Guide to the
NASA Ames Research Center Artifacts Collection, 1939-2009
ART1387

NASA Ames History Office
NASA Ames Research Center

Contact Information:
NASA Ames Research Center
NASA Ames History Office
Mail-Stop 207-1
Moffett Field, CA 94035-1000
Phone: (650) 604-1032
Email: ARC-DL-history@mail.nasa.gov
URL: http://history.arc.nasa.gov/

Collection processed by:
NASA Ames History Office staff and interns, including Leilani Marshall, April Gage, Allison Tara Sundaram, and Danielle Lopez.

Finding aid written by:
April Gage, October 2012

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Descriptive Summary

Title:
NASA Ames Research Center Artifacts Collection, 1939-2009

Collection Number:
ART1387

Creator:
Ames Research Center

Dates:
Inclusive: 1935-2009

Extent:
645 items

Repository:
NASA Ames History Office
Moffett Field, California 94035

Abstract:
The Artifact Collection contains a wide range of objects related to the history of Ames, dated from approximately 1939 to 2009. This is an artificial collection comprised of items donated by many different organizational units and individuals associated with NACA, NASA, and Ames.

Administrative Information

Access:
Collection is open for research.

Publication Rights:
Copyright does not apply to United States government records. For non-governmental material, researcher must contact the original creator.

Preferred Citation:
Expanded:
NASA Ames History Office, NASA Ames Research Center. Moffett Field, California. ART1387, Artifacts Collection, [Container number]. [Identification of item]. [Date, if available].
Abbreviated:
NASA ARC. ART1387, [Container number]. [Identification of item]. [Date, if available].

Administrative History

NASA Ames Research Center (Ames, NASA Ames, and ARC), originally called Ames Aeronautical Laboratory (AAL), is the second oldest of NASA's ten field installations after Langley Research Center. Ames formed in 1939 by NASA's precursor organization, the National Advisory Committee for Aeronautics (NACA, pronounced en ay see ay), which was created by an act of Congress on March 3, 1915 "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" (Public Law 271, 1915).

Ames Aeronautical Laboratory, named for Joseph Sweetman Ames (long-time NACA Chairman from 1927-1939), was built during the massive mobilization effort that preceded the formal entry of the United States into World War II. Ames would focus on aerodynamics research, with an emphasis on high-speed aerodynamics, using flight research, wind tunnel testing, and theoretical investigation. Groundbreaking for the laboratory occurred December 20, 1939 in Santa Clara County, California, at the Naval Air Station Sunnyvale (NAS Sunnyvale, later renamed NAS Moffett Federal Airfield, also known as Moffett Field). By fall 1940, staff completed the first facilities, a flight research building and technical services building with machine and model shop, and commenced construction of four wind tunnels (two 7 x 10-foot tunnels, a 16-foot, and a 40 x 80-foot tunnel).

During the first six years, Ames exploded with growth and activity as it simultaneously developed the center and supported the war effort. Construction abounded and projects completed included two more wind tunnels, two laboratories, an electrical substation, and an aircraft hangar. As facilities and wind tunnels came online and the nation entered the war, staff worked feverishly to resolve various aircraft stability and control issues in concert with the military services and civilian aircraft companies. By 1946, Ames was honored with Lew Roddert's receipt of the prestigious Robert J. Collier Trophy for leading the center's development of an aircraft wing deicing system.

Throughout the next decade, Ames pursued wide-ranging challenges related to high-speed flight. Transonic and hypersonic wind tunnel facilities were designed and built, and engineers applied themselves to finding ways for jet aircraft to fly faster and faster. Engineers designed early simulators to complement tunnel and in-flight testing, employed a standardized methodology for enhancing flight research with pilot feedback, and invested in new computing facilities to automate cumbersome data reduction efforts in flight simulation work. Research at Ames broadened, with significant efforts in boundary layer research into applications beyond aircraft to rocket launched vehicles, ballistic missiles, and associated thermal protection systems. To conduct these investigations, Ames scientists and engineers designed new facilities to support atmospheric entry simulations such as ballistic ranges, shock tunnels, and an arc jet tunnel. In 1953, H. Julian Allen published the blunt-body concept demonstrating the reentry shape needed for a spacecraft to enter Earth's or another planet's atmosphere.

