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JOHN F. KENNEDY SPACE CENTER

KSC HISTORICAL MONOGRAPH NO. 1
(KHM-1)

HISTORICAL ORIGINS of NASA'S LAUNCH OPERATIONS CENTER to JULY 1, 1962

JOHN F. KENNEDY SPACE CENTER
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
COCOA BEACH, FLORIDA
OCTOBER 1964

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HISTORICAL ORIGINS OF NASA'S LAUNCH OPERATIONS CENTER TO JULY 1, 1962

by

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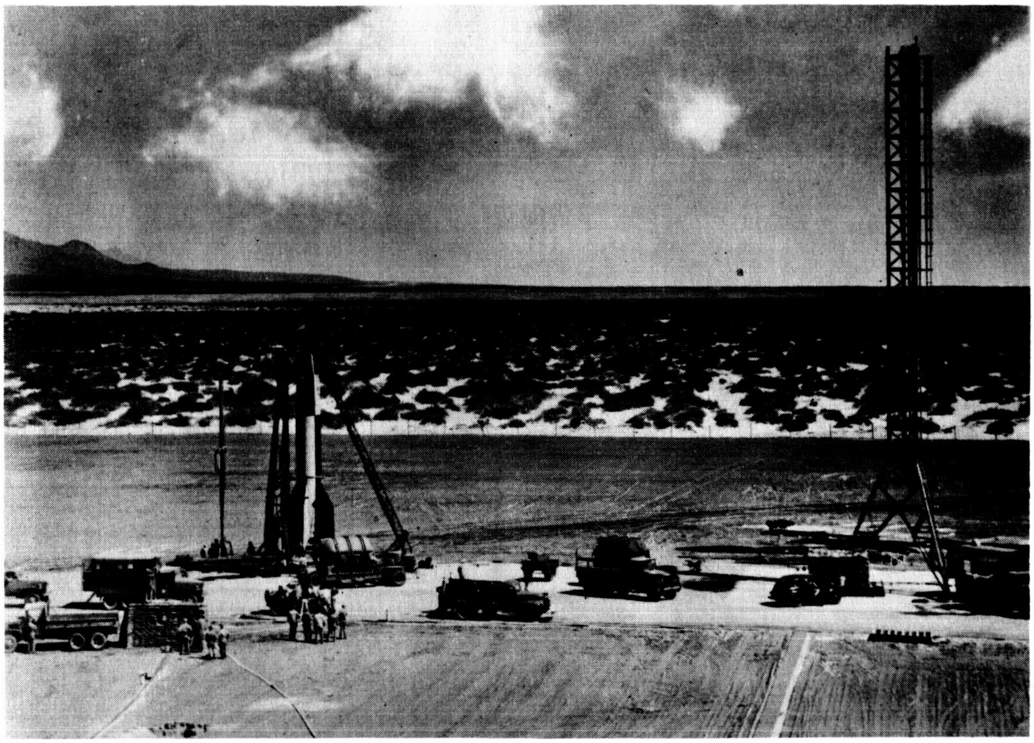
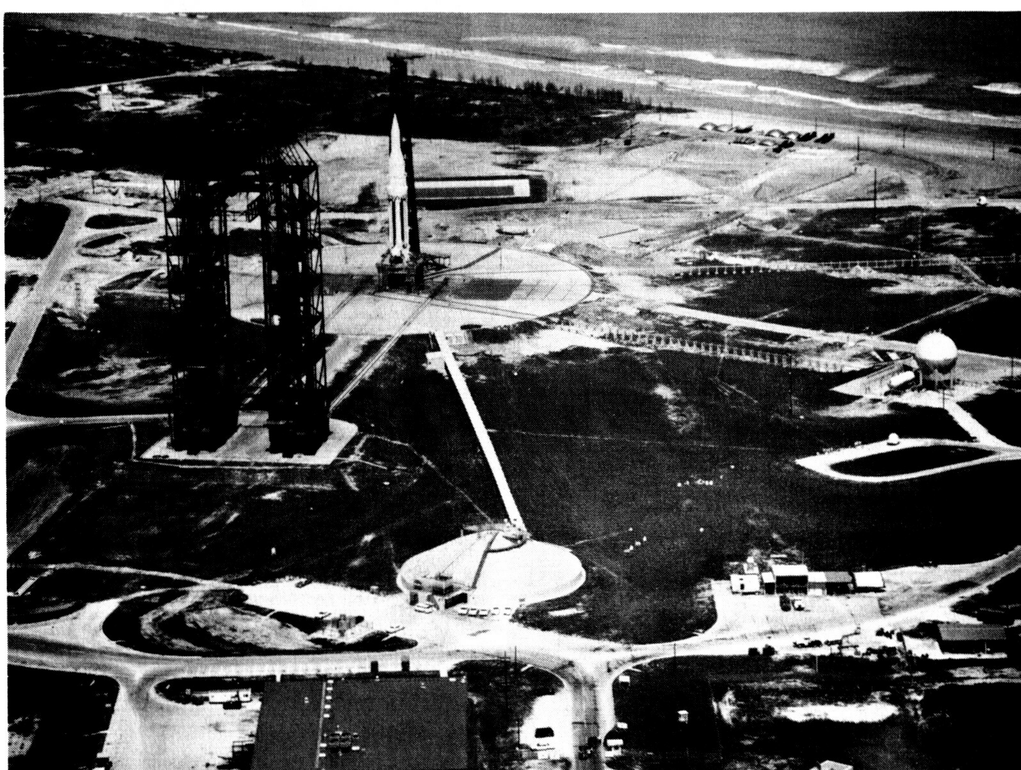


V-2 LAUNCHING SITE AT WHITE SANDS



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FOREWORD

This preliminary study is designed to serve as a reference tool for those who seek background information concerning the antecedents of NASA's Launch Operations Center which became operational on July 1, 1962. A second study, currently underway, will trace the growth and activities of this organization through its redesignation as the John F. Kennedy Space Center, NASA.

It is recognized that this account places heavy emphasis on non-NASA activities of our organization. Because the launch operations team went through its formative years prior to the establishment of NASA, such emphasis is deemed appropriate. The monograph presents, in readily accessible form, information concerning our early organization and development which hitherto could be obtained only by consulting a variety of widely scattered sources. Despite its self-imposed restrictions, it should prove to be a useful historical reference.

PREFACE

The origins of NASA's Launch Operations Center (now known as the John F. Kennedy Space Center, NASA) can be traced to the period immediately preceding World War II. It was during this period that a number of the key personnel intimately connected with this center and with its parent organization, the George C. Marshall Space Flight Center, became actively involved with the science of rocketry.

United States participation in rocketry activities was given impetus in 1945 when a number of outstanding German rocket scientists were brought to this country as part of "Operation Paperclip." The contributions of this group, combined with those of U.S. scientists and technicians, made it possible for this country to play a leading role in the development and expansion of missile and space technology.

This study is an attempt to trace briefly the development and growth of a launching agency, first under the auspices of the U.S. Army Ordnance Department and then as part of NASA's Marshall Space Flight Center. The account ends with the establishment of this agency as an independent field center (LOC) of the National Aeronautics and Space Administration.

Every effort has been made to refrain from discussing in more than a general way space programs and activities which are the responsibilities of other NASA Centers. In some cases, however, it was necessary to mention "outside" activities in order to show the role of the launching agency in the overall program.

Perhaps the most useful and most frequently consulted source of information during the preparation of this document was Dr. Eugene M. Emme's Aeronautics and Astronautics, 1915-60, along with his chronologies for 1961 and 1962. Another useful source was David S. Akens, Historical Origins of the George C. Marshall Space Flight Center, as well as the MSFC semiannual histories covering the period.

Without exception, individuals contacted for information were extremely cooperative. Although they all cannot be named here, several deserve special acknowledgement. James Cobb and Edward House, both of MSFC, were most helpful, making administrative files available and suggesting additional sources of information. Helen Brents Joiner and Mary T. Cagle, of the Army Missile Command, provided information concerning the early organizational structure of AOMC and ABMA. Locally, our library and records personnel were of great assistance in locating and obtaining copies of a number of elusive documents concerning the early days of the launching agency. Librada Russell and Mary Kihm were especially patient and helpful.

Although gaps in the story may still exist, and differences of opinion as to interpretation of events may arise, it is hoped that this book will be useful to those who consult it.

KSC Historian

CHRONOLOGY

1926

March 16	Dr. Robert H. Goddard launched the world's first liquid-fueled rocket in Auburn, Massachusetts. Flight lasted 2.5 seconds and the rocket attained a speed of 60 miles per hour.

1939

July 1	Rocket Research Project was formed under Dr. Theodore von Kármán at Cal Tech. This project became the nucleus of the nation's first center devoted to the research and development of propulsion systems.

1942

October 3	First successful launch and flight of the 5½-ton German A-4 (V-2) at Peenemünde travelled 120 miles.

1943

August	Dr. Kurt H. Debus joined the Peenemünde organization as chief test engineer.
September	Army Ordnance Department established the Rocket Branch of the Technical Division for the purpose of directing and coordinating the development of rockets and guided missiles as weapons for the Army.

1944

June 22	U.S. Army Ordnance awarded to Cal Tech a contract for research and engineering on long-range rockets and their launching equipment.
November 1	Cal Tech's Rocket Research Center was reorganized and renamed the Jet Propulsion Laboratory.
November 20	Army Ordnance signed a contract with General Electric Company to initiate the Hermes project.
December	Army Ordnance made plans under the Hermes program to study the German V-2 missile.

1945

January	German rocket scientists evacuated Peenemünde.
February 20	The Secretary of War approved Ordnance plans for the establishment of the White Sands Proving Ground, New Mexico.
March	U.S. Army Ordnance Technical Intelligence received approval from the Office of the Chief of Ordnance to initiate Operation Paperclip.
July 13	White Sands Proving Ground was activated.
August	Components for approximately 100 V-2 ballistic missiles were shipped from Germany to White Sands Proving Ground.
September	Seven German scientists recruited under Operation Paperclip, including Dr. Wernher von Braun, arrived at Aberdeen Proving Ground.
September 26	An altitude of 43½ miles was reached by the first Wac Corporal, whose booster was a modified Tiny Tim rocket. This was the first U.S. liquid-propellant rocket developed with government funds.
October	Army Ordnance established the Research and Development Service Suboffice (Rocket).
December 10	Approximately 100 German specialists arrived at Fort Bliss, Texas, and White Sands Proving Ground, where they were joined by the first seven specialists headed by Dr. Wernher von Braun.

1946

January	First missile launched at Naval Air Facility, Point Mugu, California, was a KVW-1 Loon, USN name for AAF KUW-1 robot bomb modeled on the German V-1.
January	The German scientists were organized as a guided-missile research team with Dr. von Braun as technical director.
March 22	First American rocket to escape earth's atmosphere (the Wac) reached 50-mile height after launch from White Sands Proving Ground.

1946

April 16	First V-2 launched from American soil.
June 6	Joint Army-Navy Research and Development Board created.
June 28	First V-2 rocket fully instrumented by Naval Research Laboratory for upper air research was launched from White Sands Proving Ground and attained a height of 67 miles.
October 7	The Joint Research and Development Board established the Committee on Long Range Proving Ground and directed it to examine the entire question of the advisability of developing a single national long range guided missile proving ground. The Committee was also directed to make a study of available sites.
December 17	V-2 rocket, fired from White Sands, established an altitude record (114 miles) that was not surpassed for almost 5 years.

1947

June 20	Army Ordnance established the Bumper project for development of a two-stage missile (German V-2 and modified Wac Corporal).
June 20	The Committee on Joint Long Range Proving Ground submitted a report in which it recommended that action be taken immediately to provide a joint long range proving ground. As suitable sites for the range, the Committee selected as its first choice the El Centro-Gulf of California range, and as its second choice, the Banana River-Bahama Islands range with the launching site located at Cape Canaveral, Florida.
July 8	The Joint Research and Development Board approved the recommendation of the Committee on Joint Long Range Proving Ground and responsibility for implementing the joint long range proving ground was assigned to the War Department, which in turn delegated limited responsibility for handling the matter to the Army Air Forces.

1947

July 26	National Security Act of 1947 was passed, which reorganized and coordinated armed forces under National Military Establishment headed by Secretary of Defense (of Cabinet rank) and included secretaries of the Army, the Navy, and the Air Force.
September 5	The Air Force activated a staff group, headed by Brig. Gen. Wm. L. Richardson, in the Office of the Deputy Chief of Staff for Operations, to pursue the joint long range proving ground project. This group was given the designation "National Guided Missile Range Group" and was composed of the original members, or their designated replacements, of the Joint Research and Development Board's Committee on Joint Long Range Proving Ground.
December 30	The Research and Development Board rescinded its previous directive to the War Department and issued a new directive allocating complete responsibility for implementation of the long range proving ground project to the Air Force.

1948

January	Decision was made to develop the Banana River-Bahama Islands range if a satisfactory agreement could be negotiated with the British Government.
May 13	A Bumper-Wac fired at White Sands Proving Ground was the first two-stage rocket to be launched in the Western Hemisphere.
September 1	Banana River Naval Air Station transferred to Air Materiel Command, USAF, on a standby basis for the purpose of supporting the national guided missile test and development program.
November	Redstone Arsenal officially became a Class II activity of the Ordnance Research and Development Division.

1949

May 11	Public Law 60, 81st Congress, authorized establishment of a joint long range proving ground for guided missiles, and for other purposes (subsequently established in the Cape Canaveral area).
June 10	Banana River Naval Air Station redesignated Joint Long Range Proving Ground by Headquarters USAF, GO 37, dated June 10, 1949.
August 10	National Security bill changed National Military Establishment to executive Department of Defense; made departments of Army, Navy and Air Force "military departments."
September	Representatives of the Suboffice (Rocket) surveyed the Huntsville Arsenal facilities and proposed that their organization be transferred there from Fort Bliss.
October 1	Joint Long Range Proving Ground was activated as a joint undertaking of the Army, Navy, and Air Force under executive control of Chief of Staff of the Air Force.

1950

April 1	Missile staff headed by Dr. von Braun was moved from White Sands Proving Ground to Army Ordnance's Redstone Arsenal, Huntsville, Alabama.
April 15	The Ordnance Guided Missile Center was officially established at Redstone Arsenal.
May 16	Department of Defense officially delegated responsibility for the proving ground to the Air Force. The Headquarters, Joint Long Range Proving Ground became the Headquarters, Long Range Proving Ground Division. Air Force GO 38, dated May 17, renamed the Joint Long Range Proving Ground the Long Range Proving Ground Air Force Base.
July 24	The first missile launched from Cape Canaveral was Bumper No. 8, a German V-2 with a 700-pound Army-JPL Wac Corporal as second stage.
August 1	Long Range Proving Ground Air Force Base was redesignated Patrick Air Force Base in honor of Maj. Gen. Mason M. Patrick (first chief of U.S. Army Air Service).

1950

October	The movement of Suboffice (Rocket) from Fort Bliss to Redstone Arsenal was completed with the transfer of the Hermes C-1.
December	Rocket and guided-missile research and development activities at Redstone Arsenal were divided into two major centers: Ordnance Guided Missile Center and Ordnance Rocket Center.

1951

June 30	Headquarters, Long Range Proving Ground Division redesignated Air Force Missile Test Center by GO 19, Headquarters, Air Research and Development Command, and assigned to that command.
August 7	Viking 7 attained an altitude of 135 miles over White Sands to set new altitude record.
August	Ordnance Guided Missile Center and Ordnance Rocket Center became the Guided Missile Development Branch and the Rocket Development Branch of the newly established Technical and Engineering Division.
December 1	Experimental Missiles Firing Branch established, with Dr. Kurt H. Debus as Chief.

1952

January 21	Guided Missile Development Branch and Rocket Development Branch were elevated to group status in the reorganization of the Technical and Engineering Division.
September 18	Ordnance Missile Laboratories established, with Brig. Gen. H. N. Toftoy appointed as director. The Technical and Engineering Division became a part of the newly established organization.
September 19	Last V-2 fired. During the course of six years, 63 V-2's were launched at White Sands Proving Ground.
November	The Guided Missile Development Group and the Rocket Development Group were separated from the Technical and Engineering Division and placed on an equal organizational level with the division as laboratories.

1953

January	The Guided Missile Development Laboratory became the Guided Missile Development Division of the Ordnance Missile Laboratories with the Missile Firing Laboratory, formerly the Experimental Missiles Firing Branch, as one of its ten subordinate branches.
August 20	Redstone missile No. 1 was fired by Army Redstone Arsenal personnel at Cape Canaveral, and was the first successful heavy ballistic missile launch by the U.S.

1954

August 3	Joint Army-Navy feasibility study to launch a satellite into a 200-mile earth orbit was initiated. The study, designated Project Orbiter, was based on plan to use Redstone as booster and LOKI rockets (JPL-developed) for subsequent stages.

1955

February 14	Killian committee recommended that an intermediate range ballistic missile be developed concurrently with the Air Force intercontinental ballistic missile programs.
September 9	Project Vanguard, proposal by Naval Research Laboratory, after receiving recommendation of the DOD Advisory Group, was approved by DOD Research and Development Policy Council.
November 8	DOD approved Army's proposal to develop the Jupiter IRBM.

1956

February 1	Army activated the Army Ballistic Missile Agency at Redstone Arsenal, Huntsville, Alabama, to weaponize the Redstone and to develop the Jupiter IRBM. Maj. Gen. J. B. Medaris was commanding general.
March 14	First Jupiter A (Redstone) missile launching by Army Ballistic Missile Agency at Cape Canaveral.
September 20	First Jupiter C was launched at Cape Canaveral, attained an altitude of 680 miles and travelled 3,300 miles downrange.

1957

March 1	First launch of an operational prototype Jupiter.
May 31	First successful launching of U.S. IRBM, Jupiter.
August 8	Army-JPL Jupiter C fired a scale-model nose cone 1,200 miles downrange from Cape Canaveral with a summit altitude of 600 miles. Recovery of nose cone marked first recovery intact of an object from outer space.
October 4	Sputnik I, first man-made earth satellite, was launched by USSR--remained in orbit until January 4, 1958.
November 3	Sputnik II, carrying a dog named Laika, was launched by USSR. The satellite remained in orbit until April 14, 1958.
November 7	President Eisenhower announced creation of an office of Special Assistant to the President for Science and Technology and appointment of Dr. James R. Killian, Jr., to the new advisory post.
November 8	Secretary of Defense Robert McElroy directed the Department of Army to launch a scientific satellite with a modified Jupiter C as part of the International Geophysical Year.

1958

January 31	Explorer I, the Free World's first earth satellite, was placed in orbit by a modified Jupiter C, its payload discovering the radiation belt identified by Dr. James A. Van Allen.
February 4	President Eisenhower directed Dr. Killian to head a committee to study and make recommendations on the governmental organization of the Nation's space program.
February 7	Advanced Research Projects Agency established by DOD and placed in charge of the Nation's outer space program.
March 17	Vanguard I, second U.S.-IGY satellite, launched into orbit.

1958

March 26	Third U.S.-IGY satellite, Explorer III, a joint ABMA-JPL project, successfully launched by Army, yielded valuable data on radiation belt.
March 27	Lunar probes utilizing Jupiter C rocket were assigned to Army Ballistic Missile Agency.
March	Juno II program (utilizing a missile similar to the Jupiter C), originally proposed in December 1957, was approved by ARPA.
March 31	Army Ordnance Missile Command was created.
April 1	Army Ballistic Missile Agency, Army Rocket and Guided Missile Agency, Jet Propulsion Laboratory, and White Sands Proving Ground became elements of the Army Ordnance Missile Command.
April 2	In a message to Congress, President Eisenhower proposed the establishment of a national aeronautics and space agency into which the National Advisory Committee for Aeronautics would be absorbed.
May 18	First recovery intact of a full-scale IRBM nose cone launched by Jupiter missile.
June 16	Pacific Missile Range officially established under Navy management.
July 26	Explorer IV, fourth U.S.-IGY satellite, successfully launched by Army Jupiter C.
July 29	President Eisenhower signed H.R. 12575, making it the National Aeronautics and Space Act of 1958 (Public Law 85-568), redefining the U.S. space program.
August 15	Advanced Research Projects Agency authorized the Army Ordnance Missile Command to initiate a development program to provide a large space vehicle booster of approximately 1.5 million pounds thrust. (Unofficially designated Juno V; later became Saturn.)
August 19	Dr. T. Keith Glennan and Dr. Hugh L. Dryden were sworn in as Administrator and Deputy Administrator, respectively, of the National Aeronautics and Space Administration.

1958

September 18	Vanguard III, sixth U.S.-IGY satellite, successfully injected into orbit.
October 1	First official day of NASA. National Advisory Committee for Aeronautics personnel, responsibilities, and facilities were officially absorbed into the NASA organization.
October 1	President Eisenhower issued Executive Order 10783, transferring to NASA responsibility for several DOD projects, including Project Vanguard from the Navy, and lunar probes, scientific satellites, and several engine research programs, including the F-1, 1.5-million-pound-thrust engine, from ARPA and the AF.
October 7	Project Mercury formally organized by NASA.
October 11	Pioneer I, U.S.-IGY space probe under direction of NASA and with the Air Force Ballistic Missile Division as executive agent, launched from Cape Canaveral.
November 6	Army completed Redstone flight testing with perfect 250-mile shot.
November 26	The name "Project Mercury" was officially assigned to the man-in-space effort of the United States.
November 28	Air Force Missile Test Center officially announced establishment at the Atlantic Missile Range of the Directorate of NASA Tests, with Melvin N. Gough as Director.
December 3	Agreement signed effecting transfer to NASA of JPL personnel, facilities, and remaining budget appropriations to be effective on January 1, 1959. Another agreement made Army Ordnance Missile Command and its subordinate organizations "immediately, directly and continuously responsive to NASA requirements."
December 6	The third U.S.-IGY space probe--the second under direction of NASA with Army as executive agent--was launched from Cape Canaveral by a Juno II.

1959

January 8	NASA requested 8 Redstone-type launch vehicles from the Army to be used in Project Mercury development flights.
February 3	ARPA cancelled Juno V identification and officially named the project Saturn.
March 3	Pioneer IV, fourth U.S.-IGY space probe, a joint ABMA-JPL project under direction of NASA, was launched by a Juno II rocket from Cape Canaveral and achieved earth-moon trajectory, passing within 37,000 miles of the moon before going into permanent solar orbit. It was the first U.S. sun-orbiter.
April 2	Seven astronauts were selected for Project Mercury.
April 27	Project Mercury assigned DX (highest) priority rating.
April	Jupiter combat training launch program initiated following an agreement between ABMA and the Air Force whereby the Missile Firing Laboratory would train Air Force and NATO troops in Jupiter missile launching techniques.
May 1	First formal statement of functions and authority for Atlantic Missile Range Operations Office came in the form of a memorandum from the NASA Administrator.
May 6	ABMA Jupiter IRBM made successful 1,500-mile flight at Cape Canaveral and was declared operational by the Air Force.
May 28	ABMA Jupiter IRBM launched a nose cone carrying two living passengers (monkeys), Able and Baker.
June 5	Construction for Saturn was started at Cape Canaveral.
July 1	Responsibility for Centaur development was transferred from DOD (ARPA) to NASA.
July 5	Construction of Saturn Launch Complex 34 began (blockhouse construction and launch pad fill).

1959

September 9	NASA boilerplate model of Mercury capsule was successfully launched on an Atlas (Big Joe) missile from Cape Canaveral and recovered in the South Atlantic after surviving re-entry heat of more than 10,000^{o} F.
October 13	Explorer VII, the seventh and last U.S.-IGY earth satellite, and now under direction of NASA with the Army as executive agent, was launched into an earth orbit by a modified Army Juno II.
October 21	President Eisenhower, by executive order, indicated that the Development Operations Division of ABMA would be transferred to NASA, subject to the approval of Congress.
November 18	NASA assumed technical direction of the Saturn project, pending its formal transfer from the Army.
November 18	Agreement between Department of Army and NASA on Objectives and Guidelines for the Implementation of the Presidential Decision to Transfer a Portion of ABMA to NASA, dated November 16, 1959, was signed by the NASA Administrator and the Secretary of the Army.
December 16-17	Army-NASA Transfer Plan was formally approved by the Secretary of the Army and Acting Secretary of Defense on December 16, and by the NASA Administrator on December 17.

1960

January 18	Project Saturn was approved as a program of highest national priority (DX rating).
January	Construction began at Cape Canaveral on Launch Complex 36 for the Centaur project.
February 25	First test launch of Army's Pershing tactical missile from Cape Canaveral.
March 15	President Eisenhower officially announced transfer of the Development Operations Division to NASA. He named the new NASA field installation at Huntsville the George C. Marshall Space Flight Center.

1960

March 15	Saturn project officially transferred to NASA from ABMA.
April	NASA Test Support Office for AMR approved as a function with the NASA Launch Operations Agency, with Lt. Col. Asa B. Gibbs, USAF, selected as its Director.
June 1	Memorandum of Agreement between ABMA and NASA MSFC, Support Requirements to be furnished by LOD to Test, Evaluation and Firing Laboratory.
June 14	NASA announced the creation of Launch Operations Directorate to become operational on July 1; to be headed by Dr. Kurt H. Debus.
July 1	NASA George C. Marshall Space Flight Center, with Dr. Wernher von Braun as its Director, officially opened with formal transfer to NASA from ABMA, at Redstone Arsenal, Huntsville, Alabama. MFL officially became LOD.
July 1	Saturn project formally transferred to MSFC.
August 5	Vertical Launch Facility No. 34 (VLF-34) blockhouse construction was completed at Cape Canaveral.
August 18	Blockhouse construction was completed at Launch Complex 36 (Centaur).
October 27	Pacific Missile Range NASA Test Support Office officially activated and Comdr. Simon J. Burttschell appointed Director.

1961

January 3	NASA's Space Task Group, charged with carrying out Project Mercury and other manned space flight programs, officially became a separate NASA field element.
February 15	James E. Webb was sworn in as NASA Administrator.
April 18	Memo of Agreement on Participation of 6555th Test Wing (Dev) in the Centaur R&D Flight Test Program (outlining Program Responsibilities of NASA, LOD, and Wing).

1961

May 5	Freedom 7, manned Mercury spacecraft (No. 7) carrying astronaut Alan B. Shepard, Jr., as pilot, was launched from Cape Canaveral by Mercury-Redstone (MR-3) launch vehicle, to an altitude of 115 miles and a range of 302 miles. It was first American manned space flight. Flight lasted 14.8 minutes; a speed of 5,100 mph was reached.
May 19	Responsibility for Pershing launch operations at Cape Canaveral was transferred from LOD, MSFC, to the Test Evaluation and Firing Laboratory, ABMA.
May 25	President Kennedy appeared before Congress to request that this Nation set a goal to make a manned lunar exploration within this decade, and that Congress give its full support to NASA in attaining this goal.
June 5	Saturn Launch Complex 34 was dedicated in a brief ceremony by NASA. Construction of the complex was supervised by the Army Corps of Engineers. Giant gantry, which weighs 2,800 tons and is 310 feet high, is the largest movable land structure in North America.
June 23	Joint study was undertaken by NASA and DOD to make recommendations of the launch site to be used for the manned lunar exploration missions.
June 27	Final missile fired in Redstone series completed 8-year military test program.
July 12	Construction began on Special Assembly Building (Saturn) at Cape Canaveral.
July 17	A Joint Tenancy Agreement for NASA and DOD use of the Atlantic Missile Range was signed by the Commander, AMR, and the Director of Launch Operations, NASA.
July 21	MR-4, Liberty Bell 7, manned by Mercury Astronaut Virgil I. Grissom, made a successful 15-minute, 118-mile high, and 303-mile long flight downrange. Premature blowout of excape hatch caused flooding of capsule and made pickup of Grissom by helicopter difficult. Capsule sank in 18,000 feet of water after warning-light indicated helicopter engine was overheating and capsule was cast loose. Second successful manned suborbital space flight.

1961

August 15	Saturn booster for SA-1 flight arrived at Cape Canaveral by former Navy barge Compromise.
August 18	NASA announced that analysis of Project Mercury suborbital data indicated that all objectives of that phase of the program had been achieved, and that no further Mercury-Redstone flights were planned.
August 23	Ranger I test satellite of unmanned lunar spacecraft, launched from AMR by Atlas-Agena B into low parking orbit, but did not attain its programmed eccentric orbit.
August 24	NASA announced decision to launch manned lunar flights and other missions requiring Saturn and Nova-class vehicles from expanded Cape Canaveral facilities. NASA planned to acquire approximately 80,000 acres north and west of the Cape for this purpose.
August 24	Agreement Between DOD and NASA Relating to the Launch Site for the Manned Lunar Landing Program (Webb-Gilpatric Agreement).
September 13	Contract awarded by Army Engineers for construction of Launch Complex 37, to include a service structure, a blockhouse, and an umbilical tower on a 120-acre site at north end of Cape Canaveral.
September 21	D. Brainerd Holmes appointed NASA's Director of Manned Space Flight Programs.
October 27	Largest known rocket launch to date, the Saturn first stage booster was successful on its first test flight from Cape Canaveral (SA-1).
November 17	LOD presented its planning proposal to the Commander, AFMTC, concerning the Master Plan for the Manned Lunar Landing Program and its integration with the overall Master Plan for AMR.
November 18	Ranger II placed into low orbit by Atlas, but Agena second stage failed to restart, leaving deep-space probe Ranger in parking orbit.
November 20	NASA LOD announced establishment of Offices of Financial Management and of Procurement and Contracts to support NASA activities at AMR previously done by MSFC.

1962

January 26	Ranger III was launched from Complex 12 in attempt to land an instrumented capsule on the lunar surface. Spacecraft missed Moon by approximately 23,000 statute miles and entered a solar orbit.
February 20	First U.S. manned orbital space flight, MA-6, completed three orbits with Lt. Col. John H. Glenn, Jr., as astronaut. Mercury spacecraft, Friendship 7, re-entered and touched down in Atlantic Ocean near Grand Turk after 81,000-mile, 4-hour and 56-minute flight.
February 23	Astronaut John Glenn returned to the Cape for welcoming ceremonies and news conference. President John F. Kennedy personally greeted Lt. Col. Glenn and awarded him the NASA Distinguished Service Medal.
March 7	NASA announced the establishment of the Launch Operations Center at Cape Canaveral, with Dr. Kurt H. Debus as Director, effective July 1, 1962.
March 7	NASA established a Launch Vehicle Operations Division (LVOD) as a new division of MSFC; also the Pacific Launch Operations Office at the Pacific Missile Range, discontinuing the NASA Test Support Office.
March 16	USAF Titan II was successfully launched on its first flight from the Cape. Titan II will be used as the booster for NASA's two-man spacecraft, Gemini.
April 10	Fifty-five delegates from the United Nations toured the Atlantic Missile Range at the invitation of the State Department. Six Communist countries were represented, but no delegates from the USSR were present.
April 23	Ranger IV was launched by an Atlas-Agena, but an apparent failure of the spacecraft's central computer and sequencer prevented Ranger from making a controlled descent onto the surface of the moon. The instrumented spacecraft was destroyed when it impacted the moon 64 hours after launch. While the probe was not a complete success, it was the first mission by the United States to result in lunar impact.

1962

April 25	Saturn vehicle (SA-2) was successfully launched from Complex 34 in the second successful Saturn flight test. Dummy second and third stages, filled with water, were detonated at 65 miles altitude (Project Highwater), and the water ballast formed an artificial cloud.
May 8	The first Centaur F-1 was launched. An explosion 55 seconds after lift-off, apparently caused by structural failure that resulted in a fuel tank rupture, destroyed the vehicle.
May 24	Second U.S. manned orbital space flight, MA-7, with Commander M. Scott Carpenter as pilot in Mercury capsule Aurora 7, completed three orbits. Re-entry caused landing impact point to be over 200 miles beyond intended area.
May 27	Astronaut M. Scott Carpenter returned to the Cape for news conference and welcoming ceremonies following his three-orbit mission of May 24.
June 8	MSFC-LOC Separation Agreement signed; summarized the transfer of certain resources, activities, and responsibilities of MSFC to LOC, and established the LOC and LVOD organization and missions on an interim basis pending final resolution of LOC organization and mission. The new organization was to become operational July 1.

I. KUMMERSDORF TO REDSTONE ARSENAL

The Treaty of Versailles in 1920, which disarmed Germany as a military power, specified the types of weapons, the number of each, and the rounds of ammunition for each type which could be retained by the German Army. The Treaty also provided for policing by representatives of the League of Nations to ensure the observance of the Treaty provisions. There was no mention of rockets.

Post-World War I Rocket Development in Germany

Late in 1929, the Ballistics and Munitions Branch of the German Army Weapons Department, under the direction of Dr. Karl Becker, decided to investigate the possibility of military application of rocket propulsion. Several months later, Dr. Walter Dornberger, a German artillery officer, engineer, and rocket enthusiast, was assigned to the Ballistics and Munitions Branch. Dr. Dornberger combined his efforts with those of Dr. Becker to locate individuals with whom to place small subsidies to support rocket experiments.[1]

After two years of failure by the recipients of the subsidies to produce notable results in the development of a liquid-fueled rocket motor, the German Army Weapons Department established its own experimental station in Kummersdorf near

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1. Willy Ley, Rockets, Missiles, and Space Travel, Revised Edition, The Viking Press, New York, 1957, pp. 198, 199.

Berlin.[2] On October 1, 1932, Wernher von Braun joined the Army Weapons Department and became a member of Dr. Dornberger's specialist Staff.[3]

The failures experienced by the Kummersdorf staff in the attempts to reconcile engines and rocket designs during 1931 and 1932 brought about the realization that an entirely new concept in rocket design was needed. In 1933, the first of a new series of rockets, designated as the Aggregate 1 or A-1, was introduced. The initial successes of this 650-pound-thrust, 4.6-foot rocket led to the design and development of the A-2 and A-3 types, and, subsequently, to the A-4 of World War II fame.[4]

By 1936, the progress made by the Kummersdorf scientists drew the attention of the German Air Ministry. An agreement between the two military organizations resulted in the provision of sufficient funds to build a new experimental station at Peenemünde as a joint research and testing center. The elements of the Kummersdorf staff involved with the Aggregate development program, including Dr. von Braun, were transferred to Peenemünde in 1937 under the military supervision of Colonel Dornberger.[5]

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2. Walter Dornberger, V-2, The Viking Press, New York, 1954, p. 20.
3. Ibid., p. 27.
4. Ley, Rockets, Missiles, and Space Travel, pp. 201, 211.
5. Ibid., p. 203. Dr. Kurt H. Debus joined the Peenemünde organization in August 1943 as chief test engineer.

In 1939, work began on the design of the A-4. Three years later, on October 3, 1942, the first A-4 (V-2) was launched successfully.[6] The A-4 was accepted by Hitler as a new weapon of war in July 1943. Designated the V-2, it was launched against England in September 1944. With the V-2 operational, the Peenemünde scientists, under Dr. von Braun, concentrated their efforts on the research and development of a new guided missile capable of spanning the Atlantic Ocean. The new missile consisted of two stages--the first, the A-10, to have a takeoff weight of approximately 85 metric tons. The second stage, the A-9, was a winged rocket approximately the size of the V-2. Although a few prototype models of the A-9 were built, the A-10 was not developed beyond the design stage.[7]

By January 1945, the increased momentum of the Allied military offensive in Europe and the rapidly decreasing German defensive resources made it evident that Germany's capitulation was close at hand. The German rocket scientists, faced with the realization that further experimentations were impossible, evacuated Peenemünde. The majority of the top level scientists and engineers were moved to locations in the Harz mountain region of Bavaria. By May 1945, most of these rocket specialists had surrendered to elements of the American forces who occupied the area. Among these specialists was Dr. Debus, who had been in

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6. Eugene M. Emme, Aeronautics and Astronautics, 1915-1960, NASA, Washington, 1961, p. 44.
7. Ley, Rockets, Missiles, and Space Travel, pp. 238, 239.

charge of the principal experimental V-2 launching site during the latter months of Peenemünde's operations. Dr. Debus later was transferred to the British-occupied facilities near Cuxhaven where he served as test engineer for Operation Backfire, a series of V-2 firings conducted by the British.

U.S. Army Ordnance Rocket and Guided-Missile Development

The United States was not totally inactive in rocket development during this period. As early as 1941 proposals had been made to the War Department to initiate programs to design and develop a guided missile similar in design and performance to the German Fieseler FI-103, later known as the V-1. The War Department did not take official action until September 1944, three months after the first V-1 attacks on England. A year earlier, however, in September 1943, the Army Ordnance Department had established the Rocket Branch of the Technical Division for the purpose of directing and coordinating the development of rockets and guided missiles as weapons for the Army.[8] At that time, Army Ordnance also requested the Rocket Research Project of the California Institute of Technology (Cal Tech) to investigate the feasibility of developing long-range surface-to-surface guided missiles. The Ballistic Research Laboratory (BRL), Aberdeen Proving Ground, Maryland, was asked to make a similar study.[9] In late September 1943, the BRL study was submitted by

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8. Brig. Gen. H. N. Toftoy, "Army Missile Development," Army Information Digest, December 1956, p. 22.
9. Ibid.

Army Ordnance to the National Defense Research Committee. In November, Dr. Theodore von Kármán, Director of the Rocket Research Project, submitted a proposal to Army Ordnance for developing long-range surface-to-surface guided missiles.[10] An analysis and evaluation of the von Kármán proposal resulted in a request from Army Ordnance to Cal Tech, in January 1944, to initiate a research and development program based upon the precepts outlined in the von Kármán study. In May 1944, the progress shown by Cal Tech's rocket laboratory in developing the Private "A" missile led to the awarding of a $3,300,000 contract to Cal Tech for continued research in rocket propulsion and aerodynamics. This contract originated what was later to be identified as the ORDCIT project.[11] Between December 1 and December 16, 1944, 24 of the 500-pound, 92-inch Private "A" missiles were test fired at Camp Irwin, California. The fully charged missiles (numbers 7 through 24) had average ranges of over 18,000 yards.[12]

On November 20, 1944, two months after the first tactical firings of the V-2's against England, Army Ordnance signed a contract with the General Electric Company to initiate the Hermes project.[13] Army Ordnance plans under this program called for the

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10. Emme, Aeronautics and Astronautics, p. 46.
11. Toftoy, "Army Missile Development," Army Information Digest, p. 22.
12. Rocket Development Division, Research and Development Service, Office, Chief of Ordnance, Ordnance Department Guided Missile Program, March 13, 1947, Section IV, "Results of ORDCIT Private 'A' Firings."
13. Contract No. W30-115-ORD 1768, R.A.D. No. 3435.

development of a long-range guided missile and a surface-to-air antiaircraft missile. Studies of all available information on the German V-2 and Wasserfall missiles were begun in December 1944.

After receiving verified information concerning the range of the V-2, the Ordnance Department recognized the inadequacies of the existing artillery and rocket proving grounds for testing missiles of similar, or possibly greater, ranges. A survey of military reservations was made shortly after initiating the ORDCIT project. In November 1944, the Government-owned land adjacent to the Fort Bliss military reservation was selected. War Department approval was obtained and the White Sands Proving Ground (WSPG) was established.

During March 1945, the U.S. Army Ordnance Technical Intelligence received approval from the Office of the Chief of Ordnance to initiate Operation Paperclip. This attempt to secure the services of Germany's outstanding rocket scientists and engineers to work in the United States under individual contract agreements was started in June.

Prior to the signing of any jurisdictional or occupational agreements between the Allies, American forces had removed the components of approximately 100 V-2's from the mass-production plant located near Niedersachswerfen, Germany.[14] During the advance through Germany, and later while occupying the Harz

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14. Ley, Rockets, Missiles, and Space Travel, p. 244.

mountain areas, the American Forces discovered over 40 boxes of guided-missile documents. These were shipped to the Army Ordnance facilities at the Aberdeen Proving Ground.

The components of the V-2's were shipped from Germany to WSPG in August 1945.[15] In September, the first seven of the German scientists recruited under Operation Paperclip, including Dr. von Braun, arrived at Aberdeen Proving Ground to assist in the sorting and cataloging of the German missile documents.[16]

The scope of the activities at Fort Bliss requiring Army Ordnance supervisory administration greatly increased with the arrival of the captured V-2's and the activation of the test facilities at WSPG. In order to maintain a more direct operational control, Army Ordnance established the Research and Development Service Suboffice (Rocket) in October 1945. The primary responsibility of this organization was to supervise the work of assembling and the eventual testing of the V-2's by the General Electric Company under the Hermes project contract. In November 1945, the seven German specialists were transferred to Fort Bliss, accompanied by Maj. J. P. Hamill, the newly appointed project officer for Suboffice (Rocket). This group was joined by

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15. Emme, <u>Aeronautics and Astronautics</u>, p. 51.
16. David S. Akens and Paul H. Satterfield, Historical Monograph, <u>Army Ordnance Satellite Program</u>, Army Ballistic Missile Agency, November 1, 1958 (George C. Marshall Space Flight Center Reprint, December 1, 1962), p. 36.

over 100 additional Paperclip scientists and engineers (including Dr. Debus) in December.

Early in January 1946, the German scientists were organized as a guided-missile research team with Dr. von Braun as technical director. This team was assigned to the Hermes project to provide technical assistance in sorting and identifying the V-2 components; to work with their American counterparts in the assembling, handling, and launching techniques peculiar to the V-2's; and to design for fabrication the critical components not included in the shipments or which were damaged beyond use. On March 15, 1946, V-2 No. 1 was fired in a static test. Approximately one month later, on April 16, the first V-2 was launched from American soil.[17]

In addition to the responsibilities of providing technical assistance to the General Electric Company personnel, the Paperclip specialists initiated research and design studies for a long-range guided missile similar to the A-9 and A-10 combination conceived at Peenemünde during the war. In February, Maj. Gen. G. M. Barnes, Chief, Research and Development, Office of the Chief of Ordnance, visited Fort Bliss to discuss various problems with Major Hamill, Dr. von Braun, and others. During his visit, the concepts being developed by the "von Braun team" were presented to him. Two months later, the Hermes contract with the General Electric Company

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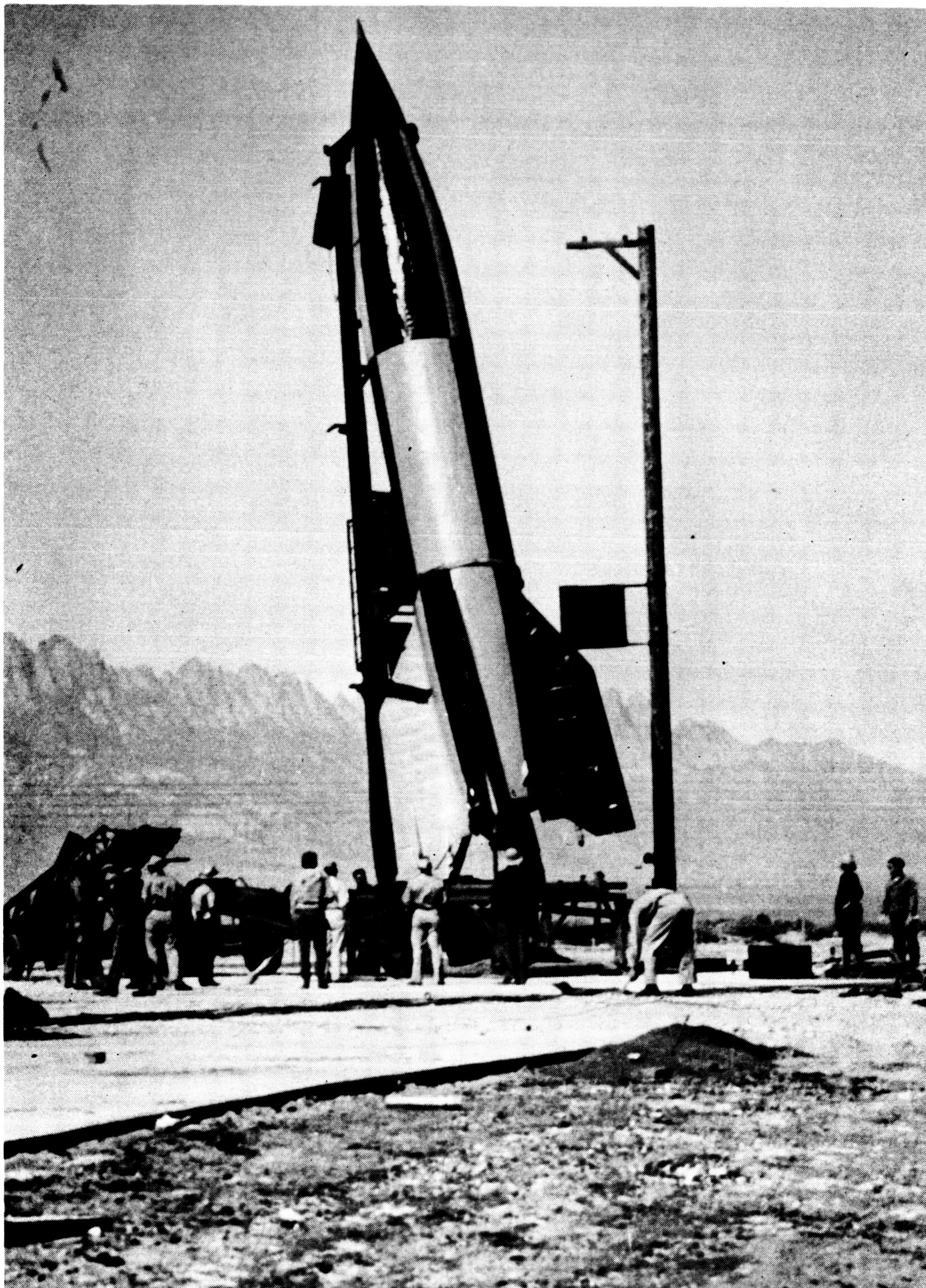
17. Emme, Aeronautics and Astronautics, p. 53.



V-2 BEING PLACED IN POSITION FOR
LAUNCHING AT WHITE SANDS

was supplemented to incorporate the design, engineering, and testing of a new series of missiles to be developed by the Paperclip scientists and fabricated by General Electric. The supplement included the preliminary design and development of ramjet-type missiles and large, multistage missiles, identified as the Hermes B and C series, respectively.[18]

On May 29, 1947, a modified V-2, carrying a payload designed to test aerodynamic aspects important to the development of the ramjet and a glider stage for the Hermes C missile, was successfully launched from WSPG. It attained an altitude of 49.3 miles, but its 47-mile flight ended with near disastrous results. The missile lifted from the pad normally, but after four seconds it did not program as anticipated and impacted near Juarez, Mexico.[19] As a direct result of this incident, further launches were suspended at WSPG until adequate instrumentation systems could be installed to provide a complex, but effective, range safety system.[20] It is possible that this incident stimulated actions to establish a long-range proving ground as proposed by President Harry S. Truman in 1945.

After the preliminary developments of the Hermes B missile were completed, the program was transferred to the General

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18. Ordnance Department Guided Missile Program, March 13, 1947, Section V, "Hermes Project," and Section VI, "Hermes II Project."
19. Ibid., "Results of Hermes II Firings," in Section VI.
20. David S. Akens, MSFC Historical Monograph No. 1, Historical Origins of the George C. Marshall Space Flight Center, Huntsville, Alabama, December 1960, p. 33.

Electric facilities at Schenectady, New York. The project group continued its research on the Hermes C missile. The Hermes C was a surface-to-surface, multistage missile capable of transporting a 1,000-pound warhead 2,000 or more nautical miles.[21]

Coordination of Armed Forces Rocket and Guided-Missile Programs

The achievements of the German V-1's and V-2's in 1943 and 1944 provided the incentive for the various branches of the Armed Forces to concentrate their efforts on the development of guided missiles. An intraservice controversy developed as to who would be given the responsibility for the War Department's missile programs. In September 1944, a decision made by Brig. Gen. W. A. Borden, Chief, New Developments Division of the War Department, gave the responsibility for developing wingless ballistic-type missiles (V-2 type) to the Army Ordnance Department and pilotless-aircraft-type missiles (V-1 type) to the Army Air Force.[22] This decision sufficed for a time. In January 1945, the Joint Committee on New Weapons and Equipment created the Guided Missiles Committee to formulate a broad research and development program for guided missiles.[23] In November 1945, the Guided Missiles Committee drafted a report which recommended a program to coordinate the efforts of the services in guided-missile development. The Joint Army-Navy Research and Development Board was created on June 6,

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21. Ordnance Department Guided Missile Program, Section V, "Table No. 2 - Hermes Missiles."
22. Emme, Aeronautics and Astronautics, p. 48.
23. Ibid., p. 49.

1946, to coordinate all activities of joint interest, which included the field of guided missiles.[24]

Implementing the joint program for guided missiles, however, caused a reoccurrence of the controversy. In October 1946, the War Department made the decision that, within the Army, the Army Air Force be given over-all cognizance for all guided-missile development.[25] The decision also specified that Army Ordnance projects were to continue under the agencies with existing contractual agreements.

The National Security Act, signed by President Truman on July 26, 1947, gave the Air Force equal service status with the Army and Navy, and created the National Military Establishment under a Secretary of Defense. The Air Force relinquished its responsibility for the Army's missile program, which was subsequently assigned to Army Ordnance.[26] The Joint Research and Development Board was superseded by the Research and Development Board of the Department of Defense (DOD) in September. The Research and Development Board proposed that rocket and guided-missile projects be assigned on an individual basis according to the end use of the project and the capability of the service organization to develop them.[27] During October the Committee on

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24. Ibid., p. 54.
25. Toftoy, "Army Missile Development," Army Information Digest, p. 30.
26. Emme, Aeronautics and Astronautics, p. 57.
27. Toftoy, "Army Missile Development," Army Information Digest, p. 30.

Guided Missiles of the Research and Development Board was assigned the responsibility of coordinating efforts of the military services developing earth satellites.[28]

The Army Ordnance Department had retained the services of the most experienced groups in rocket design and rocket propulsion. Consequently, by 1948, Army Ordnance was responsible for the development of rockets for the Army Field Forces and the Marine Corps, aircraft rockets and jatos for the Air Force, and the appropriate operational support systems.[29] By the end of 1948, it was evident, if Army Ordnance were to meet its commitment in rocket and guided-missile development, that the management functions pertaining to these programs, such as research and development, procurement, and other support activities, would have to be transferred from the Ordnance Department headquarters organization and moved from the Pentagon to a field installation. A survey of available facilities was made, and, in October 1948, planning was underway to reactivate the Redstone Arsenal, Huntsville, Alabama, as the rocket research and development center. In November 1948, the Redstone Arsenal officially became a Class II activity of the Ordnance Research and Development Division.[30]

By the end of 1949, no definite decision had yet been made by DOD as to which service organization would have the

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28. Emme, Aeronautics and Astronautics, p. 58.
29. U.S. Army Rocket and Guided Missile Agency Historical Summary, 1 April 1958 - 30 June 1958, p. 2.
30. Ibid., p. 4.

over-all responsibility for the rocket and guided-missile development programs. As a result, the Army, the Air Force, and the Navy continued working independently and competitively on their respective programs. Each service had acquired its own team of scientists, and development and testing laboratories; had negotiated contracts with independent laboratories for research; and had awarded contracts to industrial organizations for missile support system fabrication. The first concrete action was not taken until March 1950, when the Joint Chiefs of Staff assigned the exclusive responsibility for strategic guided missiles to the United States Air Force.

