

AIR FORCE ROCKET ENGINE SUMMARY

5,000,000 POUNDS THRUST STUDY
1,500,000 POUNDS THRUST

FEASIBILITY & DESIGN
STUDIES COMPLETED

NAVAHO

300,000 to 400,000 POUNDS THRUST

ATLAS BOOSTER

TITAN BOOSTER

NAVAHO

THOR, JUPITER, PIONEER & JUNO BOOSTER

HI ENERGY

TITAN SUSTAINER

ATLAS SUSTAINER

HUSTLER

RASCAL

SENTRY

ARPA UPPER STAGE

EARLY THOR & JUPITER

BOMARC

F84 & F86

NAVAHO

REDSTONE & EXPLORER

B-47

XF-91

56,000 POUNDS THRUST

60,000 POUNDS THRUST

FIRST TURBINE-FED ENGINE

ATO

AZO

X-1

X-2

1942

44

46

48

1950

52

54

56

58

1960

9

04692398

7-17-66

31 May 1991

THRUST

12

FDAT item for inclusion - Feb 1960
in C.I.S. A. Possibilities in Congressional hearing
1 Dec 1959

STATUS OF ADVANCED RECONNAISSANCE SYSTEM

1. PROBLEM. What is the status of the Advanced Reconnaissance System?

2. POSITION. The W-117L has been separated into three separate programs: SMCS, HEAS and DISCOVERER. The SMCS program is being developed to provide SAC with a satellite reconnaissance system by both photo and direct techniques. HEAS is being designed to provide SMCS with an advanced sensitive satellite warning system for the detection, at the earliest time possible, of enemy HEAS. DISCOVERER will provide the previous two systems with engineering information necessary to insure the reliability required. In addition, DISCOVERER specimens will be tested for the purpose of determining data for SMCS's future role in space. On 10 September 1959 the Secretary of Defense directed the Air Force to be responsible for operation of the SMCS and HEAS systems. By direction of the Deputy Secretary of Defense SMCS, HEAS and DISCOVERER were returned to the Air Force effective 17 November 1959. The Advanced Reconnaissance Projects Agency had been changed with the responsibility for development of these programs since February 1958. Development, SMCS and DISCOVERER plans are being prepared for submission to the Department of Defense for approval by 15 January 1960.

3. REQUIREMENTS. During the past year the SMCS program has undergone major modifications. In December 1959 the program was restructured by AFSA to include the following:

- a. Consolidation of the 4" missile based system.
- b. Acquisition of the 16" missile system.
- c. Integration of the capability to recover both a new mapping and charting system and a new high resolution photo reconnaissance system.

In May of 1959 the Air Force was directed to cancel the mapping and charting development effort which had been initiated. In June 1959 the Air Force was directed, because of AFSA cost limitations, to consider replacing the high resolution reconnaissance recovery system. By direction of the Deputy Secretary of Defense of 17 November 1959 the Air Force was directed to again structure the SMCS program to provide capability of the recovery system. The development plan reflecting the latest changes to the program is to be reviewed by Air Force Headquarters on or about 15 December 1959. The presently approved development plan dated 20 January 1959 includes an Advanced Reconnaissance program. The initial SMCS-based SMCS satellite which will have components of both the SMCS and HEAS systems as required is scheduled for firing from the Pacific Missile Range in June 1960.

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The MIDAS system has been approved in principle but is undergoing a thorough analysis to be certain that the total reliability is sufficient to guarantee the economical feasibility of this infrared warning system. In accordance with this spirit and by direction of the Deputy Secretary of Defense a development plan is being prepared for this system which will be submitted to Air Force Headquarters for review about 15 December 1959. The initial launch of the MIDAS satellite will be accomplished in February 1960 from the Atlantic Missile Range. Two months later another firing will be made from the same location. After this, test operations will be shifted to the Pacific Missile Range to accomplish Polar orbital tests. It is hoped that after the first two launches from the AMR some degree of confidence in system reliability will have been shown which will permit this program to be developed concurrently with the operational buy program. As of now, there exists no approval of the operational program.