With passage of the National Aeronautics and Space Act in 1958 following the Soviet Union's successful Sputnik I and II satellite missions in 1957, Ames became part of the National Aeronautics and Space Administration (NASA), along with the other three NACA laboratories (Langley, Lewis, and Dryden). Under the Space Act mandate NACA laboratories were redesignated as NASA research centers (e.g., Ames was renamed NASA Ames Research Center) and given a new charter.

> ... The aeronautical and space activities of the United States shall be conducted so as to contribute materially to one or more of the following objectives:
> (1) The expansion of human knowledge of phenomena in the atmosphere and space;
> (2) The improvement of the usefulness, performance, speed, safety, and efficiency of aeronautical and space vehicles;
> (3) The development and operation of vehicles capable of carrying instruments, equipment, supplies and living organisms through space;
> (4) The establishment of long-range studies of the potential benefits to be gained from, the opportunities for, and the problems involved in the utilization of aeronautical and space activities for peaceful and scientific purposes.
> (5) The preservation of the role of the United States as a leader in aeronautical and space science and technology and in the application thereof to the conduct of peaceful activities within and outside the atmosphere.
> (6) The making available to agencies directly concerned with national defenses of discoveries that have military value or significance, and the furnishing by such agencies, to the civilian agency established to direct and control nonmilitary aeronautical and space activities, of information as to discoveries which have value or significance to that agency;
> (7) Cooperation by the United States with other nations and groups of nations in work done pursuant to this Act and in the peaceful application of the results, thereof; and
> (8) The most effective utilization of the scientific and engineering resources of the United States, with close cooperation among all interested agencies of the United States in order to avoid unnecessary duplication of effort, facilities, and equipment (Public Law 85-568, 1958).

With the transition to NASA, Ames also added public information officers to fulfill NASA's requirement to widely disseminate information about its activities.

In its first few years as a NASA center, Ames curbed some of its aeronautical research efforts and reorganized objectives to accommodate the space age by adding a manned satellite team, elevating aerothermodynamics research, and forming new vehicle environment, space sciences, and life sciences divisions. Facilities completed to support aerothermodynamics and materials research included a hypervelocity free-flight facility, another ballistics range, additional arc jet tunnels, and small wind tunnels equipped to hold gasses and function at high speeds and temperatures. Ames engineers designed a suite of flight simulators capable of combining mechanical and computer-simulated movement to achieve up to six degrees of motion. The many uses for flight simulators, which continued to evolve, included training America's astronauts. Later, in 1965, a new life sciences research laboratory was dedicated and centrifuges, such as the flight and guidance centrifuge that came online in 1971, supported emerging studies in exobiology and human factors research.

With an impressive and growing collection of wind tunnels, laboratories, computing and other facilities, and with experience in a wide array of basic and applied research applications, the center had laid a firm foundation from which it continued to grow its

research and program management capabilities over the decades. Ames has led NASA's efforts in many areas, such as astrobiology, space life sciences, human factors research, planetary science and exploration, small satellites, materials science, nanotechnology, aeronautics, air traffic management, computational fluid dynamics, supercomputing, and information technology applications. Highlights of the center's activities include the wingless M2-F2 lifting body craft Ames conceived, tested, and built in the 1950s, which contributed to the development of the reusable Space Shuttle design that first flew in 1981. Aerothermodynamics and materials research conducted by the center produced thermal protection materials used on reentry vehicles from the Apollo capsules and Space Shuttle, to all of NASA's planetary probes and Mars landers. Ames designed, built, and managed eight Pioneer spacecraft in the 1960s and 1970s, which studied the sun, Venus, and the outer planets and achieved some impressive firsts. Pioneers 10 and 11 were the first spacecraft to safely travel through the asteroid belt, first to encounter Jupiter and Saturn, and first manmade objects to pass beyond the orbit of Pluto. The Pioneer Venus orbiter and multiprobe craft were first to map Venus and characterize the planet's atmosphere. Ames contributed to the design and execution of many other small satellite missions, such as Viking 1 and 2, all of the Mars exploration rovers, Galileo, Stardust, Lunar Prospector, and LCROSS, as well as telescopes, such as Spitzer and Kepler. Ames launched a fleet of airborne science platforms, including Kuiper Airborne Observatory (KAO), the first major airborne astronomical research laboratory aboard a modified Lockheed C-141. Among the accomplishments of KAO, which completed over 1,400 flights, was the discovery of the rings around Uranus and scientific data concerning conditions in space contributing to the formation of stars. At present, the next generation platform designed by Ames is in the skies in the form of a modified Boeing 747SP aircraft called the Stratospheric Observatory for Infrared Astronomy.

