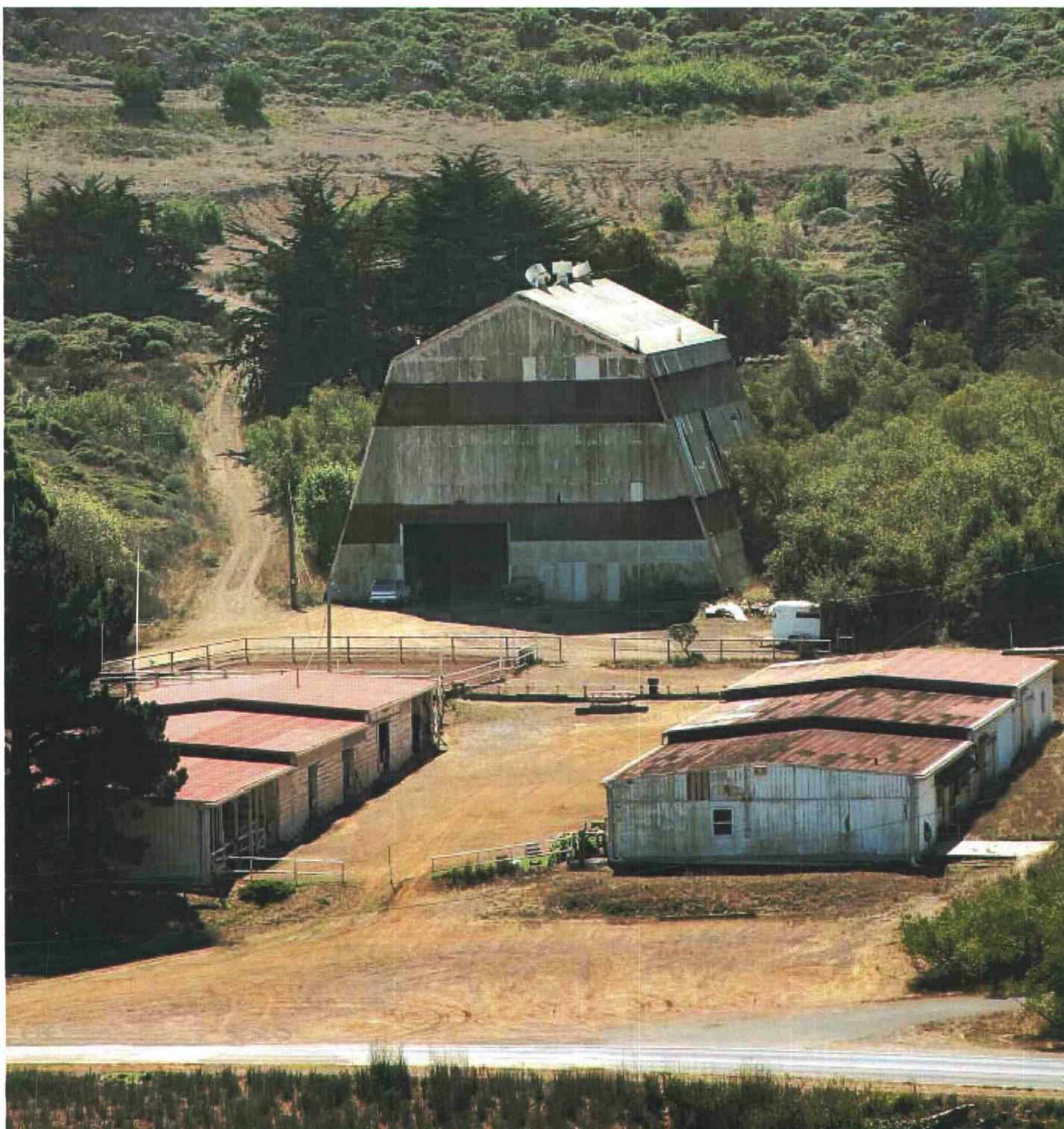




# Fort Barry Balloon Hangar and Motor Vehicle Sheds

## *Abbreviated Historic Structures Report*





Fort Barry Balloon Hangar, 1939.  
(PARC, GOGA 32423)

Cover Photo: Fort Barry Balloon Hangar and Motor Vehicle Sheds, 2004.  
(John Martini)

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# Fort Barry Balloon Hangar and Motor Vehicle Sheds

## *Abbreviated Historic Structures Report*

Golden Gate National Recreation Area  
San Francisco, California

Produced by the Cultural Resources and Museum Management Division  
National Park Service

U.S. Department of the Interior  
Washington, DC



# Introduction

*This Abbreviated Historic Structure Report was prepared by the National Park Service (NPS), Division of Cultural Resources and Museum Management (CRMM), Golden Gate National Recreation Area (GGNRA).*

## Preparation

The Historical Architect in charge of the report was Jane Lehman (NPS-CRMM). John Martini, Historical Consultant, conducted the historical research. Tennebaum-Manheim Engineers provided the Structural Evaluation, Aviva Litman Cleper Architects provided the architectural evaluation, and Rudy Carrasquilla Construction Consultant provided the cost estimates.

## Relevant Documents

The Fort Barry Balloon Hangar is one of many cultural resources within the Forts Baker, Barry and Cronkhite Historic District located within the Marin Headlands section of the Golden Gate National Recreation Area. The *General Management Plan/Environmental Analysis* (GMP, September 1980) is the main planning document for the GGNRA.

The 1973 National Register of Historic Places form, expanded in 1979, lists the Fort Barry Balloon Hangar as a contributing feature to the Forts Baker, Barry and Cronkhite Historic District. When a National Historic Landmark nomination for the Seacoast Fortifications of San Francisco Bay is completed in the near future, the hangar will be listed as a contributing structure. The hangar, building FA-905, is also included on the List of Classified Structures.

Two documents written about the Golden Gate National Recreation Area contain sections about Fort Barry and the Balloon Hangar. The Historic Resource Study entitled *Seacoast Fortifications San Francisco Harbor* was written by Erwin Thompson and published by the National Park Service, Denver Service Center, in May 1979. Shortly after this document another Historic Resource Study, *History of Forts Baker, Barry and Cronkhite*, was written by Erwin Thompson and published by the Denver Service Center in November 1979.

There are four primary sources of research materials:

- 1) The Historic Document Collection of the Golden Gate National Recreation Area, located at the Park Archives and Records Center at the Presidio of San Francisco;
- 2) The Historic Document Collection of the Golden Gate National Recreation Area housed at the Park Archives and Records Center;
- 3) The Sierra Pacific Area branch of the National Archives and Records Administration (NARA), located at San Bruno; and
- 4) The Main branch of NARA located in Washington, D.C.

## Executive Summary

This Historic Structures Report is being prepared in order to document the existing conditions and provide guidance for the maintenance and preservation of the Fort Barry Balloon Hangar and the adjacent Motor Vehicle Sheds.

## Historic Significance

*The balloon hangar at Fort Barry is a surviving element of the U.S. Army's brief experimentations with using tethered balloons as part of the nation's system of coastal defenses. Constructed and abandoned the same year, the structure is the only surviving hangar of its type that actually housed an army balloon, and one of only two examples of its type known to survive in the country. As such, it has a national level of significance for its part in the evolving stories of both coastal defense and military aviation.*

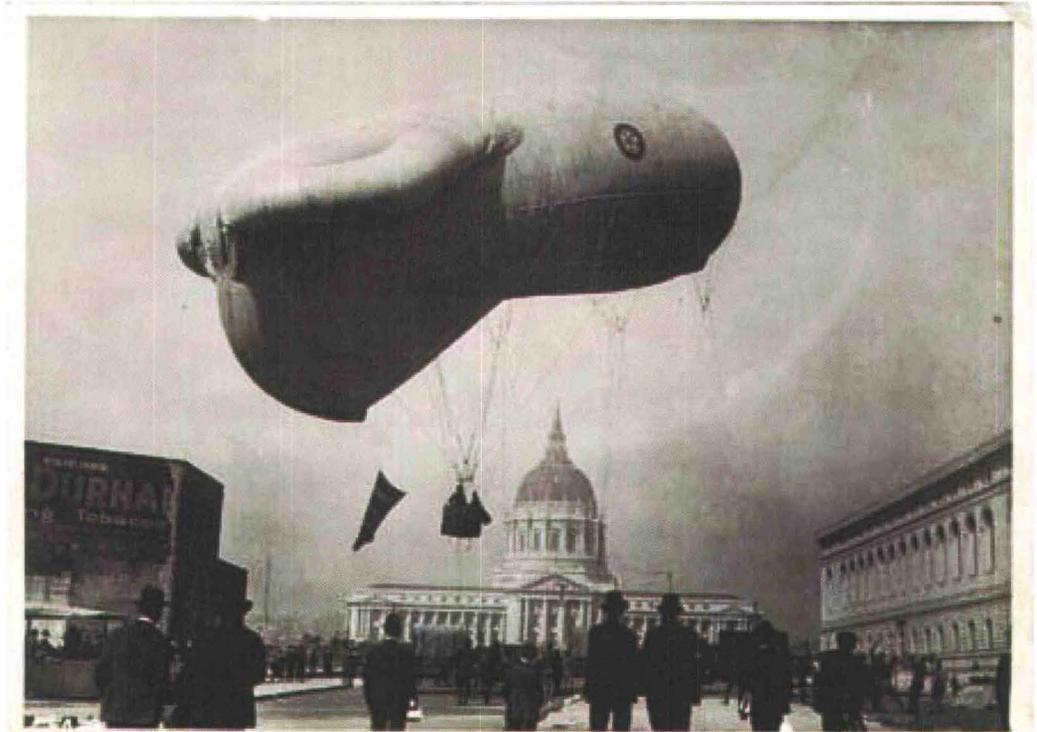
The U.S. Army began experimenting with using lighter-than-air craft during the Civil War when, in 1861 the Union Army contracted with civilian balloon company for relaying signals, spotting artillery fire and watching enemy troop movements. An official Air Division was organized in 1864 as a replacement for the civilian Balloon Corps, and the division was made part of the Signal Corps or Signal Service, names that were used interchangeably from 1864 to 1891. Tethered to the ground and inflated with hydrogen, the balloons were considered to be less than successful in their embryonic role. In 1908, The U.S. Army's Board of Ordnance and Fortifications authorized \$25,000 for the purchase of a dirigible, and a new Aeronautical Division was created. In August that year, the single hydrogen-filled airship constituted what would eventually become the US Air Force. Shortly thereafter, the Division was headquartered at Fort Omaha, Nebraska, the home of the Signal Corps School.<sup>1</sup>

### World War I and 1920s

During World War I, both the Allies and the Germans experimented with using balloons in combat, both in the familiar "fixed" role of tethered spotting platforms and also in the form of powered dirigibles, which were capable of carrying out long-distance bombing sorties. When the United States entered the war in 1917, only three U.S. balloon companies existed: the 2<sup>nd</sup>, 14<sup>th</sup> and 24<sup>th</sup>. General John J. Pershing, realizing the value of the balloons, repeatedly requested 125 balloon companies for his Allied Expeditionary Force. However, only 26 companies arrived in France and of these only 17 were sent to the front.<sup>2</sup>

The Americans did not have much of their own equipment, though, and instead adopted the French army's "Caquot Type R" observation balloons. Measuring 92 ft. long and 32 ft. diameter, the Type R could stay aloft in winds as high as 70 mph. These airships (sometimes derisively called "sausage balloons" because of their bulbous

C3 Army Balloon at San Francisco City Hall, circa 1929. (San Francisco Public Library: SFPL AAB-7399)



shape) consisted of a hydrogen-filled body equipped with fins that provided stability in rough air, and a suspended wicker basket that held a two-man crew. Communication between the observers and the ground crew was via a telephone cable spliced onto the mooring line. Before long, the Americans began manufacturing their own version of the French balloons, which the army designated the Type C-3. During 1918-1919, nearly a thousand C-3s were manufactured in the U.S.<sup>3</sup>

The Caquot design proved durable, and the sausage balloons continued to be manufactured up through World War II, where they frequently saw use as unmanned “barrage balloons” designed to ward off low-flying aircraft. (Only one Caquot Type R / C-3 is known to exist today, and is on display at the U.S. Air Force Museum in Dayton, Ohio.)

