HISTORICAL ORIGINS

of the

GEORGE C. MARSHALL SPACE FLIGHT CENTER

HUNTSVILLE, ALABAMA

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HISTORICAL ORIGINS OF THE GEORGE C. MARSHALL SPACE FLIGHT CENTER

by

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DEDICATION OF GEORGE C. MARSHALL SPACE FLIGHT CENTER

Dignitaries attending the September 8 dedication of George C. Marshall Space Flight Center include, left to right: Dr. T. Keith Glennan, Administrator of NASA; Dr. Wernher von Braun, Director of MSFC; President Dwight D. Eisenhower; Mrs. George C. Marshall, widow of the late General Marshall; and Major General August Schomburg, Commanding General, AOMC (far right). General Marshall's bust is in the forefront.

FOREWORD

The George C. Marshall Space Flight Center is the latest complex to join the National Aeronautics and Space Administration. Although NASA as a governmental agency is young, it is composed of many research and development organizations whose roots go deep into the history of rocket propulsion and missile technology. We at Huntsville are proud of the contributions our scientists and engineers have made in applying their missile knowledge and experience to the development and advancement of astronautics.

We hope that this volume will help acquaint others with the historical beginning and traditions of the Marshall Space Flight Center. Like rocketry itself, the late General of the Army George C. Marshall was first recognized in war but later achieved world stature and lasting fame as a man of peace. Our group was once a part of the U. S. Army's famed Army Ballistic Missile Agency at the Redstone Arsenal; now our responsibilities have been turned away from the military and focused on the fascinating problems of the exploration and scientific investigation of space. Our present responsibilities at Huntsville in the exploration and scientific investigation of space inspire us to continued hard work as we make our contribution to the greater history ahead for the entire NASA organization. Our missions here in Huntsville inspire us to work even more diligently as we make our contributions to the future history of man's conquest of the solar system.

Wernher von Braun
Director

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PREFACE

The development of rocket propulsion and the writing of history both go back into antiquity. Rocketry began centuries ago as a weapon of war. The recording of history antedates Thucydides. The art and science of rocketry and of history seem to have some methodological similarities. Both are called "scientific" in that they are both constrained by the dictates of objectivity and the application of proved knowledge. The recording and analysis of history needs to be as accurate and reliable as the science and technology of rocketry itself.

The historical background involving ideas, hardware, people, and facilities at the George C. Marshall Space Flight Center is one of general interest to all Americans. It is to many an important story. It spans three decades, beginning in Germany, transferring to North America, and now extending to the Universe itself. It is a history featuring such earthly landmarks as Peenemünde, Fort Bliss, Jet Propulsion Laboratory, White Sands, Redstone Arsenal, and the Army Ballistic Missile Agency, the antecedents of what is now George C. Marshall Space Flight Center. Its future history will be concerned with the Moon and nearby planets.

This first historical monograph concludes with the official dedication of MSFC by President Dwight D. Eisenhower. It seems axiomatic that some points in this record may be subject to differing interpretations to some readers. All human beings are historians to greater or lesser degree. Also, many points in this history involve intimate

memories of people in MSFC, and thus are subject to minute analysis. Thus, this volume is documented. The author assumes responsibility for the selectivity and authority of the documents utilized, and would suggest that footnotes are worthwhile stepping stones for the stimulated or curious reader.

In the final analysis, if this history is read and creates interest, it will serve a worthy purpose. For knowledge and curiosity are indivisible: the same curious mind that looks to the future is also well informed about the past.

In the preparation of chis manuscript the indispensible efforts of Dr. Eugene M. Emme, NASA Historian, and Helen T. Wells, Editorial Clerk in the MSFC Historical Office, are gratefully acknowledged, as well as the support of many past and present colleagues in ABMA and MSFC. Not all can be mentioned here, but the following must be named, first from AOMC: Lieutenant Colonel J. E. Aber, Control Office; James L. Daniels, Jr., Research and Development Operations; James H. Draughon, Control Office; James M. Grimwood, Historical Division; Helen Brents Joiner, Historical Office; Robert A. Smith, III, Control Office; and Walter Wiesman, Personnel Office.

Special thanks within MSFC go to John Bensko, Research Projects Division; Foster Haley, Public Information Office; J. R. McMenemy, Office of Management Services; T. F. Morring, Saturn Systems Office; D. M. Morris, Office of the Director; Erich Neubert, Office of the Director; Frederick I. Ordway, III, Space Systems Information Branch;

Robert Purdie, Test Division; and V. C. Sorensen, Office of Management Services.

The offices of the various programs at Marshall Space Flight Center have reviewed and approved sections concerning their activities. Sizable portions of this history have been read and approved by the Center's Office of Deputy Director for Research and Development, Office of Deputy Director for Administration, Office of the Chief of Management Services, Office of Space Systems Information Branch, as well as the offices of Research and Development and the Historical Division of the Army Ballistic Missile Agency. Other portions have been reviewed and accepted by the Center Public Information Office, the Missile Test Facility Branch of the Test Division, and the offices of Deputy Director for Agena and for Centaur.

D. S. A.

CHAPTER I: HISTORICAL HIGHLIGHTS

This chapter chronicles major events antedating the establishment of the George C. Marshall Space Flight Center. The selection of historical highlights is always arbitrary to a certain extent. Even a long list of events cannot ever be fully definitive. MSFC, however, has long historical roots, and many of the accomplishments of its leading personnel as well as their contributions to other programs are rather well known.

Although some of the personnel of MSFC have participated in rocketry since the early 1930's, this chronology begins with the impetus provided in World War II, both in the United States and abroad. Other references will cover the period prior to World War II.

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.

October - German scientists successfully fired and recovered A-5 development rockets with gyroscopic controls and parachutes, attaining altitude of 7½ miles and a range of 11 miles.

1941

July - First successful U. S. jet-assisted take-off accomplished in an Ercoupe at March Field by Lt. Homer A. Boushey, with pressed powder–propellant JATO rockets developed by Cal Tech.

July - Navy initiated development of Mousetrap, shipbased 7.2-inch mortar-fired bomb which became first USN rocket placed into fleet action, in May 1942.

October 6 - Redstone Ordnance Plant was activated at Huntsville, Alabama.

November-December - Russians used AA rockets against Luftwaffe aircraft in defense of Moscow and air-to-air rockets on their Stormovik Il-4 fighters.

During 1941 - Project ORDCIT began at California Institute of Technology under the direction of Dr. von Kármán.

1942

April 7--24 - Douglas A-20A completed 44 successive take-offs using liquid propellant JATO, developed by Cal Tech's Frank S. Malina.

June 13 - First test of the German A-4 (V-2) rocket at Peenemünde was unsuccessful.

October 3 - First successful launch and flight of the 5½-ton German V-2 at Peenemünde traveled 120 miles.

1943

February 26 - Redstone Ordnance Plant at Huntsville, Alabama, was redesignated Redstone Arsenal.

May-June - Germans operationally test-fired 750 V-2's from Blizna, Poland, launching as many as 10 a day.

July - Serious training of units for field employment of V-2 began at Peenemünde. In January 1944, operational command of V-2 operations was given to Gen. Richard Metz, leaving Gen. Dornberger in charge of V-2 development.

August 17-18 - Royal Air Force attacked Germany's Peenemünde Rocket Research Center, causing heavy damage and delaying V-weapon program by weeks or months.

September - German production of A-4's (V-2's) for research purposes reached approximately 20 rockets per month.

November - Theodore von Kármán of JPL submitted proposal to Army Ordnance for developing long-range surface-to-surface missiles.

1944

February - Army Ordnance and AAF initiated development of surface-to-air high-altitude supersonic guided missile, which subsequently became XSAM-A-7 Nike I.

May 31 - First launching of the experimental VB-7 vertical bomb, incorporating television.

June 13 - The first German V-1's were launched from France against England, with four of the eleven striking London.

June 22 - U. S. Army Ordnance awarded to California Institute of Technology a contract for research and engineering on long-range rockets and their launching equipment.

September 8 - First German V-2's fell on England.

November 1 - Cal Tech's Rocket Research Center was reorganized and renamed the Jet Propulsion Laboratory (JPL).

1944
(continued)

November - Army Ordnance initiated Hermes program for research and development of ballistic missiles.

December 1-16 - Twenty-four Private-A rockets were test-fired at Camp Irwin, California.

December - Army Ordnance made plans under the Hermes program to study the German V-2 missile.

1945

January 24 - Germans successfully launched A-9, a winged prototype of the first ICBM (the A-10) designed to reach North America. A-9 reached a peak altitude of nearly 50 miles and a maximum speed of 2,700 m.p.h.

January 31 - U. S. Army Office of Chief of Ordnance (OCO) authorized Bell Telephone Laboratories, Inc. to begin study on an anti-aircraft missile system, the Nike.

February 8 - U. S. Army Corps of Engineers issued Real Estate Directive 4279 to acquire land for a rocket proving ground in the Fort Bliss, New Mexico, area.

February 20 - The Secretary of War approved Ordnance plans for the establishment of the White Sands Proving Ground (WSPG), New Mexico.

March - Project Paperclip to recruit German missile scientists was initiated in the Pentagon.

April 1-13 - Seventeen rounds of Private-F rockets were fired at Hueco Range, Fort Bliss, Texas.

April - At time of German collapse, more than 20,000 V-weapons, V-1's and V-2's, had been fired. Although figures vary, best estimate is that 1,115 V-2 ballistic rockets had been successfully fired against England and 1,675 against continental targets.

June 25 - Construction began at White Sands Proving Ground.

1945
(continued)

July 4 - Baby Wac rocket, one-fifth scale model of Wac Corporal proposal, flight tested at Camp Irwin by JPL.

July 9 - WSPG was established as a Class IV activity under the control of the Army's Chief of Ordnance.

July 10 - Blockhouse construction began at White Sands Proving Ground.

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 20 - Wernher von Braun and six other key German rocket scientists arrived in the United States, under Project Paperclip.

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.

September 27 - The first firing of a Wac dummy (Round 1) occurred at WSPG.

October 11 - First firing of a full Wac Corporal (Wac-A) at WSPG attained an altitude of 235,000 feet.

October - Secretary of War Patterson approved plan to bring top German scientists to U. S. to aid military research and development.

December 10 - Fifty-five German specialists arrived at Fort Bliss, Texas, and White Sands Proving Ground, where they were joined by the first seven specialists headed by Wernher von Braun.

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January 16 - U. S. upper atmosphere research program was initiated with captured German V-2 rockets. A V-2 panel of representatives of various interested agencies was created, and a total of more than 60 V-2's were fired before the supply ran out.

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.

March 6 - The Department of the Interior issued to the War Department a permit authorizing use of White Sands National Monument area as an "experimental bombing range."

March 15 - V-2 No. 1 was static fired at WSPG.

March 22 - First American rocket to escape earth's atmosphere (the Wac) reached 50-mile height after launch from WSPG.

April 1 - Bell Aircraft Corp. contracted with the AAF to produce a 100-mile guided missile, later designated the Rascal.

May 8 - Chief of Naval Operations directed BuAer to make preliminary investigation of earth satellite vehicle, such an investigation to "contribute to the advancement of knowledge in the field of guided missiles, communications, meteorology, and other technical fields with military applications."

June 14 - The U. S. Navy established the U. S. Naval Ordnance Missile Test Center at WSPG.

June 28 - First V-2 rocket fully instrumented by NRL for upper-air research was launched from WSPG and attained a height of 67 miles.

September 17 - WSPG static tested the motor and propellant equipment for the Nike R&D System.

September 26 - WSPG first test-fired an experimental booster for the Nike R&D System.

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October 24 - V-2 rocket No. 13 carried a camera which took motion pictures of the earth at approximately 65 miles altitude. The coverage was an estimated 40,000 square miles.

December 5 - V-2 No. 16 at WSPG impacted a record-breaking 111.1 miles from point of firing.

December 17 - WSPG fired V-2 No. 17, first night firing of a V-2 in the United States. The flight was successful, the V-2 reaching a record-making altitude of 116 miles.

1 9 4 7

January 23 - Telemetry operated successfully for the first time in a V-2 firing.

February 17 - Final test firing of Tiny Tim booster occurred at WSPG.

February 17 - A Wac Corporal (Wac B) attained an altitude of 240,000 feet at WSPG.

February 20 - V-2 No. 20 was first of a series of flights known as "Blossom Project," requested by the Air Material Command for purposes of testing ejection of a canister and recovery by parachute. The flight also tested fruit flies and various types of seeds exposed to cosmic rays of the upper atmosphere.

May 22 - The first Corporal E round was fired at WSPG. This was the first launching of a surface-to-surface guided missile guided by radar ground-control.

May 29 - A modified V-2 landed 1½ miles south of Juarez, Mexico, narrowly missing an ammunition dump maintained by a mining company, and the result was new safety measures at WSPG. The malfunction occurred because the modified V-2 carried four Ramjet intake nozzles around the nose cone, and this caused the coasting.

1947
(continued)

June 20 - Army Ordnance established the Bumper project for development of a two-stage missile (German V-2 and modified Wac Corporal).

September 6 - Army Ordnance cooperated with the Navy in an experimental firing of a V-2 from the deck of the U. S. S. Midway.

1948

March 18 - V-2 Upper Atmosphere Research Panel, representing all U. S. interested agencies, was renamed the Upper Atmosphere Rocket Research Panel.

May 13 A Bumper-Wac fired at WSPG was the first two-stage rocket to be launched in the Western Hemisphere.

June 11 - WSPG made the first of a series of V-2 launches known as "Albert," named after the monkey used in the first flight. Indications were that the monkey died of suffocation.

July 26 - Two separate rockets fired from White Sands, one a V-2 which reached an altitude of 60.3 miles, the other a Navy Aerobee which reached an altitude of 70 miles, carried cameras which photographed the curvature of the earth.

September 15 - Committee on Guided Missiles of the Research and Development Board approved recommendation that Army Hermes project "be given the task of providing the National Military Establishment with a continuing analysis of the long-range rocket problem as an expansion of their task on an Earth Satellite Vehicle."

September 16 - WSPG became a Class II activity by authority of Department of the Army General Order 59.

1949

February 24 - Bumper-Wac No. 5 sent its upper stage to a height of approximately 244 miles and a speed of 5,510 miles per hour, the greatest velocity and altitude yet reached by a man-made object.

June 6 - Albert II was the second V-2 flight carrying a live monkey, the monkey dying on impact.

October 28 - The Secretary of the Army approved the transfer to Huntsville, Alabama, of WSPG rocket scientists and their equipment.

December 12 - Albert IV was the last monkey sent aloft in a series of V-2 tests at WSPG. The successful flight indicated no ill effects on monkey Albert until his death on impact of the V-2.

1950

March 21 - The U. S. Army Adjutant General ordered transfer of the missile personnel headed by Wernher von Braun from White Sands to Redstone Arsenal, Alabama.

April 1 - The German missile personnel headed by Dr. von Braun were moved from WSPG to Redstone Arsenal, Alabama.

May 3 - The Honest John system was initiated by Army Ordnance.

May 19 - The first Hermes A-1 test rocket was fired at WSPG.

June 28 - The last firing of 52 V-2's fired at WSPG and Florida Missile Testing Range.

June - VfR, the German Rocket Society disestablished by Hitler in 1933, passed resolution calling for international conference of all astronautical societies.

July 1 - The Lacrosse surface-to-surface guided missile project, begun by Naval Ordnance in 1947, was transferred to the Department of the Army by Joint Chiefs of Staff.

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July 24 - Bumper No. 8, a German V-2 with a 700-pound Army-JPL Wac Corporal, was fired from Long-Range Proving Ground at Cape Canaveral; the first-stage V-2 climbed 10 miles, separated from the second-stage Corporal which traveled 15 more miles. This was the first missile launch from Cape Canaveral.

July 29 - The Bumper No. 7, consisting of a V-2 first stage and Wac Corporal second stage, reached the highest velocity (Mach 9) attained by a man-made object to that date. The firing took place at Long-Range Proving Ground, Florida, the second launch at the Cape.

August 31 - V-2 No. 51 carried the last of five Aero-Medical Laboratory experiments. The first four of these experiments, known as the Albert series, had carried anaesthetized monkeys. This last flight carried a non-anaesthetized mouse photographed by a camera. The film survived the impact, though the mouse did not.

October 26 - The Army contracted with Douglas Aircraft Company for design, development, fabrication, and flight testing of rockets having Honest John specifications.

December - Construction started at Grand Bahama Island for the first tracking station on the Florida Missile Test Range, later the Atlantic Missile Range.

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January 16 - Air Force established Project MX-1593 (Project Atlas), study phase for an intercontinental missile. Contract was given Consolidated-Vultee Aircraft on January 23.

May 16 - An Army Field Forces Board report called for a surface-to-air missile system featuring "homing-all-the-way" guidance; Project Hawk was the result of this report.

1951
(continued)

June 22 - JPL fired the first of a series of 3,544 Loki missiles at WSPG, the program ending after September 1955 with a record of the most rounds fired in ten years at WSPG.

June 30 - Army contract with General Electric terminated, after 67 rockets were assembled and tested at WSPG.

August 7 - A Navy Viking 7 rocket set an altitude record for single-stage rockets, climbing to 136 miles and reaching a speed of 4,100 m.p.h., at White Sands.

September 20 - USAF made first successful recovery of animals from a rocket flight when a monkey and 11 mice survived an Aerobee flight to an altitude of 236,000 feet.

October 10 - WSPG fired the Corporal E No. 11, which has existed since then as the basic configuration of the Corporal tactical missile.

October 29 - Firing of sixty-sixth V-2 at White Sands Proving Ground concluded U. S. use of these German missiles in upper-atmosphere rocket research.

October 31 - Responsibility for Hermes II activity was transferred to the Ordnance Guided Missile Center at Redstone Arsenal, with Hermes II redesignated the RVA-A-3 test vehicle.

1952

February 15 - Flight Determination Laboratory was established at WSPG.

February 25 - Nike I (the tactical Nike) was first test-fired at WSPG, although the Nike Firing Program had started in mid-summer 1946.

March - Theodore von Kármán was named Chairman of NATO's Advisory Group for Aeronautical Research and Development.

1952
(continued)

July 22 - First production-line Nike made successful flight.

1953

June 5 - A missile was fired from the underground launcher installation constructed by the Army Corps of Engineers at WSPG.

August 20 - The first successful firing of the Army's Redstone missile was achieved by Redstone Arsenal (RSA) personnel at Cape Canaveral.

1954

February 12 - The Aerophysics Development Corp. agreed to fabricate equipment for the Dart program, under the technical supervision of Redstone Arsenal.

August 17 - The first firing of a Lacrosse "Group A" missile was conducted at WSPG.

August 24 - The first flight test of the Dart was conducted at WSPG.

October - NRL Aerobee fired at White Sands took photographs at 100 mile-altitude, first picture taken of complete hurricane, off the Texas Gulf coast.

December 31 - U. S. Army Ordnance terminated the Hermes Project, during which there was development of the highest performance liquid-fuel rocket in the U. S. to that date; development of the largest solid propellant rocket motor flown to that date; and development of the first stabilized platform inertial guidance system with air bearing gyros and accelerometers for ballistic missiles.

1955

June 29 - The first successful test-firing of Nike B was made at WSPG.

July 29 - President Eisenhower endorsed USNC-IGY earth satellite proposal and the White House announced that "the President has approved plans by this country for going ahead with the launching of small, unmanned, earth-circling satellites as part of the U. S. participation in the International Geophysical Year which takes place between July 1957 and December 1958. Scientific responsibility was assumed by the National Academy of Sciences, fiscal responsibility by the National Science Foundation, and responsibility for logistic and technical support by the Department of Defense."

August 16 - The first Hawk missile was fired at WSPG.

September 9 - DOD Advisory Group known as Stewart Committee recommended that proposed Navy satellite program utilizing Viking and Aerobee-Hi rockets for satellite development proceed, with Chairman Homer J. Stewart submitting a dissenting minority report. The DOD Policy Council endorsed the majority recommendation. Designated Project Vanguard, this tri-service program was placed under Navy management and DOD monitorship. Objectives of Project Vanguard were: to develop and procure a satellite launching vehicle; to place at least one satellite in orbit around the earth during the IGY; to accomplish one scientific experiment; and to track flight.

October 2 - National Academy of Sciences' IGY Committee established Technical Panel for the Earth Satellite Program, with Richard E. Porter as Chairman, to plan the scientific aspects of the program.

November 8 - Secretary of Defense approved Jupiter and Thor IRBM programs, the first based on experience gained by Redstone Arsenal team from V-2 and Redstone, the latter on experience gained from Atlas program.

December 1 - The President assigned highest priority to ICBM and Thor and Jupiter IRBM programs.

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February 1 - Army Ballistic Missile Agency (ABMA) was activated. ABMA's nucleus was Redstone Arsenal's Guided Missile Development Division.

March 14 - ABMA launched the first Jupiter A (modified Army Redstone missile) at Cape Canaveral, Florida.

April 23 - Army informed the OSD that a Jupiter missile could be fired in an effort to orbit a small satellite in January 1957.

August 8 - Largest U. S. test stand for rocket motors was completed at Redstone Arsenal, slated for Jupiter IRBM.

September 20 - A Jupiter C missile attained an altitude of 680 miles and a range of more than 3,300 miles.

December 8 - First test rocket in the U. S.-IGY satellite program, a one-stage NRL Viking, attained an altitude of 126 miles and a speed of 4,000 m.p.h. The rocket carried a "minitrack" radio transmitter which was ejected at 50 miles and tracked.

1 9 5 7

May 31 - The 1500-mile Jupiter was fired successfully at Atlantic Missile Range. This was the Army's first successful launching of an IRBM for this distance.

August 8 - A Jupiter C, launched by the Army at Cape Canaveral, attained an altitude of 600 miles and a range of over 1,300 miles. Recovery of the scaled-down nose cone marked the first recovery of an object from outer space.

1957
(continued)

October 4 - Sputnik I, the first earth satellite, was launched by the U. S. S. R. and remained in orbit until January 4, 1958.

November 3 - Sputnik II, carrying a dog named Laika, was launched by the U. S. S. R. The satellite remained in orbit until April 14, 1958.

November 8 - The Secretary of Defense directed the Army to prepare to attempt two satellite launchings in March 1958.

November 15 - ABMA was authorized to obligate $3.5 million for the scientific satellite project.

December 17 - First successful firing of USAF Atlas ICBM, the missile landing in the target area after a flight of some 500 miles, on the 54th anniversary of the Wright brothers' first flight.

1958

January 4 - Sputnik I reentered the atmosphere and disintegrated.

January 12 - President Eisenhower, in answering the December 10, 1957, letter of Soviet Premier Nikolai A. Bulganin regarding a summit conference and disarmament, proposed that the Soviet Union and the United States "agree that outer space should be used only for peaceful purposes."

January 17 - First launch of Navy Polaris test vehicle occurred at Cape Canaveral.

January 31 - Explorer I, the Free World's first earth satellite, was placed in orbit by a Juno I (modified Jupiter C), its payload discovering the radiation belt identified by Dr. James A. Van Allen.

February 6 - The Senate passed S. Res. 256, creating a Special Committee on Space and Astronautics to frame legislation for a national program of space exploration.

February 7 - Department of Defense established the Advanced Research Projects Agency (ARPA), responsible for the nation's outer space program.

February 14 - "Basic Objectives of a Continuing Program of Scientific Research in Outer Space," a report by the Technical Panel on the Earth Satellite Program of the National Academy of Sciences IGY Committee, was published. The report proposed a program of space research extending beyond the IGY.

March 5 - Explorer II failed to orbit due to failure of last stage to ignite, a joint ABMA-JPL project.

March 26 - The Army's Juno I (modified Jupiter C) successfully launched into orbit the third U. S. earth satellite, Explorer III.

May 1 - Scientific findings from two Explorer satellites disclosed an unexpected band of high-intensity radiation extending from 600 miles above the earth to possibly an 8,000-mile altitude. The radiation, which was described by Dr. James A. Van Allen as "1,000 times as intense as could be attributed to cosmic rays," was believed to come from ionized gas.

May 18 - Jupiter Missile No. 5, from Patrick Air Force Base at 12:05 a.m. E.S.T., launched America's first tactical type re-entry nose cone.

July 17 - The first completely guided Jupiter IRBM was flight tested from Cape Canaveral Missile Test Annex at 4:05 a.m. E.S.T.

July 26 - The Army's Juno I (modified Jupiter C) successfully launched into orbit the Explorer IV satellite.

July 29 - President Eisenhower signed the National Aeronautics and Space Act, redefining the U. S. space program.

August 15 - ABMA was ordered to begin work on a 1½ million-pound-thrust booster for the multi-stage vehicle program, later named Project Saturn, the project authorized and financed by ARPA.

August 24 - Explorer V was successfully launched with a Jupiter C; all stages fired, but orbit was not achieved because of collision of parts of booster with instrument compartment.

September 25 - Dr. T. Keith Glennan, NASA Administrator, announced the activation of NASA as of October 1, 1958.

September - Saturn design studies were authorized to proceed at Redstone Arsenal, for development of 1½ million-pound-thrust, clustered-engine first stage.

October 1 - The Navy's Project Vanguard and 400 Naval Research Laboratory scientists were assigned to NASA on its first day of operation. Also transferred to NASA from the Department of Defense were lunar probes, satellite projects, and engine development research programs.

October 11 - Pioneer I, U. S.-IGY space probe under direction of NASA and with the AFBMD as executive agent, was launched from Cape Canaveral by a Thor-Able-I booster. Traveling 70,700 miles before returning to earth, the probe determined radial extent of the Great Radiation Belt, made first observations of earth's and interplanetary magnetic field, and made the first measurements of micrometeorite density in interplanetary space.

October - Air Force awarded contract to Pratt and Whitney for Centaur vehicle with hydrogen-burning chamber based on research of Lewis Research Center between 1953 and 1957. Centaur Project later was transferred to NASA.

November 6 - Army completed Redstone testing with a perfect 250-mile shot.

November 8 - Second U. S.-IGY space probe under NASA with Air Force as executive agent was Pioneer II. Third and fourth stages failed to separate.

December 3 - President Eisenhower ordered the transfer of JPL, its functions and facilities, to NASA.

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(continued)

December 6 - Pioneer III, launched by ARMA-JPL under NASA direction, reached an altitude of 63,580 miles and discovered a second Van Allen radiation belt.

December 13 - Monkey Gordo traveled into outer space in the nose cone of a Jupiter missile. Although searchers failed to recover the cone and its passenger, telemetry furnished valuable bio-medical information.

December 19 - President Eisenhower's Christmas message, beamed from Project Score satellite in orbit, was the first voice beamed in from space.

1 9 5 9

January 2 - U. S. S. R. launched Lunik I into a solar orbit, with a total weight of a reported 3,245 pounds. Lunik I, called Mechta (dream) by the Russians, was the first man-made object placed in orbit around the sun.

January 8 - NASA requested from the Army eight Redstone-type vehicles to be used in support of Project Mercury.

February 28 - Discoverer I, satellite of 1,450 pounds, was successfully launched into polar orbit by USAF Thor-Hustler booster from Pacific Missile Range.

March 3 - Pioneer IV, launched by a Juno II, was the second Army-conducted NASA lunar probe. The missile passed within 37,000 miles of the moon before placing Pioneer IV into orbit around the sun. Communications were maintained with Pioneer IV for a record-making distance of 406,620 miles.

April 2 - Seven astronauts were selected for Project Mercury, after a series of the most rigorous physical and mental tests ever given to U. S. test pilots.

April 13 - Discoverer II satellite successfully placed into polar orbit by Thor-Agena A booster, but capsule ejection malfunctioned causing it to impact in the vicinity of Spitzbergen on April 14 instead of in the vicinity of Hawaii. It was the first vehicle known to have been placed in a polar orbit and was the first attempt to recover an object from orbit.

April 27 - DX priority (highest national priority rating) was assigned to Project Mercury.

During April - The Tiros meteorological satellite program was transferred from the Department of Defense to the responsibility of NASA for the National Meteorological Satellite Program. At the same time, a Joint Meteorological Satellite Advisory Committee was established.

May 26 - ABMA static fired a single H-1 Saturn engine.

May 28 - Monkeys Able and Baker, passengers in a Jupiter nose cone, were the first primates recovered alive from a flight into outer space.

June 5 - Construction began at Cape Canaveral for the Saturn.

September 9 - First launch of operational Air Force Atlas ICBM from Vandenberg Air Force Base was successful, and second Atlas ICBM was fired from AMR the same day.

September 12 - Russia's Lunik II, launched with a total payload weight of 858.4 pounds, became the first man-made object to hit the moon (September 13). This launching coincided with the visit of Premier Nikita Krushchev to the United States.

September 18 - Vanguard III, sixth U. S.-IGY satellite, successfully injected into orbit, marking the end of Vanguard launching activities.

October 4 - Lunik III, Russia's translunar earth satellite, began photographing trip around the moon.

1959
(continued)

October 8 - Pioneer IV reached first aphelion (estimated 107,951,000 miles) in its orbit around the sun at 8:00 p.m. E.S.T. Since launch on March 3, Pioneer IV was tracked by JPL's Goldstone tracking station to 407,000 miles from earth.

October 13 - Explorer VII, launched by the Army's Juno II, was placed in orbit around the earth. The 91½-pound satellite relayed more information from outer space than had any other U. S. satellite to date.

October 21 - President Eisenhower announced his decision to transfer a portion of ABMA's personnel, facilities, and missions to NASA.

November 2 - President Eisenhower announced his intention to transfer the Saturn project from the Army to NASA monitorship.

November 18 - NASA assumed technical direction of the Saturn project pending its formal transfer from the Army.

1960

January 14 - President Eisenhower directed the transfer of ABMA's Development Operations Division and its space-related missions to NASA.

March 11 - Pioneer V, NASA space probe, successfully launched by Thor Able-4, began its historic flight to measure radiation and magnetic fields in space, and to communicate over great distances.

March 15 - The George C. Marshall Space Flight Center, NASA's Huntsville Facility, was so named by Executive Order of President Eisenhower.

1960
(continued)

March 28 - ABMA static fired two of the Saturn booster's eight engines. The successful firing lasted for 8 seconds.

April 6 - ABMA successfully static fired four of the Saturn's engines for 7 seconds.

April 29 - ABMA conducted the first static firing of all eight engines of the Saturn booster. The successful test lasted for 8 seconds.

May 17 - Second full-scale static firing of the Saturn booster's cluster of eight Thor-Jupiter type engines lasted for 24 seconds and generated more than 1.3 million pounds of thrust.

May 26 - All eight engines of the Saturn first stage were fired on the test stand at Huntsville for 35 seconds, the longest static firing to date.

June 3 - Complete eight-engine static firing of Saturn was successfully conducted for 75 seconds.

June 8 - The Saturn booster's cluster, capable of producing 1½ million pounds of thrust, was static fired for 110 seconds.

June 14 - NASA announced the formation of its Launch Operations Directorate (LOD), headed by Dr. Kurt Debus of MSFC.

June 15 - Saturn static test firing of 121 seconds was successful.

July 1 - Formal transfer ceremonies at Huntsville, Alabama, officially opened NASA's George C. Marshall Space Flight Center.

1960[1]
(continued)

August 19 - Sputnik V, weighing 5 tons and carrying 2 dogs, was launched into orbit around the earth.

August 21 - U. S. S. R. announced safe recovery of biologic payload of Sputnik V after 17 orbits, and reported that the two canine passengers were in excellent physical condition.

September 8 - President Eisenhower and Mrs. George C. Marshall formally dedicated the George C. Marshall Space Flight Center and toured facilities.

