FIFTY YEARS OF FLIGHT RESEARCH: A CHRONOLOGY
OF THE LANGLEY RESEARCH CENTER, 1917-1966

(HHN-65)

by

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The first half-century of the Langley Research Center is but a portion of the full history of American aviation. Many basic innovations in aeronautical development in the United States derive from fundamental research carried on at Langley, the only laboratory of the National Advisory Committee for Aeronautics for over two decades. In helping to fill the long-neglected gap in the history, the achievements of the Langley Research Center are of significance and considerable general interest. Like its namesake, Samuel Pierpont Langley, pioneer astrophysicist and aerodynamicist, the Langley Laboratory was to assume an active role in the advancement and use of flight, both in the atmosphere and beyond.

This chronology is neither a history nor intended to be a complete investigation of the history of aeronautical technology. A documented chronology on the people, facilities, and work at Langley will, hopefully, help describe the evolution of the first major government research laboratory in aerodynamics. Since the establishment of the National Advisory Committee for Aeronautics in 1915, and the setting up of their first laboratory in Hampton, Virginia, the Langley Laboratory has risen to a position of highest regard in the community of aeronautical research. The relations of the laboratory with the air services of the Army and Navy and the developing American aeronautical industry are an important impetus for, and consequence of, much of the research carried on.
American military agencies, early concerned with rapid advancement of flight technology, helped spur the expansion of the NACA, and their role in the Langley history must be considered.

It is hoped that this chronology will also provide a basic guide for the historian concerned about the evolving relations of the Federal Government with science and technology through a major research laboratory, and of the role of that laboratory with military and commercial aviation, and the American aerospace industry. Indeed, the Langley experience fostered the rapid growth of the NACA just prior to World War II, from which the X-research aircraft, Project Mercury, and Lunar Orbiter are symbolic latter-day achievements.

The fruition of the Federal role in the fields of aeronautics and astronautics is most evident today in the work carried on by the National Aeronautics and Space Administration. That such was no historic accident is one outcome of the chronological beginning on the full history of the Langley Research Center. Hopefully, the historical effort will provide new insights and meanings into the overall history of the United States.

The author is indebted to many for their assistance in the preparation of this chronology. Drs. Eugene M. Emme and Frank W. Anderson of the NASA Historical Office offered both advice and encouragement in the completion of the work. T. Melvin Butler, Robert Mulac, William Williams, and Mrs. Neva Brooks, all of the
Langley Research Center, were most generous with their time. My colleagues in the NASA Seminar, "History, Social Science and Space," J. Michael Kemp, Loftus E. Becker, Jr., Charles Atkins, and John Cooper, helped provide an atmosphere conducive to intensive historical research. The usual sobriquet that all errors are the sole responsibility of the author applies to the results of the investigation.

MDK
CHAPTER I
PRIOR TO ESTABLISHMENT OF LANGLEY LABORATORY, 1901-1916

Winter, 1901: First complete wind tunnel laboratory, equipped for wide range of aerodynamic experiments and with instruments capable of exact measurements, was devised by A. F. Zahm and erected on grounds of Catholic University of America. (N. H. Randers-Pherson, "Pioneer Wind Tunnels," in Smithsonian Miscellaneous Collections, Vol. 93, No. 4, 1/19/35)

October 7, 1903: Charles M. Manly, chief assistant to Samuel P. Langley, was launched from top of house-boat in an heavier-than-air machine. Attempt to fly was a failure, the plane wrecked and Manly barely escaped drowning. It was the first attempt in the history of the world to fly, with a man as pilot, in a motor-driven heavier-than-the-air machine. Machine used was invented by Langley while the motor was an invention by Manly. Attempt at flight was on the Potomac River, off Widewater, Va. ("Initial Events in the History of Aviation--Chronology.")

December 8, 1903: The second and last trial of the Langley aerodrome. Machine, piloted by Charles M. Manly, was wrecked in launching from a houseboat on the Potomac River. (Chronology of American Aerospace Events, 1)

December 14, 1903: The world's first power airplane flight was made off Kill Devil Hill, Kitty Hawk, N.C., by Wilbur Wright--105 feet in 3.5 seconds. Because plane crashed so soon after take-off, flight is not considered either as sustained or controlled as are the flights of 17 December. (Chronology of American Aerospace Events, 1)

December 17, 1903: First sustained controlled power airplane flights were made by Orville and Wilbur Wright at Kitty Hawk, N.C. On fourth and longest flight of the day the plane flew 852 feet in 59 seconds. (Chronology of American Aerospace Events, 1)

December 23, 1907: War Dept. issued the first specifications for a flying machine. ("Origins of NACA," draft MSS, NASA Historical Archives, 6)

During 1907: Group composed of Alexander Graham Bell, Glenn H. Curtiss, J. A. D. McCurdy, F. W. Baldwin, and Lt. Thomas E. Selfridge formed the Aerial Experimental Association with the
1901 - 1914 Continued

object of "constructing a practical aerodrome, driven by its own motive power, and carrying a man." Before the association was dissolved in 1909, the members designed four machines which were constructed at the Curtiss factory at Hammondsport, N. Y., and successfully flown. ("Origins (of NACA)," draft MSS, NASA Historical Archives, 5)

July, 1909: Wright brothers demonstrated a plane which more than met the specifications of the War Dept. and became the first man-carrying machine to be owned by the Government. ("Origins (of NACA)," draft MSS, NASA Historical Archives, 6)

February 10, 1910: Board of Regents of Smithsonian Institution awarded first Langley Medal to the Wright brothers in Washington, D. C., "for advancing the science of aerodynamics in its application to aviation by their successful demonstrations of practicability of mechanical flight by man." (Chronology of American Aerospace Events, 6)

January 18, 1911: House of Representatives passed an appropriation of $125,000 for Army aeronautics. (Shrader, Fifty Years of Flight, 13)

April, 1911: One of Washington papers reported that, at a dinner to be sponsored by the Aeronautical Society, President Taft would announce the establishment of an aeronautical laboratory with work being performed by the Bureau of Standards, but with the laboratory itself being administered by the Smithsonian Institution. Naval Constructors opposed it. (Pearson notes, NASA Historical Archives)

During 1911: Initial effort to have the President assign aeronautical research functions to the Smithsonian and alternate proposal that they be assigned to Navy were objected to on jurisdictional grounds. (Pearson notes, NASA Historical Archives)

- Congressional appropriation of $125,000 to Army Signal Corps enabled purchase of a few training planes and establishment of a flying school at College Park, Maryland. ("Origins (of NACA)," draft MSS, NASA Historical Archives, 6)

- Capt. W. I. Chambers (USN), officer-in-charge of naval-aviation experiments, proposed that a national aeronautical research laboratory be set up under Smithsonian Institution. Along with
1901 - 1914 Continued

objections by both War and Navy Depts., plan was referred to President Taft's Committee on Economy and Efficiency, from which it was never returned. (Hunsaker, Forty Years of Aeronautical Research, 243)

December 19, 1912: National Academy of Sciences appeared to be influential in persuading President Taft to appoint on Dec. 19, 1912, a 19-man commission to consider a national laboratory and its scope, organization, and cost, and to make a recommendation to Congress. Taft, on advice of Secretary of Navy G. von L. Meyer, created this commission. (Hunsaker, Forty Years of Aeronautical Research, 244)

During 1912: Navy Dept. received a $25,000 grant from Congress which it used in starting a small experimental plant at Washington Navy Yard. This was the first Government laboratory devoted to the study of aeronautics. ("Origins of NACA," draft MSS, NASA Historical Archives, 7)

March 12, 1913: Having met three times, the Presidential Commission unanimously recommended establishment of an aeronautical research laboratory. Laboratory was to be directed by regents of Smithsonian. Policy direction was to come from a 13-man committee, including six government representatives; management of lab was to be by a presidentially-appointed director with annual salary of $5,000. Total operating expenses for first year were estimated at $50,000. (Walter T. Bonney, draft MSS, with notation "For Smithsonian, 7/18/55," NASA Historical Archives)

May 1, 1913: Board of Regents of Smithsonian Institution granted C. D. Walcott the authority to reopen the Langley Laboratory at the Smithsonian. (Lee Pearson, "The Aerodynamic Laboratory," draft MSS, NASA Historical Archives)

May 6, 1913: Langley's old Aerodynamical Laboratory at the Smithsonian was reopened. (Shrader, Fifty Years of Flight, 15)

May 9, 1913: President Wilson approved request that representatives of Depts. of War, Navy, Agriculture and Commerce serve on advisory committee to study aeronautical developments. These departments designated committee members and, in addition, a number of civilians were selected for membership. (Pearson notes, NASA Historical Archives)
1901 - 1914 Continued

**During May 1913:** Trustees of MIT decided to establish a course of instruction in aerodynamics and requested the Navy to designate a qualified officer to prepare and conduct it. Jerome C. Hunsaker was so designated. (Walter T. Bonney, draft manuscript, with notation "For Smithsonian, 7/18/55," in NASA Historical Archives)

**During June 1913:** Jerome C. Hunsaker, Assistant Naval Constructor, detailed to MIT by Secretary of Navy Daniels, to develop courses in aerodynamics. (Shrader, Fifty Years of Flight, 15)

**September 30, 1913:** As of this date, U.S. Army had 17 aeroplanes with 23 officers and 91 enlisted men on aeronautical duty. (Shrader, Fifty Years of Flight, 15)

**October 9, 1913:** Franklin D. Roosevelt, Acting Secretary of Navy, appointed Capt. W. I. Chambers as Senior Member of a Board to draw plans for organization of a Naval Aeronautic Service. (Shrader, Fifty Years of Flight, 15)

**During December 1913:** Smithsonian Board of Regents authorized C. D. Walcott to present to Congress the need for appointment of an advisory committee for aeronautics. Walcott did this the following March, submitting subject in connection with appropriation for Langley Aerodynamical Laboratory of the Smithsonian Institution. (Draft MSS on establishment of NACA, NASA Historical Archives, 6)

**During 1913:** Jerome C. Hunsaker and Albert F. Zahm made an inspection tour of the European aeronautical research facilities as agents of the Smithsonian Institution. (NACA files, NASA Historical Archives)

**May 28, 1914:** Aerodrome, originally built by S. P. Langley (somewhat modified) was flown at Hammondsport, N. Y. Plane had crashed into the Potomac River in 1903 when an attempt to launch it by catapult was made. (Dayton (Ohio) Journal, 5/29/14)

**July 18, 1914:** Aviation section of Signal Corps was created by Congress, with responsibility for "the operation or supervision of operation of all military aircraft, all pertinent appliances, signalling apparatus when installed on air craft and training in aeronautics." ("Origins (of NACA)," draft MSS, NASA Historical Archives, 25)
December 10, 1914: Smithsonian Board of Regents authorized the Chancellor of the Smithsonian, Chief Justice of the United States Edward D. White, to appoint a committee of its members to consider the subject of an advisory committee for aeronautics. White appointed Alexander G. Bell, Senator William J. Stone of Missouri, Rep. Ernest W. Roberts of Mass., and John B. Henderson, Jr., regents, and C. D. Walcott, Secretary to consider the "Questions relative to the Langley Aerodynamical Laboratory." First meeting convened Jan. 30, 1915, in the committee room of Senator Stone, a member of the Smithsonian Board of Regents. (Hunsaker, Forty Years of Aeronautical Research, 245, Walter T. Bonney, draft MSS, with notation, "For Smithsonian, 7/18/55," in NASA Historical Archives)

During 1914: When World War I erupted it was reported that France had 1,400 airplanes, Germany 1,000, Russia 800, Great Britain 400, and the United States, 23. (Hunsaker, Forty Years of Aeronautical Research, 243)

January 26: Senator Ben Tillman of South Carolina introduced a joint resolution which would provide for appointment of an advisory committee for aeronautics. It was referred to Senate Committee on Naval Affairs and Committee on Military Affairs. This action was the result of a memorandum prepared by C. D. Walcott, Smithsonian Secretary, which vigorously advocated establishment of an advisory committee for aeronautics. (Levine, "United States Aeronautical Research Policy," 12)

February 1: Congressman Roberts introduced in the House a resolution for an advisory committee on aeronautics which was referred to the House Committee on Naval Affairs. Also a "Memorial on the need for a National Advisory Committee on Aeronautics" was delivered to the Speaker of the House. Navy endorsed the idea in a letter dated Feb. 12 and signed by Franklin D. Roosevelt.
1915 Continued

as Acting Secretary of Navy. (Hunsaker, Forty Years of Aeronautical Research, 245; Walter T. Bonney, draft MSS, with notation, "For Smithsonian, 7/18/55," NASA Historical Archives)

February 19: Congressman Roberts, reporting on need for NACA, said: "Besides these governmental agencies (he named Bureau of Standards, Weather Bureau and War and Navy Depts.) for the development of aviation, individuals in civilian life have devoted time and expense in the scientific study and practical development of aeronautics. At the present time all of these agencies, both governmental and private, work independently without any coordination of activities." (Hunsaker, Forty Years of Aeronautical Research, 248)

March 3: Act of Congress passed establishing (National) Advisory Committee for Aeronautics. It was a rider-on a Naval Appropriation Bill. $5,000 appropriated for NACA's first year. (See Appendix A.) (Shrader, Fifty Years of Flight, 16 and numerous sources)

April 2: President Wilson, probably acting on the advice of C. D. Walcott, Smithsonian Secretary, appointed the members of the NACA, as provided by law. Membership was noteworthy in that it included the highest professional levels. (See Appendix C.) (Pearson notes, NASA Historical Archives)

April 23: By direction of the President, Secretary of War called the first meeting of NACA in his office. At meeting word "National" was prefixed to title "Advisory Committee for Aeronautics." Brig. General G. P. Scriven was elected temporary chairman, and Naval Constructor H. C. Richardson temporary secretary. ("First Meeting of NACA," draft MSS, NASA Historical Archives)

June 11: Secretary of NACA was authorized "to obtain the services of a clerk at not over $100.00 per month." ("Preparation for World War I," draft MSS, NASA Historical Archives; Exec. Comm. Min., 6/11/15)

June 14: H. C. Richardson, NACA Secretary, officially requested authorization from the Secretary of Navy to hire John F. Victory as clerk. (H. C. Richardson to Sec. of Navy, 6/14/15)
1915 Continued

**June 23:** First employee of NACA, John F. Victory, was hired. His letter of appointment (in nature of a transfer from the Washington Navy Yard) was signed by Franklin D. Roosevelt, then Assistant Secretary of the Navy. In 1917 Victory was named assistant secretary of NACA; 10 years later he became secretary, and in 1945, executive secretary. (Hunsaker, *Forty Years of Aeronautical Research*, 214; "Preparation for World War I," draft MSS, NASA Historical Archives, 43)

**During the year:** When Brig. General George P. Scriven, Chief Signal Officer, asked for over $1,000,000 for aviation for FY 1915, Secretary of War Lindley Garrison reduced estimate to $300,000 before submitting it to Congress; Congress pared it still more, so that only $250,000 was finally granted. ("Origins (of NACA)," draft MSS, NASA Historical Archives, 9)

1916

**February 12:** U.S. Post Office Dept. issued its first air-mail advertisement inviting bids for carrying the mails by airplane in Massachusetts and in Alaska. (Shrader, *Fifty Years of Flight*, 17)

**March 22:** NACA statement said about 4,000 airplanes annually would be needed to put and keep U.S. on proper military footing. Of this number, 1,000 would be attached to an army of 1,000,000 men, 200 to the fleet, 800 would be for harbor and seacoast defense, and 2,000 for training pilots. (Wash. Post, 3/23/17)

**May 11:** Clerk of NACA reported letter from C. D. Walcott, Smithsonian Secretary, dated 4/29/16, enclosing extract of letter from A. F. Zahm of the Curtiss Aeroplane Company, inviting attention to the facilities of Curtiss Company and offering to cooperate with NACA in advancement of aerotechnical science. (Exec. Comm. Min., 5/11/16)

**June 8:** NACA Executive Committee met with representatives of aircraft and aeronautic motor manufacturers to consider the present status of motor construction and design, and difficulties
being experienced in practice. This was first meeting in effort toward cooperation in securing motors for aeronautic work and to standardize aeronautic motors and accessories. (Victory files, NASA Historical Archives; Wash. Post, 6/9/16)

Executive Committee of NACA passed resolution that they considered it "very advisable to take up the development of dirigibles in this country immediately, and that the sum of $3,000,000 should be made immediately available, and continue available until expended." (C. D. Walcott, NACA Chairman, to Senator Ben Tillman, 6/12/16)

June 18: Executive Committee invited engine manufacturers to attend meeting in C. D. Walcott's office at Smithsonian Institution to discuss problem of obtaining more powerful and more reliable engines and to bring about a better understanding between builders and users. (Hunsaker, Forty Years of Aeronautical Research, 252)

August 10: Members of Subcommittee on Motive Power of NACA authorized to visit various manufacturers of aeronautic motors and other industrial establishments, with a view to stimulating interest in development of aeronautics, and particularly the aeronautic motor. ("Important Events in Early History of NACA," prepared for J. F. Victory, 12/5/29, 3)

August 29: NACA requested $85,000 and received $82,515.70 for FY 1917 as a part of Naval appropriation bill. $68,957.35 later went toward laboratory construction at Langley Field. (NACA 2nd Annual Report, 1916, 17)

During August: Congress directed the Secretary of War to investigate various military reservations in effort to find one which would serve as an aeronautical experiment station. If none could be found, the Secretary was to use $300,000 which Congress provided for purchase of such land as might be needed. (Public Information Office Files, LaRC)

September 15: Army appointed a Board of Officers to select a site for experimental station. During next few weeks members of Board searched for a location which had following characteristics: a tract of flat land (1,600 to 1,800 acres) fronting on a large body of water, so that facilities would be available for flights over land and water; east of the Mississippi River and south of Mason and Dixon Line, where weather generally
1916 Continued

would be favorable for flying; not more than a twelve-hour ride by train from Washington, so facilities of Bureau of Standards could be used easily; not so close to an unprotected coast as to be vulnerable to attack or capture in event of war. On Nov. 10, 1916, after having examined 15 locations, the Board of Officers recommended a site 3 or 4 miles north of Hampton, Va. (Public Information Office Files, LaRC)

October 2: At suggestion of Col. G. O. Squier, a NACA subcommittee was appointed to consider need of NACA as to site for experimental work, with authority to visit and inspect such sites as may be necessary, and to secure the cooperation of the War and Navy Depts. and Weather Bureau for selection of sites for their own use. Members of subcommittee were C. D. Walcott, C. F. Marvin, and S. W. Stratton. Committee recommended that War Dept. (which alone had funds available) purchase land about 4 miles north of Hampton, Va., for use by Army and Navy as an aircraft proving ground. It was named Langley Field. War Dept. used it for pilot training during WWI. Navy, in order to test seaplanes, eventually established its center in Norfolk, Va. (Hunsaker, Forty Years of Aeronautical Research, 250; "Important Events in Early History of NACA," prepared for J. F. Victory, 12/5/29, 3)

October 27: In a report on "Nomenclature for Aeronautics," issued by NACA, the name "airplane" was substituted for any "form of aircraft heavier than air which has wing surface for sustenance, with stabilizing surfaces, rudders for steering, and power plant for propulsion through the air." Thus the word "aeroplane" was dropped. (Phila. Inquirer, 10/28/16)

November 9: Representatives of War and Navy Depts. present at meeting of NACA Executive Committee to discuss site for experimental field. After withdrawal of guests, NACA Secretary S. W. Stratton was instructed to communicate with Mr. Brooker, President of First National Bank, Hampton, Va., and with Surgeon General Rupert Blue, inquiring as to the health conditions in the vicinity of Hampton. Members of Executive Committee authorized to inspect proposed site at Hampton, Va. on Nov. 18. (Exec. Comm. Min., 11/9/16)

November 18: Public Health Service informed NACA that its investigation of health conditions in Hampton, Va., vicinity showed
that only disease which should be given particular attention in judging the suitability of area for a research laboratory was malarial fever. PHS said, however, that prevalence of malaria in Hampton area was no greater than in most other tidewater sections of Atlantic coast, south of Washington. (A. H. Glennan, Acting Surgeon General, to H. C. Richardson, USN, NACA, 11/18/16)

November 23: NACA accepted site near Hampton, Va., which the Army Board of Officers had recommended as an experimental station and suggested that land be obtained as soon as possible. The Navy, more desirous of testing seaplanes, set up its laboratory in Norfolk, Va. (Public Information Office Files, LeRC)

December 7: General G. O. Squier, Signal Corps, reported to NACA that Secretary of War had approved Committee's recommendation as to location of site for experimental station. S. W. Stratton, NACA Secretary, instructed to request permission for NACA to use certain portions of proposed proving ground now being acquired. Letter to Secretary of War authorized, urging that necessary steps be taken to secure authority to expend $1,500,000 out of appropriated funds for improvement of field for proving ground. Permission for use of portion of field requested of Secretary of War in letter of 12/12/16, and granted by letter of 12/27/16. ("Important Events in Early History of NACA," prepared for J. F. Victory, 12/5/29, 3)
CHAPTER II
EARLY YEARS OF THE LANGLEY LABORATORY, 1917-1929

1917

January 10: Comptroller of Treasury held NACA to be an independent
Government establishment (finding confirmed by Comptroller
General in 1927). As result, request for an adjustment to
1918 appropriation was submitted to House Appropriations

January 11: S. W. Stratton, NACA Secretary, read a memorandum from
Capt. V. E. Clark of War Dept., dated 1/9/17, referred to
NACA by Brig. General G. O. Squier, Chief Signal Corps Officer
(USA), in reference to excessive cost of airplanes. (Exec.
Comm. Min., 1/11/17)

During January: War and Navy Depts. both complained to NACA about
prohibitive prices for aircraft, said to be due to extra item
of royalty added by each firm in anticipation of infringement
suits by owners of alleged basic aeronautic patents; they
were then threatening all other airplane and seaplane manu­
facturers with such suits, and causing thereby a general
demoralization of entire industry. (Sp. Exec. Comm. Min.,
2/3/17)

February 3: NACA Executive Committee met with representatives of
Wright Martin Aircraft Co., owner of Wright patent, who ex­
plained the aims of the corporation and outlined its views
regarding royalties, stating that basic idea was to develop
an aeronautic engine superior to any other in existence; that
they were willing to waive the license fee entirely; and that
company had a capacity of about 3,000 engines a year. At this
meeting two plans were discussed: first, for Congress to
authorize the purchase of Wright patent for use of the Govern­
ment and by manufacturers under suitable regulations; second,
formation of an organization to effect a cross-license agree­

February 10: NACA Chairman authorized by Executive Committee to
address letter to Secretary of War requesting assignment to
Committee of building sites for laboratory, hangar, experimental
and power plants at Hampton, Va. NACA first requested assign­
ment when War Dept. had completed blueprints of Langley Field.

