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U. S. NAVAL ORDNANCE TEST STATION
CHINA LAKE, CALIFORNIA

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IN REPLY REFER TO:
402/GFC:bac
Serial 4381

OCT 14 1959

11ND-NOTS-2700/4 (12-58)

From: Commander, U. S. Naval Ordnance Test Station
To: Director
U. S. Naval Research Laboratory
Washington 25, D. C.

Subj: Aircraft Launched Earth Satellite Payload Information; request for

Encl: (1) Aircraft Launched Earth Satellite Description
(2) Payload Information Sheet

1. Enclosure (1) is a brief description of an aircraft launched earth satellite vehicle that the Naval Ordnance Test Station has designed. It is estimated that a vehicle of this type can be manufactured for approximately $65,000.

2. In addition to low cost, the advantages of an aircraft launched satellite vehicle of this design include, flexibility in launch location and direction, no delays in launching due to vehicle fueling, increased reliability and a minimum time for checkout and countdown. The Station believes that these features can be obtained with the proposed vehicle and that space research requiring small payloads can be conducted more readily at a lower cost. Although the vehicle design is simple, the feasibility of some aspects of the concept can only be demonstrated by firing instrumented test vehicles. It is believed that the number of exploratory space applications for low cost vehicles of this type would warrant further work including a development program by the Station. A survey of possible payload configurations is therefore being conducted. The payload environmental conditions and limitations are as follows:

	1000 Statute Mile Polar Orbit	300 Statute Mile Polar Orbit	Inclined 30-deg. 300 Statute Mile Orbit
Payload Weight, lbs. (from F4D aircraft)	10	15	20
Payload Weight, lbs. (from F4H aircraft)	20	27	40
Payload Volume, cu. in.	1,200	1,200	1,200
Maximum acceleration, g's	25	25	25
Maximum temperature, °F (due to aerodynamic heating)	150	150	150
Spin rate, rev/sec.	5 to 8	5 to 8	5 to 8

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3. It is planned that the payload survey include preparation by the Station of payload layouts of existing sensors and instrumentation developed for the IGY program and other scientific research effort that can be conducted with earth satellites within the capability of the vehicle. Enclosure (2) lists payload information which would be helpful in estimating the payload flexibility and potential of the vehicle.

4. In conducting a preliminary survey of the literature it was found that a number of people at your activity are working on experiments that might be packaged in the payload described in enclosure (1). Listed below are the people and their experiments as indicated by the survey.

Name	Experiment
[redacted]	Thermal Radiation Reconnaissance
	Neutron Reconnaissance
	Radioactivity Sampling
H. O. Lorenzen	Electronic Intelligence Reconnaissance
[redacted]	Infrared Reconnaissance
	Optical Detection of Ballistic Missiles
	Night Cloud Cover
	Ionosphere Studies and 12-foot Sphere
	Cosmic Rays
	Lyman Alpha and Hydrogen Densities

5. It would be greatly appreciated if the appropriate information could be filled in on the enclosed forms for the experiments listed above. Since the above information was obtained from a document dated 10 December 1957, it would also be appreciated if data on recently designed experiments are included.

[redacted]
By direction

Copy to:
NRL (w/encls)
[redacted]
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[redacted]

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NOTS AIRCRAFT LAUNCHED EARTH SATELLITE VEHICLE

The NOTS vehicle is designed to be launched from the F4D or the F4H aircraft. There will be no restrictions on launching point or direction, other than safety considerations for impact of jettisoned stages and vehicle propulsion energy limitations.

The vehicle utilizes four stages of solid propellant boosters, has simple methods of stage separation and a programming system without moving parts. Figure 1 is an outline sketch of the vehicle showing principal components. Vehicle stabilization from aircraft release to firing of the second stage is accomplished by four fins. These are canted to provide spin stabilization during the remainder of the trajectory and orbiting of the payload. Figure 2 shows the initial trajectory and sequence of delivery and firing events. To provide a safe separation distance from the aircraft, the first stage booster is fired 5 seconds after vehicle release.

