SATELLITE SYSTEMS DATA BOOK

DISCOVERER PROGRAM

LOCKHEED AIRCRAFT CORPORATION
MISSILE SYSTEMS DIVISION
SUNNYVALE CALIFORNIA

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LMSD-6164B
Revision 1
1 June 1961

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PAGE NO.	REV.	DATE	CLASS	PAGE NO.	REV.	DATE	CLASS
Title Page	B-1	6/1/61	S	Title Page	B	5/15/61	S
c-1	B-1	"	U	c-1	B	"	U
SECTION I							
*3.6.7	B	5/15/61	C	3.6.7	B	5/15/61	C
3.6.9	B-1	6/1/61	C				
3.6.11	B-1	"	C				
3.6.13	B-1	"	C				

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MISSILES and SPACE DIVISION

LMSD-6164B
15 May 1961

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REPORT CHANGE RECORD
FOR
DISCOVERER DATA BOOK

The following additions, revisions, or errata corrections, should be incorporated into the document identified above. This Report Change Record page should be inserted as the first page of the affected report preceding the title page. If a page in the original document is eliminated and/or replaced by the instructions which follow, the page must be destroyed according to the Air Force directive governing such destruction.

CONTRACT NUMBER

ADDENDUM PAGE	REVISION		ERRATA		REVISION OR ERRATA CORRECTION (CORRECT IN INK)	CORRECTION MADE	
	REMOVE PAGE	INSERT PAGE	REMOVE PAGE	INSERT PAGE		INITIAL	DATE
					Section I, p. 6.6.6, Change LMSD-6165B to read LMSD-6164B Section II, p. 1.6.7, Change Section I to read Section II		

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REVISION 1

1 JUNE 1961

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SATELLITE SYSTEMS DATA BOOK

DISCOVERER PROGRAM

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LMSD-6164B
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PAGE NO.	REV.	DATE	CLASS	PAGE NO.	REV.	DATE	CLASS
The material contained in this revision represents a complete replacement of material presently appearing in the Discoverer Data Book. Remove all pages in the current data book and replace with the attached pages.							

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INTRODUCTION

The SATELLITE SYSTEMS DATA BOOK is a collection of documents, each of which functions as an authoritative reference source for a particular Satellite Systems Program as indicated below. Each document's binder carries the title "SATELLITE SYSTEMS DATA BOOK" and the sub-title applicable to the binder's content material. Each Program data book carries on its title page, but not on the binder thereof, the LMSD report number assigned to the document as noted below.

Sub-title	LMSD Report No.	Content Material
Discoverer Program	6164	Program, flight, and design parameters and descriptions of Discoverer Satellite.
MIDAS Program	6165	Program, flight, and design parameters and descriptions of MIDAS Satellite and Ground Data Handling Equipments.
Samos Program	445641	Program, flight, and design parameters and descriptions of Samos Satellite and Ground Data Handling and Recovery/Retrieval Equipments.
NASA/Agena Program	447000	Program, flight, and design parameters and descriptions of NASA/Agena vehicle and associated LMSD activities.
Advent/Agena Program	448168	Program, flight, and design parameters and descriptions of Advent/Agena space vehicle and associated LMSD activities
Samos II Program	448169	Program, flight, and design parameters and descriptions of the Agena vehicle and associated LMSD activities in support of the Samos II Program.
Terms and Definitions	447576	Terms encountered in the space effort and definitions thereof; charts and tables of technical data applicable to the space effort.

Each SATELLITE SYSTEMS DATA BOOK for a specific Program is maintained on a continuing basis for the life of the Program to reflect the "as is" condition of the flight parameters and of the space and ground hardware. To implement this maintenance, each data book will be re-issued periodically, such re-issuances to be identified as a lettered change, e.g. LMSD-6165A. Revised data will be issued between lettered changes, with instructions as to the insertion of new pages and the deletion of any previously issued pages which might no longer be applicable and/or effective. These pages are identified as numbered revisions to the current change, e.g. LMSD-6165A, Revision 1. A succeeding lettered re-issuance will incorporate the interim numbered revisions as well as new material.

It is to be noted that any data, information, or illustration contained in any SATELLITE SYSTEMS DATA BOOK document for a specific Program is solely for internal reference purposes and does not by its presentation therein, constitute a contractual obligation or commitment.

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INTRODUCTION

The SATELLITE SYSTEMS DATA BOOK - DISCOVERER PROGRAM, LMSD-6164, is a reference document for the Discoverer Satellite System, including the overall System objectives, the flight and design parameters centered in the Discoverer satellite, the delineation of the inter-related structure and systems of the satellite, and a description of the ground handling equipment applicable to the Biomedical Recovery Capsule (BRC).

The SATELLITE SYSTEMS DATA BOOK - DISCOVERER PROGRAM will be revised on a continuing basis to maintain it concurrently with the overall Program philosophy, the flight parameters, and the design configurations. Major revisions will be disseminated periodically as "re-issues," identified as a lettered change. Revised data will be issued between lettered changes, with instructions as to the insertion of new pages and the deletion of old pages. These revisions are numbered, e.g. "Rev. 1, Rev. 2, Rev. 3, Rev. 4," etc. A succeeding lettered change will incorporate the interim revisions as well as any new material. It is the intent of the Data Book Staff that the SATELLITE SYSTEMS DATA BOOK - DISCOVERER PROGRAM contain, at any given time, only material pertinent to current and projected Discoverer satellites and their affiliated equipments. Since LMSD Report No. 6164 is an "unbound" document, each page thereof is classified with the degree of security determined by the content of the page.