11
1917 Continued

War Dept. expressed willingness to assign plot to NACA, but not until the construction of field was in a more advanced state. (Exec. Comm. Min., 2/10/17)


March 22: NACA met with representatives from Aircraft Manufacturers' Association, the Army and the Navy to consider ways and means to accelerate aerial preparedness. (Exec. Comm. Min., 3/22/17)

March 29: Otto Praeger, Second Assistant Postmaster General, and his assistant, E. R. White, attended a meeting of NACA Executive Committee and requested Committee's advice as to air mail service under appropriation of $100,000 for FY 1918. Request referred to Subcommittee on Aerial Mail Service. (Exec. Comm. Min., 3/29/17)


April 6: U.S. declared war on Germany. As of this date, the Aviation Section of Signal Corps consisted of 35 pilots, 1,987 enlisted men, and 55 training airplanes. Navy had 38 officer-pilots, 163 enlisted men, and 54 airplanes. (Shrader, Fifty Years of Flight, 19)

April 10: NACA Executive Committee recommended to Council of National Defense that a Board be appointed to be known as the Aircraft Production Board. Purpose of this board would be to coordinate country's efforts in aeronautics. (Exec. Comm. Min., 4/10/17)

April 19: Secretary of NACA, S. W. Stratton, reported that War Dept. had secured a site for an experimental field near Hampton, Va., and that NACA had been granted space on this ground (Plot 16) for location of its field laboratory. (Exec. Comm. Min., 4/19/17)
May 16: Council of National Defense passed a resolution establishing the Aircraft Production Board to assist in the war effort. ("Chapter V," draft MSS on NACA, NASA Historical Archives, 4)

May 25: Army awarded a contract for construction at Langley Field to the J. G. White Engineering Corporation of New York City. (Public Information Office Files, LaRC)


June 14: Suggestion was made to NACA Executive Committee by Capt. de Guiché, a member of the French Scientific Mission, regarding advisability of testing aeronautical engines in a chamber where the pressure could be reduced from full atmospheric pressure at sea level to half an atmosphere. (Exec. Comm. Min., 6/14/17)

June 28: Langley Field, Va., was authorized as a NACA experimental air station. Contract entered into with J.G. White Engineering Corporation of New York City for erection of Committee's research laboratory building at Langley Field on a cost-plus-7% basis and at an estimated cost of $80,900. (Chronology of American Aerospace Events, 18; Exec. Comm. Min., 7/12/17)

July 17: Excavation for research laboratory of NACA at Langley Field, Va., was started. (Victory Day Book, in National Archives, RG255)

July 24: Manufacturers Aircraft Association, Inc., signed a Cross-License Agreement. W. F. Durand, NACA Chairman, contended that agreement represented a complete solution of patent situation in aircraft industry. (W. F. Durand, NACA Chairman, to J. Daniels, Sec. of Navy, 7/27/17)

August 29: First flight of Liberty engine made. An aeronautical mechanical engineer employed by NACA had been detailed, at request of Aircraft Production Board, to assist in development of Liberty engine, and to supervise its trials which were made at Pike's Peak. Two months later the necessary changes had been completed and engine was being used in American-produced DeHaviland-4 plane. ("Men and Machines," draft MSS, NASA Historical Archives, 124)
1917 Continued

October 16: Final Army tests of airplane radio-telephone at Langley Field, Va., achieved records of 25 miles for plane-to-plane communication and 45 miles airplane-to-ground. (Chronology of American Aerospace Events, 18)

November 15: NACA Executive Committee authorized preparation of plans and specification for constructions at Langley Field of a wind tunnel of Eiffel type with approximately a 5-foot wind stream and with an insert provided to give a cross section of about $2\frac{1}{2}$ feet and with the highest velocities practicably attainable. (Exec. Comm. Min., 11/15/17)

During November: C. D. Walcott, W. F. Durand, and S. W. Stratton, all NACA members, inspected manufacturing plants and flying fields at Dayton, Ohio; Buffalo, New York; and Detroit, Michigan, to obtain first-hand information on the condition of U.S. aviation program. ("Men and Machines," draft MSS, NASA Historical Archives, 119)

During the year: NACA asked for and received an appropriation for FY 1917 of $85,000. Of these funds, $68,958 went toward construction of new laboratory at Langley Field. Controller of Treas. made very important decision on 1/1/17, namely that NACA was held to be an independent agency, thus the budget estimates for FY 1919 were referred to Committee on Appropriations of House of Representatives instead of Committee on Naval Affairs as they had been up until that time. (Stoney, "NACA from Birth to Death," 10)

February 19: J. F. Victory, Assistant Secretary of NACA, visited Langley Field and recommended that all necessary services be acquired to construct the laboratory. (Exec. Comm. Min., 2/23/18)

April 29: S. W. Stratton, as Chairman of NACA Subcommittee on Buildings, Laboratories, and Equipment, submitted the plans and specifications for wind tunnel building to be erected at Langley Field. Plans were approved for construction of first wind tunnel (5-foot) at Langley. (Exec. Comm. Min., 4/29/18)
1918 Continued

May 11: First American-made airplane received by American Expeditionary Force fighting in Europe. (Shrader, Fifty Years of Flight, 20)

May 20: By Presidential executive order, the Signal Corps was completely separated from all aviation matters and two new mutually dependent branches of War Dept. were formed, the Bureau of Aircraft Production and Bureau of Military Aeronautics. (Copy of Executive Order in File 25-36, NASA Historical Archives)

During July: Functions of the NACA regarding inventions were somewhat altered when the War Dept. established an inventions section of the General Staff to which all inventions were to be referred. ("Men and Machines," draft MSS, NASA Historical Archives, 134)

August 5: J. F. Victory, NACA Assistant Secretary said that the military was planning to take over all construction work at Langley Field on Aug. 15. He thought this would include the NACA wind tunnel building which would save the NACA much labor cost, "as there will be no way of charging the time of soldier labor." (J. F. Victory to C. D. Walcott, NACA Exec. Comm. Chairman, 8/5/18)

August 8: NACA Executive Committee resolution to accept offer of Dept. of Military Aeronautics to take over existing contracts for construction of a research laboratory and wind tunnel building at Langley Field. (Exec. Comm. Min., 8/18/18)


During the year: Development of flight instrumentation started. The first instrument development program noted called for the development of instruments for measuring engine torque and rpm, propeller thrust, airspeed, angle of attack, and inclination of the wing chord. (H. A. Soulé, "Notes on Flight Research," 8/4/48)
January 15: Col. Thurman H. Bane (USA) recommended that control of Langley Field and all experimentation at field remain with Air Service, but felt that this must be carefully presented to NACA. Also recommended that NACA be reimbursed by Air Service for buildings and other improvements installed at Langley Field, and that ownership of these buildings be transferred to Air Service. (T. H. Bane to Maj. General Kenly, USA, 1/15/19)

February 26: President Wilson approved and submitted to House of Representatives recommendations of NACA for legislation placing licensing and regulation of aerial navigation in charge of Dept. of Commerce. (Shrader, Fifty Years of Flight, 22)

April 10: S. W. Stratton, NACA Secretary, recommended construction of an engine dynamometer laboratory at Langley Field, utilizing five airplane hangar sections recently transferred to NACA by the Division of Military Aeronautics. Construction was authorized at an approximate cost of $15,000. Purpose of lab was to test internal combustion engines, conduct researches and advance development in aircraft engines. (Exec. Comm. Min. 4/10/19; Aircraft Journal, 4/19/19)

May 20: NACA authorized establishment of a foreign office with headquarters in Paris, to be under general supervision of the Committee on Publications and Intelligence and under immediate supervision of a technical assistant in Europe. Paris office opened in June 1919 with William Knight in charge. May 1921, John Jay Ide succeeded Knight. (C. D. Walcott, NACA Exec. Comm. Chairman, to Sec. of War, 5/20/19)

June 12: John H. DeKlyn, Engineer in Charge of Buildings and Construction at IMAL, wrote that there were great difficulties between civilian employees and military commander at Langley Field, Capt. E. J. House. (J. H. DeKlyn to J. F. Victory, NACA Assist. Sec., 6/12/19)

June 20: Research authorized for free flight tests. They were to compare the data on characteristics of airplanes in flight for comparison with wind tunnel results for the same machine. (Res. Authorization #10, Langley Files)
1919 Continued

July 25: J. S. Ames, Chairman of NACA Committee on Aerodynamics, reported that, after studying memoranda, he recommended that research laboratory be removed from Langley Field and relocated in vicinity of Washington. Soon an uncompleted parkway project, then known only temporarily as Bolling Field, became the chief contender for proposed relocation of the laboratory. ("The Langley Laboratory," draft MSS, NASA Historical Archives, 12; Exec. Comm. Min., 7/25/19)

During the summer: First flight research program undertaken at IMAL when an investigation was made of the lift and drag of the JN4H airplane. Two JN4H airplanes were used. Flying done by E. T. Allen, Lt. H. M. Cronk, and others. Technical Report No. 70 described this work and noted need for special talents for research pilots. (H. A. Soule, "Notes on Flight Research," 8/4/48)

October 2: Full NACA Committee passed resolution that estimates of expenses for 1921 should include $20,000 to provide for construction of quarters for civilian employees at Langley Field. (NACA Min., 10/9/19)

October 29: Report written by J. F. Victory, NACA Assistant Secretary, outlining procedure for Army, Navy, and NACA for coordinate proposals to Congress to authorize Bolling Field as permanent aviation field. (Exec. Comm. Min., 12/25/29)

During the year: Many problems arose over housing and commissary privileges for civilian employees at Langley Field. NACA said if nothing could be worked out, perhaps a move of Committee's activities to Bolling Field was in order. With Army planning to continue its experimental work in aeronautics at McCook Field, Dayton, Ohio, and with Navy's experimental aviation work centered across Hampton Roads at Norfolk, NACA felt it had compelling reasons for moving its field station activities to Bolling Field, just across the Anacostia River from the Capital. It asked Congress to authorize the move. (Walter T. Bonney, draft MSS with notation "For Smithsonian, 7/18/55," NASA Historical Archives; Exec. Comm. Min., 1919 passim.)

George W. Lewis was appointed Executive Officer of the NACA. (Memo, H. J. E. Reid, IMAL Director, to J. C. Hunsaker, NACA Chairman, 8/4/48)
February 12: C. D. Walcott, NACA Chairman, reported letter dated 2/12/20 to Rep. Kahn, suggesting introduction in House of bill similar to one of Senate (S. 3516) to authorize Secretary of War to furnish quarters at Langley Field, Va., to civilian employees of NACA. (Exec. Comm. Min., 2/12/20)

February 16: John F. Victory, Assistant Secretary of NACA, reported that Langley station was operating with "poor efficiency, and morale is low." Also said that John H. DeKlyn, Engineer in Charge of Buildings and Construction, was incompetent and should be dismissed. (Memo, J. F. Victory to NACA Exec. Office, 2/16/20)

March 1: NACA proposed a national aviation policy establishing a Bureau of Aeronautics in Commerce Dept., authorizing airplane competition to stimulate new designs, increasing Army and Navy appropriations, extending the air mail service, and expanding research at its Langley laboratory. NACA also broadened its effect by offering use of its facilities and personnel to industry and universities, to further research and experimental work outside of Government. (Policy Planning for Aeronautical Research and Development, Senate Committee on Aeronautical and Space Sciences (89th Cong., 2d Sess.), 39)

April 22: J. S. Ames, Chairman of NACA Aerodynamic Committee, reported that Committee had undertaken 3 specific aerodynamic investigations for the Navy Dept. at Langley Field at estimated cost of $11,000. (NACA Min., 4/22/20)

NACA passed resolution to name its field station the Langley Memorial Aeronautical Laboratory, subject to the approval of the Attorney General. (NACA Min., 4/22/20)

April 30: W. F. Durand, S. W. Stratton, and J. F. Victory visited and inspected IMAL. They felt the lab would be in full operation by June of that year. (Exec. Comm. Min., 5/10/20)

June 2: Leigh M. Griffith, Senior Staff Engineer at IMAL, felt that invitation to dedication to be held at Langley gave erroneous impression that NACA was in some way under the Air Service. Format of the invitation was changed by its author, Chief Physicist E. P. Warner. (Memo, L. M. Griffith to NACA Exec. Office, 6/2/20)
June 11: Formal dedication of the Langley Memorial Aeronautical Laboratory. NACA Chairman W. F. Durand read letter from Joseph Tumulty, Secretary to President, dated 5/26/20, enclosing Attorney General's opinion that no existing law would prohibit naming of field station in honor of Samuel P. Langley. NACA members made an inspection of the lab and the 5-foot wind tunnel was operated for the first time. Rear Admiral D. W. Taylor (USN) told of how much help Navy had given to NACA. He also spoke of the help NACA had been to the Navy. (Exec. Comm. Min., 6/11/20; D. W. Taylor Speech, copy in National Archives, RG 255)

July 2: L. M. Griffith, Engineer-in-charge of LMAL, said that, despite William Mitchell's charge, no Major Dale had, to his knowledge, visited Langley or interfered with Mitchell's tests in any way. Mitchell had charged that the laboratory personnel had conspired to put him in a bad light. (Memo, L. M. Griffith to NACA Exec. Office, 7/2/20)

July 13: Cdr. J. C. Hunsaker (USN) elected Honorary Fellow of Royal Aeronautical Society of England, marking first time in history of this society that this distinction was conferred on one not a British subject. (Shrader, Fifty Years of Flight, 24)

September 20: Resolution in NACA Executive Committee that Chairman request Chief of Air Service to lend a Fokker type airplane to Committee for use in conduct of research work at LMAL under direction of NACA Committee on Aerodynamics. (Exec. Comm. Min., 9/20/20)

November 11: Finding no Fokker D-7 available for loan to the NACA, Executive Committee passed resolution authorizing Chairman to ask Chief of Air Service for either a Junker or VE-7 airplane for research at LMAL. (Exec. Comm. Min., 11/11/20)

During the year: Start of flight pressure distribution investigations by NACA. 110 orifices were placed in horizontal tail of the JN4H. These orifices were hooked to a battery of liquid-in-glass manometers and photographs were taken. The equipment could be used only for steady flight. (H. A. Soule, "Notes on Flight Research," 8/4/48)
January 9: Executive Committee authorized construction at IMAL of a compressed air type of wind tunnel designed by Dr. Max M. Munk, technical assistant of the committee. (Exec. Comm. Min., 1/9/21)

January 13: Research authorized to compare wind characteristics in models and free flight in order to furnish accurate and complete data on which to base performance estimates. (Res. Authorization 1/14, Langley Files)

January 27: Special Executive Committee Meeting held to discuss request from General William Mitchell (USAS) that NACA engineering staff vacate quarters at Langley by 2/1/21. Mitchell said Air Service could use NACA buildings and would pay $200,000 through appropriate Congressional legislation. Resolution passed authorizing NACA Chairman to appoint himself and S. W. Stratton, NACA Secretary, to study legal steps necessary to effect removal of NACA research activities from Langley to another site, "probably Bolling Field, D. C." (Sp. Exec. Comm. Min., 1/27/21)

February 1: Civilian employees at IMAL surrendered all married and bachelor quarters, as requested by General William Mitchell. (Exec. Comm. Min., 2/10/21)

February 10: J. S. Ames, Chairman of NACA Executive Committee, and S. W. Stratton, NACA Secretary, recommended waiting on move from Langley until action was taken by Air Service and Congress in providing a new location for the Engineering Division, then located at McCook Field, Dayton, Ohio. (Exec. Comm. Min., 2/10/21)

April 1: President Harding requested NACA to organize a subcommittee with representatives from War, Navy, Post Office and Commerce Depts., and civilian life to take up question of Federal regulation of air navigation, air routes to cover the whole U.S. and cooperation among the various departments of Government concerned with aviation, reporting:

a. What can and should be done without further legislative action;

b. What legislative action and appropriations are necessary to carry into effect the recommendation of the subcommittee.

(W. G. Harding to C. D. Walcott, NACA Chairman, 4/1/21)
April 12: President Harding, in address to Congress, recommended the establishing of a Bureau of Aviation within the Commerce Dept. (Shrader, Fifty Years of Flight, 25)

H. J. E. Reid, later LMAO Director, began work at the Langley Laboratory, as a junior engineer. (Memo, H. J. E. Reid, to J. C. Hunsaker, NACA Chairman, 8/4/48)

June 9: J. S. Ames, NACA Executive Committee Chairman, presented project for construction of a compressed-air wind tunnel (20 atmospheres) with a 5-foot test section at LMAO. The tunnel had been designed by Max M. Munk, technical assistant of the NACA. Utilizing compressed air, it would allow for "scale effects" in aerodynamic model experiments. NACA Exec. Comm. authorized its construction. (Exec. Comm. Min., 6/9/21; Hunsaker, Forty Years of Aeronautical Research, 256)

September 15: Research authorized to test pressure distribution over wings of an airplane in accelerated flight. At time, no data was available on flow of air or distribution of load over an airplane wing during accelerated flight. It was hoped this information would be of great value to airplane designers. (Res. Authorization 753, Langley Files)

November 15: Initial U.S. flight of airship Roma was made at Langley Field, Va. (Emme, Aeronautics and Astronautics: 1915-1960, 14)

During the year: William E. Borah, Republican Senator from Idaho, introduced Senate Joint Resolution 77, intended to transfer NACA's technical duties and equipment to Bureau of Standards, its buildings to War Dept., and its advisory functions to the War Council. Resolution received little support in Congress. ("Attempts to Abolish Committee," draft MSS, NASA Historical Archives, 1)

Multiple-capsule manometer was placed in use. The 3-element control-position recorder, the tudder, and the stick-force recorder were also developed. (H. A. Soule, "Notes on Flight Research," 8/4/43)
February 23: NACA announced that a new manometer or instrument for recording air pressure on wing and tail surfaces of airplanes at different points simultaneously had been designed and developed by F. H. Norton, and engineer at IMAL. (Wash. Star, 2/23/22)

April 20: J. S. Ames, NACA Executive Committee Chairman, reported that, because of a recent fire in one of the wooden hangars at Langley Field, all wooden hangars had been surveyed and condemned, and it would be necessary for NACA to erect steel hangars for housing its airplanes. (NACA Min., 4/20/22)

May 20: Because of overwork, the NACA Executive Committee delayed action on a main committee thought that Langley engineers might design commercial aircraft. (Exec. Comm. Min., 5/20/22)

June 16: Lt C. L. Bissell (USAS) began a series of night cross-country flights between Bolling Field, D. C., and Langley Field, Va. (Emme, Aeronautics and Astronautics: 1915-1960, 15)


August 1: After earlier difficulties, relations between personnel at IMAL and commander at Langley Field were greatly improved. Col. Danforth, Commanding Officer of Langley Field, had turned over to IMAL without cost the material for erection of two steel airplane hangars needed by the committee. It was also reported that relations with the Navy were quite good. (J. F. Victory, NACA Assist. Sec., to C. D. Walcott, NACA Chairman, 8/1/22)

September 22: Maj. General Mason M. Patrick, Chief of Air Service, said, "The results of practically all the investigation carried on by the Committee (NACA) are of great interest and value to the Army Air Service." (NACA files, NASA Historical Archives)

October 19: NACA full committee held its annual meeting at IMAL. They inspected the research facilities at the laboratory. They were able to view the first operation of the variable density
1922 Continued

wind tunnel, although lack of adequate electric power prevented concurrent operation of both wind tunnels. This tunnel was destroyed by fire in 1927 and not replaced in fully effective operation until 1931. (NACA Min., 10/19/22; Abbott, Critique of Levine Thesis, 70)


December 21: Secretary of Navy Edwin Denby said: "I...note with interest that much of the work undertaken by the Committee (NACA) has been of inestimable value to Naval aeronautics. The efforts of the Committee have done much to place America in a foremost position in the study of the science of aeronautics. Allow me to express to you the appreciation of the Naval Service for the work accomplished by your organization." (NACA files, NASA Historical Archives)

