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DEPARTMENT OF THE ARMY PAMPHLET 70-5-8

USSR: MISSILES, ROCKETS AND SPACE EFFORT

A Bibliographic Record 1956-1960

HEADQUARTERS, DEPARTMENT OF THE ARMY SEPTEMBER 1960

ANALYSTS' NOTE

This bibliographic survey has been made at the request of the Office, Chief of Research and Development, Department of the Army.

It covers the period 1956–1960 in recognition of the fact that during the past four years the Soviets managed to score heavily in developing their missiles and rockets and space exploration programs. This bibliographic compilation brings under one cover the various aspects of the Soviet effort—from rocket bases and installations to their "missile diplomacy." The study does not attempt to be exhaustive, but strives to present a rounded picture of Soviet activities and achievements and the inherent dangers that face the United States and the rest of the Free World as Russia continues to make her "peaceful progress."

It is hoped that this pamphlet will answer, at least partially, the needs of those who are engaged in the monumental task of tracking down, evaluating, and understanding the scope and implications of Soviet missile and space effort.

The materials are arranged in alphabetical order by title within major and subordinate subjects groups. The titles listed are for the most part available in the holdings of the Army Library.

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I. Artificial Earth Satellites

A. Miscellaneous Aspects

BRUSSELS FAIR; THE SOVIET PAVILION, by Lev Petrov, in *USSR*, No. 8, (23), (1958) 38–44. In English.

The article includes photos of Soviet sputniks which were exhibited at the fair.

THE EFFECT OF GEOPHYSICAL FACTORS ON THE MOTION OF A SATELLITE. Oliivanii geofizicheskikh faktorov na dvizhenie sputnika, by I. M. Iatsunskii, in *Uspekhi Fizicheskikh Nauk*, v. 63, No. 1a (Sep 1957) 59–71.

Establishment of a problem pertaining to the specification of coefficients included in the mathematical expression of disturbing forces, based on satellite coordinates.

EARTH SATELLITE: LINK IN OVERALL SCIENTIFIC AND TECHNICAL DEVELOPMENT, by Alexander Topchiev, in *USSR*, No. 1(16), (1958) 10–14.

EARTH'S FIRST ARTIFICIAL SATELLITE; SPUTNIK, in *Engineer*, v. 204 (18 Oct 1957) 599.

THE NEW EXPLORATION, by T. R. F. Nonweiler, in *Astronautics*, v. 39, No. 2 (Oct 1958) 34–37.

Brings up to date the records of the Russian earth satellites and discusses what has already been learned about satellite behavior that contributes toward the ultimate aim of space flight.

RED SPUTNIK PLANS AVAILABLE LAST JUNE, by E. Clark, in *Aviation Week*, v. 67 (25 Nov 1957) 30–31.

THE ROAD TO COSMOS. MATERIALS OF NEWSPAPER "PRAVDA" ABOUT THE THREE SOVIET ARTIFICIAL SATELLITES OF THE EARTH. Put' v kosmos. Materialy gazety "Pravda", 1958. 320 p. In Russian.

The chapters are on: a new era in the development of world science; the first Soviet artificial earth satellite; the second Soviet artificial earth satellite; the third Soviet artificial earth satellite; Soviet upper atmosphere research by means of rockets; and K. E. Tsiolkovskii—the founder of rocket technology. Includes some scientific data obtained by Sputniks I and II. Illustrated.

RUSSIAN EARTH SATELLITE MAY BE IN THE AIR NOW, in *Science News Letter*, v. 71, No. 20 (18 May 1957) 306.

States that scientists agree on the possibility that Russia has secretly sent a man-made satellite out into space.

SCULPTORS TO CARVE SPUTNIK OBELISK, in *USSR*, No. 11 (26), (1958) 57–59. In English.

Details of a contest sponsored by the Moscow City Council "to chisel in enduring stone that moment when the first Sputnik was launched." Designs and models submitted by more than 1,000 contestants, sculptors and architects from every part of the Soviet Union are now on public display. Photos of some of the models.

SILICON SOLAR BATTERIES AS SOURCES OF ELECTRIC POWER FOR ARTIFICIAL EARTH SATELLITES. Kremnievye solnechnye batarei kak istochniki elektricheskogo pitaniia iskusstvennykh sputnikov zemli, by V. S. Vavilov and others, in *Uspekhi Fizicheskikh Nauk*, v. 63, No. 1a (Sep 1957) 123–129. In Russian.

Sources of power supply for telemetering and research instruments in artificial earth satellites.

SOVIET SATELLITE CARRIER ROCKET, by H. Odishaw, in *Science*, v. 126 (27 Dec 1957) 1334.

SOVIET SATELLITE INSTRUMENTATION, by Herbert Friedman, in *Astronautics*, v. 3, No. 2 (Feb 1958) 32–33 plus.

Comparison of Russian and U.S. techniques reveals different approaches to the problem of measuring solar X-ray and ultraviolet radiation.

SOVIET SHOWS SATELLITE-A-MONTH CAPABILITY, by E. Clark, in *Aviation Week*, v. 67 (11 Nov 1957) 29–30.

SOVIET WRITINGS ON EARTH SATELLITES AND SPACE TRAVEL. New York, Citadel Press, 1958. 253 p.

With chapters on: man in outer space; artificial satellite orbits and observations; utilization of artificial satellites; space voyages; artificial satellites of solar system bodies; initiation of space travel; earth satellites and geophysical problems; Sputnik II; life in sputnik; conducting optical observations; what Sputnik I disclosed above radio wave propagation; Russian Air Force views on sputniks; Soviet sputniks and radio electronics; what Sputniks I and II disclosed about outer space; Sputnik III in flight; design of the third Soviet sputnik; and solar battery of Sputnik III; among others.

SPUTNIK, in *Science*, v. 126 (18 Oct 1957) 739–740.

SPUTNIK, in *Scientific American*, v. 197 (Nov 1957) 66–67.

SPUTNIK AND ITS SATELLITES, by W. White, in *American Speech*, v. 33 (May 1958) 153–154.

SPUTNIK AND VANGUARD: A COMPARISON, by H. H. Koelle, in *Astronautics*, v. 2, No. 5 (Dec 1957) 32–33 plus.

"An educated guess as to what the first Soviet launching vehicle was like, along with analysis of the different approaches used by Russia and this country in constructing their orbital carriers."

SPUTNIK HAS LONG HISTORY, in *Science News Letter*, v. 72 (19 Oct 1957) 245.

SPUTNIK NOT SO SECRET, by Victor P. Petrov, in *Missiles and Rockets*, v. 3, No. 3 (Mar 1958) 82.

A diligent and painstaking study of Soviet periodicals, and especially technical and scientific magazines, could have given us some valuable advance information on the SPUTNIKS. A review of some of the information that was available before the Sputniks were launched.

SPUTNIK I—II; TEXTS OF SOVIET ANNOUNCEMENTS, OCTOBER 4 AND NOVEMBER 3, 1957, in *Current History*, v. 34 (Jan 1958) 48–50.

SPUTNIK II, by H. I. W. Massey, in *The New Scientist*, v. 2, No. 51 (7 Nov 1957) 14–15.

Comments on details of the satellite, its orbit, and why the USSR regards space travel to be of such importance. "Only one matter requires to be thoroughly tested before we can say that a manned journey to the moon is possible. This concerns the danger of being exposed to cosmic rays."

SPUTNIK II, in *New Republic*, v. 137 (11 Nov 1957) 3–4.

SPUTNIK; WHAT ARE ITS TECHNICAL IMPLICATIONS? in *Electronic Industries and Tele-Tech*, v. 16 (Nov 1957) 70–74 plus.

SPUTNIKS I AND II, by Fred L. Wolff, in *Space Age*, v. 1 (Nov 1958) 48–49.

TOWARD NEW SUCCESSES IN SPACE FLIGHTS, by L. I. Sedov. Washington, Department of Commerce, Office of Technical Services, 1959. (Translation from Russian. OTS: 59–16, 637.)

This paper presents the author's views of Soviet achievements in the launching of three artificial earth satellites and a space rocket.

TOWARDS SPACE FLIGHT, by A. R. Weyl, in *Aeronautics*, v. 38, No. 1 (Mar 1958) 32–35.

"Achievement and competition in the field of astronautics have greatly intensified over the past three months, and 'space flight' now occupies the attention of many serious minded people." Summarizes the satellite programs of the Soviet Union and the U.S. and notes the interest for space flight projects in both countries.

B. Soviet Successes and U.S. Reactions

THE CHALLENGE OF THE SPUTNIKS, ed. by Richard Witkin. New York, Doubleday, 1958. 96 p.

In the words of: President Eisenhower; Bernard Baruch; Edward Teller; Thomas K. Finletter; Bertrand Russell; Charles E. Wilson; Krafft A. Ehricke; Eric Sevareid; Clare Boothe Luce; Trevor Gardner; Marguerite Higgins, and others.

THE MENACE IN THE MIRROR'S IMAGE, by R. Pearson, in *Christian Century*, v. 75 (1 Jan 1958) 10–12.

"Whatever information SPUTNIK I and its successors may give the Russians about the realm of outer space, it is not likely to prove more important than what it tells them about us. Seldom has there been more revealing testimony to the fundamental nature of the American people than our reactions to the announcement that the Soviet Union had launched its satellite."

MISSILE PROGRAM READIES FOR OVERHAUL, in *Chemical Week*, v. 81 (19 Oct 1957) 31–32.

Two conclusions reached after Russia's SPUTNIK was placed in its orbit: SPUTNIK was not propelled by a high-energy (e.g., boron) fuel; responsibility for development and production of long-range missiles will be centralized, in an attempt to make it easier for participating companies to deal with the Department of Defense.

MUCH NEWS WAS BAD NEWS . . . . REACTIONS TO SPUTNIK, in *Air Force*, v. 40, No. 12 (Dec 1957) 35–36 plus.

Sample editorial news throughout the U.S. and in foreign countries.

"NEAT SCIENTIFIC TRICK": SPUTNIK III IN ORBIT, in *Missiles and Rockets*, v. 3 (Jun 1958) 44–45.

PRESIDENT'S VIEWS ON RUSSIA'S SATELLITE, in *U.S. News and World Report*, v. 43 (18 Oct 1957) 118–120 plus.

No "reason to grow hysterical . . . no additional threat to U.S." The President also said that the satellite does prove that the Russians possess "a very powerful thrust in their rocketry, and that is important."

REDS HOPED THAT MOON WOULD PANIC US, in *Saturday Evening Post*, v. 230 (9 Nov 1957) 10.

THE SHOWCASE WAR, by C. Dreker, in *Nation*, v. 185 (16 Nov 1957) 335–339.

The effect on U.S. of Soviet orbiting of its SPUTNIK and the advanced state of rocketry in the USSR. What it means as far as preparedness is concerned. "If the best we can hope for, under present conditions is a war of technology and nerves, we must get used to it." Threats associated with technological diplomacy are still of "unlimited magnitude . . . Big threats cost no more than little ones, and make better headlines." Inevitably, when weapons are no longer used, only tested, the time will come when they will no longer be made. "That time is not yet."

SOVIET SATELLITES; U.S. REACTIONS, by W. C. Davidon, in *Bulletin of the Atomic Scientists*, v. 13 (Dec 1957) 357–358.

SPUTNIK AND AMERICAN PUBLIC OPINION: AN ASTONISHING NUMBER OF CITIZENS LOOKED NO FURTHER THAN THEIR OWN POCKETBOOKS WHEN THE FIRST RUSSIAN SATELLITE WENT BY, by Samuel Lubell, in *Columbia University Forum*, v. 1 (Winter 1957) 15–21.

SPUTNIK AND US; WORLD ROUNDUP OF SCIENTIFIC COMMENT, in *Product Engineering*, v. 28 (4 Nov 1957) 23–24.

THE SPUTNIK PEARL HARBOR; EDITORIAL, by Peter J. Schenk, in *Air Force*, v. 40, No. 11 (Nov 1957) 34 plus.

SPUTNIK POSES QUESTION, in *Steel*, v. 141 (14 Oct 1957) 68–69.

WHAT SPACE MEN SAY ABOUT U.S. AND THE SATELLITE, in *U.S. News and World Report*, v. 43 (25 Oct 1957) 45–50.

C. Applications

BIGGER SPUTNIKS TO BOOST TELEVISION, in *Missiles and Rockets*, v. 3, No. 1 (Jan 1958) 58 plus.

A Soviet scientist says that the use of an earth satellite to boost the present range of television broadcasts is "wholly realistic."

COSMIC RAYS STUDIED FROM SPUTNIK II, in *Missiles and Rockets*, v. 3, No. 1 (Jan 1958) 58.

Some data on the subject as stated by a Soviet scientist.

INVESTIGATION OF THE SOLID INTERPLANETARY MATTER WITH AID OF ROCKETS AND EARTH SATELLITES. Issledovanie tverdoi sostavliaiushchei mezhplanetnogo veshchestva s pomoshch'iu raket i iskusstvennykh sputnikov zemli, by S. M. Poloskov and T. N. Nazarova, in *Uspekhi Fizicheskikh Nauk*, v. 64, No. 16 (Sep 1957) 253–255. In Russian.

THE PROBLEM OF MEASUREMENT OF PRESSURE AND DENSITY OF UPPER LAYERS OF ATMOSPHERE USING AN ARTIFICIAL EARTH SATELLITE. Zadacha izmereniia davleniia i plotnosti vysokikh sloev atmosfery s pomoshch'iu iskusstvennogo Sputnika Zemli, by B. S. Danilin and others, in *Uspekhi Fizicheskikh Nauk*, v. 43, No. 16 (Sep 1957) 205–225. In Russian.

Discussion of the role of an artificial satellite in the study of pressure, density, temperature, and composition of the upper atmosphere.

RED WAR SPUTNIKS IN THE WORKS? by Raymond L. Garthoff, in *Missiles and Rockets*, v. 3, No. 6 (May 1958) 134 plus.

Some Russian experts in this country claim the time for achievement of a U.S.S.R. war moon

is not far off. Soviet writings on the subject have mentioned several destructive roles for such a vehicle in the event of war. Current Russian silence on even the possibility of a military satellite suggests the existence of considerable Soviet sensitivity to the subject.

REDS PLAN SPUTNIK TV-RELAY, in *Electronics*, v. 31, No. 36 (5 Sep 1958) 34.

Soviet satellite for relaying TV broadcasts appears to be in the planning stages, with scientists anxious to carry out preliminary tests of both the rocket vehicle and the broadcast relay apparatus. TV satellite would give the Russians an electronic "foot in the door" of countries inhabited by some 2.2 billion persons.

D. Descriptive Data

DETAILS OF SPUTNIK SURPRISE SCIENTISTS, by David A. Anderton, in *Missile Engineering*, v. 2, No. 2 (Jan 1958) 6–8.

The surprising details and the meaning behind the details.

DETAILS ON SPUTNIK SURPRISE SCIENTISTS, by D. A. Anderton, in *Aviation Week*, v. 67 (21 Oct 1957) 30–31.

EARTH SATELLITES, by W. H. Stephens, in *RAeS Journal* (Jul 1959) 394–410 plus.

Presentation of design characteristics of Soviet and American satellites, and discussion of the scientific explorations made possible by their use.

FIRST SATELLITE RESULTS ARE IN, in *Astronautics*, v. 3, No. 1 (Jan 1958) 50 plus.

Preliminary scientific reports on Soviet satellites indicate that they are bigger than originally estimated.

FOUR OBJECTS REPORTED IN SPUTNIK ORBIT, in *Aviation Week*, v. 68, No. 21 (26 May 1958) 28–29.

At least four separate objects are reported to be in the Sputnik III orbit: instrumented satellite, final stage rocket satellite, nose cone, and one and possibly more, lightweight bodies with a minimum of several square feet. Also lists instrumentation of Sputnik II. With a picture and diagram (from Pravda) of Sputnik III and its components.

SCIENTIST COMPARES U.S.-RED SATELLITES, by S. B. Kramer, in *Aviation Week*, v. 68, No. 21 (26 May 1958) 50–51 plus.

A large group of parameters are common to all U.S. and Red satellites. These parameters—are compiled and compared. Accompanying charts list the parameters and present the data for Vanguard I, Explorer I and III, and Sputnik I, II, and III. Comparisons are made, for example, on instrumentation, orbit lifetimes, velocities, etc.

SOVIET ARTIFICIAL EARTH SATELLITES. Sovetskie iskusstvennye sputniki zemli, by A. Lozinskii, in Ezhegodnik Bol'shoi Sovetskoi Entsiklopedii, Moscow, "Goudarstvennoe Izdatel'stvo Bol'shaia Sovetskaia Entsiklopediia," 1958. p. 423–424. In Russian.

Description of Sputniks I and II; equipment carried on board; some of the observations made; tracking stations in the U.S.S.R.; and other pertinent information.

SOVIET SPUTNIK STRESSES SIMPLICITY, by Richard E. Stockwell, in *Canadian Aviation*, v. 31 (Sep 1958) 38–39.

Deals with Sputnik I, II, and III.

SOVIET SPUTNIKS. London, Soviet News Booklets, 1958. 52 p. (Soviet News Booklet No. 25.)

Based on material published by Soviet scientists.

U.S.—U.S.S.R.: SATELLITES AND SPACE PROBES, in *Aviation Week*, v. 70, No. 10 (9 Mar 1959) 102–103 plus.

Table showing name, designation, launch date, lifetime, dimensions, shape, weight, initial altitude, speed, and other information on Sputnik I, II, III, and Mechta, as well as the various launched and projected satellites and space probes of the United States.

E. Environmental Aspects

DOG IN SPACE, by Irwin Hersey, in *Astronautics*, v. 2, No. 5 (Dec 1957) 30–31 plus.

Some estimates on the size, shape, and methods, of propulsion used to launch the second SPUTNIK into space.

LIFE IN SPUTNIK, by P. Isakov, in *Astronautics*, v. 3, No. 2 (Feb 1958) 38–39 plus.

A Russian biologist examines problems involved in keeping a living organism alive in space and reveals Soviet approaches.

ON TO THE MOON, in *Scientific American*, v. 197 (Dec 1957) 58–59.

Russia's SPUTNIK II, its "animal passenger" and implications for future developments.

RUSSIANS RELEASE FIRST DATA ON SPUTNIK II BIOLOGICAL EXPERIMENTS, in *Astronautics*, v. 3 (Jul 1958) 68–69.

SPUTNIK II DATA, in *Missiles and Rockets*, v. 3, No. 2 (Feb 1958) 166.

Diagram showing the outside factors that influenced the dog "Laika" and body factors which were registered.

SPUTNIK II THROUGH RUSSIAN EYES, in *Astronautics*, v. 3, No. 1 (Jan 1958) 48–49 plus.

Data on the structure of the satellite and the biological experiments performed.

SPUTNIKS AND SPACE SHIPS; BREAKING THROUGH THE BIOLOGICAL BARRIER, in *USSR*, No. 4 (19), (1958) 17–19. In English.

Could a living organism stay alive once beyond the earth's atmosphere? The answer was provided by Sputnik II and Laika's heartbeats, heard by radio stations around the world. A dog, a living, breathing organism, had traveled in cosmic space. Describes what Soviet experiments with animals in rockets mean in terms of: the effects of speed on the body; effects of weightlessness and acceleration; and other physiological aspects of cosmic flight. Photo of Laika in her compartment ready for installation in Sputnik II.

F. Instrumentation

SOVIETS TEST SPUTNIK INSTRUMENTS, in *Electronics*, v. 31 (4 Apr 1958) 49.

Sputnik III.

SPUTNIK III INSTRUMENTATION, in *Aviation Week*, v. 70, No. 7 (16 Feb 1959) 51.

Photos showing: Sputnik III mass spectrometer tube with associated electronic unit; ionization manometer and dc amplifier; and nose magnetometer with electronic unit.

SPUTNIK III—LABORATORY IN SPACE, in *USSR*, No. 7 (22), (1958) 2–3. In English.

Description of scientific equipment of Sputnik III which was launched on May 15, 1958. Illustrated.

G. Launching

BOTH SIDES OF THE MOON [SUCCESSFUL LAUNCHING OF THE WORLD'S FIRST ARTIFICIAL SATELLITE], in *Economist*, v. 185 (12 Oct 1957) 99–101.

PROBLEMS OF LAUNCHING AN EARTH SATELLITE, by Martin Summerfield, in *Astronautics*, v. 2, No. 4 (Nov 1957) 18–86 plus; v. 2, No. 5 (Dec 1957) 34–37 plus.

The careful examination of the technical considerations inherent in any such project reveals the magnitude of the engineering feat accomplished by the Russians in the successful SPUTNIK launching. This analysis of flight performance, multistage techniques and firing programs offers an indication as to design of SPUTNIK I launcher and suggests the vehicle is capable of putting a 50-pound payload on the moon.

REDS PLAN SATELLITE LAUNCH FROM ANTARCTIC, by Seabrook Hull, in *Missiles and Rockets*, v. 4, No. 3 (21 Jul 1958) 8–9.

Alexander Nesmyanov, President of the U.S.S.R. Academy of Sciences made a statement that the Soviets "will eventually launch satellites from Mirny," Russia's big and permanent base at Wilkes Land or, as Russian maps call it, the Pravda coast of Antarctica.

RUSSIA'S SECOND SATELLITE, by Kenneth W. Gatland, in *Spaceflight*, v. 1, No. 6 (Jan 1958) 204–205.

An appraisal of the techniques necessary to place half a ton of research equipment in orbital motion round the Earth.

SOME VARIABLE PROBLEMS IN CONNECTION WITH THE LAUNCHING OF AN ARTIFICIAL EARTH SATELLITE. Nekotorye variatsionnye zadachi, sviazannye s zapuskom iskusstvennogo sputnika zemli, by D. E. Okhotsimskii and T. M. Eneev, in *Uspekhi Fizicheskikh Nauk*, v. 63, No. 1a (Sep 1957) 5–32. In Russian.

Study of the problem of launching an artificial earth satellite into its orbit. This is assumed to be possible by means of a rocket accelerator with one or more stages.