From the Apollo lunar surface magnetometers to various devices like the chemistry and mineralogy experiment on Mars today, Ames has designed scientific instrument packages for conducting investigations about the composition and character of other planets and phenomena in our solar system. Since 1971, Ames scientists have used data from NASA's exploration of our solar system with numerical modeling and supercomputing, to produce sophisticated analyses of the compositions, atmospheres, and other complex characteristics of outer and inner planets, including Earth.

Since the 1940s, Ames conducted extensive tests of air and spacecraft in its wind tunnels and developed various techniques to automate data reduction and visualization. In the 1970s, Ames developed the field of computational fluid dynamics. In addition to a long legacy of airframe testing and flight simulation, the center has advanced new aircraft designs, such as short-haul/takeoff research aircraft like the XV-15 Tilt Rotor aircraft in use today.

Many three-dimensional objects have been produced in support of the center's diverse areas of research and investigation for NACA and NASA, from the onset of the Second World War through the dawn of the space and information ages, and beyond. Artifacts such as models, artwork, and instrumentation were designed for testing, conceptual, and educational purposes. These objects have been created at Ames in facilities such as instrumentation

laboratories, machine shops, and model shops, and made to order by outside contractors, from local artists to aerospace companies.

Sources Consulted

Bugos, Glenn E. Atmosphere of freedom: 70 years at the NASA Ames Research Center. Washington, D.C.: NASA SP-2010-4314, 2010.
Hartman, Edwin. Adventures in research: A history of Ames Research Center, 1940-1965. Washington, D.C.: NASA SP-4302, 1970.
Public Law 271, 63rd Congress. H.R. 20975, March 3, 1915.
Public Law 85-568, 85th Congress, H.R. 12575, July 29, 1958.

Scope and Content

The Artifact Collection contains 645 objects generated by the research, programs, accomplishments, and outreach efforts at Ames since the NACA groundbreaking on December 20, 1939. Materials in this collection are arranged into eight series: Artwork, Models, Scientific Instruments, Equipment, Awards, Ephemera and Commemorative Items, Exhibits and Signage, and Miscellaneous. This collection of objects provides three-dimensional examples of the center's technical pursuits and achievements. It contains tools used in research and development, technology models and spares, artworks depicting designs and plans, and honors received for successful efforts. Also included are signage, mementos, and ephemera commemorating anniversaries, missions, and collaborations.

Represented across the collection are Ames contributions to science and engineering for nearly three quarters of a century. Evidence of the center's involvement in aeronautics research includes artwork and models of innovative aircraft designs, as well as awards for engineering breakthroughs. Items related to planetary exploration include artifacts from the Pioneer Project era, such as scale models, several original paintings depicting artist conceptions of planetary encounters by various Pioneers, and prestigious awards. While aeronautics research and space projects are well represented, the collection also reflects the broad array of other competencies at Ames, such as supercomputing, airborne science applications, and human factors research.

System of Arrangement

The collection is arranged into eight series:
I. Artwork
II. Models
III. Scientific Instruments
IV. Equipment
V. Awards
VI. Ephemera and Commemorative Items
VII. Exhibits and Signage
VIII. Miscellaneous

Series Descriptions

Series I: Artwork, 1946-1994, 74 items.