November 3 - Explorer VIII, launched by MSFC at Cape Canaveral, was placed in orbit around the earth by a Juno II rocket. The 90-pound satellite's payload began the most extensive measurements of the ionosphere ever attempted. MSFC prepared the payload, and designed and developed the Juno II vehicle; GSFC originated and built the scientific experiments; JPL provided the vehicle's 3-stage upper assembly.

December 19 - A modified Redstone launched the one-ton Mercury capsule 135 miles high and 235 miles down range on the AMR. The space capsule was recovered "in excellent condition" about 50 minutes after firing.

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1. The NASA Historian in Headquarters is currently finalizing a detailed chronology on Aeronautics and Astronautics, 1915-1960, which will help place MSFC's chronology in broader historical context.

CHAPTER II: PRIOR TO REDSTONE ARSENAL

American research in rocketry extends back several decades. In 1914 Robert Hutchings Goddard received a United States patent for a rocket using liquid and solid fuels, and another patent for a multistage rocket for reaching high altitudes. Between 1914 and 1917 Goddard received seventy patents on rockets and rocket apparatus. And, on March 16, 1926, a Goddard rocket flew 184 feet in 2.5 seconds at Worcester, Massachusetts. This was history's first liquid fuel rocket flight.[1] Worcester became the Kitty Hawk of rocketry.

Jet Propulsion Laboratory

The first organized rocket research and development group in the United States was called Project ORDCIT (Ordnance-California Institute of Technology).[2] This project began in 1936 at Cal Tech,

1. See E. M. Emme, Robert H. Goddard: World Rocket Pioneer, NASA Historical Report No. 1, July 1960, MSFC Hist. Off. files.

2. By April 15, 1945, Cal Tech had fired more than 24 "Private A" and "Private F" rockets. Two were dummies, for testing the launcher and boosters. Rocket Development Div., R&D Service, Office, Chief of Ordnance (OCO), Ordnance Department Guided Missile Program, Mar. 13, 1947, Chap. IV, Army Rocket and Guided Missile Agency (ARGMA) Tech. Lib. files.

when Dr. Theodore von Kármán led a small group of scientists interested in design fundamentals of a high altitude sounding rocket. This preceded the formation, on July 1, 1939, of the Rocket Research Project under Dr. von Kármán, the Project becoming the nucleus of the nation's first center devoted to the research and development of propulsion systems. It was reorganized on November 1, 1944, and renamed the Jet Propulsion Laboratory (JPL).[3] This work led to the first mass-produced American rocket-assisted take-off unit (JATO).[4] It was followed by authorization from Major General G. M. Barnes to proceed also with a high altitude rocket project at Cal Tech. This was in 1944, and the rocket projects under this authorization became known officially as Project ORDCIT.[5]

Origins of Project Paperclip

By this time, the outcome of World War II was growing clear, and U. S. Army officials began advocating the exploitation of German scientific knowledge. Germany's V-1 and V-2 weapons were among the spectacular innovations of the War.[6] As Major General H. N. Toftoy stated, in

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3. JPL is presently active in the NASA lunar program.

4. JATO = Jet Assisted Take-Off.

5. Maj. R. B. Staver, The Future of Ordnance in Jet-Propulsion, Army Ord. Dept., Dec. 17, 1945, p. 8, ARGMA Tech. Lib. files. Maj. Staver added: "The writer can speak with some knowledge of the facts as it was he, who in December 1943, first recommended to General Barnes and Colonel Ritchie that the ORDCIT project be undertaken. Under the circumstances it appeared logical at that time."

6. For review of German V-2 rocket development, see the following: Joseph W. Angell, "Guided Missiles Could Have Won," Atlantic Monthly, Dec. 1951 and Jan. 1952; Walter Dornberger, V-2--Schuss ins Weltall (American ed. V-2), New York, 1954; Kenneth W. Gatland, Project Satellite (contributions by Dr. Wernher von Braun), New York, 1958; Daniel Lang, "Reporter At Large," New Yorker magazine, Apr. 21, 1951; Willy Ley, Rockets, Missiles, and Space Travel, New York, 1951; and Peter Van Slingerland, "How We Let The Missile Secrets Get Away," Look magazine, Feb. 4, 1958.

describing American reaction to enemy rocket skill during World War II: "There is no quicker way to stimulate use of a new weapon than to discover it in use by the enemy."[7] Major General H. J. Knerr, U. S. Strategic Air Forces, early recommended to Lieutenant General Carl Spaatz, USSTAF, that the "AAF make full use of the established German Technical facilities and personnel before they were destroyed or disorganized."[8]

Knerr also discussed the subject of exploiting German technical know-how with the Honorable Robert A. Lovett, Assistant Secretary of War for Air, during Lovett's first visit to the European Theater early in 1945. Knerr strongly advocated to Lovett that the U. S. begin immediate exploitation of knowledge and experience of the German scientists, and allow them to bring their families with them to the United States, "not only for the mental stability it would give the men to know they were safe. . . but to prevent. . . their being taken hostage in the scientists' absence."[9]

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7. Maj. Gen. Toftoy, "Army Missile Development," Army Information Digest, Vol. 11, Dec. 1956, p. 10.

8. Center for the rocket facilities and personnel was historically famous Peenemünde, occupied in April 1937 by Dr. Wernher von Braun and his rocket associates. Peenemünde also included the German Air Force (Luftwaffe) and the Army (Wehrmacht); the V-1 "buzz-bomb" and the V-2 rocket originated there. In August 1943 Peenemünde suffered 815 casualties from a Royal Air Force raid, yet mass production of the A-4 (V-2) began in October 1943. Within 12 months, A-4 launchings were 85 percent successful, with a total of 3,300 tactical units launched by the end of World War II.

9. Interview with Maj. Gen. Knerr, Sec. Gen., Air Board, Hq, AAF, Apr. 24, 1947, cited in Harriet Buyer and Edna Jensen, History of AAF Participation in Project Paperclip, May 1945--March 1947, Aug. 1948, p. 5, Research Studies Institute, Maxwell AFB, Ala.

Those were difficult days of crucial Allied bargaining amid some distrust, conditioned also by U. S. desire that Soviet Russia intervene against the Japanese in the Pacific Theater.

It was on April 26, 1945, that the Joint Chiefs of Staff issued Order 1067, directing General Eisenhower to "preserve from destruction and take under your control records, plans, documents, papers, files and scientific, industrial and other information and data belonging to . . . German organizations engaged in military research."[10]

Foremost among the individuals who closely supervised the rocket and missile features of Project Paperclip was the then Colonel H. N. Toftoy.[11] As Army project officer for Paperclip, Toftoy called Washington from Europe in May 1945 to request immediate transfer to this country of some 300 German rocket scientists and technicians. He received no answer, so he flew to Washington to personally expedite action. There he succeeded in gaining approval by the Secretary of War for the transfer of 127 German scientists and technicians to the U. S. Little wonder that, in later years, General Toftoy became popularly known as "Mr. Missile."

Working closely with Colonel Toftoy on Project Paperclip was Major James P. Hamill of Ordnance Technical Intelligence. Not only did Colonel Toftoy and Major Hamill pursue the objectives of Project Paperclip to the letter, but they also let nothing of technical value escape

10. As quoted in Van Slingerland, "How We Let The Missile Secrets Get Away," Look, Feb. 4, 1958, p. 23.

11. "Men of the Missile Command," Army Information Digest, Oct. 1958, p. 61.

their attention. They succeeded, for example, in acquiring technical data from the Nordhausen V-2 Plant just prior to its physical seizure by the Russian Army. Major Hamill has said:

> We knew about the Nordhausen plant long before we took it. The written orders I received indicated that Nordhausen was to be in the Russian zone and that all plans and equipment were to be left for the Soviet. These orders originated at a very high level. Unofficially and off the record I was told to remove as much material as I could, without making it obvious that we had looted the place.[12]

One result of Project Paperclip was that approximately 130 of Germany's top scientists, after interrogation and background investigations by intelligence officials, were offered six-month contracts to come to the United States.[13] The U. S. promised to provide housing for the families remaining in Germany until arrangements could be made to bring them overseas at a later date.

One hundred nearly-complete V-2's were brought to the United States by transports, together with a large collection of plans, manuals, and other documents. Three hundred boxcar loads of material went from Nordhausen to Antwerp, thence to the United States.[14]

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12. Maj. Hamill, as quoted by Peter Van Slingerland, "How We Let The Missile Secrets Get Away," Look, p. 23.

13. These contracts had a renewal option for an additional six months. Later the scientists were given 5-year contracts, but the government ruled that these were unlawful, and so one-year contracts succeeded the six-month contracts.

14. In June 1945, while evacuating remaining scientists and families (24 hours before the Russians arrived), the U. S. found five trunks filled with Dr. Dornberger's notes, hidden in abandoned salt mines. Later, one of the German specialists said: "We probably got a complete set of plans, but the Russians probably got a nearly complete set, too. You know, with things like plans, you always make copies." Before leaving Nordhausen, U. S. forces debated blowing up the plant, but since they lacked the authority, they felt forced to leave it for Russian capture a few hours later. Dr. Dornberger said some of the machine tools left

The first seven members of the German V-2 specialists from Peenemünde, headed by Wernher von Braun, arrived in this country at Fort Strong, Massachusetts, on September 20, 1945.[15] The Army then transported them to the Aberdeen Proving Ground, Maryland. Their first task was to help process German guided missile documents captured in Europe. With the help of these German specialists, Aberdeen collated, translated, evaluated, and catalogued many tons of reports, charts, and drawings. The German specialists, often at a glance, were able to classify a document as important or trivial. These men were working with documents which they themselves wrote or helped to compile. On December 10, 1945, fifty-five German specialists arrived at Fort Bliss, Texas, and White Sands Proving Ground, to be joined by the first seven specialists at the conclusion of the Aberdeen project.[16]

At White Sands

From the beginning the von Braun group worked closely with General Electric and Army Ordnance personnel at White Sands. In this way German know-how passed rapidly on to Americans, and after approximately 15 months the entire von Braun group transferred from White Sands to Fort Bliss.[17]

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in Nordhausen were unique in the world, and estimated that the plans for the A-9/A-10 may have helped 15 to 20 percent in building the Sputniks. Peter Van Slingerland, "How We Let The Missile Secrets Get Away," Look, p. 23.

15. These first seven were Wernher von Braun, Erich W. Neubert, Theodor A. Poppel, August Schulze, Eberhard Rees, Wilhelm Jungert, and Walter Schwidetzky. Hq., U. S. Forces, European Theater, TO, Sept. 15, 1945, KCRC files, Kansas City, Mo.

16. Interview with Walter Wiesman, Communication Advisor, AOMC, Nov. 15, 1960.

17. Interview with Erich W. Neubert, Asso. Dep. Dir. for R&D, MSFC, Dec. 1, 1960.

Under Project Paperclip, as a whole, there were 1,136 Germans and Austrians in the United States on May 18, 1948; 492 of these were specialists, and 644 were dependents. Of the 492 specialists, 177 were with the Army, 205 with the Air Force, 72 with the Navy, and 38 with the Department of Commerce but under Army custody.[18] The largest single group of specialists was associated with the Air Force and the second largest with the Army--146 at Wright Field, and 121 at Fort Bliss.[19]

White Sands Proving Ground, in addition to having top personnel from Peenemunde as well as 300 freight carloads of V-2 components, proved an ideal testing range. A flat, isolated desert area, about 125 by 40 miles, the range had the world's most massive building to that date--the firing site blockhouse. Blockhouse construction began on July 10, 1945. When completed, its concrete walls were ten feet thick, and its roof had a maximum thickness of 27 feet. The blockhouse was built to withstand the impact of a rocket at 2,000 m.p.h. WSPG was to be the U. S. Center for rocket development for half a decade.

Early in 1946 White Sands readied its first V-2's for launching from American soil. The planned schedule called for firing about two V-2's

18. Volume II, Appendix to History of USAF Participation In Project Paperclip, Aug. 1948, final 3 pages of Appendix, "Paperclip Strength Report," Research Studies Institute.

19. "At Fort Bliss, however, was a cohesive group, representing most of top echelon at Peenemünde." Interview with Walter Wiesman, ABMA, Oct. 13, 1958. Wiesman, one of the Germans, was at Fort Bliss in 1948. "Most of Peenemünde's top echelon came to the U. S. Army, rather than elsewhere," further explains Col. W. J. Durrenberger, "because the U. S. Army desired the 'whole team,' and because of Colonel Toftoy's ability to get along with people." Interview with Col. Durrenberger, AOMC, Oct. 27, 1958.

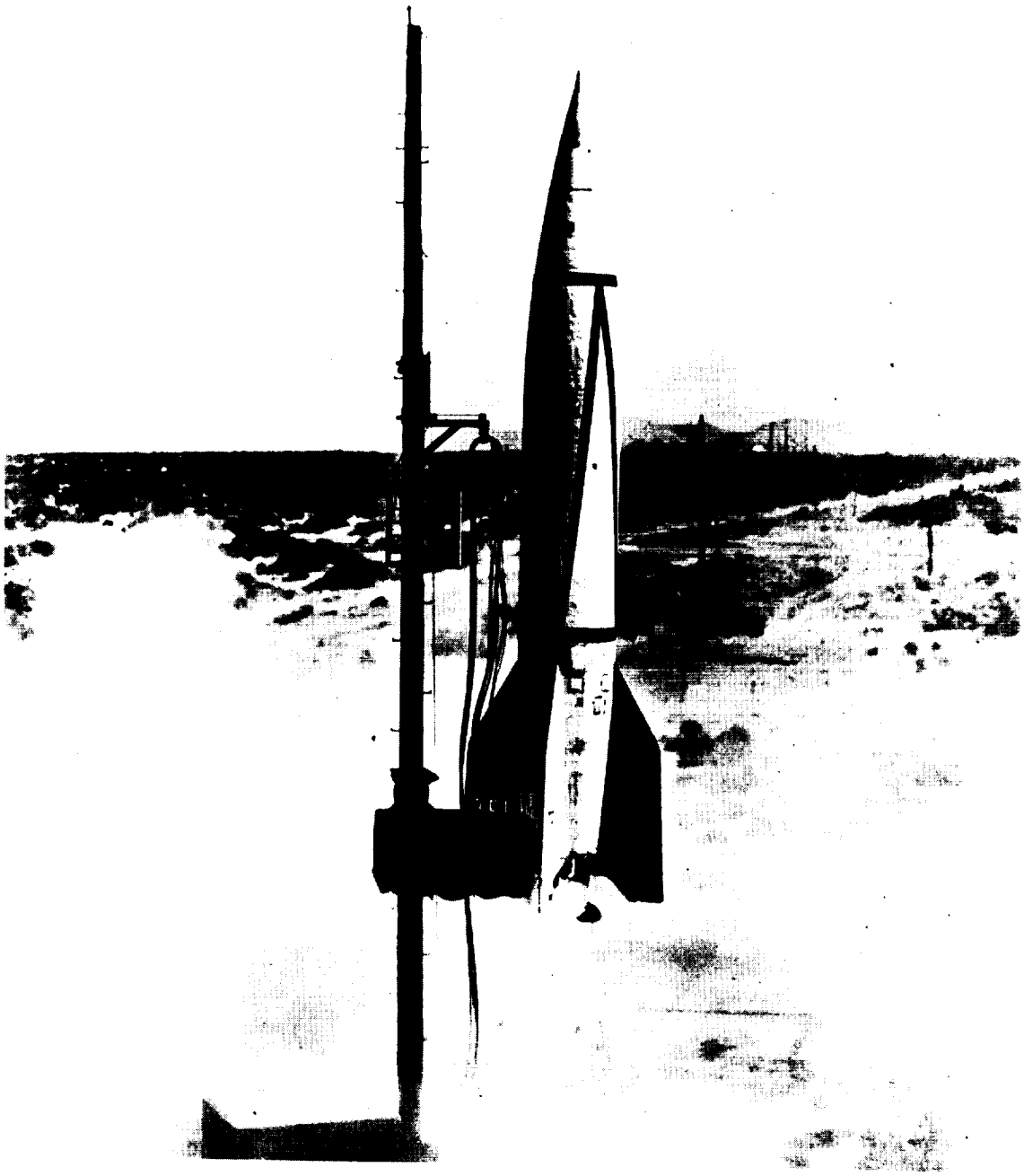
a month. V-2 No. 1 was fired as a static test at White Sands on March 14, 1946.[20] Thus was begun what involved 52 V-2 firings from White Sands Proving Ground and Florida Missile Testing Range, until the last one was fired on June 28, 1950. The V-2 performed well: Rocket No. 17, on December 17, 1946, reached the highest altitude in Project Hermes, 116 miles; No. 16, on December 5, 1946, the longest range, 111.1 miles.[21] From these early firings, Army Ordnance personnel learned to handle and fire large ballistic missiles, and to develop basic design knowledge for future rockets and ground support equipment for military application.

Meanwhile, Project ORDCIT also continued to function at White Sands. In addition to the "Private" rockets mentioned earlier, Project ORDCIT included the development of the "Corporal" and "Wac Corporal" rockets, which were to earn their own place in history. Their history, as of March 31, 1947, could be summarized as follows:

> Corporal. Fabrication and testing of the components of the No. 1 prototype of this missile are being pushed to enable the first round to be fired in May of this year. The critical components continue to be the tanks. The first unit of telemetering equipment for the missile has been completed and is now being calibrated. Sixty-three (63) motor and vane test runs have been made, the last test being of the motor which will be used in the Number 1 missile.
>
> Wac Corporal. Firings of the booster unit for the Wac Corporal commenced at White Sands Proving Ground in September 1945, with the first complete missile being

20. Ordnance Department Guided Missile Program, Chap. VII-3.

21. Final Report, Project Hermes, V-2 Missile Program, General Electric Report No. R52 AO510, Sept. 1952, cited in Willy Ley, Rockets, Missiles, and Space Travel, p. 460. The highest flying V-2, however, was not Rocket 17 (116 miles); it was TF-1 fired on Aug. 22, 1951 (which reached 133 miles).



FLIGHT OF V-2 AT WHITE SANDS

A Firing in 1946

> fired in October 1945. A total of seventeen (17) of the booster rocket units, some with and some without dummy Wac Corporal missiles, have been fired. Firing of the last three missiles was conducted by the 1st AAA Guided Missile Battalion. Initial development tests are now considered to be complete. Twenty-five (25) of the missiles are to be made for the Signal Corps, and an additional fourteen (14) are to be constructed for further ORDCIT test requirements. Preparation of drawings for this production is now under way at Douglas Aircraft Company.[22]

On February 17, 1947, a Wac Corporal attained an altitude of 240,000 feet.[23] However, the most historic achievement of the Wac Corporal occurred on February 24, 1949, when Bumper-Wac No. 5 sent its upper stage to a height of approximately 250 miles and a speed of 5,510 miles per hour. This was the highest velocity and altitude yet reached by a man-made object.

The Bumper-Wac had resulted from the basic need to confirm theories and provide necessary data on multi-stage rocket flight. This included: (1) the separation and ignition of the second-stage rocket in highly rarefied air; (2) the stability of a second-stage rocket launched at extremely high velocities and altitudes; (3) the aerodynamic effects at high Mach numbers obtainable in no other way at that time.

The Bumper-Wac consisted of a V-2 first stage with its nose modified to accommodate a Wac Corporal. This represented the combined efforts of all Army Ordnance personnel including the German engineers, JPL, Douglas Aircraft, and General Electric. The first full-powered flight was

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22. Ordnance Department Guided Missile Program, Chap. IV-3. The "Corporal" was so named because it would go higher than the "Private."

23. Ordnance Department Guided Missile Program, Chap. IV-3. Also see Development & Testing of Rockets & Missiles at White Sands Proving Ground, 1945--1955, Oct. 1, 1959, p. 55, AOMC Hist. Off. files.

entirely successful. It was thus that Army Ordnance efforts resulted in the launching of a man-made object beyond the earth's atmosphere. This historic flight lasted 12 minutes and necessitated a directional correction of several miles to adjust for the earth's rotation.

On September 6, 1947, the Army Ordnance team cooperated with the Navy in an experimental firing of a V-2 from the deck of the U. S. S. Midway. The rocket, not originally designed to accommodate a ship's rolling motion at launching, took off in an erratic manner; nevertheless, the firing proved that a large ballistic missile could be launched from the deck of a ship. This event took place, as will be recalled, while the B-36 controversy raged in Washington. The difficulty of handling liquid oxygen fuel did encourage Navy examination and use of solid propellants, first in the sounding rocket program of the Naval Research Laboratory. This later bore results in the Polaris program.

Back at White Sands, success was not achieved without difficulties. One V-2, for example, failed to fly on its pre-set flight path and passed directly over El Paso, Texas, and over Juarez, Mexico, where a fiesta was in progress. Fortunately, this errant missile impacted on a barren hill. White Sands operations were immediately halted pending the instituting of a complex and effective range safety system. The system consisted essentially of a combination of radar tracking with automatic plotting boards, precise and continuous electronic impact prediction, backed up by visual observation through a sky screen on which safety limits appeared.[24]

24. Maj. Gen. Toftoy, "Army Missile Development," Army Information Digest, pp. 25-27.

The U. S. V-2 program conducted at White Sands Proving Ground, both an Army and Navy venture with German assistance, contributed much to the rapid postwar progress in the missile field.

The Proving Ground's first history has this to say of Navy cooperation:

> In the fall of 1945, the Chief of Ordnance /had/ invited the Chief of the Bureau of Ordnance of the Navy, through the Office of the Secretary of the Navy, to participate in the activities at White Sands Proving Ground. This invitation was very favorably received in the Navy and, as a result, the Bureau of Ordnance and Bureau of Aeronautics jointly accepted and made available funds from both bureaus to augment the facilities at the Proving Ground. The concept of this acceptance and augmentation was definitely to avoid duplication and to provide additional facilities so that the potential value of the Proving Ground, for all military services, was greatly enhanced.[25]

Personnel at White Sands fired many V-2's and other rockets in collaboration with scientific institutions seeking data on the upper atmosphere and the effects of cosmic radiation.[26] This phase became so obviously important that the Naval Research Laboratory developed its Viking rocket to continue its sounding work with the large rockets after the supply of V-2's was exhausted.

These early days at White Sands Proving Ground were indeed historic. Some records achieved at White Sands lasted several years, such as the February 24 Wac Corporal flight. Yet, as we look back, it is not the individual achievements that come to mind first. More important is the

25. History of Activities, White Sands Proving Ground, Las Cruces, New Mexico, 9 July 1945--31 December 1952, p. 30, OCO Hist. Br. files.

26. See Homer E. Newell, Jr., ed., Sounding Rockets, New York, McGraw Hill, 1959.

fact that the United States immediately after World War II began to move firmly into outer space. Without White Sands, or its counterpart, the Explorers and Pioneers of this past decade might still be on the drawing board.

CHAPTER III: AT REDSTONE ARSENAL

By 1950 the Army's missile program required a central location and improved facilities. At this point, Fort Bliss Research and Development had performed its original mission of firing V-2's (A-4's), of initiating studies on long-range rocket-propelled missiles of all types, and of assisting the Army, Navy, and industrial organizations engaged in rocket or guided missile research.[1] The search for better physical facilities for an expanding program led to Huntsville, Alabama.

Redstone Arsenal

In September 1949 Fort Bliss officials inspected Huntsville Arsenal, which had been an Army Chemical Corps installation.[2] They proposed the transfer to Huntsville of the White Sands rocket scientists and their equipment. The Secretary of the Army approved this recommendation on October 28, 1949.[3] By November 1950, 500 military personnel, 130 German scientists, 180 General Electric contractor personnel, and 120 Civil Service employees moved from Fort Bliss to Redstone. They brought their scientific equipment for research and development of rockets with them.[4]

1. The original mission is stated in Memo, Asst. Chief of Ordnance (Army) to CO, R&D Service Sub-Office, Ft. Bliss, KCRC, Kansas City, Mo.
2. Huntsville Arsenal was a $70,000,000 Chemical Corps installation constructed during WW II. Inactivated later, the area became part of Redstone Arsenal. ARGMA Historical Summary, Oct. 21, 1958, ARGMA Hist. Off. files.
3. Executive Office Diary, April 1950, Redstone Arsenal Hist. files, in ARGMA Historical Summary, p. 8.
4. ARGMA Historical Summary, p. 9.

Army Ordnance had determined by 1951 that its surface-to-surface military requirements should be met by a family of large ballistic missiles consisting of Corporal, Hermes A-3, and a proposed Redstone missile. These were to be weapons of three different ranges and firepower.

Later, two missiles satisfied Army requirements when funds became extremely short, and so the Army terminated the Hermes program. Postwar developments of new and greatly improved solid-propellant rockets at JPL and Redstone Arsenal gradually placed solid propellants in a competitive position with liquid propellants for use as military missiles, both as to performance and to weapon size. First flight tests of a large, solid-propellant motor were made in the Hermes RV-A-10 test vehicle.[5]

The Army Ordnance group, before arriving at Redstone Arsenal, was the first in history to "send an object outside the earth's atmosphere."[6] This success occurred at White Sands Proving Ground with the flight of the Wac Corporal on February 24, 1949. This altitude record stood for over eight years.

After coming to Redstone Arsenal and while working on the Army Ordnance family of battlefield long-range missiles, the rocket developers recognized the great significance of applying rocket propulsion to space flight. In 1953 Wernher von Braun, then Chief, Guided Missile Develop-

5. See Maj. Gen. H. N. Toftoy, "Army Missile Development," Army Information Digest, Vol. 11, Dec. 1956, pp. 31-32.

6. JPL Report, No. 20-100, Mar. 17, 1958, p. 55, ABMA Tech. Doc. Div. files.

ment Division, OML,[7] prepared a detailed proposal for orbiting an earth satellite. Entitled "A Minimum Satellite Vehicle Based Upon Components Available From Missile Development of the Army Ordnance Corps," this engineering plan suggested that the Army Ordnance could launch an earth satellite with rocket hardware then available, namely the fast-developing Redstone missile.[8] Such belief on the part of the Army Ordnance led to a further suggestion that the launching of a scientific earth satellite should be a joint undertaking with the Navy.[9] The result of this was Project Orbiter, a joint Army-Navy concept for launching an earth satellite.[10]

By 1955, however, the Air Force and the Naval Research Laboratories began formulating their own proposals for orbiting satellites, proposals supported by detailed theoretical statistics.[11] These proposals, as

7. OML = Ordnance Missile Laboratory, located at Redstone Arsenal.

8. Special Rpt. RP-1, "Project Orbiter," by Robert W. Seese, ABMA Development Operations Division (DOD), Sept. 14, 1956, p. 7, MSFC Hist. Off. files.

9. Previously, in 1954, the Army expressed desire that the Navy and Air Force join it in a mutual satellite program, the Navy initially to provide tracking stations at sea. The original concept was to orbit a 5-pound, inert slug about 2 feet in diameter, using a 4-stage rocket with a Redstone booster and clustered Loki rockets. The Navy agreed, but the Air Force declined such a program because of interest primarily in long-range studies of heavier satellites. See Ltr., Chief, GMDD, Ord. Msl. Lab., RSA, to Chief, Aeromedical Br., Air R&D Command, no subj., Dec. 23, 1954, ABMA Hist. Div. files.

10. This project, estimated to cost $17,700,000, actually used a half million dollars only, such money paying for preliminary design and engineering work, and some hardware experimentation on components. U. S. Senate, Comm. on Armed Services, Inquiry Into Satellite and Missile Programs, Part II, Washington, GPO, 1958, p. 1699.

11. The full history of the U. S. ICBM, IRBM, and scientific earth satellite development between 1953 and 1958 awaits definitive documentation. There is, for example, no documented and available history of Project Vanguard, as well as the various ballistic missile programs. A recent general work with a Redstone Arsenal setting is the book by Maj. Gen. J. B. Medaris (ret.), entitled Countdown for Decision, New York, Putnam, 1960.

compared to the original Army concept, required development of new main components to produce an instrumented satellite vehicle system.[12] With these proposals, the interservice problem of the urgent missile programs as well as differing satellite proposals came to a head in Washington.

The Honorable Donald A. Quarles, then Assistant Secretary of Defense for Research and Development, appointed a scientific panel, the Ad Hoc Advisory Group on Special Capabilities, to study the various satellite proposals. Headed by Dr. Homer J. Stewart, the panel recommended that an active earth satellite project was feasible, and decided in favor of the proposed NRL Vanguard satellite program. The panel's decision was not unanimous, Chairman Stewart heading a minority report.[13]

In August 1955 the Department of Defense R&D Policy Council approved the recommendations of the Ad Hoc Committee.[14] Several days after the Council recommendations, Major General Leslie E. Simon, Assistant Chief of (Army) Ordnance for R&D, wrote to the Assistant Secretary of Defense for R&D, pointing out what he considered errors of fact and reasoning in selecting the Vanguard program instead of Project Orbiter.[15] This effort

12. Report of the Ad Hoc Advisory Group on Special Capabilities, Off. of Asst. Sec. of Defense (OASD), Washington, Aug. 1955, Appendix, pp. A-1--B-1, ABMA Cont. Off. files.

13. Report of the Ad Hoc Advisory Group on Special Capabilities, pp. i-17, MSFC Hist. Off. files. The complete story behind this decision must await future historians.

14. "Project Orbiter," Sept. 14, 1956, p. 7. Also, Report of the Ad Hoc Group on Special Capabilities.

15. Memo from Asst. Chief of Ord. to Asst. Sec. of Defense, R&D, Aug. 15, 1955, "Scientific Satellite Program"; report, "Comments on a Few Statements Contained in Majority Response to Minority Statement in Ad Hoc Committee Advisory Group Report," Aug. 17, 1955; and report, GMDD, OML, RSA, "Comments on Project Slug," Aug. 17, 1955. All in ABMA Hist. Div. files.

failed, however, and the Vanguard program for the U. S. earth satellite under the International Geophysical Year program continued. Project Orbiter was shelved at Huntsville.[16]

Project Orbiter plans at Huntsville were not, however, discarded or forgotten. Designs and hardware were utilized in the missile program for testing re-entry nose cones. It was quickly evident that "the same engineering design and the preliminary hardware work that had been done with this half million dollars under Project Orbiter could now be put to use," Major General John B. Medaris told a Senate investigating committee. The General added:

> Project Orbiter envisioned a four-stage missile, the first being the Redstone booster liquid, and the second, third, and fourth being clustered solid-propellant rockets.. . ./Loading the fourth stage/ with sand instead of powder. . . would give a test of the multiple-stage rocket for use in testing the nose cone and in recovering one.. . . The result was the firing in September of 1956 of the famous or infamous Missile 27. . ./which/ described a ballistic trajectory of about 3,330 miles in range, and, of course, in doing so achieved an altitude of about 600 miles.[17]

To many at Huntsville, it seemed destined that their missile efforts would inevitably lead to space flight.

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16. No attempt has been made to untangle the various and sometimes heated opinions regarding the satellite decisions, particularly after Sputnik I was launched on October 4, 1957. The basic chronology, however, deserves inclusion here.