The first firing in the DISCOVERER program was conducted from Vandenberg Air Force Base in February 1959. Since then a total of eight DISCOVERER satellites have been launched from there. In general a high degree of success has been achieved and our general knowledge regarding launching and control of satellites has been vastly improved. Factors inherent within the program have prevented the Air Force from achieving the final result: the recovery of the satellite capsule from orbit in the general area of Hawaii. Since the last firing, 20 November 1959, the test program has been stopped until a thorough analysis of all components and subsystems of the satellite and their location has been made to insure a higher probability of successful recovery.

4. ~~DISCOVERER PROGRAM AIR FORCE HEADQUARTERS.~~
Discon.
5. ~~DISCOVERER.~~ Major D. S. Floyd, Office, Director of Advanced Technology, AFSA.
6. ~~DISCOVERER AND THE OTHER LAUNCHES.~~ Brigadier General E. A. Dunbar, Director of Advanced Technology.
7. ~~DISCOVERER PROGRAM TO GET THE OTHER INFORMATION.~~ Major D. S. Floyd, Office, Director of Advanced Technology.

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SECRETARY OF DEFENSE

Immediate Air Force Administration Program

1. Closely related to the Air Force TMSM program are the development projects to provide an emergency TMSM and the Advanced Reconnaissance System (Recoverable Photographic Capsule) W-117L. There are four additional projects, all of which use TMSM as a booster, which the Air Force desires to initiate immediately. Eleven TMSM boosters, which are part of our present TMSM development program, can be used for these projects from Calendar 1954 and on.

2. Four projects are:

Television Satellite. A small television camera to be carried in a satellite to provide global coverage for military, commercial and scientific purposes. The satellite is combined with the TMSM engine to boost the satellite to orbit. This combination would be virtually identical to that required for the Recoverable Photographic Capsule W-117L already underway. First flight of this combination made in September 1954.

Recoverable Satellite. This system could carry a camera system all around the world by decelerating the satellite to re-enter the atmosphere. The satellite is combined with a TMSM engine to boost the satellite to orbit. First flight can be made in 1954.

Scientific Satellite. The use of TMSM and the TMSM engine will enable the Air Force to launch a three-ton scientific satellite by October 1954.

Space Launch. As previously recommended, the Air Force has launched a space rocket under the TMSM program with an experimental payload by October 1954. In addition to the scientific data that will be obtained from such a launch the United States would gain a major inter-continental ballistic missile in launching its missiles to the Soviet Union.

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3. Regarding items 2a and d above, the Air Force can undertake their accomplishment or participate in such projects as may be deemed appropriate.

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ADVANCED RESEARCH AGENCY

28 May 1954

THE AIR FORCE

THE AIR FORCE

by the early planning
but both political and
the Air Force is
the technical possibilities
by technical means, and
might have of the

of such acceleration
it should be assumed
it will be in addition

the program is similar
to the program being
to suggest a program

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AFSA ORDER SUMMARY (NUMERICAL) (continued)

