National Aeronautics and Space Administration

# Hangar 1

## Moffett Field Naval Air Station

**Historic American Engineering Record #CA-335**

**www.nasa.gov**

# HANGAR 1
# NAS MOFFETT FIELD

**Location:** Hangar 1 is located on the property of the former Naval Air Station Moffett Field (NAS Moffett Field). The property is presently part of the National Aeronautics and Space Administration's (NASA) Ames Research Center at Moffett Field. Moffett Field is located between the cities of Mountain View and Sunnyvale, Santa Clara County, California.

**Present Owner**: NASA

**Present Use**: Vacant

**Significance**: The following Statement of Significance is excerpted from the July 1994 National Register nomination for NAS Moffett Field (formerly NAS Sunnyvale) prepared by Bonnie Bamburg of Urban Programmers of San José, California:

"In the nation's quest to provide security for the lengthy expanse of its coastlines the opportunity for air reconnaissance was realized by the futuristic Admiral William A. Moffett. Through his efforts, two Naval Air Stations were commissioned in the early 1930's to port the two U.S. Naval Airships (dirigibles) he believed capable of this challenge. The Naval Air Station Sunnyvale was the Pacific Coast location selected, designed, and developed to port the U.S.S. MACON (ZRS 5). The immense structure, Hangar 1, designed to house the U.S.S. MACON, with its larger counterpart in Akron, Ohio, remain the two largest structures in the United States without internal support. At the onset of WWII, the base was expanded with Hangars 2 and 3 which were designed to accommodate the smaller blimps and balloons used for reconnaissance, until the range of heavier than air aircraft (airplanes) was sufficient to patrol the coast. The significance of the U.S. Naval Air Station Sunnyvale Historic District is attributed to its association with the expanding defense capabilities of the U.S. Navy, the engineering technology found in lighter than air ships, the design of the hangar and system for porting the dirigible and in the plan and architectural style of the station designed to support this defense technology. The significance of Hangar 1, was recognized when it was designated a Naval Historical Monument. It has been designated a California Historic Civil Engineering Landmark by the San Francisco section, American Society of Civil Engineers, and has been determined eligible for listing in the National Register of Historic Places by the U.S. Navy in consultation with the California State Historic Preservation Officer. The entire historic district is supported for listing in the National Register of Historic Places at the National level of significance under Criterion A for its association with coastal defense and naval

technology that has made a significant contribution to the broad pattern of our history; and Criterion C reflecting the distinctive type, period, method of construction and high artistic values that are represented in the 1933 station plan and buildings. In 1942, the station was recommissioned, U.S. Naval Air Station, Moffett Field, in recognition of the significant contribution to naval history by Admiral Moffett, contributions that have gained him the unofficial title, "Father of Naval Aviation."

## PART I. HISTORICAL INFORMATION

### A. Physical History

#### 1. Date of erection:

Construction of Hangar 1 began on October 5, 1931. It was commissioned for use on April 12, 1933, and officially completed on July 1, 1933.

#### 2. Architect:

Hangar 1 was designed by staff architects and engineers of the Department of the Navy's Bureau of Yards & Docks. Rear Admiral A.L. Parsons, Chief of the Bureau of Yards & Docks, served as the designer-in-charge. Lieutenant Commander Earl L. Marshall was officer-in-charge of construction. The principal designer was Ernest L. Wolf, a civil engineer employed by the Goodyear-Zeppelin Corporation of Akron, Ohio.

#### 3. Original and subsequent owners:

Originally constructed by the U.S. Navy as the centerpiece of NAS Sunnyvale, the U.S. Army took over the administration of the base in 1935 following the destruction of the dirigible *U.S.S. Macon*. The base remained under Army control until 1942 when the Navy reassumed control of the base. The Navy retained ownership of NAS Moffett Field until 1994, when the base was closed as part of the Base Realignment and Closure (BRAC) process. At that time, the Navy turned NAS Moffett Field over to NASA.

#### 4. Original and subsequent occupants:

From 1933 to 1935, the Navy used Hangar 1 to house the *U.S.S. Macon* and its associated Sparrowhawk aircraft. After the Army assumed control of NAS Sunnyvale in 1935, it used the building to house training aircraft. Following the Navy's resumption of control of the base in 1942, it housed blimps in Hangar 1. By the end of the Second World War, the Navy no longer housed blimps in the hangar, but stored training aircraft of various types instead. From 1945 until NAS Moffett Field was decommissioned in 1994, the Navy used Hangar 1 to house a variety of aircraft, in particular P2 and P3 Orion surveillance aircraft.

## 5. Builder, contractor, suppliers:

Raymond Concrete Company completed general site grading for Hangar 1, constructed the concrete slab floor and foundations and installed the tracks for the doors and the tug. Wallace Bridge & Structural Steel Company built Hangar 1's massive steel frame. Siems-Helmers, Inc. attached the "Robertson Protected Metal" (RPM) wall cladding. E. C. Nichols installed the hangar lights and power system, and Otis Elevator Company was responsible for installing the two parabolic-track elevators within the building.

## 6. Original plans and construction:

The original design and construction drawings for Hangar 1 were prepared by the Department of the Navy's Bureau of Yards & Docks, Twelfth Naval District Public Works Office at San Bruno, California. The drawings were approved by Rear Admiral A. L. Parsons, who signed them off on August 5, 1931. Although fifty sheets were prepared, only a handful are known to survive today. Most of the drawings that survive consist of engineering details. Few illustrate the original plans, exterior elevations, or sections.

Constructed to house the airship *U.S.S. Macon*, Hangar 1 has an immense rectangular footprint measuring 1,133 ft long by 308 ft wide, and it rises to 198 ft from the floor to the top of the trusses. Bands of rectangular, steel-framed industrial windows and steel pedestrian and vehicular doors line the east and west walls. The north and south walls are comprised of pairs of colossal "orange peel" doors.

Within the interior, reinforced-concrete perimeter foundations support the regularly spaced steel parabolic trusses that extend along the length of the building. Designed to accommodate the Navy's largest dirigibles, the interior was kept entirely free of columns or other obstructions. The interior of the hangar was originally open with the exception of two-and three-story buildings located under the trusses along the east and west walls. These structures housed machine shops, maintenance shops, laboratories, offices, classrooms, and storage rooms. Steel stairs and two elevators provided access to the network of catwalks that access the ceiling-mounted cranes, light fixtures, and other roof-mounted mechanical equipment. Steel rails ran the length of the building, serving to draw the immense dirigible into the interior.

Outside Hangar 1, steel rails once extended from the building's interior to a mooring mast that was originally located on the landing slip to the south. Still extant are two stucco-clad floodlight/control towers located immediately east of the hangar (Buildings 32 and 33). Personnel assigned to these towers used flags, floodlights and mechanical equipment to assist dirigible crews to safely land at NAS Moffett Field. The towers are small, with footprints of approximately 20 ft x 20 ft , with smaller round observation towers protruding from their roofs. Both are contributors to the NAS Sunnyvale (Moffett Field) National Register Historic District.

## 7. Alterations and additions:

The exterior of Hangar 1 remains largely unchanged, although a small number of steel and glass canopies have been added above existing doors. Some doors and windows have also been replaced. The tracks that led to the mooring mast, as well as the mooring mast itself, have been removed. Within the interior, since the end of the Second World War, several contemporary one-and two-story wood-frame offices and training rooms have been constructed in the northerly portion of the hangar's interior. The original office and shops structures have also been remodeled with contemporary finishes, including gypsum board partition walls, vinyl base moldings, and suspended acoustical ceilings. These non-contributing materials replaced original plaster and fiberboard interior walls and ceilings.

## B. Historical Context:

*Lighter-Than-Air Aviation:*
American military use of what would eventually be called "Lighter-than-Air," or "LTA," technology dates back to the Civil War, when the Union Army used hydrogen-filled balloons with suspended wicker baskets for reconnaissance purposes. However, it was not until after the First World War that the Navy first began to experiment with LTA technology on a large scale. Hangar 1 at NAS Moffett Field is one of the most significant structures to be built for the Navy's short-lived but influential LTA program, which thrived between the First and Second World Wars.

LTA technology was first put to the test on a major scale by the German military during the First World War. In addition to traditional reconnaissance missions, German forces used large hydrogen-filled dirigibles for ferrying cargo and for a handful of bombing raids over London. Known as "Zeppelins" and named for their maker, Ferdinand Graf von Zeppelin, German successes with rigid-hulled dirigibles during wartime spurred the adoption of LTA technology in the United States, England, France and Italy after the First World War. After the war, Germany remained at the forefront of civilian applications of LTA technology, building a large fleet of Zeppelins for commercial transatlantic passenger service. Germany's LTA program came to a dramatic end on May 6, 1937, when the *Hindenburg* went up in flames as it attempted to land at Lakehurst, New Jersey.

Inspired by German successes with LTA technology during the First World War, the U.S. Navy embarked upon an exploration of potential LTA applications during the 1920s. Valued for their speed and range without refueling (up to ten thousand miles), dirigibles were thought to be ideal for coastal surveillance and anti-submarine patrols. LTA aircraft were more effective in reconnaissance work than conventional propeller-driven aircraft because they could cruise at slower speeds without stalling and patrol vast sections of ocean and coastline without refueling.

As early as the 1920s, the Navy developed a plan for dealing with potential war in the Pacific with Japan. Nicknamed Plan Orange, the strategy

involved dispatching an advance squadron of airships to determine the location of Japanese battle groups before sending in conventional attack aircraft. The first two dirigibles specially built for this purpose were the *U.S.S. Shenandoah* and the *U.S.S. Los Angeles*. Commissioned by the Navy in 1923 and 1924, the airships were promptly nicknamed "dreadnoughts of the sky." Although designed with American military objectives in mind, both were built in Germany and delivered as part of its war reparations to the United States. The *U.S.S. Shenandoah* crashed less than a year after it was commissioned, on September 3, 1925. Used primarily for training purposes, the *U.S.S. Los Angeles* was grounded in 1932 and eventually dismantled at NAS Lakehurst in 1939.

*U.S.S. Akron and U.S.S. Macon:*
This strategy of using dirigibles as the advance reconnaissance wing of the Navy was carried a step further with the development of the *U.S.S. Macon* and *U.S.S. Akron* by the Navy in 1929. Capable of launching and retrieving their own fixed-wing aircraft, these most up-to-date dirigibles served as de facto airborne aircraft carriers. Designed and built in Akron, Ohio, by the Goodyear-Zeppelin Company (a joint American and German venture), the *U.S.S. Akron* and *U.S.S. Macon* were each powered by eight engines providing a total of 4,500 horsepower. Both could achieve top speeds of 72 knots, or 85 miles per hour. Fully loaded, the dirigibles could carry sixty tons of fuel, giving them a range of about 11,000 miles. Particularly vulnerable to attack due to their size and relative slowness, both were armed with sixteen 50-caliber machine guns and five specially designed Curtiss F9C Sparrowhawk fighter planes that could be launched and recovered through an ingenious hook system called a "trapeze." The airships were each manned by twelve officers and forty-five enlisted men. Flying at top speed, with their aircraft positioned sixty miles out on each beam, the airships could provide an effective surveillance sweep of sixty to 180 miles.

Commissioned in late October 1931, the *U.S.S. Akron* was built first. Stationed at NAS Lakehurst, New Jersey, the Navy used the *U.S.S. Akron* for tactical support missions, sending it and its crew to participate in naval maneuvers in the Caribbean and Pacific throughout the first half of 1932. Unfortunately, being especially vulnerable to electrical storms, the early dirigibles were not especially safe. On April 4, 1933, the less than two-year-old dirigible embarked on a trip from Lakehurst to Rhode Island. While flying over the Atlantic coast of New Jersey, the *U.S.S. Akron* encountered a major electrical storm. Although its crew fought a valiant battle to keep the airship aloft, it crashed tail-first into the waters off Atlantic City, taking the lives of all but three of the seventy-six men on board, including Rear Admiral William A. Moffett, Chief of the Navy's Bureau of Aeronautics and a champion of LTA technology.

The *U.S.S. Macon*, the 6,500,000 cubic-foot sister ship of the *U.S.S. Akron*, was also built in Akron, Ohio. Its maiden voyage inauspiciously followed the destruction of its sister ship by only a few weeks. After several test flights, the *U.S.S. Macon* was commissioned in June 1933. Initially based at NAS Lakehurst, the *U.S.S. Macon* was soon transferred to the West Coast; it arrived at NAS Sunnyvale to much fanfare on October 15, 1933, after a 70-

hour cross-country flight. While stationed at NAS Sunnyvale, the *U.S.S. Macon* was housed and maintained in the newly completed Hangar 1.

