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IN THIS ISSUE

FIRST NUCLEAR GYROSCOPE REVEALED.

General Precision Inc.'s aerospace group announces that the company has developed a research model of a nuclear gyroscope. This is the first time, it was claimed, that this type of gyro has been made to operate. The nuclear gyroscope, which contains no

moving parts and has inherent resistance to severe vibrations, acceleration force, and shock, may lead to significant advances in navigation and guidance for aircraft, space vehicles, and large missile boosters.

The nuclear gyro utilizes the spin of the atom. It is frictionless, has no bearings to wear out, and has no balanced parts to be deflected or disturbed. It requires little or no warm-up time, remains accurate and reliable, and has an indefinite lift.

In Fig. 1, a scientist inspects a fuel cell for insertion into the nuclear gyro (center of photograph; a second nuclear gyro is at the right).

Initial uses of the nuclear gyro are seen on spacecraft where extremely high acceleration forces are encountered during liftoff and reentry. The gyro's expected indefinite life span and reliability also will be invaluable in providing navigation information to space vehicles during deep space probes and for long-range satellites. Additional possible applications include the use of the nuclear gyro on aircraft, marine vessels, and missiles. The research model of the nuclear gyroscope, which utilizes optically pumped mercury isotopes, is being used to obtain data needed for the final design of a deliverable experimental model. (Sources: Data supplied by General Precision, Inc.)

THE ATMOSPHERE OF MARS: A STUDY OF NO_2 CONTENT. A recent paper by H. Spinrad, published in the Jet Propulsion Laboratory Programs Summary, gives a comparison of recent studies of the NO_2 content in the atmosphere of Mars. He presents a new determination of the upper limit to the NO_2 contained in the Martian atmosphere. It is jointly offered with spectrographic evidence that was gathered on several dates, in order to reduce possible time-variable phenomena. Comparisons were made of detailed enlargements of Mars and sky spectrograms in the appropriate spectral regions; a search for the NO_2 bands proved negative.