17. U. S. Senate, Comm. on Armed Services, Inquiry Into Satellite and Missile Programs, p. 1700.

CHAPTER IV: ARMY BALLISTIC MISSILE AGENCY

As the feasibility of ballistic missiles in national defense became clearly evident, so also did the need for increased and centralized facilities. On February 1, 1956, the Army established the Army Ballistic Missile Agency (ABMA) at Redstone Arsenal.[1] The new organization integrated the Guided Missile Development Division and the Redstone Missile mission into one organization. Even more important, the Secretary of the Army, through the Chief of Ordnance, delegated to ABMA unparalled authority in the development and procurement fields. In so doing he delegated

> . . .practically every authority in the development and procurement fields which could be delegated by the Secretary under the provisions of law and Department of Defense regulations. In effect, this. . . virtually eliminated delay except. . . in securing funds and approvals from the Department of Defense levels.[2]

Moreover, "top Army experts" were transferred by the Army to ABMA, to assure a high calibre of work as well as a close liaison between the Agency (producer) and the military requirements specialists (user). Esprit de corps became ABMA's trademark. Commonplace remarks of official visitors were, "There seems to be a sense of mission here," and, "People are in a hurry."[3] The race for ballistic missiles was on.[4]

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1. Dept. of the Army, Gen. Orders No. 68, Dec. 22, 1955, p. 1, MSFC Hist. Off. files.

2. History of Army Ballistic Missile Agency, 1 February--30 June 1956, ABMA Hist. Div., Nov. 1956, p. ix, MSFC Hist. Off. files.

3. In 1958 Secretary of the Army Wilbur H. Brucker visited ABMA. He stated that he found an "unusual" sense of urgency at ABMA.

4. For an interesting discussion of ABMA research and development in rockets, see Department of Defense Appropriations for 1958, Part II, Subcomm. of the Comm. on Appropriations, Washington, GPO, 1957, p. 1508. This Subcommittee asked Dr. von Braun what he expected to learn from

Meanwhile, the group's Redstone missiles were earning the newspapers' sobriquet of "old faithful," for their developmental performance at Cape Canaveral. The lessons of White Sands and even Peenemünde were being applied to great advantage.

The mission of the Army Ballistic Missile Agency was established in an Ordnance Corps Order of January 19, 1956. This order assigned to ABMA the responsibility for research and development of the Redstone Missile Program and the Intermediate Range Ballistic Missile Program.[5]

While military missile development proceeded, space flight thoughts were yet alive at Huntsville. In May 1956 the Special Assistant for Guided Missiles, Secretary of Defense, refused a request by the Assistant Secretary of Defense for R&D, presented originally by ABMA,[6] for approval of ABMA's Jupiter C re-entry test vehicle as an alternate to Project Vanguard. In writing to the Chief of Staff for R&D, Department of the Army, the Special Assistant stated that "without any indications of serious difficulties in the Vanguard program no plans or preparations should be initiated for using any part of the Jupiter or Redstone program for scientific satellites."[7]

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going to the moon. In answering, von Braun quoted Faraday, who was asked about his research on electrical induction. "What is the purpose of a newborn baby? We find out in time." Department of Defense Appropriations for 1958, p. 1525.

5. Ord. Corps Order 3-56, OCO, Dept. of the Army, "Mission of Army Ballistic Missile Agency (ABMA), Effective 1 February 1956," Jan. 19, 1956, pp. 1 and 2. See also AOMC Gen. Order No. 62, "Mission of Army Ballistic Missile Agency," Aug. 26, 1959. Both in MSFC Hist. Off. files.

6. Presentation to Ad Hoc Study Group on Special Capabilities, Apr. 23, 1956, MSFC Hist. Off. files.

7. Letter, Dep. Asst. Sec., Off. of the Asst. Sec. of Defense, to Lt. Gen. James M. Gavin, Chief, R&D, "Army Capabilities for Scientific Satellite," May 15, 1956, ABMA Hist. Div. files. For interesting sidelights on this and other space developments, see Lt. Gen. James M. Gavin, War and Peace in the Space Age, Harper, 1958.

Technical information from ABMA's missile programs went continuously and routinely to the Vanguard Project. On January 29, 1957, the Chief of Research and Development, Department of the Army, requested ABMA to supply information on use of the Jupiter C missile as an earth satellite launcher.[8] On February 1, 1957, ABMA answered that the Army vehicle could accommodate the instrumentation of the Vanguard scientific payload but not the satellite itself.[9] In April 1957 ABMA proposed to the Chief of R&D, Department of the Army, that it orbit, as a backup for Vanguard, six satellites with Jupiter C-type launch vehicles, each satellite weighing about 17 pounds. This plan called for orbiting the first satellite not later than September 1957, and the second one by the end of Calendar Year 1957, the total program costing about 18 million dollars.[10] On May 7, 1957, R&D, Department of the Army, reiterated that there was no plan at present for having ABMA back up Project Vanguard. And, on June 21, 1957, General A. P. O'Meara visited ABMA with instructions from the Department of Defense that ABMA's mission was not concerned with earth satellites.[11]

On August 8, 1957, a Jupiter C, launched from Cape Canaveral, attained an altitude of 600 miles and a range of over 1,300 miles.[12]

8. TT, Comm. Gen., ABMA, to Chief of R&D, Dept. of the Army, Jan. 31, 1957, ABMA Cont. Off. files.

9. TT, Comm. Gen., ABMA, to Chief of R&D, Dept. of the Army, Feb. 1, 1957, ABMA Cont. Off. files.

10. Memo for Record, Plans Br., Cont. Off., ABMA, "Project 618," Apr. 24, 1957, Cont. Off. files. Also, Cont. Off. report, "Project 618 Program--Budget Requirements," Apr. 9, 1957.

11. Memo for Record, Dep. Chief, R&D, "Conversation with Gen. Medaris at RSA, 21 June 1957," June 22, 1957, ABMA Hist. Div. files.

12. "ABMA 'Firsts'," Undated Report, ABMA Hist. Div., MSFC Hist. Off. files.

After Russia's successful Sputnik I launching on October 4, 1957, Secretary of the Army Brucker wrote the Secretary of Defense, again offering the services of ABMA in orbiting a satellite:

> The first Jupiter C attained an altitude of 650 miles and a range of over 3,300 miles. We have already proven the three most difficult stages of a four-stage satellite vehicle.. . ./Army Ordnance would require/ four months from a decision date to the first launching of a missile designed to place a satellite in orbit. Over the period of a year the Army would be prepared to launch up to six such vehicles. We would require a total of $12,752,000 of non-Army funds for this purpose.

Secretary Brucker added that prior to the first launch of a Jupiter satellite the Army could point out, if desirable for psychological purposes, "that we have already three satellite test vehicles (the Jupiter C's fired in the Jupiter program)." He stated further that the Army "would continue to cooperate with regard to the scientific instrumentation presently planned for Vanguard."[13]

The Secretary of Defense responded by requesting the Army to restudy its proposal for supporting Vanguard. Secretary Brucker answered that "we recommend the launching of a Jupiter C satellite in February and another in April. These would give us the basic knowledge which would help us to place a Vanguard sphere in orbit in June." To give added assurance he suggested that plans include a fourth satellite in orbit in September 1958. The four-satellite project, known as Project 416, included orbiting of Vanguard instrumentation, the program costing an estimated $16.2 million.[14]

13. Memo, Sec. of the Army to Sec. of Defense, "Soviet Satellite," Oct. 7, 1957, ABMA Hist. Div. files.

14. Memo, Sec. of the Army to Sec. of Defense, "Army Support of Vanguard Program," Oct. 23, 1957, ABMA Cont. Off. files.

At a meeting on October 25, 1957, the Ad Hoc Advisory Group on Special Capabilities, headed by Chairman Homer J. Stewart, unanimously endorsed Project 416.

The Secretary of Defense, on November 8, directed the Army to prepare to attempt two satellite launchings during March 1958. On November 15, 1957, ABMA was authorized to obligate $3.5 million for this purpose.[15] A few days later Secretary Brucker recommended to the Secretary of Defense that the Army launch the first satellite on January 30, 1958, in order to make modifications, if necessary, for the one to be launched on March 6, 1958. This plan would provide the most assurance for a successful launching of a satellite by the March 1958 date announced by the President.[16] The Department of Defense readily agreed. ABMA now had a green light to apply rocketry to space flight.

Space Flights Under ABMA

The immediate post-Sputnik weeks were of an unprecedented nature in American history. This was no surprise to American rocket specialists. Russia had orbited Sputnik I; the U. S. had orbited nothing. The eyes of the entire world were now on U. S. rocketry scientists.

Yet the accomplishments of 1958 and 1959 were to demonstrate basic competence and broad-based nature of American scientific application of rocketry in spite of Soviet "spectaculars" and propaganda. In this effort, ABMA made its contribution.

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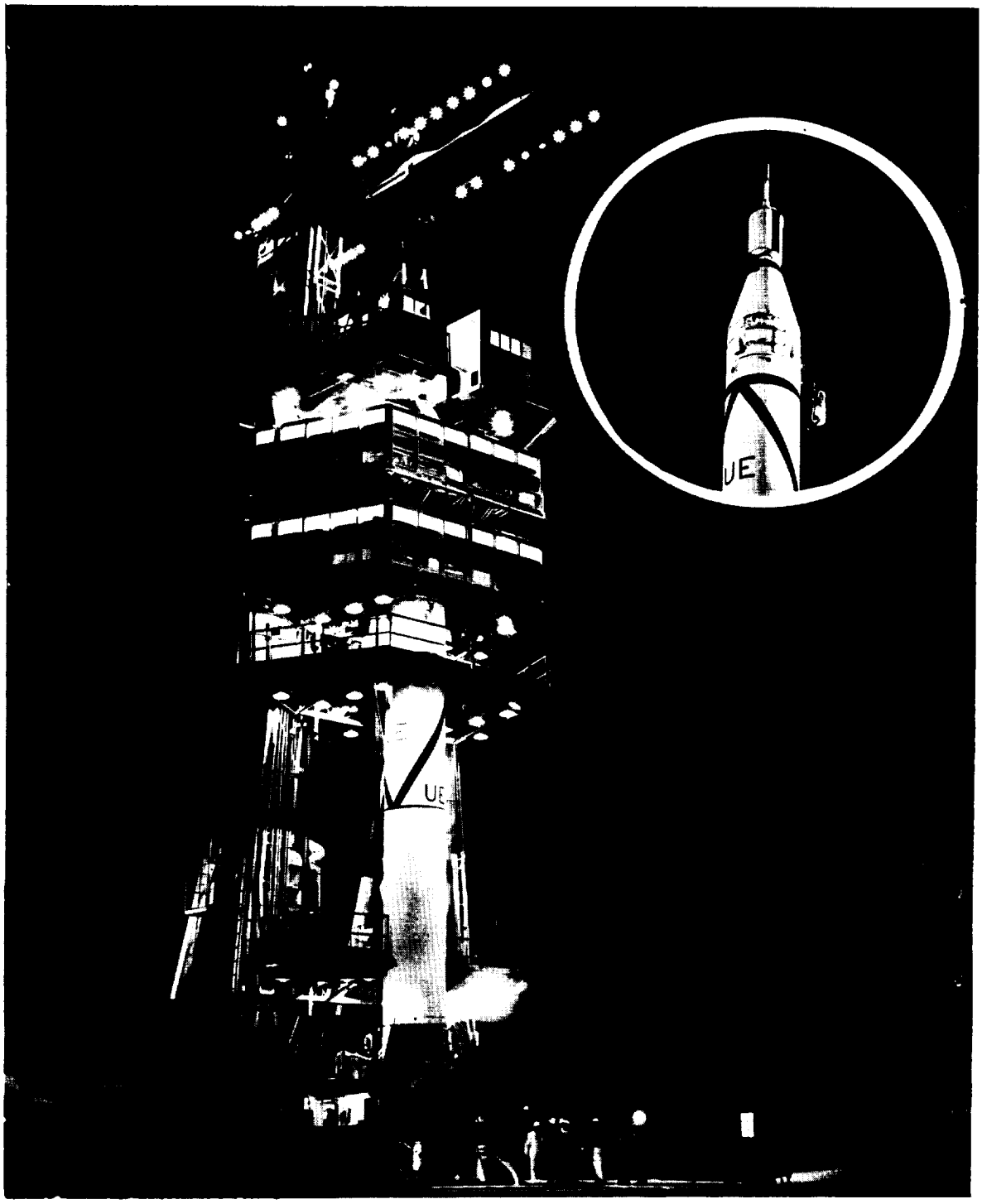
15. Satellite Information Notebook, ABMA Cont. Off., Mar. 1958, Tab H, ABMA Cont. Off. files.

16. Memo, Sec. of the Army to Sec. of Defense, "Scientific Satellite Program," Nov. 20, 1957, ABMA Hist. Div. files.



EXPLORER I

Final preparation on launching night of first U. S. satellite, January 31, 1958. Insert shows close-up of satellite atop the Jupiter C.

First, within four months after Sputnik I, ABMA's Jupiter C No. 29, on January 31, 1958, sent Explorer I into orbit, after bad weather postponed launching on January 29 and 30. Special fuel, UDMH-Deta, raised the engine thrust from a normal 78,000 to 83,000 pounds.

Called Explorer I upon its successful launching from Cape Canaveral at 10:48 p.m. E.S.T., the 30.8-pound satellite, including instruments, was a U. S. contribution to the International Geophysical Year. At 220 miles altitude, lowest point of orbit, the satellite reached a velocity of 18,500 miles per hour. At apogee, 1,700 miles altitude, there was a velocity of 15,400 miles per hour.[17]

For scientific purposes the satellite carried a cosmic ray measuring device, a gauge for determining cosmic dust, thermometers, and telemetry equipment consisting of Microlock and Minitrack transmitters. One transmitter battery had a life expectancy of two weeks; the other transmitter had two months expectancy. Estimates of the life expectancy of the satellite were as low as 10 years and as high as 20.[18]

After the success with Explorer I, Jupiter C No. 26 was fired for the purpose of orbiting Explorer II. This orbiting failed. Lift-off was normal at 1:28 p.m. E.S.T., March 5, 1958, and the vehicle closely followed the predicted trajectory as indicated by optical, DOVAP, Beat-Beat, and radar tracking. Proper altitude was maintained and second and third stage ignition occurred.

17. "Firing Test Report Jupiter C Missile 29," ABMA Development Operations Division (DOD), Mar. 24, 1958, ABMA Hist. Div. files.

18. "Artificial Earth Satellite 1958 - Alpha," ABMA Dev. Oper. Div., Feb. 26, 1958. Also, "Aeroballistic Evaluation Test Flight Jupiter C 26," Dept. of the Army Memo No. 321, Mar. 1, 1958. Both in ABMA Hist. Div. files.

The missile was to place an 18.83-pound instrument payload in orbit around the Earth as a contribution to the International Geophysical Year. The scientific instruments included in the payload were: (1) Cosmic ray counter of the State University of Iowa; (2) Erosion gauges to determine the cosmic dust for the Air Force Cambridge Research Center; (3) Thermometer for the Jet Propulsion Laboratory; (4) Microlock instrumentation for tracking by microlock doppler; and (5) Antennae for telemetering of scientific data using minitrack instrumentation.[19]

The first stage performed satisfactorily, LOX fuel-depletion occurring approximately 7 seconds before the predicted cutoff time of 149.1 seconds. However, the electronic tracking system indicated the proper velocity of stage one was not obtained.

Ignition of the second stage occurred at 390.41 seconds of flight time; 394.4 seconds had been predicted. The fourth stage did not fire, causing the satellite to fall. The Army's second satellite attempt thus ended in failure.[20]

Explorer I was successful, Explorer II was not. On March 26, 1958, Jupiter C No. 24 placed Explorer III in orbit.[21] It rose from Cape Canaveral, Florida, at 12:38 p.m. E.S.T., and it also carried experiments as a part of the International Geophysical Year. The missile carried aloft an 18.53-pound scientific payload.

19. "Jupiter C Missile RS-26, Thermal Environment Analysis System Report," Rpt. No. DSD-TM-4-58, ABMA/S&M Lab., 23 May 1958, ABMA Hist. Div. files.

20. Dept. of the Army Tech. Note No. 108, Aeroballistics Lab., Flight Eval. Br., Apr. 2, 1958, ABMA Hist. Div. files.

21. Jupiter C-24 was a "standby replacement" for Jupiter C-26.

Electronic tracking and telemetry records indicated a satisfactory launching, except that Explorer III orbited with greater eccentricity than predicted.[22]

Explorer III had the same type of carrier vehicle as Explorer I. Its instrumentation, however, included a miniature tape recorder not on the first satellite. This recorder made it possible to collect radiation information throughout the entire orbit, and then return the information to earth upon signal as the satellite passed over ground stations. Explorer III's battery-powered transmitters had a life expectancy of about two months.

The tremendous sweep of Explorer III's somewhat eccentric orbit, from 117 to 1,740 miles above earth, made it "splendid for cosmic ray research."[23] Explorer III's perigee was the closest to earth of any satellite, U. S. or Russian, orbited to date. The satellite out-lasted its two-month batteries, thus furnishing all the data planned.

During its lifetime the satellite swung closer to earth at the rate of several hundred feet a day. By early June both transmitters ceased to function reliably; but scientists had learned that cosmic radiation at higher altitudes was considerably more intense than anticipated. They also learned that atmosphere density was several times greater than that predicted in pre-satellite calculations. As for temperature, scientists

22. TT, Dir., MFL, PAFB, to Comm. Gen., ABMA, Mar. 29, 1958, "Data Report on Flight Test of Jupiter C Missile 24 (Explorer III)," ABMA Hist. Div. files.

23. Dr. James A. Van Allen, as quoted in Redstone Rocket, Apr. 9, 1958.

discovered that man can control space vehicle temperature within limits acceptable for human survival.

During this era of satellite orbiting, there was an important achievement in the return of objects sent into outer space. Jupiter Missile 5 launched America's first tactical type re-entry nose cone from Cape Canaveral, at 12:05 a.m. E.S.T., May 18, 1958. Less than five hours later, the Navy recovered the nose cone from the sea.[24]

Jupiter Missile 5 was followed by the first completely guided Jupiter IRBM to be flight tested. This missile, Jupiter Missile 6, rose from Cape Canaveral at 4:05 a.m. on July 17, 1958. Ignition, lift-off, programming, and cutoff were normal. The flight marked the second successful flight test of a full-scale nose cone. The recovery of the nose cone occurred one and one-half hours after the missile left the Cape.[25]

Four months to the day after Explorer III, Explorer IV went into orbit, July 26, 1958. Sent into orbit from Cape Canaveral, Explorer IV's instrumentation was oriented toward measuring effects of nuclear explosion at high altitudes. Explorer IV carried four radiation counters, as compared to the single counters in Explorers I and III; it thus could

24. History of ABMA, 1 Jan.--30 June 1958, ABMA Hist. Div., p. 74, MSFC Hist. Off. files.

25. History of ABMA, 1 Jul.--31 Dec. 1958, ABMA Hist. Div., p. 21, MSFC Hist. Off. files.

provide many times the accurate counting rate. As with Explorers I and III, the State University of Iowa designed and supplied the radiation detectors.

Because of the extra radiation counters in Explorer IV, it could not carry a tape recorder, as in Explorer III, nor the micrometeorite and temperature experiments of Explorers I and III. As it was, both Explorers IV and V carried unusually heavy instrumentation.[26] To have it cover most of the earth's surface, the scientists also increased the incline toward the equator of Explorer IV's orbital plane (and planned the same for V).[27]

The first lunar flight attempt by the ABMA group was with a modified Jupiter Missile 11 (Juno II),[28] fired from Cape Canaveral at 12:44 a.m. E.S.T., December 6, 1958. However, the attempted lunar probe with Pioneer III was unsuccessful, Jupiter 11 failing to attain escape velocity after cutoff occurred approximately 3.7 seconds too soon. Malfunction of the fuel depletion switch probably caused the early cutoff.

26. Dr. Wernher von Braun, "The Explorers," Speech before International Astronautical Federation, Amsterdam, Aug. 25-30, 1958, p. 8, in Army Ordnance Satellite Program, ABMA Hist. Monograph, Nov. 1, 1958, p. 69, MSFC Hist. Off. files.

27. Interview with Dr. Ernst Stuhlinger, Dir., Research Projects Lab., ABMA, Nov. 5, 1958.

28. Juno II was now a NASA project. It will be remembered that the Juno program began under ARPA Order 1-58. Then, on October 9, 1958, nine days after the establishment of NASA, NASA issued Order HS-1 for continuation of work begun under ARPA Order 1-58. This work included the development and firing of one Juno I space vehicle with the mission of placing a 12-foot diameter sphere into orbit around the earth, the development and firing of two Juno II space vehicles to carry lunar probes into space, the development and firing of one Juno II vehicle to place a scientific payload in orbit around the earth, and the preparation of one Juno II vehicle as a backup for the above lunar probe and earth satellite programs. NASA Order HS-4, issued on October 9, 1958, was issued for continuation of work begun under ARPA Order 12-59. This work included the development and firing of one Juno II vehicle to place a 100-foot inflatable sphere into orbit. AOMC, Satellite & Space Program Progress Report for NASA, Nov. 18, 1958, p. 1, MSFC Hist. Off. files.

Pioneer III did go farther into outer space than any other previous probe by the ABMA group. It traveled 66,654 miles toward the moon, and was a successful test of the four-stage Juno II vehicle in the main power phase. Also tested successfully was the guidance system and the heat protecting shroud for the upper stages.[29]

The group's final important firing of 1958 was Jupiter Missile 13. This missile flew from Cape Canaveral at 3:58 a.m. E.S.T. on December 13. Its nose cone traveled on course to its target, while telemetry equipment tested the cone's live passenger Gordo, a South American squirrel monkey. Though searchers failed to recover the cone and its passenger, telemetry furnished invaluable information about live reaction to rapidly accelerated flight, weightlessness, and other biological factors concerned with flight up to and back from outer space.[30] An important test was a recording of the monkey's heart beat as the animal rode to outer space and returned to earth, a taped recording in much demand by scientific groups.[31]

ABMA's next big firing, an important one, came early in 1959. ABMA launched Juno II Missile 14 at the Atlantic Missile Range, 12:11 a.m. E.S.T. on March 3. This was NASA's fourth space probe and it was the second Army missile to launch a NASA lunar probe experiment. The missile placed Pioneer IV on a trajectory which carried past the moon and into orbit around the sun, to become the first U. S. solar satellite.

29. Progress Report on NASA Programs, Nov.--Dec. 1958, Jan. 15, 1959, pp. 1-2, ABMA Cont. Off. files.

30. Jupiter Progress Report for December 1958, Jan. 8, 1959, pp. 1-2, ABMA Hist. Div. files.

31. The recording created interest at the NASA-BMC Presentation, Jan. 6-8, 1959. See Memo for Record, ABMA Cont. Off., "Trip Report by Col. Drewry Concerning NASA-BMC Presentation," Jan. 13, 1959, ABMA Hist. Div. files.

PIONEER IV SPACE PROBE

A Juno II rocket is ready to send Pioneer IV on its way to the sun.

ABMA postponed firing from the first scheduled date because of the weather, and from the second scheduled date of March 1-2 because of payload power supply difficulties. The Agency launched the satellite on March 3, with no holds.

Juno II 14's mission involved an escape guidance experiment and a determination of the Pioneer IV trajectory in its path toward the moon. The JPL payload carried a cosmic ray counter, a trackable beacon, and an optical device for determining location in space relative to the moon.

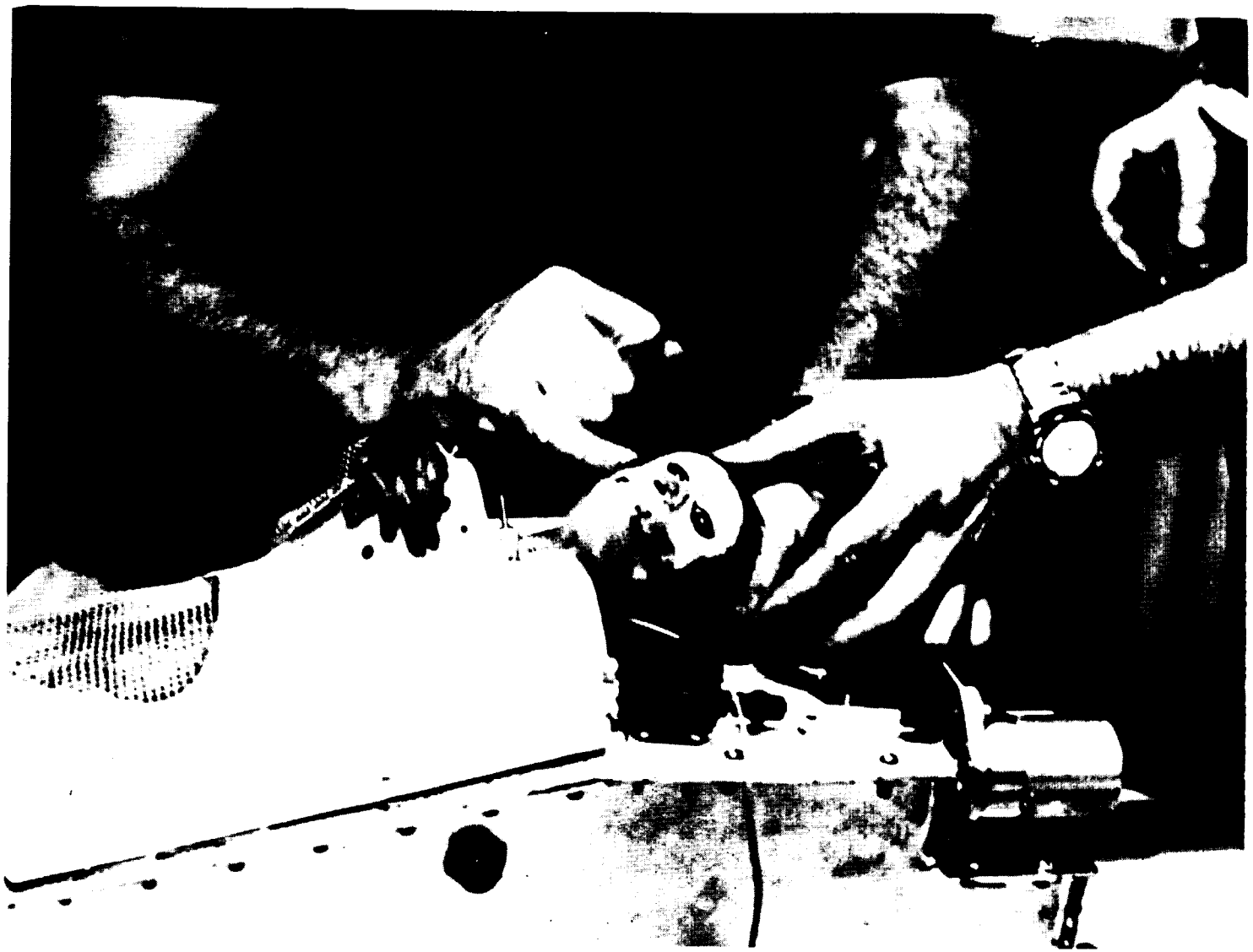
The conical portion of the shroud separated by means of explosive bolts and springs, 12 seconds after the top section had separated from the booster. By 11:00 a.m. the satellite had a velocity of 6,162 m.p.h., and had traveled 84,800 miles.[32] By 9:15 a.m. on March 5, the satellite had a velocity of 3,960 m.p.h. and had traveled 406,620 miles. The Goldstone tracking station lost contact with the probe at that time.[33] Contact was momentarily regained at 9:24 a.m. No further contact with Pioneer IV was expected.[34]

After launching a solar satellite, the group then sent into, and recovered from, outer space the first primate passenger. Jupiter Missile 18 left Cape Canaveral at 2:35 a.m. E.S.T. on May 28, 1959. In the nose cone were an American-born Rhesus monkey, Able, and a squirrel monkey, Baker, as well as yeast, corn, mustard seeds, fruit-fly larvae, human

32. Satellite & Space Program Progress Report for NASA, Feb. 15, 1959, pp. 2-3, ABMA Hist.Div. files.

33. Radio contact with Pioneer IV for 406,620 miles established a communications record.

34. "ABMA News for You," Mar. 3, 1959, ABMA Hist. Div. files.



FAMOUS MONKEY ABLE

Monkey Able, the American-born Rhesus monkey, after recovery by U.S.S. Kiowa of the nose cone of JUPITER R&D Missile 18, launched at Cape Canaveral, Florida, on May 28, 1959.

blood, mold spore, and fish eggs.

The nose cone impacted on the pre-selected target and was aboard the recovery ship approximately 90 minutes after liftoff. Able and Baker were alive. This first successful recovery of primates after flight into outer space provided information to be used in studying the possible effects of rocket flight to be expected upon human performance, such as the psychological effects of noise, acceleration, deceleration, vibration, rotation, and gravity-free state. The bio-medical experiments were supervised by the Surgeon General's Office, Department of the Army, and the Navy Bureau of Medicine and Surgery in support of the NASA Space Program.

Accumulated during the flight was a great deal of bio-astronautical data pertaining to the effect of rocket flight upon primates, and of cosmic radiation upon lower forms of animal life.[35]

ABMA next launched the complex Explorer VII satellite, its last historic satellite orbiting before joining NASA. The group had scheduled Juno II Vehicle 19A for launching in September 1959; however, debris from the explosion of Jupiter Missile 23 on September 16 damaged 19A.[36]

Juno II 19A successfully placed a 91.5-pound scientific earth satellite, Explorer VII, in orbit on October 13, 1959. The vehicle rose from Cape Canaveral at 10:31 a.m. E.S.T. on the appointed date. All satellite experiments functioned satisfactorily, with the first stage

35. "Control Office Historical Report, 1 Jan.--30 Jun. 1959," ABMA Cont. Off., p. 2, ABMA Hist. Div. files. The Able-Baker capsule was officially accepted by the Smithsonian Institution, Washington, D. C., at a ceremony on November 17, 1960.

36. Vehicle 19A, consisting of four stages, had the mission of carrying a back-up payload of the Juno II Vehicle 16 type.

EXPLORER VII

On October 13, 1959, Juno II 19A launched Explorer VII, a 91.5-pound satellite.

flight, main cutoff, and separation occurring as intended. Injection of Explorer VII into orbit occurred at 3:39 p.m. E.S.T.[37]

The group's responsibility for this firing included a real-time determination of upper stage and payload performance with the primary mission of making a quick calculation of orbital parameters. This task was accomplished.