In 1920 the Air Service decided to dispatch several balloon companies to the Pacific Coast to carry out experiments with the Coast Artillery in coordinating fire control between aerial observers and fixed shore batteries. The 14<sup>th</sup> and 24<sup>th</sup> companies arrived in San Francisco on April 10, 1920, and were assigned respectively to Fort Funston in San Francisco and Fort Baker in the Marin Headlands. At the time of its arrival at Fort Baker, the 24<sup>th</sup> Company was under the command of First Lieutenant F. J. Durrschmidt, Air Service. During their three weeks at San Francisco the balloons did little flying. Instead, the companies’ mission during this early phase

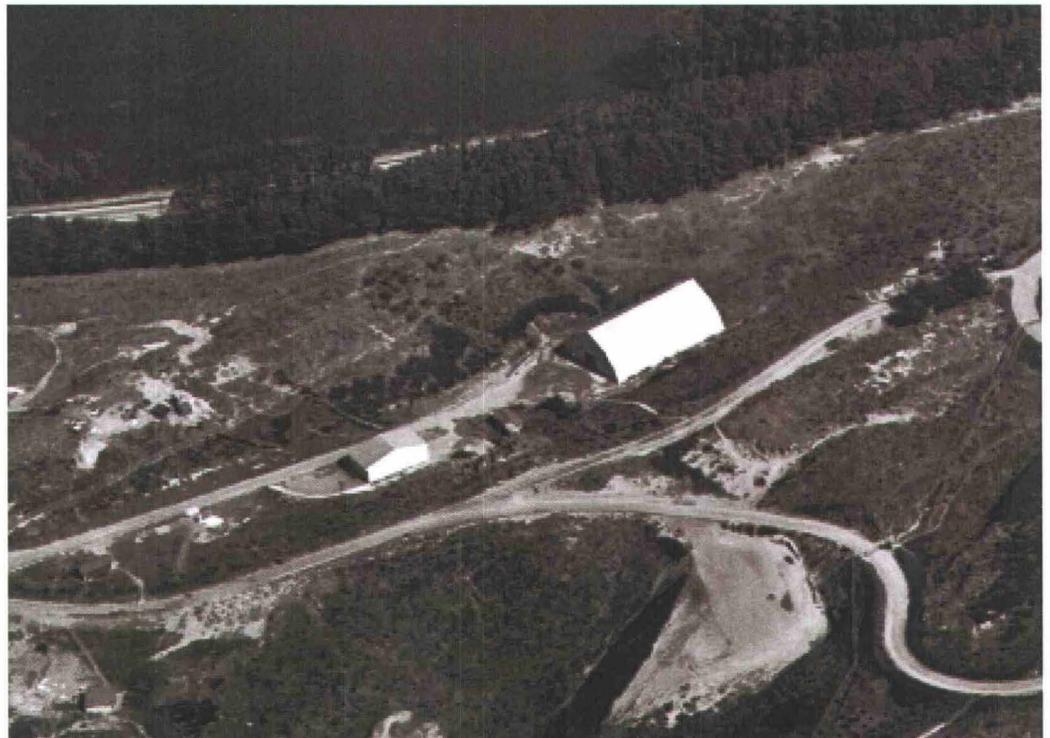
was to identify locations for future hangars and billets, and in a study of existing coastal artillery systems and the nature of the work involved.<sup>4</sup>

Each company’s equipment consisted of a Type C-3 tethered observation balloon, a type A-7 spherical “free” balloon, a portable hydrogen generator, numerous vehicles, mooring winches, and a maze of ground tackle and rigging equipment. At this time there were no buildings specifically designed for the balloon companies’ use, either for housing the troops and their equipment or for storing the balloons, so the balloons were apparently deflated when not in active service.

The 24<sup>th</sup> was briefly detached to Fort Worden in Washington State in May 1920 where they carried out similar duties planning future balloon sites in the Harbor Defenses of Puget Sound. An idea of the amount of equipment allocated to the balloon companies is indicated by a report filed upon the arrival of the 24<sup>th</sup> at Fort Worden, which stated the company’s equipment filled eight railroad cars.<sup>5</sup>

The company returned to San Francisco later that summer and on November 24, 1920, the Coast Artillery carried out the first balloon-assisted firings of a major caliber gun battery, when a crew from the 24<sup>th</sup> Balloon Company moored at Fort Barry directed the fire of the two 12-inch guns near Point Bonita at Fort Barry. According to the *Air Service Newsletter*:

Ft. Funston Balloon Hangar, San Francisco, 1942 (now demolished). (PARC, GOGA)



*Battery Mendell (12 inch disappearing guns) fired 22 shots at a pyramidal target with an approximate range of 14,000 yards, the target being towed by a tug with a tow line of 500 feet. The tracking and spotting were done by balloons and the data obtained from the Balloon Plotting Room. No direct hits were obtained on the pyramidal but had it been actual service conditions with a ship as the target at least five of the shots would have been direct hits. ... these results have laid a foundation upon which future improvements can be built with lasting and definite advantage to the Service.<sup>6</sup>*

The army was apparently satisfied that the balloons were going to be a permanent part of the Coast Artillery's arsenal, and in mid-1920 authorized the construction of permanent balloon hangars and associated "generator house" buildings at eight army posts around the country. Work subsequently began on the hangars at Fort Barry and Winfield Scott on 27 July 1920, and both were completed by 26 June 1921 at a total combined cost of \$199,787.<sup>7</sup> (Shortly afterwards a third hangar was constructed at Fort Funston<sup>8</sup>, but it was of a different design from the Scott and Barry hangars.<sup>9</sup>)

Experiments continued during the latter part of 1920 and into 1921 on various techniques for directing artillery fire. The first method was the simplest, consisting of a single balloon with two observers in the wicker basket watching for the splash (called "the fall of shot") when a shell landed near a target, and relaying corrections back to the battery. One observer used a simple telescope to track the moving target and watched

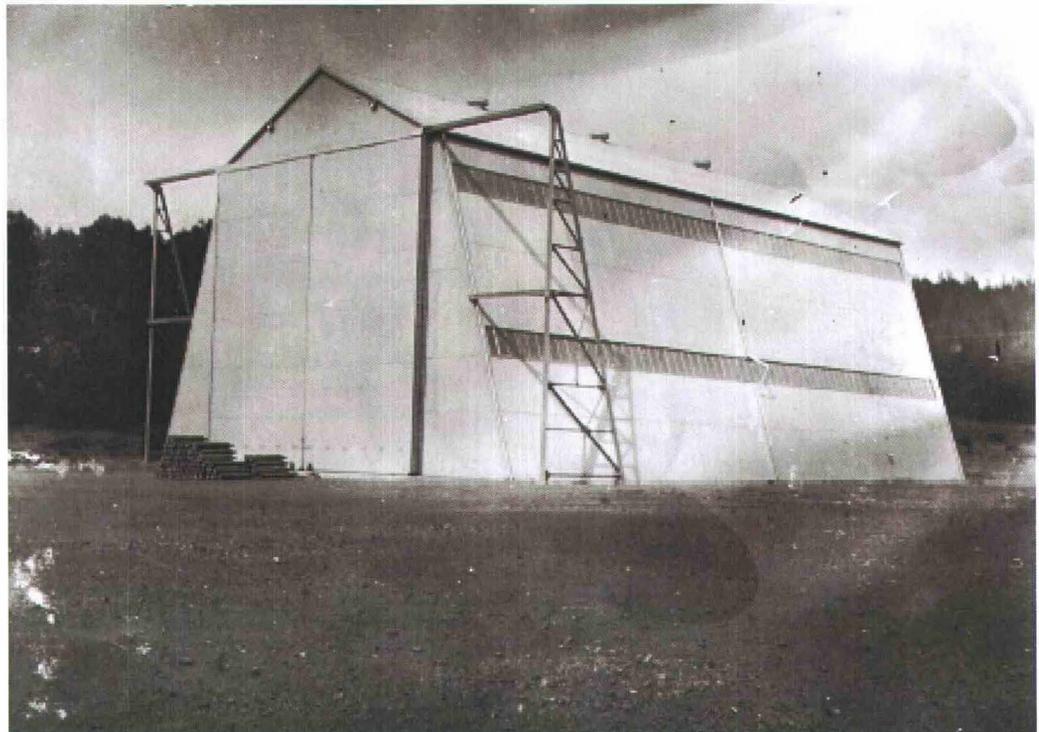
for the splash. When he saw the splash he verbally relayed his observations and corrections to the second crewman, who was connected via telephone to switchboard on the ground and from there to the plotting room at the battery. These corrections, usually stated succinctly as "Up 200 yards" or similar, would then be factored into the aiming directions relayed to the gun crew.

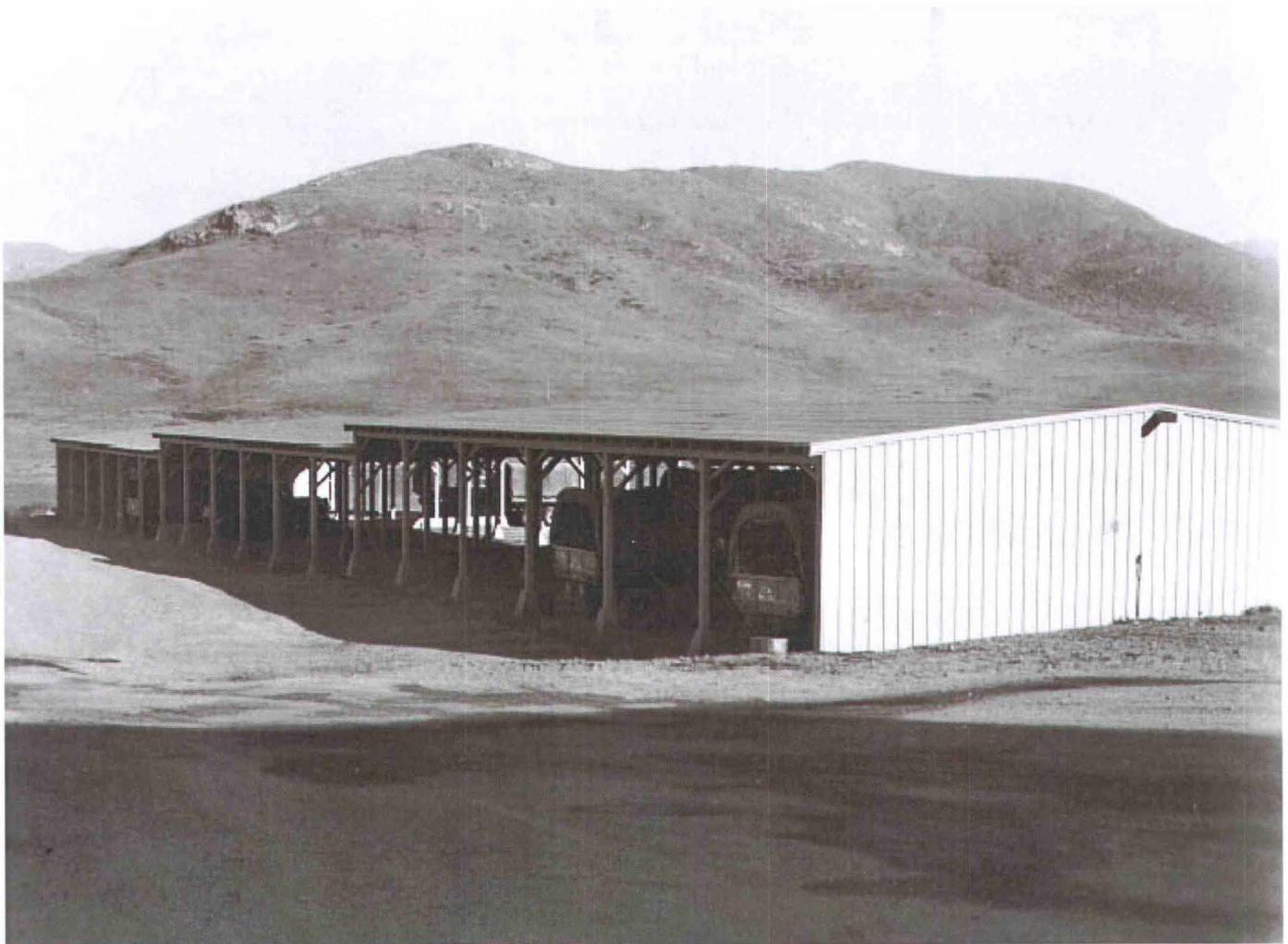
The second technique was more complex, consisting of observers in two tethered balloons simultaneously taking bearings on a moving target and having a ground crew calculate the range to the target. Since the two balloons were moored a known distance apart their positions formed a "base line", and their differing angles of view towards the target could be used to calculate the distance to the target using simple trigonometry. At the San Francisco experiments, one balloon from the 24<sup>th</sup> Balloon Company was tethered at Fort Barry while a balloon from the 14<sup>th</sup> Company was moored above Fort Miley, providing a baseline the width of the Golden Gate.

Of course, innumerable variables and complications had to be thrown into this seemingly simple bit of math work, not the least of which was the fact that the baseline was constantly changing its length due to the wind-tossed motion of the balloons.

Wind was a constant problem for the balloons, and during January 1921 both of the companies in San Francisco lost a balloon due to high winds. Nevertheless, the army felt that experi-

**Ft. Scott Balloon Hangar, San Francisco, circa 1939 (now demolished). (PARC, GOGA 32422)**





East Vehicle Shed, Ft. Barry, California, 1940. (PARC, GOGA 32423)

ments in the base line range finding merited continued refinement, and work continued on the permanent hangars.<sup>10</sup>

As noted above, the balloon hangar at Fort Barry was completed on June 27, 1921. Although it was not officially recorded, it is believed the 24<sup>th</sup> Balloon Company moved its balloon into the new structure not long afterwards. It is known they were still on-site at Fort Baker in late June, though, because the monthly report states that on the 25<sup>th</sup> the entire company had been engaged in fighting grass fires “which raged on with the high winds.” In addition, the company was engaged in a class in “Balloon Fabric work and Rigging”, presumably in the new hangar building.<sup>11</sup>

However, their occupancy would not be a long one; before the end of 1921 both balloon companies were removed from the Harbor Defenses of San Francisco. (The companies never returned to Puget Sound, despite the fact that an identical hangar to the one at Fort Barry had been completed at Fort Worden in December 1921. That hangar never did house a balloon.<sup>12</sup>)

#### World War II Era

The use of the Fort Barry hangar is not recorded from the time of the Balloon Companies’ departure in late 1921 until the start of World War II, but likely it was held in reserve for the future return of an army balloon. The building was still listed in the post quartermaster’s records as ‘Hangar (Balloon), Capacity: 1 Balloon’ as late as 1939.<sup>13</sup> Also, the hangar still retained its towering sliding doors until well into 1942. Recognizing the army’s penchant for putting empty spaces to use, though, it’s likely the hangar’s interior served as a convenient warehouse for Forts Baker, Barry and Cronkhite – a use that could be quickly changed back into hangar space on short notice.