The upper limit to Martian NO_2 abundance is presented as

$$\frac{10 \text{ cm-atm}}{25 \times 4} = 0.1 \text{ cm-atm}$$

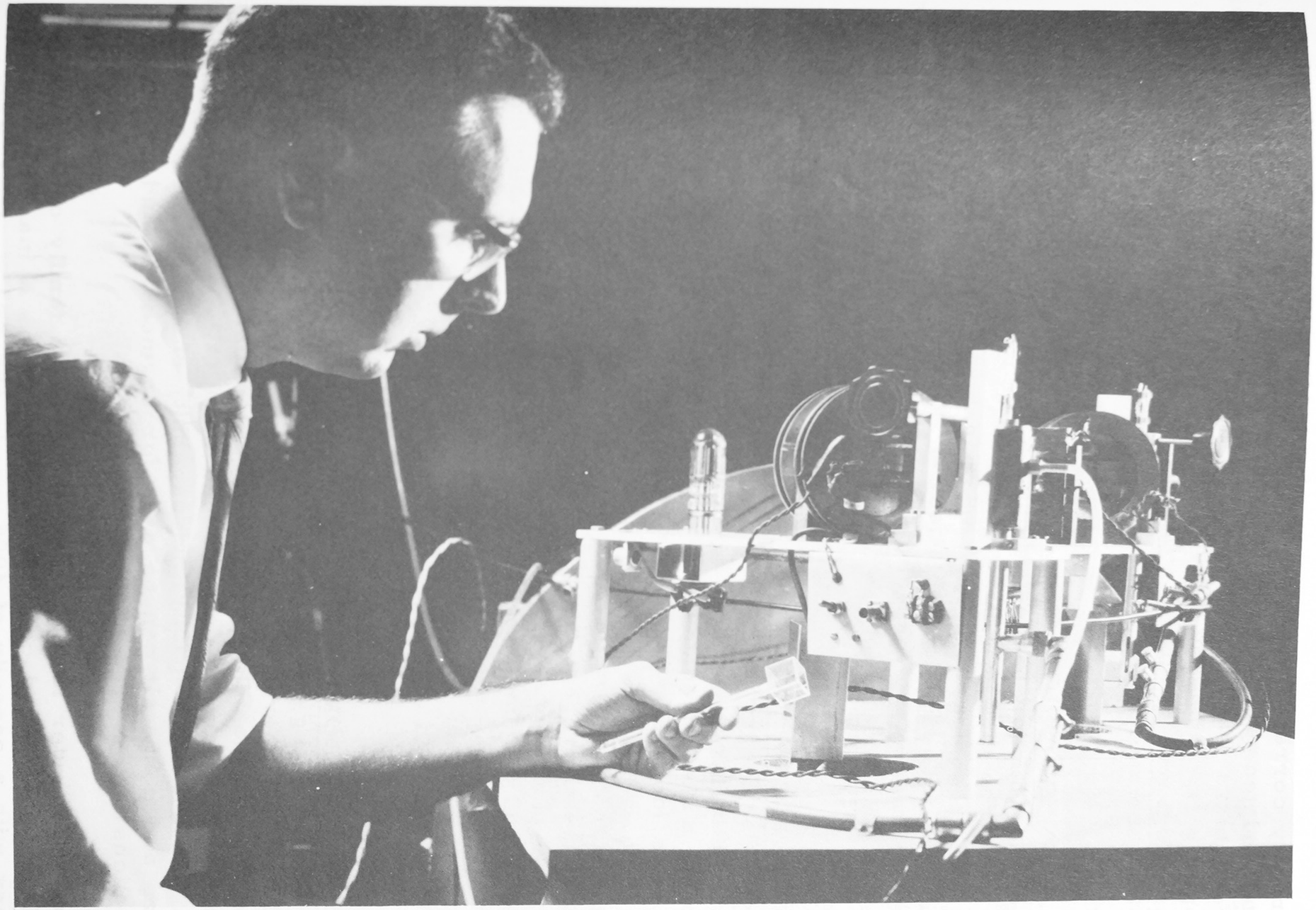

FIG. 1

Laboratory corrections that include pressure differences, doppler effects, and temperature differences are suggested as a final check. It is concluded that the upper limit to the NO_2 content of the Martian atmosphere is 1 mm-atm. (Source: Jet Propulsion Laboratory, Space Programs Summary, No. 37-18, Vol. IV, October 1, 1962 to December 1, 1962)

GEOLOGY STATION ESTABLISHED. The US Department of the Interior has established a new field office at Flagstaff, Arizona. The station will be the headquarters for training astronauts in field geology and for testing instruments for use in lunar exploration. The station will also be used by the US Geological Survey in its lunar investigation and geological mapping program. (Source: Science, Vol. 139, March 1, 1963)

AUTOMATIC WELDER USED IN SPACECRAFT FABRICATION. Air Reduction Sales Company has produced a new precision welding package for joining large aerospace structures. Featuring a skate-mounted welding head, the process equipment package is identical with units now in use to fabricate sections of the Saturn S-II booster and Apollo spacecraft (Fig. 2). It is designed for flat, vertical, or horizontal welding and can handle both gas metal-arc and gas tungsten-arc welding processes. The use of the electronically controlled welding skate permits greater precision and eliminates the need for the massive, costly fixtures required to weld large structures. The unit also shows promise in the field-erection of storage tanks. (Source: Data supplied by AIRCO)

VERSATILE COMPUTER IS ECONOMICAL, COMPACT. A low-cost, 41-kg (90-lb) computer with a big memory has been developed by General Precision, Inc. It is now in volume production following a pilot production run; initial deliveries from the production run have begun. Called the LGP-21, the new computer offers the memory capacity and capability of computers many times its size and cost. It can be used for engineering and scientific applications.