The second stage booster is fired at the perigee of the elliptical trajectory by the horizon sensing trigger. This device, consisting of a small telescope with an infrared sensing cell at its focus, is actuated by reflected energy from the earth when the rotating vehicle is within a predetermined angle with the local horizontal. Figure 3 illustrates schematically how the horizon trigger functions and Figure 4 shows a block diagram of one channel of the programming circuit. Reliability is increased by using redundant circuitry throughout.

Additional velocity increments are provided by the third and fourth stage boosters, which are fired by electronic timers. Injection into orbit occurs at the trajectory apogee on the opposite side of the earth when the fourth stage booster is fired. A typical orbit is shown in Figure 5.

ENCLOSURE 1

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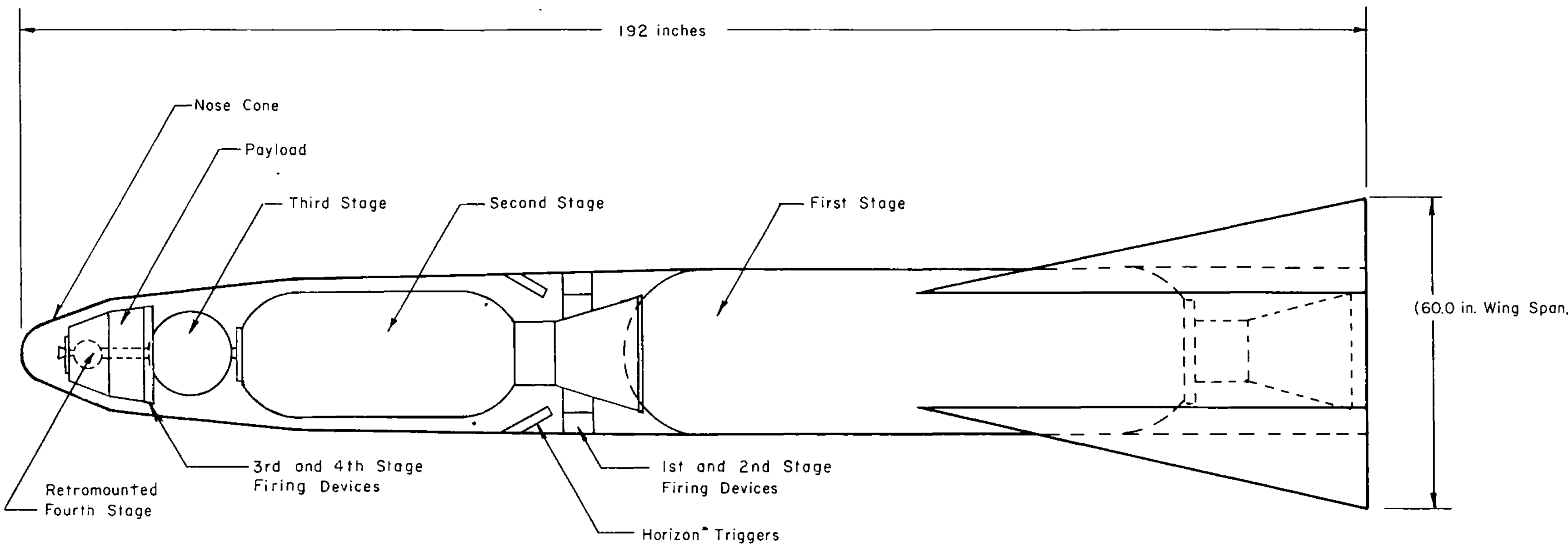