In 1941 the Marin Headlands forts experienced a massive buildup of troop strength as the army prepared for possible war with Japan and Germany. During this “Mobilization” period the army must have realized the obsolescence of the balloon hangar, and its landing field north of the hangar doors was converted into a motor pool area with covered sheds for trucks and vehicles. The capacious interior of the hangar was likely

converted to workshop spaces at the same time. In 1943 the hangar experienced its first major remodeling when the sliding doors were removed and the balloon entrance enclosed with siding material salvaged from the big doors, and shops and offices were constructed along the hangar's side bays.<sup>14</sup>

#### **Nike Missile Era**

At the outbreak of the Cold War, the hangar was once more converted to a new use; this time as an Ordnance Repair Shop for anti-aircraft surface-to-air missiles emplaced beginning in early 1953 in the Marin Headlands at the end of the Korean War. During the period 1953-1959, the balloon hangar continued to be used as a maintenance facility for routine missile repairs for nearby Nike launch sites SF-87 at Fort Cronkhite and SF-88 at Fort Barry. (Higher-level repairs and servicing of the missiles took place at the Presidio.) This role would continue until at least 1959 when the larger Nike-Hercules missiles came into service and specially-designed assembly and test buildings were built at every Hercules battery, thus lessening the need for the central assembly and test facility located in the hangar.<sup>15</sup>

#### **Presidio Riding Stables**

In 1966, the Presidio Riding Stables were granted the use of the former vehicle sheds and the hangar building. The stables were part of the "quality of life" recreational facilities provided by the U.S. Army for its Presidio garrison and their dependents, and it operated as part of the military's "non-appropriated funding activities." As part of

the Presidio Stables, the 1940s vehicle sheds in front of the hangar were enclosed and turned into horse stalls and tack rooms, while the hangar's interior was converted into an indoor riding rink.

**Ft. Worden Balloon Hangar, Port Townsend, Washington, 2001. McCurdy Pavillion/Littlefield Green. (Michael Shopenn)**



# Application of Criteria of Evaluation

## 1. Balloon Hangar

Despite its various uses and modifications, the Fort Barry Balloon Hangar still maintains a high degree of integrity, retaining significant characteristics from its three defensive roles: first, as an Air Service facility that aided in the coastal defense system and experimentation during the period 1920-1921; second, as a World War II motor pool site that supported the Harbor Defenses of San Francisco from 1940-1945; and finally as a Cold War anti-aircraft and missile maintenance facility from 1953 to sometime after 1959.

The balloon hangar takes on an added degree of significance given that it is the only remaining example of two identical hangars built around San Francisco during the early 1920s. Also, it is the only surviving example on the West Coast of a hangar that actually housed an observation balloon. By contrast, the Fort Worden balloon hangar was completed many months after the last Balloon Company departed the Puget Sound area, and its interior has been completely re-modeled for use as a theater.

It is considered to have National Level significance under both National Register Criteria A and C, and Local Level Significance under Criterion A.

**Criterion A (National):** The Fort Barry Balloon Hangar has association with the U.S. Army's tentative yet important experiments following World War I utilizing aerial balloons for spotting enemy targets. This embryonic mission would in time evolve to include fixed-wing and rotary-wing aircraft, reconnaissance "spy planes" (such as the U-2 and SR-71 Blackbird) and even satellites for gathering information on enemy location and movements. It is also the only example of its type in the nation that actually housed an army Air Service reconnaissance balloon.

**Criterion A (Local):** The Fort Barry hangar served two important defense-related missions following its balloon use with important relevance to the local story of San Francisco harbor defense. First, beginning in 1940, the hangar and its adjacent vehicle sheds served as a central motor pool for vehicles assigned to the Coast Artillery units in the Marin Headlands during World War II. Second, during the Cold War, the hangar was converted into a central Ordnance Repair Shop that supported the two Nike missile launch sites constructed in Forts Barry and Cronkhite.

(The launch site at Fort Barry has been restored to its appearance c1960.) Its interior still contains many small-scale features relating to this later Nike use, including three lean-to office additions, electrical and compressed air utility connections, and various wall stencils.

**Criterion C (National):** As mentioned above, the Fort Barry Balloon Hangar is a rare surviving example of an Air Service airship hangar. The basic gambrel-roof design and dimensions of the original hangar remain unchanged, and its interior layout still retains the open, airy feeling of an aircraft hangar. Although other Air Service *aircraft* hangars are known to exist around the country, this is the only example of an *airship* hangar that retains its important interior configuration in an unaltered state. (Of the eight identical hangars built under the original 1920 program only the hangars at Forts Barry and Worden survive, and as noted above, the one at Worden is highly modified.)

## 2. Vehicle Sheds.

The two frame vehicle sheds in front of the hangar are rare examples of "Series 700" design structures erected by the army on the eve of World War II. Once common at Bay Area military posts, these nondescript yet functional vehicle sheds have all been demolished except for the pair at Fort Barry. Their subsequent role as a motor pool facility for the Coast Artillery and Air Defense Artillery makes them important elements of the story of the defense of San Francisco Bay during World War II and the Korean War. Even though altered by enclosing most of their originally open bays, the sheds' exterior dimensions and rooflines remain in their original configuration. Also, the entire northern third of Bldg 902 remains in its origin open bay configuration, complete with bare earth floors.

The sheds are considered to have Local Level Significance under Criterion A and Regional Level significance under National Register Criterion C:

**Criterion A (Local):** The Fort Barry vehicle sheds served two important defense-related missions relevant to local story of San Francisco harbor defense. First, beginning in 1940, the sheds and adjacent hangar served as a central motor pool for storage and maintenance of vehicles assigned to the Coast Artillery units in the Marin Headlands during World War II. Second, during the Cold War, the sheds continued as vehicle storage for the Air Defense Units and Nike sites in the Marin Headlands.

**Criterion C (Regional):** As mentioned, above

the vehicle sheds are the sole surviving examples in the San Francisco area of once-common style of military building. The National Park Service has made a commitment to preserving other Series 700 building examples remaining in Forts Baker, Barry, and Funston, and these functional structures contribute significantly to that preservation effort.

In short, the Fort Barry hangar complex is an extremely significant area. The hangar is already included as an element of the Forts Baker, Barry, and Cronkhite National Register District. The complex' three buildings are also contributing elements to a potential National Historic Landmark district on the Harbor Defenses of San Francisco.

**(Endnotes)**

<sup>1</sup> *Keepers At the Gate*, by V.J. Gregory, Port Townsend Publishing Co, Port Townsend, WA. 1976. pg 206-207

<sup>2</sup> Gregory, pg 204

<sup>3</sup> USAF Museum website [http://www.wpafb.af.mil/museum/early\\_years/ey5a.htm](http://www.wpafb.af.mil/museum/early_years/ey5a.htm) "Caquot Type R Observation Balloon"

<sup>4</sup> *Air Service Newsletter*, "14<sup>th</sup> and 24<sup>th</sup> Balloon Companies to Cooperate with Coast Artillery", 27 April 1920

<sup>5</sup> Gregory, pg 203

<sup>6</sup> *Air Service Newsletter*, "For the First Time in History of the World Problem Fired In Which All Data Was Supplied From the Air By Balloon." 29 December 1920.

<sup>7</sup> Lt. Col. I.L. Fredendall, Construction QM, June 30, 1921, "Completion Report of Balloon Hangars at Forts Barry and W. Scott." Completion Reports, Ft. Winfield Scott, RG77, Office of the Chief of Engineers, NARA

<sup>8</sup> *Historic Resource Study: Seacoast Fortifications San Francisco Harbor*. National Park Service: Denver, 1980. pg 288

<sup>9</sup> See aerial photo of Fort Funston taken February 1942 in the Kenneth Cooper Collection, PARC, GOGA

<sup>10</sup> Thompson, pg 288

<sup>11</sup> *Air Service Newsletter*, "24<sup>th</sup> Balloon Company, Fort Baker, Calif." June 25, 1921

<sup>12</sup> Gregory, pg 207

<sup>13</sup> "Post Building Book, Fort Barry, California," entry for Bldg. No. 141, PARC

<sup>14</sup> Drawing, "Alterations to Balloon Hangar, Fort Barry," 24 August 1943. Drawer 213, Folder 1, PARC, GOGA

<sup>15</sup> Oral History interview with Peter Bohan, U.S. Army (ret.). GOGA-2647. Mr. Bohan served as Chief Warrant Officer at Nike Site SF88L, Fort Barry, from 1958 until 1963.

# Timeline

**1920** April. The 24<sup>th</sup> Balloon Company arrives at Fort Baker to begin operations with Coast Artillery units. August. Plans prepared for "Standard Dirigible Balloon Hangars for Aviation Stations"

**1921** Hangar completed on 27 June 1921. Total cost: \$99,893.50 (including cost of adjacent hydrogen generating building.)

**1939** 30 June 1939. Building Book entry: "Total expenditures to date [1921-1939]: \$1,903.22"

**1940** Building Book entry: "Total expenditures F.Y. 40: \$7.49"-Two vehicle sheds constructed on former balloon landing field north of hangar. OQMG general plan #700-329. [Bldgs. 901 & 902]

**1942** Building Book entry: "M.R. [Misc. Repairs?] F.Y. 42: \$94.81 / \$2,205.52"

**1943** Hangar converted to Motor Pool uses-Plan dated 24 August 1943 "Alterations to Balloon Hangar". Large roller doors and supports removed. Door opening framed-in and covered with salvaged corrugated asbestos. Two 10'x12' warehouse-type hanging doors installed. 3'x6'8" swing-in personnel doors built into the larger doors.- Plan dated 10 November 1943. "Offices for Fort Barry Motor Pool inside Balloon Hangar." 16'x40' building with shed roof constructed inside hangar against east wall. Contains three rooms. - Plan dated 26 November 1943 "Latrine at Bldg. 141, Fort Barry, Motor Pool for the 6<sup>th</sup> CAC". Latrine room added at south end of offices shown on earlier drawing.

**1944** Portion of motor vehicle shed no 143 (present Bldg. 901) converted to paint shop by enclosing southern third of structure with board siding with new windows and vehicle doors. Windows added to existing southern wall.

**1946** Aerial photo taken in October shows completed motor pool complex. However, former hydrogen generator house is no longer present.

**1953** Hangar converted to Antiaircraft Artillery (AAA) maintenance facility.-Plan dated 20 June 1953 "Rehabilitation of Balloon Hangar to Heavy Armament Shop. Shows numerous alterations and new construction including new offices and latrine; new floor slab; new roller door and personnel door at north end; upgraded utility systems; new surrounding walkways and con-

crete apron on north side. - Notations regarding siding and roof: "Deteriorated roofing to be replaced with 22 ga. Galvanized corrugated metal"; "Existing corr. Siding to remain"; "Remove existing corr. Asbestos coated sheet iron all around bldg and replace w/ corrugated cement asbestos siding"; "Colored corrugated glass fiber sheets" to be added to existing window openings. - Both courses of windows apparently enlarged in height, and additional plexiglass windows added on remodeled north facade. - Cinderblock transformer vault added to west side of structure.

**1954** Plan dated 21 May 1954 "Bldg 907 - Ft. Barry / Nike Assembly Area". Shows interior with missile assembly and test equipment in place, including ten disassembled Nike-Ajax missile bodies and warheads

**1959** Plan dated 15 September 1959 "Bldg 907 - Fort Barry. Housing for Air Receivers". Shows new wood structure for air compressor and reservoir tanks to be constructed adjacent to south exterior wall of hangar.