The new computer is the latest addition to a family of General Precision small-sized computers. It features a magnetic disc memory with a capacity of 4096 words (36,864 decimal digits),

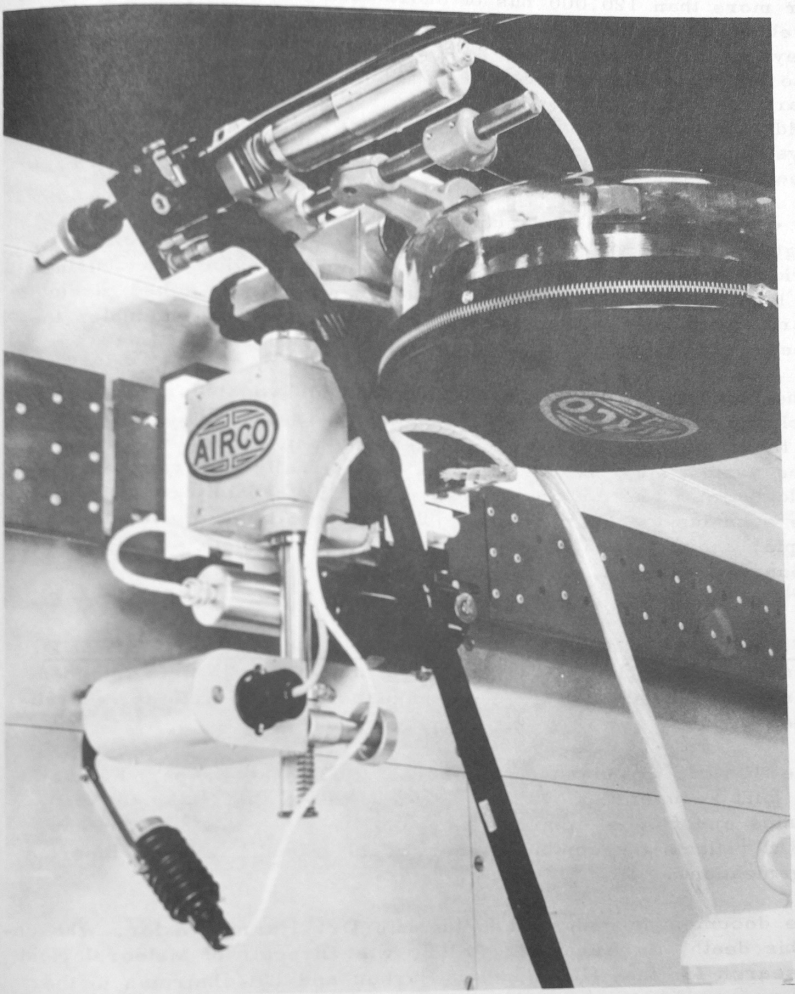

FIG. 2

or more than 120,000 bits of information. The large memory as well as the availability of a large library of programs are twin keys to the computer's versatility and power. A program instructs the computer how to solve a problem. With the large memory, a variety of either simple or complex problems can be solved. In addition to the computer with its 4096-word memory, the basic system includes an electric typewriter with paper-tape punch and reader (Fig. 3).

A variety of other input-output devices may be added including high-speed punches and readers, electric typewriters, and a priority-interrupt system. New input-output devices can be installed in less than 15 min by plugging in an appropriate etched circuit card and connecting the device via a cable. This eliminates the need for any basic computer modifications.

The computer has a compact 23-instruction vocabulary. This includes all of the basic arithmetic functions, permitting full range to the solution of engineering, scientific, and accounting problems. The system may also be used as an internally programmed desk calculator. The computer's large memory capacity permits storing the solutions to a variety of problems inside the computer for rapid, accurate problem-solving. (Source: Data supplied by General Precision, Inc.)

"U. S. STANDARD ATMOSPHERE, 1962" ANNOUNCED.

A detailed description of the Earth's atmosphere that is intended to meet the needs of space age research and operations is available now in a new 278-page report.

The "U. S. Standard Atmosphere, 1962" was prepared under the joint sponsorship of the US Air Force, the National Aeronautics and Space Administration and the US Weather Bureau, and it reflects the combined effort of 29 scientific and engineering organizations.

The document is dedicated to the late Dr. Harry Wexler, who until his death on August 11, 1962, was Director of Meteorological Research for the US Weather Bureau and Co-chairman to the Committee on Extension to the Standard Atmosphere (COESA), which prepared the new report. He had led other similar efforts for nearly 15 years.