Fig. I VEHICLE LAYOUT

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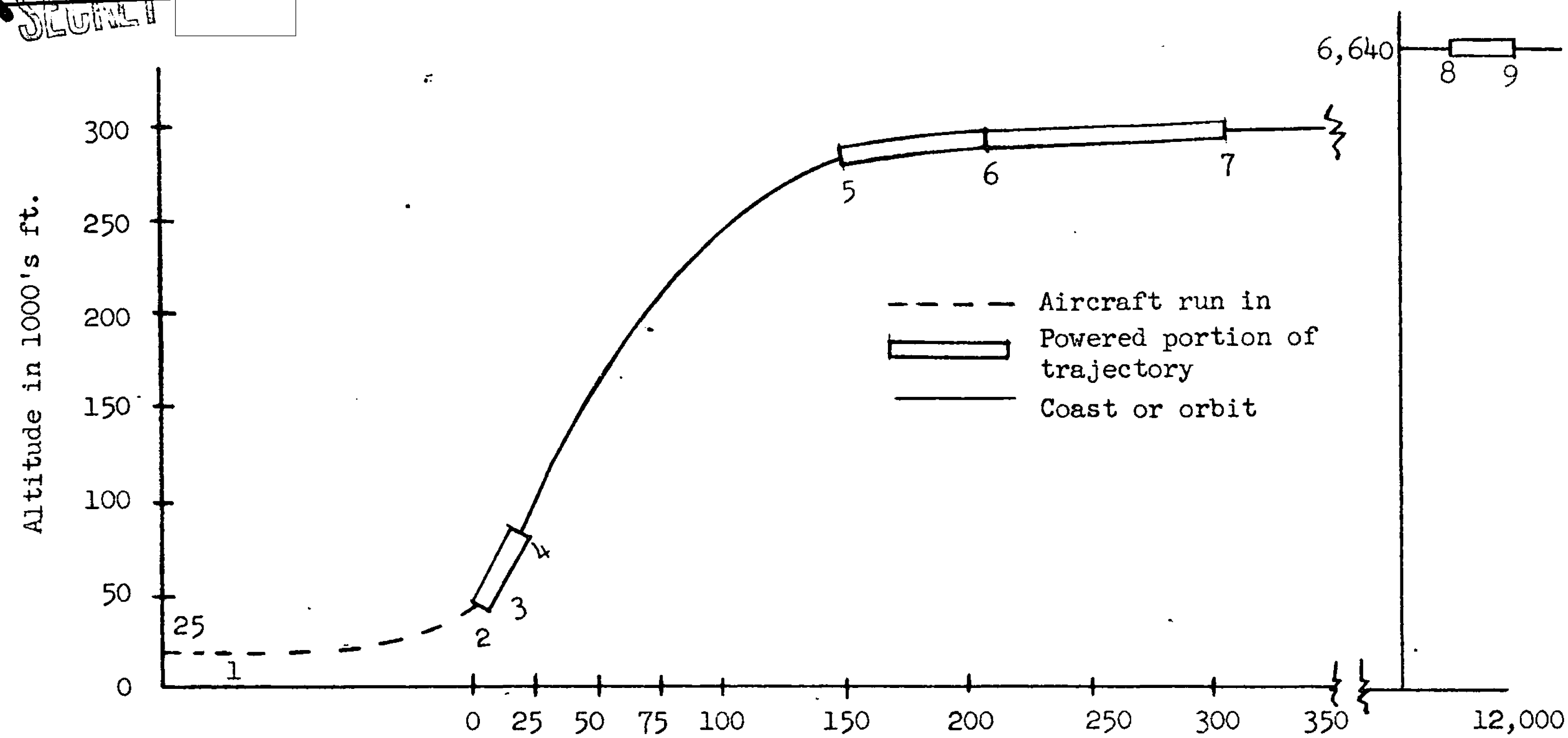

Event	Time sec.	Elevation Angle degree	Altitude 1000/s ft	Velocity ft/sec	Range mile
1. Aircraft run-in and pull up	-	0	25	750	-
2. Vehicle release	0	56	35	700	0
3. Fire 1st Stage	5	47	37	570	0.3
4. Begin 1st Coast	39	25	95	7,900	20
5. Fire 2nd Stage and jettison 1st Stage	138	3	280	6,900	150
6. Fire 3rd Stage and jettison 2nd Stage	177		283	19,200	235
7. Begin 2nd coast - jettison 3rd Stage	202		292	27,300	329
8. Fire 4th Stage - jettison nose cone	3,200	0	6,644	21,100	12,000
9. Burnout of 4th Stage	3,203	-0.5	6,643	22,370	12,012