The SATELLITE SYSTEMS DATA BOOK - DISCOVERER PROGRAM, LMSD-6164, is divided into major sections of material, which are then subdivided into pages. The first digit of a page number indicates the major grouping within the section, such as "Missions and Objectives" or "Spaceframes;" the second digit of a page number indicates the flight configuration to which the material on that given page refers. The third digit of the page number is the sequential number of that page for a given write-up or description, which page may contain either textual material, illustrative material, or both. An example from the Table of Contents follows:

SECTION II

1.0	STRUCTURE AND SYSTEMS, SPACE VEHICLE	
1.3	Spaceframe	
1.3.1	Flight Configuration III	
1.3.2	General Arrangement	
1.3.3	Inboard Profile	
1.3.4	*	
1.3.5	Fwd. Equipment Racks	
	*	* Test Material

It is intended that each write-up and/or description be a self-contained unit; therefore, a minimum of cross referencing is used.

To assist the Data Book user in locating specific systems, subsystems, components, or other descriptions, a general index is provided at the back of the book and detailed indexes are included at the end of each write-up. The general index contains the basic write-up number in which given reference material may be located. Each such basic write-up is subdivided in accordance with the flight configurations, as indicated above, and those individual write-ups have the detailed indexes appended as the last paragraph in each write-up. An example of this somewhat unusual indexing follows:

GENERAL INDEX (main - at back of Data Book)

. . . . .

Motor, Velocity

. . . . .

Spin Gas Bottle — Section II, Page 4.0 ff

Section II, Page 8.0 ff

"INDEX" (supplemental - at back of individual write-ups)

4.6 Guidance and Control, Flight Configuration VI

. . . . . .

8.0 INDEX

Velocity Motor, Mod II — Para. 3.1.3

It is to be noted that the SATELLITE SYSTEMS DATA BOOK - DISCOVERER PROGRAM, LMSD-6164, is an internal information document, and any data or information contained herein does not, by that fact, constitute a contractual obligation or commitment.

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MISSILES AND SPACE DIVISION

SATELLITE NUMBER / Flight Configuration	SEC. NUMBER	DATE	Did Satellite attain orbit?	VELOCITY Feet/Sec.	APOGEE Naut. Miles	PERIGEE Naut. Miles	ECCENTRICITY	PERIOD Minutes	USEFUL ORBITAL LIFE	ACTIVE ORBITAL LIFE	Was capsule recovered?	REMARKS
3205-1019 FC I	*	1/21/59	No	-	-	-	-	-	-	-		Instrumented payload. Malfunction during countdown caused ullage rockets, retro-rockets, separation bolts, and horizon scanner fairing pin pullers to fire when hydraulic motor was turned on. Launch was aborted.
3205-1022 FC I	I	2/28/59	Yes	N/A	N/A	N/A	N/A	N/A	-	13	N/R	Instrumented payload. No telemetry or radar orbit contact made. Sporadic CWAT contact reported. Satellite believed to have been damaged structurally and/or thermally at injection or during first pass.
2205-1018 FC II	II	4/13/59	Yes	25,850	196.3	135.4	0.008	90.5	N/A	5-28	No	Biomedical research capsule containing four mechanical mice. Engine shutdown by command (source unknown, but believed to be due to relay malfunction). Capsule ejected and believed to have landed near Spitzbergen, Norway; was not recovered (by us).
2205-1020 FC II	III	6/3/59	No	-	-	-	-	-	-	-	No	Biomedical research capsule, containing four live mice. Premature engine burnout due to fuel exhaustion resulted in insufficient satellite velocity to attain orbit.
2205-1023 FC IV	IV	6/25/60	No	-	-	-	-	-	-	-	No	AET Payload. Premature engine burnout, resulting in insufficient velocity to attain orbit.
2205-1029 FC IV	V	8/13/59	Yes	26,468	399.3	118	0.0373	96.1	N/A	46	No	AET payload. Burnout due to propellant exhaustion. Orbit achieved. Capsule separated but not recovered. Unexplained internal heat loss affected mercury battery; recovery sequence not accomplished.
2205-1028 FC IV	VI	8/19/59	Yes	26,079	454.8	122.4	0.047	95.3	N/A	63	No	AET payload. Burnout due to propellant exhaustion. Orbit achieved. Capsule separated but not recovered. Recovery sequence believed not accomplished. Radar interference experienced on VAFB tracking net. Same thermal problems as in Discoverer V.
2205-1051 FC IV	VII	11/7/59	Yes	26,235	379.3	104.2	0.049	94.65	2	15	No	AET payload. An apparent failure of the satellite 400-cycle power supply occurred during the first orbit, resulting in the disablement of the satellite guidance system, which includes the D-timer which controls the capsule ejection sequence. The satellite was assessed to be tumbling throughout its orbital passes.