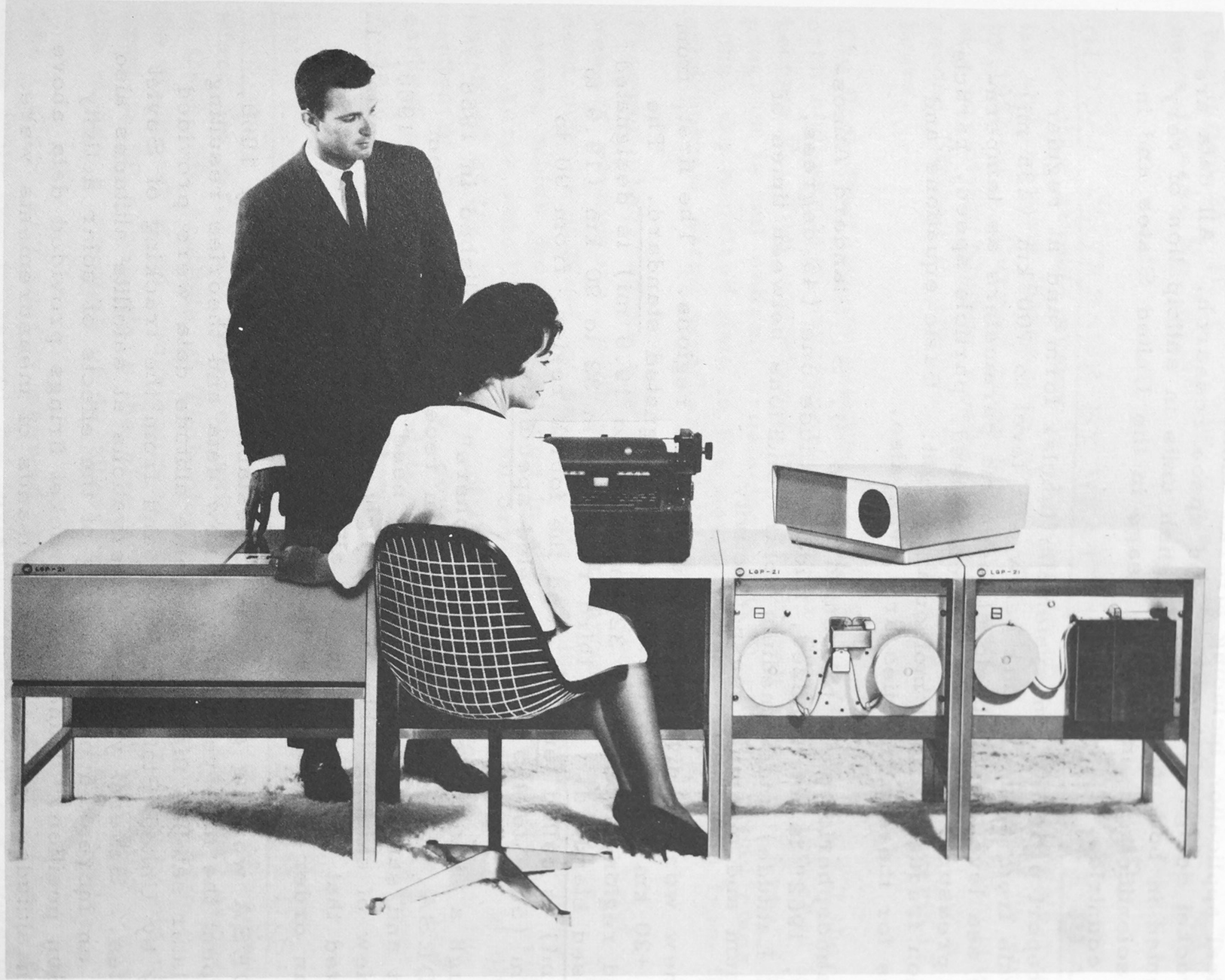

FIG. 3

The "U. S. Standard Atmosphere, 1962" is intended for widespread practical application including aircraft altimeter calibration, aircraft and rocket design, aeronomy, and space research. All data are presented in both metric and English units in anticipation of very wide scientific and engineering usage in the United States and in other countries.

The report provides, in systematic tabular form and at regular intervals from 5 km (3 mi) below sea level to 700 km (435 mi) above sea level, such basic atmospheric parameters as temperature, pressure, density, and sound speed, particle speed, particle collision frequency, and molecular weight. Basic equations and curves for these properties are given also.

