



Eighteenth session

INTERNATIONAL CO-OPERATION IN THE PEACEFUL USES OF
OUTER SPACE

Letter dated 22 August 1963 from the Permanent Representatives of the Union of Soviet Socialist Republics and the United States of America to the United Nations addressed to the Secretary-General

We have the honour to submit documents relating to the First Memorandum of Understanding to implement the Bilateral Space Agreement of 8 June 1962, for which circulation as a United Nations document was requested on 5 December 1962.^{1/} The Memorandum resulted from a series of meetings between Dr. Hugh Dryden of the National Aeronautics and Space Administration and Academician A.A. Blagonravov of the Academy of Sciences of the Union of Soviet Socialist Republics.

We request that these documents be circulated to all United Nations Members as an official United Nations document.

(Signed) A. STEVENSON
Permanent Representative of the
United States of America to the
United Nations

(Signed) N. FEDORENKO
Permanent Representative of the
Union of Soviet Socialist Republics
to the United Nations

^{1/} Official Records of the General Assembly, Seventeenth Session, Annexes, agenda item 27, document A/C.1/880.

8 July 1963

Dear Academician Blagonravov:

In my letter of 7 May 1963, I indicated that NASA had no changes to propose concerning the text of the "First Memorandum of Understanding to implement the Bilateral Space Agreement of 8 June 1962 between the Academy of Sciences of the USSR and the National Aeronautics and Space Administration of the United States", agreed to by us in Rome on 20 March of this year. It is now my pleasure to inform you similarly with regard to the text of the mutual understandings reached by us in Geneva on 24 May concerning the new Section IV, "Magnetic Field Survey through the Use of Artificial Satellites".

I propose, therefore, that the First Memorandum of Understanding, incorporating the new Section IV, and the changes to Section IV also agreed to by us in Geneva on 24 May, become effective as of the date of your response to this letter, confirming approval by the Soviet Academy of Sciences. I hope that by this time your Academy has already approved both the original Rome document and the subsequent Geneva text, and I shall look forward to hearing from you in this regard.

Sincerely yours,

(Signed) Hugh L. DRYDEN
Deputy Administrator

Academician A.A. Blagonravov
Academy of Sciences of the USSR
Leninski Prospekt 14
Moscow, USSR

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1 August 1963

Dear Dr. Dryden:

The Academy of Sciences of the USSR has instructed me to inform you of its consent to the recommendations on the questions of implementing the bilateral agreement on outer space between the National Aeronautics and Space Administration of the United States of America and the Academy of Sciences of the USSR, which were presented during the Soviet-American talks on the peaceful exploration of outer space on 20 March 1963 in Rome, taking into account Section IV of the text of recommendations (Magnetic Survey through the Use of Artificial Satellites), which were prepared on 24 May 1963 at Geneva.

The Academy of Sciences of the USSR expresses its hope that the agreement on peaceful exploration and utilization of outer space which has been reached, will promote further co-operation between Soviet and American scientists in this worthy cause in the name of scientific progress and the strengthening of peace on Earth.

Respectfully,

(Signed) A.A. BLAGONRAVOV
Chairman of the Commission,
Academician

Dr. Hugh L. Dryden
Deputy Administrator of the National
Aeronautics and Space Administration
Washington 25, D.C.

FIRST MEMORANDUM OF UNDERSTANDING
TO IMPLEMENT THE BILATERAL SPACE AGREEMENT
OF JUNE 8, 1962

BETWEEN THE ACADEMY OF SCIENCES OF THE USSR AND
THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION OF THE US

I - PREAMBLE

The purpose of the present Memorandum of Understanding is to begin the implementation of the sections of the bilateral space agreement of June 8, 1962 dealing with a coordinated meteorological satellite program, world magnetic survey using satellites, and a passive communication satellite experiment. It also provides for future discussions by the scientists of both countries of scientific results obtained from deep space probes (Mariner II and Mars I).

II - COORDINATED METEOROLOGICAL SATELLITE PROGRAM

A. Exchange of Meteorological Satellite Data

The bilateral space agreement of June 8, 1962 provided that the exchange of meteorological satellite data between

Moscow and Washington be of approximately equivalent interest to the two countries.

The following sections describe the data to be exchanged. It is agreed that, in general, the data exchange is to be completed within six hours of the observation time so that it will be useful in weather analysis and forecasting.