N/A - not available
N/R - not required

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SATELLITE SYSTEMS DATA BOOK

SATELLITE NUMBER / Flight Configuration	MISC. NUMBER	DATE	Did Satellite attain orbit injection?	VELOCITY Feet/Sec.	APOGEE Naut. Miles	PERIGEE Naut. Miles	ECCENTRICITY	PERIOD Minutes	USEFUL ORBITAL LIFE	ACTIVE ORBITAL LIFE	Was capsule recovered?	REMARKS
2205-1050 FC V	VIII	11/20/59	Yes	26.951	909	100	N/A	103.7	N/A	90+	No	AET payload. Burnout due to propellant exhaustion following accelerator-integrator malfunction. Excessive injection velocity resulted in a relatively high eccentricity and an abnormally long period. Programmer was adjusted on Pass 2 to allow for this longer period. Separation occurred; re-entry sequence was normal. Recovery was not effected.
2205-1052 FC V	IX	2/4/60	No	-	-	-	-	-	-	-	-	AET payload. Satellite's helium quick-disconnect failed to function properly, resulting in separation of part of the fitting and loss of helium gas for propellant pressurization. Booster MECO occurred approximately 19 seconds early at 145.06 seconds after liftoff. Satellite's pitch gimbal actuator failed to function properly with resultant uncontrolled tumbling of satellite shortly after satellite engine start.
2205-1054 FC V	X	2/19/60	No	-	-	-	-	-	-	-	-	AET payload. Booster began to oscillate in the pitch plane immediately after liftoff. Discoverer was destroyed by ground command 56.36 seconds after liftoff.
2205-1055 FC V	XI	4/15/60	Yes	26.015	329	91	0.032	92.32	2 days	11 days	No	AET payload. Booster and satellite performance most successful to date. Capsule separated but was not recovered. Effective retro velocity of capsule was determined to be approximately half the predicted value for proper re-entry, due to capsule spin deficiency.
2205-1053 FC VII	XII	6/29/60	No	-	-	-	-	-	-	-	-	Diagnostic payload. Launch and ascent were normal except that due to a malfunction in the pitch channel of the satellite horizon scanner, the satellite arrived at burnout with an attitude that resulted in a flight-path angle of -8.3 degrees. The satellite failed to achieve orbit and impacted downrange of the launch facility.
2205-1057 FC VII	XIII	8/10/60	Yes	25.786	379	137	0.0326	94.1	2 days	84 days	Yes	Diagnostic payload. Very successful operation, culminating in the recovery of a space capsule. New cold gas spin system utilized for capsule spin-de-spin. Capsule was retrieved from the water by helicopter from USNS Haiti Victory.

N/A - not available
N/R - not required

APPROVED BY	TITLE	PREPARED BY
APPROVED BY	DISCOVERER FLIGHT SUMMARY	APPROVED BY

SATELLITE NUMBER / Flight Configuration	MISC. NUMBER	DATE	Did Satellite attain orbit Injection?	VELOCITY Feet/Sec.	APOGEE Naut. Miles	PERIGEE Naut. Miles	ECCENTRICITY	PERIOD Minutes	USEFUL ORBITAL LIFE	ACTIVE ORBITAL LIFE	Was capsule recovered?	REMARKS
2205-1056 FC V	XIV	8/18/60	Yes	26,126	441	103.5	0.046	94.54	1-1/2 days	30 days	Yes	AET payload. Performance was good except for instability for a period after injection and prior to capsule ejection. The latter resulted in an impact over 430 miles south of that predicted. The first in-flight recovery of a space capsule was achieved by a C-119 aircraft.
2205-1058 FC V	XV	9/13/60	Yes	26,015	416	114.2	0.040	94.2	1 day	44 days	No	AET payload. Satellite attitude perturbations resulted in control gas depletion prior to reorientation for capsule ejection. Capsule ejected, however, and was located 960 miles southeast of predicted impact point. Inclement weather prevented capsule retrieval before capsule sank.
6205-1061 FC VI	XVI	10/26/60	No	-	-	-	-	-	-	-	No	AET payload. Functions controlled by D-timer after satellite-booster separation did not occur. Satellite failed to attain orbit.
6205-1062 FC VI	XVII	11/12/60	Yes	26,280	538	103.1	0.0582	96.44	2-1/2 days	28 days	Yes	AET payload. Most successful flight to date. Recovered payload capsule after two days of orbit. The second in-flight recovery of a space capsule was accomplished, utilizing the C-119 aircraft. Satellite, with payload, orbited during strongest solar flare ever recorded. BREMSTRAHLUNG effects noted on biological elements in lead shielded containers.
6205-1103 FC VI	XVIII	12/7/60	Yes	25,820	380	136	0.031	93.67	5 days	55 days	Yes	AET-L payload. Capsule ejection occurred on the third day of orbit (Pass 48). An in-flight recovery was effected by a C-119 aircraft. Post-ejection reorientation of the satellite to a horizontal tail-first attitude was accomplished.
6205-1101 FC VIII	XIX	12/20/60	Yes	25,860	348	116	0.033	92.9	6-1/2 days	17 days	N/R	Radiometer payload to determine infrared background radiation of the earth. In the period following launch between loss of telemetry and acquisition by the Kodiak Tracking Station the control gas was lost. Consequently the satellites orbital stability was lost. Nevertheless considerable payload data was obtained.