The atmospheric model presented in the "U. S. Standard Atmosphere, 1962" is an idealized, middle-latitude one (45 degrees, North Latitude) under medium solar conditions between times of maximum and minimum sunspot activity.

The new work is divided into four altitude regions. The first, from -5 to +20 km (-3.1 to +12.4 mi) is designated standard. The second region, from 20 to 32 km (12.4 to 19.9 mi) is designated proposed standard. The third region from 32 to 90 km (19.9 to 55.9 mi) is called tentative, and the fourth region, from 90 to 700 km (55.9 to 435 mi) is labeled speculative.

Although a similar "standard atmosphere" was published in 1958 by COESA, the wealth of information recently acquired from rocket and satellite data pointed to a need for revision. In 1960, a review of existing tables in the light of orbital data from Sputnik 1 indicated that densities at higher altitudes were in error by more than an order of magnitude (tenfold).

A COESA working group was re-established in January 1960, and spent the next year studying new data and theories resulting from later satellite flights. Extreme altitude data were provided mainly by United States satellites and from the tracking of Soviet satellites. Several years of observations at satellite altitudes also led to an increased understanding of the effects of solar activity and Sun position. Hundreds of rocket firings provided data above balloon altitudes, where many thousands of measurements were made.

The "U. S. Standard Atmosphere, 1962" may be purchased from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. The price is $3.50. (Source: NASA news release No. 63-35)

GLOBAL COVERAGE BY WEATHER SATELLITES PLANNED. A weather satellite system is expected to give meteorologists regular and frequent information about the Earth's weather in its entirety by 1965-66. Current plans for the system include the launching of a prototype Nimbus weather satellite in 1963, followed by a second Nimbus to provide TV and infrared coverage every 12 hours.

The first two Nimbus satellites are to be developmental; if they orbit and perform satisfactorily, another pair will be launched to become the first operational Weather Bureau system. Even if this program is not entirely satisfactory, the Weather Bureau plans to utilize the acquired data in the same manner as the data from the experimental Tiros weather satellites.

Frequent observations are required for the detection of brief weather phenomena, such as thunderstorms and tornadoes. This need may be fulfilled by an alternate satellite system known as Aeros, which would be placed in a synchronous equatorial orbit. One Aeros satellite in such an orbit could provide a view of about one-third of the Earth; three of these satellites could, with the exception of the polar regions, cover the Earth's weather. The earliest probable launching date for Aeros is 1966. (Source: Aviation Week, July 2, 1962)

UNIVERSE'S MOST POWERFUL ELEMENTS ARE DISCUSSED. Radio galaxies that are invisible sources of radiation afford the strongest radio emissions detectable on Earth, according to California Institute of Technology astronomers. Dygnus A, the strongest of 24 radio sources studied, has an energy output equal to 20 billion stars the size of our Sun; in terms of watts, this means a strength of 40 billion billion billion billion watts.

The Caltech sky survey showed that the radio emission usually comes from two immense, but invisible, masses of gas close to a visible galaxy of stars that is between the two clouds. The

farther apart the gas clouds, the larger they are. Sometimes two galaxies are located between a pair of gas clouds, and sometimes a star galazy may have two pairs of clouds, one small pair near the galaxy and a larger pair farther out in space.

The clouds vary not only in size but also in distance apart. There may be as many as 2 million light-years between the outer edges of a pair of radio clouds. However, radio astronomers believe that the clouds are comparatively short-lived, lasting only a million years before expanding into such thin concentrations of matter that they just fade away.

Astronomers have suggested several ways in which the enormous radio energy of the clouds of gas may have been created: a chain reaction of thousands of exploding suns within a galazy could be responsible, or the energy may have been released when a super-large star, millions of times bigger than our Sun, formed and exploded in the core of a galaxy.

Three Caltech radio astronomers mapped the locations and outlines of the gas clouds with twin 27.5-m (90-ft) diameter radio telescopes. Their relation to optically visible galaxies was found by superimposing these radio maps on photographs. (Source: The Washington Post, March 10, 1963)

SPUTNIK RECOVERED IN WISCONSIN. On September 5, 1962 at about 09:50 UT, Satellite 1960 ϵ1 (Sputnik IV) re-entered the Earth's atmosphere over North America, with many fragments reaching the end of their orbit over the state of Wisconsin. A steel body was subsequently found in a street of Manitowoc, Wisconsin. Radioisotope analyses determined that this body had been exposed to the radiation environment above the atmosphere; thus it was concluded that the body was part of Sputnik IV.