In all of the joint activities relating to meteorological satellites and exchange of meteorological data, the pertinent recommendations of the World Meteorological Organization shall be given due consideration.

1. Cloud Photographs

a. Selection of Photographs

Cloud photographs will be exchanged; the selection of those to be transmitted will be based on the following criteria:

1. Areas of the earth having few conventional observations.
2. Pictures along active international air routes, particularly oceanic.
3. Pictures containing patterns of meteorological significance such as fronts, vortices, cloud bands and streets.

b. Accuracy of Location

1. Positions of identifiable cloud elements in the pictures will be located with an accuracy

of about 200 km. Where landmarks are available, this accuracy should be about 100 km. It is expected that this accuracy will be improved later.

2. The pictures will include latitude and longitude grids at 2° intervals.

c. Brightness Levels

1. At the satellite receiving stations, six to ten brightness (gray) levels* will be contained in the pictures.
2. The pictures as received at the end of the communications link will contain five to six brightness levels, if possible.
3. To aid in the interpretation of cloud images, copies of some of the original pictures transmitted over the link will be mailed to the other country.

d. Resolution

1. The ground resolution provided by the pictures initially will be about 2.5 km and are expected to improve to about 1 km.

*Brightness levels should be clearly distinguishable by eye, such as the ratio of the intensities of adjacent steps being equal to the square root of two.

e. Field of View

1. The minimum field of view, on the earth's surface, of each picture will be about 1000 km on a side.

2. Nephanalyses

- a. Nephanalyses will be transmitted for all pictures received by the meteorological satellites.
- b. Wherever possible, format, representation, and map projections will follow World Meteorological Organization recommendations.
- c. Polar stereographic projection will be used, except in equatorial areas where Mercator projection will be used.
- d. A map scale of 1:20,000,000 or 1:15,000,000 will be used as convenient to the transmitting country.

3. Other Satellite Observations

As satellite observation techniques are developed to the point where they provide new useful information for weather forecasting, the data obtained will be considered for inclusion in this exchange program.

B. Exchange of Techniques and Results of Scientific Research

To assist in making maximum use of the satellite data in weather analysis and forecasting, there will be an exchange, on a basis of mutual interest, of techniques of interpretation and analysis.

It is also desirable to exchange scientific literature and data for research purposes, and to organize cooperative symposia.

C. Exchange of Conventional Meteorological Data

The establishment of a facsimile quality communications link between Washington and Moscow for the exchange of satellite data provides an opportunity, when it is not being used for the transmission of satellite data, for the exchange of related data obtained by conventional means of observations, and related maps, which will allow for improved correlation between satellite and conventional observations. Each country will indicate which of these data, available in the other, it wishes to receive and determine the priority of transmission. Some details of the exchange of the conventional data are given in an appendix and others are expected to be clarified, as they arise, by an appropriate working group.

D. Establishment of Communication Link

With the understanding that the regular exchange of meteorological data obtained from meteorological satellites will commence in the beginning of the second half of 1964, NASA and the Academy of Sciences of the USSR consider it desirable, in the beginning of the first half of 1964, to start the occasional exchange of conventional meteorological data and experimental satellite data and for this purpose to establish the communication link between Moscow and Washington provided in the agreement of June 8, 1962.

1. Characteristics of the Communication Link

The communication link shall be arranged on a four-wire basis, for full-time use, allowing simultaneous transmission of facsimile telegraphy information in both directions. Technical parameters of the communication link shall conform to the CCITT series T recommendations.

The link shall be equipped for non-simultaneous voice use to allow technical and meteorological coordination as necessary.

2. Characteristics of Terminal Equipment

Terminal equipment used for transmission of weather maps and charts shall conform with WMO recommendation 10.6.17/I - "Standardization of International Meteorological Transmissions by Facsimile - Equipment Characteristics." The preferred index of cooperation will be 576. The drum speed shall be 60, 90, or 120 rpm, depending upon the results of the technical tests.

Additional requirements for the terminal equipment for transmitting information obtained from meteorological satellites shall be determined during 1963. Each party shall provide and operate its own terminal equipment.

3. Routing of Communication Link

The circuit for the link shall be routed Washington - New York - London or Paris - Berlin - Poland - Moscow, assuming first that adequate facilities (circuits) are available over this route and second, that tests prove this routing to be technically acceptable to both NASA and the Academy of Sciences of the USSR. Technical arrangements for those sections of the link from Washington to Berlin shall be made by NASA. Technical arrangements for those sections of the link from Berlin to Moscow shall be made by the Academy of Sciences of the USSR.