N/A - not available
N/R - not required

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SATELLITE NUMBER / Flight Configuration	DISC. NUMBER	DATE	Did Satellite attain orbit injection?	VELOCITY Feet/Sec.	APOGEE Naut. Miles	PERIGEE Naut. Miles	ECCENTRICITY	PERIOD Minutes	USEFUL ORBITAL LIFE	ACTIVE ORBITAL LIFE	Was capsule recovered?	REMARKS
6205-1104 FC VI	XX	2/17/61	Yes	25,690	435	162	0.0366	95.31	4-1/2 days	184 days	No	AET-H payload. Attitude stability, power, and communications were satisfactory through Pass 32. Subsequently S-Band beacon and telemetry were lost. Such loss was not due to loss of primary power. No recovery attempted. BTL guidance system carried on booster for developmental testing; command and control thereby only simulated. Performance of the system adjudged satisfactory.
6205-1102 FC VIII	XXI	2/18/61	Yes	25,984* 25,999	N/R 583	127* 138	0.0383* 0.0589	93.87* 97.84	3 days	177 days	N/R	Radiometer payload; to determine infrared background radiation of the earth. Satellite was first to use the re-start capability of the engine. Under positive control of Kodiak Tracking Station, rocket engine was re-started and maintained full thrust for approximately one (1) second. No problems in performance were apparent through Pass 2. On next contact (Pass 6), the 400-cps single-phase power amplifier had failed, resulting in loss of attitude stability. Performance of the payload was good. 4.3 micron data was as anticipated; 2.7 micron data appeared questionable. Interpretation of payload data is difficult due to attitude instability. Payload data was in agreement with that from DISC XIX (Satellite 1101). Cooling gas pressure for the 4.3 micron detector dropped by Pass 15 to point where radiometer was not sufficiently cooled. 4.3 micron data subsequent is not expected to be useable. Telemetered satellite instrumentation and payload data was received until power depletion which occurred on Pass 54.
6205-1105 FC VI	XXII	3/30/61	No	-	-	-	-	-	-	-	No	AET-L payload. Failure of the hydraulic control system occurred approximately 20 seconds before engine cutoff. Attitude control was lost. Engine thrust duration was shorter than predicted, probably as a result of attitude variations and resultant propellant sloshing. Orbital velocity was not achieved.

* at end of 1st burn

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SATELLITE NUMBER / Flight Configuration	DESC. NUMBER	DATE	Did Satellite attain orbit injection?	VELOCITY Feet/Sec.	APOGEE Naut. Miles	PERIGEE Naut. Miles	ECCENTRICITY	PERIOD Minutes	USEFUL ORBITAL LIFE	ACTIVE ORBITAL LIFE	Was capsule recovered?	REMARKS
6205-1106 FC VI	XXIII	4/8/61	Yes	25,600	351	142	0.0257	94.674	5 days	124 days	No	AET-H payload. Injection into orbit was satisfactory. Operation thru Pass 6 were normal. Between Pass 6 and Pass 9 horizon scanner anomalies appears. Between Passes 9 and 10 all control gas was expended. This loss prevented further damping of attitude variations. Capsule ejection was advanced to Pass 32. A spurious skip command was registered, and ejection of the capsule occurred on Pass 31. The capsule was injected into a new and higher orbit because of the incorrect attitude of the satellite at time of ejection.

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As defined in the "Terms and Definitions Data Book," a configuration, as pertaining to a satellite, is:

> "the structure and installed system equipments which make a space vehicle, or associated ground equipment and item, identifiable in itself and distinct from others with which it is not completely interchangeable."

Flight configuration is primarily determined by the nature or distinction of the respective payload. Secondarily, a change in configuration may be predicated upon a major difference in the space vehicle structure and/or systems, viz. spaceframe and/or propulsion system.

Flight Configuration	Series	Serial No.	Payload	Spaceframe	Propulsion System
I	2306	1019, 1022	Instrumented	IX Tank	BAC 9048
II	2306	1018, 1020	Biomedical Research Capsule, MK I	IX Tank	BAC 9048
III (Not flown as yet)	2306	1025	Biomedical Research Capsule, MK II	IX Tank	BAC 9048
IV	2306	1023; 1029, 1030, 1051	AET	IX Tank	BAC 9048
V*	2306	1050, 1052, 1054, 1056, 1058, 1059	AET	IX Tank	BAC 9048
VI	6306	1061, 1062	AET	2X Tank	BAC 9061
VII	2306	1063, 1067	Diagnostic	1X Tank	BAC 9048
VIII	6306	1101, 1102	Radiometer	2X Tank	BAC 9061
VI	6306	1103-1120	AET-H or AET-L	2X Tank	BAC 9096

+ no launch
1104 no

BAC 9048 = USAF YLR 81-BA-5
BAC 9061 = USAF XLR 81-BA-7
BAC 9096 = USAF XLR 81-BA-9

*Incorporates structure and systems changes from FC IV

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I GENERAL

1.0 DISCOVERER PROGRAM

The Discoverer Program is an experimental effort centered in the development of a space vehicle capable of carrying diverse payloads in either satellite or space probe operations. The Discoverer Program has thus far produced the Discoverer Satellite System which is based upon the Agena space vehicle and which includes the components listed in Para. 2.0 below. Evidence of the success of the Discoverer Satellite System lies in the degree to which the Agena space vehicle is being adapted to other space programs. System components designed for the Discoverer Satellite System are being adapted to other satellite and probe programs. Meanwhile, the scientific spatial research for which the Discoverer Satellite System was designed is continuing, utilizing advanced configurations of the Discoverer satellite.

2.0 DISCOVERER SATELLITE SYSTEM COMPONENTS

The Discoverer Satellite System includes the following:

2.1 The Discoverer Vehicle, consisting of: (a) the Discoverer satellite which is composed of the LMSD-developed Agena space vehicle as the carrier and a Discoverer payload; and (b) the Discoverer booster which is the Douglas Aircraft-developed Thor (DM-21) satellite launching vehicle, modified to function as the first stage thrust device for the Discoverer satellite.

