National Aeronautics and Space Administration

BUDGET ESTIMATES

FISCAL YEAR 1967

Volume I

SUMMARY DATA

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1967 ESTIMATES

SUMMARY DATA

TABLE OF CONTENTS

VOLUME I

Page No.

Special Analyses

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1967 ESTIMATES

GENERAL STATEMENT

The National Aeronautics and Space Administration was established on October 1, 1958, pursuant to The National Aeronautics and Space Act of 1958, approved on July 29, 1958. The Act states that the policy and purpose of the United States activities in space will be: to conduct space and aeronautical activities for peaceful purposes for the benefit of all mankind. These activities should contribute materially to: the expansion of human knowledge in the atmosphere and space; the improvement and usefulness of aeronautical and space vehicles; the development and operation of space vehicles; the establishment of long range studies; the preservation of United States leadership in aeronautics and space technology and utilization; the dissemination of pertinent information gained in the program to civil and military agencies; the cooperation with other nations in aeronautics and space activity pursuant to peaceful interests; and the effective utilization of scientific and engineering talents and facilities of the nation.

A total of $5,012,000,000 is requested to maintain effort in current programs at a level deemed important to the maintenance of the United States world position in space and aeronautics.

The industrial community, under contracts with the NASA, will continue to carry forward the prime design, development and fabrication effort of the NASA program. Specific elements of the activity will continue to be pursued within NASA installations, other government agencies, universities and research contractors which have the necessary level of expertise in special areas of engineering and science. The major elements of the program fall within the following categories:

MANNED SPACE FLIGHT: The attainment of a capability for manned space operations and exploration through the Gemini and Apollo development efforts, and studies of advanced missions which would exploit and extend this capability to the best national interest.

SPACE SCIENCE: An unmanned space flight program directed toward the study of the earth, moon, sun, planets, stars and interplanetary space through the use of sounding rockets, earth orbiting spacecraft, lunar spacecraft and interplanetary probes.

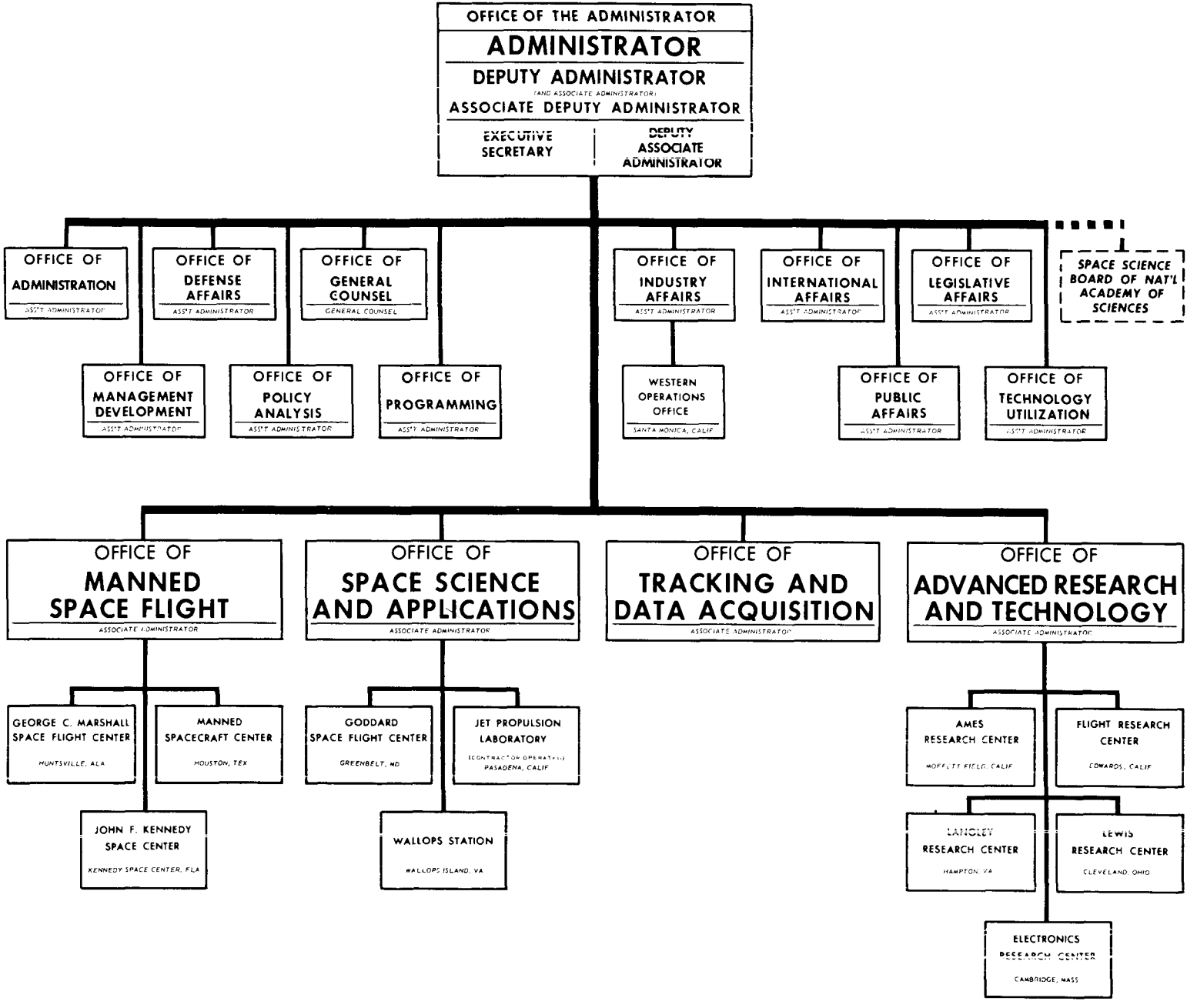
APPLICATIONS: A program directed toward adapting spacecraft, instrumentation and data gathering technology to support beneficial space applications such as operational meteorological and communications systems.

ADVANCED RESEARCH AND TECHNOLOGY: An effort required to provide the fundamental knowledge and the technological base for the future aeronautics and space programs.

Detailed justification of the FY 1967 budget estimate for the total program of $5,012,000,000 is provided in the following three volumes:

Volume		Amount
II	Research and Development	$4,246,600,000
III	Construction of Facilities	101,500,000
IV	Administrative Operations	663,900,000
	TOTAL	$5,012,000,000

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION



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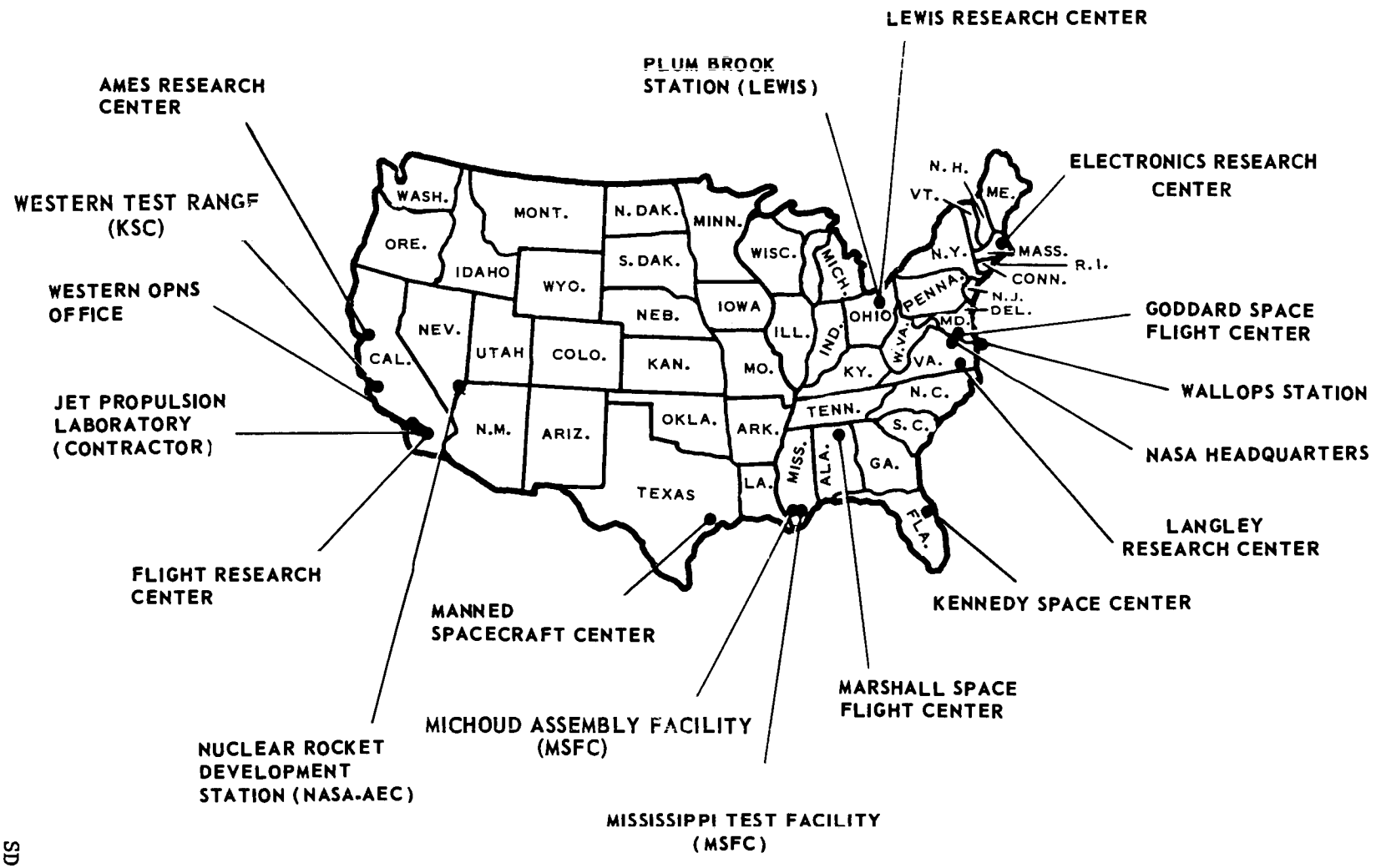
NASA INSTALLATIONS



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Note: no line for Space Med, 1964—

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1967 ESTIMATES

SUMMARY OF RESEARCH AND DEVELOPMENT BUDGET PLAN BY BUDGET ACTIVITY AND RELATED FINANCING

	Fiscal Year 1965	Fiscal Year 1966	Fiscal Year 1967
Budget Activity:			
1. Manned Space Flight:			
(a) Gemini.....	$308,400,000	$226,611,000	$40,600,000
(b) Apollo.....	2,614,619,000	2,967,385,000	2,974,200,000
(c) Advanced mission studies.....	26,000,000	10,000,000	8,000,000
2. Scientific Investigations in Space:			
(a) Physics and astronomy.....	176,029,000	189,132,000	167,300,000
(b) Lunar and planetary exploration....	267,442,000	326,523,000	260,800,000
(c) Bioscience.....	31,001,000	46,200,000	39,900,000
(d) Launch vehicle development....	138,191,000	90,300,000	61,700,000
3. Space Applications.....	70,467,000	83,682,000	88,100,000
4. Space Technology.....	299,320,000	248,500,000	247,900,000
5. Aircraft Technology....	35,240,000	41,496,000	33,000,000
6. Supporting Activities:			
(a) Tracking and data acquisition....	253,236,000	231,065,000	279,300,000
(b) Sustaining university program.....	46,000,000	46,000,000	41,000,000
(c) Technology utilization....	4,750,000	4,750,000	4,800,000
Total Budget Plan....	$4,270,695,000	$4,511,644,000	$4,246,600,000

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1967 ESTIMATES

SUMMARY OF RESEARCH AND DEVELOPMENT BUDGET PLAN BY BUDGET ACTIVITY AND RELATED FINANCING

	Fiscal Year 1965	Fiscal Year 1966	Fiscal Year 1967
Financing:			
Appropriation	$4,363,594,000	$4,531,000,000	$4,246,600,000
Transferred to-			
"Construction of facilities" (78 Stat. 658)	-3,545,000	---	---
"Administrative operations" (79 Stat. 534)	---	-27,896,000	---
Appropriation (adjusted)	4,360,049,000	4,503,104,000	4,246,600,000
Transferred to "Construction of facilities" in FY 1966	-354,000	---	---
Prior year funding applied - available from adjustments to FY 1962 and prior budget plans	2,263,000	---	---
Reprogramming to (-) or from prior year budget plans	-76,690,000	8,540,000	---
Comparative transfer to "Administrative Operations"	-14,573,000	---	---
Total financing of the budget plan	$4,270,695,000	$4,511,644,000	$4,246,600,000

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1967 ESTIMATES

SUMMARY OF RESEARCH AND DEVELOPMENT BUDGET PLAN BY PROGRAM BY COGNIZANT OFFICE

BUDGET ACTIVITY	OFFICE/PROGRAM	Fiscal Year 1965	Fiscal Year 1966	Fiscal Year 1967
	MANNED SPACE FLIGHT.....	$2,949,019,000	$3,203,996,000	$3,022,800,000
1a	Gemini.....	308,400,000	226,611,000	40,600,000
1b	Apollo.....	2,614,619,000	2,967,385,000	2,974,200,000
1c	Advanced missions.....	26,000,000	10,000,000	8,000,000
	SPACE SCIENCE AND APPLICATIONS.....	$732,362,000	$783,237,000	$661,400,000
2a	Physics and astronomy...	139,082,000	143,500,000	131,400,000
2b	Lunar and planetary exploration.....	206,027,000	251,337,000	197,900,000
6b	Sustaining university program.....	46,000,000	46,000,000	41,000,000
2d	Launch vehicle development.....	96,500,000	55,300,000	33,700,000
*	Launch vehicle procurement.....	154,487,000	178,700,000	152,000,000
2c	Bioscience.....	28,501,000	36,700,000	35,400,000
3	Meteorological satellites.....	30,991,000	38,900,000	43,600,000
3	Communication and applications technology satellites.	30,774,000	32,800,000	26,400,000
	ADVANCED RESEARCH AND TECHNOLOGY.....	$331,328,000	$288,596,000	$278,300,000
4	Basic research.....	21,231,000	22,000,000	23,000,000
4	Space vehicle systems...	44,193,000	35,000,000	36,000,000
4	Electronics systems.....	25,622,000	32,300,000	36,800,000
4	Human factor systems....	13,320,000	14,900,000	17,000,000
4	Space power and electric propulsion systems....	58,220,000	45,200,000	42,500,000
4	Nuclear rockets.....	57,000,000	58,000,000	53,000,000
4	Chemical propulsion.....	76,502,000	39,700,000	37,000,000
5	Aeronautics.....	35,240,000	41,496,000	33,000,000
6a	TRACKING AND DATA ACQUISITION.....	$253,236,000	$231,065,000	$279,300,000

BUDGET ACTIVITY	OFFICE/PROGRAM	Fiscal Year 1965	Fiscal Year 1966	Fiscal Year 1967
6c	TECHNOLOGY UTILIZATION...	$4,750,000	$4,750,000	$4,800,000
	TOTAL BUDGET PLAN.....	$4,270,695,000	$4,511,644,000	$4,246,600,000

*Funds for the procurement of launch vehicles are statistically distributed to unmanned flight programs (e.g. Physics and Astronomy, Space Vehicle Systems).

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1967 ESTIMATES

DISTRIBUTION OF RESEARCH AND DEVELOPMENT BUDGET PLAN BY INSTALLATION AND FISCAL YEAR

(In thousands of dollars)

PROGRAM OFFICE	TOTAL	J. F. KENNEDY SPACE CENTER, NASA	MANNED SPACECRAFT CENTER	MARSHALL SPACE FLIGHT CENTER	GODDARD SPACE FLIGHT CENTER	PACIFIC LAUNCH OPERATIONS OFFICE	WALLOPS STATION	AMES RESEARCH CENTER	ELECTRONICS RESEARCH CENTER	FLIGHT RESEARCH CENTER	LANGLEY RESEARCH CENTER	LEWIS RESEARCH CENTER	SPACE NUCLEAR PROPULSION OFFICE	HEADQUARTERS	WESTERN OPERATIONS OFFICE
Office of Manned Space Flight															
1965	2,949,019	56,110	1,418,648	1,435,989	389	-	-	39	-	-	2,400	1,160	-	33,367	917
1966	3,203,996	121,109	1,479,182	1,574,635	425	-	-	230	-	-	700	-	-	25,215	2,500
1967	3,022,800	164,505	1,363,400	1,466,295	500	-	-	250	-	-	-	-	-	25,350	2,500
Office of Space Science and Applications															
1965	732,362	2,674	2,608	1,462	186,868	99	1,150	34,683	275	10	67,388	199,083	-	107,230	128,832
1966	783,237	3,327	14,400	10,607	195,404	-	2,830	37,948	650	5	68,217	179,843	-	106,597	163,409
1967	661,400	4,019	15,200	495	189,193	-	3,640	31,463	750	15	35,960	147,371	-	93,146	140,148
Office of Advanced Research and Technology															
1965	331,328	-	1,512	28,911	8,517	-	-	19,391	2,333	7,638	34,953	122,084	45,760	31,648	28,581
1966	288,596	250	2,355	17,264	9,678	-	-	18,775	6,554	14,919	40,749	69,431	50,218	37,765	20,638
1967	278,300	250	3,370	17,496	9,701	-	-	21,455	12,400	7,925	41,127	61,603	48,500	31,833	22,640
Office of Tracking and Data Acquisition															
1965	253,236	-	-	2,000	179,252	-	5,100	-	-	1,900	2,200	-	-	7,015	55,769
1966	231,065	-	-	1,500	155,950	-	5,835	-	-	1,880	2,000	-	-	10,400	53,500
1967	279,300	-	-	1,500	199,600	-	6,400	-	-	2,100	2,100	-	-	12,000	55,600
Office of Technology Utilization and Policy Planning															
1965	4,750	-	-	-	-	-	-	-	-	-	-	-	-	4,750	-
1966	4,750	-	-	-	-	-	-	-	-	-	-	-	-	4,750	-
1967	4,800	-	-	-	-	-	-	-	-	-	-	-	-	4,800	-
Total Budget Plan															
1965	4,270,695	58,784	1,422,768	1,468,362	375,026	99	6,250	54,113	2,608	9,548	106,941	322,327	45,760	184,010	214,099
1966	4,511,644	124,686	1,495,937	1,604,006	361,457	-	8,665	56,953	7,204	16,804	111,666	249,274	50,218	184,727	240,047
1967	4,246,600	168,774	1,381,970	1,485,786	398,994	-	10,040	53,168	13,150	10,040	79,187	208,974	48,500	167,129	220,888

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1967 ESTIMATES

DISTRIBUTION OF RESEARCH AND DEVELOPMENT BUDGET PLAN BY INSTALLATION AND FISCAL YEAR

(In thousands of dollars)

PROGRAM		TOTAL	J. F. KENNEDY SPACE CENTER, NASA	MANNED SPACECRAFT CENTER	MARSHALL SPACE FLIGHT CENTER	GODDARD SPACE FLIGHT CENTER	PACIFIC LAUNCH OPERATIONS OFFICE	WALLOPS STATION	AMES RESEARCH CENTER	ELECTRONICS RESEARCH CENTER	FLIGHT RESEARCH CENTER	LANGLEY RESEARCH CENTER	LEWIS RESEARCH CENTER	SPACE NUCLEAR PROPULSION OFFICE	HEADQUARTERS	WESTERN OPERATIONS OFFICE[1/]
OFFICE OF MANNED SPACE FLIGHT, TOTAL	1965	2,949,019	56,110	1,418,648	1,435,969	389	-	-	39	-	-	2,400	1,160	-	33,367	917
	1966	3,203,996	121,109	1,479,182	1,574,635	425	-	-	230	-	-	700	-	-	25,215	2,500
	1967	3,022,800	164,505	1,363,400	1,466,295	500	-	-	250	-	-	-	-	-	25,350	2,500
Gemini	1965	308,400	-	308,050	-	-	-	-	-	-	-	-	-	-	350	-
	1966	226,611	-	226,211	-	-	-	-	-	-	-	-	-	-	400	-
	1967	40,600	-	40,300	-	-	-	-	-	-	-	-	-	-	300	-
Apollo	1965	2,614,619	55,610	1,100,973	1,430,516	389	-	-	39	-	-	1,200	1,160	-	24,087	645
	1966	2,967,385	120,509	1,249,371	1,569,135	425	-	-	230	-	-	700	-	-	24,515	2,500
	1967	2,974,200	163,905	1,320,500	1,461,795	500	-	-	250	-	-	-	-	-	24,750	2,500
Advanced mission studies	1965	26,000	500	9,625	5,473	-	-	-	-	-	-	1,200	-	-	8,930	272
	1966	10,000	600	3,600	5,500	-	-	-	-	-	-	-	-	-	300	-
	1967	8,000	600	2,600	4,500	-	-	-	-	-	-	-	-	-	300	-
OFFICE OF SPACE SCIENCE AND APPLICATIONS, TOTAL	1965	732,362	2,674	2,608	1,462	186,868	99	1,150	34,683	275	10	67,388	199,083	-	107,230	128,832
	1966	783,237	3,327	14,400	10,607	195,404	-	2,830	37,948	650	5	68,217	179,843	-	106,597	163,409
	1967	661,400	4,019	15,200	495	189,193	-	3,640	31,463	750	15	35,960	147,371	-	93,146	140,148
Physics and astronomy	1965	139,082	-	-	755	110,244	-	1,090	1,557	-	10	2,226	-	-	22,866	334
	1966	143,500	-	-	62	108,498	-	2,550	2,586	-	5	2,272	-	-	27,075	452
	1967	131,400	-	-	25	100,961	-	3,400	2,563	-	15	1,100	-	-	22,836	500
Lunar and planetary exploration	1965	206,027	-	2,608	435	1,267	-	-	15,734	-	-	50,050	97	-	9,256	126,580
	1966	251,337	-	14,400	375	1,164	-	-	12,763	-	-	53,115	-	-	12,913	156,607
	1967	197,900	-	15,200	300	1,200	-	-	7,000	-	-	23,200	-	-	14,300	136,700
Sustaining university program	1965	46,000	-	-	-	-	-	-	-	-	-	-	11	-	45,986	3
	1966	46,000	-	-	-	-	-	-	-	-	-	-	-	-	46,000	-
	1967	41,000	-	-	-	-	-	-	-	-	-	-	-	-	41,000	-
Launch vehicle development	1965	96,500	1,321	-	152	1,557	-	-	-	100	-	735	91,302	-	1,333	-
	1966	55,300	820	-	10,000	250	-	-	-	200	-	570	42,820	-	640	-
	1967	33,700	700	-	-	-	-	-	-	250	-	600	31,550	-	600	-
Launch vehicle procurement	1965	154,487	1,353	-	-	19,496	99	-	-	-	-	13,737	107,673	-	12,129	-
	1966	178,700	2,507	-	-	18,580	-	-	-	-	-	11,600	137,023	-	5,625	3,365
	1967	152,000	3,319	-	-	22,205	-	-	-	-	-	10,400	115,821	-	-	255
Bioscience	1965	28,501	-	-	-	385	-	60	17,392	-	-	-	-	-	9,145	1,519
	1966	36,700	-	-	-	420	-	100	22,599	-	-	30	-	-	11,214	2,337
	1967	35,400	-	-	-	420	-	100	21,900	-	-	30	-	-	10,450	2,500
Meteorological satellites	1965	30,991	-	-	120	29,505	-	-	-	175	-	425	-	-	766	-
	1966	38,900	-	-	170	35,400	-	180	-	450	-	630	-	-	2,070	-
	1967	43,600	-	-	170	39,300	-	140	-	500	-	630	-	-	2,860	-
Communication and applications technology satellites	1965	30,774	-	-	-	24,414	-	-	-	-	-	215	-	-	5,749	396
	1966	32,800	-	-	-	31,092	-	-	-	-	-	-	-	-	1,060	648
	1967	26,400	-	-	-	25,107	-	-	-	-	-	-	-	-	1,100	193

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1967 ESTIMATES

DISTRIBUTION OF RESEARCH AND DEVELOPMENT BUDGET PLAN BY INSTALLATION AND FISCAL YEAR

(In thousands of dollars)

PROGRAM		TOTAL	J. K. KENNEDY SPACE CENTER, NASA	MANNED SPACECRAFT CENTER	MARSHALL SPACE FLIGHT CENTER	GODDARD SPACE FLIGHT CENTER	PACIFIC LAUNCH OPERATIONS OFFICE	WALLOPS STATION	AMES RESEARCH CENTER	ELECTRONICS RESEARCH CENTER	FLIGHT RESEARCH CENTER	LANGLEY RESEARCH CENTER	LEWIS RESEARCH CENTER	SPACE NUCLEAR PROPULSION OFFICE	HEADQUARTERS	WESTERN OPERATIONS OFFICE[1/]
OFFICE OF ADVANCED RESEARCH AND TECHNOLOGY, TOTAL	1965	331,328	-	1,512	28,911	8,517	-	-	19,391	2,333	7,638	34,953	122,084	45,760	31,648	28,581
	1966	288,596	250	2,355	17,264	9,678	-	-	18,775	6,554	14,919	40,749	69,431	50,218	37,765	20,638
	1967	278,300	250	3,370	17,496	9,701	-	-	21,455	12,400	7,925	41,127	61,603	48,500	31,833	22,640
Basic research	1965	21,231	-	-	916	257	-	-	1,966	95	3	1,901	2,234	-	7,503	6,356
	1966	22,000	-	-	815	117	-	-	1,910	595	30	2,119	2,731	-	8,627	5,056
	1967	23,000	-	-	850	120	-	-	2,100	1,000	30	2,200	2,800	-	8,500	5,400
Space vehicle systems	1965	44,193	-	629	16,444	1,231	-	-	3,354	-	1,825	10,594	2,408	-	3,474	4,234
	1966	35,000	-	435	4,201	1,751	-	-	3,076	250	1,010	11,466	3,087	-	6,006	3,718
	1967	36,000	-	670	3,096	2,081	-	-	3,475	250	1,010	14,282	3,223	-	3,713	4,200
Electronics systems	1965	25,622	-	465	3,685	2,967	-	-	3,480	2,178	1,038	6,660	400	-	2,022	2,727
	1966	32,300	-	525	4,003	2,975	-	-	3,718	5,110	698	7,260	539	-	3,906	3,566
	1967	36,800	-	450	4,200	2,960	-	-	4,100	10,000	660	7,420	540	-	3,180	3,290
Human factor systems	1965	13,320	-	365	355	-	-	-	4,233	60	1,750	4,053	232	-	2,172	100
	1966	14,900	-	795	310	25	-	-	5,224	359	1,500	4,246	125	-	2,216	100
	1967	17,000	-	1,100	300	-	-	-	5,830	700	1,250	5,000	-	-	2,820	-
Space power and electric propulsion systems	1965	58,220	-	53	2,415	3,512	-	-	191	-	-	1,324	43,517	-	1,351	5,857
	1966	45,200	-	100	2,010	4,260	-	-	110	50	-	846	28,768	-	4,565	4,491
	1967	42,500	-	650	1,650	3,990	-	-	50	300	-	700	26,065	-	3,045	6,050
Nuclear rockets	1965	57,000	-	-	1,375	-	-	-	-	-	-	-	9,846	45,760	13	6
	1966	58,000	-	-	1,125	-	-	-	-	-	-	-	6,599	50,218	58	-
	1967	53,000	-	-	900	-	-	-	-	-	-	-	3,550	48,500	50	-
Chemical propulsion	1965	76,502	-	-	3,721	550	-	-	-	-	-	1,369	49,588	-	11,973	9,301
	1966	39,700	250	500	4,800	550	-	-	540	-	-	2,877	15,205	-	11,271	3,707
	1967	37,000	250	500	6,500	550	-	-	500	-	-	2,900	12,800	-	9,300	3,700
Aeronautics	1965	35,240	-	-	-	-	-	-	6,167	-	3,022	9,052	13,859	-	3,140	-
	1966	41,496	-	-	-	-	-	-	4,197	190	11,681	11,935	12,377	-	1,116	-
	1967	33,000	-	-	-	-	-	-	5,400	150	4,975	8,625	12,625	-	1,225	-
OFFICE OF TRACKING AND DATA ACQUISITION	1965	253,236	-	-	2,000	179,252	-	5,100	-	-	1,900	2,200	-	-	7,015	55,769
	1966	231,065	-	-	1,500	155,950	-	5,835	-	-	1,880	2,000	-	-	10,400	53,500
	1967	279,300	-	-	1,500	199,600	-	6,400	-	-	2,100	2,100	-	-	12,000	55,600
Tracking and data acquisition	1965	253,236	-	-	2,000	179,252	-	5,100	-	-	1,900	2,200	-	-	7,015	55,769
	1966	231,065	-	-	1,500	155,950	-	5,835	-	-	1,880	2,000	-	-	10,400	53,500
	1967	279,300	-	-	1,500	199,600	-	6,400	-	-	2,100	2,100	-	-	12,000	55,600
OFFICE OF TECHNOLOGY UTILIZATION AND POLICY PLANNING	1965	4,750	-	-	-	-	-	-	-	-	-	-	-	-	4,750	
	1966	4,750	-	-	-	-	-	-	-	-	-	-	-	-	4,750	-
	1967	4,800	-	-	-	-	-	-	-	-	-	-	-	-	4,800	-
Technology utilization	1965	4,750	-	-	-	-	-	-	-	-	-	-	-	-	4,750	-
	1966	4,750	-	-	-	-	-	-	-	-	-	-	-	-	4,750	-
	1967	4,800	-	-	-	-	-	-	-	-	-	-	-	-	4,800	-
TOTAL BUDGET PLAN	1965	4,270,695	58,784	1,422,768	1,468,362	375,026	99	6,250	54,113	2,608	9,548	106,941	322,327	45,760	184,010	214,099
	1966	4,511,644	124,686	1,495,937	1,604,006	361,457	-	8,665	56,953	7,204	16,804	111,666	249,274	50,218	184,727	240,047
	1967	4,246,600	168,774	1,381,970	1,485,786	398,994	-	10,040	53,168	13,150	10,040	79,187	208,974	48,500	167,129	220,888

1/Amount for Western Operations Office includes funds for the Jet Propulsion Laboratory as shown in the Research and Development program justification (Vol. II)