This series consists of original artwork, including seventy paintings, one lithograph, one sculpture, and drawings, the bulk of which were created in the 1970s and 1980s. Most of the works in this series were commissioned by Ames for practical purposes, unlike NASA's art program launched in 1962 by administrator James Webb, in which renowned artists were invited to enrich the historical record of the momentous occasion of humankind's ascent into space. Ames hired local artists to depict projects and technologies pursued by the center's scientists and engineers. The works were used as illustrations for technical reports and presentations, and for publicity pieces, such as brochures, press releases and other informational handouts. The Public Information or Public Affairs Office would locate, hire, and pay the artists, and provide reproductions of their works, while scientists or engineers from the various units, such as the Pioneer Project Office, Space Projects Division, or Space Sciences Division, would help define the images they wanted illustrated. According to artist Rick Guidice, who produced the majority of the pieces in this series, scientists and engineers provided technical instruction and sometimes sketches of what they needed. And, in the 1970s and 1980s, the Public Affairs Office would pay artists such as Guidice about $800-$1500 per painting. Once completed, many of the works were professionally photographed by Ames photographers. While photographic reproductions were systematically numbered, cataloged, and archived, the paintings themselves were not, so this series represents a small portion of artwork commissioned by Ames.

Subjects range from astronomical artworks illustrating spacecraft and space scenes, to aircraft, SETI installations, and existing or proposed research facilities. The Pioneer Program managed by Ames is heavily represented in this series, with depictions of spacecraft, trajectories, and planetary encounters. While most provide concrete representations of technologies and research endeavors, some convey concepts, such as human exploration. For example, a collection of paintings and illustrations created by Rick Guidice for two different brochures juxtaposes the series of Pioneer spacecraft (Pioneers 1-13) flying through space with images of human exploration technologies over the centuries, such as dog sleds, ocean ships, hot air balloons, and covered wagon trains.

Images of space settlements are also well represented in this series. In the 1970s Ames researched the feasibility of setting up orbital space colonies in a series of summer studies, the first being a joint study hosted by Ames and Stanford University in 1975, with Gerard K. O'Neil from Princeton University as a participant. Paintings by Rick Guidice and Don Davis illustrating the settlement designs came out of these efforts. Depicted are orbital colonies, with their residential and work modules, farming, animal husbandry, and mining operations, as well as support apparatuses necessary for building, powering, and supplying settlements.

Artists identified include Robert Bausch, Chesley Bonestell, Christopher Cross, Don Davis, Carter Emmart, Michael Fornalski, Gebing, Rick Guidice, Peter Gutkin, Attila Hejja, Paul Hudson, Lucille Maritz Mastin, Ludek Pesek, and Robert Rauschenberg. The bulk of the items were created by Rick Guidice.

Other items of note are:

- Lucille Maritz Mastin drawing (pencil on mylar, 1946) of the Twelve Foot Wind Pressure Tunnel, depicting this NACA-era wind tunnel in detail, with cutaways exposing the inside and showing machinery, controls, operators, and the wind tunnel propeller blades.
- Robert Rauschenberg lithograph (1970), "White Walk" from the Stoned Moon Series, signed and dated by the artist. Edition 19 of 53, this three-color lithograph represents a celebration of NASA's Apollo mission to the moon. The series was commissioned by NASA Headquarters as part of the NASA Art Program.
- Chesley Bonestell painting (1976) entitled "Pittsburgh at L-2" signed by the artist. Depicted here is a machine with international markings docked at an asteroid to conduct mining operations. Three astronauts engaged in a space walk float in formation like sprightly acrobats at one end of the station, while a red and white spaceship approaches.

Series II: Models, 1957-2009, 361 items.
This series consists of aircraft, spacecraft and other models created from about 1957 through 2009. Included are wind tunnel models, desktop, and large display models (some to scale), partial- to full-scale engineering mockups, and technical models.