2.2 The Discoverer Payload, which may be: (a) the Heavyweight Advanced Engineering Test (AET-H) package; (b) the Lightweight Advanced Engineering Test (AET-L) package; (c) the Biomedical Recovery Capsule; and/or (d) specialized equipment, such as a radiometer package or Oscar.

2.3 The Discoverer launch complex, including the launch pad and associated facility(s) and integral equipments, the operations ground equipments (OGE); the maintenance ground equipments (MGE); the Vandenberg Tracking Station (VTS) in its launch functions, the telemetry ship(s), and the Satellite Test Center (STC) in its launch control functions.

2.4 The Discoverer ground station complex, including the satellite tracking and acquisition (T&A) stations, satellite instrumentation and payload data read-in and satellite system command (RI/C) stations, and the STC in its orbital control functions.

2.5 Communications Network, consisting of the equipments in the facilities for communication between the ground complex stations and the STC for the exchange of satellite performance data and commands to satellite and for inter-station administrative communications.

2.6 Recover/Retrieval Equipments, consisting of those airborne and surface equipments used for air recovery and sea retrieval of the payload capsules.

2.7 Human Engineering, for the support of design and operation of the satellite, booster, and ground equipments.

Note: (1) Geophysical Research Directorate (GRD) Equipments, which are not components of the Discoverer Satellite System but which may be carried, on a non-interference basis, for additional scientific research purposes. Satellite weight contingency usually determines number of GRD equipments which may be carried on a given Discoverer satellite.

(2) Special Equipments "piggy-backed" on a non-interference basis.

3.0 PROGRAM OBJECTIVES

The objectives of the Discoverer Program are as follows:

3.1 Develop and demonstrate the equipment, techniques, and procedures for launching the Discoverer vehicle.

3.2 Demonstrate the capability in the propulsion system of the single-burn, extended duration operation and the re-start (dual-burn) operation, in their respective configurations.

3.3 Demonstrate the capability of the Discoverer satellite to attain the planned orbit.

3.4 Demonstrate the capability of the Discoverer satellite to reorient itself and to maintain the programmed attitude throughout the useful orbital life of the satellite.

3.5 Develop and demonstrate the equipment, techniques, and procedures by which the Discoverer satellite obtains the scientific data, including the environmental data, for which it is placed in orbit; demonstrate the capability to obtain such data on orbit.

3.6 Develop and demonstrate the equipment, techniques, and procedures for the transmission of scientific data and data pertaining to satellite systems performance and environment to RI/C stations.

3.7 Develop and demonstrate the equipment, techniques, and procedures for acquiring, tracking, and commanding the satellite during ascent-to-orbit and in orbit.

3.8 Develop and demonstrate the equipment, techniques, and procedures for utilizing supplemental tracking aids, such as Doppler beacons and satellite-borne tracking lights.

3.9 Develop and demonstrate the equipment, techniques, and procedures for processing data received from orbiting satellite and the preparation of ephemerides therefrom.

3.10 Develop and demonstrate capsule recovery by ejecting capsules from satellites in orbit, propelling them in an appropriate descent trajectory, enabling recovery for examination and evaluation.

3.11 Develop and demonstrate equipment, techniques, and procedures for in-flight recovery of ejected payload capsules and for sea retrieval of the capsules in the event that air recovery is not effected.

3.12 Evaluate satellite, system, and subsystem performance as the basis for refinements in the current equipments and to determine the parameters for more advanced design configurations, including spaceborne structures and equipments and associated ground equipments.

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1.0 GENERAL

Launch Site	Vandenberg Air Force Base (VAFB)
Launch Azimuth	172°
Flight Configuration	VI
Payload	Recoverable Advanced Engineering Test Package Light (AET-L) Heavy (AET-H)
Satellite Series and Serial Numbers	6205-1061, 1062 6205-1103 thru 1120*

Orbit Parameters/	AET-L	AET-H
Injection Altitude (statute miles)	150	190
Eccentricity	.033	.020
Orbital Period (nominal minutes)	93.8	94.4
Orbital Plane Inclination (degrees)	81.8	81.8
Useful Orbital Life (hours)	100	100

*Satellite 1120 incorporates a payload which represents a departure from the alternate payloads available for the remainder of the satellites in the flight configuration.

/Parameters applicable to Flight Configuration VI Satellites 1107 and subsequent, except Satellite 1120.

2.0 FLIGHT MISSION

2.1 Demonstrate the compatibility of the booster and satellite, as components of the Discoverer Program Flight Configuration VI vehicle, to place the satellite at an altitude, velocity, and attitude requisite to achievement of satellite injection.

2.2 Demonstrate the capability of the satellite: (1) to separate from the booster with a minimum of ascent trajectory disturbance, and (2) to provide the second stage thrust, supplemental to the booster-induced first stage thrust, to achieve the planned orbital injection altitude and velocity.

2.3 Demonstrate the capability of the satellite to carry the Advanced Engineering Test Package in either the lightweight (AET-L) or the heavyweight (AET-H) configuration, as determined 19 days prior to launch readiness date for the individual flight test.

2.4 Demonstrate the capability of the satellite: (1) to orbit in the planned attitude at an acceptable altitude for the planned period of useful orbital life; (2) to accomplish the events requisite to ejection of the payload; and (3) to eject the payload into an acceptable re-entry trajectory for recovery/retrieval.