Establishment of Long Range Proving Ground

At the same time these management problems were under discussion, the matter of locating and establishing an appropriate proving ground for the longer range missiles had to be settled. As early as 1946, when War Department officials established requirements for a strategic missile with a range of 150 to several thousand miles, it was apparent that the existing testing ranges were grossly inadequate. On October 7, 1946, the Joint Research and Development Board created the Committee on Long Range Proving Ground to examine the possibility of establishing a single national long-range guided-missile proving ground. The Committee was also directed to make a study of available sites. As a result of the study, on June 20, 1947, the Committee recommended that a long-range proving ground be established immediately, and selected the El Centro-Gulf of California range as its first choice. As its second choice, the Committee chose the Banana River-Bahama Islands range with the launch site at Cape Canaveral, Florida.[31] On July 8, the Joint Research and Development Board approved the recommendation that action be taken, and responsibility for implementing the program was delegated to the War Department. After the National Security Act was signed by President Truman, the United States Air Force (USAF) assumed this responsibility.

Faced with the impossibility for obtaining a favorable agreement with Mexico, the U.S. Government commenced negotiations with the British Government concerning development of the Banana River-Bahama Islands range. On September 1, 1948, the facilities of the Banana River Naval Air Station were transferred to the Air Force and reactivated on a stand-by basis pending the outcome of the negotiations with the British. On May 11, 1949, President Truman signed Public Law 60, which authorized the Secretary of the Air Force to establish a joint long range proving ground to be used by the Army, the Navy and the Air Force for testing guided missiles and other weapons.[32] The Banana River Naval Air Station was redesignated the Joint Long Range Proving Ground (JLRPG) on June 10, 1949, and placed on active status effective October 1. From then until April 10, 1950, it was operated for the Armed Services by the

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31. Marven R. Whipple, Air Force Missile Test Center History, 1 January 1952 - 30 June 1952, p. 2. See JLRPG Committee Report, PG 27-4, dated 20 June 1947.
32. Marven R. Whipple, Air Force Missile Test Center History, 1 January 1952 - 30 June 1952, pp. 3, 4.

Advance Headquarters, JLRPG, under the direction of Col. H. R. Turner, U.S. Army. On that date this organization was deactivated and replaced by Headquarters, JLRPG, under the command of Brig. Gen. W. L. Richardson, USAF.[33] When the Air Force was made responsible for JLRPG on May 16, 1950, Headquarters, JLRPG was superseded by Headquarters, Long Range Proving Ground Division (LRPGD), an independent operating agency under direct control of the Chief of Staff, USAF.[34] On May 17, JLRPG was redesignated the Long Range Proving Ground Air Force Base and, on August 1, 1950, was renamed Patrick Air Force Base.[35] In May 1951, LRPGD was assigned to the Air Research and Development Command and renamed Air Force Missile Test Center (AFMTC) effective June 30, 1951.[36]

In February 1950, the Coast Guard had agreed that those areas of Cape Canaveral which were under its jurisdiction and control, could be used as a launch site. The acquisition of 11,728 acres, included in the original site, then began. On May 9, 1950, construction was started on the first permanent facilities and by June 20, a temporary blockhouse and launch pad were completed. On July 24, a team of General Electric and U.S. Army personnel fired Bumper No. 8, the first missile to be launched from the new test range.[37]

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33. Marven R. Whipple, Index of Military Units Assigned and Attached to AFMTC October 1949 - December 1960, p. 42.
34. Ibid., p. 46.
35. Ibid., p. 154.
36. Ibid., p. 46.
37. Ibid., p. 155.

II. REDSTONE

When the Huntsville Arsenal, an installation adjacent to Redstone Arsenal, became available in July 1949, a proposal was made to consolidate all Ordnance rocket and guided-missile development activities in one central location. In September 1949, representatives of the Suboffice (Rocket) surveyed the Huntsville Arsenal facilities and proposed that their organization be transferred from Fort Bliss to the Huntsville location. The move was approved by the Secretary of the Army in October 1949, and the movement directive was issued the following March. Many of the Huntsville Arsenal facilities were transferred to the Redstone Arsenal effective April 1, 1950.

Ordnance Guided Missile Center

The first unit of the Suboffice (Rocket) organization was transferred to the Redstone Arsenal during the next two weeks. This group formed the nucleus of the Ordnance Guided Missile Center (OGMC), which was officially established on April 15, 1950. The primary mission of OGMC was to serve as the principal Army Ordnance organization for research and development of guided missiles.[1] At that time the Hermes II program was the most important guided-missile project under development for Army Ordnance.

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1. ARGMA Historical Summary, 1 April 1958 - 30 June 1958, p. 8.

As the transfer from Fort Bliss progressed, the Hermes II project was gradually consolidated. In June 1950, the Hermes B-1, which had been under development at the General Electric Company facilities at Schenectady, was moved to the Redstone Arsenal. The Hermes II, being developed at Redstone Arsenal, and the Hermes B-1 were rocket-ramjet combinations designed to carry a 1,000-pound warhead for distances between 500 and 1,500 nautical miles. The movement from Fort Bliss to Redstone Arsenal was completed with the transfer of the Hermes C-1 in October 1950. The 130 German scientists and more than 800 military, civil service, and contractor personnel were involved in the transfer.[2]

In addition to working on the Hermes II project, the scientific staff of OGMC continued to act as consultants to Army Ordnance, DOD, and other agencies on special problems relating to long-range guided missiles and space vehicles. This responsibility was first assigned to the scientific staff by the Committee on Guided Missiles of the Research and Development Board in September 1948.[3]

Between January and October 1950, a series of events occurred which affected the research and development programs assigned to OGMC. First of all, the progress in the development of atomic warheads, following President Truman's decision in January 1950 to reinstitute research in nuclear bombs, made it

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2. Ibid., p. 9
3. Emme, Aeronautics and Astronautics, p. 60.

necessary to revise the design of guided missiles to increase the payload capabilities. Secondly, during fiscal year 1950, Army Ordnance had been operating under a limited budget, making it necessary to restrict rocket and guided-missile development to programs meeting specific military requirements. Finally, the outbreak of the Korean war in June caused officials to reapportion available funds to give first priority to the development and production of field-type rockets.

In September 1950, an Ordnance Corps directive was issued requiring a project study on a missile capable of carrying a payload varying between 500 to 3,000 pounds with a range between 150 and 500 nautical miles. A proposal to modify the Hermes C-1 to meet the new requirements was presented to the Office of the Chief of Ordnance and accepted. During the time the transfer to Redstone Arsenal was in process, however, the Office of the Chief of Ordnance modified the payload and range requirements by increasing the payload capability to 6,900 pounds with a range of 155 nautical miles.[4] The work of redesigning the Hermes C-1 to meet the new requirements was initiated upon completion of the transfer to Redstone Arsenal.

In December 1950, the rocket and guided-missile research and development activities at the Redstone Arsenal were divided

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4. Ordnance Guided Missile and Rocket Program, Volume X, Technical Report, Hermes Guided Missiles Systems (Inception through June 30, 1955), pp. 12, 21.

into two major centers: OGMC, with the responsibility for the entire Army Ordnance guided-missile development program; and the Ordnance Rocket Center (ORC), which was responsible for research, development, and the limited production of rockets, and related fuels and propellants. As a consequence of the numerous requests from various military services for new or improved rocket weapons and the emphasis on the development of the Hermes C-1, the Redstone Arsenal became Army Ordnance's principal center for research and development, engineering, procurement, and manufacturing or assembling functions pertaining to the Army's rocket and guided-missile programs.[5]

In May 1951, the development work on the Hermes II and Hermes B-1 as tactical missiles was discontinued. They were retained as research test vehicles, however, and redesignated as the RTV-G-3 and RTV-G-6, respectively. At the same time, the Hermes C-1 was assigned to the experimental surface-to-surface missile category as the XSSM-G-14.[6] The progress achieved in the design and development aspects of this guided missile made it possible to establish January 1953 as a tentative launching date for the first completed missile.

Beginning in August 1951, a series of organizational changes were initiated which reflected the growth in the Arsenal's

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5. ARGMA Historical Summary, 1 April 1958 - 30 June 1958, pp. 9, 10.
6. Memo for Prof. v. Braun et al. from Assistant Chief, Planning & Design Branch, subj: Missile Designation, May 2, 1951.

activities. The first of these changes established the Technical and Engineering (T&E) Division to direct the activities of rocket and guided-missile research, design, development, and testing. ORC and OGMC were organized as the Rocket Development Branch and the Guided Missile Development Branch, respectively, and became subordinate organizations within the new division.[7]

Experimental Missiles Firing Branch Established

At the time this organizational change occurred, an effort was made to establish a missile launching agency as an organizational entity, separate from, but closely integrated with, the guided-missile developing agency. The purpose of having a separate launch agency would be to prevent the reoccurrence of problems encountered by both the launching and the developing personnel at Fort Bliss. These problems had resulted from the lack of a centralized authority at the launch site to control and coordinate the prelaunch and launch activities of the various military and civilian research organizations. In view of the fact that the XSSM-G-14 was to be launched from a proving ground several hundred miles from the developing agency headquarters at Redstone Arsenal, an organization with the responsibility and authority to control, coordinate, and integrate prelaunch and launch activities appeared as a necessity.

Numerous discussions of the launch agency concept, held during October and November 1951, culminated in the decision to

7. Redstone Arsenal GO 5, August 3, 1951.

establish an organizational element within the developing agency with the responsibility of directing the launch activities of the XSSM-G-14 at AFMTC. This decision marked the first organizational step toward an eventual independent launch operations center.

On December 1, 1951, the Experimental Missiles Firing Branch was established with the assigned responsibility "to supervise all experimental firings of the Redstone missile (XSSM-G-14, by then called Major), including the selection of a suitable site for these firings."[8] Dr. Debus, Assistant Technical Director, Guided Missile Development Branch, became chief of the new branch.

Redstone Launch Site Facilities at Cape Canaveral

While these events were taking place, the Redstone Arsenal had taken steps to obtain the necessary facilities at Cape Canaveral for the Major launch program. The initial contact made in September resulted in a request from AFMTC for detailed information concerning the missile specifications, estimated facilities requirements, and the tentative firing schedule. These details were compiled and forwarded to AFMTC in early October 1951.[9]

In the latter part of that month, Capt. J. K. Hoey and Mr. T. M. Moore, representing the T&E Division, visited AFMTC to ascertain the status of the Redstone Arsenal's request. They were informed that AFMTC would have extreme difficulty, from a budgetary standpoint, in meeting the facilities requirements in time for the

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8. Redstone Arsenal, Huntsville, Alabama, Historical Summary, 1 July 1951 - 31 December 1951, Chapter IV, Part 9, p. 34.
9. Progress Report, Experimental Missiles Firing Branch, March 3, 1952.

proposed Major firing schedule. Furthermore, AFMTC could not make a commitment until the facilities requirements were formally confirmed in writing. In addition, since the Commanding General, AFMTC, had indicated that, with few exceptions, all missile assembly facilities were to be located in the Patrick Air Force Base area, detailed justifications had to be prepared before AFMTC would approve the construction of the Major missile assembly facility near the launch site as indicated in the Redstone Arsenal's facilities request.[10] In early December, the official requirements confirmation and the necessary justifications were prepared according to AFMTC stipulations, and, by January 1952, facility and support equipment planning was underway. Dr. Debus, as chief of the Experimental Missiles Firing Branch, visited AFMTC between January 7 and January 12. This first visit served as an orientation of the general area and of the existing facilities at Patrick Air Force Base and Cape Canaveral.[11]

By May, although progress was being made in the negotiation for the construction of the major facilities and for services required in launching missiles 1 and 2, it was apparent, because of funding problems, that not all of the facilities could be finished in time to meet the firing schedules of these first missiles. Redstone Arsenal and AFMTC representatives made provisional

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10. Trip Report, Patrick Air Force Base, Capt. Hoey and Mr. T. M. Moore, n.d.
11. Trip Report, AFMTC, Dr. Kurt H. Debus, January 7-12, 1952, January 19, 1952.

arrangements for the use of temporary facilities to avoid any delay in the scheduled initial launches.[12] The Redstone Arsenal, however, continued to develop design criteria for the permanent facilities to be used in the Redstone missile program.[13]

In August 1952, Dr. Debus visited AFMTC to submit plans and specifications for the firing pads and blockhouse facilities, later designated as Redstone Launch Complex 56 (LC-56). During this visit, AFMTC requested the assistance of the Redstone Arsenal in preparing detailed justifications for the Redstone facilities requirements so that AFMTC could obtain the necessary appropriations in the fiscal year 1954 budget.[14] AFMTC also requested and received a detailed list of requirements for the Redstone launch program for 1954.

By September 1952, a preliminary draft of a Master Plan for Cape Canaveral facilities had been completed. This draft did not include the Redstone Final Assembly Building located at the cape as proposed by Dr. Debus and justified to AFMTC the previous December. At the request of the Redstone Arsenal, this requirement was included in the finalized draft of AFMTC's Master Plan presented to Air Force and DOD officials. Since two approaches to the

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12. Memo for Technical Editor, Technical & Engineering Division, from Chief, Experimental Missiles Firing Branch, subj: History, May 14, 1952.
13. A letter from the Office, Chief of Ordnance, dated April 3, 1952, indicated that the Major missile had been officially assigned the name "Redstone," which had been in popular usage for some time.
14. Trip Report, AFMTC, Dr. Kurt Debus, August 14-18, 1952.

location of missile assembly facilities had been presented, approval was withheld pending the results of a detailed study to be performed by AFMTC on the merits of a combined assembly operation at the cape, as proposed in the Redstone Arsenal requirements, versus the split assembly operations between the cape and the base. In December 1952, representatives from Redstone Arsenal presented the Redstone justification to the Assistant to the Secretary of Defense.[15] The Master Plan (which included the Redstone requirements) was approved by the Air Force and DOD officials by the end of January 1953. From this time on, the concept of combined assembly operations at the cape was adopted by AFMTC for other range users.

During the last three months of 1952, a combination of factors occurred which caused a slippage in the launchings of Redstones 1 and 2, tentatively scheduled for January 1953. First, AFMTC notified the Redstone Arsenal that it did not have sufficient funds to secure equipment and complete the temporary facilities in time for the January launchings. Secondly, in November 1952, Army Ordnance changed the payload specifications which required modifications to the design of the Redstone missile and to the crane capacities at the launch facilities. As a result, the launch dates for the first Redstones were reset for July 1953.

In early November, AFMTC also notified the Redstone Arsenal that construction of the permanent facilities could not

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15. Trip Report, AFMTC, Dr. Hans Gruene and Capt. R. A. Petrone, December 7-12, 1952.

be started during fiscal year 1953 due to a substantial cut in AFMTC appropriations for that year.[16] Funds for these facilities were appropriated in the fiscal year 1954 budget, but since the lead time for construction was 12 to 15 months, the facilities would not be available until the fall of 1954, or possibly, even later. AFMTC suggested that the temporary facilities to be provided for Redstones 1 and 2 be used for later firings on a shared basis with other range users. This suggestion was considered unacceptable, however, since the Experimental Missiles Firing Branch required continuous occupancy of the facilities if the Redstone launch schedule was to be met. Efforts by the Redstone Arsenal during the spring of 1953 to assist AFMTC in securing additional funds were unfruitful. Since a full-scale launch program could not start until the permanent facilities were completed, the Redstone Arsenal planned to use the temporary facilities to avoid any further delay to the program than necessary.

Experimental Missiles Firing Branch Organizational Growth

On January 21, 1952, the T&E Division experienced another minor reorganization. Of consequence was the growth in responsibility of both the Rocket Development Branch and the Guided Missile Development Branch. These organizations were elevated to group status on that date.[17] As of April 26, 1952, the responsibilities

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16. Memo for Chief, Launching and Handling Branch, from Chief, Experimental Missiles Firing Branch, subj: Toledo Scale, November 14, 1952.
17. Redstone Arsenal GO 4, January 21, 1952.

of the Guided Missile Development Group were functionally divided among ten branches, one of which was the Experimental Missiles Firing Branch.[18]

When Suboffice (Rocket) was transferred to the Redstone Arsenal, except for key personnel and contractor employees assigned to specific development projects, the majority of those trained in the techniques of rocket launching by the German scientists had remained at WSPG. As a result, in 1950, when Army Ordnance had determined that the proposed Redstone missile was to be developed as its long-range, maximum-payload ballistic missile, it was obvious that additional rocket specialists would be needed to supplement the existing guided-missile research and development group. This was particularly true for the Experimental Missiles Firing Branch, which had been assigned the responsibility for all experimental firings of the Major missile. Dr. Debus, prior to the activation of the launch agency, initiated requests for additional personnel in order to staff the key positions within his organization by December 1, 1951.[19] It was estimated that the Experimental Missiles Firing Branch would require 170 people to meet the proposed launching schedule of 15 missiles per month.[20] The developing agencies also needed additional scientists and engineers. In the

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18. Redstone Arsenal GO 9, April 29, 1952.
19. Memo for Civilian Personnel Officer, GMDB, from Chief, Experimental Missiles Firing Branch, subj: Request for Personnel. Although undated, the attached requests establish the reporting date for new personnel as December 1, 1951.
20. Progress Report, Experimental Missiles Firing Branch, March 3, 1952.

fall of 1951, however, the demand for qualified people in these categories far exceeded the supply.

In order to obtain additional scientific, engineering, and technical capability to meet the needs of its expanding missile development projects, Army Ordnance initiated a recruiting program to secure the services of additional German scientists. In February 1952, Dr. Eberhard Rees, representing the Army Ordnance Corps, returned to Germany where he contacted 65 specialists, 40 of whom were made tentative offers of employment. In his report, he indicated that 29 either had accepted or had shown a definite interest in coming to this country under Government contract.[21] Although Dr. Rees received many acceptances of the offers, the changes in policy toward the guided-missile research and development programs instituted at the beginning of the Korean war were still in effect. Development work on the Redstone continued, but efforts to obtain increased capability in research and development were curtailed by a personnel ceiling which had been imposed upon these activities.

In March and April 1952, plans were made to build up the organization of the Experimental Missiles Firing Branch with personnel borrowed from other Redstone Arsenal organizations. Training programs, designed to familiarize the temporarily assigned

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21. Report on German Specialists Contacted for Ordnance in Germany, by Eberhard Rees, March 30, 1952.

personnel with launching activities, were prepared and tentatively scheduled.[22]

In September 1952, Dr. Debus, aware of the progress in the development of the Redstone and the time and manpower required to prepare for and carry out the scheduled Redstone launch program, re-emphasized his need for additional personnel. At that time, Dr. Debus listed the strength of the Experimental Missiles Firing Branch as 14, only 2 of whom were working full time on the branch mission; 7 were working either full time or part time for other branches to complete equipment for missiles 1 and 2; and 5 employees were in the field in full-time training positions. It was evident to him that, although key developer personnel could be used in firing missiles 1 and 2, unless he could initiate training for approximately 20 additional employees, later firings would be affected.[23] It was also apparent that since several thousand total manhours were necessary to conduct prelaunch and launch activities, the continued use of key developer personnel in performing these activities would definitely affect the rate of progress in the Redstone and other missile development programs.

Since its establishment in November 1951, the Experimental Missiles Firing Branch experienced a steady increase in the scope

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22. Memo for Technical Editor, Technical & Engineering Division, from Chief, Experimental Missiles Firing Branch, subj: History, May 14, 1952.
23. Memo for Deputy Technical Director from Chief, Experimental Missiles Firing Branch, subj: Consequences of Extended Personnel Ceiling, September 26, 1952.

of its responsibilities. Approximately 13 months later, in December 1952, the branch had an authorized personnel strength of 21, and an actual strength of 19.[24]

24. Memo for Chief, Operations Office, GMDD, from Chief, Missile Firing Laboratory, subj: Manning Charts, January 5, 1953.

III. THE MISSILE FIRING LABORATORY

In June 1952, upon the retirement of Col. Carroll D. Hudson, Brig. Gen. Thomas K. Vincent assumed command of Redstone Arsenal. A major reorganization was planned to attain greater management control over the Arsenal's increased responsibilities in the Ordnance Corp's rocket and guided-missile programs. The first change was effected on September 18 with the establishment of the Ordnance Missile Laboratories (OML).[1] The T&E Division became a part of the OML organization, and Brig. Gen. H. N. Toftoy, chief of the T&E Division, was appointed director of OML.

Missile Firing Laboratory Established

An evaluation of the interfunctional relationships which had existed within the T&E Division since its establishment clearly indicated the dissimilarities in the procedures, philosophy, and missions of the rocket and guided-missile development programs. As a result of these dissimilarities, in November 1952, the Rocket Development Group and the Guided Missile Development Group were separated from the T&E Division and placed on an equal organizational level with T&E Division as the Rocket Development Laboratory and the Guided Missile Development Laboratory of OML.[2] Two months later, in early January 1953, the Guided Missile Development

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1. Redstone Arsenal GO 24, September 18, 1952.
2. These titles were used in the brief transition period between mid-November 1952 and early January 1953 pending the issuance of a Redstone special order announcing the internal organizational changes.

Laboratory became the Guided Missile Development Division (GMDD) of OML and its ten subordinate branch organizations were given laboratory status. The title of the launch agency was changed from Experimental Missiles Firing Branch to Missile Firing Laboratory (MFL), with Dr. Debus remaining as chief.

The basic mission of MFL remained the same as that of its predecessor. The specific functions which were assigned to MFL, however, were expanded to include many of the responsibilities which had been unofficially assumed by the Experimental Missiles Firing Branch during 1952. The new responsibilities evolved from the need for a centralized point of liaison between the Redstone Arsenal and AFMTC in matters relating to the construction and installation of facilities, and in determining the support services to be furnished by AFMTC for the Redstone program.

On January 9, 1953, in an effort to solve the Redstone Arsenal-AFMTC liaison problem, the chief of GMDD issued a directive stating that all communications with AFMTC concerning development of facilities and services must be initiated by MFL.[3] This directive was complemented by a similar directive from General Vincent issued on April 14, 1953, which authorized the Chief of MFL and the Redstone Project Officer to communicate directly with AFMTC on routine matters. Correspondence on matters of policy or obligation of funds would continue to be processed through Redstone

3. Memo for all Laboratory Chiefs from Chief, GMDD, subj: Communications with AFMTC, January 9, 1953.

Arsenal headquarters.[4] While the directives served to eliminate many problems relating to authority and coordination, the demands on the time of MFL personnel were proportionately increased.

Preparations for Initial Redstone Launches--Personnel and Facilities

Although the number of authorized personnel spaces had been increased to 22 in January 1953, in early February the number of people assigned to MFL remained at 19.[5] At this time the MFL organization was divided into the Guidance, Control and Network Section, Mechanical Section, and RF and Measuring Section, in addition to the office of the chief. With the launch of the first Redstone scheduled for July, MFL made arrangements to "borrow" additional personnel from other GMDD organizations to assist in the prelaunch and launch activities. On March 3, MFL re-emphasized the fact that these arrangements would enable the launch agency to meet the firing schedule for missiles Nos. 1 and 2, but that:

> It is imperative that a skeleton organization level be achieved immediately, otherwise the specific mission of meeting the Redstone Firing Schedule cannot be consummated. The personnel of the skeleton organization must begin orientation and preparation for the firing of Missile #1 in order that thay may participate in the firing and thereby be enabled to train other personnel acquired after the first firing....

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4. Ltr, CG, RA to CG, AFMTC, subj: Correspondence between the AFMTC and Redstone Project Liaison Office at AFMTC, April 14, 1953.
5. List, Personnel in Missile Firing Laboratory, GMDD, February 5, 1953.

> It is believed that the number of firings for any given period after Missiles Nos. 1 and 2 will be decreased by three or four to one if the personnel situation is not solved.[6]

Possibly the persistence of Dr. Debus, combined with the likelihood of delays in future launchings as indicated in the MFL memorandum, provided the incentives for generating action. On June 30, an official list of operational personnel was issued, indicating those selected for temporary duty at AFMTC for the firing of Redstone No. 1. Of the 79 people involved, 37 were personnel assigned to MFL.[7]

On July 17, 1953, Dr. Debus and Dr. Hans Gruene arrived at AFMTC to make initial preparations for the influx of representatives from the various laboratories who were to participate in the facilities and missile checkout and the launch of Redstone No. 1. The preliminary checkout tests began July 30, and on August 20 the MFL team launched Redstone No. 1.[8] After the success achieved with Redstone No. 1, the plans to launch Redstone No. 2 proceeded on schedule.

By August 1953, GMDD was planning additional missile research and development programs including the resumption of ramjet investigations, design of a ramjet missile, and development of a

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6. Memo for Chief, GMDD, from Chief, MFL, subj: Projected Personnel Requirements through 31 March 1953, March 3, 1953.
7. Official List of Operational Personnel for AFMTC, June 30, 1953. Of the 37 personnel assigned to MFL, 28 were civilians and 9 military.
8. For additional information on this launch and all subsequent launches, see Appendix B.

500-mile-range missile. At the same time, GMDD plans called for an average launching rate of four missiles per month by July 1954 through calendar year 1955. GMDD headquarters requested MFL to submit a mobilization plan reflecting the anticipated manpower requirements necessary to accomplish its assigned missions satisfactorily during that period. In response to this request MFL indicated a need for 130 additional civilian personnel in order to meet its obligations.[9]

For the launch of Redstone No. 1, 42 specialists from other GMDD laboratories had been loaned to MFL for temporary duty at AFMTC. Even if the necessary personnel could be hired, the time required to train new personnel to perform the functions associated with launchings would make it impossible for MFL to develop its own launch team before the scheduled launches of Redstones Nos. 2 and 3. Therefore MFL planned to utilize the services of the same specialists to man the key positions during the next two or three firings. When GMDD was assigned new missile development programs, however, OML made no provision for additional manpower. The services of the development personnel on loan to MFL were needed elsewhere and would be withdrawn from MFL following the launch of Redstone No. 2. This problem was alleviated somewhat

9. Memo for GMDD Headquarters, from Hans F. Gruene, with Mobilization Plan attached, August 27, 1953.

by the addition of 3 spaces during the fall and the provision for 20 more commencing January 1954.[10]

During, and immediately following, the launch of Redstone No. 1, MFL's authority in directing the launch program and in coordinating the liaison activities with AFMTC was questioned again. In late October, MFL submitted a revision of its functional statements for OML's approval.[11] The revision delineated MFL's specific responsibilities and authorities in directing launch activities, facility development, and liaison activities with AFMTC, and established the pattern and guidelines for its future growth.

On January 11, 1954, MFL, again supported by specialists from other GMDD laboratories and utilizing temporary facilities, began the prelaunch tests and checkouts for Redstone No. 2. Sixteen days later, on January 27, Redstone No. 2 was successfully launched. Construction progress of Redstone's permanent facilities was observed during this time and discussed with General Toftoy when the group returned to Redstone Arsenal. Acting on the information he had received, General Toftoy contacted AFMTC to request an official status report on construction progress; to offer any assistance he could provide to expedite facilities completion; and to learn what plan AFMTC could offer for the continued use of the temporary

10. Memo for Chief, GMDD, from Chief, MFL, subj: Request for Assignment of Twenty (20) Spaces, December 15, 1953.
11. Memo for Chief, Management Office, from Chief, MFL, subj: Revision of Functional Statement, October 28, 1953.

facilities to prevent any further delays in the Redstone launch program.[12]

Faced with an ambitious launch schedule for the Matador, Snark, and Bomarc programs which required almost full-time use of the limited facilities at Cape Canaveral, as well as an economy drive to reduce expenditures, AFMTC could not provide satisfactory solutions to MFL's facilities problems. In May 1954, AFMTC indicated to the Commanding General, Redstone Arsenal, that the Corps of Engineers' reports reflected estimated completion dates ranging from December 3, 1954, through March 1955 for the various Redstone facilities. However, AFMTC felt that a more realistic completion date for these facilities would be about June 1955.[13] As a result, on May 28, 1954, Redstone Arsenal requested that the Office, Chief of Ordnance, intercede on behalf of the Redstone Arsenal with the USAF and the Corps of Engineers to ensure the completion of Redstone facilities by the earlier dates.[14] The completion dates as requested by Redstone Arsenal were affirmed on August 30 by AFMTC.[15] In mid-September, AFMTC presented the Redstone Arsenal with a time schedule for the changeover of Redstone facilities and,

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12. Transcript of telecon between Dir, OML, RA, and Chief of Staff AFMTC, PAFB, Florida, subj: Facilities at PAFB, February 16, 1954.
13. Ltr, DCS/Operations, AFMTC, to CG, RA, subj: Status of Redstone Permanent Facilities, CCAAFB, May 21, 1954.
14. Ltr, Dir, OML, to Chief of Ordnance, subj: Delay of Redstone Missile Program Due to Lack of Facilities at PAFB, May 28, 1954.
15. TWX from Comdr, AFMTC to CG, RA, August 30, 1954.

at that time, gave assurance that AFMTC was expediting the completion of the facilities to meet the changeover dates.[16] With this assurance, GMDD and MFL proceeded with plans to secure materials and equipment which were to be furnished by the Redstone Arsenal and installed as the facilities were made available.[17]

Although the launch attempt for Redstone No. 3 failed, the successful launch and flight of Redstone No. 4 provided Army Ordnance with sufficient justification to continue the development of the missile. On September 29, 1954, Army Ordnance awarded a contract to the Chrysler Corporation for production of Redstone missiles.[18] By December 31, 1954, MFL had launched five missiles from the temporary facilities at Cape Canaveral.

The experience gained by MFL during the early Redstone firings clearly indicated that a minimum of 80 people would be required to meet the proposed launch program for 1955. A request for additional spaces made by MFL in the summer of 1954 was granted and a recruitment program was initiated to obtain the additional required personnel.[19] In early March 1955, a manpower survey conducted within the GMDD disclosed that the number of GMDD employees exceeded its authorized personnel spaces. A restriction

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16. Ltr, Chief, GMDD, to CG, AFMTC, subj: Time Schedule for Changeover of Redstone Facilities, October 4, 1954.
17. The first missile launched from the new Redstone facilities was Redstone No. 9 on April 20, 1955.
18. Emme, Aeronautics and Astronautics, p. 76.
19. 1st Ind, Chief, MFL, to Deputy Chief, GMDD, subj: Personnel Ceiling, April 4, 1955.

REDSTONE NO. 4

on hiring additional personnel was imposed, pending reduction of overstrength in the division.[20] Although it had been authorized 80 spaces in the summer of 1954, MFL had been unable to fill and maintain its authorized complement. This was due to the limited number of qualified people available, many of whom refused to accept employment requiring extended temporary duty at AFMTC, and to transfers and terminations of MFL personnel because of the undesirable conditions connected with temporary duty assignments.[21] On April 15, MFL was notified that its authorized civilian strength had been reduced to 71.[22]

Project Orbiter

In August 1954 and in February 1955, two separate and unrelated events occurred which played important roles in establishing guidelines for the growth of GMDD and its eventual transition from a guided-missile development agency into an integral part of this Nation's space programs. The first event took place on August 3, 1954, with the initiation of a joint Army-Navy feasibility study to launch a satellite into a 200-mile earth orbit. The study, designated as Project Orbiter, was based on a plan to use a Redstone missile as the booster and LOKI rockets developed by Jet Propulsion Laboratory (JPL) for subsequent stages.[23] The study was completed

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20. Memo for GMDD, Distribution A, from GMDD, Operations Office, subj: Personnel Ceiling, April 13, 1955.
21. 1st Ind, Chief, MFL, to Deputy Chief, GMDD, subj: Personnel Ceiling, April 4, 1955.
22. Memo for MFL from Operations Office, GMDD, subj: Personnel Ceiling, April 15, 1955.
23. Emme, Aeronautics and Astronautics, p. 75.

and submitted to DOD in late summer of 1955. A similar plan which had been developed by the Naval Research Laboratory (NRL) utilizing the Viking and Aerobee-Hi rockets was also presented. The NRL proposal received the recommendation of the DOD Advisory Group. Designated as Project Vanguard, it was approved by the DOD Research and Development Policy Council on September 9, 1955.[24] Although Project Orbiter was discontinued, thereby suspending any further efforts by the Army to develop an earth satellite program, the study served to establish the Army's potential for future space efforts.

Jupiter Program--Development and Facilities

The second event, of more immediate consequence, was the recommendation by the Killian committee, on February 14, 1955, that an intermediate range ballistic missile (IRBM) be developed concurrently with the Air Force intercontinental ballistic missile (ICBM) programs. This recommendation was followed by a series of proposals from the Department of the Army, Research and Development, that the abilities and experience of GMDD be utilized to develop a missile with the range of an IRBM. In September 1955, GMDD prepared a proposal to develop a missile with a 1,500-nautical-mile range.[25] The Department of the Army presented the GMDD proposal to DOD. After considering the development facilities and the qualified

24. Ibid., p. 79.
25. History of Army Ballistic Missile Agency, 1 February - 30 June, 1956, p. 4.

personnel of GMDD available at the Redstone Arsenal, on November 8, 1955, DOD approved the proposal to develop the Jupiter IRBM.[26]

In December, President Dwight D. Eisenhower assigned the ICBM and IRBM programs the highest priorities. In response to the urgency of the Jupiter for national defense, the Department of the Army organized the Army Ballistic Missile Agency (ABMA) to direct the development of the Redstone weapon system and the Jupiter missile. On December 22, 1955, ABMA was officially established at the Redstone Arsenal as a class II activity under the jurisdiction of the Chief of Ordnance, and placed on active status effective February 1, 1956.[27] GMDD, including its subordinate laboratory organizations, was transferred to ABMA as the Development Operations Division. Under ABMA, the Development Operations Division continued development of the Jupiter and Redstone.

The Jupiter IRBM was to be designed for launching from Army mobile land launchers or from Navy ships. Since the Redstone facilities at AFMTC would be in constant use for testing the Redstone missile as a tactical missile and as a test vehicle for Jupiter systems and components, as well as for the testing of a multistage version of the Redstone under joint development by GMDD and JPL, MFL proposed new facility construction for Jupiter launchings.[28]

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26. Emme, <u>Aeronautics and Astronautics</u>, p. 80.
27. Dept. of the Army, GO 68, December 22, 1955.
28. Memo for Chief, Test Planning Office, GMDD, from Chief, MFL, GMDD, subj: Required Facilities and Instrumentation at PAFB, November 23, 1955.

The Redstone facilities at AFMTC consisted of the Missile Assembly Building D, Blockhouse 56, vertical launch facilities, and various items of instrumentation. To accommodate the Jupiter program, MFL requested the construction of a similar launch complex and a vertical launch facility adapted to simulated ship launchings. Since the expanding MFL programs had created the need for engineering and laboratory work to be performed at the launch site, the facilities proposal also included the construction of an engineering and laboratory building.[29]

In January 1956, agreements were concluded with AFMTC for the location of the new facilities adjacent to the Redstone facilities. The criteria design packages were completed and submitted through AFMTC to the District Corps of Engineers, Jacksonville, Florida, by February 13, 1956.[30] Variances in estimates of construction costs between MFL original estimates and those by the Corps of Engineers delayed the starting dates of actual construction until late that summer. The new launch complex which was designated as LC-26 was completed for the launch of Jupiter Missile AM-2 in August 1957.

The priority assigned to the Jupiter program under ABMA opened doors for the Development Operations Division that had been closed since the start of the Korean war. This was apparent to MFL, not only from the relatively short time required to complete

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29. Ibid.
30. Memo for Comdr, ABMA, from Dir, MFL, subj: Cost Increase of MFL Facilities at Florida Missile Test Range, June 18, 1956.

the Jupiter facilities,[31] but also the lifted restrictions on MFL's authorized personnel spaces. Between January and August 1956, MFL increased in civilian personnel strength to 130, with an additional 38 authorized spaces unfilled.[32]

MFL Personnel Given Permanent Duty Station at AFMTC

In the fall of 1956 the ABMA staff initiated an investigation of the costs of maintaining large portions of MFL's organization on temporary duty at AFMTC. The investigation disclosed that many problems of communication, time reporting, and paycheck distribution had plagued MFL since the initiation of the Redstone launch program in August 1953. Although procedural changes for time reporting and pay authorizations had reduced the frequency of difficulties in these areas, the problems of communication and the costs of maintaining personnel for long periods of time on temporary duty status remained.

As a result of the ABMA staff investigation, the Deputy Commander, ABMA, directed that extended temporary duty be discontinued. On December 21, a list was published containing the names of 90 classification act and wage board employees permanently assigned at AFMTC effective December 24, 1956.[33]

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31. Redstone facility requirements, confirmed in December 1951, completed April 1955; Jupiter facilities design criteria completed February 1956; facilities, August 1957.
32. Memo for Record by Chief, Resident Liaison Office, subj: Meeting on Personnel Space Allocations held 1400 hours, 8 August 1956, August 17, 1956.
33. DF, Dir, MFL, to ORDAB-P, subj: MFL Personnel to be Put on Permanent Change of Station to AFMTC, December 21, 1956.

During 1956, MFL launched 10 missiles, bringing the total of its launches at AFMTC to 21. These 10 included 9 Redstones used as test vehicles for Jupiter components (Jupiter A's), and a Jupiter C, the first in a series of long-range ballistic missiles developed for re-entry tests of the Jupiter nose cone.

The Navy's withdrawal from the Jupiter program in November 1956 to initiate its own IRBM program eliminated the need for further development of a Jupiter missile designed for ship launchings, as well as MFL's need for simulated ship launching facilities. Concentrated effort of the Development Operations Division in developing the land-based version resulted in the first launch of an operational prototype Jupiter missile on March 1, 1957.

As a result of the accelerated Redstone and Jupiter launch programs, combined with a continued sophistication in ground support equipment, as well as in the data acquisition, interpretation and evaluation required for these programs, MFL faced a continual need for additional qualified personnel. ABMA recognized MFL's problem and by December 31, 1957, the laboratory was authorized 285 civilian spaces. At that time the actual civilian personnel strength had reached 230, as compared to 176 at the end of the previous January.[34]

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34. Personnel Status Reports, to ORDAB, Administrative Office, from MFL, January 31, 1957, and December 31, 1957. In addition to civilian personnel, MFL had 43 military personnel in January and 55 in December.

Army's Participation in United States Space Program

The Russian success in launching SPUTNIK I on October 4, 1957, closely followed by SPUTNIK II on November 3, 1957, had an immediate and profound effect upon this Nation and the governmental agencies involved with satellite development. The Navy was completing final preparations for the launch of Vanguard TV-3, a three-stage vehicle designed to place a satellite in orbit.[35] On November 8, five days after the launch of SPUTNIK II, the Secretary of Defense directed the Department of the Army to launch a scientific satellite with a modified Jupiter C.[36] On January 31, 1958, MFL launched Jupiter C No. 29, which placed EXPLORER I in an earth orbit.

The launch of EXPLORER I, the first successful U.S. earth satellite, created a new area of activity for ABMA, the Development Operations Division, and MFL. In March 1958, the Army Ordnance Missile Command (AOMC), under the command of Maj. Gen. John B. Medaris, was established at the Redstone Arsenal to direct the Army efforts in rocket, guided-missile, and space projects. ABMA became a subordinate unit of AOMC and remained as the Army's guided missile and space projects development agency. Several proposals which had been made to DOD by ABMA during 1957 in regard to space programs were now submitted by AOMC to the DOD's newly established Advanced

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35. The first U.S. attempt to place a satellite in orbit, on December 6, 1957, failed due to loss of thrust.
36. Emme, Aeronautics and Astronautics, p. 92.

Research Projects Agency (ARPA) for approval. The Juno II program, which had been originally proposed in December 1957, was approved by ARPA in March 1958. On August 15, ARPA authorized AOMC to "initiate a development program to provide a large space vehicle booster of approximately 1.5 million pounds thrust based on a cluster of available rocket engines."[37] This booster was unofficially designated Juno V.

In addition to its role in support of the new space programs assigned to the Army, MFL began the design studies and criteria development of the facilities for the Pershing program. During the summer and early fall of 1958, MFL concluded the Redstone weapon system training program, through which selected Army Field Artillery units were trained in the techniques of handling and launching the Redstone missile. It also completed the launch program for the research and development phase of the Redstone weapon system. A total of 38 Redstones were launched from AMR during these phases of the Redstone program.

By November 1958, approximately five years after its activation, MFL had expanded its organization to include a Special Project Staff, a Scientific and Technical Staff, a Military Support Office, a Data Coordination Office, and a Program Coordination, Engineering Services and Administration Office, in addition to its three original operational units. By the latter part of November,

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37. ARPA Order No. 14-59, August 15, 1958, Dir. of ARPA to CG, AOMC.

MFL's civilian manpower strength totalled 282, which consisted of 191 classification act and 91 wage board employees.[38]

Juno V (Saturn) Facilities at AMR

On October 30, 1958, some two months after ARPA authorized the Juno V project, representatives of MFL and the Systems Support Equipment Laboratory of the Development Operations Division met to discuss their responsibilities regarding the program. It was decided that MFL would have full responsibility, including budgeting and funding, for design, construction, and installation of the proposed Juno V launch complex.[39] In November 1958, a meeting was held between representatives of the District Corps of Engineers, the architect and engineering firm of Maurice Connell and Associates of Miami, Florida, and ABMA to discuss the development of site criteria for the Juno V facilities.[40] Both MFL and AFMTC prepared proposals based on estimated site requirements. In early January 1959, ARPA representatives visited Cape Canaveral to discuss these proposals, and selected the one made by AFMTC to locate the launch facilities approximately 4,800 feet from the Air Force Titan Complex 20.

38. MFL Personnel Report, November 24, 1958.
39. Memo for Record from Prog. Coord. Engrg. Srvs. & Admin. Office, subj: Juno V (Saturn Prog.) October 30, 1958.
40. ABMA, Development Operations Division, DOD Memorandum No. 36-58 subj: Commanding General's Staff Meeting #39, December 8, 1958.

On February 3, 1959, ARPA cancelled the Juno V identification and officially named the project Saturn.[41] Later that month, a contract was awarded for the construction of the blockhouse, and site preparation for the Saturn facilities, designated as Launch Complex 34 (LC-34), was begun. In April ARPA appropriated funds to AOMC for construction of the Saturn facilities. The AOMC Engineer Office immediately forwarded the initial monies for the blockhouse construction and for the launch pad fill. Construction of this facility was started on July 5, 1959.[42]

The vehicle system, however, was still in a "proposed design" status. MFL was delayed in establishing the final design criteria for the service structure and pad facilities pending the selection of a vehicle system configuration. In early May 1959, ARPA approved a modified Titan and a modified Centaur for the second and third stages, respectively.[43] On May 11, 1959, a revised schedule for these facilities called for awarding the construction contract for the service structure on July 15, 1959, with a beneficial occupancy date of July 15, 1960. The launch pad dates were set approximately one month later than the service structure. Although construction of the access roads, utilities, and the blockhouse proceeded, Saturn configuration changes affected

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41. Saturn Systems Office, MSFC, Saturn Illustrated Chronology, April 1957 - November 1962, February 15, 1963. p. 5.
42. Ibid., p. 6.
43. Ibid.

the service structure requirements and resulted in a series of design modifications. Consequently, the construction of this facility was not started until August 1960.[44]

Other MFL Activities

In October 1959, when President Eisenhower announced his intention to transfer the Development Operations Division to the National Aeronautics and Space Administration (NASA), the MFL, in addition to its responsibilities for Saturn facilities development, was continuing the technical direction of the construction of the Pershing launch facilities, LC-30, and the modifications to LC-26 for the Jupiter combat training launch program. The latter program was initiated in April 1959, following an agreement between ABMA and the Air Force whereby the MFL personnel would train Air Force and NATO troops in Jupiter missile launching techniques.

During 1959, the MFL organization structure remained unchanged, but in order to meet MFL's increased scope of activities ABMA had increased MFL's authorized civil service spaces to 319 by December 31, 1959.[45]

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44. Ibid., p. 15.
45. Personnel Status Report, December 31, 1959. In addition to the civilian personnel, MFL was authorized 64 military personnel.

IV. THE LAUNCH OPERATIONS DIRECTORATE

Prior to 1946, this Nation's interest in space science and space exploration had been primarily limited to upper atmosphere studies and the launching of sounding rockets. Satellite studies had been conducted independently by the Armed Forces and various civilian agencies with little or no interchange of technical information. Although Project Vanguard had been approved as this country's program for space activities in relation to the International Geophysical Year (IGY), the major emphasis, supported by congressional appropriations, remained in the field of developing IRBM's and ICBM's for national defense.

Establishment of NASA

On November 7, shortly after the successful launch of SPUTNIK II, President Eisenhower announced the creation of an office of Special Assistant to the President for Science and Technology, and the appointment of Dr. James R. Killian, Jr., to the new advisory post.[1] Later, on February 4, 1958, the President directed Dr. Killian to head a committee to study and make recommendations on the governmental organization of the Nation's space program.[2]

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1. Alison Griffith, The National Aeronautics and Space Act, Public Affairs Press, Washington, D. C., 1962, p. 9.
2. Emme, Aeronautics and Astronautics, p. 95.

Subsequent investigations and studies of the progress made by the individual efforts of the Armed Forces' organizations and the interest expressed by the President in space exploration for peaceful purposes led to the recommendation by the Committee that a civilian agency be established to direct a unified national effort in the scientific and technical aspects of space activities. President Eisenhower presented this recommendation to the Congress on April 2, 1958. In his message, the President proposed the establishment of a national aeronautics and space agency which would absorb the existing National Advisory Committee for Aeronautics (NACA). By April 14, the Bureau of the Budget had drafted the President's proposal, and Congress, in a series of bills, confirmed the recommendations. In May, Dr. Abe Silverstein, Associate Director of NACA's Lewis Flight Propulsion Laboratory, was transferred to NACA headquarters to assist in drafting the organization of the proposed national space agency.[3] The National Aeronautics and Space Act, encompassing the President's Science Advisory Committee's basic recommendations, was passed by Congress and signed by the President as Public Law 85-568 on July 29, 1958.[4]

Public Law 85-568 officially established the National Aeronautics and Space Council, an advisory group to the President on aeronautical and space activities; the National Aeronautics and Space Administration (NASA) to plan, direct, and conduct aeronautical

3. Ibid., p. 99
4. Griffith, The National Aeronautics and Space Act, p. 16.

and space activities; and the Civilian-Military Liaison Committee to provide a channel of communication and consultation between NASA and DOD. It provided for Presidential appointments of an administrator and deputy administrator of NASA. It also provided for the abrogation of NACA 90 days after the law's enactment, or sooner, by proclamation of the NASA Administrator. At that time the NACA organization, personnel, and facilities would be transferred to NASA.[5]

On August 19, 1958, Dr. T. Keith Glennan and Dr. Hugh L. Dryden were sworn in as Administrator and Deputy Administrator, respectively, of NASA. On September 25, 1958, Dr. Glennan proclaimed that NASA had been organized and was prepared to discharge its duties effective at the close of business September 30, 1958.[6] NACA personnel, responsibilities, and facilities were officially absorbed into the NASA organization on October 1, 1958. On that same date President Eisenhower issued Executive Order 10783, transferring to NASA the responsibility for several DOD projects, including Project Vanguard from the Navy, and lunar probes, scientific satellites, and several engine research programs, including the F-1, 1.5-million-pound-thrust engine, from ARPA and the Air Force.

Atlantic Missile Range Operations Office Established

Less than two weeks later, on October 11, 1958, NASA's first space probe, PIONEER I, was launched from Cape Canaveral.

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5. Public Law 85-568, Sections 301(a) and 301(e).
6. NASA, First Semiannual Report to Congress, Washington, D.C., GPO, 1959, Appendix E, p. 66.

Since NASA's launch activity was expected to increase during the following months, Administration officials realized the necessity of establishing an official single point of contact at the Atlantic Missile Range (AMR) with the Commander, AFMTC, to perform technical coordination and liaison functions.

On November 28, 1958, AFMTC officially announced the establishment at AMR of the Directorate of NASA Tests, with Melvin N. Gough as Director.[7] For the first several months following his assignment by NASA to perform various liaison functions at AMR, Mr. Gough worked with only a skeleton staff and without a specific charter of responsibilities.

The first formal statement of functions and authority for the Gough organization came in the form of a memorandum from the NASA Administrator on May 1, 1959. Included among the functions assigned to the NASA Atlantic Missile Range Operations Office (AMROO) were the maintenance of effective liaison, and the representation of NASA with the Commander and various staff members; the provision of necessary services in support of NASA technical programs and projects at AMR; the coordination of arrangements for the scheduling of NASA test programs and projects at AMR, including the use of range facilities in accordance with NASA-DOD agreements and procedures; and the exercise of administrative supervision

7. AFMTC Daily Bulletin No. 232, November 28, 1958. This title was one assigned by AFMTC authorities in order to show similarity to the Directorates of Army Tests and Navy Tests, which were also part of AFMTC's organizational structure.

over all personnel assigned to AMR on NASA projects.[8] NASA AMROO reported directly to the Office of Space Flight Development.

Mercury-Redstone

During October 1958, in addition to directing the launch of its first space probe, NASA formally organized Project Mercury as its manned satellite program. A Space Task Group was formed at Langley Research Center and was assigned the responsibility for directing all phases of this program. Also in October, NASA requested that the personnel and facilities of the Jet Propulsion Laboratory (JPL) and approximately 100 ABMA scientists engaged in satellite and space vehicle booster development be transferred from the Department of the Army to NASA. NASA's purpose in making the request was to consolidate the development of spacecraft, launch vehicles, and space booster engines under the direction of a single Government agency. In the initial discussion between the representatives of NASA and the Department of the Army, the Army agreed to the transfer of JPL but refused to transfer the ABMA scientists, stating that the loss would reduce its scientific capability to the extent of endangering the national defense effort.