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FIG. 2. INITIAL TRAJECTORY

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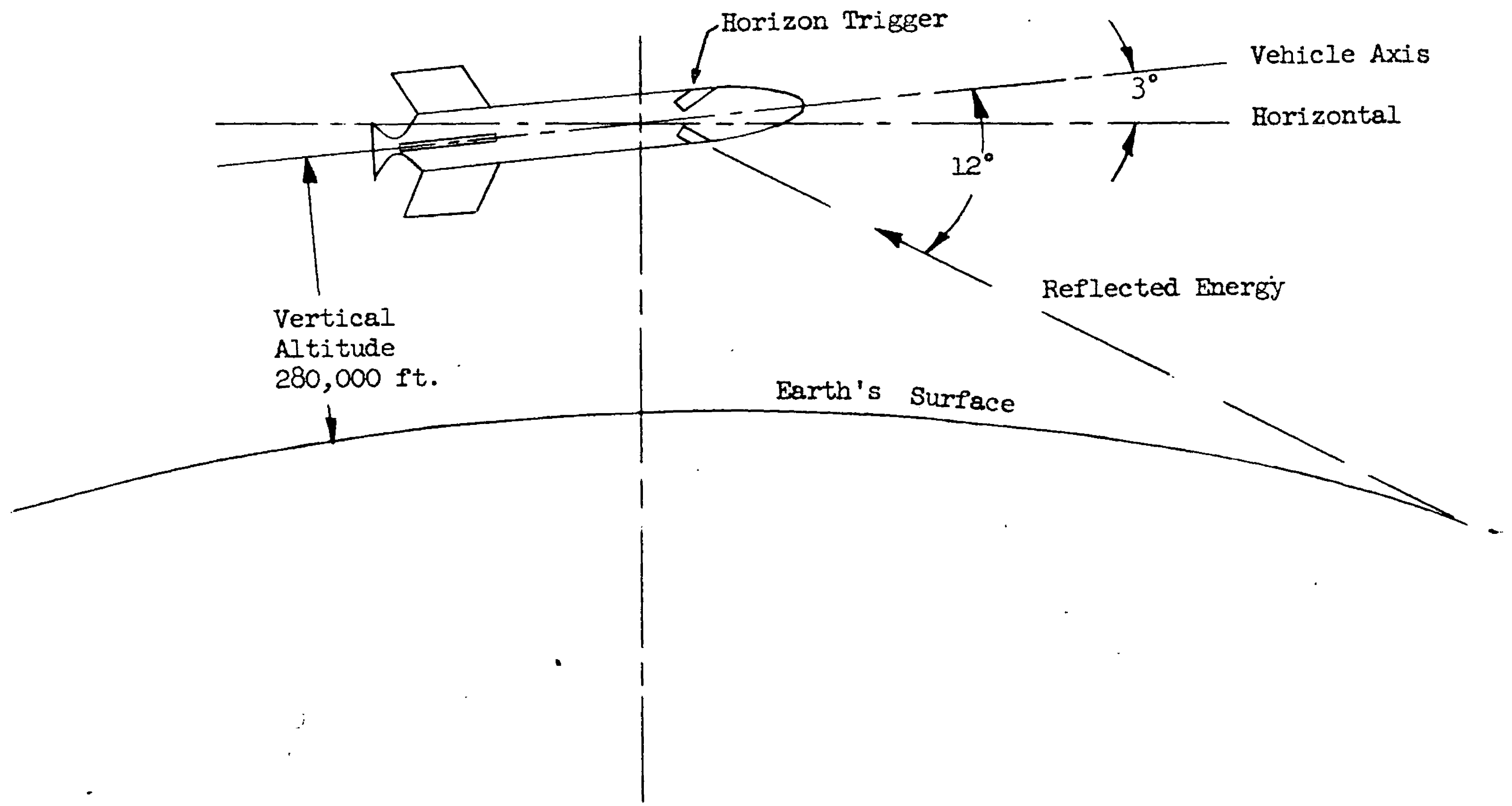