2.5 Demonstrate the capability of the satellite to telemeter to Discoverer read-in and command (RI/C) stations data relative to environmental conditions internal and external to the satellite structure and to satellite system and payload equipment performance.

2.6 Secure scientific data and information by means of the AET payload.

2.7 Demonstrate the capability of the satellite to telemeter scientific data secured by the AET package.

2.8 Demonstrate the capability of the recoverable capsule, after ejection from the satellite: (1) to interrupt the orbital altitude and velocity induced by the satellite; (2) to stabilize itself, decelerate in the planned re-entry trajectory; (3) to re-enter the atmosphere; (4) to identify itself to Discovery recovery/retrieval forces and equipments while trajecting to the planned target area; and (5) to maintain its contents in the planned internal environment from countdown through recovery/retrieval.

2.9 Demonstrate the capability of the Discoverer recovery/retrieval forces and equipments to air-recover the payload package in its capsule housing or to retrieve it from the ocean target area.

2.10 Demonstrate the capability of the payload capsule to maintain the affected AET package in a controlled environment from preparation for launch until recovery/retrieval.

2.11 Demonstrate the compatibility of the payload-associated and general ground support equipments in supporting the satellite and its payload in preparation-for-launch, countdown, and launch.

2.12 Demonstrate the capability of the Discoverer ground station complex, including associated stations, as applicable to individual flight tests, to acquire and track the satellite, predict its orbital path and period, command and control certain satellite system and payload equipment operations, accept data telemetered from the satellite, and provide pertinent data to the Satellite Test Center.

2.13 Demonstrate the capability of the Discoverer communications network to convey from each of the Discoverer integral ground stations and the associated ground stations to the Satellite Test Center data and information pertinent to the affected flight test.

2.14 Demonstrate the capability of the Satellite Test Center: (1) to maintain an overriding control (i) of the vehicle countdown, launch, and ascent to separation, (ii) of the satellite final ascent to orbit, orbit, and ejection of the payload capsule, (iii) of the recovery/retrieval forces and equipment, (iv) of the ground station operations, and (v) of the communications network; (2) to compile ephemeris tables; and (3) to process, compile, and disseminate to affected agencies data and information from and about the recovered payload package.

3.0 PRIMARY TEST OBJECTIVES

3.1 Discoverer Vehicle. Test and evaluate the capability of the Discoverer Flight Configuration VI vehicle, composed of a Discoverer booster and a Discoverer satellite, to provide for injection of the satellite into the planned polar orbit, including:

(a) The structural and aerodynamic conformation of the booster and satellite in countdown and during the launch phase.

(b) The nature of any separation perturbations induced in the satellite by the booster.

3.2 Discoverer Booster. Test and evaluate the capability of the Discoverer booster, a Douglas Aircraft-developed Thor (DM-21) satellite launching vehicle, to function as the first stage thrust device, including:

(a) Structural integrity under launch phase conditions.

(b) Capability of the booster's guidance and control system to: (1) to execute programmed commands, including roll and pitch routines; (2) to accept commands from Douglas ground operations for control of booster system equipment operations, including hard shutdown of the main engine and of the vernier engines; and (3) to accept commands from Douglas ground operations for transmission to the satellite, including SS/D timer brake control holding and, in the case of satellites 6-205-1105 and subsequent, integrator minus velocity gain corrections.

(c) Capability to maintain stability of the successively programmed or commanded attitudes for the required periods of time.

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(d) Capability to achieve the planned apogee within acceptable tolerances of altitude, velocity, and attitude.

3.3 Discoverer Satellite. Test and evaluate the capability of the Discoverer satellite as the second stage thrust device and payload carrier to orbit at the nominal altitude in the inflight, horizontal attitude, including:

(a) Structural, aerodynamic, and spatiodynamic integrality under launch, coast, orbital boost, and orbit phase conditions, including reorientation.

(b) Capability to withstand and damp out separation perturbations.

(c) Capability to achieve an orbit of acceptable eccentricity by use of a relatively extended propulsion system operating time.

(d) Capability to damp out possible reorientation perturbations within acceptable time tolerances.

(e) Capability to maintain a stable attitude on orbit.

(f) Capability to orient to the proper attitude and to eject the payload capsule with a minimum of disturbance to the capsule.

3.4 Discoverer Satellite Spaceframe. Test and evaluate the capability of the Discoverer satellite spaceframe to house, support, and/or carry satellite system and payload equipments, including:

(a) Capability to withstand and/or modify within acceptable limits shear loads, torques, and stresses induced by Discoverer booster thrust, booster separation, orbital rocket engine thrust, nose section housing separation, and programmed attitude changes.

(b) Capability to maintain center of pressure in consonance with the center of gravity within acceptable tolerances.

(c) Capability of the external paint and color code pattern to provide a means for optical tracking in the launch phase.

3.5 Discoverer Satellite Propulsion System. Test and evaluate the capability of the Discoverer satellite porpulsion system to provide the orbital altitude and velocity thrust incremental to the booster-induced thrust to assure injection, including:

(a) Capability to start on programmed signal from the SS/D timer, burn for a relatively extended period of time, and shut down on command signal from the SS/D integrator.

(b) Capability of the (USAF XLR-81-BA9) (RAC Model 8096) engine to properly utilize the propellant supply under applicable flow rate and pressurization conditions.

(c) Capability to vent the unexpended propellant supply and propellant pressurization gas supply within acceptable time limits after propulsion system command shutdown.