Explorer VII continues to circle the earth every hour and forty-one minutes sending back valuable radiation and weather information. The extremeties of the satellite's orbital coverage are 50 degrees latitude North and South, covering much of the earth's surface.[38]

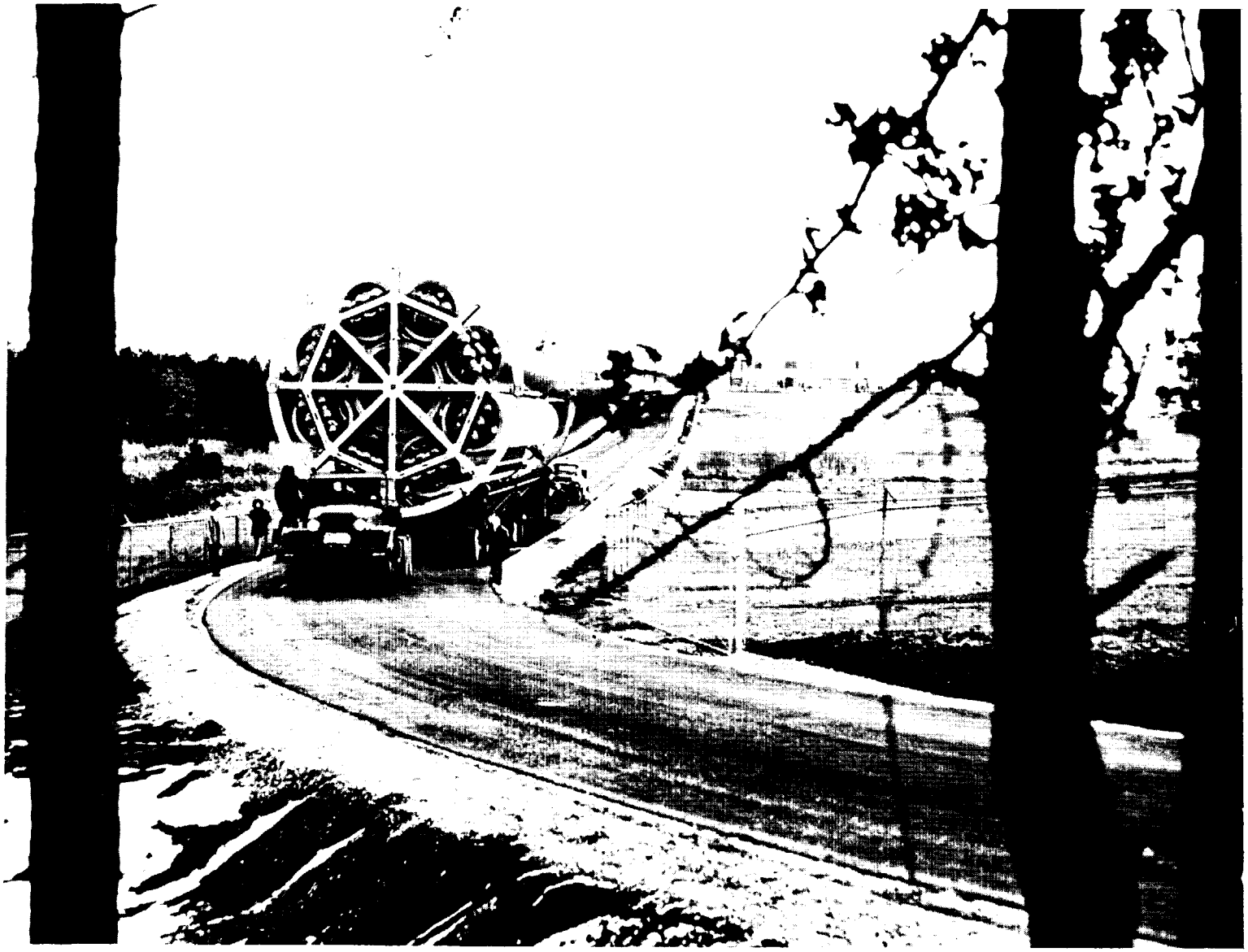
But whereas the Explorer program thus far was in terms of pounds, a new program was emphasizing the lifting of tons into outer space. This was the important new U. S. Saturn program. By early 1957, ABMA designers had been considering the possibility of a large, clustered-engine first stage for a space vehicle. In December 1957 ABMA submitted to the Department of Defense a "Proposal for a National Integrated Missile and Space Vehicle Development Program." This historic document suggested the need for a booster of 1.5 million-pound thrust. On August 15 ARPA[39] initiated the Saturn program by authorizing a space booster of 1.5 million pounds thrust.[40] ABMA responded with a clustering of eight H-1

37. Satellite & Space Program Progress Report for NASA, Nov. 6, 1959, pp. 3-4, ABMA Hist. Div. files.

38. DF, Director ABMA/S&M Lab. to Director, ABMA/DOD, "Missions and Features of Jupiter Missile AM-19A," Sept. 24, 1959, p. 1, ABMA Hist. Div. files.

39. ARPA, the Advanced Research Projects Agency, directed the space programs of the Department of Defense.

40. ARPA Order 14-59, Aug. 15, 1958, Dir. of ARPA to CG, AOMC, p. 1, MSFC Hist. Off. files.



SATURN BOOSTER AT REDSTONE ARSENAL

Major effort is required to transport the Saturn booster a short distance from the Fabrication Laboratory to the static test stand.

liquid propellant engines built essentially from existing Jupiter and Thor engine components. Foremost among alternate proposals to the eight-engine concept was a concept for clustering four E-1 engines. This concept lost out because of the estimated cost of completing the E-1 engine development, and because of the time the development would require. By using the H-1 engine, an improved version of the S-3 Jupiter and Thor engine, ARPA could furnish the nation a quick, relatively inexpensive, reliable booster capable of lifting into orbit or outward for space travel a multi-ton payload.

On November 21, 1958, the Director of ARPA and the Commanding General of AOMC signed a "Memorandum of Agreement" outlining part of the research and development schedule for the Saturn booster.[41] This was followed by an ARPA supplement to its original August 15, 1958, order, the supplement authorizing, in addition to the original booster of 1.5 million-pound-thrust, the development of a multi-stage vehicle.[42]

ARPA Order 47-59, dated December 11, 1958, authorized AOMC to design, construct, and modify the ABMA Captive Test Tower as well as determine design requirements for Saturn launch facilities. Later that month ARPA authorized AOMC to conduct design studies of various vehicle configurations incorporating the Saturn booster as first stage.[43] On March 17, 1959, ABMA submitted to ARPA a Saturn system study, which recommended

41. History of Army Ballistic Missile Agency, 1 Jul.--31 Dec. 1958, p. 50, MSFC Hist. Off. files.

42. Quarterly Progress Report on ARPA Orders 14-59 & 47-59, for First Quarter CY 1959, Apr. 7, 1959, MSFC Hist. Off. files.

43. ARPA Order 14-59, Amendment No. 3, Dir. of ARPA to CG, AOMC, p. 1, ABMA Cont. Off. files.

that either the Atlas or Titan rocket be used as second stage of the Saturn vehicle. ARPA responded with a decision to use a modified Titan for the second stage and a Centaur for the third stage. However, ARPA subsequently ordered AOMC to suspend all expenditures relating to stage diameter of the modified Titan.[44]

On December 7, 1959, ARPA authorized ABMA to make an engineering study of a Saturn configuration consisting of four hydrogen-oxygen engines as second stage and two hydrogen-oxygen engines (modified Centaur) as third stage. This version of the Saturn vehicle became known as the C-1.

A decision on the Saturn configuration was reached with the December 15 report from the Silverstein Committee ("Saturn Vehicle Team"). This long-range report recommended that the Saturn vehicle utilize hydrogen-oxygen upper stages. Initial vehicles would be the C-1 configuration; advanced vehicles would incorporate a new high thrust hydrogen-oxygen engine.[45]

The long-range Saturn program developed into a program for several configurations, each one a logical follow-on to the previous version. Initial plans called for the first Saturn configuration to consist of:

1. The booster unit made up of a cluster of eight conventional liquid fueled rocket engines, each developing 188,000 pounds of thrust, or an overall thrust of about 1,500,000 pounds.

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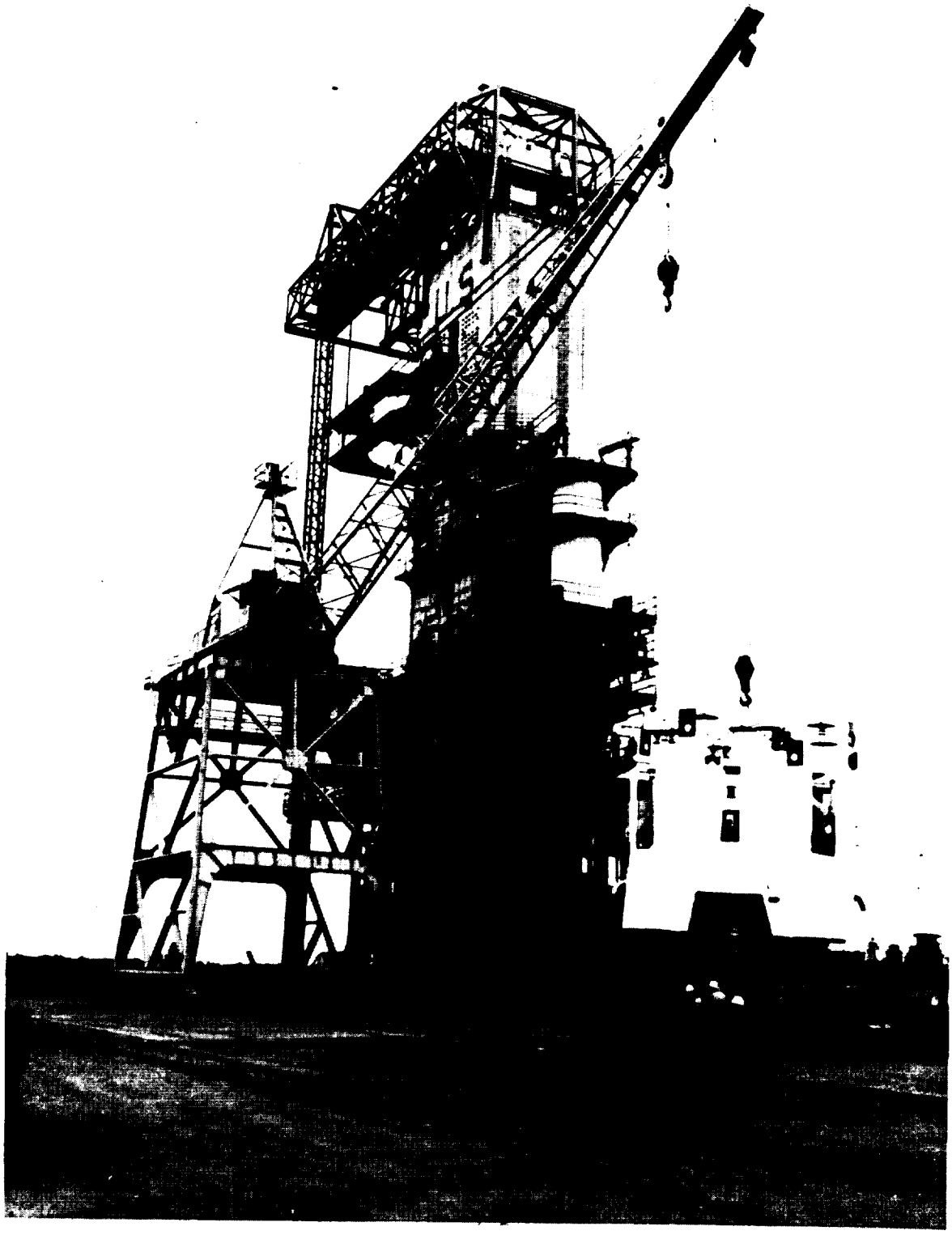
44. Project Saturn: Development and Funding Plan FY - 1961, Jul. 1, 1960, p. 2, MSFC Hist. Off. files.

45. Project Saturn: Development and Funding Plan FY - 1961, p. 2.



SATURN AT THE TEST STAND

A mockup of the Saturn's tail section is lifted into place at ARMA's Test Stand.

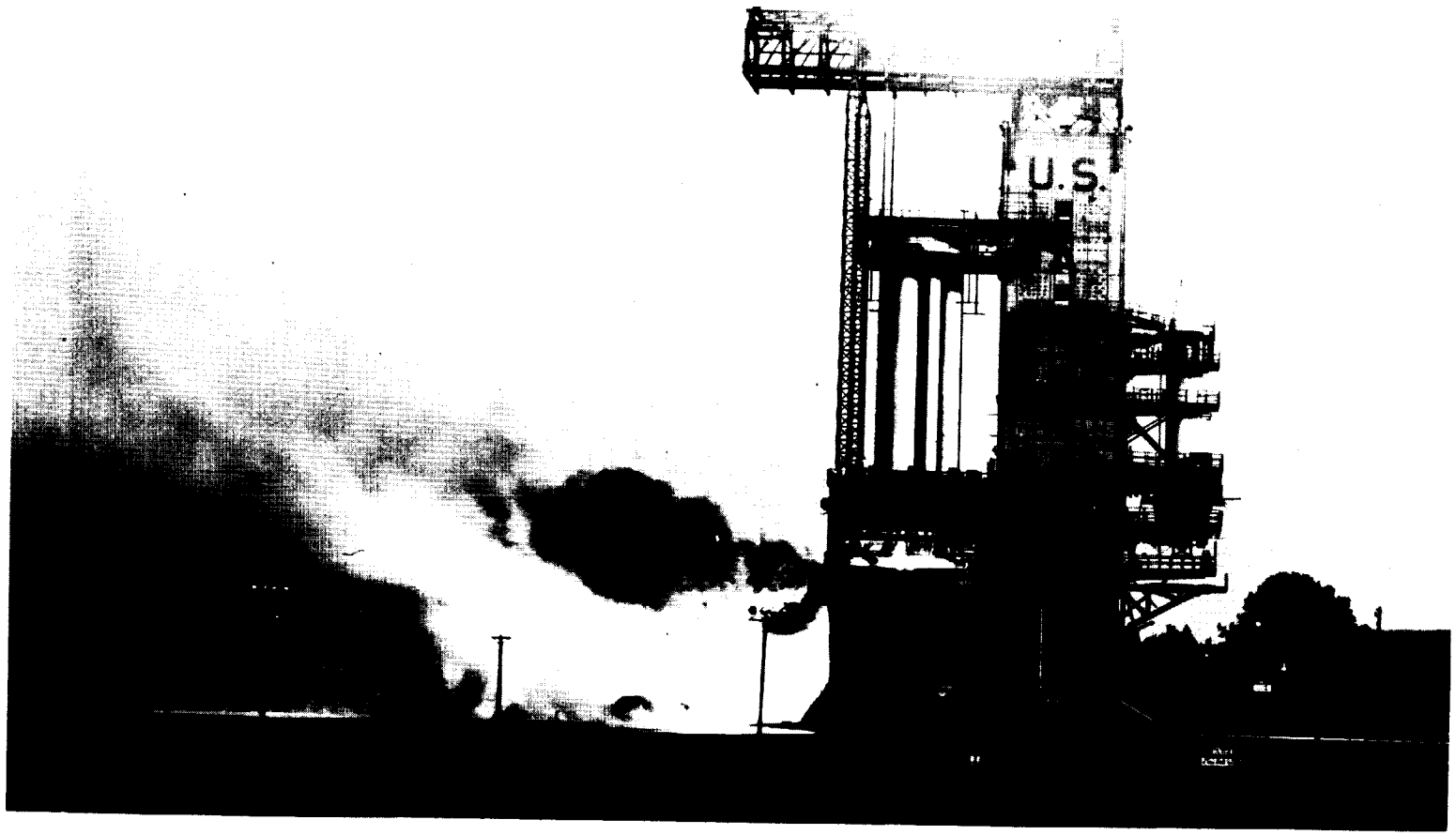
2. The second stage would be powered by four liquid hydrogen-fueled engines of 20,000 pounds thrust each. A contract for the development of the second stage was awarded to Douglas Aircraft. Subsequent to the award, the engine thrust level was reduced to 17,500 pounds.

3. The third stage would be a modified Centaur powered by two liquid hydrogen-fueled engines identical to those of the second stage.

For satellite missions, this configuration, standing about 180 feet tall, would orbit payloads of from 23,000 to 25,000 pounds, depending upon the altitude desired.

On January 14 ABMA began construction of a static test stand for the Saturn booster. This test stand, 177 feet high, was under construction during all of 1959. On January 4, 1960, ABMA installed in the test stand a mock-up of the Saturn booster. The purpose of this mock-up installation was to determine how the actual booster would fit into the stand and to test methods for servicing the booster. On February 1, 1960, the mock-up was removed, and with installation of the booster the following static firings occurred:

Firing	No. of Engines	Date (1960)	Duration
1st	2 engines	March 28	8 seconds
2nd	4 engines	April 6	7 seconds
3rd	8 engines	April 29	8 seconds
4th	8 engines	May 17	24 seconds
5th	8 engines	May 26	35 seconds
6th	8 engines	June 3	75 seconds
7th	8 engines	June 8	110 seconds
8th	8 engines	June 15	121 seconds



STATIC FIRING OF SATURN BOOSTER

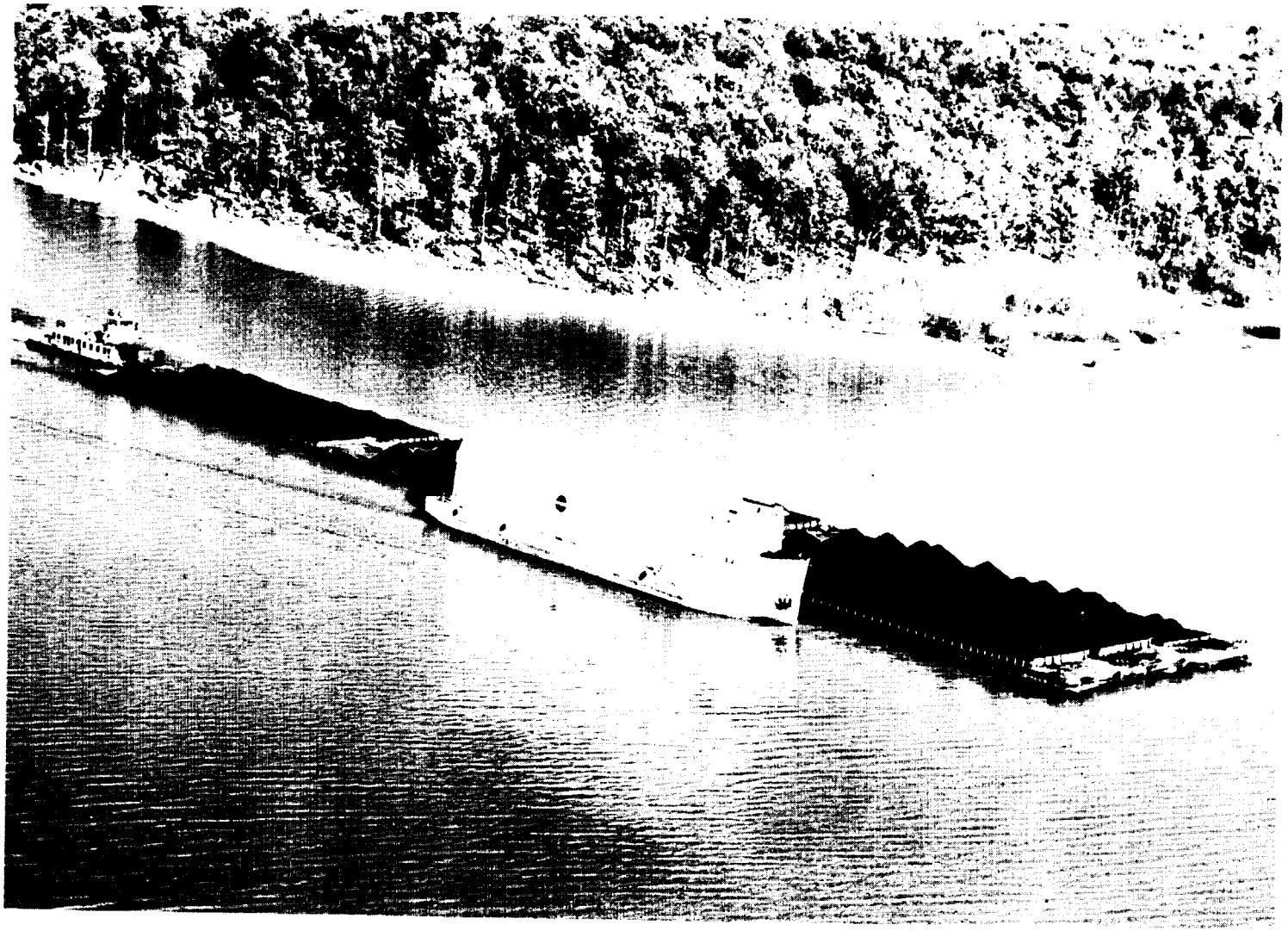
This is one of a series of eight successful static firing tests at Redstone Arsenal between March 29 and June 17, 1960.

On July 20, 1960, work began on a new static test stand, a "Dynamic Test Stand," located several hundred feet from the stand that accommodated the booster for the above firings. Completion date for this new stand is approximately February 1961. Its 204 feet will accommodate the full three-stage Saturn vehicle. The engines will not be "hot fired" in this stand. Instead, its purpose is to accommodate a three-stage Saturn so that personnel can test vibrarions, stage matings, firing procedures, etc. The prime objective of these tests is the dynamic behavior of the entire vehicle under launch hold down and simulated free flight conditions. The final stages with payload will also be tested.

From Huntsville the assembled Saturn first stage, too large for truck or available aircraft, will be transported by barge to Cape Canaveral. At Cape Canaveral it will find awaiting it an entire launch complex dominated by the 310-foot Service Structure.[46]

The important Saturn program offered a fitting challenge to the ABMA group that transferred to NASA on July 1, 1960. Behind part of this group was space experience that extended back thirty years. During the past two years, Explorer I was orbited under critical conditions. Explorer VII, the last Explorer before transfer of the group to NASA, was highly complex. In between were successful flights of live primate passengers, the orbiting of lunar and solar satellites, and the refinement of the ablation principle for returning objects from outer space. If experience was the proper index, their future would be interesting indeed.

46. The above Saturn information is from an October 28, 1960, interview with Robert Purdie, Operations & Control, MSFC Test Div.; and a November 30 interview with R. E. Lindstrom and Stan R. Reinartz, Saturn Systems Off., MSFC.



PALAEMON

The 180-foot-long Saturn barge arrived at its "home port" at Marshall Space Flight Center on November 22, 1960, after a 16-day journey from Houston, Texas. Named after the Greek sea-god and protector of ships, Palaemon will transport the Saturn booster to Florida next year for its first flight test. (Photo courtesy of MSFC "Marshall Star" and Southern Barge Lines, Paducah, Kentucky.)

CHAPTER V: THE TRANSFER TO NASA

Background

Early in 1958 President Eisenhower's Science Advisory Committee and the President's Advisory Committee on Governmental Organization had recommended the establishment of a civilian agency to direct non-military space activities. On April 2, 1958, President Eisenhower, in a special message to Congress, stated that "aeronautical and space science activities sponsored by the United States /should/ be conducted under the direction of a civilian agency except for those projects primarily associated with military requirements."[1] Congress therefore passed the National Aeronautics and Space Act, signed into law by President Eisenhower on July 29, 1958.

The National Aeronautics and Space Act established the National Aeronautics and Space Administration (NASA), making it responsible for conducting scientific exploration of outer space for peaceful purposes.[2]

1. U. S. House of Representatives, Eleventh Report by the Committee on Governmental Operations, Sept. 2, 1959, p. 141, ABMA Tech. Doc. Div.

2. Although a civilian agency, NASA would maintain liaison with the Department of Defense. The Act established a National Aeronautical and Space Council consisting of: The President, the Secretaries of State and Defense, the Administrator of NASA, the Chairman of the AEC, one other government member, and not more than three members from civilian life. The Act also established a Civilian-Military Liaison Committee, through which the Administration and the Department of Defense would advise and consult with each other on aeronautical and space activities. The Act established, for the Committee, a chairman, appointed by the President; one or more representatives from the Department of Defense; one or more representatives from each of the Departments of the Army, Navy, and Air Force; and representatives from NASA equalling in number the representatives from the military departments. See Public Law 85-568, National Aeronautics and Space Act, July 29, 1958, Sections 201 and 204.

On September 25, 1958, Dr. T. Keith Glennan, NASA Administrator, announced the activation of NASA as of October 1, 1958.[3]

The National Aeronautics and Space Act, as passed by Congress and approved by the President, gave the President of the United States the authority to transfer to the National Aeronautics and Space Administration

> . . . any functions (including powers, duties, activities, facilities, and parts of functions) of any other department or agency of the United States, or of any officer or organizational entity thereof, which relate primarily to the functions, powers, and duties of the /National Aeronautics and Space/ Administration. . . .[4]

President Eisenhower exercised this authority on October 1, 1958, when he transferred to NASA the responsibility for several space and rocket engine projects, including the Navy's Project Vanguard. The President again exercised this authority on December 3, 1958, when he directed the transfer to NASA of the Jet Propulsion Laboratory (JPL) of the California Institute of Technology.

Also on December 3, 1958, NASA and the Department of the Army agreed to make the resources of the Army Ordnance Missile Command (AOMC)[5]

3. Dr. T. Keith Glennan, A Proclamation, Sept. 25, 1958, in 44th Annual Report of the National Advisory Committee for Aeronautics, 1958 (Final Report), p. 115, MSFC Hist. Off. files. NASA initially was comprised of the 43-year-old National Advisory Committee for Aeronautics (NACA), consisting of approximately 8,000 personnel and 5 laboratories. NACA's facilities became NASA's Wallops Island Station (Virginia) and four Research Centers: Langley (Hampton), Lewis (Cleveland), Ames (Moffett Field), and the Flight Research Center (Edwards AFB).

4. PL 85-568, July 29, 1958, Section 302(a).

5. AOMC, with Headquarters at Redstone Arsenal, Alabama, had four subordinate agencies: White Sands Missile Range, New Mexico; Army Rocket & Guided Missile Agency, Redstone Arsenal; Army Ballistic Missile Agency, Redstone Arsenal; and Redstone Arsenal (Agency), operating in support areas for the other elements of the Command.

responsive to the needs of NASA's civilian space activities, provided that assignments from NASA were considered as "additional" to the Command's essential military requirements. This Agreement gave the Commanding General of AOMC full authority "to utilize the resources of his Command. . . for the accomplishment of assigned NASA projects."[6]

The Decision to Transfer

On October 21, 1959, President Eisenhower announced his decision regarding the Army Ballistic Missile Agency's Development Operations Division as follows:

> To strengthen the national space effort and provide for America's changing requirements in this field, I have concluded that the Army Ballistic Missile Agency can best serve the national interest as an integral part of the National Aeronautics and Space Administration.. . . As part of this action, the development of "super-booster" special vehicle will be consolidated in the aeronautical and space administration under the immediate direction of this team. I have directed that this program be vigorously pressed forward. The specific plan and details involved in this transfer, including provision for continuation of military missile programs now assigned to ABMA, will be ready to lay before the Congress when it reconvenes.[7]

On this same date NASA Administrator Dr. T. Keith Glennan stated:

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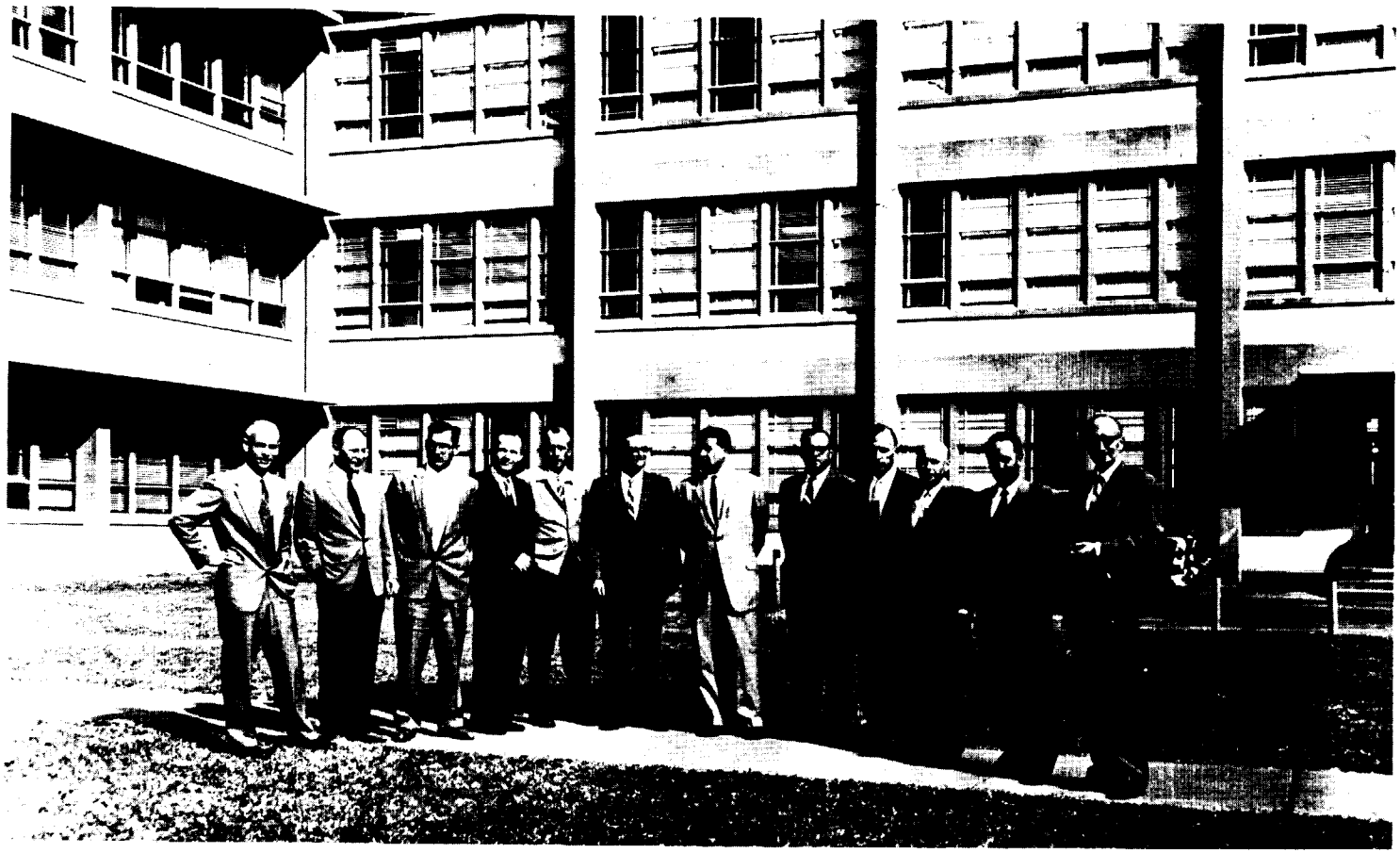
6. "Cooperative Agreement on the Army Ordnance Missile Command between the National Aeronautics and Space Administration and the Department of the Army, Dec. 3, 1958, pp. 1-2, MSFC Hist. Off. files.

7. President Eisenhower, Statement, Oct. 21, 1959, in TT, AOMC Central files. ABMA's Development Operations Division (DOD) was composed of 10 laboratories: Aeroballistics, Computation, Fabrication & Assembly Engineering, Guidance & Control, Missile Firing, Research Projects, Structures & Mechanics, Systems Analysis & Reliability, Test, and Systems Support Equipment Laboratories.



ABMA SCIENTISTS

Top scientific specialists led the Army's space efforts at ABMA before transfer of the team to MSFC. From left to right: Dr. Ernst Stuhlinger, Director- Research Projects Office; Dr. H. Hoelzer, Director - Computation Laboratory; K. L. Heimburg, Director - Test Laboratory; Dr. E. D. Geissler, Director - Aeroballistics Laboratory; E. W. Neubert, Director - Systems Analysis & Reliability Laboratory; Dr. W. Haeussermann, Director - Guidance and Control Laboratory; Dr. Wernher von Braun, Director - Development Operations Division; W. A. Mrazek, Director - Structures and Mechanics Laboratory; Hans Hueter, Director - System Support Equipment Laboratory; Eberhard Rees, Deputy Director - Development Operations Division; Dr. Kurt Debus, Director - Missile Firing Laboratory; H. H. Maus, Director - Fabrication and Assembly Engineering Laboratory.

