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ARMY BALLISTIC MISSILES COMMITTEE
DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C.

ORD/I 4717 (S)

10 April 1958

MEMORANDUM FOR: DIRECTOR OF GUIDED MISSILES,
DEPARTMENT OF DEFENSE

SUBJECT: Army Scientific Satellite Progress Report No. 1 (U)

In compliance with your Memorandum, 6 March 1958, subject: "Monthly Summarization of Significant Events and Progress in the Scientific Satellite Program (U)," forwarded herewith is "Army Scientific Satellite Report No. 1" for March 1958.

ROBERT E. COFFIN
Colonel, GS
Executive Secretary

1 Incl (2 copies)
Army Sc Sat Rpt No.1

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DEPARTMENT OF THE ARMY

ARMY BALLISTIC MISSILES COMMITTEE

ARMY

SCIENTIFIC SATELLITE

PROGRESS REPORT

NO. 1

MARCH 1958

WASHINGTON 25, D. C.

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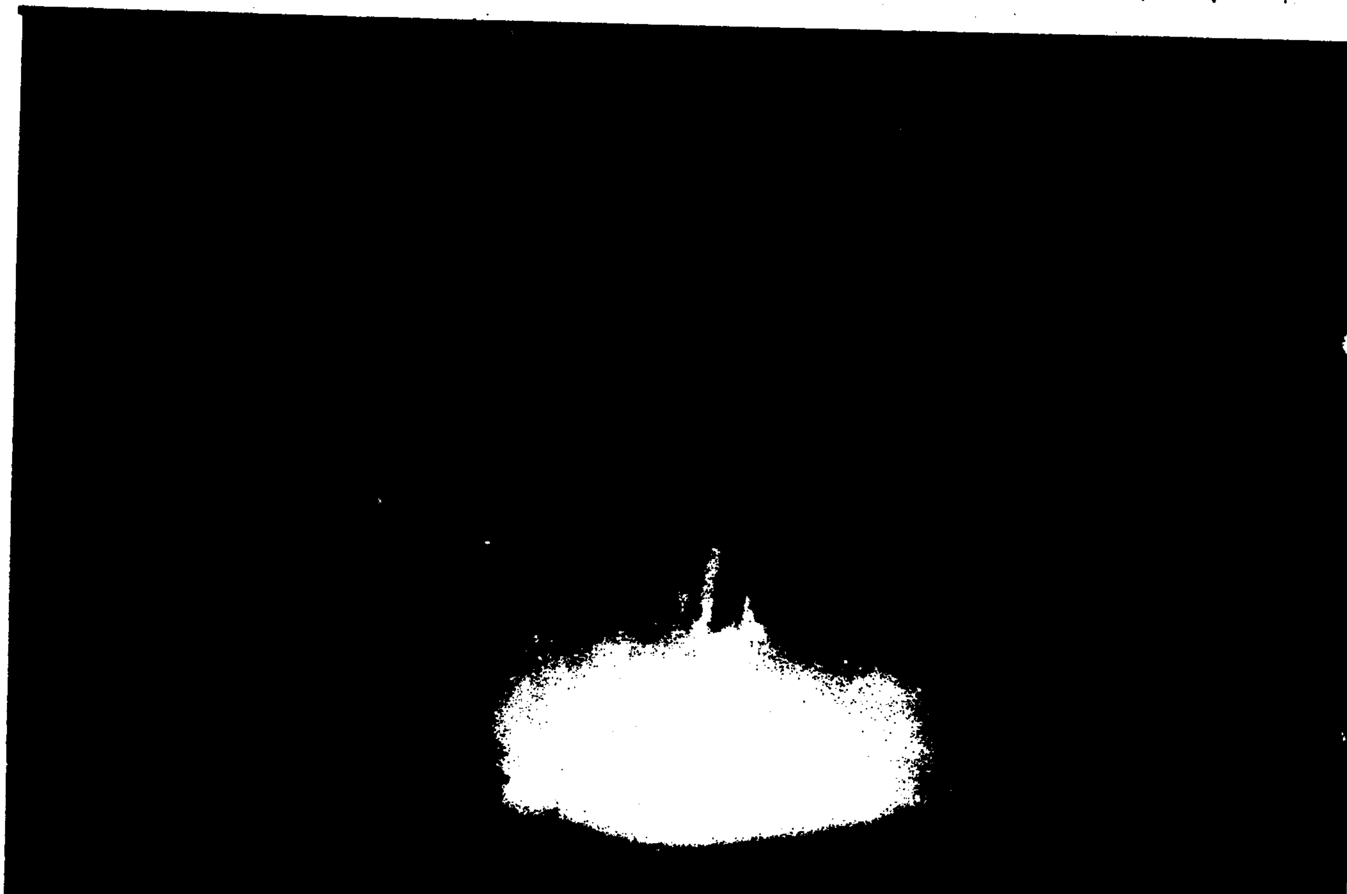