FIG. 3 HORIZON TRIGGER

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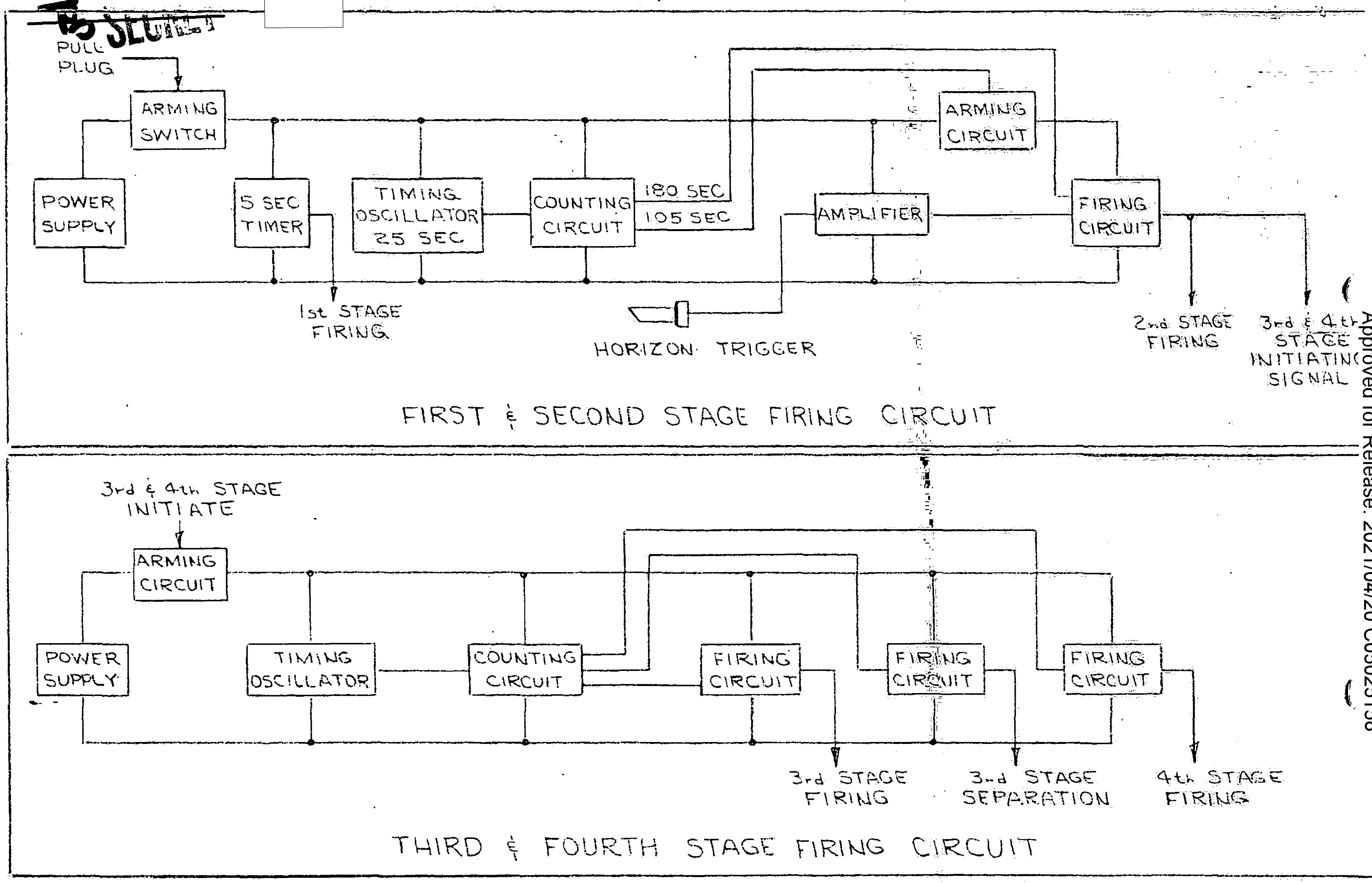