799-342 (Follows P. Sum 4) No. 3

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1967 ESTIMATES

SUMMARY OF APPROPRIATIONS

(In thousands of dollars)

Appropriation	P.L. 88-507 Fiscal Year 1965	P.L. 89-128 Fiscal Year 1966	Fiscal Year 1967
Research and Development.....	$4,363,594	$4,531,000	$4,246,600
Construction of Facilities.....	262,880	60,000	101,500
Administrative Operations.....	623,526	584,000	663,900
TOTAL.....	$5,250,000	$5,175,000	$5,012,000

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1967 ESTIMATES

SUMMARY OF APPROPRIATIONS (ADJUSTED)

(Thousands of dollars)

	Total	Research and Development	Construction of Facilities	Administrative Operations
FISCAL YEAR 1965				
Independent Offices Appropriation Act, 1965 (78 Stat. 657-8)	$5,250,000	$4,363,594	$262,880	$623,526
NASA Appropriation Transfers (78 Stat. 658)	---	-3,545	3,545	---
Transfer to "Operating expenses, Public Buildings Service," General Services Administration (78 Stat. 655)	-273	---	---	-273
Appropriation (adjusted)	$5,249,727	$4,360,049	$266,426	$623,253
FISCAL YEAR 1966				
Independent Offices Appropriation Act, 1966 (79 Stat. 533-4)	$5,175,000	$4,531,000	$60,000	$584,000
NASA Appropriation Transfers (79 Stat. 534)	---	-27,896	---	27,896
Transfer to "Operating expenses, Public Buildings Service," General Services Administration (79 Stat. 531	-76	---	---	-76
Appropriation (adjusted)	$5,174,924	$4,503,104	$60,000	$611,820
FISCAL YEAR 1967				
Appropriation request	$5,012,000	$4,246,600	$101,500	$663,900

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1967 ESTIMATES

SUMMARY OF BUDGET PLAN BY APPROPRIATION BY BUDGET ACTIVITY

(Thousands of dollars)

Appropriation Title	Total	Manned Space Flight	Scientific Investigations In Space	Space Applications	Space Technology	Aircraft Technology	Supporting Activities
Fiscal Year 1965.....	$5,166,339	$3,452,371	$692,656	$83,187	$498,564	$82,163	$357,398
Research and development..	4,270,695	2,949,019	612,663	70,467	299,320	35,240	303,986
Construction of facilities	261,107	199,770	8,343	---	21,291	3,729	27,974
Administrative operations.	634,537	303,582	71,650	12,720	177,953	43,194	25,438
Fiscal Year 1966.....	$5,183,051	$3,518,408	$727,045	$95,059	$431,433	$87,016	$324,090
Research and development..	4,511,644	3,203,996	652,155	83,682	248,500	41,496	281,815
Construction of facilities	59,587	21,401	7,084	---	13,435	682	16,985
Administrative operations.	611,820	293,011	67,806	11,377	169,498	44,838	25,290
Fiscal Year 1967.....	$5,012,000	$3,387,468	$605,280	$100,643	$450,656	$103,688	$364,265
Research and development..	4,246,600	3,022,800	529,700	88,100	247,900	33,000	325,100
Construction of facilities	101,500	54,378	6,322	---	11,089	21,011	8,700
Administrative operations.	663,900	310,290	69,258	12,543	191,667	49,677	30,465

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1967 ESTIMATES

PERSONNEL SUMMARY AND COSTS

	1965	1966	1967
Personnel Data			
End year employment:			
Permanent positions	33,200	33,924	34,339
Other temporary positions	1,100	600	600
Total positions	34,300	34,524	34,939
NASA funded	34,248	34,466	34,888
Reimbursable	52	58	51
Average number of all employees	32,669	33,290	34,032
Average GS grade	10.3	10.4	10.5
Average GS salary	$10,255	$10,904	$11,134
Average salary, grades established by the Administrator (Wage Board)	$7,190	$7,388	$7,445
Average salary of ungraded positions (Excepted and PL-313)	$22,268	$23,278	$23,278
Personnel compensation:	(In thousands of dollars)		
Net salary, permanent positions	$311,050	$333,672	$355,351
Other positions	3,670	3,573	3,204
Other compensation	18,548	18,898	17,364
Total compensation	$333,268	$356,143	$375,919
NASA funded	332,722	355,511	375,354
Reimbursable	546	632	565
Personnel benefits:			
Retirement	$20,068	$21,411	$22,821
Health benefits	2,109	2,204	2,334
Life insurance	973	1,033	1,102
All other (Incentive awards, uniforms, social security contributions, etc.)	608	698	875
Total benefits	$23,758	$25,346	$27,132
NASA funded	23,713	25,299	27,090
Reimbursable	45	47	42

	1965	1966	1967
Total personnel costs.....	$357,026	$381,489	$403,051
NASA funded.....	356,435	380,810	402,444
Reimbursable.....	591	679	607

MANPOWER REQUIREMENTS

In FY 1967 an additional 450 positions are planned for the Electronics Research Center in accordance with the phased buildup for that installation. Post-flight studies of the early Gemini flights showed a strong relationship between spacecraft hours in flight and manhours in flight and requirements for supporting personnel for launch, mission operations, and tracking. Therefore, as a result of these workload indicators, an allocation of 365 is planned for the Kennedy Space Center and the Goddard Space Flight Center to support the heavy emphasis on launching and tracking of manned space flight missions. These increases are partially offset by a target reduction of 400 positions throughout the agency which will not be filled as they become vacant.

Analysis of Increases in Personnel Costs for Fiscal Year 1967

In FY 1967 the cost of personnel compensation and benefits will be $21.6 million greater than FY 1966. Of this amount $3.8 million is caused by the full year effect of the Federal Employees Salary Act of 1965, effective in October 1965. The most significant increase reflects the cost of providing for a net increase of 846 manyears for permanent personnel. Actual increases include 621 manyears for new FY 1967 positions at the Kennedy Space Center, the Electronics Research Center, and the Goddard Space Flight Center, and an increase of 425 manyears related to the new positions filled during FY 1966. These increases of 1,046 manyears are partially offset by the saving of 200 manyears resulting from not filling 400 vacancies due to the 1965 retirement legislation. The cost of the net additional manyears is estimated at $9.8 million.

Reimbursement to the Department of Defense for military personnel detailed to NASA will increase by $1.1 million in FY 1967 over FY 1966. In FY 1966, 128 trained military personnel, who became available because of the phase out of the Atlas and Titan I missile systems, were detailed to NASA for the support of Gemini and Apollo flight operations. In FY 1966 the Department of Defense paid the entire cost of these personnel. NASA will assume the funding responsibility for these personnel in FY 1967.

In addition to the increased costs resulting from the salary increase, additional manyears, and reimbursement for military personnel, there is an increase of $9.9 million resulting from the structural changes in the personnel complement. The total increase of $24.6 million is offset by a decrease of $.4 million in temporary employment and $2.6 million in overtime and holiday pay, for a net increase of $21.6 million. The net increase for personnel compensation and benefits consists of $19.8 million for compensation and $1.8 million for benefits.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1967 ESTIMATES

COMPUTATION OF PERSONNEL COSTS BY INSTALLATION AND FISCAL YEAR

(In thousands of dollars)

FISCAL YEAR 1965 ACTUAL	Total	J. F. Kennedy Space Center, NASA	Manned Spacecraft Center	Marshall Space Flight Center	Goddard Space Flight Center	Pacific Launch Operations Office	Wallops Station	Ames Research Center	Electronics Research Center	Flight Research Center	Langley Research Center	Lewis Research Center	Space Nuclear Propulsion Office	Headquarters	Western Operations Office
Personnel Compensation:															
Permanent positions	$325,818	$24,069	$41,391	$73,635	$37,965	$204	$3,862	$21,093	$2,593	$5,689	$38,587	$45,017	$1,419	$26,308	$3,985
Pay above the stated annual rate	1,271	92	159	280	146	1	38	80	10	22	148	173	5	101	15
Lapses (deduct)	-16,039	-5,849	-187	-1,283	-2,100	-14	-112	-638	-1,301	-71	-876	-859	-115	-2,464	-170
Net cost of permanent positions	311,050	18,312	41,363	72,632	36,011	191	3,788	20,535	1,302	5,640	37,859	44,331	1,309	23,945	3,830
Other personnel compensation	22,218	1,795	4,713	6,714	2,046	22	649	492	60	465	1,496	2,108	9	1,366	285
Total personnel compensation	$333,268	$20,107	$46,076	$79,346	$38,057	$213	$4,437	$21,027	$1,362	$6,105	$39,355	$46,439	$1,318	$25,311	$4,115
Reimbursable	546	---	---	1	545	---	---	---	---	---	---	---	---	---	---
NASA funded	332,722	20,107	46,076	79,345	37,512	213	4,437	21,027	1,362	6,105	39,355	46,439	1,318	25,311	4,115
Total personnel benefits	$23,758	$1,355	$3,154	$5,528	$2,716	$15	$305	$1,549	$100	$441	$2,880	$3,373	$94	$1,959	$289
Reimbursable	45	---	---	---	45	---	---	---	---	---	---	---	---	---	---
NASA funded	23,713	1,355	3,154	5,528	2,671	15	305	1,549	100	441	2,880	3,373	94	1,959	289
Total personnel costs	$357,026	$21,462	$49,230	$84,874	$40,773	$228	$4,742	$22,576	$1,462	$6,546	$42,235	$49,812	$1,412	$27,270	$4,404
Reimbursable	591	---	---	1	590	---	---	---	---	---	---	---	---	---	---
NASA funded	356,435	21,462	49,230	84,873	40,183	228	4,742	22,576	1,462	6,546	42,235	49,812	1,412	27,270	4,404
FISCAL YEAR 1966 ESTIMATED															
Personnel Compensation:															
Permanent positions	$353,072	$27,808	$50,226	$76,173	$38,559	---	$4,211	$22,299	$5,919	$5,979	$40,491	$47,854	$1,510	$27,849	$4,193
Pay above the stated annual rate	1,355	107	193	293	148	---	16	84	23	23	156	184	5	107	16
Lapses (deduct)	-20,755	-1,909	-5,793	-2,129	-1,408	---	-106	-997	-2,678	-229	-1,148	-1,900	-64	-2,165	-228
Net cost of permanent positions	333,672	26,006	44,626	74,337	37,299	---	4,121	21,386	3,264	5,773	39,499	46,138	1,451	25,791	3,981
Other personnel compensation	22,471	2,540	5,291	5,869	1,788	---	571	549	125	539	1,537	1,855	9	1,490	308
Total personnel compensation	$356,143	$28,546	$49,917	$80,206	$39,087	---	$4,692	$21,935	$3,389	$6,312	$41,036	$47,993	$1,460	$27,281	$4,289
Reimbursable	632	---	---	---	632	---	---	---	---	---	---	---	---	---	---
NASA funded	355,511	28,546	49,917	80,206	38,455	---	4,692	21,935	3,389	6,312	41,036	47,993	1,460	27,281	4,289
Total personnel benefits	$25,346	$1,930	$3,368	$5,558	$2,784	---	$333	$1,584	$262	$453	$2,993	$3,499	$106	$2,167	$309
Reimbursable	47	---	---	---	47	---	---	---	---	---	---	---	---	---	---
NASA funded	25,299	1,930	3,368	5,558	2,737	---	333	1,584	262	453	2,993	3,499	106	2,167	309
Total personnel costs	$381,489	$30,476	$53,285	$85,764	$41,871	---	$5,025	$23,519	$3,651	$6,765	$44,029	$51,492	$1,566	$29,448	$4,598
Reimbursable	679	---	---	---	679	---	---	---	---	---	---	---	---	---	---
NASA funded	380,810	30,476	53,285	85,764	41,192	---	5,025	23,519	3,651	6,765	44,029	51,492	1,566	29,448	4,598
FISCAL YEAR 1967 ESTIMATED															
Personnel Compensation:															
Permanent positions	$364,599	$29,897	$50,790	$76,720	$41,163	---	$4,315	$22,435	$10,604	$6,009	$40,627	$48,371	$1,501	$27,945	$4,221
Pay above the stated annual rate	1,396	108	196	296	158	---	17	86	40	23	156	186	5	107	16
Lapses (deduct)	-10,644	-1,703	-453	-1,747	-1,100	---	-47	-519	-1,835	-24	-133	-1,399	-32	-1,538	-111
Net cost of permanent positions	355,351	28,302	50,533	75,269	40,221	---	4,285	22,002	8,809	6,008	40,650	47,158	1,474	26,514	4,126
Other personnel compensation	20,568	2,475	4,333	5,002	1,907	---	580	570	203	502	1,349	1,906	9	1,432	300
Total personnel compensation	$375,919	$30,777	$54,866	$80,271	$42,128	---	$4,865	$22,572	$9,012	$6,510	$41,999	$49,064	$1,483	$27,946	$4,426
Reimbursable	565	---	---	---	565	---	---	---	---	---	---	---	---	---	---
NASA funded	375,354	30,777	54,866	80,271	41,563	---	4,865	22,572	9,012	6,510	41,999	49,064	1,483	27,946	4,426
Total personnel benefits	$27,132	$2,068	$3,824	$5,660	$3,016	---	$345	$1,629	$687	$481	$3,043	$3,581	$108	$2,373	$317
Reimbursable	42	---	---	---	42	---	---	---	---	---	---	---	---	---	---
NASA funded	27,090	2,068	3,824	5,660	2,974	---	345	1,629	687	481	3,043	3,581	108	2,373	317
Total personnel costs	$403,051	$32,845	$58,690	$85,931	$45,144	---	$5,210	$24,201	$9,699	$6,991	$45,042	$52,645	$1,591	$30,319	$4,743
Reimbursable	607	---	---	---	607	---	---	---	---	---	---	---	---	---	---
NASA funded	402,444	32,845	58,690	85,931	44,537	---	5,210	24,201	9,699	6,991	45,042	52,645	1,591	30,319	4,743

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

PROPOSED APPROPRIATION BILL

RESEARCH AND DEVELOPMENT

For necessary expenses, not otherwise provided for, including research, development, operations, services, minor construction, supplies, materials, equipment; maintenance, repair, and alteration of real and personal property; and purchase, hire, maintenance, and operation of other than administrative aircraft necessary for the conduct and support of aeronautical and space research and development activities of the National Aeronautics and Space Administration, [$4,531,000,000] *$4,246,600,000,* to remain available until expended. *(42 U.S.C. 2451, et seq., 50 U.S.C. 151–160, 511–515; Independent Offices Appropriation Act, 1966; additional authorizing legislation to be proposed.)*

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1967 ESTIMATES

RESEARCH AND DEVELOPMENT

Program and Financing (in thousands of dollars)

	Budget Plan			Costs to this appropriation		
	1965	1966	1967	1965	1966	1967
Program by activities:						
Direct program:						
1. Manned space flight:						
(a) Gemini.....	308,400	226,611	40,600	277,585	249,800	135,200
(b) Apollo.....	2,614,619	2,967,385	2,974,200	2,703,042	3,211,300	3,029,900
(c) Advanced mission studies.....	26,000	10,000	8,000	19,318	25,300	10,100
2. Scientific investigations in space:						
(a) Physics and astronomy..	176,029	189,132	167,300	170,146	199,800	146,700
(b) Lunar and planetary exploration.....	267,442	326,523	260,800	312,026	341,600	257,900
(c) Bioscience.....	31,001	46,200	39,900	34,220	47,600	38,800
(d) Launch vehicle development.....	138,191	90,300	61,700	134,210	115,400	64,700
3. Space applications.....	70,467	83,682	88,100	77,290	101,200	90,700
4. Space technology.....	299,320	248,500	247,900	298,523	264,000	234,500
5. Aircraft technology.....	35,240	41,496	33,000	21,537	35,300	36,900
6. Supporting activities:						
(a) Tracking and data acquisition.....	253,236	231,065	279,300	168,251	267,700	256,600
(b) Sustaining university program.....	46,000	46,000	41,000	8,430	27,900	28,800
(c) Technology utilization.	4,750	4,750	4,800	4,451	5,100	2,700
Total direct program costs, funded.....	4,270,695	4,511,644	4,246,600	4,229,029	4,892,000	4,333,500

Program and Financing (in thousands of dollars) - Continued

	Budget Plan			Costs to this appropriation		
	1965	1966	1967	1965	1966	1967
Reimbursable program:						
1. Manned space flight:						
(a) Gemini	2,082	5,242	.....	1,726	6,889	.....
(b) Apollo	541	475	700	266	548	700
2. Scientific investigations in space:						
(a) Physics and astronomy	190	.....	.....	196	90	.....
(d) Launch vehicle development	3,418	2,000	1,500	150	5,225	1,500
3. Space applications	35,336	40,204	43,500	25,127	83,505	43,500
4. Space technology	40,131	36,000	40,200	39,472	36,255	40,200
5. Aircraft technology	1,065	950	500	.....	1,986	500
6. Supporting activities:						
(a) Tracking and data acquisition	.....	129	100	56	135	100
(b) Sustaining university program	10	.....	.....	.....	10	.....
Total reimbursable program costs	82,773	85,000	86,500	66,993	134,643	86,500
Total program costs, funded	4,353,468	4,596,644	4,333,100	4,296,022	5,026,643	4,420,000
Change in selected resources 1/	.....	.....	.....	124,538	-311,000	-80,500
10 Total	4,353,468	4,596,644	4,333,100	4,420,560	4,715,643	4,339,500

799-467 O - 66 - 3

RESEARCH AND DEVELOPMENT

Program and Financing (in thousands of dollars) - Continued

		Budget Plan			Costs to this appropriation		
		1965	1966	1967	1965	1966	1967
10	Total	4,353,468	4,596,644	4,333,100	4,420,560	4,715,643	4,339,500
	Financing:						
	Receipts and reimbursements from:						
11	Administrative budget accounts	-75,758	-75,835	-74,400	-75,758	-75,835	-74,400
14	Non-Federal sources[2]	-7,015	-9,165	-12,100	-7,015	-9,165	-12,100
16	Comparative transfer to other accounts	14,573	.....	.....	14,573	.....	.....
17	Recovery of prior year obligations	.....	.....	.....	.....	-11,035	.....
21	Unobligated balance available, start of year:						
	For completion of prior year budget plans	.....	.....	.....	-242,033	-226,261	-105,276
	Available to finance new budget plans	-2,263	.....	.....	-2,263	-20,005	.....
23	Unobligated balance transferred to "Construction of facilities" (73 Stat. 439, 74 Stat. 436, 75 Stat. 355, 77 Stat. 439 and 78 Stat. 658)	354	.....	.....	5,719	24,486	.....
	Reprogramming to or from prior year budget plans	76,690	-8,540	.....	.....	.....	.....
24	Unobligated balance available, end of year:						
	For completion of prior year budget plans	.....	.....	.....	226,261	105,276	98,876

Program and Financing (in thousands of dollars) - Continued

	Budget Plan			Costs to this appropriation		
	1965	1966	1967	1965	1966	1967
Available to finance new budget plans.....	.....	.....	.....	20,005	.....	.....
New obligational authority	4,360,049	4,503,104	4,246,600	4,360,049	4,503,104	4,246,600
New obligational authority:						
Current authorization:						
40 Appropriation.....	4,363,594	4,531,000	4,246,600	4,363,594	4,531,000	4,246,600
41 Transferred to—						
"Construction of facilities" (78 Stat. 658).....	-3,545	.....	.....	-3,545	.....	.....
"Administrative operations" (79 Stat. 534).....	.....	-27,896	.....	.....	-27,896	.....
43 Appropriation (adjusted).	4,360,049	4,503,104	4,246,600	4,360,049	4,503,104	4,246,600
Relation of obligations to expenditures:						
10 Total obligations.....				4,420,560	4,715,643	4,339,500
70 Receipts and other offsets (items 11-17).....				-68,200	-96,035	-86,500
71 Obligations affecting expenditures.....				4,352,360	4,619,608	4,253,000
72 Obligated balance, start of year.....				1,710,564	2,078,469	2,178,077
74 Obligated balance, end of year.....				-2,078,469	-2,178,077	-2,091,077
90 Expenditures.....				3,984,456	4,520,000	4,340,000

Program and Financing (in thousands of dollars) - Continued

	1964	1965 Adjustments	1965	1966 Adjustments	1966	1967
[1]Selected resources as of June 30 are as follows:						
Stores	32,340	6,522	38,862	.....	38,862	38,862
Unpaid undelivered orders	1,308,709	.....	1,432,129	-11,035	1,110,094	1,029,594
Advances	12,599	.....	13,716	.....	13,716	13,716
Total selected resources	1,353,648	6,522	1,484,707	-11,035	1,162,672	1,082,172

[2]Reimbursements from non-Federal sources are receipts for services performed on Communications Satellite Corporation projects (42 U.S.C. 2473).

	1965 actual	1966 estimate	1967 estimate
Note.—Reconciliation of budget plan to obligations:			
Total budget plan	4,353,468	4,596,644	4,333,100
Deduct portion of budget plan to be obligated in subsequent years	199,401	105,276	98,876
Add obligations of prior year budget plans	266,493	224,275	105,276
Total obligations	4,420,560	4,715,643	4,339,500

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1967 ESTIMATES

SUMMARY OF RESEARCH AND DEVELOPMENT BUDGET PLAN BY PROGRAM BY COGNIZANT OFFICE
(In thousands of dollars)

BUDGET ACTIVITY	OFFICE/PROGRAM	Fiscal Year 1965	Fiscal Year 1966	Fiscal Year 1967
	MANNED SPACE FLIGHT.....	$2,949,019	$3,203,996	$3,022,800
1a	Gemini.....	308,400	226,611	40,600
1b	Apollo.....	2,614,619	2,967,385	2,974,200
1c	Advanced missions.....	26,000	10,000	8,000
	SPACE SCIENCE AND APPLICATIONS.....	$732,362	$783,237	$661,400
2a	Physics and astronomy...	139,082	143,500	131,400
2b	Lunar and planetary exploration.....	206,027	251,337	197,900
6b	Sustaining university program.....	46,000	46,000	41,000
2d	Launch vehicle development.....	96,500	55,300	33,700
*	Launch vehicle procurement.....	154,487	178,700	152,000
2c	Bioscience.....	28,501	36,700	35,400
3	Meteorological satellites.....	30,991	38,900	43,600
3	Communication and applications technology satellites.	30,774	32,800	26,400
	ADVANCED RESEARCH AND TECHNOLOGY.....	$331,328	$288,596	$278,300
4	Basic research.....	21,231	22,000	23,000
4	Space vehicle systems...	44,193	35,000	36,000
4	Electronics systems.....	25,622	32,300	36,800
4	Human factor systems....	13,320	14,900	17,000
4	Space power and electric propulsion systems....	58,220	45,200	42,500
4	Nuclear rockets.....	57,000	58,000	53,000
4	Chemical propulsion.....	76,502	39,700	37,000
5	Aeronautics.....	35,240	41,496	33,000

BUDGET ACTIVITY	OFFICE/PROGRAM	Fiscal Year 1965	Fiscal Year 1966	Fiscal Year 1967
6a	TRACKING AND DATA ACQUISITION.....	$253,236	$231,065	$279,300
6c	TECHNOLOGY UTILIZATION....	$4,750	$4,750	$4,800
	TOTAL BUDGET PLAN.....	$4,270,695	$4,511,644	$4,246,600

*Funds for the procurement of launch vehicles are statistically distributed to unmanned flight programs (e.g. Physics and Astronomy, Space Vehicle Systems).

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1967 ESTIMATES

NEW RESEARCH AND DEVELOPMENT PROJECT

	Fiscal Year 1966	Fiscal Year 1967
Electronic Systems Program		
Earth Coverage Horizon Measurement	---	$1,000,000

The purpose of this project is to obtain a thorough knowledge of the infrared characteristics of the earth's horizon for the purpose of designing space vehicle guidance and control systems.

The present knowledge and theories of the earth's radiance characteristics will be rigorously examined and an effective measurement program will be delineated. The measurement program will thereafter be mechanized to produce engineering data suitable for use in the design and development of instruments which sense the earth's infrared horizon.

The funding requested will provide for completion of analytical studies, conceptual design of spacecraft systems, analysis of ground support requirements, and supporting cost analysis.

RESEARCH AND DEVELOPMENT

FISCAL YEAR 1967 ESTIMATES

SUMMARY

OFFICE OF MANNED SPACE FLIGHT — GEMINI PROGRAM

PROGRAM OBJECTIVES AND JUSTIFICATION:

The Gemini program objectives are to develop an operational capability in manned space flight and through this capability to conduct specific experiments and tests which support Apollo, Department of Defense programs and scientific investigations. In the Gemini program, the United States is developing and demonstrating the capability for long-duration flights of at least 14 days, rendezvous and docking, post-docking maneuvers, extravehicular activity, and controlled re-entry.

The Gemini effort in FY 1967 will be devoted primarily to final hardware deliveries and operational activities required for manned rendezvous missions.

SUMMARY OF RESOURCES REQUIREMENTS:

	(Thousands of Dollars) 1965	1966	1967
Spacecraft	$165,300	$107,211	$19,100
Launch vehicles	115,400	88,600	8,500
Support	27,700	30,800	13,000
Total	$308,400	$226,611	$40,600

BASIS OF FUND REQUIREMENTS:

Spacecraft

The Gemini spacecraft is a two-man capsule designed to sustain long-duration missions and provide capability for rendezvous and docking in earth orbit. Gemini systems are substantially more sophisticated and versatile than those used in Mercury. The spacecraft includes a number of subsystems which are being used for the first time in manned space flight. McDonnell Aircraft Corporation of St. Louis, Missouri, is the principal contractor. The FY 1967 estimate supports delivery and checkout of the last two spacecraft, engineering support for launches to be conducted in FY 1967, and preparation and publication of final flight and program summary reports.

Launch Vehicles

Three separate vehicles are required for the Gemini program: the Gemini Launch Vehicle (GLV), the Atlas Standard Launch Vehicle (Atlas SLV-III), and

the Gemini Agena Target Vehicle (GATV). The GLV, which places the spacecraft in orbit, is a Titan II intercontinental ballistic missile modified for manned flight.

The Atlas SLV-III and the GATV are also military vehicles adapted to meet the unique requirements of Gemini.

The Space Systems Division of the Air Force Systems Command, acting similarly to a NASA prime contractor, is procuring these vehicles. The FY 1967 estimate provides for the incremental funding required by the Air Force for delivery of the last two GLV, the last two SLV-III, and the last GATV, as well as operational support of the vehicles to be launched during the fiscal year.

Support

Gemini support provides for crew operations, flight operations, and spacecraft and launch vehicle support for the remaining Gemini manned missions.

Crew operations involve three types of effort: simulation equipment and support, astronaut training, and specialized in-flight devices. Flight operations include the planning, support, and actual flight from lift-off to recovery. Spacecraft and launch vehicle support include funding for such items as the life support systems, extravehicular activity equipment, and the experiments to be performed on the various flights.

SCHEDULE OF LAUNCHES

Schedule of Significant Research and Development Events

Ground Tests

The ground development and qualification test program for major Gemini hardware was essentially completed early in calendar year 1965.

Flights	Successfully launched on:
Gemini I	April 8, 1964
Gemini II	January 19, 1965
Gemini III	March 23, 1965
Gemini IV	June 3, 1965
Gemini V	August 21, 1965
Gemini VI A	December 15, 1965
Gemini VII	December 4, 1965
	Scheduled for launch:
Gemini VIII through XI	Calendar year 1966
Gemini XII	Early in calendar year 1967

799-467 O - 66 - 4

RESEARCH AND DEVELOPMENT

FISCAL YEAR 1967 ESTIMATES

SUMMARY

OFFICE OF MANNED SPACE FLIGHT — APOLLO PROGRAM

PROGRAM OBJECTIVES AND JUSTIFICATION:

The goal of the Manned Space Flight program is to provide a broad national capability for manned space exploration, which will achieve and maintain a position of leadership for the United States. A specific objective in acquiring this capability is to land men on the moon and return them safely to earth within this decade. The Apollo program will not only meet the specific objective, but will also create a broad base of operational capability in manned space flight and the associated skills and technology; a valuable complex of development, manufacturing, test, and operational facilities; and an experienced government and industrial team.

To accomplish the objective, the Apollo program requires the development of a highly reliable spacecraft, capable of supporting three men in space for periods up to two weeks, docking in space, landing on and returning from the lunar surface, and safely re-entering the earth's atmosphere. The program includes three large launch vehicles - the Saturn I, which completed its flight series in July 1965; the Saturn IB; and the Saturn V. The Saturn IB and V are being developed and qualified for manned space flight.

Major phases of the Apollo program include design, development, and ground test of spacecraft and Saturn-class launch vehicle hardware, unmanned qualification flights, manned earth orbital flights, and manned lunar flights. During FY 1967, the Apollo program will be in a period of intensive ground and flight qualification testing.

SUMMARY OF RESOURCES REQUIREMENTS:

	(Thousands of Dollars)		
	1965	1966	1967
Spacecraft	$1,009,898	$1,170,600	$1,200,600
Saturn I	40,265	800	---
Saturn IB	262,690	274,185	216,400
Saturn V	964,924	1,177,320	1,191,000
Engine development	166,300	134,095	111,000
Mission support	170,542	210,385	255,200
Total	$2,614,619	$2,967,385	$2,974,200

BASIS OF FUND REQUIREMENTS:

Spacecraft

Development ground testing of boilerplate Apollo command and service modules (CSM) will be completed by the end of FY 1966. Ground testing of Block I CSM is underway and major emphasis will be placed on ground and flight qualification during FY 1967. Five Block I flight-CSM are in various stages of assembly, systems installation, and checkout in preparation for shipment to the John F. Kennedy Space Center (KSC). These Block I CSM will be used for early unmanned and manned earth-orbital flights on the Saturn IB and Saturn V. Block II CSM will have upgraded subsystems to provide the capability for lunar missions. During FY 1967, an intensive ground test program will be conducted to qualify Block II CSM systems. In addition, the first flight Block II CSM will be delivered to KSC for pre-flight checkout and ten more Block II CSM will be progressing through assembly, systems installation, and in-factory checkout.