ABMA's JUPITER C Missile 29 lifting the first U. S. satellite from the Air Force Missile Test Center, 31 January 1958.

FIG. 1

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ARMY BALLISTIC MISSILES COMMITTEE
DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C.

ARMY SCIENTIFIC SATELLITE PROGRESS REPORT NR. 1

MARCH 1958

SUMMARY

Two JUPITER-C satellite launching vehicles were successfully fired during March. The first, JUPITER-C Missile 26, carrying EXPLORER II, was fired on schedule from the Atlantic Missile Test Range on 5 March. Launching and performance of the first three stages were normal, but the fourth stage did not ignite. As a result, the satellite did not go into orbit.

The Army was therefore directed to fire a third JUPITER-C satellite launching vehicle in support of the IGY. JUPITER-C Missile 24 was successfully launched on schedule on 26 March, placing EXPLORER III, the second U. S. Army satellite, into orbit. EXPLORER III is orbiting with greater eccentricity than predicted, but its estimated life expectancy of four to six months will insure full accomplishment of its scientific missions. In fact, the greater eccentricity of the orbit is providing vital scientific information over a wider spectrum than would have been provided by the predicted orbit. At present perigee altitude is approximately 125 miles and apogee altitude 1735 miles. The period of revolution is 116 minutes.

With two satellites in orbit, the Army has successfully completed the first phase of its scientific satellite program as directed by the Secretary of Defense on 8 November 1957. It is significant that, with the exception of the two days delay resulting from weather in launching the first U. S. satellite, the three JUPITER-C satellite launching vehicles incurred a total of only 44 minutes hold time from all causes. The first two missiles were launched 18 minutes after the pre-scheduled hour and the third only 8 minutes after the pre-scheduled hour.

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Regrading data cannot be predetermined

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ARMY SCIENTIFIC SATELLITE PROGRESS REPORT NO. 1

March 1958

I. The first phase of the Army's scientific satellite program, as directed by the Secretary of Defense on 8 November 1957, was successfully completed on 26 March 1958 with the injection into orbit of EXPLORER III.

II. Launching Vehicles.

JUPITER-C Missile 26, carrying EXPLORER II, was successfully launched from the Atlantic Missile Test Range at 1328 hours, 5 March 1958.

Ignition, mainstage, and initial flight were normal. The first stage cutoff by LOX depletion occurred at X plus 149.1 seconds. Coast to apex was close to the precalculated trajectory, and second stage ignition came at 390.5 seconds. Velocity and attitude conditions at this time were apparently satisfactory for successful injection into orbit. However, the 31.5 pound scientific satellite did not go into orbit.

Reduction of data since the time of firing has indicated that third stage ignition was normal, but no velocity increase was apparent from the fourth stage which apparently did not ignite. As a result, orbital velocity was not achieved. Indications are that the satellite (fourth stage) travelled approximately 1,900 miles and burned up on reentry into the atmosphere.

The scientific missions of the EXPLORER II satellite were identical with those for EXPLORER III which are described below.

Missions which were accomplished with Missile 26 and which provide vital data and experience in satellite operations are as follows:

a. Use of the Microlock and Minitrack-type transmissions for tracking the payload, [illegible] performance of the solid propellant [illegible]

[illegible] (type

c. Determination of apex of the trajectory early in the flight by taking a ten-second measurement after first stage cutoff and separation and computing the apex by four separate methods, S-band radar, DOVAP, missile borne accelerometer, and C-band radar. Data from the first three are compared with nomograms for apex prediction. In the fourth method the C-band radar data is fed directly into an IBM 704 computer for an apex prediction.