H. Orbits and Orbiting

DETERMINATION OF THE LIFETIME OF THE ARTIFICIAL EARTH SATELLITE AND STUDY OF THE SECULAR DISTURBANCES OF ITS ORBIT. Opredelenie vremeni sushchestvovaniia iskusstvennogo sputnika zemli i issledovanie vekovykh vozmushchenii ego orbity, by D. E. Okhotsimskii and others, in *Uspekhi Fizicheskikh Nauk*, v. 63, No. 1a (Sep 1957) 35–50. In Russian.

Development of a rapid and accurate method for the determination of the lifetime of a satellite (including the circular and elliptical orbits) study

of the secular disturbances of its orbit, and presentation of graphs and tables.

DETERMINING THE LIFETIME OF AN ARTIFICIAL EARTH SATELLITE AND AN INVESTIGATION OF SECULAR PERTURBATIONS OF ITS ORBIT, by D. E. Okhotsimskii and others. Washington, Department of Commerce, Office of Technical Services, 1959. (Translation from Russian. OTS: 59–16, 767.)

One of the most important problems connected with creating an artificial Earth satellite is that of obtaining a sufficiently reliable calculation of its lifetime in orbit. The graphs and tables given in the article make possible a rapid calculation of lifetime by multiplying a value taken from table or graph by a certain quantity which is a simple function of the basic parameters of the satellite. From the results which are given, one can calculate not only lifetime but also the law determining the change in the orbit's parameters with time for any given parameters of the satellite and for a rather wide range of the satellite's initial parameters.

ON THE MOTION OF AN ARTIFICIAL SATELLITE IN AN ECCENTRIC GRAVITATIONAL FIELD OF THE EARTH ENCOUNTERING ATMOSPHERIC RESISTANCE. O dvizhenii iskusstvennogo sputnika v netsentral'nom pole tiagoteniia zemli pri nalichii soprotivleniia atmosfery, by G. P. Taratynova, in *Uspekhi Fizischeskikh Nauk*, v. 63, No. 1a (Sep 1957) 51–58. In Russian.

Development of a method using a high-speed electronic computer to calculate the orbit of an artificial earth satellite, taking into account the basic disturbing forces acting on the satellite. Includes development of a method of integration and derivation of the equation of motion of a satellite in the eccentric gravity field.

ORBITING LABORATORY; SPACE TO SPACE IN SPUTNIK THREE, by K. W. Gatland, in *Engineering*, v. 185, No. 4813 (6 Jun 1958) 722–723.

Sputnik III.

PERTURBATION OF ELLIPTIC ORBITS BY ATMOSPHERIC CONTACT. SOME DEDUCTIONS FROM OBSERVATIONS OF THE ORBITS OF THE FIRST RUSSIAN SATELLITES, by T. R. Nonweiler, in *British Interplanetary Society, Journal*, v. 17, No. 1 (Jan-Feb 1959) 15–20.

Reviews information presently available concerning the action of air resistance on the orbit of the first Russian satellites.

RUSSIA PICKS TOUGHER SATELLITE ORBIT, in *Aviation Week*, v. 67 (29 Jul 1957) 31–32.

SPUTNIK I'S LAST DAYS IN ORBIT, by J. D. Kraus and E. E. Dreese, in *Proceedings of the Institute of Radio Engineers*, v. 46 (Sep 1958) 1580–1587.

I. Scientific Findings and Data

ARTIFICIAL EARTH SATELLITES, ed. by L. V. Kurnosova. Volumes 1 and 2. New York, Plenum Press, 1960. 107 p. Translated from Russian.

The original texts of Volumes 1 and 2 were published by the USSR Academy of Sciences Press, Moscow, in 1958. Volume 1 deals with results of the investigation carried out according to the IGY Program with the help of the first and second artificial earth satellites. Volume 2 includes articles which contain results of scientific investigations carried out with the third Soviet artificial satellite. In the course of the IGY, investigations on a number of problems were carried out simultaneously through the use of various devices and various methods. For this reason the articles contained in this collection also contain material on investigations carried out with rockets which are of the same character as investigations with artificial satellites. The articles presented are the revised texts of reports at the Fifth Assembly of the Special IGY Committee, which took place at Moscow in August, 1958, and are only a part of the material processed up to the moment of the present collection. Illustrated.

ARTIFICIAL EARTH SATELLITES, trans. by J. L. Zygielbaum. Pasadena, California Institute of Technology, Jet Propulsion Laboratory, 1959. (AI/Translation No. 2.)

The following articles dealing with results of scientific investigations obtained with the help of SPUTNIK III have been translated and are presented in this report: "The Dynamic Effects on the Motion of Earth Satellites"; "Certain Results of Measurements of Thermodynamic Parameters of the Stratosphere Using Help of Meteorological Rockets"; "Perturbations of the Gas Environment Caused by a Flight of a Satellite"; "Preliminary Results in Determining the Atmospheric Density Above 100 km"; "Investigation of the Ion Composition of the Earth's At-

mosphere with Rockets and Satellites"; "Soviet Investigations of the Ionosphere with the Help of Rocket and Satellites"; "Preliminary Report on Geomagnetic Measurements by the Third Soviet Earth Satellite"; "Investigation of Micrometeorites with Rockets and Satellites"; "Discovery of Corpuscles with the Help of SPUTNIK III"; "The Study of Soft Components of Cosmic Rays Beyond the Limits of Atmosphere"; "Heavy Nuclei in Primary Cosmic Radiation"; "Solar Batteries"; and "Acoustical Method for the Measurement of Mechanical Parameters of Meteorites."

MEASUREMENT OF THE CONCENTRATION OF POSITIVE IONS ALONG THE ORBIT OF AN ARTIFICIAL EARTH SATELLITE. Izmerenie kontsentratsii polozhitel'nykh ionov vdol' orbity iskusstvennogo sputnika Zemli, by K. I. Gringauz and M. Kh. Zelikman, in *Uspekhi Fizicheskikh Nauk*, v. 43, No. 16 (Sep 1957) 239–252. In Russian.

RESULTS OF SCIENTIFIC INVESTIGATIONS MADE BY SOVIET SPUTNIKS AND COSMIC ROCKETS, by V. I. Krassovsky. New York, American Rocket Society, 1959. (Paper 1050A–59.)

Presented at the 14th Annual Meeting of the American Rocket Society, Washington, D.C., 16–20 November 1959. This paper describes the various experiments which the Russians have performed with their SPUTNIKS and cosmic rockets. The results of these experiments are given and interpreted.

SPUTNIK AS A TOOL FOR SECURING GEODETIC INFORMATION, by L. Gold, in *Journal of the Franklin Institute*, v. 266 (Aug 1958) 103–107.

SPUTNIK FACTS COLLECTED, in *Science News Letter*, v. 72 (7 Dec 1957) 358.

J. Telemetering

RUSSIAN SATELLITE TRANSMITS SOME DATA, in *Aviation Week*, v. 67 (14 Oct 1957) 27.

WHAT'S BEHIND SPUTNIK? SOVIET ADVANCES IN INFORMATION THEORY, in *Electronics Business Edition*, v. 30 (10 Nov 1957) 27.

K. Tracking

ASTRONOMICAL OBSERVATIONS OF ARTIFICIAL EARTH SATELLITES. Astronomicheskie nabliudeniia iskusstvennykh sputnikov zemli, by A. G. Masevich, in *Vestnik Akademii Nauk, SSSR* (May 1959) 85–94. In Russian.

Equipment and methods used; photographic techniques employed; and some of the results obtained.

AUTOMATIC TRACKING SYSTEM ON AN OSCILLATING FOUNDATION WITH POWER GYROSCOPE DRIVE. O slediashchem privode s giroskopami na kolebliushchemsia osnovanii, by S. G. Kolesnichenko, in *Avtomatika i Telemekhanika* (Aug 1959) 1103–1110. In Russian.

The device measures the absolute angular velocity of the line of bearing of celestial bodies or artificial earth satellites.

CAMERA READY TO TRACK SOVIET SATELLITE, by R. Hawkes, in *Aviation Week*, v. 67 (28 Oct 1957) 123 plus.

EYES ON THE SKY, in *Astronautics*, v. 2, No. 5 (Dec 1957) 40–41 plus.

A brief description of the optical and visal tracking program now being used to establish the SPUTNIK orbits, based on a paper by Fred L. Whipple and J. Allen Hynek presented at the IAF Barcelona parley.

THE FIRST DAYS OF SPUTNIK I, by V. C. Reddish and others, in *Spaceflight*, v. 1, No. 6 (Jan 1958) 198–202.

Reports of the tracking work carried on during the days immediately following the launching of Russia's first artificial Earth satellite.

FIRST RUSSIAN SATELLITE TRACKED BY CADF [COMMUNICATED ANTENNA DIRECTION FINDING], in *Interavia*, v. 13 (May 1958) 423.

INFRARED OBSERVATIONS ON RUSSIAN SPUTNIKS, by L. Manns. Pasadena, California, U.S. Office of Naval Research, 1959. (Proceedings of the Infrared Information Symposia, V. 4, No. 3.)

This paper presents techniques used to detect the infrared radiation from Sputnik II, celestial observations, and direct observations made on Sputnik II. The systems used were PbS systems, which simplify equipment and experimental procedure and also give maximum sensitivity to solar reflection.

PHOTOGRAPHIC TRACKING OF ARTIFICIAL SATELLITES IN THE USSR. Washington, Department of Commerce, Office of Technical Services, 1959. (Translation from Russian. OTS: 59–16, 481.)

This paper is divided into the following sec-

tions: Photographic Stations; Limitations of the Network; Meteor Stations; Aerological Stations; Photography at Visual Stations; Cameras and Shutter Systems; Standard Meteorology; Oscillating Plate Method; Moving Grid Method; Moving Film Method; Spectrophotography; Optical-Electronic Transducers; Photoelectric Registration of Passage; Change of Brightness Studies.

RADIO OBSERVATIONS ON THE RUSSIAN SATELLITES; PANEL DISCUSSION, in *Institute of Electrical Engineers, Proceedings*, v. 105, (Mar 1958) pt. B, 81–115.

SCIENTIFIC OBSERVATIONS OF THE ARTIFICIAL EARTH SATELLITES AND THEIR ANALYSIS, by H. S. W. Massey and R. L. F. Boyd, in *Nature*, v. 181, No. 4602 (11 Jan 1958) 78–80.

British methods for radio, visual, and radar tracking of Soviet satellites.

SOVIETS USE ELECTRONIC NETWORK TO TRACK SPUTNIK III, in *Aviation Week*, v. 69, No. 24 (15 Dec 1958) 48–49 plus.

Some data gleaned from Pravda admitting that Russia has an extensive electronic tracking network. In an extensive article describing scientific findings made with Sputnik III, Pravda notes that for the first Sputnik, 60,000 electronic and 400 optical observations were processed, and for the second Sputnik, 12,800 electronic and 2,000 optical observations. Tens of thousands of observations of the third Sputnik already have undergone processing. Some of the findings reported are discussed.

SPUTNIK I TRACKED BY MILLSTONE RADAR, in *Missiles and Rockets*, v. 3, No. 1 (Jan 1958) 154.

Activities and equipment at the Millstone Hill radar of Lincoln Lab in Westford, Mass., which has been detecting and predicting the two Russian satellites orbits since shortly after their launchings on 4 October and 3 November 1957

SPUTNIKS OVER BRITAIN, by G. C. Sponsler, in *Physics Today*, v. 11, No. 7 (Jul 1958) 16–21.

A summary of the tracking procedures employed by British observers of the first Russian Sputniks. Radio observations, radar sightings, and analysis.

TRACKING THE RED MOONS, by G. R. Whitfield, in *Aeroplane*, v. 94 (7 Feb 1958) 178–179.

Radio observations of the Russian earth satellites at the Mullard Radio Astronomy Observatory, Cambridge.

U.S.S.R. USING NEW METHOD TO PHOTOGRAPH EARTH SATELLITES, in *Aero/Space Engineering*, v. 17 (Jun 1958) 29.

II. IGY: Soviet Contributions

INFORMATION ON SOVIET BLOC INTERNATIONAL GEOPHYSICAL COOPERATION—1959. Washington, Department of Commerce, Office of Technical Services, 1959. (PB 131632–80.)

Part I. Rockets and Artificial Earth Satellites. The design, propulsion launching, guidance, and flight-path monitoring are all discussed in this translation. Part II. Upper Atmosphere. The density and content of interplanetary space is evaluated by correlating scattered pieces of information obtained from infrared spectra, magnetic-field studies, and research-rocket experiments.

'METEO' ROCKET, in *Military Review*, v. 37, No. 10 (Jan 1958) 76.

Description of the METEO rocket which is being used by the Soviets in IGY research in Antarctica to secure information on air temperatures and densities up to an altitude of 56 miles.

ON THE WAY INTO THE COSMOS. Na puti v kosmos, by V. Dobronravov, in *Kryl'ia Rodiny* (Jun 1957) 20–22. In Russian.

Discussion of developments for the geophysical year and means of attaining future goals.

ROCKETS AND ARTIFICIAL EARTH SATELLITES IN UPPER ATMOSPHERE STUDIES. Rakety i iskusstvennye sputniki zemli v issledovaniiakh verkhnei atmosfery, by E. K. Fedorov and G. A. Skuridin, in *Vestnik Akademii Nauk, SSSR*, v. 27, No. 8 (Aug 1957) 37–48. In Russian.

Includes description of the IGY program, with details of equipment and instrumentation used and problems encountered.

[RUSSIA CLAIMS IT WILL LAUNCH EARTH SATELLITES DURING IGY], in *Air Force*, v. 40 (Mar 1957) 20.

RUSSIANS TALK ABOUT ROCKETS AT IGY CONFERENCE, in *Astronautics*, v. 2, No. 4 (Nov 1957) 85–86.

Details of Soviet research rockets and rocket experiments.

SELECTED TRANSLATIONS FROM SOVIET-BLOC INTERNATIONAL GEOPHYSICAL YEAR LITERATURE: ARTIFICIAL EARTH SATELLITE OBSERVATIONS. Washington, Department of Commerce, Office of Technical Services, 1959. (OTS: 59–11, 743.)

This paper presents translations of the following articles: "Camera for Photographing the Satellite"; "Simple Method for Rapidly Determining the Approximate Coordinates of Artificial Earth Satellites from Photographs Taken by the NAFA ZS/25 Camera"; "Question on the Rotation of Sputnik II"; "Approximate Prediction of the Ephemerides of Artificial Earth Satellites"; "Change in the Brightness of Sputnik II"; "On the Rotation of Sputnik II Around Its Axis"; "Scheme for Sending Signals During Visual Observations of an Artificial Earth Satellite"; "Attachment for the AT–1 Telescope for Determining Horizontal Coordinates of the Artificial Earth Satellite"; "Equipment for Photographing an Artificial Earth Satellite"; "Improving the Operation of the Signal Device in Artificial Earth Satellite Observations."

SOVIETS PREPARE FOR INTERNATIONAL GEOPHYSICAL YEAR, by Serge L. Levitsky, in *Military Electronics*, v. 2, No. 5 (May 1957) 22–23.

The Soviet program for the IGY and description of the proposed Soviet satellite (reported to be a minimum of 50 pounds, but probably much heavier, possibly 100 pounds).

SOVIETS REPORT TO IGY ON SATELLITE DOG, in *Aviation Week*, v. 69 (18 Aug 1958) 51 plus.

THE STUDY OF THE UPPER ATMOSPHERE BY MEANS OF ROCKETS, AT THE ACADEMY OF SCIENCES, U.S.S.R., by S. M. Poloskov and B. A. Mirtov, in *British Interplanetary Society, Journal*, v. 16, No. 75 (Apr-Jun 1957) 95–100. Translation.

Discussion of the Russian program for IGY and a brief description of various testing devices to be employed.

THE USSR EARTH SATELLITE PROJECT FOR THE INTERNATIONAL GEOPHYSICAL YEAR. Canada, Defence Research Board, Directorate of Scientific Intelligence, 1956. 14 p. (Report No. 8/56.) (ASTIA No. AD–107628.)

Contents: The International Geophysical Year; Plans for High Altitude Observations by Rockets and Artificial Satellites; The United States Satellite, Project Vanguard; The USSR Satellite Project; Choice of Orbit for the Soviet Satellite; Guidance Problems; Tracking Methods; Instrumentation and Telemetering.

III. Missiles and Rockets

A. Miscellaneous Aspects

BEHIND-IRON-CURTAIN ROCKET SHOW, in *Missiles and Rockets*, v. 2 (Feb 1957) 74–75.

BEHIND THE LUNIKS, by Y. A. Pobedonostsev, in *Astronautics*, v. 5, No. 1 (Jan 1960) 30–33 plus.

"This account of early Soviet rocket and jet propulsion experimentation by a Stalin prize-winning Russian scientist, himself an early experimenter, reveals a history going back some three decades." The development of Soviet Rocket engineering, showing "what has made it possible for the Soviet Union to launch the world's first cosmic rocket." With photos.

CONTEMPORARY MILITARY TECHNOLOGY. Sovremennaia voennaia tekhnika, comp. by Maj. Gen. Moskovsky. Moscow, Voennoe Izdatel'stvo, 1957. 276 p. In Russian.

Nuclear weapons and scientific developments.

DETAILS EMERGE ON SOVIET'S LARGE ROCKET PROGRAM, by Donald J. Ritchie, in *Missiles and Rockets*, v. 4, No. 17 (27 Oct 1958) 16–17.

Technical literature coming from behind the Iron Curtain gives valuable information on developments since the end of WW II. It is possible from these sources to construct a rough picture of the development of the rocket engine in the Soviet Union. The early years through 1940 are fairly clear. However, the postwar years remain a relative blank.

THE DEVELOPMENT OF ROCKET TECHNOLOGY, by Maj. Gen. V. A. Semenov, in *Sovetskaia Rossiia* (14 Sep 1957). In Russian.

GUIDED MISSILES AND ROCKETS. Upravliaemye snariady i rakety, by V. P. Petrov. Moscow, DOSAAF, 1957. 119 p. In Russian.

NEW SOVIET EQUIPMENT, in *Armor*, v. 67, No. 1 (Jan–Feb 1958) 32–33.

Photos of: surface-to-surface missiles similar to the CORPORAL; surface-to-surface missiles similar to the HONEST JOHN; and a surface-to-surface missile similar to the REDSTONE.

RED MISSILE ARSENAL PACKS LONG RANGE PUNCH, in *Aviation Age*, v. 29, No. 4 (Apr 1958) 20–21 plus.

A review with pictures and diagrams of Russian missiles, based on information received from "a special correspondent in Europe," giving design, performance and development details on 25 such missiles covering the entire range from ICBM to air-to-air types.

REDS PROPOSE FREIGHT ROCKETS, in *Missiles and Rockets*, v. 2 (Jun 1957) 40.

RUSSIANS AHEAD IN MISSILE METALLURGY, IN PRODUCT ENGINEERING? INTERVIEW WITH D. VON LUDWIG, in *Product Engineering*, v. 28 (11 Nov 1957) 115.

SOME PROBLEMS OF PROVIDING FOR SCIENTIFIC RESEARCH ON ROCKETS, by A. A. Blagonravov, in *American Rocket Society Journal* (Jan 1960) 22–27.

Discussion of some particular solutions to instrumentation problems in Soviet rockets. These include the isolation of measuring instruments from the rocket carrier to eliminate disturbances caused by rocket motion, ejection and recovery of scientific apparatus, description of the heat control system used in Lunik III, and some problems resulting from the use of animals (principally dogs) for space investigation.

SOME PROBLEMS OF PROVIDING FOR SCIENTIFIC RESEARCH ON ROCKETS, by A. A. Blagonravov. New York, American Rocket Society, 1959. (Paper 1052A–59.)

Presented at the 14th Annual Meeting of the American Rocket Society, Washington, D.C., 16–20 November 1959. This paper is designed to show how the Russians solved some of their problems relating to rocket flight. Auxiliary power systems, recovery systems, packaging of instruments, orientation systems, temperature control, and design of ecological systems for rockets are discussed briefly.

THE SOVIET AIR AND ROCKET FORCES, ed. by Asher Lee. New York, Praeger, 1959. 311 p.

Offers a "full-scale analysis" of Russian airpower today. While the book is largely concerned with conventional aircraft, a chapter on Soviet missiles provides an analysis of Russian achievements in the field of rocketry. In summary, the author states that the Soviets obviously have enormous rocket engines, but their satellites are less sophisticated than ours and the guidance systems they use are almost primitive by our standards.

SOVIET MISSILES. Les engins speciaux Sovietiques, by D. Laurent, in *Docaere* (Jul 1956) 3–12. In French.

Presentation of data on recent developments in the USSR, covering air-to-air, air-to-surface, surface-to-surface, surface-to-air, and water-to-surface missiles, with details of experimental installation and test centers.

[SOVIET MISSILES], in "GUIDED MISSILES." Long Island City, N.Y., Federal Procurements Publications, Inc., 1957. p. 443–444.

Description of the following Soviet missiles. COMET–1, COMET–2, J–1, J–2, J–3, ME–G, METEO, M–1, M–100–A, POL–1, POL–2, SPUTNIK, T–1, T–2, T–3, T–4, T–4A, T–5, T–6, and T–7A.

SOVIET MISSILES, by Alfred J. Zaehringer, in *Missile Design & Development*, v. 7, No. 1 (Jan 1960) 39–40; No. 2 (Feb 1960) 26–28; No. 4 (Apr 1960) 29–30.

Part 1—Liquid Rockets, points out that Soviet progress is basically due to an early start on long-thrust engines. Also briefly discusses and lists Soviet liquid missiles. Part 2—Solid Rockets, deals with discussion of progress of Soviet solid propellants and ground-to-ground, ground-to-air, and air-to-air missiles. With type listing. Part 3—Cruise Missiles, Ramjets, and Hybrid Rockets.

SOVIET ROCKET GEAR, in *Electronics*, v. 31, No. 18 (2 May 1958) 19.

An official Russian announcement in Pravda reporting details of the firing of a single-stage rocket containing one and a half tons of instruments and going up 294 miles.

SPUTNIK'S ROCKET CALLED OFFSHOOT OF WORLD WAR II GERMAN V-BOMB, in *Oil Paint and Drug Reporter*, v. 172 (14 Oct 1957) 3 plus.

TABLE OF SOVIET MISSILES, by Alfred J. Zaehringer, in *Journal of Space Flight*, v. 8, No. 5 (May 1956) 1–4.