FY 1967 activity on the lunar excursion module (LEM) will include completion of the major portion of ground development and qualification testing. Test articles will undergo structural, thermal-vacuum, and propulsion testing at the Manned Spacecraft Center, the White Sands Test Facility, and the Arnold Engineering Development Center. Ground qualification testing of key LEM systems, including electric power, reaction control, communications, propulsion, landing gear, and environmental control, will be concluded. The first flight LEM will be completed, delivered to KSC, and tested on a Saturn IB in FY 1967. Ten additional flight LEM will be in manufacture and checkout, and two of these LEM will be delivered to KSC in preparation for flight.

Saturn I and IB

The Saturn I project completed its flight series in July 1965. No funds are being requested in FY 1967. Saturn IB launches will begin with unmanned development flights in calendar year 1966. In calendar year 1967 four launches are scheduled, including long duration manned missions. During FY 1967, a total of four vehicles will be delivered to the Kennedy Space Center. Fabrication, assembly and checkout of the last four Saturn IB vehicles will be in process during the fiscal year.

Saturn V

During calendar year 1967 the first launch of a Saturn V vehicle will occur. FY 1967 development effort will be concentrated on the ground testing that will culminate in the first flight qualification test. Dynamic testing of the entire vehicle will continue at the Marshall Space Flight Center. FY 1967 also represents the peak year, to date, for production and delivery of Saturn V vehicles. The first 3 flight vehicles will be delivered during the fiscal year and an additional 7 vehicles will be in fabrication, assembly, or checkout by the end of FY 1967.

Engine Development

H-1 development effort will consist, primarily, of the field and test support required to provide quick response analysis and problem solving associated with the flight evaluations of engine performance on Saturn IB vehicles. Qualification testing of the F-1 engine and the up-rated J-2 engine will be completed during FY 1967. Other work on these two engines will include the test and field activity required to support the flight programs of the Saturn IB and Saturn V. No RL-10 activity is scheduled for FY 1967. Space flight use of the RL-10 engine was limited to the Saturn I which has completed its flight program.

Mission Support

In FY 1967, support effort will continue for the over-all launch, flight, crew and recovery operations; program-wide systems engineering; supporting development required for the successful accomplishment of manned space flights; and for the maintenance of hardware production capability for Apollo applications, project definition and payload development.

SCHEDULE OF LAUNCHES

Schedule of Significant Research and Development Events

Events	Calendar Year
First Saturn IB Launch	1966
First Manned Saturn IB Launch	1967
First Saturn V Launch	1967
First Manned Saturn V Launch	1968
First Manned Lunar Landing	Before end of the decade

RESEARCH AND DEVELOPMENT

FISCAL YEAR 1967 ESTIMATES

SUMMARY

OFFICE OF MANNED SPACE FLIGHT — ADVANCED MISSIONS PROGRAM

PROGRAM OBJECTIVES AND JUSTIFICATION:

The objective of the Advanced Missions Program is to examine advanced manned space flight mission concepts. Included are logical extensions of the national space capability through analysis of present hardware systems for growth potential; development of requirements for future systems; provision of guidance for research and technology activities; provision of technical information and cost data upon which future program decisions can be based; and initiation of the definition, preliminary design, and specification of probable future missions.

SUMMARY OF RESOURCES REQUIREMENTS:

	(Thousands of Dollars)		
	1965	1966	1967
Advanced missions studies.....	$26,000	$10,000	$8,000
Total.....	$26,000	$10,000	$8,000

BASIS OF FUND REQUIREMENTS:

Advanced studies provide the basis for the planning and selection of future manned space flight missions. Specific areas of investigation include manned earth orbital, lunar, and planetary missions.

The FY 1967 requirements for manned earth orbital studies support preliminary systems definition of space station concepts, based on alternate configurations examined during FY 1966. Configurations under review include a long-term station not requiring resupply, using the present family of subsystems and launched with a Saturn V, and an optimized space station capable of supporting planetary flight. Preliminary systems definition will also be conducted on a ferry/logistic system for use with these concepts. Particular attention will be given to the description and definition of experiment modules which can be used in conjunction with the various space station concepts and which can be operated by the crew of the space station. In addition, efforts will continue on the selection and description of candidate experiments for advanced missions and the constraints of these experiments on the space station and the logistic system will be assessed. The ultimate growth capability of such a space station into a planetary mission module will be considered, as well as the earth orbital requirements for a new and larger spacecraft with inherently greater experimental man-hour capabilities.

The FY 1967 funding for manned lunar mission studies provides for the definition of an extended lunar exploration plan and related conceptual designs. The results of comparative evaluations of shelter and mobility concepts, as well as various modes of payload delivery to the lunar surface, will be combined with the recommendations of the scientific community to formulate a comprehensive lunar exploration plan. This work will provide the basis for decisions concerning the initiation of program definition for an advanced lunar exploration system.

Manned planetary mission studies have established the feasibility of a number of mission modes and system concepts for Mars and Venus fly-bys, as well as Mars landing missions. The FY 1967 requirements cover more detailed analysis of systems feasibility, systems concepts, and technological requirements. Studies will focus on manned planetary spacecraft concepts that can be applied to the broadest range of missions and launch dates. Objectives, schedules, and costs will be studied to identify the most promising concepts for detailed engineering design.

Launch vehicle studies to support earth orbital, lunar, and planetary manned missions will also be conducted during FY 1967. These studies will stress preparation for systems definition of improved Saturn vehicles, as well as reusable transport concepts. The related requirements for operational and support facilities will also be studied.

RESEARCH AND DEVELOPMENT

FISCAL YEAR 1967 ESTIMATES

SUMMARY

OFFICE OF SPACE SCIENCE AND APPLICATIONS — PHYSICS AND ASTRONOMY PROGRAM

PROGRAM OBJECTIVES AND JUSTIFICATION:

The objective of the Physics and Astronomy program is to increase our knowledge of the space environment of the earth, the sun and its relationship to the earth and the interplanetary medium, and the fundamental physical nature of the universe. In order to achieve this objective, research programs have been undertaken to intensively study the upper atmosphere, the ionosphere, the earth's magnetosphere, the region beyond the boundaries of the magnetosphere, solar radiation and the solar wind and their interactions with these regions, cosmic rays from beyond the solar system, radiation from stars and other celestial bodies in areas of the spectrum which cannot be observed from the earth's surface, and the geodetic figure of the earth.

While the objective of the program has been divided into three major areas, they are by no means independent of each other. Knowledge gained in one area contributes to the understanding of the others. Many studies contribute directly to knowledge in all three areas. The practical applications of the knowledge gained in this program can be clearly demonstrated in terms of support for other national programs such as meteorology, communications, manned space flight, and cartography. However, the program is primarily intended to be a basic research program dedicated to the expansion of human knowledge. As such, it is integrated with the programs of educational and scientific research institutions throughout the United States and in many foreign countries. Substantial efforts are made to insure that the results of the research are made generally available on a basis that will make the knowledge most useful to facilitate future advancements in technology, scientific research, and education.

SUMMARY OF RESOURCES REQUIREMENTS:

	(Thousands of Dollars)		
	1965	1966	1967
Supporting research and technology/Advanced studies..	$21,057	$23,800	$22,900
Solar observatories.....	16,597	24,500	11,900
Astronomical observatories.....	32,644	24,600	29,200
Geophysical observatories.....	30,352	28,600	23,400
Explorers.....	21,565	21,400	23,000
Sounding rockets.....	16,867	18,500	19,000
Data analysis.....	---	2,100	2,000
Total.....	$139,082	$143,500	$131,400

BASIS OF FUND REQUIREMENTS:

Supporting Research and Technology

The objectives of the Supporting Research and Technology program are to provide a sound theoretical base for the flight programs; to initiate development of instrumentation for future experiments; to provide laboratory data as a basis for evaluation of flight data; to conduct ground-based balloon and aircraft observations for correlation with flight program results; and to provide scientific experiments and scientific support for the manned space flight program.

Advanced Studies

Advanced studies establish the concepts, characteristics, and feasibility of future unmanned earth-orbital and interplanetary missions. Among the missions to be studied are small modular scientific satellites of the Explorer class, other specialized Explorers, galactic probes, and small interplanetary probes.

Solar Observatories

The objective of the Orbiting Solar Observatory (OSO) program is to promote advancement in the study of solar physics through the use of current space techniques which permit scientific expansion in solar research by eliminating the atmospheric distortions which are normally prevalent with ground-based observations. The solar observatories are, therefore, designed to provide a thorough investigation of the sun and its changing activities. They will systematically and uniformally study the rapid changes as well as the long term changes in solar radiation during a solar cycle and probe into the underlying causes of these changes by analyzing regions of activity. The OSO's operated during the period of minimum solar activity with the flights of OSO-I and II in 1962 and 1965, respectively. Continuous program effort will be pursued with OSO into the period of maximum solar activity.

Astronomical Observatories

The Orbiting Astronomical Observatory (OAO) is designed to provide a precisely stabilized observatory above the atmosphere so that fundamental information about the universe can be obtained. These observatories will be capable of making astronomical observations of electromagnetic radiation in the ultraviolet and X-ray regions of the spectrum which do not penetrate the earth's atmosphere, and high resolution observations in the visible regions of the spectrum. The first OAO will be ready to fly early in 1966, and will carry a variety of ultraviolet, X-ray and gamma ray telescopes. Spacecraft and experiment development for three additional OAO's is currently in progress. During FY 1966, funds will provide launch, operational and data analysis support for OAO-A, refurbishment of the prototype spacecraft for the OAO-A_2 mission, development of spacecraft for OAO-B and C missions, and experiment development for OAO-B, A_2 and C. Fiscal year 1967 funds will support launching,

orbital operations, and data analysis for the OAO-B mission, for a continuation of effort on OAO-A_2 and C, and for the initiation of hardware development for the OAO-D spacecraft and experiments.

Geophysical Observatories

The objective of the Orbiting Geophysical Observatory (OGO) program is to develop a standard earth-orbiting observatory capable of carrying large numbers of experiments in a wide variety of orbits to simultaneously investigate the geophysical phenomena and interrelationships of solar activity, the interplanetary and galactic medium, the terrestrial magnetosphere, and the atmosphere. The first two spacecraft in this series, OGO-I and II, have been launched. OGO-I has operated effectively for over a year in an eccentric orbit and has obtained valuable scientific data from almost all of its 20 experiments despite a failure to attain earth-orientation caused by improper boom deployment. CGO-II was launched successfully into polar orbit late in 1965 and is returning important data even though it is no longer able to stabilize due to early depletion of the gas supply. Two more missions are planned for launching into eccentric orbits and two more missions are planned for launching into polar orbit.

Fiscal year 1966 funds provided for the launch of OGO-II (C), for analysis of data from OGO-I and II, for the completion and launch of OGO-B, for continuation of development of OGO-D and E spacecraft and experiments, and for the initiation of experiment development for OGO-F. Fiscal year 1967 funds will provide for the completion and launch of OGO-D, for the completion of OGO-E, and refurbishment of the prototype spacecraft for the OGO-F mission. They will also support data analysis for the first four OGO missions, and experiment development for OGO-E and F.

Explorers

The Explorer class of satellites has been one of the most efficient and economical means of accomplishing a variety of scientific missions. A substantial portion of the scientific data gathered and many new discoveries are attributable to instruments carried in Explorer spacecraft. These spacecraft, most of which are launched by the relatively inexpensive Scout and Delta vehicles, are specifically designed for particular scientific investigations, and are flown in orbits particularly suitable for these investigations.

These spacecraft are developed by NASA installations, industry, universities, and cooperating foreign countries. Many smaller organizations have been able to gain competence and experience by participating in the development of these small Explorer spacecraft.

In FY 1966, increased emphasis is being given to Astronomy Explorers with major funding of the Radio Astronomy Explorers and initiation of the X-ray Astronomy Explorer. A Scout launch vehicle was also provided for a Solar Explorer developed by the Naval Research Laboratory. Development of Geophysical and Interplanetary Explorers is being continued at a reduced level of effort,

799-467 O - 65 - 5

and the Geodetic Satellite program is being continued at a level effort.

The FY 1967 program provides for further reduction of the level of effort for Geophysical and Interplanetary Explorers, providing only for continuation of launches of Interplanetary and Energetic Particles Explorers and the international cooperative program in the 1968-1969 time period. The program for Astronomy Explorers will provide for continuation of observations into the 1968-1969 time period with emphasis on X-ray and radio observations of the sun. Geodetic investigations will be continued using the satellites in the currently approved program.

Sounding Rockets

Sounding rockets have proven to be the only effective means of making scientifically valuable studies of the upper atmosphere at altitudes above 20 miles and below perigee altitudes of earth satellites. These rockets are relatively small and inexpensive vehicles capable of carrying wide varieties of instrumentation for the study of the atmosphere, ionosphere, energetic particles, and studies in astronomy and solar physics. Sounding rocket flights have been extremely useful for developing instrumentation for later use on satellites. The usefulness of sounding rockets for astronomical observations, particularly observations of the sun and stars in the X-ray and ultraviolet regions of the spectrum, has been greatly enhanced by the development of attitude control systems.

The small cost increase in the sounding rocket program in FY 1966 and FY 1967 is largely due to the development and increased use of improved attitude control systems; and to an increased use of the larger, more expensive vehicles to carry stabilized payloads, as well as heavier payloads, with several instruments for a number of simultaneous measurements.

Data Analysis

This project provides a means of honoring NASA's obligation of making the scientific information gained from space explorations available to the public. Data accumulated from NASA's orbiting observatories, Explorers, sounding rockets, and space probes is being reduced and placed in storage at the National Space Science Data Center located at the Goddard Space Flight Center. Here it is catalogued and distributed to interested researchers. Fiscal year 1966 and FY 1967 funds provide for the operation of the Data Center and for the support of research tasks utilizing the data stored there.

SCHEDULE OF LAUNCHES

Schedule of Significant Research and Development Events

Project	Events	Quarter	Calendar Year
Solar Observatories	Launch fourth OSO	2	1966

Project	Events	Quarter	Calendar Year
	Launch fifth OSO (Launches at approximately nine month intervals thereafter)	1	1967
Astronomical Observatories	Launch first OAO	1	1966
	Launch second OAO (Launches at about one year intervals thereafter)	1	1967
Geophysical Observatories	Launch OGO-II in polar orbit	4	1965
	Launch third OGO into eccentric orbit	2	1966
	Launch fourth OGO into polar orbit (Launches at about nine month intervals thereafter)	1	1967
Explorers	Launch IQSY solar explorer	4	1965
	Launch active Geodetic Explorer	4	1965
	Launch ISIS-X (Alouette II and direct measurements Explorer XXXI)	4	1965
	Launch French Satellite FR-1A	4	1965
	Launch Atmosphere Explorer	2	1966
	Launch passive Geodetic Explorer	2	1966
	Launch Interplanetary Explorer into orbit anchored to the moon	3	1966
	Launch Interplanetary Explorer into eccentric orbit	4	1966
	Launch Italian San Marco Satellite	4	1966
	Launch lunar-anchored and eccentric orbit Interplanetary Explorer, first integrated Canadian-U.S. International Satellite for Ionospheric Studies (ISIS), active Geodetic Explorer, first Radio Astronomy Explorer, Air Density/Injun Explorers, third United Kingdom satellite, and two European Space Research Organization satellites.		1967

Project	Events	Quarter	Calendar Year
	Launch six Explorers for coordinated solar-terrestrial-interplanetary studies, and three for astronomical observations	-	1968
	Launch four Explorers for coordinated solar-terrestrial-interplanetary studies and one for astronomical observatories	-	1969
Sounding Rockets	Collect cosmic dust samples during meteor showers	4	1965
	Obtain first radio observations of Jupiter from above ionosphere	-	1966
	Coordinated geophysical measurements to study solar-terrestrial-interplanetary relationships during a period of increasing solar activity	-	1965-1967
	Coordinated geophysical measurements to study solar-terrestrial-interplanetary relationships during the period of the active sun	-	1967-1972
Data Analysis	Initiate distribution of reduced data and financial support of research proposals	4	1965

RESEARCH AND DEVELOPMENT

FISCAL YEAR 1967 ESTIMATES

SUMMARY

OFFICE OF SPACE SCIENCE AND APPLICATIONS — LUNAR AND PLANETARY PROGRAM

PROGRAM OBJECTIVES AND JUSTIFICATION:

The objective of the Lunar and Planetary program is the scientific exploration of our solar system utilizing both unmanned and manned spacecraft and earth-based research. The exploration of the Moon, the planets Venus and Mars, and the intervening interplanetary space are immediate objectives but eventually the outer planets and their moons, comets, asteroids and corresponding planetary and interplanetary space environment will be explored. Achievement of these objectives will provide data to better understand the origin, history and mechanisms of development of our solar system and may provide evidence of the existence of forms of life elsewhere.

There are three lunar flight programs. The first of these, the Ranger program, has been completed and provided a much better understanding of the nature of the surface of the moon from high resolution photographs. The Surveyor program will soft land a series of unmanned spacecraft with a complement of instruments on the surface of the moon to make first hand observations and obtain physical measurements. The landed Surveyor spacecraft will survey the immediate area to determine the suitability of that site for later manned missions. The Lunar Orbiter program was conceived and initiated to complement the information obtained by Ranger and to work in a team relationship with Surveyor in conducting scientific investigations and locating and certifying suitable landing sites for Apollo. Lunar Orbiter will be capable of photographing all regions of the moon and therefore, will be a useful tool in continuing lunar exploration. Scientific instruments and techniques are also being developed for lunar investigations capitalizing on man's capabilities and the payload return capabilities of the Apollo program.

The Planetary and Interplanetary program has yielded a wealth of scientific information on the planets and interplanetary environment from the Mariner II encounter with Venus, the Mariner IV flyby of Mars and the Pioneer VI launch into solar orbit. Additional Mariner and Pioneer launches are planned during FY 1966-1969 to measure interplanetary phenomena and continue exploration of the inner planets. Mariner launches to Venus in 1967 and Mars in 1969 will use the Mariner IV design, and pave the way for the detailed exploration of these planets by the Voyager program now planned to be available for the 1973 Mars and subsequent opportunities.

SUMMARY OF RESOURCES REQUIREMENTS:

	(Thousands of Dollars) 1965	1966	1967
Supporting research and technology/Advanced studies....	$24,140	$38,600	$40,100
Ranger.....	11,037	1,000	---
Surveyor.....	81,814	111,637	90,400
Lunar orbiter.....	49,500	52,400	24,600
Mariner.....	17,368	18,000	26,100
Voyager.....	7,168	17,000	10,000
Pioneer.....	15,000	12,700	6,700
Total.....	$206,027	$251,337	$197,900

BASIS OF FUND REQUIREMENTS:

Supporting Research and Technology/Advanced Studies

Supporting Research and Technology provides essential support to approved flight missions as well as the necessary feasibility studies and other advanced work required to establish future missions. The Lunar and Planetary Science program develops new concepts and ideas for scientific investigation of the moon and planets to the stage where they can be proposed as flight experiments for future missions. Ground based observations provide scientific data for the design and calibration of and comparison with flight experiments. Examples are spectroscopic observations of Mars and radio wave observations of Venus. The Advanced Technical Development program develops equipment which will be extremely reliable and able to survive both a rigorous sterilization and long exposure in a deep space environment. Development of landing technology to ensure safe planetary landings of Voyager type spacecraft is receiving particular emphasis. Planning for the future in Lunar and Planetary program requires the continued study of advanced missions. Current year studies indicate the potential of trajectories which swing-by one planet enroute to a different, target planet, in terms of the reduction of trip time and energy required to the target planet. Mission trajectories to Mars, Venus, and Mercury as well as Jupiter and the outer planets were included. Spacecraft conceptual design studies have been largely confined to Mars and Venus missions during FY 1965 and FY 1966, but a minimal effort has been maintained on flights to Jupiter and to comets and asteroids. The Manned Lunar Science program plans scientific investigations, develops equipment for manned lunar missions. Major scientific objectives of early manned missions to the moon are the observation of natural phenomena, collection of representative samples and emplacement of monitoring equipment. The Lunar Mapping program supports both the manned and unmanned flight programs.

Surveyor

The Surveyor system will soft land unmanned spacecraft on the lunar surface to make measurements which should significantly improve our understanding of

the nature of that body. A successful landing will yield important information on landing technology and the surface characteristics (roughness, bearing strength, dust coverage) which affect the landing and data on the immediate area as a possible site for later manned landings. Because the Surveyor design concepts are basically the same as those being used on Apollo, the landing of Surveyor on the moon will demonstrate the over-all feasibility of later manned landings and will demonstrate the successful development of a technology which has many elements in common with the Apollo Lunar Excursion Module, such as the radar altimeter, radar doppler velocity sensors, closed-loop terminal guidance system, variable-thrust rocket engines, leg-type landing gear, S-band communications and tracking to lunar distances. Surveyor represents a considerable advance in spacecraft technology over earlier systems. During 1965, major problems were corrected and the first descent test conducted successfully. In order to maximize the probability of obtaining lunar surface data at the earliest possible time to support the first Apollo missions, the effort was reduced on the 2500 pound spacecraft in order to concentrate on the 2200 pound spacecraft, which will be used on the first seven flights. Two lunar missions are planned for 1966 and the remaining eight flights of the current series are planned to be completed by the end of 1968. Fiscal year 1967 funds will provide for the launch and mission operations of spacecraft two through four, assembly and test of spacecraft five through seven and initial hardware procurement for the final three spacecraft in the currently planned ten flight series.

Lunar Orbiter

The Lunar Orbiter is the low altitude lunar reconnaissance satellite member of the Surveyor-Orbiter team which will conduct unmanned scientific investigations of the moon prior to the Apollo period. The Orbiter will provide both high resolution photographs (comparable to Ranger pictures immediately preceding impact) and broad area coverage of the lunar surface. The combination will yield stereo coverage and permit topographic mapping of the moon, and correlated with data from landed Surveyors, will go far toward reducing uncertainties of subsequent lunar landings. Analysis of orbital data from Lunar Orbiter missions will disclose much about the nature of the moon's shape, its mass distribution and internal structure. Development and testing of the Lunar Orbiter prototypes will be completed and first flight spacecraft will be launched during the current year. Fiscal year 1967 funds will cover three more launches and post-launch operations and prepare for the final mission of this five flight program.

Mariner

The objectives of the Mariner program are to conduct flight missions in the vicinity of Mars and Venus to obtain information about their surfaces and atmospheres, and to measure magnetic fields, energetic particle and micrometeoroid flux in interplanetary space and close to the planets. The Mariner II flyby of Venus on December 14, 1962, and Mariner IV's encounter with Mars on July 14, 1965, produced the first direct measurements of other planets from space. With the delay in initiation of Voyager flights,

additional Mariner flights have been introduced. The spare spacecraft from the Mariner IV program will be refitted to be launched by Atlas-Agena for a flyby of the planet Venus in 1967. Development of a spacecraft based on the Mariner IV design is also underway for two flights to Mars in 1969 to be launched on Atlas-Centaur. Fiscal year 1967 funding will support continued development of the Venus 1967 and Mars 1969 missions as well as an attempt to reestablish telemetry communications with the Mariner IV spacecraft when it returns to the vicinity of the earth in early 1967.

Voyager

Voyager is developing the capability for detailed study of the near planets. The primary goal of these missions is to obtain detailed information on atmospheric, surface, and body characteristics, with special emphasis on the possible existence and nature of life on the planets. Voyager flights will also further our knowledge of the interplanetary medium between earth and the planets by conducting scientific and engineering measurements while in transit. Although the system is initially being developed to explore the planet Mars, it will provide a basic capability which can be generally applied to the exploration of the near planets by automated spacecraft.

To meet these objectives, the spacecraft must be capable of orbiting the planet and landing a scientific payload on the surface. Presently this spacecraft is conceived to consist of three modules; a bus-orbiter module, a retro-propulsion module, and an entry capsule module. Definition studies have indicated the desirability of launching two of the Voyager spacecraft on a single Saturn V launch vehicle to take advantage of this vehicle's weight lifting capability and planned reliability. Currently efforts are underway to further define the mission, the spacecraft system and the capsule system design. The Voyager effort will be continued at the system definition level through FY 1967, resulting in possible first flights for the 1973 Mars opportunity. The funding requested for FY 1967 will be used to continue the overall mission studies, the capsule design studies, and supporting activities leading to detailed system design and breadboard testing planned to be initiated in FY 1968.

Pioneer

Pioneer will investigate the interplanetary environment and the propagation of solar and galactic phenomena through this medium, by launching spacecraft during a period of increasing solar activity over the next several years. Pioneer data will be correlated with similar measurements made near earth to provide simultaneous observations at widely separated points in space. Pioneer VI was successfully launched in December 1965 into solar orbit. Four additional Pioneer missions are scheduled to alternate between missions approaching as close as 0.8 A.U. and going out as far as 1.2 A.U. from the sun (1 A.U. is equal to the mean earth to sun distance, 92,900,000 miles). Because Pioneer experiments largely measure charged particle fluxes and magnetic fields, great care has been taken in the design and construction of

the Pioneer spacecraft to make it magnetically clean. The residual spacecraft magnetic field for Pioneer VI was less than one hundred-thousandth of the earth's field, an order of magnitude better than any previous spacecraft. Funding requested for FY 1967 will support continued development, fabrication, test, launch, and post-launch operations for the remaining four flights of the current Pioneer series.

SCHEDULE OF LAUNCHES

Schedule of Significant Research and Development Events

Project	Events	Quarter	Calendar Year
Surveyor	Surveyor A launch	2	1966
Lunar Orbiter	Lunar Orbiter A launch	2	1966
Pioneer	Pioneer B launch	3	1966
Surveyor	Surveyor B launch	3	1966
Lunar Orbiter	Lunar Orbiter B launch	4	1966
Surveyor	Surveyor C, D, E & F launches	-	1967
Lunar Orbiter	Lunar Orbiter C, D & E launches	-	1967
Pioneer	Pioneer C launch	-	1967
Mariner	Mariner Venus launch	-	1967
Surveyor	Surveyor G, H, I & J launches	-	1968
Pioneer	Pioneers D & E launches	-	1968
Mariner	Two Mariner Mars launches	-	1969
Voyager	Voyager-Mars launch	-	1973

799-467 C - 66 - 6

RESEARCH AND DEVELOPMENT

FISCAL YEAR 1967 ESTIMATES

SUMMARY

OFFICE OF SPACE SCIENCE AND APPLICATIONS — SUSTAINING UNIVERSITY PROGRAM

PROGRAM OBJECTIVES AND JUSTIFICATION:

The basic objective for the formation and continuing development of the Sustaining University Program is NASA's desire to strengthen the universities while seeking their help in accomplishing the Agency's mission. NASA supports the training of graduate students in space-related disciplines, the construction of urgently needed facilities at universities engaged to a significant degree in space-oriented research or research potentially applicable to the space program, and the conduct of a variety of multidisciplinary research. Attainment of this objective will help replenish the national manpower supply of highly trained people, make available suitable laboratory facilities in which space-related research may be conducted efficiently, and broaden the national base of research upon which technological progress ultimately depends.

SUMMARY OF RESOURCES REQUIREMENTS:

	(Thousands of Dollars)		
	1965	1966	1967
Training	$25,000	$25,000	$22,000
Research facilities	10,000	8,000	7,000
Research	11,000	13,000	12,000
Total	$46,000	$46,000	$41,000

BASIS OF FUND REQUIREMENTS:

Training

The objectives of the training grants program are to increase the supply of highly trained scientists and engineers to conduct research and development in space-related fields, and to provide an adequate source of leaders for the nation's industries, government research centers, and universities.

About 1,000 new students will begin their three years of training under the NASA predoctoral training program in FY 1967. In September 1965, 1,275 new students began their training. About 1,335 new students will begin their training in September 1966. In addition to the predoctoral program, a limited number of special training activities are provided for select groups who will make valuable contributions to the space effort. The special activities will include the Summer Faculty Fellowship Program, which provides an opportunity for young college or university faculty members to participate in

ongoing research projects at a NASA center and concurrently engage in related seminars or classroom discussions at a nearby university. In addition to summer training for faculty, NASA will sponsor a few summer programs for exceptionally talented undergraduates who are to be chosen on a national basis to participate in an exploratory program in space science or in space technology. Twenty two million dollars is being budgeted for all these training activities.

Research Facilities

Maximum benefit to the nation requires university participation in the space program. It can be realized only if adequate facilities are provided in which to perform laboratory research and to develop experimental flight packages. The NASA Research Facilities program is directed at providing these needed campus facilities at those universities already heavily committed to the space program. Facilities acquisition funded under this program through FY 1966 will provide approximately one and one half million (1,500,000) square feet of needed laboratory space at a cost of forty seven million dollars. These facilities will be located throughout the country, and will vary from highly specialized technical facilities to general purpose laboratories depending upon the individual university's need and potential.

A continued, orderly, and deliberate acquisition rate is planned during FY 1967 to provide for construction of an additional two hundred thousand (200,000) square feet of laboratory space at a cost of seven million dollars.

Research

The chief goal of the research segment of the Sustaining University Program is to expand and improve the capabilities of the nation's universities to conduct research in space and aeronautical science and technology. This is being accomplished through a program of multidisciplinary research grants to universities already deeply engaged in the space program and to other institutions not currently participating. These grants serve to encourage and develop new research talents and interests and thus provide a broader base for national space research.

There are now about 40 multidisciplinary research grants in effect in 40 universities located throughout the country. Each university has different assets and capabilities, and our relationship with each varies accordingly. In general, however, the research tasks are broadly defined and permit redefinition of areas of greatest importance as work progresses. In all cases the choice of the research approach is vested in the participating investigators at the university, thus assuring maximum application of existing resources and the most productive utilization of capabilities.

For the continued growth of these special purpose research programs in FY 1967, approximately 71 projects will be supported at a cost of $12 million. Sixty five of these grants will be for the continuation of projects supported in FY 1965, and the remainder will be to universities participating in this program for the first time.

RESEARCH AND DEVELOPMENT

FISCAL YEAR 1967 ESTIMATES

SUMMARY

OFFICE OF SPACE SCIENCE AND APPLICATIONS LAUNCH VEHICLE DEVELOPMENT PROGRAM

PROGRAM OBJECTIVES AND JUSTIFICATION:

The purpose of the Launch Vehicle Development program is to assure a timely, economical availability of launch vehicle capability to meet unmanned mission requirements. Continuing study of mission requirements points up needs in terms of improved vehicle performance. As the mission requirements exceed present vehicle capability, these performance increases are translated into systems improvements, configuration changes, improved operating techniques, new stages, new launch vehicles or combinations thereof. If major development is required to meet new mission needs, implementation of the development would be within the Launch Vehicle Development program. The Scout and Delta development programs, generated and implemented in this fashion, were completed in FY 1963. The Centaur development program is expected to be completed in a similar manner in FY 1967.