Throughout the winter of 1933-34, the *U.S.S. Macon* participated in training exercises throughout the Pacific to test its scouting abilities. In July 1934, its crew astounded Navy brass by intercepting the *U.S.S. Houston* (which was carrying President Franklin D. Roosevelt) during a long-distance training mission across the Pacific. The *U.S.S. Macon* continued to take part in training exercises throughout 1934 and early 1935. Its speed and range, enhanced by its squadron of five Sparrowhawks, proved the airship's ability to locate fleets and individual vessels, a skill that could be crucial to winning a war in the Pacific. Like its sister ship the *U.S.S. Akron*, the *U.S.S. Macon* survived only a short time. On February 12, 1935, while en route to Sunnyvale after completing a training mission, the *U.S.S. Macon* encountered a storm off Point Sur, California. The wind tore off one of the airship's fins and the dirigible crashed into the ocean. Although most of the *U.S.S. Macon's* crew was saved, the crash, following so soon after the destruction of the *U.S.S. Akron*, effectively ended the Navy's LTA program at this time.

*NAS Sunnyvale:*
Even before the *U.S.S. Akron* and the *U.S.S. Macon* were authorized in 1929, the Navy began searching for suitable locations for dirigible bases across the continent. With one existing LTA base on the East Coast, at Lakehurst, New Jersey, the Navy identified the Midwest and Pacific Coast as likely candidates for new bases. The first all-new LTA base outside Lakehurst was built at Akron, Ohio; not coincidentally the home of the Goodyear-Zeppelin works.

With bases established on the East Coast and in the Midwest, the Navy turned its attention to the West Coast. Japanese expansionism in Asia and the Pacific alarmed American military officials, especially given the largely unguarded expanse of Pacific coastline between Puget Sound and the Mexican border. In 1929, a site selection committee headed by Admiral William A. Moffett studied ninety-seven locations along the coast. Gradually, the committee narrowed this number to two potential sites: the first being a ranch in the Santa Clara Valley, near the small town of Mountain View; and the other being a rectangular tract comprised of 2,032 acres on Kearny Mesa, eleven miles north of downtown San Diego (presently the site of the Marine Corps Air Station Miramar).

Although the Santa Clara Valley tract possessed several advantages, including more level topography and better meteorological conditions, the Kearny Mesa property was located much closer to the Navy's Pacific Fleet headquarters in San Diego. However, supporters of the Santa Clara Valley site included many prominent local politicians (led by San Francisco mayor James "Sunny Jim" Rolph) and business people, led by a real estate broker named Laura Whipple. Well-aware that a dirigible base would increase land values in the still-rural Santa Clara Valley, Whipple touted the site's suitability for dirigible aviation, including unobstructed approaches over water, abundant fresh water supplies, direct rail access, and good flying weather for most of the year. San Diego officials upped the ante by

offering Kearny Mesa to the Navy at no cost. In response, Bay Area governments from four surrounding counties, including Santa Clara, San Mateo, San Francisco, and Alameda Counties, began raising funds to purchase the Sunnyvale site for donation to the Navy.

The Bay Area consortium, known as the "Landholders Commission," eventually raised $470,000 to purchase an option for 1,000 acres of Rancho Ynigo, a level tract of farmland located right on San Francisco Bay between the communities of Sunnyvale and Mountain View. Originally granted in 1844 by the Mexican government to Lupe Ynigo, a member of the Ohlone tribe, Rancho Ynigo was a relatively small ranch (originally only 1,700 acres). The ranch was, however, very notable in the history of California as one of only a handful of Mexican land grants given to a Native American.

On December 12, 1930, after three years of study, the House of Representatives approved a bill sponsored by San José Congressman Joseph Free to accept the Mountain View site. A year later, in February 1931, President Herbert Hoover signed a bill authorizing the acceptance of 1,000 acres of Rancho Ynigo from the Landholders Committee. On August 2, 1931, the Landholders Committee paid $476,065.90 for the land and immediately transferred it to the Navy for the nominal sum of $1. The proposed new Navy base was welcomed by local residents, many of whom believed that its construction and subsequent operation would bring hundreds and perhaps even thousands of much-needed jobs and related federal spending to Depression-wracked Northern California.

*Construction of Hangar 1:*
Although the new base was located closer to Mountain View than to Sunnyvale, Navy officials pushed for omitting the word "mountain" from the station name because they feared that it would suggest to Congress that the site was ringed with mountains and therefore unsafe for LTA aviation, resulting in a vote against funding its construction. The new facility was therefore named NAS Sunnyvale. Congress appropriated $5 million to develop the station in the summer of 1931. The Bureau of Yards & Docks subsequently went to work designing the buildings, landscapes, utilities, and circulation network for the base.

The Navy put Lieutenant Commander Earl Marshall in charge of designing the base, with assistance on Hangar 1 provided by Ernest Wolf, an engineer on staff with the Goodyear-Zeppelin Corporation. Unquestionably the most important building on the base, Hangar 1 was designed in large part by Dr. Hugo Ekener, a German immigrant engineer at Goodyear-Zeppelin in Akron. Ekener's design, which was very similar to the dirigible hangar at NAS Akron, was to be the largest enclosed clear-span volume in the United States. Ekener's scheme used massive parabolic trusses to support the building's steel exterior membrane. Although intended to be an utterly utilitarian building, the use of the parabolic trusses gave Hangar 1 a modernistic streamlined shape resembling the dirigibles that would eventually be housed there.

On August 7, 1931, the Navy solicited bids for the construction of Hangar 1, the first building to be built at NAS Sunnyvale. The hangar would cost

$2.25 million to build, nearly half the total amount appropriated to construct NAS Sunnyvale. Of this amount, $1,116,044 went to the Wallace Bridge & Structural Steel Company of Seattle to fabricate the steel trusses, framing, and doors. Seims-Heimers, Inc. of San Francisco received $398,937 to construct the roofing and windows. The remainder of the money went to various other contractors for site grading work, concrete foundations and floor slab, light fixtures and power distribution systems, carpentry work to build the office and shops buildings, railroad tracks, and fabrication of a mooring mast.

Construction commenced on October 5, 1931, with the driving of the first stake into the ground by Mr. Wolf. Work would continue for the next year and a half. After the groundbreaking, bulldozers roared into action, converting acres of agricultural land into the Navy's newest airfield. During grading and construction, crews encountered dozens of Indian artifacts, which were given to Stanford University, testifying to the occupation of the area by untold generations of Native Americans.

Construction of Hangar 1 required about 20,000 tons of structural steel and about 25,500 cubic yards of concrete. The hangar was constructed using an innovative building tool—a huge timber traveler mounted on eight fifty-ton railroad flatcars running on three parallel railroad tracks. Weighing 500 tons, standing 194 ft high, and mounting three stiff-leg derricks, the traveler enabled the installation of complete 72 ft-long bay assemblies, each consisting of a three-hinged arched truss resting on rigid A-frames, roof members, and catwalks. The assemblies weighed some 350 tons but the traveler could mount each one in as little as three-and-a-half days. The traveler was set perpendicular to the walls of the hangar and moved north to south, seventy-two feet at a time, allowing more efficient construction of the hangar framework. The building was divided into three separate sections of truss and framework, with expansion joints running through the entire arched profile. The truss and sheathing was supported at ground level on a 30 in. wide concrete wall, which in turn was supported by continuous concrete footings. Tunnels used for steam pipes, helium deflation pipes, and other service systems were installed in the concrete foundation.

The "orange-peel" doors were also put into place by the traveler. The doors consisted of two independent leaves weighing about 500 tons each, which run on a curved track. When operational, each leaf moved at approximately twelve feet per minute and took about twelve minutes to fully open. Each leaf was operated by a 250-horsepower rack and pinion motor.

Two standard gauge railroad tracks, spaced 80 ft apart, were installed through the hangar and extended beyond it at both ends for nearly a half mile, terminating at the two mooring circles. To the south of the hangar, a massive nine-story mooring mast was installed which allowed the dirigibles to be secured by the nose and from this point, towed by motorized tugs into the hangar. The mooring mast moved along the railroad tracks and facilitated the transport of the ship into the hangar.

The interior of the hangar was designed to house workshops, storage spaces, and special auxiliary apparatuses such as an air-conditioned storage vault for spare gas cells. Today this storage vault is referred to as the Cork Room, the walls being encased in roughly six inches of cork with oak flooring. Upon completion of the hangar structure in 1932, extensive service systems such as electrical lighting and power systems were installed.

Although only partially complete, NAS Sunnyvale received its first visit from a dirigible, the *U.S.S. Akron*, on May 15, 1932. In order to be able to welcome the *Akron*, the Navy hastened completion of the mooring mast. Installation of the tracks for the tram and tail dolly, necessary to transport the dirigible into the hangar, was also expedited. Approximately 20,000 people, many of whom sat on house roofs or automobiles, eagerly awaited the arrival of the *U.S.S. Akron*. It remained at NAS Sunnyvale for two months before returning to Lakehurst.

NAS Sunnyvale was commissioned on April 12, 1933. Upon its completion, Hangar 1 was taller than all the buildings in Santa Clara County except for the Bank of America office building in downtown San José. The size of Hangar 1 is slightly smaller than the hangar in Akron, Ohio, although the design is almost identical. Tragically, the hangar was completed just days after the crash of the *U.S.S. Akron* off the New Jersey coastline. In response to the death of Rear Admiral William A. Moffett in the crash, the Navy decided to name the landing field at NAS Sunnyvale after Moffett. Under the Navy, the name of the air station remained NAS Sunnyvale, following standard Navy practice of naming air stations after physical locations instead of persons as the Army did.

By the time the *U.S.S. Macon* arrived at NAS Sunnyvale on October 15, 1933, the newly commissioned installation was considered to be the finest and most technologically advanced airship station in the world. Located at the eastern end of the central plaza, Hangar 1 dwarfed the rest of the buildings on the base. In fact, the rest of the base was designed to be on axis with Hangar 1, itself oriented parallel to the prevailing winds in the area.

With Hangar 1 well underway, the Navy began constructing a small post to the southwest of the hangar. Designed by the Navy's Bureau of Yards & Docks, the post was symmetrically arranged around a wide grass mall, or "plaza," as it was labeled on the plans. The plaza was placed on axis with Hangar 1, so that upon entering the main gate, visitors were immediately overwhelmed by the outline of the hangar looming beyond the delicately detailed administration buildings of NAS Sunnyvale. Most of the more prominent administration and residential buildings were designed in the Spanish Colonial Revival style, or as the Navy called it, "California Style." This style, popularized during the late 1920s and early 1930s, was used for all the prominent buildings on the plaza, including the Administration Building (Building 17), Bachelor Officers' Quarters (Building 20), Dispensary (Building 23), and the Balloon Hangar (Building 2). Similar to Hangar 1, many of the utilitarian buildings and structures were designed Streamline Moderne style instead of the Spanish Colonial Revival.

*Moffett Field Army Air Corps Base:*
Hangar 1's role as the home base of the *U.S.S. Macon* came to a close on February 12, 1935, when the dirigible went down in a storm off Point Sur, California. Returning home after a training mission, the Macon encountered a storm and crashed into the Pacific. Coming only two years after the loss of the *U.S.S. Akron* in similar circumstances, the crash brought about an abrupt end to the Navy's controversial LTA program. No longer in need of Hangar 1, the Navy transferred NAS Sunnyvale to the Army Air Corps, in exchange for an Army airfield at North Island, near San Diego. Following its practice of naming installations after individuals rather than places, the Army changed the name of NAS Sunnyvale to Moffett Field Army Air Corps Base.

During the Army's tenure, which lasted until the outbreak of the Second World War, Moffett Field was the home base for the 82nd Army Observation and the 9th Air Base Material squadrons. Initially, the base was underutilized, with the cavernous expanse of Hangar 1 occupied by a handful of training craft and a single observation blimp. With rearmament underway, the amount of activity significantly increased at Moffett Field by the end of the decade. In 1938, the Army transferred elements of the 18th and 20th pursuit squadrons to the base, increasing Moffett Field's population to 5,000 enlisted men and 300 officers. In 1940, Moffett Field became home to the Army Air Corps' West Coast pilot training center. Hundreds of pilots, including actor James Stewart, received pilot training at Moffett Field. The dramatic increase in the number of enlisted personnel during the late 1930s and early 1940s resulted in the need for additional living quarters at Moffett Field. Built in the southwestern part of the base, the inexpensive prefabricated barracks, derisively nicknamed "Splinter City" by its inhabitants, were similar to other mass-produced military housing built during wartime.

*Second World War:*
The long anticipated conflict with Japan began on December 7, 1941, with the bombing of Pearl Harbor. Although the United States had long been preparing for war, the nation was still not in a position to effectively retaliate. During the first few months of 1942, various branches of the military began reorganizing to fight a war in the Pacific, transferring soldiers and trainees to bases all along the West Coast. Because war with Japan would be a largely oceanic war, the Army traded several of its bases on the West Coast to the Navy in exchange for facilities elsewhere. In the Bay Area, the Army transferred Benton Field in Alameda and Moffett Field to the Navy. Moffett Field, re-commissioned by the Navy on April 16, 1942, was renamed NAS Moffett Field, a departure from the Navy's usual naming conventions.