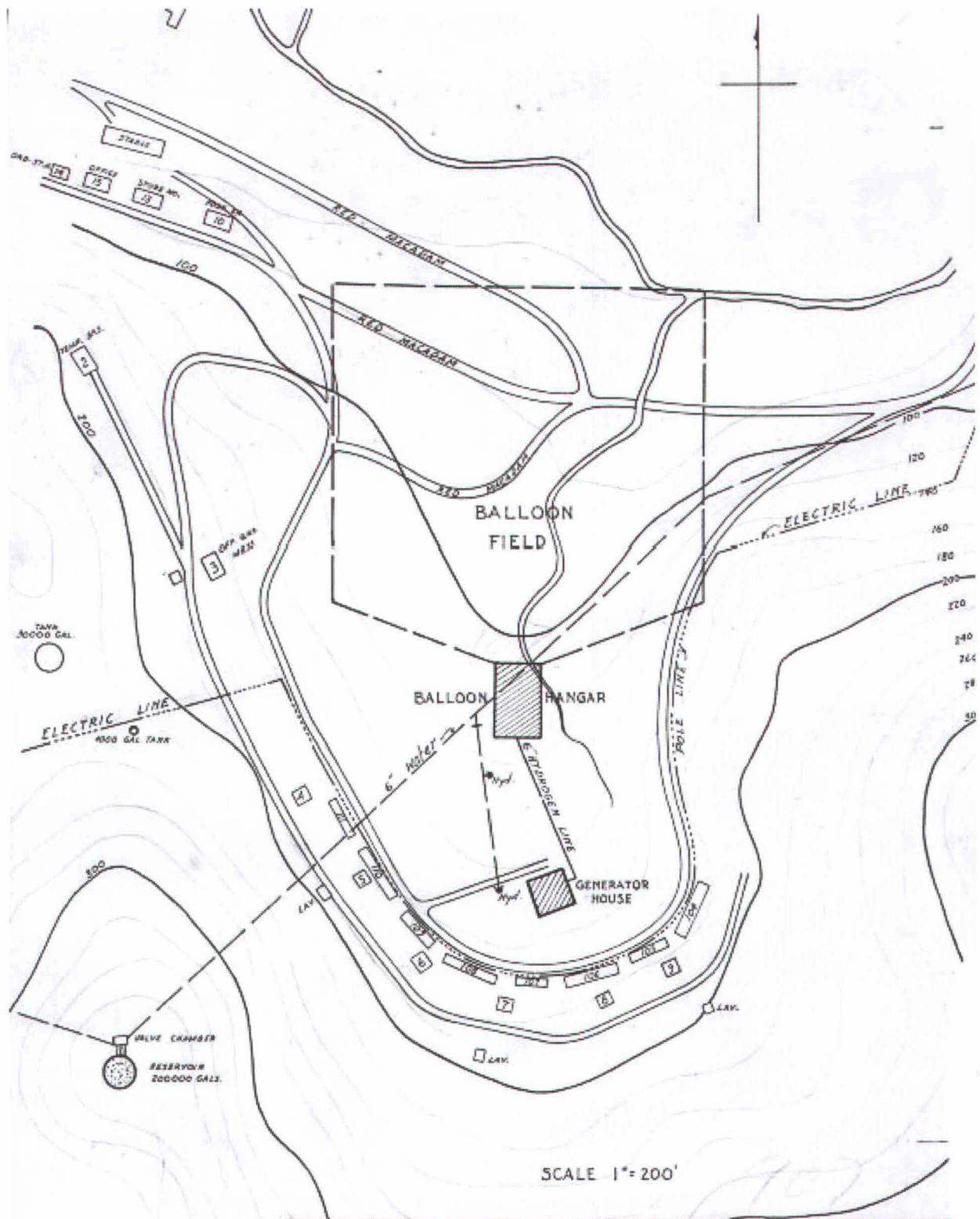
**1966** Presidio Riding Stables receive permit from army to use old vehicle sheds and hangar for riding stables.

**1982** New concrete ramp added alongside west side of Bldg. 901 to improve drainage in adjacent paddock.

**1984** Fire alarm system installed in Bldgs 901 and 902

**1985** Electrical systems upgraded in Bldgs 901 and 902 by removing existing electrical lights and power distribution and installing new.

**1994** Presidio Stables given year-to-year Special Use Permit by National Park Service to continue their operations in hangar and vehicle sheds.



Q.M. CORPS U.S. ARMY: CONSTRUCTION SERVICE  
 THIRD DISTRICT OFFICE: SAN FRANCISCO, CALI  
**FORT BARRY- CAL.**  
**SHOWING BALLOON HANGAR ETC.**

JOB NO. 6378	APPROVED <i>[Signature]</i> L.O.M.C.	JULY 27, 1921
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6378

# Developmental History

*Although the Balloon Hangar housed coastal defense balloons for only a short period of time, it has demonstrated its usefulness in many different ways throughout its 85-year history.*

## Pre-Hangar Era

The site of the future Fort Barry Balloon Hangar was originally part of the sprawling Rancho Saucelito, a Mexican land grant given by the Mexican government in 1833 to William Antonio Richardson, a naturalized British citizen. In 1866 Richardson's successor owner, William Throckmorton, sold much of Rancho Saucelito to the U.S. Government for defensive purposes. The newly acquired military post was initially dubbed "Lime Point Military Reservation" but in 1892 the area was renamed Fort Baker in honor of Edwin Baker, a former senator and Union officer who had been killed during the Civil War. The boundary between the new military post and Throckmorton's land to the north was a zigzag boundary that roughly followed the course of the small stream that drained westward to today's Rodeo Beach.

The Balloon Hangar area was not developed for the first 38 years the army controlled Fort Baker. The site in its natural state was a U-shaped valley opening towards the north, drained by a small rivulet that eventually merged with the larger Rodeo Creek running down the middle of the valley. Sheltered from the prevailing westerly winds, the small valley was reminiscent of other bowl-shaped valleys still surviving in today's Marin Headlands, such as the former Chiolli ranch site north of Rodeo Beach and the Gerbode Preserve directly across the valley from the hangar site.

The military first developed the unnamed valley in 1904-1905 as part of a large-scale project to establish a "Departmental Rifle Range" in Fort Baker. At this time, every army post had its own target range where troops would train with a variety of rifles and small arms. However, the quality of these ranges varied widely and the army decided that, in the interests of uniformity of training, soldiers should travel to centralized, properly designed ranges for their periodic marksmanship qualifications. Constructed by military convicts ferried over from Alcatraz Island, the Departmental Range at Fort Baker was designed as central training facility where troops from around the western states could come for annual rifle and small arms qualifications. Work began in November 1904 and was substantially completed by May 1905.<sup>1</sup> (In December 1904 the

army subdivided Fort Baker into two smaller forts — Baker and Barry — and the proposed rifle range became part of Fort Barry.)

The future balloon hangar site initially served as the temporary camp site for enlisted men and officers assigned to the Departmental Range, and during the course of constructing the range the curving perimeter of the valley was carved into two parallel benches or terraces for the quarters. The upper terrace held permanent (albeit crudely built) mess halls, latrines, and living quarters for officers while the lower bench held prepared platforms where enlisted men and NCOs would pitch tents for the duration of their stay at the range.<sup>2</sup>

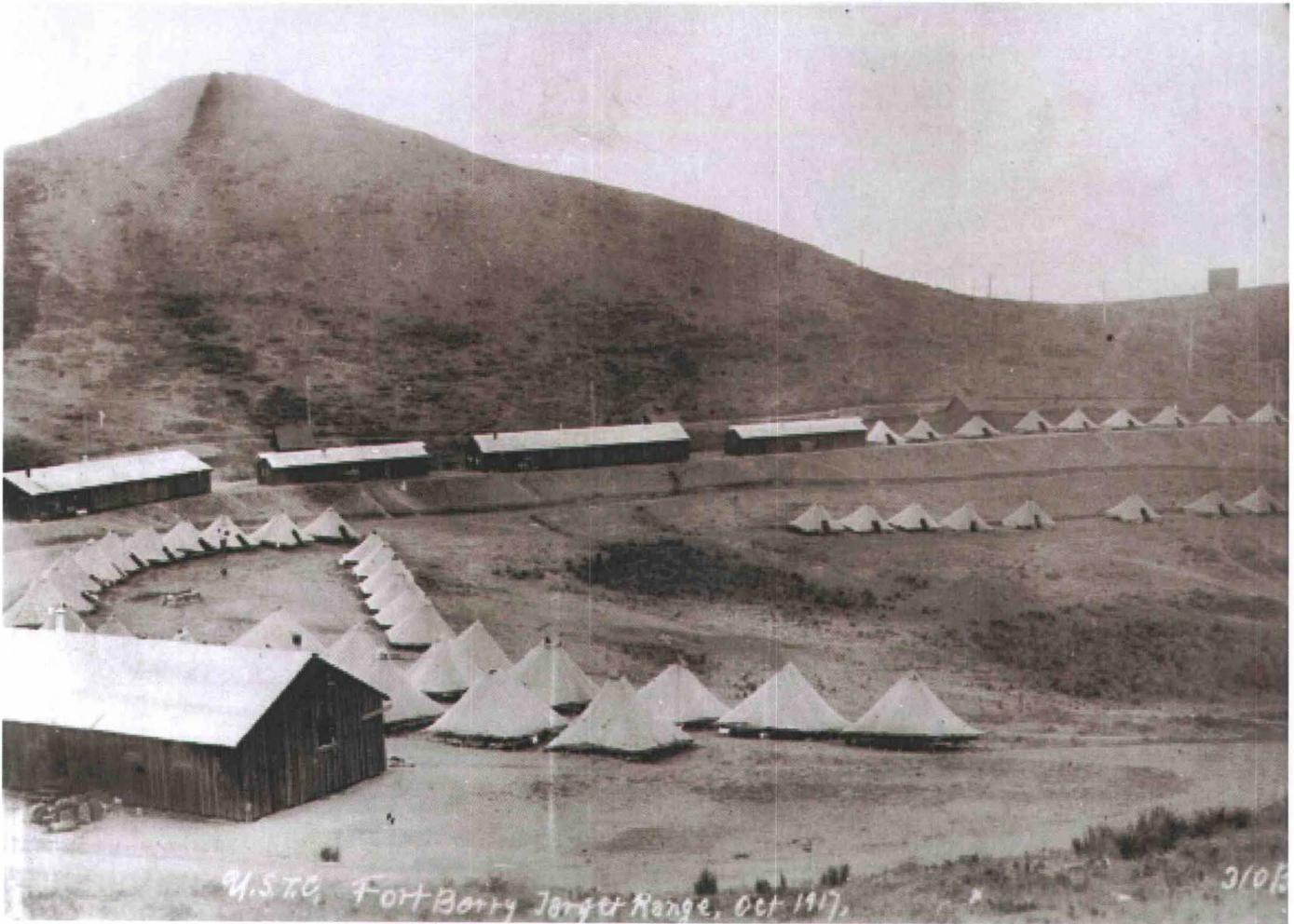
Several companies at a time could be accommodated at the encampment valley, and a small detachment of soldiers remained on-site at all times to provide what might be called administrative overhead. By 1910, the temporary frame structures consisted of a barn, an office, a storehouse, a cookhouse, a post exchange, an officers' quarters, and six mess kitchens.<sup>3</sup> (See figure "USTC [U.S. Training Camp] Fort Barry Target Range")

This housing area saw regular (if intermittent) use during the 1900s and 1910s while the adjacent Departmental Range served as a centralized firearms qualification area for soldiers on the Pacific Coast. However, during World War I the range's housing areas were pressed into service as a full-time cantonment for troops undergoing training at the Presidio and other nearby military posts before being shipped overseas. Following the war, the valley briefly assumed the additional role of housing ROTC cadets assigned to the San Francisco area.

## Balloon Company Era

On April 14, 1920, the 24<sup>th</sup> Balloon Company arrived at Fort Baker to begin its training and coordination activities with the Coast Artillery. However, as noted previously, little in the way of actual flying was done during the first few weeks as the company spent most of its time "choosing suitable locations for permanent buildings for balloon garrisons, and in the study of Coast Artillery Systems and the nature of the work involved."<sup>4</sup> At that time, their equipment consisted

Site plan of Balloon Hangar and landing field showing buildings associated with the temporary camp site for the Departmental Rifle Range, July 27, 1921. (Drwr. 213, Folder 1, PARC, GOGA)



Departmental Rifle Range Camp, 1917. (PARC, GOGA 3045)

of a Type C3 tethered observation balloon, a spherical or “free” balloon, a portable hydrogen generator, mooring winches, numerous vehicles, and ground support equipment.

Shortly afterward, the 24<sup>th</sup> was dispatched to the defenses of the Columbia River but returned later that summer, and on November 24, 1920 the Company participated in target ranging exercises at Battery Mendell, Fort Barry.<sup>5</sup> Presumably, since there was no permanent hangar, the balloons were inflated for training missions such as this one and then deflated for stowage – a time consuming and probably frustrating situation for the soldiers.

It was quickly realized that the balloon companies, if they were to become a permanent adjunct to the Coast Artillery companies, needed permanent structures both for the men and their balloons. In late 1920 the army authorized the construction of permanent balloon hangars and associated “generator house” buildings at eight army posts around the country. The locations selected were as follows: Forts McKinley and Williams in Portland, ME; Forts Nahant and Andrew in Boston; Forts Barry and Winfield Scott in the

Presidio of San Francisco; and Forts Worden and Casey on Puget Sound.<sup>6</sup>

In August and September 1920, the Construction Division of the War Department approved standardized plans for “Dirigible Balloon Hangars for Aviation Stations” to be used for the eight coast defense locations.<sup>7</sup>

The specifications for each hangar complex were identical, calling for a steel hangar covered with galvanized iron, 120 by 76 feet, rising to an elevation of 60 feet; a generator house of steel construction on a concrete foundation, 80 feet square; a frame storehouse, 30 by 70 feet; and a frame garage 30 by 60 feet. In addition, each group of buildings required six acres of surrounding land, much of it for use as a landing field and staging area for the ground support and mooring equipment.<sup>8</sup>

In the meantime, the 24<sup>th</sup> Balloon Company continued to work with the artillerymen of the Marin forts. The need for a hangar was emphasized when a southwest wind blew into the Marin Headlands in early 1921 and nearly tore loose a balloon tethered in the open in “a valley pro-

ected on all sides but the north”, presumably the future site of the hangar. During the storm the wind got beneath the balloon, lifted it up, and “pulled some two dozen screw anchors from the ground, which had been softened by the previous rains. In spite of the hard fight put up by the balloon guards, amid entangling rigging and flying screw anchors and sand bags, the balloon pulled away and was wrecked.”<sup>9</sup>

Another balloon must have been acquired, though, because in March the 24<sup>th</sup> Company reported they had been assisting in range finding for the 6-inch guns at Battery Guthrie, Fort Barry. However, progress on a permanent hangar was being made, and the Company’s entry in the *Air Service Newsletter* for that month noted:

*Rain has prevented much flying on the part of the Twenty-fourth Balloon Company and has softened the balloon bed of the organization to such an extent that it had to be abandoned. A new bed is being made on a good hillside location which is well drained. It is reported that the material for a new balloon hangar has been shipped and it is expected that the Twenty-fourth Company will soon be well housed. Because of the bad weather in early February there was not much flying, but the Company finished its new balloon bed, laid out new field telephone lines, and carried out drills and recruit instruction.*<sup>10</sup>

According to the “Completion Report” on the hangars at Forts Barry and Scott filed by the Constructing Quartermaster, actual construction on the Fort Barry hangar began on 27 July 1920, with site preparation work carried out by contract laborers. The location of the balloon hangar was described as “stiff blue clay overlaid by a layer of adobe, approximately by 2 feet in thickness”, and preparatory to construction work the area was cleared off grass and burned, and a 12-inch tile drain laid and the field rough graded.<sup>11</sup>

Primary work on the hangars at both Forts Barry and Scott was carried out by Lange & Bergstrom of San Francisco and McClintic-Marshall Co. of Pittsburgh, PA, who supplied the steelwork for the Fort Barry hangar and the other seven hangars to be constructed around the country. The work was performed under the direction of the Constructing Quartermaster, Lt. Colonel Ira L. Fredendall, and his assistants, and was directly under a civilian Superintendent of Construction and a civilian Inspector as assistant for a period of about ten weeks.<sup>12</sup>

The Completion Report is cited here at length because of the information it yields about the

construction of the hangar:

*Excavations were made with steam shovel and material was moved with 5 ton motor trucks. The field was surfaced with red rock from a local quarry. Grading was completed August 20<sup>th</sup> [1920]. ... Work on foundations and concrete floors was started January 3, 1921, and completed April 27<sup>th</sup> – a 10-foot gasoline driven mixer was used. Steel erection was started March 21<sup>st</sup> and completed April 21<sup>st</sup> – a guy derrick and steam hoist were used. Painting was started April 22<sup>nd</sup> and was completed June 27<sup>th</sup>. Covering was started April 25<sup>th</sup> and completed June 25<sup>th</sup>. Electric wiring was started April 26<sup>th</sup> and completed May 7<sup>th</sup>. Finish grading was started May 3<sup>rd</sup> and completed June 25<sup>th</sup>. Contractors had to furnish transportation between San Francisco and Fort Barry and all materials had to be hauled about 5 miles. The rainy season delayed concrete work considerably.*<sup>13</sup>

According to the Fort Barry “Building Book” maintained by the fort’s quartermaster, the Balloon Hangar was officially completed on 27 June 1921 and initially designated Bldg No 141. Total cost was listed as \$99,893.50<sup>14</sup>

In its original form, the Balloon Hangar was a rectangular building measuring 77’ x 120’ with sloping sides and a peaked roof, reaching a maximum interior height of approximately 65’ 10”. The most notable feature of the building was a pair of sliding doors on its north façade, each measuring approximately 22’9” wide x 44’9” high, which slid open a supporting gantry to allow entry of an inflated balloon.<sup>15</sup> Original completion drawings for the hangar have not been located, but apparently the interior was entirely open in this initial configuration. With its 120’ interior clear space, the hangar was easily large enough to accommodate simultaneously an inflated Type C3 observation balloon and a smaller free balloon.

In addition to the hangar proper, the new balloon complex included a generator house located approximately 200 feet southeast of the hangar where the highly flammable hydrogen gas for inflating the balloons was located. A buried 6” gas pipe connected the generator house to the hangar.

The final element of the complex was a spacious “balloon field” located north of the hangar where the airships could be launched and retrieved, and their ground tackle laid out. The field encompassed a square area roughly 500 feet on a side that dropped in elevation roughly 40’ from south to north. The field was also crisscrossed by several roads and creeks, and does



Fort Barry Balloon Hangar, 1939.  
(PARC, GOGA 32423)

not appear to have been a prepared landing surface in the modern sense of an airfield. Instead, it was likely just a designated open area that was to be kept free of future construction to allow room for the safe handling of the balloons.<sup>16</sup>

It is not known how long the 24<sup>th</sup> Balloon Company used the new hangar at Fort Barry, but according to the *Air Service Newsletter* both the 24<sup>th</sup> and the 14<sup>th</sup> Companies had relocated to Crissy Field in the Presidio by November 1921. Again, the records are mute on when the two companies finally left San Francisco since no reference to either of them has been found in the *Newsletter* after that time.<sup>17</sup>

#### Coast Artillery Use

The looming but empty balloon hangar became a fixture on the Fort Barry landscape during the 1920s and '30s. Although the Quartermaster's building book still referred to the structure as a hangar as late as 1939, the building was merely being kept in reserve for the possible eventual return of a balloon outfit. Up through the end of FY1939, expenditures on the hangar totaled \$1,903.22 for unspecified improvements and maintenance.<sup>18</sup> However, recognizing the army's penchant for putting empty spaces to use, it is

likely the hangar's interior served as a warehouse for Forts Baker and Barry – a use that could quickly revert to hangar space on short notice. (A supporting fact for this theory is that the hangar still retained its towering sliding doors until well into 1943.)

In 1940 the United States began to mobilize its military forces for possible involvement in the expanding European war, and yet another coast artillery fort was established in the Marin Headlands to augment Forts Baker and Barry: Fort Cronkhite, located on the north side of Rodeo Lagoon. This new fort comprised several artillery emplacements and a cantonment area for several companies of the 6<sup>th</sup> and 56<sup>th</sup> Coast Artillery Regiments.

During this period, the old balloon field area north of the hangar became the site of two expansive vehicle sheds hastily constructed to house the growing fleet of vehicles assigned to the posts. These sheds were virtually identical, each measuring 46' x 216' and consisting of 18 covered bays arranged in three stair-stepped sections of six bays each. The sheds were constructed according to standardized drawing #700-329, and were completed in September

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*The most notable feature of the building was a pair of sliding doors on the front facade, each measuring approximately 22'9" wide x 44'9" high, which slid open a supporting gantry to allow entry of an inflated balloon.*

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1940 at a total cost of \$8,976.28.<sup>19</sup> (See figure "Vehicle Sheds Ft. Barry (Balloon Hgr) August 1940")

At the same time the vehicle sheds were completed the old hangar also seems to have been recruited for a new use as a maintenance building for the trucks and jeeps parked in the adjacent sheds, because the Building Book bears a handwritten notation under the hangar photo stating it was "used for Cronkite [sic] Motor Pool."<sup>20</sup> Whether this new function was the result of intentional planning by the army or personal initiative on the part of Coast Artillery GIs is unknown.

Midway through World War II, the hangar began to be modified from its original 1920 configuration as its use as a motor pool became firmly established. The first major alteration occurred in August 1943 when the sliding balloon doors were removed and their opening enclosed with materials salvaged from the doors. Vehicle access to the interior was now to be provided by two 10' x 12' sliding doors and personnel access was via two 3' x 6'8" doors, one in each of the larger doors. As part of the remodeling, the steel gantry frames supporting the rolling doors, technically known as bents, were also demolished.<sup>21</sup> In November, a two-room office with adjacent latrine for the motor pool was constructed in the northeast corner of the building, just inside one of the new vehicle doors. Built of tarpaper covered board-and-batten walls with an angled roof, the

no frills office was probably similar to "emergency" construction buildings erected elsewhere by the army about the same time.<sup>22</sup>

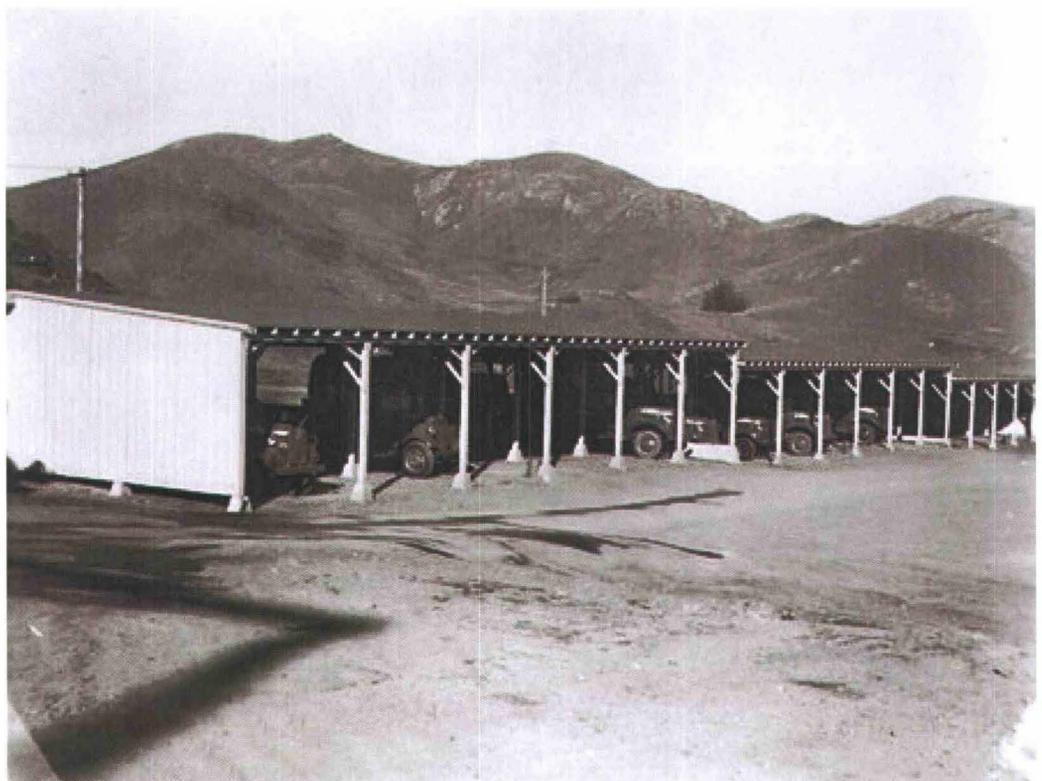
In 1944 the vehicle sheds underwent their first alteration when the southern third of today's Bldg 901 was enclosed to create a paint shed, probably for painting motor pool vehicles. To accomplish this, six stalls at the end closest to the hangar were enclosed on three sides with wood framing and plank walls. (The fourth side was already enclosed by the existing shed end.) Vehicle doors and windows were included in the new walls, and new windows were added to the existing end wall.<sup>23</sup> This area today serves as a combination office/break room and tack room for the Presidio Stables.

#### **Post-War and Cold War Eras**

The army records contain no information on uses of the balloon hangar following World War II but likely the structure was left empty, as were dozens of other buildings in Forts Baker and Barry when the army demobilized following the war. This era of quiet was to be short-lived, however, because in 1951 the army began to re-arm the Headlands forts at the outbreak of the Korean War. This time the anticipated threat was from enemy aircraft rather than warships, and radar directed anti-aircraft guns began to be emplaced on hilltops throughout Forts Baker, Barry and Cronkhite.

In 1953 the army began to upgrade its anti-aircraft

West Vehicle Shed, Ft Barry, 1942.  
(PARC, GOGA 32423)





gun batteries with radar directed surface-to-air Nike missiles. These missiles were state-of-the-art in the early 1950s and required highly trained artillery crews to operate and maintain their complex electronics and propulsion systems. The army planned to construct permanent launch sites at two locations in the Headlands for the storage and maintenance of the missiles, but their completion dates wouldn't be until 1955. When the first missiles arrived in the Headlands in mid-1953, their emplacements were earthwork field positions located in the vicinity of the not-yet constructed permanent launch sites. Maintenance would have to be carried out elsewhere.

As part of the support system for the new Nikes, the former motor pool in the Fort Barry balloon hangar was converted into a "heavy armament repair shop" where the missiles could be serviced and repaired. For a second time the building was altered for a new use, but this time with more radical results. As part of the renovations the following actions took place:

- New 4" concrete floor slab poured atop existing 6" concrete floor throughout the interior
- Both vehicle doors removed and replaced with a single, larger roll-up door in the location of the former eastern door.
- Installation of gas heaters, compressed air lines and water lines
- New electrical service and light fixtures
- Addition of a concrete apron along the north end of the building for use as a wash stand
- Replacement of corrugated roof
- Replacement of existing glass windows with double-wide courses of translucent plexiglass windows
- Replacement of lowest course of corrugated siding on all four sides with heavier gauge corrugated cement asbestos siding
- Construction of a three small structures within the hangar: a new latrine in the northwest corner; a new tool room and parts room structure in the southwest corner; and a new office in the northeast corner that replaced the 1943 structure.<sup>24</sup>

By 1954 the use of the building was clearly known, and a floor plan prepared on 21 May that year clearly labeled the structure "Nike Assembly

Area." This drawing shows the interior of the hangar totally converted to missile servicing activities, with the bays on both sides being used as test areas for assembled missiles and various missile subassemblies and components.<sup>25</sup> (See figure "Bldg 907 - Ft Barry / Nike Assembly Area" 21 May 1954).

In 1955 the two permanent launch sites in the Marin Headlands were completed and designated SF-87 at Fort Cronkhite and SF-88 at Fort Barry. Despite the fact that each site was equipped with its own assembly and test buildings, the hangar continued to serve as a central maintenance facility for the two sites. In a 1998 interview, former Chief Warrant Officer Peter Bohan of SF-88 stated that the hangar operated as a first-level maintenance facility where repairs were carried out that couldn't be handled at the launch sites but that didn't require transport to the higher-level maintenance facility at the Presidio.<sup>26</sup>

Repairing missiles in the Fort Barry hangar seems to have been preferable to sending the weapons to the Presidio for another reason: in order to transport a missile across the Golden Gate Bridge, it missile had to be disassembled and placed in containers ("canned") for security reasons. By contrast, the Nike-Ajax missiles could be hauled intact to the hangar without risk of compromising security (or alerting civilians) since they never had to leave the military-controlled area.