During the year: An extensive investigation of maneuverability was made in order to find a satisfactory definition of this term and to find definite means of measuring it. The work was all done on a JN4H by measuring angular velocity produced by definite movements of its control. (NACA 8th Annual Report, 1922, 12)

An automatic balance for use in compressed-air tunnel, a high pressure manometer designed to stand a pressure of 20 atmospheres, and a wire balance for the No. 1 wind tunnel for making biplane and triplane tests were constructed at IMAL. (NACA 8th Annual Report, 1922, 11)

IMAL comprised six units, namely, a research laboratory building, including administrative and drafting office, machine and woodworking shops, and a photographic and instrument labs; two aerodynamic labs, one containing an open-type wind tunnel and the other a compressed-air wind tunnel; two engine dynamometer labs, one of permanent type and the other a converted airplane hangar; and on the flying field, an airplane hangar. (NACA 8th Annual Report, 1922, 5)

Wing pressure distribution work started on a Thomas Morse MB-3. Also the first landing and take-off measurements were made at IMAL and the pressure distribution work was extended by measurement of pressures on the nose of a non-rigid airship.
1922 Continued

Flight also assisted in calibration of wind tunnels by determining the turbulence level in the free atmospheres using sphere. (H. A. Soule, "Notes on Flight Research," 8/4/48)

1923

May 23: Research authorized to determine pressure distribution over envelope of a CCC-class airship when airship is maneuvered at different air speeds and under different atmospheric conditions. Research completed in 1930. (Res. Authorization #76, Langley Files)


During the year: IMAL was organized with five subdivisions: power plants, wind tunnel, flight test, technical service, and property and clerical divisions. (NACA 9th Annual Report, 1923, 5)

The Noble Order of the Green Cow, IMAL social organization, was started. In the early days, it was almost exclusively an organization to "initiate" new IMAL employees, but in 1925 it began holding regularly scheduled social events. (IMAL Bulletin, 6/5/43)

1924

February 13: Research authorized to obtain pressure distribution over wing section of a VE-7 airplane. Investigation was requested by Army Air Service on 1/29/24. (Res. Authorization #99, Langley Files, Exec. Comm. Min., 2/13/24)
1924 Continued

April 24: J. S. Ames, Chairman of NACA Executive Committee, told full committee that on his recent trip to Europe, he found that the British were much impressed with effectiveness of NACA scheme of organization at Langley Field, coordinating laboratory investigations with full-scale tests in flight, all in close cooperation with the military and naval aviation authorities. (NACA Min., 4/24/24)

J. S. Ames, Chairman of NACA Executive Committee, said that there was much public distrust about aeronautics, and that this was probably fomented periodically by paid agents; that in his opinion the present unhealthy situation stood in the way of honest consideration by Congress of the practical question of aeronautical development. (NACA Min., 4/24/24)

As a result of supercharger investigation at Langley Field, the possibility of supercharging from sea level and boosting the engine power, for use in bombing airplanes and obtaining a good rate of climb, was being considered. (Report of Chairman of Comm. on Power Plants for Aircraft to NACA, 4/24/24)

June 12: J. S. Ames, Chairman of NACA Executive Committee, reported a letter dated 6/4/24 and written by C. D. Walcott, NACA Chairman, to J. W. Shannahan of Hampton, Va., relative to the need for erecting an apartment house and a number of small homes at Hampton to accommodate the increasing personnel of NACA laboratory force at Langley Field. He then read a letter dated 6/6/24 from Mr. Shannahan, stating that he would take up the matter with prominent citizens in the community with a view to taking appropriate action to relieve the situation. (Exec. Comm. Min., 6/12/24)

July 16: J. S. Ames, Chairman of NACA Executive Committee, described new methods developed at IMAL for determining pressure distribution in a wind tunnel and in air, by which it was now possible to make pressure distribution tests in one day, where it formerly required a series of tests extending over a couple of months. (Exec. Comm. Min., 7/16/24)

August 19: Research authorized to determine approximate adaptability of supercharged air-cooled engine to conditions encountered in flight. (Res. Authorization #119, Langley Files; Exec. Comm. Min., 8/19/24)
1924 Continued

August 20: An accident involving an airplane used in research at LMAL resulted in the death of the junior aeronautical engineer, Stevens Bromley, who was acting as observer, and serious injury to the pilot, Smith J. DeFrance, who vowed never to fly again following the accident. This was the first serious accident experienced during approximately six years of active research. (Exec. Comm. Min., 9/20/24)

November 24: NACA Committee on Aerodynamics summarized in its annual report that it had direct control of aerodynamic research conducted at Langley...and it was "in close contact with all aerodynamical work being carried out in the United States." (NACA 10th Annual Report, 1924)

December 2: J. S. Ames, Chairman of NACA Executive Committee reported that Committee had developed at LMAL all necessary recording instruments to make a continuous record of pressure distribution, accelerations, and other factors in free flight tests. (Exec. Comm. Min., 12/2/24)

December 9: Civil Aeronautics Act, proposing to establish a Bureau of Civil Aeronautics in the Dept. of Commerce, was reintroduced in Congress by Rep. Samuel E. Winslow (Mass.). (Shrader, Fifty Years of Flight, 31)

During the year: Some of the first measurements on airfoils at high speeds (M 0.95) were made by Briggs and Dryden of the National Bureau of Standards, in cooperation with the NACA and Ordnance Dept. of the Army. (?, "History and Development of the NACA," draft MSS, NASA Historical Archives, 5)

First propeller tests at LMAL. 7 propellers were used in tests made on a VE-7, and a comparison of a series of wings on a Sperry Messenger started the same year was the first of the comparative type tests where a systematic approach was made to come up with a better device. (H. A. Soule, "Notes on Flight Research," 8/4/48)
February 2: President Calvin Coolidge signed the Kelly Bill which authorized the Postmaster General to contract air-mail routes with private operators. (Shrader, Fifty Years of Flight, 32)

February 18: J. F. Victory, NACA Assistant Secretary, reported that, in his observation of the hearings of House Aircraft Committee, only matter of direct interest to NACA was charge of General William Mitchell that NACA had retarded development of aviation. NACA Chairman J. S. Ames stated that the NACA would take no official cognizance of these views of General Mitchell. Mitchell said that LMAL "uses large appropriations of money for matters that could be handled far better in a central engineering aeronautical department." (Exec. Comm. Min., 2/18/25)

June 25: Executive Committee of NACA authorized construction of a wind tunnel large enough to test full-scale airplane propellers under conditions of flight. This tunnel was to have a circular test section 20 feet in diameter and was to be powered by two diesel engines rated at 1,000 hp. each. Its air speed was 110 mph and, at the time it was placed in operation in 1927, it was the largest wind tunnel in the world. (Exec. Comm. Min. 6/25/25; Stoney, "NACA From Birth to Death," 14)

September 12: President Calvin Coolidge appointed President's Aircraft Board "for the purpose of making a study of best means of developing and applying aircraft in national defense and to supplement the studies already made by the War and Navy Depts." Actually Board was to answer questions raised by the Lampert hearings. (Draft MSS chapter of NACA History, A-1, NASA Historical Archives, 6)

October 22: J. S. Ames, NACA Executive Committee Chairman, said that Max M. Munk of LMAL had developed a method which enabled him to predict the drag of any system of wings from knowledge of drag of a monoplane wing, and he had also evolved a theory as to the interference of the walls of a wind tunnel. (NACA Min., 10/22/25)

November 10: Investigation authorized of forces on seaplane floats under landing conditions, for purpose of improving the specifications for design of float bracing. (Res. Authorization #166, Langley Files; Exec. Comm. Min., 11/10/25)
1925 Continued

November 10: Research authorized for using discs in attempting to standardize wind tunnel results. Process was to test discs in Langley tunnels then send to other wind tunnels for tests in a similar manner. (Res. Authorization #70B, Langley Files; Exec. Comm. Min., 11/10/25)

December 31: Leigh M. Griffith resigned as Engineer-in-Charge of LMAL. J. S. Ames, NACA Executive Committee Chairman, remarked that since H. J. E. Reid had been appointed Engineer-in-Charge there had been a marked improvement in the relations with the townspeople of Hampton and the vicinity. (Exec. Comm. Min., 2/5/26)

1926

January 1: Henry J. E. Reid officially appointed Engineer-in-Charge of LMAL, a post he held until May 1960, when he retired as Director of NASA's Langley Research Center. (Victory Files, NASA Historical Archives)

February 4: Prof. E. P. Warner of MIT took a group of his aeronautical engineering students on an inspection tour of LMAL. (Exec. Comm. Min., 3/19/26)

May 20: Air Commerce Act of 1926, "to encourage and regulate the use of aircraft in commerce, and for other purposes," was signed by President Calvin Coolidge. (Exec. Comm. Min., 6/30/26)

May 24: NACA held its first joint conference with representatives of aircraft manufacturers and operators at LMAL. Besides being given an inspection tour, guests had an occasion to criticize and to suggest new research on problems they felt were especially pressing. (NACA Min., 10/21/26; Hunsaker, Forty Years of Aeronautical Research, 260)

June 25: Largest wind tunnel in the world (20-foot throat), the Propeller Research Tunnel, authorized for LMAL. (NACA 12th Annual Report, 1926, 6)
1926 Continued

June 30: Research authorized to determine effect of various forms of cowling on drag characteristics of a pursuit airplane and on the cooling characteristics of an air-cooled engine. Requested by Bureau of Aeronautics, Navy Dept. in letter dated 6/1/26, this research eventually led to the invention of the famous NACA cowling for which NACA received the Collier Trophy. (Res. Authorization #172, Langley Files; Exec. Comm. Min., 6/30/26)

July 8: Floyd L. Thompson, later Director of LaRC, began his Government service as an aeronautical engineer in the flight research division of IMAL. (LaRC Release)

November 20: Max M. Munk was made Aerodynamical Advisor to the Engineer-in-Charge of IMAL. It was felt that through this Dr. Munk could devote his entire time and energies exclusively to studying and advising upon fundamental problems of flight. (Exec. Comm. Min., 1/21/27)

During the year: Efforts to have NACA transferred to Dept. of Commerce were defeated through efforts of NACA Executive Committee Chairman Charles D. Walcott and Sen. Hiram Bingham (Conn.). Pushing for the transfer was Herbert C. Hoover, Secretary of Commerce. (Correspondence between C. D. Walcott and H. Bingham, 1925-1926; J. F. Victory, NACA Assist. Sec., to W. F. Durand, NACA Chairman, 12/18/25)

. On request of Aeronautical Research Committee of Great Britain, IMAL tested a model of the RAF 15-wing section on a Bristol fighter airplane, a model of the RAF 19-wing section on a BE-2E airplane, and a model of the RAF 30-section on a Bristol fighter airplane, for comparison with results of wind-tunnel and full-scale tests conducted on these sections in England. (NACA 12th Annual Report, 1926, 15)

. Very extensive pressure distribution tests were made with a PW-9. Flight spin tests were started and water pressures on seaplane floats were first measured. (H. A. Soule, "Notes on Flight Research," 8/4/48)
February 3: 13 employees at LMAL requested permission to use Langley Field on Wednesday afternoons for purpose of taking from a private tutor instruction in flying, using a private airplane for the purpose. Question was referred to J. F. Victory, NACA Assistant Secretary, for further study. (Exec. Comm. Min., 2/25/27)

February 9: C. D. Walcott, one of the original 12 members of NACA and its chairman, died in Washington. The NACA passed a resolution in tribute to his memory. Orville Wright, still feuding with the Smithsonian Institution of which Walcott was Secretary, refused to sign the NACA memorial. (NACA 13th Annual Report, 1927, 1)

May 24: Second General Conference between representatives of aviation industry and NACA held at LMAL. In addition to aircraft manufacturers and operators, aeronautical trade journals and educational institutions engaged in teaching of aeronautical engineering were invited to send representatives to this conference. (NACA 13th Annual Report, 1927, 14; Exec. Comm. Min., 6/22/27)


John F. Victory, who had been in NACA's service since its organization in 1915 and had served as Assistant Secretary since 1917, was appointed Secretary of the NACA. (Exec. Comm. Min., 6/22/27)

August 1: A fire occurred in the variable-density wind tunnel destroying interior of structure, including the wind tunnel cones, balance, propeller, and all instruments. Fire occurred during a test of an airplane model at 20 atmospheres and was caused by the bursting under pressure of an electric-light bulb which short-circuited and caused an arcing that ignited the adjacent wood. In rebuilding, at a cost of $20,000, the tunnel wood and other inflammable materials were to be eliminated and structure made fireproof. (Exec. Comm. Min., 9/8/27)
1927 Continued


November 30: Propeller research tunnel was completed. It was to make possible accurate full-scale tests on aircraft propellers as well as aerodynamic tests on full-size fuselages, landing gears, tail surfaces, and other aircraft parts, and on model wings of large size. First wind tunnel in world in which the main parts of a full-size airplane could be investigated. (Victory files, NASA Historical Archives)

During the year: Study of requirements for thermal ice prevention was begun at ILAL by Theodore Theodorsen and W. C. Clay. Since then practically all phases of airplane icing problems have been studied. (Gray, Frontiers of Flight, 309)

1928


March 28: Assistant Secretary of Commerce for Aeronautics called a conference of representatives of Army Air Corps, Bureau of Aeronautics of Navy, Weather Bureau, Bureau of Standards, NACA, and Dept. of Commerce to study cause and prevention of ice formation on aircraft. (Shrader, Fifty Years of Flight, 40)

May 15: 3rd Annual Aircraft Engineering Research Conference held at ILAL. Educational institutions engaged in aeronautical education and aeronautical trade journals were invited to send representatives. (Exec. Comm. Min., 6/28/28)

June 28: Research authorized for investigation to determine conditions under which ice forms on structures of aircraft and to
1928 Continued


September 19: Packard Motor Car Company first flew a diesel engine airplane. For a while it appeared to some that the gasoline engine might be replaced by a somewhat different type of power plant. (Abbott, "Review of Levine Thesis," 129)

During September: NACA undertook coordination of research programs in universities in connection with engineering to aid in coordinating work and improving courses in aeronautical engineering and to promote the study of aeronautics and meteorology. (Victory files, NASA Historical Archives)

During the year: LMAL demonstrated high lift by boundary-layer control by means of pressure or suction slots in an airfoil in the atmospheric wind tunnel. (NACA 14th Annual Report, 1928, 25)

- Interior structure of variable-density wind tunnel which had been destroyed by fire on 8/1/27 was rebuilt at LMAL, design of the tunnel being changed to an open-throat type. (NACA 14th Annual Report, 1928, 6)

- First refrigerated wind tunnel for research on prevention of icing of wings and propellers placed in operation at LMAL. (NACA 14th Annual Report, 1928, 6)

- High-speed jet tunnel, later to be known as the 11-inch high-speed tunnel, was reported on by the LMAL staff, and at the manufacturers' conference results of tests of the Sperry Messenger in the propeller-research tunnel were presented. These tests showed that the landing-gear drag on that airplane amounted to 40% of the total drag. (H. J. E. Reid, LMAL Director, to J. C. Hunsaker, NACA Chairman, 8/4/48)

- Eastman N. Jacobs, LMAL engineer, later to receive the Collier Trophy for work on airfoils, constructed his own monoplane and taught himself to fly. (Newport News Daily Press, 12/19/37)
February 18: Thomas Carroll, IMAL Chief Test Pilot, reported talking with Capt. George R. White, a friend, about White's Ornithopter. White claimed to have flown by attaching some sort of contraption to his arms and using his own power. White also was working with ideas on jet propulsion. It must be noted that Carroll believed White's accounts to be true. (Memo, Thomas Carroll to IMAL Engineer-in-Charge, 2/18/29)

March 2: Membership of NACA was increased to fifteen and in 1938 two of these were designated from the Civil Aeronautics Authority. In 1948 membership was increased to 17. (Anonymous draft MSS, NASA Historical Archives)

March 19: J. S. Ames, NACA Chairman, in letter to Secretary of War, requested permission for erection at desirable locations at IMAL of full-scale wind tunnel and a seaplane channel. They were approved 6/6/29. (Exec. Comm. Min., 3/22/29)


July 2: William McAvoy, IMAL Flight Research Division, complained that when airplanes were borrowed for research purposes the length of the loan was often too short and an extension was necessary. He asked that all further borrowing of airplanes be handled through the office of the Engineer-in-Charge rather than by himself. (Memo, W. H. McAvoy, to H. J. E. Reid, IMAL Engineer-in-Charge, 7/2/29)

September 30: G. W. Lewis, NACA Director of Aeronautical Research, brought to IMAL attention the Hall XFM-1 pursuit type airplane which pilots who had flown it, reported would not spin. (G. W. Lewis to IMAL, 9/30/29)

During the year: Robert J. Collier Trophy, awarded annually "for the greatest achievement in aviation in America the value of which has been thoroughly demonstrated by actual use during the preceding year," went to NACA for development of cowling for radial air-cooled engines. (Shrader, Fifty Years of Flight, 45)
CHAPTER III
DEPRESSION DECADE, 1930-1940

1930

During January: World's first full-scale tunnel under construction at IMAL. (30 feet high, 60 feet wide). (NACA 16th Annual Report, 1930, 7)


June 2: President Herbert C. Hoover presented the Collier Trophy to J. S. Ames, NACA Chairman, in a ceremony on the White House grounds. Award was for development of the NACA cowling for radial air-cooled engines. (Exec. Comm. Min., 6/24/30)

During the year: IMAL was organized with six divisions: aerodynamics, power plants, technical service, flight operations, property and clerical, and a new hydrodynamic division. (Victory files, NASA Historical Archives)

First vertical wind tunnel for study of airplane spinning was placed in operation at IMAL. (Exec. Comm. Min., 9/25/30)

During early 1930's: "Langley research continued accent on the civil industry and particularly on factors affecting the safety and, consequently, the saleability of flight." (Soule, "Lean Years," 7)

1931


May 27: 6th Annual Aircraft Engineering Research Conference held at IMAL. During conference the full-scale wind tunnel and NACA tank were formally dedicated. NACA tank was to provide information and data regarding the performance of seaplanes on water analogous
1931 Continued

to information furnished concerning performance of airplanes in
air. Tank was enlarged 10/1/37. (NACA Min., 10/22/31; Victory
files, NASA Historical Archives)

October 18: S. W. Stratton, member of NACA since its inception and
secretary of the main committee, died in Boston, Mass. (NACA Min.,
10/22/31)

During the year: Many times NACA was reminded of the need for
economy in the expenditure of funds due to the precarious state
of the national economy. (NACA Min., 1931, passim.)