> The President's action further clarifies the management organization of the nation's space program with NASA now assuming responsibility for the development of space booster vehicle systems of high thrust--the field of dominant interest to the personnel of the DOD of ABMA. . . .[8]

The President's October 21 decision to transfer ABMA's Development Operations Division meant that concurrent with the transfer NASA would acquire total responsibility for the Saturn project. Following the President's decision, and while the actual transfer was under preparation, NASA assumed technical direction of the project. This assumption was authorized by a November 1959 agreement between NASA and the Department of Defense.[9] Meanwhile, ARPA continued its business management, pending the transfer of the Huntsville facilities.[10]

On the day after President Eisenhower's October 21 announcement, Dr. Glennan and other NASA officials met with Army officials at Redstone Arsenal, Alabama. The group discussed the transfer of the Development Operations Division. During this visit Dr. Glennan and his party held meetings with an AOMC-ABMA staff management group, with the Development Operations Division laboratory directors, and with a larger group of key DOD personnel. Dr. Glennan emphasized the fact that the primary mission of the proposed NASA group would be the development of the program for a large space vehicle system.[11]

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8. Dr. T. Keith Glennan, Statement, Oct. 21, 1959, in TT, AOMC Central files.

9. Memorandum of Understanding, NASA Asso. Dir. and Dept. of Defense Dir. of Defense Research & Engineering, Nov. 18, 1959, MSFC Hist. Off. files.

10. U. S. Senate, Comm. on Aeronautical and Space Sciences, NASA Authorization Subcomm., Hearing on House Joint Resolution 567, Feb. 18, 1960, Testimony of Dr. Glennan, p. 26.

11. Memo for Record, Lt. Col. Glenn Crane, Special Asst. to CG, AOMC, "Summary Notes of Dr. Glennan's Visit to AOMC on 21 /sic/ October 1959," Oct. 24, 1959, MSFC Hist. Off. files.

ARMY BALLISTIC MISSILE AGENCY

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REDSTONE ARSENAL ALABAMA

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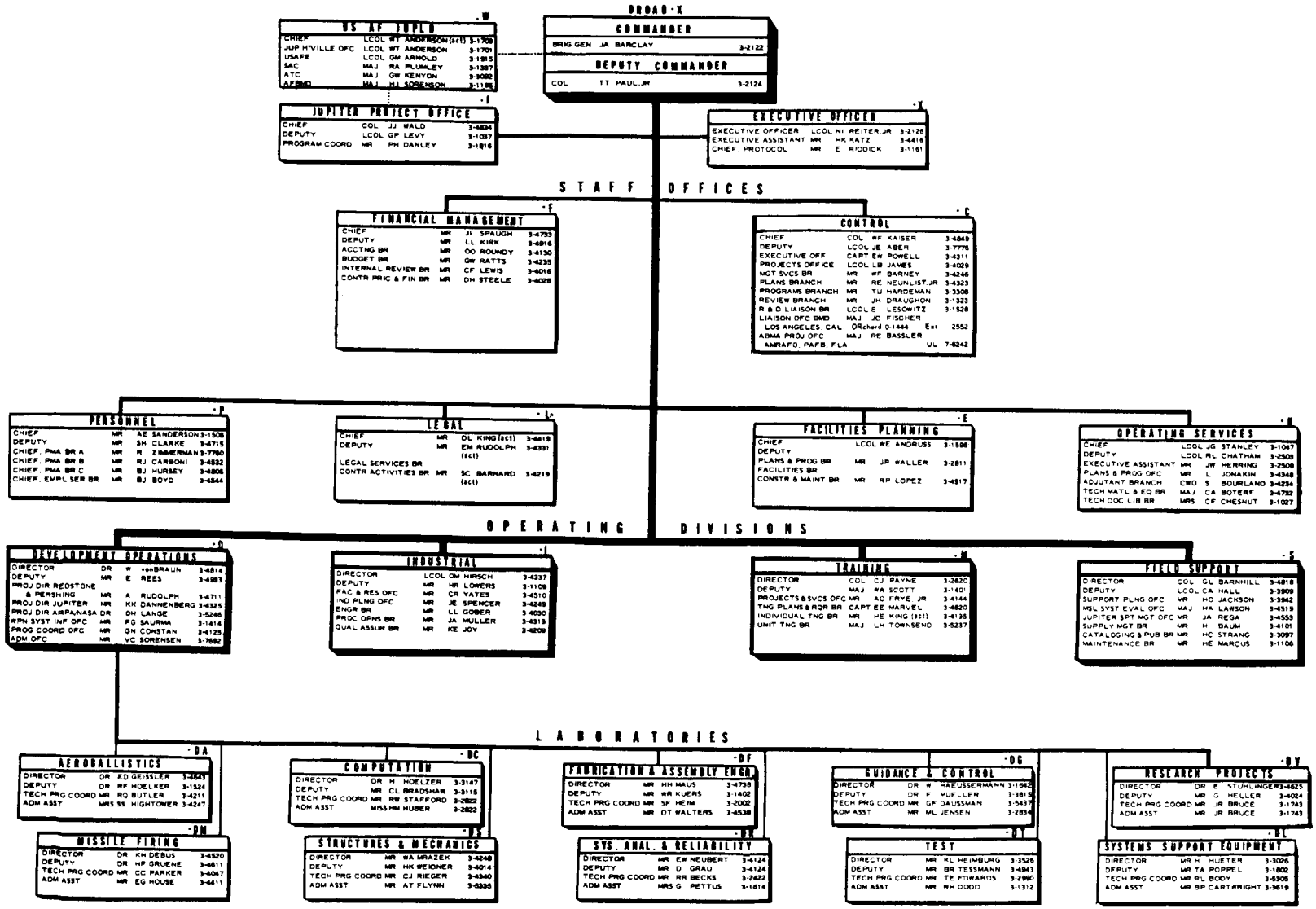

Prepared by Plans & Programs Office, Operating Services Office, ORDAB-HB Comm Ext 3-4548 for changes & for corrections

On October 30, 1959, NASA and the Department of Defense jointly recommended to President Eisenhower that the transfer include. . .

> personnel and such facilities and equipment which are presently assigned /to the Development Operations Division/ and required for the future use of NASA. . . and such other personnel, facilities and equipment for administrative and technical support of the transferred activity as may be agreed upon.. . .
>
> The detailed implementation of the actions proposed will be accomplished through the subsequent negotiation of cooperative agreements between the Department of Defense and NASA.[12]

On November 18 the Secretary of the Army and the Administrator of NASA signed an agreement establishing guidelines for the transfer. This agreement called for selection and appointment of a principal negotiator from the Army and from NASA. For NASA the principal negotiator would be the Director of Business Administration, and for the Army he would be the Deputy Chief of Ordnance. The principal negotiators would establish subordinate study or negotiation teams. It was agreed that a draft transfer plan would be submitted to President Eisenhower by December 15.[13]

In compliance with the provisions of the October 30 NASA-Department of Defense agreement, AOMC established a project task force. The task force members, under the direction of Colonel Calvin A. Heath, Chief,

12. Memorandum for the President, "Responsibility and Organization for Certain Space Activities," Oct. 21, 1959, signed by Dr. Glennan (NASA) and Sec. Gates (OSD) Oct. 30, 1959, approved by the President Nov. 2, 1959, pp. 1-2, Appendix A.

13. "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," Sections D & E, Nov. 16, 1959, signed by Dr. Glennan (NASA) and Sec. Brucker (Army) Nov. 18, 1959, Appendix B.

AOMC Control Office, were responsible for working directly with the NASA representatives headed by Mr. Albert F. Siepert, NASA Director of Business Administration. The AOMC Task Force members could exchange information and discuss problems relative to the transfer but could not make final decisions or commitments.[14]

The NASA Representatives and the AOMC Task Force members discussed problems in the following areas: facilities and real estate (both Huntsville and Cape Canaveral); personnel (civilian, military, and contractor); services; equipment, stocks, and supplies; timing and funding; and policies and procedures for selecting personnel to be transferred.[15]

On December 6 the Army-NASA negotiators drafted an initial plan for the transfer to NASA of the Development Operations Division and various Army supporting areas. The NASA Administrator, the Secretary of the Army, and the Acting Secretary of Defense reviewed the Transfer Plan and approved it with only slight modification.[16] As approved, this Plan provided NASA with a "substantially independent operating research and development organization and capability," meanwhile assuring "the continued performance by the Army of it's /sic/ mission." The Plan also provided for "the continuance of service by the Army of the transferred group and. . . for retention by the Army of capability for continuing

14. Memo, Gen. Barclay (Acting Dep. Comm. Gen., AOMC) to Army Project Officers and Task Force Members et al., "Establishment of A Project Task Force to Study Proposed Transfer of Functions and/or Organizations to NASA," Nov. 3, 1959, MSFC Hist. Off. files.

15. Memorandum of Transmittal, "NASA Discussion Papers Related to the Transfer. . .," Nov. 24, 1959, MSFC Hist. Off. files.

16. The Army-NASA Transfer Plan, dated Dec. 11, 1959, was signed by Administrator Glennan (NASA) on Dec. 17, by Sec. Brucker (Army) on Dec. 16, and by Acting Sec. Douglas (Defense) on Dec. 16, 1959. See Appendix C.

weapons system management." Fundamental to the plan was "a concept of phasing of operations and responsibility. . . to prevent dislocation or disruption of ongoing programs.[17]

As scheduled by November 18 agreement, NASA Headquarters and the Department of the Army Headquarters forwarded the approved plan to the Executive Office of the White House. On January 14, 1960, President Eisenhower submitted to Congress a plan for the transfer of the DOD to NASA.[18] In urging Congress to accept the Plan, the President referred to NASA's responsibility for developing high thrust space vehicles, and stated:

> . . . I have concluded that it is in the best interest of the Nation. . . to provide NASA with an organization capable of and equipped for developing and operating large space vehicle boosters and conducting related research. This can be done by transferring to NASA the Development Operations Division of the ABMA and certain supporting personnel. At the same time it is recognized that the Army must continue to discharge its responsibilities for the development of missile systems. The transfer plan forwarded herewith is designed to accomplish these purposes.. . .[19]

The Plan would be effective automatically within 60 days, unless formally disfavored by Congressional resolution.[20]

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17. Army-NASA Transfer Plan, Dec. 11, 1959, "Summary and Concepts," p. 1, Appendix C.

18. See previously cited announcement of the President's decision to order the transfer, October 21, 1959.

19. President Eisenhower, Exec. Order 10793, Jan. 14, 1960, MSFC Hist. Off. files.

20. "Transfer Plan: Making Certain Transfers from the Department of Defense to the National Aeronautics and Space Administration," transmitted by the President and delivered to Congress Jan. 14, 1960, Sec. 3. See also PL 85-568, Jul. 29, 1958, Sec. 302(a).

In the interests of expediting the transfer by removing "any unnecessary obstacles or delaying factors in the prosecution of. . ./national space science and exploration/ programs," the House of Representatives resolved on February 8 that the President's transfer plan take effect immediately.[21] Nevertheless, hearings on the House Joint Resolution conducted by the NASA Authorization Subcommittee of the Senate Committee on Aeronautical and Space Sciences failed to produce Senate action. Accordingly, the President's January 14 Transfer Plan automatically became effective after 60 days, on March 14, 1960.

On March 14 the Saturn program's unexpended and unobligated funds for fiscal year 1960 were transferred to NASA. This funding transfer was a further step toward NASA's assuming full responsibility for Project Saturn on July 1. Although the NASA facility was established on March 14, ABMA's Development Operations Division did not formally transfer to NASA until July 1. In the interim, NASA's Mr. Delmar Morris was delegated the authority normally given the head of a NASA field installation. Mr. Morris would serve as Deputy Director for Administration under Dr. Wernher von Braun, Director, upon the transfer of July 1.[22]

21. U. S. House of Representatives, Joint Resolution 567, Feb. 8, 1960.

It is significant that Secretary Brucker (Army) expressed the following views: "Since the apparent purpose of House Joint Resolution 567 is to give early congressional approval to the transfer plan submitted by the President and since it is not intended to interfer /sic/ by forced acceleration with the orderly transition planned for July 1, 1960, the Department of the Army, on behalf of the Department of Defense, expresses no objection to the adoption of the resolution." Letter, to Congressman Overton Brooks, Chairman, Comm. on Science & Astronautics, Feb. 4, 1960, in Hearing on H. J. Res. 567, Feb. 18, 1960, p. 3.

22. Dr. Glennan, NASA Administrator, "Establishment of NASA Huntsville Fability," NASA Circular No. 57, Mar. 14, 1960, MSFC Hist. Off. files.

On March 15, 1960, President Eisenhower issued an Executive Order which formally named the Huntsville facilities being transferred to NASA:

> Whereas, these facilities are destined to play a major role in man's conquest of outer space and its utilization for peaceful purposes for the benefit of all mankind; and. . .
>
> Whereas, the late General of the Army George C. Marshall devoted his life to the service of his country and to the advancement of the cause of peace throughout the world:
>
> Now, therefore, by virtue of the authority vested in me as the President of the United States, I hereby designate the facilities of the National Aeronautics and Space Administration at Huntsville, Alabama, as the George C. Marshall Space Flight Center; and such facilities whall hereafter be known and referred to by that name.[23]

Implementing the Transfer

Transfer problems too detailed for the December 11 Transfer Plan itself were solved by "cooperative agreements" on the levels of the specific problems. On December 10 NASA and AOMC announced the assignment of individuals responsible for preparing cooperative agreements in the areas outlined in the Transfer Plan.[24]

NASA and AOMC continued negotiations to reach agreement on implementing the various aspects of the transfer as well as on establishing

23. President Dwight D. Eisenhower, Exec. Order 10870, Mar. 15, 1960, MSFC Hist. Off. files.

24. "Army-NASA Transfer: Assignment of Responsibility for Preparation of Implementation Plans," Dec. 10, 1959, MSFC Hist. Off. files.

methods of operation as of July 1. For example, on April 4, 1960, NASA and the Army agreed upon the direction of construction projects (primarily in support of Project Saturn) to transfer from AOMC to NASA.[25] And, on May 31, the Deputy Director for Administration, Marshall Space Flight Center (MSFC), and the Commander, Army Ballistic Missile Agency, signed a Files Transfer Procedure.[26]

MSFC and AOMC negotiators prepared a draft operating agreement on June 10.[27] On August 16 the Deputy Director for Administration, MSFC, and the Commanding General, AOMC, signed this agreement delineating working relationships between MSFC and AOMC. By the terms of this agreement, AOMC would provide to MSFC certain administrative and logistic support services, and MSFC would provide to AOMC specified support services.[28]

Detailed procedures implementing this basic operating agreement were negotiated, by affected representatives of MSFC and AOMC's agencies in all areas listed in the basic agreement. Many of the procedures had been finalized before the basic operating agreement was signed. Nevertheless, all procedures were subject to the principles agreed upon in the August 16 document.

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25. "Cooperative Agreement between the National Aeronautics and Space Administration and the Corps of Engineers, Department of the Army, on Construction," Apr. 4, 1960, cited in Letter, Maj. Gen. August Schomburg, CG, AOMC, to Dr. T. Keith Glennan, May 6, 1960, p. 1, MSFC Hist. Off. files.

26. "Files Transfer Procedure of US AOMC and Marshall Space Flight Center," May 31, 1960, signed by Col. R. M. Hurst, Comm., ABMA, and Mr. D. M. Morris, Dep. Dir. for Admin., MSFC, MSFC Hist. Off. files.

27. DF, Col. Kaiser, Chief, Cont. Off., AOMC, to Commander, ABMA, "Status of Agreements with NASA for Support of ABMA," Jul. 8, 1960, p. 1, MSFC Hist. Off. files.

28. "Agreement between the U. S. Army Ordnance Missile Command, Ordnance Corps, Department of the Army and George C. Marshall Space Flight Center, National Aeronautics and Space Administration," signed by Maj. Gen. Schomburg, CG, AOMC, and Mr. D. M. Morris, MSFC Dep. Dir. for Admin., Aug. 16, 1960, MSFC Hist. Off. files.

Also finalized in August was the Army-NASA agreement on use of Redstone Arsenal land and facilities. The Agreement gave NASA 99-year, irrevocable and renewable occupancy and use of the land and facilities of the entire "NASA Complex" as well as of certain facilities outside the "NASA Complex."[29]

Meanwhile, on June 14 NASA announced the formation of the Launch Operations Directorate (LOD). The nucleus of the Directorate was ABMA's Missile Firing Laboratory, which was a part of the Development Operations Division. Under Dr. Kurt Debus, LOD assumed "on an expanded basis, the functions of the NASA Atlantic Missile Range Operations Office which initiated NASA's operations at AMR and established NASA launch operations procedures."[30]

Two more important agreements were finalized late in June. MSFC and AOMC reached agreement on transferring procurement and contracting functions on June 27. The two parties agreed on appropriate procedures for handling the six general areas of contracting and procurement.[31] At the close of business June 30, 1960, MSFC assumed "responsibility, accountability, and custody for all equipment on the property books of the Development Operations Division and Technical Materials and Equipment Branch, ABMA. . .." Items of equipment properly belonging to NASA,

29. "Agreement between the Department of the Army and the National Aeronautics and Space Administration for Use of Land and Facilities at Redstone Arsenal, Alabama," signed by Sec. Brucker (Army) Aug. 10, 1960, and Dr. Glennan (NASA) Aug. 15, 1960, p. 1, MSFC Hist. Off. files.

30. NASA News Release 60-212, "NASA Outlines Launch Organization," June 14, 1960, MSFC Hist. Off. files.

31. "Procedures for the Transfer of Procurement and Contracting Functions from US AOMC to Marshall Space Flight Center," June 27, 1960, signed by D. M. Morris, Dep. Dir. for Admin., MSFC, June 30 and by Col. T. W. Cooke, COFS, AOMC, June 29, 1960, MSFC Hist. Off. files.

as agreed upon, would be transferred by December 31, 1960; items of equipment properly belonging to the Army would be re-transferred by December 31, 1960.[32]

By June 30 just a little more than eight months had passed since the President's October 21, 1959, decision to establish NASA facilities at Huntsville. During this time NASA and the Army had jointly developed a plan for the transfer of ABMA personnel and facilities to NASA; President Eisenhower had officially ordered the transfer of ABMA personnel and facilities to form the nucleus of the George C. Marshall Space Flight Center; and NASA and AOMC negotiations had resulted in cooperative agreements for MSFC-AOMC transfer and operating procedures. Still to be finalized were many of the detailed operating agreements.

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32. "Responsibility, Accountability, and Custody of Equipment," agreement signed by D. M. Morris, Dep. Dir. for Admin., MSFC, and T. W. Cooke, COFS, AOMC, June 30, 1960, MSFC Hist. Off. files.

CHAPTER VI: ORGANIZATION AND MISSION

Introduction

The George C. Marshall Space Flight Center[1] officially began operations on July 1, 1960. On that date Major General August Schomburg, Commanding General, AOMC, formally transferred the agreed-upon missions, personnel, and facilities to Dr. Wernher von Braun, Director of NASA's Center, in a ceremony in front of the MSFC-ABMA joint headquarters.

MSFC has fourteen staff and project offices: Agena and Centaur Systems, Chief Counsel, Financial Management, Future Projects, Management Services, Operations Analysis, Patent Counsel, Procurement and Contracts, Public Information, Reliability, Technical Program Coordination, Technical Services, Saturn Systems, and Weapons Systems.[2]

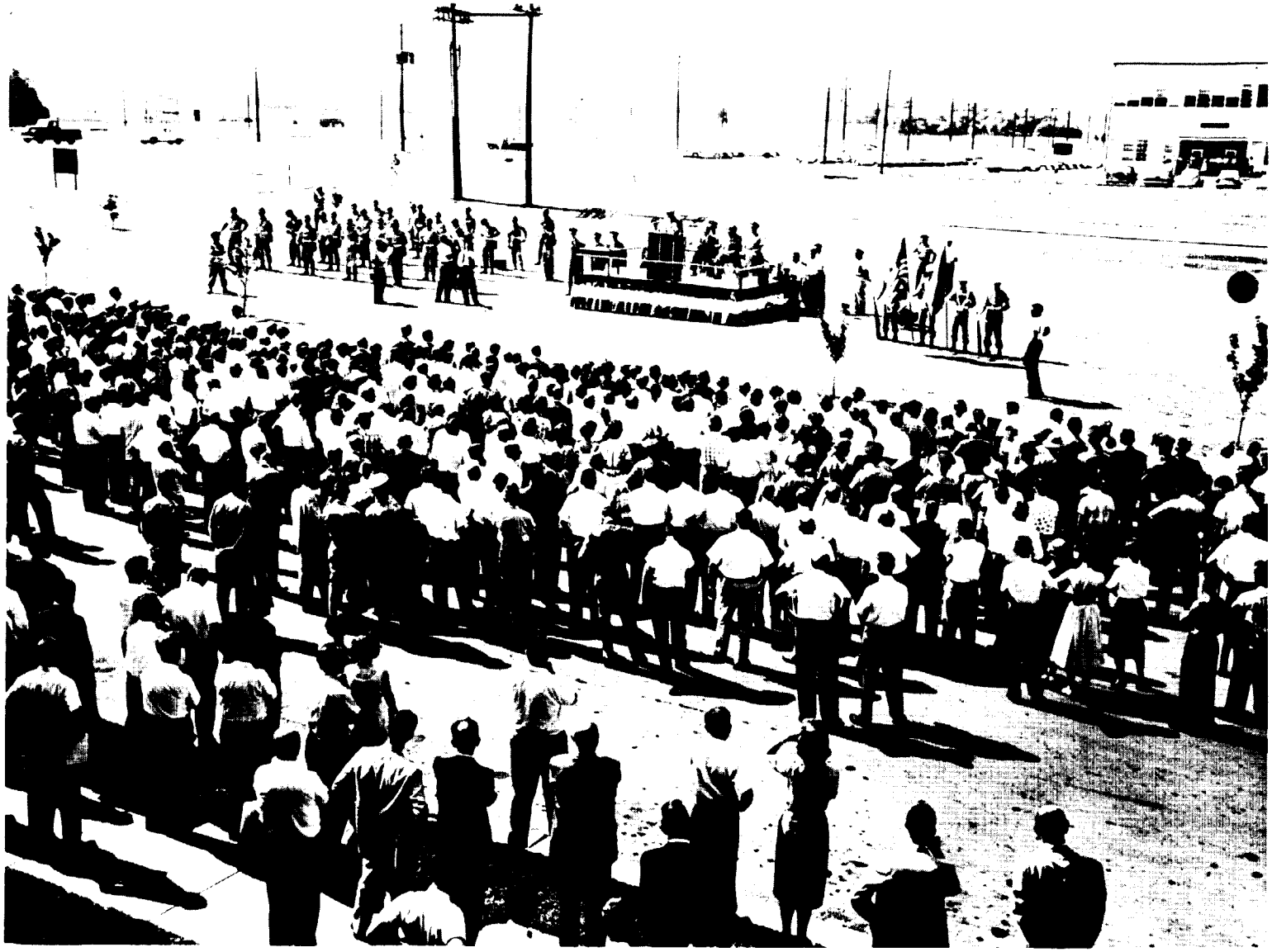
The Center has nine segments responsible for technical functions:[3] Aeroballistics, Computation, Fabrication and Assembly Engineering, Guidance and Control, Launch Operations Directorate, Quality, Research Projects, Structures and Mechanics, and Test.[4]

1. The Center is directly responsible to the NASA Office of Launch Vehicle Programs, Major General Don R. Ostrander, Director. "The Office of Launch Vehicle Programs is responsible for the development of the large booster systems needed for space flight and for the supervision of the launching operations necessary to place a satellite or space probe in its proper trajectory." Morton J. Stoller, Asst. Dir. for Satellite & Sounding Rocket Programs, NASA, "The U. S. National Aeronautics and Space Administration's Space Flight Program," Sept. 12, 1960, pp. 4-5, MSFC Hist. Off. files.

2. Initially, the Center had twelve staff and project offices. Established later were the Patent Counsel and the Reliability Office.

3. See Appendix D for a brief description of the functions of MSFC's segments.

4. Systems Support Equipment Division was abolished on October 1, 1960, with its functions being transferred to other MSFC divisions. Quality Division was formerly designated Systems Analysis & Reliability Division.



TRANSFER OF DEVELOPMENT OPERATIONS DIVISION TO MSFC

Dr. Wernher von Braun and Major General August Schomburg officiate at the July 1, 1960, official transfer of DOD from ABMA to MSFC. The transfer ceremony took place in front of ABMA-MSFC joint headquarters, building 4488.

Programs

NASA's mission is to plan, direct, and conduct the non-military aeronautical and space activities of the United States.[5] The George C. Marshall Space Flight Center supports NASA with launch vehicle systems design, development, and launching.[6]

A large program under the responsibility of MSFC is the Saturn Program, discussed in Chapter IV. Of top priority, the three-stage Saturn is expected to have a 1963 payload capability of 20,000 pounds. The Saturn C-1 (first version) will serve in launching heavy loads into outer space and into orbit around the Earth.[7]

MSFC is also responsible for development of the Centaur launch vehicle, for the development of the Agena B stage of the Atlas-Agena B and Thor-Agena B boosters, and for directing the F-1 single-chamber engine program.[8] The Center is providing the Mercury-Redstone vehicle for NASA's Project Mercury.

Centaur. MSFC has responsibility for the Atlas-Centaur project, an advanced version of an Atlas-based system.[9] A liquid hydrogen and liquid oxygen stage will be used on an Atlas booster in the Centaur

5. See PL 85-568, National Aeronautics and Space Act, Jul. 29, 1958, Sec. 102(b) and Sec. 203(a).

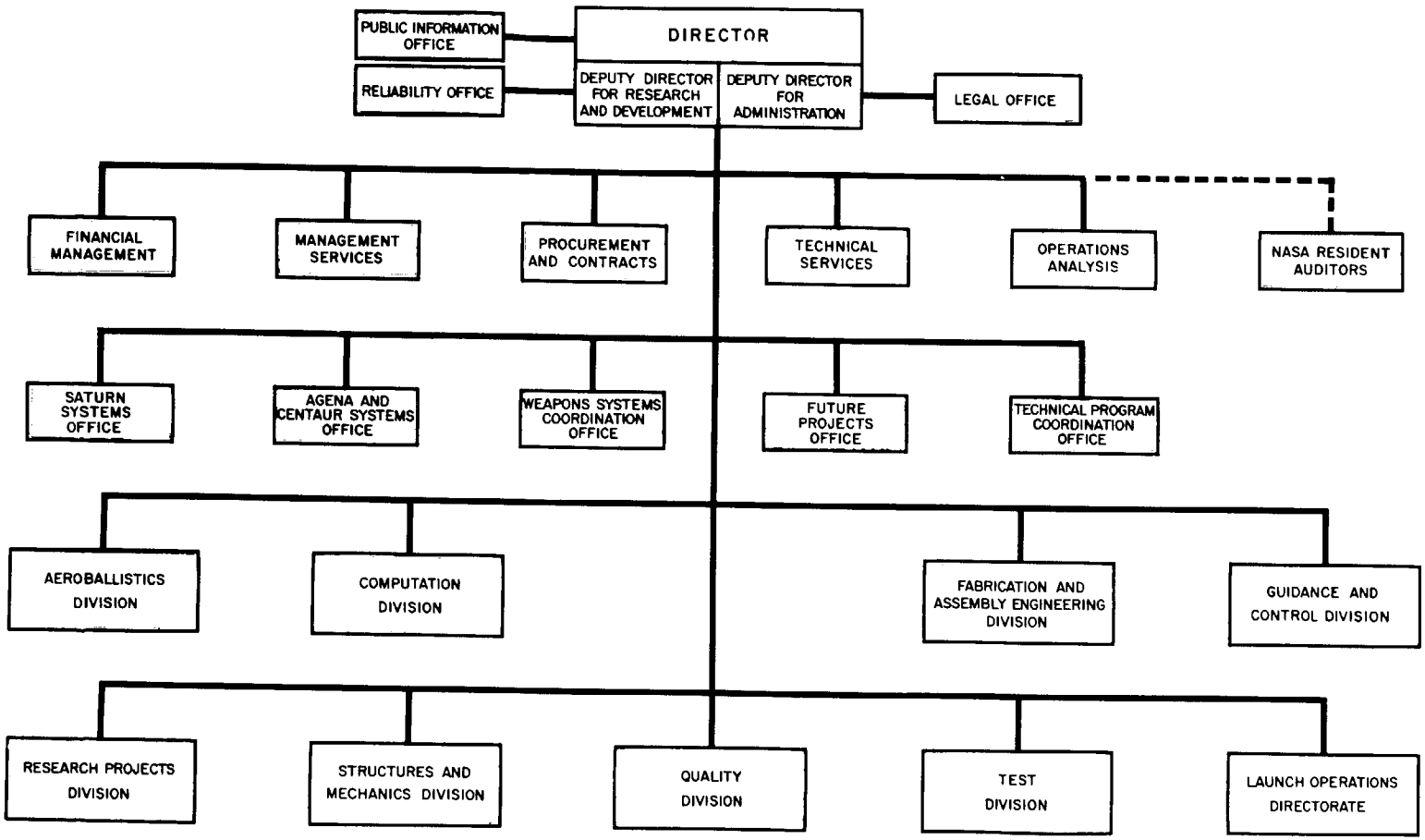
6. MSFC's firing responsibility is centered in the Launch Operations Directorate (LOD), which supervises NASA launch operations at the Atlantic and Pacific Missile Ranges.

7. M. J. Stoller, "The U. S. National Aeronautics and Space Administration's Space Flight Program," p. 16.

8. NASA, Third Semiannual Report to the Congress, Oct. 1, 1959--March 31, 1960, Aug. 30, 1960, p. 160.

9. Dr. Wernher von Braun, Dir., MSFC, "United States Space Carrier Vehicle Program," Aug. 16, 1960, Presentation at the 11th International Astronautical Congress, Stockholm, Sweden, p. 4.