<u>AFSA ORDER NUMBER</u>	<u>DATE</u>	<u>AFSC PROJECT OFFICE</u>	<u>ASSIGNED TO</u>	<u>AMOUNT \$</u>	<u>FOR</u>
24-59-1	30 Oct 58	RBR	WADC (How Chan)	\$ 2,094,000	Solid Propellants Research ↓ Meteorological Applications of Satellite Data
24-59-2	11 Dec 58		CNR (VarTomas; Stanford Tech Inst; Aerojet-2; U of Calif; Mat Res Corp)		
24-59-3	14 Jan 59		CNR (US Bur of Mines)		
26-59	29 Sep 58	RBR	CRC	1,151,000	
27-59	27 Sep 58	RDE	RADC (Columbia U)	1,328,500	ORDIR (224A)
29-59	30 Sep 58	RDE	RADC (Bendix)	2,144,297	ESAR (224A)
30-59	9 Oct 58	RDE	CRC-WADC (RCA)	3,435,000	Optical Missile Test Range Instrumentation (224A)
31-59	9 Oct 58	RDE	CRC (Stanford Tech Inst.)	570,000	Ship ACANIA (224A)
37-59	6 Nov 58	RDE	HqAADC (Convair)	1,374,500	R&D Systems Studies (224A)
38-59	5 Nov 58	AFEMD	AFEMD (Lockheed)	750,000	Subsystem "G" (224A)
41-59	17 Nov 58	AFEMD	AFEMD	9,827,000	Pt. Arguello Launch Complex
42-59	26 Nov 58	RDE	CRC	0	Geophysics Work for 224A
				(Est 1,445,000)	
46-59	15 Dec 58	RDE	RADC (Convair)	200,000	Radar Discrimination Program (224A)
				(Est 550,000) additional	
48-59	16 Dec 58	AFEMD	AFEMD	0	DISCOVERER-THOR
50-59	19 Dec 58	RDE	CRC	299,000	
				(Est 1,000,000 addit'l)	Space Track Interim System
54-59	20 Jan 59	AFEMD	AFEMD	1,000,000	Communications Satellite
56-59	19 Jan 59	RBR	RADC (Lincoln Labs)	0	Advanced Radar Techniques
				(Est 500,000)	
58-59	22 Jan 59	RDE	WADC	0	Precision IR Tracking Unit
				(Est 1,500,000)	

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AREA ORDER SUMMARY (BY AREA PROGRAM AREA)

MISSILE DEFENSE

6-58-1	\$ 460,000	Studies on Satellite Interceptor
6-58-5	955,000	Molecular Interactions(224A)
6-58-6	500,000	Decoy Discrimination(224A)
6-58-7	660,000	Precision IR (Optical) Tracking (224A)
27-59	1,328,500	ORDIR (224A)
29-59	2,144,297	ESAR(224A)
30-59	3,435,000	Optical Missile Test
31-59	570,000	Ship ACANIA(224A)
37-59	1,374,500	BMD System Studies (224A)
38-59	750,000	Subsystem "G" (224A)
42-59	1,445,000	Geophysics Work for 224A
46-59	750,000	Radar Discrimination Program(224A)
58-59	1,500,000	Precision IR Tracking Unit
TOTAL	\$ 15,872,297	

PROPELLANT CHEMISTRY

24-59	\$ 2,094,000	Solid Propellants
6-58-8	380,000	Three Advanced Propulsion Studies
TOTAL	\$ 2,474,000	

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ARPA ORDER SUMMARY (BY ARPA PROGRAM AREA)

MILITARY SPACE TECHNOLOGY

Lunar Probes (2-58)	7,600,000	(Transferred to NASA)
SENTRY (9-58)	148,200,000	
Facilities (41-59)	9,827,000	Pt. Arguello Launch Complex
DISCOVERER (48-59)	(Undefined portion) Financial Breakout being prepared of SENTRY \$)	
Boosters (17-59)	5,090,000	10 THOR - 2 ATLAS
Cloud Cover Satellite		Navy Payload
Navigation Satellite		Navy Payload $\frac{1}{2}$
Others to be defined		
Communications Satellite (54-59)	1,000,000	Army Payload
Tracking & Data Reduction		
Interim Space Surveillance Center (50-59)	299,000	
Multi-Satellite Data Reduction Study (6-58, Task No. 9)	197,992	
SCORE (18-59)	699,000	
Research Studies and Exploratory Investigations		
Lincoln Lab-Re-Entry Physics (13-59)	4,516,000	
Advanced Radar Techniques (56-59)	500,000	
Nuclear Bomb Propelled Vehicle (6-58-3)	999,750	
Meteorological Application of Satellite Data (26-59)	1,151,000	
Nuclear & Hi-Altitude Effects (other than those applying to AICEM) Studies		
ARGUS (4-58)	2,565,126	
Study on Effect of Space Weapons on Electronic Systems (6-58-2)	578,542	
Quick Key - Information Center for Hi-Alt Effects (11-59)	144,000	
HEF Upper Stage (19-59)	16,000,000	