NASA purchased an Autogiro and started work on rotary wing air-

During 1931-1932: Langley ran tests on possibility of running engines
on hydrogen. Lighter-than-air planes were being tested. Back-
fires in hydrogen caused many small fires. (Interview with Edmund
C. Buckley, 8/18/66)

1932

March 2: Smith J. DeFrance, engineer-in-charge of full-scale wind
tunnel at IMAL, reported that the tunnel was operating even better
than had been expected. (Exec. Comm. Min., 3/2/32)

May 25: 7th Annual Aircraft Engineering Research Conference held at
IMAL. (Exec. Comm. Min., 10/6/32)

June 14: Flight research laboratory opened. It was to provide
facilities for housing airplanes used in flight research, a re-
pair shop, and office space for the staff of the lab. (Exec.
Comm. Min., 10/6/32)

December 9: President Herbert C. Hoover signed Executive Order #5960
transferring NACA to office of Secretary of Commerce and the labo-
atory to the Bureau of Standards. Executive Order later was
nullified by the House of Representatives. (NYT, 1/14/33; J. F.
Victory, NACA Sec., to J. S. Ames, NACA Chairman, 12/10/32)
1932 Continued

December 29: Charles A. Lindburgh stated that he opposed the consolidation of the NACA and Bureau of Standards. (C. A. Lindburgh to J. S. Ames, NACA Chairman, 12/29/32)

1933

January 6: Senator Hiram Bingham (Conn.) agreed that any change in the status of NACA would be unwise. He felt that there was no danger of any immediate reorganization taking place. He had been, however, defeated in the 1932 election. (H. Bingham to J. S. Ames, NACA Chairman, 1/6/33)

January 19: House of Representatives voted down (203 to 176) the Hoover plan for Government reorganization. This kept NACA from abolition and IMAL from becoming a part of the War Dept. (NYT, 1/20/33)

February 2: War Dept. said it did not recommend that IMAL or NACA be placed under its jurisdiction. (Douglas MacArthur, Acting Sec. of War, to Senator Frederick Hale, 2/2/33)

April 4: Naval airship crashed resulting in death of Rear Adm. William A. Moffett (USN), a member of NACA for over 12 years. (NACA Min., 4/20/33)


August 23: Intensive rains caused flood at IMAL. Many materials and much equipment was ruined. It was said that Abe Silverstein's materials were saved only because they were all kept on top of his desk. (Interview with Edmund C. Buckley, 8/18/66)

August 25: NACA requested and received permission to use portion of $200,000 allotted to Committee by PWA for repairing damage done by storm of Aug. 23, 1933. (NACA Min., 10/19/33)

August 29: Electric current was reestablished at Langley Laboratory. It had been off since storm of Aug. 23. (E. R. Sharp, Chief Clerk and Property Officer, IMAL, Memo for files, 8/29/33)
1933 Continued

**September 11:** Second large storm of the year at LMAL but no serious damage was reported. (NACA Min., 10/19/33)

**September 15:** H. J. E. Reid, Engineer-in-Charge of LMAL, estimated damage during Aug. 23 storm at $160,459. (H. J. E. Reid to E. H. Chamberlin, NACA Hq, 9/15/33)

**October 30:** In response to oral suggestion from PWA, NACA Director of Aeronautical Research requested authority to redistribute the original allotment of $200,000 among seven of the original 18 projects. (Exec. Comm. Min., 11/14/33)

**November 10:** Eugene L. Vidal, Director of Aeronautics of Dept. of Commerce, requested NACA to undertake work for Aeronautics Branch in connection with furtherance of the improvement of safety and efficiency in civil aviation, which it was contemplated would stimulate the use of aircraft and growth of the aviation industry. NACA accepted on 11/21/33. (Exec. Comm. Min., 1/23/34)

**December 12:** J. S. Ames, NACA Chairman, wrote the Federal Emergency Administration of Public Works outlining need for a full-speed wind tunnel capable of producing air speeds up to 500 miles per hour at an estimated cost of $478,300. Approved 1/29/34. (Exec. Comm. Min., 1/23/34)

1934

**January 12:** President F. D. Roosevelt, in a message to Congress, said: "I concur in the Committee's (NACA) opinion that the continuous prosecution of fundamental research in aeronautics is essential to the national defense and to the future of air transportation upon a sound economic basis." ("Replies to Queries Submitted by Federal Aviation Commission," 9/11/34, 16)

**February 9:** President F. D. Roosevelt issued an Executive Order cancelling all existing air-mail contracts, because of evidence of fraud and collusion, and designating the Army Air Corps to take over operation of the air mail. (Shrader, Fifty Years of Flight, 56)
**1934 Continued**

**February 19:** Army Air Corps started the actual carrying of the air mail. (Shrader, Fifty Years of Flight, 56)

**May 7 - June 1:** Air mail operations by Army Air Corps were gradually terminated. (Shrader, Fifty Years of Flight, 56)

**May 23:** 9th Annual Aircraft Engineering Research Conference held at IMAL. (Exec. Comm. Min., 6/14/34)

**June 12:** Air Mail Act of 1934, which included provision for appointment of a Federal Aviation Commission, signed by President Roosevelt. (Shrader, Fifty Years of Flight, 56)

**June 28:** 24-inch, high-speed wind tunnel completed at IMAL at a cost of $12,600. (Exec. Comm. Min., 10/18/34)

**August 11:** New engine research laboratory completed at IMAL at expenditure of full allotment of $114,000. (Exec. Comm. Min., 10/18/34)

**September 5:** A 15-foot spin tunnel was constructed at IMAL. Airflow in tunnel was vertically upward, and speed was adjusted to hold the model at the observer's station. (Exec. Comm. Min., 10/18/34)

**October 20:** G. W. Lewis, NACA Director of Aeronautical Research, submitted to Federal Emergency Administrator of Public Works Harold I. Ickes a request for $50,000 to provide for prompt application of results of NACA's researches on airplanes in flight. NACA would use funds to purchase experimental airplane wings, models, and other equipment for the purpose. (Exec. Comm. Min., 11/13/34)

**During the year:** Nye Committee investigation into background of WW I somewhat damaged image of American aircraft industry. (NACA Min., 1934, passim.)
April 3: Free-spinning wind tunnel and free-flight tunnel and connecting building completed. These were to test models of airplanes of which the spinning and stability characteristics were either unknown or known to be unsatisfactory, and to carry on general research on problem of spinning and stability. Had a 15-foot diameter. (Victory files, NASA Historical Archives)


September 20: C. N. Montieth, Vice President and Chief Engineer of Boeing Aircraft, wrote to NACA: "You may recall sending us, some time ago, the data which you had obtained on the so-called 'balanced flap.' It appeared to give such promising results that we decided to use it on our model 299 bomber (B-17). We were also much gratified to find that the NACA symmetrical airfoil lived up to our expectations. It appears that in addition to the effectiveness of the flap, the ailerons are more effective, for a given area, than with the conventional airfoil.

"So, with the use of the NACA cowl in addition, it appears that you organization can claim a considerable share in the success of this particular design. And we hope that you will continue to send us your 'hot dope' from time to time. We lean rather heavily on the committee for help in improving our work." (Newport News Times-Herald, 5/9/45)

During the year: W-1 airplane with the first of the modern tri-cycle landing gears was tested. (H. A. Soule, "Notes on Flight Research," 8/4/48)
January 6: Maj. General Oscar Westover, Chief of Army Air Corps, called a meeting of the joint Army-Navy Aeronautical Board, of which he was chairman, to discuss part which NACA would play in event U.S. became involved in the war. One decision was to place NACA under direction of Aeronautical Board in event of war, to obtain closer cooperation between the services and NACA. ("Some Effects of the War on the NACA," 5/28/42, copy in NASA Historical Archives)

March 3: As result of report submitted by NACA European Representative J. J. Ide regarding greatly increased aeronautical research activities and facilities in Great Britain, France, Germany, and Italy, NACA established a Special Committee on Aeronautical Research Facilities with Rear Adm. Ernest J. King as Chairman, to survey the aeronautical research needs in this country. (Memo, "Some Important Facts Regarding Expansion of NACA Research Facilities," 1/17/45, NASA Historical Archives)

March 28: High-speed wind tunnel (8-foot) completed at IMAL. It was for testing models of aircraft and aircraft parts in a high-speed air stream approaching the speed of sound; it had capacity of 500 mph. NACA also approved recommendations for additional wind tunnel at IMAL to operate at 250 mph and for lengthening NACA seaplane tank. (Memo, "Some Important Facts Regarding Expansion of NACA Research Facilities," 1/17/45, NASA Historical Archives)


June 22: First Deficiency Appropriation Act, 1936, appropriated $1,000,000 for wind tunnel and $267,000 for increasing length of seaplane tank. (Memo, "Some Important Facts Regarding Expansion of NACA Research Facilities," 1/17/45, NASA Historical Archives)


September 12: World's largest high-speed wind tunnel (8-foot throat) placed in operation at IMAL under direction of Russell G. Robinson. (NACA Min., 10/22/36)
1936 Continued

September 18: Storm did much damage to IMAL. However, because of precautions taken after the 1933 flood, replacement estimate was only $2,111.00. (H. J. E. Reid, Engineer-in-Charge, IMAL, to NACA, 9/28/36)

October 22: NACA authorized establishment of Special Committee on Relation of NACA to National Defense in Time of War, under chairmanship of Maj. General Oscar Westover, Chief of Army Air Corps. Until study was completed no approval to accept reserve commission would be granted to workers at IMAL. (NACA Min., 10/22/36)

November 5: Several Italian aviation and automotive experts, interested in engineering aspects of aviation, visited IMAL. Visitors included Lt. Col. Vincenzo Coppola, Air Attache, Italian Embassy; Carlo Pezzani, Italian firm Piaggio; Luigi Maniscalchi of the Ala Littoria; and Guiseppe Gabrielli and Manilio Stisvelli, both of the Fiat Company. (Newport News Daily Press, 11/5/36)


During the year: First time general expenditure of NACA exceeded $1,000,000. Major portion of all money went to IMAL. 1936 was first year that Congress voted construction money since 1930. (Soule, "Lean Years," 2)

Inventory of Langley showed it had a laboratory staff of 370 workers equipped with a flight research laboratory, an engine research laboratory, an instrument laboratory, ten wind tunnels and a towing tank. (Gray, Frontiers of Flight, 23)

1937

January 21: Maj. General Oscar Westover, Army Air Corps, reported that E. P. Warner had expressed the opinion that plans should be laid for obtaining services of scientists in time of war; They were to function in the NACA lab at Langley Field.
1937 Continued

Warner also felt that IMAL was very vulnerable to air attack and could not be replaced in less than 9 months to a year. He therefore felt that any precautions that could be taken in time of peace to determine upon the location, cost, project plan, and method of construction of a duplicate or enlarged facility in the interior of the country near some good source of power would be most advisable. (Westover Memo, 1/21/37)


March 1: First operational Boeing B-17 delivered to the GHQ Air Force at Langley Field, Va. (Emme, Aeronautics and Astronautics: 1915-1960, 35)

May 4: Employees at IMAL were informed that any speculation in corporate stocks or bonds by them was contrary to Government policy. (J. F. Victory, NACA Sec., to IMAL, 5/4/37)

May 6: Hindenburg, world's largest dirigible, exploded and burned at Lakehurst, N. J., killing 35 people. (Newport News Daily Press, 5/7/37)


June 9: G. W. Lewis, NACA Director of Research, said that security at IMAL was so restricted that foreigners, when taken there, were shown only the laboratory's exterior. (Newport News Daily Press, 6/9/37)

July 21: Five members of the Japanese Imperial Army, headed by Col J. K. Okada, Chief of Aviation missions, made an inspection tour of IMAL. (Newport News Daily Press, 7/21/37)

During November: Low-turbulence wind tunnel for investigation of laminar flow airfoil constructed at IMAL. (Emme, Aeronautics and Astronautics: 1915-1960, 35)

December 6: Eastman N. Jacobs, IMAL aeronautical engineer, was awarded the Sylvanus Albert Reed Award for 1937. Award was for Jacobs' work on aerodynamic improvement of airfoils. It was said that all modern military and commercial airplanes used
1937 Continued

wing sections developed by him. Jacobs' wing improved the safety as well as performance characteristics of airplanes. (Wash. Star, 12/6/37)

During the year: One byproduct of IMAL's use of spin tunnel was development of free-flight tunnel. With this facility C. H. Zimmerman, who was responsible for construction of the 15-foot spin tunnel, extended idea of moving air past a free model to gliding flight. (Soule, "Lean Years," 13)

The DC-3 airplane was flight-tested at IMAL, at the request and with assistance of an airline that had purchased one of first to be constructed. Of particular interest to IMAL and the operator was the difficulty or ease with which it could be stalled and its behavior before the angle of attack could be reduced and airplane unstalled. (Soule, "Lean Years," 14)

Take-off and landing violences were occurring with sufficient frequency to be serious, and caused the hydrodynamic researchers at IMAL to shift their attention more and more to studies of porpoising and skipping. (Gray, Frontiers of Flight, 71)

1938

February 10: Scientists at IMAL used goose down to make visible the flow of air and other gases inside the cylinder of a fast-running airplane engine. High-speed motion picture cameras recorded these currents of gases in split thousandths of a second. (Newport News Daily Press, 2/10/38)

February 27: Good-will flight to Buenos Aires of six B-17's, which had left Miami on Feb. 17 under Lt. Col. Robert D. Olds, returned to Langley Field, Va. (Emme, Aeronautics and Astro-nautics: 1915-1960, 36)

April 21: Navy delivered an XF2A-1 airplane to IMAL for tests initiating the full-scale wind tunnel tests which resulted in increasing the speed of this aircraft by 31 mph. It also led to utilization of NACA testing of other high-performance aircraft for both the Army and Navy and to attainment of data directly applicable to design of other new aircraft. This was
1938 Continued

the first in a long series of "clean-up" tests for Army and Navy. (Policy Planning for Aeronautical Research and Development, Senate Committee on Aeronautical and Space Sciences (89th Cong., 2d Sess.), 41)

June 15: Two-dimensional low-turbulence tunnel built at IMAL. First test made of an airfoil designed to promote laminar flow showed a drag about half of the lowest ever recorded for an airfoil of comparable thickness. This was beginning of NACA low-drag airfoil sections. (NACA files, NASA Historical Archives)

August 19: Westover Report suggested building a new research center somewhere in interior of country or on west coast. Special Committee on Future Research Facilities was authorized to study location of additional laboratory facilities. Committee appointed 10/24/38 under chairmanship of Rear Adm. Arthur B. Cook, Chief of Bureau of Aeronautics of Navy. (Exec. Comm. Min., 8/19/38, 10/24/38)

Research authorized for investigation of flying qualities of Army B-17. Informally requested by Army Air Corps as result of earlier information submitted by IMAL. (Res. Authorization #630, Langley Files; Exec. Comm. Min., 8/19/38)

August 22: Civil Aeronautics Act, coordinating all nonmilitary aviation under the Civil Aeronautics Authority, became effective. (Shrader, Fifty Years of Flight, 65)

December 16: Executive Committee of NACA approved a resolution to close NACA laboratories to all visitors until further notice other than official visitors, because of threat of war. (Exec. Comm. Min., 12/16/38)

First successful test of NACA high-speed motion picture camera, developed by C. D. Miller, conducted at IMAL; the camera later was used extensively in photographic analysis of combustion and operated up to rates of 40,000 photographs per second. (Emme, Aeronautics and Astronautics: 1915-1960, 37)

December 30: Special Committee on Future Research Facilities of NACA report recommended that Committee's present research laboratory at Langley Field, Va., should be augmented by immediate establishment of a second research station on West Coast at Sunnyvale, Calif. They urged at IMAL a structures research laboratory, a stability wind tunnel, a 20-foot 300 mph
1938 Continued

wind tunnel, and a new electric power line. Congress did not authorize the second laboratory until 8/9/39. (Exec. Comm. Min., 1/10/39; Hunsaker, Forty Years of Aeronautical Research, 261)

During the year: Because of construction and shortage of personnel, the Annual Aircraft Engineering Research Conference, usually held at IMAL, was cancelled.

. Aircraft industry achieved increased indirect access to NACA Main Committee through its lobbying for passage of Civil Aeronautics Act, which provided that two CAA representatives have membership on the Main NACA Committee. (Levine, "U. S. Aeronautical Research Policy," 50)

. Germany had 6000 first-line combat planes and an additional 2000 in reserve, and Italy had about 2000 first-line and 1000 second-line war planes. United States had less than 100 combat aircraft, many of them obsolete. (Levine, "U.S. Aeronautical Research Policy," 83)

1939

January 21: G. W. Lewis, NACA Research Director, elected President of the Institute of the Aeronautical Sciences for 1939. (Shrader, Fifty Years of Flight, 67)

February 3: Supplemental estimates as presented to Congress by President Roosevelt were modified to provide $10,000,000 for research station at Sunnyvale, Calif., $2,140,000 for additional facilities at IMAL, $297,000 for augmenting the research staff, $36,000 for coordination program, and $250,000 for special investigations in educational institutions, making a new total of $12,723,000. (Memo, "Some Important Facts Regarding Expansion of NACA Research Facilities," 1/17/45, NASA Historical Archives)

During February: Airflow Research staff at IMAL initiated reevaluation of jet propulsion for aircraft at speeds higher than considered by Buckingham in NACA Report No. 139 published in 1923. (NACA 32nd Annual Report, 1946, 25)
March 18: Maj. Carl F. Green was appointed to Langley Field to represent the Material Division at LMAL as a means of liaison between applied research and development activities of the Division and NACA. General H. H. Arnold, Army Air Corps, remarked action taken because of necessity from Air Corps viewpoint of having a much closer relationship between Material Division at Wright Field and Committee's laboratory at Langley Field. (Exec. Comm. Min., 6/23/39)

March 22: House Appropriations Committee reported adversely on appropriation for Sunnyvale, Calif. project but included Langley Laboratory item in Second Deficiency Appropriation Bill, 1939, which was subsequently approved. NACA efforts to have Sunnyvale item inserted in bill by Senate were unsuccessful. (Memo, "Some Important Facts Regarding Expansion of NACA Research Facilities," 1/17/45, NASA Historical Archives)

April 20: Free-flight tunnel placed into operation at LMAL. (Emme, Aeronautics and Astronautics: 1915-1960, 37)

May 2: LMAL 19-foot pressure wind tunnel and 12-foot free-flight wind tunnel dedicated in ceremony at 14th Annual Inspection of LMAL. The 19-foot tunnel was to obtain high Reynolds number tests at moderately high speeds, and particularly to test propellers at air speeds close to those experienced in flight. (Sp. Exec. Comm. Min., 5/2/39; Victory files, NASA Historical Archives)

May 10: Special confidential technical conference on aerodynamics held at LMAL, attended only by representatives of Army and Navy air services and of manufacturers engaged in projects for military services as specifically designated by the services. On May 12, a similar conference was held on power plants. (Exec. Comm. Min., 6/23/39)

June 22: Secretaries of War and Acting Secretary of Navy recommended that NACA should be assigned a definite place in the National Mobilization Plan in order that the Nation receive benefits of National Mobilization Board's advice and research in time of war as well as peace. They said that approximately 75% of investigations conducted by NACA were undertaken on specific requests of Army and Navy. (Harry H. Woodring, Sec. of War, and William D. Leahy, Act. Sec. of Navy, to F. D. Roosevelt, 6/22/39)
1939 Continued

July 5: Robert H. Hinckley, Chairman of Civil Aeronautics Authority, said that a great deal more aeronautic-research must be done and the facilities at IMAL were already overtaxed. He pleaded for establishment of other research facilities. (Newport News Daily Press, 7/6/39)

October 7: J. S. Ames, NACA Chairman and President Emeritus of The Johns Hopkins University, announced his resignation from the NACA because of ill health. (NACA Min., 10/19/39)

October 19: The Lindburg Committee on Aeronautical Research Facilities submitted a report charging that the U.S. was deficient in engine research facilities, and that it was "of the utmost importance for the development of aviation in general, and for our defense program in particular, to take immediate steps to remedy this deficiency." (NACA Min., 10/19/39)

November 7: J. F. Victory, NACA Secretary, reported transmittal by General H. H. Arnold on 11/7 of action of War Dept. signed by Louis Johnson, Assistant Secretary of War and dated 10/30/39, granting NACA permission to use and occupy an additional area at Langley Field as indicated. The Secretary stated that this area was on the northwest portion of Langley Field, about 2 miles from the Committee's present activities, and would be used as a site for the 16-foot high-speed wind tunnel, the structures research laboratory, the stability research tunnel, a central heating plant, and a substation. (Exec. Comm. Min., 11/16/39)

December 7: Assistant Secretary of War, Louis Johnson, executed a permit for NACA to use and occupy approximately 62 acres of land at Moffett Field, Calif., for construction of aeronautical research laboratory authorized by act approved 8/9/39. (Exec. Comm. Min., 2/7/40)

Late in year: E. R. Sharp, IMAL Administrative Officer, said in a speech to the Hampton Kiwanis Club that of the 641 employees then at Langley, 212 had married local girls. (Newport News Daily Press, nd/39)

During the year: IMAL first experimented with extensions of the vertical tail as a means of curing such ailments as rudder lock. (Gray, Frontiers of Flight, 157)

Survey of thunderstorm conditions was completed by the loads research group at IMAL after two summers of studies at various
1939 Continued

altitudes. Flying laboratory for this work was a Lockheed XC-35 two-engine airplane. Cabin was pressurized, thus enabling crew and research engineers to work without oxygen masks at any height within the range of the airplane. Systematic observations and recordings were made of atmospheric turbulence and storminess up to 34,000 feet. (Gray, Frontiers of Flight, 175)

NACA developed the sealed internal balance, applied two years later in the P-51, also in A-26, P-59. R. T. Jones developed the beveled trailing edge balance--applied on several military planes. (NACA Files, NASA Historical Archives)

1940


June 26: Congress authorized, at recommendation of NACA, a new flight-propulsion laboratory. It was built in Cleveland adjacent to the municipal airport there. (Exec. Comm. Min., 9/13/40)

July 23: Fire in IMAL variable-density wind tunnel, of unknown cause, occurred while tunnel was in operation at a pressure of 20 atmospheres; electrical wiring within tunnel was completely destroyed and balance and balance controls damaged. Operation was discontinued. (Exec. Comm. Min., 9/13/40)

July 29: President F. D. Roosevelt, Secretary of Navy Frank Knox, and Secretary of Commerce Harry Hopkins made a short tour of the facilities at IMAL. (Exec. Comm. Min., 9/13/40)

October 3: Permit obtained from War Dept. for construction at IMAL of power generating plant on Langley Field military reservation, instrument dated 10/3/40. (NACA Min., 10/24/40)
1940 Continued

October 18: Structures laboratory, for testing airplane structures and materials, was completed at IMAL. (Victory files, NASA Historical Archives)

October 24: J. C. Hunsaker, NACA member, raised question of extent to which pressing research problems had displaced fundamental, long-range problems in the Committee's work. G. W. Lewis, Director of Aeronautical Research, replied that such displacement had occurred to an extent of about 50%. (NACA Min., 10/24/40)

November 25: NACA announced publically that it would erect an $8,400,000 engine research laboratory at Cleveland Municipal Airport. (Sp. Exec. Comm. Min., 11/26/40)

December 26: Fire damage at IMAL of $12,875. Cause believed to be a short circuit. (Exec Comm. Min., 2/27/41)
February 27: Research authorized for investigation to develop a satisfactory device for braking airplanes in high-speed dives. (Res. Authorization #820, Langley Files; Exec. Comm. Min., 2/27/41)

March 6: Dr. Briggs and special subcommittee visited IMAL and, as result of visit and subsequent consideration, submitted a report dated 3/25/41, signed by all members, recommending supplemental estimates for IMAL in amount of $1,325,341. (NACA Min., 4/24/41)

March 29: Vannevar Bush, NACA Chairman, organized a special committee on Jet Propulsion with Dr. W. F. Durand of Stanford University as chairman. (NACA Min., 4/24/41)