When EXPLORER II did not go into orbit, the Army was directed by the Department of Defense to fire a third JUPITER-C missile to inject into orbit a scientific satellite identical to EXPLORER II. This mission was successfully accomplished on 26 March 1958 when JUPITER-C Missile 24 injected EXPLORER III into orbit at 1245 hours EST.

The countdown was without incident, the firing command being given at 1238 hours, eight minutes after scheduled time. Performance of the propulsion stages was exceptionally good. Ignition, mainstage, and initial flight were normal. First stage cutoff occurred to 155.5 seconds (as opposed to 155.7 seconds predicted), and second stage ignition, by command from an on-board timer, occurred at 396.3 seconds (as compared with 396.0 seconds predicted).

Reduction of data since the time of firing indicates that second stage ignition apparently occurred prior to achievement of actual apex. As a result, EXPLORER III is estimated to be orbiting with greater eccentricity than predicted, but its estimated life expectancy of four to six months will insure more than adequate time for full accomplishment of all missions. In fact, the greater eccentricity of the orbit is providing vital scientific information (particularly with respect to the primary cosmic ray experiment) over a wider spectrum than would have been provided by the predicted orbit. At present, perigee altitude is estimated to be approximately 125 miles and apogee altitude 1,735 miles. The period of revolution is 116 minutes.

III. <u>Satellites and Scientific Instrumentation</u>.

Two EXPLORER scientific satellites are now in orbit. They are collecting and reporting data in accomplishment of the following scientific missions:

a. Cosmic ray count (State University of Iowa experiment).

b. Measurement of amounts of cosmic dust by erosion gauges (AF Cambridge Research Center experiment).

c. External and internal temperature measurements.

d. Telemetering scientific data by use of Microlock and Minitrack-type transmitters.

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There are two basic differences in the scientific instrumentation carried in the two satellites, the more important being in the primary cosmic ray experiment. EXPLORER III carried a miniturized tape recorder (Figure 2) which records cosmic ray count throughout the orbit and plays back upon receipt of a coded interrogation signal from one of the Minitrack ground stations. Since the time required to play back and transmit the information to the ground is only approximately five seconds, the life of the high power transmitter in EXPLORER III will be materially longer than that of EXPLORER I (which transmitted continuously). More important, information on cosmic ray intensity is obtained throughout each orbit whereas EXPLORER I cosmic ray measurements were obtainable only when the satellite was within range of one of the ground stations. The second major difference in the instrumentation payloads is the omission from the EXPLORER III payload of a microphone for micrometeorite density measurements.

Detailed descriptions of the two satellites follow:

<u>Specifications</u>	<u>EXPLORER I (Fig. 4)</u>	<u>EXPLORER III (Fig. 3)</u>
Weight	30.80 pounds	31.00 pounds
Shell	7.50 pounds	7.50 pounds
Instrumentation	10.63 pounds	10.83 pounds
Final rocket (empty)	12.67 pounds	12.67 pounds
Length	80 inches	80 inches
Diameter	6 inches	6 inches
***	***	***
High Power Transmitter		
Antenna	Turnstile	Dipole
Power	50 to 60 milliwatts	50 to 60 milliwatts
Frequency	108.00 megacycles	108.00 megacycles
Life expectancy	12 days (actual)	2 months
Low Power Transmitter		
Antenna	Dipole	Dipole
Power	10 milliwatts	10 milliwatts
Frequency	108 megacycles	108.0 megacycles
Life expectancy	2 months (Still operating on 31 Mar 58)	2 months

It will be noted that the turnstile antenna used by [illegible]

EXPLORER I and II has been eliminated in EXPLORER III. Instead insulated sections of the satellite case are used to form a dipole antenna in a manner similar to that used with the low power antenna on all three satellites. Reduction of data from EXPLORER I has indicated that it is probable that the turnstile antenna had caused the satellite to precess about its spin axis almost immediately. Preliminary data from EXPLORER III, which indicates that there was virtually no such precession of the satellite during its first two days in orbit, appears to confirm that the turnstile antenna was responsible for the inordinate precession of the first satellite.