(d) Capability to provide turbine power to hydraulic control system motor.

(e) Capability of the propellant subsystem to provide oxidizer and fuel at the required flow rates and pressures.

3.6 Discoverer Satellite Electrical Power System. Test and evaluate the capability of the Discoverer satellite electrical power system to supply electrical power to satellite system and payload equipments for the ascent-to-orbit and the planned useful orbital life of the satellite, including:

(a) Capability of the primary battery installation to supply basic power, directly or via the power distribution subsystem to satellite system and payload equipments.

(b) Capability of the power distribution subsystem, including the 400 cps and 2000 cps inverters, 400 cps power amplifier, load limiters, and voltage regulators: (1) to add an increment to the battery input dc voltage to assure an output of 28.5 volts dc to affected equipments; (2) to convert battery input dc voltage to 115 volts ac, three-phase, 400 cps and one-phase, 2000 cps as applicable to affected equipments; (3) to convert battery input +dc voltage to -dc voltage output to affected equipments; and (4) to control these output voltages and frequencies within acceptable tolerances.

3.7 Discoverer Satellite Guidance and Control System. Test and evaluate the capability of the Discoverer satellite guidance and control system to provide programmed navigational and attitudinal control of the satellite from separation through capsule ejection and to initiate, modify, and/or terminate certain satellite system equipment operations at selected times during this period, including:

(a) Capability of the horizon scanner: (1) to establish the local vertical after separation and to maintain it until reorientation;(2) to establish the local vertical after reorientation and to maintain it until initiation of attitude change for the payload capsule ejection: (3) to detect satellite attitude deviations resulting from drag or from gyro drift; and (4) to supply error signals to torque the affected IRP gyro(s) proportionate to the deviation(s).

(b) Capability of the inertial reference package: (1) to establish satellite attitude references from the Discoverer vehicle orientation at separation; (2) subsequently to accept gyro torquing signals from the horizon scanner, the SS/D timer, and the SS/D integrator, as applicable; (3) to supply corresponding differential error signals for attitude correction and definitive attitude change, as applicable, to the flight control electronics system, from separation to payload capsule ejection; and (4) to supply satellite acceleration signal to the SS/D integrator during orbital boost.

(c) Capability of the SS/D (sequence) timer to start, modify, and/or stop satellite system equipment operations from separation through reorientation and during the payload capsule ejection sequence, as listed in the Timed Sequence of Events, Section IV, Page 2.9 ff.

(d) Capability of the SS/D integrator: (1) to supply IRP pitch gyro torquing signal(s) to induce a residual satellite pitch rate during the coast phase; (2) to accept minus velocity gain corrections for final setting of the satellite velocity to be gained during orbital boost; (3) from the Discoverer ground operations, in the case of 6205-1104, and (4) from the DAC ground operations BTL guidance equipments via the booster guidance system and umbilical to the satellite, in the case of 6205-1105 and subsequent; (5) to accept satellite acceleration signals from the IRP longitudinal accelerometer; (6) to determine satellite achievement of the desired orbital velocity gain; and (5) to supply a corresponding hard shutdown command to the propulsion system to terminate orbital boost.

(e) Capability of the resistive voltage networks to supply voltages required for torquing of the IRP gyros on the basis of signals from the horizon scanner, SS/D timer, and SS/D integrator, as applicable.

(f) Capability of the secondary junction box to convert guidance and control system function signals to a form suitable for telemetry.

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(g) Capability of the flight control electronics system: (1) to accept differential error signals from the IRP pitch, yaw, and roll attitude (displacement) gyros, rate signals from its own pitch, yaw, and roll rate gyros, and, during propulsion system operation, piston position signals from the hydraulic control linear transducer; (2) process them; and (3) supply control signals to the pneumatic control system from separation through capsule ejection, to the hydraulic control system during propulsion system operation.

(h) Capability of the pneumatic control system to provide the required thrust impulse(s), on the basis of control signals from the flight control electronics system, for satellite pitch, yaw, and roll control during the coast, reorientation, and orbit phases and payload capsule ejection and for satellite roll control during the orbital boost phase.

(i) Capability of the hydraulic control system to provide, on the basis of control signals from flight control electronics system, engine gimballing torque(s) for pitch and yaw control during the propulsion system operated.

3.8 Discoverer Satellite Communications System. Test and evaluate the capability of the Discoverer satellite communications system: (1) to accept commands from Discoverer RI/C stations; (2) to start, stop, and/or modify satellite system equipment operations; and (3) to transmit pertinent data to affected Discoverer ground stations, including:

(a) Capability of the command subsystem: (1) to accept real-time commands from Discoverer RI/C stations via the S-Band transponder for adjusting operation of the SS/H orbital timer; (2) to program satellite system orbital events by means of the SS/H orbital timer, subject to the modifications via the transponder.

(b) Capability of the identification subsystem: (1) to supply CW identification transmitter signals to Discoverer T&A and RI/C stations for satellite acquisition, and tracking, and orbit prediction purposes; (2) Doppler signals to associated Transit stations for acquisition and tracking purposes.

(c) Capability of the telemetry subsystem to transmit to Discoverer RI/C stations data relative to satellite system, and special equipment and instrumentation performance and internal and external environmental conditions, either directly or by tape recording and reproduction.

(d) Capability of the antenna subsystem to accept commands and transmit data for the affected subsystems.