SUMMARY OF RESOURCES REQUIREMENTS:

	(Thousands of Dollars)		
	1965	1966	1967
Supporting research and technology/advanced studies..	$7,100	$4,000	$4,000
Centaur development.....	89,400	51,300	29,700
Total.....	$96,500	$55,300	$33,700

BASIS OF FUND REQUIREMENTS:

Supporting Research and Technology/Advanced Studies

The purpose of Advanced Studies is to define future vehicle requirements and to establish the methods by which needed performance increases can best be developed. The Supporting Research and Technology efforts are directed toward developing the new technology and techniques shown to be needed by the Advanced Studies.

The FY 1966 and FY 1967 studies and technology efforts have been focusing on high-energy mission requirements for a small energetic (kick) stage as an addition to existing launch vehicles. Other efforts on solid propellant performance prediction, operational hazards and overall vehicle performance requirements will be continued in FY 1967.

Centaur Development

The Atlas/Centaur is under development as a high-energy upper stage, burning liquid hydrogen and liquid oxygen that will provide the required capability for NASA's unmanned lunar missions. The Centaur program has provided technology for the handling, storage, and use of liquid hydrogen in the space environment. Another feature of the Centaur vehicle is its utilization of an all-inertial guidance system through the complete mission profile.

Funding for FY 1967 is for completion of the developmental effort on the Centaur vehicle and improvement effort on the RL-10-A3 engines, formerly funded by the Office of Manned Space Flight.

SCHEDULE OF LAUNCHES

Schedule of Significant Research and Development Events

Project	Events	Quarter	Calendar Year
Centaur	Launch of AC-8 to demonstrate Centaur two-burn capability	1	1966
	Launch of AC-9 to demonstrate Centaur two-burn to lunar impact capabilities	4	1966

RESEARCH AND DEVELOPMENT

FISCAL YEAR 1967 ESTIMATES

SUMMARY

OFFICE OF SPACE SCIENCE AND APPLICATIONS LAUNCH VEHICLE PROCUREMENT PROGRAM

PROGRAM OBJECTIVES AND JUSTIFICATION:

The objective of the Launch Vehicle Procurement program is to provide launch vehicles and launch support for unmanned space missions. In addition to the purchase of vehicle hardware, this program includes a broad spectrum of supporting activities required to meet each specific mission objective. The launch vehicles currently procured through this program are: Scout, Delta, Thor-Agena, Atlas-Agena, and Centaur.

Launch Vehicle Procurement is presented separately; however, vehicle funding requirements related to specific flight projects are shown as a parenthetical notation with the applicable project to provide a total estimate of project requirements.

SUMMARY OF RESOURCES REQUIREMENTS:

	(Thousands of Dollars) 1965	1966	1967
Scout	$13,287	$11,700	$10,400
Delta	32,374	27,900	22,900
Agena	55,040	71,100	54,700
Centaur	44,814	64,000	64,000
Atlas	8,972	4,000	---
Total	$154,487	$178,700	$152,000

BASIS OF FUND REQUIREMENTS:

Scout Procurement

The purpose of the Scout Procurement program is to provide a reliable, relatively inexpensive vehicle for general space research. It is the smallest of the basic NASA family of launch vehicles and meets the requirements for a variety of small-sized payloads for orbital, probe and re-entry missions. The FY 1967 funds for Scout procurement will be utilized to initiate new procurements of Scout vehicles and launch services. Funds will be applied to continue procurement of first, second, third, and fourth stage motors to meet calendar year 1967 launch requirements. Funding is also provided for other support requirements, such as adaptation of the Scout vehicles to satisfy spacecraft and mission peculiar requirements.

Delta Procurement

The purpose of the Delta Procurement program is to provide a reliable launch vehicle for a wide variety of medium-size satellites and small space probes. Included in the FY 1967 request are funds to continue procurement of Thor boosters, Delta second stages and third stages to meet launch schedule requirements for the Delta vehicle. Fiscal year 1967 funds will also provide for launch service requirements and other supporting services.

Agena Procurement

In combination with Thor and Atlas boosters, the Agena second stage is employed extensively by NASA. The restartable Agena stage provides considerable latitude in mission capability among the various earth orbital and lunar or planetary missions. Funds requested for FY 1967 will provide for continued procurement of the basic Agena stages, Atlas and Thor boosters, and the adaptation of the Agena stages for mission peculiarities. The necessary Atlas, Thor and Agena launch support, i.e., launch services, propellants, supporting services, etc., will also be provided.

Centaur Procurement

The Centaur vehicle is a high-performance, general purpose launch vehicle for use on unmanned lunar, planetary, scientific, and applications missions which exceed the capability of the Atlas-Agena vehicle. The present procurement of operational Centaur vehicles is programmed to meet the requirements of the Surveyor unmanned lunar surface exploration project. There are two operational Centaur-Surveyor launches planned for calendar year 1966. Funds requested for FY 1967 are to continue Centaur procurement in support of the Surveyor program and to complete procurement of Atlas-Centaur vehicles for the first seven Surveyor missions; provide launch services and other supporting services for calendar year 1967; and provide for initiation of procurement of additional Atlas boosters, RL-10-A3 engine sets, and Centaur stages.

Atlas Procurement

This project consists of procurement of Atlas launch vehicles for unmanned missions. Two vehicles were procured for the Space Vehicles Systems program, (Project FIRE). Funds indicated in FY 1966 and 1967 are for the SLV-3X, Atlas improvement program. This effort was initiated late in FY 1965 to provide greater payload capabilities for all missions utilizing the Atlas booster.

SCHEDULE OF LAUNCHES

The over-all mission plan for launches during this period is:

Vehicle	Calendar Year 1965	Calendar Year 1966	Calendar Year 1967
Scout	4	3	8
Delta	6	6	9
Agena	4	7	11
Atlas	1	-	-
Centaur	2	4	4
Total	17	20	32

RESEARCH AND DEVELOPMENT

FISCAL YEAR 1967 ESTIMATES

SUMMARY

OFFICE OF SPACE SCIENCE AND APPLICATIONS — BIOSCIENCE PROGRAM

PROGRAM OBJECTIVES AND JUSTIFICATION:

The Bioscience program has two fundamental objectives; the search for extraterrestrial life with primary emphasis directed to Mars and the development of a basic understanding of the effects of the space environment on terrestrial organisms by means of ground-based experiments and the Biosatellite project. A supporting program of basic and applied research is being conducted in support of these objectives. The accomplishment of these objectives should increase our understanding of the nature and origin of life, including the possibility that life exists on Mars, provide for the testing of biological hypotheses in the areas of genetics, developmental biology, environmental physiology, and general metabolism, furnish valuable data pertaining to biological requirements for prolonged manned space flight, and result in the development of various new procedures and devices which may have medical and other applications to human beings.

SUMMARY OF RESOURCES REQUIREMENTS:

	(Thousands of Dollars)		
	1965	1966	1967
Supporting research and technology	$12,501	$15,100	$14,700
Biosatellite	16,000	21,600	20,700
Total	$28,501	$36,700	$35,400

BASIS OF FUND REQUIREMENTS:

Supporting Research and Technology

The search for extraterrestrial life is one of the primary objectives of the Bioscience program. This effort includes ground-based studies designed to provide an integrated experiment system capable of determining the physical and chemical characteristics of Mars and search in various ways for the existence of life, and a planetary quarantine effort intended to assure, with a high degree of probability, that terrestrial organisms will not contaminate Mars.

The Exobiology effort supports this objective in various ways, for example, by analyzing fossil remains in ancient terrestrial rocks, in quest of data pertaining to the history of terrestrial life. In addition, studies on proteins and their amino acids, and the fact that 18 amino acids are constituents of our contemporary biota, and about half of these remain stable

799-467 O - 66 - 7

for millions of years, suggest that gas chromatography, mass spectrometry, and the application of classical chemical techniques may be employed in the biological exploration of the Moon and Mars.

Investigations in the planetary quarantine area indicate that heat is the most feasible agent for use in spacecraft sterilization. It will be necessary to develop parts capable of withstanding the heat required, minimize the number of biological organisms on the spacecraft when it undergoes sterilization, and protect the sterile spacecraft from recontamination during launch.

Environmental, Physical, and Behavioral Biology support basic and applied research, and some technological development in support of the Bioscience objectives. Environmental Biology is fundamentally concerned with the biological effects of the space environment on living organisms, including man. It is investigating the effects of weightlessness on the cardiovascular and nervous systems, and on general metabolism, and the environmental extremes which various organisms can endure and still survive. Physical Biology supports research in comparative physiology, bioinstrumentation, and molecular biology. Nutritional studies have shown that men can live on chemically-defined liquid diets for at least six months without apparent ill effects. In biological telemetry and electron microscopy, the development of a multi-channel sensing implantable device, and superconducting lenses, should further research efforts in various biological areas. Behavioral Biology is studying the effects of zero gravity and other conditions of the space environment on the behavior of organisms, including brain-behavior relationships of importance to organisms in environmental adaptation.

The Bioscience program for manned missions is assisting in the development of flight experiments for Gemini and Apollo earth-orbiting missions. Several experiments have already been flown yielding information on the effects of radiation and weightlessness on white blood cells. An effort is also underway to define experiments, and mission and spacecraft requirements for future manned missions.

Biosatellite

The Biosatellite program will investigate the effects on biological systems of such unique aspects of the space environment as weightlessness, the effects of combined weightlessness and radiation, and the removal of living systems from the direct influence of the Earth's periodicity.

The three-day flights will consist of general biology and radiation experiments intended to explore the effects of weightlessness, and weightlessness combined with radiation, on animal cells and insects. The 30-day flights will investigate the effects of weightlessness on general metabolic behavior and performance of a primate, as well as its effects on the primate's cardiovascular and nervous systems. The 21-day flights consist of general biology experiments, investigation of gross body composition and function and circadian rhythms in mammals.

SCHEDULE OF LAUNCHES

Schedule of Significant Research and Development Events

Project	Events	Quarter	Calendar Year
Biosatellite	Biosatellite First Launch	-	1966
	Biosatellite Second, Third and Fourth Launch	-	1967
	Biosatellite Fifth and Sixth Launch	-	1968

RESEARCH AND DEVELOPMENT

FISCAL YEAR 1967 ESTIMATES

SUMMARY

OFFICE OF SPACE SCIENCE AND APPLICATIONS METEOROLOGICAL SATELLITES PROGRAM

PROGRAM OBJECTIVES AND JUSTIFICATION:

The objectives of the Meteorological Satellites Program are: (1) development of a satellite capability for, (a) global and local readout of cloud cover day and night, (b) global quantitative measurement of temperature, wind, moisture, and other meteorological factors as a function of height under continuous and variable time scales; (2) develop and implement for the Department of Commerce, Environmental Science Services Administration (ESSA), the TIROS Operational Satellite (TOS) System; (3) develop a meteorological sounding system to explore and study the atmospheric region 20 to 60 miles above the earth; (4) develop new and improved techniques and equipment; and (5) explore the use of manned spacecraft for Meteorology.

Objectives (1) and (2) are accomplished by the TIROS/TOS Improvements, Meteorological Flight Experiments, and Nimbus projects; objective (3) by Meteorological Soundings project, and objectives (4) and (5) by Supporting Research and Technology and Advanced Studies.

Ten TIROS spacecraft, including TIROS X funded by ESSA, have been successfully launched since April 1960 to test spacecraft systems and sensors and provide operational meteorological data for use by ESSA. One Nimbus spacecraft has been launched and three additional flights are planned to provide cloud cover and vertical atmospheric measurement data. Approximately 50 large research rockets and 100 small developmental sounding rockets are launched per year to explore the region 20 to 60 miles above the earth and obtain meteorological data from this region. The investigation of scientific techniques; design and development of advanced hardware for meteorological application; study of data acquisition techniques; and feasibility studies on future spacecraft designs and capability including manned experiments are conducted in Supporting Research and Technology and Advanced Studies.

SUMMARY OF RESOURCES REQUIREMENTS:

	(Thousands of Dollars)		
	1965	1966	1967
Supporting research and technology/ Advanced studies.....	$7,311	$8,300	$9,100
TIROS/TOS improvements.....	4,100	3,700	2,600
Meteorological flight experiments.	1,200	3,900	5,500

	(Thousands of Dollars)		
	1965	1966	1967
Nimbus	$16,000	$20,000	$23,400
Meteorological soundings	2,380	3,000	3,000
Total	$30,991	$38,900	$43,600

BASIS OF FUND REQUIREMENTS:

Supporting Research and Technology/Advanced Studies

The objectives of the Supporting Research and Technology effort are: (1) to develop and evaluate components for potential meteorological satellite system application; (2) to design and develop satellite sensors for the detection and controlled acquisition of meteorological data directly from the atmosphere and from other sources; (3) to investigate scientific techniques and tools for the systematic observation, analysis and subsequent interpretation of meteorological atmospheric phenomena, and (4) to optimize satellite performance and information retrieval techniques through advanced system analyses. The results of the Supporting Research and Technology program are applicable both to research and development goals of NASA and to the operational systems of the Environmental Science Services Administration (ESSA). In FY 1967, funds are required to continue important atmospheric research into newly-measurable phenomena and expanded observation techniques. Efforts continue in the design of improved control subsystems and data processing loops to achieve greater efficiency, capacity, and life in future meteorological satellites. Sensors and instrumentation systems for advanced cameras and infrared detectors will be developed.

Advanced Studies will be conducted leading to the development of advanced unmanned systems. Advanced component developments will be investigated to determine reliable design interfaces for long life and low power operations in future satellites.

Applications for manned space missions include the study and development of advanced meteorological sensors and other equipment from manned orbital spacecraft. Several investigations of this type have taken place on manned Gemini flights. Studies of experiments for Apollo manned orbital missions were initiated in FY 1965 and FY 1966 to select experiments to take full advantage of manned space flight missions and capabilities. Fiscal Year 1967 funds will be used to continue this effort.

TIROS/TOS Improvements

The objectives of the TIROS/TOS Improvements project are to provide research and development toward advanced meteorological satellite systems and to provide continuing development support for the ESSA funded TIROS Operational System (TOS). During 1965, the ninth and tenth TIROS satellites

were successfully launched. TIROS IX demonstrated the capability of a cart-wheel configured spacecraft to provide daylight cloud cover pictures on a global basis daily. This configuration is the basic design being used in the TOS system. TIROS X, the first ESSA funded spacecraft, was launched in July 1965 to ensure cloud picture coverage during the 1965 hurricane season. Efforts are being continued to develop flight hardware for improvements to the TOS system, to improve reliability and extend subsystem and component life and to meet operational data requirements. The FY 1967 funds are required to continue funding TOS Improvement subsystems aimed primarily at developing the automatic picture transmission (APT) with recorder for the TOS spacecraft, increasing the life and reliability of vidicons and advancing the technology for night sensors.

Meteorological Flight Experiments

The objectives of the Meteorological Flight Experiments are to conduct meteorological research and development on non-meteorological satellites and space vehicles. The first experiments are for the advancement of technology leading to a capability for continuous viewing of the visible disc of the earth with its cloud and radiation data, and for nearly continuous detail viewing of shortlived meteorological phenomena such as thunderstorms, tornadoes and other individual cloud cells. Also, weather data dissemination experiments (WEFAX) will be conducted to demonstrate the meteorological usefulness of transmitting weather information via synchronous satellites to local users on a regional and world-wide basis. The FY 1967 funds are required to complete procurement of the high and low resolution cameras for Applications Technology Satellites, ATS-A; the Image Dissector or equivalent spin scan camera, and Omega Position Location Experiment (OPLE) spacecraft hardware for ATS-C; to initiate the camera and WEFAX hardware development, operations and data evaluation of the ATS meteorological experiments data.

Nimbus

The objectives of Nimbus are: (1) to develop a spacecraft with adequate power supply and stabilization to test a number of meteorological sensors, (2) to develop a variety of meteorological sensors to obtain day and night cloud cover, and atmospheric data such as pressure, temperature, wind and water vapor at various altitudes over the globe, and (3) to test these sensors and associated data acquisition and handling techniques prior to recommending their use on the operational systems of ESSA.

The successful launch of Nimbus I on August 28, 1964 proved the basic spacecraft configuration and the usefulness of the meteorological sensors tested. A failure in the solar array drive reduced power which caused termination of useful data after approximately one month of successful operation. The next spacecraft (Nimbus C) is scheduled for launch in 1966. A new experiment, a Medium Resolution Infrared Radiometer (MRIR) will be flown, in addition to improved versions of the sensors tested on Nimbus I.

The MRIR experiment will permit a full global study of the earth's heat balance, and represents one of the most significant meteorological experiments so far undertaken.

Nimbus C will provide to ESSA, in nearly real-time, High Resolution Infrared Radiometer (HRIR) data for operational purposes; and initiate experimentation with nighttime direct local readout of HRIR data through APT ground stations. The current Nimbus program includes the development of two additional spacecraft (Nimbus B and D) scheduled for launch in 1967 and 1969 respectively. Significant spacecraft and meteorological sensor advances are being developed for testing on these flights such as: (1) a 50-watt radioisotope thermoelectric generator (RTG) which will demonstrate the feasibility of RTG long life power supplies for meteorological satellites; (2) new experiments for determining the temperature profile and the water vapor content of the atmosphere such as spectrometers developed by NASA and ESSA; (3) a sensor to measure the solar flux in the ultraviolet spectral region to determine its influence on the upper layers of the atmosphere; and (4) initial experimentation in collecting, recording, and relaying data from a number of sensors placed on and above the earth's surface to record atmospheric and meteorological data.

The FY 1967 funds are required to provide for the ground operations and support for Nimbus C; and to complete the development of the more advanced Nimbus B experiments as well as to continue the development of the spacecraft; and to initiate the development of the Nimbus D spacecraft and its advanced experiments.

Meteorological Soundings

This project consists of three areas of effort as follows: (1) large research rockets; (2) small developmental sounding rockets; and (3) field experiment support. The objective of the large research rockets is to develop and improve sensors and techniques for measuring the characteristics of the atmosphere in the region 40 to 60 miles above the earth. The objective of the small developmental sounding rockets is to develop a reliable, inexpensive, self-sufficient system, including the rocket vehicle, sensors and data acquisition, which will provide routine measurements of the basic atmospheric parameters in the region 20 to 40 miles above the earth. Field experiment support provides for conducting sounding rocket experiments in cooperation with other countries, on a cost-sharing basis. The data provided by these experiments is made available immediately to all participants, then later to the scientific community at large. The FY 1967 funds are required to provide for the launch of approximately 50 large research rockets of the Nike/Cajun class, 100 small developmental sounding rockets of the Arcas/Hasp class, for development and improvement of the sounding rocket system, initiation of design and development efforts on an advanced system, and for the continuation, extension and development of field experiment support jointly with countries in South America, Europe, and Asia.

SCHEDULE OF LAUNCHES

Schedule of Significant Research and Development Events

Project	Events	Quarter	Calendar Year
TOS*	Launch of OT-2 and OT-3	1	1966
Nimbus	Launch of Nimbus C	2	1966
TOS*	Launch of TOS A through H. One APT and one AVCS spacecraft to be kept operating in orbit.	about 1 per Qtr.	1966-67
Nimbus	Launch of Nimbus B		1967
Nimbus	Launch of Nimbus D		1969

* Funded by ESSA.

RESEARCH AND DEVELOPMENT

FISCAL YEAR 1967 ESTIMATES

SUMMARY

OFFICE OF SPACE SCIENCE AND APPLICATIONS

COMMUNICATION AND APPLICATIONS TECHNOLOGY SATELLITES PROGRAM

PROGRAM OBJECTIVES AND JUSTIFICATION:

The previously separate Communication Satellite Program and the Applications Technology Satellites Program are combined into one program entitled Communication and Applications Technology Satellites. The objectives of the combined program are: (1) to assure that technology required for establishment of future communication, navigation, and other applications satellite systems is developed; (2) to study requirements for and technically assess the applicability of satellites to the future needs of communication, navigation, and other promising applications systems; and (3) to fulfill NASA's responsibilities under the Communications Satellite Act of 1962.

Serving as relay stations at altitudes that are within line-of-sight of distant points on the earth's surface, communications satellites offer microwave communication over long distances, not presently attained by high frequency radio. They therefore offer the potential for providing all types of telecommunications services on a world-wide basis. Studies are underway to determine the need for an improved world-wide navigation system, traffic control, search and rescue, and communication systems for aircraft and ships. Satellites offer great potential in this area. Five Applications Technology Satellites scheduled for launch in the 1966-1969 period offer the potential of testing and evaluating advanced subsystems applicable to communications, meteorology, navigation, and other purposes; testing and evaluating satellite structures and stabilization systems peculiar to communications, navigation and other satellite endeavors; and offer the potential for determining the radiation levels and the long-term effects of this environment on spacecraft components at different altitudes, particularly the synchronous altitude where very little environmental data exists. The Echo, Relay and Syncom projects are completed except for continued data reduction and analysis activity.

SUMMARY OF RESOURCES REQUIREMENTS:

	(Thousands of Dollars)		
	1965	1966	1967
Supporting research and technology/advanced studies...	$2,124	$4,500	$4,600
Echo II.....	325	---	---

799-467 O - 66 - 3

	(Thousands of Dollars)		
	1965	1966	1967
Relay	$462	$200	---
Syncom	168	100	---
Early gravity gradient test satellite	5,000	---	---
Applications technology satellites	22,695	28,000	21,800
Total	$30,774	$32,800	$26,400

BASIS OF FUND REQUIREMENTS:

Supporting Research and Technology/Advanced Studies

The Supporting Research and Technology (SR&T) is basically concentrated in four areas; (1) Communication and Navigation, (2) Applications Technology, (3) Advanced Missions, and (4) Data Analysis. The SR&T effort will identify and solve critical technical problems, advance the state-of-the-art, provide the basis for advanced satellite projects and provide data analysis on life-time data on Echo II, Relay and Syncom.

Echo II

The Echo project consisted of design, development, launch and evaluation of a large inflatable passive communication satellite. Other than a low level effort in experiments on Echo II, the project has been completed. No FY 1966 funds are required. FY 1967 funds required for continued data analysis are included in the SR&T line item.

Relay

Project Relay consisted of the design, development, launch and evaluation of two intermediate altitude active communications satellites. This project demonstrated the capability to economically and reliably perform narrowband and wideband communication between widely separated ground stations for long periods of time. Relay I was successfully launched in December 1962 and Relay II in January 1964. Except for continued communications and radiation experiments data reduction and analysis, the project is completed. Funds required for FY 1967 are included in the SR&T line item.

Syncom

Project Syncom consisted of the design, development, launch, and evaluation of synchronous altitude active communication satellites. This project demonstrated the capability of performing communications experiments including telegraph, digital data, and TV demonstrations reliably, economically, and for long periods of time. The project was completed following the launch of Syncom III in August 1964 and subsequent successful demonstrations. Effort is continuing in communications experiments data reduction and analysis. Funds required for FY 1967 are included in the SR&T line item.

Early Gravity Gradient Test Satellite

The Early Gravity Gradient Test Satellite project consisted of the design, development and flight testing of a gravity gradient stabilization system in support of the Defense Communications Satellite program. The NASA and the DOD entered into an agreement whereby the Air Force Space Systems Command will be responsible for the procurement of flight hardware and will flight test the gravity gradient system as an integral part of the initial Defense Communications Satellite flights. The NASA will continue to monitor this effort and provide technical assistance to the Air Force. FY 1965 funds of $5,000,000 are available to the Air Force to cover costs of the spacecraft. No FY 1966 or FY 1967 funds are required by NASA.

Applications Technology Satellites

This project consists of the design, development, launch, and evaluation of a basic spacecraft capable of performing communications, meteorological, gravity gradient stabilization, scientific and other technological experiments. The project includes five launches: one being a gravity gradient stabilized satellite in a 6,500 mile circular orbit; two launches of spin stabilized satellites; and two launches of gravity gradient stabilized satellites into synchronous orbit. All five satellites will carry meteorological, communications, scientific and other technological experiments; in addition, the 6,500 mile orbit, and two synchronous satellites will carry gravity gradient experiments. FY 1967 funds will provide for the first launch (spin stabilized, synchronous orbit) and preparation for the second launch (6,500 mile orbit) and continued development and testing of the remaining three spacecraft and experiments. Operations and initial data analysis for the first flight will also be provided for with FY 1967 funds.

SCHEDULE OF LAUNCHES

Schedule of Significant Research and Development Events

Project	Events	Quarter	Calendar Year
ATS-B	Launch of spin stabilized spacecraft into synchronous orbit	4	1966
ATS-A	Launch of 6,500 mile gravity gradient stabilized satellite	2	1967
ATS-C	Launch of spin stabilized spacecraft into synchronous orbit		1968
ATS-D	Launch of gravity gradient stabilized satellite into synchronous orbit		1968
ATS-E	Launch of gravity gradient stabilized satellite into synchronous orbit		1969

RESEARCH AND DEVELOPMENT

FISCAL YEAR 1967 ESTIMATES

SUMMARY

OFFICE OF ADVANCED RESEARCH AND TECHNOLOGY — BASIC RESEARCH PROGRAM

PROGRAM OBJECTIVES AND JUSTIFICATION:

The objective of the Basic Research Program is to initiate and administer fundamental research in the physical and mathematical sciences. This research is required for the expeditious, efficient and economical development of future aeronautical and space vehicles. It provides the wealth of basic knowledge on which the future missions of NASA can be built. The Basic Research Program is concentrated in the NASA Research Centers, supplemented by a contract program with universities, non-profit institutions, industry and other Government agencies. Basic research covers a wide spectrum, from extremely fundamental studies of the nature and behavior of matter to more applied studies such as the prevention of catastrophic stress-corrosion failure of titanium tanks when filled with nitrogen tetroxide. The broad objective of this program is the increase and dissemination of knowledge in areas considered vital to the future of NASA.

SUMMARY OF RESOURCES REQUIREMENTS:

	(Thousands of Dollars)		
	1965	1966	1967
Supporting research and technology.....	$21,231	$22,000	$23,000
Total.....	$21,231	$22,000	$23,000

BASIS OF FUND REQUIREMENTS:

The Basic Research Program concentrates on four major disciplines related to NASA's current and future missions. These disciplines are: Fluid Physics, Electrophysics, Materials and Applied Mathematics. The following examples show how existing and planned research contributes to the NASA program.

Liquids relating to magnetic fields may lead to unique space power systems and provide a means for studying and controlling fluids in "zero-gravity" situations. Nuclear magnetic resonance techniques have been used to detect hydrogen nuclei in soil and rock samples; such knowledge could indicate the presence of trace amounts of water in samples from the moon and planets. New materials investigations may lead to lighter-weight structural materials, chemically stable and radiation resistant coatings, high temperature and high strength materials for propulsion systems, advanced ablatives for thermal

protection, more versatile electronic materials, and bearings and lubricants for high temperature use. Proposed aeronautical and spacecraft structures may be designed with more safety and efficiency as a result of new and improved mathematical methods.

RESEARCH AND DEVELOPMENT

FISCAL YEAR 1967 ESTIMATES

SUMMARY

OFFICE OF ADVANCED RESEARCH AND TECHNOLOGY SPACE VEHICLE SYSTEMS PROGRAM

PROGRAM OBJECTIVES AND JUSTIFICATION:

The objectives of the Space Vehicle Systems program are to identify and solve the critical design problems associated with space vehicle launch and ascent through the atmosphere, flight through space, entry into the atmosphere of the earth and other planets, and landing. To this end research is conducted on a broad front in spacecraft and launch vehicle aerothermodynamics and structures and in a number of technological disciplines of importance to space flight which include high energy radiation, meteoroids, vacuum, thermal radiation and temperature control, and the control of fluids in the weightless state. The program is directed toward providing the advanced technology base for future space vehicles and missions, and at the same time providing support for existing vehicle development programs in the solution of immediate design problems.

SUMMARY OF RESOURCES REQUIREMENTS:

	(Thousands of Dollars)		
	1965	1966	1967
Supporting research and technology	$25,707	$26,000	$28,700
Project FIRE	1,811	500	---
Lifting body flight and landing tests	1,400	1,000	1,000
Scout reentry project	400	3,000	4,800
Project Pegasus (Saturn-launched meteoroid experiment)	13,690	2,500	---
Small space vehicle flight experiments	1,010	2,000	1,500
Scout-launched meteoroid experiments	175	---	---
Total	$44,193	$35,000	$36,000

BASIS OF FUND REQUIREMENTS:

Supporting Research and Technology

The requested funds are needed to carry out an agressive research and advanced technology program in aerothermodynamics, structures, and space environmental factors and to develop authoritative space vehicle design criteria in these and other areas. Emphasis will be placed in the technologies of atmosphere entry and spacecraft terminal descent and landing with special reference to (1) advanced controlled entry vehicles for manned space flight applications and readily refurbishable ablative heat shields for such vehicles; (2) vehicle concepts, heating, and heat protected structures for atmosphere entry at planetary flight speeds of 50,000 feet per second and greater; (3) advanced controlled terminal descent techniques and systems for semi-ballistic manned entry vehicles; and (4) parachute and decelerator technology for terminal descent in the thin atmosphere of Mars. Research will also be conducted on aerothermodynamic and structural problems of importance to current launch vehicles. Special attention will be given to the difficult problems involved in recovery and reuse of launch vehicle stages. In space environmental factors, emphasis will be placed on the critical problem of further defining the meteoroid environment, on which major progress was made during the past year with the successful launchings of the large Pegasus meteoroid detection satellites. Research will be continued and augmented in the areas of high energy radiation effects and shielding and the behavior of fluids in the weightless state for which important new in-house research facilities have become available and require support.

The Space Vehicle Systems program is carried out in-house at all major NASA Centers, with the primary effort conducted at the Langley, Ames, Lewis and Flight Research Centers, and is supplemented by research conducted by contract with industry and educational institutions.