April 22: Special Committee on Jet Propulsion organized under NACA, adopted a resolution recommending the most active prosecution practicable of the project now under development at IMAL under direction of E. N. Jacobs, to the point which would make possible tests of the non-flying model construction. (W. F. Durand to Exec. Comm. NACA, 4/23/41; NACA Min., 4/24/41)

During April: G. W. Lewis, Hartley Soule' and Richard V. Rhode, all of NACA, testified before the Subcommittee on Safety in Air of the Senate Committee on Commerce on subject of NACA's investigation and report on the flying and stalling characteristics of the DC-3 passenger transport airplane. (Exec. Comm. Min., 6/24/41)

May 1: Two-dimensional tunnel was completed. It was to give reliable data on airfoils as applied in flight at large Reynolds numbers. Models were mounted in jet of compressed air at pressures varying from one to ten atmospheres. (Victory files, NASA Historical Archives)

June 28: Office of Scientific Research and Development (OSRD), with Vannevar Bush, Chairman of NACA, as Director, was established by President Roosevelt. Bush resigned as NACA Chairman and was replaced by J. C. Hunsaker. (Exec. Comm. Min., 6/24/41)
October 23: Research authorized for investigation to design a cargo-type airplane which could be operated efficiently from small airports. Requested by Federal Loan Agency, 9/20/41. (Res. Authorization #906, Langley Files; NACA Min., 10/23/41)

December 5: 16-foot tunnel completed at IMAL. It was to investigate a high Reynolds numbers and high air speeds various aerodynamic problems of military airplanes, especially cowling and cooling of full-size aircraft engines. (Exec. Comm. Min., 1/15/42)

December 8: All of the airplanes at Langley Field took off for the West Coast. Also all Army personnel, with the exception of a skeleton crew, left Langley. Most of the planes were B-17's. (Interview with Richard V. Rhode, 8/19/66)

During December: NACA Secretary reported 30 resignations of employees at IMAL during December and expressed opinion that unless legislation were enacted in very near future the Committee's research staff would be crippled by loss of employees to nearby activities offering greater earning opportunities. (Exec. Comm. Min., 1/15/42)

During the year: John Stack and his associates in compressibility research at IMAL began to prospect the type of propeller that would be efficient at 500 mph at an altitude of 25,000 feet. At the time many engineers doubted if efficient propeller operation at 500 mph was possible. The group at IMAL went to work in eight-foot tunnel, which at that time was capable of experiments at 550 mph. (Gray, Frontiers of Flight, 213)

Techniques had been sufficiently developed to obtain low drag at large enough scale for practical application. Then the first low-drag-wing fighter was built—the P-51. (NACA files, NASA Historical Archives)

Apprenticeship system began at IMAL which trained men in ten different trades while they learned to be such things as machinists, sheetmetal workers, aircraft mechanics, draftsmen, metal modelmakers and aviation metalsmiths. (Public Information Office Files, LaRC)

January 9: A stability wind tunnel for simulating rolling and yawing flight was completed at IMAL, as well as a second seaplane
1942 Continued

Towing tank and an impact basin for research on hulls and hull loads. (Exec. Comm. Min., 1/15/42)

January 15: Research authorized to determine cause of and remedy for buffeting and diving accents on P-38 airplane at high speeds. Research was to be done on production airplane with minimum change as soon as possible. Requested by Army Air Corps, 11/24/41. (Res. Authorization #928, Langley Files; Exec. Comm. Min., 1/15/42)

During March: NACA announced that they would hire girls between ages of 16 and 25 who are experienced modelplane builders and flyers to work at IMAL. Work on aircraft instruments and balancing and testing of airplane models in NACA wind tunnels. Starting salary was $1,260. (Model Aviation, March 1942, 15)

April 26: S. Paul Johnston, Coordinator of Research for NACA, was made Manager of Curtiss-Wright Corporation's office in Washington, D.C. (Shrader, Fifty Years of Flight, 79)

July 11: Memo for Division Chiefs and Section Heads at IMAL warned them to be on constant surveillance for "probable" fifth column activities such as agitation, propaganda, espionage, sabotage and actual physical attack. (H. J. E. Reid, Engineer-in-Charge, IMAL, Memo, 7/11/42)


General Louis Hershey, Selective Service Director, sent a special representative, Lt. Col. Henry F. Rhodes, to IMAL to study NACA's personnel problem as affected by SS Act; as result Col. Rhodes would recommend Committee be accorded status "War Production Industry." (Exec. Comm. Min., 9/10/42)

Secretary of NACA stated that personnel problem had become acute not so much by induction as by consequent unrest and resignation of employees as evidenced by fact that at IMAL since 1/1/42 64 employees had been drafted and approximately 500 others had resigned. Stated plans were being studied to accord to essential NACA personnel an inactive military reserve status including training of apprentices for military service at appropriate ratings. (Exec. Comm. Min., 9/10/42)

October 22: Tank No. 2, for testing models of floats for seaplanes and hulls for flying boats by drawing them through salt water of
1942 Continued

long basin at high speeds up to about 35 mph, was completed. (NACA Min., 10/22/42)

October 24: Smithsonian Secretary, Dr. C. G. Abbot, settled the Wright-Langley controversy over originator of flight which had raged since Langley's aerodrome was flown in 1914. Abbot admitted that too many modifications had been made in the aerodrome prior to the 1914 flight to claim that it might have been able to fly prior to the flight of the Wright brothers in December 1903. (Smithsonian Release, 10/24/42)

November 8: IMAL announced that women would be hired for "vital war work" in the laboratory. They would hold jobs formerly held only by men. By June 1943, nearly 200 women were at work at IMAL. (Newport News Daily Press, 11/8/42; Norfolk Ledger-Dispatch, 6/23/43)

November 10: Seaplane impact basin, for measurement of impact loads on seaplane hulls, was completed at IMAL. (Victory files, NASA Historical Archives)

December 17: Edward R. Sharp was named to be in charge of Aircraft Engine Research Laboratory at Cleveland. (Exec. Comm. Min., 12/17/42)

During the year: B-29 Superfortress, which made some of the earliest bombing attacks on Japan in WW II, was tested in the IMAL wind tunnels. (Newport News Daily Press, 6/19/44)

1943

January 20: IMAL began hiring Hampton High School graduates to work part-time in the sheetmetal, wood, machine and pattern making shops and photographic laboratories, at 50¢ per hour for 3½ hours work each day and 8 hours on Saturday. Later IMAL also began hiring adults with another job on a part-time basis. (Newport News Daily Press, 1/21/43, 4/18/43)

February 5: Atmospheric wind tunnel additions placed into operation. (NACA Min., 4/22/43)
1943 Continued

April 27: Four officials of Selective Service, accompanied by John F. Victory, NACA Secretary, visited IMAL and discussed the draft problems the laboratory had encountered. (Exec. Comm. Min., 5/20/43)

November 4: Secretary of Navy Frank Knox visited IMAL and said in a speech to the staff that "the Army as well as the Navy is depending on NACA to provide solutions for the technical problems incident to the requirement of a rapidly advancing technology." (Newport News Daily Press, 11/5/43)

December 18: Eastman N. Jacobs, LMAL engineer, expressed the opinion that new airplanes should be designed in order to take advantage of developing discoveries in jet propulsion. He said that in both the U.S. and in England development of jet power units themselves had progressed beyond the development of suitable airplanes to employ them. (Min. of Conf. on Jet Propulsion in England, 12/18/43)

During the year: John Stack of IMAL advanced the idea of constructing an airplane to be flown above the speed of sound. Main point of this plan was that an airplane could be designed strong enough to combat problems of the transonic regime and fast enough to go through that range very swiftly, and thus fly safely in the smoother and more controllable area of supersonic flight. This plan brought about the X series of airplanes. (Stoney, "NACA From Birth to Death," 25)

First supersonic wind tunnel was put into operation at LMAL. (Gray, Frontiers of Flight, 46)

Construction started on a women's dormitory near IMAL to house 368 unmarried women employed at the Laboratory and in other national defense work. (IMAL Bulletin, 7/10/43)

1944

1944 Continued

January 27: J. C. Hunsaker, NACA Chairman, announced agreement whereby essential NACA employees of draft age in IMAL would be placed in an inactive reserve status in the Army. In all cases they would perform their civilian duties under exclusive administrative management of the NACA. President Roosevelt approved plan 2/10/44. (Exec. Comm. Min., 1/27/44)

March 16: At seminar at IMAL, attended by AF, Navy, and NACA personnel, NACA proposed on the basis of considerable study that a jet-propelled transonic research airplane be developed. This proposal ultimately led to the X-1 research airplane project. (Emme, Aeronautics and Astronautics: 1915-1960, 47)

July 27: In response to inquiry at NACA Executive Committee meeting by C. G. Abbot, there was a general discussion of robots and their possibilities for military and other uses. The subject was under study by the military services and it was thought that the assistance of NACA might be requested. (Exec. Comm. Min., 7/27/44)

During July: Robert R. Gilruth of Langley Field Research Division, prompted by the need for an experimental method of gathering aerodynamic data at transonic speeds, conceived the wing-flow method (utilizing the transonic-airflow field over the top surface of the wing of a high-speed subsonic airplane, usually a P-51 fighter, as a "flying wind tunnel" for testing small semi-span wing and airplane models). Wing-flow method of testing for the procurement of data in the transonic regime was first used at IMAL. (NACA 40th Annual Report, 1954, 4; H. A. Soule, "Notes on Flight Research," 8/4/48)

September 22: Antionio Ferri, a major in the Italian Air Corps, who had been in charge of compressibility research at Guidonia, Italy, was detailed to IMAL for consultation and assistance in the study of high-speed phenomena with particular respect to the approach to higher Mach numbers in flight and in wind tunnels, and to the coordination of wind-tunnel theory with flight results. (NACA Min., 10/19/44)

During Fall: Preliminary studies were made of velocity gradients above wings of high-speed subsonic airplanes to determine feasibility of utilizing the wing-flow method in transonic model tests, at IMAL. This led in the following winter to tests of a series of small airfoil models by this method, and later to use of rockets in flying aircraft models. (Emme, Aeronautics and Astronautics: 1915-1960, 48)
1944 Continued

During October: H. J. E. Reid, Engineer-in-Charge of IMAL, became scientific Chief of War Depts. Alsos Mission charged with picking up as much information as possible on the enemy's scientific research and development. (Emme, Aeronautics and Astronautics: 1915-1960, 48)

November 30: George W. Lewis, Director of Aeronautical Research for NACA, awarded the Spirit of St. Louis Medal for his work in aviation during the past 25 years. (Shrader, Fifty Years of Flight, 85)

During November: First flight use of a radio telemeter for transmitting research data at transonic speeds, by the bomb-drop technique at IMAL. (Emme, Aeronautics and Astronautics: 1915-1960, 48)

During December: A meeting was held at IMAL to discuss the formation of an organization that would devote its efforts to the study of stability and maneuverability of high-speed weapons. From the outset, work was pointed toward supersonic flight testing. (Mercury Chronology, 1)

1945

April 3: "It was the NACA which initiated steps for development of jet-propulsion which may well have a revolutionary effect on flight in this country. It formed a special committee and aroused the interest of three firms, General Electric, Westinghouse and Allis-Chalmers, in accepting membership. As a result, each developed designs of jet-propulsion units, two of which are now in production, while the third is deemed adapted for post-war development." (NYT editorial, 4/3/45)


May 21: Secretary of Commerce Henry A. Wallace visited IMAL. He emphasized the need for continuing post-war aeronautical research to advance civil aircraft "with particular emphasis on airplanes for the private flier." (Newport News Times-Herald, 5/22/45)
1945 Continued

June 27: Post-war work focused on more speed, higher altitudes, and new and better power plants, including both jet and rocket engines. To aid research work in these areas, a Pilotless Aircraft Research Station (PARD) for launching rockets was established at Wallops Island, Va., as an adjunct to IMAL. (Exec. Comm. Min., 9/13/45; Rosholt, Administrative History of NASA, 21)

June 28: NACA Industry Consulting Committee was established with its objective being the promotion of the understanding of the mutual policy problems of the industry and NACA, as distinguished from detailed technical problems. (Exec. Comm. Min., 6/28/45)

August 7: NACA scientists foresaw the possibility of an atomic engine for aircraft. They said it was not fantastic to visualize a fuel supply the size of a brick with sufficient power to fly around the world many times. (Newport News Daily Press, 8/8/45)

September 8: W. F. Durand, appointed by President Wilson in 1915 as one of the original members of NACA, resigned from NACA to retire at the age of 86. (Exec. Comm. Min., 9/13/45)

October 18: NACA PARD launched the first successful drag research vehicle for wing and body research, forerunner of a large series of flight tests of various wings and bodies in a combination of transonic and supersonic speeds providing basic design information later applied on all later supersonic aircraft and missiles. (Emme, Aeronautics and Astronautics: 1915-1960, 51)

During the year: Extensive research program conducted of load effect of the landing shock on wing, body, tail, and other structural components, as well as on the landing gear itself at IMAL. (Gray, Frontiers of Flight, 171)

1946

February 7: Aviation Writers Inspection held at IMAL. This was one of the first inspections held at IMAL following the end of World War II. (Interview with William Underwood, 8/19/66; Exec. Comm. Min., 3/21/46)
February 11: IMAL complained that they were losing employees and also not able to hire some of those desired because of a generally inadequate salary scale. The competition from industry was not only for scientists, but also model builders, etc. (Memo of T. Melvin Butler, 2/11/46, NACA files, NASA Historical Archives)

March 12: NACA Committee on Aeronautics resolved that a definite program of recruiting and education adequately supported financially should be undertaken by NACA to enable it to place much greater emphasis on the understanding of fundamental phenomena which underlie systematic research and the solving of specific difficulties. (Exec. Comm. Min., 3/21/46)

April 25: At request of Chairman John Crowley of Committee on Aerodynamics, NACA Chairman was authorized to appoint a Special Subcommittee on the Upper Atmosphere under the Committee on Aerodynamics. This subcommittee was established with Harry Wexler, U.S. Weather Bureau, as chairman. (NACA Min., 4/25/46)


June 1: J. C. Hunsaker, NACA Chairman, suggested that J. F. Victory, NACA Secretary, should see Senator Mead, Chairman of Senate Investigating Committee on Aviation Planning, and his staff and try and suggest the changes suggested in the report of the Mead Committee. (J. C. Hunsaker, to G. W. Lewis, 6/1/46)

June 6: The Mead Senate Investigating Committee report on aviation planning during and after the war was issued. The Government was criticized for a lack of realistic preplanning by the responsible Government officials. Also criticized was lack of a policy for the level of production of military type aircraft and the aviation productive capacity to be maintained in stand-by condition. (Chicago Tribune, 6/7/46)

June 19: NACA PARD launched first successful control-surface research vehicle at Wallops Island, Va., for evaluating controllability with a roll rate transmitter and Doppler radar. (Emme, Aeronautics and Astronautics: 1915-1960, 54)

August 15: John Crowley, of IMAL, submitted a recommendation from Comm. on Aerodynamics that an investigation be authorized at IMAL of means for reducing the sound emanating from airplanes.
1946 Continued

Noise factor considered by the CAA as one of most important problems of the day. Authorization was delayed until IMAL report could be secured. Finally authorized 10/24/46. (Exec. Comm. Min., 8/15/46; NACA Min., 10/24/46)

September 13: 13 engineers, instrument technicians, and technical observers were ordered TDY from Langley Laboratory to the Air Force test facility at Muroc, Calif., to assist in the X-1 flight research program. Named as the NACA Muroc Flight Test Unit, this group under Walter Williams was the origin of the NASA Flight Research Center at Edwards, Calif. (Emme, Aeronautics and Astronautics: 1915-1960, 55)

December 8: First successful powered (RMI XLR-11 rocket engine) flight of an XS-1, flown by Chalmers Goodlin, Bell test pilot, reached a speed of 550 mph. This was first U.S. aircraft designed for supersonic speeds. (Emme, Aeronautics and Astronautics: 1915-1960, 55)

During the year: A major accomplishment at IMAL was a research missile capable of flight velocities above 1,100 mph. This rocket-propelled missile was developed by the group at PARC on Wallops Island, Va., and many different wing forms were tried, ranging in angle of sweep from 0° to 520, and in aspect ratio from 1.5 to 2.7. (Gray, Frontiers of Flight, 347)

Transonic bump technique--using floor- or wall-mounted airfoil surface in subsonic wind tunnel to get transonic flow--developed in 7-by 10-foot wind tunnel at NACA Langley Laboratory. A similar development was conducted by Lockheed in the California Cooperative Tunnel during the same period. This technique was a logical step from the earlier wing-flow technique developed by the Langley Flight Research Division, and it permitted testing in the range of Mach numbers from low subsonic to Mach 1.2 until the slotted-throat transonic tunnel was developed and put into operation at Langley 2 years later. (Emme, Aeronautics and Astronautics: 1915-1960, 56)

A new 9 inch supersonic tunnel was built at IMAL taking the place of the older model. Also built was a Helicopter Test Tower to permit study of rotor performance, control, and vibration characteristics at wind speeds representing hovering flight. Experimental rotor blades using new shapes, materials, or construction methods could be employed in these tests without incurring the risks of flight testing such articles. (NACA files, NASA Historical Archives)
January 8: First experimental operation of model slotted-throat wind tunnel. IMAL's Ray H. Wright, working theoretically, and Vernon G. Ward, working experimentally with a parasite tunnel attached to the Langley 16-foot high-speed tunnel, collaborated in an effort that resulted in establishment of transonic flow with the use of longitudinal slots in the walls of the throat of a conventional subsonic tunnel. Known as the slotted-throat technique, first major installation was made in the Langley 80-foot subsonic high-speed tunnel in Dec. 1949, a breakthrough in wind tunnel technique. (Emme, Aeronautics and Astronautics: 1915-1960, 56)

January 24: J. C. Hunsaker, NACA Chairman, announced that the Sylvanus Albert Reed Award for 1946 was presented by the Institute of the Aeronautical Sciences to Robert T. Jones, of NACA, "for his contributions to the understanding of flow phenomena around wings and bodies at speeds below and above the speed of sound." (Exec. Comm. Min., 1/24/47)

April 25: NACA PARD launched its first rocket-propelled model of a complete airplane for performance evaluation (AF XF-91), at Wallops Island, Va. This was followed by flight tests of models of practically all Air Force and Navy supersonic airplanes. (Emme, Aeronautics and Astronautics: 1915-1960, 56)

May 20: 16th General Inspection of IMAL. Inspection had gotten so large that it was necessary to hold two sections, the second one on 5/28/47. (Exec. Comm. Min., 6/5/47)


October 14: The Bell X-1, a small stubby-winged rocket plane, pierced the so-called "sonic barrier." (Maurice Munger, "Notes on Aviation Progress through Research," draft MSS, NASA Historical Archives, 15)

October 30: H. J. E. Reid, Engineer-in-Charge of IMAL (1926-1960), received the Medal of Merit from President Truman for wartime contributions to American airpower. (Exec. Comm. Min., 1/15/48)
1947 Continued

November 26: First successful hypersonic-flow wind tunnel (11 inch) placed into operation at mach 7 at IMAL. (Emme, Aeronautics and Astronautics: 1915-1960, 58)

December 16: General Omar N. Bradley, Army Chief of Staff designate, paid a visit to IMAL. Demonstrations were given of some of the most interesting and important work of the laboratory. (Exec. Comm. Min., 1/15/48)

1948


June 28: James H. Doolittle was appointed a member of NACA by President Truman. (Exec. Comm. Min., 7/14/48)

July 12: G. W. Lewis, one of country's most prominent Government research figures associated with NACA died at Lake Winola, Penn., at age of 66. (Exec. Comm. Min., 7/14/48)

October 13: First launching of a rocket-propelled "flying wind tunnel" model by NACA PARD at Wallops Island, Va., to measure roll damping of wings at transonic speeds. (Emme, Aeronautics and Astronautics: 1915-1960, 60)

December 17: Collier Trophy for 1948 was awarded jointly to John Stack, NACA; Lawrence D. Bell, President, Bell Aircraft Corporation; and Capt. Charles E. Yeager (USAF) for the conception, construction, and flying of the supersonic Bell X-1 special research airplane. Award presented by President Truman. (Exec. Comm. Min., 12/16/48)

1949

March 7: Hoover Commission report said: "The National Advisory Committee for Aeronautics should be taken into a new Bureau of
1949 Continued

Civil Aviation in the Department of Commerce. This bureau would supplant the Civil Aeronautics Administration." (NYT, 3/8/49; Exec. Comm. Min., 3/17/49)

May 18: Annual IMAL Inspection, first session held. (Exec. Comm. Min., 5/19/49)

May 20: Research and Development Board of DO instructed NACA of its approval of the 8-foot slotted-working-section transonic wind tunnel to be constructed at IMAL. (Exec. Comm. Min., 6/16/49)

May 21: John Stack, Deputy Chief of Research for NACA, contended that supersonic planes could be made useable for combat during an inspection of the NACA laboratories by members of the aircraft industry. (AP/Wash. Star, 5/22/49, A24)

September 3: H. L. Dryden, NACA Director of Research, stated that, with concurrence of NACA Hq., the Office of the Chief Signal Officer, Dept. of the Army, had appointed Lt. Col. David R. Guy as Liaison Officer to the NACA, to make monthly trips to IMAL to coordinate projects of common interest. (Exec. Comm. Min., 9/3/49)