Tracking of EXPLORER I and III is accomplished by Microlock and by world-wide IGY Minitrack systems.

IV. Status of Funds (In millions of dollars).

Program Cost	Obligations	Expenditures (Estimated as of 31 March 1958)
$ 3.500	$ 3.500	$ 3.471

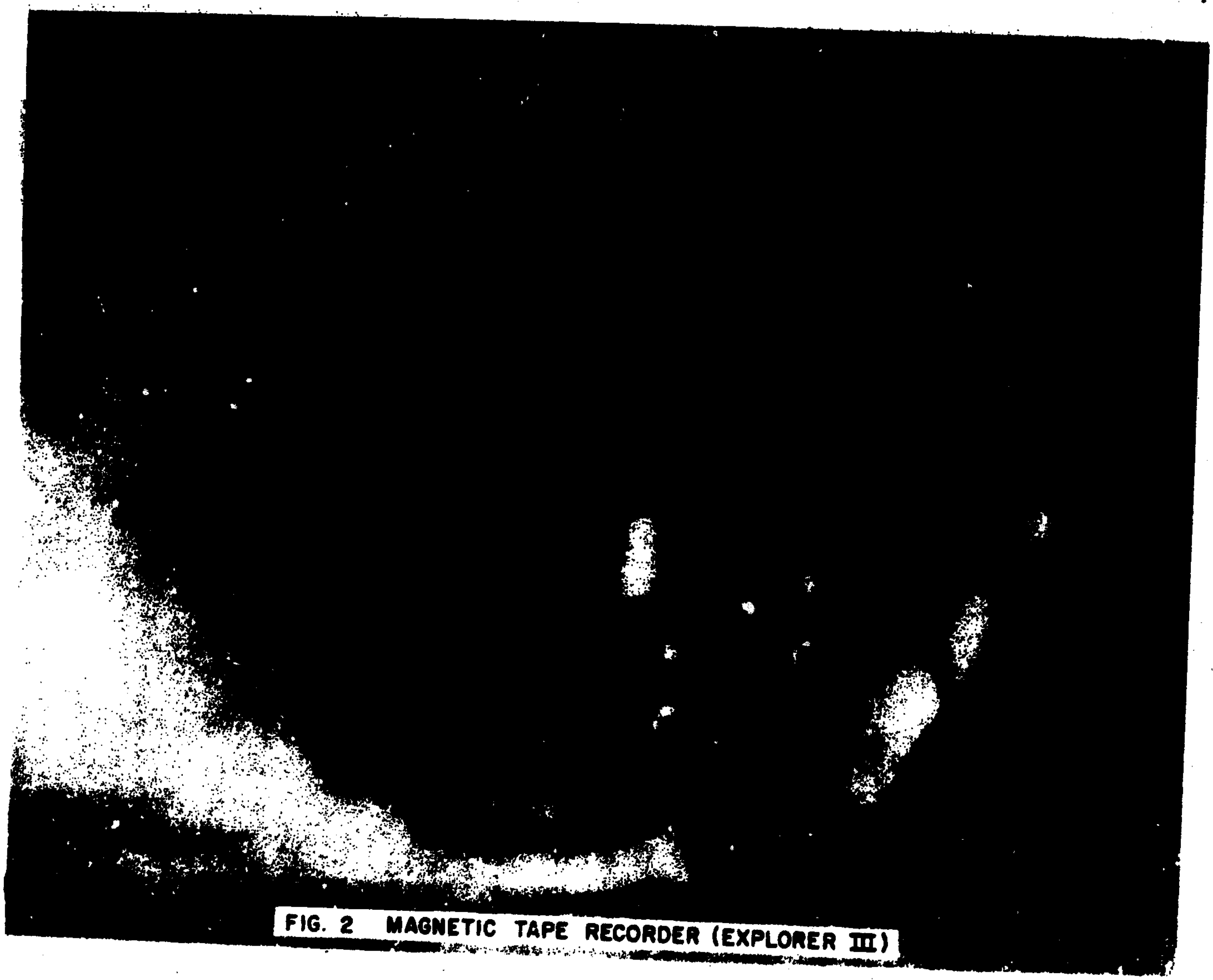

FIG. 2 MAGNETIC TAPE RECORDER (EXPLORER III)