Lifting Body Flight and Landing Tests

Fiscal Year 1967 funds are required for the conduct of an extensive flight test program at Flight Research Center on the M-2 and HL-10 vehicles, a program in which both NASA and USAF test pilots will participate. The program is aimed at investigation of the critical terminal approach and landing phase of flight of unconventional wingless vehicles typical of a class of lifting configurations having improved maneuvering capabilities in atmosphere entry flight. The two test vehicles were constructed by the Northrop Corporation to NASA specifications. The M-2 has been delivered and is nearing flight readiness; the HL-10 is nearing delivery and will reach flight readiness in the spring of 1966. The test program will be conducted by carrying the vehicles aloft by a B-52 aircraft and releasing them to gliding flight at 40,000 feet and Mach 0.8.

Scout Reentry Project

The funds requested are needed for anchor point flight experiments launched by Scout vehicles. This is a continuing program whose objective is to support

the advancement of atmosphere entry technology, with particular emphasis on the technologies of aerothermodynamics and heat protective structures. These experiments are conducted with the aim of correlating, verifying, and extending research results obtained in laboratory facilities.

The flight experiments will (1) determine the performance of an advanced ablative heat shield material of interest to ballistic entry vehicle applications; (2) investigate performance and characteristics of ablative heat shields for application to refurbishable heat protection systems for lifting reentry configurations; (3) measure heating rates associated with turbulent boundary layers at high Mach numbers and high Reynolds numbers; and (4) develop, in an intermediate step, the flight techniques, systems, and instruments required for later 50,000 feet per second entry flight tests.

Small Space Vehicle Flight Experiments

Fiscal Year 1967 funds are needed for selected flight experiments using small rocket launch vehicles to verify results obtained in ground-based facilities and to investigate problems which can only be studied under actual flight conditions. Flight experiments will be conducted in this program to determine the deployment, loading, and descent characteristics of advanced parachutes, for application to the problem of terminal descent and landing of instrumented payloads in the thin atmosphere of Mars. The experiments will be launched by Nike rockets to altitudes near 100,000 feet to simulate conditions expected in the Martian atmosphere.

Funds are also included for ablation materials performance experiments at intermediate speeds between those obtained in the Scout-launched experiments and those achievable in ground-based facilities. These experiments provide a vital link in the correlation of ground and flight research. These flights also incorporate research on techniques and instrumentation aids for payload recovery, an essential feature of future heat shield materials flight experiments which will permit post-flight examination and analysis of specimens.

RESEARCH AND DEVELOPMENT

FISCAL YEAR 1967 ESTIMATES

SUMMARY

OFFICE OF ADVANCED RESEARCH AND TECHNOLOGY — ELECTRONICS SYSTEMS PROGRAM

PROGRAM OBJECTIVES AND JUSTIFICATION:

The objective of the program is to advance electronics systems technology to provide attractive options for future aeronautical and space missions. Laboratory research is conducted both in-house and under contract in the problems of guidance, control, communications, tracking, instrumentation, data processing and electronic components. Flight experiments are undertaken to relieve limitations of the earth-bound laboratory environment or to verify laboratory results where the earth-based laboratory simulation is inadequate to accurately portray space or aeronautical conditions.

Guidance research has the objective of employing new concepts having the potential of substantially reducing the quantity of moving parts or of otherwise decreasing complexity, size, weight and power requirements. Inertial, optical, and electromagnetic means are employed to exploit these concepts. In control systems research, automatic and manual flight control and space or aeronautical vehicle attitude control technology improvements are sought. Emphasis is placed on establishing new concepts and verifying them on flight control simulators, leading eventually to experimental and operational flight on real vehicles.

The ability to communicate over interplanetary distances and to accomplish deep space tracking functions is limited. Research is performed to provide a firm technological base for the evolution of future system configurations. Investigations in the microwave, millimeter and sub-millimeter, and optical frequency domains are conducted to develop the basic concepts and components required to improve system capabilities.

In the area of instrumentation and data processing, the technology applied to the processing of Mariner IV pictures to reduce noise and improve contrast leads to a host of new technological requirements for future missions. Included are needs for on-board data storage of millions of bits of information and pre-transmission processing to relieve the requirement for greater spacecraft transmitter power and bandwidth.

Component technology research involves the basic elements of all electronic systems and subsystems. Efforts are centered on the development of new and improved space-qualified components and methods for achieving increased reliability in future system applications.

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SUMMARY OF RESOURCES REQUIREMENTS:

	(Thousands of Dollars) 1965	1966	1967
Supporting research and technology	$23,222	$30,000	$34,000
Flight projects	2,400	2,300	2,800
Total	$25,622	$32,300	$36,800

BASIS OF FUND REQUIREMENTS:

Supporting Research and Technology

FY 1967 funds are required to continue and increase support of guidance technology based on the promising aspects of the laser gyroscope, new concepts in horizon scanning and laser radar. Manual control of launch vehicles for recoverable booster programs, and potential applications of new components to such low fuel and weight attitude control systems as the control moment gyro require support. Work leading to utilization of the laser in deep space communications and new microwave tubes for improvement of present systems in the same area requires increased support. Increased emphasis in FY 1967 will be placed on statistical and optical data processing so that future missions can transmit more meaningful data from space in less bandwidth. Unique applications of computers on the ground are required, especially in the area of better communications between computer and man. Adaption of microelectronic technology to space system components is essential to meet requirements of decreased size, weight and power consumption. FY 1967 funds are necessary to expand this effort and investigate techniques to reduce interconnections between microcircuits and to provide for improved inspection techniques to better understand the physics of failure. Increased emphasis will be placed on reducing the power consumed by electronic circuitry.

Flight Projects

Radio attenuation by plasma sheaths generated in the earth and planetary entry process continue to disrupt vital communication between spacecraft and earth. Earth based simulation of reentry conditions especially for planetary entry and return velocities is totally inadequate as the state-of-the-art is now understood. Project RAM (Radio Attenuation Measurements) requires funding to permit diagnostic flights and flights in the real environment to test alleviation concepts. Funds are also required to gather more data in the manned space flight program to evaluate the effects of spacecraft windows on the performance of improved space sextants.

Horizon sensors for determining spacecraft attitude are dependent on an accurate knowledge of the earth's radiation characteristics as viewed from space. Current programs (SCANNER) are developing techniques for measuring these characteristics. The Earth Coverage Horizon Measurement project requires funds to provide a statistical description of the earth's horizon radiance profile over a broad range of seasonal and climatic variations.

RESEARCH AND DEVELOPMENT

FISCAL YEAR 1967 ESTIMATES

SUMMARY

OFFICE OF ADVANCED RESEARCH AND TECHNOLOGY — HUMAN FACTOR SYSTEMS PROGRAM

PROGRAM OBJECTIVES AND JUSTIFICATION:

This program has four major objectives: (1) to determine man's reactions to the unique environments of space and aeronautical flight, (2) to define the essential requirements for sustaining and protecting man in these environments, (3) to develop the technology necessary to provide suitable life support and protective systems, and (4) to integrate man's capabilities with those of machines to obtain composite systems of superior performance.

The scope, as well as the success, of future manned space missions will depend upon the effective utilization of man for extended periods of time. This requirement is equally important to the success of future aeronautical systems. Considerations of man's performance capability and psychophysiological limitations directly affect equipment design and performance specifications. Such considerations are essential when man is to be integrated as a functional part of a total system. The success of new manned systems requires that Human Factors research stays in step with all other aspects in the development of a new system. The increasing priority of certain lagging Human Factors investigations and technological developments is reflected by the requested funding increases detailed below.

This program is accomplished through a multi-disciplines approach. It includes researchers in nearly every field of medicine, and in biology, psychology, engineering, physics, and electronics. They are located in NASA centers, DOD aerospace medical facilities, universities, and industries located throughout the country.

SUMMARY OF RESOURCES REQUIREMENTS:

	(Thousands of Dollars)		
	1965	1966	1967
Supporting research and technology	$12,160	$13,000	$15,500
Small biotechnology flight projects	1,160	1,900	1,500
Total	$13,320	$14,900	$17,000

BASIS OF FUND REQUIREMENTS:

Supporting Research and Technology

This is an integrated program directed toward the accomplishment of the four major objectives of the overall Human Factors System Program. The program includes effort toward understanding the physiological and psychological reactions of men to the environmental conditions of space travel, including cardiovascular, metabolic, and nutritional reactions. The research involved covers microbiology, definitions of systems to sustain life in the hostile environment, studies of man-machine interactions, and research toward defining and solving next-generation of man into the operational system of future air and spacecraft.

Small Biotechnology Flight Projects

These projects cover a continuing series of small flight experiments designed either to validate results of laboratory research or to obtain essential information not obtainable from research in the laboratory. Experiments to be performed in FY 1967 include the measurement of physiological processes in humans under conditions of stress encountered in flight and measurements of the adaptability of animals to prolonged orbital flight.

RESEARCH AND DEVELOPMENT

FISCAL YEAR 1967 ESTIMATES

SUMMARY

OFFICE OF ADVANCED RESEARCH AND TECHNOLOGY

SPACE POWER AND ELECTRIC PROPULSION SYSTEMS PROGRAM

PROGRAM OBJECTIVES AND JUSTIFICATION:

The space power and electric propulsion systems program provides research and technology to evolve new and improved methods of power generation and electric propulsion for space applications. The program includes work aimed at more efficient and practical use of nuclear, solar and chemical energy for the generation and utilization of electric power in space; as well as the development of the technology of electric thrustors powered by either solar or nuclear power systems.

All space vehicles require electric power for operation of such equipment as communications, telemetry, guidance, stabilization and scientific instruments. The power level and duration varies widely (watts to megawatts and hours to years) depending on the purpose of the vehicle, but the trend is toward the higher power levels and longer mission durations. This trend results from the availability of larger launch vehicles such as the Saturn and from the desire to undertake more ambitious programs. All power system experience to date has been at relatively low power levels, less than 1 kilowatt, and the vast majority of applications have involved solar cell and battery systems. This experience has shown that current solar cell and battery systems will require major improvements in performance, particularly at the higher power levels, and that advanced systems that are more compact and independent of the sun will be required.

Electric thrustor systems offer promise of significant savings in spacecraft weight, trip time or increased payload. The power required ranges from watts for attitude control systems to megawatts for manned interplanetary propulsion systems. Solar cells appear to be satisfactory power sources for the lower power thrustors. Work is needed on the system aspects of electric thrustors in anticipation of several early applications.

SUMMARY OF RESOURCES REQUIREMENTS:

	(Thousands of Dollars)		
	1965	1966	1967
Supporting research and technology	$36,770	$38,200	$37,000
Space electric rocket test (SERT)	2,300	3,000	---
SNAP-8 development	19,150	4,000	5,500
Total	$58,220	$45,200	$42,500

BASIS OF FUND REQUIREMENTS:

Supporting Research and Technology

All spacecraft utilize electric power for their operation. The space power portion of the space power and electric propulsion program is aimed at providing the technology for making significant and worthwhile improvements in operational systems, i.e. solar cells and batteries, and achieving the potential advantages of advanced systems such as isotope and reactor power plants.

The electric thrustor portion of the program includes the technology necessary for early applications of low thrust systems powered by solar cell power plants, and a longer range effort toward the continued improvement of thrustors over the entire range of applications from small spacecraft position control systems to large nuclear powered manned interplanetary propulsion systems. The program is paced to provide new technology information in a timely and economical manner consistent with possible future mission requirements.

SNAP-8 Development

Development of SNAP-8 power conversion system performance and endurance will be continued toward the 35 KWe, 10,000 hour objective. During FY 1967 it is expected that the endurance testing of the major components will be advanced to the 2500 hour point. Technical support investigations in boiler performance, materials and long life instrumentation initiated in late FY 1966 will be continued in FY 1967. Operation at 35 KWe of the first breadboard power conversion system will be continued in FY 1967, and automatic system startup will be investigated.

RESEARCH AND DEVELOPMENT

FISCAL YEAR 1967 ESTIMATES

SUMMARY

OFFICE OF ADVANCED RESEARCH AND TECHNOLOGY — NUCLEAR ROCKETS PROGRAM

PROGRAM OBJECTIVES AND JUSTIFICATION:

The mission of the Nuclear Rockets program is to provide the necessary research, design, and engineering data, test hardware, and general technology required to develop nuclear rocket systems with power levels, operating times, restart conditions, and specific impulse values suitable for advanced space missions. Nuclear rocket systems have been found to have high performance capabilities that will provide major advantages over chemical systems in terms of payloads, costs, and mission flexibility.

Through the use of nuclear rocket propulsion, significant performance advantages accrue to many advanced space missions such as lunar base logistic operations, deep space probing with heavy complex spacecraft, and manned exploration of the planets.

The major areas of effort are the research and engineering of the nuclear reactor, the development of certain non-nuclear components, and the integration of the reactor and non-reactor components into a complete experimental engine system.

The experimental ground test engine system is being investigated to provide an essential understanding of the interaction of components in nuclear rocket engines and of the system performance characteristics. Progress in the technology phase warrants the initiation of specific engine development in FY 1967.

SUMMARY OF RESOURCES REQUIREMENTS:

	(Thousands of Dollars)		
	1965	1966	1967
Supporting research and technology	$20,891	$21,000	$16,900
NERVA	35,370	36,000	33,100
NRDS operations	739	1,000	3,000
Total	$57,000	$58,000	$53,000

BASIS OF FUND REQUIREMENTS:

Supporting Research and Technology

The supporting research and technology effort supplies four basic needs (1) general supporting research and technological data for current projects; (2) necessary basic technology for the development of future generations of nuclear rocket engines and vehicles; (3) feasibility analyses of advanced nuclear propulsion concepts; and, (4) studies of the special safety problems of nuclear rockets.

This effort also includes research on the components and systems required for both the reactor and engine of future nuclear rocket propulsion systems. The major problems studied are those associated with developing systems that will operate reliably under the adverse conditions of reactor radiation and temperature extremes inherent in the nuclear rocket engine.

NERVA

The objective of the NERVA technology effort is to develop the technology of nuclear rocket engine systems utilizing graphite solid-core reactors. Progress in the graphite reactor program has been very good. Altitude equivalent performance levels in excess of 750 seconds specific impulse at 55,000 pounds of thrust have been achieved for extended durations. In view of the reactor progress, increased emphasis is being devoted to the engine system phase. This effort includes the development of critical non-nuclear components, such as the nozzle, turbopump and control system, and the integration of these components with the reactor into meaningful nuclear rocket engine systems tests. It is important to gain a thorough understanding of the interactions of the various components during start-up, full power operation, operation at off-design conditions, and during cool-down periods. With this knowledge we can develop components and systems leading to the development of operational flight engine systems with a high assurance of success.

NRDS Operations

The mission of the Nuclear Rocket Development Station in Nevada is to provide a site for ground static testing of reactors, engines, and eventually, vehicle stages for the nuclear rockets program. The funds under this project provide for NASA's share of the base support services necessary in the maintenance and operation of the facilities at the site.

RESEARCH AND DEVELOPMENT

FISCAL YEAR 1967 ESTIMATES

SUMMARY

OFFICE OF ADVANCED RESEARCH AND TECHNOLOGY — CHEMICAL PROPULSION PROGRAM

PROGRAM OBJECTIVES AND JUSTIFICATION:

The objective of the chemical propulsion program is to establish a sound base of technology on which to plan and to develop propulsion equipment for space program missions. The spectrum of applications includes launch vehicles, upper stages, spacecraft, and auxiliary devices such as personnel mobility devices. The research work covers a broad range of engineering sciences, with the intent to provide a stockpile of technical information from which to draw to meet any future propulsion requirement. The work covers basic studies and experiments such as measurements of chemical and physical properties of propellants, ignition and combustion phenomena, classical and non-equilibrium thermodynamic processes, studies of fluid mechanics, gas dynamics, heat transfer, and solid mechanics. It also includes the examination of new materials, propellants, or processes, and examination and documentation of techniques, procedures, and specifications. This base covers the examination of new concepts and the obtaining of data to establish their feasibility. Future requirements and new problem areas are identified.

The experimental engineering program concentrates engineering effort toward demonstrating the adequacy of our technology to meet attractive mission requirements. This work involves the design, fabrication, and test of functional model propulsion systems and subcomponents to prove that the basic technologies can be integrated to create practical and reliable propulsion machinery. This advanced engineering test work saves engineering cost and development time by providing prior to development clearly defined operational limits, preliminary engineering specifications, design criteria, and fabrication process details. It provides a realistic assessment of the required test program, test facilities, special tooling, and test equipment. This work also provides both potential development costs and the associated schedules for development of an improved operational engine.

SUMMARY OF RESOURCES REQUIREMENTS:

	(Thousands of Dollars) 1965	1966	1967
Supporting research and technology.....	$24,762	$33,500	$33,500
M-1 engine project.....	24,910	2,000	---
Large solid motor project.....	26,800	4,200	3,500
Small chemical propulsion flight projects.....	30	---	---
Total.....	$76,502	$39,700	$37,000

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BASIS OF FUND REQUIREMENTS:

Supporting Research and Technology

Advanced engine design concepts for improving vehicle performance with chemical propellants are being investigated for launch vehicle and upper stage application; the high energy propellants are being examined for use in spacecraft where high specific impulse offers significant weight savings. A liquid propellant experimental program is concentrating initially on spacecraft propulsion related to applications during the next decade. It includes examination of high performance propulsion systems using hydrogen and fluorine propellants and of space-storable propellants suitable for use after extended duration flight in the space environment. The experimental program also covers work on advanced high performance engine systems that will succeed the discontinued M-1 engine.

The solid propellant motor program includes research on nondestructive testing techniques for inspection and qualification of loaded motors, ignition and instability problems, thrust vector control systems, methods of combustion termination, and improved processing techniques. New requirements under investigation are stop-restart capability, more accurate thrust alignment, and improved predictability of propellant burning rate. An experimental engineering program will develop the technology related to solid motor development to the point of demonstrated applicability to launch vehicles, spacecraft, and auxiliary propulsion use.

Large Solid Motor Project

The first phase of this program will be completed in early calendar year 1966. Program continuation will involve development of the technology of critical subsystems.

Subscale motors of 156" size will be used for testing of such subsystems as thrust vector control, failure warning, and abort implementation. These features will ultimately be integrated into 260" size motor tests.

RESEARCH AND DEVELOPMENT

FISCAL YEAR 1967 ESTIMATES

SUMMARY

OFFICE OF ADVANCED RESEARCH AND TECHNOLOGY — AERONAUTICS PROGRAM

PROGRAM OBJECTIVES AND JUSTIFICATION:

The primary role of the Aeronautics program is to improve the efficiency, utility, and safety of aircraft. General objectives are: (1) to provide leadership in the generation of advanced aircraft concepts, (2) to seek technological advances needed to develop superior aircraft, and (3) to supply industry with advanced data for the design of new aircraft. The scope of the NASA aeronautical research program includes work in aerodynamics, structures, materials, air breathing propulsion, and operational aspects including safety, noise, and pilot and aircraft integration. These are the technical disciplines that provide the data needed for the construction of advanced aircraft. Studies of these problems also point to the most profitable paths for technological advances in the future. For example, the XV-5A fan-in-wing aircraft, the tilt-wing XC-142A V/STOL transport, and the variable sweep concept for the F-111 all appeared several years ago as NASA research concepts having great promise. In the years between the first indication of the value of the concept and the first flights of the vehicles, NASA aided in the detailed formulation of the concepts and in substantiating the over-all capabilities of practical vehicles based on these concepts.

In addition, NASA has conducted extensive wind tunnel tests, simulator programs, and flight investigations using appropriate testbed aircraft to substantiate predicted performance and operational characteristics of these vehicles and to aid in the solution of problems of a developmental nature. In this regard, advanced technical development in support of military and civil aircraft procurement continues to be conducted. This work is performed in cooperation with government-sponsored contractors at the request of the cognizant government agencies.

Experimental research and development aircraft and engineering test pilot proficiency aircraft considered necessary to carry out and support the aeronautics effort are included under this program.

SUMMARY OF RESOURCES REQUIREMENTS:

	(Thousands of Dollars) 1965	1966	1967
Supporting research and technology	$ 8,163	$10,261	$ 9,000
X-15 research aircraft	1,425	883	900
Supersonic transport	19,953	14,056	14,100

	(Thousands of Dollars) 1965	1966	1967
V/STOL aircraft.....	2,987	2,000	5,000
Hypersonic ramjet experiment...	2,712	5,000	2,000
XB-70 flight research program..	---	9,296	2,000
Total	$35,240	$41,496	$33,000

BASIS OF FUND REQUIREMENTS:

Supporting Research and Technology

The Supporting Research and Technology program in Aeronautics in FY 1967 will include studies directed toward improvement of subsonic, supersonic, and hypersonic aircraft. For example, wind tunnel investigations of the aerodynamic interference between engine nacelles and wings at high subsonic speeds; studies of new structural design concepts required to fabricate reliable lightweight structures suitable for long lifetimes under high temperature conditions, for supersonic and hypersonic aircraft; studies of air-breathing propulsion cycles and engine components to increase efficiency and permit the design of efficient lightweight engines for V/STOL aircraft, supersonic transport, and hypersonic aircraft; and studies directed toward improving flight safety and increasing operational flexibility of present and proposed aircraft, especially under adverse or "all-weather" flight conditions will be conducted.

X-15 Research Aircraft

The X-15 research program, conducted in cooperation with the Department of Defense, is providing data on manned, maneuverable hypersonic flight. The X-15 remains the only research capability in the world for studying hypersonic flight in its true environment. Experimental results to date have given basic insight into problems of aerodynamics, structures, propulsion and operations during hypersonic flight. Of major importance, the X-15 results have given and will continue to give confidence and guidance to research in ground based hypersonic research facilities enabling exploration in depth of many hypersonic flight problems. In six and one-half years of flight test, from June 1959 to December 1965, the X-15 program not only has contributed to the increased confidence of designers of current high-performance aircraft, but has focused attention on the areas which required additional research. The future program will be directed toward these areas, to provide information for the next logical step in our flight research program--manned, maneuverable hypersonic cruise flight.

Supersonic Transport

NASA's research effort and support for the national supersonic transport (SST) program will continue in 1967 at about the same level as in FY 1966, but with a substantial shift in emphasis. The Federal Aviation Agency and

its contractors will by then be carrying the major activity in prototype configuration development, structural design, and development of the first-generation engines. The NASA will maintain a major effort on advanced propulsion systems and materials for advanced engines, expand its operational research, carry major responsibility in noise and sonic boom research and make available its unique facilities and technical resources as needed during prototype development.

A large part of the requested funds will be used in the field of propulsion for continuing contract research on engine components and materials started in FY's 1965 and 1966. In FY 1967, however, the contract program will be reduced and at the same time, the in-house effort will be increased to provide research information required for second-generation SST engine development.

V/STOL Aircraft

A major part of the increase in funding in FY 1967 will cover studies of a new VTOL research airplane capable of providing more accurate information on the influence of all-weather landing operation capability on the design of high-performance tactical V/STOL types. A feasibility study will be initiated to determine the characteristics required of such a research airplane, and to identify existing conventional high-performance aircraft which could be modified to provide the vehicle needed. Wind tunnel studies will be undertaken to determine the effectiveness of the modifications proposed. Actual modification of the existing vehicle--which the Air Force has agreed to provide from its inventory--may begin. Related flight studies of the requirements for pilot displays to effect safely such VTOL all-weather landing operation, begun in FY 1966, will continue using the NASA Bell 204B helicopter; a flight investigation of an advanced landing-approach aid for STOL aircraft, recently initiated using a conventional transport airplane, will be extended in FY 1967 to more realistic approach conditions following procurement of a suitable STOL aircraft.

Hypersonic Ramjet Experiment

A feasibility study and design competition is currently in progress between the Garrett Corporation, the General Electric Corporation, and the Marquardt Corporation to determine an optimum configuration for a liquid hydrogen fueled ramjet engine capable of being operated between Mach 3 and 8. In this speed regime both subsonic and supersonic combustion systems can be studied using a convertible combustion arrangement.

Upon completion of the current phase I studies, an evaluation will be undertaken to select one or more of the study phase contractors to continue with detailed design, experimental wind tunnel verification, fabrication, and proof test of the selected concepts. This second phase of the program is expected to require 29 months for completion.

XB-70 Flight Research Program

The NASA, by virtue of its statutory responsibility for aeronautical research and technology within the United States Government, has the responsibility to provide the research information and advanced technology needed for design, development, construction, and flight tests of the prototype supersonic transport.

The use of the USAF XB-70 aircraft as a research tool will be supported jointly by the USAF and the NASA. It will provide the NASA with the ability to validate its basic aerodynamic theories and experimental results obtained in ground facilities to account for, as examples, effects of vehicle size (Reynolds Number) on skin friction and heat transfer, effects of elastic structure deformation on aerodynamics and the effect of heat soak on this deformation, effects of vehicle inertia combined with low damping (high altitude) on vehicle control requirements, effect of vehicle size on sonic boom generation and propagation, inlet control system requirements and many others. All of these problems have been and will continue to be the subject of major research efforts in analysis and ground based facilities. The XB-70 program will provide vital guidance and assessment of the soundness of these programs, assuring that major programs such as the supersonic transport will proceed on a sound basis.

RESEARCH AND DEVELOPMENT

FISCAL YEAR 1967 ESTIMATES

SUMMARY

OFFICE OF TRACKING AND DATA ACQUISITION TRACKING AND DATA ACQUISITION PROGRAM

PROGRAM OBJECTIVES AND JUSTIFICATION:

The purpose of this program is to provide tracking and data acquisition support to meet the requirements of flight projects. Responsive and efficient support is provided for all NASA projects, and as mutually agreed, for projects of the Department of Defense, other government agencies, universities, private corporations, international organizations, and other countries engaged in mutual research endeavors.

Support is provided for manned and unmanned flights; for spacecraft, launch vehicles, sounding rockets, and research aircraft; for earth orbital and sub-orbital missions, lunar and planetary missions, and space probes.

Types of support provided include tracking to determine the position and trajectory of vehicles in space, acquisition of data from scientific experiments and on the engineering performance of spacecraft and launch vehicle systems, transmission of commands from ground stations to spacecraft, communication of information between various ground facilities and mission control centers, and processing of the data acquired from the space vehicles. Without this vital support, the NASA space research program would not be possible.

Tracking and data acquisition support is provided by a world-wide network of ground stations (including Department of Defense stations and instrumented ships), and by general purpose facilities in launch areas. These stations are linked together by a network of ground communications which provides the real-time information necessary for critical decisions. Facilities also are provided to process into meaningful form the large amounts of data which are collected from flight projects.

Tracking and data acquisition facilities are used for support of current missions. At the same time, they must be augmented to meet the requirements of missions in the immediate future. Concurrently, planning must proceed for projects which are even further in the future, and equipment and techniques must be developed to assure a sound technological approach for the support of the more complex mission requirements of the next generation.

SUMMARY OF RESOURCES REQUIREMENTS:

	(Thousands of Dollars) 1965	1966	1967
Operations	$95,254	$129,600	$199,000
Equipment	144,482	87,665	66,500
Supporting research and technology	13,500	13,800	13,800
Total	$253,236	$231,065	$279,300

BASIS OF FUND REQUIREMENTS:

Operations

Funds are required for the operation and maintenance of the world-wide tracking and data acquisition facilities. The FY 1967 operation program reflects the support required for the more complex unmanned flight missions and the support for the increasing activity in the manned space flight program. New and augmented facilities, including ships and aircraft, are becoming operational with corresponding increase in communications requirements. Increase in personnel and additional logistic support must be provided to operate and maintain the new facilities and equipment.

Equipment

The tracking and data acquisition support requirements for forthcoming flights establish the equipments that must be procured and the facilities that must be modified. The FY 1967 funds for this purpose reflect a decrease mainly due to prior years' funding of the major portion of the Apollo requirements. Procurements to meet manned space flight requirements will continue in FY 1967, as well as procurement of equipments required for the support of future unmanned missions.

Supporting Research and Technology

Supporting Research and Technology is the activity whereby advanced systems, components and techniques are developed and are then used to implement the various networks to meet the requirements of new flight projects. The program for FY 1967 will emphasize improvements for increasing the reliability and lifetime of existing systems and for determining techniques for efficient utilization of these systems to meet upcoming requirements.

RESEARCH AND DEVELOPMENT

FISCAL YEAR 1967 ESTIMATES

SUMMARY

OFFICE OF TECHNOLOGY UTILIZATION — TECHNOLOGY UTILIZATION PROGRAM

PROGRAM OBJECTIVES AND JUSTIFICATION:

The primary objective of the Technology Utilization program is to provide for the widest practicable and appropriate dissemination to industry of information concerning NASA activities and results which appear to have industrial applications potential. Technology Utilization also includes projects to study and evaluate those factors which will improve our understanding of the implications of the space program.

SUMMARY OF RESOURCES REQUIREMENTS:

	(Thousands of Dollars)		
	1965	1966	1967
Identification	$1,235	$1,220	$1,165
Evaluation	645	680	650
Dissemination	1,970	2,000	2,085
Analysis	900	850	900
Total	$4,750	$4,750	$4,800

BASIS OF FUND REQUIREMENTS:

Identification

The Identification effort is carried out by special personnel who search for ideas, innovations, processes and techniques which appear to have potential for non-aerospace application and report them quickly to NASA Headquarters. The Identification effort also includes the identification of incremental advances in technology. Research institutes, universities and private companies identify these incremental advances in technology by reviewing broad areas of space research and developing state-of-the-art summaries called Technology Surveys. This program will be continued at about the same level during FY 1966 and FY 1967.

Evaluation

The technical information reported to Headquarters is forwarded to a group of Research Institutes and evaluated for novelty, technical feasibility and relevance to non-aerospace industry. The product of this evaluation is a flow of new items, processes and techniques having non-aerospace potential. These

789-467 O - 66 - 11

products are then made the subject of one of several publications: Tech Briefs, Technology Utilization Notes, or Technology Utilization Handbooks. Although the current emphasis on new technology reporting is expected to increase the rate of documents coming into the system, the funding requested for FY 1967 will permit continuation of this evaluation effort at about the same level as for FY 1966 and FY 1965.