Here's how Bohan described the hangar's use:

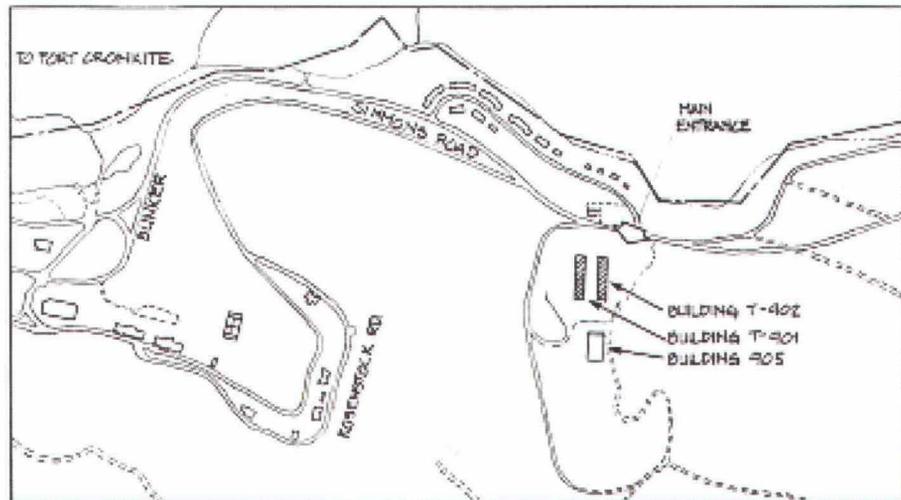
*[The hangar] was not a full-time operation, either. So if a missile had to be tested by their people [i.e., technicians from Fort Baker] according to their manuals, OK, we'd take the missile and we'd bring it on over to the hangar. Now, let me put it this way. We did not 'can it' when we took it to the hangar. We weren't out in a public area. But if we went down to Fort Baker or anyplace else, OK, then they canned it there at the balloon hangar or we canned it at the site because we knew it was leaving the area altogether.*<sup>27</sup>

It is not known exactly when missile repairs ceased to take place at the hangar, but it must have continued well after 1959 because in September that year, a small frame building was constructed on the south side of the hangar for an air compressor and two air receivers, replacing the portable air compressors that had served the building since 1953. The compressed air was piped from the new building to the various assembly and test stations lining the sides of the hangar, where it was used to test hydraulic and

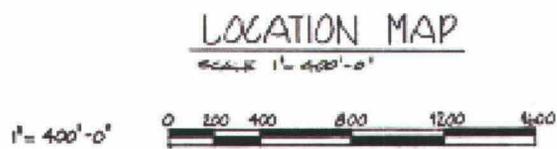
Floor plan of the Balloon Hangar showing its use as a Nike Assembly Area, May 21, 1954. (Drwr 213, Folder 1, PARC, GOGA)



Above: Ft. Barry Aerial, circa 1970.  
(U.S. Navy)



Ft. Barry Location Map, 1985. (NPS)



compressed air systems inside the missile bodies.<sup>28</sup> This date also corresponds to the period when the original Nike-Ajax missiles were being replaced at the two Headlands launch sites by the much larger Nike-Hercules missiles, and the new air compressors were likely needed to provide additional pressure for the Hercules' more robust systems.

#### Riding Stable Era

As stated above, it is not known exactly when the Nike service facility was phased out, but in 1966 the Presidio Riding Stables assumed control of the balloon hangar complex. Operating under a permit from the Sixth U.S. Army, the stable members converted the former vehicle sheds into tack rooms and horse stalls, and constructed paddocks and corrals adjacent to the sheds.<sup>29</sup> Inside the balloon hangar itself, a riding rink was created by lining the perimeter of the central open area with stout wooden planks and filling it with clean dirt and sand. The former office building at the northeast corner was turned into an informal storage area, and the tool room/supply room at the opposite corner was left abandoned in place. The missile assembly and test bays located outside the rink served as additional 'dead storage' for the stable operation. The only physical alteration to the hangar seems to have been the demolition of the 1953 latrine located in the northwest corner of the hangar and the creation of two emergency exits along the side of the hangar. (The latter were made by the simple expedient of removing several corrugated panels and installing paper "EXIT" signs over the resulting openings.)<sup>30</sup>

Throughout their occupancy of the hangar complex the Riding Stables have continued to carry out periodic upgrades to the structures, albeit primarily the former vehicle sheds, to deal with problems such as poor drainage, sanitation, and security upgrades. These actions have included installation of a septic tank and leeching field in 1976<sup>31</sup>; re-roofing the sheds and installing fire detector systems in 1984<sup>32</sup>; installing additional wooden flooring in the stalls along with an exterior ramp to deal with bad drainage in the west paddock in 1985<sup>33</sup>, and replacing the existing power distribution and electrical lighting systems in 1985.<sup>34</sup>

In 1994, with the closing of the Presidio imminent, the Presidio Stables formally incorporated themselves as the "Presidio Riding Club". Following base closure of the Presidio, the stables were issued a renewable year-to-year Special Use Permit by the Golden Gate National Recreation Area to carry out the programs.<sup>35</sup>

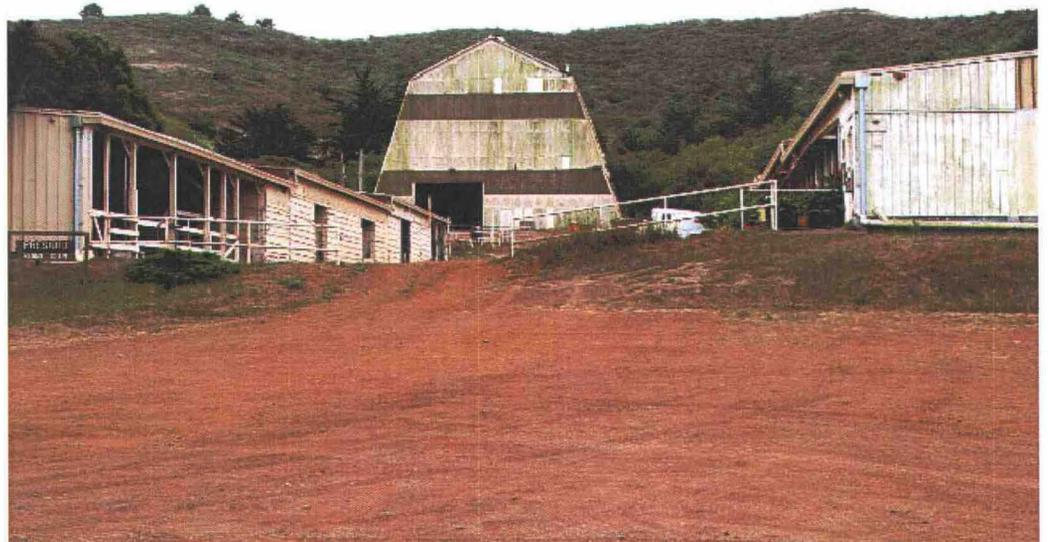
At the time of this writing, the Presidio Riding Club still continue their operations in the three historic structures, and are still negotiating with the National Park Service for a long-term lease on the complex.<sup>36</sup>

#### Endnotes)

<sup>1</sup> "Historic Resource Study: Forts Baker, Barry, Cronkhite, Golden Gate National Recreation Area", by Erwin Thompson, Denver Service Center, NPS, 1979. Pg 93-94

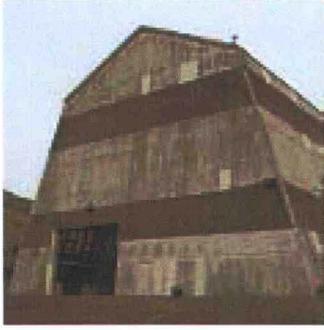
<sup>2</sup> Photographs, "USTC Fort Barry Target Range October 1917" and "ROTC No. 62 Fort Barry", both in GOGA-3045, PARC, GOGA

Presidio Riding Club, 2003. (Jane Lehman)



- <sup>3</sup> Thompson, pg 94
- <sup>4</sup> *Air Service Newsletter*, 29 December 1920
- <sup>5</sup> *Air Service Newsletter*, 29 December 1920
- <sup>6</sup> Drawing “Standard Dirigible Balloon Hangar for Aviation Station”, 1920, Park Archives & Records Center (hereafter PARC), Drawer 213, Folder 3
- <sup>7</sup> Blueprints, “Dirigible Balloon Hangars for Aviation Stations, Construction Division, War Department, Washington, D.C.”, Contract 9528. Dated 8/20/1920 and 9/29/1920. Drawer 213, Folder 1, PARC, GOGA
- <sup>8</sup> Gregory, pg 204
- <sup>9</sup> *Air Service Newsletter*, 12 January 1921.
- <sup>10</sup> *Air Service Newsletter*, 15 March 1921
- <sup>11</sup> “Completion Report On Construction of Balloon Hangars, Generator Houses, etc. at Forts Barry and Winfield Scott, Calif. Under Lump Sum Contracts by Lange & Bergstrom and McClintic-Marshall Co.”, by Lt. Col. Ira L. Frienddall, Constructing Quartermaster, Q.M. Corps, 30 June 1921. Construction Completion Reports, Entry 391, Box 286, Record Group 77, Office of the Chief of Engineers, NARA
- <sup>12</sup> “Completion Report”, page 9-10
- <sup>13</sup> “Completion Report” page 8
- <sup>14</sup> “Historic Record of Buildings, Fort Barry, California”. Entry for Bldg 141 “Hangar (Balloon)”. Park Archives & Records Center (PARC), Golden Gate National Recreation Area (GOGA).
- <sup>15</sup> “Historic Record of Buildings, Fort Barry”
- <sup>16</sup> Drawing, “Fort Barry – Cal. Showing Balloon Hangar Etc.”, 27 July 1921. Drawer 213, Folder 1, PARC, GOGA.
- <sup>17</sup> “Historic Resource Study: Seacoast Fortifications, San Francisco Harbor”, by Erwin Thompson, Denver Service Center, NPS, 1980. Pg 288.
- <sup>18</sup> “Historic Record of Buildings, Fort Barry”
- <sup>19</sup> “Historic Record of Buildings, Fort Barry, California”. Entry for Bldgs T-142 and T-143 “Motor Vehicle Shed (Temporary)”. PARC, GOGA
- <sup>20</sup> “Historic Record of Buildings, Fort Barry, California”. Entry for Bldg 141 “Hangar (Balloon)”. Park Archives & Records Center (PARC), Golden Gate National Recreation Area (GOGA). The handwriting beneath the photo matches handwriting used to make entries elsewhere on the page dated 1940.
- <sup>21</sup> Drawing, “Alterations to Balloon Hangar, Fort Barry,” 24 August 1943. Drawer 213, Folder 1, PARC, GOGA
- <sup>22</sup> Drawings “Offices for Fort Barry Motor Pool Inside Balloon Hangar, Bldg #141, Fort Barry, California”, 10 November 1943, and “Latrine at Bldg No. 141, Ft Barry, Motor Pool for the 6<sup>th</sup> C.A.”, 26 November 1943. Both, Drawer 213, Folder 1, PARC, GOGA
- <sup>23</sup> Drawing “Paint Shed in Motor Shed No 143, Regimental Motor Pool, 6<sup>th</sup> CA”, Plan 7143-E-182, 17 January 1944. Drawer 213, Folder 1, PARC, GOGA
- <sup>24</sup> Drawings “Conversion of Balloon Hangar for Use as Armament Shop” (4 sheets), 30 June 1953. Drawer 213, Folder 1, PARC, GOGA
- <sup>25</sup> Drawing, “Bldg 907 – Fort Barry / Nike Assembly Area”, 21 May 1954. Drawer 213, Folder 1, PARC, GOGA
- <sup>26</sup> Oral History interview with CWO Peter Bohan, U.S. Army (ret.). 1998. GOGA-2647. PARC, GOGA
- <sup>27</sup> Bohan
- <sup>28</sup> Drawing, “Bldg 907 – Fort Barry. Housing for Air Receivers”. 15 September 1959. Drawer 213, Folder 1, PARC, GOGA
- <sup>29</sup> Public information handout sheet prepared by the Presidio Stables, n.d.
- <sup>30</sup> On-site inspections of Fort Barry Balloon Hangar, January and April 2004.
- <sup>31</sup> “Progress Report: Installation of Septic Tank at Leaching Field, Horse Stables, Bldg 901, Fort Barry”, 6 July 1977. ADPWE-2, Box 14, Folder “Installation Septic Tank”, PARC, GOGA. At the time this report was prepared the project had been temporarily halted awaiting unspecified NPS actions.
- <sup>32</sup> “Report of Proceedings of the Governing Council for the Presidio Riding Club”, 17 October 1984. ADPWO-3, Box 5, Folder “PSF Riding Stable”, PARC, GOGA
- <sup>33</sup> “Report of Proceedings of the Governing Council for the Presidio Riding Club”, 17 December 1984 and 1 February 1985. ADPWO-3, Box 5, Folder “PSF Riding Stable”, PARC, GOGA
- <sup>34</sup> Drawing, “Rewire Stable Facilities at Fort Barry, Buildings T-901 and T-902”, 30 July 1985. Drawer 213, Folder 1, PARC, GOGA
- <sup>35</sup> Letter, Supt. Brian O’Neill, GOGA, to Lt. Col. Davis, HQ 6<sup>th</sup> U.S. Army, 5 July 1994. ADPCA, Box 3, Folder “Riding Club”, PARC, GOGA
- <sup>36</sup> Interview with Jay Eichenhorst, GOGA Business Office, 6 July 2004.