Wind tunnel models include a Galileo Jupiter probe descent module, an unidentified space probe, M2 and HL-10 lifting bodies, an X-36 aircraft, a McDonnell Douglas 279-3 aircraft, airfoils, a helicopter rotor, and an aircraft flap. These are variously composed of steel, stainless steel, brass, aluminum, composite, and wood, and range in size from a few inches to several feet across, with some weighing hundreds of pounds.

Aircraft display models include lifting bodies and experimental space plane designs (M2, X-38 Crew Return Vehicle, Rockwell X-30 National Aero-Space Plane, Orbital Sciences X-34), oblique wing designs, supersonic transport vehicles, airborne science platforms (Boeing DC-8 Airborne Laboratory, C-130 Earth Resources Aircraft, Lockheed U-2 Earth Survey Aircraft/ER-2 High Altitude Research Aircraft, Boeing 747SP Stratospheric Observatory for Infrared Astronomy), experimental aircraft (Martin Marietta X-24C Hypersonic Research Vehicle, Grumman X-29A, Sikorsky Rotor Systems Research Aircraft X-Wing, McDonnell Douglas X-36 Tailless Fighter Agility Research Aircraft, Bell XV-15 Tilt Rotor), and others such as the Northrop T-38 Talon, Lockheed C-130 Hercules, De Havilland Canada DHC-5 Quiet Short-haul Research Aircraft, and the Antonov An-225 Mriya CCCP-82060 heavy lift Soviet cargo plane, with space shuttle "Buran" mounted on top. These models are composed of wood, plastic, and metal, and many have display stands.

Spacecraft models include Explorer 12, Mariner 4, Pioneers 6-9, 10 and 11 (Pioneers Jupiter and Saturn), 12 and 13 (Pioneer Venus orbiter and multiprobe bus), Viking, Galileo, and versions of the Infrared Astronomical Satellite. These models are made of metal and plastic, and many have display stands with identifying placards.

The bulk of this series is a collection of 278 plastic models, comprising tiny replicas of international military and domestic aircraft designs from 1908 through 1946.

Items of note:

- A multi-colored plexiglass technical model built by Charles P. Sonnett that illustrates a "collision-free" magnetohydrodynamic shock observed by the three-axis fluxgate magnetometer on Mariner II.
- A full-scale engineering mockup of Pioneers 6-9, a series of identical spin-stabilized, solar cell and battery-powered satellites launched in the 1960s to orbit the Sun and study solar and interplanetary phenomena such as the solar wind and interplanetary magnetic field. This mockup is constructed from actual flight materials, such as real solar cells, and appears to be fully wired and instrumented.
- A full-scale engineering mockup of internal features of the Galileo Jupiter Probe's descent module, constructed out of wood with paper markers.
- Scale models used by the Columbia Accident Investigation Board to study the 2003 Columbia Space Shuttle accident. This set, which was used by G. Scott Hubbard, includes Space Shuttle wing leading edge components composed of plastic, a reinforced carbon carbon (RCC) T-seal cross-section, and a reproduction of the foam believed to have struck the shuttle's wing.

Series III: Scientific Instruments, 1940s-1980s, 65 items.
This series consists of scientific instruments that were either created or used by people at NASA Ames. Included are instruments designed by the center's scientists and engineers for space science applications, such as spacecraft scientific experiment flight spares and engineering mockups. Other tools used in the course of research and development efforts include various manual and electronic calculators, computer components, balances, galvanometers, and surveying instruments.

Items of note:

- Prototype of the lunar surface magnetometer designed during the Apollo program. This type of magnetometer accompanied Apollo missions 12, 15 and 16 as part of the Apollo Lunar Surface Experiments Package (ASLEP), housed in the Lunar Module.
- Pioneer era science instruments, such as a cosmic dust detector (Pioneer 8-9), plasma analyzer (Pioneer 10-11), Geiger Tube Telescope (Pioneer 10-11), and nephelometer (Pioneer Venus).
- Galileo Jupiter space probe flight spares, such as an atmospheric structure instrument with temperature sensor.