During December: First continuous transonic flow established in NACA's IMAL 8-foot high-speed wind tunnel with use of slotted-throat technique. This was a major milestone in wind-tunnel technique. (Emme, Aeronautics and Astronautics: 1915-1960, 63)

During the year: Complete fixed-component combined loads testing machine was completed and operated at IMAL, remaining in use through 1960. It was first machine capable of applying forces along each of three axes and moments about those axes (positive and negative), in any combination of forces and moments, each applied independently. (Emme, Aeronautics and Astronautics: 1915-1960, 63)

1950

January 27: Herbert H. Hoover, chief pilot in charge of the Flight Operations Branch of the Flight Research Division of IMAL, was
1950 Continued

awarded the Air Medal by President Truman in recognition of his contribution to flight research beyond the speed of sound. (Langley Release, 1/27/50)

May 19: House Appropriations Committee recommended that Congress vote $75,000,000 to build three huge supersonic wind tunnels to be used in designing better warplanes. The tunnel to be built at IMAL would have a 4-foot test section. (Newport News Daily Press, 5/20/50)

June 2: H. J. E. Reid, IMAL Director, said that a cooperative agreement could be made between IMAL and the Commanding Officer at Langley Air Force Base whereby VGH recorders would be installed in B-45 airplanes to obtain information on airplanes flying at high altitudes and high speeds. (Exec. Comm. Min., 6/2/50)

June 12: High-speed wind tunnel will be constructed at IMAL by Eichleay Co., Pittsburgh, under $2,540,000 contract from NACA. (Av. Week, 6/12/50)

October 19: J. F. Victory, NACA Secretary, reported that the U.S. Government, on behalf of NACA, had acquired by condemnation 420.46 acres of land adjoining IMAL to provide for expansion. (NACA Min., 10/19/50)


During the year: NACA PARD demonstrated low drag of thin delta wing (which led to F-102, F-106, B-58) with rocket-powered model flights. (Emme, Aeronautics and Astronautics: 1915-1960, 66)

Worldwide analysis of atmospheric turbulence and gusts was made at IMAL based on data taken with NACA-developed VG and VGH recorders on commercial airline operations and transpacific and South American routes. (Emme, Aeronautics and Astronautics: 1915-1960, 66)

January 29: Daniel Guggenheim Award for 1950 went to H. L. Dryden, NACA Director, for "outstanding leadership in aeronautical research and fundamental contributions to aeronautical science." (Exec. Comm. Min., 12/15/50)
1951 Continued

During January: NACA IMAL conducted the first flights of man-carrying jet-supported platform at Wallops Island, Va., in exploratory investigations. In these tests, a person was supported by a jet-thrust device (platform) attached to his feet. (Policy Planning for Aeronautical Research and Development, Senate Committee on Aeronautical and Space Sciences (89th Cong., 2d Sess., 1966), 41)

April 12: In a letter to J. F. Victory, NACA Secretary, C. G. Abbot said that he felt that the invention of the airplane, submarine, and atomic modifications were the three greatest misfortunes to have come to the human race. (C. G. Abbot to J. F. Victory, 4/12/51)

April 26: Arrangements made for continuing essential operation of NACA in case Washington was subjected to enemy attack. IMAL was selected as temporary relocation center. Done in accordance with instructions of the Executive Office of the President. (NACA Min., 4/26/51)

May 19: New supersonic wind tunnel, estimated to cost $15,000,000, would be constructed by NACA at IMAL. Project announced by H. J. E. Reid, Director of IMAL, in connection with current inspection of research facilities there by 1,700 engineers, military officers, Government officials, and aircraft and airline executives. (Langley Release).

August 30: First successful launching of NACA PARD of an underslung or "piggyback" rocket booster system, at Wallops Island, Va. (Emme, Aeronautics and Astronautics: 1915-1960, 67)

November 8: First successful launching of a research model propelled by the helium gun catapult, by IMAL PARD at Wallops Island, Va. (Emme, Aeronautics and Astronautics: 1915-1960, 68)

During December: Richard T. Whitcomb of IMAL verified the "area rule" in NACA's new transonic wind tunnels. This enabled significant gain in jet aircraft speeds with what became known as the "coke bottle" or "wasp waist" shape. (Emme, Aeronautics and Astronautics: 1915-1960, 68)
February 14: H. L. Dryden, NACA Director, said that in a study at IMAL comparing earnings of high-school graduates under the wage-board system and college graduates under Civil Service it was found that at the end of eight years the professional man was $12,000 behind in total earnings, and it took 14 years for him to equal the wage-board employee in total earnings, and five years to equal him in annual earnings. (Exec. Comm. Min., 2/14/52)

March 28: J. C. Hunsaker, NACA Chairman in effort to define "basic research," said: "Basic research is fundamental research to find new knowledge, methods of analysis and measurements, or instrumentalities, which might have application in many fields of technology." (Memorandum, 3/28/52, NASA Historical Archives)

May 20: Langley held a huge bond rally. Lab was awarded "Minute Man" flag for outstanding performance in buying bonds. Approximately 3,000 of 3,300 at lab bought bonds. (Langley Release; Exec. Comm. Min., 7/14/52)

July 14: NACA Committee on Aerodynamics recommended that NACA increase its research efforts on problems of manned and unmanned flight at altitudes between 12 and 50 miles and at speeds of mach 4 through 10. As a result of this recommendation, IMAL began preliminary studies on this project and immediately identified several problem areas. Langley considered aerodynamic heating to be the most serious. (Min. of NACA Comm. on Aerodynamics, 6/24/52; Exec. Comm. Min., 7/14/52)

August 14: Herbert H. Hoover, Chief Test Pilot for IMAL, was killed when his parachute failed to open after a mid-air explosion of a B-45 bomber. His companion, John A. Harper, parachuted to safety. (Newport News Times-Herald, 8/15/52; Exec. Comm. Min., 10/16/52)

October 15: First flight of X-3 airplane. It had shown effective control about all three axes. This was the culmination of about 9 years work. (NACA Min., 10/16/52)

December 17: Collier Trophy for "greatest achievement in Aviation in America" during 1951 went to John Stack and his associates for the conception, development, and practical application of the transonic wind-tunnel throat. (Exec. Comm. Min., 12/16/52)
1952 Continued

**During the year:** Personnel of IMAL and Ames laboratory were engaged in research on aerodynamic characteristics of reentry configurations. Knowledge acquired from these efforts along with those of industry and the military services was used in Project Mercury. (Message, NASA Space Task Group to NASA Hq., 7/5/60)

1953

**January 26:** John Stack, IMAL, awarded Sylvanus Albert Reed Award "for his leadership in the design, development, and practical operation of transonic wind tunnels." (Exec. Comm. Min., 1/23/53)

**During January:** NACA completed and put into operation its new giant $14,000,000 jet-engine test facility at Lewis Flight Propulsion Laboratory, in Cleveland. (Shrader, *Fifty Years of Flight*, 169)

**May 5:** NACA announced it had put into operation another large transonic wind tunnel at IMAL. New tunnel had an 8-foot test section. Not only could speed be varied while the tunnel was operating, but also pressure and temperature. (Langley Release)

**June 10:** Rep. George P. Miller (Calif.) spoke on House floor of his recent visit to IMAL and praised the work of the NACA and its importance to the national defense. (Exec. Comm. Min., 7/13/53)

**July 30:** Preliminary studies were completed by C. E. Brown, W. J. O'Sullivan, Jr., and C. H. Zimmerman at IMAL relative to the study of the problems of manned space flight and a suggested test vehicle to investigate these problems. (Letter, NACA to High Speed Flight Research Station, 7/30/53)

**October 14:** President Eisenhower issued Executive Order 10492, approving an official seal for NACA. Seal was a representation of the famous photograph depicting the first successful flight of an airplane. Official seal was prepared by the Heraldic Branch, Office of the Quartermaster General, Dept. of the Army, and was mounted on the wall in the Board Room at Headquarters. (Memo of J. F. Victory, NACA Sec., 10/28/53; NACA Min., 10/23/53)
1953 Continued

October 23: H. L. Dryden, NACA Director, reported that he had authorized IMAL to discontinue the operation of the Gust Tunnel, in connection with the program for utilization of personnel only for the most important and urgent programs. (NACA Min., 10/23/53)

November 19: H. L. Dryden, NACA Director, reported that the Douglas X-3 research airplane was not able to obtain the speeds originally contemplated (about mach 2.0) because of failure in the development of the original design of J46 turbojet engine with which the airplane was intended to be powered. (Exec. Comm. Min., 11/19/53)

1954

During March: NACA's IMAL, Ames Aeronautical Laboratory, and High Speed Flight Station began the studies that led to the X-15 program. This early work was the first to identify all major problems in detail and examine feasible solutions. Only then could the researchers decide how big their first step should be. (Stillwell, X-15 Research Results, 12)

October 14: First American four-stage rocket was launched by the Pilotless Aircraft Research Division of IMAL at Wallops Island, Va. (Emme, Aeronautics and Astronautics: 1915-1960, 76)

1955

April 14: NACA began devoting increasing amount of research effort to vibration and flutter and started making changes in the 19-foot tunnel at IMAL for investigation of dynamic flutter models. Modifications provided for operation over a greater range of mach numbers and of Reynolds number and at an altitude range from 0 to 95,000 feet, freon being used for the higher altitudes. (NACA Min., 4/14/55)

Rep. Carl Vinson (D-Ga.), chairman of the House Military Affairs Committee, wrapped up NACA's contribution in a single sentence:
"There is not a military or commercial plane flying today in this country that does not reflect in some way the research of the NACA." (Arlington (Va.) Daily Sun, 4/14/55)

**August 5:** First operation of the IMAL 4-by-4-foot wind tunnel of the Unitary Plan. First project undertaken was investigation of the loads and stability characteristics of the Navaho missile for the Air Force. (Exec. Comm. Min., 9/15/55)

**September 11:** Announcement made to press of development by Richard T. Whitcomb, of IMAL, of the area rule concept of airplane design and its application to two supersonic military airplanes, the Grumman F11F-1 and the Convair F-102A, to reduce sharply the drag rise which occurs at supersonic speeds. (Exec. Comm. Min., 9/15/55)

**October 20:** Arthur Raymond, NACA member, showed film of operation of the landing-loads track at IMAL. Facility consisted of track 2250 feet long with a car on it propelled by a stream of water and with arresting gear at the end, for investigation of the effects of forward speed on landing-gear performance. (NACA Min., 10/20/55)

**December 17:** Richard T. Whitcomb of IMAL was awarded Collier Trophy for 1954 for discovery and application of the area rule. (Exec. Comm. Min., 11/17/55)

**During the year:** NACA IMAL and Ames Aeronautical Laboratory developed high-temperature jets, wind tunnels, and other facilities for use in materials and structures research at hypersonic speeds. (Message, NASA Space Task Group to NASA Hq., 7/5/60)

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1956

**August 24:** A five-stage, solid-fuel rocket test vehicle, the world's first, was launched to a speed of mach 15 by IMAL's Pilotless Aircraft Research Division at Wallops Island, Va. (House Rpt. 67, 87th Cong. 1st Sess., 27)

**October 25:** Conference held at IMAL to inform military services and selected representatives of the U.S. aircraft industry in some
1956 Continued

detail of the research, design decisions, and design procedures for the X-15 project that had been carried out to date by the contractor, North American Aviation, and the NACA laboratories. (Exec. Comm. Min., 2/21/57)

**During the year:** IMAL Structures Research Division initiated electric arc-powered jets work, using DC and AC current and liquid nitrogen, liquid air and aqueous air jets. On Dec. 19, first successful use of AC arc jet using gaseous air was performed. Twenty-four arc tunnels were subsequently developed and extensively used on many materials and structures research problems associated with reentry of bodies into the atmosphere. (Emme, Aeronautics and Astronautics: 1915-1960, 84)

- Pilotless Aircraft Research Division (PARD) of IMAL completed solid-propellant, rocket-design studies leading to an improved Deacon rocket motor called the Cajun. (Emme, Aeronautics and Astronautics: 1915-1960, 84)

1957

**January 17:** H. L. Dryden, NACA Director, reported that arrangements were being made to decommission the NACA Stability Wind Tunnel at IMAL about 4/1/57, since it had been decided that the staff of the tunnel should be assigned to the investigation of more urgent research problems in the higher-speed range. (Exec. Comm. Min., 1/17/57)

**April 1:** H. L. Dryden, NACA Director, said that there was a serious problem in the pay scales of engineers and scientists working for NACA. "If high-level research is to continue in Government, a solution to the pay problem must be found before Congress goes home." (H. L. Dryden to Frederick J. Lawton, 4/1/57)

**During July:** Study was initiated by IMAL on the use of solid-fuel upper stages to achieve a payload orbit with as simple a launch vehicle as possible. This was the beginning of the Scout test-vehicle concept. (Emme, Aeronautics and Astronautics: 1915-1960, 87)
October 4: Russians put SPUTNIK I into orbit around the earth. U.S. Government interest in space exploration immediately became more urgent. Date often called "Dawn of the Space Age."

November 21: First step of leaders of NACA on preparation of a proposal for the assignment of the space role followed the traditional lines of NACA procedure as they established a special committee on space technology, headed by H. Guyford Stever, Associate Dean of Engineering at MIT. (Levine, "US Aeronautical Research Policy," 146)

During November: As a result of studies conducted the previous year, Maxime Faget, later the Assistant Director for Engineering and Development at MSC, and his associates at IML prepared a ballistic shape for a manned satellite development project. (Link, Space Medicine in Project Mercury, 65)

Development of satellite launch vehicle focused upon all solid fuel systems at IML, a major step in the origin of Scout. (Emme, Aeronautics and Astronautics: 1915-1960, 92)

During December: Maxime Faget of IML proposed ballistic shape of Mercury capsule, while A. Eggers of Ames and E. S. Love and J. V. Becker of IML proposed glider configurations of manned spacecraft later incorporated in Dyna-Soar and Apollo studies. (Emme, Aeronautics and Astronautics: 1915-1960, 93)

NACA proposed and led in development of Polaris reentry body based on work done at IML, 1952-56. (Emme, Aeronautics and Astronautics: 1915-1960, 93)

1958

January 29-31: Conference held at Wright-Patterson AFB, Ohio, to review concepts for manned orbital vehicles. NACA informally presented two concepts then under study at IML: the one proposed by Maxime A. Faget involved a ballistic, high-drag capsule with heat shield on which the pilot would be prone during reentry, with reentry being accomplished by reverse thrust at the apogee of the elliptical orbit involving a deceleration load of about 8g, and proceeding to impact by a parachute landing; the other Langley proposal called for the development of a triangular
platform vehicle with a flat bottom having some lift during reentry. (Memo, C. A. Syvertsen to Director, IAL, 2/18/58)

During January: Maxime A. Faget and Paul E. Purser, later Special Assistant to the Director, MSC, conceived a solid-fuel design for the launch vehicle to be used in the research and development phase of a manned satellite project. Designated "Little Joe," this launch vehicle was used extensively in the early testing stages of Project Mercury. (Link, Space Medicine in Project Mercury, 65)

February 27: Experience with X-15 design indicated that many of weight figures advanced by IAL for the drag or lift configurations of the reentry vehicle (later to become the Mercury spacecraft) were too low, according to Walter C. Williams, Chief of the NACA High-Speed Flight Station. (Letter, NACA Hq. to IAL, 2/27/58)

During February: NACA Langley's PARD conceived and placed in operation the "opposed gun" technique for studying projectile impacts. (Emme, Aeronautics and Astronautics: 1915-1960, 96)

During March: At LAL, a working committee studied various manned satellite development plans and concluded that a ballistic entry vehicle launched with an existing intercontinental ballistic missile propulsion system could be utilized for the first manned satellite project. (Memo, W. J. North to NASA Administrator, 8/14/60)

April 2: In a message to Congress, President Eisenhower proposed establishment of a National Aeronautics and Space Agency into which the existing NACA would be absorbed. This agency was to have responsibility for civilian space exploration and aeronautical research. (Griffith, National Aeronautics and Space Act, 14)

April 27: President Eisenhower transmitted to Congress the 1958 Annual Report of NACA. The document was the 44th and final report of the agency submitted by its chairman. (NASA Release 59-122)

During April: Maxime A. Faget and associates conceived the idea of using a contour couch to withstand the high g-loads attendant to acceleration and reentry forces of manned space flight. Fabrication of test-model contour couches was started in LAL shops in May 1958, and the concept was proved feasible on July 30 of the same year. (Grimwood, Mercury Chronology, 20)
1958 Continued

**During June:** Preliminary specifications of first manned satellite vehicle were drafted by LAL personnel under supervision of M. A. Faget and C. W. Mathews. After a number of revisions and additions, these specifications were used for the Project Mercury spacecraft contract with McDonnell Aircraft Corporation. A working group of representatives from LAL and Lewis Laboratory was formed for the purpose of outlining a manned satellite program. (Grimwood, *Mercury Chronology*, 21)

**July 29:** President Eisenhower signed the National Aeronautics and Space Act, establishing the NASA. NACA, once the NASA was formed, ceased to exist. LAL became a part of NASA and was renamed the Langley Research Center.

**August 21:** The final meeting of the NACA Executive Committee took place at NACA Headquarters in Washington. (Exec. Comm. Min., 8/21/58)

**September 26:** NASA Administrator T. Keith Glennan announced that on September 30 the NASA would absorb the NACA facilities and officially change the name of the research centers. (NACA Release, 9/26/58)

**October 1:** National Aeronautics and Space Administration officially came into existence. NASA took over all facilities which had formerly been a part of the National Advisory Committee for Aeronautics.

**October 6:** Personnel from LaRC visited the Army Ballistic Missile Agency to open negotiations for procuring Redstone and Jupiter launch vehicles for the manned satellite projects. (Memo, Space Task Group to NASA Hq, 11/13/58)

**October 17-18:** LaRC personnel visited the Air Force Ballistic Missile Division, Inglewood, Calif., to open negotiations for procuring Atlas launch vehicles for the manned satellite project. (Memo, W. J. North to NASA Administrator, 8/14/60)

**November 5:** Space Task Group (STG) officially formed at LaRC to implement a manned satellite project. These 45 men were the embryo work force of Project Mercury. Robert R. Gilruth was named Project Manager and Charles J. Dolan, Technical Assistant to the Director of LaRC, was made Assistant Project Manager. (Memo, F. L. Thompson to all concerned, 11/5/58)

**November 7:** A contractor briefing, attended by some 40 prospective bidders on the manned spacecraft, was held at LaRC. More detailed specifications were then prepared and distributed to
about 20 manufacturers who had stated an intention to bid on the project. (Memo, George Low to NASA Administrator, 11/7/58)

November 26: STG personnel presented a proposed program for LaRC support in the Little Joe phase of Project Mercury. Langley was favorably inclined, and after a survey of manpower and facility availability, notified STG on 12/5/58 of its willingness to support the program. LaRC tasks involved contracting for engineering, construction, services, data processing, analysis, and reporting research results. (Memo, C. A. Sandahl for Associate Director, NASA LaRC, 12/9/59)

December 1: Design of the Big Joe spacecraft for the Project Mercury reentry test was accomplished by the STG. Construction of the spacecraft was assigned as a joint task of the Langley and Lewis Research Centers under the direction of the STG. (Memo, W. J. North to NASA Administrator, 8/14/60)
CHAPTER V

LANGLEY AS A NASA RESEARCH CENTER, 1959-1966

1959

January 23: Funds in the amount of $1,556,200 were made available to LaRC for Little Joe development program. Remaining funds of total program costs ($3,946,000) had already been made available to Langley in a previous transfer of funds. (Memo, George Low to A. Silverstein, 1/23/59)

During January: When the Joint AF-NRC Committee on Bioastronautics visited the STG at LaRC, there was a lively discussion about need for bioastronautical experimentation, not merely to test the life-support system of the spacecraft, but to determine the effects of combined stresses upon man. (Link, Space Medicine in Project Mercury, 116)

February 20: Responsibility for planning and contracting for Project Mercury tracking facilities was formally assigned to LaRC. (Memo, NASA Hq. to LaRC, 2/20/59)

February 26: STG and LaRC personnel visited the Arnold Engineering Development Center, Tullahoma, Tenn., to ascertain if the AEDC facilities were equipped to perform tests on scale models of the Mercury spacecraft and to arrange a testing schedule. (Memo W. M. Bland, Jr., to Director of Project Mercury, 3/4/59)

March 1: Scout, "poor man's rocket," was jointly announced by NASA and AF. Concept of Scout originated at LaRC in 1958, based upon extensive experience with staged solid-propellant rockets. (Emme, Aeronautics and Astronautics: 1915-1960, 107)

March 3: LaRC launched first in a series of six-stage solid-fuel rocket research vehicles, the world's first, from Wallops Island, Va., to a speed of mach 26 in a reentry physics program. (Emme, Aeronautics and Astronautics: 1915-1960, 107)

March 9: Tests were in progress at LaRC and Wallops Island on several types of ablating materials under environmental conditions that would be experienced by a spacecraft reentering from orbit. (Memo, H. S. Carter and C. A. Sandahl to Associate Director LaRC, 3/16/59)