The renewed Navy presence at NAS Moffett Field ushered in a new era of LTA use on the base. Following its acquisition of the base in 1942, the Navy stationed its first blimp scouting squadron: ZP-32, at NAS Moffett Field. The need to patrol the vast Pacific coastline provided new impetus to the Navy's dormant LTA program. However, unlike the 1920s and 1930s, rigid dirigibles were not in favor. Instead, the majority of the Navy's new

airships were inflatable blimps. Under the aegis of the Naval Airship Training Command, the base's primary mission became one of training personnel to man the observation blimps used for Japanese submarines along the long Pacific coastline.

Training for blimp service included knowledge of rigging and handling LTA craft, engineering and maintenance of engines, care of passenger pigeons used for communication, and aviation techniques. Once capable of flying the blimps, airmen were taught how to patrol and scout for enemy submarines, other vessels, and mines. They were also instructed on how to identify schools of fish, information reportedly relayed to fishermen in Monterey and San Francisco, especially as the war progressed and the threat of attack receded.

Throughout the Second World War, NAS Moffett Field remained the only Navy air base dedicated to LTA training and deployment. Every day dozens of airmen took off and landed at the base on their way to and from patrolling missions along the Pacific coast. The large number of blimps and fixed-wing aircraft needing shelter taxed the capacity of Hangar 1, requiring the construction of two additional hangars—Hangars 2 & 3—in 1942. Unlike Hangar 1, these additional hangars were built of wood and concrete due to wartime restrictions on the use of steel. NAS Moffett Field also became home to the Assembly and Repair Department, whose job it was to fabricate the L-type airships from scratch and assemble the K-type airships sent directly from the manufacturer for assembly at Moffett Field.

As the threat of Japanese attack began to recede with continued American successes in the Pacific, the Navy's LTA program entered a period of decline. As early as the end of 1942, NAS Moffett Field became a joint LTA and Heavier-than-Air (HTA) – fixed-wing aircraft facility. By January 1944, the last K-type airship was delivered to Moffett Field for assembly, and by November 1945, the station's first airship squadron, ZP-32, was decommissioned. At the conclusion of the Second World War, the Navy re-designated Moffett Field an exclusively HTA facility, extended the runways, and rebuilt the aprons and taxiways. The last blimp to operate at Moffett Field was deflated in August 1947, bringing to a close a short but compelling chapter of Naval aviation history.

*Jet Era:*
The Second World War initiated astonishing advances in aviation technology; the war that began with biplanes and dirigibles ended with rockets and jet fighters. After a brief period of peace, the outbreak of the Korean War in 1950 ushered in the new era of jet fighter warfare. Immediately after the outbreak of hostilities on the Korean Peninsula, the Navy began transferring jet squadrons to NAS Moffett Field, beginning with the F3D and VC-3 squadrons. During the Korean War, Moffett Field became a full-fledged jet fighter base, home to many of the carrier-based squadrons guarding the Pacific. In 1953, NAS Moffett Field was designated one of the Navy's nine "Navy Master Jet Stations."

The rapid growth of suburbia in the Santa Clara Valley and nearby Peninsula during the 1950s began to impinge upon the jet operations at

Moffett Field and in 1954, the Navy opened Naval Air Landing Field (NALF) Crow's Landing, an auxiliary landing field located fifty-four miles east of Moffett Field in the San Joaquin Valley. Following the delivery of supersonic jets in 1957, including the F11 Tiger and the F8U Crusader, it became increasingly difficult to train pilots over the urbanized Bay Area. First, there was the potential risk of colliding with civil airliners flying in and out of San Francisco, San José and Oakland Airports. In addition, there was the auditory impact of jets flying overhead (including periodic sonic booms) on local residents inhabiting the tract houses below, where orchards had so recently grown. The jet era at Moffett Field came to a halt with the opening in 1961 of NAS Lemoore in California's then sparsely populated San Joaquin Valley.

*Orion Era:*
The departure of the jet squadrons to NAS Lemoore compelled the Navy to find a new use for NAS Moffett Field. Although airships were no longer a part of the picture, Moffett Field witnessed a return of its original purpose as an installation dedicated to anti-submarine search and patrol. In 1964, the Navy designated the base as the Pacific headquarters for P-3 Orion anti-submarine aircraft. In 1973, the station became the headquarters of the Commander of the Patrol Wing for the U.S. Pacific Fleet. Responsible for submarine patrol operations across the Pacific, NAS Moffett Field was the largest P-3 base in the world.

With the end of the Cold War nowhere in sight, NAS Moffett Field continued its role as the headquarters for the P-3 Orion force until the early 1990s. As late as the 1980s, the base was still being expanded, as evidenced by the construction of the Orion Park Housing Complex in 1985 and Shenandoah Square in 1989. The fall of the Berlin Wall and the dissolution of the Soviet Union occurred in rapid succession in the fall of 1989 and spring of 1990. Suddenly, the United States found itself faced with the so-called "Peace Dividend."

Seeking to save money by closing redundant and unnecessary bases, Congress passed the Base Closure Act of 1990. As mandated by the act, Congress created the Base Realignment and Closure Commission (BRAC), a group charged with determining which bases should be kept open and which should be closed. In 1991, the commission placed NAS Moffett Field on the list of bases to be closed; and in August of that year, Congress voted to accept the recommendation. Over the next three years, various squadrons either moved to other bases or were decommissioned, with the last active duty P-3 squadron departing Moffett Field on December 21, 1993. On July 1, 1994, NAS Moffett Field was formally decommissioned.

The historic significance of Moffett Field was recognized comparatively early on and in 1966, Hangar 1 was designated a U.S. Navy Historic Site. In January 1994, just six months prior to NAS Moffett Field being decommissioned, the former naval air station was listed in the National Register of Historic Places.

Following its closure, NAS Moffett Field came under the stewardship of NASA's Ames Research Center. The Ames Aeronautical Laboratory was

originally established in 1939 by Congress as the West Coast headquarters of the National Advisory Committee on Aeronautics (NACA). Its campus was built on land adjacent to NAS Moffett Field. In 1958, after Congress created NASA as part of the National Aeronautics and Space Act, the Ames Aeronautical Laboratory became a NASA field center. NASA Ames Research Center evolved into one of the most active research and development centers in the United States, eventually occupying 500 acres adjacent to the NAS Moffett Field.

NASA assumed responsibility for NAS Moffett Field upon its closure in 1994, including the massive Hangar 1. Vacant and without a use for the first time in its history, plans were initially made to convert part of the structure into a museum. When dangerous levels of lead and PCBs were discovered, the hangar was vacated and now stands empty and unused.

## PART II. ARCHITECTURAL INFORMATION

### A. General Statement:

Constructed at the terminus of the plaza occupying the center of the main post of NAS Moffett Field, Hangar 1 contrasts with the domestic scale and finely rendered Spanish Colonial Revival architectural vocabulary of the other buildings on the main part of the base. In terms of its visual prominence, Hangar 1 qualifies as being one of the most compelling visual landmarks of the Santa Clara Valley and the Bay Area as a whole, visible from as far away as San Francisco. It is also significant as a feat of engineering, with its colossal hinged trusses and mammoth doors that run on tracks along the north and south façades. Designed by the Navy's Bureau of Yards & Docks, there is only one other similar hangar in the United States, the dirigible hangar at the former NAS Akron. With its streamlined steel-clad façades and rounded shape, Hangar 1 is the epitome of the aeronautically influenced Streamline Moderne style popularized by American industrial designers during the 1930s and 1940s. The Streamline Moderne style was itself heavily influenced by objects in motion, including locomotives, ocean liners, automobiles, and dirigibles; making Hangar 1 a stylistic cousin to the airships that once berthed inside it.

#### 1. Architectural Character:

The Streamline Moderne style found favor with civilian and government architects due to the style's simple lines and adaptability to industrial, mass-produced materials. The style, called Streamline Moderne, PWA Moderne, or Stripped Classic, simplified traditional Beaux Arts architecture to its essence, removing extraneous ornament and flattening cornices, pilasters, and entry surrounds. As opposed to the theatrical contemporary Art Deco style, buildings designed in the Streamline Moderne style employed a modern, industrial aesthetic characterized by continuous surfaces, steel or stucco finishes and detailing, flat or curved roofs, rounded corners, "speed line" moldings, and large expanses of glass block or steel ribbon windows. Taking design cues from utilitarian objects such as ocean liners, locomotives, and automobiles, designers who popularized the style in the 1930s, including Raymond Loewy and Norman Bel Geddes, applied the industrial aesthetic to all manner of consumer goods. During the Depression, the Federal Government, especially New Deal agencies such as the Public Works Administration (PWA) and the Works Progress Administration (WPA), embraced the Streamline Moderne style for public building projects due to its modern appearance and the lack of complicated ornament or expensive materials.

Hangar 1's streamlined shape is dictated by the need to accommodate large airships inside. Given this parameter, there could be no interior partitions, columns or any other obstructions that would interfere with moving the airships into the building. The engineers who designed Hangar 1 chose the parabolic truss as being the most effective way to satisfy this requirement. These trusses, in conjunction with the huge "orange peel" doors at either end of the building, effectively determined the overall shape of the building. The exterior skin of the structure was made of an innovative, fire-resistant material called Robertson Protected Metal (RPM). Most of the exterior is composed of this material, which consists of corrugated steel

sheets coated with layers of preoxidized petroleum asphalt, asphalt saturated asbestos felt containing polychlorinated biphenyls (PCBs), and a layer of asphalt-based weather proofing compounded with bitumen. These sheets are bolted into place onto the trusses. The "orange peel" doors, also clad in RPM, are mounted on electric motor-powered trucks that run on steel tracks. Four rows of ribbon window appear flush with the skin of the building and punctuate the exterior at regular intervals.

The interior of the building clearly reveals its distinctive construction; fourteen hinged steel truss arches span the space, with x-bracing stabilizing the trusses. Similar to the dirigibles themselves, the trusses are interlaced with catwalks for access to the upper areas. Two elevators—only one still exists, albeit in an altered state—were installed at the midpoint of the hangar for access to the upper catwalks.

Two-and three-story frame office and shops buildings line the east and west walls of Hangar 1; these workshops were integral to the operation and maintenance of the dirigibles. Some of these rooms still exist. Other character-defining features that still remain inside the building include the 'explosion-proof' light fixtures manufactured by Crouse-Hinds and the dirigible tie-downs encased in the original concrete floor.

### 2. Condition of Fabric:

Overall, Hangar 1 appears to be in fair condition. Vacant since 2002, the building shows some signs of disrepair, including water intrusion, bird infestation, corroded window frames and broken window panes. Many of the interior finishes, mostly added to the building since 1950, are deteriorated. The RPM is deteriorating rapidly and it must be painted regularly to avoid depositing lead and other toxins into the environment. However, aside from the RPM, most of these problems are reversible.

## B. Description of Exterior:

### 1. Overall Dimensions:

Size is Hangar 1's chief character-defining feature. The building is 1,133 ft long and 308 ft wide and 198 ft high at the ridgebeam. The building's footprint covers eight acres, or 323,062 sq. ft. Along with a similar hangar in Akron, Ohio, Hangar 1 is one of the largest clear-span interior spaces in the United States.

### 2. Foundations:

Hangar 1 features a reinforced-concrete perimeter wall foundation with reinforced concrete pilings beneath the 8 in. concrete slab floor.

### 3. Walls:

The exterior walls are composed of Robertson Protected Metal, which is a proprietary material composed of steel sheets coated with three layers,

including a layer of preoxidized petroleum asphalt, a layer of asphalt-saturated asbestos felt treated with polychlorinated biphenyls (PCBs), and finally, a layer of asphalt-based weather proofing containing bitumen. As a final step, the sheets were corrugated. The exterior features layers of silver-colored paint, including a recently applied layer intended to diminish the PCB infiltration into the environment.

*West Facade:*
From the ground up, the west façade presents a sloped concrete foundation approximately 4 ft above ground level. A variety of swinging pedestrian doors and roll-up vehicular doors penetrate the high concrete base at regular intervals. Door conditions have changed considerably, and many windows have been replaced over time. Several doors have steel and glass canopies.

Above the concrete foundation, the walls follow the profile of the parabolic trusses inside and gradually merge into the roof. The position of trusses within the interior is indicated on the exterior by flat metal panels, while silver-painted Robertson Protected Metal sheaths the bulk of the structure. Near the top of the building, redwood sheathing covers the parabolic arches. The redwood sheathing is, in turn, covered by a five-ply surface membrane composed of rolls of roofing felt with hot-mopped asphalt between the layers. The top layer is made up of a flood coat of asphalt and gravel.

The west facade is divided into eleven structural bays corresponding to the location of trusses. At the ground level, directly above the high concrete base, each bay contains a multilight steel sash window consisting of ninety-two lights. Some of the lights are operable, as either awning or pivot sash. Located directly above is a steel multilight ribbon window composed of forty-six individual lights. The third band of fenestration is a multilight steel ribbon window consisting of sixty-three lights. The uppermost ribbon window is located at the point where the walls merge into the roof. This fourth and highest band of fenestration is comprised of 105 lights. Originally, all of the windows were glazed with wire glass, but much of this material has been replaced over time with regular sheet glass, especially on the lower two levels where breakage has been more frequent. Much of the glass on the lowest level has been painted gray to match the walls.