Series IV: Equipment, 13 items.
This series consists of pieces of equipment used in flight research and testing, airborne science, and virtual reality applications from about the 1940s through the 1980s. As with the scientific instruments series in this collection, some of the objects were designed by people at Ames. Of note is a virtual reality data glove designed during the mid 1980s for use in the Virtual Environment Workstation (VIEW), as a step toward using robotics to remotely automate space stations some day. Also of note is a Space Shuttle Spacelab life science

experiment module. Standing approximately twelve feet high and three and a half feet wide, this massive piece of hardware was designed for life science research in zero gravity. Included is a glove box type of enclosure, electronics box assembly, and power switching panel.

Series V: Awards, 1935-2002, 36 items.
This series consists of plaques, trophies, medals, certificates and other commendations conferred on NASA Ames and individuals. Some honors are internal to NASA but most are from various national and international institutions. Commendations for the Pioneer missions (10-13) are among the most prestigious awards in this collection.

Items of note:

- Langley Gold Medal awarded to Joseph Sweetman Ames by the Smithsonian Institution in 1935. Since 1927, the award has only been given to twenty one individuals.
- Collier Trophy given to Lewis A. Rodert for "His pioneering research and guidance in the development and practical application of a thermal ice-prevention system for aircraft."
- Columbus medal and certificate given to Ames Research Center by the City of Genoa, Italy for engineering humankind's first encounters with the planet Jupiter with the flights of Pioneers 10 and 11.
- Diplomas (Diplome d'Honneur) awarded to Ames from the Fédération Aéronautique Internationale (FAI): one in 1979 for the Pioneer missions to Venus and another in 1999 for the Lunar Prospector mission.

Series VI: Ephemera and Commemorative Items, 1975-2003, 19 items.
This series mainly includes plaques, coins, certificates, patches, postage stamps, and other items commemorating anniversaries, missions, and collaborations. Included are framed replicas of the gold-colored anodized aluminum Pioneer 10 plaque, dubbed the "First Work of Art to Leave the Solar System;" handmade plaques commemorating the 50th anniversary of Ames; a plexiglass cylinder commemorating the 30th anniversary of the Search For Extraterrestrial Intelligence (SETI) program, which began at Ames; and a plaque dedicating an Ames research facility to the memory of Carl Sagan (the facility, sited for the northwest portion of the Ames campus near building N249, was never built). Of note is a framed National Advisory Committee for Aeronautics (NACA) testimonial in tribute to Joseph S. Ames (original, circa 1939), which is signed by special committee members, including Vannevar Bush, Charles A. Lindbergh, and Orville Wright.

Series VII: Exhibits and Signage, 1946-2009, 64 items.
This series is composed of educational exhibits, as well as signage and wall display material put on view around the center over the years. Included are a large, wooden sign with NACA logo hand-carved in the shape of the NACA wings, framed items such as center director portraits, 70th anniversary signage, and exhibits featuring such things as reusable thermal protection tiles, ablated materials, casts of tektites found around the world, computer arrays, and the Pioneer 11 trajectory.

Series VIII: Miscellaneous, 13 items.
This series contains an assortment of miscellaneous objects: thermal protection material samples, such as Space Shuttle tiles and Avocat, a table with beveled glass top and legs made from wind tunnel blades, and desktop sculptures featuring core capabilities of Ames.

Indexing Terms

The following terms may be used to index this collection.

Corporate Name
Ames Research Center
United States. National Advisory Committee for Aeronautics

Subjects
Aerospace--Equipment and supplies
Aerospace--Instruments
Aircraft--Models
Ames Research Center--Art collections
Ames Research Center--Awards
Astronomy in art
Engineering models
Ephemera
Commemorations
Scientific apparatus and instruments
Signage and signboards
Space vehicles--Coatings
Space vehicles--Models
Wind tunnel models

Separated Material

None.

Related Collections

AFS1070.8A: Archives Reference Collection

The Smithsonian National Air and Space Museum Object Collections, such as the Human Spaceflight and Space Science Collections, contain related material.

The Computer History Museum holds objects related to computing at Ames.

The Moffett Field Historical Society Museum holds some objects related to aeronautics and space flight research conducted at Ames.