March 17: First flight launching of a spin-stabilized 20-inch diameter spherical rocket by LaRC PARD at Wallops Station, Va. (Emme, Aeronautics and Astronautics: 1915-1960, 107)
March 26: STG, LaRC, and Air Force School of Aviation Medicine personnel met to plant bio-pack experiments that would be placed in several of the Little Joe research and development test flights. (Min. of Meeting, Project Mercury, 6/18/59)

LaRC received approval for funds to conduct hypersonic flight tests for Mercury spacecraft. Langley's PARD would conduct tests on heat transfer rates at a velocity of mach 17, and dynamic behavior tests from a velocity of mach 10 to a subsonic speed. (Memo, NASA Director of Aeronautical and Space Research to Director, Space Flight Development, 3/26/59)

April 12: Tests were in progress at LaRC in which an aluminum honeycomb structure was used partially to absorb the spacecraft impact load. Robert R. Gilruth, Project Mercury Director had stated his belief of this requirement on 1/16/59. (Memo, H. S. Carter to Associate Director, NASA LaRC, 4/21/59)

May 17: LaRC was in process of preparing a one-fourteenth scale model of the Mercury spacecraft for launch from Wallops Island, Va., on a five-stage rocket to a speed of mach 18. (Memo, H. S. Carter to Associate Director LaRC, 6/3/59)

June 1: Personnel strength in support of Project Mercury included 204 at the STG, 98 at LaRC, 44 at Lewis Research Center, and 21 on the Mercury tracking network, for a grand total of 363. (Chart, STG Complement Analysis, 6/1/59)

June 12: A Source Selection Panel and a Technical Evaluation Board were organized and manned at LaRC to evaluate Mercury tracking and ground instrument action proposals. (Memo, H. J. E. Reid, LaRC Director, to all concerned, 6/12/59)

July 6: Results of the technical and management evaluation of Mercury tracking network proposals were presented to the LaRC Source Selection Board. (NASA STG, Project Mercury (Quarterly) Status Report No. 3 for Period Ending July 31, 1959)

During July: Portion of Chincoteague (Va.) Naval Air Station transferred to NASA for use in connection with Wallops Station rocket range. (Emme, Aeronautics and Astronautics: 1915-1960, 111)

September 16: LaRC was in process of conducting ablation heat-shield tests on nine model shields in support of Project Mercury. However, the Big Joe test of the preceding week demonstrated the
1959 Continued

feasibility of the ablation heat-shield concept for reentry and verified the suitability of materials selected for such purposes. (Memo, R. L. O'Neal to Chief, Flight Systems Division, STG, 9/16/59)

September 17: First successful power test flight of the X-15 took place. (Speech by J. F. Victory, Assist. to NASA Administrator, 9/29/59)

1960

April 7: Ablation tests on nine Mercury heat shield models in the subsonic arc tunnel at LaRC were completed. (Letter, NASA STG to L. T. McMillan, Project Manager, McDonnel Aircraft Corporation, 4/7/60)

April 18: Scout test vehicle, with live first and third stages, was launched from Wallops Station, Va., but vehicle broke up after first stage burnout. (Emme, Aeronautics and Astronautics: 1915-1960, 122)

April 23: NASA launched first of five Aerobee-Hi sounding rockets from Wallops Station, Va., in program to measure ultra-violet radiation. (Emme, Aeronautics and Astronautics: 1915-1960, 122)

May 20: Floyd L. Thompson was appointed Director of the LaRC. He succeeded H. J. E. Reid, who had been Director since 1926. (Public Information Office Files, LaRC)

May 23: Mercury spacecraft No. 4 (production number), after being instrumented and prepared by the STG and LaRC for flight tests, was delivered to Cape Canaveral for the first Mercury-Atlas mission. (Grimwood, Mercury Chronology, 100)

September 21: Because of poor tower separation of the production spacecraft in the off-the-beach abort test at Wallops Island, Va., NASA personnel at LaRC started a series of jettison rocket tests. It was found that rocket performance had been only about 42% of the desired level, and experiments were started to raise thrust effectiveness. (NASA STG, Project Mercury (Quarterly) Status Report No. 8 For Period Ending October 31, 1960)

December 14: A presentation on the benefits of rendezvous to the national space program was given to the incoming Associate Administrator of NASA, Dr. Robert Seamans and his staff. A preview
1960 Continued

of these presentations was given to the management of the STG on 12/10/60. (John D. Bird Memorandum, 2/17/66)

1961

January 4: Ablation model test with electric arc attained 4,000°F for 105 seconds at LaRC, in one of a series of tests begun in September 1960. (Aeronautics and Astronautics: 1961, 1)

January 5: J. C. Houbolt made a presentation to the Space Exploration Council at which time he discussed rendezvous and the Lunar-Orbit Rendezvous Plan. (John D. Bird Memorandum 2/17/66)

January 20: Marshall Space Flight Center (MSFC) awarded contracts to North American Aviation and Ryan Aeronautical to develop paraglider recovery system for the Saturn booster. The system was based upon concept developed by Francis M. Rogallo of LaRC. (Aeronautics and Astronautics, 1961, 3)

March 20: Charles J. Dolan named Associate Director of LaRC. He had been associated with the NASA Space Task Group since its formation at LaRC in November 1958. (NASA Release 61-54)

During April: Navy reactivated former NACA hydrodynamic research facilities at LaRC, to conduct R & D on hydrofoils, air-cushion vehicles, hydroskis, catamarans, STOL seaplanes, torpedoes, and underwater rockets. NASA continued investigations at other facilities of Langley on ditching and water landing of space vehicles. (Aeronautics, May 1961, 114)

May 15-17: Final reports of study contracts on Project Apollo presented by the three contractors at LaRC and STG. (Aeronautics and Astronautics, 1961, 20)

May 23: In a brief ceremony, a bust of Samuel P. Langley was presented by Paul Garber, Curator of the National Air Museum, to LaRC, during which Dr. Langley's first demonstration of mechanical flight with his "aerodrome" model in 1896 and his scientific contributions to astrophysics were reviewed by Garber and Deputy NASA Administrator H. L. Dryden. (Aeronautics and Astronautics, 1961, 21)
1961 Continued

June 12: NASA's Incentive Awards Committee determined that H. J. E. Reid, Director Emeritus of LaRC, would receive NASA's outstanding Leadership Medal. (Aeronautics and Astronautics, 1961, 26)

June 30: H. J. E. Reid, senior staff associate and former Director of LaRC, retired after over four decades of Government service. He began as a junior engineer at Langley in April 1921, became Director in 1926, in which capacity he served for 34 years. (Aeronautics and Astronautics, 1961, 30)

During July: LaRC simulated spacecraft flights at speeds of 8,200 to 8,700 feet per second in approaching the moon's surface. With instruments preset to miss the Moon's surface by 40 to 80 miles, pilots, with control of thrust and torques about all three axes of the craft, were able to establish orbits 10 to 90 miles above the surface of the moon. They used a graph of vehicle rate of descent and circumferential velocity, an altimeter and vehicle attitude and rate meters. Tests were reported by M. J. Queijo and D. R. Riley of LaRC. (NYT, 7/27/61)

August 2: Sydney Chapman of the British Royal Observatory reported at LaRC-National Research Foundation-VPI conference that evidence suggested existence of a third radiation belt surrounding the Earth--except for areas above the poles--at altitudes between 20,000 and 28,000 miles. (Wash. Post, 8/7/61)

August 11: NASA LaRC awarded contract to Marquardt Corp. to increase structural wind tunnel testing temperature from 600° to 2,000° F. (Aeronautics and Astronautics, 1961, 39)

August 25: EXPLORER XIII (S-55A) placed into orbit by NASA Scout from Wallops Island, Va. The micrometeorite counting satellite was developed by LaRC and Goddard Space Flight Center. (NASA Release 61-192)

During August: Golovin Committee was organized to study the national booster program and to analyze the usage of boosters for the lunar mission. Members of the NASA Hq. staff working with this group including Harvey Hall asked that the Lunar-Orbit Rendezvous concept be presented to them for consideration in the form of a mission plan. (John D. Bird, Memorandum, 2/17/66)

September 23: NASA planned to spend $6 million on expansion of its Langley facilities in this fiscal year, according to Rep. Thomas H. Downing after a conversation with NASA Administrator James E. Webb. Rep. Downing said that he was satisfied that the lower peninsula area of Virginia would not suffer financially
1961 Continued

when the STG moved to Houston, Tex. (Newport News Daily Press, 9/23/61)

November 1: Scientists and engineers of Langley and the Space Task Group were guests of the Peninsula Chamber of Commerce honoring the 46 years of NACA and NASA on the Virginia peninsula. (Newport News Daily Press, 11/1/61)

November 7: NASA announced award of a contract to North American Aviation, Inc., to study the feasibility of a large erectable manned space station based on Langley concept. (Newport News Daily Press, 11/7/61)

November 15: J. C. Houbolt sent a letter to Robert Seamans, NASA Associate Administrator, presenting the Lunar-Orbit Rendezvous Plan and outlining certain deficiencies in the national booster and manned rendezvous programs. The letter protested the exclusion of the Lunar-Orbit Rendezvous Plan from certain committee activity aimed at defining the national program for lunar exploration. (John D. Bird Memorandum, 2/17/66)

November 16: William J. O'Sullivan, Jr., of Langley was awarded the Second NASA Invention and Contribution Award for conception and development of the inflatable space vehicle. (NASA Release 61-252)

December 19: NASA announced that Ira H. Abbott, Director of Advanced Research and Technology, would retire in January after 32 years service with NACA and NASA. Beginning with the Langley Aeronautical Laboratory in 1929, Abbott became internationally known for his aerodynamic research, in more recent years as supervisor of X-15, supersonic transport, nuclear rocket, and advanced reentry development programs. (Aeronautics and Astronautics, 1961, 75)

1962

February 16: Hartley A. Soule of Langley retired after 34 years service at Langley. Soule was instrumental in establishment of what became the NASA Flight Research Center at Edwards, Calif., and
1962 Continued

directed the research on the X-1 and X-15. More recently he was NASA Project Director for the multimillion dollar Project Mercury worldwide tracking and ground instrumentation system. (LaRC Release)

February 13: NASA announced Project Fire, a high-speed reentry heat research program to obtain data on materials, heating rates, and radio signal attenuation on spacecraft reentering the atmosphere at speeds of about 24,500 mph. Under LaRC management, Project Fire would use Atlas D boosters and the reentry velocity package would be powered by Antares solid-fuel motor (3rd stage of Scout). (NASA Release 62-33)

April 2-3: Joseph Shea reviewed the Lunar-Orbit Rendezvous Plan as a possible mission mode in a NASA Hq. meeting attended by representatives of the various NASA centers. (John D. Bird Memorandum, 2/17/66)

April 28: First details of an orbital space station under feasibility study, one shaped like a doughnut and inflated once in orbit, revealed at LaRC. Design of space stations had begun in November 1960 at LaRC. Paul Hill, chief of the Applied Materials and Physics Division, stated that structures were now under study which could hold from 4 to 30 people. (Newport News Daily Press, 4/29/62)

During April: J. C. Houbolt, of LaRC, writing in April issue of Astronautics, outlined the possible advantages of lunar-orbit rendezvous for a manned lunar landing as opposed to direct flight from earth or earth-orbit rendezvous. (Astronautics, April 1962, 26)

May 4: "Dynamic Model" study on one-fifty scale Saturn rocket at LaRC offered useful concept for testing structural characteristics of the future Nova rocket. (Virginian-Pilot (Norfolk-Portsmouth), 5/5/62)

During May: LaRC announced contract with Space-General Corp. for development of an inflatable paraglider to measure micrometeoroid flux in lower regions of space up to 700,000 feet. Inflatable Micrometeoroid Paraglider (IMP) would test new sensor system consisting of alternate layers of mylar and aluminum and will determine suitability of inflatable reentry paraglider. (Space Bus. Daily, 6/1/62)
June 23: Virginia State Exchange Clubs awarded Distinguished Virginian Award to W. J. O'Sullivan, head of the Space Vehicle Group at LaRC. (Newport News Daily Press, 6/20/62)

July 7: Ryan project engineer W. F. Everest was slightly injured in crash of Ryan Flexwing aircraft undergoing flight-test research at LaRC. 40-foot wingspan aircraft based on Rogallo concept had completed aerodynamic tests in LaRC's full-scale wind tunnel and was to be flight tested by LaRC and Army Transportation Research and Engineering Command. (Newport News Daily News, 7/8/62)

During July: Decision to use Lunar-Orbit Rendezvous Plan for initial manned lunar exploration was announced by NASA. Shortly thereafter a talk was given by D. Brainerd Holmes, NASA Director of Manned Space Flights, at an American Rocket Society meeting in which he explained the reasoning behind the choice of the Lunar-Orbit Rendezvous Mode. (John D. Bird Memorandum, 2/17/66)

August 2-3: In meeting at LaRC, Langley and MSC personnel presented reports on space station studies to officials from NASA Hq. and other interested agencies. (Av. Week, 8/6/62, 25)

During September: Conclusion that wheel-shaped station was technically feasible and identification of problems that still existed were revealed in NASA Technical Note D-1504; compilation of 11 papers by LaRC staff. Selection of this 150-ft. diameter, 171,000 lb. structure was result of studies by Langley for more than 2 years and detailed analyses by North American Aviation, Inc., for past 6 months. (NASA TN D-1504)

Issue of ARG Astronautics contained series of articles by LaRC scientists and others and reviewed LaRC research program on manned space-station technology since early 1960. (Astronautics, 9/62)

November 1: Mercury Procedures Trainer No. 1, redesignated Mercury Simulator, was moved from Langley Field on July 23, 1962, and installed and readied for operations in an MSC building at Ellington AFB, Houston, Tex. (Activity Report, Flight Crew Operations Division, MSC, 8/20-28/62)

November 9: F. L. Thompson, LaRC Director, announced construction of $12.3 million space radiation effects laboratory would begin in March and would be completed in about two years. Facility, to
1962 Continued

be operated by NASA and three Virginia colleges, would be used to study effects of radiation on space vehicle materials and components; it would simulate radiation hazards astronauts and spacecraft would encounter in space. (Newport News Daily Press, 11/10/62)

November 24: DOD announced selection of contractor for 22 test models of TFX aircraft, the Convair Division of General Dynamics, with Grumman Aircraft Engineering Corp. as an associate. Based upon much work at LaRC, TFX fighter was designed in USAF and USN versions, having variable geometry wings for flight speeds up to 1,650 mph. (DOD Release 1907-62; NYT, 11/25/62; UPI, Wash. Post, 11/25/62, A4)

1963

February 14: Catalytic Construction Co. of Philadelphia was selected by NASA for negotiations of contract to build, install, and test synchrocyclotron and related equipment and services for Space Radiation Effects Laboratory, to be built in Newport News, Va., under LaRC management. (NASA Release 63-30)

March 14: NASA and FAA announced they were completing plans for joint study of supersonic transport operation. Study would be based on four different SST concepts evolved by NASA Ames and Langley Research Centers and on simulation of air traffic environments of today and of the 1970s. (NASA Release 63-53; FAA Release 28)

April 9: LaRC personnel visited Cape Canaveral to provide assistance in preparing the tethered balloon experiment for Mercury-Atlas (MA-9) mission. This work involved installing force measuring beams, soldered at four terminals, to which the lead wires were fastened. (Memo, Thomas Uranas to Asso. Director, LaRC, 4/25/63)

April 26: F. L. Thompson, Director of LaRC, announced he had formally accepted on NASA's behalf custody of 110 acres of Government land at Oyster Point, Newport News, Va., for use as site of Space Radiation Effects Laboratory being established by NASA. (Langley Release)
1963 Continued

During April: Wind-tunnel studies to evaluate aerodynamic drag and jet engine mass air-flow characteristics with 3/10 scale model of free-flight lunar landing test vehicle were begun at LaRC. Data from Langley tests would be supplied to Bell Aerosystems Co., building two full-scale lunar landing research vehicles under contract from Flight Research Center. (Av. Wk., 4/22/63, 77)

During first week in June: Technical progress reports on supersonic transport study contracts were made by Boeing Co.'s Transport Div. and Lockheed-California Co. to LaRC. Final reports on the nine-month contracts would be made in November. (NASA Release 63-129; Langley Release)

June 9: F. L. Thompson, LaRC Director, was awarded honorary Doctor of Science degree by College of William and Mary. On previous day, he was awarded honorary Doctor of Science degree by University of Michigan. (LaRC Release, 6/10/63)

June 14: Invention of retrometer, device relaying light beam over which voice messages are transmitted, by LaRC scientist N. E. Thomas was reported in Newport News Times-Herald. (Newport News Times-Herald, 6/14/63)

June 21: At 39th annual joint meeting of Virginia Engineering and Technical Societies F. L. Thompson, LaRC Director, announced that whenever the U.S. decided to go ahead with a manned orbiting laboratory, LaRC would be ready. "Although there is no NASA approved flight project for a manned space station at the present time, Langley will be in a position through its studies to provide many of the answers to design and operational problems when such a program is given the go signal." (Newport News Daily Press, 6/22/63)

June 24: In an interview, John Stack said: "We were doing research on the problems of supersonic transport down at Langley Research Center all through the late 1950's. We knew then that it was feasible." (Policy Planning for Aeronautical Research and Development, Senate Committee on Aeronautical and Space Sciences (89th Cong., 2d Sess.), 37)

August 5: Some historic achievements of LaRC reported in the press: invention of world's first transonic wind tunnels; discovery of the "area rule," a design principle regarded as key to practical supersonic flight; invention of automatically inflatable satellites, leading to development of world's first communications satellite (Echo); development of first all-solid fuel launch
1963 Continued

vehicle (Scout) to place U.S. satellite in orbit. (W. Warwick, R. I., Pawtuxet Valley Times, 8/5/63)

August 9: LaRC announced contract awarded to Basic Construction Co. for building to house synchrocyclotron of NASA's Space Radiation Effects Laboratory at Oyster Point, Newport News, Va. (LaRC Release)

August 12-16: Conference on artificial satellites held at VPI, sponsored by VPI in cooperation with NSF and LaRC. F. L. Thompson, LaRC Director, addressed banquet and called on educators attending to join with NASA and other research organizations to develop new and more effective means for accelerating effective distribution and assimilation of newly acquired research information. (NASA Release 63-173; LaRC Release)

August 30: NASA announced that LaRC had issued requests for proposals for instrumented Lunar Orbiter probes which would be launched by 1966 to secure topographic data on the moon's surface. (NASA Release 63-196; LaRC Release)

September 12: Department of Labor's second annual William F. Patterson Memorial Award presented to LaRC "in recognition of apprenticeship program excellence." (Newport News Daily Press, 9/12/63)

September 17-19: Technical session on supersonic transport aircraft held at LaRC, with representatives of Boeing Co. and Lockheed-California Co. reporting on results of their feasibility studies performed under LaRC contract. (NASA Release 63-210; LaRC Release)

October 1: In a ceremony coincident with NASA's fifth anniversary, F. L. Thompson, LaRC Director, presented a model of a Mercury space capsule to the new municipal aerospace park in Hampton, Va. (Newport News Times-Herald, 10/1/63)

October 14: Lunar landing research facility was nearing completion at LaRC. A gantry structure 400 ft. long and 250 ft. high with a 50 ft. clearance would suspend a model of the Lunar Excursion Module (LEM), sustaining 5/6 of the model's weight to simulate the 1/6 lunar gravity and enable astronauts to practice lunar landings. (Av. Wk., 10/14/63, 83)

October 28: LaRC asked 36 companies for proposals on Project Scanner, a spacecraft that would establish the radiation characteristics of the earth's horizon and develop horizon-scanning techniques.
1963 Continued

Program would involve two flight models complete with reentry heat shield, plus one backup. (Space Bus. Daily, 10/29/63, 165)

During October: H. J. E. Reid, Director of LaRC for 34 years prior to his retirement, was named "Elder Statesman of Aviation" by the National Aeronautic Association. (LaRC Release)

December 17: National Aviation Hall of Fame president, James Jacobs, announced selection of Samuel Pierpont Langley to Aviation Hall of Fame. (Cong. Rec. 12/17/63, 23666-67)

1964

February 5: LaRC awarded two contracts for construction on Vehicle Antenna Test Facility to aid in solving spacecraft communications problems; $1,265,505 contract to Hat Harrison Associates for construction of the building, and $280,630 contract to B. F. Goodrich Sponge Products Div. for design and installation of anechoic chambers for the facility. (LaRC Release)

February 19: NASA announced FRC had issued requests for proposals for construction of two low-speed lifting-body gliders. NASA would furnish the selected contractor with information obtained in research with M-2 concept at Ames Research Center and the HL-10 lifting-body at LaRC. (NASA Release 64-41)

March 3: Douglas Aircraft Co. was awarded follow-on study contract for Manned Orbital Research Laboratory by LaRC, to refine the NASA concept and examine the feasibility of cylindrical six-man space station using equipment providing intermittent artificial gravity. Selection of Douglas for contract negotiation was announced previous December. (LaRC Release)

April 14: Atlas D sent Project Fire spacecraft from AMR to test reentry spacecraft. Experiment was conducted by LaRC. NASA Release 64-69; AP, Wash. Post, 4/15/64)

April 19: NASA Technology Utilization Report on the retrometer, a new system of voice communications transmitted on a beam of light, was published. Invented at LaRC by N. E. Thomas, the retrometer differed from previous light beam communications
1964 Continued

systems in that the originating station required no power other than the human voice. (NASA T-U Rpt. SP 5005; NASA Release 64-82)