The north elevation of the Balloon Hangar showing the existing 15' x 20' opening and the two tiers of corrugated glass fiber sheets. (Jane Lehman, 2002)

The vertical trusses form bays along the sides of the Balloon Hangar and the glass fiber sheets let in an ample amount of natural light. (John Martini, 2004)



The three ventilators on the roof lean at different angles. (John Martini, 2004)

An attempt is made to patch the asbestos board siding with corrugated metal siding of the incorrect profile. (John Martini, 2004)

## Physical Description – Balloon Hangar (FA-907)

*The Fort Barry Balloon Hangar is a large, distinctive building nestled into a hillside in the Marin Headlands. The hangar is a gambrel-shaped structure. It has a rectangular floor plan 76'-2" x 120'-0", and is approximately 53' high at its ridge. The inside of the building is essentially one large open space and is currently being used as a riding ring by the Presidio Horse Stables. In front of the hangar are two long, low buildings that were originally constructed as Motor Vehicle Sheds, but are currently being used as horse stables with paddocks surrounding them.*

*The gambrel walls have an approximately 3:1 slope and are covered with corrugated siding. There are two bands of corrugated fiberglass on the walls of the building which serve to let natural light inside. Drainage is poor and shrubbery has grown up around the south, east and west sides of the building limiting access to these sides.*

### Exterior

#### Foundation

The foundation consists of concrete piers at each column. There is a 6" high concrete curb and a 2'-0" x 6" concrete apron running around the perimeter of the building. There is a 10" concrete slab in the center of the structure while the slabs on the east and west wings of the building are only 4" thick.

#### Structure

Field constructed trusses form the roof and walls of the hangar. The trusses are 20' on center and assembled from steel angles. The top and bottom chords are 4x3 angles and the intermediate members are 2½ x2 angles. The purlins are 4" channels, approximately 4' on center, that span between the trusses and carry the roof sheathing.

#### Wall Surfaces

**Historic Building** - The original sheathing used on both the roof and walls of the building was corrugated asbestos-coated sheet iron. This sheathing was partially removed in 1953 and the lower section was replaced with the current corrugated cement asbestos siding.

Two extremely large (approximately 22' x 46' high) sliding doors were mounted on the north side of the building. (See photo inside front cover.) These doors were suspended from steel structures that projected out beyond the sides of the building. The doors and frames were re-

moved in 1943 and replaced with two 10' x 12' garage doors and one passage door.

There were two horizontal bands of windows on the original building, similar to the factory style windows of the time. These were approximately 4' tall and ran the entire length of the building at a head height of 20' and 42'. (Check type of original windows)

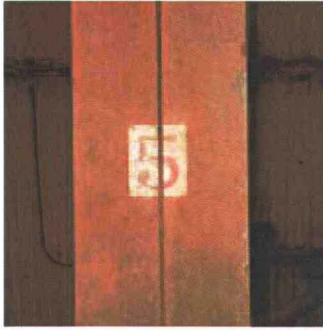
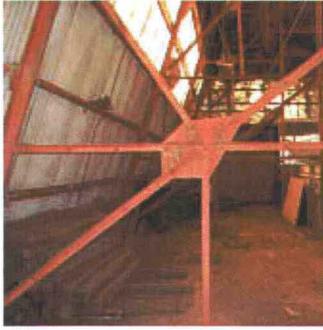
**Current Building** - The lowest tier of the Balloon Hangar siding is corrugated cement asbestos siding in approximately 3' x 6' sheets. They are 3/8" thick with a 4.2" profile in the corrugations. This siding is cracked and broken in many places and has a great deal of green algae on the exterior. Where sheets of siding have broken, an attempt to patch the surface with corrugated metal siding has been undertaken. The upper tiers of siding are the original corrugated asbestos coated iron sheets. These are generally in very poor condition.

The two 10' x 12' garage openings were replaced with one 15' x 20' opening which is still existing. The metal roll up door is still in place.

Two rows of translucent, colored corrugated glass fiber sheets exist in place of the original windows. When the sheathing on the first tier was replaced, the window heights were doubled to approximately 9' tall. These sheets are in fair condition.

#### Roofing

The roof sheathing is 22 ga. galvanized corru-



The structure's original field-assembled trusses are clearly visible. (John Martini, 2004)

Stenciled number on Bay 5 remaining from the Balloon Hangar's use as a maintenance garage during World War II. (John Martini, 2004)

The southwest interior corner of the Balloon Hangar shows the original vertical trusses, rooms built during the Nike Assembly use of the building, plus the wall of the current indoor riding rink. (John Martini, 2003)

gated metal on a 1:4 roof slope. The current roofing was installed in 1953.

There are 3 round metal ventilators mounted on the roof.

Included within this report is a structural and an architectural analysis of this building. It gives a detailed assessment of the condition of the steel framing members and of the condition of outer skin of the building, including the roof, walls, and window areas.

## Interior

Because the building was originally constructed to house hydrogen filled observation balloons, it was designed to have a large unobstructed interior space in which to inflate and work on the balloons. The clear space within the hangar is 45' wide by 120' long and is almost 46' high. The vertical trusses supporting the sloping wall form six 15' by 20' bays along each side. The large open space is still very much intact although its use has changed several times over the years.

### Floor

The floor throughout the interior space is concrete. According to the plans a new concrete floor was placed in 1953 when the building was converted into its missile storage use. The concrete is 10" thick in the open center portion and 4" thick in the side bays. The majority of the

open space is currently being used as a horse-riding arena. There is a layer of soft fill approximately 12" thick covering the majority of the main floor area.

### Walls

During the hangar's previous uses as a motor pool garage and Nike assembly area several rooms were constructed along the perimeter of the building in the bays formed by the trusses. Two 15' x 20' rooms, with a loft above, still exist in the northeast corner of the interior. There is 1x8 V-groove siding on the walls and remnants of the railing around the loft.

There were also rooms in the other three corners of the space. There are parts of the roofs, walls, doors and windows of these rooms remaining, however they are not complete.

A fence was constructed of horizontal 2x6's to form the outer edges of the riding rink.

### Mechanical and Plumbing

There are several overhead gas heaters remaining in the building. They are very rusted and presumably have not been used since the facility was decommissioned from military use. One water heater is remaining in the corner that was previously used as the restroom.

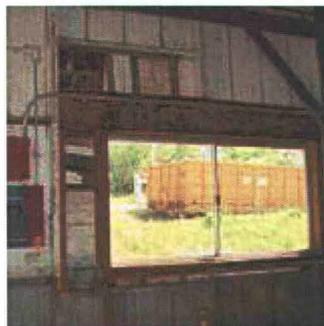
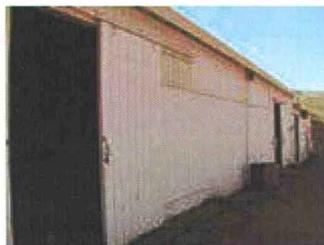




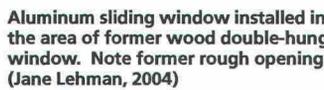
Motor Vehicle Shed interior showing 4x4 post and beam and cross bracing. (John Martini, 2004)



Original design of the Sheds had exposed rafter ends. Gutters and small roofs over the openings were added later. (Jane Lehman, 2004)



Sliding doors hanging from overhead tracks on West Vehicle Shed. (Jane Lehman, 2004)



Aluminum sliding window installed in the area of former wood double-hung window. Note former rough opening. (Jane Lehman, 2004)

## Physical Description – Vehicle Sheds (FA-905 and FA-906)

*The two long low buildings directly in front of the Balloon Hangar are the Motor Vehicle Sheds. They are rectangular buildings 216'-0" long by 46'-0" deep with their long side oriented in the north-south direction. The buildings were originally built as temporary structures during World War Two.*

*Although they have since been enclosed, they were originally built as open-sided carports to protect motor vehicles. The buildings are located on the gently sloping, former landing field and are composed of three 72' wide sections*

### Structure

The vehicle sheds are constructed of 4x4 posts and beams, 12'-0" on center in both directions. There are 4x4 cross braces at the corners of all the columns. The foundations are individual precast concrete piers. The roof framing is 2x4 @ 16" on center with 2x6 sheathing on top.

When the vehicle sheds were built in 1940, the end walls were filled in with 2x4 framing and 1x8 vertical sheathing, but the long sides were open on the front and back. This created a carport with easy access for pulling vehicles in and out.

When the vehicle sheds were converted into horse stables in the 1960s, most of the long side walls were filled in with framing and sheathing. There is one section on the north end of FB-905 that was never filled in and retains much of its integrity. Originally the floors were dirt, however, some of the bays have had concrete floors added.

### Roofing

The roof framing is a very shallow gable with the raking edges on the north and south of the buildings. There is red asphalt composition roll roofing on the Vehicle Sheds. The east Shed has recently been re-roofed, but the west Shed has an extensive collection of patches on the roof.

Six-inch deep aluminum gutters have been added to the front and back eaves of both Sheds. These follow the roof line and drop down in short downspouts from one gutter to the next. The only downspouts are at the far north end of the buildings.

### Siding

There is a collection of different types of siding on the buildings at this time. There is 1x8 and 1x6 vertical siding, and 1x12 horizontal board and batten siding. There are some areas that have no siding and some areas that have siding to a height of approximately 3-ft.

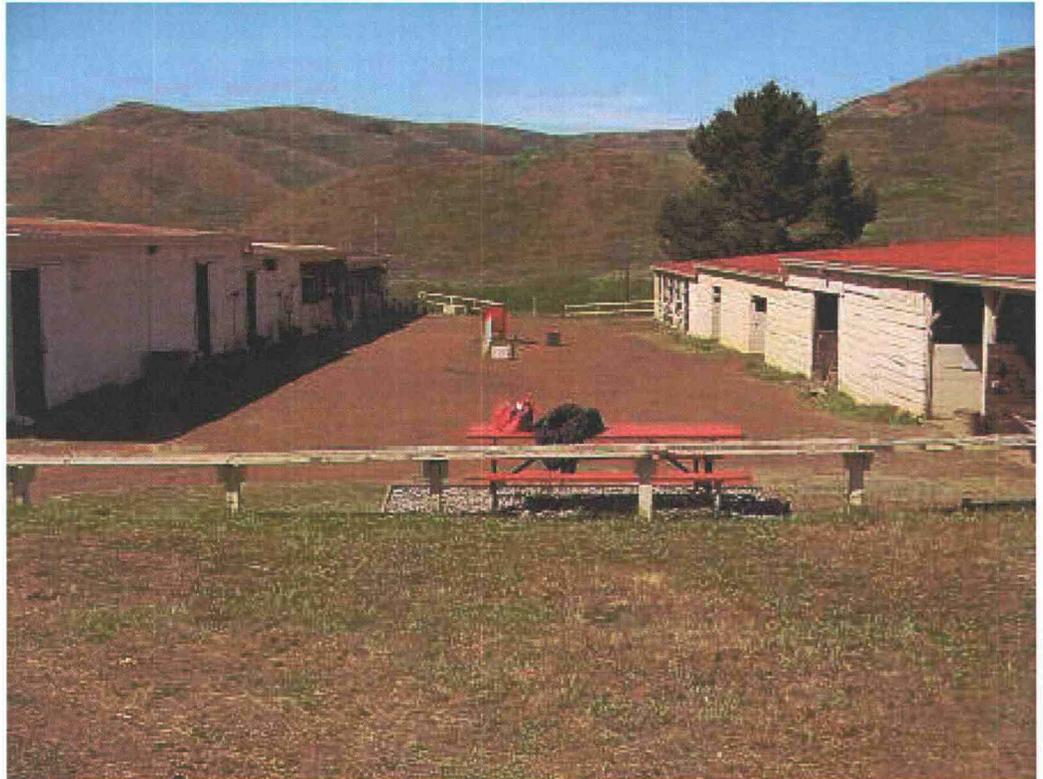
The walls at the far ends of the Sheds have original 1x8 vertical siding. On the north end of the building there is a lot of algae and organic growth that should be cleaned off. The horizontal 1x12 siding was added during the conversion to a riding stable. All of the siding on the structures needs paint.