Joint technical tests of the communication link along the selected route shall be conducted during January 1964, and after this the communication link will be put into regular operation.

4. Cost of the Communication Link

NASA and the Academy of Sciences of the USSR shall, within one month, agree upon a suitable mechanism for the handling of charges over the entire link in such a way as to provide for equal sharing of cost of the whole line by the two parties.

5. Reception of Meteorological Data by Weather Services of Other Countries

The desire of Weather Services of other countries to bridge the line on a receive-only basis in order to obtain meteorological data for their own use will be welcomed with the condition that each such Weather Service will make a proportional contribution to the total expenses of the communication link.

6. Coordination

NASA and the Academy of Sciences of the USSR shall, within 60 days, designate representatives for continuing direct technical coordination of details concerning this link.

E. Coordinated Launchings of Weather Satellites

The Bilateral Space Agreement of June 8, 1962, provided, among other things, for the coordinated launching of operational weather satellites. It is considered desirable to initiate coordinated launchings of weather satellites towards the end of the experimental period in order to gain experience with such coordination and to provide for more frequent receipt and exchange of data of both experimental and operational value.

The Academy of Sciences of the USSR and NASA therefore agree to convene a suitable Joint Working Group by the end of 1963, so that arrangements may be made, consistent with

the provisions of the June 8, 1962 agreement, for mutually agreeable launching schedules.

III - ARRANGEMENTS FOR PASSIVE COMMUNICATIONS SATELLITE EXPERIMENTS

A. General

The National Aeronautics and Space Administration and the Academy of Sciences of the USSR agree to participate jointly in passive communications experiments using a large reflector satellite, Echo II, (referred to as Echo A-12" in the agreement of June 8, 1962), which NASA is expected to launch prior to the middle of 1964.

B. Satellite Characteristics

The satellite to be used in these experiments shall be approximately 44 meters in diameter and shall be constructed of a material having a radio wave reflectivity of 98%. It will carry two telemetry transmitters (approximately 136 mc/s) to be used as tracking aids. The intended orbit will be inclined about 82° to the equator and will be roughly circular at an altitude of 1290 km.

C. Frequencies and Route

Communications experiments shall be carried out at frequencies of approximately 162 mc/s between the USSR (Zemenki Observatory, Gorky State University) and the United Kingdom (Jodrell Bank Observatory, University of Manchester).

In view of the technical desirability of carrying out communication experiments with a passive satellite using higher frequencies, NASA and the Academy of Sciences of the USSR shall consider, within three months following the date of this agreement, the possibility of extending these tests into the microwave region of the radio frequency spectrum. The possibility of arranging radar and optical observations of the Echo II satellite sphere during the period of its inflation and thereafter shall be considered within the same period.

D. Arrangments

The Academy of Sciences of the USSR shall make necessary arrangements for use of the Gorky State University facilities. NASA shall make necessary arrangements for the use of the facilities of the University of Manchester at Jodrell Bank. Within sixty days NASA and the Academy of Sciences of the USSR shall appoint representatives to begin and carry on continuing technical coordination with respect to the experiments at approximately 162 mc/s. NASA will request the appointment of a corresponding technical representative of the University of Manchester.

In case the question of using higher frequencies for carrying out the passive satellite experiments is settled positively, NASA shall arrange, through the General Post

Office of the United Kingdom, for the use of the Goonhilly Downs Station and shall request that technical representatives also be appointed by the General Post Office. The technical representatives for NASA and the Academy of Sciences of the USSR, referred to in the preceding paragraph, shall also serve to carry on continuing technical coordination for these experiments or other representatives may be named for this purpose.

It is understood that there will be no mutual money reimbursements between NASA and the Academy of Sciences of the USSR for the use of any facilities.

E. Orbital Information

NASA shall provide a prediction of the expected initial orbital elements at least two months prior to launching of the satellite. Actual orbital elements based on tracking information will be supplied for the duration of the experimental period, at intervals of approximately once per week, or as necessary for adequate pointing of the communication antennas. The Academy of sciences of the USSR shall provide tracking data on orbits that are visible in the USSR but not in the USA in a form to be mutually agreed on by the technical representatives.