April 27: NASA announced that LaRC would conduct tests with Boeing 707 air transport prototype to find ways to lower landing and takeoff distances required for large jet transports. NASA pilots and engineers would study performance and handling characteristics of the aircraft in three-month program. (NASA Release 64-100)

During April: Shipments of nearly six million pounds of large components for LaRC's $12.5 million Space Radiation Effects Laboratory began arriving. Beginning in mid-1965, the new facility would be operated by Virginia Associated Research Center (VARC), comprised of representatives of the College of William and Mary, UVa, and VPI. (LaRC Release)

May 14: LaRC announced three key management appointments: E. C. Draley was appointed Assistant Director for Flight Projects; J. E. Duberg was named an Assistant Director in charge of the research activities of the Dynamic Loads Div. and the Structures Research Div., and F. B. Smith was appointed Assistant Director responsible for the Analysis and Computation Div., the Instrument Research Div., and the Space Mechanics Div. (LaRC Release)

May 18-22: Review of recent accomplishments in advanced aeronautical and space research was held during Inspection Week at LaRC. More than 2,000 guests from aerospace industry, Congress and Government agencies, and educators and civic officials attended the inspection. (LaRC Release)

May 23: Open House at LaRC, in conjunction with field inspection during the previous week, featured specially prepared exhibits and other items of interest for citizens of Virginia and nearby areas. (NASA Release 64-99; NASA Announcement 64-89)

May 25: Major improvements in performance of supersonic transport shapes had come from aerodynamic refinements at LaRC. (NASA Release 64-120)

Douglas Aircraft Co. Missile and Space Systems Div. summarized study on Manned Orbital Research Laboratory (MORL) made for LaRC. Douglas said it would be possible for U.S. to have a six-man operational space station within the next five years. MORL would
1964 Continued

be launched with Saturn IB, would remain in orbit just over one year. (Houston Post, 5/25/64)

June 17: NASA purchased hingeless rotor helicopter, the XH-51N Research Vehicle, from Lockheed Aircraft Corp. for use in flight research at LaRC. The cost would be $556,158. It would be used as a flying laboratory to assess the loads and flying qualities problems that are likely to be encountered by operational aircraft of the hingeless rotor type. (NASA Release 64-147; LaRC Release)

June 29: New research project would study feasibility and design concept of advanced hypersonic ramjet engine, NASA announced. Work would extend ramjet propulsion technology which NASA and NACA had been developing for more than 15 years. To be conducted under LaRC direction, the project was being organized to determine potential of the ramjet as a propulsion system for hypersonic flight. Project would use hydrogen as fuel. (NASA Release 64-158)

June 30: Museum of Modern Art in New York opened exhibition titled "20th Century Engineering," which featured 195 spectacular and dramatic structures combining beauty with utility. LaRC wind tunnel was represented among the dams, antennas, observatories, skyscrapers, and other structures. (Huxtable, NYT, 6/30/64, 29)

July 23: LaRC asked industry for proposals on kind of launch vehicle it would take to put a small spacecraft into orbit around the sun. Purpose of the program would be to put an instrumented satellite into position for a clear view and study of the sun's plasma corona. (Newport News Daily Press, 7/24/64)

September 15: F. L. Thompson, LaRC Director, said that the problem of maintaining radio communications with astronauts during atmospheric reentry may have been solved. He said LaRC research in Project Ram (Radio Attenuation Measurement) showed that ejection of small amount of liquid into the air "provides an effective means of dealing with the radio blackout." (Speech to National Space Club, Washington; NSC Release)
January 11: LaRC scientist Windsor L. Sherman proposed conversion of Project Mercury spacecraft into unmanned, recoverable orbiting telescope platforms. (Av. Wk., 1/11/64, 23)

January 13: LaRC scientists Harry W. Carlson and Francis E. McLean said that for the first time there was hope for a significant reduction in the sonic booms expected from proposed supersonic airliners. (Clark, NYT, 1/14/65)

January 24: Eldridge H. Derring, Executive Assist. to the Associate Director and head of the Research Staff Office of LaRC, died after an illness of several months. (Langley Researcher, 1/29/65, 8)

February 18: LaRC announced it would negotiate with Ling-Temco-Vought, Inc., an $8 million incentive contract to provide complete system management for the Scout launch vehicle. Contract would continue support services and materials LTV had provided under several contracts. (NASA Release 65-54)

March 22: LaRC scientists Arthur L. Newcomb, Jr., Nelson J. Groom, and Norman M. Hatcher reported at the IEEE National Convention on their work on an infrared sensing instrument to help a spacecraft determine which way was up. The new sensor concept was expected to be useful for weather and communications satellites, as well as for space probes and other types of spacecraft. (LaRC Release)

Theo E. Sims, Manager of LaRC's Project Ram, reported results of reentry communications blackout research before the IEEE national convention in New York. Sims said significant progress had been made toward understanding the fundamental nature of the blackout problem and suggested that vehicle shape selection, signal frequency choice, use of static magnetic fields, and material addition to the flow field were all possible solutions. (LaRC Release)

April 15: NASA selected three aerospace firms to develop a concept and prepare preliminary design for hypersonic ramjet research engine. Hypersonic Ramjet Experiment Project would be under the technical direction of LaRC. (NASA Release 65-110)

April 26: DOD had asked NASA to consider using Minuteman I missiles, scheduled to be removed from their silos, as launch vehicles,
1965 Continued

Missiles and Rockets reported. After being considered for two months at NASA Hq., the study was transferred to LaRC. LaRC was expected to complete its feasibility investigation in three to four weeks. (NAR, 4/26/65, 7)

May 1: Robert Kulthau and William Boring, LaRC contractors at the Univ. of Virginia, succeeded in making operational the first free-molecular-flow wind tunnel. This device would prove useful in measuring aerodynamic forces acting on the surfaces of a satellite in a circular orbit. (O'Sullivan, LaRC, 5/7/65)

May 9-12: During NASA Conference on Aircraft Operating Problems, NASA scientists reported to Government and industry technical experts on research accomplishments leading to improved aircraft usefulness and safety. Held at LaRC, the technical sessions were under the sponsorship of NASA's Office of Advanced Research and Technology and included 34 papers. (NASA Release 65-160)

June 7: Educators from various elements of NASA and a group of 65 lecturers employed in the NASA spacemobile program began a week-long training session at LaRC. (LaRC Release)

June 30: Lunar Landing Research Facility, a controlled laboratory for exploring and developing techniques for landing a rocket-powered vehicle on the moon, had been put into operation at LaRC. The $3.5 million facility included a rocket-powered flight test vehicle which would be operated while partially supported from a 250-ft. high, 400-ft. long gantry structure to simulate the one-sixth gravity of the moon in research to obtain data on the problems of lunar landing. (LaRC Release)

During the week of July 4: Ambassador Tran Thien Khiem, South Viet Nam, visited LaRC. (Langley Researcher, 7/16/65)

July 16: A 707 jet transport, owned and fitted by the Boeing Co. with extensive instrumentation, had arrived at LaRC for a four-month program of supersonic transport experiments. The research program would assess simulated landing approaches with both the fixed-wing and variable-sweep concepts, including conditions such as emergency use of cruise sweep-back during a landing. (NASA Release 65-233)

September 20: Three basic capsule designs for the Project Voyager Mars lander vehicle were being studied by a special planetary missions technology steering committee at LaRC. (Av. Wk., 9/20/65, 28)
1965 Continued

October 11: Formation of a Voyager Landing-Capsule Task Team at Ames and Langley Research Centers to assist JPL during early phases of the design was announced by NASA. This would include research and analytical support. (ARC Release)

October 28: A Group Achievement Award was presented at LaRC's annual awards ceremony to Eugene Schult, Head of the Scout Project Office, in recognition of "the outstanding Scout vehicle success record during the past eighteen months." (LaRC Release)

November 15-18: F. L. Thompson, LaRC Director, delivered a keynote address on "Advances in Aircraft Technology." He discussed the importance of scientific research to the continued leadership of the U.S. in the field of air transportation with particular reference to the next decade. (LaRC Release)

December 20: NASA announced it had extended the Scout Reentry Heating Project to include one more ballistic flight and had invited industry to submit proposals for the design of the spacecraft. Sub-orbital reentry experiment was scheduled for 1967 and would be sixth in the LaRC project. (NASA Release 65-384)

1966

January 18: LaRC awarded a $5 million contract to Virginia Associated Research Center to operate NASA Space Radiation Effects Laboratory--a $15 million facility established by LaRC for research in support of national programs in space technology--through mid-1970. (LaRC Release)

March 8: LaRC awarded General Electric Co. $3,000,000 incentive-type contract to build the sixth spacecraft in NASA's Scout-launched reentry heating flight series. The 13-ft. conical spacecraft would be launched to measure heating rates associated with turbulent air flow close to vehicular surface--conditions which could not be simulated with ground equipment. (LaRC Release; NASA Release 66-54)
March 10: NASA awarded Honeywell, Inc., a $230,000 study contract to determine alternate approaches and concepts for measuring horizon radiance characteristics over earth's surface. LaRC-directed study would support Project Scanner rocket flight tests. (LaRC Release; NASA Release 66-57)

April 6: Astronauts had made more than 1,000 "flights" in the Rendezvous Docking Simulator and other facilities at LaRC to help develop techniques for the operation of vehicles in space. The simulator had been used extensively by Gemini VIII Astronauts Neil A. Armstrong and David R. Scott who performed world's first space docking March 16. (LaRC Release)

April 11: LaRC would negotiate $450,000 study contract with Martin Co. for 11-month study of "costs, crew size, and complexity of a flight research program using a manned lifting body vehicle." In conducting the study, the firm would be required to consider an HL-10 lifting-body concept capable of carrying one, two, four, six, or eight crew members. HL-10 was considered representative of advanced lifting entry vehicles. (NASA Release 66-82; LaRC Release)

April 26: LaRC would test parachutes for possible landing of instrumented unmanned capsules on Mars beginning in summer 1966, in support of NASA's Voyager planetary exploration project. Parachutes would be carried by balloons and sounding rockets to 130,000 ft. altitude--where thin earth atmosphere simulates Martian atmosphere--and would then be deployed behind test units accelerated to mach 1.2 in level flight. (NASA Release 66-90; LaRC Release)

May 4: NASA selected Control Data Corp. and IBM for competitive negotiations of a $15 million contract to furnish a large-scale digital computer complex at LaRC. (NASA Release 66-102)

May 13: NASA was negotiating $35,000 contract with RCA for continued research on simplified process for manufacturing microelectric printed circuits by printing patterns of paste or slurry through screens onto a ceramic wafer. Contract would be managed by LaRC. (NASA Release 66-103)

June 9: LaRC engineers Upshur T. Joyner and Walter B. Horne received Society of Automotive Engineers' Arch T. Colwell Merit Award--presented annually to authors of papers "of outstanding technical
or professional merit"—for "Pneumatic Tire Hydrolapping and Some Effects on Vehicle Performance." (LaRC Release)

June 17: NASA had selected Control Data Corp. to furnish large-scale computer complex for LaRC under $20 million, fixed-price contract. Complex would utilize computers with wide variety of simulators and increase LaRC's capability and effectiveness in conducting advanced research. (NASA Release 66-152)

June 23: LaRC reported that about 10,000 persons had written to them during past year for general information on aeronautics and space. (LaRC Release)

July 7: 1966 AIAA Fellows were selected in recognition of prolonged, significant achievements in aerospace technology. Among those selected was Francis H. Rogallo of LaRC. (HYT, 7/8/66, 12)

August 10: NASA's LUNAR ORBITER I (Lunar Orbiter A) unmanned spacecraft was successfully launched by Atlas-Agena D booster from EIR in first U.S. attempt to orbit the moon and photograph possible landing sites for Apollo astronauts. Lunar Orbiter program was managed by LaRC under direction of NASA's Office of Space Science and Applications. (NASA Release 66-195; Wash. Post, 8/15/66)

August 14: LUNAR ORBITER I became first U.S. satellite to circle the moon when it successfully entered lunar orbit—only 15 mi. off target—after 32-hr., 236,310-mi. flight from EIR. (Wilford, HYT, 8/15/66, 1, 23; O'Toole, Wash. Post, 8/15/66, A1, A13)

August 16: NASA successfully launched 50-lb. Project Scanner instrumentation package from Wallops Station to 300-mi. altitude on 13.5 min. suborbital flight. Managed by LaRC, Project Scanner was advanced research program to obtain data for designing and developing improved horizon-scanning instrumentation for space missions. (Wallops Release 66-53)

August 30: Project officials at LaRC said all picture-taking and preliminary readouts by LUNAR ORBITER I had been completed. (NASA Release 66-233)

August 31: LaRC announced scientists were receiving two frames of film from LUNAR ORBITER I on each orbit. Spacecraft's cameras had exposed 215 frames of film to the moon's surface during picture-taking assignment that began when it entered lunar orbit Aug. 14 and was announced completed Aug. 30. If spacecraft maintained present schedule, it would complete transmissions of photographs by Sept. 15. (AP, HYT, 9/1/66, 2)
1966 continued

September 2: LaRC invited four aircraft manufacturers—Boeing Co., Lockheed Aircraft Corp., Douglas Aircraft Co., and General Dynamics Corp.—to submit by Sept. 30 proposals for a research program to reduce noise generated by commercial jet transports. (NASA Release 66-242)

September 23: LaRC awarded parallel seven-month study contracts valued at $390,000 each, to Northrop Corp. and Fairchild-Hiller Corp. to design V/STOL aircraft for research on handling qualities and operation during instrument approach in the terminal area. Aircraft would be used by NASA and USAF to gather flight research information necessary to improve operation of V/STOL jet aircraft in hovering and transition speed range. (NASA Release 66-259)
APPENDIX A

LAW ESTABLISHING THE NACA

In the Naval Appropriation Act (Public No. 271, 63d Congress) approved March 3, 1915, the following provision was made for a National Advisory Committee for Aeronautics:

"An Advisory Committee for Aeronautics is hereby established, and the President is authorized to appoint not to exceed twelve members, to consist of two members from the War Department, from the office in charge of military aeronautics; two members from the Navy Department, from the office in charge of naval aeronautics; a representative each of the Smithsonian Institution, of the United States Weather Bureau, and of the United States Bureau of Standards; together with not more than two additional persons who shall be acquainted with the needs of aeronautical science, either civil or military, or skilled in aeronautical engineering or its allied sciences: Provided, that the members of the Advisory Committee for Aeronautics, as such, shall serve without compensation: Provided further, That it shall be the duty of the Advisory Committee for Aeronautics to supervise and direct the scientific study of the problems of flight, with a view to their practical solution, and to determine the problems which should be experimentally attacked, and to discuss their solution and their application to practical questions. In the event of a laboratory or laboratories, either in whole or in part, being placed under the direction of the committee, the committee may direct and conduct research and experiment in aeronautics in such laboratory or laboratories: And provided further, That rules and regulations for the conduct of the work of the committee shall be formulated by the committee and approved by the President.

"That the sum of $5,000 a year, or so much thereof as may be necessary, for five years is hereby appropriated, out of any money in the Treasury not otherwise appropriated, to be immediately available, for experimental work and investigations undertaken by the committee, clerical expenses and supplies, and necessary expenses of members of the committee in going to, returning from, and while attending, meetings of the committee: Provided, That an annual report to the Congress shall be submitted through the President, including an itemized statement of expenditures."
APPENDIX B

CHAIRMAN OF THE NACA

George P. Scriven 1915-16
Brigadier General, U. S. A.
Chief Signal Officer

William F. Durand 1916-18
Prof. and Head of Department
of Mechanical Engineering
Stanford University, Calif.

John R. Freeman 1918-19
Consulting Engineer
Providence, R. I.

Charles D. Walcott 1919-27
Secretary
Smithsonian Institution

Joseph S. Ames 1927-39
Professor of Physics
President, John Hopkins
University

Vannevar Bush 1939-41
President, Carnegie Institution
Washington, D. C.

Jerome C. Hunsaker 1941-56
Head of Depts., Aeronautical and
Mechanical Engineering, M.I.T.

James H. Doolittle 1956-58
Vice President, Shell Oil Co.
New York
APPENDIX C

MEMBERS OF IIEAC

Charles G. Abbot, 1928-1945
Joseph P. Adams, 1952-1956
John R. Alison, 1947-1948
Joseph S. Ames, 1915-1939
Henry H. Arnold, 1938-1946
Allen V. Astin, 1952-1958
Thurman H. Bane, 1919-1922
Preston R. Bassett, 1953-1956
George H. Brett, 1939-1942
Lyman J. Briggs, 1933-1945
Mark L. Briston, 1915-1916
Detlev W. Bronk, 1948-1958
William A. M. Burden, 1942-1947
George K. Burgess, 1932-1932
Vanvar Bush, 1938-1948
Leonard Carmichael, 1953-1958
John H. Cassady, 1950-1952
Virginius E. Clark, 1917-1918
Thomas S. Combs, 1952-1953
1955-1956
Karl T. Compton, 1948-1949
Edward U. Condon, 1945-1951
Donald H. Connolly, 1940-1942
Arthur B. Cook, 1931, 1934
1936-1939
Laurence C. Craigie, 1951-1954
Thomas T. Craven, 1919-1921
Frederick C. Crawford, 1954-1958
John F. Curry, 1924-1926
Ralph S. Damon, 1953-1956
Thomas W. S. Davis, 1950-1953
William V. Davis, 1956-1958
Robert E. Doherty, 1940-1941
James H. Doolittle, 1948-1958
Donald B. Duncan, 1947-1948
William F. Durand, 1915-1933
1941-1945
Oliver P. Echols, 1942-1945
Fred D. Fagg, Jr., 1937-1938
James E. Fechet, 1928-1931
Aubrey W. Fitch, 1944-1945
Paul D. Foote, 1957-1958
Benjamin D. Foulois, 1929-1930
1932-1936
John R. Freeman, 1918-1919
Clifford C. Furnas, 1956-1957
Mathias B. Gardner, 1952-1953
William E. Gillmore, 1926-1929
Willis R. Gregg, 1934-1938
Harry F. Guggenheim, 1929-1938
Lloyd Harrison, 1953-1955
John F. Hayford, 1915-1923
Ronald M. Hazen, 1946-1954
Clinton M. Hester, 1938-1940
Robert H. Hinckley, 1939-1942
Wellington T. Hines, 1957-1958
Jerome C. Hunsaker, 1922-1923
William L. Kenly, 1918-1919
Walter G. Kilner, 1939-1940
Ernest J. King, 1933-1936
Sydney M. Kraus, 1936-1943
Emory S. Land, 1923-1929
Charles A. Lindbergh, 1931-1939
William Littlewood, 1944-1953
Theodore C. Lonnquest, 1947-1952
John S. McCain, 1942-1944
Charles J. McCarthy, 1957-1958
Lawrence W. McIntosh, 1923-1924
William P. MacCracken, Jr., 1929-1938
Charles F. Marvin, 1915-1934
George J. Mead, 1939-1944
Charles T. Menoher, 1919-1921
Marc A. Mitscher, 1945-1946
William A. Moffett, 1921-1933
Denis Mulligan, 1938
Robert B. Murray, Jr., 1953-1954
Edward J. Noble, 1938-1939
Byron R. Newton, 1915-1918
Donald W. Nyrop, 1951-1952
Ralph A. Ofstie, 1953-1955
Ernest M. Pace, Jr., 1943-1944
Mason H. Patrick, 1921-1927
Carl J. Pfingstag, 1955-1957
Edward M. Powers, 1945-1949
Henry C. Pratt, 1930-1935
John D. Price, 1948-1950
Michael I. Pupin, 1915-1922
Donald L. Putt, 1949-1958
James T. Pyle, 1957-1958
Donald A. Quarles, 1954-1956
Arthur W. Radford, 1946-1947
Arthur E. Raymond, 1946-1956
Samuel Reber, 1915-1916
Francis W. Reichelderfer, 1939-1958
Delos W. Rentzel, 1948-1951
Holden C. Richardson, 1915-1917
Lawrence B. Richardson, 1944-1946
Edward V. Rickenbacker, 1956-1958
Augustine W. Robins, 1935-1939
Louis S. Rothschild, 1955-1958
Oswald Ryan, 1954
Wallace C. Sabine, 1918
Gordon P. Saville, 1950-1951
George P. Scriven, 1915-1917
Carl Spaatz, 1946-1948
George O. Squier, 1916-1918
Leslie C. Stevens, 1946-1947
Samuel W. Stratton, 1915-1931
David W. Taylor, 1917-1938
John H. Towers, 1917-1919
1929-1931
1939-1942
Nathan F. Twining, 1954-1957
Hoyt S. Vandenb eugene L. Vidal, 1933-1937
Charles D. Walcott, 1915-1927
Edward P. Warner, 1929-1945
William Webster, 1950-1951
 Oscar Westover, 1936-1938
Alexander Wetmore, 1945-1952
Ralph D. Weyerbacher, 1934-1936
Thomas D. White, 1957-1958
Walter P. Whitman, 1951-1953
Orville Wright, 1920-1948
Theodore F. Wright, 1942-1953
APPENDIX D

ENGINEERS-IN-CHARGE

LANGLEY LABORATORY

Leigh M. Griffith  1920-1926

Henry J. E. Reid  1926-1960

Floyd L. Thompson  1960-present
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