A table which brings up to date Soviet missile development. New developments include medium range and intercontinental missiles (T–2 and T–3), the I–2 rocket interceptor, the J–3 submarine-launched cruise missile, and the T–7A ballistic rocket. Data on 26 various missiles and rockets.

WHAT'S NEW WITH RED AIRPOWER, in *Air Force*, v. 39, No. 9 (Nov 1956) 20.

Brief notes concerning: (a) the name of a

Russian Intercontinental Ballistic Missile; (b) a new Russian rocket power plant numbered "742"; (c) an air-to-air missile for use against bombers which was designed but never built in the immediate post-war period; and (d) a number three airfield near Novosibirsk, with two large runways, which is claimed to be a test site for missiles, including some that are over sixty feet high. The missiles may be manufactured at nearby Kamenskoye.

B. Armed Services

ARMED FORCES. Vooruzhennye sily, in *Bol'shaia Sovetskaia Entsiklopediia*, v. 50, 3d ed. Moscow, Gosudarstvennoe Nauchnoe Izdatel'stvo "Bol'shaia Sovetskaia Entsiklopediia," 15 Aug 1957. p. 417–429. In Russian.

Historical, organizational, and administrative description of the Armed Forces of the USSR, brought up to date.

ARMED FORCES OF THE USSR. Vooruzhennye Sily USSR, in *Ezhegodnik Bol'shoi Sovetskoi Entsiklopedii*. Moscow, Gosudarstvennoe Nauchnoe Izdatel'stvo "Bol'shaia Sovetskaia Entsiklopediia," 1957. p. 45. In Russian.

Brief description of the current state of readiness of the Soviet Armed Forces. States that they are equipped with "various types of atomic and thermonuclear weapons, powerful rocket and rocket-launching weapons of various types, including long-range rockets."

ARMY IN BEING, by Raymond L. Garthoff, in *Army*, v. 8, No. 6 (Jan 1958) 51–56.

Their successes with SPUTNIKS and ICBM's are not enticing the Kremlin to discount land forces. The 175-division Soviet Army in being is armed with modern weapons of all kinds and is emphasizing new tactical concepts, including ground and air mobility. In the Soviet view modern mass armies continue to be the "main element of the armed forces."

THE CHANGING SOVIET FORCES AND THEIR FIGHTING CAPACITY, in *Tairiku Mondai* (Jul 1956) 1. Translated from Japanese.

"The Soviet military setup is being drastically adapted to repulse the enemy with annihilative surprise attacks by aircraft and guided missiles designed for strategic atomic and hydrogen bombing. Thus, the air force is replacing the army as the nucleus of the Soviet war machine. Unusual efforts are being exerted to improve strategic bombers and guided missiles, especially medium-range guided missiles (600 to 800 miles), whose range may be extended to 1,500 miles in the future."

GUIDED ROCKETS. Upravliaemye rakety, in *Ezhegodnik Bol'shoi Sovetskoi Entsiklopedii*. Moscow, Gosudarstvennoe Izdatel'stvo Bol'shaia Sovetskaia Entsiklopediia," 1957. p. 596–600. In Russian.

This article describes American, French, and British missiles of various types. The state of the art in the Soviet Union is limited to the following statement: "Soviet Armed Forces now possess rocket and rocket-launching weapons of various types, including long-range rockets, as well as antiaircraft rocket weapons and other means of antiair defense."

THE "HENSCHEL HS–17, BUTTERFLY," NEW RUSSIAN ANTIAIRCRAFT ROCKET. El "Henschel HS–17, Butterfly," nuevo cohete antiaéreo Ruso, in *Ejército*, v. 17, No. 200 (Sep 1956) 60. In Spanish.

Brief description of Russia's "most modern" antiaircraft rocket.

HOW THE SOVIETS ORGANIZE THEIR AIRPOWER, by Raymond L. Garthoff, in *Air Force*, v. 41, No. 2 (Feb 1958) 58–60 plus.

The organization; the high command; Air Defense Forces; Long-Range Air Force; Airborne Forces; Naval Air Forces; Frontal Aviation; and Headquarters of the Air Forces. Includes some information on the status of missiles within the Soviet airpower structure. Organizational charts.

HOW THE SOVIETS RUN THEIR MISSILE PROGRAM, by Raymond L. Garthoff, in *Air Force*, v. 40, No. 12 (Dec 1957) 53–54.

How the program was organized and how it is being conducted.

A LOOK AT SOVIET WEAPONS, in *Army Information Digest*, v. 12, No. 8 (Aug 1957) 2–14.

"The Soviet Army is the only major force in the world today that has a completely new post-war arsenal of weapons, in being, in the hands of trained troops, capable of fighting either a nuclear or nonnuclear war, big or small, in any kind of climate or terrain." This review of Soviet weapons includes some information and photo on new, long-range and highly accurate track-mounted multiple rocket launchers.

MISSILES ARE ARTILLERY, SOVIET LEADERS SAY, in *Army*, v. 7, No. 11 (Jun 1957) 29.

Documented statements of professional Soviet military leaders on missiles.

MISSILES OF THE U.S.S.R., by Alfred J. Zaehringer, in *Ordnance*, v. 42, No. 226 (Jan-Feb 1958) 639–642.

Russian interest in rockets and space flight goes back to 1903, and recent disclosures of satellites and guided missiles show that the Soviets have modern weapons under development and in mass production.

A NEW LOOK FOR THE SOVIET GROUND FORCES, by Lt. Col. Irving Heymont, in *Military Review*, v. 36, No. 10 (Jan 1957) 54–62.

Includes photos of the 6-inch rocket launcher (16 round); 9-inch rocket launcher (12-round); and the new 4-round rocket launcher, capable of firing four large diameter rockets, which was first seen in 1954 parades.

THE NEW-LOOK SOVIET WEAPONS, in *Army Information Digest*, v. 13, No. 3 (Mar 1958) 24–33.

Includes information and photos on Soviet rockets and missiles.

THE NEW REDUCTION IN THE SOVIET ARMED FORCES, by N. Galay, in *Institute for the Study of the USSR, Bulletin (Munich)*, v. 3, No. 7 (Jul 1956) 47–52. In English.

On May 15, 1956 the Soviet government announced its decision to reduce, by May 1, 1957, its armed forces by 1,200,000 men, this figure not including the 640,000 men reduction reportedly carried out at the end of 1955. Evaluates how this announced reduction will affect the ground, air, and naval forces, and notes that as far as the reductions in number of planes and air formations in the Soviet bomber command are concerned, these will be made up for by the development of fighter and attack planes, and by the development of ballistic missiles and the resources of anti-aircraft artillery.

A NEW SCIENTIFIC POWER FOR THE WORLD TO RECKON WITH, in "GUIDED MISSILES." Long Island City, N.Y., Federal Procurement Publications, Inc., 1957. p. 425–429.

The political and military significance of the Soviet announcement on 25 August 1957 of successful testing of an ICBM. The Soviet IRBM and ICBM program; dangers facing U.S. from the Soviet ICBM threat; ten top targets in U.S. that could be reached by ICBM's launched in Russia or Siberia; and conjectural description of the Soviet ICBM (by stages).

THE NEW SOVIET WEAPONS, by Garrett Underhill, in *Ordnance*, v. 42, No. 223 (Jul-Aug 1957) 57–61.

The Reds do not regard guns and shells as "old" or nuclear weapons and missiles as "new" but as mutually complementary elements of a modern defensive and offensive system constantly kept up to date.

ROCKETS AND SOVIET WAR DOCTRINE, in *Military Review*, v. 38, No. 12 (Mar 1959) 99.

Digested from an editorial in Aeronautics (Gt. Brit.), June 1958. From the structure of her armed forces, and in particular, from what is known of her aircraft, missiles, and rockets, "it must be concluded" that Russia plans in a single "compartment" and not two different "compartments" the deterrent for total war and the conventional forces for limited war. She does not believe that war can be divided into these or any other separate categories.

RUSSIA'S GUIDED WEAPONS, by Kenneth W. Gatland, in *RAF Flying Review*, v. 13, No. 10 (Jul 1958) 42.

Data on a representative selection of weapons of the following classes: surface-to-surface (tactical), surface-to-air, and surface-to-surface (tactical support).

THE SOVIET ARMY, ed. by B. H. Liddell Hart. London, Weidenfeld, 1956. 480 p.

The aim of this book is to provide a reliable account, and comprehensive picture, of the Soviet Army in all its aspects—by drawing on and piecing together the knowledge of a wide range of experts in various countries who have made a special study, or have had direct experience, of particular aspects and organs of this Army. The book covers two periods: the Red Army 1918–1945 and 1946–1955, and for the most part deals with the various branches of the Soviet Army (e.g., Infantry, Artillery, Airborne Forces, Chemical Army), and its doctrines, however there are also intermittent references to rockets and missiles and for this reason it is being included in the bibliography. Maps and illustrations. Biographical notes on contributors to this book.

SOVIET ARMY WEAPONS ARE MODERN, by Mark S. Watson, in *Army*, v. 8, No. 6 (Jan 1958) 57–59.

The American observer cannot fail to see that the Soviet Army has weapons and equipment which are fully equal to what we have been developing, and some which are actually superior. Description of some of these weapons, including missiles.

THE SOVIET UNION'S ROCKETS AND TANKS, in *Interavia*, v. 13, No. 1 (Jan 1958) 45–46.

Basically the new Soviet rocket weapons "can be considered as modernized artillery whose range, due to the employment of reaction propulsion, has been improved many times and whose mobility in the combat areas has been increased by the use of self-propelled armored mounting serving as both a means of transport and as launching platforms." With photos, charts, and diagrams on Soviet tactical rocket weapons.

THE SOVIETS CLOSE THE GAP, by Col. T. C. Mataxis, in *Infantry School Quarterly*, v. 47, No. 1 (Jan 1957) 18–28.

Current Soviet developments in weapons and tactics (including rockets) surpass capabilities originally credited them. Photo of truck-mounted, multiple 8-inch rocket launcher.

THE SOVIETS FORGE AHEAD, by Col. Theodore C. Mataxis, in *Infantry*, v. 48, No. 2 (Apr-Jun 1958) 14–27.

The Soviets are equipping their huge Army with "impressive" new weapons and equipment. The latest Red Army parade included powerful and mobile tactical weapons including guided missiles which "appear to match and possibly surpass those in the hands of our troops."

SOVIETS STUDY MILITARY ASPECTS OF SPACE, in *Aviation Week*, v. 70, No. 10 (9 Mar 1959) 313–319.

"Soviet airpower in 1959 will be based upon expanding programs for both missiles and manned aircraft with a strong research and development effort aimed at achievement of military useful space vehicles. There is considerable evidence that the Soviets are pushing hard along parallel lines in equipping their operational forces in being with both the latest model missiles and manned aircraft for both offensive and defensive purposes. There is no evidence that manned aircraft development or production is being phased out or abandoned in favor of exclusive concentration on missiles."

TWO RUSSIAN ROCKETS, in *Economist*, v. 184 (31 Aug 1957) 661–663.

C. Bases and Installations

GUIDED MISSILE BASES [RUSSIAN], in *Military Review*, v. 37 (Jun 1957) 73.

KAPUSTIN YAR SERVES AS RUSSIA'S CAPE CANAVERAL, by Frank G. McGuire, in *Missiles and Rockets*, v. 3, No. 2 (Feb 1958) 61–62.

Description of Russia's major launching complex at Kapustin Yar, near Stalingrad, from which both SPUTNIK vehicles and ICBM's are launched; and how Air Force radar in Turkey and Iran monitors the launchings at Kapustin Yar.

ROCKET BASES [IN RUSSIA], in *Military Review*, v. 38 (Aug 1958) 72.

[RUSSIAN MISSILE BASES, PLANTS AND CENTERS], in *Missiles and Rockets*, v. 2 (Feb 1957) 40–41.

[SOVIET MISSILE AGENCIES AND INSTALLATIONS], in "GUIDED MISSILES." Long Island City, N.Y., Federal Procurement Publications, Inc. 1957. p. 443–444.

Names and locations of 71 missile agencies and installations in the Soviet Union, arranged in alphabetical order.

SOVIET STRENGTH IN THE BALTIC AREA, in *Military Review*, v. 36, No. 2 (Feb 1957) 95–101.

Includes information on Soviet guided missile installations. (Translated and digested from an article by Col. Chabanier in REVUE de DEFENSE National, France, July 1956.)

WORLD RAPIDLY ADDING MORE MISSILE RANGES, by William Q. Miller, in *Missiles and Rockets*, v. 5, No. 10 (9 Mar 1959) 15–17.

United States is negotiating in hopes of cooperation in man-in-space plans. Existing ranges vary from relatively small facilities to those extending thousands of miles. Small nations are participating at a fast-growing rate. Some data on Russian ranges. With worldwide map of missile/space test ranges.

D. IRBM and ICBM

BEHIND THE RED SATELLITES, by F. J. Krieger, in *Astronautics*, v. 3, No. 11 (Nov 1958) 32–33 plus.

Soviet activities in the field of ballistic missiles and space flight.

CHRONOLOGY OF THE MOST IMPORTANT EVENTS IN THE FIELD OF NATURAL SCIENCE AND TECHNOLOGY. Khronologiia vazhneishikh sobytii v oblasti estestvoz-

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naniia i tekhniki, in *Bol'shaia Sovetskaia Entsiklopediia*, v. 50, 2d ed. Moscow, Gosudarstvennoe Nauchnoe Izdatel'stvo "Bol'shaia Sovetskaia Entsiklopediia," 15 Aug 1957. p. 717–725. In Russian.

This chronological table includes the following information: the first Soviet atom bomb was tested in 1949; the first Soviet hydrogen bomb was tested in 1953; the first Soviet ICBM and first earth satellite were launched in 1957.

FACTS AND FICTION ON THE ICBM; SOVIET ANNOUNCEMENT, by R. Hotz, in *Aviation Week*, v. 67 (2 Sep 1957) 21.

GERMAN RETURNEES SKETCH RED IRBM POWER UNIT, by Alfred J. Zaehringer, in *Missiles and Rockets*, v. 4, No. 3 (21 Jul 1958) 11.

Even though the U.S.S.R. has not shown its operational IRBM, the T–2, or its Sputnik launcher, a glimpse behind the "ballistic iron curtain" has been provided by the German rocket "collectives" which worked for the Reds from the end of WW II to 1950. With sketch.

INTERCONTINENTAL MISSILES AND OTHER VEHICLES FOR STRATEGIC WEAPONS, by Maj. Gen. G. I. Pokrovskii, in *Sovetskii Patriot* (11 Sep 1957). In Russian.

MIGHTY RED MISSILE, in *Life*, v. 43 (9 Sep 1957) 39–42.

"A good guess" with diagrams "on how the Soviet intercontinental rocket works." Also U.S. missiles "on hand and in works."

MISSILE'S FIRST VICTIM. [RUSSIAN INTERCONTINENTAL MISSILE DROPPED ON THE BULLSEYE OF AMERICAN PUBLIC OPINION], in *Economist*, v. 184 (7 Sep 1957) 762.

THE NEW RUSSIAN SPACE-ROCKET, in *Spaceflight*, v. 2, No. 6 (Apr 1960) 183–184.

Details of the Russian multistage rocket which was launched nearly 7,700 miles into the Central Pacific Ocean on 20 January 1960 and which was reported by Tass News Agency together with comments by leading Soviet authorities.

NEWS CONFERENCE, AUGUST 27, 1957, J. F. Dulles, in *U.S. Department of State Bulletin*, v. 37 (16 Sep 1957) 457–458.

Concerning the significance and meaning of the Soviet announcement about ICBM and the successful testing of the missile.

[NEWS FROM RUSSIA ABOUT THE INTERCONTINENTAL BALLISTIC MISSILE], by A. Bryant, in *Illustrated London News*, v. 231 (7 Sep 1957) 374.

THE PROBLEM OF THE INTERCEPTION OF THE INTERCONTINENTAL BALLISTIC MISSILES, by Maj. V. Kriksunov, in *Sovetskaiia Aviatsiia* (25 Apr 1957). In Russian.

REAL THREAT OF MOSCOW'S MISSILE, by H. Schwartz, in *New York Times Magazine* (15 Sep 1957) 20 plus.

Behind the development of an intercontinental weapon lies the totalitarian regime's ability to concentrate all resources to one end, regardless of the people's needs.

REDS BRAG ABOUT HYDROGEN MISSILE; WASHINGTON REACTION, in *Aviation Week*, v. 64 (30 Apr 1956) 28.

RUSSIAN ROCKET [INTER-CONTINENTAL BALLISTIC MISSILE], by C. Falls, in *Illustrated London News*, v. 231 (7 Sep 1957) 381.

RUSSIANS STUDY ICBM DECEPTION BY FRAGMENTATION OF FINAL STAGE, in *Missile Engineering*, v. 2, No. 2 (Jan 1958) 48.

Concern in U.S. over the reported Soviet investigation of a technique to penetrate U.S. missile defenses by confusing defending antimissile defending radars with large numbers of decoy warheads. Problems that face U.S. antimissile missilemen.

RUSSIA'S GUIDED MISSILE PROGRAM, in *Missiles and Rockets*, v. 2 (Feb 1957) 33–41.

Russians are producing missiles in quantity. The stock pile of antiaircraft missiles and IRBM's should certainly be regarded with respect, while the imminence of the Russian ICBM is a threat of the first magnitude.

SAENGERS DESCRIBE SOVIET MISSILES, in *Aviation Week*, v. 67 (16 Sep 1957) 73.

Dr. Irene Bredt-Saenger and her husband, Dr. Eugene Saenger, two German rocket scientists revealed that the USSR has four long-range, surface-to-surface missiles currently in production or development. Two of them have intermediate ranges and the other two are of the intercontinental type.

SCIENCE AND TECHNOLOGY IN COMTEMPORARY WAR, by Maj. Gen. G. I. Pokrovsky. New York, Frederick A. Praeger, 1959. 180 p.

An unabridged translation from the Russian by Raymond Garthoff of the author's key writings designed to cultivate an awareness in Soviet military leaders of the implications of the technological resolution. The author examines the roles of new weapons—from Sputniks to ICBM's—and claims Soviet superiority in these weapons. The last part of the book presents an article by the author discussing not only the nature, advantages and limitations of long-range ballistic missiles, but also the merits of such alternative strategic weapons systems as earth satellites, balloons and long-range bomber aircraft.

THE TRANSCONTINENTAL BALLISTIC MISSILE, in *Rocket-Jet Flying*, v. 133 (Winter-Spring 1956) 8–9.

Sketches depicting such a probable Russian missile in various stages of flight, and section sketch of the missile showing stages 1, 2, and 3 with the jet-born stage in the rear.

USSR MAY HAVE TESTED ATOM ROCKET, by Alfred J. Zaehringer, in *Missiles and Rockets*, v. 4, No. 25 (22 Dec 1958) 13–14.

E. Propellants and Propulsion

ATOMIC ROCKET TO MARS; RUSSIAN PROJECT, in *Science News Letter*, v. 70 (1 Dec 1956) 343.

EVALUATION OF INTERNAL LOSSES IN LIQUID ROCKET ENGINES. Otsenka Vnutrennikh poter' v kamere ZHRD, by A. V. Kvasnikov, in *Izvestiia Aviatsionnoi Tekhniki*, No. 1 (1958) 95–105. In Russian.

Describes a system for evaluation of internal losses in liquid rocket engines, based on the application of thermodynamic analyses and simple experimental data.

ON THE STRENGTH OF LIQUID ROCKET COMBUSTION CHAMBERS HAVING ATTACHED TUBES. K voprosu o prochnosti kamery sgoraniia ZHRD so sviazannymi obolochkami, by S. A. Dubenets, in *Izvestiia Aviatsionnoi Tekhniki*, No. 1 (1958) 133–142. In Russian.

PHOTONIC PROPULSION DISCUSSED BY REDS, in *Missiles and Rockets*, v. 2 (Jul 1957) 68.

REDS PUSH PROPELLANT RESEARCH, in *Missiles and Rockets*, v. 3, No. 1 (Jan. 1958) 60.

Soviet propellant research is in high gear and is now feeding the vast missile hardware program. Some data on Soviet research on oxidants, fuels, free radicals, and materials.

SOVIET ROCKET? in *Rocket-Jet Flying*, v. 138 (Fall-Winter 1957) 1.

Sketch of the Soviet three-stage rocket which launched SPUTNIK II.

SPUTNIK PROVES RUSSIANS HAVE BEST ROCKET ENGINES, FIRST RATE GUIDANCE SYSTEM, in *Product Engineering*, v. 28 (21 Oct 1957) 21.

SPUTNIK II MAY BE AN INDICATION SOVIETS HAVE NEW EXOTIC FUEL, in *Oil Paint and Drug Reporter*, v. 172 (11 Nov 1957) 4 plus.

F. Submarine-Launched Missiles and Rockets

ASW; ANTI-SUBMARINE WARFARE. Washington, Department of the Navy, Office, Chief of Naval Operations, 1959. 38 p.

A report in pictures and text on the increasingly important role of the U.S. Navy in anti-submarine warfare. The Soviet naval build-up and what we have and what we need in equipment, weapons and preparedness to meet the Soviet threat. Danger from Soviet missile-carrying submarines is pointed out.

GUIDED MISSILES AND TORPEDOES, by Lt. Col. V. Glukhov, in *Red Star* (16 Aug 1956). In Russian.

LAUNCHING MISSILES FROM SUBMARINE, by G. Partel, in *U.S. Naval Institute Proceedings*, v. 84, No. 8 (Aug 1958) 132 plus.

Translated from Rivista Maritima, (Italy) March 1958. Some of the principal problems confronting modern technology in submarine warfare. The Soviet submarine strength and indications of submarine missile technique, and possible means of coping with the threat of submarine missile launchers.

MISSILE-CARRYING SUBMARINES—A NEW FACTOR OF STRATEGIC PLANNING, by Hans Schoenberg, in *Military Review*, v. 39, No. 1 (Apr 1959) 102–106.

Translated and digested from Wehrkunde (Germany), May 1958. The development of U.S. atomic-powered submarines capable of launching guided missiles. German developments for the U.S.S.R., and the possibilities of Soviet development of missiles for the fleets.