F. Planned Types of Transmission

The passive Echo II satellite experiments shall basically consist of measurements of the quality of transmission over the circuit between the USSR and the UK for the following kinds of transmissions:

- (a) Unmodulated carrier
- (b) Single frequency modulation
- (c) Telegraphy
- (d) Facsimile and voice if feasible.

It shall also be an objective of these experiments to test the feasibility of direct communication between the US and the USSR using the Echo II satellite as a part of the link. For this purpose NASA will arrange for the part of the link from the US to the UK.

G. Exchange of Observational Data

The results of the experiments and observations shall be promptly exchanged between NASA and the Academy of Sciences of the USSR, and be made generally available to the scientific and technical community. Information about the equipment used for the experiments shall be exchanged to the extent necessary for the interpretation of these data.

H. Future Plans

NASA and the Academy of Sciences of the USSR will continue experimental research with active communications

satellites under their national programs; after the completion of preliminary national tests, negotiations will be continued to discuss the possibility of joint experiments of mutual interest with active communications satellites.

IV - MAGNETIC FIELD SURVEY THROUGH THE USE OF ARTIFICIAL SATELLITES

1. Objectives

It shall be the aim of the cooperative effort at this stage to produce a mapping of the earth's magnetic field by using US and USSR Satellites flow during the International Year of the Quiet Sun (IQSY).

2. Satellite Orbits

The forms of orbits, their altitudes and inclination to the equator will be selected by the satellite-launching country, in accordance with the objective of the experiment. It is agreed that the accuracy of determining space and time coordinates for the separate magnetic measurements on the satellite be such that after necessary processing by the satellite-launching country the magnetic data would not contain errors greater than plus or minus 10 gammas.

3. Times of Satellite Launchings

The times of satellite launchings will be determined by the satellite-launching country and will take place during the IQSY. It is recommended that Launchings take

place in 1965 since one may expect, in 1965, that the ground-based magnetic observatory programs of all countries participating in the IQSY will be in full operation.

4. Lifetime of Satellites

It is agreed that the lifetime of each satellite be such that the minimum density of magnetic measurements from each satellite correspond to no less than one per 200 kilometer square on the earth's surface.

5. Satellite Apparatus

It is agreed that absolute magnetometers of various types be used, such as optical pumping and proton precession magnetometers. It is recommended that the sensitive elements of magnetometers be located on the satellites in such a way as to minimize the effects of magnetic fields from the spacecraft.

6. Time Variation Corrections

With a view towards the desirability of working out a common method of introducing time variation corrections into the results of observations from satellites, it is agreed that each side conduct research in this direction and exchange results with the other side. The following possibilities should be considered:

- a. Comparison of satellite magnetic measurements taken at different times but corresponding to

the same region of space within a diameter of 10-20 kilometers;

- b. Comparison between experimental data obtained from satellites with those from ground-based magnetic observatories.

For the compilation of a magnetic map it is agreed that the results of satellite measurements made on magnetically quiet days be utilized.

In connection with the above, an exchange is recommended between the Academy of Sciences of the USSR and the NASA of the USA, namely: microfilm copies of magnetograms and tables of hourly averages of magnetic elements. In addition, copies of magnetograms shall be accompanied by data on the preliminary base line values, scale values, temperature coefficients, and types of instruments.

It is agreed that these data be exchanged no later than three months after the month of observation from the following observatories:

<u>USSR</u>	<u>USA</u>
Yakutsk	Sitka
Sverdlovsk	College
Irkutsk	Fredericksburg
Odessa	Tucson
Tashkent	San Juan
	Guam

It is agreed that the final base line values be exchanged on a quarterly basis.

7. Exchange of Satellite Magnetic Measurements

It is agreed to exchange results of magnetic measurements from satellites in the form of scientific articles or reports containing information on the satellite equipment, the data, its accuracy, methods of processing, introduced corrections, and estimates of the accuracy achieved judged necessary by the authors of the experiment.

It is agreed that each side if necessary will furnish by mail to the other side any additional data which may help to clarify the questions which arise in the use of the data received by exchange to remove the difficulties in utilization of those data.

8. Exchange of Data from Magnetic Surveys of Other Types

It is agreed to exchange comparable amounts of data from magnetic surveys which may be necessary for the compilation of a magnetic map and which are made without using satellites (ground, sea, aerial surveys) in the form of maps or of reports with attachments giving the results of surveys in tabular form, indicating coordinates and the times to which these data refer.