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NASA ORDER SUMMARY (NUMERICAL)

<u>NASA ORDER NUMBER</u>	<u>DATE</u>	<u>AEDC PROJECT OFFICE</u>	<u>ASSIGNED TO</u>	<u>AMOUNT</u>	<u>FOR</u>
HS-2	9 Oct 58	AFEND	AFEND	1,997,000	Continues AFMA 2-58
HS-5	23 Oct 58	AFEND	AFEND	8,958,000	Venus Probes
HS-6	23 Oct 58	AFEND	AFEND	7,120,000	Earth Satellites
HS-13	4 Nov 58	RDR	WABC (Rocketdyne)	426,000	Rocketdyne Engine Contract
HS-24	25 Nov 58	AFEND	AFEND	1,000,000	Atlas Booster
HS-36	9 Dec 58	AFEND	AFEND	6,000,000	9 Atlas Boosters

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ARPA ORDER SUMMARY (MEMORIAL)

<u>ARPA ORDER NUMBER</u>	<u>DATE</u>	<u>ARDC PROJECT OFFICE</u>	<u>ASSIGNED TO</u>	<u>AMOUNT</u>	<u>FOR</u>
2-58	27 Mar 58	AFBMD	AFBMD	\$ 7,600,000	Lunar Probes
4-58 (Indirect)	28 Apr 58	RDR	AFBWC(Lincoln Labs)	2,565,126	ARGUS
6-58-1	16 Jan 58	RDC	HqARDC(RCA-Convair)	460,000	Studies on Satellite Interceptor
6-58-2	19 Jun 58	RDR	CRC(G.E.)	578,542	Study on Effect of Space Weapons on Electronic Sys
6-58-3	25 Jun 58	RDR	AFBWC(Gen Atomics)	999,750	Study Nuclear Bomb-Propelled Vehicle
6-58-5	4 Nov 58	RDC	AFBWC	0	Molecular Interactions (224A)
6-58-6	10 Dec 58	RDC	AFBWC	(Est 955,000)	Decoy Discrimination (224A)
6-58-7	9 Jan 59	RDC	HqARDC(Lockheed)	(Est 500,000)	Precision IR(Optical) Tracking (224A)
6-58-8	21 Jan 59	RDR	OSR(Aerojet) (BNI) (Giannini)	(Est 60,000 600,000 addt'l)	Three Advanced Propulsion Studies
6-58-9	27 Jan 59	RDC	OSR (Rand)	380,000	Multi-Satellite Data Processing Study
9-58	30 Jun 58	AFBMD	AFBMD(Lockheed & others)	(Est 197,992)	SENVRY
11-59	4 Aug 58	RDR	OSR (Rand)	148,200,000	Information Center for Hi-Alt Effects
13-59	13 Aug 58	RDR	CRC(Lincoln Labs)	144,000	Lincoln Lab Re-entry Physics
17-59	4 Sep 58	AFBMD	AFBMD	4,516,000	10 THOR - 2 ATLAS Vehicles
18-59	27 Aug 58	AFBMD	AFBMD	5,090,000	SCORE
19-59	29 Aug 58	RDC	HqARDC(Pratt-W;Convair)	699,000	HEF Upper Stage
				16,000,000	

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COPY

February 14, 1958

MEMORANDUM FOR THE SECRETARY OF DEFENSE

SUBJECT: THOR and WS-117L Program

1. Closely related to Air Force THOR and WS-117L programs are five projects, all of which, I believe, should be undertaken promptly by the Air Force. THOR boosters can be made available for these projects from 1958 authorized production without adversely affecting the IRBM program.