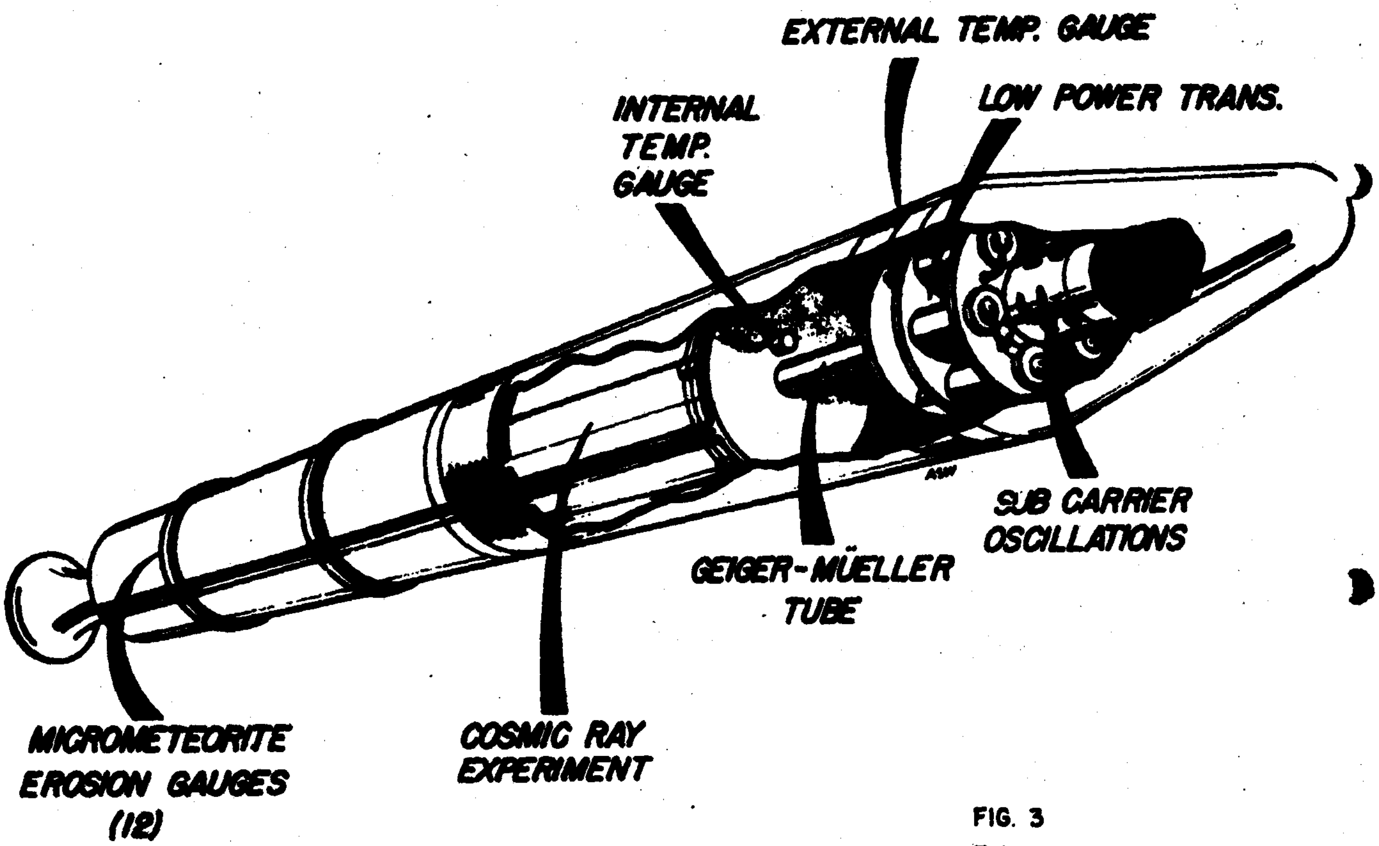

FIG. 3
EXPLORER III