Dissemination

Dissemination activities are focused on exploiting the normal channels of communication that are in existence or which can be developed. Two general techniques of dissemination are employed. The first is by mailing lists consisting of over 8,000 industrial companies and individuals who receive information in some cases on all Technology Utilization publications, and in others only those in their technical areas of interest. The second form of dissemination is through experimental regional dissemination centers. Fiscal Year 1967 funds will be used to support current programs at these Centers with appropriate modifications and improvements; and also provide support for several pilot projects with other agencies. In addition, two new experimental dissemination centers are planned.

Analysis

In recognition of the much broader impact of NASA programs than simply that of a major one in advancing science and technology, support is given to a study program to analyze the impact of the space program on the regional and local economy, and on industries, private institutions and different types of manpower. The principal aim here is to have researchers assist in characterizing NASA's impact as it has affected their regions and to develop analyses which lead to consideration of improved policies within the constraints of existing legislation.

A recognition of the need to solve critical management problems and possibly to develop wholly new techniques for managing such a large and complex Research and Development enterprise as the NASA led to the support of study areas that include the organization and management of large R&D projects, the diversified roles of the research director, the government-industry contracting system, conditions under which the transfer of new technology takes place in the economy, and top level policy and decision-making in large R&D organizations. During FY 1967 NASA will continue to support a modest program of research on such management areas.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

PROPOSED APPROPRIATION BILL

CONSTRUCTION OF FACILITIES

For advance planning, design, and construction of facilities for the National Aeronautics and Space Administration and for the acquisition or condemnation of real property, as authorized by law, [$60,000,000] *$101,500,000*, to remain available until expended. *(42 U.S.C. 2451, et seq., 50 U.S.C. 151–160, 511–515; Independent Offices Appropriation Act, 1966; additional authorizing legislation to be proposed.)*

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1967 ESTIMATES

CONSTRUCTION OF FACILITIES

Program and Financing (in thousands of dollars)

	Budget Plan			Costs to this appropriation		
	1965	1966	1967	1965	1966	1967
Program by activities:						
Direct program:						
1. Manned space flight.....	199,770	21,401	54,378	445,041	331,000	158,800
2. Scientific investigations in space.....	8,343	7,084	6,322	28,037	24,400	9,400
3. Space applications.....	.....	.....	.....	2,405	1,100	200
4. Space technology.....	21,291	13,435	11,089	58,659	54,100	26,800
5. Aircraft technology.....	3,729	682	21,011	1,286	3,800	3,700
6. Supporting activities.....	27,974	16,985	8,700	60,353	119,600	56,100
Total direct program costs, funded.....	261,107	59,587	101,500	595,781	534,000	255,000
Reimbursable program:						
3. Space applications.....	.....	.....	.....	227	2,465	.....
Total program costs, funded.....	261,107	59,587	101,500	596,008	536,465	255,000
Change in selected resources[1]...	.....	.....	.....	-72,564	-197,933	-139,000
10 Total.....	261,107	59,587	101,500	523,444	338,532	116,000

CONSTRUCTION OF FACILITIES

Program and Financing (in thousands of dollars) - Continued

	Budget Plan			Costs to this appropriation		
	1965	1966	1967	1965	1966	1967
10 Total.....	261,107	59,587	101,500	523,444	338,532	116,000
Financing:						
21 Unobligated balance available, start of year, for completion of prior year budget plans....	.....	.....	.....	-544,791	-293,492	-39,446
22 Unobligated balance transferred from "Research and development" (73 Stat. 439, 74 Stat. 436, 75 Stat. 355, 77 Stat. 439 and 78 Stat. 658).....	-354	.....	.....	-5,719	-24,486	.....
Reprogramming to or from prior year budget plans.....	5,673	413	.....	.....	.....	.....
24 Unobligated balance available, end of year, for completion of prior year budget plans....	.....	.....	.....	293,492	39,446	24,946
New obligational authority..	266,426	60,000	101,500	266,426	60,000	101,500
New obligational authority:						
40 Appropriation.....	262,880	60,000	101,500	262,880	60,000	101,500
42 Transferred from "Research and development" (78 Stat. 658)...	3,545	.....	.....	3,545	.....	.....
43 Appropriation (adjusted)....	266,426	60,000	101,500	266,426	60,000	101,500

Program and Financing (in thousands of dollars) - Continued

	Budget Plan			Costs to this appropriation		
	1965	1966	1967	1965	1966	1967
Relation of obligations to expenditures:						
71 Total obligations (affecting expenditures)				523,444	338,532	116,000
72 Obligated balance, start of year				626,065	618,608	462,140
74 Obligated balance, end of year				-618,608	-462,140	-278,140
90 Expenditures				530,902	495,000	300,000

	1964	1965	1966	1967
[1]Selected resources as of June 30 are as follows:				
Unpaid undelivered orders	588,239	515,037	317,104	178,104
Advances	614	1,252	1,252	1,252
Total selected resources	588,853	516,289	318,356	179,356

	1965 actual	1966 estimate	1967 estimate
Note.—Reconciliation of budget plan to obligations:			
Total budget plan	261,107	59,587	101,500
Deduct portion of budget plan to be obligated in subsequent years	113,260	5,648	24,946
Add obligations of prior year budget plans	375,597	284,593	39,446
Total obligations	523,444	338,532	116,000

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1967 ESTIMATES

SUMMARY OF CONSTRUCTION OF FACILITIES BUDGET PLAN BY LOCATION

(In thousands of dollars)

Location	Fiscal Year 1965	Fiscal Year 1966	Fiscal Year 1967
Ames Research Center.....	$5,668	$2,749	---
Electronics Research Center....	10,000	5,000	$10,000
Goddard Space Flight Center....	2,314	2,400	710
Jet Propulsion Laboratory.....	3,582	---	350
John F. Kennedy Space Center, NASA.....	88,618	7,782	37,876
Langley Research Center.....	3,640	8,250	6,100
Lewis Research Center.....	770	867	16,000
Manned Spacecraft Center.....	23,907	4,180	13,800
Marshall Space Flight Center...	12,454	2,309	581
Michoud Assembly Facility.....	6,450	285	700
Mississippi Test Facility.....	58,891	1,910	1,700
Various Locations.....	33,114	20,183	6,478
Wallops Station.....	1,699	1,048	205
Facility Planning and Design...	10,000	2,624	7,000
Total Plan.....	$261,107	$59,587	$101,500

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

INSTALLATION SUMMARY
CONSTRUCTION OF FACILITIES
FISCAL YEAR 19 67 BUDGET ESTIMATES

(Dollars in thousands)

NASA INSTALLATION	COGNIZANT PROGRAM OFFICE FOR INSTALLATION	LOCATION OF INSTALLATION	COUNTY	NEAREST CITY
Ames Research Center	Advanced Research & Technology	Moffett Field, Calif.	Santa Clara	Mountain View

INSTALLATION MISSION

Laboratory research in aerodynamics, thermodynamics, materials, structures, guidance and control, space sciences, environmental biology, life detection, life synthesis, human factors, and fundamental physics and chemistry; project management of unmanned spaceflight projects (scientific probes and satellites); development of scientific-experiment payloads for spaceflight projects managed at Ames and elsewhere.

PERSONNEL STRENGTH	FY 1965	FY 1966	FY 1967
NASA PERSONNEL *(End of Year)*	2270	2240	2211
CONTRACTOR AND OTHER PERSONNEL	331	383	411
TOTAL ALL PERSONNEL	2601	2623	2622

LAND	NO. ACRES
NASA-OWNED	226
OTHER GOVERNMENT AGENCY-OWNED	-
NON-FEDERAL *(Leases, easements)*	-
TOTAL LAND	226

TOTAL CAPITAL INVESTMENT* *(Including NASA-Owned Land) (as of June 30, 19 65)*	$ 175,016.0

PROJECT LINE ITEM	COGNIZANT OFFICE	FY 1959 THRU CURRENT YEAR	FY 1967 *(Estimated)*	FUTURE YEARS *(Estimated)*	TOTAL ALL YEARS *(Estimated)*
ALL OTHER PROJECTS		50,710.5			
TOTALS		50,710.5			

CF 6

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* *Includes work in process.*

799-467 O - 66 - 12

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

INSTALLATION SUMMARY
CONSTRUCTION OF FACILITIES
FISCAL YEAR 1967 BUDGET ESTIMATES

(Dollars in thousands)

NASA INSTALLATION	COGNIZANT PROGRAM OFFICE FOR INSTALLATION	LOCATION OF INSTALLATION	COUNTY	NEAREST CITY
Electronics Research Center	Advanced Research & Technology	Cambridge Massachusetts	Middlesex	---

INSTALLATION MISSION The mission of the Electronics Research Center is to increase the agency's capability in space electronics by providing the knowledge and advanced technology needed to overcome deficiencies in electronic systems and components. The Center organizes, manages, and conducts a comprehensive program of basic and applied space electronics research. It also provides a focal point for national space electronics research, coordinating nationwide research efforts and sponsoring electronics research conducted by industry, universities, and private institutions.

PERSONNEL STRENGTH	FY 1965	FY 1966	FY 1967
NASA PERSONNEL *(End of Year)*	250	550	1000
CONTRACTOR AND OTHER PERSONNEL	-0-	-0-	40
TOTAL ALL PERSONNEL	250	550	1040

LAND	NO. ACRES
NASA-OWNED	-
OTHER GOVERNMENT AGENCY-OWNED	-
NON-FEDERAL *(Leases, easements)*	-
TOTAL LAND	-

TOTAL CAPITAL INVESTMENT* *(Including NASA-Owned Land) (as of June 30, 1965)*	$ -

PROJECT LINE ITEM	COGNIZANT OFFICE	FY 1963 THRU CURRENT YEAR	FY 1967 *(Estimated)*	FUTURE YEARS *(Estimated)*	TOTAL ALL YEARS *(Estimated)*
Space Guidance/Optical Communications Laboratory	ART	624	4,954	-	5,578
Qualifications and Standards/Electronic Components Laboratory	ART	140	3,046	-	3,186
Center Support Facilities (Phase III)	ART	130	2,000	-	2,130
ALL OTHER PROJECTS		18,006			
TOTALS		18,900	10,000		

CF 7

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

INSTALLATION SUMMARY
CONSTRUCTION OF FACILITIES
FISCAL YEAR 19 67 BUDGET ESTIMATES

(Dollars in thousands)

NASA INSTALLATION	COGNIZANT PROGRAM OFFICE FOR INSTALLATION	LOCATION OF INSTALLATION	COUNTY	NEAREST CITY
Flight Research Center	Advanced Research & Technology	Edwards AFB, Calif.	Kern	Lancaster, Calif.

INSTALLATION MISSION

This Center conducts research in and evaluates problems of manned flight, both within and outside the atmosphere. The work includes problems of takeoff and landing, low-speed flight, supersonic and hypersonic flight, and reentry to verify predicted characteristics and to identify unexpected problems in actual flight.

PERSONNEL STRENGTH	FY 1965	FY 1966	FY 1967
NASA PERSONNEL *(End of Year)*	669	618	610
CONTRACTOR AND OTHER PERSONNEL	191	220	240
TOTAL ALL PERSONNEL	860	838	850

LAND	NO. ACRES
NASA-OWNED	--
OTHER GOVERNMENT AGENCY-OWNED	218
NON-FEDERAL *(Leases, easements)*	--
TOTAL LAND	218

TOTAL CAPITAL INVESTMENT* *(Including NASA-Owned Land) (as of June 30, 1965)*	$ 31,398.0

PROJECT LINE ITEM	COGNIZANT OFFICE	FY 1959 THRU CURRENT YEAR	FY 1967 *(Estimated)*	FUTURE YEARS *(Estimated)*	TOTAL ALL YEARS *(Estimated)*
ALL OTHER PROJECTS		5,932.2			
TOTALS		5,932.2			

CF 8

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

INSTALLATION SUMMARY
CONSTRUCTION OF FACILITIES
FISCAL YEAR 1967 BUDGET ESTIMATES

(Dollars in thousands)

NASA INSTALLATION	COGNIZANT PROGRAM OFFICE FOR INSTALLATION	LOCATION OF INSTALLATION	COUNTY	NEAREST CITY
Goddard Space Flight Center	Space Science and Applications	Greenbelt, Maryland	Prince George's	Greenbelt, Maryland

INSTALLATION MISSION

This Center is responsible for complete development of unmanned sounding rockets and orbiting spacecraft experiments in basic and applied science. The work covers scientific satellites, and communications and weather satellites which orbit in cislunar space (region between the earth and the moon). In addition, the Center manages NASA's Delta rocket and two world-wide tracking, data acquisition and data reduction networks.

PERSONNEL STRENGTH	FY 1965	FY 1966	FY 1967
NASA PERSONNEL *(End of Year)*	3782	3625	3807
CONTRACTOR AND OTHER PERSONNEL	2306	2712	2869
TOTAL ALL PERSONNEL	6088	6337	6676

LAND	NO. ACRES
NASA-OWNED	554
OTHER GOVERNMENT AGENCY-OWNED	650
NON-FEDERAL *(Leases, easements)*	3
TOTAL LAND	1,207

TOTAL CAPITAL INVESTMENT* *(Including NASA-Owned Land) (as of June 30, 1965)*	$ 197,236.0

PROJECT LINE ITEM	COGNIZANT OFFICE	FY 1959 THRU CURRENT YEAR	FY 1967 *(Estimated)*	FUTURE YEARS *(Estimated)*	TOTAL ALL YEARS *(Estimated)*
Forty-Foot Antenna Test Bed	TDA	10.0	710.0	-	720.0
ALL OTHER PROJECTS		82,227.6			
TOTALS		82,237.6	710.0		

CF 9

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

INSTALLATION SUMMARY
CONSTRUCTION OF FACILITIES
FISCAL YEAR 1967 BUDGET ESTIMATES

(Dollars in thousands)

NASA INSTALLATION	COGNIZANT PROGRAM OFFICE FOR INSTALLATION	LOCATION OF INSTALLATION	COUNTY	NEAREST CITY
Jet Propulsion Laboratory	Space Science and Applications	Pasadena, California	Los Angeles	Pasadena, California

INSTALLATION MISSION

The Jet Propulsion Laboratory (JPL) is a government-owned research and development facility, operated by the California Institute of Technology under a contract with the National Aeronautics and Space Administration. The Laboratory carries out research programs and unmanned lunar and planetary space projects for NASA, and conceives and executes advanced development and experimental engineering investigations to further the technology required for the nation's space program.

PERSONNEL STRENGTH	FY 1965	FY 1966	FY 1967
JPL ~~NASA~~ PERSONNEL *(End of Year)*	3998	4250	4250
CONTRACTOR AND OTHER PERSONNEL	932	1061	1173
TOTAL ALL PERSONNEL	4930	5311	5423

LAND	NO. ACRES
NASA-OWNED	145.9
OTHER GOVERNMENT AGENCY-OWNED	--
NON-FEDERAL *(Leases, easements)*	25.8
TOTAL LAND	171.7
TOTAL CAPITAL INVESTMENT* *(Including NASA-Owned Land) (as of June 30, 1965)*	$128,177.2

PROJECT LINE ITEM	COGNIZANT OFFICE	FY 1959 THRU CURRENT YEAR	FY 1967 *(Estimated)*	FUTURE YEARS *(Estimated)*	TOTAL ALL YEARS *(Estimated)*
Utilities Installations	SSA	3,308	350	2,000	5,658
ALL OTHER PROJECTS		34,569			
TOTALS		37,877	350		

CF 10

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

INSTALLATION SUMMARY
CONSTRUCTION OF FACILITIES
FISCAL YEAR 19 67 BUDGET ESTIMATES

(Dollars in thousands)

NASA INSTALLATION	COGNIZANT PROGRAM OFFICE FOR INSTALLATION	LOCATION OF INSTALLATION	COUNTY	NEAREST CITY
John F. Kennedy Space Center, NASA	Manned Space Flight	Merritt Island, Florida	Brevard	Cocoa Beach

INSTALLATION MISSION

The Center conducts overall planning and supervision of the integration, test, checkout, and launch of NASA space vehicle systems at the Eastern Test Range (ETR) and Merritt Island, and provides support services for all NASA elements located in the area.

PERSONNEL STRENGTH	FY 1965	FY 1966	FY 1967
NASA PERSONNEL *(End of Year)*	2491	2666	2796
CONTRACTOR AND OTHER PERSONNEL	8192	13847	14535
TOTAL ALL PERSONNEL	10683	16513	17331

LAND	NO. ACRES
NASA-OWNED	84,305
OTHER GOVERNMENT AGENCY-OWNED	121
NON-FEDERAL *(Leases, easements)*	3,351
TOTAL LAND	87,777

TOTAL CAPITAL INVESTMENT* *(Including NASA-Owned Land) (as of June 30, 1965)*	$ 561,762.0

PROJECT LINE ITEM	COGNIZANT OFFICE	FY 1961 THRU CURRENT YEAR	FY 1967 *(Estimated)*	FUTURE YEARS *(Estimated)*	TOTAL ALL YEARS *(Estimated)*
Launch Complex 39	MSF	418,435.9	29,500.0	-	447,935.9
Extension to Central Supply Complex	MSF	5,857.0	600.0	-	6,457.0
Addition to KSC Headquarters Building	MSF	9,097.5	3,500.0	-	12,597.5
Utility Installations - MILA	MSF	179.0	2,897.0	-	3,076.0
Modifications to Launch Complex 17	SSA	1,921.0	740.0	6,000.0	8,661.0
Modifications to Launch Complex 12	SSA	1,283.0	639.0	5,000.0	6,922.0
ALL OTHER PROJECTS		388,359.6			
TOTALS		825,133.0	37,876.0		

CF 11

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* *Includes work in process.*

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

INSTALLATION SUMMARY
CONSTRUCTION OF FACILITIES
FISCAL YEAR 1967 BUDGET ESTIMATES

(Dollars in thousands)

NASA INSTALLATION	COGNIZANT PROGRAM OFFICE FOR INSTALLATION	LOCATION OF INSTALLATION	COUNTY	NEAREST CITY
Langley Research Center	Advanced Research & Technology	Langley AFB	--	Hampton, Virginia

INSTALLATION MISSION The LRC undertakes research to provide a technical base for such missions as: (1) Manned and unmanned exploration of space; (2) Improvement of performance and utility of airborne flight. The Center plans, develops and operates necessary facilities; generates new and advanced concepts; provides research advice and assistance to other branches of the Government; disseminates scientific and technical information; searches for and identifies potential industrial applications involved in the course of research.

PERSONNEL STRENGTH	FY 1965	FY 1966	FY 1967
NASA PERSONNEL *(End of Year)*	4374	4304	4249
CONTRACTOR AND OTHER PERSONNEL	477	544	587
TOTAL ALL PERSONNEL	4851	4848	4836

LAND	NO. ACRES
NASA-OWNED	540
OTHER GOVERNMENT AGENCY-OWNED	3619
NON-FEDERAL *(Leases, easements)*	17
TOTAL LAND	4176

TOTAL CAPITAL INVESTMENT* *(Including NASA-Owned Land) (as of June 30, 1965)*	$ 276,178

PROJECT LINE ITEM	COGNIZANT OFFICE	FY 1959 THRU CURRENT YEAR	FY 1967 *(Estimated)*	FUTURE YEARS *(Estimated)*	TOTAL ALL YEARS *(Estimated)*
Reactive Chemical Distribution Area	ART	74	1,089	-	1,163
V/STOL Transition Research Wind Tunnel	ART	548	5,011	-	5,559
ALL OTHER PROJECTS		65,264			
TOTALS		65,886	6,100		

CF 12

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* *Includes work in process.*

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

INSTALLATION SUMMARY
CONSTRUCTION OF FACILITIES
FISCAL YEAR 1967 BUDGET ESTIMATES

(Dollars in thousands)

NASA INSTALLATION	COGNIZANT PROGRAM OFFICE FOR INSTALLATION	LOCATION OF INSTALLATION	COUNTY	NEAREST CITY
Lewis Research Center	Advanced Research & Technology	Cleveland, Ohio Sandusky, Ohio 1/	Cuyahoga, Erie	Cleveland Sandusky

INSTALLATION MISSION The Center provides research and development in the areas of advanced propulsion and space power generation. Basic and applied research is conducted in-house on materials and metallurgy; cryogenic and liquid-metal heat-transfer fluids; pumps and turbines; combustion processes, propellants, tankage, injectors, chambers, and nozzles; system control dynamics; plasmas and magnetohydrodynamics; space meteoroid damage and zero-gravity effects. The Center maintains technical management of NASA contracts on chemical and electric propulsion and on nuclear and solar space power systems, including the Centaur and Agena engine programs.

PERSONNEL STRENGTH	FY 1965	FY 1966	FY 1967
NASA PERSONNEL *(End of Year)*	4917	4842	4779
CONTRACTOR AND OTHER PERSONNEL	441	453	510
TOTAL ALL PERSONNEL	5358	5295	5289

LAND	NO. ACRES
NASA-OWNED	6330
OTHER GOVERNMENT AGENCY-OWNED	-
NON-FEDERAL *(Leases, easements)*	65
TOTAL LAND	6395
TOTAL CAPITAL INVESTMENT* *(Including NASA-Owned Land) (as of June 30, 1965)*	$ 265,754

PROJECT LINE ITEM	COGNIZANT OFFICE	FY 1959 THRU CURRENT YEAR	FY 1967 *(Estimated)*	FUTURE YEARS *(Estimated)*	TOTAL ALL YEARS *(Estimated)*
Expansion of Propulsion Systems Laboratory for Supersonic Research (Cleveland)	ART	700	14,000	-	14,700
Installation of Equipment at Hydrogen Heat Transfer Facility for Hypersonic Propulsion Research (Plum Brook)	ART	197	2,000	-	2,197
ALL OTHER PROJECTS		91,228			
TOTALS		92,125	16,000		

NASA FORM 1029 (REV. JUN 65) PREVIOUS EDITIONS ARE OBSOLETE.

* *Includes work in process.*

1/ Includes Plum Brook Station at Sandusky, Ohio.

CF :3

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

INSTALLATION SUMMARY
CONSTRUCTION OF FACILITIES
FISCAL YEAR 19 67 BUDGET ESTIMATES

(Dollars in thousands)

NASA INSTALLATION	COGNIZANT PROGRAM OFFICE FOR INSTALLATION	LOCATION OF INSTALLATION	COUNTY	NEAREST CITY
Manned Spacecraft Center	Manned Space Flight	Houston, Texas	Harris	Houston

INSTALLATION MISSION

The Manned Spacecraft Center has as its primary mission the development of spacecraft for manned space flight programs. The Center is also responsible for manned space flight operations and conduct of astronaut training.

PERSONNEL STRENGTH	FY 1965	FY 1966	FY 1967
NASA PERSONNEL *(End of Year)*	4431	4928	4866
CONTRACTOR AND OTHER PERSONNEL	3112	5078	5366
TOTAL ALL PERSONNEL	7543	10006	10232

LAND	NO. ACRES
NASA-OWNED	1600
OTHER GOVERNMENT AGENCY-OWNED	
NON-FEDERAL *(Leases, easements)*	
TOTAL LAND	1600

TOTAL CAPITAL INVESTMENT* *(Including NASA-Owned Land) (as of June 30, 19 65)*	$ 241,093.5

PROJECT LINE ITEM	COGNIZANT OFFICE	FY 1962 THRU CURRENT YEAR	FY 19 67 *(Estimated)*	FUTURE YEARS *(Estimated)*	TOTAL ALL YEARS *(Estimated)*
Lunar Sample Receiving Laboratory	MSF	495	9,100		9,595
Flight Crew Training Facility	MSF	60	1,100		1,160
Engineering Building	MSF	145	2,600		2,745
Center Support Facilities	MSF	56	1,000		1,056
ALL OTHER PROJECTS		85,659			
TOTALS		86,415	13,800		

CF 14

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* *Includes work in process.*

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

INSTALLATION SUMMARY
CONSTRUCTION OF FACILITIES
FISCAL YEAR 19 67 BUDGET ESTIMATES

(Dollars in thousands)

NASA INSTALLATION	COGNIZANT PROGRAM OFFICE FOR INSTALLATION	LOCATION OF INSTALLATION	COUNTY	NEAREST CITY
Marshall Space Flight Center	Manned Space Flight	Huntsville, Alabama	Madison	Huntsville, Alabama

INSTALLATION MISSION

The mission of the Marshall Space Flight Center is to develop launch vehicles, engines and vehicle systems for Manned Space Flight programs. The Center also performs advanced studies and research in the general field of astronautics.

PERSONNEL STRENGTH	FY 1965	FY 1966	FY 1967
NASA PERSONNEL *(End of Year)*	7431	7071	6975
CONTRACTOR AND OTHER PERSONNEL	5588	5381	5335
TOTAL ALL PERSONNEL	13019	12452	12310

LAND	NO. ACRES
NASA-OWNED	
OTHER GOVERNMENT AGENCY-OWNED	1797
NON-FEDERAL *(Leases, easements)*	64
TOTAL LAND	1861

TOTAL CAPITAL INVESTMENT* *(Including NASA-Owned Land) (as of June 30, 19 65)*	$ 319,555

PROJECT LINE ITEM	COGNIZANT OFFICE	FY 1961 THRU CURRENT YEAR	FY 1967 *(Estimated)*	FUTURE YEARS *(Estimated)*	TOTAL ALL YEARS *(Estimated)*
Hazardous Operations Laboratory Addition	MSF	691	581		1,272
ALL OTHER PROJECTS		139,295			
TOTALS		139,986	581		

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* *Includes work in process.*

CF 1.5

769-467 O - 66 - 13

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

INSTALLATION SUMMARY
CONSTRUCTION OF FACILITIES
FISCAL YEAR 1967 BUDGET ESTIMATES

(Dollars in thousands)

NASA INSTALLATION	COGNIZANT PROGRAM OFFICE FOR INSTALLATION	LOCATION OF INSTALLATION	COUNTY	NEAREST CITY
Michoud Assembly Facility	Manned Space Flight	New Orleans, La.	Orleans Parish	New Orleans, La.

INSTALLATION MISSION

The mission of the Michoud Assembly Facility is the manufacturing of the first stages of the Saturn family of launch vehicles.

PERSONNEL STRENGTH	FY 1965	FY 1966	FY 1967
NASA PERSONNEL *(End of Year)*	280	295	295
CONTRACTOR AND OTHER PERSONNEL	11455	11313	11016
TOTAL ALL PERSONNEL	11735	11608	11311

LAND	NO. ACRES
NASA-OWNED	905
OTHER GOVERNMENT AGENCY-OWNED	6
NON-FEDERAL *(Leases, easements)*	
TOTAL LAND	911

TOTAL CAPITAL INVESTMENT* *(Including NASA-Owned Land) (as of June 30, 1965)*	$ 117,617

PROJECT LINE ITEM	COGNIZANT OFFICE	FY 1962 THRU CURRENT YEAR	FY 1967 *(Estimated)*	FUTURE YEARS *(Estimated)*	TOTAL ALL YEARS *(Estimated)*
Modification of the Chemical Waste Disposal System	MSF	32	700		732
ALL OTHER PROJECTS		42,852			
TOTALS		42,884	700		

CF 16

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* *Includes work in process.*

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

INSTALLATION SUMMARY
CONSTRUCTION OF FACILITIES
FISCAL YEAR 19 67 BUDGET ESTIMATES

(Dollars in thousands)

NASA INSTALLATION	COGNIZANT PROGRAM OFFICE FOR INSTALLATION	LOCATION OF INSTALLATION	COUNTY	NEAREST CITY
Mississippi Test Facility	Manned Space Flight	Pearl River, Miss.	Hancock	Bay St. Louis, Miss.

INSTALLATION MISSION

The mission of the Mississippi Test Facility is the static test firing of large vehicle stages and propulsion systems.

PERSONNEL STRENGTH	FY 1965	FY 1966	FY 1967
NASA PERSONNEL *(End of Year)*	43	120	120
CONTRACTOR AND OTHER PERSONNEL	1729	3440	2513
TOTAL ALL PERSONNEL	1772	3560	2633

LAND	NO. ACRES
NASA-OWNED	20,996
OTHER GOVERNMENT AGENCY-OWNED	
NON-FEDERAL *(Leases, easements)*	117,874
TOTAL LAND	138,870

TOTAL CAPITAL INVESTMENT* *(Including NASA-Owned Land) (as of June 30, 19 65)*	$ 164,854

PROJECT LINE ITEM	COGNIZANT OFFICE	FY 1963 THRU CURRENT YEAR	FY 19 67 *(Estimated)*	FUTURE YEARS *(Estimated)*	TOTAL ALL YEARS *(Estimated)*
Facilities to Support S-IC and S-II Test Program	MSF	133,355	1,700		135,055
ALL OTHER PROJECTS		101,867			
TOTALS		235,222	1,700		

CF 17

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* *Includes work in process.*

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

INSTALLATION SUMMARY

CONSTRUCTION OF FACILITIES

FISCAL YEAR 19 67 BUDGET ESTIMATES

(Dollars in thousands)

NASA INSTALLATION	COGNIZANT PROGRAM OFFICE FOR INSTALLATION	LOCATION OF INSTALLATION	COUNTY	NEAREST CITY
Pacific Launch Operations Office	Space Science and Applications	Vandenberg AFB (Point Arguello) California	Santa Barbara	Lompoc, California

INSTALLATION MISSION

The mission of the Pacific Launch Operations Office covers two broad areas: (1) Representing NASA, in its relationships with the Western Test Range, including negotiating for and coordinating the use of range services and facilities to support requirements developed by NASA Centers or by local project representatives; and (2) Providing or arranging for administrative, logistic, and technical support for NASA programs and projects at the Western Test Range.

PERSONNEL STRENGTH	FY 1965	FY 1966	FY 1967
NASA PERSONNEL *(End of Year)*	22	-	-
CONTRACTOR AND OTHER PERSONNEL	106	-	-
TOTAL ALL PERSONNEL	128	-	-

LAND	NO. ACRES
NASA-OWNED	-
OTHER GOVERNMENT AGENCY-OWNED	-
NON-FEDERAL *(Leases, easements)*	-
TOTAL LAND	

TOTAL CAPITAL INVESTMENT* *(Including NASA-Owned Land) (as of June 30, 19 65)*	$ 1,187

PROJECT LINE ITEM	COGNIZANT OFFICE	FY 1959 THRU CURRENT YEAR	FY 19 67 *(Estimated)*	FUTURE YEARS *(Estimated)*	TOTAL ALL YEARS *(Estimated)*
ALL OTHER PROJECTS		2,469.5			
TOTALS		2,469.5			

CF 18

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* *Includes work in process.*

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

INSTALLATION SUMMARY
CONSTRUCTION OF FACILITIES
FISCAL YEAR 19 67 BUDGET ESTIMATES

(Dollars in thousands)

NASA INSTALLATION	COGNIZANT PROGRAM OFFICE FOR INSTALLATION	LOCATION OF INSTALLATION	COUNTY	NEAREST CITY
Space Nuclear Propulsion Office (NRDS)	Advanced Research & Technology	Jackass Flats, Nevada	Nye	Las Vegas, Nevada

INSTALLATION MISSION

The mission of the Nuclear Rocket Development Station (NRDS) is to provide a site for ground static testing of the reactors, engines, and eventually, vehicles associated with nuclear rocket development.