REDS BUILD INTERIM MISSILE/SUB FLEET; SEAGOING MISSILE AMONG NEW DEVELOPMENTS, by Frank G. McGuire, in

Missiles and Rockets, v. 3, No. 7 (Jun 1958) 64.

With a chart of Soviet missiles adaptable to submarine launching.

REDS MOVE AHEAD WITH SUB-LAUNCHED IRBMs, by Erik Bergaust, in *American Aviation*, v. 20, No. 2 (18 Jun 1956) 25–29.

Features of a submarine-towed missile launcher.

THE RUSSIAN NAVY'S SHIPS AND ORGANIZATIONS, by Hanson Baldwin, in *Our Navy*, v. 51, No. 11 (1 Dec 1956) 20 plus.

As part of an assessment of the strength of the Soviet Navy, Mr. Baldwin notes: "there are many reports, but without hard evidence, that Soviet submarines have launched guided missiles and are capable of handling so-called nuclear torpedoes . . ."

RUSSIA'S ANSWER TO OUR SAC BASES, by Anthony Vandyk, in *Missiles and Rockets*, v 2 (May 1957) 62–63.

Development of IRBM—launching submarines permits USSR to lag behind in ICBM work.

SUBMARINE-LAUNCHED MISSILE (RUSSIA), in *Military Review*, v. 36 (Sep 1956) 72.

SUBMARINE-LAUNCHED MISSILES [USSR], in *Military Review*, v. 38 (Sep 1958) 81.

SUBMARINE MISSILES; REDS MOVE AHEAD, in *Missiles and Rockets*, v. 2 (Feb 1957) 54–55.

G. Upper Atmosphere Research

ANIMAL SPACE TRAVELERS RETURNED TO EARTH, in *USSR*, No. 11 (26), (1958) 56. In English.

Details of a launching of a Soviet 1-stage rocket in the summer of 1958. The rocket with two dogs aboard was shot 280 miles into upper atmosphere and was returned safely to earth. This rocket carried 3,726 pounds of geophysical and radiotelemetering instruments with their power sources. Photo of the two dogs (Belyanka and Pyostraya) as filmed by the rocket's motion picture camera installed in the animal's compartment.

INVESTIGATIONS OF THE COMPOSITION OF THE UPPER ATMOSPHERE USING ROCKETS. Raketnye issledovaniia sostava atmosfery na bol'shikh vysotakh, by B. A. Mirtov, in *Uspekhi Fizicheskikh Nauk*, v. 43, No. 16 (Sep 1957) 181–196. In Russian.

PRESSURE MEASUREMENTS IN THE UPPER ATMOSPHERE. Izmerenie davleniia v verkhnei atmosfere, by V. V. Mikhnevich, in *Uspekhi Fizicheskikh Nauk*, v. 43, No. 16 (Sep 1957) 197–204. In Russian.

Analysis of data and description of apparatus used for pressure measurements in the upper atmosphere.

ROCKETS AND ARTIFICIAL EARTH SATELLITES IN INVESTIGATIONS OF THE UPPER ATMOSPHERE, by Evgenii K. Tederov and G. A. Skurden. New York, U.S. Joint Publications Research Service, 1958. 17 p.

ROCKETS EXPLORE THE UPPER ATMOSPHERE, in *USSR*, No. 9 (24), (1958) 8–13. In English.

A review of Soviet exploration of upper atmosphere with information on some of the findings. With photos, some of which are: container with geophysical instruments after its descent from a rocket flight 132 miles high; recovered container with instruments and a dog; first Soviet research rocket launched in 1933 (liquid-fuel powered); devices for measuring electronic concentration; ionization and magnetic gauges; dog and container after return to earth; the dogs Malyshka, Linda and Kozyavka posing for the press.

RUSSIAN DOGS PROBE UPPER AIR, in *Missiles and Rockets*, v. 2 (Mar 1957) 31.

SOVIET GEOPHYSICAL ROCKETS, Sovetskie geofizicheskie rakety, in *Radio*, No. 4 (Apr 1959) 34a–35a. In Russian.

Photos of: Soviet geophysical rocket MR1; last stage of geophysical rocket A2; recovered containers of Soviet geophysical rockets; and electronic equipment for upper air research.

IV. Space Exploration

A. Miscellaneous Aspects

THE ACID TEST, by Wernher von Braun, in *Signal*, v. 12, No. 7 (Mar 1958) 5–6 plus.

Includes a current estimate of the Soviet understanding of the significance of man's "imminent conquest of space" and what they are doing about it.

BEHIND THE SPUTNIKS: A SURVEY OF SOVIET SPACE SCIENCE, by Tirmin J. Krieger. Washington, Public Affairs Press, 1958. 380 p.

Based largely on translations of Soviet scientific articles published in Rand Corporation

studies of 1956 and 1957, this volume was brought up to date by the addition of early press reports on the first Sputnik. A history of the development of astronautics in Russia and an examination of Russian research and theory on Sputniks, flights to the moon, interplanetary travel and communications, biological aspects of manned spaceflight, and intercontinental rocketry.

BY ROCKETPLANES INTO COSMOS. Na raketoplanakh v kosmos, by N. Romanov, in *Grazhdanskaia Aviatsiia* (Oct 1959) 13–15. In Russian.

Discussion, based on available data, of various possibilities of cosmic flight, including propulsion systems, propellants, trajectories, design aspects, and human factors.

CHALLENGE OF THE VERTICAL FRONTIER, by Capt. Christopher C. Shaw, in *U.S. Naval Institute Proceedings*, v. 84, No. 4 (Apr 1958) 48–59.

Examines certain scientific aspects of Russia's current technology "triumphs" and discusses in general terms the physiological, social, and philosophical aspects of the "Age of Space."

FLIGHT TO THE STARS, by Victor Kaznevsky, in *USSR*, No. 4 (19), (1958) 16. In English.

An artist's conception of a cosmic ship of the future and description of its characteristics and how it will function.

INTERVIEW WITH THE SOVIET DELEGATION, by Irwin Hersey and John Newbauer, in *Astronautics*, v. 5, No. 1 (Jan 1960) 34–35 plus.

The 1959 American Rocket Society Annual Meeting "provided unique opportunity for U.S. and Soviet space scientists to discuss matters of mutual interest." In this report comments on the following topics were made by members of the Soviet delegation at the meeting: on the general attitude of the USSR toward space exploration; on funding the Soviet space program; on the goals of the Soviet space program; on the difference between the Soviet and American attitude toward space scientists; on U.S. space achievements; on U.S. Soviet cooperation in space experiments; on the future; on the Soviet man-in-space program; on Soviet biological experiments; on space radiation; on Lunik guidance; on tracking; on Soviet launching failures; on a Soviet equatorial launching site; on fantasy and reality; on the Russian amateur rocketry problem.

KEEPING UP TO DATE ON SOVIET ASTRONAUTICS, in *Astronautics*, v. 4, No. 4 part 1 (Apr 1959) 30–32 plus.

An analysis of Russian periodical literature showing that, while there is as yet no single publication devoted to the subject, a good deal of space flight material can be found in certain magazines and newspapers.

PROGRAMS FOR FUTURE SPUTNIKS DETAILED BY RUSSIAN SCIENTISTS, in *Missile Engineering*, v. 2, No. 2 (Jan 1958) 10–11.

A brief review of statements made by Soviet scientists in various articles on the subject of space exploration by Soviet vehicles.

RED ROCKETS FOR VENUS, in *Missiles and Rockets*, v. 2 (Aug 1957) 57.

ROCKET AND JET PROPULSION. Raketenund strahltriebwerke. Berlin, Veb Verlog Technik, 1958. 81 p. In German.

Translated excerpts from the Large Soviet Encyclopedia. Also includes excerpts on earth satellites and outer space.

RUSSIAN EXPERT SAYS SOVIET SCIENCE CAN BEAT HEAT, in *American Aviation*, v. 19, No. 22 (26 Mar 56) 39–40.

"Obvious way" to overcome supersonic thermal problems is to fly at great altitudes, but new heat-resistant alloys are also being used, according to RED STAR (Krasnaia Zvezda).

SOVIET ASTRONAUTICS, by A. J. Zaehringer, in *Missiles and Rockets*, v. 2 (Feb 1957) 45–46 plus.

SOVIET SCIENTIST SEES NEED FOR MANNED STATION IN SPACE; ABSTRACT, by N. A. Varvarov, in *Aero/Space Engineering*, v. 17 (Sep 1958) 27.

SOVIET SPACE PLANS SPELLED OUT, in *Missiles and Rockets*, v. 2 (Aug 1957) 54.

SOVIETS DISCUSS SATELLITE CREW RECOVERY, by Frank G. McGuire, in *Missiles and Rockets*, v. 4, No. 6 (11 Aug 1958) 51–52.

Discussion of an article by P. Isakov in the Soviet Army newspaper, Red Star, on "The Problem of Returning Satellite Crews From the Cosmos." Another article by G. I. Pokrovsky in a Soviet technical magazine discusses the possible natural forces in space which could be used to propel a space vehicle.

SPACE FLIGHT NOTES: SOVIET ASTRONAUTICS, by John Gustavson, in *Jet Propulsion*, v. 27, No. 3 (Mar 1957) 313–317.

". . . We are able to find in Russia today genuine interest in space flight, a well-developed rocket technology, and competent scientists and engineers. Moon projects have been mentioned from time to time, and Russia also claims to prepare an artificial satellite which may very well precede the VANGUARD. The Russian satellite is believed to be of the same size (20 in. diam.), but heavier than the VANGUARD satellite (100 lb instead of 20 lb). We must not underestimate the potential of Soviet Russia—neither politically nor astronautically."

SPACE PIONEER [KONSTANTIN EDUARDOVITCH TSIOLKOVSKY, RUSSIA'S "FATHER OF SPACE TRAVEL"], by Geoffrey Norris, in *RAF Flying Review*, v. 14 (Oct 1958) 81–82.

SPUTNIK INTO SPACE, by M. Vassiliev. London, Souvenir Press, 1958. 147 p.

This book was originally published by the State Publishing House, Moscow, under the title PUTESHESTVIIA V KOSMOS (Journeys Into Kosmos). It consists of translated articles that reflect on the scope of Soviet space exploration effort and provide some information on what the Russians have learned and what they plan for in future.

SPUTNIK III EXPLORES THE COSMOS, by Alexander Nesmeyanov, in *USSR*, No. 1 (28), (1958) 24–27. In English.

The President of the Academy of Sciences of the U.S.S.R. describes some of the information obtained by Sputnik III.

SPUTNIKS AND AFTER, by Karl Gilzen. London, Macdonald, 1959. 285 p.

Translated from the Russian with supplementary material added. The foundations of astronautics, the principles of this science, its present and future. This book tells of Russia's preparations for the first leap into Space, of the extraordinary difficulties that have to be surmounted and of the wonderful possibilities promised by the achievement of interplanetary travel.

A TRIP INTO THE COSMOS, by Boris Lyapunov, in *Culture and Life*, No 1 (1958) 22–26.

Soviet plans for rocket and space flight.

USSR RE-ENTRY SOLUTION DUPLICATES U.S. METHOD, in *Missiles and Rockets*, V. 4 (21 Jul 1958) 31.

USSR TALKS UP SPACE PLANS, in *Electronics*, v. 31, No. 22 (30 May 1958) 17.

Instrumentation plays vital role in Soviet research rockets "as a space race for men's minds shapes up." Pravda "chides microscopic satellites and boasts" of new data from tons of instruments sent to record heights. Instruments to test Einstein's theories are reported.

B. Astronauts

SEDOV: MAN IN SPACE IS NEXT SOVIET GOAL, by Erik Bergaust, in *Missiles and Rockets*, v. 4, No. 9 (1 Sept 1958) 10–11.

THE SOVIET ASTRONAUTICAL PROGRAM, by F. J. Krieger, in *Astronautics*, v. 4, No. 7 (Jul 1959) 43 plus.

"A three-phase plan, calling for simultaneous satellite experiments, lunar exploration, and investigation of the planets, may produce a Russian astronaut by the end of 1960 and see the insignia of the U.S.S.R. planted on the moon by 1967, the 50th anniversary of Communist power."

VOLUNTEERS FOR SPACE TRAVEL, in *USSR*, No. 9 (24), (1958) 12–13. In English.

Interdepartmental Committee for Interplanetary Communication, of the U.S.S.R. Academy of Sciences has the function of coordinating research data—technological and biological—on future space flights. Since the day Sputnik I was launched, the Committee has been "flooded" with requests from volunteers who want to man the first space ship launched. Photos of some of the volunteers and what they said in their letters to the Committee.

C. Environmental Aspects

LIFE SUPPORT SYSTEMS FOR SPACE TESTED IN NEW SOVIET SATELLITE, by Evert Clark, in *Aviation Week*, v. 72, No. 21 (23 May 1960) 27–28.

First trial flight of the five-ton spacecraft launched by the Soviet Union on 15 May was aimed primarily at testing life support systems that will allow a man or men to conduct research on "long" flights into outer space.

A MAN IN SPACE (BY B. DANILIN, IN IZVESTIA, JULY 24, 1959), trans. by J. L. Zygielbaum. Pasadena, California Institute of Technology, Jet Propulsion Laboratory, 1959. (JPLAI/Translation No. 4.)

This report presents a survey of the problem which will be encountered in the course of putting

a man into space and bringing him back to Earth again safely. These problems are: acceleration, weightlessness, meteor bombardment, cosmic radiation, and re-entry.

SOVIET MAN IN SPACE, in *Astronautics*, v. 5, No. 1 (Jan 1960) 36–38 plus.

A transcript of the question-and-answer period which followed the showing of films on Russian biological experiments of the 14th American Rocket Society Meeting and produced some valuable information on their program.

V. Moon Exploration

AFTER THE SPUTNIKS: NEXT STOP—THE MOON! by Kenneth W. Gatland, in *Royal Air Force Flying Review*, v. 13, No. 4 (Dec 1957)

Discusses Sputniks I and II and what the requirements are for reaching the moon.

ARE THE LUNIK III PHOTOS FAKES? by Merton E. Davies in *Astronautics*, v. 5, No. 6 (Jun 1960) 46 plus.

"An American expert says 'No,' noting that scanty technical data about film processing and a misinterpretation of details in the pictures have been responsible for some recent charges that the photos are phonies."

CERTAIN PROBLEMS ON THE DYNAMICS OF FLIGHT TO THE MOON, by V. A. Yegorov. Washington, Department of Commerce, Office of Technical Services, 1959. (Translation from Russian. OTS: 59–16, 771.)

In 1953–1955 the systematic investigation of a group of problems was conducted, and computations were made with an electronic computer in the Mathematics Institute of the Academy of Sciences, USSR. The basic results of this work are set forth in this article. The full-size model used to obtain the data was a conical-shaped capsule with a segment of a sphere as the bottom and weighed 1,172 lb. The base of the cone was seven feet in diameter and the spherical segment had a radius of curvature of 10.5 ft. The maximum impact acceleration reached was 60 g applied at a rate of 25,000 g/sec. Literature on human tolerance to accelerations indicates that a rate of 1500 g/sec to a level of 40 g is about maximum for survival without injury. For the velocity expected with a parachute (30 ft/sec), the distance required to stop within the tolerable acceleration limits is 8.54 in. This could be obtained by supporting the occupant with a crushable structure or a mechanical spring system.

DID LUNIK DROP MOON PACKAGE? in *Electronics*, v. 32, No. 43 (23 Oct 1959) 42b–43.

Early lunik data suggests possibility of an instrument drop on moon, with orbiting "interplanetary station" acting as a relay to earth. A drawing and discussion are presented in support of the contention that the Soviet were holding back facts about the moon station fired into orbit by them on 4 October.

FIRST BRIDGE ACROSS SPACE, in *Spaceflight*, v. 2, No. 4 (Oct 1959) 100–101.

Some details of the discussion of Russia's Lunik II at a press conference at the USSR Academy of Sciences on 14 September 1959.

THE FIRST SOVIET MOON ROCKET. Washington, U.S. Congress, 1959. (86th Congress, 1st Session.)

This report was prepared for the use of the Committee on Science and Astronautics. It contains a summary of the information released by the USSR on the Soviet Cosmic Rocket which was launched 2 January 1959. The implications of this accomplishment as to the status of Russian space technology are discussed.

FROM MAN-MADE SATELLITES TO VOYAGES TO THE MOON [SUMMARY OF AN ARTICLE BY PROFESSOR V. DOBRONRAVOV PUBLISHED IN THE NEWSPAPER PROMYSHLENNO-EKONOMICHESKAYA GAZETA, OCT 20, 1957], in *Soviet News* (28 Oct 1957) 60.

HOW GOOD IS THE LUNIK III PHOTOGRAPHY? by Merton E. Davies, in *Astronautics*, v. 5, No. 5 (May 1960) 28–29 plus.

Selection of full-moon lighting indicates objective was to record maximum area without particular regard to quality. Ground resolution, estimated from close study of the photos, is about 30 miles. With photos.

HOW SOVIETS MAY LAND MAN ON MOON, by Boardman Rising, in *Aviation Week*, v. 70, No. 19 (11 May 1959) 54–59 plus.

Unmanned instrument carrier and lunar surface exploratory unit may precede manned lunar round-trip expedition. How an expedition might appear if multiple launchings are assumed. Tentative weight breakdown for a typical lunar landing vehicle, equipment list and weight breakdown and estimated performance figures for a lunar expedition. With sketch.

HOW SOVIETS MAY LAND MAN ON MOON, by Boardman Rising, in *Space Technology*, v. 2, No. 3 (Jul 1959) 22–24.

How they can accomplish this and what their chances of success are.

LUNIK II HITS THE MOON, in *Spaceflight*, v. 2, No. 4 (Oct 1959) 98–100.

Details of the launching of the second Soviet space rocket, which was launched on 12 September 1959 and which "reached the moon at 2 minutes 24 seconds past 10 (past midnight, Moscow time)." Includes statement issued by Tass on 12 September.

LUNIK III—SOVIET NEWS COVERAGE OF THE THIRD SOVIET COSMIC ROCKET, OCTOBER 4–30, 1959, trans. by J. L. Zygielbaum. Pasadena, California Institute of Technology, Jet Propulsion Laboratory, 1959. (AI/Translation No. 14.)

The articles in this report cover the Soviet reports on the flight of LUNIK III and discuss the scientific information, specifically the photographs of the invisible side of the Moon, obtained from the flight.

LUNIK III TRAJECTORY PREDICTIONS, by J. E. Michaels and others, in *Astronautical Sciences Review*, v. 2, No. 1 (Jan-Mar 1960) 13–16.

Using available tracking data as released by Tass, the trajectory of Lunik III vehicle has been calculated by the General Electric Lunar Computer Program. The total trajectory with a re-entry prediction is presented. Perturbations of the Moon and Sun resulting in a decay in perigee distance are discussed. A comparison with Russian trajectory predictions is included. Features of the computer program used in the calculations are discussed.

MISSILES: FICTION AND FACT, PHOTOGRAPHS, in *New York Times Magazine* (19 Jan 1958) 10–11.

Photographs from a Russian film that helped inspire the rumors, a futuristic story of the first flight to the moon. Also photos of American missile research and production.

[OBSERVATIONS OF THE SODIUM CLOUD.] Na gornoi astronomicheskoi stantsii, by M. N. Gnevyshev, in *Vestnik Akademii Nauk SSSR* (May 1959) 99–100. In Russian.

Brief discussion of optical measurements taken of the sodium cloud released by the Soviet cosmic rocket.

ORBITS OF COSMIC ROCKETS TOWARD THE MOON, by L. I. Sedov, in *American Rocket Society Journal* (Jan 1960) 14–21.

Discussion of the fundamentals of space flight, including the basic requirements of propulsion, guidance, and take-off conditions. The collision case is considered, and the properties of a set of trajectories, sufficiently accurate for use in the solution of some practical problems, are listed. Available data on the orbits of the three Soviet cosmic rockets are also given.

THE OTHER SIDE OF THE MOON, in *Spaceflight*, v. 2, No. 5 (Jan 1960) 130–137.

Full translated text of the announcement carried in the Soviet press on 27 October 1959 concerning the third Soviet space probe (Lunik III launched 4 October) which photographed the hidden side of the moon. The automatic interplanetary station, path of flight, photography and transmission of pictures, and the moon's hidden face. With diagrams and pictures.

PRELIMINARY RESULTS OF DATA PROCESSING FROM THE SECOND SOVIET COSMIC ROCKET, SEPTEMBER 18–23, 1959 (IZVESTIA AND PRAVDA), trans. by J. L. Zygielbaum. Pasadena, California Institute of Technology, Jet Propulsion Laboratory, 1959. (AI/Translation 15.)

The following newspaper articles are translated: "The Rocket, the Moon and Life"; "The Cosmos Discloses Its Mysteries"; "Magnetic Fields of the Universe"; "Tass Communique About the First Results of the Launching of the Cosmic Rocket to the Moon"; "The First Flight to the Moon"; "How the Flight to the Moon Was Accomplished."

RED MOON ROCKET ON LAUNCHING PAD? in *Missiles and Rockets*, v. 3, No. 3 (Mar 1958) 37.

States that the Russians already have tried—unsuccessfully—to reach the moon and that "they will get a moon rocket under way before the United States."

SOME PROBLEMS OF DYNAMICS OF THE FLIGHT TO THE MOON. Nekotorye voposy dinamiki poleta k lune, by V. A. Egorov, in *Doklady Akademii Nauk SSSR*, No. 113 (1 Mar 1957) 46–49. In Russian.

Discussion of dynamics of the flight to the moon, including such problems as the necessary speed, trajectory shape, orbit around the moon,

and landing on the moon. An abstract of this paper in *Uspekhi Fizicheskikh Nauk*, v. 63, No. 1a (Sept 1957) 73–117.

SOME PROBLEMS OF DYNAMICS OF FLIGHT TO THE MOON. O nekotorykh zadachakh dinamiki poleta k lune, by V. A. Egorov, in *Uspekhi Fizicheskikh Nauk*, v. 63, No. 1a (Sep 1957) 73–117. In Russian.

Data on work done in 1953–55 concerning the following problems: shape and classification of trajectories; possible trajectories of Moon circling with return to Earth; possibilities of periodic circling of the Moon and Earth; the minimum initial speed needed to reach the Moon; evaluation of the different trajectories.