8. NASA Management Manual, General Management Instructions, No. 2-2-13, Effective Date September 17, 1959, subj: Functions and Authority - NASA Atlantic Missile Range Operations Office (AMROO). This superseded the Memo from the Administrator, dated May 1, 1959, same subject, but did not change any of its provisions. (See Appendix A, p. A-30.)

Subsequent discussions, however, resulted in two agreements, both of which were signed on December 3, 1958. One agreement effected the transfer to NASA of the JPL personnel, facilities and remaining budget appropriations on January 1, 1959.[9] In the other agreement, although the Army retained its scientific capability, the AOMC and its subordinate organizations were made "immediately, directly and continuously responsive to NASA requirements."[10]

In October 1958, coincidental to the Army-NASA transfer discussions, representatives of NASA and AOMC met to discuss the use of Redstone and Jupiter vehicles in support of the manned satellite project. As a result of the meeting, AOMC tentatively agreed to supply ten Redstone and three Jupiter missiles for sub-orbital missions in the U.S. man-in-space project. In November, NASA informed AOMC to proceed with an eight-vehicle Redstone and three-vehicle Jupiter program. A development and funding plan for AOMC's support of the manned satellite program, dated December 12, 1958, which was based on eight Redstone and three Jupiter boosters, was partially accepted in January 1959 when NASA requested AOMC to construct and launch eight Redstone and two Jupiter boosters.[11]

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9. NASA, First Semiannual Report to Congress, Appendix H, pp. 81, 82.
10. Ibid., Appendix I, p. 86.
11. Teletypes, NASA Headquarters to CG, AOMC, January 8 and 16, 1959. As developmental planning for Project Mercury evolved, NASA notified AOMC, on July 8, 1959, that in order to reduce the variety of launching vehicles, the Jupiter missile would not be used.

On January 27, Dr. Debus announced the appointment of a project engineer and coordinator to represent all phases of MFL's responsibility in the Mercury-Redstone program.[12] MFL started immediately with the initial planning phases to modify Launch Complex 56 to meet the requirements for this program.

Saturn

NASA also expressed interest in the clustered-engine concept under development by ABMA for ARPA and listed the Saturn booster as one of the vehicles in a series of space booster vehicles to be developed under the national space vehicle program.

In the late spring of 1959, elements within DOD questioned the military need for a booster as large and powerful as the proposed Saturn. The Office of Defense Research and Engineering of DOD made studies to determine whether military needs justified the continued support of the Saturn program, or whether requirements could be met more efficiently with a smaller booster which could be developed at less cost.

On July 27, 1959, Dr. H. F. York, Director of Defense Research and Engineering, and also Chairman of the Booster Evaluation Committee, indicated to both the Director of ARPA and to the Secretary of the Air Force that the studies revealed a similarity in the requirements for the second stage of the Saturn and the requirements for the Air Force's proposed Dyna-Soar booster. To

12. DF, Dir, MFL, to ORDAB Distribution, subj: ADAM (Mercury) Project Engineers for MFL, January 27, 1959. Emil Bertram named as overall Project Engineer and Coordinator.

avoid unnecessary duplication of effort, Dr. York recommended a common development of these projects. On July 29, 1959, the ARPA Director ordered that all work cease on the Saturn second stage pending the results of further studies. ABMA, however, was authorized to proceed with plans to conduct static firings of the Saturn booster tentatively scheduled for early 1960.[13]

In August, the Air Force proposed the Titan C, a space booster utilizing a Titan II first stage and a Titan I second stage, as the launch vehicle for the Dyna-Soar program. At that time Dr. York considered cancelling the Saturn program, but a final decision was withheld in deference to possible NASA requirements.[14] In September, presentations on the Saturn, Titan C, and Nova were made to Dr. York and the Booster Evaluation Committee by the proponents of the three systems. The purpose of the presentations was to determine which of the systems "would most feasibly promote NASA space objectives... the Saturn program was selected because it offered the most immediate advantages of the systems presented."[15]

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13. Saturn Illustrated Chronology, pp. 6, 7. (In December 1958, a National booster program was developed by NASA and DOD to provide a basis for long range planning in the development of a family of boosters to be used by both agencies in carrying out their respective space activities. This committee evaluated and recommended boosters to be developed and used by various departments and agencies within DOD.)
14. U.S. Congress, House, Committee on Science and Astronautics, Space, Missiles, and the Nation (House Report No. 2092), July 5, 1960, Washington, D.C., GPO, 1960, p. 11.
15. Saturn Illustrated Chronology, p. 7.

Meanwhile, on September 18, 1959, Secretary of Defense Neil H. McElroy issued a DOD order entitled "Satellite and Space Vehicle Operations," which served as an outline for reorienting the space activities performed by the organizational elements of DOD.[16] On September 23, Dr. York announced the reorganization of the military space and missile program as indicated in Secretary of Defense McElroy's order, which gave the Air Force the major role (including the development of large space boosters) in DOD space activities.[17] ARPA retained control of the Saturn program during the transition period required for completing the transfer arrangements. Since the Saturn was selected by the Booster Evaluation Committee as the system to promote NASA's space objectives, on September 24, 1959, ARPA requested ABMA to initiate a study to determine the two Saturn configurations which would best increase the vehicle's capabilities to carry NASA's payloads.[18]

DOD and NASA Proposed Transfer

At the time the Air Force was assigned the responsibility for the military space program, a decision was made within DOD that no military requirements existed for space boosters of Saturn's size and power. Discussions were initiated by Secretary of Defense McElroy with Dr. Glennan concerning the possibility of transferring the Saturn project and its development team to NASA.

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16. Emme, Aeronautics and Astronautics, p. 113.
17. Ibid., pp. 113, 114.
18. Saturn Illustrated Chronology, p. 7.

The discussions resulted in a tentative agreement which was presented to President Eisenhower and a selected group of his personal advisers. On October 21, 1959, the President announced his intention to transfer ABMA's Development Operations Division to NASA unless Congress should disapprove, as provided in Section 302 (c) of the National Aeronautics and Space Act.[19] NASA was also assigned the responsibility for developing all high-thrust launch vehicles for both military and scientific space programs. On November 18, NASA assumed technical direction of the Saturn project, pending its formal transfer from ARPA, but did not obtain full control of the program until the following March.[20]

On October 22, Dr. Glennan, accompanied by members of his staff, arrived at Huntsville to discuss NASA's tentative plans for the ABMA organizational elements included in the proposed transfer. During his brief four-hour stay, he held separate meetings with the AOMC-ABMA staff management group, the Development Operations Division laboratory chiefs, and later with a group of approximately 100 selected key personnel from that division. Some of the highlights of his discussion (the same speech was presented to each group) were that he intended to organize NASA into four major divisions, i.e., General Administration (Washington, D.C.), R&D Center Activities (such as Lewis, Langley, and Ames), Payload

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19. NASA, <u>Third Semiannual Report to Congress</u>, Washington, D.C., GPO, 1960, p. 118.
20. <u>Saturn Illustrated Chronology</u>, p. 8.

and Payload Operations (Goddard and JPL) and Vehicle Systems and Launching Operations (Redstone Arsenal); to center at Redstone Arsenal all of NASA's broad interests in the space booster field; to have the development of NASA's large booster system program accomplished by the Redstone group; and to combine the Saturn and Nova programs into a single long-range program. Mr. A. F. Siepert, Director, Office of Business Administration, and a member of the visiting group, was appointed by Dr. Glennan to have overall responsibility for NASA in negotiating and planning for the transfer.[21]

On October 30, 1959, Dr. Glennan and the Secretary of Defense, Thomas Gates, signed a joint memorandum recommending to the President "certain actions designed to clarify responsibilities, improve coordination, and enhance the national space effort." The memorandum also included a recommendation for the transfer of the Development Operations Division to NASA and stated that, subject to Presidential approval, staff teams would be formed immediately to prepare the necessary implementing documents.[22]

The Transfer Plan Developed

As early as October 23, the MFL staff, in anticipation of the transfer to NASA, held discussions for the purpose of

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21. Memo for Record, Special Assistant to CG, AOMC, subj: Summary Notes of Dr. Glennan's Visit to AOMC on 21 [sic] October 1959, October 24, 1959.
22. Memorandum for The President from NASA Administrator and Secretary of Defense, subj: Responsibility and Organization for Certain Space Activities, October 30, 1959. See Akens, Historical Origins of MSFC, Appendix A.

developing an outline of information to be compiled for NASA's use in preparing a transfer plan.[23] MFL also initiated steps to develop an organizational plan to reflect new responsibilities and functions under NASA. Since a statement of mission assignments from NASA was not available at that time, Dr. Debus suggested proceeding with the organizational plan by using known assignments and some assumptions based on MFL's knowledge of NASA's operations at AMR. Based on its experience in operating at AMR, MFL also anticipated problems in the division and assignment of facilities, coordination of new facility construction, priority assignments to obtain support services, and in liaison with AFMTC concerning range support requirements for missile tests.

By the first week in November, AOMC and NASA had appointed task force groups to conduct studies and recommend which facilities, equipment, and organizational elements should be included in the formal Army-NASA Transfer Plan Agreement.[24] NASA requested information pertaining to MFL's organization, methods of operation, facilities, and personnel. NASA also requested recommendations in the form of a proposal for MFL's continued operation at AMR under NASA. The information was compiled and submitted to the

23. Memo for Record, Administrative Officer, MFL, subj: NASA Changeover, October 27, 1959.
24. DF, Acting Deputy CG, AOMC, to Project Officers and Task Members, et al., subj: Establishment of a Project Task Force to Study Proposed Transfer of Functions and/or Organizations to NASA, November 3, 1959.

NASA Task Group on November 12, 1959.[25] On November 18, an agreement on the objectives and guidelines for implementing the transfer was signed by the NASA Administrator and Secretary of the Army.[26] The Army-NASA Transfer Plan, dated December 11, 1959, was formally approved by the Secretary of the Army and Acting Secretary of Defense on December 16, and by the NASA Administrator on December 17.[27]

OLVP and OSFP Established at NASA Headquarters

Shortly before the formal transfer plan received final approval, a reorganization within NASA headquarters was announced. In addition to the already established Offices of Business Administration, Aeronautical and Space Research, and Space Flight Development, NASA created a fourth major unit, the Office of Launch Vehicle Programs (OLVP). Responsibilities of OLVP included NASA booster and propulsion systems development, and the launching operations at the Atlantic and Pacific Missile Ranges, as well as other possible future launch sites. Also, the Atlantic Missile Range Operations Office was transferred from the Office of Space Flight Programs (OSFP), formerly Office of Space Flight Development, to OLVP.[28]

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25. MFL Support Operations Data for NASA Task Force Use, November 12, 1959.
26. Agreement Between the Department of the Army and NASA on the Objectives and Guidelines for the Implementation of the Presidential Decision to Transfer a Portion of ABMA to NASA, November 16, 1959. See Akens, Historical Origins of MSFC, Appendix B.
27. Army-NASA Transfer Plan. See Akens, Historical Origins of MSFC, Appendix C.
28. NASA, Third Semiannual Report to Congress, p. 118.

Maj. Gen. Don R. Ostrander, USAF, Deputy Director of ARPA, was appointed director of the new office, effective January 1, 1960. The ABMA's Development Operations Division would become an integral part of OLVP on the date of its transfer to NASA.[29]

The Launch Operations Agency

In early January 1960, MFL was requested to submit a proposal on the organizational structure and responsibility statements for a NASA launching agency based on its earlier recommendations to the NASA Task Force Group. MFL's proposal was completed by January 12, 1960, and forwarded to OLVP.[30] Before the end of February, OLVP had verbally approved the general organizational concepts and functions contained in the MFL proposal.[31]

The NASA Launch Operations Agency (LOA), as proposed by MFL, contained all the organizational elements of MFL, as well as some elements from other Development Operations Division laboratories which had been assigned to support MFL's missions. These elements were primarily from the Systems Support Equipment Laboratory, whose function was to design facilities and support equipment for both permanently mounted and mobile missile launchers.

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29. NASA News Release No. 59-270, December 8, 1959.
30. Memo for Dir, Development Operations Division, from Dir, MFL subj: Proposed Centralized Launch Operations Agency under NASA, January 13, 1960; Ltr, Dir, Development Operations Division, to Deputy Dir for Launch Vehicle Programs, NASA, subj: Future Launch Operations, January 14, 1960.
31. Memo for Deputy Director, Development Operations Division, from Dir, MFL, subj: Directorate of NASA Test Support at AMR, February 24, 1960.

The Director, Development Operations Division, concurred with the transfer of those elements designing permanent type facilities utilized in NASA projects to the direct supervision of MFL, but retained the mobile launcher and support equipment design groups within the Systems Support Equipment Laboratory of the Development Operations Division.[32]

The proposed LOA also provided for a Directorate of NASA Test Support at both the Atlantic and Pacific Missile Ranges. The NASA test support offices were to be subordinate elements of LOA and were to function as the liaison activities between the various NASA organizations utilizing the test ranges and the range management. For all practical purposes, the NASA AMR test support office was to assume the responsibilities presently performed by the NASA AMROO.

After receiving word that OLVP had approved the general organizational concepts, MFL proceeded with the details of the new launch agency's organization structure and functions. During late February 1960, other NASA organizations directly associated with launching activities questioned the extent of the responsibilities and authority of the proposed NASA centralized launching agency in directing NASA's launch operations. Of major concern was the plan to establish the Directorate of NASA Test Support at AMR to perform

32. Ltr, Dir, Development Operations Division, to Deputy Dir for Launch Vehicle Programs, NASA, subj: Future Launch Operations, January 14, 1960.

the functions which had been assigned to AMROO. The objections stemmed from the NASA reorganization made effective on January 1, 1960, which transferred AMROO from OSFP to OLVP. The transfer eliminated the direct channel of communication between the payload groups of the OSFP centers and AFMTC. If a NASA test support office were to be established as outlined in the MFL proposal, the payload groups would be forced to rely upon the technical support of that office in accomplishing their missions and upon the administrative support of LOA, a subordinate organization of the Huntsville center of OLVP.

NASA Test Support Office

In March 1960, the Director of Business Administration, NASA, indicated the trend of NASA's thinking at that time.

> Our current planning has been that the detailed administrative or housekeeping operations for the entire NASA party /AMROO, and other NASA elements/ at the Cape /Canaveral/ would ultimately be handled by an extension of the administrative services which are already quite well staffed under MFL....
>
> All formal arrangements in this area we have held in abeyance pending the top organization decisions from Dr. Glennan, and pending an actual visit by Dr. von Braun's recently appointed Deputy, Del Morris.[33]

By April the NASA Test Support Office for AMR had been approved as a function within the NASA Launch Operations Agency with Lt. Col. Asa Gibbs, USAF, selected as its director. A similar office was

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33. Ltr, Dir of Business Administration, NASA, to Dir, NASA AMROO, March 10, 1960.

later approved for the Pacific Missile Range (PMR).[34] Negotiations continued between OLVP and OSFP to reach an agreement on the organizational relationships between LOA and the payload groups assigned at AMR. In early May, the Office of Flight Missions (OFM) was proposed as the central contact point for OSFP's payload and spacecraft organizations at AMR. This office was to be a part of LOA, and under its administrative supervision. However, the Director of OFM was to serve as the local representative of the Director of OSFP. By May 5, transfers were arranged for the majority of the AMROO staff to either the Space Task Group, LOA, or OFM at the cape.

Questions were also posed concerning the launch agency's status within the NASA organizational structure and the consistency of its organizational titles with other NASA elements of equal level. MFL, in assuming that the Development Operations Division would be made responsible for the research and development of all NASA's space booster vehicles, proposed that the launch agency be a subordinate unit of that division. Its responsibilities as presented, however, included the direction of launch activities for all NASA launch operations at AMR, PMR, and other possible future launch sites. Since LOA's responsibilities approximated those of other NASA organizations at center level, some consideration was given to separating LOA from the Development Operations

34. PMR NTSO officially activated and Comdr. Simon J. Burttschell appointed Director October 27, 1960. Memo for Comdr. Burttschell et al., from Chief, MSFC Liaison Branch, subj: Establishment of PMR Office, October 26, 1960.

Division and making it an independent center, reporting directly to OLVP. For a short time the launch agency was unofficially called the "Launch Operations Center."

LOD is Established

On March 15, 1960, when President Eisenhower officially announced the transfer of the Development Operations Division to NASA, he named the new NASA field installation at Huntsville the George C. Marshall Space Flight Center (MSFC).[35] By mid-April the decision was made to keep the launch agency as an integral part of MSFC, under which it was to have directorate status. Its organization and basic functions remained virtually unchanged from the original proposal made by MFL the previous January, except for the addition of OFM.[36] On June 13, 1960, NASA officially announced the termination of AMROO and the establishment of the Launch Operations Directorate (LOD) and OFM, to be effective July 1.[37]

In preparation for the transfer to NASA, between January and June 1960 MFL conducted studies of the manpower requirements necessary to staff the NASA launch agency. Under ABMA, there were 535 people working in the functional areas to be assigned to LOD. Of this number, 319 were civil service employees directly assigned to MFL, and the remaining 216 were military, contractor, and civil

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35. Executive Order No. 10870, March 15, 1960.
36. See Appendix A for organizational structures and functional statements.
37. NASA Announcement No. 156, subj: NASA Organizational Changes at AMR and PMR, June 13, 1960.

service personnel assigned or attached in support of MFL missions. To support LOD's assigned missions, MFL determined that it would require 447 civil service employees, 105 contractor personnel, and an additional 34 spaces as support for business administration functions. At the time of the transfer, MSFC allotted 438 civil service spaces and 106 contractor spaces to LOD. Later, an additional 32 civil service spaces were added.[38]

Facility Transfer Arrangements

In addition to developing and establishing the organization for NASA's centralized launch agency, MFL shared in the responsibility for implementing the Army-NASA Transfer Plan. The Transfer Plan resulted from the Army-NASA agreement of November 1959, which provided for the transfer of manpower, real estate, facilities, and the continuing functional relationships of the Development Operations Division and MFL regarding the support of Army programs. The agreement stated in general terms what was to be transferred and set July 1, 1960, as the effective date, but left a number of the details regarding individuals or specific items to be arranged by the lower echelons of management directly concerned with the individuals or items in question.

In early March 1960, negotiations were initiated between the Army representatives at AMR and MFL representatives to effect an agreement on the transfer of Army facilities to NASA, and for

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38. MSFC LOD, Special Report on Support Operations at the AMR by LOD, December 21, 1960, Part 4, Personnel Strength.

the control of shared facilities which were included, but not specifically referenced, in the Transfer Plan. Throughout the transition period from Army to NASA jurisdiction, MFL's position was unique. While negotiating an agreement with the Army representatives for the transfer of various Army facilities at AMR to NASA, it was imperative that MFL maintain operations as the Army's launch agency. MFL also continued to supervise the design, construction, and installation of facilities and instrumentation for the Saturn, Pershing, and Mercury-Redstone projects on an uninterrupted basis.

By mid-March, MFL had prepared support agreements for the transfer of control for various facilities, services, and functions which were considered necessary to accomplish its missions, and had submitted them to the Development Operations Division for necessary action. The major problem which delayed the agreement evolved from different interpretations of the term "control of" regarding those facilities to be occupied on a joint basis, particularly Hangar R. The Development Operations Division, having received a request from the Director, OLVP, for budget data on facility requirements for inclusion in NASA's fiscal year 1962 budgetary requests, as well as a request from the Commander, AFMTC, that a Master Plan of NASA facility requirements at AMR be submitted as soon as practicable, took prompt action to solve the problem.[39]

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39. DF, Dir, Development Operations Division, to CG, AOMC, subj: Facilities at Cape Canaveral Involved in the Army-NASA Transfer, March 24, 1960.

SATURN FACILITY
LC-34 Construction Area (May 9, 1960)

On June 9, 1960, in a letter to the Director of OLVP, the Deputy Commanding General, AOMC, stated that it was agreed Dr. Debus would have operational control over all Army facilities in the Industrial Area at AMR, including the planning, utilization, and operation of all facilities. He also indicated that a request had been submitted to the Department of the Army for approval to relinquish to NASA complete responsibility for Launch Complex 26.[40] Although this facility was not included in the Army-NASA Transfer Plan agreements completed by July 1, 1960, the recommendation remained as a matter for further consideration.

During September and October 1960, representatives of AOMC and MSFC held meetings to resolve the remaining problems concerning facilities at AMR. Again the use of the term "control" became a matter of issue. A compromise resulted in a new agreement which became a separate document to supplement the AMR facilities agreement of the Army-NASA Transfer Plan. The new agreement, which was concluded on October 13, 1960, assigned Hangar R to AOMC, but under the operational control of LOD. Launch Complexes 26 and 56 were assigned to LOD for use in Mercury, Juno II, Redstone, and Jupiter CTL. It was agreed that AOMC would be given first priority for the use of Complex 26, or an equivalent complex, for future Army programs.[41]

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40. Ltr, Deputy CG, AOMC, to Dir, Launch Vehicle Programs, NASA, June 9, 1960. See Supporting Document No. IV.
41. Agreement between USAOMC and MSFC on Facilities at the AFMTC, October 13, 1960.

NASA Master Plan for Facilities at AMR

While negotiating with the Army concerning the transfer of facilities, MFL was also developing a master plan for NASA facilities at AMR. A facilities planning task force was established in early March 1960, following the request from the Commander, AFMTC, for a master plan of all NASA facility requirements to support the NASA 10-year program.[42] The Director, MFL, instructed the task force group to first develop a master plan for facility requirements for an initial 3-year period, and then follow up with a 10-year plan.

On April 21, 1960, the Deputy Director, MFL, presented a briefing on the master plan to AFMTC representatives. The initial plan called for a consolidation of NASA program activities in the southern portion of the AMR Industrial Complex. Included in this area were Hangars D and R, MFL technical buildings, and Hangar S, assigned to Project Mercury as the capsule checkout building. (See following page for map of Industrial Complex of Cape Canaveral Missile Test Annex.) The plan also called for the utilization of Hangars E and H to support the NASA Agena and Centaur programs and the temporary use of Hangar AE for the JPL Agena group until a spacecraft laboratory could be constructed. In addition, an engineering and operations building was to be constructed for use

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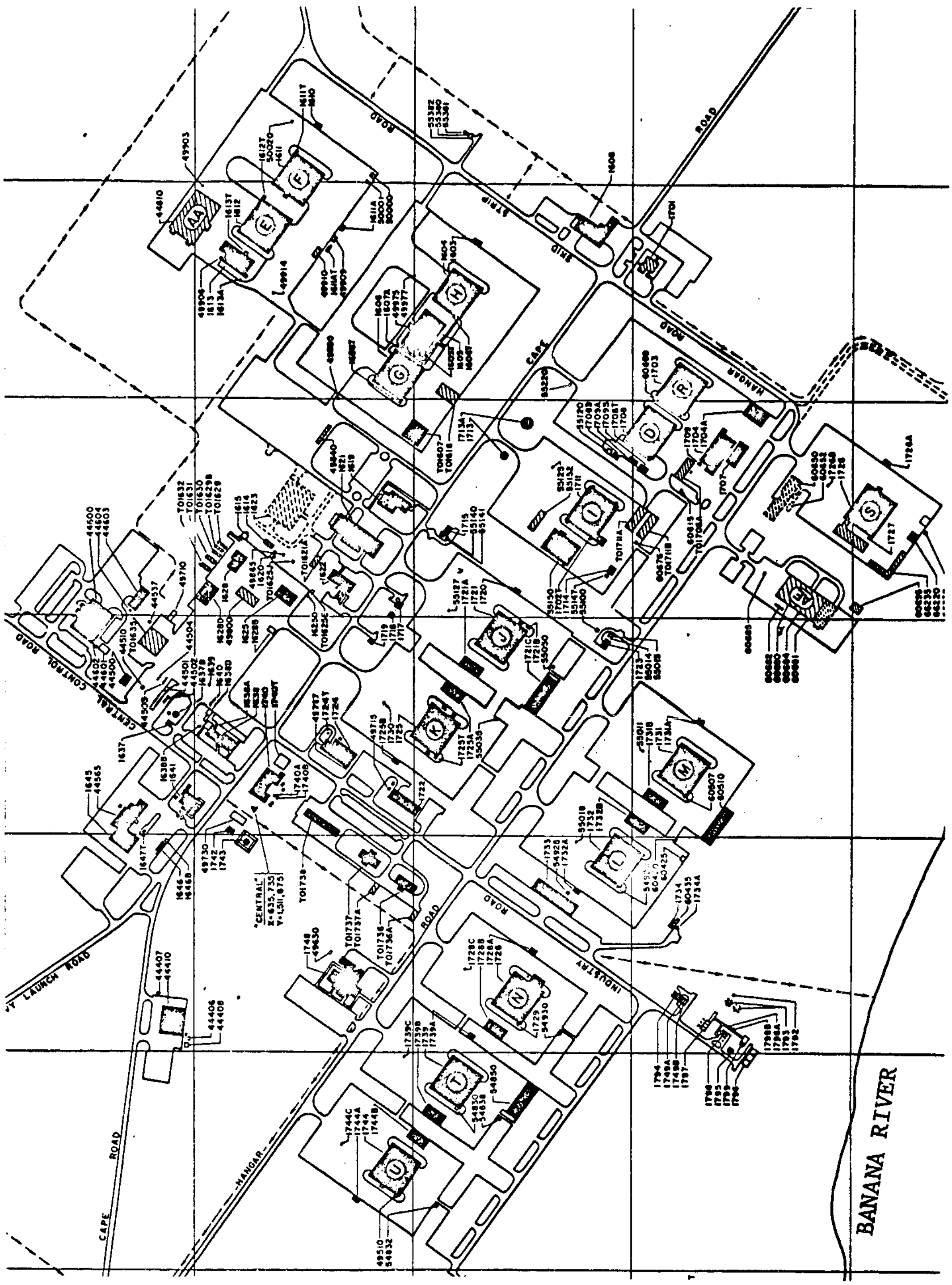
42. DF, Dir, Development Operations Division, to CG, AOMC, subj: Facilities at Cape Canaveral Involved in the Army-NASA Transfer, March 24, 1960.



INDUSTRIAL COMPLEX
CAPE CANAVERAL MISSILE TEST ANNEX
DECEMBER 1960

by Project Mercury and a new section added to the engineering and laboratory building to provide space for additional engineering personnel who were required to support NASA programs.[43]

Although the basic plan was approved by the Commander, AFMTC, the Air Force Ballistic Missile Division (AFBMD), which was assigned the Air Force responsibility in the Agena and Centaur programs, proposed to retain Hangars E and H for Air Force utilization, as well as building AE, until completion of the research and development phase of the Mace program. Goddard Space Flight Center, which had been utilizing a portion of Hangar H for its Delta project, also required facilities before September 1, 1960, since the first Centaur vehicle was scheduled to arrive at AMR on or before that date. By August 1960, plans were underway to construct a spacecraft laboratory for the JPL group and to modify Hangar AE for Delta as soon as it was made available by AFBMD.

Launch Facility Modifications

MFL's study of Atlas launch facilities in the summer of 1960 led to MFL's recommendation that the launch complexes which were to be shared by the USAF and NASA should be modified to increase the launch capability of the complexes.[44] The modifications would provide each program with a primary launch facility and a

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43. Memo for Record by Deputy Dir, MFL, subj: Briefing of AMR on NASA Master Facilities Plan, April 27, 1960.
44. Report on Launch Facilities for Agena, Centaur, and Mercury, prepared by Chief, Program Coordination Test Support Office, September 1, 1960.

backup facility in case of damage to the primary facility. Discussions concerning the modifications continued during 1960, and, in March 1961, an agreement was reached between NASA headquarters and ARDC on the modifications and construction of the Atlas launch stands.[45] NASA LOD became responsible for modifications to Launch Complex 12 and for construction of an additional pad at Launch Complex 36. During this same period LOD was also developing design criteria for a new Saturn complex (LC-37).

Manned Lunar Landing Program

A major event which led to the establishment of the Launch Operations Center occurred in the spring of 1961 with the presidential and congressional approval of NASA's Manned Lunar Landing Program (MLLP). This program had been listed as a mission target beyond 1970 in the NASA 10-year plan for space exploration originally presented to the Congress in January 1960. Although NASA had awarded contracts in the fall of 1960 for project studies (Project Apollo) in preparation of eventual lunar exploration, opposition at that time from scientific and governmental agencies to manned space flight beyond Project Mercury resulted in reductions to NASA's fiscal year 1962 budget appropriations, which consequently affected the F-1 engine (Nova) development and associated programs.

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45. Air Force/NASA, Memo of Understanding Regarding the Modification and Construction of Atlas Launch Stands at AMR, March 1961.

In February 1961, President John F. Kennedy directed a thorough review of all programs related to the space effort.[46] Although in March Congress approved a supplemental appropriation to the NASA fiscal year 1962 budget to restore support to the man-in-space programs, the launch and orbital flight of a Russian manned spacecraft on April 6 emphasized the gap which had developed between Russian and U.S. space achievements. On May 25, President Kennedy appeared before Congress to request that this Nation set a goal to make a manned lunar exploration within this decade, and that Congress give its full support to NASA in attaining this goal.[47] MLLP was unanimously approved by Congress, and, by July, NASA and DOD were engaged in cooperative efforts, at various levels, to facilitate the NASA space program.

On July 17, the Director, LOD, and the Commander, AFMTC, signed an agreement on AFMTC support of NASA/LOD operations at AMR.[48] Shortly thereafter, on July 31, these organizations submitted the results of a joint study on prospective launch sites for the new MLLP.[49] On August 24, as a consequence of this study,

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46. U.S. Senate, Hearings before the Committee on Aeronautical and Space Sciences, 87th Congress, February 28 and March 1, 1961, NASA Scientific and Technical Programs, statement of James E. Webb, NASA Administrator, February 28, 1961, p. 3.
47. Eugene M. Emme, NASA Historian, Historical Origins of NASA, July 1, 1962, pp. 11, 12.
48. Range Use and Support Agreement between LOD/MSFC/NASA and AFMTC/AFSC, July 17, 1961. See Supporting Document No. VIII.
49. Joint memo for Associate Administrator, NASA, from Dir, LOD, and Comdr, AFMTC, subj: Joint Report on Facilities and Resources Required at Launch Site to Support NASA Manned Lunar Landing Program (Phase I Report), July 31, 1961.

NASA announced the selection of the Cape Canaveral area as the launch site for MLLP, and that it planned to acquire an additional 80,000 acres for necessary expansion of the Cape facilities. This decision was made with the concurrence of DOD.[50] The official announcement coincided with the signing of an agreement between NASA and DOD relating to the management and funding of the MLLP launch site.[51]

As a result of the increased emphasis placed on NASA space programs, a reorganization occurred within NASA which was designed to more effectively achieve its space goals.[52] Among the changes, OSFP and OLVP were discontinued and the headquarters organizations directly associated with manned space flight were transferred to the newly created Office of Manned Space Flight (OMSF). At the same time, the field installations were made directly responsible to the Associate Administrator.

Launch Operations Center Proposed

In September 1961, LOD was requested to submit a proposal for an independent NASA launching agency which would conform to the functional realignments made during the NASA reorganization. In complying with this request, LOD prepared two proposals, both

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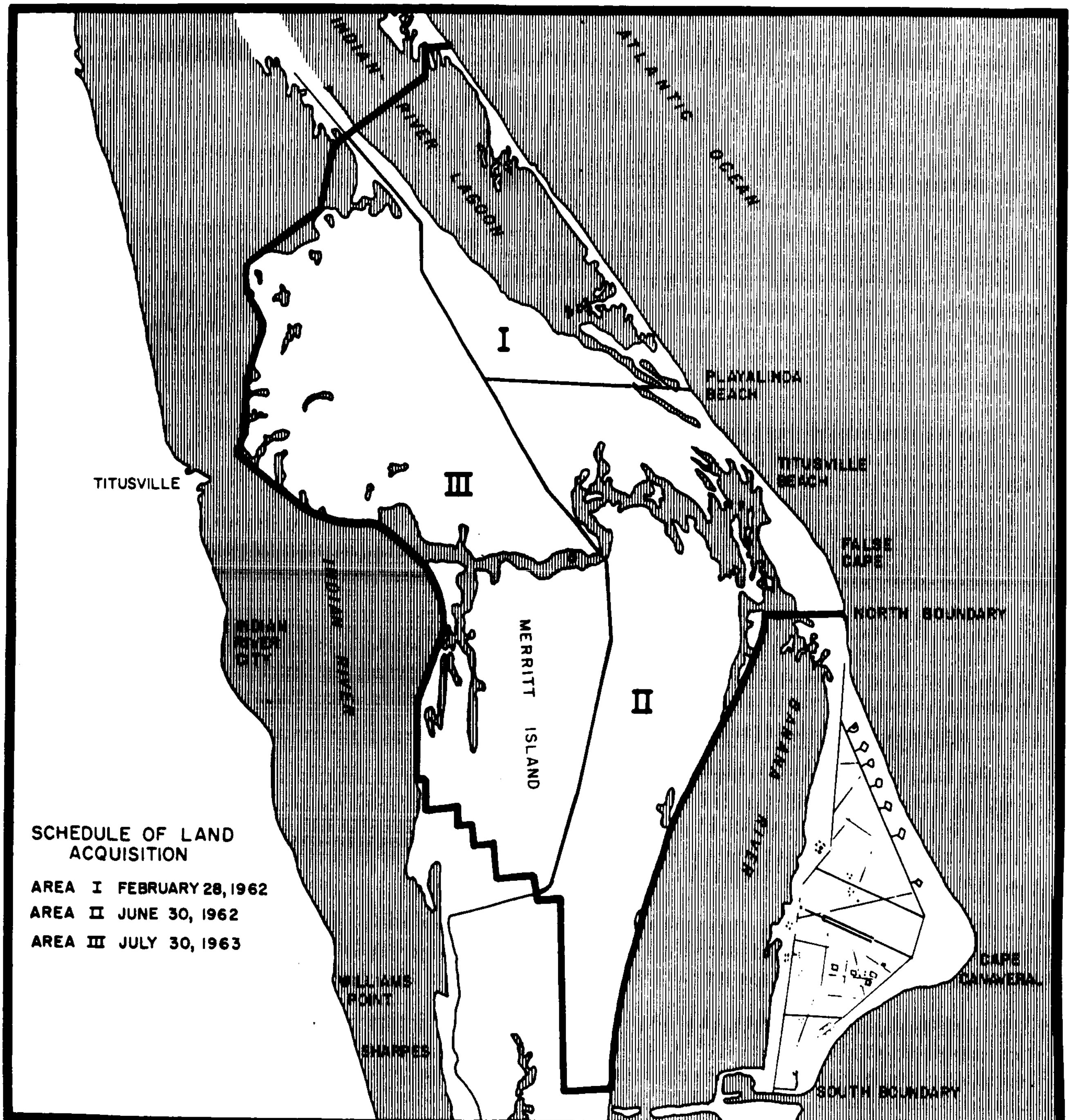
50. NASA News Release, No. 61-189, August 24, 1961.
51. Agreement Between DOD and NASA Relating to The Launch Site for the Manned Lunar Landing Program, August 24, 1961 (commonly referred to as the "Webb-Gilpatric Agreement"). See Supporting Document No. IX.
52. Report to the Congress from the President of the United States, United States Aeronautics and Space Activities, 1961, Washington, January 1962, p. 29.



INDIAN RIVER LAGOON
ATLANTIC OCEAN
I
PLAYALINDA BEACH
III
TITUSVILLE
TITUSVILLE BEACH
FALSE CAPE
NORTH BOUNDARY
INDIAN RIVER CITY
INDIAN RIVER
MERRITT ISLAND
II
BANANA RIVER
SCHEDULE OF LAND ACQUISITION
AREA I FEBRUARY 28, 1962
AREA II JUNE 30, 1962
AREA III JULY 30, 1963
CAPE CANAVERAL
WILLIAMS POINT
SHARPES
SOUTH BOUNDARY

of which provided for centralized management and support organizations. Proposal I also provided for a centralized launch team, while Proposal II called for separate launch teams, provided by, and responsible to, their respective centers.[53]

At the time the LOD proposals were being drafted, MSFC requested the Associate Administrator to authorize a financial plan for LOD and to provide additional personnel spaces to broaden and strengthen LOD's administrative and support functions. The plan, as proposed by MSFC, would transfer to LOD from MSFC a large part of the responsibility for programming and scheduling; procurement and contracting; planning, supervising and coordinating facilities construction; industrial safety; limited personnel management; and the paying and accounting aspects of financial management.[54] One of the first steps taken in this direction was the establishment of the offices of Financial Management and Procurement and Contracts on November 20, 1961.[55]

In the latter part of November and in early December representatives of LOD and AFMTC held discussions concerning the preparation of a Master Plan for MLLP and its integration with the overall Master Plan for AMR. On November 17, LOD presented its planning proposal to the Commander, AFMTC, and his staff.

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53. Dir, LOD, Analysis of Major Elements Regarding the Functions and Organization of Launch and Spaceflight Operations, October 10, 1961.
54. Ltr, Associate Deputy Dir for Administration, MSFC, to Associate Administrator, NASA, September 26, 1961.
55. Emme, Aeronautical and Astronautical Events of 1961, p. 65.

Although it was well received, AFMTC requested additional time to study the plan before signing an agreement for its implementation.[56]

At the same time some consideration was given by elements within NASA headquarters to establish an Eastern Operations Office to represent NASA at AMR. LOD, after considering the funds to be expended by NASA at AMR, land utilization, launch responsibilities and the many interface problems with the Range, recommended either Proposal I or Proposal II outlined by Dr. Debus in October. Objections to a NASA Eastern Operations Office were made by LOD to MSFC following discussions in a meeting with AFMTC on December 8.[57] During this meeting it was agreed that MLLP planning must be jointly accomplished. AFMTC, however, pointed out problem areas with NASA which resulted from the methods of operation of NASA organizations at AMR. AFMTC indicated that LOD, as NASA's single point of contact with the Range, "must represent or coordinate all NASA inputs into the Range, including technical requirements and support <u>solutions</u>.... [and that] instrumentation planning must include launch, injection, and <u>world-wide</u> requirements."[58] Both LOD and AFMTC opposed an extension of the existing Mercury working arrangements, which had been approved in agreements with AOMC and the Air Force early in the Mercury program, for new programs such as MLLP.

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56. Minutes of Meeting with Comdr, AFMTC, and his staff, on LOD proposal for Master Planning, held on November 17, 1961, prepared by Assistant to the Director, LOD, November 29, 1961.
57. Memo for Dir, LOD, from Assistant to the Dir, LOD, subj: Problem Areas for Discussion with Dir, MSFC, on 11 Dec. 1961.
58. <u>Ibid</u>.

PORTION OF NASA INDUSTRIAL AREA

The discussions also revealed differences in AFMTC's and LOD's interpretations of the Webb-Gilpatric agreement, particularly in regard to funding responsibilities.

Following the activation of OMSF in November 1961, NASA headquarters continued efforts to consolidate MLLP management. As a part of this further consolidation, headquarters considered the major expansion taking place at AMR, primarily in the area of manned space flight, and decided that this expansion should be made a part of the OMSF organization.

Launch Operations Center Established

On March 7, 1962, NASA discontinued LOD as a component of MSFC and established the Launch Operations Center (LOC) at AMR as an independent field installation. Dr. Debus was appointed Director of the new center, to report to the Director, OMSF. Also established by NASA at this time were a Launch Vehicle Operations Division (LVOD), as a new division of MSFC, and the Pacific Launch Operations Office at PMR. At the same time the NASA Test Support Office at PMR was discontinued.[59] The details concerning functional responsibilities, manpower, and the transfer of ownership of property and funds were to be completed prior to July 1, 1962, the official date for the new center to commence independent operations. In a release to the Nation's news media, Dr. Robert C. Seamans, Jr., NASA's Associate Administrator, indicated the areas of responsibilities to each of

59. NASA Circular No. 208, March 7, 1962. See Appendix A to Supporting Document No. X.

the new organizations. According to Dr. Seamans, LOC would serve all NASA projects at Cape Canaveral, and would consolidate under "a single official all of NASA's operating relationships with the Air Force Commander of AMR."[60]

In order to effect an orderly transition from MSFC's LOD to the independent status of LOC, the Director, MSFC, appointed an LOC-MSFC Separation Task Group. This group, consisting of representatives of both organizations, was instructed to prepare a draft of an operations plan by April 25, 1962.[61] A discussion draft of LOC's basic operational concepts was completed June 1, 1962.[62] These concepts were based upon the organization and functions of the second proposal for an independent launching agency submitted to NASA headquarters the previous October.[63] The discussion draft served as the basic guideline for the functional division of MSFC and LOC, although changes to the document were recommended by both MSFC and LOC.

On June 8, 1962, the MSFC-LOC Separation Agreement was signed by representatives of each of these organizations.[64] This agreement summarized the transfer of certain resources, activities,

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60. NASA News Release No. 62-53, March 7, 1962.
61. Memo for Distribution (branch level) from Dir, MSFC, subj: LOC-MSFC Separation Task Group, April 10, 1962.
62. Discussion Draft, Basic Concepts for the Operation of LOC at AMR, June 1, 1962. See Appendix B to Supporting Document X.
63. See Analysis of Major Elements Regarding the Functions and Organization of Launch and Spaceflight Operations, October 10, 1961.
64. MSFC-LOC Separation Agreement, June 8, 1962. See Supporting Document X.

and responsibilities of MSFC to LOC, and established the LOC and LVOD organizations and missions on an interim basis, pending final resolution of LOC organization and mission. The subsequent relationship between MSFC and LOC was also established on an interim basis pending finalization of basic operational concepts and missions of LOC. The agreement also provided for the transfer of 375 civil service spaces from the MSFC-LOD organization to LOC, and for 5 civil service spaces to the Pacific Launch Operations Office. The 286 personnel assigned to launch operations were retained by MSFC for LVOD. The Director, LOC, however, was authorized to utilize the services of LVOD personnel on an interim basis in executing the missions of LOC.

Although the effective date of the separation was established as July 1, 1962, MSFC agreed to phase out its support of LOC as LOC attained self-supporting status. A series of detailed separation plans were prepared covering each of the areas discussed in the agreement to implement the separation.[65] The Launch Operations Center was officially activated as a NASA field installation on July 1, 1962. Since the formation of the center was the result of organizational realignments of responsibilities involving no change in physical location, but only functional transfers of personnel, the event occurred without fanfare, dedication, or any type of public celebration.

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65. Ibid.

GLOSSARY OF ABBREVIATIONS

GLOSSARY OF ABBREVIATIONS

ABMA	Army Ballistic Missile Agency
AFBMD	Air Force Ballistic Missile Division
AFMTC	Air Force Missile Test Center
AMR	Atlantic Missile Range
AMROO	Atlantic Missile Range Operations Office (NASA)
AOMC	Army Ordnance Missile Command
ARPA	Advanced Research Projects Agency
BRL	Ballistic Research Laboratory
Cal Tech	California Institute of Technology
DOD	Department of Defense
GMDD	Guided Missile Development Division
ICBM	intercontinential ballistic missile
IGY	International Geophysical Year
IRBM	intermediate range ballistic missile
JLRPG	Joint Long Range Proving Ground
JPL	Jet Propulsion Laboratory
LOA	Launch Operations Agency
LOC	Launch Operations Center
LOD	Launch Operations Directorate
LRPGD	Long Range Proving Ground Division
LVOD	Launch Vehicle Operations Division
MFL	Missile Firing Laboratory
MLLP	Manned Lunar Landing Program

MSFC	George C. Marshall Space Flight Center
NACA	National Advisory Committee for Aeronautics
NASA	National Aeronautics and Space Administration
NRL	Naval Research Laboratory
OFM	Office of Flight Missions
OGMC	Ordnance Guided Missile Center
OLVP	Office of Launch Vehicle Programs
OML	Ordnance Missile Laboratories
OMSF	Office of Manned Space Flight
ORC	Ordnance Rocket Center
OSFP	Office of Space Flight Programs
PMR	Pacific Missile Range
R&D	Research and Development
T&E Division	Technical and Engineering Division
USAF	United States Air Force
WSPG	White Sands Proving Ground

APPENDIXES

APPENDIX A

ORGANIZATIONAL GROWTH AND DEVELOPMENT

OF

MFL/LOD

1951 - 1962

This appendix consists of a series of organization charts and mission statements depicting the growth of the launch team under the direction of Dr. Debus from the original organization established in November 1951 to the activation of LOC on July 1, 1962. Many of the charts, particularly those dated after 1957, show officially approved organizations. Some of the charts of earlier organizations were prepared based upon information obtained from memorandums, personnel requisitions, or other administrative records.

Much pertinent information was unavailable in reference to various programs, numerous minor revisions to mission statements, and the number of contractor and military personnel assigned to the launching agency. In addition, this appendix contains the organization chart and mission statements of the NASA Atlantic Missile Range Operations Office. Although this organization was not a segment of the launching team, the missions it performed and a portion of its assigned personnel were absorbed into the Launch Operations Directorate on July 1, 1960.

REDSTONE ARSENAL

ORDNANCE
GUIDED MISSILE
CENTER

TECHNICAL DIRECTOR
W. VON BRAUN

ASST. TECHNICAL DIRECTOR
K. DEBUS

MISSION OF OGMC:

ARMY ORDNANCE GUIDED MISSILE RESEARCH AND DEVELOPMENT.

CIVILIAN PERSONNEL: "PAPER CLIP" SCIENTISTS, ENGINEERS & TECHNICIANS

MONTH	DEC.	DEC.
YEAR	1950	1951
DASE	118	118

DATES. APRIL 1950 - AUG. 1951

REDSTONE ARSENAL

TECHNICAL AND ENGINEERING DIVISION *

GUIDED MISSILE *
DEVELOPMENT BRANCH

TECHNICAL DIRECTOR
W. VON BRAUN

EXPERIMENTAL **
MISSILES
FIRING BRANCH

CHIEF
K. DEBUS

MISSION OF EX. MIS. FIR. BR.:

TO SELECT LAUNCH SITE AND TO CONDUCT ALL EXPERIMENTAL FIRINGS OF THE MAJOR MISSILES (RENAMED REDSTONE APR. 52)

CIVILIAN PERSONNEL:

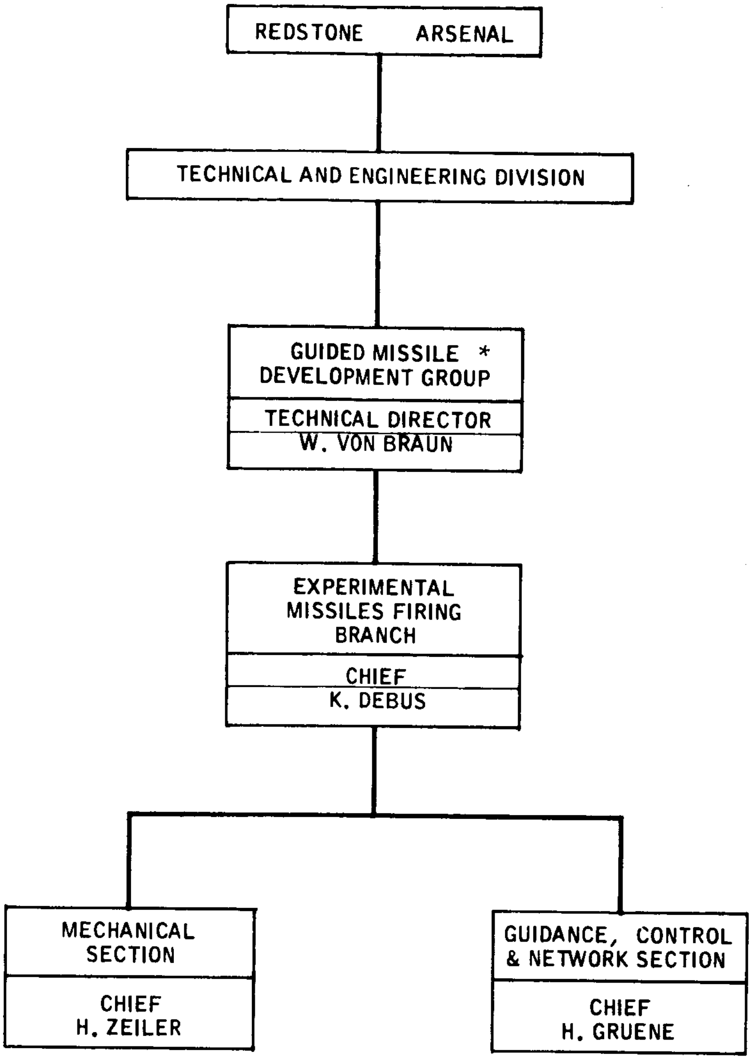
MONTH	NOV.	DEC
YEAR	1951	1951
DASE	1	3***

* EST. AUGUST 1951

** EST. NOV. 1951, DR. DEBUS, CHIEF

*** DR. DEBUS, DR. H. GRUENE & A. ZEILER

DEC. 1951



MISSION OF EX. MIS. FIR. BR.:

TO CONDUCT LIAISON BETWEEN REDSTONE ARSENAL AND THE AFMTC CONCERNING FACILITIES FOR REDSTONE PROJECT.

TO CONDUCT LIAISON BETWEEN GMDG BRANCHES TO ASSURE THAT CHANGES TO MISSILE DESIGN AFFECTING LAUNCH REQUIREMENTS WERE REFLECTED IN MODIFICATIONS TO REDSTONE LAUNCH FACILITIES EITHER PLANNED OR UNDER CONSTRUCTION.