*South Facade:*
The south facade is comprised of a pair of giant "orange peel" doors. These originally provided access to the dirigibles into Hangar 1. Each door is constructed of ten trusses and is clad in eight panels of RPM sheathing. The doors are also punctuated by two levels of fenestration within each of the eight door panels. The lower level features fixed multilight steel windows composed of twelve lights and the upper level features fixed steel windows of fifteen lights. The motor-driven doors are operated by rack and pinion gears that activate wheeled "trucks." These trucks, which are attached to the bottom of the doors, run on tracks that follow the arc of the building's footprint.

*East Facade:*
The east façade of Hangar 1 faces the runways, San Francisco Bay and the adjoining salt ponds beyond. In regard to materials, massing, and fenestration, the east and west façades are almost identical, except for the non-original entry within the fifth bay from the south. This entry was enlarged to allow the Sparrowhawk planes assigned to the *U.S.S. Macon* to be moved in and out of Hangar 1 without having to operate the "orange peel" doors. This opening is filled with glazed steel doors that fold up into the building. Each door consists of a steel lower plate with a multilight fixed steel window comprised of fifteen lights.

*North Facade:*
The north facade is identical to the south facade.

**4. Structural System:**

Hangar 1 is a steel-frame building consisting of a series of fourteen, three-hinge steel parabolic trusses located every 72 ft on center. Temperature expansion is provided for by the use of two transverse expansion joints that divide the structure into three components, with large orange peel doors anchored to reduce end thrust on the door framing and opening mechanisms. The uppermost 70 ft of Hangar 1 consists of 2 in. redwood sheathing.

**5. Openings:**

**a. Doorways and doors:**

The truck-mounted, motor-powered "orange peel" doors at the south and north facades of the building move along semicircular tracks. The doors themselves are constructed of large trusses sheathed in RPM metal panels similar to the rest of the exterior. The east elevation features a door opening added to allow smaller aircraft to be moved in and out of the hangar without having to open the main doors. This smaller doorway features folding glazed steel panel doors. The east and west walls have many other door openings, including corrugated metal roll-up doors and a mixture of wood and steel pedestrian doors dating from various periods.

**b. Windows:**

Each structural bay of Hangar 1 features four bands of ribbon windows fitted with steel industrial sashes. While most individual lights are fixed, others are operable awnings or pivot sashes. The "orange peel" doors of the north and south facades feature two levels of similar steel industrial windows.

**6. Roof**

**a. Roof shape, covering:**

In regard to its shape, the roof of Hangar 1 forms the upper portion of the parabola established by the trusses within the building and it merges seamlessly into the walls below. The uppermost portion of the walls—the portions painted black—are composed of RPM over redwood. The flat portion of the roof, which is not visible from the ground, is constructed of redwood sheathing covered with five-ply roofing materials composed of layers of asphalt, felt and gravel.

## C. Description of Interior:

### 1. Floor Plans:

*First Floor:*
Intended to shelter and repair dirigibles and other military airships, Hangar 1 was originally designed as a large unconventionally supported enclosure without interior columns or other projecting elements aside from the office and shop structures built under the trusses along the east and west walls. Since the end of the Second World War, Hangar 1 was no longer used to store airships; the interior of the structure has been partially infilled with several one-and two-story frame and hollow clay tile office and training structures.

According to an early 1932 plan of Hangar 1, the offices and shops along the east wall housed the following uses: Operations Office, Rigid Air Ship Riggers, and Ground Gear. The shops on the west side housed the following functions: Joiner Shop, Plating, Machine Shop, Fabric Shop, Inspection & Testing Lab, Instrument Shop, Office Space, Structural Wire and Netting Shop, Metal Shop, and Aircraft Engine Over-Haul Shop. Most are built of hollow-clay tile walls with six sliding doors on each side that provided access to the shops.

*Second Floor:*
The second floor originally housed support functions for the shops and offices on the first floor. Most of the interiors have been reconstructed since the end of the Second World War.

*Third Floor:*
In addition to offices, the third floor contains the "Cork Room," an air conditioned and cork-lined space designed for the maintenance and repair of gas cells used to keep the dirigibles aloft. This room has a ceiling-mounted track for hanging the cells for drying.

### 2. Stairways:

Steel stairs and catwalks extend throughout Hangar 1, providing access to the upper reaches of the building's interior. Continuous steel stairs between trusses 7 & 8 and 1 & 2 provide access from the main floor to the uppermost catwalks.

### 3. Flooring:

The interior of Hangar 1 features a concrete slab floor. The floor is divided into a grid by regular expansion joints. Beneath the floor is a steam tunnel containing gas and water lines. Originally, narrow gauge tracks extended the length of the floor. These were built to allow a tramway to tow the dirigible from the hangar's interior to the mooring mast on the south landing slip. Flooring in the office mezzanines is of various materials,

including wood, resilient sheet flooring, and carpet, little of which is original or historic.

**4. Wall and ceiling finish:**

The interior of Hangar 1 is unfinished, consisting for the most part of exposed steel trusses and framing. The interiors of the former office and shops structures feature contemporary finish materials, including gypsum board walls and ceilings. The third floor of the office and shops structure on the east wall features one of the most significant interior spaces within Hangar 1, the Cork Room. The Cork Room, used for storing and maintaining the dirigible gas cells, is finished in a 6 in. layer of cork.

**5. Openings:**

**a. Doorways and doors:**
Most interior doors within Hangar 1 open to the exterior and have therefore been described previously. The only exceptions are the office and shops structures on the east and west walls of the interior. Originally, access to these structures was provided by large sliding doors located at regular intervals. Although some remain intact, most have been replaced with contemporary steel doors.

**b. Windows:**
Most interior windows within Hangar 1 open to the exterior and have therefore been described previously. However, the office and shops structures on the east and west walls of the hangar interior are punctuated at regular intervals by original six-light wood pivot sash windows.

**6. Decorative features and trim:**

Hangar 1 is a feat of pure engineering; every detail is strictly functional in purpose and as a result there is no applied ornament. The aesthetic quality of Hangar 1 is defined by its engineering. Designed to accommodate large military dirigibles, the hangar itself mimics the shape of the airships stored within. This characteristic, combined with the bands of ribbon windows, imbues the building with characteristic qualities of the Streamline Moderne style popular during the 1930s and 1940s.

**7. Hardware:**

Built with an extremely specialized use in mind, Hangar 1 contains hardware seen in very few other buildings and structures. Perhaps most interesting are the steel tie-downs located at intervals on the concrete slab floor of Hangar 1. The guide ropes attached to the airship would be secured around the tie-downs, keeping the dirigible in place. Other unique hardware and equipment include the standard gauge tracks, the 150-horse power motors and wheeled trucks used to operate the "orange peel" doors

on the north and south walls of the building, and a pair of ceiling mounted cranes with cabs that could be raised and lowered to access various sections of the airship exterior.

## 8. Mechanical Equipment:

### a. Heating, air conditioning, ventilation:

Hangar 1 features a steam tunnel that was originally used to transport steam and hot water from the Heating Plant to the hangar for heating and maintenance purposes. The operations office and other finished spaces were equipped with radiators powered by steam from the Heating Plant. Ventilation in Hangar 1 is achieved by opening the operable awning and pivot sash in the ribbon windows on the exterior of the building.

### b. Lighting:

Hangar 1 is illuminated by a variety of light fixtures. Presently, the main hangar space features contemporary fluorescent fixtures. Some original wall-mounted fixtures survive within the interior of the hangar, including several Westinghouse "explosion-proof" fixtures (Style #1082) with fittings by Crouse Hinds. Large banks of push button light switches operate the original light fixtures. The shops and offices located along the east and west walls possess an assortment of light fixture types, ranging from original ceiling mounted incandescent fixtures with metal shades to contemporary fluorescent tube lighting. On the roof of the Hangar, the Moffett Field Navigational Aid Beacon provides guidance to aircraft landing at or passing over Moffett Field.

### c. Plumbing:

Hangar 1 has an assortment of men's and women's toilet rooms in the office and shops buildings located along the east and west walls. The toilet rooms feature 1940s-era porcelain fixtures with some contemporary replacement fixtures. The main hangar floor also features remnants of plumbing fixtures originally used to supply the dirigibles with water.

### d. Electrical:

Hangar 1 has a modern electrical distribution system installed within the historic vaults. This system enters the building in a 12KV underground feeder and is distributed via under-floor conduits to six above-floor vaults, each vault placed within the perimeter of the building. The vaults are equipped as follows:

**Vault 1:** 1000KVA transformer, 12KV-480/277; 500KVA transformer 12KV-208/120; two 12KV rated disconnect switches. Both transformers feed loads inside Hangar 1.

**Vault 2:** 150KVA transformer, 12KV-208/120; 75KVA transformer 12KV-208/120; one 12KV rated disconnect switch. Both transformers feed loads inside Hangar 1 as well as Buildings 118 and 119.

**Vault 3:** 300KVA transformer, 12KV-480/277; 300KVA transformer 12KV-

208/120; one 12KV rated disconnect switch. Both transformers feed loads inside Hangar 1 as well as Buildings 33, 83, and 347.
**Vault 4:** Two 225KVA transformers, 12KV-208/120; one 12KV rated disconnect switch. Both transformers feed loads inside Hangar 1.
**Vault 5:** One 225KVA transformer, 12KV-208/120; one 12KV rated disconnect switch. Transformer feed loads inside Hangar 1.
**Vault 6:** One 225KVA transformer, 12KV-208/120; one 12KV rated disconnect switch. Transformer feeds loads inside Hangar 1 as well as Building 85.

## D. Site:

### 1. General Setting and Orientation:

Set within a flat and largely open landscape of former marshlands, Hangar 1 was once visible from miles away. Today it remains visible from many higher elevations in Santa Clara Valley and adjoining San Francisco Peninsula, even after the mass suburbanization that took place in the region after the Second World War. Hangar 1 is oriented parallel to the prevailing winds in the area, with its long axis extending from the northwest to the southeast. To the west of Hangar 1 is the original main post of NAS Moffett Field. Cummins Avenue separates the hangar from the built-up portions of the former base. Located immediately east of the hangar are four ancillary buildings that originally served Hangar 1, including two small towers (Buildings 32 and 33) and two shops buildings. Beyond the ancillary buildings are runways, Hangars 2 and 3, San Francisco Bay, and adjoining salt ponds.

### 2. Outbuildings:

Two small towers known as Buildings 32 and 33 (originally called the North and South Floodlight Towers, respectively) are contributing buildings to the Shenandoah Plaza National Register Historic District. Completed on January 1, 1934, both buildings are designed in the Streamline Moderne style similar to other utilitarian structures built on the base in the early 1930s. Building 32 is a two-story, reinforced-concrete building. Its foundation measures 15 ft x 15 ft and contains roughly 638 sq. ft of space. According to Navy records, Building 32 cost $13,149 to build. Building 33, also a reinforced-concrete building, was originally identical to Building 32, but in 1940 the Army added a control tower to the roof, raising the structure to three stories. Both buildings are rectangular structures with round towers projecting from their corners. Both have relatively few openings; the original openings feature original wood-panel doors and double-hung wood windows. Prominent belt courses mark the division between the first and second floor levels on both buildings.