SOVIET CITIES ON THE MOON? by A. Parry, in *Science Digest*, v. 43 (Feb 1958) 29–35.

SOVIET MOVIE SHOWS REACH FOR THE MOON, in *Time*, v. 70 (28 Oct 1957) 24–25.

SOVIET NEWS COVERAGE OF THE FLIGHT OF THE SECOND COSMIC ROCKET TOWARD THE MOON (SEPTEMBER 13–20, 1959), trans. by J. L. Zygielbaum. Pasadena, California Institute of Technology, Jet Propulsion Laboratory, 1959. (AI/Translation No. 10.)

The following articles appeared in Soviet newspapers after the launching of the second cosmic rocket: "TASS Communique About the Launching of a Cosmic Rocket Toward the Moon by the Soviet Union"; "The Movement of the Second Soviet Cosmic Rocket", "What Do We Know About the Moon?"; "Photo Recording of the Artificial Comet, New Triumph"; "TASS Communique, Higher and Higher"; "The Flight of the Second Soviet Cosmic Rocket"; "Astronomers Observed the Artificial Comet"; "Sterility of the Cosmic Rocket"; "From the Earth to the Moon"; "Here She is, the Artificial Comet"; "Where Did the Rocket Container Land?"; "The Moon: Facts and Presumption"; and, "Next—Mars and Venus".

SOVIET PROBE PIONEERS NEW TECHNIQUES, by Evert Clark, in *Space Technology*, v. 3, No. 1 (Jan 1960) 44–46.

Complex flight tactics employed as Soviet vehicle photographs moon's far side, transmits results.

SOVIET SPACE ROCKET. Washington, Department of Commerce, Office of Technical Services, 1959. (Translation PB 59–16, 407.)

This paper is a translation of a USSR report relative to the multistage space rocket launched in the Soviet Union in the direction of the Moon, 2 January 1959. Subject headings include: (1) the flight of the space rocket; (2) the last stage of the space rocket and the container with scientific apparatus; (3) complex of measuring equipment; (4) the study of the cosmic rays; (5) the study of the interplanetary matter gaseous component and the corpuscular solar radiation; (6) the study of meteoric particles; (7) magnetic measurements; and (8) artificial sodium comet and equipment to form it.

SOVIETS CERTAIN THEY'LL BE FIRST ON MOON, by Victor P. Petrov, in *Missiles and Rockets*, v. 4 (8 Sep 1958) 50 plus.

"Long-standing, deeply scientific studies of space travel lend strength to belief of leaders and citizens."

SOVIETS HIT MOON, DATA FLOW IMPROVES, by Evert Clark, in *Space Technology*, v. 2, No. 4 (Oct 1959) 4–6.

The successful launching of an 858.44-lb instrumented payload to the surface of the moon by the Soviet Union 13 September 1959. Acceleration data; Soviet lunar probe performance.

SPUTNIK II—PRELUDE TO THE MOON? in *Chemical and Engineering News*, v. 35, No. 45 (11 Nov 1957) 27.

Although there is disagreement, most US experts feel Russia has made an engineering breakthrough, but Russia claims a superfuel. "The next big breakthrough is obviously the moon, and it is certainly closer than anyone in the West would have believed a few months ago." Some data on SPUTNIK II and the implications of this dog-bearing satellite.

TEN HOURS TO THE MOON, in *Science News Letter*, v. 72 (11 Nov 1957) 310–311.

A trip to the moon is no longer a dream but a target at which American and Russian scientists are shooting, with good chances of hitting it soon.

THE THIRD COSMIC ROCKET OF THE USSR. DIE 3. Kosmische Rakete der UdSSR, by L. T. Kayser and D. E. Kölle, in *Raketentechnic & Raumfahrtforschung* (Jan–Mar 1960) 23–25. In German.

Description of Lunik III, including the instrumentation and flight path, as well as some data obtained by it.

THE THIRD SOVIET COSMIC ROCKET (PRAVDA AND IZVESTIA, OCTOBER 27, 1959), trans. by J. L. Zygielbaum. Pasadena,

California Institute of Technology, Jet Propulsion Laboratory, 1959. (AI/Translation 15.)

A description of the "automatic interplanetary station" used by the Soviets to photograph the hidden side of the Moon is presented. The orbital characteristics of the station are analyzed and the methods using a phototelevision system for photography and transmission of images of the hidden side of the Moon are described.

USSR MOON ROBOT SHOT TESTS FORESEEN, by Evert Clark, in *Space Technology*, v. 3, No. 2 (Apr 1960) 14–15.

Test firings of "more powerful" Soviet space rockets into the Central Pacific Ocean this year are believed to be aimed at proving a vehicle that would put robot tank "laboratories" on the moon and launch the first Russian into space.

WAS MOONSHOT 4TH USSR TRY? in *Electronics*, v. 32, No. 40 (2 Oct 1959) 26–27.

Soviets may have closed information leaks on firings from January to September. Moonshot gear believed similar to Lunik I's.

WILL REDS BE FIRST TO REACH THE MOON, by Howard Simons, in *Science Digest*, v. 41, No. 4 (Apr 1957) 93–94.

The Russians are building an atomic-powered engine for an interplanetary missile and believe that both the moon and Mars will be reached within the next five to ten years as a logical step after the launching of the earth satellite.

VI. Solar Exploration

COSMIC ROCKET—FIRST ARTIFICIAL MINOR PLANET. Kosmicheskaia raketa—pervaia iskusstvennaia malaia planeta, by N. S. Iakhontova, in *Priroda*, No. 4 (Apr 1959) 5–10. In Russian.

A discussion of the probabilities that the Soviet solar rocket, launched on 2 January 1959 will be observable from the earth in 5 years, and that by then the progress in astronomical equipment will be such as to make observations of the Lunik possible.

THE FIRST ARTIFICIAL SATELLITE OF THE SUN. Pervyi iskusstvennyi sputnik solntsa, by G. V. Petrovich, in *Vestnik Akademii Nauk SSSR*, No. 3 (Mar 1959) 8–14. In Russian.

Details of the launching of the Soviet solar rocket on 2 January 1959 and an outline of Soviet trends in space exploration in the near future.

THE FIRST ROCKET IN THE COSMOS, in *USSR*, No. 3 (30), (1959) 14–19. In English.

Four articles on the launching of the Soviet solar rocket on January 2, 1959. The instruments it carried, the type of information it was after, and the scientific implications. Photos of the rocket's separable container with scientific and measuring equipment; the instrument frame of the container with its equipment and power sources; and of the Soviet ensign carried in the rocket's container.

LAUNCHING OF COSMIC ROCKETS AND ASTRONOMICAL PROBLEMS. Zapusk kosmicheskikh raket i astronomicheskie problemy, by B. V. Kukarkin, in *Priroda*, No. 3 (Mar 1959) 7–8. In Russian.

A discussion of the opportunities in astronomy resulting from the overcoming of so-called second velocity by the Soviet solar rocket which was launched on January 2, 1959.

MAN'S FIRST ARTIFICIAL PLANET PLACED IN ORBIT AROUND THE SUN, in *USSR*, No. 2 (29), (1959) 3. In English.

On January 2, 1959, the Soviet Union launched a multistage cosmic rocket in the direction of the moon. The rocket eventually passed the moon and entered its final orbit around the sun. The cosmic rocket carries a pennant with the emblem of the Soviet Union and the inscription: "Union of Soviet Socialist Republics. January 1959." Includes brief description of instruments, radio, and other equipment aboard.

MECHTA RADIATION DATA, by S. N. Vernov and others, in *Astronautics* (Jul 1959) 23 plus.

Description of Mechta's instrumentation for recording cosmic rays and terrestrial corpuscular emission, and discussion of data related to a distance range of 8,000 to 150,000 km. from the earth's center.

MECHTA'S TRIP PAST MOON MAY HAVE BEEN INTENTIONAL, by W. A. Daley and D. H. Robet, in *Aviation Week*, v. 70 No. 13 (30 Mar 1959) 66–67.

Presents a thesis that the Soviet solar satellite "Mechta" launched on January 28, 1959 was not intended to achieve a lunar impact and instead was meant to be used as a heliocentric satellite, using the moon for a slingshot, and for lunar photography along with physical measurements. The authors evaluate Mechta's payload, launching time, cutoff velocity and trajectory, and

conclude that a heliocentric orbit probably was a goal rather than the result of a miscalculation, and that Mechta may be a part of a program to determine the Astronomical Unit with greater accuracy, leading to a shot at Venus this year or at Mars in the Fall of 1960.

ON THE LAUNCHING OF COSMIC ROCKET IN DIRECTION OF THE MOON. O zapuske kosmicheskoi rakety v storonu luny, in *Priroda*, No. 1 (Jan 1959) 1–3. In Russian.

Details on the Soviet solar rocket launched on January 2, 1959. Describes equipment carried in the last stage of the rocket and the type of scientific information it was expected to obtain. With a step-by-step description of the rocket's progress in space from 3 hours Moscow time on January 3 through 10 hours on January 5.

RAYS FROM OUTER SPACE, by Sergei Vernov, in *USSR*, No. 6 (33), (Jun 1959) 40–41. In English.

The Soviet cosmic rocket launched early this year carried instruments to study cosmic radiation. The results are now available of the study of cosmic rays near the earth and at distances of more than 60,000 miles from the earth's center. Implications of the new findings to space research.

SOVIET COSMIC ROCKET Sovetskaia kosmicheskaia raketa, in *Priroda*, No. 2 (Feb 1959) 17–30. In Russian.

The flight of the Soviet solar rocket which was launched on January 2, 1959. Type of equipment carried in the last stage of the rocket; tracking facilities; type of cosmic ray measurements the rocket's equipment was designed to obtain; magnetic measurements; and how the artificial comet was produced by the last stage which carried the needed equipment and chemicals. Photo of the artificial comet as obtained at 3 hours 56 minutes 20 seconds Moscow time, on January 3, 1959 by the main astronomical observatory of the Academy of Sciences of the U.S.S.R.

THE SOVIET COSMIC ROCKET CH–10 "MECHTA." Die Sowjetrushische Kosmische Rakete CH–10 "Mechta," by Alfred Alphi, in *Flugwehr & Technik* (Mar 1960) 63–64. In German.

Presentation of available data on the Soviet "Mechta," including guidance, propulsion, and structural aspects.

SOVIET PLANET. Sovetskaia planeta, by I. Merkulov, in *Kryl'ia Rodiny* (Mar 1959) 8–9. In Russian.

Description of the Soviet cosmic rocket, including its trajectory, instrumentation and launching.

SPACE INVESTIGATIONS—SELECTED TRANSLATIONS (IZVESTIA, JULY 7–8 AND SEPTEMBER 2, 1959), trans. by J. L. Zygielbaum. Pasadena, California Institute of Technology, Jet Propulsion Laboratory, 1959. (AI/Translation No. 9.)

This report is divided into two sections. The first section deals with high-altitude flight of experimental animals and includes the following articles: "TASS Communique"; "The Assault on the Upper Atmosphere Continues"; "Nearing the Great Goal"; "A Tremendous Scientific Achievement"; "Scientists Peek Into Cosmos"; "The Third Flight of 'Courageous' "; "This is Very Interesting"; and "Where is 'Snowflake'?" Part II contains the article, "Where is the Soviet Solar Satellite Now?"

VII. USSR vs US

THE BATTLE FOR OUTER SPACE, in *Business Week* (9 Nov 1957) 30.

So far, the Russians are far ahead of the West; their SPUTNIK II was even more impressive than their first; but even their rocket-to-the-moon project leaves questions.

BEATEN TO ICBM PUNCH? RUSSIANS MADE FIRST FLIGHT TEST, in *Aviation Week*, v. 66 (20 May 1957) 31.

BEATING THE ATLAS; RUSSIAN AND AMERICAN INTERCONTINENTAL MISSILE PROGRAMMERS, in *Economist*, v. 184 (31 Aug 1957) 676.

A CATALOGUE OF THE SPACE AGE, in *Interavia* (Sep 1959) 1 plus.

Survey of Soviet and U.S. earth satellites and space probes launched during the last two years.

CHALLENGE OF SPACE, by Wernher von Braun, in *Ordnance*, v. 43, No. 23 (May-Jun 1959) 901–903.

The Soviets gained a head start in the race for space only because the United States was interested in military missiles of limited range rather than in superpowerful rocket engines that could launch a satellite.

COUNTDOWN FOR TOMORROW, by Martin Caidin. New York, Dutton, 1958. 288 p.

The inside story of earth satellites, rockets and missiles and the race between American and

Soviet science, and the military and political implications. With chapters on: SPUTNIK diplomacy as practiced by Soviet officials since SPUTNIK I; the hopes and failures of the PROJECT VANGUARD; Soviet plans for the conquest of space and airpower and the ICBM. Photos.

GARDNER WARNS RUSSIA IS AHEAD ON IRBM, BLAMES U.S. RIVALRIES, in *Aviation Week*, v. 65 (23 Jul 1956) 31.

HOW WE LET THE MISSILE SECRETS GET AWAY, by Peter Van Slingerland, in *Look*, v. 22, No. 3 (4 Feb 1958) 22–23.

"A series of fuzzy directives is to blame for America's costly blunder in letting the Soviet Union get Germany's missile secrets. The Communists did not get all of the basic German research on missiles. But what they got was enough to contribute perhaps to 15 or 20 per cent to the launching of their SPUTNIKS." Relates the story behind the German V–2 rocket arsenal near Nordhausen, Thuringia, first discovered by U.S. Army in 1945, but which was later left to the Soviet occupation forces.

IF RUSSIA WINS MISSILE RACE, in *U.S. News and World Report*, v. 40 (20 Jan 56) 25–26.

IMPACT OF RUSSIAN SATELLITE TO BOOST U.S. RESEARCH EFFORT, in *Missile Engineering*, v. 2, No. 2 (Jan 1958) 8–9.

Washington's reaction to Soviet successes with SPUTNIKS.

INTO SPACE: MAN'S AWESOME ADVENTURE, in *Newsweek*, v. 50 (14 Oct 1957) 37–41.

The launching of SPUTNIK I, its meaning and implications, what the U.S. is planning in earth satellites, SPUTNIK II, and why the U.S. is lagging.

IS RUSSIA REALLY AHEAD IN MISSILE RACE? Symposium, in *U.S. News and World Report*, v. 40 (4 May 1956) 34–35.

THE MEANING OF "SPUTNIK", by Irwin Hersey, in *Astronautics*, v. 2, No. 4 (Nov 1957) 22–25 plus.

Some comments on the successful launching of the first earth satellite by the Soviets. Implications.

OFFICIAL U.S. VIEW ON RUSSIAN MISSILE; EXCERPTS FROM NEWS CONFERENCE, AUGUST 27, 1957, by J. F. Dulles, in *U.S. News and World Report*, v. 43 (6 Sep 1957) 33.

OUTER SPACE: UN, US, USSR, by Avrahm G. Mezerik. New York, International Review Service, 1960. 52 p.

RED MISSILE SHAKES PENTAGON, in *Business Week* (31 Aug 1957) 30.

RUSSIA CONFIRMS ICBM FIRING; CONGRESS DEBATES U.S. PROGRESS, in *Aviation Week*, v. 67 (2 Sep 1957) 27–28.

RUSSIA TAKES LEAD IN MISSILES, in *Business Week* (21 Oct 1957) 39–41 plus.

SOVIET IRBMS, ICBMS JOLT U.S., in *Missiles and Rockets*, v. 2 (Sep 1957) 47.

SOVIET LEAD IN SPACE DUE TO FORESIGHT, in *Aviation Week*, v. 68 (16 Jun 1958) 285–288.

SOVIETS CAPITALIZE ON SPACE LEADERSHIP, in *Aviation Week*, v. 70, No. 10 (19 Mar 1959) 109–110 plus.

"Soviet Russia is expected to retain her commanding lead in space technology for many years—probably for longer even than the four to five years estimated by U.S. experts in recent hearings before Congress. A major reason for this is Soviet Russia's greater need for and appreciation of space flight achievements as weapons of propaganda and prestige, an appreciation still not fully shared by the U.S." Some details of scientific aspects of the newest Seven-Year Plan and goals for space exploration.

U.S., SOVIETS RACE TO DEVELOP AIR-LAUNCHED BALLISTIC MISSILE, in *Space Technology*, v. 3, No. 2 (Apr 1960) 48–50.

Boeing B–52H will carry GAM–87A Sky Bolt; Soviet plans to use Bear turboprop, Bounder platforms.

THE USSR AND THE NATO POWERS; THE MILITARY BALANCE, in *Air Force*, v. 43, No. 3 (Mar 1960) 38–42 plus.

A comparative analysis of the armed forces of the Soviet Union (including rockets and guided missiles) and the NATO powers, as published recently by the Institute of Strategic Studies, London. The following Soviet missiles are described: Ground-to-ground ballistic missiles T–1, T–2, T–3, T–4, T–4a, T–5, T–5B and T–5C, T–7A; Sea-to-ground ballistic missiles Komet, Golem; Ground-to-ground guided missile J–1; Ground-to-air guided missiles T–6, T–7, T–8; and Air-to-Air missile M–100.

WHAT'S ORBITING IN THE SKY NOW, in *U.S. News and World Report*, v. 48, No. 13 (28 Mar 1960) 42–43.

A rundown on the U.S. and Russian satellites still aloft.

WHY THE RUSSIANS BEAT US, by Walter Lippman, in *Air Force*, v. 40, No. 11 (Nov 1957) 37.

WHY THE SOVIETS SUCCEED, by R. Hotz, in *Aviation Week*, v. 68 (20 Jan 1958) 21.

VIII. Missile and Space Strategy and Diplomacy

AIR FORCE CHIEF STRESSES SOVIET RETALIATORY POWER, in *Current Digest of the Soviet Press*, v. 9, No. 36 (16 Oct 1957) 6–8.

Commander-in-chief of the USSR Air Force, Air Marshal K. A. Vershinin answers questions of Pravda correspondent (text published in Pravda September 8). The question and the answers are reflective of the new Soviet missile-diplomacy.

THE CONVERSION OF WEST GERMANY INTO THE MAIN ATOMIC AND ROCKET NATO BASE. Prevrashchenie Zapadnoi Germanii v glavnuiu atomnuiu i raketnuiu bazu NATO, by B. Kononiuk and F. Nikol'skii, in *Mirovaia Ekonomika i Mezhdunarodnye Otnosheniia*, No. 5 (May 1959) 120–129. In Russian.

Soviet view of the role of West Germany in the defensive plans of NATO. Considers that the establishment of missile bases in West Germany (states that as of December 1958 the plans called for 222 installations for launching rockets of various types with atomic charges) is a "threat to peace" and discusses Soviet proposals for the "solution of the problem in the interest of the entire German nation."

JAPANESE EDITOR'S INTERVIEW WITH KHRUSHCHEV, in *Current Digest of the Soviet Press*, v. 9, No. 26 (7 Apr 1957) 3–7 plus.

N. S. Khrushchev's interview with Mr. Tomoo Hirooka, Editor in Chief of Japanese Newspaper Asahi Shimbun, 18 June 1957. (Text published in Pravda June 30). In the course of the interview Mr. Khrushchev made reference to Soviet Union's position during the 1956 conflict between Egypt and Great Britain, France, and Israel: ". . . We pointed then to the position in which Britain and France would find themselves in the event of an attack by other countries which possess modern weapons. It was pointed out that it is not necessary to send one's navy or troops to some country or other, that it is possible to act from afar, by using rockets for instance . . ."

KHRUSHCHEV: WE HAVE ALREADY WON OVER YOU; INTERVIEW, by N. Khrushchev, in *U.S. News and World Report*, v. 43 (6 Dec 1957) 98–100.

MAN OF THE YEAR, in *Time*, v. 71 No. 1 (6 Jan 1958) 16–20.

Portrait of Nikita Khrushchev, and how he exploits Russia's SPUTNIKS and rockets for missile-diplomacy.

MESSAGE FROM CHAIRMAN OF U.S.S.R. COUNCIL OF MINISTERS N. A. BULGANIN TO FEDERAL CHANCELLOR K. ADENAUER OF THE FEDERAL GERMAN REPUBLIC, in *Current Digest of the Soviet Press*, v. 9, No. 51 (29 Jan 1958) 20–21.

Using the occasion to promote the new Soviet missile-diplomacy Mr. Bulganin stated in his message: "It should be frankly stated that the conversion of the F. G. R. into a bridgehead for American rocket weapons and the Bundeswehr's acceptance of atomic weapons, as planned by the military leaders of NATO, will certainly not make the F. G. R. less vulnerable, and instead will only increase the danger of an atomic war on its territory." Text published in Pravda and Izvestia December 12.

MESSAGE FROM CHAIRMAN OF U.S.S.R. COUNCIL OF MINISTERS N. A. BULGANIN TO UNITED STATES PRESIDENT DWIGHT D. EISENHOWER, in *Current Digest of the Soviet Press*, v. 9, No. 50 (22 Jan 1958) 19–21.

Mr. Bulganin airs his views on the reasons behind the "crucial moment" that "has arrived in the development of the international situation." Among the many reasons: that the United States is going to share its rocket weapons with NATO members states and station them on their territories. Text published in Pravda and Izvestia December 12. Delivered by Ambassador G. Zarubin to U.S. Department of State on December 10.

MISSILES IN SOVIET STRATEGY, by Raymond L. Garthoff, in *Air Force*, v. 41, No. 7 (Jul 1958) 91–92.

Excerpts from the author's book, Soviet Strategy in the Nuclear Age, dealing with the role of missiles, in particular, the IRBM and ICBM—in Soviet military strategy.

THE NEW SOVIET STRATEGY, by Isaac Deutscher, in *Reporter* (3 Oct 1957) 10–12.

There are some outward signs of an official recognition by the Soviet military leadership of the supremacy of aviation over all other armed forces. Reviewed are the influences that produced this recognition as well as the role of missiles within the new Soviet strategy.

THE ROLE OF SCIENCE AND TECHNOLOGY IN CONTEMPORARY WAR. Rol' nauki i tekhniki v sovremennoi voine, by Maj. Gen. G. I. Pokrovsky. Moscow, Znanie, 1957. 24 p. In Russian.