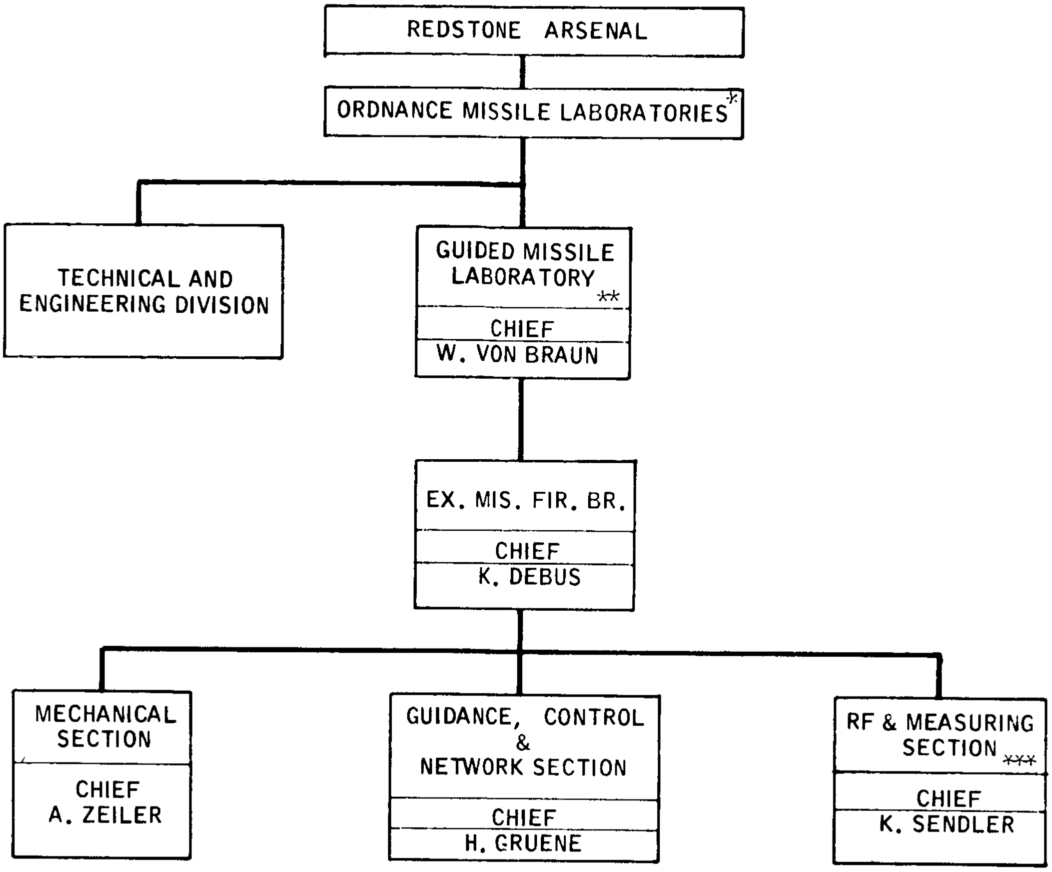
TO TRAIN A LAUNCH TEAM FOR REDSTONE FIRINGS.

EX. MIS. FIR. BR. CIVILIAN PERSONNEL, DASE/CIV. SER.:

MONTH	SEPT.
YEAR	1952
ON BOARD	14

* BECAME GROUP AFTER JAN. 1, 1952

SEPTEMBER 1, 1952



MISSION OF EX. MIS. FIR. BR.:

NO AVAILABLE RECORD OF MISSION CHANGES.

EX. MIS. FIR. BR. CIVILIAN PERSONNEL, DASE/CIV. SER.:

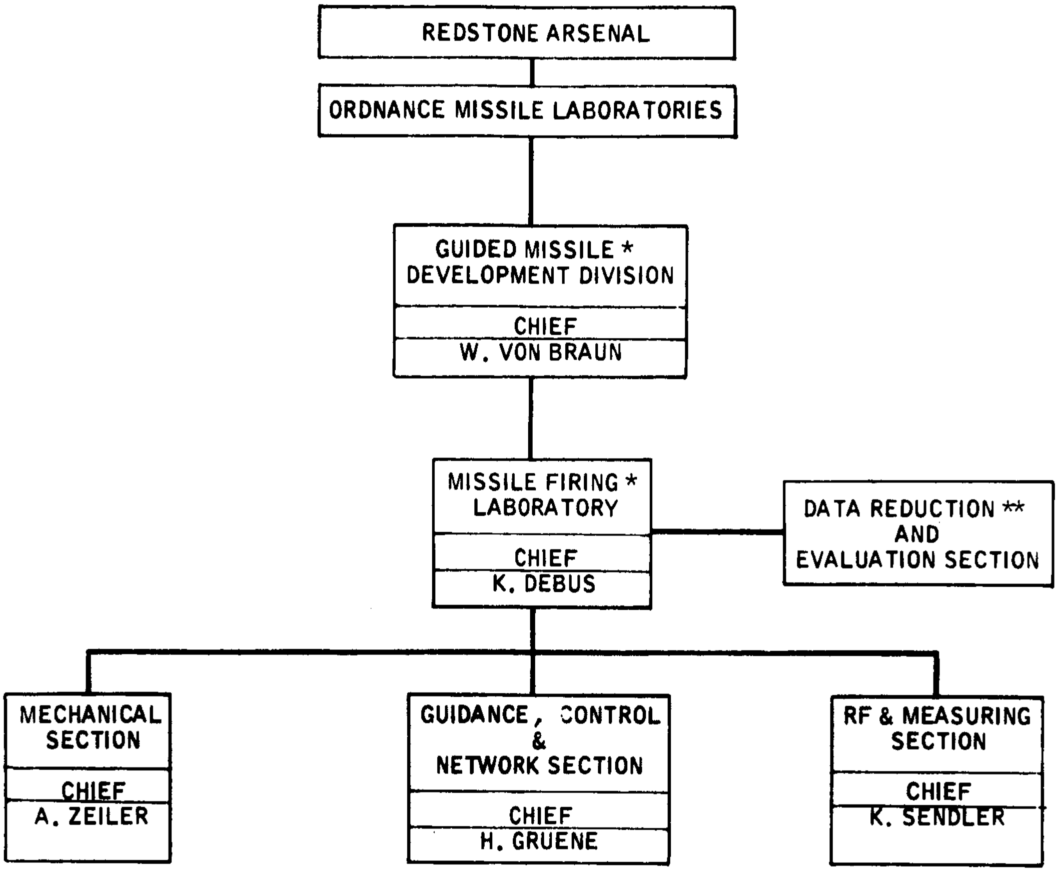
MONTH	DEC.
YEAR	1952
ON BOARD	18

* EST. SEPT. 18, 1952

** LABORATORY TITLE USED OCT. - DEC. 1952

*** OFFICIALLY ACTIVATED OCT 20, 1952

DEC. 1952



MISSION OF MISSILE FIRING LABORATORY:

SEE FOLLOWING PAGES

MFL CIVILIAN PERSONNEL, CIV. SER.:

MONTH	JULY	DEC.	DEC.
YEAR	1953	1953	1954
ON BOARD	28	38	52

* EST. EFFECTIVE JAN. 1953
** EST. CIRCA NOV. 1953

JAN. 1953 - DEC. 1954

MISSILE FIRING LABORATORY

FUNCTIONAL STATEMENT

October 28, 1953

(Excerpt)

Missile Firing Laboratory:

To function as the Missile Firing Laboratory for the Guided Missile Development Division, with the following specific responsibilities:

1. Principal field agency for assembly, preparation and firing of all experimental guided missiles as assigned to and under development by the Guided Missile Development Division.

2. Establish and maintain close coordination of all agencies connected with and in charge of preparing missiles for firings and pertaining field test equipment.

3. Exercise technical supervision of all prelaunching, launching, and post-launching activities of this agency at a remote proving ground, such as assembly, handling, and erection of missiles, preflight testing of components, missiles, and measuring equipment, evaluation of preflight tests, fueling, firing, flight observation and control, data reproduction, evaluation of flight performance, from records and recovered parts, procurement and disposition of fuels, etc.

4. Review results of single firings and impact patterns of missile series regarding accuracy and reliability of the system with a view toward recommending modifications of components or systems, and changes, additions, or deletions of the program.

5. Determine necessary and desirable design changes for guided missiles and associated ground equipment, which are dictated by operations such as adjustments, calibrations, regulations, etc., and by failures and malfunctions of structures or components, and submits detailed recommendations of such design changes to the Guided Missile Development Division for proper action.

6. Make on-the-spot changes and modifications of missile and associated equipment, such as missile networks, etc., when required to insure proper functioning of missile and to meet firing schedules.

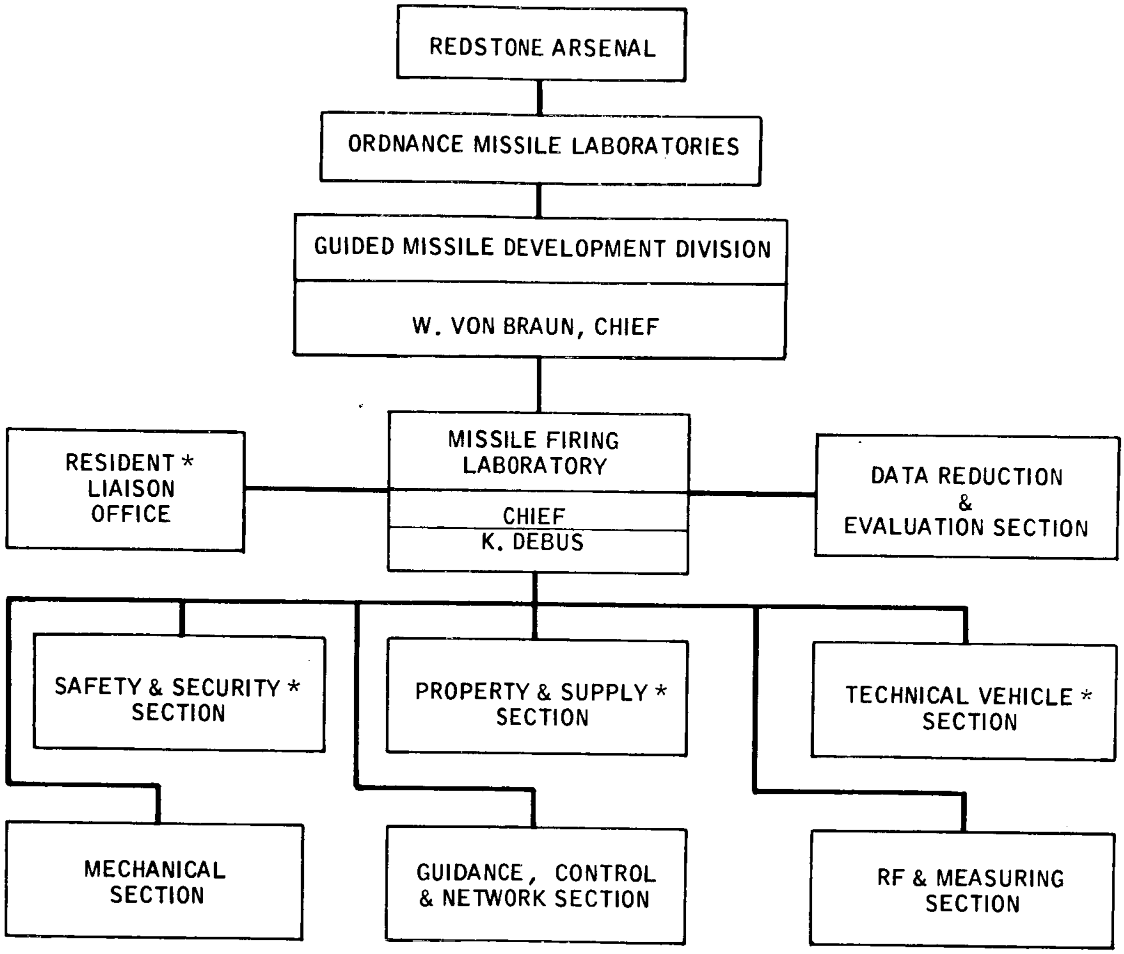
7. Design, fabricate and modify test, measuring, and calibration equipment as required to fulfill program objectives.

8. Dissemination of complete data to the Guided Missile Development Division Development Board.

9. Prepare, establish, maintain facilities, and supervise personnel to perform these functions.

10. Represent Experimental Missile Firing in higher level conferences and serve as technical adviser in the above fields.

11. Coordinate Ordnance Guided Missile Programs in their conduct of tests at the joint long-range proving ground (Banana River).



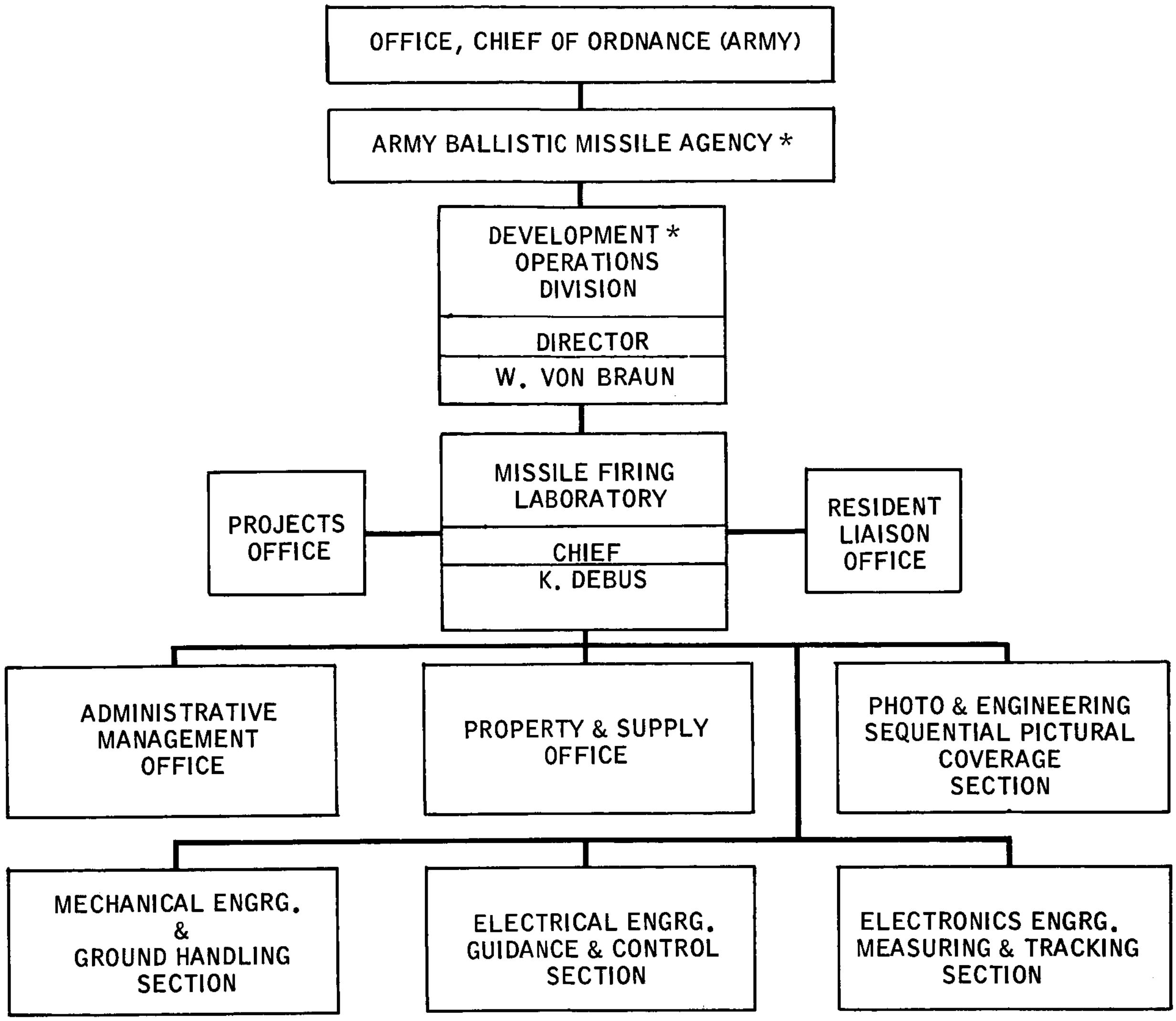
MISSION OF MFL:
EXPANDED TO INCLUDE JUPITER PROGRAM

MFL CIVILIAN PERSONNEL, CIV. SER.:

MONTH	DEC.
YEAR	1955
ON BOARD	74

* EST. BY MAY 1955

DEC. 1955



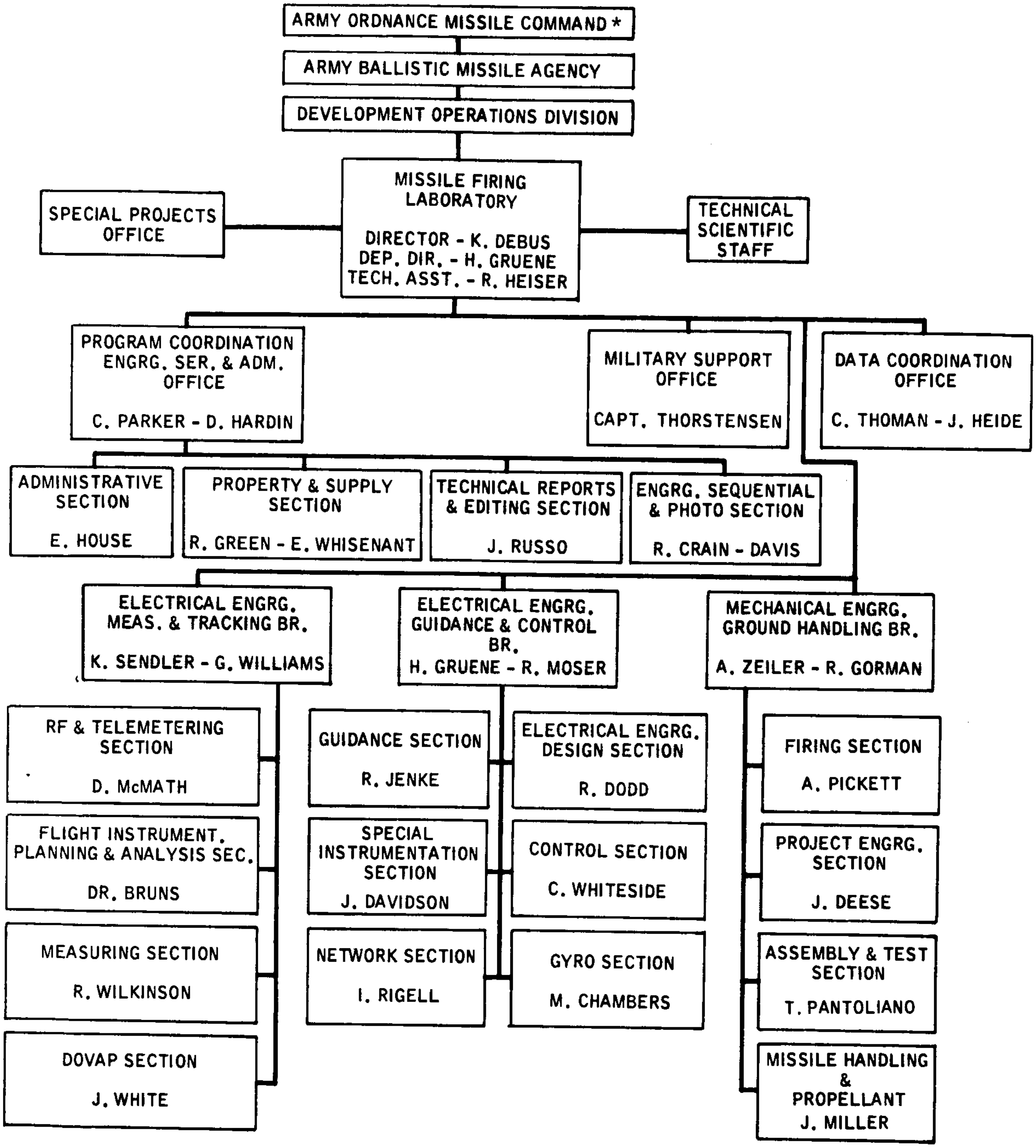
MISSION:
NO AVAILABLE RECORD OF MISSION CHANGES

MFL CIVILIAN PERSONNEL, CIV. SER.:

MONTH	JUNE	DEC.	DEC.
YEAR	1956	1956	1957
ON BOARD	99	176	221

* ESTABLISHED EFFECTIVE FEB. 1, 1956

FEB. 1, 1956 - DEC. 1957



MISSION:

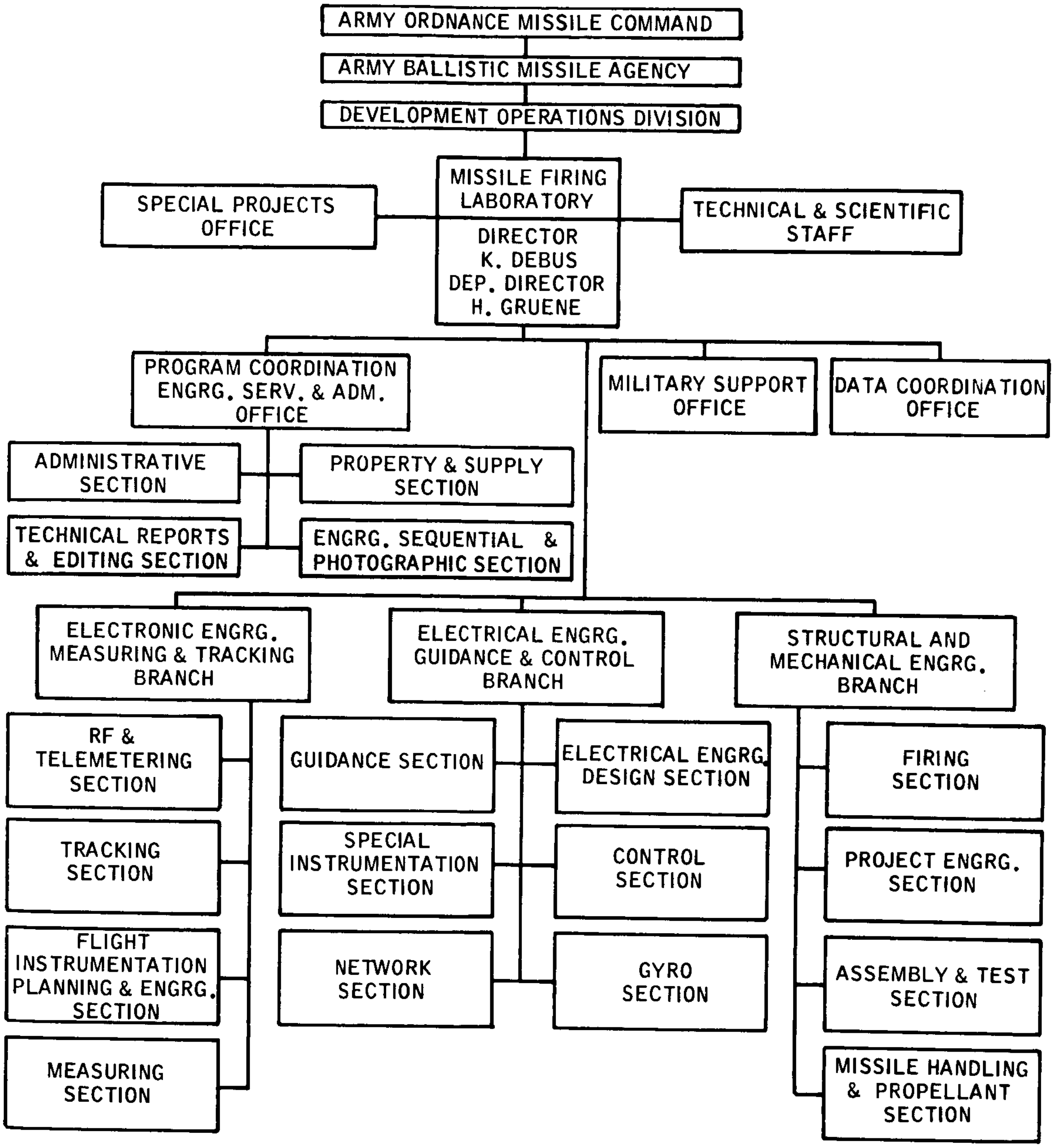
EXPANDED TO INCLUDE ARMY EXPLORER SATELLITE SERIES

MFL CIVILIAN PERSONNEL, CIV. SER.:

*ESTABLISHED EFFECTIVE JULY 1, 1958

MONTH	DEC.
YEAR	1958
ON BOARD	282

OCTOBER 10, 1958



MISSION:

SEE FOLLOWING PAGES

MFL CIVILIAN PERSONNEL, CIV. SER.:

MONTH	MAR.
YEAR	1959
ON BOARD	312

MARCH, 1959

MISSILE FIRING LABORATORY

FUNCTIONAL STATEMENT

March 5, 1959

(Excerpt)

MISSILE FIRING LABORATORY

Mission

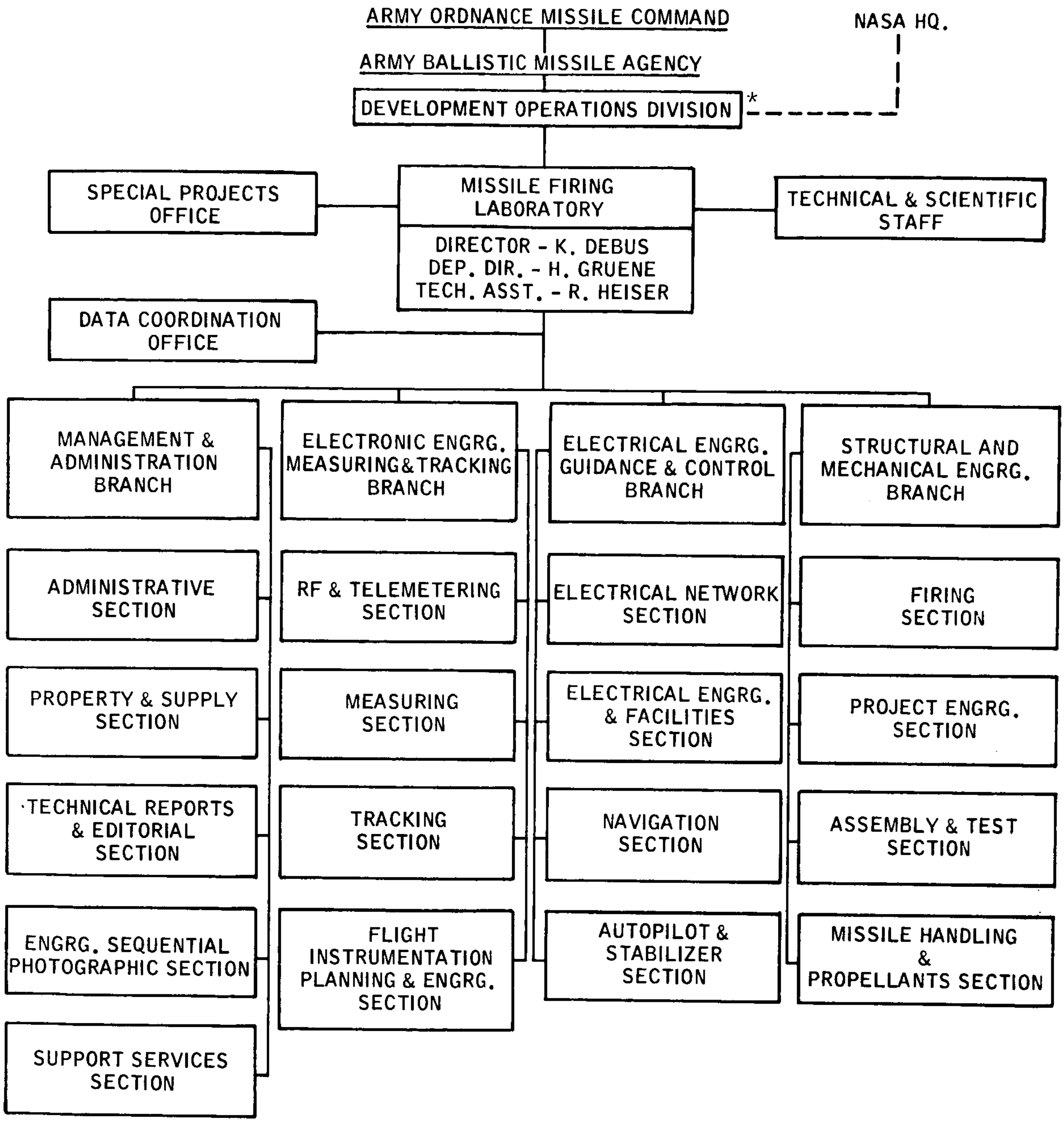
1. To execute experimental firing programs of assigned ballistic missiles and space vehicles, coordinating all government and non-government interests involved.

2. To perform such pre-flight testing and check-out of components, sub-assemblies, assemblies and instrumentation as necessary to insure functional in-flight reliability.

3. To accumulate, analyze, evaluate, and disseminate pre-flight and flight data for information of all concerned and as a basis for recommending design changes.

4. To assist in troop training firing of tactical missiles and training of contractor launch crews.

5. To research, develop, operate and maintain facilities and equipment required at Atlantic Missile Range, such other continental and extra-continental proving grounds as are designated, and their associated support stations.



MISSION:

NO AVAILABLE RECORD OF MISSION CHANGES.

MFL CIVILIAN PERSONNEL, CIV. SER.:

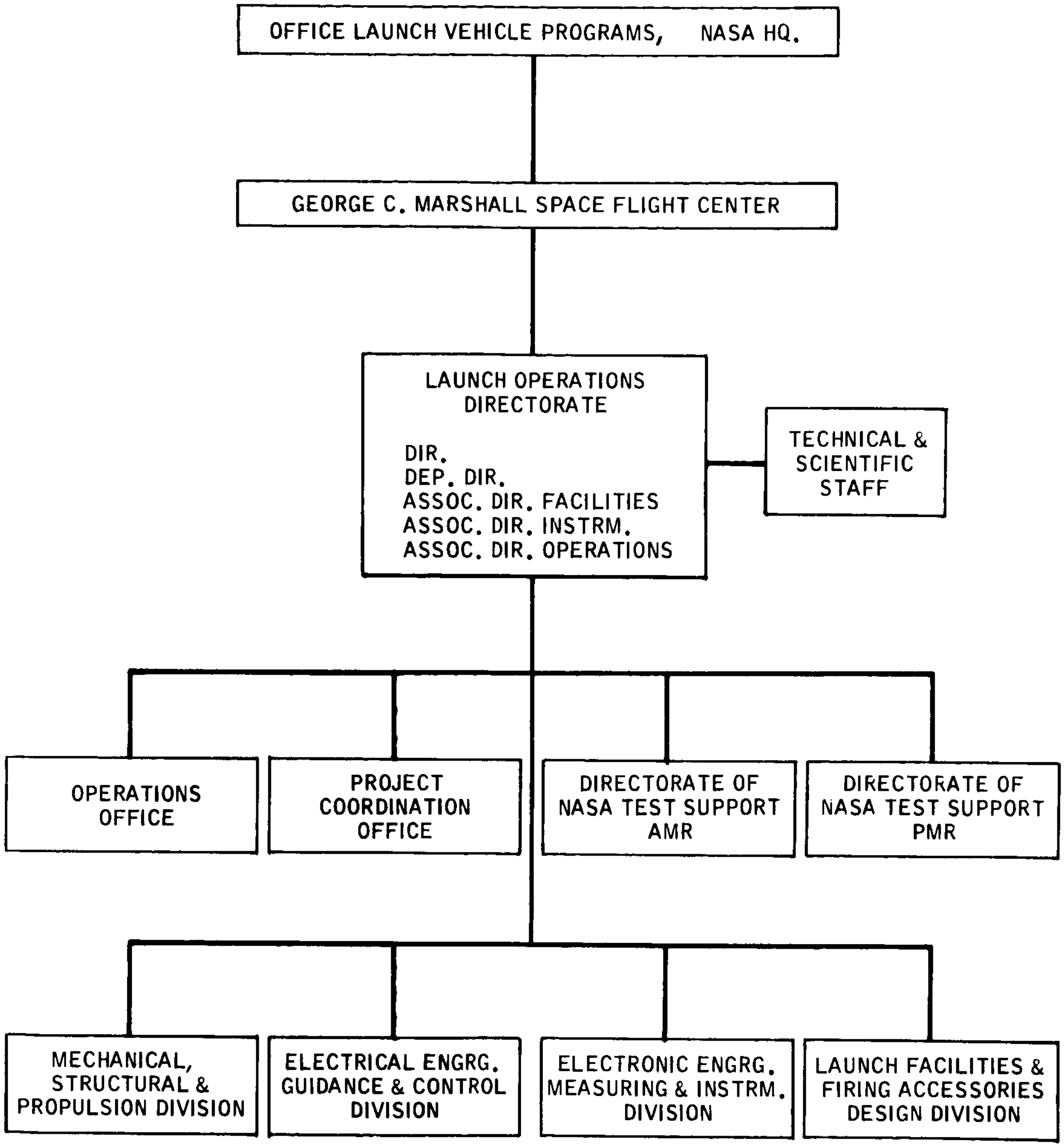
MONTH	DEC.
YEAR	1959
ON BOARD	312

* INDIRECT REPORTING RELATIONSHIP ESTABLISHED AS RESULT OF ARMY-NASA TRANSFER AGREEMENT, DEC. 1959

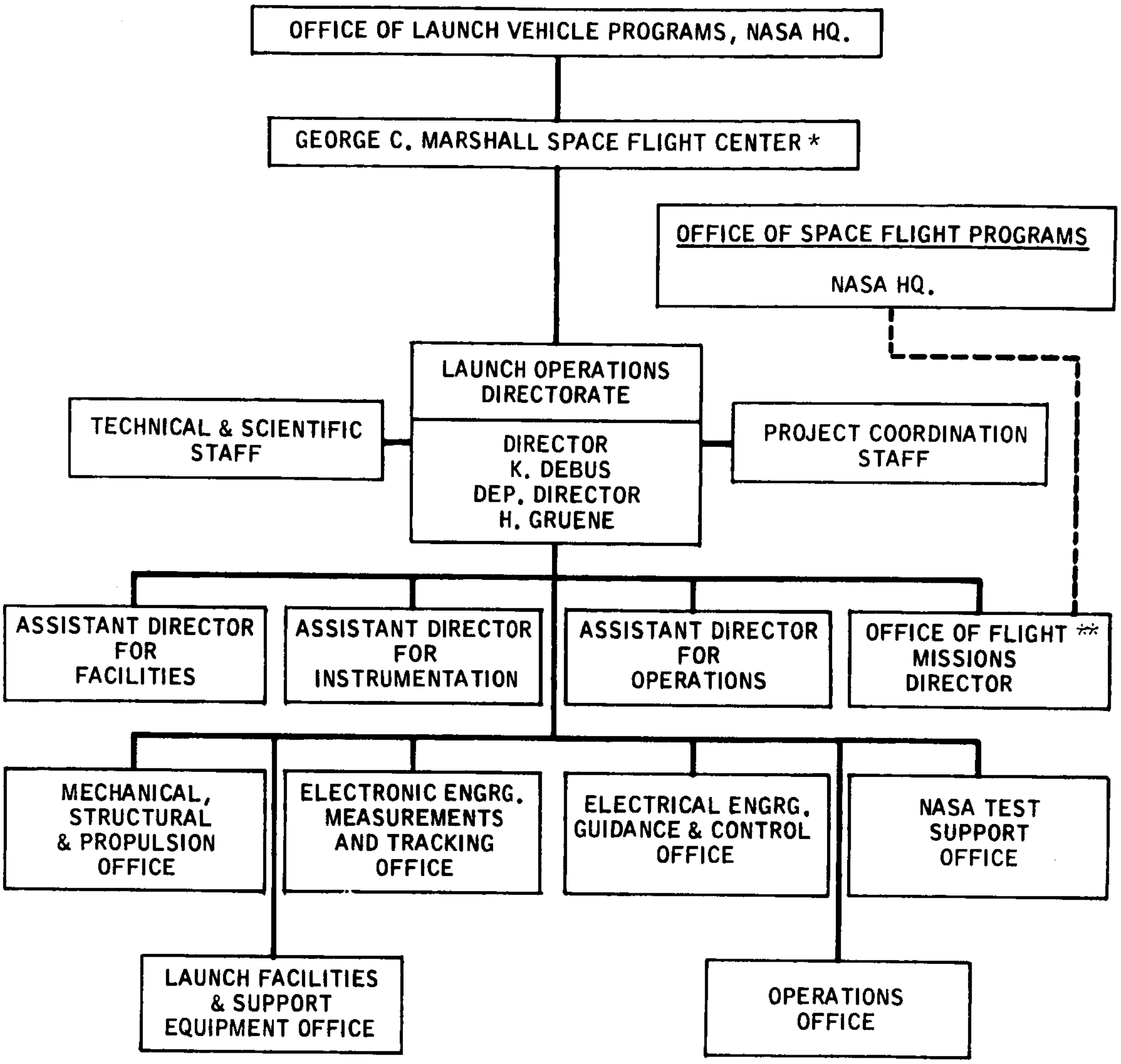
NOTE: SEE CHART A-16 FOR OFFICIAL NASA AMR ORGANIZATION

DEC. 1959

PROPOSED ORGANIZATION FOR NEW
NASA/LAUNCH OPERATIONS DIRECTORATE



MAY 6, 1960



MISSION OF LOD:

SEE MANAGEMENT INSTRUCTION 2-2-9 ON FOLLOWING PAGES

LOD CIVILIAN PERSONNEL, CIV. SER.:

MONTH	JULY
YEAR	1960
ONBOARD	314

* ESTABLISHED MARCH 1960 EFFECTIVE JULY 1, 1960.
** OFM STAFF REPORTED TO THE OSFP BUT WERE UNDER THE ADMINISTRATIVE SUPERVISION OF LOD.

MAY 30, 1960

PART I	NO. 2-2-9
NASA MANAGEMENT MANUAL	EFFECTIVE DATE
GENERAL MANAGEMENT INSTRUCTIONS	July 1, 1960

SUBJECT: FUNCTIONS AND AUTHORITY - NASA LAUNCH OPERATIONS DIRECTORATE

1. PURPOSE

This Instruction establishes the functions and authority of the NASA Launch Operations Directorate (LOD) as a part of the George C. Marshall Space Flight Center.

2. FUNCTIONS

a. The NASA Launch Operations Directorate is assigned the following functions for all NASA launch operations except as noted below:

(1) Serving as the NASA point of coordination for the preparation and submission of all requirements for launch support and for the negotiations with Atlantic Missile Range (AMR) and Pacific Missile Range (PMR) officials to fulfill such requirements. The channel into the Atlantic Missile Range shall be the Chief of the Office of NASA Test Support (LOD) who carries the title of Director, NASA Test Support, when serving on the staff of the Commander, AMR. This channel for obtaining launch support shall cover all NASA activities except that:

(a) AMR requirements for DELTA flights will be forwarded to the Range by the Launch Directorate without technical evaluation by the Directorate. Technical Management of Delta vehicle activities at AMR, including launch operations, will remain under control of the Goddard Delta Vehicle Projects Branch. Standard facility and resources support, such as buildings and local transportation, for PROJECT DELTA will be provided by LOD.

(b) Launch operation requirements for PROJECT MERCURY will be processed directly with the Range through the special channels established for MERCURY with only the formal submission of these requirements to be made through the Director of NASA Support (LOD). MERCURY requirements for recovery operations and world-wide support outside the Cape Canaveral AMR launch complex will be transmitted by the NASA Space Task Group directly to the Department of Defense representative for PROJECT MERCURY. Standard facility and resources support, such as buildings and local transportation, for PROJECT MERCURY will be provided by LOD.

(2) Serving as the central NASA activity at both the Atlantic and Pacific Missile Ranges with general responsibility for all phases of NASA launch operations, including, however, only such activities for MERCURY and DELTA missions as are specifically assigned to the Directorate. The general responsibility encompasses such activities as the following:

(a) Local range scheduling;

(b) Performance of checkout, countdown, and launch for vehicles designed by the George C. Marshall Space Flight Center;

(c) Surveillance of other launch operations and tests (as assigned);

(d) Over-all countdown supervision and blockhouse control;

(e) Establishment of pad and in-flight safety concepts and criteria in cooperation with Range personnel;

(f) Participation in measuring and tracking of R&D and tactical vehicles (as assigned);

(g) Accumulation, analysis, and dissemination of launch vehicle flight and failure data;

(h) Preparation of necessary range documentation, including the integration of documentation materials prepared by spacecraft and vehicle groups, the formal submission of such documentation to the Range and the subsequent negotiation with the Range when necessary;

(i) Release of NASA vehicle launch information, including data dissemination to Headquarters technical groups and to NASA Public Information personnel; and

(j) Coordinating industrial safety and range security problems for NASA missions.

(3) Providing administrative supervision of personnel assigned by the Office of Space Flight Programs to serve in the Office of Flight Missions (see paragraph 2b).

(4) Providing logistical and administrative services for all NASA (or JPL) personnel stationed at AMR, including those on temporary duty and those personnel detailed to the Office of Flight Missions (OFM). Service to flight mission groups shall be made available at levels commensurate with that provided other personnel in LOD. The services shall include the provision and maintenance of facilities, office furniture and related equipment, all phases of security, visitor control and assistance, travel arrangements, procurement and supply of standard technical supplies, motor pool transportation, payroll and travel services, administrative communications, photographic and reproduction services, and minor construction.

(5) Planning and coordinating the use of AMR and PMR facilities provided by or assigned to NASA, such as:

(a) Participating in planning for future vehicle projects, particularly as they are influenced by launch operations criteria.

(b) Developing concepts and (as assigned) designing or helping others to design new or modified physical facilities for NASA use on the Range.

(c) Developing and completing design, through prototype, for special ground and tracking instrumentation on assigned projects, where such equipment cannot be supplied by the operating Ranges.

(6) Providing technical, administrative, and logistic support for Army and Air Force vehicle programs as requested in accordance with the NASA-Army Transfer Plan of December 16, 1959.

b. Within the NASA Launch Operations Directorate, and under its administrative supervision, an Office of Flight Missions is assigned the following special functions:

(1) Serving as the local representative of the Director, Office of Space Flight Programs (OSFP), to:

(a) Coordinate OSFP activities at AMR.

(b) Keep the Office of Space Flight Programs directly informed on spacecraft program matters in which Space Flight Program mission groups are involved.

(2) Acting as the formal contact point between the Launch Operations Directorate and the several flight mission groups using the Range.

(3) Obtaining logistical and administrative services for the flight mission groups from the various support organizations of Launch Operations Directorate as available.

(4) Expediting and coordinating the preparation of payload and mission documentation requirements by the flight mission groups, and delivering these requirements to the LOD Project Coordination Staff on a timely basis, for inclusion in the overall requirements for each launch assignment.

(5) Providing the Launch Operations Directorate with projections of support requirements for flight mission groups, including those of an unusual nature, in order that LOD may plan, program, and staff support organizations to accommodate such requirements.

3. RESPONSIBILITY OF THE DIRECTOR, LAUNCH OPERATIONS DIRECTORATE

The Director, LOD, reports directly to the Director of the George C. Marshall Space Flight Center and is responsible for the exercise of the functions assigned to the LOD.

4. SCOPE OF AUTHORITY

The Director, LOD, is authorized and directed to take such action as is necessary to carry out the responsibilities assigned to him within the limitations of this and other official NASA communications and issuances.

5. RELATIONSHIPS WITH OTHER OFFICIALS

In performing the functions assigned to him, the Director, LOD, is responsible for recognizing the responsibility and authority of other NASA officials, and for assuring that actions he may take are properly coordinated with other NASA groups having joint interests and are in accordance with NASA policies.

6. APPROVAL OF ORGANIZATION

The organization of NASA Launch Operations Directorate is outlined on the attached organization chart. Modifications or changes in basic organization structure are subject to the approval of the Administrator, NASA.

7. RECISION

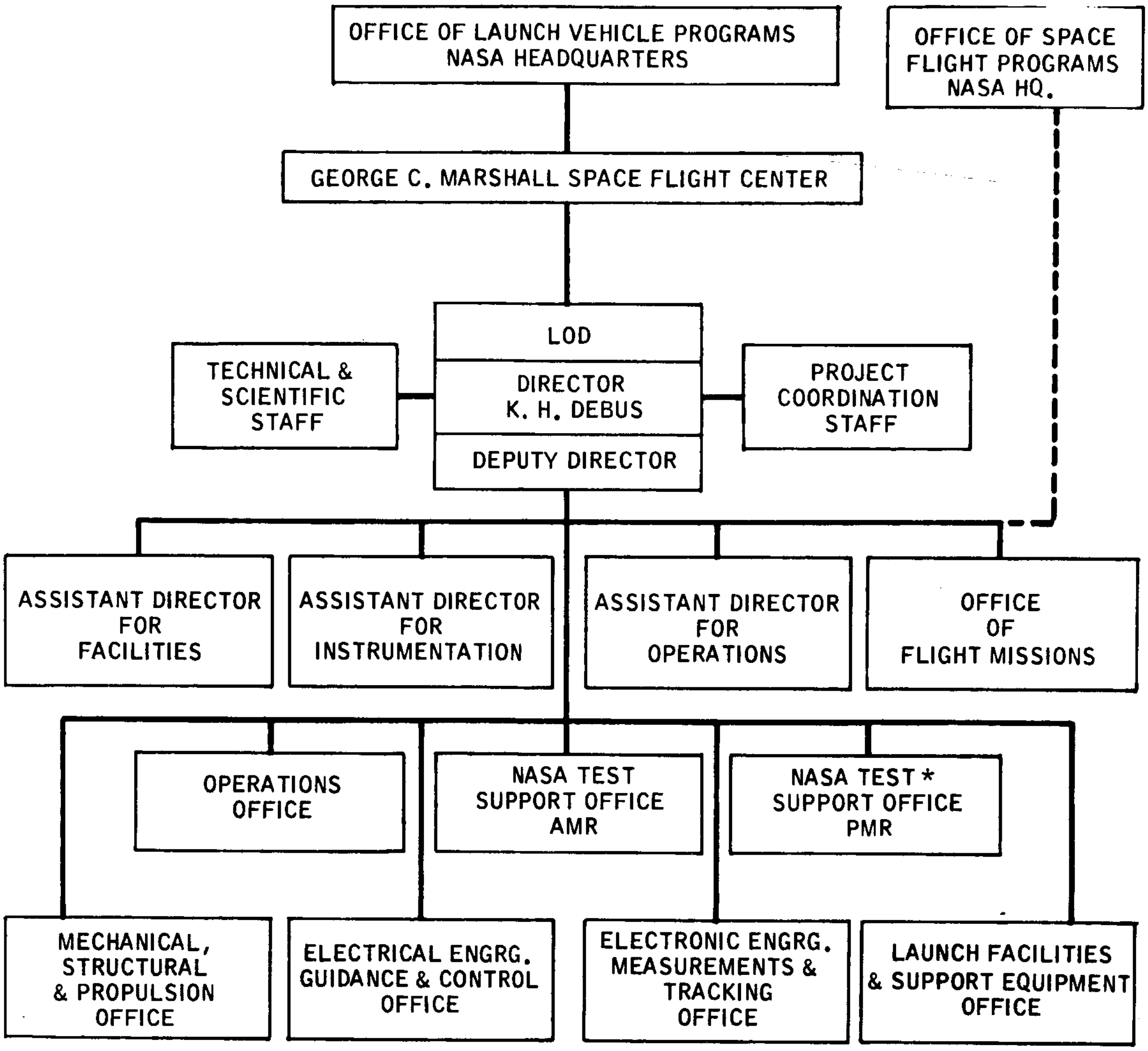
This Instruction supersedes the General Management Instuction 2-2-13, September 17, 1959, "Functions and Authority - NASA Atlantic Missile Range Operations Office (AMROO)."

8. EFFECTIVE DATE

This Instruction is effective July 1, 1960.

/s/ Keith Glennan
Administrator

T.S. NO. 115 Date July 1, 1960



MISSION:

SEE MANAGEMENT INSTRUCTION 2-2-9.1 DATED OCT. 27, 1960
ON FOLLOWING PAGES

LOD CIVILIAN PERSONNEL, CIV. SER.:

MONTH	DEC.
YEAR	1960
ONBOARD	419

* ESTABLISHED BY MGT. INSTR. 2-2-9.1, OCT. 27, 1960

DEC. 1960

PART I | NO. 2-2-9.1
NASA MANAGEMENT MANUAL | EFFECTIVE DATE
GENERAL MANAGEMENT INSTRUCTIONS | October 27, 1960

SUBJECT: ESTABLISHMENT OF NASA TEST SUPPORT OFFICE, PACIFIC MISSILE RANGE

1. PURPOSE

This Instruction establishes the functions and authority of the NASA Test Support Office, Pacific Missile Range, as a segment of the Launch Operations Directorate, George C. Marshall Space Flight Center.

2. FUNCTIONS

The NASA Test Support Office is responsible for coordinating all NASA launch operations at the Pacific Missile Range as set forth in General Management Instruction 2-2-9. This will include:

a. Registering of all planned tests and programs.

b. Securing all support requirements for all phases of NASA launch operations, including such activities for MERCURY and DELTA missions as are specifically assigned to the Launch Operations Directorate.

3. RESPONSIBILITY OF THE CHIEF, NASA TEST SUPPORT OFFICE

a. The Chief, NASA Test Support Office, reports directly to the Director, Launch Operations Directorate, and is responsible for the exercise of the functions assigned to the NASA Test Support Office.

b. He also serves as Director, NASA Test Support Office, on the staff of the Commanding Officer, Pacific Missile Range.

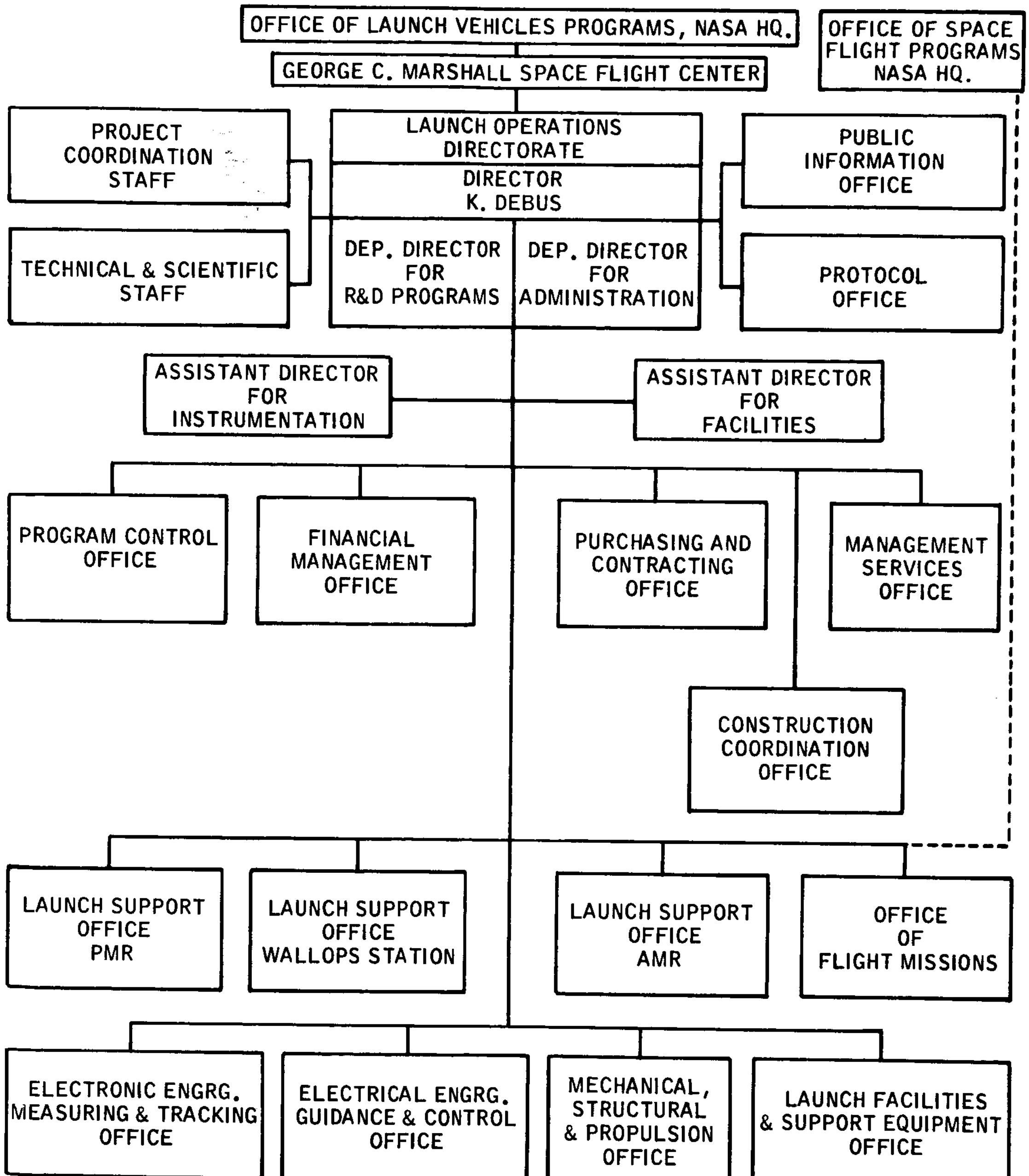
4. SCOPE OF AUTHORITY

The Chief, NASA Test Support Office, is authorized and directed to take such action as is necessary to carry out the responsibilities assigned to him within the limitations of this and other official NASA communications and issuances.