GEORGE C. MARSHALL SPACE FLIGHT CENTER

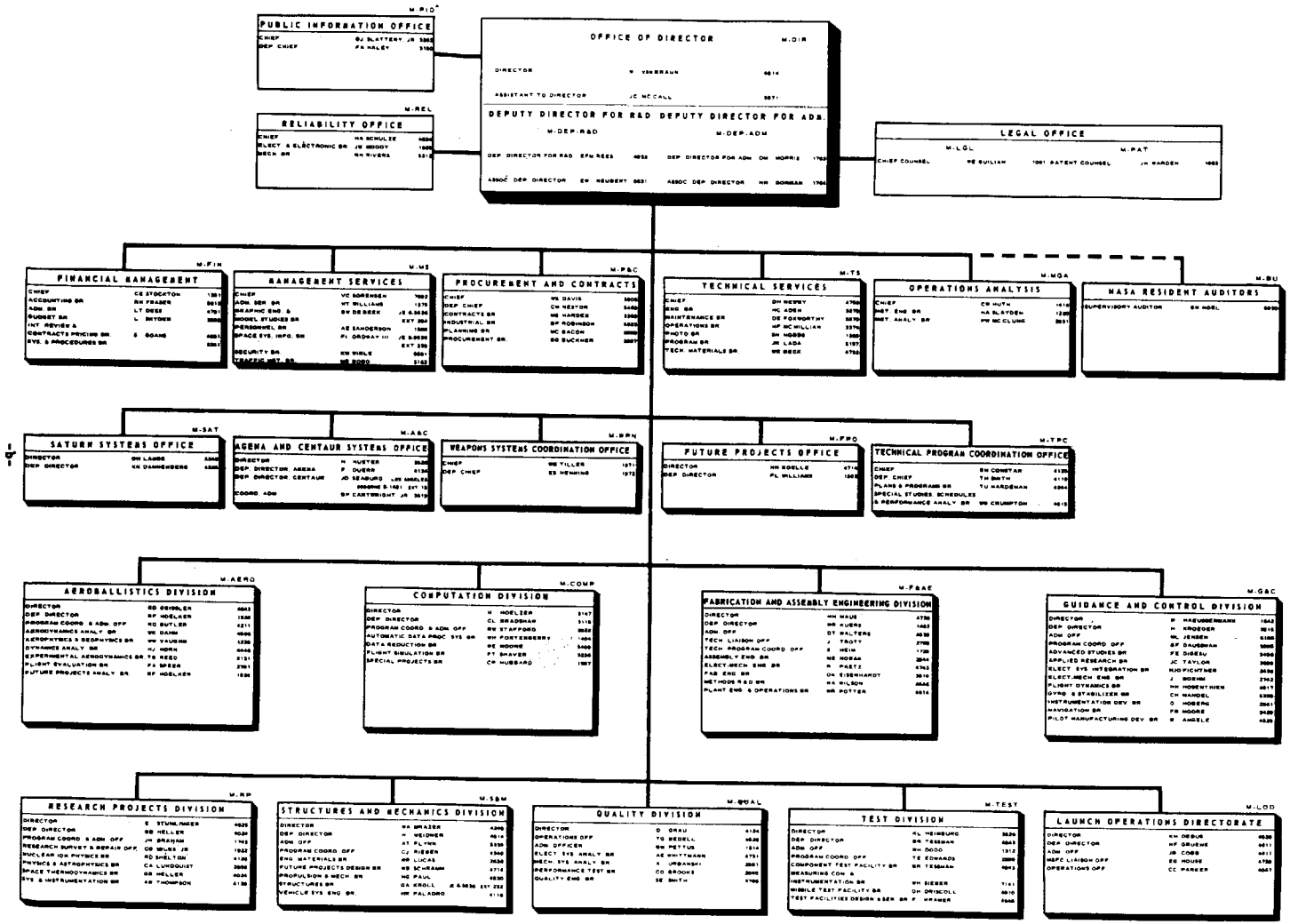


APPROVED: Wernher von Braun
WERNHER VON BRAUN
DIRECTOR, MSFC

DATE: 26 October 1960

GEORGE C MARSHALL SPACE FLIGHT CENTER

HUNTSVILLE, ALABAMA



November 28, 1960

vehicle.[10] The Centaur's twin liquid oxygen-liquid hydrogen rocket engines can "be ignited in space, cut off, and refired several times in accordance with programmed instructions from the guidance system."[11]

MSFC's contractors for the Centaur project include Convair-Astronautics Division of General Dynamics Corporation, Minneapolis-Honeywell (under sub-contract to Convair), and Pratt & Whitney Aircraft Division of United Aircraft Corporation. Convair is developing the Centaur vehicle; Minneapolis-Honeywell is developing the guidance system; and Pratt & Whitney is constructing the liquid hydrogen second-stage engine.[12]

On August 20 Convair received the second ground test engine from Pratt & Whitney. After inspection and minor corrections, the second engine was installed on the propulsion test vehicle on September 7. This vehicle was virtually completed and awaiting activation of the test stand. Also on September 7 Convair placed the C-2 vehicle in hydrostatic test at San Diego.[13]

Agena B. 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 vehicle for NASA missions."[14]

10. This Centaur will form the upper stage of the Saturn C-1 vehicle. See Stoller, "NASA's Space Flight Program," p. 13.

11. Dr. von Braun, "U. S. Space Carrier Vehicle Program," p. 5.

12. NASA, Third Semiannual Report to Congress, Aug. 30, 1960, pp. 44-45.

13. Monthly Letter Report--Centaur Project, Hans Hueter, Dir., Agena & Centaur Systems Off., MSFC, to Comdr. William Schubert, NASA Hq., Sept. 20, 1960, pp. 1-2, MSFC Hist. Off. files.

14. NASA-Agena B Progress Report, 1 Jan.--31 Mar. 1960, p. 1, MSFC Hist. Off. files.

On February 15, 1960, the Team--consisting of members from NASA Headquarters, ABMA, JPL, Goddard Space Flight Center, and NASA's Western Operations Office--presented its recommendations to General Don R. Ostrander. The Agena B program was approved.[15]

Under the technical direction of MSFC, the Agena B is being developed as the upper stage for both the Thor-Agena B and the Atlas-Agena B vehicles. Scheduled for use in NASA's meteorological and satellite programs, the Thor-Agena B will be able to place a payload of over 1,500 pounds into a 300-mile orbit.[16] The Air Force assigned certain of its Thor boosters to chis program, with production of these boosters scheduled to begin in May 1961.[17]

The Atlas-Agena B vehicle will be used to transport the first series of lunar probe spacecraft for JPL, and will also be used in communications and other satellite programs.[18] The first Atlas-Agena B should provide a payload capability of more than 5,500 pounds. Production of the Atlas booster was scheduled to begin in October 1960.[19]

Meanwhile, NASA had scheduled the Agena B for the following launchings:

Dates	Launch Vehicles	Spacecraft
July--December 1961	Atlas-Agena B	Ranger I
	Atlas-Agena B	Ranger II

15. NASA-Agena B Progress Report, p. 2.
16. Dr. von Braun, "U. S. Space Carrier Vehicle Program," p. 4.
17. NASA-Agena B Progress Report, 1 Jun.--1 Jul. 1960, p. 1, MSFC Hist. Off. files.
18. Stoller, "NASA's Space Flight Program," p. 14.
19. NASA-Agena B Progress Report, 1 Jun.--1 Jul. 1960, p. 1. For description of Centaur & Agena, see Hans Hueter, "The Agena and Centaur Programs," in NASA-Industry Program Plans Conference, Sept. 27-28, 1960, Huntsville, Ala., MSFC Hist. Off. files.

January--July 1962	Atlas-Agena B	Ranger III
	Atlas-Agena B	Topside Sounder (S-27)
	Atlas-Agena B	Ranger IV
	Thor-Agena B	Nimbus I
July--December 1962	Atlas-Agena B	Ranger V
	Thor-Agena B	Backup Vehicle
	Thor-Agena B	Nimbus II[20]

Mercury-Redstone. Project Mercury's long-range mission is to place a manned spacecraft into orbital flight around the earth and to safely recover the spacecraft and its passenger. The Atlas missile is scheduled to place the Mercury spacecraft in orbit.[21]

In the fall of 1958 NASA formed a Space Task Group at Langley, assigning to the Group the technical direction of Project Mercury. The NASA Space Task Group included as its working members technical and medical personnel from the Army, Navy, and Air Force.[22] Responsibility for the NASA Space Task Group was transferred from Langley to Goddard Space Flight Center (GSFC) in December 1959.[23]

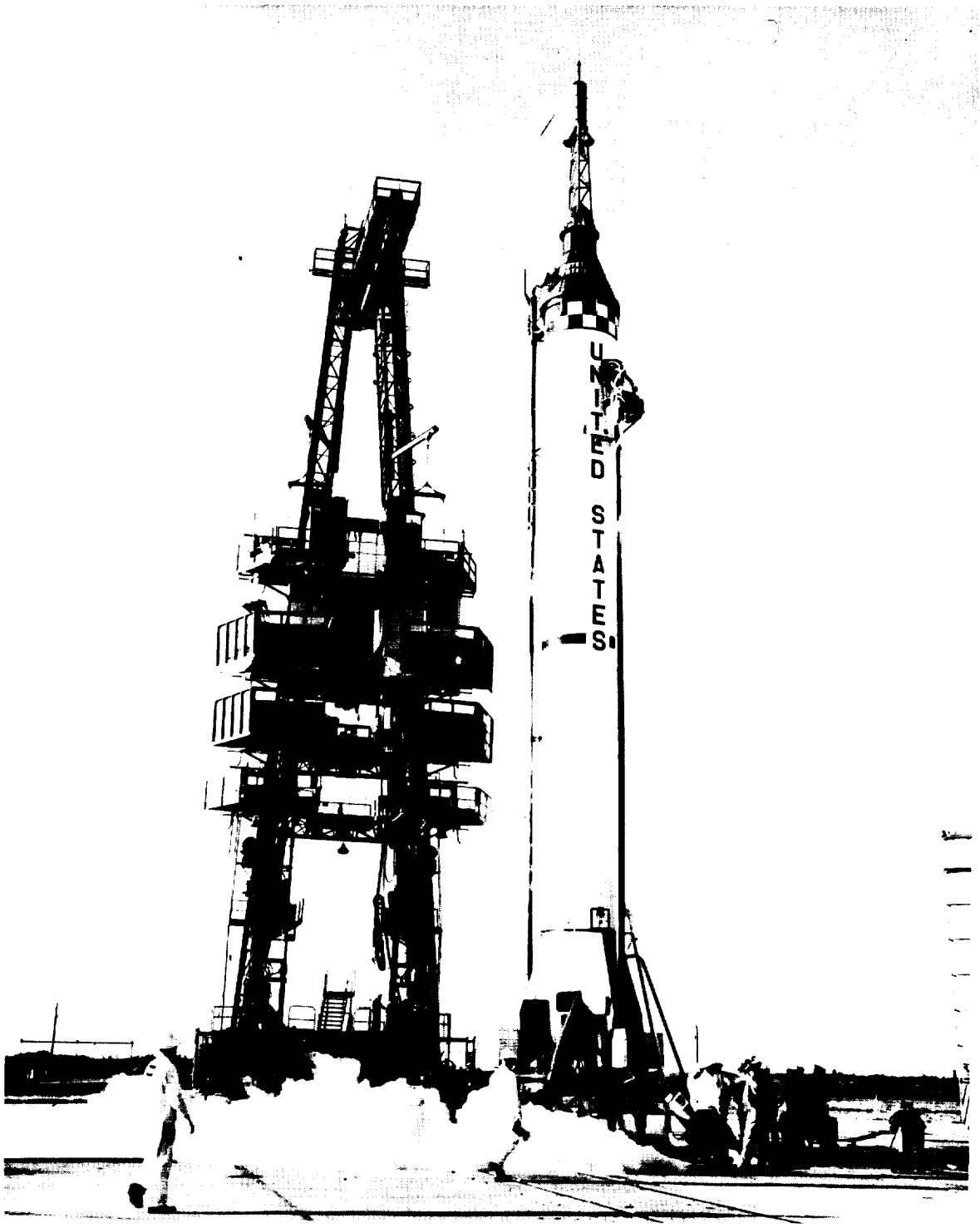
The entire Mercury project will place a manned spacecraft in orbital flight around the earth, investigate man's performance capabilities and ability to survive in a true space environment, and recover the spacecraft and the man safely.

20. NASA-Agena B Progress Report, 1 Aug.--1 Sept. 1960, pp. 2-3, MSFC Hist. Off. files.

21. U. S. Senate, Comm. on Aeronautical and Space Sciences, "Project Mercury: Man-In-Space Program of the National Aeronautics and Space Administration," Rpt. No. 1014, 86th Cong., 1st Sess., Washington, GPO, 1959, p. 24.

22. U. S. Senate, "Project Mercury," p. 6.

23. NASA, 2nd Semiannual Report to the Congress, Mar. 17, 1960, p. 135.



PROJECT MERCURY

A Project Mercury spacecraft, with a Mercury-Redstone booster, is readied for its flight test at Cape Canaveral.

MSFC is furnishing Mercury-Redstone vehicles for Project Mercury ballistic flights. The Mercury-Redstone Program is a preliminary part of the over-all Project Mercury. Mercury-Redstone flights will launch a manned spacecraft 130 miles into space, providing a period of weightlessness in flight of five minutes--long enough to test human reaction to the gravity-free state--in preparation for orbital flight.

MSFC acquired responsibility for the development of the Mercury-Redstone vehicle in the July 1, 1960, transfer of personnel, facilities, and missions from ABMA. McDonnell Aircraft Corporation has responsibility for the spacecraft. Goddard Space Flight Center's Space Task Group maintains technical supervision of the over-all Project Mercury.

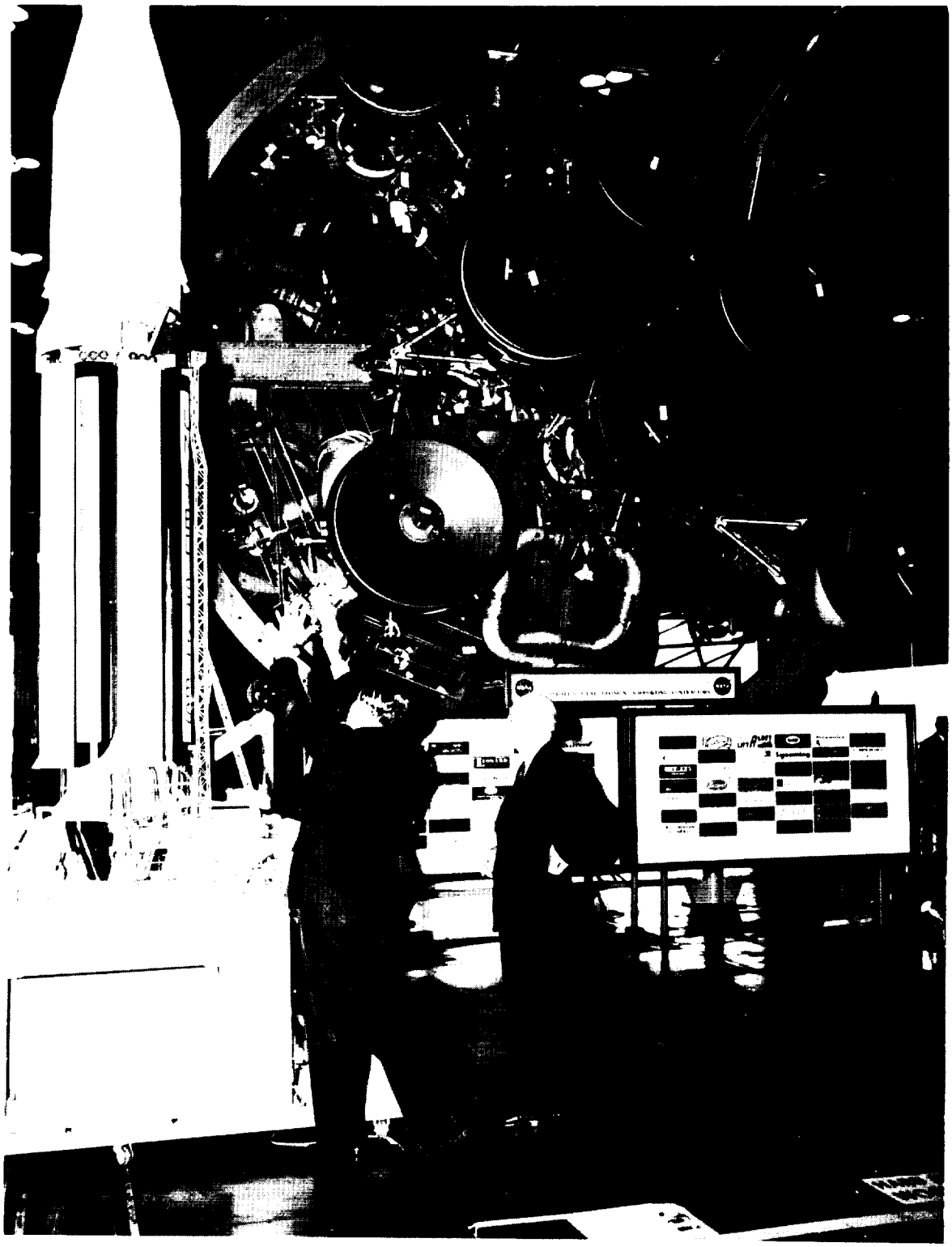
Early in September MSFC technicians in Huntsville performed final acceptance tests on the Mercury-Redstone No. 1 (MR-1), including Redstone booster acceptance tests and booster-spacecraft electrical compatibility tests. The vehicle successfully completed all major operating requirements.[24]

Dedication of the Center

The new 1200-acre space center at Redstone Arsenal was named the George C. Marshall Space Flight Center by Presidential Executive Order dated March 15, 1960.[25] Six months later, President Eisenhower, Mrs. George C. Marshall, Dr. T. Keith Glennan, Alabama Governor

24. Systems Analysis & Reliability Div., MSFC, "Final Acceptance Test Report MR-1," Sept. 12, 1960, Rpt. No. MM-M-SAR-2-60, p. ii, MSFC Hist. Off. files.

25. See Chapter V for text of Exec. Order 10870.



PRESIDENT EISENHOWER TOURS PLANT AREA

President Eisenhower and Dr. von Braun inspect a Saturn booster following MSFC dedication ceremonies on the morning of September 8, 1960.

John Patterson, and many other dignitaries arrived at MSFC to participate in the formal dedication of the $100,000,000 Center.

General Marshall was praised by President Eisenhower as a "man of war, yet a builder of peace. . . the symbol of renewed hope for scores of millions of suffering people through his great plan for Europe that will forever bear his name." President Eisenhower complimented the Army missile and space achievements at Redstone Arsenal, and pointed to the scientists who today feel "as if Venus and Mars are more accessible to them than a regimental headquarters was to me as a platoon commander forty years ago."[26]

The highlight of the ceremony was the unveiling by Mrs. Marshall and President Eisenhower of the bust of George C. Marshall. The bust was sculptured in 1953 by Kalervo Kallio, a well known Finnish sculptor. Kallio originally modeled Marshall in clay. A plaster bust, molded from the clay, was shipped to the sculptor's studio near Helsinki, Finland, where the 21-inch high, 18-inch wide bust was sculptured in red granite.

Following the ceremony, the President and other visitors toured the MSFC plant area and, after a two-hour stay on the installation, the President and his party departed. The people of MSFC returned to work with renewed dedication.

Thus, a new chapter in the history of man's conquest of space is unfolding at NASA's George C. Marshall Space Flight Center at

26. See Appendix F for full text of President Eisenhower's remarks. The remarks of Hon. John Patterson are Appendix E.

Huntsville, Alabama. Mindful of its rich traditions and long experience, the Center looks forward to the scientific exploration of space, which holds great promise for the benefit of all mankind. Born in war, and nurtured by military requirements, rocket propulsion is one of the great technological developments offering science the means of investigating the newly available frontier of space. In this challenging effort, the people at Huntsville will undoubtedly continue to play a prominant role.

RESPONSIBLE OFFICIALS IN FORMATION OF MSFC

Representing NASA Headquarters and MSFC, these officials performed major work in formation of the new Center. Left to right: Delmar M. Morris, Deputy Director for Administration, MSFC; Eberhard Rees, Deputy Director for Research and Development, MSFC; Dr. Wernher von Braun, Director, MSFC; Dr. T. Keith Glennan, Administrator, NASA; and Maj. Gen. Don R. Ostrander, Director, Office of Launch Vehicle Programs, NASA.

APPENDICES

APPENDIX A

MEMORANDUM FOR THE PRESIDENT, "RESPONSIBILITY AND ORGANIZATION FOR CERTAIN SPACE ACTIVITIES"

October 30, 1959

MEMORANDUM FOR The President

SUBJECT: Responsibility and Organization for Certain Space Activities

The Secretary of Defense and the Administrator of NASA have agreed upon, and recommend to the President, certain actions designed to clarify responsibilities, improve coordination, and enhance the National space effort. The actions recommended below are consistent with the steps taken by the Secretary of Defense to clarify responsibilities and assignments in the field of military space applications within the Department of Defense.

The Secretary of Defense and the Administrator have agreed upon and recommend to the President the following actions:

A. The assignment to NASA of sole responsibility for the development of new space booster vehicle systems of very high thrust. Both the DOD and NASA will continue with a coordinated program for the development of space vehicles based on the current ICBM and IRBM missiles and growth versions of those missiles.

B. The transfer from the Department of the Army to NASA of the Development Operations Division of the Army Ballistic Missile Agency, including its personnel and such facilities and equipment which are presently assigned and required for the future use of NASA at the transferred activity, and such other personnel, facilities and equipment for administrative and technical support of the transferred activity as may be agreed upon.

C. The provision by the Army to NASA of such administrative services as may be agreed upon to effect a smooth transition of management and funding responsibility of the transferred activity.

The Secretary of Defense and the Administrator of NASA are in agreement on the following:

1. The Nation requires and must build at least one super booster and responsibility for this activity should be vested in one agency. There is, at present, no clear military requirement for super boosters, although there is a real possibility that the future will bring military weapons systems requirements. However, there is a definite need for super boosters for civilian space exploration purposes, both manned and unmanned. Accordingly, it is agreed that the responsibility for the super booster program should be vested in NASA. It is agreed that the recommendations to center this function in NASA and to transfer the Development Operations Division of ABMA to NASA are independent of any decisions on whether either or both of the super booster systems currently under development are continued in their presently conceived form.

APPENDIX A

2. The transfer of the Development Operations Division of ABMA shall include transfer of responsibility for Saturn, together with 1960 funds allocated for the project, and transfer to the NASA 1961 budget of such amounts as may be approved for this project in the 1961 Department of Defense budget.

3. In carrying out its responsibilities the NASA will keep the Department of Defense thoroughly and completely informed on its booster program and will be fully responsive to specific requirements of the Department of Defense for the development of super boosters for future military missions as requested by the Secretary of Defense.

4. It is NASA's intent to center at the transferred activity the bulk of its space booster vehicle systems work, including an appropriate research and development effort, and ultimately, substantial responsibility for NASA launch operations.

5. It is agreed that NASA will provide support to the Department of Defense and military services at the transferred activity in the same manner as it now does at all other field centers.

6. The management and employment of the transferred will be the responsibility of NASA, and no commitment is possible with respect to levels of staffing or funding for the operation. NASA, however, will make every possible effort within its responsibilities and resources to utilize the capabilities of the Development Operations Division of ABMA.

7. The transfer of personnel, facilities, and equipment will be on a nonreimbursable basis.

8. The Department of the Army will provide and maintain on a reimbursable basis station-wide services as required by NASA within the Redstone Arsenal complex.

9. NASA will provide for continuation, transfer, or phasing out of military projects under way at the transferred activity as may be requested and to the extent funded by the Department of Defense, and will undertake at the transferred activity such additional military projects as may be agreed upon by NASA and the Department of Defense.

10. The Department of Defense, the Department of the Army, and NASA, recognizing the value to the Nation's space program of maintaining at a high level the present competence of ABMA will cooperate to preserve the continuity of the technical and administrative leadership of the group.

11. The detailed implementation of the actions proposed will be accomplished through the subsequent negotiation of cooperative agreements between the Department of Defense and NASA.

The Secretary of Defense and the Administrator of NASA have reached agreement and recommend approval of the above actions in the firm belief that the National space effort requires a strong civilian agency and program and a strong military space effort by the Department of Defense, and clear lines of responsibility and authority if the U. S. is to employ its best efforts in the exploration of outer space and to assure the defense of the Nation.

If the President approves the recommended actions set forth in A, B, and C above, the Secretary of Defense and the Administrator of NASA will proceed immediately to form the necessary staff teams to develop the required implementing documents.

(Signed)
T. KEITH GLENNAN
Administrator, NASA

(Signed)
THOMAS S. GATES
Secretary of Defense

APPENDIX B

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

C O P Y

November 16, 1959

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

A. Authority

National Aeronautics and Space Act of 1958 (PL85-568, 72 Stat. 426)

B. References

1. Memorandum for the President, subject: Responsibility and Organization for Certain Space Activities, dated 21 October 1959 in behalf of the Secretary of Defense by the Deputy Secretary of Defense, and Dr. T. Keith Glennan, Administrator of the National Aeronautics and Space Administration

2. Cooperative Agreement on the Army Ordnance Missile Command Between the National Aeronautics and Space Administration and the Department of the Army dated 3 December 1958.

C. Purpose

The purpose of this Agreement is to supplement the Agreement between the Secretary of Defense and the Administrator of NASA with respect to the transfer of a portion of ABMA to NASA and the assignment to NASA of certain responsibilities in the space booster vehicle field to the extent these actions involve the Department of the Army. The areas covered by this agreement are:

1. Generalized agreement on the objectives to be sought;
2. Method and procedure for conducting negotiations and arriving at detailed agreements;
3. Timing of the required actions.

D. Policy

The Army and NASA agree and recognize that abrupt changes or other disrupting actions which adversely affect either the ongoing military or space programs must be avoided. The Army and NASA therefore agree to establish as the dominant consideration, with respect to timing, funding and pace of agreed upon actions, that there be no adverse effect on current programs. To this end, each party will cooperate in the rendering of service to the other, to the degree necessary to achieve this objective. Until such time as the transfer is approved by the Congress, reference B2 will continue in effect.

C O P Y

E. General Objectives

The objectives of the negotiations are to arrive at a mutually agreeable detailed plan for implementation of the President's decision to transfer a portion of ABMA, primarily the Development Operations Division (DOD), to NASA. The plan is to provide for:

1. The transfer to NASA of the personnel, facilities and equipment presently assigned to the Development Operations Division of the Army Ballistic Missile Agency. However, NASA recognizes that certain employees of this division are primarily engaged in the technical supervision of contractors and monitoring or management of military weapons systems and components. NASA further recognizes that the Army regards the accomplishment of such functions by the Army as essential. NASA and the Army will reach mutual agreement as to those personnel who desire to and will remain with the Army for accomplishment of Army programs, with full recognition that the balanced capability of DOD will not be impaired.

2. The transfer to NASA of such other personnel, facilities, and equipment of the ABMA and Redstone Arsenal as agreed upon for administrative and technical support of thetransferred activity. Insofar as practicable, NASA and the Army will give full consideration to the desires of individuals to remain with the Army or to transfer to NASA.

3. Identification and agreement concerning station-wide services which can be operated more effectively and economically on a centralized basis serving both NASA and the Army in order to avoid unnecessary duplicate organizations. This shall include the appropriate means of assessing reimbursable costs on the users.

4. Provision for the continued detail of enlisted technical personnel presently assigned to DOD to the extent mutually agreed upon.

5. Identification and use or transfer of land required for DOD operations as may be agreed upon. It is recognized that NASA, with respect to its possible future needs for land, will participate as a member of the Master Planning Board in the long range land utilization planning of Redstone Arsenal.

6. Identification and agreement on joint use of certain Redstone Arsenal test facilities and ranges which might be needed for use in future Army and/or NASA programs. The objective here is to avoid building duplicate facilities wherever joint use agreements could meet the needs.

7. Identification and transfer to NASA of stocks and inventories assigned to or purchased for DOD which would be used primarily in the performance of NASA missions. Items which would be used primarily in the performance of Army missions will remain the property of the Army. General purpose items and supplies will be shared as agreed upon.

8. Provision for continued funding by the Army and NASA through Fiscal Year 1960 of their respective programs at ABMA which had been approved prior to the Presidential decision to transfer a portion of ABMA to NASA. NASA recognizes that Army funding in 1961 will be related only to those specific projects, including supporting research, it desires to place in the transferred unit.

F. Methods and Procedures

1. The Army and NASA will each select and appoint a principal negotiator. For the NASA, the principal negotiator is the Director of Business Administration, and, for the Army the Deputy Chief of Ordnance.

2. The principal negotiators for theArmy and NASA will agree upon and establish such subordinate study or negotiation teams as may be required. These teams will recommend to the principal negotiators an appropriate agreement for the area assigned.

3. These agreements, as approved by the principal negotiators, will be consolidated into an over-all agreement and approved through channels in both agencies, with final concurrence from the Secretary of the Army and the Administrator of NASA respectively.

4. Subsequent to the submission by the President to the Congress, the principal negotiators will continue to function as long as may be necessary to assist in the completion of planning for these transfer arrangements.

G. Timing

1. The principal negotiators will schedule the staff studies and negotiation so as to permit submission of the necessary documents to the Executive Office of the President by December 15, 1959. It is recognized that detailed agreements in every area of Army-NASA relations may not be possible in the time available; however, agreement in meaningful principle must be reached in every major area and work will be expedited to complete the detailed agreements at the earliest possible date.

C O P Y

2. It is recognized that it may be desirable to stagger the effective dates for the transfer actions of certain personnel or supporting service functions, in order that both organizations can make the necessary adjustments without disruption of programs.

Date:

Washington, D. C.

/s/ T. Keith Glennan - 18 Nov. 59
T. KEITH GLENNAN
Administrator, NASA

/s/ Wilbur M. Brucker - 18 Nov. 59
WILBUR M. BRUCKER
Secretary of the Army

APPENDIX C

ARMY-NASA TRANSFER PLAN

Army-NASA Transfer Plan

The following Army-NASA Transfer Plan to implement the President's decision of 21 October 1959 to transfer a portion of ABMA to NASA has been reviewed and approved by the undersigned.

Administrator, NASA

Secretary of the Army

DEC 16 1959

DEC 17 1959

ACTING Secretary of Defense

DEC 16 1959

APPENDIX C

INDEX

December 11, 1959

SUMMARY AND CONCEPTS OF ARMY-NASA TRANSFER PLAN

In accordance with the agreement between the National Aeronautics and Space Administration (NASA) and the Department of Defense dated October 21, 1959, approved by the President on November 2, 1959, and the supplementary agreement between NASA and the Department of the Army dated November 16, 1959, relating to the transfer of the Development Operations Division of the Army Ballistic Missile Agency to NASA, the following transfer plan has been jointly developed by NASA and the Department of the Army.

General Concepts

The plan provides for the transfer to NASA of personnel, facilities and equipment of the Development Operations Division and of appropriate supporting organizations in sufficient numbers and quantities to provide NASA with a substantially independent operating research and development organization and capability.

The plan recognizes and provides for the continued performance by the Army of it's mission. Two basic methods are used to achieve this result. First by providing for the continuance of service to the Army of the transferred group and second, by providing for retention by the Army of capability for continuing weapons system management.

Fundamental to the plan is a concept of phasing operations and responsibility in a manner calculated to prevent dislocation or disruption of ongoing programs.

Personnel

Generally, all personnel of the Development Operations Division will be transferred to NASA. However, in order to enable the Army to maintain a weapons systems management capability up to 350 personnel of the Division will be offered an opportunity to remain with the Army. This group includes personnel currently in the weapons system project manager offices and a complement of representative skills from each laboratory area. The completion of current weapons systems assignment will be accomplished using the capabilities of the transferred group with a phasing out of NASA and assumption by the Army as may be agreed upon.

In general, the new NASA organization at Redstone Arsenal will be locally self-sufficient. To accomplish this and to avoid unnecessary duplication of facilities or central service type organizations, the plan provides for the transfer of 815 personnel in the areas of support services provided the Development Operations Division from AOMC organization at Redstone Arsenal. This number represents about two-thirds of the supporting staff which NASA will ultimately require and recognizes the Army's personnel requirements to continue to carry out its continuing mission.

The determination of numbers of personnel to be transferred from the service support areas was based upon the following general alignment of functions. Functions involving the management control functions such as fiscal, budget, personnel, and planning, and functions involving immediate service to the technical groups, such as supply, facility and equipment maintenance, and physical security, will be operated by the NASA organization. Functions relating to station-wide services such as

foundry, perimeter security, electric, steam and water service, will be provided the new NASA organization by the Army on a reimbursable basis.

The approximately 250 enlisted military personnel now within the Development Operations Division will be phased out over a period of time. In general, the unskilled group will be phased out almost immediately and the more skilled specialties over a somewhat longer but specifically agreed upon time span. No officer personnel would remain with the transferred organization.

Land and Facilities

The plan provides for making available to NASA a contiguous area at Redstone Arsenal encompassing virtually all the facilities now used by the Development Operations Division. It has been possible to achieve this with a minimum of displacement of either Development Operations Division or Army personnel. A few minor structures now used by DOD outside the NASA area are to be retained by the Army and a few structures within the NASA area now used by the Army will be released to NASA.

ABMA headquarters office structure (4488 and 4484) will remain with the Army but will be shared until appropriate permanent arrangements can be made.