## PART III. SOURCES OF INFORMATION

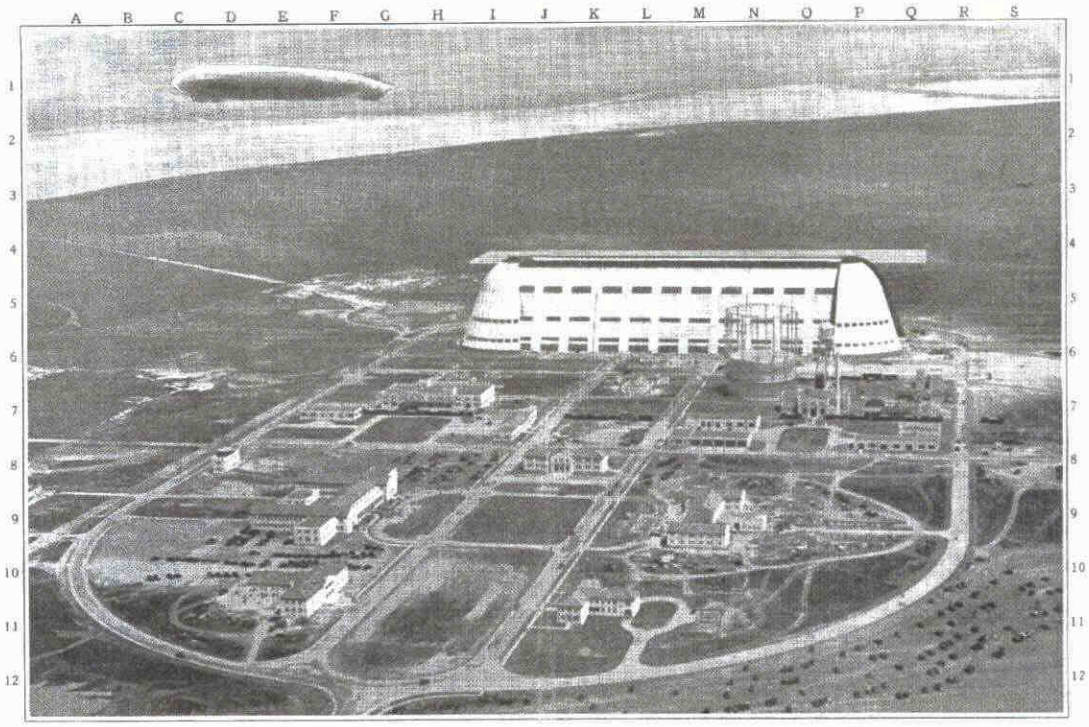
### A. Architectural drawings:

The only original architectural drawings known to exist is a partial set of construction drawings prepared by the Department of the Navy, Bureau of Yards & Docks. Signed by Bureau Chief A. L. Parsons, only twenty-five sheets out of a total of fifty have been located. Seventeen drawings, titled: "U.S. Naval Air Station Sunnyvale, Calif.," were reproduced as part of this HAER documentation project and are listed below.

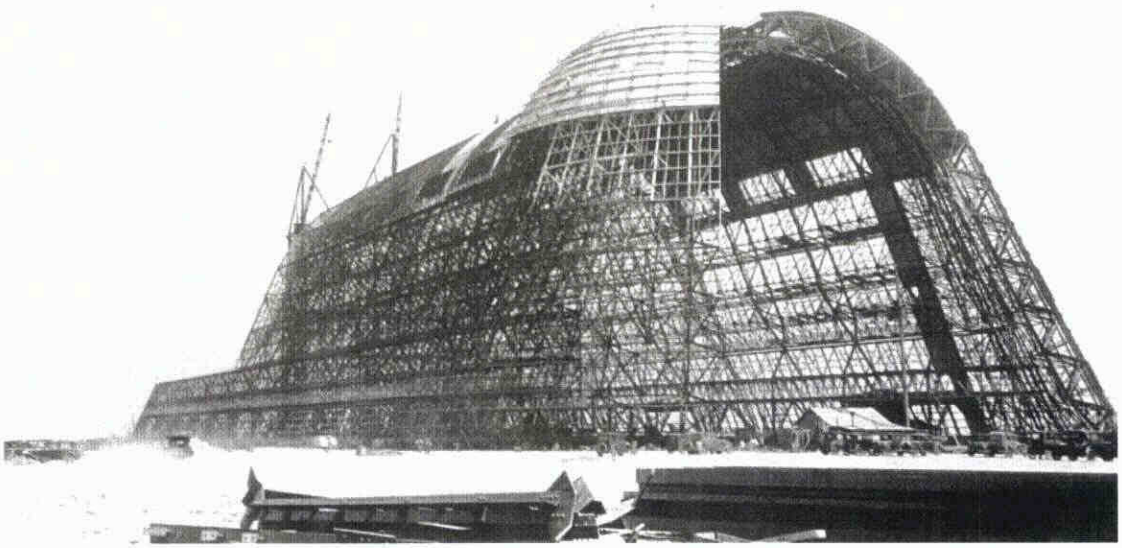
**Existing Architectural Drawings**

| Sheet No. | Sheet Title | Date | Scale |
|---|---|---|---|
| 1 of 17: (M4-001-G5) | Hangar 1-General Map | n.d. | n/a |
| 2 of 17: (112571) | Modification of R.R. Track Layout | Oct. 1931 | 1in.=100 ft |
| 3 of 17: (113983) | Sewer and Water Systems | Aug. 1932 | 1/32 in. = 1 ft |
| 4 of 17: (301-107) | Plan of Hangar 1: 1st Floor Plan | Oct. 1985 | 1/32 in. = 1 ft |
| 5 of 17: (301-108) | Plan of Hangar 1: 2nd Floor Plan | Oct. 1985 | 1/32 in. = 1ft |
| 6 of 17: (301-109) | Plan of Hangar 1: 3rd Floor Plan | Oct. 1985 | 1/32 in. = 1 ft |
| 7 of 17: (112235) | Section at Stairs & Elevators – General Plan | Aug. 1931 | 3/32 in. = 1 ft |
| 8 of 17: (112207) | A Frames #1, #2, #3, #6, #7, #8, #9, #12, #13 | Aug. 1931 | Various |
| 9 of 17: (11210) | Arches #4, #5, #10, #11 | Aug. 1931 | Various |
| 10 of 17: (11222) | Longitudinal Trusses 40 ft Span | Aug. 1931 | 3/16 in. = 1 ft |
| 11 of 17: (11226) | Mezzanine Floor Framing | Aug. 1931 | Various |
| 12 of 17: (11236) | Mezzanine & Ceiling Framing at Elevators & Stairs | Aug. 1931 | Various |
| 13 of 17: (11242) | Sections & Stresses | Aug. 1931 | Various |
| 14 of 17: (11245) | Main Door Covering & Supports | Aug. 1931 | Various |
| 15 of 17: (11246) | Main Door Rib Details | Aug. 1931 | Various |
| 16 of 17: (11248) | Main Door Bolsters | Aug. 1931 | Various |
| 17 of 17: (11249) | Main Door Truck Girder & Rack | Aug. 1931 | Various |

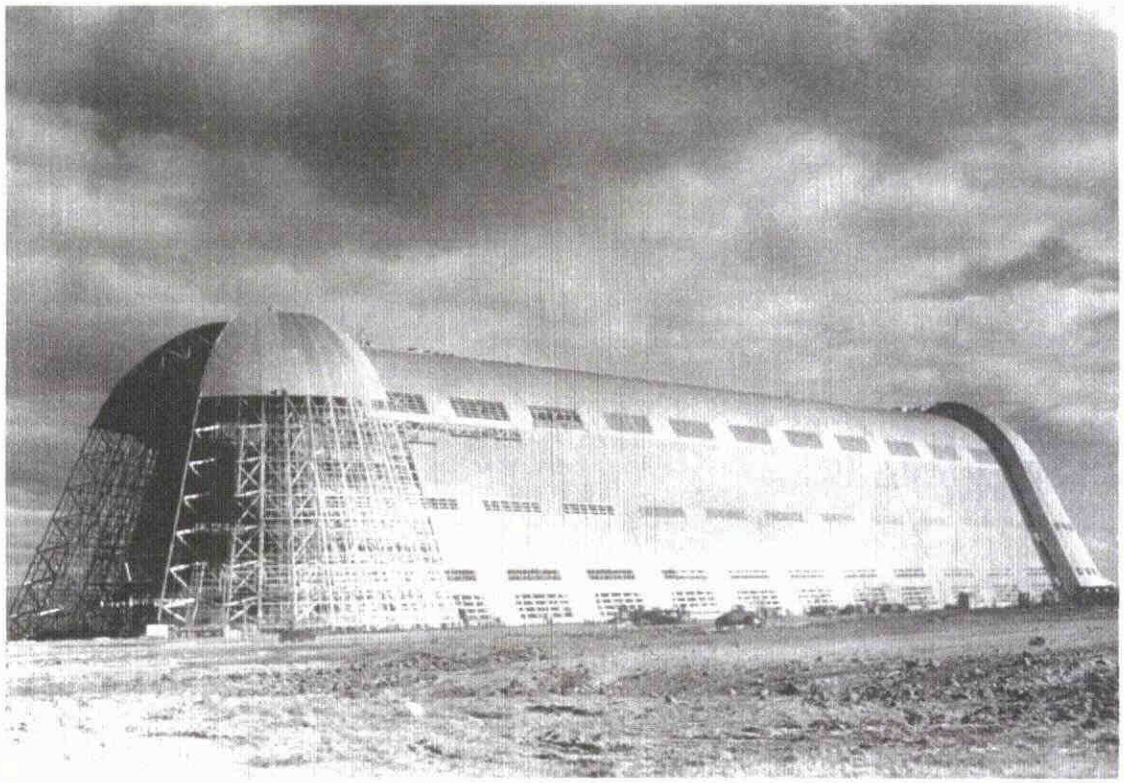
## B. Early views:



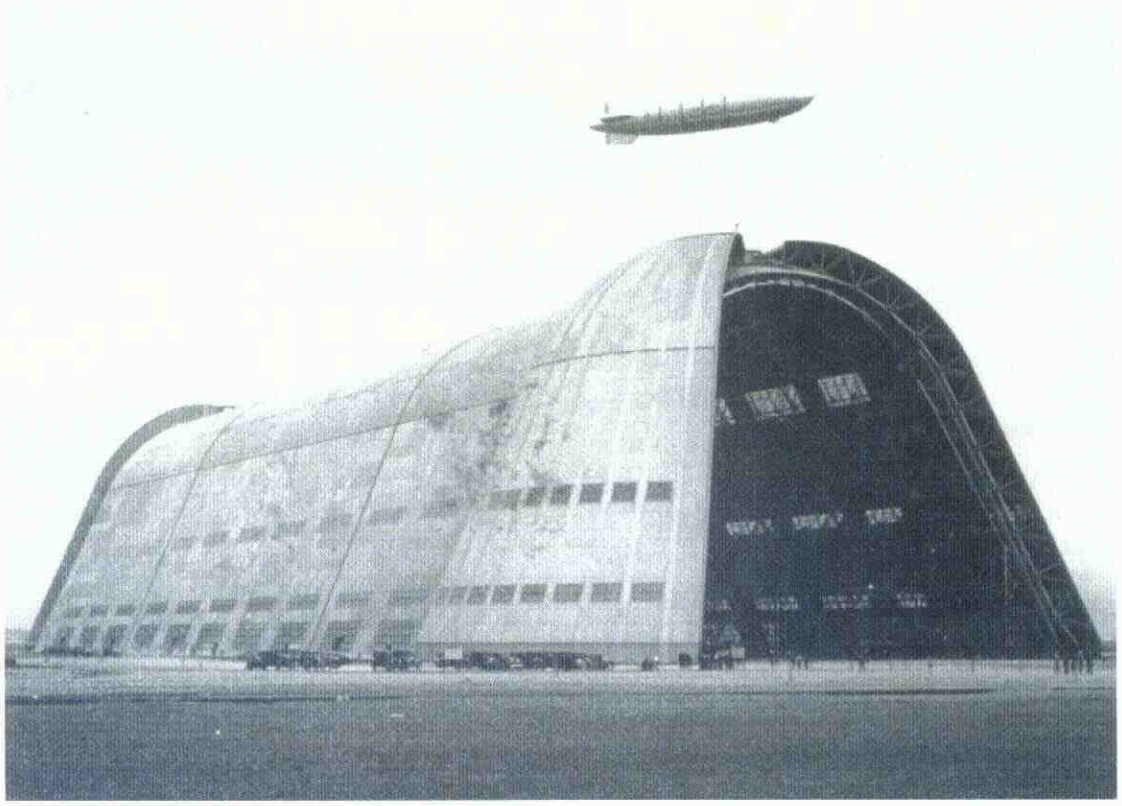

**Aerial view of NAS Moffett Field, ca. 1933; view toward northeast.**
**Source: Moffett Field Historical Society**



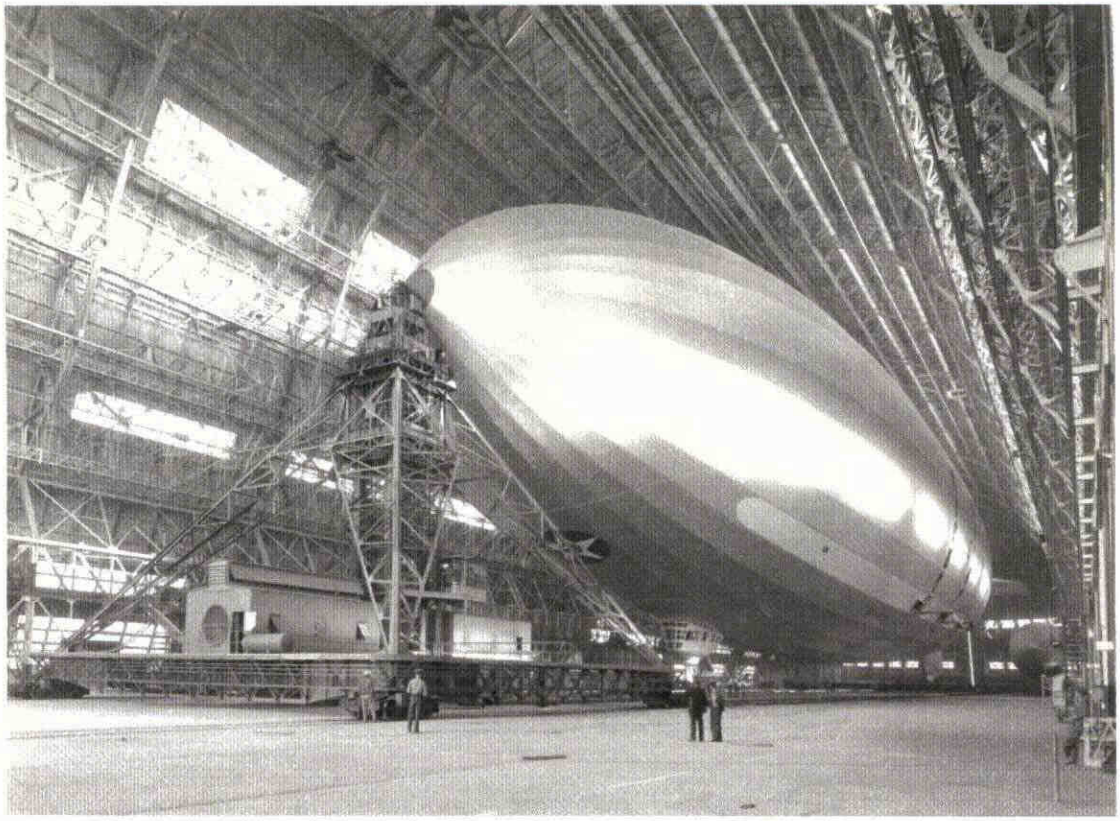
**Hangar 1 under construction, ca. 1933; view toward southwest. Photo taken by Herman E. Finell. Source: Moffett Field Historical Society**