5. RELATIONSHIPS WITH OTHER OFFICIALS

In performing the functions assigned to him, the Chief, NASA Test Support Office, is responsible for recognizing the responsibility and authority of other NASA officials, and for ensuring that actions he may take are properly coordinated with other NASA groups having joint interest and are in accordance with NASA policies.

/s/ T. Keith Glennan
Administrator



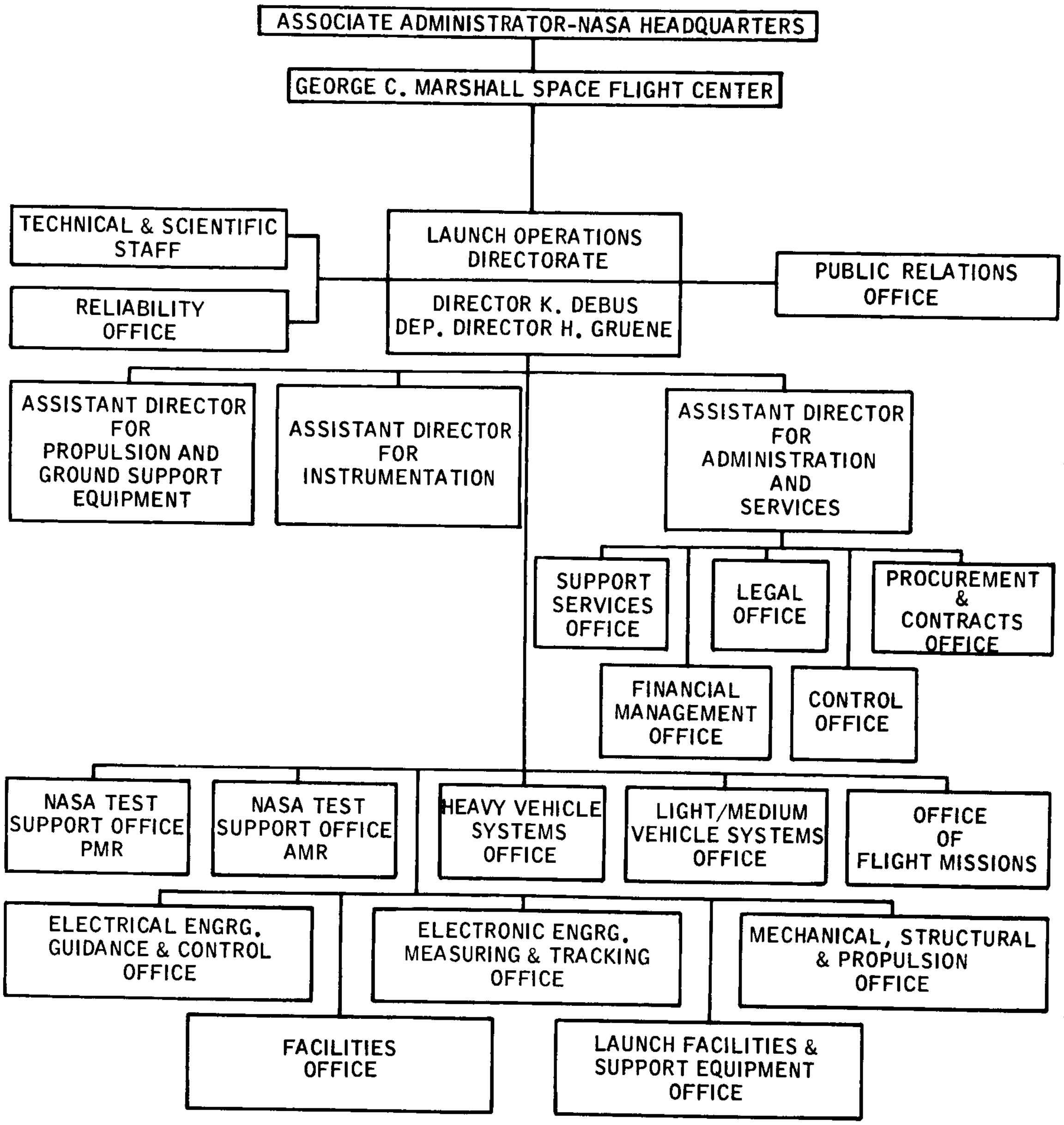
MISSION:

NO AVAILABLE RECORD OF MISSION CHANGES.

LOD CIVILIAN PERSONNEL, CIV. SER.:

EXACT FIGURES NOT AVAILABLE. ESTIMATED 455 - 465 BASED UPON 438 AUTHORIZED DEC. 1960 PLUS ASSURANCES OF 27 ADDITIONAL SPACES.

MAY 26, 1961



MISSION:

NO AVAILABLE RECORD OF MISSION CHANGES.

LOD CIVILIAN PERSONNEL, CIV. SER.:

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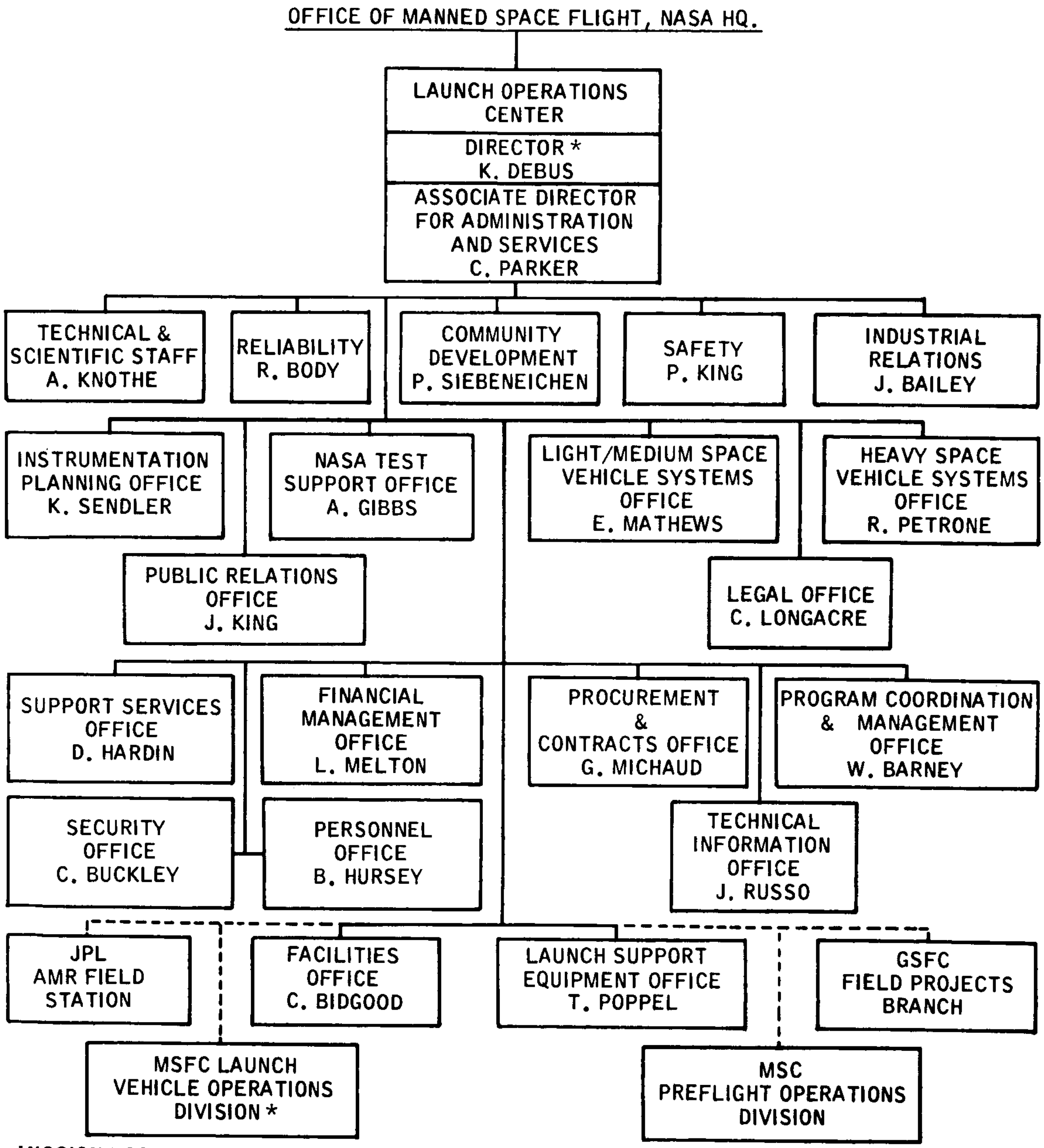
YEAR	1961	1962
ONBOARD	495	666

JAN. 1962



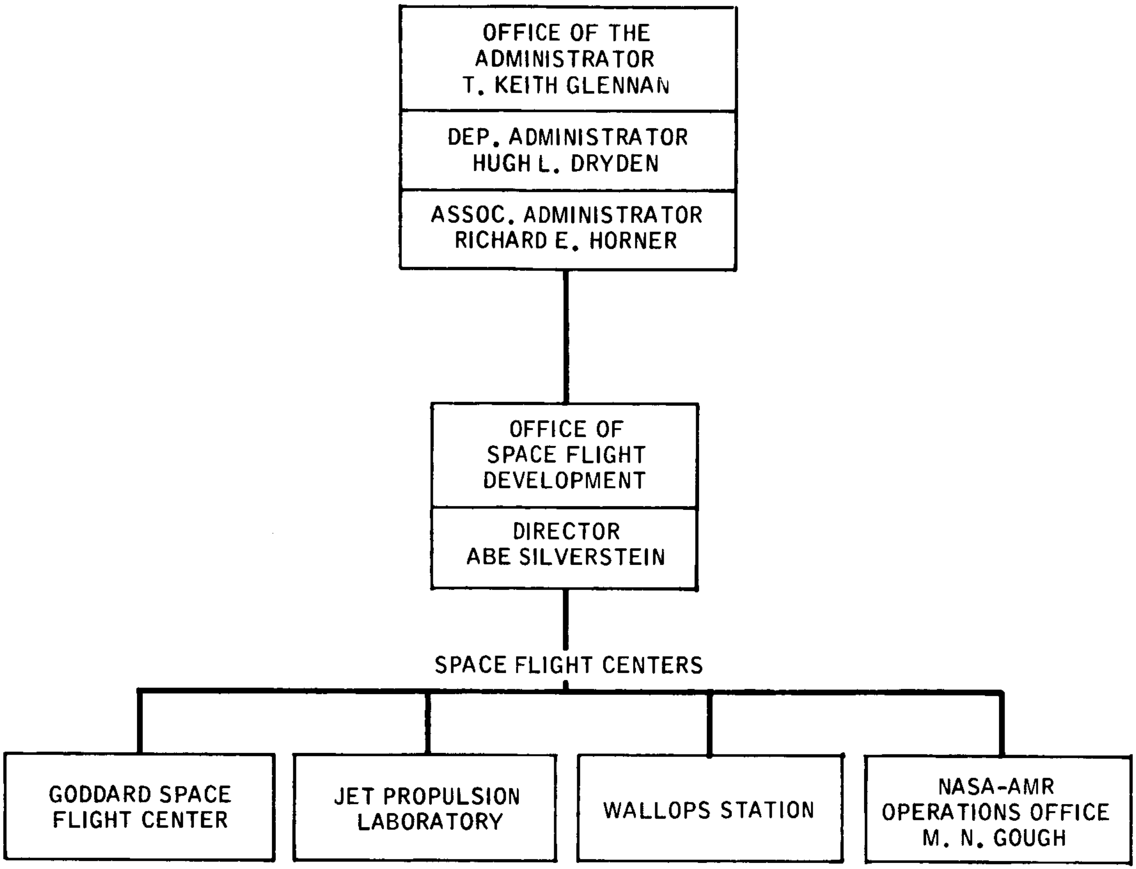
MISSION LOC:
SEE APPENDIX B TO SUPPORTING DOCUMENT XI

LOC CIVILIAN PERSONNEL, CIV. SER.:

MONTH	JULY
YEAR	1962
ONBOARD	323

* ALSO SERVES AS DIRECTOR, MSFC LAUNCH VEHICLE OPERATIONS DIVISION

JUNE 29, 1962



MISSION OF NASA AMROO:

SEE MGT. INSTR. 2-2-13 FOLLOWING PAGES.

NOTE:

THIS CHART IS A SEGMENT OF THE NASA ORGANIZATION CHART DEPICTING ONLY THE REPORTING RELATIONSHIPS OF THE NASA SPACE FLIGHT CENTERS WITHIN THE NASA HEADQUARTERS ORGANIZATION.

SEPT. 15, 1959

PART I

NO. 2-2-13

NASA MANAGEMENT MANUAL

EFFECTIVE DATE

GENERAL MANAGEMENT INSTRUCTIONS

September 17, 1959

SUBJECT: FUNCTIONS AND AUTHORITY - NASA ATLANTIC MISSILE RANGE OPERATIONS OFFICE (AMROO)

1. PURPOSE

This Instruction incorporates into the NASA MANAGEMENT MANUAL the statement of functions and authority of the NASA Atlantic Missile Range Operations Office (AMROO), issued May 1, 1959.

2. FUNCTIONS

The NASA AMROO, headed by a Director and a Deputy Director, is assigned the following functions:

a. Maintaining effective liaison, and representing the NASA, with the Commanding General, technical program directors, and other officials of the Patrick Air Force Base (PAFB) and AMR;

b. Providing necessary services in support of NASA technical programs and projects at the AMR;

c. Coordinating arrangements for the scheduling of NASA test programs and projects at the AMR, including the use of range facilities, in accordance with agreements and procedures established by the NASA and Department of Defense agencies involved;

d. Exercising administrative supervision over all personnel assigned to the AMR on NASA projects, and coordinating conferences, visits, and clearances of NASA staff members and other visitors to AMR on NASA business; and

e. Planning, coordinating and directing the work of the NASA AMROO.

3. RESPONSIBILITY OF THE DIRECTOR, NASA AMROO

The Director, NASA AMROO reports directly to the Director of Space Flight Development and is responsible for the exercise of the functions assigned to the NASA AMROO.

4. SCOPE OF AUTHORITY

The Director, NASA AMROO is authorized and directed to take such action as is necessary to carry out the responsibilities assigned to him within the limitations of this and other official NASA communications and issuances.

5. RELATIONSHIPS WITH OTHER OFFICIALS

In performing the functions assigned to him, the Director, AMROO is responsible for recognizing the responsibility and authority of heads of divisions and offices, Headquarters, and for assuring that actions he may take are properly coordinated with Headquarters groups having joint interests and are in accordance with NASA policies. Project Officers assigned to AMROO for specific launches shall be under the administrative and general management supervision of the Director, AMROO; they shall receive technical direction from the responsible laboratory conducting the launch.

6. APPROVAL OF ORGANIZATION

The basic organization of NASA AMROO is outlined on the attached organization chart.* Modifications or changes in basic organization structure are subject to the approval of the Director, Space Flight Development and the Administrator, NASA.

7. EXISTING INSTRUCTIONS

This Instruction supersedes the MEMORANDUM from the Administrator, May 1, 1959, Subject: Functions and Authority - NASA Atlantic Missile Range Operations Office (AMROO), but does not change any of its provisions.

8. EFFECTIVE DATE

This Instruction is effective September 17, 1959.

/s/ T. Keith Glennan
Administrator

T.S. NO. 29 DATE 9/17/59 PAGE 2

* LOC Historian's Note: NASA Organization Chart dated September 15, 1959, signed by T. Keith Glennan, superseded chart dated May 1, 1959. The chart is not included with this document.

APPENDIX B

MFL/LOD LAUNCHINGS AT AMR

AUGUST 1953 - JUNE 1962

MFL/LOD LAUNCHINGS AT AMR

The launch team headed by Dr. Debus conducted its first launch from Cape Canaveral on August 20, 1953. From that day, when Redstone missile No. 1 was launched from pad 4, through June 30, 1962, this team was directly responsible for the launching of approximately 130 missiles, or space vehicles, from the cape.*

Prior to its official transfer to NASA on July 1, 1960, MFL conducted some 90 AMR launchings, which included 41 Redstones, 9 Jupiter C's, 29 Jupiters, 6 Juno II's, and 5 Pershings. Of this number, the Juno II's and one Jupiter C were launched under NASA direction, and at least two Jupiters carried NASA experiments.

From July 1, 1960, through June 30, 1962, this group, then called LOD, was responsible for launching or directing the launching of 39 missiles or space vehicles at AMR, including 6 Redstones, 5 Jupiters, and 11 Pershings for the Army. LOD launchings for NASA consisted of 6 Mercury-Redstones, 4 Juno II's (Explorers), 4 Rangers (Atlas-Agena B's), 2 Saturns, and 1 Centaur (Atlas).

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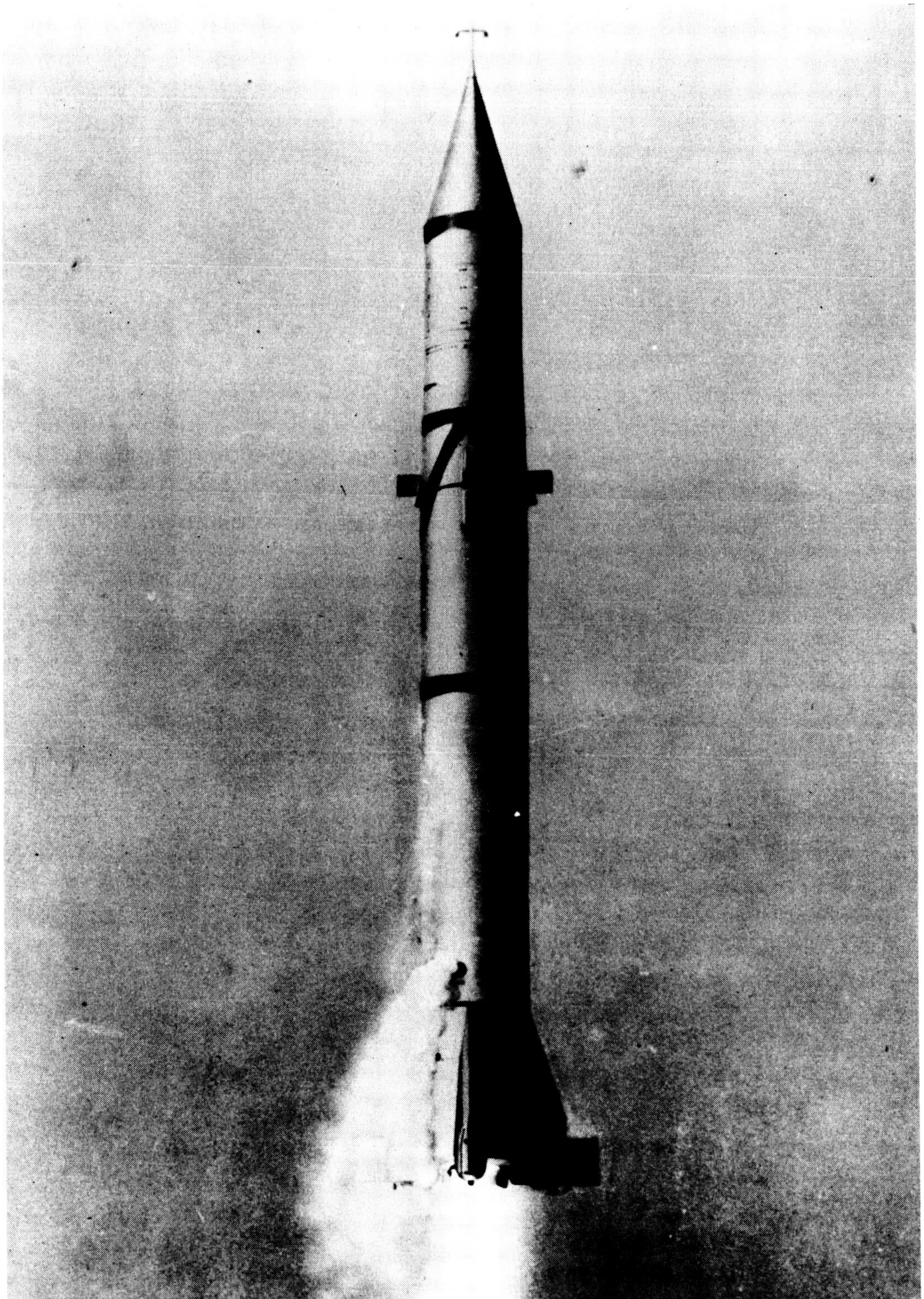
* It was MFL's experience at AMR in missile and space vehicle launchings, as well as its related experience in liaison, administrative, and technical activities, that influenced NASA first to acquire this organization in 1960, and then to elevate it to Center status in 1962. The purpose of this appendix is to summarize these launchings, providing brief background information on each program and brief vehicle descriptions. No attempt has been made to present a detailed study of the various projects, rather, only the high points have been covered for orientation or reference purposes. This is not to be construed as an official technical evaluation or description. For that, one should refer directly to the official firing test reports and related documents.



REDSTONE

REDSTONE

In 1951 the Ordnance Guided Missile Center was directed to proceed with the development of an improved surface-to-surface ballistic missile. This missile was named "Major" and later changed to "Redstone," and was America's first entry in the field of large ballistic missiles.

Starting in 1953, Redstone was subjected to a long series of successful firing tests, the first of which occurred on August 20, 1953. This was the first successful launching of a U.S.-developed heavy ballistic missile. The inertial guidance system, pioneered by the team of German scientists and engineers, is credited by the Army as a major factor in establishing the outstanding record of the Redstone.

Because of the success of the Redstone missile, in the fall of 1955 DOD decided to develop IRBM's with GMDD personnel as a key development team. ABMA was created on February 1, 1956, to expedite the development of the Army's ballistic missiles. ABMA was built around the original Redstone development team and was assigned the responsibility of weaponizing the Redstone and developing the Jupiter IRBM. For the latter assignment, Redstone fulfilled a basic and important role. ABMA was determined to continue to test the Redstone, but to also include some mission important to the development of the Jupiter missile on Redstone flights. Each Redstone from this point on carried components or elements of Jupiter requirements in support of the Jupiter development program. These missiles were called the Jupiter A's.

By the summer of 1958, the Redstone missile development program had been largely completed and the Redstone was deployed as a weapon with NATO Shield Forces in Europe.

The Redstone completed its 8-year test program on June 27, 1961, setting a reliability record of 45 successes out of 49 firings. Because of its extreme reliability, NASA selected the Redstone as the launch vehicle to be used in Project Mercury development tests.

Description

The Redstone was a high accuracy, liquid-fueled, surface-to-surface ballistic missile capable of transporting nuclear or conventional warheads against targets at ranges up to 200 nautical miles. It consisted of the warhead; the aftbody, which housed the self-contained guidance and control equipment; and the thrust unit, composed of a North American Aviation (NAA) A-7 rocket motor and the propellant tanks, which was capable of generating 75,000 pounds of thrust. Alcohol-water was used as fuel and LOX as the oxidizer. The Redstone was 69 feet long, had a diameter of 70 inches, and weighed 61,000 pounds at launch. Missile, launching equipment, and fuel were transportable. It was completely invulnerable to any external effort to upset or interfere with its all-inertial guidance system.

REDSTONE LAUNCHES*

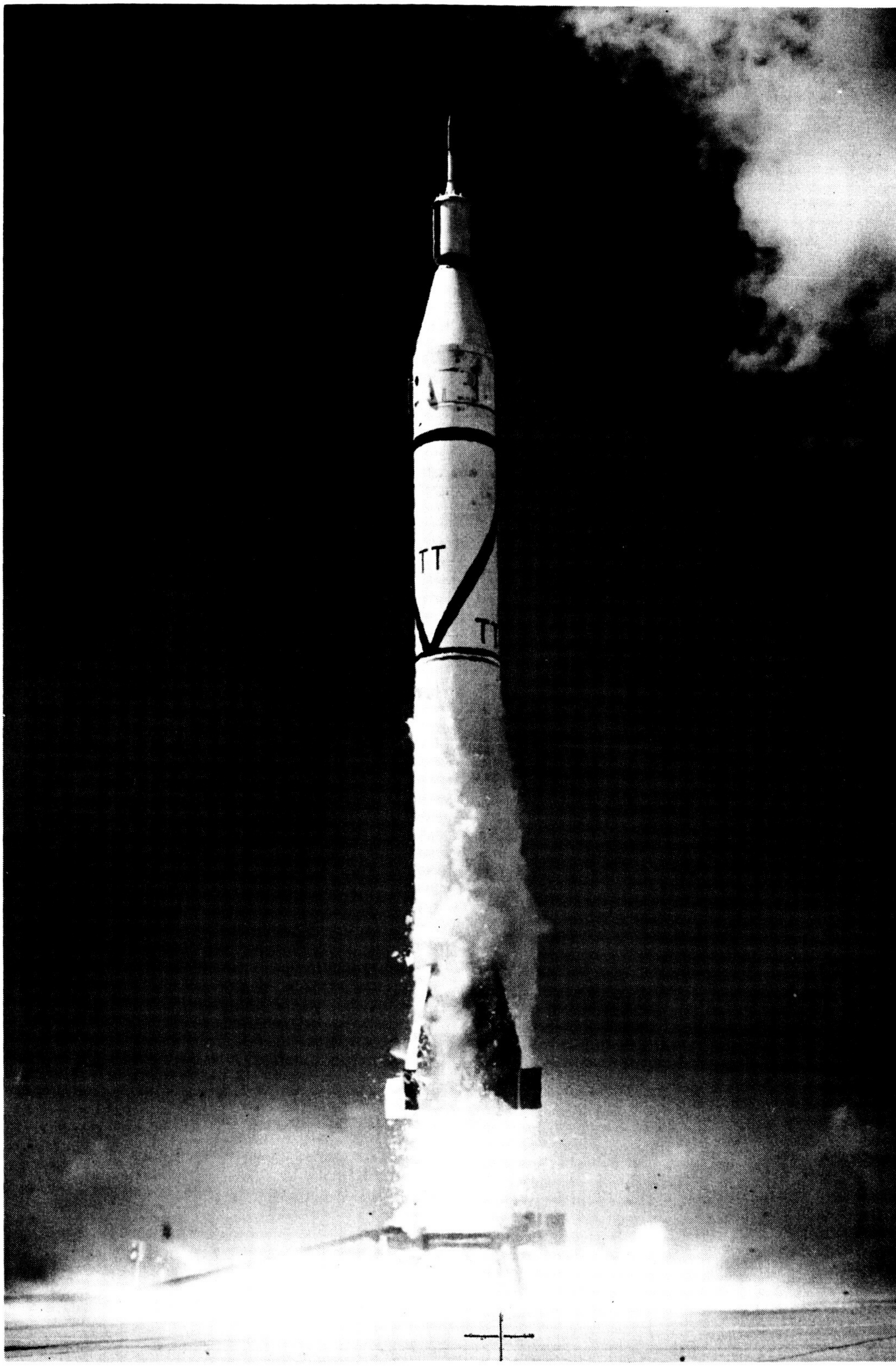
Missile No.	Date	Remarks
	1953	
1	August 20	First Redstone launched by Redstone Arsenal personnel. Largest missile launched to date from AMR.
	1954	
2	January 27	Satisfactory test flight. Speed - Mach 5.
3	May 5	Exploded on pad just after liftoff.
4	August 18	Satisfactory flight.
6	November 17	Successful flight. Altitude of 129,000 feet.
	1955	
8	February 9	Test results satisfactory.
9	April 20	First night flight.
10	May 24	First to carry complete guidance up to cut-off.
7	August 30	Initial flight test of DOFL fuze assembly.
11	September 22	First to carry complete, active guidance system.
12	December 5	Carried AZUSA as passenger. Test of complete guidance system; most satisfactory flight to date.

* Two significant Redstone launches conducted by the MFL firing team, not included in this report, were No. 50, on July 31, 1958, and No. 51, on August 11, 1958, which were successfully fired off Johnston Island in the South Pacific as a part of Project Hardtack. These were the first ballistic missiles to carry activated nuclear warheads. The warheads were detonated in the upper atmosphere.

Missile No.	Date	Remarks
	1956	
18	March 14	First "Jupiter A," third fully-guided Redstone, launched by newly formed ABMA.
19	May 15	Guidance test.
13	July 19	First Chrysler-built Jupiter A. Tested complete inertial guidance system.
20	August 8	Flight test of complete inertial guidance system. Test objectives met.
14	October 18	Used final type inertial guidance in successful flight.
25	October 30	Carried warhead. Broke up in mid-air.
28	November 13	Carried warhead for deep water impact. Stable full-range flight.
15	November 29	Used UDMH-Deta fuel for longer range. Satisfactory flight.
22	December 18	Used U-Deta fuel. Satisfactory control.
	1957	
16	January 18	Short range; test guidance. Phase I.
32	March 14	First Jupiter A shipped directly from plant and launched without static tests.
30	March 27	Phase I guidance test. Stable flight; on target.
31	June 26	Phase I guidance test; successful flight.
35	July 12	Met all test objectives.
37	July 25	Met test objectives.
38	September 10	First to use prototype tactical launching equipment.
39	October 2	Met test objectives.

Missile No.	Date	Remarks
	1957	
41	October 30	Destroyed by range safety.
42	December 10	Met test objectives.
	1958	
45	January 14	Met test objectives.
46	February 11	Redstone training flight. Assigned objectives to support Jupiter program. Landed on target.
43	February 27	Redstone training flight. Met test objectives.
1002	May 16	Redstone training graduation firing by 40th Field Artillery Missile Group. R&D objectives met in successful launch and flight. First successful troop launching of Redstone.
48	June 11	Overshot target. Carried objectives in support of Jupiter program.
54	June 24	Successful flight. Landed on target. Carried objectives in support of Jupiter program.
56	September 17	Completely successful flight. Redstone training.
57	November 5	Successful flight Block II prototype complete Redstone system. Last R&D test launch.
	1959	
2003	July 21	First Block II production missile. Engineer User Test to evaluate performance with respect to military characteristic requirements.
2004	August 4	Engineer User Test.

Missile No.	Date	Remarks
	1960	
2020	March 21	Long-range production Redstone, terminal control.
2023	August 9	Long-range production Redstone, terminal control. Range safety destroyed after 112 seconds; normal until destruct.
2037	October 5	Long-range production Redstone, terminal control. Lost control after Q.
	1961	
2038	January 21	Maximum range study of re-entry control problem. Successful flight.
2040	March 8	Engineering Qualification Production Missile. Study re-entry control.
2042	May 17	Successful 200-mile flight to study re-entry control.
2043	June 27	Test ruggedness and reliability and evaluate performance of Block II Redstone missile. Major objectives accomplished. Completed 8-year military test program.



JUPITER C (EXPLORER V)

JUPITER C

To carry out the Jupiter IRBM development program authorized by the Secretary of Defense in October 1955, the Army needed, among other things, a re-entry test vehicle for the purpose of testing solutions to the aerodynamic heating problem of re-entry. DOD gave permission to modify 12 Redstones for re-entry test purposes.

To get the additional velocity required for re-entry tests, the thrust units of the Redstones were lengthened and larger propellant tanks inserted, which increased the burning time by almost 50%. This modification, together with two additional stages, became the Jupiter C (composite re-entry test vehicle).

The third Jupiter C, which was launched on August 8, 1957, fulfilled the mission of resolving the aerodynamic re-entry heating problem. The launch vehicle propelled a scale-model nose cone more than 1,300 miles downrange, which was recovered intact from the South Atlantic by the U.S. Navy.

On November 8, 1957, ABMA was instructed to prepare for an International Geophysical Year satellite launching, employing Jupiter C as the carrier.

On January 31, 1958, a modified Jupiter C launched the free world's first scientific satellite, EXPLORER I.

Description

The Jupiter C (composite re-entry test vehicle) was a three-stage rocket which utilized a modified Redstone missile as the booster stage and clusters of scaled-down Sergeant rockets, originally developed and then modified for the Jupiter C by JPL.

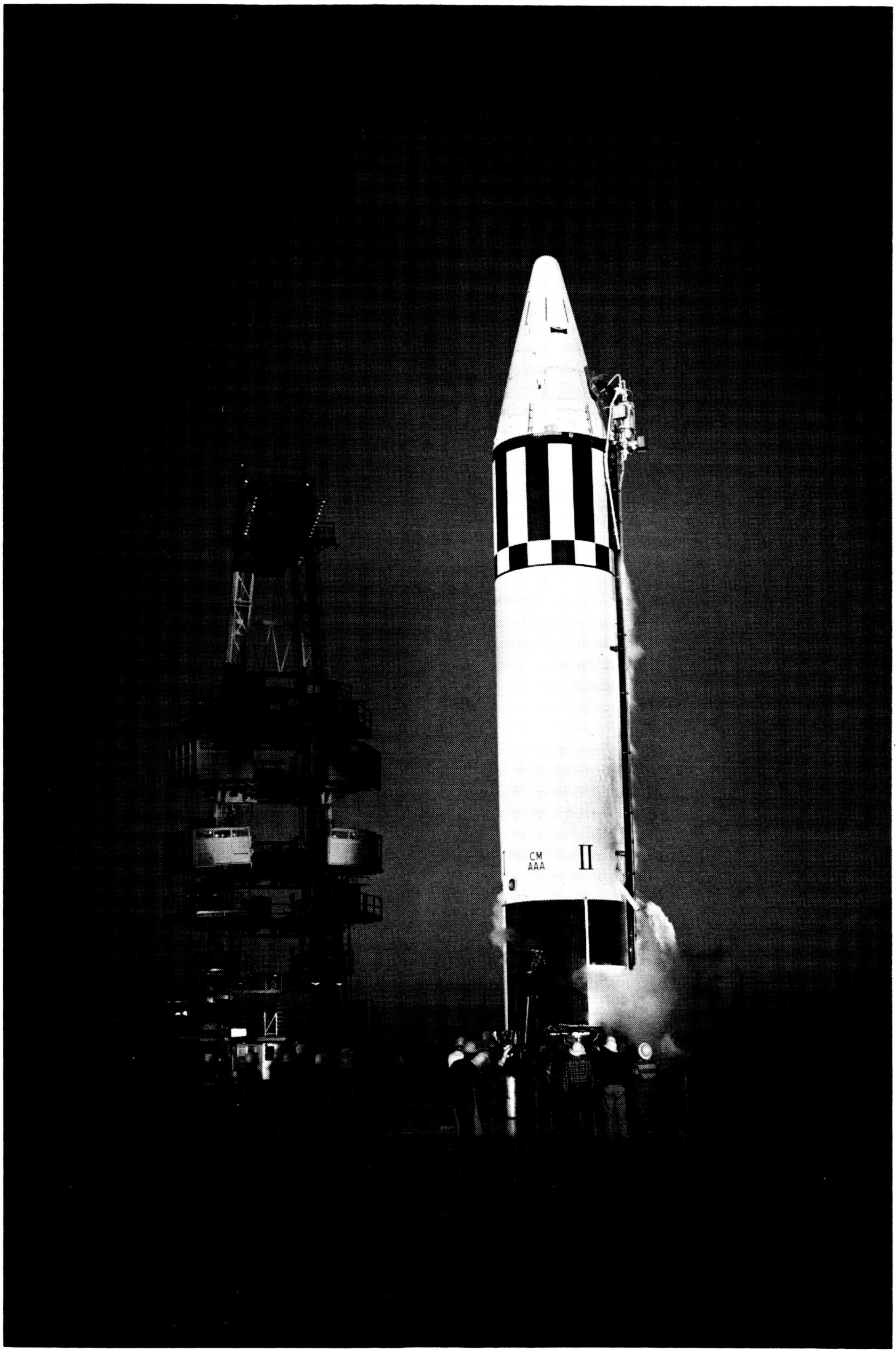
In addition to increasing the fuel capacity of the booster unit, the Redstone engine was modified to burn a more powerful fuel called hydyne. This increased the thrust of the Redstone from 75,000 to 83,000 pounds. The modified booster was 56 feet long and 70 inches in diameter.

The second stage consisted of a cluster of 11 Sergeants arranged in a ring. Three identical rockets were fitted into this ring to form the third stage. The Sergeants were solid-propellant rocket motors, each of which developed 1,600 pounds thrust in space.

JUPITER C LAUNCHES

Missile No.	Date	Remarks
	1956	
27	September 20	First long-range firing of a U.S. ballistic missile; first missile in re-entry test series carrying an inert payload to test design and capabilities of system. Attained altitude of 682 miles and traveled 3,300 miles downrange, establishing altitude and distance records, in a fully successful flight.
	1957	
34	May 15	First test missile for the study of thermal behavior of a scaled-down version of the Jupiter nose cone during re-entry. Separation did not occur; no recovery made.
40	August 8	Second test for study of thermal behavior of a scaled-down version of nose cone during re-entry complete success; all primary missions accomplished. First recovery intact of a man-made object launched into outer space following 1,300-mile flight downrange, with a summit altitude of 600 miles, demonstrated solution to aerodynamic re-entry heating problem. Shown to nation on television by President Eisenhower on November 7, 1957.
	1958	
29	January 31	Placed first U.S. scientific satellite, EXPLORER I, in an earth orbit. Contained U.S.-IGY experiment of James A. Van Allen, which discovered the radiation belt around the earth (most important discovery of the International Geophysical Year).
26	March 5	Attempt to place scientific payload, EXPLORER II, in an orbit around the earth failed. Fourth stage did not ignite, causing the satellite to fall.

Missile No.	Date	Remarks
	1958	
24	March 26	Placed third U.S.-IGY satellite, EXPLORER III, in extremely elliptical, but scientifically rewarding, earth orbit. Yielded valuable data on radiation belt (discovered by EXPLORER I), micrometeorite impacts, and temperature before returning to earth on June 28, 1958 (93 days).
44	July 26	Placed fourth U.S.-IGY satellite, EXPLORER IV, into earth orbit to study cosmic ray intensity. Carried four radiation counters, as compared to the single counters in EXPLORERS I and III, provided significant data on radiation belts before returning to earth October 23, 1959.
47	August 24	Primary mission of injecting EXPLORER V in orbit was not accomplished after successful launch; second and third stages fired at incorrect angle for orbital flight.
49	October 22	Attempt to place Beacon, a 12-foot-diameter inflatable sphere of micro-thin plastic, covered with aluminum foil, in a high altitude orbit failed. Primary factors causing non-completion of mission were failure of cluster stages to ignite and severe vibrations in missile.



JUPITER

JUPITER

Since its inception in 1955 the Jupiter IRBM system underwent several changes. Originally an Army-Navy project, this missile was to be a liquid-propellant missile with the dual capability of being launched from mobile land units or from ships at sea. Cancellation of the shipboard launching requirement relaxed design limitations which permitted the Army to adjust the length and fuel capacity of the Jupiter to achieve a 1,500-mile range.

Despite the complicated task of developing a new guidance system, the program advanced rapidly, and, on May 31, 1957, the Jupiter became the first United States IRBM to be fired successfully. This achievement was followed by other impressive "firsts" in the Jupiter development program. On May 18, 1958, the first full-scale, heat-protected IRBM nose cone was launched and later recovered, providing proof of Jupiter's ability to place a heat-protected warhead on target, and further demonstrating that a practical solution had been found for the aerodynamic heating problem. On August 28, 1958, only 30 months from the date the project was initiated, the Jupiter program had developed to such an extent that the Army delivered the first Jupiter with initial operational capability to the Air Force.

The Army successfully launched its last research and development Jupiter ballistic missile on February 4, 1960. Out of 29 research and development firings, 22 were successful, 5 were partially successful, and only 2 failed.

Having also proved its adaptability to space research, a Jupiter, which was launched by NASA on May 28, 1959, carried two monkeys, Able and Baker, to a predetermined target area where its nose cone and passengers were recovered unharmed. A modified Jupiter also served as a booster unit of the Juno II vehicle.

Description

The Jupiter was a single-stage, surface-to-surface, liquid-fueled IRBM, employing the "delta minimum all inertial guidance system," which maintained the missile on its precalculated trajectory. It was 60 feet long, had a diameter of 105 inches, and weighed 110,000 pounds at launch with its separable, nuclear warhead. It was powered by the NAA S-30 rocket engines utilizing LOX and kerosene as fuel and developed 150,000 pounds of thrust.

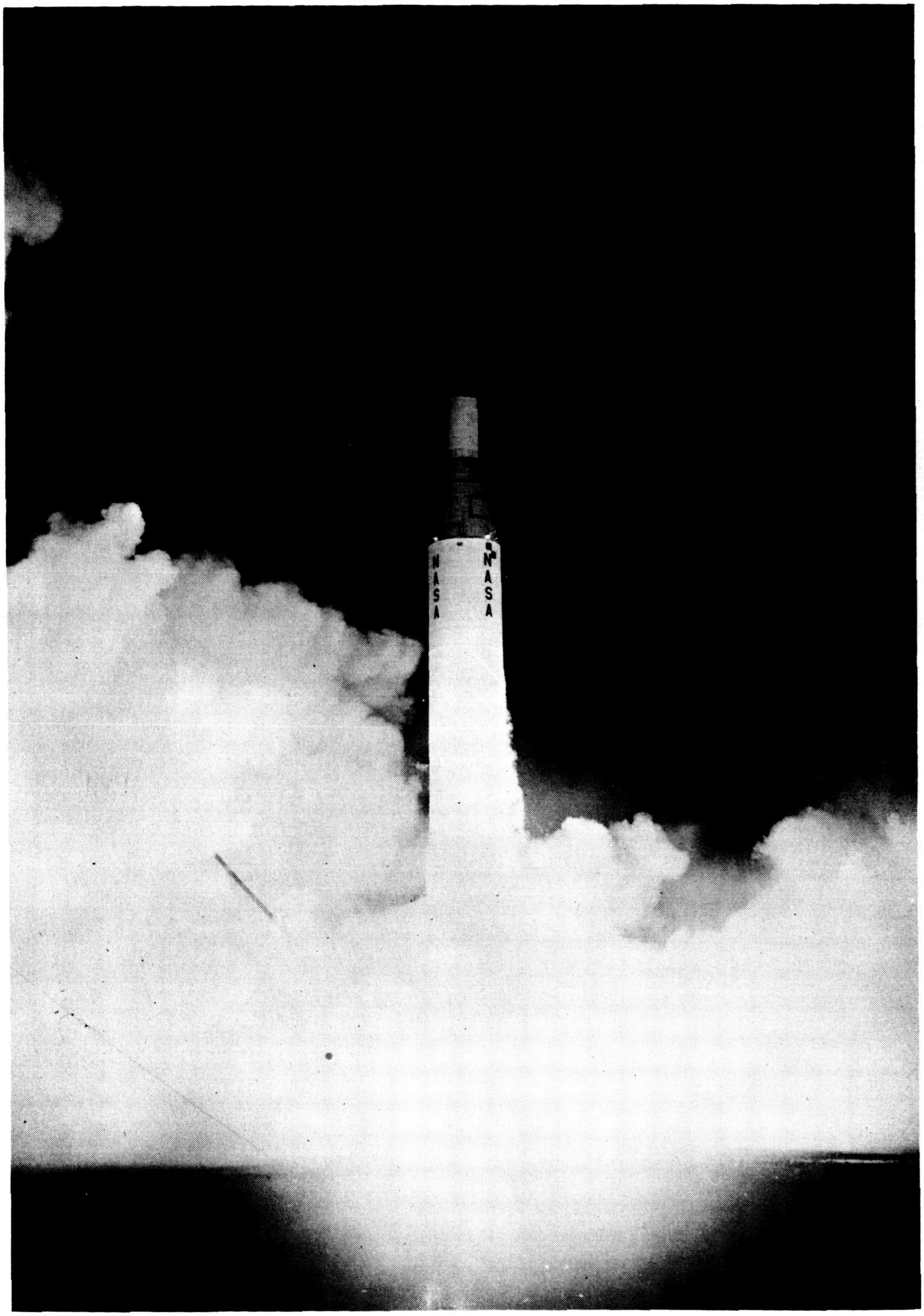
JUPITER LAUNCHES

Missile No.	Date	Remarks
	1957	
AM-1A	March 1	First operational prototype Jupiter. Exploded after 75-second flight following normal takeoff. Trajectory to this point was as predicted.
AM-1B	April 26	After normal takeoff, missile flew in a normal trajectory until it disintegrated at T + 93 seconds.
AM-1	May 31	Flight test to evaluate range capability of overall missile system complete success with all missions accomplished. First successful launch of United States IRBM set record in distance and altitude for single-stage missile.
AM-2	August 28	All missions accomplished in completely successful launch.
AM-3	October 22	First prototype Jupiter to employ all inertial guidance successfully launched; all systems performed satisfactorily.
AM-3A	November 26	Thrust failure caused premature impact; partial success.
AM-4	December 18	Thrust failure caused premature impact; partial success.
	1958	
AM-5	May 18	First recovery intact of a full-scale IRBM nose cone 4½ hours after launch.
AM-6B	July 17	First fully guided Jupiter. Perfect functioning of inertial guidance system enabled successful full-scale nose cone recovery by Navy only 1½ hours after launch.
AM-7	August 27	Second fully guided flight; primary missions were accomplished.

Missile No.	Date	Remarks
	1958	
AM-9	October 9	Fire in tail section caused range safety destruct.
AM-13	December 13	Fourth test of complete inertial guidance system. All firing missions accomplished, but third full-scale nose cone not recovered.
	1959	
CM-21	January 21	First full-production prototype tactical Jupiter IRBM successfully launched.
CM-22	February 27	Second qualification missile met test objectives.
CM-22A	April 3	Third qualification missile met test objectives.
AM-12	May 6	Successful 1,500-mile flight to further test complete missile operations in tactical configuration, especially warhead and fuzing apparatus working together as a system. Jupiter declared operational by USAF.
AM-17	May 14	Met test objectives.
AM-18	May 28	Fourth full-scale nose cone carried two monkeys, Able and Baker. Recovered in excellent condition 92 minutes after lift-off. Carried over a trajectory of some 1,965 space miles with maximum altitude of over 300 miles. Re-entered atmosphere at velocity of 10,000 miles per hour, experiencing 38 times normal pull of gravity, plus weightless period of 9 minutes.
AM-15	July 9	All objectives accomplished.
AM-19	August 26	Programmed for considerably less than normal range to demonstrate versatility in tactical use; all objectives accomplished.

Missile No.	Date	Remarks
	1959	
AM-23	September 16	Fifth full-scale nose cone carried NASA biomedical experiment. Structural failure caused explosion 13 seconds after launch.
AM-24	September 30	Met test objectives.
CM-31	October 21	Fourth qualification missile; all objectives accomplished.
CM-33	November 4	All objectives accomplished.
AM-25	November 18	Short-range test; met test objectives.
AM-32	December 9	Met test objectives.
AM-26	December 16	Met test objectives.
	1960	
AM-28	January 25	Met test objectives.
AM-30	February 4	Twenty-ninth and final test vehicle in R&D series successfully launched.
(LST) CM-217	October 20	Successful flight using full set of tactical ground support equipment for first time. Erected, checked out, serviced, and fired with same equipment as that issued to field troops, demonstrating compatibility between the tactical missile and the tactical ground support equipment. NATO troops participated.
	1961	
(CTL) CM-209	April 22	First tactical Jupiter successfully launched by NATO troops in combat training launch program.

Missile No.	Date	Remarks
	1961	
(CTL) CM-218	August 4	NATO troops successfully launched second Jupiter in CTL series. Missile closely followed predicted trajectory. Third checkout and firing with operational ground equipment.
(CTL) CM-115	December 6	Successful launch by NATO training launch crew.
	1962	
(CTL) CM-114	April 18	NATO crew successfully fired Jupiter 1,500 miles downrange.



JUNO II (PIONEER IV)

JUNO II

The Juno II project was one of the proposals originally submitted as a national space program by the Army in December 1957 and approved by ARPA in March of 1958. Control of the undertaking passed to NASA in October 1958, with AOMC serving as executive agent.

The Juno II vehicle was conceived to provide a quick and economical space vehicle. It could have been designed to accomplish more, but the philosophy was to furnish a space vehicle in a short time with a minimum amount of expense; hence, it rapidly became obsolete by the rocket state of the art. Of the 10 Juno II space missions, 4 were complete successes, 1 was a partial success, and 5 were failures.

Description

The Juno II was a four-stage vehicle which utilized a Jupiter IRBM, modified to increase the fuel capacity, and a high-speed upper assembly almost identical to that of the Jupiter C. All three upper stages of the Juno II were covered by a nose fairing to protect it against aerodynamic heating during the powered portion of the first stage flight. The fairing was jettisoned shortly after the first stage burnout and prior to the ignition of the second stage.