Existing AOMC facilities at Cape Canaveral will, in general, be shared by the Army and NASA to assure that the requirements of each are met. The Pershing and Saturn complexes now under construction will be assigned respectively to the Army and NASA.

This plan provides for the Army to grant to NASA a long-term, non-revocable, and renewable use permit for the agreed upon Redstone Arsenal land and facilities.

Equipment and Inventories

The plan provides for transfer to NASA or retention by the Army of equipment and inventories as appropriate in the particular case. In general, the plan will provide the transferred organization with equipment and supplies it requires to maintain its capability. At the same time the plan provides for retention by the Army of equipment related primarily to Army weapons system and of a share of common use equipment and inventories. Teams of NASA-Army people will effectuate this concept under agreed upon criteria. The equipment and inventories agreed upon for transfer to NASA will be transferred on a non-reimbursable basis.

Transfer Timing and Funding

The plan contemplates the transfer to NASA of the personnel of the Development Operations Division effective July 1, 1960. Between the time of the Executive Order issuance and July 1, 1960, a direct planning and technical relationship will exist between NASA and the Development Operations Division to permit sound development of transitional arrangements.

Transfer of supporting personnel would largely occur on or before July 1, 1960, as NASA builds its organization. Each service area would, however, be dealt with on a case by case basis as NASA develops its staffing, systems and procedures, with complete transition by January 1, 1961. In general, the phasing of responsibility for a service area will coincide with the transfer of the bulk of the personnel.

Funding of ongoing programs in 1960 will continue to flow from present sources for the balance of 1960, except that the unobligated funds and the unexpended funds for major contracts in the Saturn program will be transferred to NASA as of the date of the Executive Order.

The plan contemplates full assumption by NASA of managerial and funding responsibilities and functions on July 1, 1960. Effective with FY 1961, NASA will obtain on a reimbursable basis, the services to be provided by the Army. Work on military weapons systems by NASA for the Army will also be on a reimbursable basis.

TRANSFER TIMING AND FUNDING ARRANGEMENTS

GENERAL

Upon promulgation of the Executive Order, NASA will initiate actions to develop its management system at Redstone Arsenal for control on July 1 1960 of the Development Operations Division of the ABMA. This will include supporting functions which will begin to be phased into the NASA operation on or after July 1, 1960 from the AOMC to NASA.

Until July 1, 1960, the Army, being wholly responsive to NASA on NASA work, will continue to exercise management control of the personnel and programs of the DOD together with all attendant services such as programing, financial operations, and support functions.

The transfer of personnel from the Development Operations Division of the ABMA to NASA will occur on July 1, 1960. Limited numbers of key personnel in support areas will be transferred from the AOMC to NASA between the date of the Executive Order and July 1, 1960, as may be mutually agreed upon at the AOMC-NASA level. Other personnel agreed upon for transfer to NASA in the support areas will occur on July 1, 1960, except in those areas where such action is not feasible. Such transfers will be phased to be completed by January 1, 1961.

ARRANGEMENTS

A. Operations for FY 1960

Effective with issuance of the Executive Order, all unobligated balances and the unexpended balances on major contracts of ARPA-Saturn funds will be transferred from the ARPA to NASA. NASA will issue new project orders for such balances to AOMC. However, the unexpended balances on contract purchase orders which will be delivered and paid by June 30, 1960, will not be transferred.

B. Operations Affecting FY 1961

1. NASA will assume financial responsibility for the transferred operation.
2. NASA will reimburse the Army for supporting services that are furnished by the Army as may be agreed upon.
3. AOMC will provide NASA with the necessary program information which will enable NASA to include in its FY 1961 plan the requirements for advance apportionment of funds initially to finance AOMC work subject to reimbursement. AOMC requirements will be placed on NASA through the issuance of orders direct to NASA.

EQUIPMENT TRANSFER

After issuance of the Executive Order, the transfer of accountability for equipment, facilities, and inventories will proceed on a phased basis as agreed upon, to be completed by January 1, 1961. All such transfers shall be on a non-reimbursable basis.

PERSONNEL

MILITARY PERSONNEL

A. Enlisted

It is agreed that enlisted personnel of the Army will be phased out of Development Operations Division. This complement will total between 200 and 250 at the effective date of the transfer and can be broadly categorized and phased out as follows:

1. Administrative and clerical personnel will be withdrawn by the Army on or before July 1, 1960.
2. Technical personnel skilled in and currently performing in military occupational specialties will be withdrawn by the

Army, and replaced by NASA as required, between July 1 and October 1, 1960.

3. Scientific and professional personnel who were drafted and specifically placed based on academic background will remain with the NASA until expiration of enlistment. However, those whose term of enlistment runs beyond December 31, 1960, will revert to Army control between July 1 and October 1, 1960.

B. Officers

Commissioned and warrant officers will not be transferred or detailed to NASA as a part of this transfer plan.

CIVILIAN PERSONNEL

A. General

It is agreed that on July 1, 1960, there will be transferred to NASA all civilian personnel assigned to the Development Operations Division except an agreed upon complement of those who have been asked by the Army and who desire to remain in order that AOMC may continue its technical management of the Army's missile systems. An agreed upon complement of supporting personnel from other AOMC elements at Redstone Arsenal who are requested by and who desire to come to NASA will be transferred. In the selection of these complements, the objective will be to determine an equitable distribution of representative skills which will not impair the technical capability of DOD for space missions or deprive the Army of its ability to manage its Army missile programs.

The Army and NASA agree that there will be a requirement for training the support personnel selected for the transfer in NASA methods and procedures. To the extent possible without critical impairment of the current operations, the Army will release these people for limited periods to permit

them to receive training offered by NASA. Such periods may be as short as one day and are expected not to exceed a maximum of ten days.

B. AOMC Complement from the Development Operations Division

This group includes representative scientific technical, and adminiatrative skills and capabilities which will retain competence within the Army to monitor and evaluate ballistic missile systems development for which the Army is responsible. The exact composition of the group as related to present assignment of the individuals, has some degree of flexibility; however, the general distribution of functional areas is as follows:

Functional Areas	No. of Personnel
Over-all Systems Requirements	42
Trajectory Analysis & Aeroballistics	20
Structural Analysis	18
Propulsion	13
Guidance & Control	38
Static Test	22
Reliability	21
Data Reduction	12
Flight Test and Evaluation	32
Project Administration	100
Systems Support Equipment Lab.	32
	350

C. NASA Complement from AOMC

The NASA has stated a requirement and the Army agrees that personnel in the numbers and functional areas listed are needed from existing Army support organizations at Redstone Arsenal for transfer to NASA to provide the basis for a fully operative and effective organization. In a number of the functional areas listed, NASA must provide substantial augmentation in addition to the strengths shown. Both parties, however, recognize that existing Army levels of effort cannot be reduced, even temporarily, below that resulting from the transfers indicated without adverse effects. In

agreeing to these transfers, the Army accepts the situation wherein a significant portion of the total will create position vacancies for which replacements will be necessary.

Functional Area	No. of Personnel
Finance and Accounting	
Financial Management Office, ABMA	12
Finance and Accounting Division, RSA	23
Procurement	
Industrial Division, ABMA	36
Purchasing and Contracting Division, RSA	34
Legal Activities, ABMA	1
Programming and Analysis	
Programs Branch, ABMA Control Office	2
Review Branch, ABMA Control Office	5
Management Services, ABMA Control Office	2
Personnel Administration	
Civilian Personnel Office, ABMA	37
Civilian Personnel Office, RSA	8
Printing and Reproduction, RSA	13
Transportation	
Transportation Office, Headquarters, AOMC	2
Transportation Division, RSA	48
Industrial Health Service, RSA	2
Industrial Safety, RSA	4
Security, RSA	45
Pictorial Services, RSA	10
Office Services (Adjutant) ABMA	
Plans and Programs	3
Procedures	2
Travel Orders	1
Office Services	2
Mail and Records	13
Supply Support (TM&E) ABMA	326
Plant Management and Maintenance-Post Engineer, RSA	180
Public Information Activities	4
	815

FACILITIES AND REAL ESTATE

INTRODUCTION AND TIMING

The Army has gone to great lengths to develop and construct an effective physical plant for the work of the Development Operations Division. All of the laboratory facilities are located in one reasonably compact group, and not far to the south there is a similarly compact area for static testing of liquid propulsion systems. These areas are located deep within the center of the Arsenal Reservation, and can be reached only over access roadways of the Arsenal. Much of the supporting managerial and housekeeping services, moreover, are located outside these two DOD areas and, in many cases, scattered widely throughout the Army installation. It is, therefore, proposed to create for NASA an identifiable single complex of land and improvements which, insofar as practicable, can be controlled and maintained independently from the Army establishment.

Unless otherwise noted, actions to implement the Executive Order with respect to the transfer of real property would be accomplished on a phased basis by January 1, 1961.

REDSTONE ARSENAL FACILITIES

A. Land

The Army will grant a long-term, non-revocable, and renewable use permit for the land and facilities which places full control over the areas in the hands of NASA as shown in the Redstone Arsenal Reservation Map (Tab A).

The boundaries for the particular land area to be made available have been so drawn to create a self-contained complex which embraces the two main operating areas of the Development Operations Division. The exact boundaries might be changed slightly to coincide with existing surveyed

plots. Within the described area, as shown on Tab B, all improvements would be made available with the exception of the following:

Buildings 4725 and 26 - Steam Plant and Auxiliary Building
Building 4424 - Fire Station
Building 4468 - Electrical Sub-station
Other unnumbered electrical sub-stations as marked on Tabs A & B
Facility 4490 - Railroad Scales
Portable Range Tower 4565 (ARGMA) to be relocated
Major Utility Systems including railroad tracks
4636 - Sewage Lift Station

The area involved represents approximately 1200 acres of land at a total value, including structures and equipment and inventories of approximately $100 million, of which $14 million is located at Cape Canaveral.

It is recognized by both Army and NASA that future NASA R&D test efforts may require additional land or safety buffer zones. It is agreed that, consistent with the land-utilization Master Plan for the reservation, additional real estate will be made available for such requirements after taking into account both military and NASA needs. It is further agreed that NASA be given representation on the Redstone Arsenal Master Planning Board.

It is further recognized that effective use of the area made available to NASA requires that the Army retain authority to control arterial traffic which requires utilization of Martin, Dodd, and Rideout roads for the convenience of both Army and NASA.

IDENTIFICATION OF FACILITIES

The specific structures to be made available to NASA within the bounded area are listed on page 17.

SPECIAL PROBLEM AREAS

A. Administrative Office Space

Building 4488 (a three-wing, three-story ABMA headquarters building) and 4484 (a three-story structure to the immediate north of 4488) provide

engineering and administrative offices space. They are used by ABMA to house its headquarters, the DOD top staff, some DOD laboratory activities, and contractor personnel. The two structures comprise usable space of 130,000 and 39,000 net square feet respectively, and can house up to 1300 people in #4488 and up to 435 in #4484.

Both NASA and the Army have office staffing requirements for their missions which are in excess of any available central space which might be shared on an equitable permanent basis. As a result, the NASA had requested occupancy of all of #4484 and five of the nine wing-floors of #4488 (and transfer of both total facilities). The Army's offer, however, is to provide NASA the occupancy of #4484, and not transfer either facility.

In an effort to reach joint agreement, the Army and NASA chief negotiators have indicated their willingness to accommodate their needs on this basis:

(1) Buildings 4488 and 4484 will remain Army property.

(2) NASA will assume the responsibility for new construction or other action to solve its office requirements without encroaching on Building 4488. It is recognized, however, that only Building 4484 may need to remain assigned to NASA for an indefinite period.

(3) In the interim, the Army will make available space to NASA as follows:

(a) #4484 will be assigned entirely to NASA for an indefinite period until NASA can make other arrangements for central office space.

(b) Space in #4488, not to exceed _____ 1/ square feet on the third floor will remain temporarily assigned to NASA until such time as NASA can make suitable other office arrangements.

COMPUTATION FACILITIES

The DOD Computation Laboratory furnishes scientific computation and administrative processing services for AOMC and ARGMA, as well as ABMA. The structure (Building 4663) is located within the complex which would be turned over to NASA. About 65% of the total digital computer time is now devoted to NASA-ARPA programs. Both the Army and NASA negotiating teams agree that the existing Computation Laboratory is not adequate in size to provide a significant increase in activity to meet the needs of both organizations. It is agreed that the logical solution is to create separate Computer Facilities at the earliest opportunity. It is proposed as a basis of joint agreement that:

(1) The Army will assume the responsibility for new construction or other action to acquire its own permanent facility for a separate computer organization to service the AOMC components.

(2) NASA will agree on an indefinite, interim basis to furnish the AOMC, ARGMA, and ABMA scientific and data processing services on a reimbursable basis until a separate facility is available.

(3) NASA will agree to provide the Army with service which is at least equal to the level of service which prevails in the period April - June, 1960. This service will include continued operation of a 705 computer. Such agreements will provide for predetermined amounts of machine time for the Army in accordance with joint advanced program planning.

1/ Amount of space to be determined in subsequent negotiations.

SPECIAL AGREEMENTS

A. Outlying Storage Structures

Some of the identified structures (see Tab C) lying outside the transferred area, may contain items in storage which, under the definition for distribution of equipment or stock inventory, would be transferred to NASA. In such cases, the Army agrees that NASA will be permitted on an indefinite but interim basis to retain such storage until these items can be consumed or removed to facilities in the NASA complex. These structures, unless otherwise agreed, would be staffed, where necessary, by Army personnel.

B. Chrysler-Methods Development Laboratory

The Army agrees that DOD personnel will be permitted continued interim occupancy of Building 4722 (the Methods Development Laboratory) lying outside the transferred area, with the understanding that NASA will arrange their removal before the end of CY 1960.

C. Joint Use Agreements

Certain outlying facilities will remain with the Army but will be made available to NASA personnel on a joint-use basis as needed:

(1) Army Test Track
(2) Antenna Test Area and Facilities
(3) Quick-Look Antenna Site on Madkin Mountain 1/
(4) River Dock Area for Saturn purposes
(5) Jupiter Launcher Emplacement Area 2/

D. Cross-Service Agreements

Through appropriate agreements, the Army will provide to NASA services in other Army facilities at Redstone Arsenal which NASA may require for its programs. Except where otherwise agreed, the service these facilities render NASA would be provided by Army personnel. Facilities of the types contemplated are:

1/ It is recognized that this site may later need to be moved to accommodate other Army construction at this location.
2/ A reciprocal joint-use will be provided to the Army in connection with troop training use of the quick fueling stand area.

(1) Army Airfield and Facilities
(2) Miscellaneous warehouses and structures 1/
(3) Test Facilities and Ranges
(4) Access roads

Through appropriate agreements, NASA will make available to Army missions as required the transferred test facilities.

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 (see Tab D).

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 locations, and this instrumentation, together with other

1/ If needed, NASA will buy from the Army any services involving explosives storage and handling.

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 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 (see Tab D).

The warehouse building and other structures in the industrial complex will pass to the control of NASA (see Tab D). 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 systems; 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.

LIST OF FACILITIES PROPOSED

FOR TRANSFER TO NASA

4306	Cafeteria	4353	Field Support Tng.
4309	Engine Build Up	4354	Nitrogen Str. Tank
4311	Admin., Supply, etc.	4355	Nitrogen Str. Tank
4312	Security Guard	4371	Shake Table, Office & Shop
4313	Rocketdyne Serv. Center	4372	Receiving Unit
4319	Oil Pump Sta.	4373	Ground Support Equip. Lab.
4331	Missile Sys. Engrg.	4435	Motor Pool Complex
4332	Environ. Test (SA&R)	S4469	PE Storage
4334	" " "	4471	TME-Office & Storage
4335	Centrifuge	4472	TME-Pkg.
4336	Environ. Test	4479	TME-Storage Shed
4350	Fuel Test Stand	4481	Office-Lab. (SSEL)
4351	Field Support Tng.	4482	Woodwork Shop
4352	Nitrogen Mfg. Plant	4485	Network Elect.

4487	Office and Lab.
4491	Computer Bldg.
4492	Network Sys. Elec.
4493	Machine Shop
4494	TME-Storage
4495	PE Maintenance Shop and Storage
4559	Vac. Pump
4560	Observation Bunker Power Pl.
4561	Propellent Shop Support
4562	Indust. Water Storage (Mill. Gals.)
4564	Power Test Stand
4566	Engr. Offices (SS&E)
4567	Test Stand Boiler House
4569	Guard House
4570	Block House
4571	Observation Bunker
4572	Static Test Tower
4573	Static Test (Gantry Crane)
4574	Static Test, Fuel Disposal Pit
4575	" " Oxidizer
4576	Lig. Waste Disp. Tank
4577	" " Sand Filter
4578	" " U.G. Disposal
4579	" " Reservoir
4580	LWD Mixing Chamber
4581	Nitrogen Buster Battery
4582	NBB Compressor
4583	Components Test Lab.
4584	Comp. Test - Tank Pit
4585	" " Holding Pond
4586	" " " "
4588	Cold Calib. Test Stand
4589	CCTS - Observation
4590	Pit
4591	CCTS - Oxid. Disp.
4592	" Fuel Disp.
4593	" Holding Pond
4594	Fuel Storage
4595	Stat. Test Observ.
4596	Oxidizer Ready Storage
4597	Fuel Ready Storage - 10,000 gal.
4598	Nitrogen Ready Storage
4610	Engineering Office
4612	Engineering Development
4613	Compressor Bldg.
4616	Shop
4617	Flam. Stor.
4619	Test Unit
4620	Vac. & Compressor
4623	Accel. & Test Cell
4624	H_2O_2 Storage Shed
4630	Gas Pump Bldg.
4631)	
4632)	Gasoline Storage Tanks
4633)	
4634	Diesel Pump Bldg.
4635	" Storage Bldg.
4650	Guided Missile Test Shop
4658	Guard House
4659	Mosquito Oil Tank
4663	Computer Bldg.
4665	Interim Test Stand
4680	H_2O_2 Tank
4681	H_2O_2 Transfer Pump
4682	Unloading Dock H_2O_2
4683	H_2O_2 Disposal
4684	Nitric Acid Drum Storage
4685	" " Disposal
4686	LOX Tank Pit
4687	Tool Shelter
4688	Analine Furfuryl Drum Storage
4689	" " Disposal
4690	Ethyl Alcohol Tank
4691	" " Transfer Pump
4692	" " Disposal
4693	Hydrocarbon Storage
4694	" " Tool Shelter
4702	High Pressure Test
4703	Chem. Clng.
4704	Hydr. Pr. & Heat Treat.
4705	Missile Assy. Bldg.
4706	" " Hangar
4707	Struct. Fab.
4708	Missile Assy. & Insp.
S4709	Lunch Room
4710	Test Cell "C"
4711	Develop. Shop
4712	Engr. Bldg.
4713	Storage
4714	Cleaning & Treat. Shop
4715	Exped. & Prod.
4716	Pipe Fitting
4717	Propellent Storage
4718	Oil Storage
4720	Safety Office
4723	Elec. Engr.-Graphic Engr.
4727	Supply Materials & Equip.
4728	Research & Develop. Shop
4730	Shed, Air Dry
4732	Wind Tunnel & Lab.
4733	Vacuum Tank
4734	" Pump House
4735	Air Dryer
4736	Dry Air Storage Tank
4737	" " " "
4738	TME-Sub. Store
4739	Instr. Shop
4741	Beryllium & Printed Circuits
T4742	Storage (G&C)
4743	Gas Cyl. Storage

4744 Compressed Air
4746 Instrumentation Develop.
4747 Air Compressor
4748 Liquid Prop. Test Stand
4749 Test Cell "A"
4750 High Alt. Test Facility
4751 High Pressure Air Battery
4753 Comb. Test #1
4754 V. G. Water Storage
4755 Combus. Test Block #2
4760 Surface Treat.

TRANSFER OF EQUIPMENT, OPERATING STOCKS, AND SUPPLIES

GENERAL

A. Equipment

There are two general categories of equipment considered for transfer:

1. That equipment currently recorded in property accounts of ABMA. The value of the property recorded on the DOD property books approximates $45 million consisting of over 100,000 individual items, of which approximately 35,000 items represent office furniture and fixtures valued at $2-1/4 million.
2. That equipment assigned to Redstone Arsenal which is common or general use in nature, such as sedans, buses, trucks, cranes, trailers.

B. Stocks

At present there are approximately $16 million in the operating stocks of the Technical Materials and Equipment Branch of ABMA. A tabulation of such stocks by category as of the end of October, 1959, will be found in Tab E.

TM&E INVENTORY BALANCES

As of October 31, 1959

Account Number		
131121	Raw Material	$ 2,865,584
131122	Packaging Material	95,008
131123	Components & Propellants	62,873
131124	Chemicals	219,810
131125	Electrical Materials	2,430,098
131126	Structural Material	103,400
131127	Hardware	2,225,682
131128	Gasoline & POL	83,775
131129	Photo and Reproduction	485,369
131130	Small Tools	357,393
131131	Other Materials & Supplies	73,073
131132	Hand Tools	136,332
131167	Furniture & Fixtures	10,809
131168	Non-Expendable, Non-Capitalized	231,300
1321	Expendable Office & Custodial Supplies	1,000,000
1431	Returnable Reels & Containers	17,960
	SUB-TOTAL AIF	$10,398,446
1411	Components	2,536,201
1431	Capital Equipment in Inventory	345,720
1473	Excess Supplies	2,773,144
	SUB-TOTAL NON-AIF	5,655,065
	GRAND TOTAL	$16,053,511

Agreeable arrangements have been made for transfer of certain portions of both equipment and stock inventories to NASA without reimbursement.

Outlined below are the agreements on transfer of equipment and stocks.

EQUIPMENT

Equipment is defined as non-expendable non-installed items used in or by the Development Operations Division. Such equipment recorded on ABMA property books will be examined by Army-NASA teams and distributed generally as follows:

1. Equipment which is clearly identified with space effort will be transferred to NASA, including that obtained on ARPA programs, provided the specific program is also transferred to NASA.
2. Equipment which can be clearly identified with, and required for, the REDSTONE, PERSHING, and JUPITER programs will remain with the Army, except as needed for NASA to perform Army assigned missions on these programs.
3. That equipment, the use of which is common to 1 and 2 above, will be shared on an equitable basis between NASA and Army, recognizing that the essential capability of a transferred DOD facility will not be impaired, and that the Army will have a continuing R&D mission at Redstone Arsenal to develop and field ballistic missile weapon systems.

   Government-owned equipment in the hands of contractors now working in Development Operations Division Laboratories will be distributed in accordance with the above agreement.

   Common use equipment on the property books of Redstone Arsenal and utilized primarily by the DevOpDiv will be examined by a joint NASA-Army team and those items transferred that are required to support DevOpDiv activities. RSA items of equipment

utilized by DevOpDiv on a "call" or "as required" basis will not be transferred unless sufficient quantities of such equipment exist to meet the needs of both agencies. In the event such quantities of equipment do not exist the equipment will not be transferred but rather the required services will be procured by NASA from RSA on a reimbursable basis. The Army does not propose to transfer any items of RSA equipment that would require immediate replacement in order to service the Army RSA complex.

In order to minimize unncessary movement of furniture, unless otherwise agreed, the normal office furniture and fixtures of an individual identified in the two complements will remain in the custody of his present organization.

Within the limitations of 1960 funding, equipment in use by the Development Operations Division which is rented from industrial firms will continue to be rented by the Army. Beginning with Fiscal Year 1961, NASA will be responsible for the rental costs of such equipment as NASA determines there is a continuing need.

Accountability of property belonging to the USAF or USN will be transferred to NASA in accordance with the above. Permanent transfer arrangements with owning service will be the responsibility of NASA.

The ABMA-controlled, Army-owned equipment in GOCO and privately-owned plants will remain the property of the Army. It is established Department of Defense policy that other Federal agencies may utilize in place Department of Defense facilities and equipment on a non-interference basis.

The Department of Defense will transfer authority from the Department of the Army to NASA for continued utilization of equipment under control of the National Industrial Machine Tool Reserve required by the Development Operations Division.

OPERATING STOCKS AND SUPPLIES

Stocks and supplies in the custody of or on order for the account of the Technical Materials and Equipment Branch, ABMA, will be distributed as follows:

1. All stocks peculiar to or primarily usable for either Army or NASA projects will be transferred to NASA or retained by the Army, as the case may be.
2. The balance of the stocks will be shared on an agreed basis. This agreement will take into consideration such factors as amounts on hand, usage factors, and known requirements.
3. Stocks required by NASA to accomplish work on Army projects will be set aside for NASA's use, as mutually agreed.
4. A review committee composed of Army and NASA representatives shall serve for the purpose of jointly recommending stock assignments in accordance with the preceding criteria.

PROVISION OF SUPPORTING SERVICES

The Agreement between the Secretary of Defense and the Administrator of NASA signed on October 31, 1959, stated:

"The transfer from the Department of the Army to NASA . . . such other personnel, facilities, and equipment for administrative and technical support of the transferred activity as may be agreed upon."

The agreement between the Department of the Army and NASA signed on November 16, amplified this aspect of the transfer negotiations by stating:

> "Identification and agreement concerning station-wide services which can be operated more effectively and economically on a centralized basis serving both NASA and the Army in order to avoid unnecessary duplicate organizations. This shall include the appropriate means of assessing reimbursable costs on the users."

In subsequent pages of this section the joint recommendations of the principal Army and NASA negotiators on the provision of supporting services are set forth. Specific arrangements are recommended to provide supporting technical and administrative services to the Development Operations Division following its transfer to NASA. For each functional area of support, the following points are covered.

1. Present Method of Providing Supporting Services.
2. Proposed method of providing services; (a) operation by NASA, (b) provision by the Army on a reimbursable or non-reimbursable basis, (c) industrial contractor, (d) a combination of (a), (b), and (c).

Plant Management and Maintenance

The Post Engineer, Redstone Arsenal, is responsible for arsenal-wide utility services in the following areas:

1. Operation and maintenance of utilities including water, sewage, electricity and steam.
2. Fire protection and prevention
3. Construction, modification, alteration, maintenance and repair of buildings, structures, special equipment and air conditioning and refrigeration equipment.

4. Maintenance and repair of roads, other surface areas, railroads and grounds.

5. Provision of such service as custodial, insect and rodent control, refuse and garbage collection and disposal.

6. Management, engineering and master planning on all of the above, and in relation to real estate and land use.

Following the transfer of the Development Operations Division to NASA, the following services will be provided by NASA:

1. Maintenance of buildings, structures, and equipment, including special and air conditioning equipment.

2. Modifications of buildings and structures.

3. Maintenance of grounds and maintenance and repair of secondary roads and miscellaneous surfaced areas within the NASA complex.

4. Custodial services and refuse handling.

5. Insect and rodent control.

6. Fire prevention including inspection and training.

7. Operation and maintenance of water and steam in the static test area.

8. Plant and facilities planning and engineering.

The Post Engineer will continue to provide the Development Operations Division following transfer to NASA these services on a reimbursable basis:

1. Use of sanitary fill to dispose of refuse and trash.

2. Sewage service including operation, maintenance, and repair of the sewage plants and systems serving the NASA area. Modification, alterations, and new construction necessitated

solely by NASA requirements will be budgeted by NASA, with actual work accomplished by the Army on a reimbursable basis.

3. Industrial and domestic water. The operations, maintenance, and repair of the water treatment plant and the entire distribution system in the NASA assigned area, will be accomplished by the Army on a reimbursable basis with the exception of the reservoir and the Booster Pump Station in the Static Test Area. Modifications, alterations, or new construction will be handled in the same manner as sewage service.
4. Electricity through the Army's existing electrical distribution system with alterations, modifications, and additions nandled in the same manner as other utilities.
5. Maintenance, repair, modification, and new construction of the main arteries of the Redstone Arsenal road network. Modifications and construction of roads outside the NASA assigned area which are necessitated by NASA requirements will be funded by NASA with the work accomplished by the Army on a reimbursable basis.
6. Maintenance and repair of existing railroads in the NASA area. Modifications and new construction necessitated by NASA will be handled in the same manner as other utility services.
7. Steam generation and distribution.
8. Fire protection.

Equipment Management and Maintenance

The Development Operations Division has a substantial in-house capability to manage and maintain laboratory equipment. Management and maintenance of specialized laboratory equipment is performed by the Field Maintenance Division of the Redstone Arsenal and by the ARGMA Industrial Gage Laboratory and other elements of the Army at Huntsville. Maintenance of vehicles is also performed by Redstone Arsenal. Repair of office equipment is handled by the Redstone Arsenal Quartermaster.

Following transfer of the Development Operations Division, NASA will maintain vehicles, including materiel handling, equipment, office equipment, and certain internal comminications systems, such as dictograph and public address.

The Army will continue to provide the following services on a reimbursable basis:

1. Calibration of mechanical and electronic gages and instruments.
2. Repair of such equipment as generators, welders, ground handling equipment, electronic and communication equipment.

Finance and Accounting

The Finance and Accounting Division of Redstone Arsenal presently provides financial and accounting services on a centralized basis to the entire installation.

In addition, the Financial Management Office of ABMA provides financial management assistance and control to ABMA and the Development Operations Division in areas of funding, operating budgets, accounting, audit, and contract pricing.

Following transfer of the Development Operations Division, NASA will provide all of its own financial management services, including counterparts of the program review and analysis functions now performed by the Control Office of ABMA for the Development Operations Division.

Procurement and Contracting

At present two organizations located at Redstone Arsenal provide procurement and contracting services for the Development Operations Division:

1. The Purchasing and Contracting Office of Redstone Arsenal which contracts for new materials, standard stock items for inventory replenishment, new items for inventory, and items of expendable equipment. This group purchases all items for all organizations in the Redstone Arsenal complex that are not obtained through the Ordnance Districts or other Government agencies.
2. The Procurement Operations Branch of the Industrial Division of ABMA coordinates all procurements for Development Operations Division which are not made by the Procurement and Contracting Office of RSA. This Branch formulates the procurement policies and procedures of ABMA and allocates contract negotiations and administration to the Ordnance Districts or to other Government agencies as necessary. This group has no authority to sign contracts.

Following transfer of the Development Operations Division, NASA will be responsible for procurement and contracting required to support the activities of the Development Operations Division. The phasing out of Army responsibility will be handled in the following manner:

1. ABMA Industrial Division will continue to process procurement requirements to Ordnance Districts for awarding and administration of contracts through June 30, 1960. Funding will be cited through the Army sub-allotment procedures.

   Effective July 1, 1960, NASA will assume procurement responsibility of existing contracts which will continue to be administered on a reimbursable basis by the Ordnance Districts.

   Effective July 1, 1960, NASA will negotiate and award new contracts. Ordnance Districts will administer these contracts on a reimbursable basis as requested by NASA.

2. The Redstone Arsenal Procurement and Contracting Office will continue to issue purchase orders and award contracts through June 30, 1960. Effective July 1, 1960, NASA will assume all purchasing and contracting functions. Administration of other contracts will be assumed by NASA as soon after July 1, 1960, as capabilities allow.

Personnel Administration

The ABMA Personnel Office has provided Development Operations with personnel administration services. NASA will establish its own personnel office at Huntsville.

NASA will provide its own occupational health services after July 1, 1960. These services are presently provided the Development Operations Division by the Occupational Health Service, Redstone Arsenal. The U.S. Army Hospital will continue to provide emergency medical services to NASA, on an as-required reimbursable basis.

Legal Services

The Development Operations Division has received legal services from both the legal staffs at AOMC and ABMA.

NASA will establish its own legal staff at Huntsville to handle all new legal work after July 1, 1960. The Army will be responsible for processing pending contract claims, patent applications, and invention disclosures.