The principal object recovered from Satellite 1960 ϵ1 is crudely disk-shaped, approximately 20 cm (7.9 in.) in diameter and 8 cm (3.1 in.) high, with an initial mass of 9.49 kg (4.3 lb). Its rounded top surface terminates a solid, squat cylinder 15.1 $\pm$0.1 cm (5.9 $\pm$0.04 in.) in diameter. The cylinder is welded to a roughly circular plate, 1.0 cm (0.4 in.) thick. To the bottom of the plate is attached an irregular layer of material, whose appearance is such as might be expected from solidification of molten droplets

of metal in a vacuum. The circumference of the plate shows evidence of material having ablated away, and part of a shoulder between the cylinder and the plate is also filled with resolidified meta. The shoulder gives evidence of such filling around its entire circumference, and many loose fragments fitting into place on the shoulder were found nearby.

Diametrically located on the rim of the plate are two bolt holes, 0.75 ±0.02 cm (0.3 ±0.008 in.) in diameter, each with a countersunk hole 2.0 ±0.1 cm (0.8 ±0.04 in.) in diameter. One of the bolt holes is not complete, due to the melting away of its outer wall.

When the body was sawed, a bolt was found embedded in the irregular layer. One end of the bolt, which has a 6-mm (0.24-in.) diameter with 1 thread/mm, is threaded into a flanged nut. A second, apparently identical, flanged nut was found in one of the samples used for analysis.

Both the cylindrical portion and the plate are ordinary medium-carbon steel. The resolidified irregular layer has a similar composition, except that some of the more volatile trace elements in the steel are reduced in concentration.

The surface of some areas of the irregular layer of metal has a thin white coating, which has been identified as MgO. When recovered, and for several days thereafter, the irregular layer had a distinct odor of ammonia. It has been suggested that some magnesium nitride may have been present originally. This would be expected to combine with moisture in the air, releasing ammonia and leaving magnesium oxide.

Moonwatch teams had prepared organized observation of the reentry of Sputnik IV so that they were able to observe and trace the route of the Sputnik to the impact point of the fragments. Only a few of the 100 reported visual sightings (of persons not connected with Moonwatch) were reliable, and the over-all picture was not dependable.

Research groups at the Smithsonian Astrophysical Observatory, the Los Alamos Scientific Laboratory, the Air Force Cambridge Research Laboratories, the Carnegie Institute of Technology Chemistry Department, and the Brookhaven National Laboratory

have all measured radioactivities in the steel fragment found in Manitowoc. The positive results obtained by all of these groups indicate quite clearly that the Manitowoc fragment was above the Earth's atmosphere for a substantial length of time. No other method of identification provides such strong evidence of an object having been in space. The measurements of radioactivity suggest very strongly that the Manitowoc object was, in fact, a piece of Satellite 1960 ε1.

This highly successful sequence of events (observation of reentry, recovery of fragments, and scientific investigation) must be attributed to remarkably good fortune and to a determined effort by the Smithsonian Astrophysical Observatory. (Source: Special Report of Smithsonian Institution Astrophysical Observatory)

DENHAM TO DIRECT DDC DIVISION. Colonel James O. Vann, USAF, Commander of Defense Documentation Center (DDC) announced on April 8 that Dale Denham has been named Chief of the Huntsville, Alabama, Technical Operations Division of DDC, formerly known as ASTIA. Mr. Denham will assume his duties immediately, succeeding Mr. Paul McNutt, acting Chief.

As Chief of the Huntsville Office, Mr. Denham will direct a staff of six information science specialists who will provide support to missile and space and other technical programs of Redstone Arsenal as well as research and development activities of the Army, the Navy, the Air Force, the National Aeronautics and Space Administration, and the Atomic Energy Commission in Alabama, Georgia, Mississippi, and Tennessee.