PERSONNEL STRENGTH	FY 1965	FY 1966	FY 1967
NASA PERSONNEL *(End of Year)*	117	117	115
CONTRACTOR AND OTHER PERSONNEL	1495	1579	1614
TOTAL ALL PERSONNEL	1612	1696	1729

LAND	NO. ACRES
NASA-OWNED	-
OTHER GOVERNMENT AGENCY-OWNED 1/	90,000
NON-FEDERAL *(Leases, easements)*	-
TOTAL LAND	90,000
TOTAL CAPITAL INVESTMENT* *(Including NASA-Owned Land) (as of June 30, 1965)*	$ 15,194

PROJECT LINE ITEM	COGNIZANT OFFICE	FY 1959 THRU CURRENT YEAR	FY 1967 *(Estimated)*	FUTURE YEARS *(Estimated)*	TOTAL ALL YEARS *(Estimated)*
1/ By agreement between AEC and NASA of February 1962, the NRDS was established as a 90,000 acre site carved out the AEC's Nevada Test Site.					
ALL OTHER PROJECTS		15,955			
TOTALS		15,955			

NASA FORM 1029 (REV. JUN 65) PREVIOUS EDITIONS ARE OBSOLETE.

* *Includes work in process.*

CF 19

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

INSTALLATION SUMMARY
CONSTRUCTION OF FACILITIES
FISCAL YEAR 19 67 BUDGET ESTIMATES

(Dollars in thousands)

NASA INSTALLATION	COGNIZANT PROGRAM OFFICE FOR INSTALLATION	LOCATION OF INSTALLATION	COUNTY	NEAREST CITY
Wallops Station	Space Science and Applications	Eastern Shore of Virginia	Accomack	Salisbury, Maryland

INSTALLATION MISSION

The basic mission of the Station is to prepare, assemble, and launch scientific experiments, achieve the desired position, and velocity in space, track and acquire and record the data sought. These data are processed, analyzed, and reduced to meaningful form.

PERSONNEL STRENGTH	FY 1965	FY 1966	FY 1967
NASA PERSONNEL *(End of Year)*	555	530	530
CONTRACTOR AND OTHER PERSONNEL	254	355	430
TOTAL ALL PERSONNEL	809	885	960

LAND	NO. ACRES
NASA-OWNED	6,561
OTHER GOVERNMENT AGENCY-OWNED	-
NON-FEDERAL *(Leases, easements)*	9
TOTAL LAND	6,570

TOTAL CAPITAL INVESTMENT* *(Including NASA-Owned Land) (as of June 30, 1965)*	$ 75,323

PROJECT LINE ITEM	COGNIZANT OFFICE	FY 1959 THRU CURRENT YEAR	FY 1967 *(Estimated)*	FUTURE YEARS *(Estimated)*	TOTAL ALL YEARS *(Estimated)*
Rocket Storage Magazine	SSA	10	205	-	215
ALL OTHER PROJECTS		37,083			
TOTALS		37,093	205		

CF 20

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* *Includes work in process.*

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

INSTALLATION SUMMARY
CONSTRUCTION OF FACILITIES
FISCAL YEAR 19 67 BUDGET ESTIMATES

(Dollars in thousands)

NASA INSTALLATION	COGNIZANT PROGRAM OFFICE FOR INSTALLATION	LOCATION OF INSTALLATION	COUNTY	NEAREST CITY
Various Locations	Various	Not Applicable	Not Applicable	Not Applicable

INSTALLATION MISSION

PERSONNEL STRENGTH	FY 1965	FY 1966	FY 1967
NASA PERSONNEL *(End of Year)*			
CONTRACTOR AND OTHER PERSONNEL			
TOTAL ALL PERSONNEL	Not Applicable		

LAND	NO. ACRES
NASA-OWNED	
OTHER GOVERNMENT AGENCY-OWNED	
NON-FEDERAL *(Leases, easements)*	Not
TOTAL LAND	Applicable
TOTAL CAPITAL INVESTMENT* *(Including NASA-Owned Land) (as of June 30, 19 65)*	Not $Applicable

PROJECT LINE ITEM	COGNIZANT OFFICE	FY 1962 THRU CURRENT YEAR	FY 1967 *(Estimated)*	FUTURE YEARS *(Estimated)*	TOTAL ALL YEARS *(Estimated)*
Facilities for S-IVB Stage Program	MSF	11,496.2	1,100.0	-	12,596.2
Launch Vehicle Service Tower	SSA	145.0	2,443.0	-	2,588.0
Aerobee 350 Launch Facility	SSA	60.0	1,200.0	-	1,260.0
Spin Test Facility	SSA	38.0	745.0	-	783.0
Water Distribution and Sewage Disposal Systems	TDA	146.0	990.0	-	1,136.0
ALL OTHER PROJECTS		608,010.5			
TOTALS		619,895.7	6,478.0		

CF 21

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* *Includes work in process.*

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

INSTALLATION SUMMARY
CONSTRUCTION OF FACILITIES
FISCAL YEAR 19 67 BUDGET ESTIMATES

(Dollars in thousands)

NASA INSTALLATION	COGNIZANT PROGRAM OFFICE FOR INSTALLATION	LOCATION OF INSTALLATION	COUNTY	NEAREST CITY
All	Office of Associate Administrator	---	---	---

INSTALLATION MISSION

See justification.

PERSONNEL STRENGTH	FY 1965	FY 19 66	FY 19 67
NASA PERSONNEL *(End of Year)*			
CONTRACTOR AND OTHER PERSONNEL			
TOTAL ALL PERSONNEL	Not Applicable		

LAND	NO. ACRES
NASA-OWNED	
OTHER GOVERNMENT AGENCY-OWNED	
NON-FEDERAL *(Leases, easements)*	Not
TOTAL LAND	Applicable

TOTAL CAPITAL INVESTMENT* *(Including NASA-Owned Land) (as of June 30, 19 65)*	$ Not Applicable

PROJECT LINE ITEM	COGNIZANT OFFICE	FY 1962 THRU CURRENT YEAR	FY 19 67 *(Estimated)*	FUTURE YEARS *(Estimated)*	TOTAL ALL YEARS *(Estimated)*
Facility Planning and Design	AA	46,330	7,000	Not Applicable	Not Applicable
ALL OTHER PROJECTS					
TOTALS		46,330 1/	7,000		

NASA FORM 1029 (REV. JUN 65) PREVIOUS EDITIONS ARE OBSOLETE

* *Includes work in process.*

1/ This amount is "non-add" and has been distributed into the appropriate installation summary sheets.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

PROPOSED APPROPRIATION BILL

ADMINISTRATIVE OPERATIONS

For necessary expenses, not otherwise provided for, of the operation of the National Aeronautics and Space Administration, including uniforms or allowances therefor, as authorized by the Act of September 1, 1954, as amended (5 U.S.C. 2131); minor construction; supplies, materials, services, and equipment; awards; hire, maintenance and operation of administrative aircraft; purchase and hire of motor vehicles (including purchase of not to exceed [thirty] *thirty-one* passenger motor vehicles, of which [twenty-four] *sixteen* shall be for replacement only); and maintenance, repair, and alteration of real and personal property; [$584,000,000] *$663,900,000*: *Provided*, That contracts may be entered into under this appropriation for maintenance and operation of facilities, and for other services, to be provided during the next fiscal year. (*42 U.S.C. 2451, et seq., 50 U.S.C. 151–160, 511–515; Independent Offices Appropriation Act, 1966; additional authorizing legislation to be proposed.*)

799-467 O - 66 - 14

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1967 ESTIMATES

ADMINISTRATIVE OPERATIONS

Program and Financing (in thousands of dollars)

	Budget Plan			Costs to this appropriation		
	1965	1966	1967	1965	1966	1967
Program by activities:						
Direct program:						
1. Manned space flight.....	303,582	293,011	310,290	301,767	292,044	309,683
2. Scientific investigations in space.....	71,650	67,806	69,258	71,220	67,580	69,119
3. Space applications.....	12,720	11,377	12,543	12,643	11,341	12,514
4. Space technology.....	177,953	169,498	191,667	176,893	168,939	191,296
5. Aircraft technology.....	43,194	44,838	49,677	42,794	44,690	49,581
6. Supporting activities.....	25,438	25,290	30,465	25,429	25,206	30,407
Total direct program costs, funded.....	634,537	611,820	663,900	630,746	609,800	662,600
Reimbursable program:						
1. Manned space flight.....	61	.....	.....	55	6	.....
3. Space applications.....	974	2,010	1,674	979	2,011	1,674
4. Space technology.....	5	81	81	5	81	81
5. Aircraft technology.....	2	2	2	2	2	2
6. Supporting activities.....	1,312	2,307	2,043	1,333	2,300	2,043
Total reimbursable program costs.....	2,354	4,400	3,800	2,374	4,400	3,800

Program and Financing (in thousands of dollars) - Continued

		Budget Plan			Costs to this appropriation		
		1965	1966	1967	1965	1966	1967
	Total program costs, funded	636,891	616,220	667,700	633,120	614,200	666,400
	Change in selected resources[1]	.....	.....	.....	3,771	2,020	1,300
10	Total	636,891	616,220	667,700	636,891	616,220	667,700
	Financing:						
	Receipts and reimbursements from:						
11	Administrative budget accounts	.....	.....	.....	-2,179	-4,032	-3,411
14	Non-Federal sources[2]	.....	.....	.....	-175	-368	-389
16	Comparative transfers from other accounts	.....	.....	.....	-14,573	.....	.....
25	Unobligated balance lapsing	.....	.....	.....	3,289	.....	.....
	New obligational authority	.....	.....	.....	623,253	611,820	663,900
	New obligational authority:						
40	Appropriation				623,526	584,000	663,900
41	Transferred to "Operating expenses, Public Buildings Service," General Services Administration (78 Stat. 655 and 79 Stat. 531)				-273	-76	.....
42	Transferred from "Research and development" (79 Stat. 534)				.....	27,896	.....
43	Appropriation (adjusted)				623,253	611,820	663,900

ADMINISTRATIVE OPERATIONS

Program and Financing (in thousands of dollars) - Continued

	Budget Plan			Costs to this appropriation		
	1965	1966	1967	1965	1966	1967
Relation of obligations to expenditures:						
10 Total obligations				636,891	616,220	667,700
70 Receipts and other offsets (items 11-17)				-16,927	-4,400	-3,800
71 Obligations affecting expenditures				619,964	611,820	663,900
72 Obligated balance, start of year				77,262	117,220	144,040
74 Obligated balance, end of year				-117,220	-144,040	-147,940
77 Adjustments in expired accounts				-2,459	.....	.....
90 Expenditures				577,546	585,000	660,000

	1964	1965	1966	1967
[1]Selected resources as of June 30 are as follows:				
Unpaid undelivered orders	47,531	51,349	53,369	54,669
Advances	763	716	716	716
Total selected resources	48,294	52,065	54,085	55,385

[2]Reimbursements from non-Federal sources are receipts for services performed on Communications Satellite Corporation projects (42 U.S.C. 2473) and for personal property sold for replacement purposes (40 U.S.C. 481).

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1967 ESTIMATES

ADMINISTRATIVE OPERATIONS

SUMMARY OF OBLIGATIONS BY INSTALLATION
(Thousands of dollars)

	Fiscal Year 1965	Fiscal Year 1966	Fiscal Year 1967
MANNED SPACE FLIGHT			
John F. Kennedy Space Center, NASA	$52,416	$79,723	$98,108
Manned Spacecraft Center	91,036	87,550	98,212
Marshall Space Flight Center	137,787	128,260	131,934
SPACE SCIENCE AND APPLICATIONS			
Goddard Space Flight Center	92,570	64,040	71,687
Pacific Launch Operations Office	844	---	---
Wallops Station	10,931	9,446	10,166
ADVANCED RESEARCH AND TECHNOLOGY			
Ames Research Center	31,807	32,923	33,475
Electronics Research Center	3,201	6,233	15,143
Flight Research Center	10,523	9,335	9,641
Langley Research Center	58,998	63,006	62,587
Lewis Research Center	68,546	67,207	66,284
Space Nuclear Propulsion Office	1,669	1,824	1,847
SUPPORTING ACTIVITIES			
NASA Headquarters	51,516	56,286	58,667
Western Operations Office	22,693	5,987	6,149
TOTAL	$634,537	$611,820	$663,900

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1967 ESTIMATES

ADMINISTRATIVE OPERATIONS

NUMBER OF POSITIONS BY INSTALLATION

	Fiscal Year 1965	Fiscal Year 1966	Fiscal Year 1967
MANNED SPACE FLIGHT			
John F. Kennedy Space Center, NASA	2,491	2,666	2,796
Manned Spacecraft Center	4,431	4,928	4,866
Marshall Space Flight Center	7,754	7,486	7,390
SPACE SCIENCE AND APPLICATIONS			
Goddard Space Flight Center	3,782	3,625	3,807
Pacific Launch Operations Office	22	---	---
Wallops Station	555	530	530
ADVANCED RESEARCH AND TECHNOLOGY			
Ames Research Center	2,270	2,240	2,211
Electronics Research Center	250	550	1,000
Flight Research Center	669	618	610
Langley Research Center	4,374	4,304	4,249
Lewis Research Center	4,917	4,842	4,779
Space Nuclear Propulsion Office	117	117	115
SUPPORTING OPERATIONS			
NASA Headquarters	2,263	2,227	2,200
Western Operations Office	405	391	386
TOTAL	34,300	34,524	34,939

ADMINISTRATIVE OPERATIONS

FISCAL YEAR 1967 ESTIMATES

JOHN F. KENNEDY SPACE CENTER, NASA

SUMMARY

MISSION:

The John F. Kennedy Space Center is responsible for the over-all planning and supervision of the launch preparation and launch of NASA space vehicle systems at the Kennedy Space Center and the National Eastern and Western Test Ranges, and for providing administrative and technical support to all NASA elements at these locations. The Center has developed unique capabilities beginning with the Redstone program in 1952, under the Department of the Army. These capabilities include design of launch and related facilities and design of ground support equipment.

In FY 1965, the Center was assigned responsibility for manned spacecraft preparation and checkout in addition to launch responsibility. In FY 1966, launch responsibility for unmanned missions at Kennedy Space Center and the National Eastern and Western Test Ranges was also assigned to the Installation.

Launch activities have increased steadily over the past years. Apollo Saturn I launches are complete. The Kennedy Space Center will now begin Apollo Saturn IB launches; and activation and checkout of facilities for the Apollo Saturn V program and for unmanned missions including: lunar and planetary, scientific, meteorological and communications satellites. Facilities at the Kennedy Space Center have been under construction for approximately four years.

DESCRIPTION:

The Kennedy Space Center is adjacent to the National Eastern Test Range launch area. It is situated approximately 50 miles east of Orlando, Florida, in northeast Brevard County.

The total launch area occupied by the Center is 87,777 acres, of which 84,305 acres have been acquired by purchase and designated the John F. Kennedy Space Center, NASA. An additional 12 leased acres provide for radar tracking sites. The balance of the land is made up of 121 acres of public domain land and 3,339 acres under easement. In addition to the operation and maintenance of all facilities at the Center, the Center is responsible for certain facilities within both the Eastern and Western Test Range launch areas. The capital investment as of June 30, 1965, was $561,762,000.

SUMMARY OF RESOURCES REQUIREMENTS:

	(Dollars in Thousands) 1965	1966	1967
Authorized Positions, end of year	2,491	2,666	2,796
Average Number of All Employees	1,935	2,531	2,653
Administrative Operations	$52,416	$79,723	$98,108

ADMINISTRATIVE OPERATIONS

FISCAL YEAR 1967 ESTIMATES

MANNED SPACECRAFT CENTER

SUMMARY

MISSION:

The Manned Spacecraft Center develops spacecraft and related equipment for manned space flight programs, selects and trains flight crews, and conducts manned flight operations. The Center is currently engaged in two major space research and development efforts:

1. Gemini. The objectives of the Gemini program are to develop an operational capability in manned space flight and, through this capability, to conduct specific experiments and tests which support Apollo, Department of Defense programs and scientific investigations. In the Gemini program, the United States is developing and demonstrating the capability for long duration flights of at least 14 days, rendezvous and docking, post-docking maneuvers, extra-vehicular activity, and controlled re-entry.

2. Apollo Spacecraft. The Apollo spacecraft activity relates to the design, development, fabrication and test of the man-rated Apollo spacecraft. The spacecraft is comprised of three modules: Command Module, Service Module, and the Lunar Excursion Module. The three module spacecraft is designed to transport three men into lunar orbit, land two men on the lunar surface, and return the flight crew to earth.

The objective of the Apollo activity is the development of a space vehicle system and an operational capability that will result in a broad program of space exploration, including landing a flight crew on the moon and returning them to earth.

DESCRIPTION:

The Manned Spacecraft Center is located two miles east of Webster, Texas. The site, bordering Clear Lake, is approximately 20 miles southeast of downtown Houston, and 25 miles northwest of Galveston. Total NASA-owned land consists of 1,600 acres. The capital investment of the Manned Spacecraft Center at the Clear Lake site as of June 30, 1965 was $241,093,481. The Center holds an additional 55,952 acres under use agreement from the Army at the White Sands Test Facility, with a capital investment of $14,536,800. Combined capital investment of the Manned Spacecraft Center as of June 30, 1965 was $255,630,281.

799-467 O - 66 - 15

SUMMARY OF RESOURCES REQUIREMENTS:

	(Dollars in Thousands)		
	1965	1966	1967
Authorized Positions, end of year.....	4,431	4,928	4,866
Average Number of All Employees.....	4,344	4,411	4,798
Administrative Operations.....	$91,036	$87,550	$98,212

ADMINISTRATIVE OPERATIONS

FISCAL YEAR 1967 ESTIMATES

MARSHALL SPACE FLIGHT CENTER

SUMMARY

MISSION:

The Marshall Space Flight Center develops launch vehicles and space transportation systems necessary to meet national space program requirements. This includes the management of major vehicle and engine programs and related supporting research and technology programs. To accomplish this mission, Marshall possesses the necessary resources in terms of highly skilled government scientific and engineering personnel, unique laboratory facilities, and industrial contractor capability.

The Center is assigned program management responsibility for the Saturn IB and Saturn V launch vehicles, the H-1, RL-10A, J-2, and F-1 engines, and a large variety of supporting research projects. The Center also performs advanced studies and research on launch vehicles and space systems, and in the general field of astronautics, including advanced space navigation techniques. Marshall also exercises management responsibility for the Michoud Assembly Facility, the Mississippi Test Facility, and the Slidell Central Computer Facility.

DESCRIPTION:

The Marshall Space Flight Center at Huntsville, Alabama, occupies 1,797 acres acquired on a nonrevocable use permit from the Department of the Army and 64 leased acres. The capital investment at Huntsville, Alabama, as of June 30, 1965, was $319,555,000. The Michoud Assembly Facility, New Orleans, Louisiana, including the computer facility at Slidell, Louisiana, has a combined capital investment of $117,617,000 on 911 acres; and the Mississippi Test Facility, Pearl River, Mississippi, has a capital investment of $164,854,000 on 138,870 acres, of which 13,428 acres will make up the actual test area.

SUMMARY OF RESOURCES REQUIREMENTS:

	(Dollars in Thousands)		
	1965	1966	1967
Authorized Positions, end of year.....	7,754	7,486	7,390
Average Number of All Employees.....	7,623	7,469	7,278
Administrative Operations.....	$137,787	$128,260	$131,934

ADMINISTRATIVE OPERATIONS

FISCAL YEAR 1967 ESTIMATES

GODDARD SPACE FLIGHT CENTER

SUMMARY

MISSION:

The Goddard Space Flight Center is responsible for the management of applications satellite projects; unmanned scientific satellite projects; the Satellite Tracking and Data Acquisition Network (STADAN); NASA operational communications systems; pre-flight testing and evaluation of spacecraft under simulated flight conditions; design, development and management of scientific payloads for unmanned and manned space flights; and spacecraft design and construction. The Center's effort covers scientific satellites and applications satellites orbiting in cislunar space, the region between the earth and the moon.

In addition, the Center manages NASA's Delta rocket program and two worldwide Tracking, Data Acquisition and Data Reduction Networks, the Satellite Tracking and Data Acquisition Network and the Manned Space Flight Network. One of Goddard's major missions is the global tracking support of the United States manned space flight program.

By virtue of the extremely wide variety of projects and responsibilities, Goddard is one of the few installations in the world capable of conducting a full-range space science experimentation program--from theory through experiment, design and construction, satellite fabrication and testing, rocket launch and tracking, and data acquisition and data reduction. Center scientists, comprising one of the largest groups of free world space scientists are primarily concerned with cislunar measurements in magnetic field, high and low energy particles, ionospheres, aeronomy, meteorology, micrometeorites, solar physics and astronomy.

DESCRIPTION:

The Goddard Space Flight Center, located 15 miles northeast of Washington, D. C. near Greenbelt, Maryland, is situated on a 554 acre main site. Three additional areas, totaling 650 acres, are located within two miles of the Center. The total capital investment as of June 30, 1965 was $197,236,000.

SUMMARY OF RESOURCES REQUIREMENTS:

	(Dollars in Thousands)		
	1965	1966	1967
Authorized Positions, end of year.....	3,782	3,625	3,807
Average Number of All Employees.....	3,595	3,526	3,704
Administrative Operations.....	$92,570	$64,040	$71,687

ADMINISTRATIVE OPERATIONS

FISCAL YEAR 1967 ESTIMATES

PACIFIC LAUNCH OPERATIONS OFFICE

SUMMARY

MISSION:

The Pacific Launch Operations Office was consolidated under the John F. Kennedy Space Center effective October 1, 1965. The FY 1966 and FY 1967 requirements of this office are included with the estimates for the John F. Kennedy Space Center. The total capital investment as of June 30, 1965, amounted to $1,187,000.

SUMMARY OF RESOURCES REQUIREMENTS:

	(Dollars in Thousands)		
	1965	1966	1967
Authorized Positions, end of year	22	---	---
Average Number of All Employees.....	22	---	---
Administrative Operations.....	$844	---	---

ADMINISTRATIVE OPERATIONS

FISCAL YEAR 1967 ESTIMATES

WALLOPS STATION

SUMMARY

MISSION:

Wallops Station was established as a launch site of the National Advisory Committee for Aeronautics (NACA) in 1945 and was transferred to the National Aeronautics and Space Administration upon its establishment in 1958.

The basic mission of Wallops is to plan and conduct the integration, test, checkout and launch of space probes and to track, acquire, record, reduce and analyze the data sought. The Station is also responsible for conducting recovery operations for sub-orbital launches, assisting in tracking and acquiring data on spacecraft launched from other facilities, providing project management for University Explorers and administrative and management support of approved programs.

DESCRIPTION:

Wallops Station consists of three separate areas on Virginia's eastern shore: the main base, the Wallops Island Launching Site and the Wallops mainland. The main base (formerly Chincoteague Naval Air Station), about seven miles inland from Wallops Island, is the site of most administrative and support facilities. Wallops Island, which is five miles long and a half mile wide, is connected to the mainland by a causeway and bridge. Located on the Island are rocket storage buildings, blockhouses, assembly shops and the launch sites. The Wallops mainland is a one-half mile strip west of the Island and houses the radar and optical tracking sites. Wallops Station, totaling 6,561 acres, consists of 2,313 acres on the main base, 108 acres on the mainland area, 3,000 acres on the Island, and 1,140 acres of unusable marsh land. This land is government owned and the total capital investment as of June 30, 1965 was $75,323,000.

SUMMARY OF RESOURCES REQUIREMENTS:

	(Dollars in Thousands)		
	1965	1966	1967
Authorized Positions, end of year	555	530	530
Average Number of All Employees	530	523	523
Administrative Operations.....	$10,931	$9,446	$10,165

ADMINISTRATIVE OPERATIONS

FISCAL YEAR 1967 ESTIMATES

AMES RESEARCH CENTER

SUMMARY

MISSION:

The primary mission of the Ames Research Center is to conduct supporting research and technology in the physical sciences, the space sciences, and the life sciences. The Center is also assigned project management responsibility for the Pioneer and the Biosatellite projects.

Many unique facilities for simulating atmospheric and space flights, ranging from low speeds to escape velocity, are located at this Center. Research tools consist of wind tunnels, flight simulators, free flight ballistic test facilities, and specialized laboratory equipment.

Ames is the principle NASA installation in the field of human factors and the bioscience programs. The requirements of present and future space missions underscore the need for basic research in the physiological and behavior sciences concerned with the effects of space travel. The Pioneer and the Biosatellite projects are examples of this endeavor.

Other work includes the stability and control performance of a wide range of spacecraft configurations, spacecraft materials and structures, and electronic navigation and control systems. In the aeronautics field, problems associated with the supersonic transport, the V/STOL aircraft, and the hypersonic research aircraft are being emphasized. Research in the area of space sciences includes studies of solar physics, planetary environments, and geophysics.

DESCRIPTION:

The Ames Research Center is situated on 226 acres contiguous to the Naval Air Station at Moffett Field, California, all of which is owned by the NASA. The Center is located approximately 35 miles southeast of San Francisco and 15 miles northwest of San Jose, California. The total capital investment as of June 30, 1965 was $175,016,000.

SUMMARY OF RESOURCES REQUIREMENTS:

	(Dollars in Thousands)		
	1965	1966	1967
Authorized Positions, end of year....	2,270	2,240	2,211
Average Number of All Employees.....	2,224	2,244	2,222
Administrative Operations.....	$31,807	$32,923	$33,475

ADMINISTRATIVE OPERATIONS

FISCAL YEAR 1967 ESTIMATES

ELECTRONICS RESEARCH CENTER

SUMMARY

MISSION:

The primary mission of the Electronics Research Center is to increase the agency's capability in space by providing the knowledge and advanced technology needed to improve performance and reliability of space and aeronautical electronic systems and components. The electronics research being managed by the Center is largely contracted with industry and universities and focused on space electronics and components, guidance and navigation of spacecraft and space vehicles, optical communications, space and ground based computers, and microwave technology. An in-house research effort is being conducted by the Center on those tasks offering great promise in space electronics technology for future development out-of-house and on those problems requiring first-hand experience of the Center staff in order to better manage contract related research with industry and universities.

DESCRIPTION:

The Electronics Research Center is provisionally located in leased quarters in Cambridge, Massachusetts. The proposed permanent site is a tract in the Kendall Square area of Cambridge. The tract is one and a half miles west of the center of Boston, and is immediately north of the Massachusetts Institute of Technology and one and a half miles from Harvard University. It consists of about 29 acres to be conveyed by the city of Cambridge to NASA and is bounded on the north by Binney Street, on the south by Broadway, on the east by Third Street, and on the west by the New York Central Railroad. An auxiliary urban site will be required in addition to the permanent urban site as noted in the January 1, 1964 report to Congress on NASA, Electronics Research Center.

SUMMARY OF RESOURCES REQUIREMENTS:

	(Dollars in Thousands)		
	1965	1966	1967
Authorized Positions, end of year.....	250	550	1,000
Average Number of All Employees.....	134	330	842
Administrative Operations.....	$3,201	$6,233	$15,143

ADMINISTRATIVE OPERATIONS

FISCAL YEAR 1967 ESTIMATES

FLIGHT RESEARCH CENTER

SUMMARY

MISSION:

The primary mission of the Flight Research Center is to conduct flight research in and evaluate the problems of manned flight both within and outside the atmosphere. Research includes supporting research and technology effort on take-off and landing, low-speed flight, supersonic and hypersonic flight, and re-entry to verify predicted characteristics and to identify unexpected problems in actual flight.

Physical facilities consist of research and fighter aircraft, special purpose vehicles such as lifting bodies, lunar landing research vehicles, airborne simulators, and specialized ground support equipment. Other facilities include an office-laboratory building, flight maintenance hangar, a calibration hangar, and a high temperature loads calibration facility. The technical staff includes leading experts in the fields of flight research, aerodynamics, loads and structures, thermodynamics, biotechnology, and electronics.

A substantial part of the total Flight Research Center's staff is involved in direct support of the Agency's aeronautical program including the X-15 aircraft program and related projects. Support of the manned space flight program is provided to the Apollo program through efforts on lunar landing research. Other effort is directed in support of space vehicle systems, electronics, and the man-machine integration problems associated with the operation of manned vehicles.

DESCRIPTION:

The Flight Research Center is situated on 218 acres of land under permit from the Air Force Flight Test Center, Edwards, California. The Center is located near Lancaster, California, approximately 65 air miles north of Los Angeles, California. The total capital investment as of June 30, 1965, was $31,398,000.

SUMMARY OF RESOURCES REQUIREMENTS:

	(Dollars in Thousands)		
	1965	1966	1967
Authorized Positions, end of year.	669	618	610
Average Number of All Employees...	617	617	610
Administrative Operations.....	$10,523	$9,335	$9,641

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ADMINISTRATIVE OPERATIONS

FISCAL YEAR 1967 ESTIMATES

LANGLEY RESEARCH CENTER

SUMMARY

MISSION:

The mission of the Langley Research Center is the identification of technological opportunities for important progress in aeronautical and space flight; the exposure and mastery of critical problems that will confront the realization of such potentials; the provision of sound design, construction, and operations knowledge on which advanced flight activities can be based; and the management and support of major national flight projects. In this effort, the staff has demonstrated preeminence in aerodynamics, fluid physics, environmental factors, structures and materials, energy conversion, navigation and control, information systems, crew performance, life support, systems integration, and flight operations. The effective attack on crucial problems involves the development and use of advanced wind tunnel and jet facilities, flight environment and piloting simulators, flight hardware evaluation laboratories, experimental aircraft, free flight models, rocket propelled flight systems, and space vehicles. The aeronautical research programs cover the breadth of fundamental technologies, but are strongly focused on provision of an effective basis for development of advanced aircraft with extended hypersonic, supersonic, high subsonic speed, and V/STOL flight capabilities. In the space field, Langley manages and supports a large number of current earth orbital, lunar, and planetary flight projects; and conducts a penetrating program of advanced research to provide a rational foundation for future space-science, manned space flight, and space application projects.