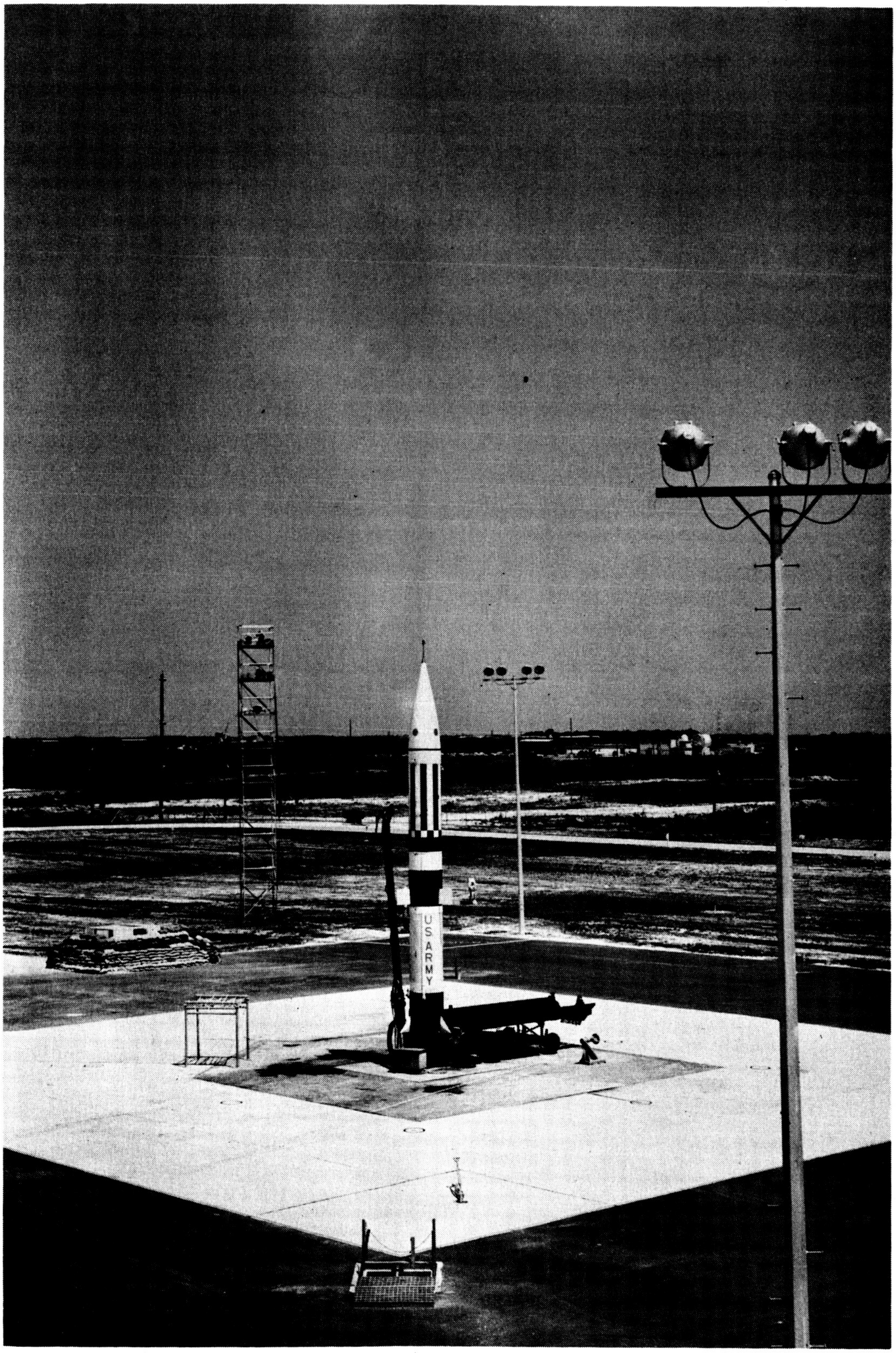
The height of the Juno II vehicle, including the conical nose fairing, was 76.7 feet, and the gross liftoff weight was about 121,000 pounds.

JUNO II LAUNCHES

Missile No.	Date	Remarks
	1958	
11	December 6	Premature cutoff of first stage failed to produce required velocity for lunar probe. Third U.S.-IGY space probe, PIONEER III, was lifted to altitude of 63,500 miles to contribute major scientific discovery of dual bands of radiation around the earth. Re-entered after 38 hours, 6 minutes.
	1959	
14	March 3	Successful launch of PIONEER IV, fourth U.S.-IGY space probe, achieved primary mission, an earth-moon trajectory. Yielded excellent radiation data and provided valuable tracking experience (probe was tracked for 82 hours, 4 minutes, to 406,620 miles, greatest distance man-made object tracked to that time), passing within 37,300 miles of the moon before going into permanent solar orbit (first U.S. sun-orbiter).
16	July 16	Attempt to place Explorer (S-1) satellite in orbit unsuccessful. Complete loss of power to guidance and control system at liftoff caused missile to deviate from intended flight path. Destroyed by range safety officer 5½ seconds after launch.
19B	August 14	Attempt to orbit 12-foot-diameter, high-visibility, aluminized sphere, Beacon, failed due to premature fuel depletion in the booster, with ensuing main engine cutoff, and unrelated upper-stage malfunction in the attitude control system.

Missile No.	Date	Remarks
	1959	
19A	October 13	EXPLORER VII, a 91.5-pound scientific satellite containing cosmic ray, solar X ray, radiation balance, and micrometeorite experiments, successfully injected into orbit around the earth. Provided significant data on trapped radiation and cosmic radiation near the earth, indicating a possible correlation with solar events and geomagnetic storms. With this seventh and last U.S.-IGY earth satellite, all experiments for the U.S.-IGY space program had been placed in orbit.
	1960	
19C	March 23	Attempt to orbit Explorer satellite (S-46), equipped to analyze radiation energies in the Van Allen radiation zones over an extended period of time. Orbit velocity not achieved due to failure of upper stages to ignite. Communication with launch vehicle was lost after second-stage burnout.
19D	November 3	All systems functioned normally and as intended to inject into an elliptical orbit a scientific earth satellite, EXPLORER VIII, carrying instrumentation for detailed measurements of ionosphere.
	1961	
19F	February 24	Primary mission of injecting into orbit an ionosphere beacon satellite (S-45) not achieved. Series of irregularities occurred following first separation preventing firing of upper stages.
19E	April 27	Placed astronomy telescope satellite, EXPLORER XI, in orbit to detect high energy gamma rays from cosmic sources and map their spacial distribution. Vehicle and all payload systems functioned as planned.

Missile No.	Date	Remarks
	1961	
19G	May 24	Primary mission of injecting artificial earth satellite (S-45a) into orbit was not achieved. Second stage was not brought to ignition because of apparent voltage drop. Satellite was to provide the means to study ionosphere measurements. Last of 10 Juno II launchings.



PERSHING

PERSHING

In addition to its new space exploration roles, ABMA was also assigned responsibility for the development of the Pershing missile. This missile was designed to have a much larger range than the Redstone, but was lighter, smaller, and more mobile.

The prime research and development contract was awarded in March 1958, and the weapons system contractor was teamed with ABMA for research and development, reliability, testing and production of the missile and associated ground equipment.

The first Pershing was delivered for testing in one year, and the first research and development flight test was conducted by MFL on February 25, 1960. MFL, as NASA's LOD, retained responsibility for the Pershing program until May 1961. During that period of approximately 27 months, 16 missiles were launched from AMR, 3 of them failures. All launches were from the missile's highly mobile "transporter-erector-launcher" (TEL), which was placed either on a concrete slab or on the missile's tracked SM-474 prime mover.

Description

The Pershing was a surface-to-surface, solid-propellant, two-stage, inertially guided missile with a selective range of approximately 400 nautical miles. It was approximately 34 feet long and had a diameter of 40 inches. A specially designed "transporter-erector-launcher" unit, transportable by plane or helicopter, made the Pershing the ultimate in mobility.

The Pershing not only doubled Redstone's range, but vastly increased the flexibility and mobility, and sharply reduced reaction time.

PERSHING LAUNCHES

Missile No.	Date	Remarks
	1960	
105	February 25	First test launch R&D series Group I; 35-mile flight, as programmed; met all test objectives.
106	April 20	Landed in target area.
107	May 10	Landed in target area.
108	June 9	Preset to perform erratic movements in short flight over Atlantic Ocean. Range safety officer was alerted to possibility that missile might have to be destroyed due to excessive conditions, but it was not necessary. Landed in target area.
109	June 30	Landed in target area.
110	July 26	Sixth and last R&D series Group I missile. Group I missiles planned to burn only through first stage; second stage was dummy.
205	September 28	First R&D series Group II missile. First failure and first attempt to separate and have second stage fire, but missile veered out of control and was destroyed by range safety officer 57 seconds after liftoff.
206	November 16	Traveled 160 miles in first fully successful flight test of 2 stages.
207	December 12	Initial flight test of new inertial guidance system successful.
	1961	
208	January 5	Fourth in R&D series Group II destroyed by automatic destruct system after 25 seconds of flight.

Missile No.	Date	Remarks
	1961	
209	January 25	All aspects of launch and powered flight as planned. Missile impacted on target approximately 145 nautical miles distant after 307-second flight.
210	February 15	All aspects of launch and powered flight as planned. Missile impacted in target area approximately 145 nautical miles from pad after 309-second flight.
211	March 2	Impacted 145 nautical miles from pad in successful flight.
212	March 15	Eighth and last of R&D series Group II. All aspects of launch and powered flight as planned.
308	April 21	First of R&D series Group III. Slicked up missile with new, more sharply tapered nose cone and more powerful motors flew an extended distance, as prescribed, for first time.
310	May 18	Second of R&D series Group III partially successful. Destroyed by range safety officer 57 seconds after liftoff. Last of Pershing missiles launched under direction of LOD.

MERCURY/REDSTONE (FREEDOM 7)

MERCURY-REDSTONE

Project Mercury, the first step in NASA's long-range manned space flight program, was formally organized on October 5, 1958.

On October 6, 1958, representatives of NASA and AOMC discussed the use of Redstone and Jupiter missiles in support of the manned satellite project. Approximately a month later, on November 3, 1958, NASA decided to proceed with an eight-vehicle Redstone program. ABMA, an element of AOMC, began production planning and scheduling for the program following formal authorization by NASA on January 8, 1959.

The purposes of the Mercury-Redstone program were to demonstrate the adequacy of the Mercury capsule and recovery methods; to acquire knowledge of space flight; to train the astronaut; and to acquire operational experience in preparation for the first manned orbital flight.

The progression of accomplishments in the Mercury-Redstone program included a ballistic suborbital flight made by a chimpanzee named "Ham," who was recovered in excellent condition; and was highlighted by two manned suborbital flights, the first with Alan B. Shepard and the second with Virgil I. Grissom as astronauts. Both manned flights demonstrated what the Mercury-Redstone phase of Project Mercury was to ascertain--that man can perform useful tasks in a space environment. These flights were so highly successful that NASA cancelled the third scheduled manned suborbital flight and terminated the Mercury-Redstone program; the objectives had been achieved.

Description

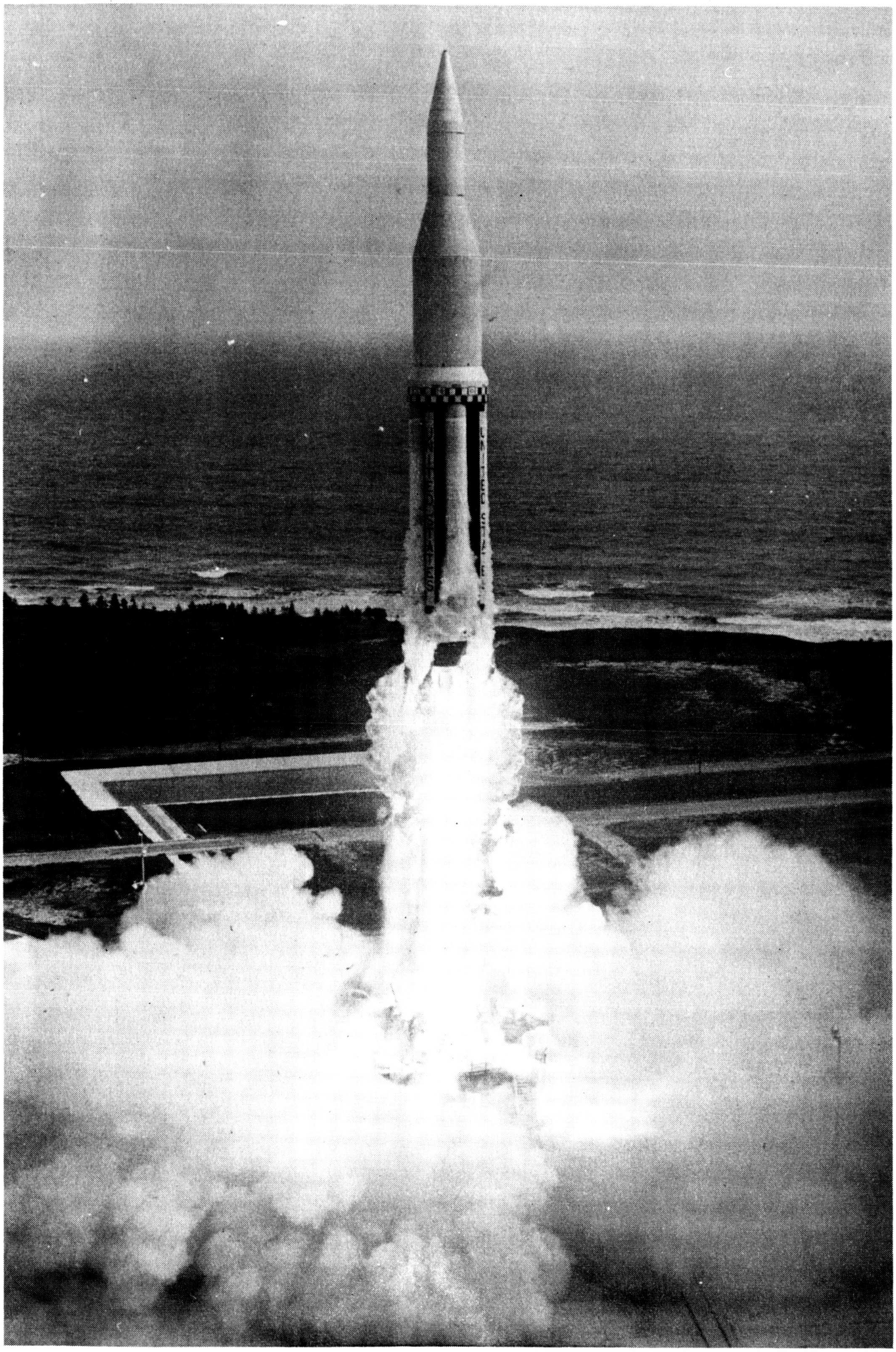
The Mercury-Redstone launch vehicle resembled the Redstone in many of its vital components, yet it differed in other respects and in its general configuration. Approximately 800 changes were required to transform the missile into a man-carrying booster.

The launch vehicle measured 54 feet from the air rudders to the capsule-booster adapter. It was 70 inches in diameter and weighed approximately 65,940 pounds when fully loaded with fuel and with the spacecraft attached. The airframe was of standard Redstone design with the center section elongated 96 inches to provide tankage for the additional alcohol and liquid oxygen. This modification was made to increase the engine burning time to the required length of time with a few seconds reserve. The vehicle was powered by an improved and simplified Rocketdyne A-7 engine which had a sea level thrust of 78,000 pounds. The general configuration of Mercury-Redstone consisted of the booster, conical capsule atop the booster, and an escape rocket mounted on a tower-like pylon structure above the capsule. The complete vehicle was 83 feet in length.

MERCURY-REDSTONE LAUNCHES

No.	Date	Remarks
	1960	
MR-1	November 21	First suborbital Mercury capsule test. Flight test terminated when signal triggered by ground connection shut down the Redstone's engine immediately after ignition. Escape tower rockets ignited almost simultaneously with engine shut-down carrying tower to approximately 4,000 feet, leaving capsule still joined to the launch vehicle, and landed 1,200 feet from launch pad. Vehicle lifted fraction of an inch off the pad when cutoff occurred; suffered minor damage when it settled back on the pad. (Capsule used again in MR-1A launch.)
MR-1A	December 19	A repeat of the first flight mission was successful with all major objectives fulfilled. Ignition, liftoff, main stage and booster powered flight performed as planned. Capsule separated from the booster, oriented its position as programmed, completed re-entry and landed in target area 235 miles downrange after reaching an altitude of 135 miles and a speed up to 4,300 miles per hour. Capsule was recovered in excellent condition 48 minutes after launch.
	1961	
MR-2	January 31	Successfully launched fully equipped, operational Mercury capsule containing 37-pound chimpanzee named "Ham" on a 16-minute suborbital flight, to an altitude of 156 miles and over a distance of 420 miles. Excessive booster velocity carried spacecraft considerably higher and farther than planned, but mission objectives--flight test of capsule and its life-support system--were achieved when spacecraft and passenger were recovered in satisfactory condition. Knowledge gained from flight enabled correction of malfunction in the launch vehicle in preparation for manned flight.

No.	Date	Remarks
	1961	
MR-BD	March 24	Booster development test flight to verify modifications necessitated by MR-2 flight. Modified Redstone carried a boilerplate Mercury capsule to an altitude of 115 miles and a distance of 311 miles downrange; test did not call for capsule separation and recovery. Completely successful flight qualified the Redstone for manned suborbital flights.
MR-3	May 5	First manned suborbital flight. FREEDOM 7, Mercury spacecraft, manned by astronaut Alan B. Shepard, Jr., successfully launched. After reaching peak altitude of 116 miles and top velocity of 5,180 miles per hour, capsule landed 302 miles downrange in Atlantic Ocean following 14.8-minute flight. All phases of flight were normal. Astronaut and capsule were recovered by helicopter within 6 minutes of landing and both were aboard the recovery vessel within 11 minutes. Astronaut underwent 5 minutes of weightlessness and experienced maximum acceleration of 11 times normal gravity on re-entry. Carried out all tasks as assigned, demonstrating that man can control a vehicle during weightlessness and high G stresses, and suffered no adverse physiological effects from flight.
MR-4	July 21	Second manned suborbital flight. LIBERTY BELL 7, manned by Mercury astronaut Virgil I. Grissom, made successful 16-minute, 118-mile-high, and 303-mile flight downrange. All phases of flight were normal, however, due to inadvertent firing of explosive hatch, capsule filled with water, increasing its weight, and recovery of spacecraft was abandoned. Astronaut was recovered and, with the exception of the missing capsule, all missions were successfully accomplished. Analysis of data indicated that the objectives of the suborbital phase of Project Mercury had been achieved and no further suborbital flights were scheduled.



SATURN (SA-1)

SATURN

The Saturn rocket, the largest launch vehicle under advanced development in the free world, is the first large rocket developed specifically for scientific space programs and manned space flight. It is expected to be the major heavy vehicle for U.S. space exploration for a number of years. Utilizing a clustered-engine concept, first proposed by ABMA in the spring of 1957, the Saturn is capable of sending payloads of several tons into earth orbit, to the moon, and into deep space.

In December 1959, a technical-plus-management committee, comprising representatives from NASA, ARPA, DOD, ABMA, and the Air Force, recommended a long-range development program for Saturn, including upper-stage engines utilizing only high-energy propellants (in this case, liquid hydrogen/liquid oxygen). This combination, first known as the Saturn C-1,* was selected as the initial vehicle to be developed, and would be a stepping stone to other follow-on vehicles. The committee also recommended that a building-block approach to upper-stage development be employed, so that the smaller, more easily developed stages could be first used atop the large booster, and the number of required engine developments could be minimized. The proposed building-block concept would yield a variety of Saturn configurations, each using previously proven developments as far as possible. These recommendations were accepted

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* Called Saturn I after February 7, 1963.

on December 31, 1959, and resulted in the establishment of a 10-vehicle research and development program. The Saturn project was approved on January 18, 1960, as a program of the highest national priority.

The primary goal of the Saturn I program is to reach operational status in time for the scheduled launch into orbit of the Apollo manned capsule. The Apollo orbital mission is the first of three major steps in the United States' plan to land men on the moon, within this decade, and return them safely to earth.

In the 10-vehicle research and development flight test program, no more than 2 live stages were planned to be flown, with only a live first stage in the first 4. While the primary purpose of these 10 flights is to prove the vehicle, several of the later vehicles will have secondary missions of testing early models of the Apollo spacecraft.

Description

The first Saturn configuration, now known as Saturn I, currently is the largest U.S. launch vehicle. The vehicle is about 163 feet high and weighs about 410 tons at liftoff. Only the first stage, designated S-I, with inert upper stages, has been flight tested.

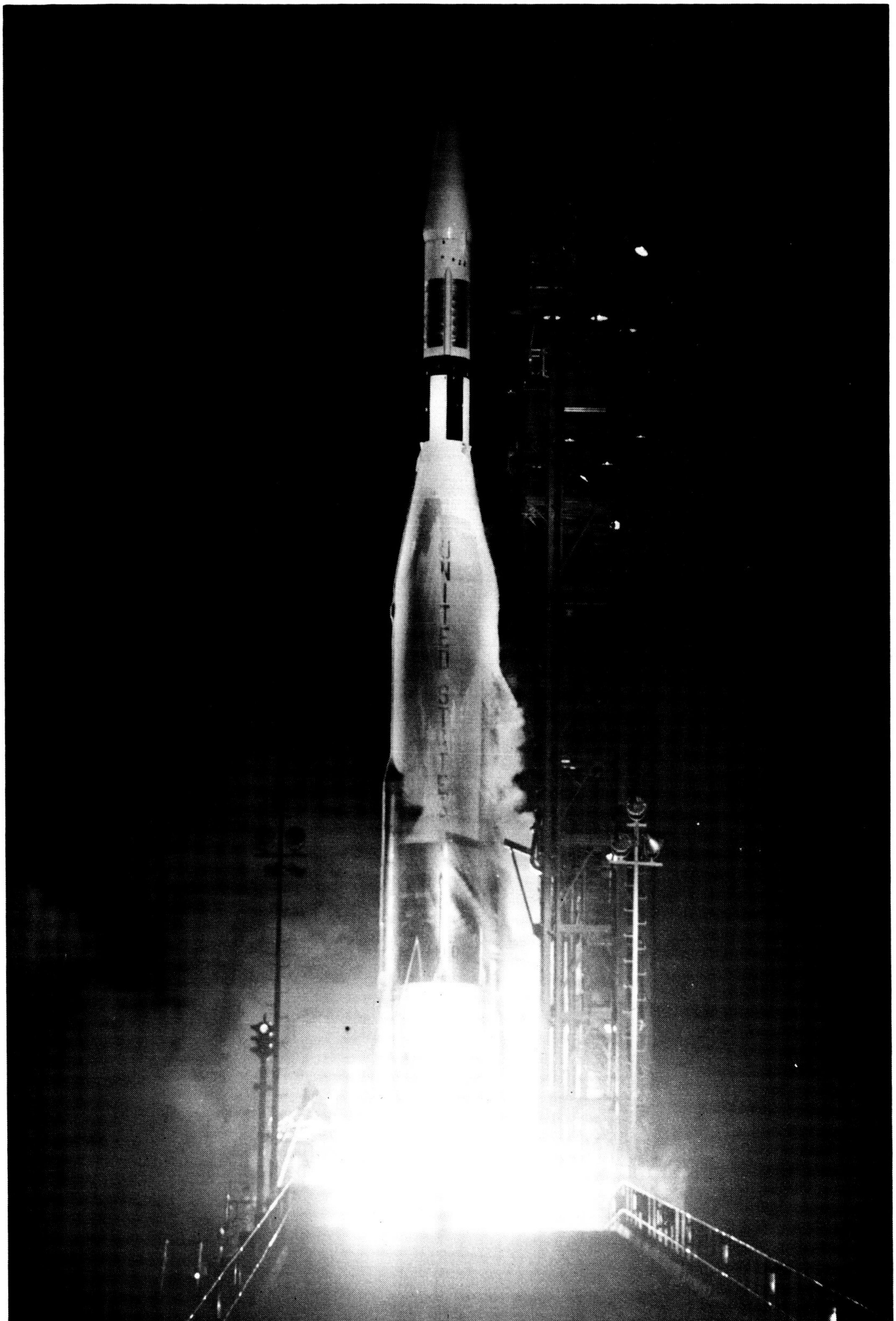
The first stage is powered by a cluster of eight Rocketdyne H-1 engines, each of which produces 188,000 pounds of thrust at sea level, for a total thrust of 1.5 million pounds. The booster is 21.5 feet in diameter and 82 feet in length.

The H-1 engine, an advanced and compact offspring of the Jupiter and Thor engines, was selected because of its relative simplicity, early availability, and proven reliability. Liquid oxygen and RP-1 (kerosene) form the propellant combination. Nine separate tanks feed the eight H-1 engines. The four inner, or inboard, engines are rigidly attached; the four outer, or outboard, engines are movable to provide direction control during the first-stage powered flight. The engines can be individually shut off on command when a malfunction is detected. Since the engines are simplified adaptations of well-proven engines, the number of malfunctions during flight is expected to be low.

The Saturn I configuration can carry a payload of about 11 tons into low earth orbit. It has basically far greater capabilities in the follow-on versions of the rocket which are planned, each one more powerful than its predecessor.

SATURN LAUNCHES

No.	Date	Remarks
	1961	
SA-1	October 27	Saturn C-1 was successfully launched in initial launch vehicle development test flight of first stage, S-I. Its 8 clustered engines, developing 1,296,000 pounds of thrust at launch, hurled 2 dummy upper stages to peak altitude of 84.8 miles and distance of 214.7 miles downrange. Reached maximum velocity of 3,607 miles per hour before plunging into ocean 8 minutes, 3.6 seconds after launch. Overall performance of the vehicle during flight was highly satisfactory, demonstrating its structural integrity.
	1962	
SA-2	April 25	Saturn C-1, successfully launched in second launch vehicle development test of first stage, generated 1.3 million pounds of thrust. A second mission for SA-2, utilizing the 2 dummy upper stages, was a bonus experiment to the booster test called Project Highwater. The vehicle was intentionally destroyed about 50 miles downrange at an altitude of approximately 65 miles, rupturing the upper stages to release 22,900 gallons of water. The purpose of the experiment was to investigate optical, ionospheric and meteorological effects of releasing a large mass of water at this altitude. Test objectives were satisfactorily attained.



RANGER I (ATLAS-AGENA B)

RANGER

Project Ranger is the first of several unmanned space projects delving into the moon's secrets. The Ranger program represents America's first attempt to obtain close-up and detailed photographs of the moon and its topography; to secure scientific data on the composition of the lunar surface; and to learn more about lunar origin, history, and structure from an instrumented capsule designed to survive a rough landing on the moon.

On December 29, 1959, NASA's Director of Vehicle Development Operations established a survey team to review the Agena vehicle to determine the feasibility of utilizing this Air Force vehicle for NASA missions. On February 15, 1960, the team recommended that an Agena B program be approved. In May 1960, NASA initiated contract negotiations for 16 Agena B vehicles for its missions. The Atlas-Agena B was to be used in Project Ranger as the launch vehicle. NASA assigned administration of the Agena B project to MSFC. Management of the vehicle program included resolving the problems encountered in the integration of launch vehicles and spacecraft, control of changes in the system to meet NASA mission requirements, and direction of launch operations. LOC was to direct the launch operations. Execution of the Ranger program was assigned to the JPL in 1960. The lunar spacecraft was designed and developed by JPL.

The Ranger project is divided into three phases. The first phase, initiated in 1961, was in the development and testing of spacecraft technology. Two spacecraft, designated Ranger I and Ranger II, were used.

The second phase, designed to rough-land on the moon a survivable "capsule" containing scientific instruments and radio transmitting equipment, was the most complicated series of events that a U.S. spacecraft had been asked to undertake. NASA assigned three identical spacecraft to the task in the hope that one of the three would be successful.

Initially, the Ranger program proposed five flights of instrumented packages during 1961 and 1962. However, on August 29, 1961, NASA announced that four additional Ranger spacecraft flights had been added to the lunar exploration program to insure more and better data upon which to base plans and spacecraft design for manned lunar flight, adding a third phase to the program. These four Rangers will carry high-resolution television cameras designed to send back to earth fine-grain television pictures of the lunar surface right up to the moment of impact.

Description

The launch vehicle for Ranger missions is a combination of two rockets. The Atlas "D" and the Agena-B. The Agena-B is powered by a single rocket engine, using liquid propellants. It has a dual-start capability which allows the vehicle to maneuver into the most advantageous position for a successful flight of the

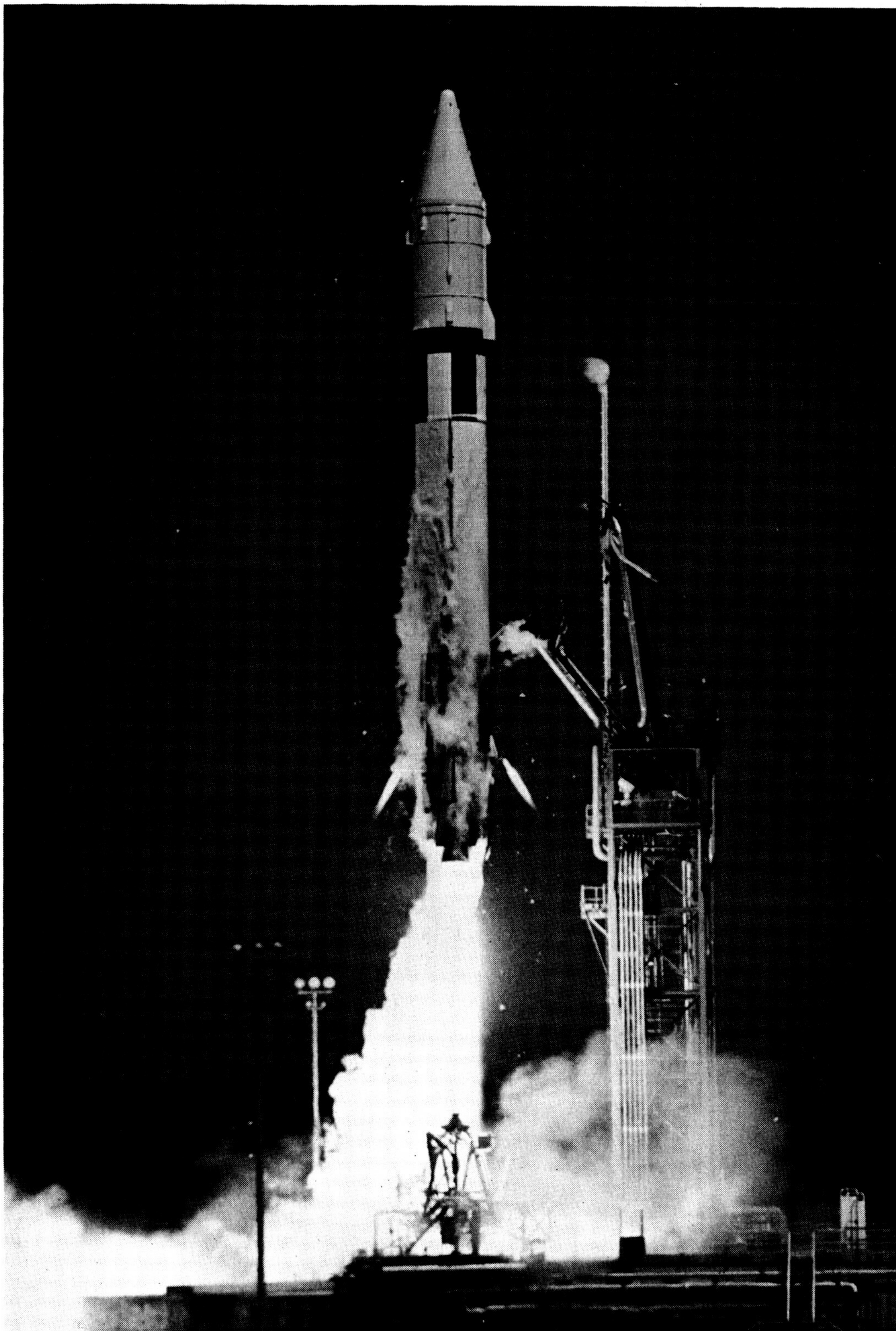
Ranger spacecraft, and to attain the objective of impacting the spacecraft on the moon's surface.

The Ranger spacecraft spans 17 feet and is 10.25 feet long, although during the launch phase of the trajectory it is completely protected by a compact shroud and is about 5 feet in diameter, 8.25 feet long, and weighs approximately 730 pounds. The 5-foot-diameter hexagon base houses most of the packaged spacecraft electronics, as well as a primary battery to provide power when the solar panels are inoperative.

RANGER LAUNCHES

No.	Date	Remarks
	1961	
RA-1	August 23	RANGER I was placed in low earth orbit instead of its prescribed highly elliptical orbit due to failure of Agena stage to restart. Test of spacecraft achieved. Returned scant scientific data before reentry on August 29, 1961.
RA-2	November 18	RANGER II was launched to test spacecraft systems for future lunar and interplanetary missions and investigate cosmic rays, radiation, and dust particles in space. Because of malfunction of Agena roll gyro, followed by premature cutoff of second burn, orbit achieved was low earth orbit rather than the deep elliptical one planned, so data was not obtained on some of the test items. Primary objective of testing the system was achieved. Re-entry on same day.
	1962	
RA-3	January 26	RANGER III was launched in the United States' first attempt to rough-land a separable instrumented capsule on the lunar surface. Lift-off was normal, but a malfunction in the Atlas airborne guidance equipment 49 seconds after launch resulted in excessive velocity and an off-course trajectory, causing the spacecraft to be injected into its lunar transfer path at excessive velocity. As a result, RANGER III arrived in the area of the moon approximately 14 hours ahead of time, passed in front of its target, missing it by 22,862 miles, and then entered a solar orbit. Flight proved out many of the systems within the payload, including the mid-flight guidance mechanism, and spacecraft provided the first measurement of interplanetary gamma ray flux.

No.	Date	Remarks
	1962	
RA-4	April 23	RANGER IV was successfully launched, went into parking orbit, and was put into proper lunar impact trajectory by restart of the Agena booster. Failure of a timer in the spacecraft's central computer and sequencer system prevented RANGER IV from making a controlled descent onto the surface of the moon and precluded the accomplishment of the engineering and scientific experiments. Injection was accomplished with sufficient accuracy for lunar impact without benefit of spacecraft midcourse maneuver. While the full flight objectives were not achieved, the probe resulted in the first lunar impact for a U.S. payload and demonstrated a high order of performance in the Atlas/Agena B/ Ranger combination.



CENTAUR (F-1)

CENTAUR

The Centaur vehicle project, which evolved from studies of strategic high-altitude satellites for early warning, global surveillance, communications, and weather reconnaissance work, was conceived by the United States Air Force (USAF) in 1958. The program was sponsored by USAF until it was adopted as a DOD project by ARPA, and continued under Air Force management until responsibility for Centaur development was transferred to NASA on July 1, 1959. NASA assigned administration of the project to MSFC on July 1, 1960, and LOD was to exercise sole launch responsibility for the 10 vehicles required for the R&D phase and for subsequent operational vehicles with NASA spacecraft.

A series of difficulties encountered in the development program delayed the first Centaur research and development flight (originally planned for January 1961) until May 1962. In addition to unexpected technical difficulties in utilizing liquid hydrogen as a fuel, the slow development of the Centaur program was attributed to, among other things, its sudden expansion from a relatively low-priority experiment in liquid hydrogen for space use into a major vehicle program; and insufficient close liaison between the Air Force technical team, which had remained in California, and MSFC. Early in 1962, however, a reorganization of the Centaur development program, which included the transfer of the Centaur Space Vehicle Project Office from California to MSFC, was effected to correct the difficulties.

The unsuccessful initial launch attempt on May 8, 1962, emphasized the need for further program evaluation. A comprehensive development plan was issued by MSFC's Centaur Project Office in June 1962, placing primary emphasis on lunar missions. An immediate objective of this plan was the development and testing of vehicle reliability for soft-landing of unmanned, instrumented payloads on the moon.

Description

The mating of the multipurpose Centaur second stage to the Air Force-developed Atlas D resulted in the most advanced of the Atlas-based series of space carrier vehicles, the Atlas-Centaur. When fully developed it will be capable of sending some 8,500 pounds into an earth orbit, 2,300 pounds to the Moon, and 1,300 pounds to Venus or Mars. These unmanned lunar and planetary exploration projects are beyond the present capabilities of the Atlas-Agena B, the only similar launch vehicle in existence.

The Centaur second stage and the payload are protected by a nose cone that is jettisoned early in flight, as soon as aerodynamic heating is no longer critical. The second stage is built of thin-gage, lightweight stainless steel, which is free of internal framework and pressurized to maintain its shape. The overall length of the Atlas-Centaur is approximately 108 feet.

The twin-engine second stage Centaur employs a new and potent fuel combination of liquid oxygen and liquid hydrogen, which develops over 30% more thrust from each pound of propellant consumed per second than the conventional kerosene and liquid oxygen combination. Centaur produces a thrust of 30,000 pounds, almost double the Agena B's thrust of 15,500 pounds. Each of the two engines has its own turbopump assembly and thrust-regulating systems. The engines can be ignited in space, cut off to permit coasting periods and restarted in accordance with programmed instructions from the guidance system.

The specially developed guidance system which uses a general-purpose type digital computer, receives information on the vehicle's position and velocity in flight; compares this against previously stored information; and, as necessary, initiates corrective action to bring the vehicle back to the desired flight path. This system is to provide, for the first time in a U.S. multistage space launching vehicle, active self-contained guidance throughout powered flight from lift-off to payload injection.

CENTAUR LAUNCH

Missile No.	Date	Remarks
	1962	
F-1	May 8	First R&D test flight to study the performance of the vehicle systems with emphasis on the separation systems and two-stage structure integrity. Vehicle behaved as planned from lift-off to approximately 54 seconds of flight when an explosion, caused by structural failure, resulted in fuel tank rupture and self-destruction of vehicle.

APPENDIX B BIBLIOGRAPHY

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SUPPORTING DOCUMENTS

SUPPORTING DOCUMENTS

I. Army-NASA Transfer Plan, excerpt: Cape Canaveral Facilities, December 11, 1959

II. Flight Test Responsibilities and Organization for the Launch Phase of Project Mercury at AMR

III. Support Requirements to be furnished by Launch Operations Directorate to Test, Evaluation and Firing Laboratory, 1 June 1960

IV. Letter, Headquarters AOMC to Director Launch Vehicle Program, NASA subj: Cape Canaveral Facilities, 9 June 1960

V. Operating Procedures at AMR between LOD/MSFC and TE&F Laboratory, August 16, 1960

VI. Memorandum of Agreement on Participation of the 6555th Test Wing (DEV) in the Centaur R&D Flight Test Program, April 18, 1961

VII. Transfer of Pershing Launch Operations Responsibility from LOD to TE&F Laboratory

VIII. Range Use and Support Agreement between LOD and AFMTC, 17 July 1961

IX. Agreement between DOD and NASA relating to the Launch Site for the Manned Lunar Landing Program, August 24, 1961

X. MSFC-LOC Separation Agreement, June 8, 1962
   - Appendix A - NASA Circular No. 208, March 7, 1962
   - Appendix B - Discussion Draft, June 1, 1962, subj: "Basic Concepts for Operation of the LOC at AMR."
   - Appendix C - Distribution of Personnel Spaces, FY 62

I

ARMY-NASA TRANSFER PLAN

CAPE CANAVERAL FACILITIES

December 11, 1959

(Excerpt)

C O P Y

CAPE CANAVERAL FACILITIES

The Army has a continuing requirement for a portion of the Army controlled launch facilities located at Cape Canaveral. NASA contrawise must have portions of these in order to pursue its missions, in addition to Saturn, such as Mercury and Juno.

The Army will not in the future have the same Firing Laboratory technical capability at Cape Canaveral as it now possesses. However, it does intend to perform its firing missions through a combination of NASA provided Missile Firing Laboratory technical supervision coupled with contractor personnel, who will ultimately (Pershing as an example) become self sufficient and no longer require MFL supervision.

In light of the above, the Pad 56 complex, together with its instrumentation as well as the JPL spin test building, will be released to NASA, since this area has been selected for Mercury Redstone shots. The Pad 26 complex will be retained by the Army. The R and D instrumentation in Pad 26 blockhouse will be transferred to NASA's Saturn blockhouse at an appropriate time, with the understanding that sufficient instrumentation remains to conduct the Jupiter combat training launches.

Hangar R and Hangar D will be controlled by AOMC and NASA respectively. Further the telemetry equipment, UDOP, and DOVAP will not be removed from their present location, and this instrumentation, together with other Cape Canaveral telemetry stations, will be transferred to NASA for use in connection with both Army and NASA missions. An AOMC-NASA use agreement will be executed with the understanding that equipment required for Redstone, Jupiter, and Pershing firing not be impaired. The Army further agrees to give unrestricted use rights of Hangar R to NASA for Saturn test and checkout subject to non-interferences of firings required to complete the Redstone and Jupiter firing programs and further to assist in early R and D Pershing firings.

The warehouse building and other structures in the industrial complex will pass to the control of NASA. However, upon equitable division between the Army and NASA of the stocks therein limited storage will be provided the Army by NASA until stock liquidation by the Army occurs.

The second floor of the E&L Building with its separate entrance will remain with the Army to the extent now assigned as office space for weapons system; however, building control will pass to NASA.

The Pershing Complex will be retained under Army control. Control of the Saturn complex will pass to the control of NASA.

II

FLIGHT TEST RESPONSIBILITIES AND ORGANIZATION FOR THE LAUNCH PHASE OF PROJECT MERCURY AT AMR

C O P Y

PROJECT MERCURY

FLIGHT TEST RESPONSIBILITIES AND ORGANIZATION FOR THE LAUNCH PHASE OF PROJECT MERCURY AT AMR

1.0 INTRODUCTION

1.1 The purpose of this document is to define the responsibilities and to outline the procedures and implementing organization for the REDSTONE launch phase of Project MERCURY at AMR.

1.2 It is the intent of this document to establish, within the framework of the NASA/ABMA relationship, procedures which are in consonance with the established procedures for ABMA operations at AMR. In this way, the current ABMA organization and operating experience can best be utilized to insure success of the launch operation, while at the same time recognizing the NASA responsibility for accomplishing the over-all objectives.

1.3 The launch organization shall be divided into three teams. One team, which has the responsibility for preparation, checkout and launch of the REDSTONE vehicle, shall be provided by ABMA. The organization and procedures already developed by ABMA for this purpose shall be fully utilized. A second team, which has the responsibility for the preparation, checkout and determination of readiness of the capsule system, shall be provided by NASA and its contractors. A third team, which shall have the responsibility for pilot readiness and aeromedical monitoring during the prelaunch phase, shall be designated by NASA.

2.0 FUNCTIONS AND RESPONSIBILITIES DURING TEST PREPARATION AND LAUNCH OPERATIONS

2.1 NASA will exercise overall control of flight test operations.

2.1.1 Operations Director (NASA) has overall mission responsibility. He is present in the Space Control Center during launch operations. He will have a representative in the blockhouse and in the AMR Central Control who will be fully informed on all aspects of the launch operations. The operations director receives status reports from the tracking and data acquisition network, the recovery organization, the NASA blockhouse representative and/or the Launch Director. When problems arise indicating a possible compromise of NASA test objectives, he determines the appropriate course of action.

C O P Y

2.1.2 Launch Director (ABMA) has technical supervision of the launch operation. He is responsible to the Operations Director for technical readiness of the complete booster vehicle system and launch complex for accomplishment of launch objectives. When technical problems related to the booster vehicle and launch complex readiness arise, he determines and executes the appropriate course of action. Technical problems arising with reference to the capsule and the astronaut are referred to the Operations Director for decision. When test termination, test scheduling, or AMR range operations are involved relative to the launch operation, the Launch Director will make the appropriate recommendations to the Operations Director who will take appropriate action with AMR.

3.0 GENERAL

3.1 Detail organization and procedures already developed by ABMA for launch of the REDSTONE ballistic missile shall be used to the fullest extent possible in the MERCURY booster vehicle launch.

ABMA /s/ J. A. Barclay DATE 11 Dec 1959
J. A. BARCLAY
Brigadier General, USA
Commander

NASA /s/ Richard E. Horner DATE 1 Jan 1960
RICHARD E. HORNER
Associate Administrator

D of D Rep, Proj MERCURY
Spt Opns /s/ D. N. Yates DATE 12 Jan 1960

III

MEMORANDUM OF AGREEMENT
BETWEEN
THE ARMY BALLISTIC MISSILE AGENCY
AND
THE NASA MARSHALL SPACE FLIGHT CENTER

SUPPORT REQUIREMENTS
to be furnished by
LAUNCH OPERATIONS DIRECTORATE
to
TEST, EVALUATION AND FIRING LABORATORY
1 June 1960

C O P Y

PREFACE

On 1 July 1960, the Development Operations Division (DOD) of the Army Ballistic Missile Agency will be transferred from the Army to NASA. At that time, the responsibility for the Army programs now performed, directed or controlled by DOD will be transferred to Research and Development Operations of ABMA.

Test, Evaluation and Firing Laboratory (TE&F), an element of R&D Operations, will be responsible for all ABMA launch operations. The purpose of these agreements between TE&F and Launch Operations Directorate (LOD) NASA, is to provide for continuing, uninterrupted performance of the Army programs until TE&F builds up the capability for performing all of the required functions and to cover the support LOD requires of ABMA.

The scope of these agreements is specifically limited to those missile systems which are currently assigned and require firings at the Atlantic Missile Range. This includes REDSTONE, PERSHING, JUPITER (LST), CTL and consulting service on the NIKE-ZEUS Targets.

These agreements provide detailed implementation of the Army-NASA agreement dated 11 December 1959, signed by Dr. Glennan, Secretary Brucker and Acting Secretary Douglas. These agreements also provide implementation of the letter from the Deputy Commander, AOMC, Maj Gen Barclay, to Maj Gen Don R. Ostrander, Dir, Launch Vehicle Programs, dated 9 June 1960. This letter assigns control of the Industrial Area to LOD and states that ABMA will provide 18 months notice to LOD for any hangar space requirements generated by new missile systems. LOD will supply hangar requirements for ABMA within NASA Industrial Area, or provide new facility.

Office space will be provided TE&F in the E&L building as outlined in Section V, Facilities at AMR. This amounts to approximately 1630 square feet on the second floor, with an additional 345 square feet of joint usage with LOD, until October of 1961.

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SECTION I

Administrative Services at AMR

1. The Army Ballistic Missile Agency and the Launch Operations Directorate shall provide all civilian and military personnel office services for Army and NASA personnel respectively. No cross-servicing will be required.

2. The ABMA and LOD shall provide their own travel arrangements including Travel Orders and T/R's, carrier reservations, local transportation arrangements, motel reservations. No cross-servicing will be provided in this area, since the systems are different.

3. The ABMA and LOD shall provide. their own timekeeping and payroll services.

4. The LOD will provide photographic and reproduction services to ABMA on a reimbursable basis within its capability and in accordance with the following:

a. ABMA will comply with LOD procedures regarding such services for classified and unclassified work.

b. LOD shall establish priorities for all photographic and reproduction services.

c. The ABMA will supply LOD with names and signature cards of individuals (including Army Contractors or other government agency personnel on Army programs) authorized to approve photographic and reproduction work orders. These cards will be kept current by the Army.

5. The LOD will provide regular mail and messenger service to Army elements located within the NASA Industrial Area. The ABMA and LOD shall provide their own classified material control and internal distribution.

6. Office supplies will be furnished to Army by LOD on the same basis as other expendable supplies. This will be established in a separate memorandum of agreement. Office furniture will be provided Army personnel within NASA controlled facilities by LOD. Office furniture within the PERSHING Complex will be provided by ABMA.

7. The ABMA and LOD will provide their own clerical personnel and office services.

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8. Communications services will be provided for Army personnel within the NASA facilities in accordance with Range agreements. Local and long distance telephone calls are charged direct to the user. Classified TWX services will be provided by the Army on a non-reimbursable basis. The Army will provide unclassified TWX services until NASA can hire and train its own operators. Replacement will be on a one-for-one basis. Paging services within the NASA Industrial Area will be performed by LOD without charge.

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SECTION II

Transportation at AMR

1. The Launch Operations Directorate will provide transportation for all NASA personnel at AMR within its capabilities. LOD will also provide transportation for all equipment, missiles, spares and supplies, and working crews for NASA conducted launches. This will include such Army personnel as are assigned as part of the work crews.

2. The Army will provide transportation for all Army personnel at AMR. Army will also provide transportation for all equipment, missiles, spares and supplies, and working crews for all Army conducted launches. This will include LOD personnel assigned as part of the launch crews or as advisors.

3. Transportation of Army personnel assigned as observers or on a training basis to NASA conducted launches will be a responsibility of the Army.

4. During the transfer phase, defined as 1 July 1960 to 1 October 1960, the Army will continue to support the LOD with vehicles and drivers as currently assigned until LOD can obtain its own.

5. Currently assigned vehicles will be transferred to NASA or retained by the Army as provided in a separate agreement on equipment.

6. Parking area for operational vehicles in the motor pool lot will be shared by LOD and Army until separate facilities are provided the Army.

7. Temporary vehicle maintenance shelters and equipment currently located in the Industrial Area will be divided between LOD and Army until such time as NASA can provide separate permanent shelter for LOD. At that time, all temporary shelters will be removed from the Industrial Area. Minor maintenance will be provided to Army by LOD on a reimbursable basis within the capability of LOD and on a "space and time available" basis.

C O P Y

SECTION III

Supply at AMR

1. The Launch Operations Directorate will issue supplies, expendable and non-expendable, to ABMA at AMR.

a. Expendable supplies will be issued to ABMA in the same manner as to LOD personnel.

b. Non-expendable items to be retained within the Industrial Area will be issued on a hand-receipt basis. Such items will not be removed from the Industrial Area.

c. Non-expendable items to be taken outside the Industrial Area will be issued on a transfer of accountability. These will become the property of the ABMA.

2. Issues will be made with or without reimbursement in accordance with agreement between the Army and NASA at Huntsville, and these issues will be part of that agreement. Further issues beyond the scope of that agreement will be reimbursable.

3. ABMA will comply with LOD procedures in requisitioning supplies and equipment.

4. ABMA will furnish and maintain current (on a quarterly basis) a list of personnel authorized to requisition supplies and signature cards for these personnel.

C O P Y

SECTION IV

Security Operations at AMR

1. The Launch Operations Directorate will provide Security services and control within the NASA Industrial Area, Complex 26 and Complex 56 and all SATURN Launch Areas.