2. The projects are as follows:

a. THOR ICBM - An existing project to test advance ICBM nose cones is based on using THOR and a VANGUARD second stage. This combination will also provide a two-stage missile carrying a 300 lb. warhead with a range of over 5,000 miles. This missile could be provided for inventory relatively cheaply and at a cost of about \$20 million more than the cost of a THOR squadron. No firm recommendation as to program on the THOR ICBM is made at this time, but it is believed operational missiles could be secured at a very early date to supplement ICBM capability, if desired.

b. Television Satellite. A small television transmitter can be installed in a satellite to provide global weather for military, commercial and scientific purposes. The THOR would be combined with the HUSTLER engine to boost the satellite to orbit. I am advised the first flight of this system can be made in September 1958.

c. Recoverable Satellite. This system could carry a variety of payloads all capable of recovery by decelerating devices. The THOR would be combined with a VANGUARD second stage to boost the satellite to orbit. Present indications are that the first flight can be made in July 1958.

d. Scientific Satellite. The use of THOR and the HUSTLER engine would enable the Air Force to launch a 300 lb. scientific satellite by October 1958.

e. Moon Impact. As previously recommended, the Air Force can launch a moon rocket using the THOR, VANGUARD 2 and VANGUARD 3 with an appropriate payload by October 1958. In addition to the scientific data that can be obtained from such a flight, the United States could make a major international psychological gain by beating the Russians to the Moon. I urge that this Air Force approach be utilized.

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C O P Y

Memo for Secy of Defense, Subj: INOE and WS-117L Program(U)

3. Regarding items 2d and e above, the Air Force can undertake their accomplishment or participate in such projects as may be deemed appropriate. I believe the dates used above should be regarded as targets and are necessarily subject to adjustment as programs proceed.

(Signed) JAMES H. DOUGLAS
Secretary of the Air Force

APPROVED (Within Air Force Resources for 1958):

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DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE
WASHINGTON 25, D. C.

FEB 27 1958

MEMORANDUM FOR VICE CHIEF OF STAFF

SUBJECT: (Unclassified) Accelerated Air Force Space Program

1. Per your request, this memorandum is submitted as actions the Air Force is taking and can take to accelerate our space program within our own means.

2. We understand that you are specifically interested in the present status and anything else that could be done (within Air Force approval authority) to accelerate the following three projects:

a. Moon Shoot - Work being done on the Thor-boosted 5,500-mile re-entry test vehicle is applicable in part to the Moon Shoot project. That project is progressing at a satisfactory rate. However, an actual Moon Shoot cannot be done without letting contracts to industry, and OSD approval must first be obtained. There is nothing more within Air Force authority we can do to accelerate this program.

b. Manned Satellite - In this general category are included such projects as the X-15B, AVCO, Martin and Convair Proposals, DYNA-SOAR, etc. Whichever ones we choose involve the letting of contracts with industry. We can go no further without OSD approval.

c. Recoverable Photo Capsule - This program is the first operational device of WS-117L. It is progressing as rapidly as possible, and we anticipate that first flight can be made in October 1958. No additional funds in FY 1958 are needed.

3. There are other projects associated with space flight that the Air Force is presently conducting that might be of interest to you. A summary of these activities follows:

a. The One Million Pound Thrust Engine - This project was started in 1955. The feasibility studies and preliminary design work was completed and advanced design competition was initiated in 1957. Proposals from five contractors are being evaluated and will be completed in early March. Approximately two months will elapse before a contract is written. The funds needed to continue this program at the rate desired are \$3.55 million in 1958 and an additional \$8 million in 1959. OSD approval has not been obtained; however, Mr. Horner has stated that such approval was not necessary (Published OSD Directives indicate it is).

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