SCIENCE AND TECHNOLOGY IN CONTEMPORARY WARS. Nauka i tekhnika v sovremennykh voinakh, by Maj. Gen. G. I. Pokrovsky. Moscow, Voennoe Izdatel'stvo, 1956. 88 p. In Russian.

Strategic implications of new technological developments.

THE SOVIET MILITARY POSTURE AS A REFLECTION OF SOVIET STRATEGY, by Herbert S. Dinerstein. Santa Monica, California, Rand Corporation, 1958. 21 p. (RM–2102. ASTIA Document Number AD 150679.)

Includes a discussion of the role occupied by missiles in Soviet strategy.

[SPUTNIK I], in "GUIDED MISSILES." Long Island City, N.Y. Federal Procurement Publications, Inc., 1957. p. 430–431.

Day-by-day highlights of the launching of SPUTNIK I covering the period 5 October 1957 when the Soviet Union announced that it had successfully launched a man-made earth satellite—through 13 October 1957, when Khrushchev played the earth satellite for all it was worth—militarily, politically, and psychologically—threatening intervention in the Syrian-Turkish crisis. Includes description of SPUTNIK I.

WAR AND THE SOVIET UNION; NUCLEAR WEAPONS AND THE REVOLUTION IN SOVIET MILITARY AND POLITICAL THINKING, by H. S. Dinerstein. Santa Monica, Rand Corporation, 1958. 265 p. (R–326).

Describes in some detail the Soviet controversy on military theory that took place between the fall of 1953 and the spring of 1955. Discusses whether and to what extent the Soviet leaders rely on the military balance to deter their presumptive enemy, the United States, and analyzes a few cases in which the domestic dispute over military policy played an important role in Soviet politics at the highest level. A section on the importance of surprise and related problems concerning the initiation of war in the nuclear era discusses Soviet views on preemptive attack and its relationship to preventive war. The report concludes with an examination of the roles assigned to the various military arms (including employment of missiles) in the execution of Soviet strategy.

WHAT THE RUSSIANS TELL . . . AND WHAT THEY DON'T TELL, by Albert Parry, in *Missiles and Rockets*, v. 2 (Feb 1957) 70–72.

The Russians rarely deny or confirm our statements concerning their missiles. However, they tell their people mostly about our guided missile work emphasizing that "we mean war only, never peace—and aggressive war, at that, not merely defense."

WHY SOVIETS PLAN "FIRST BLOW": WHAT MISSILES MEAN IN RED STRATEGY, in *U.S. News and World Report*, v. 44 (7 Feb 1958) 60–67.

IX. Source Materials

ARTIFICIAL SATELLITE OF THE EARTH. Iskustvennyi sputnik zemli, by V. P. Petrov. Moscow, Voennoe Izdatel'stvo, 1958. 306 p. In Russian.

Chapter 7 is devoted to environmental aspects. With illustrations. Bibliography on pp. 301–303.

ARTIFICIAL SATELLITES, by A. Shternfeld, Moscow, 2d. rev. ed. State Publishing House of Technical and Theoretical Literature, 1958. 424 p. In English.

This translation of Soviet publication on artificial satellites titled: "Iskusstvennye Sputniki" was prepared under the auspices of the Technical Documents Liaison Office, Wright-Patterson AFB, Ohio. The chapters deal with: the laws of motion of artificial satellites; the rocket starter of the artificial satellite; launching of artificial satellite; construction of artificial satellites; man in cosmic space; on board an artificial satellite; observation of artificial satellites and their communication with the ground; the descent to earth; and utilization of artificial satellites, among others. Appended: discussion of territorial rights to the space above the atmosphere. Illustrations.

A CASEBOOK ON SOVIET ASTRONAUTICS, by F. J. Krieger. Santa Monica, California, Rand Corporation, 21 Jun 1956. 244 p. (RM–1760.)

"In this working paper prepared by a staff member of the RAND Corporation an attempt is made to judge the extent of Soviet scientific and popular interest in astronautics as it may be determined from Russian writings on the subject. The historical, scientific, and technical aspects of rocketry are dealt with in a four-part bibliography containing books by and about early Russian proponents of astronautics, books of a popular science nature, monographic works, and periodical articles. By far the larger part of this casebook is taken up by translations from the Russian of articles (mostly 1954, 1955) selected from a variety of periodicals which interpret the problems of cosmic flight and the possible uses to which this mastery may be applied. The majority of the references supplied are for 1950–1955."

A CASEBOOK ON SOVIET ASTRONAUTICS, PART II, by F. T. Krieger. Santa Monica, California, Rand Corporation, 1957. 203 p. (RM–1922.)

"The present study, which is a continuation of RM–1760, shows that Soviet interest in astronautics is not merely academic or superficial, but is as serious and purposeful as interest can be in a subject that is sponsored to the hilt by a totalitarian regime. The format of the study is in two principal sections: the first is a two-part bibliography of Russian books and periodicals dealing with various aspects of rocketry and astronautics; the second is a series of complete translations from the Russian of articles and papers by various authorities which show the singleness of purpose in the Russian space flight program."

DIRECTORY OF GOVERNMENT MISSILE AGENCIES. Long Island City, N.Y., Federal Procurement Publications, 1957. 161 p.

". . . who buys what . . . where . . . when . . . how. Address, programs, purchasing, R&D, products, materials." A list of foreign missiles and rockets with basic specifications. A special section on the missile development in the Soviet Union.

THE HANDBOOK OF ROCKETS AND GUIDED MISSILES, by Norman J. Bowman, Chicago, Perastadion Press, 1957. 328 p.

Ground launched missiles; air launched missiles; foreign missile program (including Soviet rocket planes and auxiliary power units); jet engines for missile applications; upper atmosphere research tools; the artificial satellite; and the intercontinental missile. With tabulated data on rockets and guided missiles, drawings of rockets and missiles, and references.

NEW SOVIET ROCKET DEVELOPMENTS, by Alfred J. Zaehringer, in *RRS News*, No. 83 (Winter 55–56) 10–11.

Compilation of news notes on the achievements and state of rocket research of the USSR. Bibliography.

THE RUSSIAN LITERATURE OF SATELLITES. Part II. New York, International Physical Index, 1958. 178 p. In English.

A comprehensive treatment of the most important problems of launching, guiding, and deriving data from artificial satellites. Articles deal with: silicon solar batteries as sources of power in artificial earth satellites; investigation of the composition of primary cosmic radiation, investigation of short-wave ultraviolet solar radiation; rocket investigations of the composition of the atmosphere at great altitudes; measuring pressure in the upper atmosphere; the problem of measuring the pressure and density of the upper layers of the atmosphere using an artificial earth satellite; investigation of the ionic composition of the ionized layers of the atmosphere; measurement of the positive-ion concentration along the orbit of an artificial earth satellite; investigation of the solid component of interplanetary matter using rockets and artificial earth satellites; measurements of electrostatic fields in the upper layers of the earth's atmosphere.

SOVIET SPACE SCIENCE, by Ari A. Shternfel'd. 2d rev. and extended ed. New York, Basic Books, 1959. 361 p.

An account of what it takes to launch a satellite and also considers man in space, tracking and communication problems, satellite re-entry, and interplanetary flight. Draws largely on Western source material, offering "little insight into what the Russians are doing." With photos and illustrations.

SYMPOSIUM OF SOVIET RESEARCH ON ARTIFICIAL EARTH SATELLITES AND RELATED SUBJECTS. New York, U.S. Joint Publications Research Service, 1958. 2 v. (Report No. 187.)

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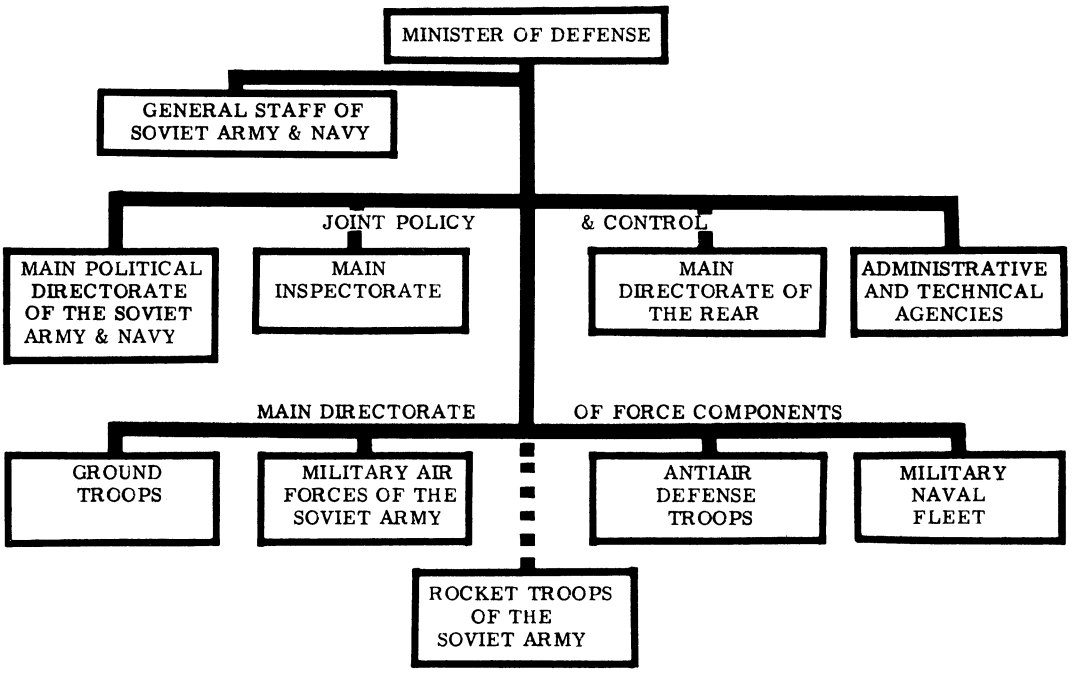
APPENDIX A

RELATIONSHIP OF ROCKET FORCES IN THE SOVIET MINISTRY OF DEFENSE



Biographic Sketch
of
Mitrofan Ivanovich Nedelin

Present Rank:	Chief Marshal Artillery
Present Position:	Commander of the Main Rocket Forces Command (Marshal of Rocketry)
Born:	Early 1900's
In World War II:	Artillery officer on Western front in battle for Moscow in 1941; on Third Ukranian Front from late 1943 to end of war at which time he emerged as a Colonel General.
After World War II:	Following the end of the war, held various responsible posts in the Main Artillery Administration of the USSR Ministry of Defense, and in 1950 became Chief of the Main Artillery Administration, holding that post through the middle of 1960; promoted to Marshal of Artillery, 1953; elected deputy of the USSR Supreme Soviet, 1954; elected candidate member, Central Committee, of the Communist Party of the Soviet Union, October, 1953, and reelected in 1956; promoted to Chief Marshal of Rocketry, Main Rocket Forces Command, 1960.
Distinctions:	Several Orders of Lenin, Order of Red Banner, among others.

APPENDIX B

SELECTED NIKITA S. KHRUSHCHEV STATEMENTS OF SOVIET "PEACEFUL PROGRESS"

When we were in America, I was often asked whether we had timed the launching of the moon rocket to coincide with my visit to the United States. I replied: Please do the same. Why have you not timed the launching of your moon rocket with my visit? You know that the Americans have tried more than once to launch a rocket to the moon. But nothing has come of it there. The launching of our artificial earth satellites and space rockets is a great feat. It was, so to speak, a defense of the diploma of maturity by the Soviet people before the whole world.

—Speech at Krasnoyarsk, October 9, 1959; Moscow radio broadcast, October 11, 1959.

The Soviet Union amazes the whole world by its achievements in science and culture. When we reported on the successful trials of our intercontinental ballistic rockets, many people abroad said: They are trying to frighten us. The Soviet Union does not possess these rockets. But when our scientists, engineers and workers created and launched into space earth satellites, it became clear also to the fools that we have intercontinental rockets. Well, everybody sees how our satellites are flying round the earth. One need only to look at the sky!

—Speech at Krasnoyarsk, October 9, 1959; Moscow radio broadcast, October 11, 1959.

The whole world knows that Soviet space rockets are sent to distant, unexplored, mysterious worlds. One of our rockets has become a satellite of the sun, another took the Soviet coat of arms to the moon, and a third photographed the moon's invisible side. At present, Soviet scientists and designers are working successfully on the development of an even more powerful rocket for the launching of heavy satellites off the earth and for space flights to planets of the solar system. The world's first atomic icebreaker, the Lenin, is already forcing ice in the northern seas.

—Speech to Indonesian Parliament, February 26, 1960; TASS, February 26, 1960.

In many fields of science and production we have already overtaken the United States, and we have no intention of relinquishing this primacy. With pride in our motherland, we note that the Soviet people were the first to build an atomic power plant and the first to build an artificial earth satellite, to launch a rocket around the sun, to deliver a rocket of their own to the moon, and to launch an interplanetary station which orbited the moon and photographed that side of the moon which is hidden from the eyes of people.

—Speech at Surabaya, Indonesia, February 22, 1960; *Pravda*, February 24, 1960.

I hope you would not say that I am trying to frighten you if I remind you that the Soviet Union has rockets in a quantity and of a quality unequaled by any other country in the world. This can be confirmed by the launching of our sputniks and cosmic rockets. Under these conditions to settle disputable questions in the way the militarist-revanchist quarters of West Germany apparently want—by war—is tantamount to suicide, to destruction of one's country.

—Letter to Chancellor Adenauer, August 18, 1959; TASS, August 26, 1959.

After the launching of Soviet artificial satellites and cosmic rockets, which demonstrated the possibilities of modern technology, the fact that the United States is now in no way less vulnerable militarily than any other country has firmly entered the minds of the American people. I believe that nobody will suspect me of trying to intimidate anybody by such words. No, this is the actual state of affairs, and it is evaluated in this way not only by us but also by Western statesmen, including statesmen of the United States itself.

—Speech to USSR Supreme Soviet; Moscow radio broadcast, January 14, 1960.

APPENDIX C

*U. S. AND U. S. S. R. SPACE SCIENCE RESULTS

(By Homer E. Newell, Jr., Assistant Director, Space Sciences, National Aeronautics and Space Administration)

TABLE 1.—*Significant firsts in sounding rocket, satellite, and space probe research*

UNITED STATES

1. A number of firsts in high altitude rocket research, including among others—
   First detailed photo of solar ultraviolet spectrum.
   First photo of complete tropical storm.
   First penetration of equatorial ionospheric current sheets.
   First detection of X-rays in high atmosphere.
   First detection of auroral particles in high atmosphere.
2. Discovery of the Van Allen Radiation Belt.
3. Discovery that the Van Allen Radiation Belt consists of at least two zones.
4. Performance of the Argus experiments.
5. The first precise geodetic use of artificial earth satellites (Vanguard I) to obtain refined information on the size and shape of the earth, providing an improved value for the flattening and showing that the earth is actually slightly pear shaped.
6. First achievement of an elementary communication satellite, in Score.

U.S.S.R.

1. First artificial earth satellite.
2. First lunar near miss.
3. First lunar impact.
4. First pictures of the hitherto unseen side of the moon.
5. First direction of what may be a current ring about the earth (the Chapman Strømer ring).
6. First routine recovery of large animals (dogs and rabbits) from high altitude rocket flights.
7. Development and routine use of meteorological sounding rocket, recoverable and reflyable.
8. First launching of a large animal (Laika) in a satellite of the earth.
9. First high capacity, maneuverable, heavily instrumented, spacecraft with fully successful long-range communications (Lunik III).

TABLE 2.—*Sounding rocket, satellite, and space probe results*

Field	United States	U.S.S.R.
Upper atmosphere	1. Rocket observations have been made of pressure, temperature, density, composition, and winds of the high atmosphere at a wide variety of locations, both day and night, and in the various seasons. 2. Upper air densities have been obtained from the tracking of both U.S. and U.S.S.R. satellites. 3. It has been shown that the radiation belt may account for much higher atmospheric temperatures observed in the auroral zone atmosphere than in the high atmosphere above the middle and equatorial regions. 4. ----------	1. Rocket observations have been made of pressure, temperature, density, composition and winds of the high atmosphere at a wide variety of locations, both day and night, and in the various seasons. 2. Upper air densities in the higher latitude regions obtained from drags on Sputniks I and III. 3. High enough flux of low energy electrons measured with Sputnik III instruments in the northern regions to account for the higher atmospheric temperatures there. 4. Direct measurement of upper air densities made with gages in Sputnik III, for heights up to 355 kilometers.

*Reprinted from: Review of the Space Program; Hearings Before the Committee on Science and Astronautics, U.S. House of Representatives, Eighty-Sixth Congress, Second Session. Washington, Government Printing Office, 1960. Pp. 258-264. (Part 1 [No. 3].)

TABLE 2.—*Sounding rocket, satellite, and space probe results*—Continued

Field	United States	U.S.S.R.
Upper atmosphere	5. Fluctuation in satellite drag, hence presumably upper air densities, have been shown, from observations on Vanguard I and Sputnik II, to be directly correlated with fluctuations in the 10 centimeters radiation from the sun, and hence solar activity.	5.
	6.	6. The routine meteorological sounding rocket has been used to give atmospheric structure data at middle-European, Arctic, and Antarctic locations showing seasonal variations as well as geographic. It turns out that the seasonal variations are different for the different altitude ranges.
	7. From both satellite and rocket observations high altitude air densities have been shown to vary widely with time of day, season, and geographic position.	7.
	8. The amounts of diffusive separation both below and above the E region of the ionosphere have been measured in sounding rocket experiments, and shown to be very slight below the E region and quite pronounced above altitudes of 110 to 120 kilometers.	8. Diffusive separation in the upper atmosphere below the E region has been measured with results that agree in general with the U.S. observations.
Ionosphere	1. Extensive electron density data have been obtained for a number of locations from rocket soundings.	1. From rocket soundings electron densities have been obtained up to and above the F region maximum.
	2. From radio signals of both U.S. and U.S.S.R. satellites, propagation characteristics of the ionosphere and electron density distributions have been obtained.	2. Electron densities above 300 kilometers were obtained by observation of the radio signals of Sputniks I and III.
	3.	3. Observations on Sputnik I showed 3.5 times as many electrons above the F region maximum as below.
	4. The heavy ions in the ionosphere above White Sands and Fort Churchill have been identified up to the F region in rocket sounding experiments.	4. The ionic composition of the ionosphere has been measured in sounding rockets to above the F region maximum.
	5.	5. Sputnik III observations showed that the predominant ion from 250 to 950 kilometers is positive atomic oxygen, O+.
	6.	6. In Sputnik III the satellite potential in the daytime ionosphere was observed to be as much as −7 volts.
	7. Very low frequency propagation data were obtained from Explorer VI.	7.
	8.	8. In the 2d Lunik, evidence of a lunar ionosphere was obtained.
Magnetic field	1. Data on earth's magnetic field were obtained from Pioneer I and Explorer VI, and a great deal of additional high-quality data are being obtained from Vanguard III.	1. Data on earth's magnetic field obtained from Sputnik III.
	2. By their magnetic effect, electric current flows were plotted in the E and lower F regions, in rocket sounding experiments in the equatorial regions.	2.

TABLE 2.—*Sounding rocket, satellite, and space probe results*—Continued

Field	United States	U.S.S.R.
Magnetic field	3.	3. On Mechta measurements were made of the earth's magnetic field and its extension into space. A marked dip in the field was discovered in the region of the radiation belt, indicating perhaps the existence of a current ring such as postulated by Chapman.
	4. Rocket measurements of the earth's magnetic field have been made in the auroral regions.	4.
	5.	5. Lunik II, on its plunge to the surface of moon, showed that the lunar magnetic field is not greater than 50 gamma.
Cosmic rays	1. Extensive data on cosmic ray intensities, composition, and interactions with matter were obtained from sounding rockets in various locations and throughout all the seasons.	1. Cosmic radiation measurements have been made in U.S.S.R. sounding rockets
	2. The cosmic ray count was obtained above the atmosphere with counters in Explorer satellites and Pioneer probe.	2. The cosmic radiation was measured in Soviet satellites and space probes.
	3. Cosmic ray counts in the first Explorers gave discovery of the radiation belt.	3. Sputnik II observations showed an increase in counting rate with height (this being at the time, an unrecognized hint of the presence of the radiation belt.)
	4. Details on the cosmic radiation as a function of time and position in space have been obtained from Explorer VI, and are being obtained from Explorer VII.	4. Sputnik III and cosmic rockets provided measurements on the heavy nuclei in the cosmic radiation.
Radiation belt	1. Radiation belt discovered with instruments in Explorer I.	1. Abnormally high cosmic ray counts were observed in Sputnik II, particularly at the high latitudes. Sputnik II showed a very high electron flux in the northern latitudes.
	2. A great amount of additional detail obtained on belt in Explorers III and IV, and the Pioneer probes. Extent of radiation belt shown by Pioneer I. Pioneer III showed belt to consist of at least 2 zones.	2. Sputnik III, Mechta, and other Soviet satellite and space probe observations confirm the U.S. findings.
	3. Pioneer IV showed the extent of the outer radiation belt to have increased greatly following a 5-day period of high solar activity, thus proving that the outer belt is of solar origin.	3.
	4. Argus experiments showed individual inner zones of the radiation belt to be very stable.	4.
	5. Argus observations lend support to conclusion that inner radiation belt produced by cosmic rays. See No. 7 below.	5.
	6. Detailed energy spectrum of radiation in radiation belt was obtained by Explorer VI.	6.