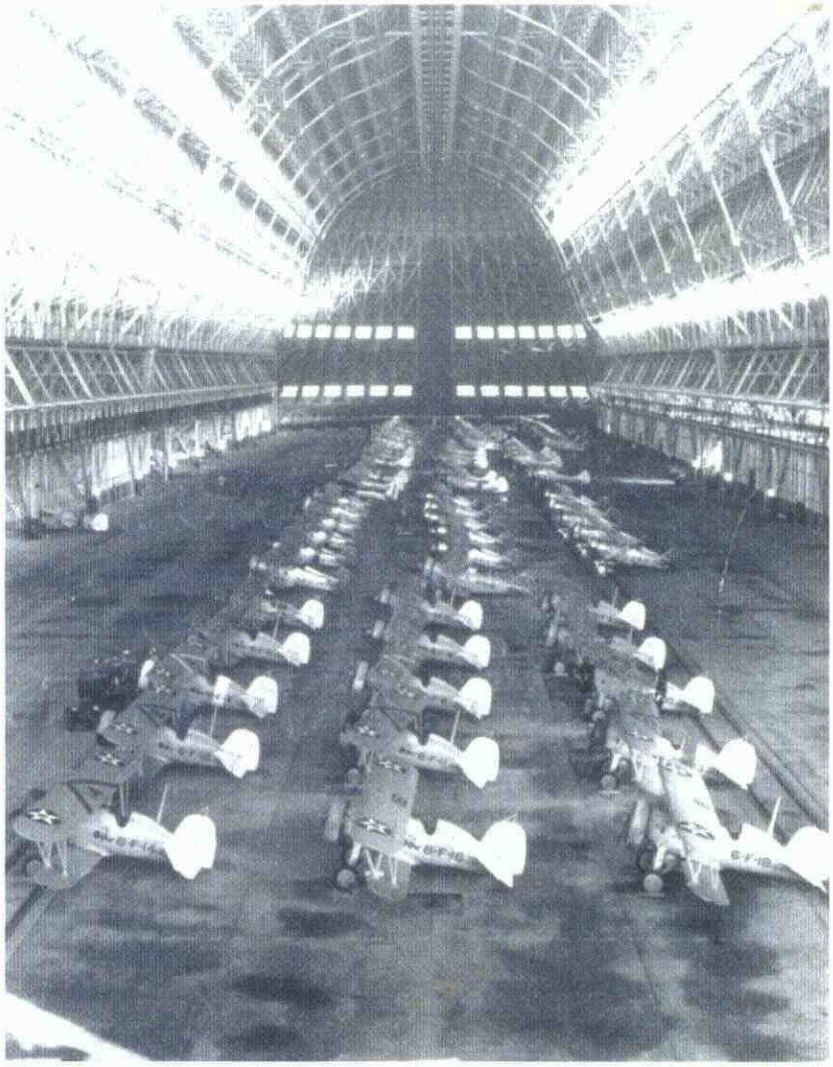
**Hangar 1 nearing completion, ca. 1933; view toward northwest. Photo taken by Herman E. Finell. Source: Moffett Field Historical Society**



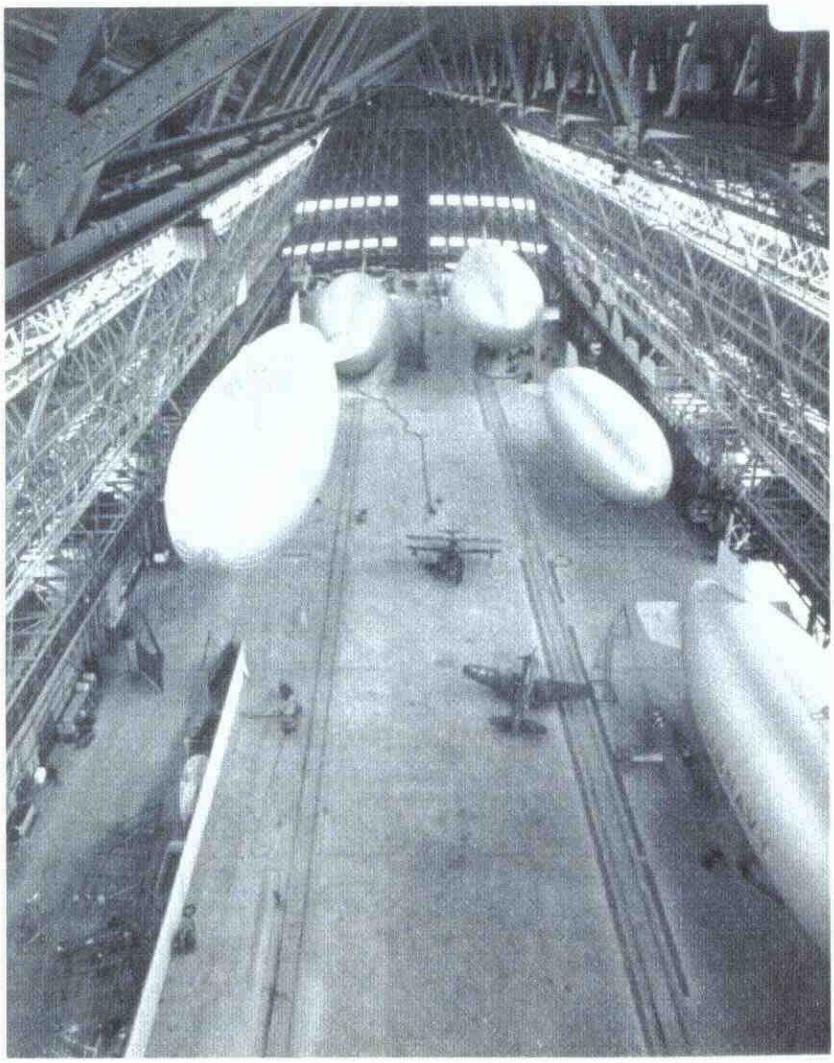
**Hangar 1 nearing completion, ca. 1933; view toward southwest with *U.S.S. Akron* above.**
**Source: Moffett Field Historical Society**



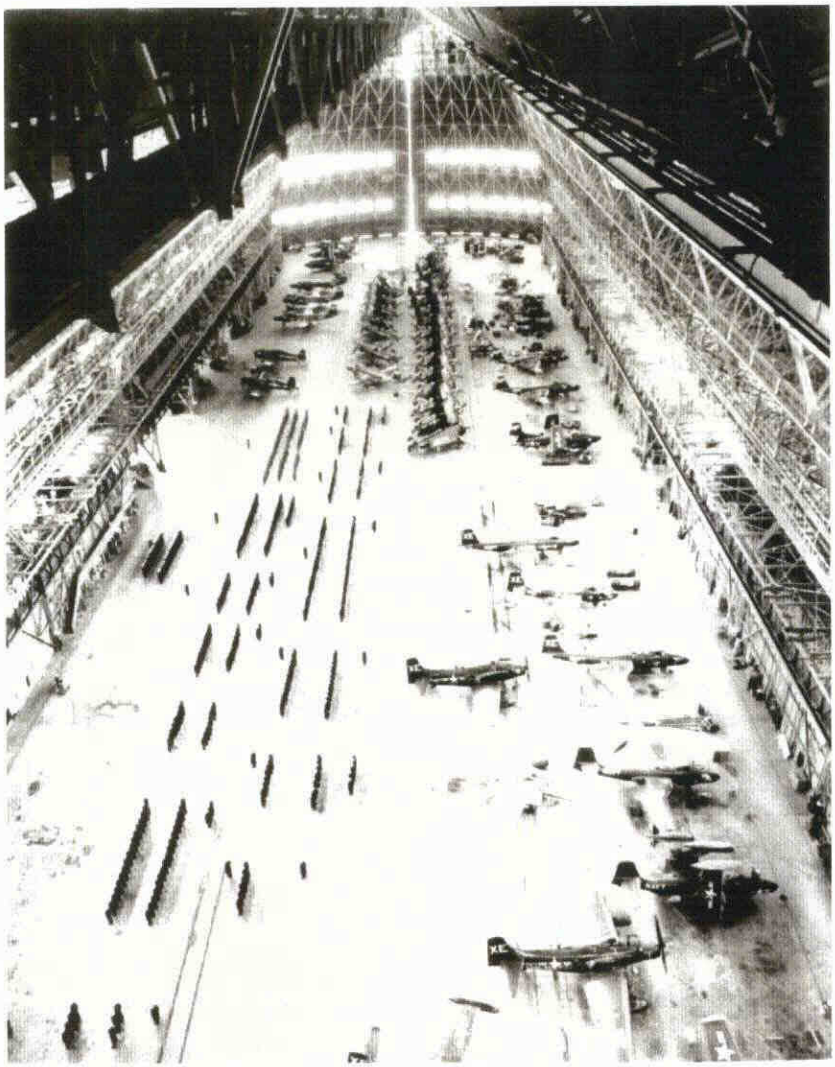
***U.S.S. Macon* inside Hangar 1, 1934.**
**Source: Moffett Field Historical Society**



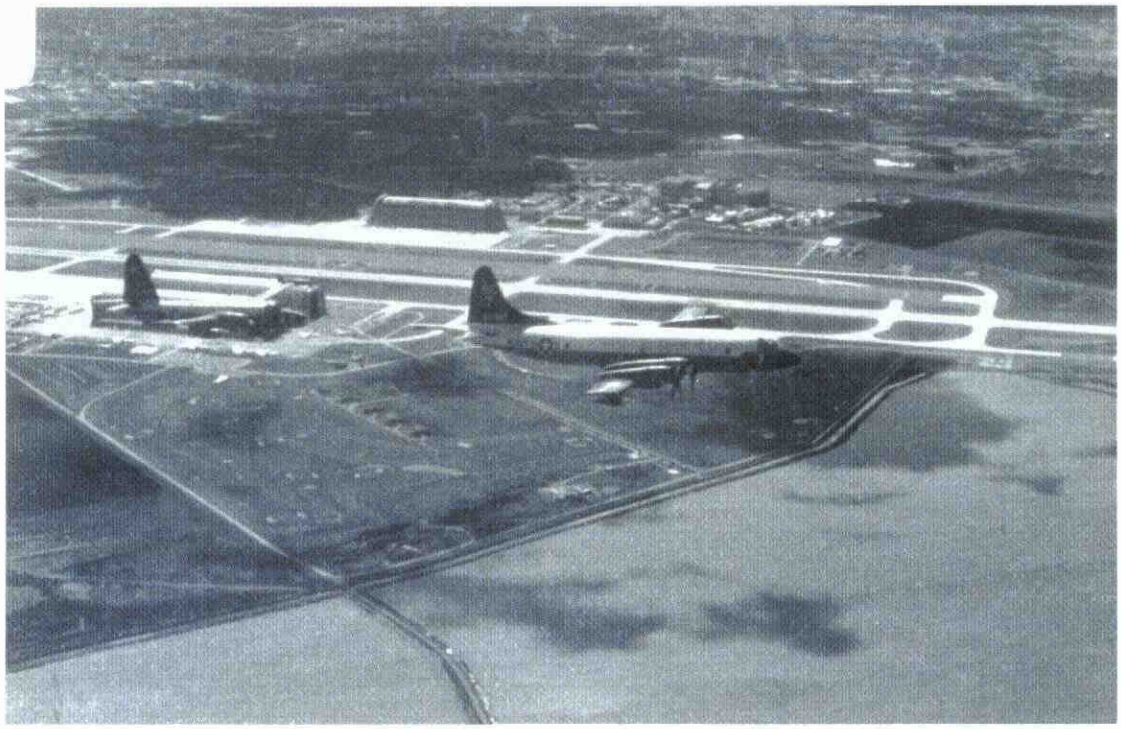
**Carrier squadrons attached to the *U.S.S. Saratoga* inside Hangar 1, 1935. Source: Moffett Field Historical Society**



**Observation blimps inside Hangar 1, 1943.**
**Source: Moffett Field Historical Society**



**Interior of Hangar 1, 1950.**
**Source: Moffett Field Historical Society**



**P2 Orion aircraft flying over Moffett Field with Hangar 1 in the background, 1963.**
**Source: Moffett Field Historical Society**

**P3 Orion aircraft flying over Moffett Field with Hangar 1 in the background, 1973.**
**Source: Moffett Field Historical Society**

## C. Interviews:

Although no formal interviews were performed as part of this HAER documentation project, Mr. Bill Stubkjaer of the Moffett Field Museum provided the author with invaluable information and historic photographs.