(e) Capability of the tracking light to provide T&A, RI/C, and associated ground stations with a means of tracking and orbit prediction.

3.9 Discoverer Satellite Payload. Test and evaluate the capability of the Discoverer satellite payload: (1) to achieve the end results of the advanced engineering tests; (2) determine the parameters for subsequent research.

3.10 Discoverer Ground Station Complex. Test and evaluate the capability of the Discoverer ground station complex to: acquire, track, command, and interrogate the satellite; receive satellite structure and system equipment data; record, process, and compile pertinent data in each station; and send such data to the Satellite Test Center over the associated communications network, including:

(a) Capability of the launch site complex, consisting of the Vandenberg Air Force Base (VAFB), VAFB Auxiliary (Point Mugu), and the telemetry ship(s), to track the satellite from lift-off through the initiation of the orbital boost phase and to receive data telemetered from the satellite reflecting structure and system environment and performance.

(b) Capability of the Discoverer tracking and acquisition (T&A) stations to acquire and track the satellite via the CW identification transmitter during active orbital life and the S-band transponder and Doppler during useful orbital life for purposes of orbit prediction and antenna positioning.

(c) Capability of the Discoverer read-in and command (RI/C) stations to: (1) insert real-time commands to change the position and velocity of the SS/H timer tape to conform the tape period to the satellite orbital period; (2) to receive data from the VHF communications equipments; and (3) to perform the tracking and acquisition operations noted in (b) above.

(d) Capability of the Discoverer-associated ground stations, including the Smithsonian Astronomical Observatories (SAO) and the Doppler Tracking Stations (cf. Sec. V, Page 1.1.2), to track the satellite by means of the tracking light and the APL Doppler signals, respectively.

3.11 Communications Network. Test and evaluate the capability of the communications network to: (1) provide communication between the several stations and the STC for purposes of ascent-to-orbit and orbit monitoring and controlling of the satellite and its systems; (2) channel other data and information relative to the flight test from the T&A and RI/C and Discoverer-associated stations to the STC.

3.12 Ground Support Equipments. Test and evaluate the capability of the general and payload-associated ground support equipments (GSE), including ground handling and service, subsystem and system checkout, and launch control and items, to support the satellite and its payload during preparation-for-launch, countdown, and launch operations.

3.13 DAC Guidance Ground Operations. For 6205-1105 and subsequent, test and evaluate the capability of the BTL guidance equipments to compute booster trajectory and supply appropriate commands via the booster guidance system to the satellite for SS/D integrator minus velocity gain corrections and for SS/D timer brake control held prior to orbital boost operations.

3.14 Recovery/Retrieval Forces and Equipments. Test and evaluate the capability of the recovery and retrieval forces and equipments: (1) to patrol and monitor the predicted payload capsule target area; (2) to vector on the descending capsule by means of radar picket aircraft; (3) to air recover the capsule or to retrieve it from the sea, depending on local conditions; and (4) to return it to the STC while maintaining it in the necessary controlled environment.

3.15 Satellite Test Center (STC). Test and evaluate the capability of the Satellite Test Center (STC). (1) to control satellite countdown and launch policy; (2) to coordinate and control Discoverer launch site, ground station, and Discoverer-associated ground station performance, including launch "go", launch, ascent-to-orbit, and orbit, in matters requiring top echelon approval; (3) to control satellite orbit operations within the limitations of the satellite command subsystem; (4) to perform, or have performed, necessary computations relative to (1), (2), and (3) to provide RI/C station(s) with necessary data relative to adjustment of the SS/H orbital timer to match the satellite orbital period(s) so as to control sequential events, including initiation of payload capsule ejection activity; and (5) to perform advanced engineering test data analysis and to disseminate to affected agencies and the Company pertinent data and information relative to the flight test.

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4.0 SECONDARY TEST OBJECTIVES

4.1 Experiment to determine environmental conditions affecting satellite system and/or payload equipment performance and integrity under orbital operating conditions, including ionospheric, heterospheric, and thermospheric actions and reactions.

4.2 Obtain geophysical data, as equipment is available on a non-interference basis with primary objectives.

4.3 Demonstrate the capability of the Discoverer Satellite to "piggy-back" special instrumentation and equipment, such as scientific research components (including "Vela Hotel") and Oscar.

4.4 Determine possible spurious radiations and irradiations on, between, and among satellite system equipments for purposes of design refinements.

4.5 Determine signal-to-noise ratio(s) of satellite system equipments for purposes of design refinements.

4.6 Compile data relative to recovery/retrieval activity for application to other Programs.

5.0 TERTIARY TEST OBJECTIVES

5.1 Determine parameters for satellite orbital control leading to further refinement of recovery/retrieval facilities, equipments, forces, techniques, and procedures.

5.2 Determine parameters for a more expanded global network of ground stations and related communications for this and other Programs with which LMSD Satellite Systems is, or may become, affiliated.

5.3 Study causes of satellite internal build-up of pressures which may contribute to satellite orbital attitude and path disturbances, including sublimation of propellant and equipment surface paints, battery conditions, venting of propellants and gases, etc..

5.4 Demonstrate the capability, after capsule ejection, to re-orient the satellite to the tail first, horizontal attitude to maintain the stability of the satellite in that attitude until electrical power and/or pneumatic control gas depletion.

5.5 Test and evaluate the capability of the sun position indicator to supply to RT/C station(s) and/or the telemetry ship(s) via the FM/FM telemetry/data relative to satellite attitude during programmed attitude changes.

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