9. International Cooperation

It is agreed that appropriate organizations under the International Council of Scientific Unions, including the International Union of Geodesy and Geophysics and

COSPAR, concerned with the World Magnetic Survey be kept informed of the proposed joint US-USSR contributions to the World Magnetic Survey and of analysis of the results. Scientific data resulting from this work which is suitable for storage and dissemination through the World Data Centers will be supplied in a timely way.

V - OTHER QUESTIONS OF COOPERATION

Representatives of the Academy of Sciences of the USSR and NASA consider it to be useful for further progress in the space sciences to exchange scientific data received as a result of the launching in the USSR of an automatic space station towards the planet of Mars and the launching in the USA of a space station towards the planet of Venus. For this purpose it is desirable to conduct meetings of scientists of the two countries to discuss the results of those experiments in outer space. The preliminary discussion of these questions will be held during the next meeting of COSPAR in June 1963 in Warsaw. Additional meetings may be arranged at a later date, dependent on progress in analyzing the data received from "Mars I" and "Mariner II" by the scientists of both countries.

VI - EFFECTIVE DATE

The recommendations proposed in the present document have a preliminary character and will be presented by both parties to the Academy of Sciences of the USSR and the National Aeronautics and Space Administration of the US for final consideration. If either of the two parties finds it necessary to make any corrections, additions, or deletions in the text of the prepared documents, then all of these changes should be made in the shortest possible time after the conclusion of discussions concerning the conduct of a world magnetic survey by means of artificial satellites, by correspondence, which will be sent to the following address in Moscow:

Academy of Sciences of the USSR:
Leninski Prospekt 14
Moscow
USSR

and to the following address in Washington:

National Aeronautics and Space Administration
Attention: Dr. Hugh L. Dryden
400 Maryland Avenue, S. W.
Washington 25, D. C.
U.S.A.

If in this final consideration there is failure to agree on any of the three major areas, the recommendations in the other major areas will continue in effect.

Rome, Italy and Geneva, Switzerland

March 20 and May 24, 1963

EXCHANGE OF CONVENTIONAL METEOROLOGICAL DATA

A. Types of Conventional Data

1. Computer Processed and Checked Upper Air Data

- a. It is not anticipated that all conventional data would be processed and transmitted but rather the data for a few selected upper air levels that are particularly significant for analysis and forecasting. Criteria for the extent of this kind of data exchange would be based on the following:
 1. Limited to these stations from which the original upper air reports are received within three to four hours at Moscow or Washington. (This amounts to a "Regional" collection).
 2. Original reports will be subjected to rapid computer processing in order to eliminate and/or correct erroneous reports and to arrange the data in a convenient and systematic form for transmission.
 3. The upper air levels useful for numerical weather prediction are 1000 mb, 850 mb, 700 mb, 500 mb, 300 mb, and 200mb.
 4. At the levels indicated above, the following data will be transmitted: temperature, geopotential height, dew point and wind.
 5. The areas and network of stations for which the data are to be transmitted will be determined later.

2. Conventional Weather Charts

Charts prepared by objective numerical techniques in graphical form should receive priority for exchange on the communications link. The types of charts that would contribute to improved world weather analyses and predictions are:

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- a. Northern Hemispheric analyses of the 1000 mb and several upper air levels such as the 500 mb, 300 mb, and 200 mb levels.
- b. Northern Hemispheric predictions for 24 hours with the possibility of extending the period of forecast to 72 hours in the future, for 500, 300, and 200 mb.
- c. It is desirable in the future to exchange extended period forecasts of five days or longer and a selection of the important working charts or diagrams that may be used in generating these forecasts.
- d. In order to coordinate satellite and conventional observations associated with important weather developments, available detailed analyses and satellite photographs for specific areas will be transmitted on request as soon as possible.

3. Timing and Frequency of Exchanges

To be of maximum operational value, all information should be submitted as early as practical.

Suggested items are:

- a. Processed upper air data within 4-5 hours of observation (twice per day).
- b. Analyses within six hours of observation (twice per day).
- c. Prognoses within 6-9 hours of observation (twice per day).

4. Map Scales and Projections

- a. Polar stereographic projections will be used for all chart exchanges.
 - b. Analysis and prognostic charts having a scale of 1:30 million or 1:40 million will be used.
 - c. Special charts exchanged on request would be on scales most convenient for the transmitting country.
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