PROGRAMMING CIRCUIT BLOCK DIAGRAM

FIG. 4

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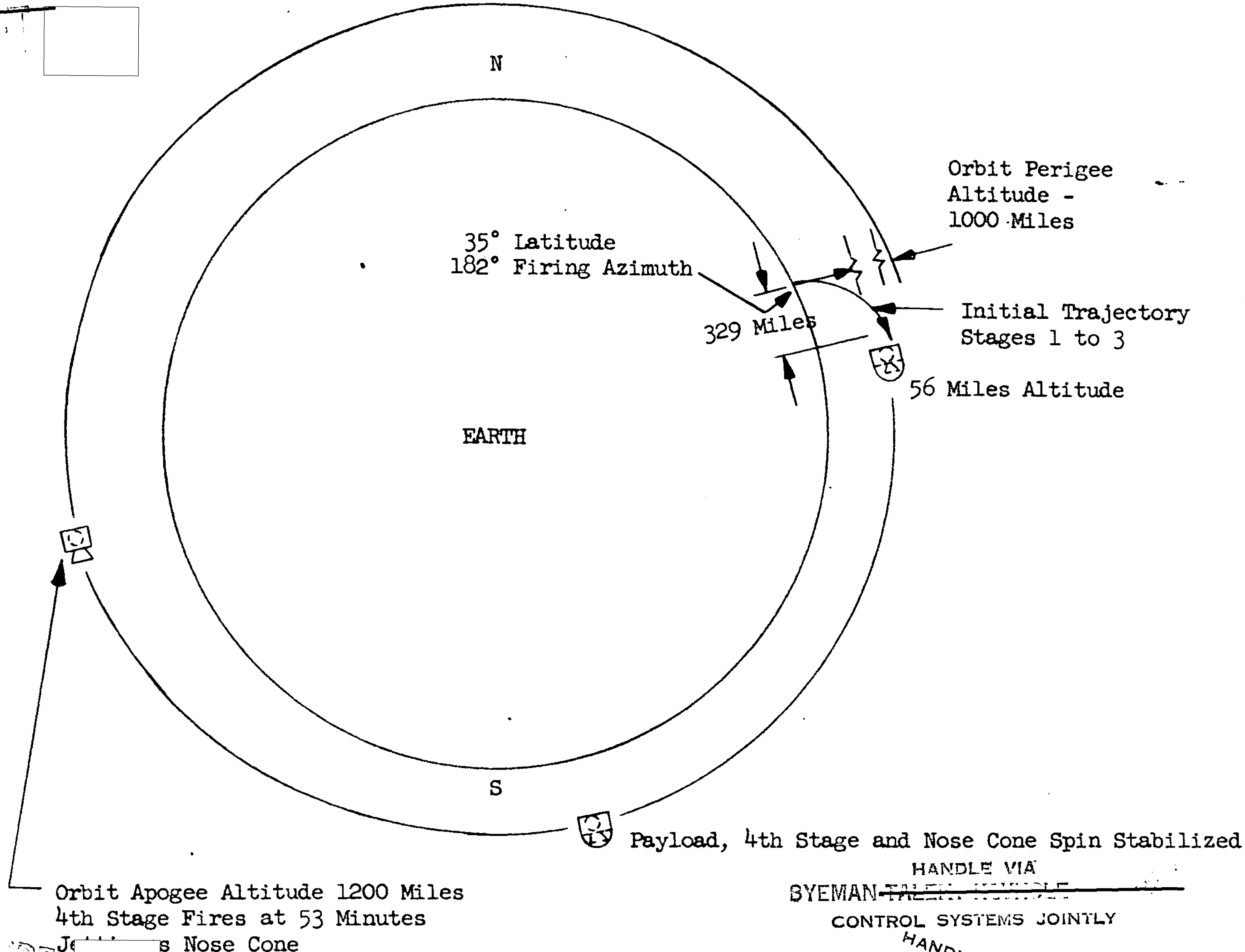

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FIG. 5 TRAJECTORY AND TYPICAL ORBIT

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a. Type of sensor or instrument __________

(1) Developed by __________

(2) For use on the __________ program

b. Physical Dimensions

(1) If available, an outline sketch is preferred.

(2) Location of center of gravity __________

(3) Weight __________

(4) Polar moment of inertia __________

(5) Transverse moment of inertia __________

c. Sensor Environmental Limitations

(1) Temperatures, maximum __________ minimum __________

(2) Acceleration __________

(3) Vibration, frequency and amplitude __________

(4) Other __________

d. Electrical Characteristics

(1) Supply voltage __________ regulation __________ drain __________

(2) Telemetry system requirements, bandwidth required __________

power required __________, operating life desired __________,

sampling rate __________, data storage required __________

e. Desired Orbit Characteristics

(1) Height, perigee __________ apogee __________

(2) Inclination __________

f. Probable frequency of performing experiment. __________

g. Experiments that should be conducted simultaneously in payload package with (a) above. __________

h. Remarks: __________

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Date __________

ENCLOSURE 2