Security Services

Redstone Arsenal provides security services for the entire installation, including the Development Operations Division. These services are furnished by the Provost Marshal and Intelligence and Security Divisions of the Arsenal.

Following the transfer of the Development Operations Division, NASA will provide for: (1) stationary guard posts in the NASA area; (2) couriers and escorts; (3) the granting or denying of personnel clearances; (4) security surveys; (5) security evaluations.

The Army will provide for the installation as a whole: (1) vehicle registration; (2) personnel registration; (3) personnel badging and passes; (4) perimeter and mobile patrols; (5) crime detection, prevention and investigation outside NASA buildings but within Arsenal boundaries (6) traffic control; and (7) visitor control. NASA will reimburse the Army for services provided.

Safety

The Redstone Arsenal Safety Division presently provides installation type safety services to the entire installation, including such services for ABMA and the Development Operations Division. Following transfer of the Development Operations Division, NASA will provide its safety services.

Public Information

Public information activities at Redstone Arsenal are carried out by the U. S. AOMC Public Information Office.

Following the transfer, NASA will provide its own public information functions.

Technical Library and Document Services

The Technical Documents Library of ABMA now services the Development Operations Division. This Library will remain a part of ABMA. The Development Operations Division will be provided the present services from, and access to, this Library on a nonreimbursable basis. Following the transfer of the Development Operations Division, NASA will reimburse the Army for special library acquisitions required by the Development Operations Division.

Communications

The Post Signal Office provides the Development Operations Division both administrative and technical communication services. Following the transfer of the Development Operations Division to NASA those services will be provided in the following manner:

A. Telephone Services

Local and long distance switching service will continue to be provided the Development Operations Division when transferred to NASA. This service will be consistent with that presently provided and will be reimbursable based upon current regulations in effect at the time of transfer. Terminal equipment required to provide this service will remain the property of the Army. NASA will fund for special purpose equipment

which may be required. New installations, removal and re-installations and rearrangement of presently installed equipments will be billed to NASA.

B. Intercommunication Systems

Upon transfer of the Development Operations Division, NASA will assume responsibility for all intercommunications, including arrangements for installation, repair, and maintenance services.

C. Communication Center

Upon transfer of the Development Operations Division, NASA will assume responsibility for activating and operating its own Communication Center. Circuits necessary for this operation will be leased by NASA from the commercial telephone system.

D. Cryptographic Service

It is anticipated that receipt and transmission of classified messages can be handled by the Army for NASA on a non-reimbursable basis. However, if the volume of classified traffic processed for NASA is such that it would require additional cryptographic personnel or overtime work of presently assigned cryptographic personnel, then NASA will reimburse the Army. Classified teleconference will be provided as available on a reimbursable basis. AOMC scheduling procedures will be adhered to.

E. Transceiver System

This system is utilized solely between the Computation Laboratory and the Missile Firing Laboratory at Cape Canaveral. NASA will assume responsibility for the circuit and maintenance of the equipment. The terminal equipment will be transferred to NASA.

F. Teledata System

This is a point to point system between the Missile Firing Laboratory, located at Redstone Arsenal, and the Missile Firing Laboratory, located at Cape Canaveral, and is used only by the Development Operations Division. Terminal equipment will be transferred to NASA and NASA will assume responsibility for the circuit.

G. Quick Look Net

This net is used to provide telephone and teletype facilities between the Computation Laboratory and satellite tracking stations. Upon transfer of the Development Operations Division to NASA the Army will have no further requirement for this system. NASA will assume full responsibility for activation and operation of this net when required.

H. Facsimile Weather Map Meteorological Service

High Altitude (SAC) facsimile weather map meteorological service is provided to the Research Projects Laboratory of the Development Operations Division of ABMA by the United States Air Force and is funded by the USAF. Continued requirement for provision of this service to NASA will be negotiated between NASA and the USAF.

Printing and Reproduction Services

Redstone Arsenal provides reproduction services to the Development Operations Division and other elements of ABMA through (1) contract printing, (2) facilities of the Arsenal printing plant and (3) on-site equipment supplied and operated at three of the Laboratories and the ABMA Headquarters.

Following the transfer, NASA will; (1) operate the on-site services; (2) contract for printing services from commercial services; (3) obtain from the Arsenal printing facilities on a limited basis special services such as plate-making and photostating on a reimbursable basis.

Photographic Services

The Pictorial Division of Redstons Arsenal provides the Development Operations Division with several types of photographic services - (1) still pictures, (2) motion pictures, (3) film library, (4) closed circuit television equipment, maintenance, and operation and (5) maintenance of camera and pictorial equipment. In addition, all of the Development Operations Division Laboratories have some in-house capability for providing their own photographic coverage including photo equipment and photographs.

Following transfer of the Development Operations Division, NASA will provide a complete in-house capability backed-up by contracts with commercial firms. USAOMC will provide these services on a reimbursable basis through FY 1961.

Transportation Services

The transportation elements of USAOMC at Redstone provide the following types of services in support of the Development Operations Division:

1. Transportation and traffic management services including commercial and military shipments of freight and passengers and transportability service on missile weapon systems.
2. Operation and allocation of commercial type motor vehicles, and post bus and taxi service.
3. Air transport services including operation of an airfield.

Following the transfer of the Development Operations Division, these services will be provided in the following manner:

1. Transportation and traffic management services will be provided by NASA.
2. Motor pool services will be provided by NASA.
3. Air support for passenger and cargo on Army-owned aircraft will be supplied on "space available" basis at no cost to NASA. In addition, NASA will obtain directly from commercial and other sources additional air transportation service.
4. NASA will be allowed to land and take-off from the Army airfield without reimbursement. Services in excess of this will be on a reimbursable basis, e.g. emergency maintenance and refueling.

Office Services

ABMA, through the Operating Services Office, provides certain administrative type services in support of the Development Operations Division. These include mail and records, office services, travel, and procedures writing.

NASA will provide all these services for the Development Operations Division following the transfer.

Supply Services

The Technical Materials and Equipment Branch, Operating Services Office, ABMA provides in-house supply services to the Development Operations Division. Supply services for other AOMC elements of RSA are provided by the Consolidated Supply Division of Redstone Arsenal. Following the transfer all of the present services provided Development Operations Division by the Technical Materials and Equipment Branch will be handled by NASA. The Branch will be transferred to NASA as a complete unit.

The Depot Division of Redstone Arsenal provides the Development Operations Division the following services:

1. Receiving, storing, and issuing all hazardous material.
2. Fabricating explosive components.
3. Disposition of hazardous material.
4. Industrial laundry services.

All of the services are highly specialized, including the industrial laundry service which involves decontamination of clothing for which commercial sources are not available.

Redstone Arsenal will continue to provide these services to the Development Operations Division on a reimbursable basis.

Redstone Arsenal provides services to the Development Operations Division for the receipt and disposal of surplus salvage, and scrap material. One central receipt and disposal yard is operated for the entire installation. The Redstons Arsenal will continue to provide these services to NASA on a reimbursable basis.

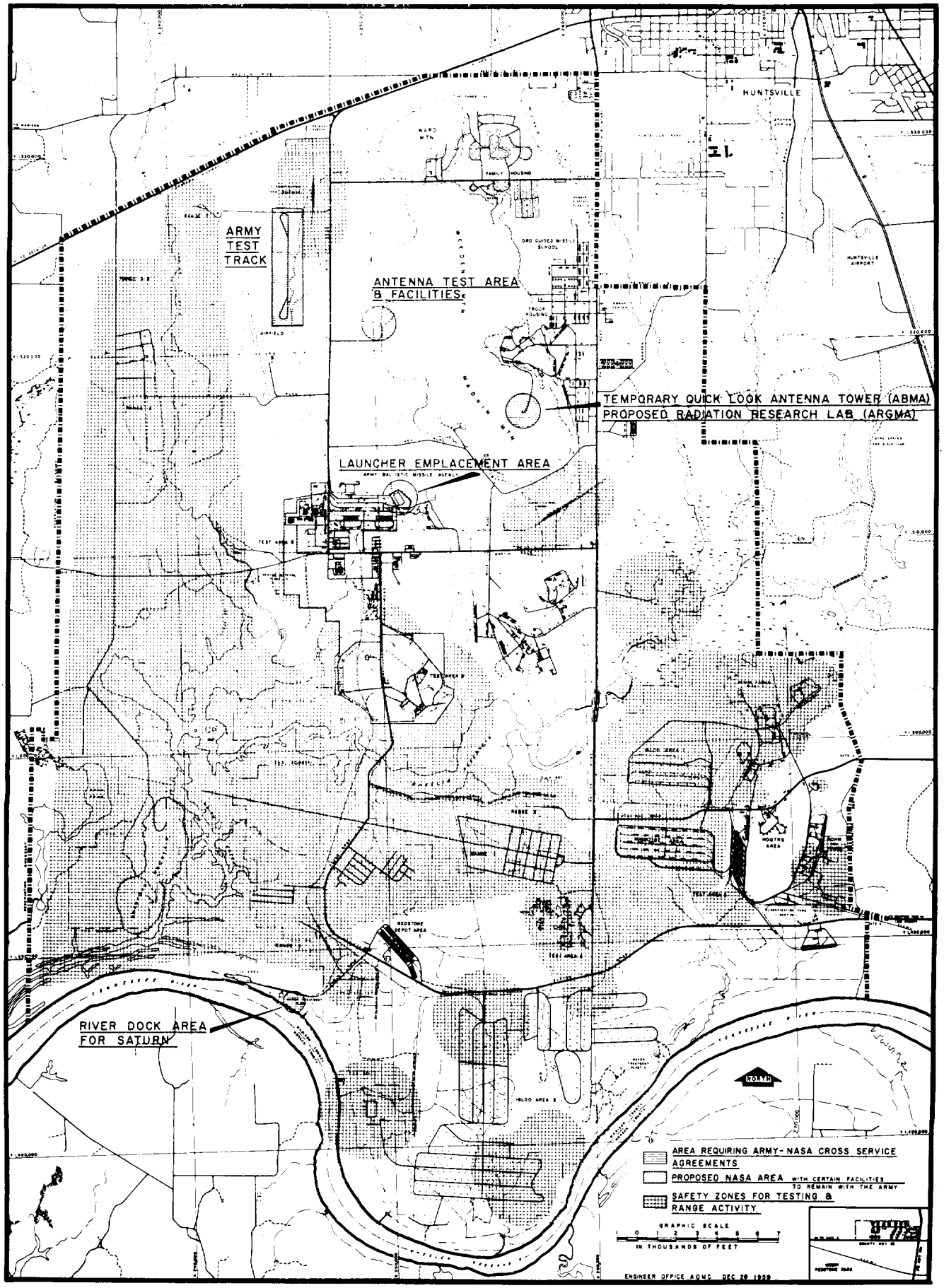
The Post Engineer operates a small high quality foundry. The Development Operations Division obtains aluminum and other types of castings from this foundry. This practice will be continued on a reimbursable basis.

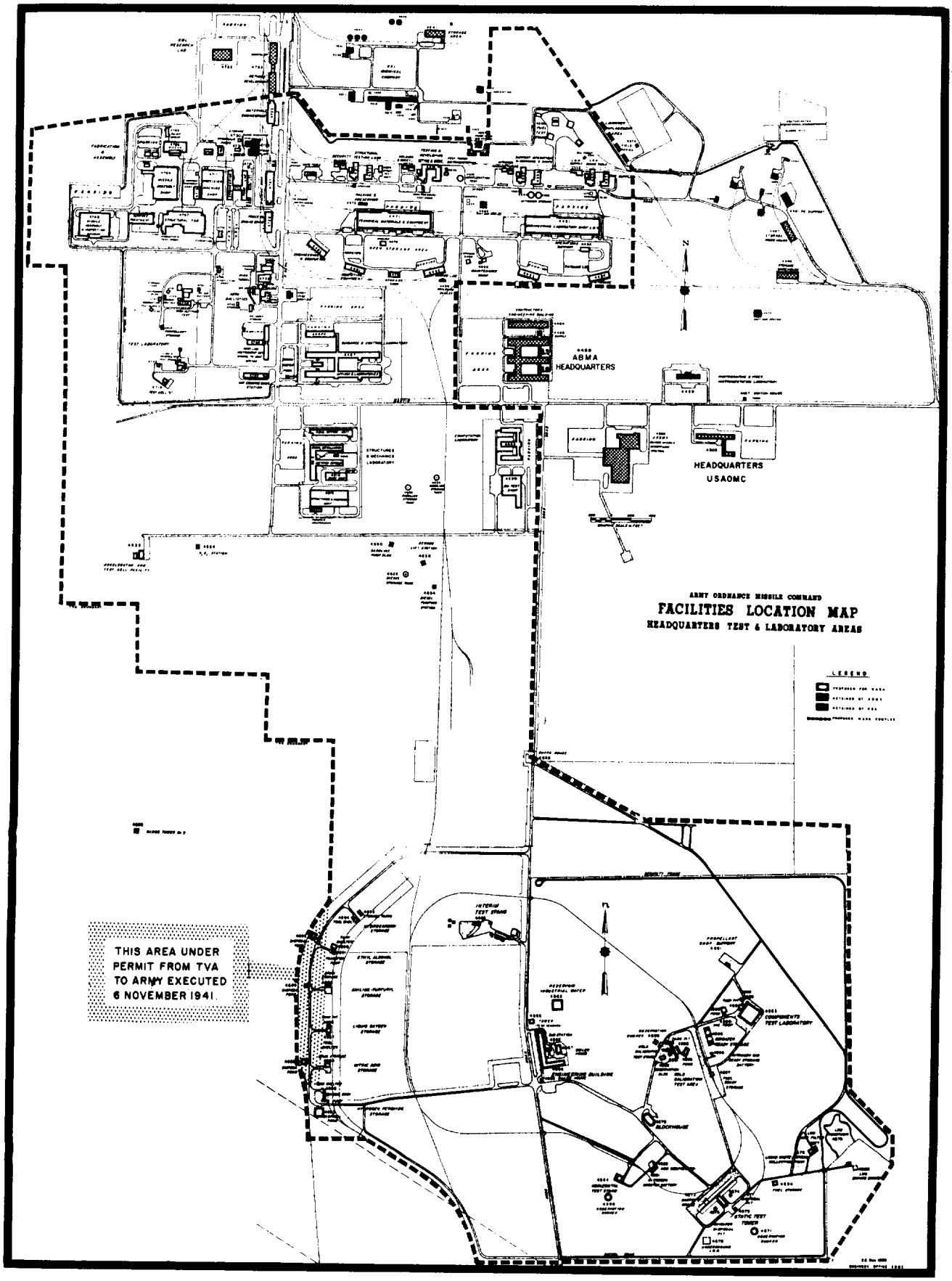
Food Service

The Post Exchange (administered by the Joint Army-Air Force Exchange Service) provides cafeteria services to the Development Operations Division. Such service includes the providing of feeding facilities such as cafeterias, snack bars, mobile units, food-vending machines, coffee carts, cigarette machines, candy machines, and soft drink machines throughout the Development Operations Division area.

Following the transfer of the Development Operations Division these services will be provided in the following manner:

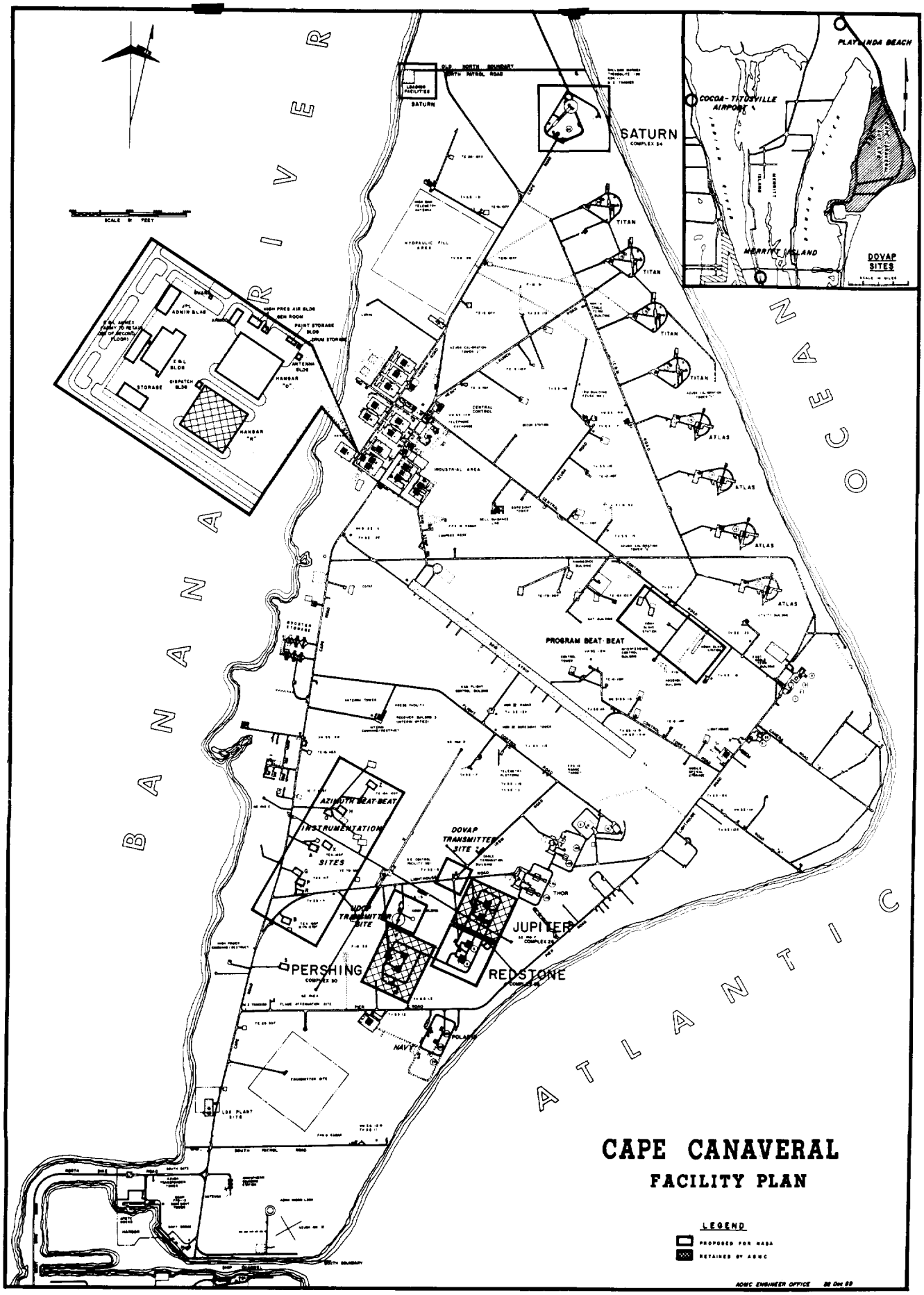
1. The Post Exchange continue to provide the aforementioned services to NASA until July 1, 1961. That NASA provide such services after this date or earlier if appropriate arrangements and funding can be accomplished.
2. All profits from such services continue to go to the Exchange Service (including profits from vending machines) until NASA is able to provide such services for itself.
3. That consideration will be given by NASA and Exchange Service to the purchase by NASA of the cafeteria equipment, in place, within the NASA occupied area at Redstone Arsenal.


HUNTSVILLE
ARMY TEST TRACK
ANTENNA TEST AREA B FACILITIES
TEMPORARY QUICK LOOK ANTENNA TOWER (ABMA)
PROPOSED RADIATION RESEARCH LAB (ARGMA)
LAUNCHER EMPLACEMENT AREA
RIVER DOCK AREA FOR SATURN
NORTH
AREA REQUIRING ARMY-NASA CROSS SERVICE AGREEMENTS
PROPOSED NASA AREA WITH CERTAIN FACILITIES TO REMAIN WITH THE ARMY
SAFETY ZONES FOR TESTING & RANGE ACTIVITY
GRAPHIC SCALE
IN THOUSANDS OF FEET
ENGINEER OFFICE AOMC DEC 29 1959


ABMA
HEADQUARTERS
HEADQUARTERS
USAOMC
ARMY ORDNANCE MISSILE COMMAND
FACILITIES LOCATION MAP
HEADQUARTERS TEST & LABORATORY AREAS
LEGEND
THIS AREA UNDER
PERMIT FROM TVA
TO ARMY EXECUTED
6 NOVEMBER 1941.

OUTLYING STORAGE AREAS WHICH MAY CONTAIN ITEMS TO BE TRANSFERRED TO NASA

3444	Storage
4496	Storage
4497	Storage
S5420	Storage Shed
5436	Storage
5437	Storage
8025	Storage
8027	Storage
8501	Storage Igloo


BANANA RIVER
ATLANTIC OCEAN
SATURN
TITAN
ATLAS
PROGRAM BEAT-BEAT
AZIMUTH BEAT-BEAT INSTRUMENTATION SITES
DOVAP TRANSMITTER SITE
THOR
JUPITER
REDSTONE
PERSHING
NAVY POLARIS
PLAYALINDA BEACH
COCOA-TITUSVILLE AIRPORT
MERRITT ISLAND
DOVAP SITES
CAPE CANAVERAL
FACILITY PLAN
LEGEND
PROPOSED FOR NASA
RETAINED BY AFMC

APPENDIX D

GEORGE C. MARSHALL SPACE FLIGHT CENTER:

FUNCTIONS OF DIVISIONS AND LAUNCH OPERATIONS DIRECTORATE

GEORGE C. MARSHALL SPACE FLIGHT CENTER

Functions of Divisions and Launch Operations Directorate

The Aeroballistics Division conducts research and development activities in aeroballistics and related sciences. Such work includes vehicle design with respect to aerodynamic parameters, control features, loads, aerodynamic heating and external fluid properties. The laboratory also conducts flight evaluation and performs research in aerophysics, geophysics, and astronomy as these sciences relate to booster systems.

The Computation Division is responsible for establishing and conducting high speed digital computation, simulation, and data reduction in the fields of space vehicle research, development, test, and flight firing. The Division operates one of the largest centers of computation equipment in the Free World.

The Fabrication and Assembly Engineering Division is responsible for producing experimental model and prototype super boosters and space vehicles. This facility has produced Redstone, Jupiter, and Saturn rockets. It is also responsible for conducting research in and development of new technology and novel manufacturing methods and procedures for advanced scientific application.

The Guidance and Control Division designs, develops, and does pilot manufacturing of guidance, control, electrical network, missile-borne tracking, measuring, telemetering and range safety devices, components, and systems for space vehicles. The Division also designs electrical ground support equipment for systems testing and firing, and designs

special test equipment associated with missile-borne guidance and control components.

The Quality Division assures that super boosters, rocket systems, their subsystems, components and related support equipment will perform satisfactorily under the conditions and purposes for which they were designed. The Division establishes and maintains a comprehensive quality control program for rocket systems during the developmental manufacturing and assembly phases, and assures that material accepted meets quality levels.

The Research Projects Division is charged with initiating and executing original and supporting scientific research in specialized fields, and with collecting and evaluating scientific and technical information with a view toward using it in future programs. Areas of activity include physics and astrophysics, space environment, nuclear physics, space thermodynamics, and electronic systems.

The Structures and Mechanics Division conducts research and development in the fields of structures, mechanics, propulsion, chemistry, and materials as related to super boosters and space vehicles. Such work includes design and development of airframes, propulsion systems, and mechanical accessories; design integration of complete missile systems; and research in the field of future rocket vehicles.

The Systems Support Equipment Division was abolished as of October 1, 1960, with its missions being transferred to other Marshall divisions. This division had been responsible for research and development in connection with rocket ground support and checkout equipment.

The Test Division performs experimental and developmental testing of super boosters and complete rocket systems and their components, including static firings. The Division conducts research and development in rocket system testing methods and techniques, and provides design criteria for test facilities and auxiliary equipment.

The Launch Operations Directorate, Cape Canaveral, Florida, is responsible for planning, coordinating, scheduling, directing and/or executing the checkout and launching of NASA boosters and space vehicles. It is responsible for participating in the measuring and tracking of space vehicles, and the designing and developing of vehicle launch facilities and accessories.

APPENDIX E

MESSAGE OF WELCOME EXTENDED PRESIDENT DWIGHT D. EISENHOWER

BY HONORABLE JOHN PATTERSON, GOVERNOR OF ALABAMA

MESSAGE OF WELCOME

EXTENDED PRESIDENT DWIGHT D. EISENHOWER
BY
HONORABLE JOHN PATTERSON
GOVERNOR OF ALABAMA

Huntsville, Alabama, September 8, 1960

Mr. President, Senator Wiley, Dr. von Braun, Distinguished Guests, Ladies and Gentlemen:

As Governor, it is a great pleasure to extend official greetings of the State of Alabama to our distinguished visitors, notably the President of the United States. We are delighted to have you visit us again, Mr. President, and we offer to you and your party a warm welcome.

We are also deeply honored to have Dr. Glennan and Mrs. Marshall here with us today. Your presence adds to the significance of this occasion, and we are extremely pleased to have both of you in Alabama.

I wish to extend to all the members of the official party the best wishes of our citizens. On behalf of the State of Alabama, I welcome you to our State and assure you of our warm, sincere hospitality.

We in Alabama are very proud of this great Federal installation. It means more jobs for our people, and more money for our economy. By virtue of its payroll, this base happens to be the largest single employer--public or private--in our State. Due to the economic impact of Redstone Arsenal, the city of Huntsville more than tripled in population during the last decade. It is now Alabama's fourth largest city, a thriving community of 72,000, and proudly boasts of its slogan "Rocket City USA."

But more than this, we as Americans are gratified at the outstanding work being performed here, in the National interest. We are elated to know of the amazing scientific advances in our missile program which have already taken place at Redstone. And now we watch with the entire Free World the development of the Saturn space project right here.

I wish to commend Dr. von Braun and his staff for their long string of scientific accomplishments for our country. They have done a great job working as a team under the guidance of the U. S. Army. Now as their research and development facilities are formally transferred to the National Aeronautics and Space Administration, I know I join with free people everywhere in wishing them good fortune and good luck. I hope their discoveries and break-throughs as members of the George C. Marshall Space Flight Center will be even more notable, and will help in their way to keep peace in the world.

APPENDIX E

Mr. President, we are delighted that you are visiting us. I wish to thank you for being here today, and I invite you, and Dr. Glennan, and Mrs. Marshall and the rest of our guests to come back to visit us in the future.

Thank you.

APPENDIX F

REMARKS BY PRESIDENT EISENHOWER AT THE DEDICATION OF THE GEORGE C. MARSHALL SPACE FLIGHT CENTER

REMARKS BY PRESIDENT EISENHOWER AT
THE DEDICATION OF THE GEORGE C.
MARSHALL SPACE FLIGHT CENTER, AT
HUNTSVILLE, ALABAMA, SEPTEMBER 8, 1960

Governor Patterson, Mrs. Marshall, Mayor Searcy, Dr. Glennan, Dr. von Braun, Members of the Congress, Other Distinguished Guests, and Fellow Americans:

It is always good to come back to our Southland, this region traditional of hospitality and friendliness. I thank you both, Mr. Governor and Mr. Mayor, for making me feel welcome, and so much at home.

I have long looked forward to visiting this spot. I know that, for an old foot solider, it will be a revelation to see at firsthand the efforts here underway to probe into the mysteries of the universe millions of miles from our earth.

Already, in brief visits with your distinguished men of rocketry, I have made a significant discovery of my own.

I find that the leaders of the new space science feel as if Venus and Mars are more accessible to them than a regimental headquarters was to me as a platoon commander forty years ago.

To move conceptually, in one generation, from the hundreds of yards that once bounded my tactical world to the unending millions of miles that beckon these men onward, is a startling transformation.

I freely admit to sentimentality in my contemplation of these advances, because so much of this dramatic accomplishment was pioneered by the United States Army, which until recently was my life and my home.

Here, under Army guidance, Redstone and Jupiter and a whole family of missiles have taken form. Here, too, was created Explorer I, America's first earth satellite. I share with the Army its gratification in these trail-blazing achievements, which have their counterparts in other services. These achievements have thrilled the American people and won plaudits throughout the world.

The momentum thus gained accelerates today under the civilian management of the new National Aeronautics and Space Administration, guided by Dr. Glennan, and his Deputy, Dr. Dryden. The gifted scientists, engineers and technicians who splendidly served the Army are now eagerly developing, for this new organization, the gigantic launch vehicle, "Saturn".

No doubt this mightyrocket system makes its presence known loudly -- possibly too loudly -- in Huntsville. But it is a significant forward step in our conquest of space and for growth in human comprehension.

Already we have improved our understanding of matter, energy, motion and life processes through our early efforts in space.

The characteristics of the radiation belts girdling the earth -- the true nature of our space environment, including solar storms -- the appearance of the earth's total cloud cover -- the feasibility of a world-wide communications system utilizing satellites -- these and other space ventures have opened new vistas of thought, understanding, and opportunity.

These, of course, are only beginnings. This past month new milestones in space exploration have been headlined throughout the world. As the months go by we shall see many more.

Marvel as we will these technical achievements, we must not overlook this truth:

All that we have already accomplished, and all in the future that we shall achieve, is the outgrowth not of a soulless, barren technology, nor of a grasping state imperialism. Rather, it is the product of unrestrained human talent and energy restlessly probing for the betterment of humanity. We are propelled in these efforts by ingenuity and industry -- by courage to overcome disappointment and failure -- by free-ranging imagination -- by insistence upon excellence -- with none of this imposed by fiat, none of it ordered by a domineering bureaucracy. In this fact is proof once again that hard work, toughness of spirit, and self-reliant enterprise are not mere catchwords of an era dead and gone. They remain the imperatives for the fulfillment of America's dream.

Not pushbuttons nor electronic devices, therefore, but superlative human qualities have brought success and fame to this place. These qualities I mention here because they typify a distinguished American -- George Catlett Marshall -- in whose name we carry forward this activity.

General Marshall was supremely endowed. He was a man of war, yet a builder of peace -- forceful and dynamic as a leader, calculating and prudent in judgement, yet warmly regarded by his associates. He was selfless, indeed self-effacing, yet known and admired throughout the world. Though dominating in personal force, in action and thought he was humble and considerate.

Northern born and Southern schooled, all-American through military service, he ultimately became a citizen of the world. I, of course, knew him best during the prosecution of World War II. I found him immune to discouragement, relentless in carrying the war to the enemy, and unsparing of himself in his leadership of the great forces he directed. But so profound was his devotion to the constructive works of peace -- so outspokenly was he their advocate as Secretary of State -- that he later became the symbol of renewed hope for scores of millions of suffering people through his great Plan for Europe that will forever bear his name. He became, in consequence, the only professional soldier ever to be honored with the Nobel Peace Prize.

During his final twenty years he lived with, he counselled and influenced, the greatest men and movements of his time. Through it all he remained unaffected, reserved, completely disinterested in self, and dedicated to our Nation's highest ideals.

We, participating in this brief ceremony, agree with Sr. Winston Churchill, that "succeeding generations must not be allowed to forget (General Marshall's) achievements and his example."

There are ways to do this that General Marshall would have prized far more than what we do here today. It is not enough that we rest with praise of his name

But we can newly resolve to work ceaselessly, with all our hearts and with such talents as we may posses, as did he throughout his life, for the good of this land and its freedoms.

Thus we shall carry forward the noble mission of our Republic, ever striving to strengthen peace, ever advancing the cause of human liberty, ever doing our best to build a better life for all.

That is what George Marshall would wish of us today.

MORE

In this spirit, and with deep satisfaction in having shared in this tribute to a revered friend, I dedicate this, the George C. Marshall Space Flight Center.

May this great Center be ever worthy of its honored name.

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