JASPIC. Five of these will be the Soviet MR-12 rocket system, each equipped with a variety of instruments designed to measure the required parameters. The NASA portion of the total measurements scheme will be conducted using four sounding rocket systems, complemented by ground-based and airborne measurements.

The proposed sequence of launches and supporting rationale follows: One MR-12 system will be launched during a quiet time to obtain background data for payload instruments and to provide a reference set of data. After sunset on the day of a magnetic disturbance, a set of three rockets will be launched approximately within a few minutes of one another. This set will consist of one NASA TMA (trimethyl aluminum) payload, and one Nike Apache diagnostic payload and one MR-12.

About three hours later, a second group of launches is planned: one MR-12, a second NASA Nike Apache and the NASA Nike Tomahawk. The nightglow will be monitored from the ground prior to the first set of launchings until after the second set. These airglow measurements will be made from the ground at Wallops Island, from Arecibo, Puerto Rico and from Huancayo, Peru, in order to obtain the latitudinal variation in the airglow produced by the particle fluxes.

Airborne measurements of airglow and of ionospheric density around the Wallops vicinity will also be made in order to ascertain the extent of local "patchiness" and provide data in the event that clouds cover the ground observation sites. The data from these sets of launches, together with the airborne and ground-based measurements, comprise the prime data comparison set.

It should be noted that it is necessary to make measurements of particles during a moderate geomagnetic disturbance for verification of literature results since there is little question that auroral type precipitation should be seen at Wallops Center under extreme conditions when the aurora is pushed far to the south. A very large event is certainly useful for intercomparison. If there is reason to expect a "giant storm" event, the operation will be modified accordingly.

The final phase of this intercomparison is to monitor the effects of the magnetic storm with time. This will be effected by use of the Soviet rockets remaining following the flights during the disturbance. Of these two Soviet time dependence flights, the exact time chosen will be determined on-site by the U.S.S.R. side and will depend upon results obtained on previous launches and will be coordinated with U.S. satellite overflights if feasible, all within two or three days after the disturbance.

The decision regarding exact launch time will be made at the site utilizing solar forecast center data on immiment solar and geomagnetic activity. For example, a new, large flare would lead to a few days delay in launching one or more of the Soviet time dependence payloads in order to monitor the effect of the new magnetic storm near its peak.

The three MR-12 launches which are planned to occur outside the period of disturbance, together with satellite and ground-based data, comprise an important comparison of Soviet in-situ measurements with U.S. ground-based measurements and are important to the understanding of the physics of the magnetosphere-ionospheric interactions over time and latitude.

PROJECT OFFICIALS

NASA

Dr. Erwin R. Schmerling Chief, Space Plasma Physics Office of Space Science NASA Headquarters	Program Manager/Scientist
Cary F. Milliner, Jr. Wallops Flight Center	Project Manager
Dr. Fred A. Morse Aerospace Corp.	Project Scientist

Soviet Academy

Dr. S. I. Avdyushin Deputy Director The Institute of Applied Geophysics	Program Scientist
Dr. G.S. Ivanov-Kholodniy Chief, Department The Institute of Applied Geophysics Hydrometeorological Service of the U.S.S.R.	Project Manager

-end-