TABLE 2.—*Sounding rocket, satellite, and space probe results*—Continued

Field	United States	U.S.S.R.
Radiation belt	7. Sounding rocket observations showed that the energetic particles of the inner radiation belt are protons of energy spectrum expected from β decay of neutrons, hence supports cosmic ray origin for hard components of inner belt.	7.
	8. Extensive additional information on the radiation belt was obtained from Explorer VI and is being obtained from Explorer VII and Vanguard III. Huge variations of many orders of magnitude in counting rates were observed in outer zone.	8.
	9. Radiological hazard of radiation belt estimated to be not serious for a direct traverse of the belt; but quite serious for a space station that spends a lot of time in the belt.	9. Radiological hazard of radiation belt estimated to be not serious for a direct traverse of the belt; but quite serious for a space station that spends a lot of time in the belt.
	10.	10. The moon was shown not to have a radiation belt detectable within the sensitivity of Lunik instruments.
Aurora	1. Rocket soundings have been used to study the electromagnetic and particle radiations in the aurora. It was found that soft radiation flux above 40 kilometers was many times the primary cosmic ray count.	1.
	2.	2. A very high flux of low energy electrons was observed in Sputniks II and III. This flux was taken to be the cause of the very high atmospheric temperature in these regions.
	3. The particles in the outer radiation belt have been shown to be the likely immediate cause of the aurora.	3. The particles in the outer radiation belt have been shown to be the likely immediate cause of the aurora.
Geodesy	1. Vanguard I observations give an oblateness of the earth of 1/298.3.	1.
	2. Vanguard I observations show the earth to be pear shaped with a 50-foot peak at the North Pole, and a 50-foot flattening at the South Pole; this appears to imply an internal strength to the earth, rather than a free flowing plasticity.	2.
Meteors	1. A fairly low count of micrometeors corresponding to a total influx of 1,000 to 10,000 tons of material per day, from Explorer and Pioneer observations.	1. Influx of material per day indicated by Sputnik III observations in general agreement with the U.S. results.
	2. A very large amount of additional data are being obtained from the Vanguard III instrumentation.	2. Additional measurements made in Soviet cosmic rocket flights.
Astronomy	1. In sounding rocket experiments ultraviolet sources in the sky have been detected and plotted.	1.
	2. The solar spectrum has been observed and photographed down to 303 angstroms.	2.
	3. Solar radiations have been observed and measured in the X-ray regions.	3.

TABLE 2.—*Sounding rocket, satellite, and space probe results*—Continued

Field	United States	U.S.S.R.
Lunar explorations	1.	1. First photos taken of the hitherto unseen side of the moon.
	2.	2. The lunar magnetic field shown to be no greater than 50 gamma.
	3.	3. Lunar ionosphere detected.
Miscellaneous experiments.	1. The Argus experiments were carried out	1.
	2. Sodium vapor was released in the high atmosphere and observed to measure its radiations, atmospheric winds, and diffusion.	2. Sodium clouds were released from Luniks II and III and observed from the ground.
	3. Various chemical contaminants were released in the high atmosphere to study the photochemical reactions that resulted.	3.
Biosciences	1. On numerous sounding rocket flights biological specimens of seeds, fruit flies, etc., have been flown and recovered for study. Larger animals, such as rats and monkeys, have been flown for study of their behavior and the effects of the flight environment on them. Recovery of such animals has been effected on numerous occasions.	1. Large numbers of sounding rocket experiments have been carried out with dogs and rabbits, in which the animals were both studied during flight and recovered after flight for further study.
	2.	2. Observations were made on the behavior of Laika, particularly heartbeat and respiration, Sputnik II.
Engineering data	1. U.S. satellites show that moderate temperatures can be achieved in orbiting vehicle.	1. U.S.S.R. satellites and space probes show that moderate temperatures can be achieved by appropriate engineering.
	2. Elementary communications link checked out in Project Score.	2.
	3. Based on radiation belt data, it is deduced that satellites may charge to a potential of some hundreds of volts in the radiation belt.	3. Sputnik III measurements show that in the daytime ionosphere the satellite acquired an appreciable negative charge corresponding to a negative potential of several volts.
	4. The meteor erosion and puncture problems have been shown in general to be not particularly serious.	4. The meteor erosion problem appears to be not particularly serious.
	5. An elementary TV scanner was checked out in Explorer VI, while some of the basic elements of a meteorological satellite were checked out in Vanguard II.	5.
	6.	6. Automatic photography of the moon and the televising of the photographs obtained back to earth has been achieved.
	7. Solar cells have been shown to be a practical, reliable source of power.	7. Solar cells have been shown to be a practical, reliable source of power.
	8.	8. A complete spacecraft, maneuverable, with temperature control, power supply, long range communications link, complicated instrumentation, etc., has been engineered and flown successfully—namely, Lunik III.

TABLE 2.—*Sounding rocket, satellite, and space probe results*—Continued

Field	United States	U.S.S.R.
Engineering data	9. It appears that the radiological hazard to space vehicle crews traversing the radiation belt directly may be relatively low, while the hazard to those in a satellite orbiting through the radiation belt would be quite serious. In addition, marked increases in proton intensities of the cosmic radiation found at the time of solar activity may be a very serious radiological hazard: dose rates of 1,000 roentgens per hour.	9. It appears that the radiological hazard to space vehicle crews traversing the radiation belt directly may be relatively low, while the hazard to those in a satellite orbiting through the radiation belt would be quite serious.
Meteorology	1. Numerous sounding rocket photos of cloud formations and significant weather areas have been taken. In particular a composite photo from one sounding rocket showed a completely developed tropical storm approaching hurricane proportions.	1.
	2.	2. A meteorological sounding rocket was developed and has been used on a routine basis for meteorological studies.
	3.	3. Detailed measures of pressures and temperatures have been obtained with the meteorological rocket for Antarctic, Arctic, and Middle European locations.
	4. Cloud picture data were obtained in Vanguard I, but motions of the satellite have so far prevented reducing the data to useful pictures. Also, very low resolution, elementary television pictures have been taken of cloud formations as seen from Explorer VI. One of these pictures was assembled and released.	4.

TABLE 3.—*Problems currently under attack*

Field	United States	U.S.S.R.
Upper atmosphere	1. A detailed study of the structure, winds, and composition of the ionospheric regions and beyond in the earth's atmosphere is underway by means of sounding rockets and earth satellites.	1. A detailed study of the structure, winds, and composition of the ionospheric regions and beyond in the earth's atmosphere is underway by means of sounding rockets and earth satellites.
	2. Work is underway to develop a routine rocket sonde for synoptic studies of the lower portion of the upper atmosphere in association with meteorological soundings.	2. The U.S.S.R. has already achieved the development of a routine rocket sonde for meteorological-type soundings into the lower portion of the upper atmosphere.
Ionosphere	Intensive rocket and satellite studies of the ionosphere in the F region and beyond are underway.	Intensive rocket and satellite studies of the ionosphere in the F region and beyond are underway.

TABLE 3.—*Problems currently under attack*—Continued

Field	United States	U.S.S.R.
Magnetic field	The United States has used search coils, saturable core magnetometers, and proton precession magnetometers in its measurements of the earth's magnetic field. The United States is preparing to use a much more sensitive instrument, the alkali vapor resonance magnetometer, for further studies of magnetic fields in space and to measure the magnetic field of the moon.	The U.S.S.R. has also used standard-type magnetometers and proton precession magnetometers for observations of the earth's magnetic field. The U.S.S.R. has made a measurement to detect the lunar magnetic field, finding none to within the sensitivity of their instrument. It is not known whether the U.S.S.R. is preparing to use the alkali vapor magnetometer in the near future.
Cosmic rays	Balloon, sounding rocket, and satellite observations of the intensity, nature, and effect of cosmic rays are underway.	Balloon, sounding rocket, and satellite observations of the intensity, nature, and effect of cosmic rays are underway.
Radiation belt	Detailed study of the radiation belt by means of sounding rockets, satellites, and space probes, with occasional use of controlled experiments is underway.	The U.S.S.R. made intensive studies of the radiation belt in Sputnik III, but at the present time appears to be investigating the belt incidentally as part of their concentration on deeper space missions; namely, on their lunik flights.
Aurora	U.S. scientists are tackling the problem of both visible and ultraviolet auroral radiations, the particles connected with the aurora, and the ultimate origin of the aurora.	The U.S.S.R. scientists are tackling the same problems.
Geodesy and celestial mechanics.	The United States is continuing use of satellites for geodetic studies.	The U.S.S.R. shows skill in applications of celestial mechanics, as witnessed by their ability to launch Lunik III with the accuracy achieved, and to predict the motions of the Lunik III spacecraft.
Meteors	The United States continues to collect data on meteors in space, using a wide variety of experimental equipments.	The U.S.S.R. has made an intensive study of micrometeors in their satellites and space probes, appearing to attack the general problem very much along the lines followed by the United States.
Astronomy	Active rocket astronomy in being. Orbiting telescopes, solar, and astrophysical observatories being worked on.	Unknown.
Lunar exploration	The United States is preparing to conduct intensive investigations of the moon, but the actual observation of the moon from space vehicles is yet to begin.	The U.S.S.R. has already achieved significant steps in its investigation and study of the moon. It may be presumed that the Soviets will continue their vigorous efforts in this area.
Planetary investigations.	The United States has minimal capability in this area at present, and on the present schedule planetary work is proceeding at a very slow pace.	The U.S.S.R. has an advanced capability in this area, and has declared its definite interest in planetary research.
Miscellaneous experiments.	The United States is using upper atmosphere regions for controlled chemical and Argus type experiments. Also planning relativity and gravity experiments.	Unknown.

TABLE 3.—*Problems currently under attack*—Continued

Field	United States	U.S.S.R.
Biosciences and man-in-space.	The United States has a first stage man-in-space program in Project Mercury. Support work of a research type is being carried out in the Discoverer program. Some experimental work is being carried out in sounding rocket flights. A well rounded, fully developed program of research in both biotechnology and biosciences is yet to be worked out.	The U.S.S.R. has a highly active program of research on animals under rocket flight and satellite conditions. It is not known how fully developed their biotechnical and fundamental biosciences programs are. It is expected, particularly from recent news releases, that the U.S.S.R. does have a man-in-space program.
Meteorology	The United States is developing rocket photographic techniques for meteorological purposes. The United States is developing a meteorological sonde for synoptic soundings. The United States is conducting fundamental satellite experiments associated with meteorology, and is taking the initial steps in the development of a meteorological satellite system.	The U.S.S.R. has already developed a working meteorological rocket sonde, which they have already put to extensive use. It is not known what the U.S.S.R. is doing in the matter of developing a satellite meteorological system.
Communications	In its rocket, satellite, and space probe telemetry the United States has shown good capability. Long-range communication systems are being worked on for deep space probes. Communication satellite systems are being worked on.	The U.S.S.R. rocket, satellite, and space probe telemetry has been successful. In particular the communications and telemetry problems of Lunik III appear to have been worked out with a high degree of competence. It is not known whether they are developing a communication satellite system, but it may be presumed that they are.
Navigation	The United States is working on a navigation satellite of high degree of refinement.	It is not known whether the U.S.S.R. is devoting effort to a navigation satellite.

SATELLITES AND SPACE PROBES ...US AND USSR

APPENDIX D

The three tables below give a comprehensive picture of all known American and Soviet space shots through March 1, 1960. The first summarizes the twenty-five objects that have orbited to date. Of these launches, thirteen satellites or their rocket bodies are still in orbit, as shown in color. The second table summarizes deep-space probes, including moon shots, while the third gives launch data and reasons for failure of twenty-four American orbital or space-probe attempts. This material has been compiled entirely from unclassified sources. . . .

SUCCESSFUL SATELLITES

	Still in Orbit on March 1, 1960	Official Name	Object	Originating Nation	Launch Date	Launch Site	Status as of March 1, 1960	Shape	Size	Apogee in Statute Miles	Perigee in Statute Miles	Period of Revolution in Minutes	Total Weight in Orbit	Weight of Instrumentation in Payload	Remarks
1.		1957 Alpha I	Rocket body for Sputnik I	Soviet Union	October 4, 1957	Near Caspian Sea	Down December 1, 1957	Cylinder	Unknown	590	141	96.2	About 4 tons	None	Final stage of launch vehicle.
2.		1957 Alpha II	Sputnik I	Soviet Union	October 4, 1957	Near Caspian Sea	Down January 4, 1958	Sphere	22.8" diameter	588	142	96.17	184 lb.	Unknown	History's first earth satellite.
3.		1957 Beta	Sputnik II ("Muttnik")	Soviet Union	November 3, 1957	Near Caspian Sea (?)	Down April 14, 1958	Cone	5½' long, 39" diameter at base	1,038	140	103.70	1,120 lb. (with third stage)	Unknown	Contained the dog "Laika."
4.	●	1958 Alpha	Explorer I	United States	January 31, 1958	Cape Canaveral	Expected to remain in orbit until 1962	Cylinder	80" long, 6" diameter	1,242	216	108.7	30.8 lb.	18.13 lb.	Discovered Van Allen radiation belt.
5.	●	1958 Beta I	Rocket body for Vanguard I	United States	March 17, 1958	Cape Canaveral	Expected to remain in orbit until 21st century	Bottle	7' long 20" diameter	2,684	402	138.2	50 lb.	None	Third-stage casing.
6.	●	1958 Beta II	Vanguard I	United States	March 17, 1958	Cape Canaveral	Expected to remain in orbit until 21st century	Sphere	6.4" diameter	2,446	405	133.8	3.25 lb.	3.25 lb.	Helps determine earth's shape.
7.		1958 Gamma	Explorer III	United States	March 26, 1958	Cape Canaveral	Down June 28, 1958	Cylinder	80" long, 6" diameter	1,746	121	115.87	31.0 lb.	18.56 lb.	Provided data on micrometeorite impacts.
8.		1958 Delta I	Rocket body for Sputnik III	Soviet Union	May 15, 1958	Near Caspian Sea (?)	Down December 3, 1958	Cylinder	Unknown	1,167	370	105.9	About 5 tons	None	Final stage of launch vehicle.
9.	●	1958 Delta II	Sputnik III	Soviet Union	May 15, 1958	Near Caspian Sea (?)	Expected to remain in orbit until March 1960	Cone	11' 9" long 5' 8" wide at base	354	109	91.5	About 3.5 tons	2,925 lb.	Heaviest test vehicle orbited.
10.		1958 Epsilon	Explorer IV	United States	July 26, 1958	Cape Canaveral	Down October 23, 1959	Cylinder	80.39" long 6.25" diameter	1,380	163	110.27	38.4 lb.	25.8 lb.	Provided data on radiation belts.
11.		1958 Zeta	Atlas	United States	December 18, 1958	Cape Canaveral	Down January 21, 1959	Atlas ICBM	85' long 10' diameter	920	110	101.46	4.375 tons	150 lb.	Project SCORE "Talking Atlas"; beamed message from President Eisenhower.
12.	●	1959 Alpha I	Vanguard II	United States	February 17, 1959	Cape Canaveral	Expected to remain in orbit until 21st century	Sphere	20" diameter	2,050	347	122.5	20.74 lb.	20.74 lb.	Weather satellite; developed wobbling motion.
13.	●	1959 Alpha II	Rocket body for Vanguard II	United States	February 17, 1959	Cape Canaveral	Expected to remain in orbit until 21st century	Bottle	7' long 20" diameter	2,279	347	129.6	50 lb.	None	Third-stage casing.
14.		1959 Beta	Discoverer I	United States	February 28, 1959	Vandenberg AFB	Down March 5, 1959	Cylinder	19.2' long 5' diameter	605	99	95.9	1,300 lb.	245 lb.	First satellite in polar orbit.
15.		1959 Gamma	Discoverer II	United States	April 13, 1959	Vandenberg AFB	Down April 26, 1959	Cylinder	19.2' long 5' diameter	220	142	90.5	1,610 lb.	245 lb. plus 195-lb. capsule	Attempt to recover reentry capsule was unsuccessful.
16.	●	1959 Delta	Explorer VI	United States	August 7, 1959	Cape Canaveral	Expected to remain in orbit until late 1960	Spheroid with vanes	29" deep 26" diameter	23,980	117	686.2	142 lb.	142 lb.	"Paddlewheel" satellite; has 4 vanes, each 18"x18".
17.		1959 Epsilon I	Discoverer V	United States	August 13, 1959	Vandenberg AFB	Down September 28, 1959	Cylinder	19.2' long 5' diameter	450	136	94	1,700 lb.	38.4 lb. plus 300-lb. capsule	Reentry capsule became 1959 Epsilon II.
18.	●	1959 Epsilon II	Discoverer V Capsule	United States	August 13, 1959	Vandenberg AFB	In orbit	Cylinder	About 2' long About 3' diameter	1,041	125	103.9	About 300 lb.	Unknown	Unrecovered reentry capsule of Discoverer V.
19.		1959 Zeta	Discoverer VI	United States	August 19, 1959	Vandenberg AFB	Down October 20, 1959	Cylinder	19.2' long 5' diameter	537	139	101.5	1,700 lb.	150 lb.	Reentry capsule not recovered.
20.	●	1959 Eta	Vanguard III	United States	September 18, 1959	Cape Canaveral	Expected to remain in orbit until 21st century	Sphere	20" sphere and 26" tube	2,325	315	129.8	100 lb.	50 lb.	Measures magnetic field and conducts X-ray environmental tests.
21.	●	1959 Theta	Lunik III	Soviet Union	October 4, 1959	Soviet Union	Expected to remain in orbit until March 1960	Ellipsoid	4.3' long 3.9' diameter	292,785	25,480	15.5 days	614 lb.	Unknown	Photographed moon before returning to orbit earth (see Lunik III below).
22.	●	1959 Iota I	Explorer VII	United States	October 13, 1959	Cape Canaveral	Expected to remain in orbit until 1975	Two united cones	30" long 30" diameter	672	346	101.2	91.5 lb.	70 lb.	Designed for radiation and micrometeorite studies.
23.	●	1959 Iota II	Rocket body for Explorer VII	United States	October 13, 1959	Cape Canaveral	Exaected to remain in orbit until 1975	Cylinder	5' long 6" diameter	671	343	101.2	Unknown	None	Final stage of launch vehicle.
24.		1959 Kappa	Discoverer VII	United States	November 7, 1959	Vandenberg AFB	Down November 26, 1959	Cylinder	19.2' long 5' diameter	550	104	95	1,700 lb.	300-lb. capsule	Reentry capsule could not be separated, causing tumbling.
25.	●	1959 Lambda	Discoverer VIII	United States	November 20, 1959	Vandenberg AFB	Expected to remain in orbit until March 1960	Cylinder	19.2' long 5' diameter	427	108	92.2	1,700 lb.	300-lb. capsule	Capsule ejected but could not be found.

UNSUCCESSFUL LAUNCHES

VANGUARD (Test Vehicle 3)
Launched: December 6, 1957. Malfunction in first stage caused loss of thrust and destruction after two seconds.

VANGUARD (Test Vehicle 3 Backup)
Launched: February 5, 1958. Faulty connection in first stage caused destruction at 20,000 feet after 57 seconds of flight.

EXPLORER II
Launched: March 5, 1958. Last stage failed to ignite. Flight time: 823 seconds.

VANGUARD (Test Vehicle 5)
Launched: April 28, 1958. Third stage failed to fire; second and third stages impacted 1,500 miles from launch site.

VANGUARD (Satellite Launch Vehicle 1)
Launched: May 27, 1958. Second-stage engine did not cut off properly, causing third stage to fly arclike trajectory to peak altitude of 2,200 miles. Third stage traveled 7,500 miles to near coast of South Africa.

VANGUARD (Satellite Launch Vehicle 2)
Launched: June 26, 1958. Second-stage motor cut off prematurely.

THOR-ABLE I (Lunar Probe)
Launched: August 17, 1958. Engine failure in first stage caused vehicle to blow up.

EXPLORER V
Launched: August 24, 1958. After successful launch and flight time of 659 seconds, orbit was not achieved because parts of booster collided with instrument compartment.

VANGUARD (Satellite Launch Vehicle 3)
Launched: September 26, 1958. Second-stage failure caused vehicle to fall back into atmosphere and burn up after apparently making one complete orbit of the earth.

PIONEER I (Lunar Probe)
Launched: October 11, 1958. Reentered atmosphere after reaching altitude of about 70,700 miles. Flight time: 43 hours, 17.5 minutes.

BEACON (Inflatable Satellite)
Launched: October 23, 1958. Payload separated from booster before burnout.

PIONEER II (Lunar Probe)
Launched: November 8, 1958. Third stage failed to ignite. Reached altitude of 963 miles. Flight time: 42.4 minutes.

PIONEER III (Space Probe)
Launched: December 6, 1958. Discovered second radiation band around earth. Reentered atmosphere December 7, 1958, after 38 hours, 6 minutes. Reached altitude of 63,580 miles.

VANGUARD (Satellite Launch Vehicle 5)
Launched: April 13, 1959. Second-stage failure. Flight time: about 500 seconds.

DISCOVERER III (Reentry Capsule)
Launched: June 3, 1959. Second stage apparently fired but tracking stations received no telemetry, indicating satellite probably did not achieve orbit.

VANGUARD (Satellite Launch Vehicle 6)
Launched: June 22, 1959. Faulty second-stage pressure valve caused failure at about 90 miles.

DISCOVERER IV (Reentry Capsule)
Launched: June 25, 1959. Though second stage fired, insufficient velocity was believed to have caused failure to achieve orbit.

EXPLORER V
Launched: July 16, 1959. Vehicle destroyed after 5.5 seconds when power to guidance failed.

BEACON
Launched: August 14, 1959. Payload failed to orbit because of premature fuel depletion in booster and malfunction in attitude control system for upper stages.

TRANSIT I (Sphere)
Launched: September 17, 1959. Satellite failed to achieve orbit when third stage did not fire.

PIONEER (Lunar Probe)
Launched: November 26, 1959. Three-stage Atlas-Able, designed to put 372-lb. instrument package in lunar orbit, failed apparently because of premature release of protective shroud covering the satellite, after about 45 seconds.

DISCOVERER IX (Reentry Capsule)
Launched: February 4, 1960. Successful launch but vehicle failed to orbit because of a fueling malfunction.

DISCOVERER X (Reentry Capsule)
Launched: February 19, 1960. Destroyed by range safety officer 56 seconds after launch at altitude of 20,000 feet.

MIDAS I (Early-Warning Satellite)
Launched: February 26, 1960. Second stage of Atlas-Agena failed to ignite.