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National Aeronautics and Space Administration. "Moffett Field History."
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Naval Airship Association. "FPC Sparrowhawk."
http://www.naval-airships.org/f9c.html

Naval Airship Association. "ZRS-5 U.S.S. *Macon*."
http://www.naval-airships.org/zrs5.html

## D. Likely Sources Not Yet Investigated:

Oral histories provided by Navy personnel and former employees would provide additional insight into how Hangar 1 has been used over time.

## E. Supplemental Material:

American Society of Civil Engineers. "Moffett Field Airship Hangar No. 1 (1933)." *Historic Civil Engineer Landmarks of San Francisco and Northern California*. San Francisco: Unpublished booklet printed for the Annual Convention of the American Society of American Engineers, October 1977.

Various correspondence pertaining to the designation of Hangar 1 as a U.S. Navy Historic Site. On file at the Moffett Field Historical Society.

**Index to Photographs:**

| | |
|---|---|
| CA-335-A-1 | View of South Doors. View toward North. |
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| CA-335-A-4 | Building 33 with Hangar 1 in the background. View toward Northwest. |
| CA-335-A-5 | Building 32 with Hangar 1 in the background. View toward Northwest. |
| CA-335-A-6 | Oblique of East Facade of Hangar 1 with Building 32 in the background. View toward South. |
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| CA-335-A-12 | Detail of Door and Window Bay on West Facade. View toward East. |
| CA-335-A-13 | Oblique View of West Facade with South Door Tracks in foreground. View toward North. |
| CA-335-A-14 | View of Southernmost Section of East Facade with Shed in foreground. View toward West. |
| CA-335-A-15 | View of Bays 1-3 of East Facade with Shed in foreground. View toward West. |
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| CA-335-A-18 | View of Bays 8-10 of East Facade with Bunker in foreground. View toward West. |
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| | |
|---|---|
| CA-335-A-20 | View of Bay 11 and North Doors on East Facade. View toward West. |
| CA-335-A-21 | Interior of Hangar 1. View toward South. |
| CA-335-A-22 | Interior of Hangar 1. View toward North. |
| CA-335-A-23 | Interior View of South Doors. View toward South. |
| CA-335-A-24 | Oblique Interior View. View toward Northeast. |
| CA-335-A-25 | Detail of South Door Framing. View toward Ceiling. |
| CA-335-A-26 | Detail of South Door Framing and Tracks. View toward Southeast. |
| CA-335-A-27 | Detail of South Door and East Wall. View toward Northeast. |
| CA-335-A-28 | Detail of South Door Truck and Mechanism. View toward Southeast. |
| CA-335-A-29 | Detail of Office and Shops Structure along West Wall. View toward Northwest. |
| CA-335-A-30 | Detail of Roof Framing with Catwalks, Elevators and Cranes. View toward Ceiling. |

## PART IV. PROJECT INFORMATION

This HAER documentation report has been prepared as a mitigation measure for the potential demolition of Hangar 1. NASA Ames Research Center began the documentation project with a survey of the building in late 2005, and concluded the project in 2006 with the submittal of the HAER report to the following entities:

Library of Congress, Washington D.C.

Northwest Information Center at Sonoma State University, Rohnert Park, California

Agencies, firms, and individuals involved in preparing the various components of the documentation include:

NASA Ames Research Center
Environmental Services Division
Facilities Engineering Branch
Logistics and Documentation Services Division
History Office

Integrated Science Solutions, Inc.

U.S. Department of the Navy

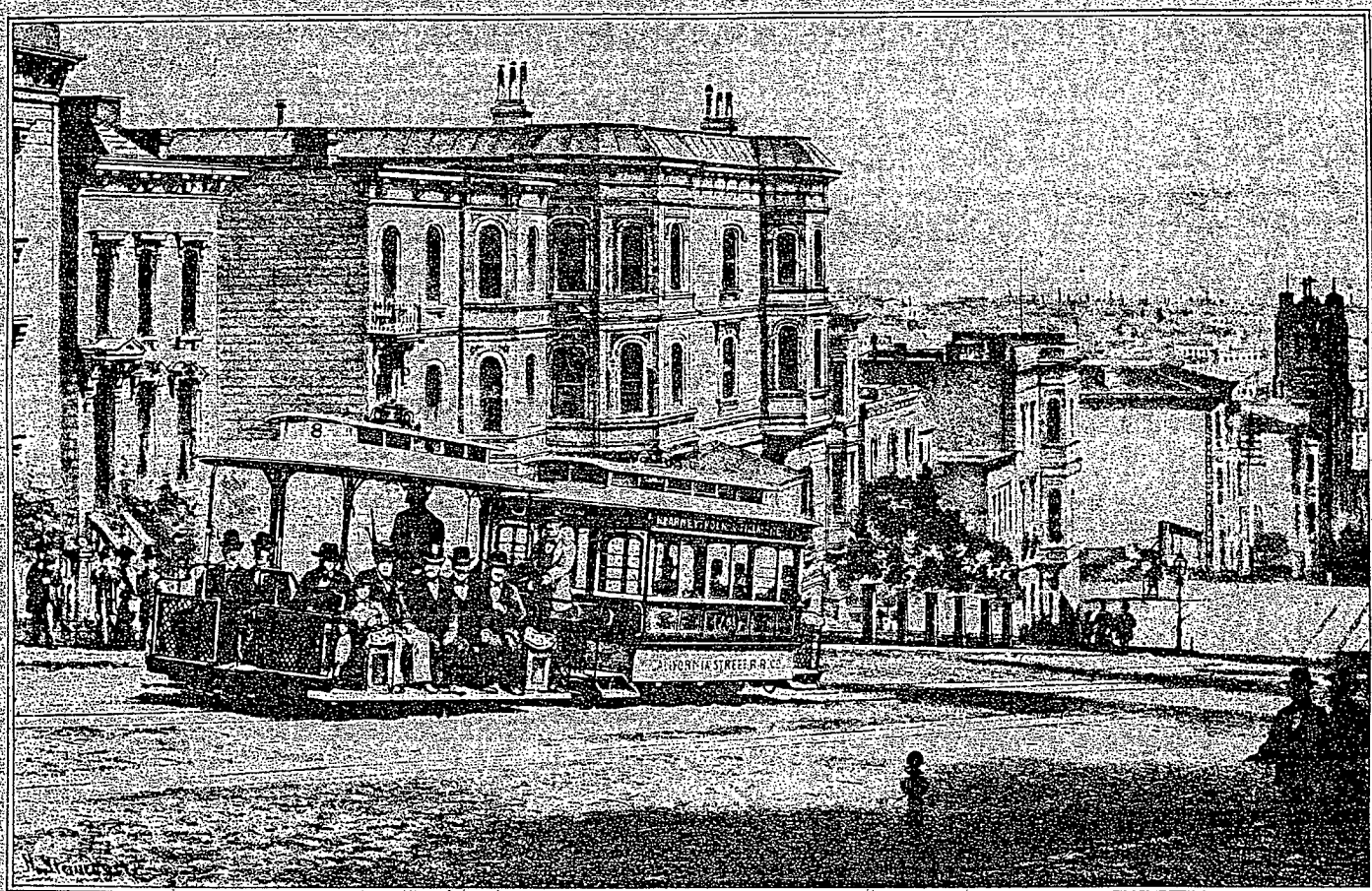
Moffett Field Historical Society

Page & Turnbull, Inc.
Historic Preservation Consultants:
Christopher VerPlanck, Elizabeth Milnarik,
José Cruz Reyes, Richard Sucré

William A. Porter, Photographer

# HISTORIC CIVIL ENGINEERING LANDMARKS

## OF SAN FRANCISCO AND NORTHERN CALIFORNIA




CALIFORNIA STREET WIRE ROPE RAIL ROAD.
STEEPEST GRADE 18 FEET IN 100 FEET.

125th Anniversary
American Society of Civil Engineers
Annual Convention
San Francisco Section, Sponsor

OCTOBER 1977

# Moffett Field Airship Hangar No. 1 (1933)

Dedicated as a California Historic Civil Engineering Landmark by the San Francisco Section, ASCE

A unique feature of America's defense program in the late 1920's and early 1930's was the experimentation with lighter-than-air craft. Patterned after the famous German zeppelins of World War I, it was hoped these huge but graceful dirigibles would become battleships of the air, floating high above the reach of guns or airplanes. Unfortunately, America's proud airships were plagued by disaster: the **Los Angeles** (LZ 126), provided as war reparations by the German Zeppelin Company in 1924, and the American-built ships **Shenandoah, Akron** and **Macon** all met violent ends, although, being helium-filled, none of the American ships died as spectacularly as the hydrogen-filled **Hindenberg.**

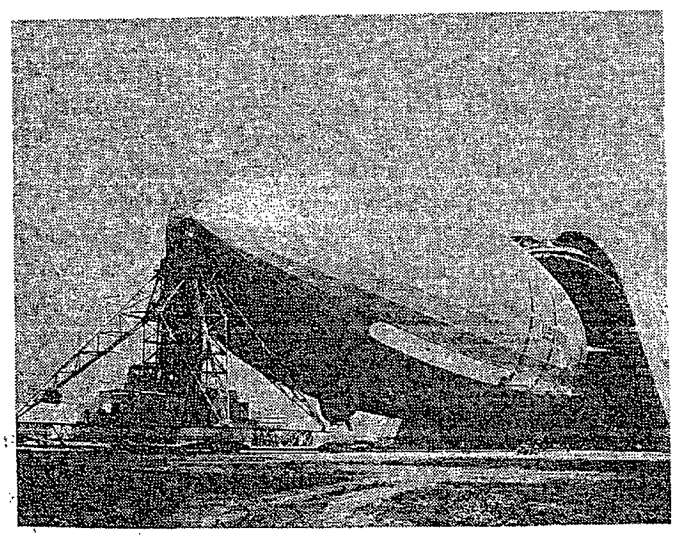
In support of the dirigible program, a chain of airship mooring and docking stations were constructed on the East Coast (**Lakehurst**), in the Midwest (**Akron**) and on the Pacific Coast. The West Coast facility, originally designated the Sunnyvale Naval Air Station, contained a unique feature: a gigantic airship dock (hangar) only a few feet smaller in size than the world's largest hangar at Akron. The design and erection of this hangar was to provide a unique test of civil engineering skill, as the profession responded to the challenge to create a structure of huge proportions and unusual configuration.

Construction of the $1.1 million hangar began in October 1931. Although intended to house the USS **Macon,** an airship of 6.5 million cubic feet,* the hangar's eight acres of clear floor space was designed ultimately to house airships of nearly twice that volume. The inverted "U"-shaped structure, 1,133 feet long, 308 feet wide and 194 feet high, quickly dominated the landscape.

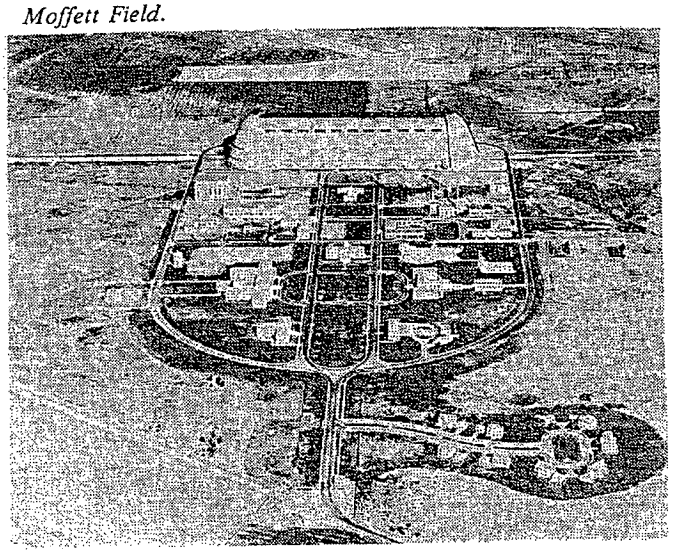
The construction of the steel framework was ingeniously done, using a huge timber traveler mounted on eight 50-ton railroad flatcars running on three parallel railroad tracks. Weighing 500 tons, standing 194 feet high and mounting three stiff-leg derricks, the traveler enabled the installation of a complete 72-foot-long bay assembly, consisting of arch truss, bracing, roof members and catwalks, totaling some 350 tons of steel, in as little as three and one-half days. This use of a traveler represented a distinct departure from methods used in the erection of previous airship docks.