DESCRIPTION:

The Langley Research Center, Hampton, Virginia, is located approximately 100 air miles south of Washington, D. C. The Center is divided into two separate areas adjacent to the runway facilities of the Langley Air Force Base, and occupies 772 acres of Government owned land. The West Area consists of 750 acres of which 320 acres are occupied under permit from the Air Force. The East Area consists of 22 acres under permit from the Air Force. Runways, some utilities, and certain other facilities are used jointly by NASA and the Air Force. In addition, there are 110 acres of NASA owned land located in the city of Newport News, Virginia, 3,277 acres under permit from other Government agencies, and 17 acres under lease. The total acreage owned, under permit, or leased, is 4,176. The total capital investment as of June 30, 1965, was $276,178,000.

SUMMARY OF RESOURCES REQUIREMENTS:

	(Dollars in Thousands)		
	1965	1966	1967
Authorized Positions, end of year.....	4,374	4,304	4,249
Average Number of All Employees.....	4,316	4,335	4,227
Administrative Operations.....	$58,998	$63,006	$62,587

ADMINISTRATIVE OPERATIONS

FISCAL YEAR 1967 ESTIMATES

LEWIS RESEARCH CENTER

SUMMARY

MISSION:

The primary mission of the Lewis Research Center is in the areas of advanced propulsion and space power generation systems. Supporting research is conducted on materials, heat transfer processes, rocket fuels and engine components, system control dynamics, plasmas and magnetohydrodynamics and zero gravity effects.

Major facilities simulate various flight conditions and range from atmospheric wind tunnels to large space environment facilities. Other specialized experimental facilities include vacuum electron beam furnaces for refinement of tungsten, liquid metal power loops for component evaluations, zero gravity drop towers, chemical rocket static thrust stands, full scale non-nuclear NERVA stand for the study of engine control dynamics, and various cryogenic component rigs.

The majority of the staff conducts in-house research, the results of which advance the frontiers of knowledge in the areas of the Center's responsibilities. The professional personnel also provide technical assistance to the related development efforts for which Lewis has managerial responsibility. The Lewis Research Center maintains technical management of NASA contracts on electric propulsion, nuclear and solar turbo-electric space power systems, and liquid hydrogen rocket technology. In addition, Lewis has the responsibility for the Atlas-Centaur and the Atlas-Agena launch vehicles.

DESCRIPTION:

The Lewis Research Center occupies two sites. The older one is on the southwest edge of Cleveland, Ohio, and occupies 364 acres of which about 15 acres are leased from Cleveland. The Plum Brook Station, near Sandusky, Ohio, occupies 6,031 acres. The total capital investment, including the Plum Brook Station, as of June 30, 1965, was $265,754,000.

SUMMARY OF RESOURCES REQUIREMENTS:

	(Dollars in Thousands)		
	1965	1966	1967
Authorized Positions, end of year....	4,917	4,842	4,779
Average Number of All Employees.....	4,861	4,748	4,642
Administrative Operations.....	$68,546	$67,207	$66,284

ADMINISTRATIVE OPERATIONS

FISCAL YEAR 1967 ESTIMATES

SPACE NUCLEAR PROPULSION OFFICE

SUMMARY

MISSION:

The Space Nuclear Propulsion Office (SNPO) is a joint office of the National Aeronautics and Space Administration and the Atomic Energy Commission. Its mission is to provide the necessary research, design and engineering data, test hardware, and general technology required to develop nuclear rocket systems with power levels, operating times, restart conditions, and specific impulse values suitable for advanced space exploration missions.

DESCRIPTION:

The SNPO Headquarters is located in Germantown, Maryland. It has three extension offices located in Ohio, Nevada, and New Mexico. Its Nuclear Rocket Development Station located in Nevada consists of 90,000 acres equipped with test stands and cells, and assembly and maintenance facilities for the ground testing of reactors and engines. The total capital investment as of June 30, 1965, of SNPO facilities amounted to $15,194,052.

SUMMARY OF RESOURCES REQUIREMENTS:

	(Dollars in Thousands)		
	1965	1966	1967
Authorized Positions, end of year.....	117	117	115
Average Number of All Employees.....	102	111	112
Administrative Operations.....	$1,669	$1,824	$1,847

ADMINISTRATIVE OPERATIONS

FISCAL YEAR 1967 ESTIMATES

NASA HEADQUARTERS

SUMMARY

MISSION:

The NASA Headquarters is responsible for the planning, coordination, and executive direction of programs established to implement the national objectives stated in the National Aeronautics and Space Act of 1958, as amended. To assist NASA general management in carrying out the technical activities, the Headquarters is organized into broad program areas: Manned Space Flight, Space Science and Applications, Advanced Research and Technology, and a support function for Tracking and Data Acquisition. In addition to the responsibility for program direction, the program offices are responsible for management of the field installations which carry out these programs. The Office of Manned Space Flight is responsible for the management of the Marshall Space Flight Center, Manned Spacecraft Center and the John F. Kennedy Space Center; the Office of Space Science and Applications for the Goddard Space Flight Center and Wallops Station, and for the administration of the contract for the operation of the Jet Propulsion Laboratory; the Office of Advanced Research and Technology for the Ames Research Center, Electronics Research Center, Flight Research Center, Langley Research Center, Lewis Research Center, and the Space Nuclear Propulsion Office.

DESCRIPTION:

The NASA Headquarters is located at 400 Maryland Avenue, S. W., Washington, D. C., and also occupies other buildings in the District of Columbia and nearby Virginia. Except for space leased in the Reporters Building and a storage area in Virginia, personnel occupy government-owned buildings.

SUMMARY OF RESOURCES REQUIREMENTS:

	(Dollars in Thousands)		
	1965	1966	1967
Authorized Positions, end of year....	2,263	2,227	2,200
Average Number of All Employees.....	1,989	2,063	2,043
Administrative Operations.....	$51,516	$56,286	$58,667

ADMINISTRATIVE OPERATIONS

FISCAL YEAR 1967 ESTIMATES

WESTERN OPERATIONS OFFICE

SUMMARY

MISSION:

The primary mission of the Western Operations Office is to provide technical, contractual, and administrative support to NASA installations for programs and projects located in Southern California and other areas west of Denver, Colorado. The Western Operations Office functions as a field service in procurement, technical and contract administration, legal and patent reviews, administrative support, and financial management activities.

The mission of the Western Operations Office also includes administrative support and services for the NASA Residence Office at the Jet Propulsion Laboratory. The Resident Office, physically located at the Jet Propulsion Laboratory in Pasadena, California, has principal contract administration responsibilities for the NASA contract with the California Institute of Technology which operates the Jet Propulsion Laboratory.

DESCRIPTION:

The Western Operations Office is located at 150 Pico Boulevard, Santa Monica, California. The Office occupies a group of leased buildings and there is no government investment in buildings or land at this location.

SUMMARY OF RESOURCES REQUIREMENTS:

	(Dollars in Thousands)		
	1965	1966	1967
Authorized Positions, end of year....	405	391	386
Average Number of All Employees.....	377	382	378
Administrative Operations.....	$22,693	$5,987	$6,149

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1967 ESTIMATES

SUMMARY OF APPROPRIATION BUDGET PLANS BY INSTALLATION

(In millions of dollars)

	Research and Development			Construction of Facilities			Administrative Operations			Total		
	1965	1966	1967	1965	1966	1967	1965	1966	1967	1965	1966	1967
John F. Kennedy Space Center, NASA....	58.8	124.7	168.8	88.6	7.8	37.9	52.4	79.7	98.1	199.8	212.2	304.8
Manned Spacecraft Center.....	1422.8	1495.9	1382.0	23.9	4.2	13.8	91.0	87.6	98.2	1537.7	1587.7	1494.0
Marshall Space Flight Center.....	1468.4	1604.0	1485.8	12.5	2.3	.6	137.8	128.3	131.9	1618.7	1734.6	1618.3
Michoud Plant.....	-	-	-	6.4	.3	.7	-	-	-	6.4	.3	.7
Mississippi Test Facility.....	-	-	-	58.9	1.9	1.7	-	-	-	58.9	1.9	1.7
Goddard Space Flight Center.....	375.0	361.5	399.0	2.3	2.4	.7	92.6	64.0	71.7	469.9	427.9	471.4
Pacific Launch Operations Office.....	.1	-	-	-	-	-	.9	-	-	1.0	-	-
Wallops Station.....	6.3	8.7	10.0	1.7	1.0	.2	10.9	9.5	10.2	18.9	19.2	20.4
Jet Propulsion Laboratory.....	206.3	234.1	218.1	3.6	-	.3	17.7	.7	.8	227.6	234.8	219.2
Ames Research Center.....	54.1	56.9	53.2	5.7	2.7	-	31.8	32.9	33.5	91.6	92.5	86.7
Electronics Research Center.....	2.6	7.2	13.1	10.0	5.0	10.0	3.2	6.2	15.1	15.8	18.4	38.2
Flight Research Center.....	9.5	16.8	10.0	-	-	-	10.5	9.3	9.6	20.0	26.1	19.6
Langley Research Center.....	106.9	111.7	79.2	3.6	8.3	6.1	59.0	63.0	62.6	169.5	183.0	147.9
Lewis Research Center.....	322.3	249.3	209.0	.8	.9	16.0	68.5	67.2	66.3	391.6	317.4	291.3
Space Nuclear Propulsion Office.....	45.8	50.2	48.5	-	-	-	1.7	1.8	1.8	47.5	52.0	50.3
NASA Headquarters.....	184.0	184.7	167.1	-	-	-	51.5	56.3	58.7	235.5	241.0	225.8
Western Operations Office.....	7.8	5.9	2.8	-	-	-	5.0	5.3	5.4	12.8	11.2	8.2
Various Locations.....	-	-	-	33.1	20.2	6.5	-	-	-	33.1	20.2	6.5
Facility Planning and Design.....	-	-	-	10.0	2.6	7.0	-	-	-	10.0	2.6	7.0
Total Budget Plan.....	4270.7	4511.6	4246.6	261.1	59.6	101.5	634.5	611.8	663.9	5166.3	5183.0	5012.0

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1967 ESTIMATES

DISTRIBUTION OF RESEARCH AND DEVELOPMENT BUDGET PLAN BY INSTALLATION AND FISCAL YEAR

(In thousands of dollars)

PROGRAM OFFICE	TOTAL	J. F. KENNEDY SPACE CENTER, NASA	MANNED SPACECRAFT CENTER	MARSHALL SPACE FLIGHT CENTER	GODDARD SPACE FLIGHT CENTER	PACIFIC LAUNCH OPERATIONS OFFICE	WALLOPS STATION	AMES RESEARCH CENTER	ELECTRONICS RESEARCH CENTER	FLIGHT RESEARCH CENTER	LANGLEY RESEARCH CENTER	LEWIS RESEARCH CENTER	SPACE NUCLEAR PROPULSION OFFICE	HEADQUARTERS	WESTERN OPERATIONS OFFICE
Office of Manned Space Flight															
1965	2,949,019	56,110	1,418,648	1,435,989	389	-	-	39	-	-	2,400	1,160	-	33,367	917
1966	3,203,996	121,109	1,479,182	1,574,635	425	-	-	230	-	-	700	-	-	25,215	2,500
1967	3,022,800	164,505	1,363,400	1,466,295	500	-	-	250	-	-	-	-	-	25,350	2,500
Office of Space Science and Applications															
1965	732,362	2,674	2,608	1,462	186,868	99	1,150	34,683	275	10	67,388	199,083	-	107,230	128,832
1966	783,237	3,327	14,400	10,607	195,404	-	2,830	37,948	650	5	68,217	179,843	-	106,597	163,409
1967	661,400	4,019	15,200	495	189,193	-	3,640	31,463	750	15	35,960	147,371	-	93,146	140,148
Office of Advanced Research and Technology															
1965	331,328	-	1,512	28,911	8,517	-	-	19,391	2,333	7,638	34,953	122,084	45,760	31,648	28,581
1966	288,596	250	2,355	17,264	9,678	-	-	18,775	6,554	14,919	40,749	69,431	50,218	37,765	20,638
1967	278,300	250	3,370	17,496	9,701	-	-	21,455	12,400	7,925	41,127	61,603	48,500	31,833	22,640
Office of Tracking and Data Acquisition															
1965	253,236	-	-	2,000	179,252	-	5,100	-	-	1,900	2,200	-	-	7,015	55,769
1966	231,065	-	-	1,500	155,950	-	5,835	-	-	1,880	2,000	-	-	10,400	53,500
1967	279,300	-	-	1,500	199,600	-	6,400	-	-	2,100	2,100	-	-	12,000	55,600
Office of Technology Utilization and Policy Planning															
1965	4,750	-	-	-	-	-	-	-	-	-	-	-	-	4,750	-
1966	4,750	-	-	-	-	-	-	-	-	-	-	-	-	4,750	-
1967	4,800	-	-	-	-	-	-	-	-	-	-	-	-	4,800	-
Total Budget Plan															
1965	4,270,695	58,784	1,422,768	1,468,362	375,026	99	6,250	54,113	2,608	9,548	106,941	322,327	45,760	184,010	214,099
1966	4,511,644	124,686	1,495,937	1,604,006	361,457	-	8,665	56,953	7,204	16,804	111,666	249,274	50,218	184,727	240,047
1967	4,246,600	168,774	1,381,970	1,485,786	398,994	-	10,040	53,168	13,150	10,040	79,187	208,974	48,500	167,129	220,888

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1967 ESTIMATES

DISTRIBUTION OF RESEARCH AND DEVELOPMENT BUDGET PLAN BY INSTALLATION AND FISCAL YEAR

(In thousands of dollars)

PROGRAM		TOTAL	J. F. KENNEDY SPACE CENTER, NASA	MANNED SPACECRAFT CENTER	MARSHALL SPACE FLIGHT CENTER	GODDARD SPACE FLIGHT CENTER	PACIFIC LAUNCH OPERATIONS OFFICE	WALLOPS STATION	AMES RESEARCH CENTER	ELECTRONICS RESEARCH CENTER	FLIGHT RESEARCH CENTER	LANGLEY RESEARCH CENTER	LEWIS RESEARCH CENTER	SPACE NUCLEAR PROPULSION OFFICE	HEADQUARTERS	WESTERN OPERATIONS OFFICE [1]
OFFICE OF MANNED SPACE FLIGHT, TOTAL	1965	2,949,019	56,110	1,418,648	1,435,989	389	-	-	39	-	-	2,400	1,160	-	33,367	917
	1966	3,203,996	121,109	1,479,182	1,574,635	425	-	-	230	-	-	700	-	-	25,215	2,500
	1967	3,022,800	164,505	1,363,400	1,466,295	500	-	-	250	-	-	-	-	-	25,350	2,500
Gemini	1965	308,400	-	308,050	-	-	-	-	-	-	-	-	-	-	350	-
	1966	226,611	-	226,211	-	-	-	-	-	-	-	-	-	-	400	-
	1967	40,600	-	40,300	-	-	-	-	-	-	-	-	-	-	300	-
Apollo	1965	2,614,619	55,610	1,100,973	1,430,516	389	-	-	39	-	-	1,200	1,160	-	24,087	645
	1966	2,967,385	120,509	1,249,371	1,569,135	425	-	-	230	-	-	700	-	-	24,515	2,500
	1967	2,974,200	163,905	1,320,500	1,461,795	500	-	-	250	-	-	-	-	-	24,750	2,500
Advanced mission studies	1965	26,000	500	9,625	5,473	-	-	-	-	-	-	1,200	-	-	8,930	272
	1966	10,000	600	3,600	5,500	-	-	-	-	-	-	-	-	-	300	-
	1967	8,000	600	2,600	4,500	-	-	-	-	-	-	-	-	-	300	-
OFFICE OF SPACE SCIENCE AND APPLICATIONS, TOTAL	1965	732,362	2,674	2,608	1,462	186,868	99	1,150	34,683	275	10	67,388	199,083	-	107,230	128,832
	1966	783,237	3,327	14,400	10,607	195,404	-	2,830	37,948	650	5	68,217	179,843	-	106,597	163,409
	1967	661,400	4,019	15,200	495	189,193	-	3,640	31,463	750	15	35,960	147,371	-	93,146	140,148
Physics and astronomy	1965	139,082	-	-	755	110,244	-	1,090	1,557	-	10	2,226	-	-	22,866	334
	1966	143,500	-	-	62	108,498	-	2,550	2,586	-	5	2,272	-	-	27,075	452
	1967	131,400	-	-	25	100,961	-	3,400	2,563	-	15	1,100	-	-	22,836	500
Lunar and planetary exploration	1965	206,027	-	2,608	435	1,267	-	-	15,734	-	-	50,050	97	-	9,256	126,580
	1966	251,337	-	14,400	375	1,164	-	-	12,763	-	-	53,115	-	-	12,913	156,607
	1967	197,900	-	15,200	300	1,200	-	-	7,000	-	-	23,200	-	-	14,300	136,700
Sustaining university program	1965	46,000	-	-	-	-	-	-	-	-	-	-	11	-	45,986	3
	1966	46,000	-	-	-	-	-	-	-	-	-	-	-	-	46,000	-
	1967	41,000	-	-	-	-	-	-	-	-	-	-	-	-	41,000	-
Launch vehicle development	1965	96,500	1,321	-	152	1,557	-	-	-	100	-	735	91,302	-	1,333	-
	1966	55,300	820	-	10,000	250	-	-	-	200	-	570	42,820	-	640	-
	1967	33,700	700	-	-	-	-	-	-	250	-	600	31,550	-	600	-
Launch vehicle procurement	1965	134,487	1,353	-	-	19,496	99	-	-	-	-	13,737	107,673	-	12,129	-
	1966	178,700	2,507	-	-	18,580	-	-	-	-	-	11,600	137,023	-	5,625	3,365
	1967	152,000	3,319	-	-	22,205	-	-	-	-	-	10,400	115,821	-	-	255
Bioscience	1965	28,501	-	-	-	385	-	60	17,392	-	-	-	-	-	9,145	1,519
	1966	36,700	-	-	-	420	-	100	22,599	-	-	30	-	-	11,214	2,337
	1967	35,400	-	-	-	420	-	100	21,900	-	-	30		-	10,450	2,500
Meteorological satellites	1965	30,991	-	-	120	29,505	-	-	-	175	-	425	-	-	766	-
	1966	38,900	-	-	170	35,400	-	180	-	450	-	630	-	-	2,070	-
	1967	43,600	-	-	170	39,300	-	140	-	500	-	630	-	-	2,860	-
Communication and applications technology satellites	1965	30,774	-	-	-	24,414	-	-	-	-	-	215	-	-	5,749	396
	1966	32,800	-	-	-	31,092	-	-	-	-	-	-	-	-	1,060	648
	1967	26,400	-	-	-	25,107	-	-	-	-	-	-	-	-	1,100	193

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1967 ESTIMATES

DISTRIBUTION OF RESEARCH AND DEVELOPMENT BUDGET PLAN BY INSTALLATION AND FISCAL YEAR

(In thousands of dollars)

PROGRAM		TOTAL	J. K. KENNEDY SPACE CENTER, NASA	MANNED SPACECRAFT CENTER	MARSHALL SPACE FLIGHT CENTER	GODDARD SPACE FLIGHT CENTER	PACIFIC LAUNCH OPERATIONS OFFICE	WALLOPS STATION	AMES RESEARCH CENTER	ELECTRONICS RESEARCH CENTER	FLIGHT RESEARCH CENTER	LANGLEY RESEARCH CENTER	LEWIS RESEARCH CENTER	SPACE NUCLEAR PROPULSION OFFICE	HEADQUARTERS	WESTERN OPERATIONS OFFICE 1/
OFFICE OF ADVANCED RESEARCH AND TECHNOLOGY, TOTAL	1965	331,328	-	1,512	28,911	8,517	-	-	19,391	2,333	7,638	34,953	122,084	45,760	31,648	28,581
	1966	288,596	250	2,355	17,264	9,678	-	-	18,775	6,554	14,919	40,749	69,431	50,218	37,765	20,638
	1967	278,300	250	3,370	17,496	9,701	-	-	21,455	12,400	7,925	41,127	61,603	48,500	31,833	22,640
Basic research	1965	21,231	-	-	916	257	-	-	1,966	95	3	1,901	2,234	-	7,503	6,356
	1966	22,000	-	-	815	117	-	-	1,910	595	30	2,119	2,731	-	8,627	5,056
	1967	23,000	-	-	850	120	-	-	2,100	1,000	30	2,200	2,800	-	8,500	5,400
Space vehicle systems	1965	44,193	-	629	16,444	1,231	-	-	3,354	-	1,825	10,594	2,408	-	3,474	4,234
	1966	35,000	-	435	4,201	1,751	-	-	3,076	250	1,010	11,466	3,087	-	6,006	3,718
	1967	36,000	-	670	3,096	2,081	-	-	3,475	250	1,010	14,282	3,223	-	3,713	4,200
Electronics systems	1965	25,622	-	465	3,685	2,967	-	-	3,480	2,178	1,038	6,660	400	-	2,022	2,727
	1966	32,300	-	525	4,003	2,975	-	-	3,718	5,110	698	7,260	539	-	3,906	3,566
	1967	36,800	-	450	4,200	2,960	-	-	4,100	10,000	660	7,420	540	-	3,180	3,290
Human factor systems	1965	13,320	-	365	355	-	-	-	4,233	60	1,750	4,053	232	-	2,172	100
	1966	14,900	-	795	310	25	-	-	5,224	359	1,500	4,246	125	-	2,216	100
	1967	17,000	-	1,100	300	-	-	-	5,830	700	1,250	5,000	-	-	2,820	-
Space power and electric propulsion systems	1965	58,220	-	53	2,415	3,512	-	-	191	-	-	1,324	43,517	-	1,351	5,857
	1966	45,200	-	100	2,010	4,260	-	-	110	50	-	846	28,768	-	4,565	4,491
	1967	42,500	-	650	1,650	3,990	-	-	50	300	-	700	26,065	-	3,045	6,050
Nuclear rockets	1965	57,000	-	-	1,375	-	-	-	-	-	-	-	9,846	45,760	13	6
	1966	58,000	-	-	1,125	-	-	-	-	-	-	-	6,599	50,218	58	-
	1967	53,000	-	-	900	-	-	-	-	-	-	-	3,550	48,500	50	-
Chemical propulsion	1965	76,502	-	-	3,721	550	-	-	-	-	-	1,369	49,588	-	11,973	9,301
	1966	39,700	250	500	4,800	550	-	-	540	-	-	2,877	15,205	-	11,271	3,707
	1967	37,000	250	500	6,500	550	-	-	500	-	-	2,900	12,800	-	9,300	3,700
Aeronautics	1965	35,240	-	-	-	-	-	-	6,167	-	3,022	9,052	13,859	-	3,140	-
	1966	41,496	-	-	-	-	-	-	4,197	190	11,681	11,935	12,377	-	1,116	-
	1967	33,000	-	-	-	-	-	-	5,400	150	4,975	8,625	12,625	-	1,225	-
OFFICE OF TRACKING AND DATA ACQUISITION	1965	253,236	-	-	2,000	179,252	-	5,100	-	-	1,900	2,200	-	-	7,015	55,769
	1966	231,065	-	-	1,500	155,950	-	5,835	-	-	1,880	2,000	-	-	10,400	53,500
	1967	279,300	-	-	1,500	199,600	-	6,400	-	-	2,100	2,100	-	-	12,000	55,600
Tracking and data acquisition	1965	253,236	-	-	2,000	179,252	-	5,100	-	-	1,900	2,200	-	-	7,015	55,769
	1966	231,065	-	-	1,500	155,950	-	5,835	-	-	1,880	2,000	-	-	10,400	53,500
	1967	279,300	-	-	1,500	199,600	-	6,400	-	-	2,100	2,100	-	-	12,000	55,600
OFFICE OF TECHNOLOGY UTILIZATION AND POLICY PLANNING	1965	4,750	-	-	-	-	-	-	-	-	-	-	-	-	4,750	-
	1966	4,750	-	-	-	-	-	-	-	-	-	-	-	-	4,750	-
	1967	4,800	-	-	-	-	-	-	-	-	-	-	-	-	4,800	-
Technology utilization	1965	4,750	-	-	-	-	-	-	-	-	-	-	-	-	4,750	-
	1966	4,750	-	-	-	-	-	-	-	-	-	-	-	-	4,750	-
	1967	4,800	-	-	-	-	-	-	-	-	-	-	-	-	4,800	-
TOTAL BUDGET PLAN	1965	4,270,695	58,784	1,422,768	1,468,362	375,026	99	6,250	54,113	2,608	9,548	106,941	322,327	45,760	184,010	214,099
	1966	4,511,644	124,686	1,495,937	1,604,006	361,457	-	8,665	56,953	7,204	16,804	111,666	249,274	50,218	184,727	240,047
	1967	4,246,600	168,774	1,381,970	1,485,786	398,994	-	10,040	53,168	13,150	10,040	79,187	208,974	48,500	167,129	220,888

1/Amount for Western Operations Office includes funds for the Jet Propulsion Laboratory as shown in the Research and Development program justification (Vol. II)

ADMINISTRATIVE OPERATIONS*

FISCAL YEAR 1967 ESTIMATES

JET PROPULSION LABORATORY

SUMMARY

MISSION:

The Jet Propulsion Laboratory (JPL), a government-owned facility, is operated by the California Institute of Technology under contractual arrangement with the National Aeronautics and Space Administration. The Laboratory has primary responsibility for the development and/or project management of complete spacecraft systems (e.g., Surveyor and Mariner), lunar and deep space unmanned scientific missions, and world-wide tracking, data acquisition, data reduction and analysis capability as required by lunar and deep space flights. Other areas of importance in the JPL program include advanced spacecraft guidance and control systems, advanced solid propellant and liquid propellant spacecraft engines, and integration of advanced propulsion systems into spacecraft.

DESCRIPTION:

The Jet Propulsion Laboratory occupies a main site of 145.9 acres in Pasadena, California, approximately twenty miles from Los Angeles. Subsidiary facilities are located at Goldstone, California; Edwards Air Force Base in Muroc, California; and at Table Mountain, California. The capital investment as of June 30, 1965 was $128,177,167.

SUMMARY OF RESOURCES REQUIREMENTS:

	(Dollars in Thousands)		
	1965	1966	1967
Authorized Positions, end of year....	3,998	4,250	4,250
Average Number of All Employees.....	4,119	4,125	4,200
Administrative Type Costs*.....	$63,151	$65,699	$71,218

*As a contractor operation, personnel and operation of installation costs at the Jet Propulsion Laboratory are included in the Research and Development appropriation. Therefore, the administrative operations type estimates for JPL are shown for comparability purposes only and are not included in the NASA Administrative Operations appropriation.

799-467 O - 66 - 17

FISCAL YEAR 1967 ESTIMATES

CONSOLIDATED STATEMENT

ON THE AERONAUTICS PROGRAM

The funding shown in the NASA Research and Development budget (Volume II) for the Aeronautics program does not totally reflect the level of effort being conducted. NASA has, in its own research centers, a very great capability to accomplish aeronautics research. This capability, exemplified by major wind tunnel complexes, operational research aircraft, and extensive flight simulation facilities, is operated by Government personnel. In order to assess the magnitude of the NASA aeronautical research effort performed, the portion of the "Administrative Operations" appropriation which supports aeronautics projects must be added to the Research and Development funds. In addition, the cost of related Construction of Facilities projects is also to be considered, since, the increased capability to conduct aeronautics research is directly related to keeping the NASA physical plant up to date.

In addition to the funding described above, there is a considerable amount of work performed in other NASA Research and Technology activities that has potential benefit to Aeronautics. This may be categorized as "other OART, Supporting Research and Technology applicable to Aeronautics" and shown, as an estimate, in the table below.

	(Dollars in Millions)		
	1965	1966	1967
Research and development	$35.2	$41.5	$33.0
Construction of facilities	3.7	.7	21.0
Administrative operations	33.4	37.4	39.5
Sub-Total	72.3	79.6	93.5
Other OART supporting research and technology applicable to aeronautics.	$30.0	$30.0	$30.0
Total	$102.3	$109.6	$123.5
Number of direct personnel engaged in aeronautics research and development effort	1,513	1,679	1,743

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1967 ESTIMATES

SUPPORTING RESEARCH AND TECHNOLOGY
(Thousands of dollars)

	Fiscal Year 1965	Fiscal Year 1966	Fiscal Year 1967
OFFICE OF MANNED SPACE FLIGHT.....	$53,900	$32,205	$32,395
Apollo supporting development..	53,900	32,205	32,395
OFFICE OF SPACE SCIENCE AND APPLICATIONS.....	$74,233	$94,300	$95,400
Physics and astronomy.....	21,057	23,800	22,900
Lunar and planetary exploration	24,140	38,600	40,100
Bioscience.....	12,501	15,100	14,700
Communication and applications technology satellites.....	2,124	4,500	4,600
Meteorological satellites.....	7,311	8,300	9,100
Launch vehicle development.....	7,100	4,000	4,000
OFFICE OF ADVANCED RESEARCH AND TECHNOLOGY.....	$172,906	$193,961	$197,600
Basic research.....	21,231	22,000	23,000
Space vehicle systems.....	25,707	26,000	28,700
Electronics systems.....	23,222	30,000	34,000
Human factors systems.....	12,160	13,000	15,500
Nuclear rockets.....	20,891	21,000	16,900
Chemical propulsion.....	24,762	33,500	33,500
Aeronautics.....	8,163	10,261	9,000
Space power and electric propulsion systems.....	36,770	38,200	37,000
OFFICE OF TRACKING AND DATA ACQUISITION.....	$13,500	$13,800	$13,800
GRAND TOTAL.....	$314,539	$334,266	$339,695

U.S. GOVERNMENT PRINTING OFFICE: 1966 O - 799-467