DEEP-SPACE PROBES

OBJECT	ORIGINATING NATION	LAUNCH DATE	LAUNCH SITE	STATUS ON MARCH 15, 1960	SHAPE	SIZE	WEIGHT	REMARKS
Lunik I ("Mechta" or "Dream")	Soviet Union	January 2, 1959	USSR	In 15-month orbit around the sun.	Sphere	Unknown	3,245-lb. final rocket stage; 797-lb. instrument package.	First successful deep-space probe. Aphelion: 123,-250,000 mi. Perihelion: 91,500,-000 mi.
Pioneer IV	United States	March 3, 1959	Cape Canaveral	In 13.5-month orbit around the sun.	Cone	20" long 9" diameter	13.4 lb.	Aphelion: 106,100,-000 mi. Perihelion: 91,700,000 mi.
Lunik II	Soviet Union	September 12, 1959	USSR	Impacted moon on September 13, 1959.	Sphere	Unknown	3,324-lb. final rocket stage; 858.4-lb. instrument package	Hit moon after traveling 236,876 mi.
Lunik III	Soviet Union	October 4, 1959	USSR	Now orbiting earth as 1959 Theta (see above).	Ellipsoid	4.3' long 3.9' diameter	3,416-lb. final rocket stage; with 344-lb. instrument package; plus 613-lb. "Automatic Interplanetary Station."	Photographed far side of moon and returned to transmit photos and then orbit earth as 1959 Theta (see above).
Pioneer V	United States	March 11, 1960	Cape Canaveral	In 311-day orbit around the sun, between earth and Venus.	Sphere	26" diameter with 4 vanes.	94.8 lb.	"Paddlewheel" satellite. Aphelion: 93,000,-000 mi. Perihelion: 74,700,-000 mi.

APPENDIX E

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C.

Office of Public Information

July 14, 1960

INTERNATIONAL
SATELLITE AND SPACE PROBE SUMMARY

The following space vehicles are in orbit as of this date:

NAME/COUNTRY	LAUNCH DATE	TRANSMITTING
Explorer I (US)	Jan. 31, 1958	No
Vanguard I (US)	March 17, 1958	Yes
*Lunik I (USSR)	Jan. 2, 1959	No
Vanguard II (US)	Feb. 17, 1959	No
*Pioneer IV (US)	March 3, 1959	No
Explorer VI (US)	August 7, 1959	No
Vanguard III (US)	Sept. 18, 1959	No
Explorer VII (US)	Oct. 13, 1959	Yes
*Pioneer V (US)	March 11, 1960	No
Tiros I (US)	April 1, 1960	Yes
Transit I-B (US)	April 13, 1960	Yes
Spacecraft (USSR)	May 15, 1960	No
Midas II (US)	May 24, 1960	Yes
Transit II-A (US)	June 22, 1960	Yes
NRL Satellite (US)	June 22, 1960	Yes

*In solar orbit: others in earth orbit.

CURRENT SUMMARY (July 14, 1960)		COMPLETE SUMMARY (Launched to date)	
Earth Orbit:	US - 11 USSR - 1	Earth Orbit:	US - 21 USSR - 5
Solar Orbit:	US - 2 USSR - 1	Solar Orbit:	US - 2 USSR - 1
Transmitting:	US - 7 USSR - 0	Lunar Impact:	USSR - 1

APPENDIX F

*SOVIET UNION MISSILES

GOLEM I (Navy)

Type: Surface-to-surface
Status: Near operational
Performance: Range—400 miles; Altitude—125 miles.
Frame: Length—54 ft.; Weight—16½ tons gross; single stage.
Remarks: Developed from German World War II plans for a sea-going V–2 (A–3). Liquid-fueled, radio-inertial guided. Designed to be launched from a capsule towed by a submarine. Nuclear capability.

GOLEM II (Navy)

Type: Underwater-to-surface
Status: RD&T
Performance: Range—1200–1300 miles
Frame: Length—nearly 60 ft.
Remarks: Advanced version of the Golem I with improvements adopted from the Army T–2. Probably radio-inertial guided, liquid-fueled. Nuclear capability.

GOLEM III (Navy)

Type: Underwater-to-air, surface-to-air
Status: Operational on surface vessels
Performance: Range—10 miles
Frame: Length—15 to 20 ft.; Diameter—20 in.
Remarks: Solid-fueled, infrared-guided. Designed to give both submarines and surface ships anti-aircraft protection.

GOLEM IV (Navy)

Type: Surface-to-air
Status: Operational on surface vessels
Performance: Range—45 miles.
Remarks: A new missile, radar-guided and solid-fueled. May also be converted to submarine use.

T-1 (Army)

Type: Surface-to-surface
Status: Operational
Performance: Range—600–775 miles
Frame: Length—50 ft.; Weight—19 tons gross; single stage.
Remarks: Mobile IRBM. LOX/hydrocarbon fueled booster generates 77,000 lbs. thrust. Radio-guided. Nuclear capability.

T-2 (Army)

Type: Surface-to-surface
Status: Operational
Performance: Range—1300–1500 miles; Speed—5000 m.p.h.
Frame: Length—between 85 and 91 ft.; Weight—55 tons; two stages.
Remarks: Liquid-fueled, 80,000 lb. thrust booster. The T–2 reportedly was the first Soviet rocket used to test an H-bomb warhead. Fired from Central Russia, the warhead was exploded at 120,000 ft. near Bennet Island in the Arctic.

T-3 (Air Force)

Type: Surface-to-surface
Status: Operational
Performance: Range—5000 miles; Speed—15,000 m.p.h.; Apogee—280 miles.
Frame: Two stages
Remarks: Liquid-fueled with booster developing 500,000 lbs. thrust. Radio-inertial-guided. HE or nuclear warhead. Russia reportedly produced 50 T-3's in 1959 and has capability to build 1200 by the end of 1963.

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T-3A (Army)

Type: Surface-to-surface ICBM
Status: Operational
Performance: Range (Model A)—6000 miles; Range (Model B)—7500 miles; Speed—15,000 m.p.h.
Frame: Model A—2 stages; Model B—3 stages
Powerplant: Liquid-fueled. Model A first stage—525,000 lbs. of thrust; Model B first stage—700,000 lbs. of thrust.
Remarks: Production of the Model A is believed to have ceased in recent months in favor of the advanced version. Original production plans reportedly called for an equal number of T-3A Model A's and T-3's. The new booster stage on the Model B is believed to be a prototype for one used in the T-4A antipodal missile. Nuclear warhead.

T-4A (Air Force)

Type: Surface-to-surface antipodal missile.
Status: Advanced RDT&E
Performance: Range—10,000 miles; Apogee—186.3 miles; Speed—13,660/m.p.h.
Frame: Length—121.02 ft.; Wing span—65.6 ft.; Max. Diameter—6.88 ft.; Launch weight—115 tons.
Powerplant: First stage has 3 LOX/kerosene engines developing 360,000 lbs. thrust.
Remarks: Catapulted from rail sled. Payload—2350 to 3100 lbs. This is the Soviet counterpart of the U.S. Dyna-Soar boost-glide bomber, stemming from the German Saenger-Bredt design conceived in World War II.

T-33 (Army)

Type: Surface-to-surface ICBM
Remarks: A new missile. No other details available.

T-4 (Army)

Type: Surface-to-surface IRBM
Status: Experimental
Performance: Range—1000 miles
Powerplant: Two stages, both liquid-fueled
Frame: Length—53 ft.

T-4 (Army)—Continued

Remarks: 1800-lb. payload may be either nuclear or HE. Some of its configurations are believed to be worked into upper stages of the T-4A.

T-5 (Army)

Type: Surface-to-surface
Status: Operational with Red Army in Eastern Europe.
Performance: Range—50–100 miles.
Frame: Length—about 36 ft.; 3 stages (advanced version may have 4 stages).
Powerplant: Solid-fueled.
Remarks: Designed for firing from multiple launchers for blitz-type saturation of target. HE or small nuclear warhead.

T-5A (Army)

Type: Surface-to-surface IRBM
Status: Operational
Remarks: Few details are available. Believed to be solid-fueled and guided.

T-5B (Army)

Type: Surface-to-surface
Status: Operational (but out of production).
Performance: Range—15–25 miles.
Frame: Length—31 ft.; Diameter—3 ft.; Weight—6000 lbs.
Remarks: Similar to the U.S. Honest John. Launched from tracked vehicle. Unguided. Carries HE and possibly a nuclear warhead.

T-6 (Army)

Type: Surface-to-air
Status: Operational
Performance: Range—20–25 miles; Speed—1500 mph; Ceiling—about 60,000 ft.
Frame: 2 stages
Warhead: HE with proximity fuze.
Powerplant: Solid fueled with cluster of 4 solid boosters.
Remarks: Fired from multiple launcher. An advanced version, the T-6A, is radar guided and believed to be operational.

T-7A (Army)

Type: Surface-to-surface
Status: Operational
Performance: Range—50 to 90 miles; Speed—Mach 5; radio command guidance.
Frame: Length—30 ft.; Diameter—2.5 ft.; Weight—about 10,000 lbs.
Powerplant: Solid fueled
Warhead: HE
Remarks: Has controllable rear fins.

T-8 (Army-Air Force)

Type: Surface-to-air (also air-to-air).
Status: Operational
Performance: Range—15 to 25 miles; Speed—Mach 2.5.
Frame: Length—13 ft.; two stages.
Powerplant: First stage is cluster of two solid fueled boosters, second stage is liquid fueled.
Warhead: HE with proximity fuze.

M-100A (Air Force)

Type: Air-to-air
Status: Operational
Performance: Range—3½ miles; Speed—Mach 2.5
Remarks: Solid-fueled, semi-active radio-radar command guidance.

ME-IGOR (Army)

Type: Anti-tank
Frame: Length—24 in.; Diameter—3 in.
Remarks: Solid-fueled. Fired from bazooka tube. Was operational, but probably used now only for training.

J-3 (Navy and Army)

Type: Surface-to-surface
Status: Operational with the Red Army and at least 7 Baltic fleet cruisers.
Performance: Range—450–600 miles; Speed—supersonic.
Frame: Length—36 ft.
Remarks: Booster is cluster of 4 solid-fuel rockets; ramjet sustainer. Guidance presumably is beam-riding or programed. Nuclear capability.

RS-82, RS-132, RS-132A (Air Force)

Type: Air-to-air
Frame: Length—unavailable; Diameter—5.2 in.
Remarks: Aircraft version of the GVAI. Used for training.

M-2 (Army-Navy)

Type: Anti-aircraft
Status: Operational with ground defense forces and aboard Baltic Sea cruisers.
Performance: Speed—Mach 2.
Frame: Length—about 25 ft.; 2 stages.
Remarks: Solid-fueled. Infrared, radar, or both used as guidance.

GVAI (Army)

Type: Barrage rocket.
Remarks: Multiple-tube launcher, fired in salvoes. May be phased out for more advanced versions.

KCAT-25 (Army)

Type: Anti-tank
Remarks: Never exhibited, believed to be operational.

KOMET I (Navy—CH 17 Army)

Type: Surface-to-surface
Performance: Range—100 miles; Speed—3000 m.p.h.
Remarks: Solid-fueled, the CH17 is reported to be operational with the Red Army. A crash program is underway to put the Comet I into service aboard submarines and surface ships. HE and nuclear warheads.

KOMET II (Navy—CH 18 Army)

Type: Surface-to-surface
Performance: Range—600 miles.
Remarks: Operational with the Red Army and from a surface vessel in calm waters. Crash program in progress with ship motion simulator equipment; R&D for submarines. Solid-fueled, nuclear warhead.

KOMET D (Air Force)

Type: Air-to-surface standoff
Status: In development and test
Performance: Range—55 miles.
Frame: Length—33.5 ft.; Diameter—about 4 ft.
Remarks: An equivalent to the British Avro, the turbojet-propelled missile may have beam-riding guidance. Warhead can be either nuclear or HE.

APPENDIX G

SOVIET MISSILES ADAPTABLE TO SUBMARINE LAUNCHING

Model	Range (Miles)	Length (Feet)	Diameter (Feet)	Thrust (Pounds)	Powerplant	Status	Remarks
J-1	375-400	27	20.6 (Wing span)	1935	PJ & 2 SPR	Obs.	520 mph top speed.
J-2	525	36.5	23.6 (Wing span)	4850	TJ & 2 SPR	Exp.	645 mph top speed.
J-3	450	37.1	23.6 (Wing span)	14,950	TJ (or RJ) & 4 SPR	Pre-Prod.	875 mph top speed.
Golem-1	395	53.8	5.41	121,000	LPR	Obs.	Oxygen & alcohol fuel.
Golem-2	1250	57	7.2	220,000 (1st Stage) 72,000 (2nd Stage)	LPR & SPR	Test	Solid-propellant booster, liquid-propellant sustainer, (acid fueled). Underwater-launch.
Golem-3	7.5	17.1	5.9	14,950	4 SPR	Exp.	Experimental prototype accounts for very short range. Used for research in extreme-depth launchings to 650 ft.
Comet I	100	36.7	4.3	53,250	SPR	Exp.	Also designated CH-17.
Comet II	625	42.3	5.9	99,000	SPR	Prod.	Waterproofed for towing behind WWII-type submarines. Also designated CH-18.
Comet III	1800	n.a.	n.a.	220,000 (?)	SPR	Test	Soviet equivalent of Polaris.
T-7A	50	25	3	18,000	SPR	Oper.	Succeeded by Comet I.

ABBREVIATIONS: Obs.—Obsolete; Exp.—Experimental; Prod.—Production; Oper.—Operational; PJ—Pulsejet; TJ—Turbojet; RJ—Ramjet; LPR—liquid propellant rocket; SPR—solid propellant rocket; n.a.—not available.

APPENDIX H

USSR Lunar Probes Will Orbit Close to Surface

by LCDR John A. Fahey, USN*

WASHINGTON—The Soviet Union has revealed detailed plans for future inspection of the moon's surface. In order to efficiently cover the entire surface of the moon, the Russians will attempt to establish a polar orbit.

Since the orientation of the moon's plane of motion in relation to the sun remains constant, using sunlight the entire surface of the moon could be photographed in four weeks (a lunar month). However, Russian scientists expect that the use of "earthshine" (ten times more brilliant than moonshine) will permit completion of the project in two weeks.

In order to avoid gravitational influences of the sun and planets, Soviet scientists have planned orbits extremely close to the moon's surface. At a given altitude the velocity of a lunar satellite will be almost five times less than the velocity of an earth satellite. This factor will greatly facilitate inspection of the moon's surface.

At a height of 30 kilometers (18.6 miles) objects, 3.8 meters (12.5 feet) in diameter, could be distinguished with the naked eye. However there are certain disadvantages in establishing such a close orbit. A satellite at this altitude will be traveling more than 1600 meters/sec (5250 feet/sec, 3580 miles/hr), and the field of view at a given moment will be about 650 kilometers (404 miles). At this height an object on the moon's surface will remain within the field of vision for six minutes, 20 seconds. Increasing the altitude to 150 kilometers (93 miles) will result in a less detailed observation. An object would have to be 19 meters (62 feet) in diameter to be distinguishable, but the field of view will increase to 1400 kilometers (869 miles) and an object will remain in the field of vision for 15 minutes, 42 seconds.

Soviet data indicate an intention to orbit a lunar *Sputnik* extremely close to the surface of the moon. It is interesting to note that plans call for a supply of fuel in the *Sputnik* for controlling the orbit. Small speed changes will be used to alter an elliptical orbit, to change the plane of orbit, and to decrease the time of passage across the unilluminated surface of the moon.

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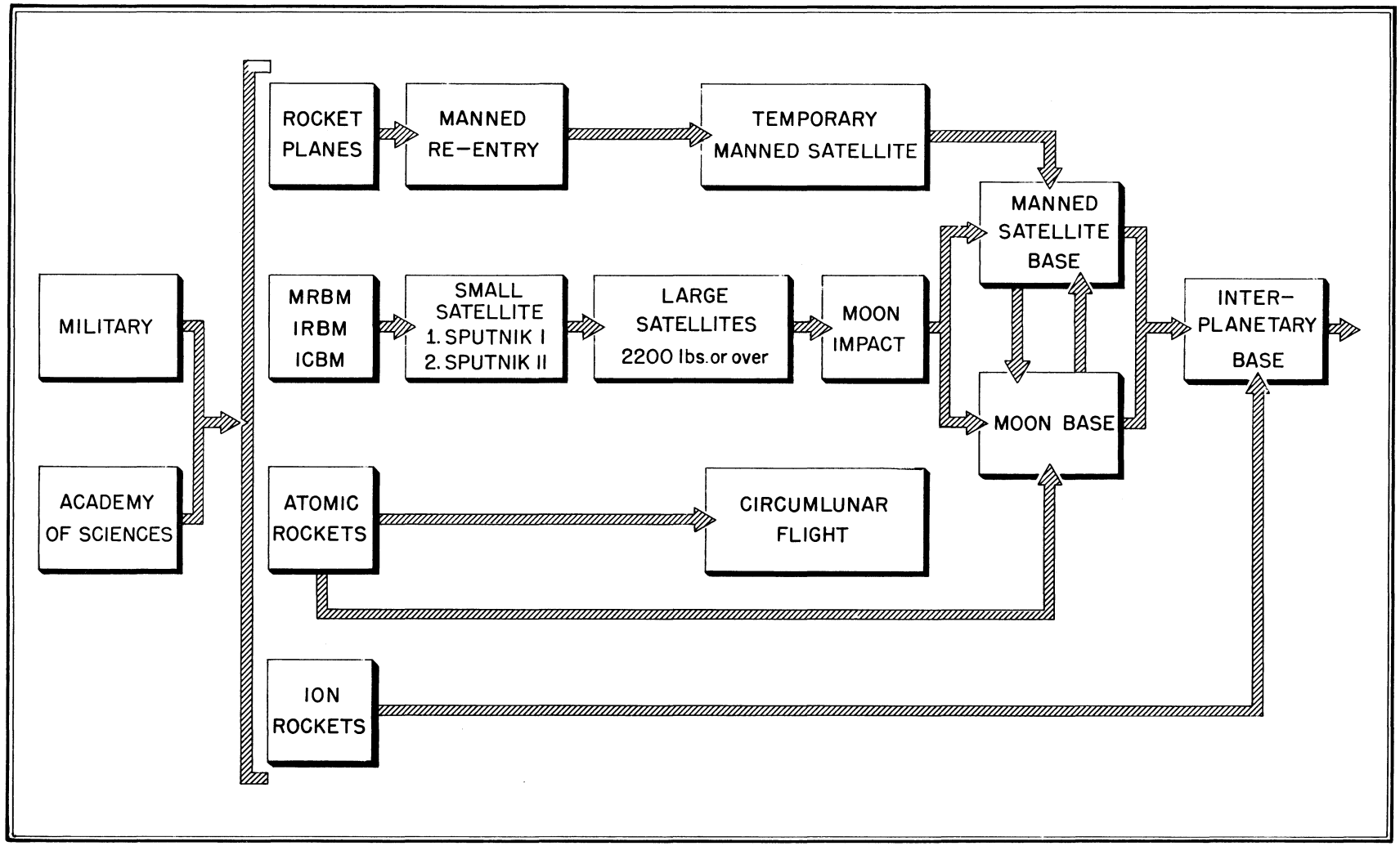
* *Head, Foreign Language Division, U.S. Naval Intelligence School, Washington, D.C.*

SOVIET LUNAR PROBE DATA

Characteristics	10 Kilometers	50 Kilometers
Velocity of orbit (meters per sec/feet per sec/miles per hr)	1,674/5,492/3,745	1,655/5,301/3,614
Decrease in velocity of orbit for each one kilometer (0.621 mile) decrease in altitude (meters per sec/feet per sec/miles per hr)	0.479/1.57/1.1	0.463/1.52—1.0
Radius of orbit (kilometers/miles)	1,748/1,086	1,788/1,110
Relationship of radius of orbit to moon's radius, (percent)	100.6	102.9
Circumference of orbit (kilometers/miles)	10,983/6,690	11,234/6,976
Angular velocity (angular seconds per sec)	198	191
Period of one complete orbit	1 hr, 49 min, 20 sec	1 hr, 53 min, 7 sec
Minimum duration of a *Sputnik* day	58 min, 24 sec	1 hr, 5 min, 5 sec
Relationship of duration of a *Sputnik* day to the period of a complete orbit (percent)	53.4	57.5
Maximum duration of a *Sputnik* night	50 min, 56 sec	48 min, 1 sec
Relation of duration of a *Sputnik* night to the period of a complete orbit (percent)	46.6	42.4
Minimum arc of orbit during which *Sputnik* in the shadow of moon	192°16′	207°10′
Maximum arc of orbit during which *Sputnik* in sunlight	167°44′	152°50′
Heavenly arc described by *Sputnik* as seen by an observer in the plane of orbit on the moon's surface	12°16′	27°10′
Length of spherical segment of moon visible from *Sputnik* (kilometers/miles)	372/231	824/512
Relationship of area of moon's visible spherical segment to surface of moon (percent)	0.286	1.398
Maximum duration of observation from a point on the moon	3 min, 42 sec	8 min, 32 sec
Acceleration of free fall in orbit (meters per sec²/feet per sec²)	1.60/5.25	1.53/5.02
Relationship of previous value above to the acceleration of free fall to the moon's surface (percent)	98.9	94.5
Minimum number of orbits required for complete coverage of the moon's surface	15	7
Angles between consecutive planes of orbit	12°1′	25°42′
Velocity required to change plane of orbit (meters per sec/feet per sec/miles per hour)	350/1,148/782	736/2,415/1,646
Total velocity required for accomplishing all changes of planes of orbits (meters per sec/feet per sec/miles per hr)	4,900/16,077/10,962	4,418/14,485/9,876
Minimum duration required for complete coverage of moon's surface	27 hrs, 20 min	14 hrs, 57 mins
Relationship of coverage of moon's surface to actual surface (percent)	160	169
Amount of excess velocity required to leave *Sputnik* for surface of moon (meters per sec/feet per sec/miles per hr)	3/9.8/5	12/39.4/27
Total velocity during descent from *Sputnik* to surface of moon (meters per sec/feet per sec/miles per hr)	1,683/5,525/3,765	1,703/5,587/3,810
Duration of descent from *Sputnik* to the surface of the moon	53 min, 30 sec	54 min, 31 sec

APPENDIX I

SOVIET ROCKET, MISSILE AND SPACE TRAVEL PROGRAM



OPERATIONAL CHART of the Soviet rocket, missile, and space travel program illustrates the step-by-step plan of operation.

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By Order of *Wilber M. Brucker*, Secretary of the Army:

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