2. The Army will provide Security services and control within the PERSHING Area (Complex 30 and related areas.)

3. During the transfer phase, defined as the period from 1 July 1960 to 1 October 1960, the Army will retain its currently assigned Security organization and provide support and training to NASA Security personnel as requested.

4. During the transfer phase, the Army and NASA will mutually develop procedures and agreements covering areas of overlap or mutual support.

5. During the transfer phase, NASA will provide office space as currently assigned to the Army. Subsequent to 1 October 1960, the Army Security Office will relocate into other quarters as assigned to the Army under Section V of this document.

C O P Y

SECTION V

Facilities at AMR

1. The PERSHING Launch Facility (Complex 30 and related areas) will remain under the control of the Army.

2. Complex 26 and Complex 56 will be under the control of LOD but will be utilized as necessary in the accomplishment of currently assigned Army Missile Systems Programs.

3. The Industrial Area will be under the control of LOD. LOD will provide space to the Army within the Industrial Area as necessary to perform the Launch programs currently assigned at AMR. The space required will be determined by mutual agreement between the Launch Operations Directorate and Test, Evaluation and Firing Lab.

a. Rooms in the E&L building numbered 1212, 1213, 1217 and 1207, which are the offices now assigned as Military, Chrysler, Martin and Picatinny will be assigned Test, Evaluation and Firing Lab on 1 July 1960. Room 1209 will be shared by LOD and TE&F for transient personnel. After 1 October 1961 TE&F and LOD will both require additional office space.

b. In the event additional space is required by ABMA for new programs at AMR, at least 18 months lead time notice will be provided to LOD. LOD will then budget for construction of a new hangar or arrange for assignment of an existing hangar at AMR to ABMA.

4. Other facilities and equipment not covered under paragraph 1., 2., and 3. above, but procured for the PERSHING Program will be retained by the Army. All equipment and severable facilities procured by Army funds which become surplus to LOD requirements will be offered to ABMA before other disposition is made. The mobile service structure planned for use on the NIKE-ZEUS Target Program will remain the property of the Army.

C O P Y

SECTION VI

NASA-ABMA Operational Support

1. TECHNICAL CONTROL: The Director, TE&F Laboratory will exercise technical control over the activities covered by this Memorandum of Agreement. This control includes program coordination within the Army and between the Army and LOD, and management of the activities directed toward the discharge of ABMA responsibilities at AMR.

2. ESTABLISHED POLICIES: Policies and procedures established by LOD (previously MFL) which pertain to relations between LOD and Martin Co., CCMD, Picatinny Arsenal, DOFL, etc., will remain in full force. Changes thereto will be mutual agreement between LOD and TE&F Laboratory.

3. LOD RESPONSIBILITY FOR PERSHING LAUNCH ACTIVITIES:

a. General: The Director, LOD will provide complete technical supervision, direction, and support necessary to launch PERSHING Missiles until such time that TE&F Laboratory has acquired a capability to assume same. It is anticipated that TE&F Laboratory will have acquired a capability to assume the full responsibility for technical supervision and direction of PERSHING Launch Operations within the 2nd Quarter of FY 62. However, TE&F will review their projected capability in Jan 1961 and notify LOD when they will assume complete responsibility, this assumption of responsibility being not before 1 July 1961.

b. Coordination with AMR: LOD shall perform all necessary coordination and liaison with AMR concerning PERSHING Launchings through the Army's delegated representative to AMR. However, in order that TE&F Laboratory be apprised of range coordination requirements and in order that a capability be established in this area, a TE&F designated representative will participate in these activities jointly with the LOD Project Coordinator until such time that TE&F Laboratory assumes complete responsibility.

c. Support by LOD (During Period LOD Retains Technical Supervision and Direction): LOD will provide the support necessary to launch PERSHING Missiles which includes but is not limited to the following:

(1) Preparation, check-out, and launch of missiles.

(2) Operation of Hangar "D" Telemetry Station.

(3) Operation of UDOP & Beat-Beat Tracking Equipment.

(4) Provision of "Quick-Look" data including reproduction of tapes and preparation of oscillograms.

(5) Scheduling of all tests.

(6) Determination of the on-board equipment and range instrumentation required to meet the objectives of each missile launch. Publish these requirements in the form of the Instrumentation Plan (Part of the Firing Test Report.) Martin furnishes one man-year to assist in this effort.

(7) Coordinate flight safety requirements.

(8) Collect data and photographic requirements and distribute gathered data and film in accordance with distribution coordinated with TE&F Laboratory.

(9) Process work orders and other facility change requests through the Army's delegated representative to AMR. Martin will furnish all the required engineering for each change request.

d. Support by LOD (Subsequent to the Assumption of Technical Supervision and Direction by TE&F Laboratory): LOD will provide support to TE&F Laboratory after the assumption of technical supervision and control by TE&F which includes the following:

(1) Operate UDOP and Beat-Beat tracking sites if required.

(2) Operate Hangar "D" telemetry station if required.

(3) Provide consulting services upon request. However, the availability of LOD personnel will determine the time and extent of the services provided.

(4) Perform accuracy checks on ST-120 platforms when requested.

(5) Support not explicitly covered herein but for which an unforeseen requirement arises. The availability of LOD personnel will determine the time and extent of services provided.

C O P Y

4. LOD RESPONSIBILITIES FOR REDSTONE LAUNCH ACTIVITIES:

a. General: The Director, LOD will provide complete technical supervision, direction, and support necessary to launch the remaining REDSTONE missiles at AMR.

b. Coordination with AMR: LOD shall perform all necessary coordination and liaison with AMR concerning REDSTONE launchings through the Army's delegated representative to AMR. However, in order that TE&F be apprised of range coordination requirements and in order that a capability be established in this area, a TE&F designated representative will participate in these activities jointly with the LOD project coordinator.

5. LOD RESPONSIBILITIES FOR JUPITER CTL LAUNCH ACTIVITIES:

LOD responsibilities shall be in accordance with Memorandum of Agreement between U. S. Army Ballistic Missile Agency and Marshall Space Flight Center for support of the U. S. Air Force JUPITER Combat Training Launch Program, dated 23 May 1960. In addition, LOD shall train TE&F personnel (Military, Civilian, or Contractor) who will be assigned to LOD by mutual agreement and who will be under the technical supervision and direction of LOD.

6. LOD RESPONSIBILITIES FOR JUPITER LST LAUNCH ACTIVITIES:

LOD will provide complete technical supervision, direction, and support necessary for the JUPITER LST Launch Activities.

Details of the agreement between ABMA and Marshall Space Flight Center have not been completed but upon completion will be made an addendum to this document.

7. RESPONSIBILITY FOR NIKE-ZEUS TARGET LAUNCH ACTIVITIES:

TE&F will assume complete responsibility for JUPITER Target Launch Activities on 1 July 1960. LOD will supply consultatory services to TE&F as requested within the limitations of the level of effort stipulated in Section VII.

8. TRAINING OF TE&F PERSONNEL:

a. The organizational structure for the TE&F Launch Branch will be similar to that of LOD. There will be a project engineer assigned for each Army project and sections in the Launch Branch will correspond to the branches within LOD.

b. TE&F project engineers will perform a dual function.

(1) Train under the direction and supervision of the corresponding LOD project engineer.

(2) Serve as an assistant to the Chief, TE&F Launch Branch, with responsibility (as contact point between TE&F and LOD) for coordinating all activities of an operational nature between TE&F and LOD.

c. Technical personnel from operating sections with the TE&F Launch Branch will be assigned to the corresponding LOD Branch for training in the LOD Area under the technical supervision and direction of LOD.

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SECTION VII

Program-Budget Planning Data

TE&F Lab Anticipated level of effort for LOD support to ABMA:

a. **PERSHING**

FY 61 Man-quarters per Quarter (Direct)

	Civilian	Military*	Total
1st Qtr	40	16	56
2nd Qtr	40	16	56
3rd Qtr	30	16	46
4th Qtr	20	16	36
TOTAL - Man-years	32.5	16.	48.5

*Military personnel will be supplied to LOD by ABMA. Therefore, MSFC will not be reimbursed for these services. In the event that ABMA is unable to maintain this level of military support to LOD, LOD will substitute civilian effort therefore within the limitations of LOD personnel strength and will be reimbursed by ABMA accordingly.

b. **REDSTONE**

FY 61 Man-quarters per Quarter (Direct)

1st Qtr - 42 man-quarters

2nd Qtr - 42 man-quarters

3rd Qtr - 42 man-quarters

4th Qtr - 18 man-quarters

Man-years 36

C O P Y

c. JUPITER TARGET

	Man-quarters per Quarter (Direct)
1st Qtr	4
2nd Qtr	4
3rd Qtr	4
4th Qtr	4
TOTAL - Man-years	4

d. Actual expenditures will be recorded by program within LOD and furnished monthly to TE&F for review. Adjustments in programs will be made by TE&F on a quarterly basis.

C O P Y

SECTION VIII

Requirements for Military Personnel at TE&F Lab at AMR

Since LOD has made formal request for TE&F Lab to maintain the current level of military personnel at AMR during the phasing period of 1 July 1960 - 1 October 1960, TE&F Lab agrees to maintain the current TD until 1 October 1960. TE&F Laboratory takes the position that these functions should be performed by civilians and that the use of enlisted personnel should be phased out as soon as civilian spaces and qualified applicants are available. Fourteen of the enlisted personnel required are for motor pool and transportation activities. Action is being initiated by TE&F Laboratory to arrange for this service to be performed by contract.

Part A of this section is a tabulation of the military personnel requirements by function, shown separately for officers and enlisted.

TE&F Laboratory plans to maintain the eighteen technical military personnel and three crypto personnel at least through FY 61 or until civilian replacements are obtained, and the six S&Ps until expiration of enlistment.

C O P Y

MILITARY PERSONNEL REQUIREMENTS
TEST, EVALUATION AND FIRING LABORATORY
AT ATLANTIC MISSILE RANGE

Part A - Requirements by Function

Administrative and Clerical:	Officers & Warrant Officers Required	Enlisted Personnel Required
Detachment A - overhead	2	4
Transportation and Motor Pool		14
Teletype-Crypto Operators		3
Scientific and Professional:		
Program Coordinator		2
Firing		1
Networks		1
Guidance		1
Project Engineer		1
Technical:		
Tracking		12
Photography		1
Firing		3
Measuring		1
Instrumentation		1

C O P Y

/s/ William L. Grafton	/s/ Kurt H. Debus
WILLIAM L. GRAFTON	KURT H. DEBUS
Director, Test Evaluation & Firing Laboratory	Director, Launch Operations Directorate

IV

LETTER, HEADQUARTERS AOMC TO DIRECTOR LAUNCH VEHICLE PROGRAM, NASA

SUBJECT: CAPE CANAVERAL FACILITIES

9 JUNE 1960

C O P Y

HEADQUARTERS
U. S. ARMY ORDNANCE MISSILE COMMAND
Redstone Arsenal, Alabama

ORDXM-CM 9 Jun 1960

Major General Don R. Ostrander
Director, Launch Vehicle Program
National Aeronautics and
Space Administration
1520 H Street, Northwest
Washington 25, D. C.

Dear General Ostrander:

Your letter of 3 May 1960 has been given considerable thought both by General Schomburg and me. It is recognized that the continuation of effective launch operations at AMR is of primary concern to both the Army and NASA.

It has already been agreed that Dr. Debus will have operational control of all facilities in the Industrial complex at AMR. In this respect, Dr. Debus will be responsible for planning, utilization and operation of all facilities in the Industrial area. In addition, I believe it would be mutually beneficial to NASA and the Army if Launch Complex 26 were taken over completely by NASA rather than being retained by the Army under the operational control of Dr. Debus. I recognize that this latter proposal is not in accordance with the Army/NASA Transfer Plan of 11 December 1959. This Command has initiated action requesting Department of Army approval in the complete transfer of Launch Complex 26 to NASA, as a change to the Army/NASA Transfer Plan. I assume that Dr. Glennan will agree with this position.

The agreement with respect to operational control by Dr. Debus and the proposal to completely turn over to NASA Launch Complex 26 is predicated upon our ability to reach detailed agreements with Marshall Space Flight Center (Dr. Debus) with respect to his continued support of Army programs. I have delegated responsibility for reaching agreement in this area to the Commander, ABMA. It is planned that this detailed agreement on operations at AMR would become an appendix to the over-all operating agreement now being negotiated between this Command and Marshall Space Flight Center.

C O P Y

ORDXM-CM

Confirming my recent telephone conversation with you, this Command agrees to give Marshall Space Flight Center (NASA) eighteen (18) months notice in the event US AOMC desires the use of Hangar R which will be under the operational control of Dr. Debus. This agreement will allow NASA to develop and implement a master facilities plan at AMR with respect to Hangar R with the understanding that should the Army need Hangar R they will have enough lead-time to either provide it or an equal replacement.

I appreciate your concern that the work of Dr. Debus, under his expanded activities, must proceed without undue interruption to either the Army or NASA programs. Let me assure you that members of this Command will do everything in their power to accomplish this aim.

Sincerely yours,

(Signed) J. A. BARCLAY

J. A. BARCLAY
Major General, USA
Deputy Commanding General

V

OPERATING PROCEDURES AT AMR

BETWEEN LOD/MSFC AND TE&F LABORATORY

AUGUST 16, 1960

C O P Y

APPENDIX III

TO

AGREEMENT BETWEEN USAOMC AND MSFC*

OPERATING PROCEDURES

AT

ATLANTIC MISSILE RANGE

BETWEEN

LAUNCH OPERATIONS DIRECTORATE
MARSHALL SPACE FLIGHT CENTER

AND

TEST, EVALUATION AND FIRING LABORATORY,
R&D OPERATIONS
ARMY BALLISTIC MISSILE AGENCY

* Historian's Note: Original Agreement dated August 16, 1960.

C O P Y

SECTION I

GENERAL

1. INTRODUCTION:

The Test, Evaluation and Firing Laboratory (TE&F), an element of Research and Development Operations, ABMA, will be responsible for all ABMA Launch Operations at Atlantic Missile Range. Until such time that TE&F establishes the capability to perform the required launch operation functions, the Launch Operations Directorate (LOD), Marshall Space Flight Center will support, as defined herein, ABMA programs. These procedures are specifically limited to the REDSTONE, PERSHING, JUPITER (LST), and JUPITER (CTL) systems. This agreement supersedes and cancels the agreement between NASA, MSFC and ABMA on Support Requirements to be furnished by LOD to TE&F Laboratory dated 1 June 1960. It is expected that the requirements for the services provided for in this section will not extend beyond 31 December 1961.

2. SERVICES:

a. The LOD will provide photographic and reproduction services to TE&F within its capability and in accordance with the following:

(1) TE&F will comply with LOD procedures regarding such services for classified and unclassified work.

(2) LOD shall establish priorities for all photographic and reproduction services.

b. TE&F will supply LOD with names and signature cards of individuals (including Army Contractors or other Government Personnel on TE&F programs) authorized to approve photographic and reproduction work orders and requisitions for supplies and equipment. These cards will be kept current by TE&F.

c. LOD will provide regular mail and messenger service to TE&F within the LOD Industrial Area on a non-reimbursable basis. TE&F and LOD will each provide its own classified material control and internal distribution.

d. Classified message service will be provided by TE&F on a non-reimbursable basis. Paging services within the NASA Industrial Area will be performed by LOD on a non-reimbursable basis.

e. The Launch Operations Directorate will issue supplies, expendable and non-expendable which are not available from AFMTC, to ABMA at AMR as requested.

(1) Expendable supplies will be issued to ABMA in the same manner as to LOD personnel.

(2) Non-expendable items to be retained within the Industrial Area will be issued on a hand-receipt basis. Such items will not be removed from the Industrial Area.

(3) Non-expendable items to be taken outside the Industrial Area will be issued on a transfer of accountability. These will become the property of the ABMA.

3. TRANSPORTATION:

a. LOD will provide local transportation (PAFB-Cape Canaveral Complex) for all equipment, missiles, spares and supplies, and working crews for LOD conducted firings. This will include such TE&F personnel as are assigned as part of the work crews.

b. TE&F will provide local transportation (PAFB-Cape Canaveral Complex) for all equipment, missiles, spares and supplies, and working crews for all TE&F conducted firings. This will include LOD personnel assigned as part of the firing crews or as advisors.

c. Transportation of ABMA personnel assigned as observers or on a training basis to NASA conducted launches will be a responsibility of the ABMA.

d. Parking area for operational vehicles in the motor pool lots will be shared by LOD and TE&F until separate facilities are provided TE&F.

4. FACILITIES:

These Operating Procedures are predicated upon an agreement being reached by the parties as to the assignment by the Air Force of facilities at AMR for use by the parties in carrying out their obligations hereunder.

C O P Y

SECTION II

OPERATIONAL SUPPORT

1. TECHNICAL CONTROL: The Director, TE&F Laboratory will exercise technical control over the activities covered by these procedures. This control includes program coordination within the ABMA and between the TE&F and LOD, and management of the activities directed toward the discharge of ABMA responsibilities at AMR.

2. ESTABLISHED POLICIES: Policies and procedures established by LOD which pertain to relations between LOD and Martin Co., CCMD, Picatinny Arsenal, DOFL, etc., will remain in full force. Changes thereto will be by mutual agreement between LOD and TE&F Laboratory.

3. LOD RESPONSIBILITY FOR PERSHING LAUNCH ACTIVITIES:

a. General: The Director, LOD will provide technical supervision, direction, and support necessary to launch PERSHING missiles until such time that TE&F Laboratory has acquired a capability to assume same. It is anticipated that TE&F Laboratory will have acquired a capability to assume the full responsibility for technical supervision and direction of PERSHING Launch Operations within the 2nd quarter of FY 62. However, TE&F will review their projected capability in January 1961 and notify LOD when they will assume complete responsibility, this assumption of responsibility being not before 1 July 1961.

b. Coordination with AMR: LOD shall perform all necessary coordination and liaison with AMR concerning PERSHING Launchings through the USAOMC Field Office at AMR (AMRAFO). However, in order that TE&F Laboratory be apprised of range coordination requirements and in order that a capability be established in this area, a TE&F designated representative will participate in these activities jointly with the LOD Project Coordinator until such time that TE&F Laboratory assumes complete responsibility.

c. Support by LOD (During Period LOD Retains Technical Supervision and Direction): LOD will provide the support necessary to launch PERSHING Missiles which includes but is not limited to the following:

(1) Preparation, check-out and launch of missiles.

(2) Operation of Hangar "D" Telemetry Station.

(3) Operation of UDOP & Beat-Beat Tracking Equipment.

(4) Provision of "Quick-Look" data including reproduction of tapes and preparation of oscillograms.

(5) Scheduling of all tests.

(6) Determination of the on-board equipment and range instrumentation required to meet the objectives of each missile launch. Publish these requirements in the form in the Instrumentation Plan (Part of the Firing Test Report). Martin furnishes one man-year to assist in this effort.

(7) Coordinate flight safety requirements.

(8) Collect data and photographic requirements and distribute gathered data and film in accordance with distribution coordinated with TE&F Laboratory.

(9) Process work orders and other facility change requests through USAOMC's delegated representative to AMR. Martin will furnish all the required engineering for each change request.

d. <u>Support by LOD (Subsequent to the Assumption of Technical Supervision and Direction by TE&F Laboratory)</u>: LOD will provide support to TE&F Laboratory after the assumption of technical supervision and control by TE&F which includes the following:

(1) Operate UDOP and Beat-Beat Tracking sites if required.

(2) Operate Hangar "D" telemetry station if required.

(3) Provide consulting services upon request. However, the availability of LOD personnel will determine the time and extent of the services provided.

(4) Perform accuracy checks on ST-120 platforms when requested.

(5) Support not explicitly covered herein but for which an unforeseen requirement arises. The availability of LOD personnel will determine the time and extent of services provided.

C O P Y

4. LOD RESPONSIBILITIES FOR REDSTONE LAUNCH ACTIVITIES:

a. General: The Director, LOD will provide technical supervision, direction, and support necessary to launch the remaining REDSTONE missiles at AMR.

b. Coordination with AMR: LOD shall perform all necessary coordination and liaison with AMR concerning REDSTONE launchings through the USAOMC Field Office at AMR (AMRAFO). However, in order that TE&F be apprised of range coordination requirements and in order that a capability be established in this area, a TE&F designated representative will participate in these activities jointly with the LOD project coordinator.

5. LOD RESPONSIBILITIES FOR JUPITER CTL LAUNCH ACTIVITIES: LOD responsibilities shall be in accordance with Memorandum of Agreement between U. S. Army Ballistic Missile Agency and Marshall Space Flight Center for support of the U. S. Air Force JUPITER Combat Training Launch Program, dated 23 May 1960. In addition, LOD shall train TE&F personnel (military, civilian, or contractor) who will be assigned to LOD by mutual agreement and who will be under the technical supervision and direction of LOD.

6. LOD RESPONSIBILITIES FOR JUPITER LST LAUNCH ACTIVITIES: LOD will provide technical supervision, direction, and support necessary for the JUPITER LST Launch Activities.

7. TRAINING OF TE&F PERSONNEL:

a. There will be a TE&F project engineer assigned for each ABMA project. TE&F project engineers will perform a dual function:

(1) Train under the direction and supervision of the corresponding LOD project engineer.

(2) Serve in TE&F Launch Branch, with responsibility (as contact point between TE&F and LOD) for coordinating all activities of an operational nature between TE&F and LOD.

b. Technical personnel of TE&F may be assigned to LOD for training under the technical supervision and direction of LOD.

/s/ William L. Grafton
WILLIAM L. GRAFTON, Director
Test, Eval & Firing Lab,
R&D Opns

/s/ Kurt H. Debus
KURT H. DEBUS, Director
Launch Operations Directorate

/s/ R. M. Hurst
R. M. HURST
Brigadier General, USA
Commander

VI

MEMORANDUM OF AGREEMENT ON PARTICIPATION OF THE 6555th TEST WING (DEV) IN THE CENTAUR R&D FLIGHT TEST PROGRAM

APRIL 18, 1961

C O P Y

April 18, 1961

MEMORANDUM OF AGREEMENT ON PARTICIPATION OF THE 6555th TEST WING (DEV) IN THE CENTAUR R&D FLIGHT TEST PROGRAM

I. PURPOSE:

To identify those portions and areas of the CENTAUR R&D Flight Test Program which are of concern to the 6555th Test Wing and jointly agree on the responsibilities and participation of the 6555th Test Wing, in order to:

1. Maintain integrity of the ATLAS booster,

2. Insure that vehicles and facilities are compatible with future military and civilian missions involving the CENTAUR vehicle,

3. And, still retain NASA's development and test prerogatives.

II. PROGRAM RESPONSIBILITIES:

NASA is responsible for the R&D phase of the CENTAUR Program. The Launch Operations Directorate has been designated by NASA to exercise launch responsibility for the 10 R&D Vehicles and for subsequent operational vehicles with NASA Spacecraft. 6555th Test Wing will exercise launch responsibility for operational CENTAUR Vehicles with DOD missions.

The present responsibility assignments and certain historical facts, as stated in the Addendum hereto, such as funding by DOD for certain CENTAUR facilities and joint use of contractors, establish areas of interest and participation by the 6555th Test Wing on which agreement is reached as indicated below.

III. AREAS OF INTEREST:

A. <u>ATLAS Booster</u>. The NASA is interested in the ATLAS booster as a tested, reliable launch platform for the CENTAUR stage. The Air Force has an identical interest and, in addition, is vitally interested in protecting the reputation and integrity of the ATLAS booster. The Air Force is also interested in minimizing undue procedural changes during the test program which would either affect booster integrity or complicate future Air Force use of the ATLAS/CENTAUR combination.

COPY

B. CENTAUR Stage. As indicated above, the development and initial test of this stage are NASA prerogatives. A NASA management organization is responsible for the conduct of this program. The DOD is vitally interested in the expeditious, successful prosecution of the program in order that the CENTAUR may be applied to critical areas of military necessity.

C. FACILITIES. NASA and the Air Force plan joint use of a large number of facilities in connection with the CENTAUR Program. Complex 36, to include Pads 36A and 36B, and Hangar H will be used initially by NASA and later by both NASA and the Air Force. Other facilities such as Hangars J and K will be shared by the CENTAUR, AGENA-B, MERCURY, and Air Force ATLAS Weapon Systems Programs contracted to Convair. (In this connection the Air Force has attempted to prevent redundancy in facilities by requiring maximum use of existing weapons system facilities in the prosecution of other programs such as CENTAUR, AGENA-B and MERCURY.)

IV. AREAS OF PARTICIPATION:

A. ATLAS Stage. The 10 vehicle CENTAUR test program will use the ATLAS D booster, generally accepted as a developed utility space booster, as a launch platform. The 6555th Test Wing will assign personnel, as necessary, for the supervision and direction of Convair's processing of these 10 boosters, while performing similar functions on other such boosters for the numerous programs using them. LOD will also monitor the processing and checkout of these boosters and, in some cases, may require additional or more rigid checkout procedures than are required by the Air Force. The 6555th Test Wing will integrate these requirements into the check-out process when requested by the LOD CENTAUR Group. During launch operations, an officer of the 6555th Test Wing will be made available as a consultant to the launch director.

B. CENTAUR Stage. In the interest of providing efficient and rapid application to military missions, the 6555th Test Wing will participate as follows: In the development of test and checkout procedures, for training purposes; in field modifications to the CENTAUR stage, as a matter of interest and education; and in test documentation, from the standpoint of coordination.

C. FACILITIES.

1. During the CENTAUR R&D Program LOD will be sole user of the CENTAUR facilities at AMR; therefore, LOD will

exercise management control of these facilities. Since these facilities will also be used by the 6555th Test Wing at some later date: (a) modifications to CENTAUR facilities and equipment will be performed only after appropriate coordination with the 6555th Test Wing, (b) modifications to ATLAS facilities and equipment will be performed only after appropriate concurrence with the 6555th Test Wing, and (c) normal or preventative maintenance, requests for facility modification, normally performed by agencies other than Convair, will be processed by LOD through the existing 6555th Test Wing channels.

2. All communications requirements will be coordinated by the CCMTA, NASA, CENTAUR Project Office and submitted to Convair for processing.

D. SECURITY.

1. Industrial security will be the responsibility of Convair; however, LOD will have the authority to badge personnel as required for access to Complex 36 and Hangar H. Requests for badging LOD personnel for Hangars J and K will be coordinated with Convair prior to submitting the badge request to PAA Security.

2. Access to a Complex during operations will be governed by a special access list approved by LOD.

V. PROCEDURES FOR HANDLING MATTERS OF JOINT CONCERN:

A. A NASA CENTAUR Project Office, to include 6555th Test Wing representation will be set up at CCMTA for:

1. Identifying joint problem areas and initiating action as appropriate for resolution.

2. Providing coordinated contractor direction on points of joint concern.

3. Coordinating and directing facility modifications.

4. Coordinating access to facilities used for more than one program through Convair Security Office.

B. The NASA CENTAUR Launch Operations Group will act as the prime mechanism for coordinating flight operations during the R&D flight test program. This group will be chaired by NASA, and the 6555th Test Wing will provide a member.

APPROVED:	APPROVED:
/s/ Kurt H. Debus KURT H. DEBUS Director Launch Operations Directorate Marshall Space Flight Center National Aeronautics and Space Administration	/s/ Paul R. Wignall PAUL R. WIGNALL Colonel USAF Commander 6555th Test Wing (Dev)

C O P Y

April 18, 1961

ADDENDUM TO
MEMORANDUM OF AGREEMENT ON PARTICIPATION OF THE 6555th TEST
WING (DEV) IN THE CENTAUR R&D FLIGHT TEST PROGRAM

Background History of CENTAUR Program

The development program for CENTAUR consists of a 10 vehicle flight test program. Unlike the ATLAS and SATURN development programs, where one agency initiated and developed a vehicle to fulfill its own needs, there has been continuous Air Force interest in the CENTAUR program since its conception. The program was conceived by ARDC and sponsored by the Air Force until it was adopted as a DOD project by the Advanced Research Projects Agency (ARPA). Subsequent to this, the program was managed for ARPA by the Air Force until it was transferred for development to the NASA. The Air Force has placed officers on loan to NASA for program management in order to maintain development continuity. The ATLAS/CENTAUR test facilities were built under Air Force direction with Department of Defense funds initially for unspecified launch vehicles, then for VEGA and CENTAUR, then CENTAUR only after cancellation of VEGA.

After development, this vehicle will be used by NASA for various space missions. Initially, the Air Force developed ATLAS will be used as a launching platform for the CENTAUR stage. Later it is expected that this stage will be combined with other boosters such as the NASA SATURN.

There is also considerable DOD interest in the CENTAUR development program since several military programs are presently projected to use the ATLAS/CENTAUR vehicle as a developed space booster system.

VII

TRANSFER OF PERSHING LAUNCH OPERATIONS RESPONSIBILITY FROM LOD TO TE&F LABORATORY

C O P Y

GEORGE C. MARSHALL SPACE FLIGHT CENTER
HUNTSVILLE, ALABAMA

MEMORANDUM

TO Distribution DATE June 2, 1961

FROM M-LOD-DIR
ORDAB-RT

SUBJECT Transfer of PERSHING Launch Operations Responsibility From NASA-LOD to ABMA, Test Evaluation and Firing Laboratory

REFERENCE: Memorandum of Understanding Between NASA Launch Operations Directorate and ABMA, Test Evaluation and Firing Laboratory, dated 15 May 1961, subject as above.

1. In accordance with the referenced Memorandum of Understanding, the responsibility for PERSHING Launch Operations at Cape Canaveral was transferred from Launch Operations Directorate, MSFC, to the Test Evaluation and Firing Laboratory, ABMA, on 19 May 1961. The details of this transfer are contained in the referenced Memorandum which is enclosed.

2. LOD will continue to support the PERSHING Program in the following major areas:

   a. Receive transmitted telemetry data, make playbacks, etc.; with the LOD Hangar D Telemeter Station in much the same manner as was done for PERSHING missiles in the past.

   b. Track PERSHING missiles with the LOD UDOP system.

   c. Perform laboratory checkouts of ST-120 platforms for approximately 20 platforms starting with Missile 308.

   d. Provide, on a non-interference basis, technical consultation services when requested by TE&F Laboratory.

   e. Provide minor support in the photographic, reproduction, and range safety areas on an emergency basis.

C O P Y

15 May 1961

MEMORANDUM OF UNDERSTANDING BETWEEN NASA
LAUNCH OPERATIONS DIRECTORATE AND ABMA,
TEST EVALUATION AND FIRING LABORATORY

SUBJECT: Transfer of PERSHING Launch Operations Responsibility from NASA-LOD to ABMA, Test Evaluation and Firing Laboratory

1. Reference: Memorandum of Agreement between the Army Ballistic Missile Agency and the NASA Marshall Space Flight Center, Support Requirements to be furnished by Launch Operations Directorate to Test, Evaluation and Firing Laboratory date 1 June 1960.

2. Time of Subject Transfer:

LOD will retain PERSHING Launch Operations responsibility through the completion of the launch operation for Missile No. 310 or until 1 July 1961, whichever is sooner. This date is known as T-Time. For missile operation No. 311, LOD personnel will be available on a standby basis for assistance and guidance to Test, Evaluation and Firing Laboratory personnel if requested. All Launch Operations for Missiles 311 and up will be the responsibility of TE&F Laboratory.

3. LOD Telemetry Ground Station Support:

LOD will provide telemetry support to PERSHING Launch Operations throughout the existing PERSHING I Program with the Hangar D Telemetry Ground Station in accordance with working agreement attached as Addendum 1.

4. UDOP Support:

Operation of downrange UDOP stations will be accomplished by the AFMTC Range Contractor. Uprange (Cape Canaveral Area) tracking will be accomplished by LOD throughout the existing PERSHING I Program in accordance with working agreement attached as Addendum 2.

5. Firing Sequencer:

LOD will continue to make available the sequencer located in Complex 56 as required for support of PERSHING I Operation.

6. Photographic Support:

LOD will honor requests on an emergency basis from Chief, AMR Branch, TE&F Lab for Photographic Support when it is deemed that such support is not readily available from the AFMTC Range Contractor.

7. Reproduction Support:

LOD will honor requests from Chief, AMR Branch, TE&F Lab for Reproduction Support on a non-interference basis. The TE&F Lab and Martin-Cocoa will develop the necessary capability in this area as soon as possible.

8. Battery Activation Facilities:

LOD will make available the Hangar D battery activation facilities for joint use by TE&F Lab until TE&F Lab can establish its own facilities.

9. Flight Instrumentation Planning:

LOD will provide PERSHING Flight Instrumentation Support after T-Time during the period that Hangar D Telemetry and UDOP support is required. Present Martin-Cocoa Engineering support will remain with LOD under TE&F Lab control.

10. Range Safety Support:

Until TE&F Lab has acquired the necessary capability, LOD will continue Range Safety Support after T-Time, assisting TE&F Lab in special AFMTC Range Safety problems. LOD will not be requested to provide continuing routine support.

11. Supply Support:

LOD will support TE&F Lab with common items (expendable type) on an emergency basis after T-Time (Item 2 above), when such items are not readily available from PAFB Supply Stocks. Nonexpendable items to be retained in the industrial area will be issued on a hand receipt basis when required by TE&F Laboratory.

12. ST-120 Checkout Support:

In accordance with a request from the G&C Division, MSFC, LOD will continue to perform laboratory checkouts of the ST-120 platforms for approximately 20 platforms starting with

Missile 308. The G&C Division will assist LOD in performing these checks when LOD manpower is heavily committed elsewhere. In the event laboratory checks of ST-120 platforms are required after 20 units, additional negotiations will be required. The first 20 units are now scheduled to be completed by 1 April 1962. All checkouts and data pertinent thereto will be accomplished on a time basis compatible with the missile work schedules furnished by the TE&F Laboratory.

13. Interim Storage Area for TE&F Lab:

LOD will provide storage space for TE&F Lab on request from Chief, AMR Branch, until such time as storage area is made available from AFMTC.

14. Teletype Service:

LOD and TE&F Lab will continue joint operation of teletype services as currently established. However, LOD and TE&F Lab will initiate action to provide separate facilities.

15. Hurricane Plan:

In the event of an impending hurricane, LOD will assist TE&F Lab in protecting their property in every way possible.

16. Files Transfer:

LOD agrees to retain current REDSTONE and PERSHING files until screened for transfer to TE&F Lab. Such file transfer action is to be completed 60 days after transfer date established in Paragraph 2 above.

17. LOD Technical Consultation Support:

LOD will provide, on a non-interference basis, technical consultation services when requested by TE&F Lab.

C O P Y

18. Agreement (referenced above) will continue to remain in effect except as modified by this Memorandum of Understanding.

/s/ Kurt H. Debus
KURT H. DEBUS
Director
Launch Operations
Directorate

/s/ William L. Grafton
WILLIAM L. GRAFTON
Director
Test, Evaluation and Firing
Laboratory

CONCURRENCE: /s/ Charles W. Parker Date 15 May 1961
CHARLES W. PARKER
Chief, AMR Branch
Test Evaluation and Firing Lab

C O P Y

WORKING AGREEMENT ON TELEMETER GROUND
STATION SUPPORT TO BE PROVIDED THE
TE&F LAB BY LOD AFTER T-TIME

1. The LOD Hangar D Telemeter Station will provide support throughout the existing PERSHING I Program. LOD will receive transmitted data, make playbacks, etc., in the same manner as they do presently but they will not check each measurement for proper function.

2. The responsibility for operation and maintenance of the Blockhouse 30 Telemeter Station, and on-board TM and RF equipment and associated check-out equipment will be transferred to the Test, Evaluation and Firing Laboratory at T-Time.

3. The Test, Evaluation and Firing Laboratory will designate a single point of contact (who may be a representative of the TE&F Laboratory or the Martin Company) for LOD TM personnel. This person, or his alternate, will be the only one authorized to request support by the LOD TM station except through scheduling. Requests for data received and processed by the TM station will be forwarded to the LOD Data Office.

4. LOD will receive open-loop telemetry and provide three sets of quick-look records on the plug-drop overall test and simulated flight test which will be distributed to Test, Evaluation and Firing Lab, Martin, and Picatinny Arsenal Field Engineering Unit. Playback records will be provided by LOD for all other overall tests. Six (6) sets of quick-look records plus two (2) copies of tapes will be provided for flight tests which will be distributed as follows by Test, Evaluation and Firing Lab (Cape).

	Oscillograms	Tapes
1. TE&F Lab (Cape)	1	
2. Martin-Cocoa	1	
3. Picatinny	1	
4. TE&F - Comp. Lab (Huntsville)	2	1
5. Martin-Orlando	1	1

C O P Y

5. Mr. White (LOD-UDOP) and Mr. McMath (LOD-Telemetry) will be members of the Test, Evaluation and Firing Laboratory Scheduling Committee and will attempt to work out schedule conflicts with Test, Evaluation and Firing Laboratory and Martin personnel. Scheduling conflicts which cannot be resolved in the aforementioned scheduling committee will be resolved by the LOD Scheduling Committee and Mr. Charles Parker, Chief, AMR Branch, Test, Evaluation and Firing Laboratory, Mr. Parker, or his designated representatives, will attend the AMR Scheduling Meeting on Thursday of each week to assist in the resolution of any conflicts which may develop in this meeting.

Addendum 1

C O P Y

WORKING AGREEMENT ON UDOP SUPPORT
TO BE PROVIDED BY LOD AFTER T-TIME

1. LOD will support the existing PERSHING I Program as in the present manner with the LOD UDOP System. LOD will operate and maintain all stations including those stations in Blockhouse 30 and Central Control.

2. All on-board UDOP equipment and transponder checkout equipment will be the responsibility of the TE&F Laboratory after T-Time.

3. The TE&F Laboratory will designate a single point of contact (who may be a representative of the TE&F Laboratory or the Martin Company) for LOD UDOP personnel. The person so designated will become thoroughly familiar with the UDOP ground equipment used for PERSHING and will be the recipient of all information regarding the status of the equipment and possible failures. This individual together with other members of the TE&F Laboratory will make the Go-No-Go decision if any part of the UDOP System is inoperative.

4. Mr. White (LOD-UDOP) and Mr. McMath (LOD-Telemetry) will be members of the TE&F Laboratory Scheduling Committee and will attempt to work out schedule conflicts with TE&F Laboratory and Martin personnel. Scheduling conflicts which cannot be resolved in the aforementioned scheduling committee will be resolved by the LOD Scheduling Committee and Mr. Charles Parker, Chief, AMR Branch TE&F Laboratory. Mr. Parker, or his designated representative, will attend the AMR Scheduling Meeting on Thursday of each week to assist in the resolution of any conflicts which may develop in this meeting.

Addendum 2

VIII

RANGE USE AND SUPPORT AGREEMENT BETWEEN LOD AND AFMTC

17 JULY 1961

C O P Y

RANGE USE AND SUPPORT AGREEMENT BETWEEN THE LAUNCH OPERATIONS DIRECTORATE, GEORGE C. MARSHALL SPACE FLIGHT CENTER, NASA, AND THE AIR FORCE MISSILE TEST CENTER, AIR FORCE SYSTEMS COMMAND, USAF, AT PATRICK AIR FORCE BASE, FLORIDA.

1. PURPOSE. This agreement describes the relationship between Air Force Missile Test Center (CENTER) and the Launch Operations Directorate (LOD) as they concern the provisions of facilities and services to LOD, other National Aeronautics and Space Administration activities and related agencies and contractors at the Atlantic Missile Range. Additionally, this agreement describes procedures by which NASA requirements for services, facilities and support will be transmitted to the Center. Finally, this agreement is to promote optimum achievement of support objectives consistent with maximum efficiency and economy.

2. REFERENCES:

a. Public Law 60, 81st Congress, Act of 11 May 1949, which authorizes establishment of a joint long-range proving ground for guided missiles, and for other purposes.

b. Public Law 85-568, National Aeronautics and Space Act of 1958.

c. Air Force Regulation 172-3, Host-Tenant Relationships, dated 10 June 1960.

d. NASA Management Manual, Part I, Number 2-2-9, dated 1 July 1960, signed by Dr. Glennan, NASA Administrator, which delegates to the Director, LOD, authority to deal with the Atlantic Missile Range and Pacific Missile Range.

e. Air Force Regulation 70-4, 5 December 1960, Air Force NASA Agreement.

f. Air Force Regulation 80-37, as amended, Air Force Aircraft Furnished the NASA, 19 August 1958.

g. DOD memoranda on the following subjects:

(1) Policy, Ranges and Space Ground Support, dated 8 June 1960.

(2) Coordination with National Missile Ranges, dated 14 August 1960.

(3) Policy, Missile and Space Vehicle Flight Safety, dated 21 November 1960.

(4) National Range Planning and Related Funding Policy, dated 19 January 1961.

h. Overall Plan - Department of Defense Support to Project MERCURY Operations, 15 January 1960.

3. DEFINITIONS:

a. Test Direction is the direction by a Range User over the execution of test programs including the determination of test programs, preparation of test articles, pursuance of article tests, the evaluation of test data, reporting of test results, and reorientation of test program based on these evaluations.

b. Test Control is the control exercised by the Center with respect to test scheduling, range safety and readiness of the Center to support a test program.

c. Common-Servicing refers to functions performed by the Center in support of Range Users for which reimbursement is not required.

d. Cross-Servicing refers to functions performed by the Center in support of Range Users for which reimbursement is required.

e. Joint-Use refers to facilities, services, systems and equipments maintained and operated for the use or benefit of two or more Range Users.

f. Single-Use refers to facilities, services, systems and equipments maintained and operated for the exclusive use or benefit, and to meet special or unique requirements, of a single Range User.

g. Facilities are divided into three categories: Support, DOD furnished mission, and NASA furnished mission. "Support facilities" means land utility systems, office buildings and the like which though made available to LOD are not peculiar to their needs. "DOD furnished mission facilities" means property other than land originally belonging to the Air Force but which is unique to the needs of LOD. "NASA furnished mission facilities" means property other than land originally belonging to NASA and which is unique to the program needs of LOD.

h. Services are administrative, technical or professional support by the Center. Excludes supplies and materials issued directly to LOD for its use.

i. Utility Systems are electric power, administrative communications, transportation and similar systems.

4. RESPONSIBILITIES OF THE LAUNCH OPERATIONS DIRECTORATE.

a. Provide the NASA single point-of-contact with the Center.

b. Exercise overall launch direction and test direction of assigned programs, whether performed by LOD or other agencies or contractors authorized by NASA.

C. Request necessary support from the Center. Furnish a current list of individuals authorized to authenticate requests.

d. Submit NASA test schedules and support requirements to the Center. Coordinate on Center Program Support Plans for adequacy in meeting test objectives.

e. Procure and operate equipment to be tested, integral, special purpose or related instrumentation, special ground support equipment, supplies, and special purpose vehicles peculiar to the test and not normally furnished by the Center in accordance with Ref 2g(4). Title and rights to this equipment funded or provided by NASA shall remain in NASA.

f. Establish and provide security requirements, restrictions, and safeguards pertaining to NASA operations and enforce those security regulations and orders established by the Center Security Program which are necessary to safeguard Center operations.

g. Reimburse the Center for costs which are reimbursable under this agreement on receipt of billing on Standard Form 1080.

h. Budget for NASA requirements for which LOD is required to reimburse the Center.

i. Supervise the operation of Center vehicles assigned to LOD, in accordance with Center procedures.

j. Classify, and transfer surplus property to the Center for disposal in accordance with Paragraph 6, 1.

k. Return, in the same condition as received except for normal wear and tear, Center property loaned to LOD.

l. Loan LOD property to the Center, as required in connection with LOD programs, or other programs by mutual agreement.

m. Coordinate NASA activities with the Center ground safety program.

n. Provide for and implement precautionary measures prescribed in the Hurricane Plan.

o. Prepare and release public information pertaining to NASA missions and operations. Public information which may reflect adversely on the Center will be coordinated with the Center Director of Information prior to release.

p. Furnish the Center with available LOD data required by the Center Commander to support the operations of LOD.

q. Provide the Center with future planning data and estimates sufficient to enable the Center to provide adequate and timely support. When sufficient time is not available for the Center to provide support, or when it is determined by NASA to be more advantageous, LOD will provide general equipment and supporting services for NASA operations.

r. Control the internal assignment and use of single-use DOD furnished mission facilities and support facilities assigned to LOD. Provisions of paragraph 6f apply to assignment, use, and reassignment of such items.

s. Develop criteria for design and construct new NASA furnished mission facilities at the Center. Proposed site plans and specifications will be submitted for review by the Center prior to project advertising. This review will be limited to insuring compatibility of the planned facility with Center plans for development of the AMR and conformance with minimum USAF construction standards. If requested by NASA, the Center will provide design and construction services on a cross-servicing basis. Design release and directives to the construction agency will be made by NASA. Upon completion of construction, the facility will be incorporated in the Center Real Property Accountability Records. (LOD may be represented at all general meetings of the Center Facilities Utilization Board).

t. Alter, relocate or modify DOD and NASA furnished mission facilities. Inform the Center of modifications, alterations, and relocations.

u. Be responsible for labor relations in all NASA activities and keep the Center informed of NASA policies and practices relating thereto.

v. Receive, process and act as host for visitors from other than NASA organizations of high position in the Government (members of Congress, Executive Branch personnel of Cabinet rank, Ambassadors and foreign visitors of equivalent rank) who desire briefings, tours, etc. on NASA projects or areas only. The Commander, AFMTC, will be notified, and unless the visit concerns an internal NASA matter exclusively, will participate as co-host. Important visitors who desire to visit NASA and Air Force operations or areas simultaneously will be received by the Commander, AFMTC, and the Director, LOD, as co-hosts. The details of the visit will be handled by the AFMTC Staff Secretariat. If information concerning the visit is received by LOD, it will be forwarded to the Staff Secretariat for action. LOD Protocol Staff will be notified, if information is received by the AFMTC.

w. Receive, process (including security clearance, when necessary) and act as host for non-VIP NASA officials, employees, consultants and contractors visiting NASA facilities. The NASA contact point, the LOD Protocol Staff, will be responsible for briefings, tours, billeting and transportation as requested by the visitors. Other visitors to NASA will be handled in accordance with Center visitor control procedures.

x. Provide range safety devices which will be installed in LOD space vehicles or systems in accordance with Center Range Safety policies and procedures.

y. Settle and pay claims for property damage or personal injury resulting from NASA activities.

z. Brief visiting dignitaries on NASA programs when LOD decides that the standard Center briefing will not suffice.

5. PROJECT MERCURY OPERATIONS. Original agreements concerning Department of Defense support to MERCURY Operations are contained in a document entitled "Overall Plan - Department of Defense Support for Project MERCURY Operations", dated 15 January 1960. This plan, with subsequent modifications, will be used for support of the MERCURY program through all currently scheduled flights.

Subsequent extensions or follow-on programs will be subject to later negotiations.

6. RESPONSIBILITIES OF THE AIR FORCE MISSILE TEST CENTER.

a. Exercise test control in the pursuance of LOD tests.

b. Prepare and implement Center plans in support of established LOD requirements.

c. Prepare Center Operational Directives in support of established LOD requirements and implement in accordance with Center range scheduling procedures.

d. As mutually agreed, maintain facilities upon completion or installation and operate and maintain instrumentation and equipment funded or provided by LOD and not an integral part of the launch vehicle or aerospace system.

e. Provide LOD with applicable Center regulations, orders and instructions.

f. Assign to LOD, DOD furnished mission facilities and support facilities needed for the accomplishment of NASA activities. NASA will have exclusive use of any single-use NASA furnished mission facilities. Upon termination of use by NASA, the facility and integral equipment will be made available to the Center for use without reimbursement. Should NASA have a requirement for use of the same facility, or a similar facility, at a later date, the Center will assign the same facility, or a similar facility, or an acceptable existing facility should such be available. If such a facility is not available, a new facility will be provided in accordance with Ref 2c.

g. Control the use, access and security of facilities used jointly by LOD and the Center as mutually agreed.

h. Include LOD security requirements in the Center security program not to include LOD's special and internal administrative security. Provide -- on a reimbursable basis -- security guards, not otherwise normally furnished, as LOD may request. (Responsibility for industrial security is established by the agreement between the Secretary of Defense and the Administrator of NASA, dated 9 June 1959.)

C O P Y

i. Advise LOD of the Center's policies and procedures required to insure efficient and economical planning and use of Center facilities and services.

j. Assist in the processing of civilian personnel on request by LOD, as mutually agreed.

k. Provide, as available and appropriate, general and special purpose vehicles and equipment to support LOD activities.

l. Dispose of surplus property in accordance with Federal Law, on a cross-servicing basis. It is agreed that the proceeds from disposal of such property shall be treated in all cases as equal to the Center's cost in effecting disposal and shall constitute full reimbursement to the Center of such cost.

m. Return, in the same condition as received except for normal wear and tear, LOD property loaned to the Center.

n. Include LOD in the Center Ground Safety Program (accident and exposure summaries of LOD will not be consolidated with those of the Center.)

o. Be responsible for normal fire prevention and inspections, including maintenance and testing of related equipment and structures.

p. Prepare the Center Hurricane Plan and make adequate provision for LOD therein.

q. Assist in the LOD public information program on request by LOD to the extent of Center capability.

r. Store explosives and similar hazardous materials.

s. Provide support to NASA aircraft in accordance with the regulation cited in paragraph 2f.

t. Make provisions for support of NASA programs in the Center's long range planning. In this regard, an observer from LOD may participate in meetings of the Facilities Utilization Board and will be furnished copies of notices and information on actions concerning LOD activities.

u. Advise LOD of Center labor relations policies and procedures.

v. Provide base housing for NASA personnel on the same basis as for other personnel at the Center.

w. Provide emergency medical services for NASA personnel on the same basis as for other personnel at the Center.

x. Be responsible for missile and space vehicle flight safety in accordance with Ref 2g (3) or as otherwise directed by higher authority.

y. Furnish base-level claims service on the same basis as for other Range Users, including conduct of claims investigations and preparation of claims officer's report.

z. Provide Purchasing and Contracting services as requested by LOD.

aa. Coordinate with NASA release of information which might reflect adversely on NASA operations.

ab. Prepare and present to visiting dignitaries a standard briefing pertaining to operations of the AMR. Briefing will conform to a standard format and the briefing script on NASA programs will be coordinated in advance with the appropriate NASA offices.