The Huntsville Division is one of six operated by DDC in addition to the Headquarters at Arlington Hall Station, Virginia, under the direction of S. Edward Pope, Deputy for Technical Operations. Each Field Division has complete microfilm collections of the more than 300,000 DDC scientific and technical documents from the three military services. Technical personnel of the Huntsville Division provide special assistance to qualified users in making full use of the DDC system for obtaining information of specific value to project engineers and scientists in the solution of technical problems. (Source: Data supplied by DDC Information Office)

LIGHT BEAM "RIFLE" MEASURES DISTANCE TO REMOTE TARGETS. A new laser rangefinder that is aimed from the shoulder like a rifle and "fires" a light beam toward distant targets has been developed by Hughes Aircraft Company. The instrument (Fig. 4), called Colidar Mark II (for coherent light detection and ranging), is a lightweight portable military rangefinder. Distances up to 11 km (7 mi) have been measured in broad daylight within an accuracy of 4.6 m (15 ft) against various buildings and landmarks, a company spokesman said. Under ideal atmospheric conditions the present model could range 97 km (60 mi) against similar targets with the same accuracy, he added.

Space uses cited include navigation, high resolution mapping, and measuring and identifying strange bodies in space.

Colidar is similar to radar: (1) a short pulse of laser light is fired against a target; (2) a telescope "collects" the light pulse reflected back from the target; and (3) a timing circuit measures and indicates the distance to the target by computing the elapsed time for the light pulse's round trip.

The present model, a field test version, weighs less than 21 kg (45 lb) including a backpack carrier containing the energy source. A production model would weigh only 9 kg (20 lb). This weight would include the "rifle" assembly and the backpack unit containing batteries, current converters, storage capacitors, range-computing electronics and digital readout equipment. (Source: Data supplied by Hughes Aircraft Co.)

TECHNICAL REPORTS AVAILABLE. The following listed technical reports can be requested through the NASA library, M-MS-IPL, Bldg. 4481.

NOTE: Those reports with an AD number may be on file in the local D D C branch in Bldg. 4484. Readers can save time by calling 876-6088 and inquiring if such reports are available before ordering them through NASA.

1. EFFECTS OF RE-ENTRY PLASMA SHEATH ON TELEMETRY TRANSMISSION, Part I, Telemetry and the Plasma Sheath, C. A. Hines. AD 290 600

FIG. 4

2. FEASIBILITY INVESTIGATION OF A PACM-FM TELEMETRY SYSTEM. AD 289 886
3. APPLICATION OF THE MODULARIZATION CONCEPT TO SATELLITE TAPE RECORDERS, P. T. Cole et al. NASA N63-10176
4. RADIOMETRIC MEASUREMENTS FROM SATELLITES, R. A. Hanel. NASA N62-16854
5. MEASUREMENTS OF THE GEOMAGNETIC FIELD BY THE VANGUARD III SATELLITE, J. C. Cain. NASA N62-16987
6. INITIAL WEIGHT LOSS OF PLASTICS IN A VACUUM AT TEMPERATURES FROM 80° to 500° F, H. R. Gloria et al. NASA N63-10625
7. RESEARCH ON ABSORBING INFRARED RAYS WITH PLASTICS AND ATTENUATING INFRARED RAYS WITH COATINGS, P. V. Susi and H. C. Donoian. AD 288 669
8. PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON RADIATION-INDUCED POLYMERIZATION AND GRAFT COPOLYMERIZATION. TID 7643
9. RESEARCH ON HIGH TEMPERATURE BEARINGS, R. D. Brown, R. A. Burton and P. M. Ku. AD 288 892
10. TELEMETRY SOLID-STATE MICROWAVE TRANSMITTER T ( )/AKT, J. Bartnik. AD 287 222
11. ADAPTIVE TECHNIQUES FOR LONG RANGE TRANSMISSION OF PULSE CODE MODULATION TELEMETRY DATA, D. H. Ellis, et al. AD 288 076
12. AN ELECTRONICALLY CONTROLLED HIGH SPEED STREAK CAMERA, O. V. Sessoms and T. W. Bailey. AD 287 531
13. IMAGE INTENSIFIER, ISOCON FEASIBILITY STUDY, R. E. Hoffman. AD 287 223