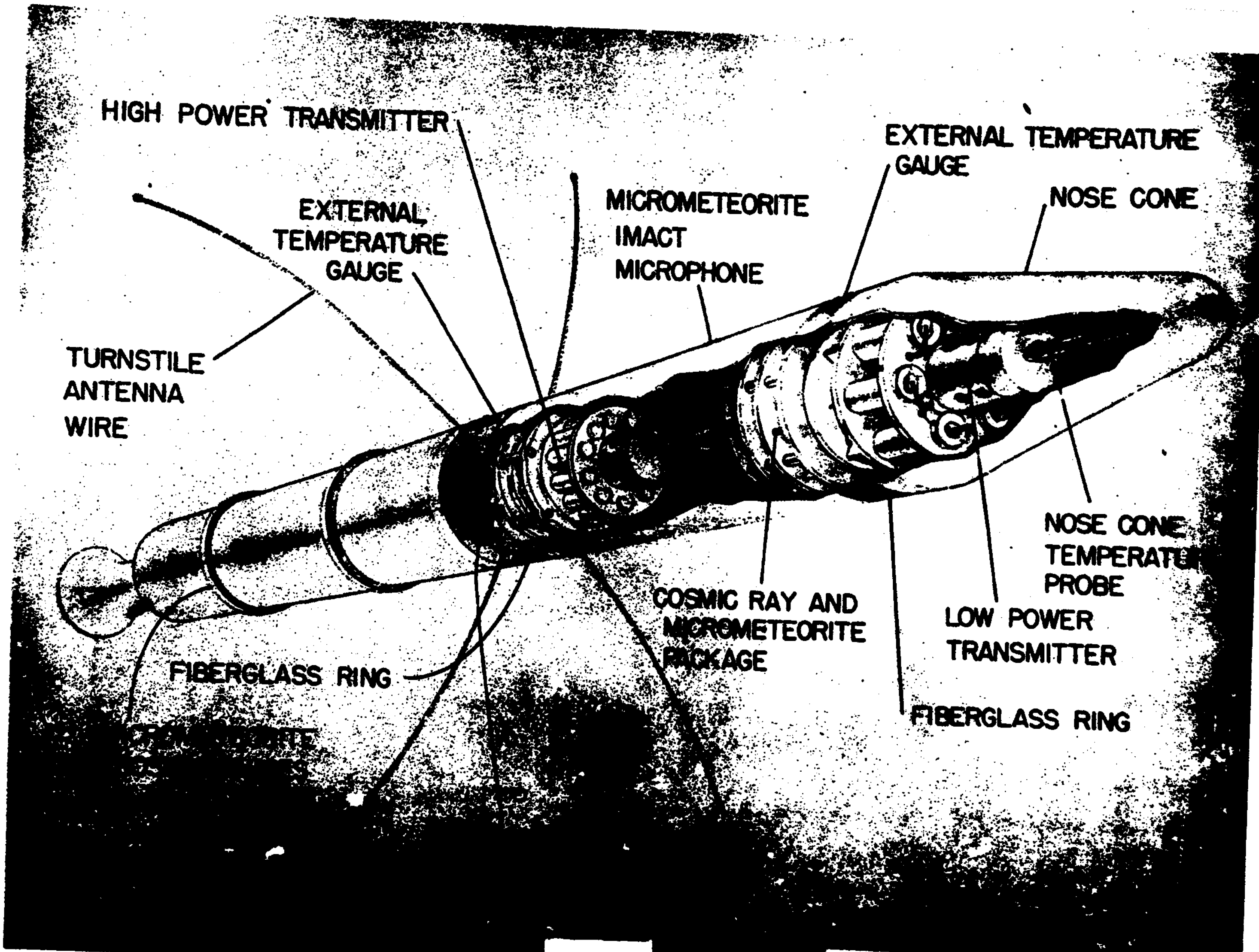

FIG. 4

EXPLORER...the first U. S. satellit