7. <u>BUDGET/FUNDING POLICY</u>. The following basic budget and funding policies apply:

a. The AMR configuration, its facilities and services, and assets in place, or Center funded at the time a LOD program is assigned, will be made available to LOD on a common-service basis, according to priority precedence of NASA programs.

b. The Center will budget and fund for the procurement, installation, operation and maintenance of joint-use range facilities, instrumentation, equipment and systems required for LOD programs, provided that time permits normal budgeting to be effected.

c. LOD will budget and fund for the procurement and installation of single-use instrumentation, equipment, facilities or systems. The operation and maintenance of single-use instrumentation or facilities will be provided on a common service basis, except when such requirements are placed on the Center too late to be budgeted for by the Center, and cannot be provided within USAF funds and resources. LOD will fund the costs until such time that budgeting can be effected.

d. Within the framework of the above basic policies, and consistent with applicable references in paragraph 2, the Center and LOD agree to the following:

(1) The Center will budget and fund for normal base logistic support to LOD.

(2) The Center will budget and fund for instrumentation, plant development, and related research and development programs required to maintain instrumentation capabilities current with anticipated requirements.

(3) Range overtime scheduled primarily for the convenience or because of technical difficulties of LOD will be provided on a cross-servicing basis. Overtime required because of valid technical program objectives will be provided on a common-service basis.

(4) The Center will furnish supplies and equipment on a cross-servicing basis when requested by LOD.

(5) Reduction of technical data collected by the Range will be provided as a common-service. Reduction of data collected by other sources will be provided without reimbursement if facilities permit on a non-interference basis.

(6) Photographic services requested by LOD will be provided as a common service.

(7) Recovery services to locate and retrieve components, reentry bodies and instrumentation packages will be provided as a common service within Range capabilities. In the event LOD requires recovery services beyond normal Range capability, the Center will obtain the necessary assistance, the costs to be borne by LOD.

(8) Flight safety will be provided as a common-service in accordance with Ref 2g(3) or as directed by higher authority. Range safety devices installed in a LOD system are the funding responsibility of LOD.

(9) The Center will provide weather services in support of launch operations.

(10) Joint-use Range communications will be provided as a common service. Single-use communications will be provided on a cross-servicing basis. Other communications services will be provided in accordance with the regulation cited in paragraph 2c, or as directed by higher authority.

(11) Organizational and field maintenance of LOD ground support equipment will be provided, as requested by LOD, on a cross-servicing basis.

(12) Satellite tracking after injection into final orbit will be provided as a common service within Center capability.

(13) Items of local procurement requested by LOD will be furnished on a cross-servicing basis.

(14) The Center Commander may waive requirements for reimbursement when considered appropriate and consistent with DOD policy.

8. EFFECTIVE DATE. The terms of this agreement shall become effective upon signature by the Commander, Air Force Missile Test Center, and Director, Launch Operations Directorate. This agreement may be changed or revised by mutual consent. Such changes will be accomplished by written amendments hereto.

/s/ Kurt H. Debus
KURT H. DEBUS
Director, LOD

17 July 1961
DATE

/s/ L. I. Davis
L. I. DAVIS, Major General
Commander, AFMTC

17 July 1961
DATE

LX

AGREEMENT BETWEEN DOD AND NASA RELATING TO

THE LAUNCH SITE FOR THE MANNED LUNAR LANDING PROGRAM

AUGUST 24, 1961

C O P Y

FOR OFFICIAL USE ONLY

AGREEMENT
Between DOD and NASA Relating to
The Launch Site for the Manned Lunar Landing Program

To accomplish Manned Lunar Landing at an early date, new major launch facilities are required, and these facilities are important items in fixing the rate at which the program can proceed. It is in the national interest that the Department of Defense and NASA pool their resources in a manner which makes effective use of the services and facilities of the Atlantic Missile Range.

In the past, the burden of expansion of range capabilities had been assumed by the Department of Defense under its obligation to operate the Atlantic Missile Range as a national asset for all users. New mission facilities which are peculiar to a given program such as launch pads, blockhouses, and assembly buildings have been provided by the agencies sponsoring the missile or space vehicle program.

It is recognized that the Manned Lunar Landing Program, because of the overall magnitude of the project, has a great impact on the Atlantic Missile Range. A large parcel of land is to be acquired that is undeveloped and needs basic improvements such as roads and utilities. The agreed roles and responsibilities of the Department of Defense and the National Aeronautics and Space Administration in their range-operator/range-user relationship at the Atlantic Missile Range will be continued, unless changed by mutual agreement.

It is agreed that:

(1) The launch site will be operated as a joint DOD/NASA venture under one manager in order to prevent duplication and promote efficiency.

(2) NASA will seek appropriations for the land acquisition. NASA will purchase the land using the services of the Corps of Engineers.

(3) NASA will seek appropriations for all improvements, facilities, and equipment as it may require on all of the land referred to under (2) above.

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(4) NASA will be responsible for the design, construction, and operation of all mission facilities and equipment for NASA programs.

(5) NASA will seek appropriations for the providing of all mission and range support facilities and equipment as are required solely for the Manned Lunar Landing Program, irrespective of their location and their use.

(6) A single agency will manage and direct all range operations to include range safety, launch scheduling, and the provision of range operations services. The Department of the Air Force is assigned this management responsibility. This excludes technical test control of NASA launch operations for which NASA will be responsible.

(7) As agent for NASA, the Department of the Air Force will: (a) Prepare and maintain a master plan of all facilities on the new site, to include the selection of sites for mission and range support facilities. NASA will be represented on the Master Planning Board. (b) Prepare design criteria for all land improvements and range support facilities subject to NASA approval; and arrange for the construction thereof. (c) Design, develop, and procure all communications, range instrumentation, and range support equipment required in support of NASA at or near the launch area.

(8) The DOD will make available existing DOD facilities for use by NASA in accord with the present agreement for the use of such facilities at Cape Canaveral by DOD and other agencies. Similarly, NASA will make available to DOD all facilities at the new site which have a common utility.

(9) The DOD will provide at Cape Canaveral and along the Atlantic Missile Range such facilities and equipment required for the common use of DOD and NASA. When provided, these will be available for use by NASA in accord with present agreement for the use of such facilities of the Atlantic Missile Range by DOD and other agencies.

(10) NASA will defray the costs of all operation and maintenance at the new site. DOD will defray the operation and maintenance cost at Cape Canaveral in accordance with existing arrangements for the common use of the installation including the Atlantic Missile Range. The cost of operation and maintenance of any part of the Atlantic Missile Range which is solely required for the Manned Lunar Landing Program will be defrayed by NASA.

C O P Y

(11) NASA will make available to the DOD such amounts as may be required to defray the cost of operation and maintenance incurred under this joint venture and chargeable to NASA in accordance with the terms of this agreement:

/s/ ROSWELL GILPATRIC Department of Defense August 24, 1961	/s/ JAMES E. WEBB National Aeronautics and Space Administration August 24, 1961

X

MSFC-LOC SEPARATION AGREEMENT

JUNE 8, 1962

Appendix A - NASA Circular No. 208, March 7, 1962
Appendix B - Discussion Draft, June 1, 1962, Subject: "Basic Concepts for Operation of the LOC at AMR."
Appendix C - Distribution of Personnel Spaces, FY 1962

C O P Y

MSFC-LOC SEPARATION AGREEMENT

June 8, 1962

/s/ Eberhard F. M. Rees
FOR
Wernher von Braun
Director
Marshall Space Flight Center

/s/ Kurt H. Debus
KURT H. DEBUS
Director
Launch Operations Center

C O P Y

MSFC-LOC SEPARATION AGREEMENT

June 8, 1962

INDEX

C O P Y

Index (continued)

* Historian's Note: Although listed in the index, this chart was not included in the Appendix.

C O P Y

SECTION I

Introduction

NASA Circular 208, dated March 7, 1962, (Appendix A) discontinued the Launch Operations Directorate of Marshall Space Flight Center, and established both the Launch Operations Center as a new independent field installation of NASA, and the Launch Vehicle Operations Division as a new division of the MSFC. Effective July 1, 1962, certain resources, activities, and responsibilities of MSFC shall be transferred to the new LOC. This agreement summarizes that transfer and the subsequent relationship between MSFC and LOC. The relationship is established on an interim basis pending finalization of basic operational concepts and missions of LOC and is predicated on similar relationships existing between LOC and other NASA Centers utilizing the Atlantic Missile Range. The June 1,,1962 draft "Basic Concepts for the Operation of the Launch Operations Center at the Atlantic Missile Range" (Appendix B) serves as the basic guideline for the functional division of MSFC and LOC although changes to this document are being recommended by both MSFC and LOC. The recommended changes will not affect the planned separation.

A series of detailed MSFC-LOC Separation Plans covering

Introduction (continued)

each of the areas discussed in this Agreement have been prepared and shall form the basis for implementing the separation (reference MSFC-LOC Separation Plans, May 25, 1962, M-DEP-R&D). Action responsibilities and dates are designated therein. Although July 1, 1962, is the effective date of the transfer, MSFC will phase out its support of LOC as LOC attains a self-supporting status.

The Director, LOD, is authorized to utilize LVOD personnel on an interim basis in executing the missions of LOC.

Supporting services between Centers are offered on a non-reimbursable basis unless specifically stated otherwise.

Organization and Missions

The LOC and LVOD organization and missions as stated below and as shown on the charts on the following pages are established on an interim basis pending final resolution of the LOC organization and missions.

The Launch Operations Center at AMR will serve as the central NASA activity at AMR with general responsibility for all phases of NASA launch operations, including serving as the NASA point of coordination for preparation and submission of all requirements for launch support and for the negotiations with AMR to fulfill such requirements. (See Chart 1 for planned organization chart.)

The Launch Vehicle Operations Division, MSFC, will serve as the MSFC activity with responsibility for all phases of MSFC launch operations activities at LOC, in coordination with other MSFC divisions, LOD and NASA Centers, including stage related:

a. Launch vehicle operations planning and scheduling

b. Pre-flight preparation and checkout

c. Pad countdown

d. Flight control operations

C O P Y

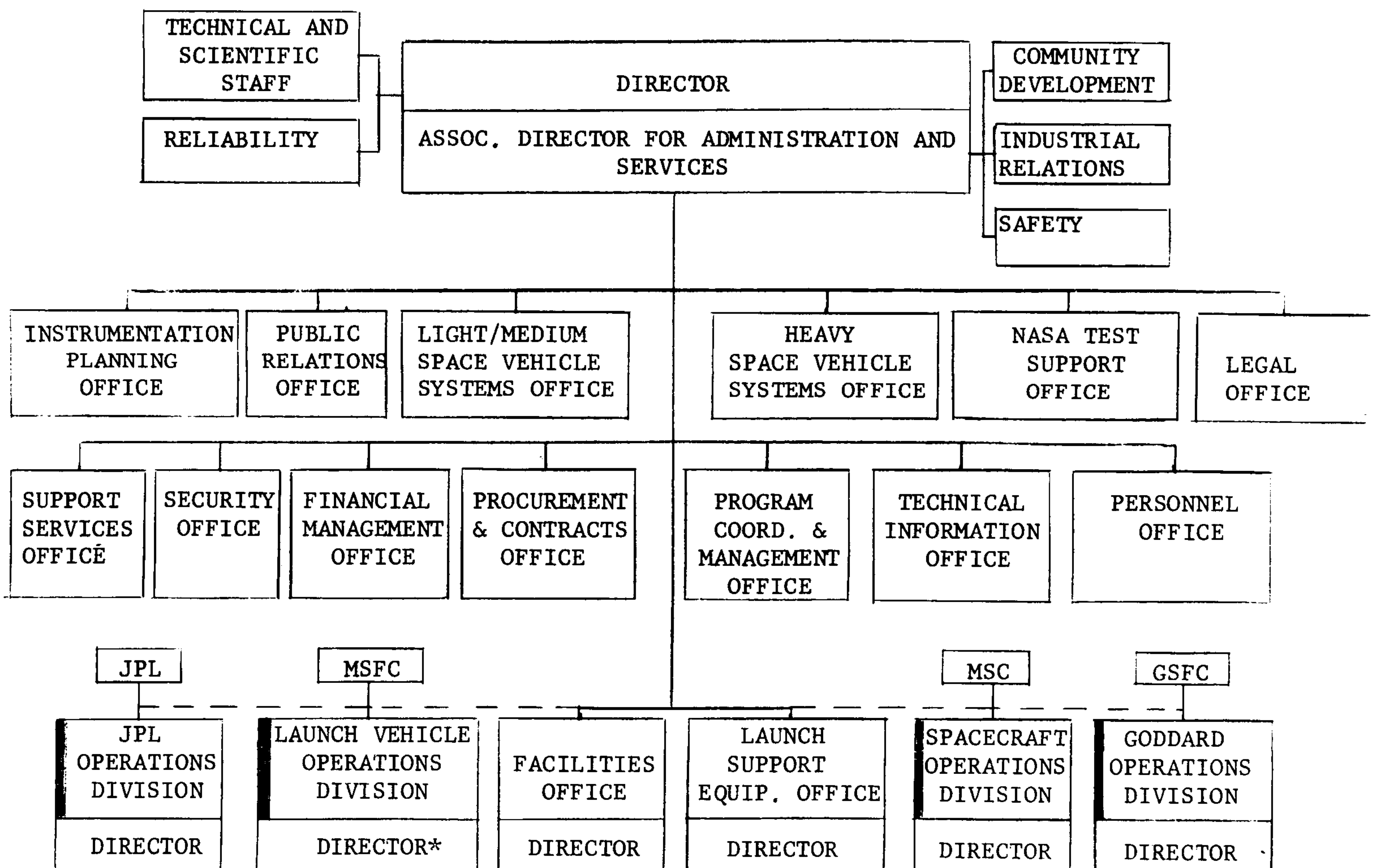
Organization and Missions (continued)

In addition, LVOD will provide tracking and data acquisition instrumentation during launch operations for MSFC, LOC and other NASA Centers are required. (See Chart 2 for planned organization chart.)

COPY

CHART 1

LAUNCH OPERATIONS CENTER

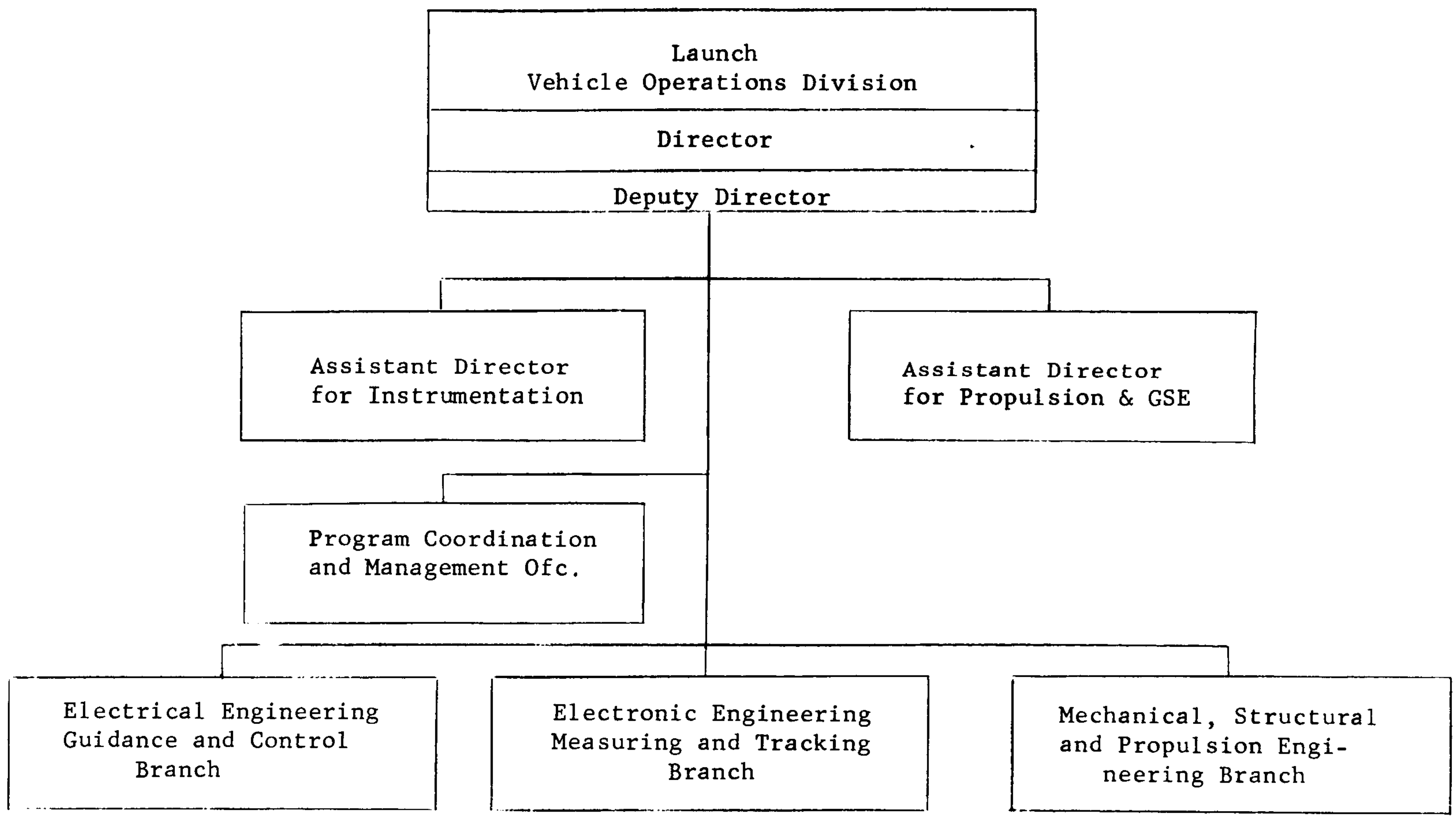


* DIRECTOR OF LOC ALSO SERVES AS DIVISION DIRECTOR

PLANNING ONLY

COPY

CHART 2
INTERIM MSFC LVOD ORGANIZATION



C O P Y

Summary of NASA Basic Concepts Document

The following is a summary of the June 1, 1962 draft of "Basic Concepts for the Operation of the Launch Operations Center at the Atlantic Missile Range." (Appendix B) The concepts listed therein are not final but represent the current status of basic guidelines being followed in accomplishing the separation of LOC from MSFC.

The NASA Launch Operations Center is responsible for the overall planning and supervision of the operational integration, checkout and launch of space flight vehicle systems at the AMR. This responsibility pertains to all NASA projects with the exception of Mercury and such elements of the Gemini Project as may be excluded by agreements between NASA and the Department of Defense.

The Launch Operations Center will provide a single point at the AMR for range support required at AMR for NASA projects. The LOC will provide administrative and technical support, and facilities to the extent such facilities are not provided by AMR in accordance with existing NASA-DOD agreements.

Vehicle and spacecraft development centers with elements located at AMR will retain responsibility for preparation and readiness of vehicle and spacecraft for launch.

C O P Y

SECTION II

Automatic Data Processing

MSFC will continue rental of computers at LOC until new computers are installed in August. At that time LOC will contract for computers in the non-scientific ADP field and MSFC will contract for scientific computers.

General Electric computation personnel at LOC will continue under contract with MSFC until contract expiration in September, 1962. At that time MSFC will contract for personnel required for scientific computation services and LOC will contract for personnel required for non-scientific computation services at Cape Canaveral.

LOC will support MSFC non-scientific computation requirements in the Cape Canaveral area, and MSFC will support LOC requirements for both scientific and non-scientific computation in the Huntsville area.

C O P Y

Communication Services

MSFC provides communication services for LOD. These services include communications circuits, frequency management, and lease of radio equipment. Following the separation of LOC, July 1, 1962, these services will be provided in the following manner:

a. LOC will assume responsibility for all communication circuits desired by LOC. This will include leasing the circuits and terminal facilities at all terminals.

b. MSFC will assume responsibility for all communication circuits desired by MSFC. This will include leasing the circuits and terminal facilities at all terminals.

c. Requirements by either LOC or MSFC will be coordinated with the other Center to avoid duplication.

d. LOC will assume responsibility for all radio equipment located at LOC.

e. LOC will assume responsibility for frequency management of LOC operational equipment.

Equipment and Supplies

The transfer of equipment and supplies from MSFC to LOC will be without reimbursement.

a. Non-expendable equipment in the separate account of LOD will be transferred to LOC July 1, 1962, by means of a certificate of transfer of property accountability and responsibility.

b. Expendable supplies and materials in the inventory account of LOD will be transferred to LOC July 1, 1962, by means of a certificate of transfer of property accountability and responsibility.

Following the separation of LOC, supply services will be provided in the following manner:

a. Dues-in equipment and supplies on order and marked for direct delivery to LOC will continue to be administered by MSFC until all dues-in are received and paper work is completed.

b. Equipment purchased by MSFC after July 1, 1962, and located at LOC will be maintained on the property books of LOC and will reflect MSFC ownership.

c. Equipment purchased by LOC after July 1, 1962, and located at MSFC, Huntsville, will be maintained on the property books of MSFC and will reflect LOC ownership.

COPY

Equipment and Supplies (continued)

d. MSFC will furnish LOC organization elements located at MSFC, Huntsville, required expendable supplies and materials on a non-reimbursable basis.

e. LOC will furnish MSFC organizational elements located at AMR required expendable supplies and materials on a non-reimbursable basis.

C O P Y

Facilities

MSFC shall be responsible for providing all facilities required by LOC in the Huntsville Area. LOC shall be responsible for providing all facilities required by MSFC in the AMR area.

MSFC will provide LOC with requirements for technical facilities as well as design criteria determined by launch vehicle requirements. LOC will prepare final design criteria and will direct design and construction for all project related facilities at AMR. MSFC will participate in facility planning and will review design criteria insofar as these affect MSFC systems.

Finance

Internal Review

LOC has been operating and will continue to operate an Internal Review Program after separation has been completed.

Budget and Programming

LOC will be responsible for programming, budgeting for and financing all institutional support activities at AMR. MSFC will be responsible for programming, budgeting for and financing the personal services and travel costs of MSFC personnel assigned to the Cape.

LOC will program and budget for all project related facilities at AMR and for those R&D projects for which LOC is assigned management control. MSFC will make its facilities requirements known to LOC in time for incorporation in the LOC Budget. Authorized funds will be allotted to LOC for project execution. MSFC will program and budget for all R&D projects for which it is assigned project management control. Authorized funds will be allotted to MSFC for project execution.

Requests for special R&D and C of F project accomplishment

C O P Y

Budget and Programming (continued)

by LOC for MSFC, not specifically budgeted for by LOC, will be initiated by MSFC issuing a written work request and issuing a sub-allotment of funds for such accomplishment.

Division of Funds

NASA Headquarters is determining the appropriate division of Funds for FY 1963, in accordance with the missions assigned to MSFC and to LOC. (A determination will be made during MSFC's year end review of those FY 1962 or prior years' funds which must be transferred to LOC for continuation by LOC of projects previously initiated by MSFC.)

Other Functions

LOC will assume the responsibility for funding, costing and reimbursing for military personnel assigned to LOC. MSFC will notify NASA Headquarters to bill LOC after July 1, 1962.

Open Customers Orders (Work) will be transferred to LOC. MSFC will notify customers of change.

MSFC will notify NASA Headquarters to transfer through Treasury the $5,000.00 Imprest Fund presently in operation at LOD.

C O P Y

Other Functions (continued)

Each Center will service the other with regard to travel (TDY) for those personnel with a duty station at the other Center. This will be funded by each Center issuing a sub-allotment of funds to the other.

Each Center will provide payroll services and labor costing for all NASA personnel stationed in its geographical area, in accordance with NASA Headquarters' instructions.

Maintenance

Following the separation of LOC, LOC will provide maintenance services at AMR for buildings, structures, grounds, utilities, motor vehicles, materials handling equipment, office machines, and reproduction equipment.

MSFC will furnish LOC information required to enable LOC to budget and program for the above services for MSFC organizational elements located at AMR.

Maintenance of Instrumentation and Ground Support Equipment at AMR is a responsibility of LOC. Maintenance facilities of the Air Force and Range Contractors at AMR will be utilized as much as possible. Maintenance of Instrumentation and Ground Support Equipment at Huntsville is a responsibility of MSFC.

Maintenance contracts for MSFC elements located at AMR will be funded and administered by LOC for maintenance of individual items or categories of equipment that cannot be performed by the Air Force or Range Contractors.

Maintenance contracts for LOC elements located at MSFC, Huntsville, will be funded and administered by MSFC for maintenance of individual items or categories of equipment that cannot be performed in-house or by existing contract.

C O P Y

Personnel Administration

MSFC shall provide personnel services including recruitment, placement, clsssification, employee relations, training program, etc., for LOC personnel located in the Huntsville area. LOC shall provide similar personnel services for MSFC personnel located in the Cape Canaveral area. MSFC and LOC shall retain responsibility to insure that the full scope of personnel program services are provided to their employees located at the other's facility.

Personnel files for MSFC personnel stationed at LOC will be transferred to LOC (when LOC Personnel Office is operational) and files of LOC personnel stationed at MSFC will remain with MSFC, with alternate "dummy files" being maintained at the home center.

The MSFC Personnel Office will provide personnel support to LOC until the LOC Personnel Office is sufficiently staffed to assume activities.

Individual personnel are being assigned to LOC or MSFC according to function in accordance with the organizational functions previously discussed. A complete listing of individual assignments will be made by June 11, 1962, and transfer of personnel will be effective July 1, 1962.

C O P Y

Division of Personnel Spaces

Division of FY '62 personnel spaces shall be made as of July 1, 1962, in accordance with the following:

LOC	375	
MSFC	286	
PLOO	5	
	666	Total*

FY '62 summer employee personnel spaces shall be divided as follows:

LOC	14	
MSFC	19	
PLOO	3	
	36	Total

Division of FY '63 personnel spaces which were included in the MSFC budget submission for LOD requirements shall be determined when the final appropriation is made. This budget submission was made prior to the creation of LOC and does not reflect actual personnel requirements of the combined LOC and LVOD. The following is a division of the FY '63

* See Appendix C for detailed breakdown.

C O P Y

Division of Personnel Spaces (continued)

submission, for information only, based on the percentage division of FY '62 spaces:

LOC	462	
MSFC	361	
PLOO	5	
	828	Total

The above division of personnel spaces has been made according to the functional concepts and missions described previously. The personnel space or spaces for a particular function are being assigned to that organization having responsibility for the function.

The division of functions between two centers will result in a higher combined personnel requirement for the two centers.

C O P Y

Photographic Services

Following the separation of LOC, photographic services will be provided in the following manner:

a. MSFC will submit requests to LOC for photographic services required in support of MSFC projects at AMR.

b. MSFC will furnish LOC planning data on new MSFC projects as early as possible to insure that special camera positions and mountings are included in the design criteria of new facilities.

c. MSFC will provide photographic support to LOC organizational elements located at MSFC, Huntsville.

d. LOC will provide photographic services and make distribution to MSFC organizational elements located at AMR and Huntsville as requested.

C O P Y

Procurement and Contracts

Procurement and Contracts Office, MSFC will transfer to LOC thirteen (13) contracts which were initiated by MSFC in support of LOC. These contracts are related to activities for which the responsibility is being transferred to LOC. The transfer of contracts will begin June 4, 1962 and will be completed, on a phased basis, on June 25, 1962. One (1) additional contract originated by MSFC is already in LOC.

Five (5) contracts, related to LOD Launch Facilities and Support Equipment Office activities which are remaining with MSFC, will be retained for administration and finalization by MSFC Procurement and Contracts Office.

In addition, the Procurement and Contracts Offices of each Center will continue to support other elements of the respective Centers located in each others' geographical region.

The time phasing of the contracts being transferred from MSFC to LOC is as follows:

June 4, 1962	NAS8-46
	NAS8-523
	NAS8-1660
	NAS8-1661
	NAS8-1633

C O P Y

Procurement and Contracts (continued)

June 11, 1962	NAS8-2435
	NAS8-2436
June 18, 1962	NAS8-2454
	NAS8-2408
	NAS8-2472
	NAS8-1666
June 25, 1962	NAS8-1504
	NAS8-1596

C O P Y

Records Administration

MSFC directs the records administration program at LOC. This includes organization and maintenance files, files disposition, and related records management functions. Following the separation of LOC, these services will be provided in the following manner:

a. Effective July 1, 1962, LOC will assume responsibility for the administration of files of LOC.

b. LOC will furnish MSFC, prior to December 31, 1962, a first generation microfilm roll of all research and development project case files on NASA projects.

c. LOC will assume responsibility for the custody, accountability and responsibility for all classified documents that are charged to LOC as of July 1, 1962. All receipts, regardless of the type of classified receipt form used, will be valid and authentic. Transfer of classified documents will be processed in accordance with NASA Policies and Procedures.

C O P Y

Security

LOC shall have responsibility for administering personnel security for both LOC and MSFC personnel located at AMR effective July 1, 1962. MSFC shall have responsibility for administering personnel security for LOC personnel stationed in Huntsville.

Administration of contractor security programs shall be conducted by MSFC for MSFC contractors and by LOC for LOC contractors except as otherwise agreed on an individual basis.

Security classification instructions shall be issued by LOC and MSFC for their respective projects and contracts.

Technical Documentation

The technical documentation function at AMR is performed by contractor personnel, funded and administered by MSFC. The contractor provides microfilm of released drawings, specifications, engineering orders, drawing release lists, parts lists, and associated documents. Following the separation of LOC, this service will be provided as follows:

a. Launch Operations Center will assume responsibility for microfilm service effective July 1, 1962, by contract arrangement.

b. MSFC will provide microfilm support for LOC organizational elements located at MSFC in Huntsville.

c. LOC will provide microfilm support for MSFC organizational elements located at AMR.

C O P Y

Technical Reports

LOC will provide technical report preparation, reproduction, and distribution services for MSFC elements located at Cape Canaveral. MSFC will provide the same services for LOC elements located in Huntsville.

C O P Y

Technical Library

Library services at Cape Canaveral will be provided by LOC for MSFC personnel. MSFC will provide library services (eventually through the Central AOMC-MSFC Library) for LOC personnel in Huntsville.

Books and documents acquired through the MSFC Technical Library which are in the possession of LOC personnel at Cape Canaveral will remain the property of LOC. LOC personnel at Cape Canaveral have books and documents charged out from the AOMC Technical Library valued at $3,500.00. LOC will reimburse AOMC in this amount.

C O P Y

Transportation and Travel

Transportation and travel services, including commercial travel, executive airlift, local ground transportation, cargo transportation, marine transportation and scheduled contract airlift will be provided on a mutually supporting basis by MSFC for LOC at Huntsville, Alabama, and by LOC for MSFC at Cape Canaveral, Florida.

Generally, the services provided will be on a non-reimbursable basis. However, actual cost of tickets and rental cars will be chargeable to the employee's home center in accordance with the cost accounting code on the individual's travel orders.

MSFC will be responsible for management of the Scheduled Contract Airlift MARSHALL Route, including programming, scheduling and reporting. Executive aircraft on a non-scheduled basis will be programmed for and managed by each Center for its own requirements. Reciprocal non-reimbursable service will be provided on "space available" basis.

Arrangements for shipping LOC and MSFC cargo physically located at MSFC will be made by MSFC and arrangements for MSFC and LOC cargo physically located at LOC will be made by LOC. The shipping Center will program and fund for outgoing shipments on a non-reimbursable basis.

C O P Y

NASA CIRCULAR NO. 208

Reference 2-2-9

Date March 7, 1962

SUBJECT: ESTABLISHMENT OF THE LAUNCH OPERATIONS CENTER AT AMR AND THE PACIFIC LAUNCH OPERATIONS OFFICE AT PMR

1. PURPOSE

This Circular establishes two new independent field installations and a Launch Vehicle Operations Division of the George C. Marshall Space Flight Center.

2. ESTABLISHMENT

a. Launch Operations Installations

(1) The Launch Operations Directorate of George C. Marshall Space Flight Center, is hereby discontinued as a component of that installation and there is hereby established the Launch Operations Center at the Atlantic Missile Range as a field installation of NASA within the meaning of General Management Instruction 2-0-2.1. Dr. Kurt H. Debus is appointed Director of the Launch Operations Center; he will report to the Director, Office of Manned Space Flight, NASA Headquarters.

(2) The NASA Test Support Office, Point Mugu, California, is hereby discontinued and there is hereby established the Pacific Launch Operations Office at the Pacific Missile Range as a field installation of NASA within the meaning of General Management Instruction 2-0-2.1. Commander Simon J. Burttschell is appointed Acting Director of the Pacific Launch Operations Office; he will report to the Director, Office of Space Sciences, NASA Headquarters.

b. Launch Vehicle Operations Division. There is hereby established a Launch Vehicle Operations Division of the George C. Marshall Space Flight Center. Dr. Hans F. Gruene is appointed Director of the Division.

APPENDIX A

C O P Y

3. FUNCTIONAL STATEMENTS AND ORGANIZATION CHARTS

a. Launch Operations Installations. The Directors of the two launch operations installations will submit a functional statement and an organization chart for their respective activities for approval of the Administrator, NASA, in accordance with General Management Instruction 2-0-1.

b. Launch Vehicle Operations Division. The Director of the George C. Marshall Space Flight Center will submit through appropriate channels a functional statement for the Launch Vehicle Operations Division of that Center.

4. RECISION

a. General Management Instruction 2-2-9 of July 1, 1960.

b. General Management Instruction 2-2-9.1 of October 27, 1960.

c. All other instructions inconsistent with this Instruction.

/s/ Hugh L. Dryden
Deputy Administrator

C O P Y

Discussion Draft
June 1, 1962

BASIC CONCEPTS FOR THE OPERATIONS OF THE LAUNCH OPERATIONS CENTER AT THE ATLANTIC MISSILE RANGE

General Responsibility - Launch Operations Center

The NASA Launch Operations Center is responsible for the over-all planning and supervision of the integration, checkout, and launch of space flight vehicle systems at the Atlantic Missile Range. This responsibility pertains to all NASA projects with the exception of Mercury, and such elements of the Gemini project as may be excluded by presently existing agreements between NASA and the Department of Defense. LOC's general responsibilities will be exercised in such a manner as to ensure that developers of launch vehicle stages, spacecraft, and components retain responsibility for the performance of their individual systems and subsystems.

General Direction and Reporting Relationships

1. The Launch Operations Center is headed by a Director, who will report to the Director of the Office of Manned Space Flight.

2. The Launch Operations Center will provide a single point at the Atlantic Missile Range for range support required at AMR for NASA projects. This general responsibility does not include relationships with the Commander of AMR

APPENDIX B

in his role as DOD representative on Mercury as presently defined.

Specific Responsibilities - Launch Operations Center

1. Technical and Administrative Support Services

The Launch Operations Center will provide all NASA elements located in the area of the Atlantic Missile Range with public relations, visitors' service, community relations, and industrial relations, legal security, purchasing and contracting, transportation, financial management, administrative and technical support services.*

Vehicle and spacecraft development Centers with elements located at AMR will retain responsibility for:

a. Supervision of launch vehicle stage and spacecraft contractors.

b. Provision of technical support peculiar to vehicle stages and spacecraft needs and not common to other NASA Center requirements.

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*This responsibility includes the Jet Propulsion Laboratory to the extent the provision of such services are consistent with NASA-CIT contractual relationships. Detailed agreements will have to be developed between LOC and JPL in this area.

c. Development and submission of technical and administrative support requirements to be met by LOC at AMR.

d. Maintenance of a minimum number of technical and administrative personnel at AMR to serve as points of liaison and coordination with LOC on support requirements.

2. Institutional Support Facilities

LOC will be responsible for obtaining, integrating, and meeting user requirements for such general purpose facilities as office buildings, warehouses, maintenance shops, utilities, and roads to the extent such facilities are not provided by AMR in accordance with existing NASA-DOD agreements. LOC will budget and provide justification for such facilities to the Office of Manned Space Flight and receive allotments of approved funds directly from NASA headquarters.

3. Program Facilities*

All program facility requirements (e.g., Apollo Spacecraft Operations and Checkout Facility) will

---

*LOC has drafted detailed procedures for handling the program facility requirements of user Centers. LOC has, also, initiated action to obtain the concurrence of the Centers on these draft procedures.

be coordinated by the Launch Operations Center based on functional requirements developed by the launch vehicle and spacecraft Centers. LOC will prepare design criteria to meet these functional requirements and obtain approval of the design criteria from the user Center.

The Launch Operations Center will be responsible for construction of NASA facilities at AMR.

4. Ground Support Equipment*

The Launch Operations Center is responsible for the physical integration of NASA ground support equipment at AMR for the various space flight vehicle systems.

LOC will prepare through a Launch Operations Working Group a facilities concept and specifications document, which will be coordinated and concurred in by all organizations affected. This document will delineate responsibility between development centers and LOC for ground support equipment.

*Steps have already been taken to delineate in detail the GSE interface problems between the Propulsion and Vehicle Engineering Division of MSFC and LOC (Launch Support Equipment Office). It is planned to initiate immediately similar action between LOC and MSC.

C O P Y

A basic guideline in preparation of this document will be that all ground support equipment which is related to more than one stage or spacecraft (e.g., fuel storage systems, feeder and general service utility lines, and high pressure systems), will be provided by LOC as part of the launch site facilities based on requirements or criteria furnished by the launch vehicle stage or spacecraft Center. All equipment that is peculiar to a particular stage or spacecraft, and which LOC agrees cannot be provided as common GSE, will be furnished by the development agency. Coordination of ground support equipment will be accomplished by panels, composed of representatives of all affected agencies, and chaired by LOC.

Launch vehicle and spacecraft development Centers are responsible for providing LOC, at the earliest possible time (preliminary design stage) with as full knowledge as possible of their ground support equipment plans and requirements. This is to ensure effective integration of these requirements into the operational capabilities of the facilities and equipment available or being constructed at AMR.

5. Tracking and Data Acquisition

LOC will act as NASA's representative in dealing with AMR on matters pertaining to tracking and data acquisition and will make arrangements for tracking and data services and support required for operations of all NASA Centers or activities at AMR.

Specifically, LOC's responsibility for tracking and data acquisition are defined as follows (see attached chart):

a. At the Cape Area

(1) Requirements for tracking and data acquisition services, equipment or facilities on the Cape area will be generated by NASA Centers (including LOC) and/or Program Offices, and will be submitted to LOC. LOC will coordinate these with AMR and make arrangements to satisfy these requirements.

(2) New equipment to meet these requirements will be provided or arranged for by LOC.

(3) LOC will arrange for or provide any services or data required for mission execution.

(4) Budgetary estimates and funding justifications for the above requirements will be generated by

DISTRIBUTION OF RESPONSIBILITIES FOR TRACKING AND DATA ACQUISITION

	Requirements	New Equipment (Provide or Arrange)	Services (Provide or Arrange)	Funding (Equipment & Services)
At Cape Area	Center (Including LOC) and/or Program Office	LOC	LOC (Launch Service) Thru LOC (Spacecraft Service)	OMSF (LOC)
OFF CAPE				
a. Within AMR cognizance as lead range	Center (Including LOC) and/or Program Office	OTDA (Thru LOC)	LOC (or OTDA through LOC) (Into OTDA)	OTDA*
b. Outside AMR cognizance	Center (including LOC) and/or Program Office	OTDA	OTDA	OTDA*

* When in accordance with DOD - NASA agreement dated August 24, 1961.

LOC and submitted to OMSF for budgetary action or funding. Funds will be allotted by Headquarters to LOC for utilization or citing to AMR as required.

b. Off the Cape Area - Within the AMR Complex (Down Range)

(1) Requirements for tracking and data acquisition services, equipment, or facilities that are within the AMR complex but not within the Cape area will be generated by NASA Centers (including LOC) and/or Program Offices and will be submitted to LOC. LOC will coordinate these requirements with AMR.

(2) Requirements for new equipment, or facilities, will be coordinated by LOC with AMR and then submitted to OTDA.

(3) Requirements for services will be coordinated and arranged for by LOC with AMR.

(4) Budgetary estimates for the above requirements, when they become a NASA financial responsibility as defined by the Webb-Gilpatric agreement, will be generated by LOC and submitted to OTDA for budgetary action or funding. Funds will be

allotted to LOC, by Headquarters, for citing to AMR as required.

6. Development of Integrated Test and Checkout Procedures

Operating procedures for the conduct of tests and checkout of integrated space flight vehicles will be developed by the appropriate integration panels, chaired by LOC, on which LOC, spacecraft and launch vehicle development Centers will be represented.

LOC is responsible for the over-all supervision of the physical integration and checkout of the space flight vehicle at AMR in accordance with predetermined and agreed upon procedures.

7. Final Countdown and Launch

The final countdown and readiness for launch of the space vehicle will be under the over-all supervision of LOC. However, each Center supplying equipment for the space vehicle will maintain a "veto" right over the status of his equipment during countdown. LOC will exercise over-all "veto" power for a specific vehicle's lack of readiness for launch.

The mission direction which takes into account (in addition to space vehicle readiness as supplied by LOC) such areas as the over-all world-wide weather, astronaut condition, etc., will be the responsibility of MSC for manned missions, and for unmanned missions, the designated project manager.

8. Range Flight Safety

Range flight safety must remain the responsibility of the AMR Commander. However, the Director of LOC is responsible for providing, or arranging for, flight safety information required by AMR. The Director of LOC is also responsible for reviewing AMR flight safety procedures and policies in terms of their effect on NASA flights and negotiating with AMR changes or waivers that may be required.

9. Abort Responsibility*

LOC will be responsible for abort of manned spacecraft prior to clearing the pad of working personnel. This responsibility will be exercised in accordance with arrangements worked out with the Range and the MSC Operations Director. After clearing the pad, abort responsibility will rest in the MSC Flight Operations Director.

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*For proposed modifications and alternatives to the concepts set forth in items 7 and 9, see letter from Kurt H. Debus to D. Brainerd Holmes on the subject of "Operational Control Centers, Functions and Responsibilities."

C O P Y

Major Responsibilities of Development Centers

In addition to the responsibilities described above, the spacecraft and launch vehicle development Centers will be responsible for:

1. Conducting or supervising the conduct of all inspections of spacecraft and launch vehicles on receipt from contractors at AMR.
2. Conducting spacecraft and launch vehicle preflight preparations and checkout at the launch site and prior to assembly of the integrated space flight vehicle.
3. Checking out crew equipment.
4. Preparing and inserting astronaut crews (or animal occupants for experimental flights,)
5. Conducting checkout of their respective systems, subsystems, and components during countdowns and deciding readiness for flight under the over-all supervision of LOC. In the case of integrated checkout, the development Centers will retain specific technical responsibility for their equipment operating under LOC's over-all management for the space vehicle integration process.

C O P Y

6. Providing the LOC Launch Director and others concerned with launch objectives and criteria (e.g., launch time limitations).

7. Conducting countdowns for other mission responsibilities, such as spacecraft tracking networks beyond the limits of the launch site.

8. Arranging for recovery of spacecraft, astronauts, launch vehicles, and data capsules. In situations where the assistance of AMR is required, the necessary arrangements will be made through LOC.

9. Evaluating performance of systems, sub-systems, and components which have been developed by the Center or by contractors under the technical supervision of the Center.

10. Supporting LOC's integration test program.

Budget and Finance

LOC will be responsible for consolidating budget estimates and financial operating plans, including all personnel, facilities construction, and development funds, for NASA activities permanently located at AMR. An outline of the procedures that will be followed in handling budget estimates, financial operating plans, and allotments of funds are /sic/ set forth in Exhibit A.

C O P Y

Support from PMR

When NASA flights from AMR require support from the Pacific Missile Range, the Commander of AMR will arrange directly with the Commander of PMR for this support.

LOC will keep the Pacific Launch Operations office informed of support requirements placed upon PMR and AMR.

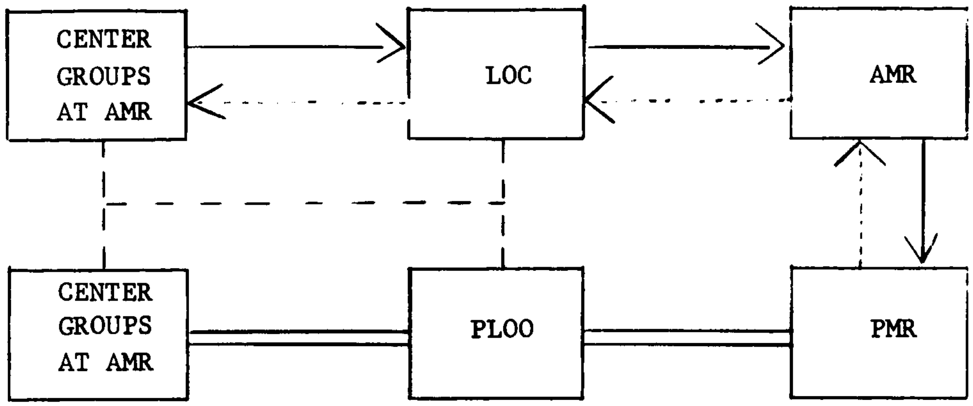
PLOO will facilitate the meeting of such requirements as requested by LOC or PMR (see attached chart.)

Likewise, LOC will facilitate the meeting of support requirements placed upon the AMR by PLOO through PMR.

Whenever the Director of LOC cannot reach agreement in behalf of NASA with the AMR Commander, he will refer the issue to the Director of OMSF who will take or initiate whatever action is required for resolution.

C O P Y

Channel for Obtaining Support
from PMR for Launchings at AMR



__________Project requirements for PMR support flow from Center Groups concerned at AMR through LOC and AMR to PMR.

. . . . . Project support plans or equivalent responses to requirements for support flow from PMR through AMR to LOC and Center Groups concerned at AMR.

\- - - - - Channel for (1) sending information copies of all requirements placed on PMR by NASA elements at AMR to PLOO or appropriate Center group at PMR (2) PLOO to obtain interpretations and decisions needed by PMR from NASA elements at AMR, and (3) NASA elements at AMR to obtain through PLOO (a) status reports or other information and (b) expediting actions.

==========NASA - PMR channel of communication.

Note: Center groups at AMR may deal directly with AMR and likewise at PMR within policies and procedures prescribed by the Directors of the respective launch installations. In addition, Center groups at one range may deal directly with Center groups at another range on range support matters in accordance with procedures accepted or prescribed by Directors of the respective launch installations.

C O P Y

Exhibit A

OUTLINE OF FINANCIAL MANAGEMENT PROCEDURES RELATED TO ESTABLISHMENT AND OPERATION OF THE NASA LAUNCH OPERATIONS CENTER AT AMR

LOC will be responsible for consolidating the budget estimates and financial operating plans for all NASA activities at AMR and submitting these to the Office of Manned Space Flight. The following general procedures will apply:

Personnel Services

Manpower and manpower dollar requirements, including travel requirements, will be estimated by elements of the various NASA Centers located at AMR and included in the budget request of their parent Center. These requirements will also be submitted to LOC for consolidation with LOC's personnel requirements for its program and NASA support activities to show total requirements for NASA personnel at AMR. The consolidated estimates for personnel services for all NASA activities at AMR will be submitted by the Director of LOC to the Director of the Office of Manned Space Flight.

Institutional Support*

Institutional support requirements will be determined by LOC and LOC will submit estimates for these requirements to the Director OMSF.

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* Costs other than object Class 10 and travel in the old S&E appropriation and old Support of Plant costs.

C O P Y

Research and Development Program Funds

Research and development program funds requested by LOC will be submitted to the cognizant Program Offices for inclusion in the cognizant Headquarters Program Office's request to the Associate Administrator.

General Purpose Facilities

General purpose facilities requirements, such as office buildings, warehouses, maintenance shops, utilities, and roads, will be determined by LOC in coordination with user organizations and LOC will include estimates for these requirements in its request that will be submitted to the Director of OMSF.

Program Facilities

LOC will prepare and submit to the cognizant Headquarters Program Director budget justifications and funding requirements for all program facilities to be constructed at AMR. These justifications and funding requirements will be based on requirements developed by the user Centers.

Unforeseen Requirements

Technical and administrative support services required by user activities will be met by LOC in the above manner providing the user has identified his requirements in sufficient time to permit consideration of these requirements in the normal budget and financial Operating Plan formulation cycles.

C O P Y

Additional requirements will be met by transfer of resources from the requesting organization to LOC via OMSF or as otherwise determined on a specific case basis by NASA Headquarters.

Funding Procedures

LOC will receive direct allotments from NASA Headquarters to finance (1) personnel services and travel of all LOC personnel, (2) total institutional support at LOC, (3) reimbursement to the Air Force for range support, (4) R&D program authority assigned directly to LOC from NASA Headquarters program offices, and (5) construction of all general purpose and program facilities for NASA at AMR.

The other Centers involved will issue a single sub-allotment to LOC to finance (1) personnel services and travel of their own personnel permanently stationed at AMR for duty, and (2) R&D program authority delegated to LOC for execution. Funds to cover personnel services and travel expenses of other Center personnel serving on temporary duty at AMR will be retained at the parent Center.

Reporting Requirements

To facilitate reporting on the total NASA activity at LOC, an information copy of each sub-allotment issued to LOC will be sent to NASA Headquarters (Code BFF) by the issuing center. Additionally, special monthly reports will be made on the status of each sub-allotment in accordance with procedures to be issued by NASA Headquarters.

COPY

June 8, 1962

DISTRIBUTION OF PERSONNEL SPACES - FY 62

Office Title	Present Allocation	LOC	LVOD	TEST	P&VE	L&M	PLOO
Office of the Director	9	5	4	0	0	0	0
Asst. Director, Administration	7	7	0	0	0	0	0
Technical/Scientific Staff	3	3	0	0	0	0	0
Reliability Office	3	1	2	0	0	0	0
Public Relations Office	8	8	0	0	0	0	0
Heavy Space Vehicle System Office	11	11	0	0	0	0	0
Light/Medium Space Vehicle Office	5	5	0	0	0	0	0
Pacific Missile Range	9	0	0	0	0	4	5
Support Services	67	51	16	0	0	0	0
Safety Office	2	2	0	0	0	0	0
Legal Office	2	2	0	0	0	0	0
Procurement and Contracts Office	27	27	0	0	0	0	0
Financial Management Office	21	21	0	0	0	0	0
Facilities Office	45	45	0	0	0	0	0
Control Office	39	39	0	0	0	0	0
Launch Support Equipment Office	61	53	0	5	3	0	0
Test Support Office, AMR	17	17	0	0	0	0	0
Measuring & Tracking Branch	96	0	96	0	0	0	0
Guidance and Control Branch	81	10	71	0	0	0	0
Structures and Propulsion Branch	75	9	66	0	0	0	0
Cadre for Launch Operations Center	78	59	0	0	0	0	0
Cadre for LVOD			19				
Sub Totals	666	375	274	5	3	4	5
Spaces for Summer Students	36	14	19	0	0	0	3
Totals	702	389	293	5	3	4	8

APPENDIX C