The air station, with its huge airship hangar, landing field for airplanes, and administrative buildings, was commissioned on April 12, 1933. A scant month later, the facility's name was changed to Moffett Field to honor the Chief of Naval Aeronautics who was killed in the crash of the airship **Akron.**

*Hangar One was built to house the gigantic airship USS* Macon.



*Early aerial view shows original layout of airship facilities at Moffett Field.*



*Dimensions of the USS **Macon,** the largest airship built for the US dirigible program, were: 785 feet long, 136 feet maximum diameter, 6.5 million cubic feet of volume, 70-man complement. Launched in 1933, the **Macon** crashed and was destroyed in 1935.

Two years later, in 1935, the tragic loss of the **Macon**, Moffett Field's "own" airship, put an end to the Navy's airship program. During World War II, the vast hangar, now known as "Hangar Number One," was used to house the blimps (nonrigid airships) and observation balloons that played an important part in coastal anti-submarine work. The hangar remains in use today as an airplane repair and storage facility, an ironic use of the greatest surviving monument to a brief, tragic but colorful chapter in man's exploration of the air.

## TECHNICAL DATA

| | |
|---|---|
| **Location** | Sunnyvale, California |
| **Dates** | First contract let: October 1, 1931<br>Commissioned: April 12, 1933<br>Name changed to Moffett Field: May 18, 1933 |
| **Cost** | Hangar: $1.1 million<br>Total facility: $5 million |
| **Engineers** | Rear Admiral A.L. Parsons (CEC) USN, Chief of the Bureau of Docks and Yards, designer; Lieut. Cdr. E.L. Marshall (CEC) USN, officer-in-charge of construction. J.H. Pomeroy personally designed and supervised the operation of the timber traveler. |
| **Dimensions** | (Hangar No. One)<br>Length: 1,133 feet<br>Width: 308 feet<br>Height (overall): 194 feet<br>Height (interior clear space): 180 feet |

## SPECIAL NOTES

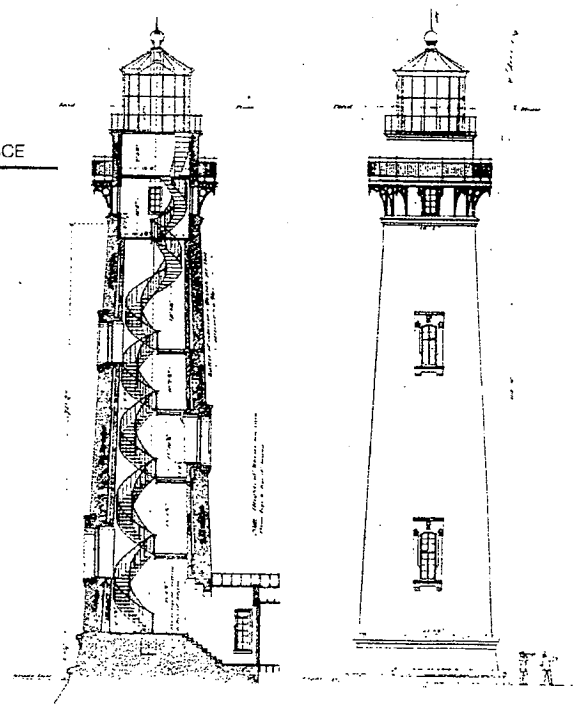
1. The hangar frame consists of a series of equal-depth arch trusses on 72-foot centers. There are eleven of these 72-foot centers. The trusses are made up of three-hinged arches resting on rigid A-frames 55 feet high. Temperature expansion is provided for by use of two transverse expansion joints that divide the structure into three units, with the end doors anchored to reduce end thrust on the door framing and opening mechanisms. The upper 70 feet of hangar cover consists of two-inch redwood sheathing and built-up asphalt felt roofing, with the rest of the sides covered with asbestos-protected metal sheets and V-beam sheathing.
2. At each end of the structure there are huge doorways made of two spherical orange-peel leaves that provide almost unobstructed openings. Each door leaf weighs 550 tons and operates on a circular rail track.

# Pigeon Point Lighthouse (1872)

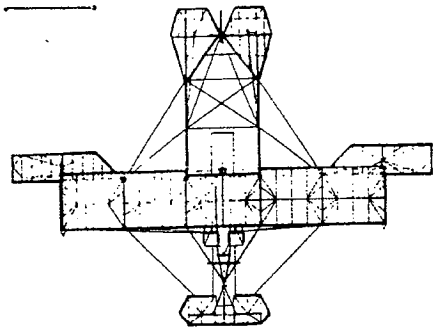
Dedicated as a California Historic Civil Engineering Landmark by the San Francisco Section, ASCE

On the foggy night of Monday, June 6, 1853, the clipper ship **Carrier Pigeon,** 130 days out of Boston with a cargo of general merchandise destined for California's gold fields, drifted aground on a headland then known as Whale Point, about 30 miles north of Santa Cruz. Although the ship itself was a total loss, Captain Doane and his crew labored to save what they could of the cargo, and there ensued a drama typical of the pioneering days of coastwise shipping in California.

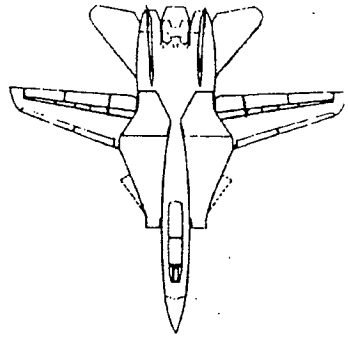
As soon as the wreck was known in San Francisco, the coastal steamship (actually a sailing ship with auxiliary steam engines) **Sea Bird** was dispatched to the wrecked **Carrier Pigeon** with instructions to attempt salvage. Later the same day, the USS **Active,** enroute to the Farallon Islands with material for the lighthouse under construction there, put in near Whale Point and



*The original drawings of the Pigeon Point Lighthouse reveal both sturdiness and a graceful beauty.*



Office of the Chief of Naval Operations
Naval Aviation History
Washington Navy Yard
Building 146
Washington, D. C. 20374



OP-05D2
2 November 1981

Mr. John Shackleton
Public Affairs Office
NAS
Moffett Field, CA 94035

Dear Mr. Shackleton:

Mr. Van Vleet has asked me to respond to your recent telephone request for a copy of the CNO letter which approved Hangar #1 at NAS Moffett Field as an historic site.

I have enclosed a copy of that letter and its endorsements, obtained through the courtesy of Mr. H. Vadnais of the Navy Memorial Museum. The original letter was in poor reading condition so Mr. Vadnais had it retyped. That copy is also included.

If you have further questions concerning naval aviation, please feel free to contact this office.

Sincerely,

Gwendolyn J. Rich

(Mrs) Gwendolyn J. Rich
Archivist

Enclosures

Copy to:

Op-09B99/jsc
Ser: 7804P09B9
3 January 1966

From: Chief of Naval Operations (Op-09B9)
To: Commandant, Twelfth Naval District/Commander, U.S. Naval Base, San Francisco

Subj: U.S. Navy Historic Site Markers for Buildings, Structures, Sites and Monuments in the Twelfth Naval District

Ref: (a) COMTWELVE/COMNAVBASE SFRAN ltr ND12-44A-2 of 22 Dec 1965
(b) CO, NAS Moffett Field ltr SI:gn of 8 Dec 1965

1. The recommendation in reference (a) to designate Hangar #1, Naval Air Station, Moffett Field as a "U.S. Navy Historic Site" is approved.

2. The proposed inscription cited in reference (b) is satisfactory, but it is suggested that the significance as succintly noted in the wording of paragraph 3 of reference (b) be included in the inscription.

/s/ E. M. ELLER
By direction

Copy to:
BUWEPS
BUDOCKS
CINCPACFLT
COMNAVAIRPAC
COMFAIRWINGSPAC
CO NAS MOFFETTFIELD

Copy to:
COMTWELVE/COMNAVBASE SFRAN (Code 00B)

AND

COMMANDER, U. S. NAVAL BASE, SAN FRANCISCO

FEDERAL OFFICE BUILDING
50 FULTON STREET
SAN FRANCISCO, CALIFORNIA 94102

IN REPLY REFER TO:
ND12-44A-2

6

From: Commandant, Twelfth Naval District/Commander, U.S. Naval Base, San Francisco

To: Chief of Naval Operations (OP-09B9)

Subj: U.S. Navy Historic Site Markers for Buildings, Structures, Sites and Monuments in the Twelfth Naval District

Ref: (a) OPNAVINST 5750.11 (NOTAL)

Encl: (1) CO NAS MOFFETT ltr SI:gn of 8 December 1965

1. In accordance with reference (a), the Commandant, Twelfth Naval District has reviewed the recommendation of the Commanding Officer, Naval Air Station, Moffett Field, enclosure (1), for designation of Hangar 1 as a "U.S. Navy Historic Site," and concurs that the structure is of historic significance.

2. It is recommended that Hangar 1 be considered favorably for designation as a "U.S. Navy Historic Site" with inscription as proposed in enclosure (1).

Copy to:
CO NAS MOFFETTFIELD
COMFAIRWINGSPAC (w/encl 1)
BUWEPS (w/encl 1)
COMNAVAIRPAC (w/encl 1)
CINCPACFLT (w/encl 1)

Copy to:
COMTWELVE/COMNAVBASE SFRAN (Code OOB)

FILE COPY
NAVAL AIR HISTORY UNIT

AVIATION HISTORICAL SUMMARY
OPNAV FORM 5750-2 (REV. 4-60) *See effective edition of OPNAVINST 5750.8*



| *Unit* | *Period Covered (From - To)* |
|---|---|
| U. S. Naval Air Station, Moffett Field, California | 1 October 1965 - 31 March 1966 |
| *Signature of Commanding Officer or authorized representative* | *Date Forwarded* |
| [signature] | 15 APR 1966 |

DIRECTIONS: Complete in duplicate semi-annually for periods ending 31 March and 30 September, retain copy and forward original to the Office of the Chief of Naval Operations, Op-05A5G, Navy Department, Washington 25, D. C., within 15 days after report period. No covering letter is required.

All units complete Part I and other Parts as indicated. Follow instructions for each blank; fill in all required blanks using "same" to avoid repeating previously recorded information. If more space is needed, attach extra sheets. Amplifying and/or historically significant documents, including photos, may be appended with proper notation under Part VI.

Security classification may be at any level consistent with content. Identify classified items within the report, by an additional stamp at their position in the report. Avoid over-classification.

PART I - ALL UNITS

*1. Designation:* Omit if same as in previous period. *If changed,* enter previous designation, date of change and the authorizing directive. New units record date and place of commissioning.

*2. Commanding Officer*

M. C. FRIEDMAN, CAPT, USN

*C.O. relieved if command changed this period*

*Date of change*

3. PERSONNEL ON BOARD

At end of reporting period. Ships give ships company only; wings and groups give staffs only; air stations give station personnel only.

| | AVIATORS | AIR PILOTS | OTHER | TOTAL |
|---|---|---|---|---|
| OFFICER | 22 | | 57 | 79 |
| ENLISTED | | 0 | 640 | 640 |
| CIVILIAN | | | 436 | 436 |

*4. Mission or function* (If changed or specifically assigned during the period, then enter a brief with dates and identity of authorizing directive.)

Same

*5. Next senior operational command (Give start and end dates if changed during this reporting period.)*

COMFAIRWINGSPAC/COMFAIRMOFFETT

6. GEOGRAPHIC LOCATION: (Air Stations omit; ships enter in Part II. Wings and groups should not record squadron locations; ship-based units give name of ship only. Enter beginning and end dates when part of period is involved.)

| PERIOD *(From - To)* | PLACE |
|---|---|
| | |

*7. Participation in special exercises, operations, and operational tests* (Principally those of a major nature rather than what is normally a part of routine operational training. Use official code names or descriptive titles, identify the overall command, and give dates, area and brief summary of own participation. Make reference to reports and orders covering the operation.)

EXERCISE BUTTONHOOK, 24 January to 5 February 1966. Support was given to this large scale ASW exercise by the Aircraft Maintenance, Supply and Operations Departments and the Officers Mess and Barracks Divisions. Letters of appreciation for support provided were received from COMFAIRWINGSPAC, CO, VP-22 and CO, VP-19.

Copy to:
COMFAIRLIVE/COMNAVBASE SFBAY (Code 00B)