### Doors and Windows

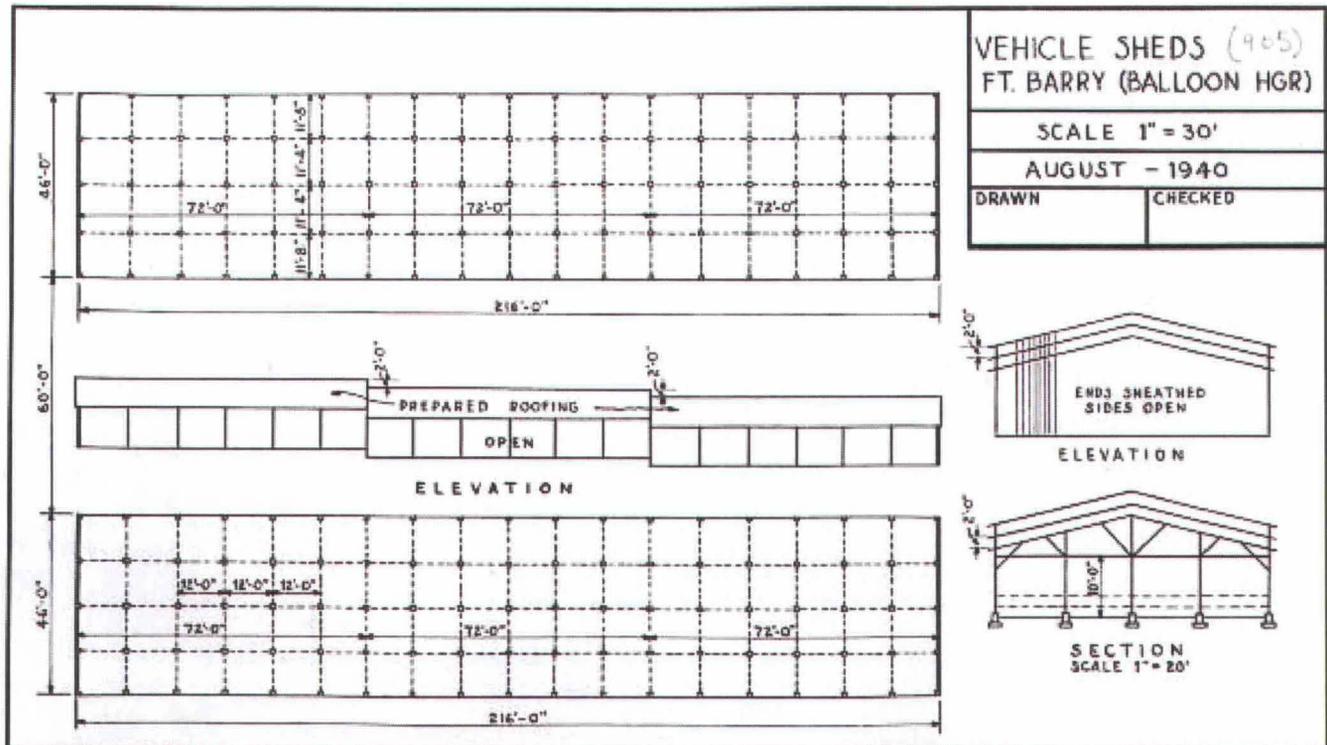
There was at least one wood frame, double-hung window in each end of the Vehicle Sheds. Several of them have been replaced with aluminum sliders of a different proportion than the original.

Originally there were no doors on the Vehicle Sheds because they were open carports. During the conversion to riding stables it became necessary to add walls and doors to the structures. It was at this time that sliding doors suspended from overhead tracks were installed. These are constructed out of vertical 1x8 siding to match the walls.

The current corral area in between the two former motor vehicle sheds. Building 906 is on the left and Building 905 is on the right. (Jane Lehman, 2004)



Plans of the original Motor Vehicle Sheds, August 1940. Part of the "Series 700" mobilization structures constructed just prior to the beginning of World War II.



901-702 905 40

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*The Balloon Hangar is an element of the Forts Baker, Barry, and Cronkhite National Register District. All three buildings are contributing to a potential National Historic Landmark District on the Harbor Defenses of San Francisco Bay.*

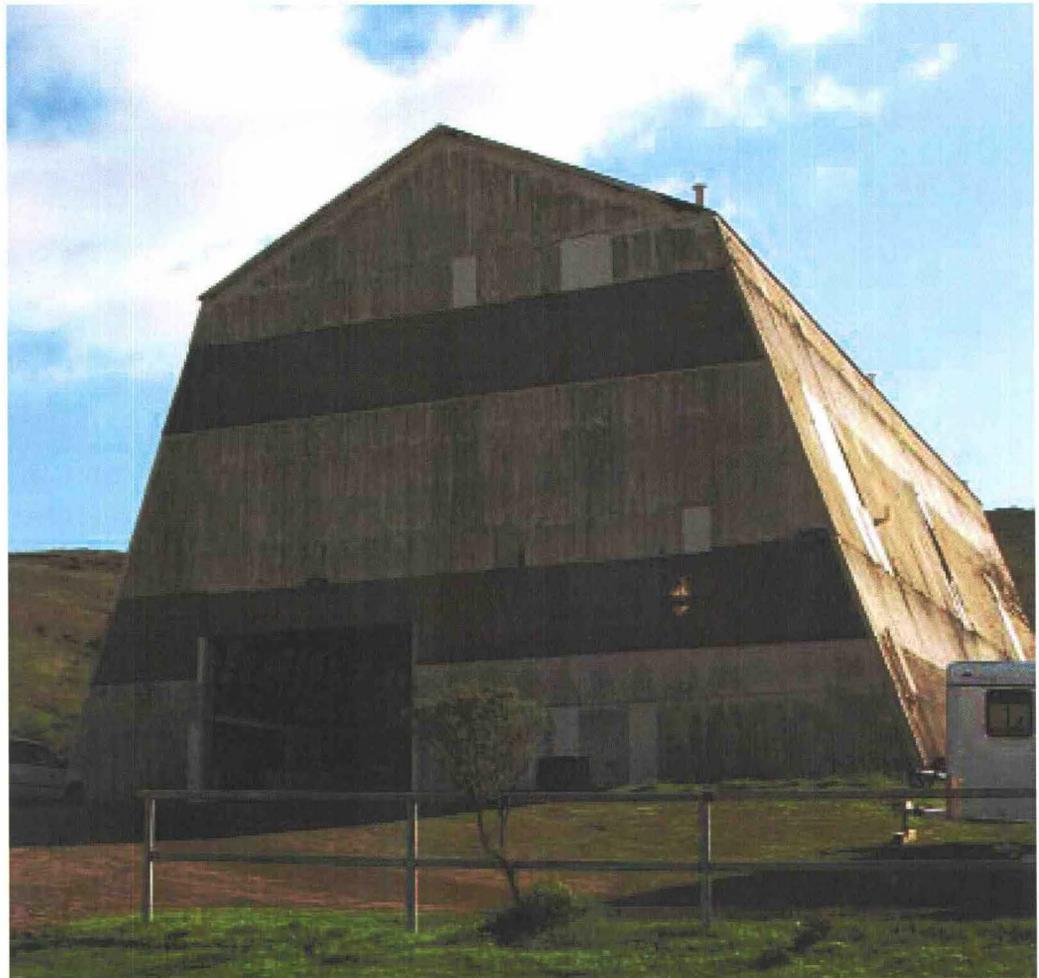
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## Significant Features of Balloon Hangar and Vehicle Sheds

*The following characteristics of these buildings are considered significant. They retain a high degree of integrity and would be very sensitive to change.*

- ◆ Rural setting - The Balloon Hangar has always been situated in a semi-rural location in the Marin Headlands. Historically the hillsides were covered with low coastal scrub plants. The plants that have been allowed to grow up against the buildings should be removed and the drainage problems must be corrected.
- ◆ Building shapes - Balloon Hangar's gambrel shape and Vehicle Shed's long, shallow profile
- ◆ Balloon Hangar's large open interior space - A riding ring is a very compatible use for this building, as would be the previous uses of a maintenance garage or an equipment assembly area.
- ◆ Visible interior structure of Balloon Hangar and Vehicle Sheds
- ◆ Balloon Hangar's corrugated siding and roofing - Much of the corrugated siding and roofing has been lost due to rust and metal fatigue. It will be necessary to replace it in the future with a similar material. The approach for this should be similar to that of preserving an historic ship, where replacement of the skin is considered essential to its preservation.
- ◆ Open bay at north end of Vehicle Shed FA-905

The Balloon Hangar's gambrel shape is a major character defining element. (John Martini, 2004)



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\_\_\_\_\_. *Progress Report: Installation of Septic Tank at Leaching Field, Horse Stables, Bldg 901, Fort Barry,*"

\_\_\_\_\_. *Report of Proceedings of the Governing Council for the Presidio Riding Club," 17 October 1984, 17 December 1984 and 1 February 1985.*

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Historic Record of Buildings, Fort Barry, Bldg 141, T-142, T-143

Oral History Interview, Peter Bohan, U.S. Army (ret.)

Letter, Supt. Brian O'Neill, GOGA, to Lt. Col. Davis, HQ 6th U.S. Army, 5 July 1994

Interview, Jay Eichenhorst, GOGA Business Office, 6 July 2004

### **Washington, D.C. National Archives**

Record Group 77, Records of Office of Chief of Engineers. National Archives

Completion Report - Fort Winfield Scott

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## NEWSPAPERS

*Air Service Newsletter*, "14<sup>th</sup> and 24<sup>th</sup> Balloon Companies to Cooperate with Coast Artillery", 27 April 1920

*Air Service Newsletter*, "For the First Time in History of the World Problem Fired In Which All Data Was Supplied From the Air by Balloon", 29 December 1920

*Air Service Newsletter*, 12 January 1921

*Air Service Newsletter*, 15 March 1921

*Air Service Newsletter*, "24<sup>th</sup> Balloon Company, Fort Baker, California", 25 June 1921

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Photograph, "Aerial - Fort Funston," February 1942, Kenneth Cooper Collection  
Photograph, "USTC Fort Barry Target Range," October 1917

Photograph, "ROTC No. 62 Fort Barry"

Drawing, "Dirigible Balloon Hangars for Aviation Stations," September 1920

Drawing, "Fort Barry, Cal. Showing Balloon Hangar Etc." 27 July 1921

Drawing, "Vehicle Sheds, Ft. Barry (Balloon Hgr), August 1940

Drawing, "Alterations to Balloon Hangar, Fort Barry," 24 August 1943

Drawing, "Pain Shed in Motor Shed No 143, Regimental Motor Pool, 6<sup>th</sup> CA," 17 January 1944

Drawing, "Conversion of Balloon Hangar for Use as Armament Shop," 20 June 1953

Drawing, "Bldg 907 - Fort Barry/Nike Assembly Area," 21 May 1954

Drawing, "Bldg 907 - Fort Barry, Housing for Air Receivers," 15 September 1959

Drawing, "Rewire Stable Facilities at Fort Barry, Buildings T-901 and T-902," 30 July 1985

### **San Francisco Public Library**

Photograph, "C3 Army Balloon at San Francisco City Hall," ca. 1929

## **WEB SITES**

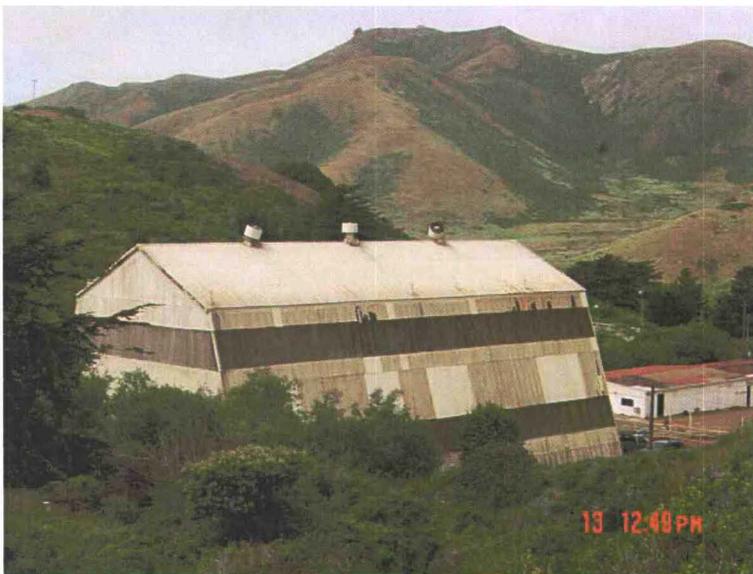
USAF Museum website [http://www.wpafb.af.mil/museum/early\\_years/ey5a.htm](http://www.wpafb.af.mil/museum/early_years/ey5a.htm) "Caquot Type R Observation Balloon"

**Appendix A**  
Structural Evaluation of Balloon Hangar  
Architectural Evaluation of Balloon Hangar  
Cost Estimate- Balloon Hangar

# Structural Evaluation of Balloon Hangar Fort Barry

for

**National Park Service**  
Golden Gate National Recreation Area  
Building 201, Fort Mason  
San Francisco, CA 94102



Submitted by:

**Tennebaum-Manheim Engineers**  
414 Mason Street, Suite 605  
San Francisco, CA 94102  
Tel: (415) 772-9891  
Fax: (415) 772-9893

June 30, 2004

## **ACKNOWLEDGEMENTS**

We would like to thank the following people who have assisted us on this project:

- Jane Lehman, Historical Architect  
National Park Service
- John Martini, Historian  
National Park Service-GOGA
- Joel R. Simmons, Contracting Officer  
National Park Service
- Steve Turpie, Project Manager  
National Park Service

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# **Structural Evaluation of Balloon Hangar**

## **Fort Barry**

### **Golden Gate National Recreation Area**

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  2. Structural Deficiencies
  3. Recommended Structural Upgrade
    - Schematic Design Drawings
  4. Photos
- Architectural Evaluation
  1. Historical Background
    - 1.1 Historical Significance
    - 1.2 Construction Chronology
  2. General Architectural Description
    - 2.1 Site
    - 2.2 Typical Existing Conditions and Visual Assessment
      - 2.2.1 Exterior Walls
      - 2.2.2 Roof
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## **EXECUTIVE SUMMARY**

The Balloon Hangar at Fort Barry is part of the Golden Gate National Recreation Area, located in the Marin Headlands, Sausalito. It was built in 1921 and is included on the List of Classified Structures and is part of a National Register District with National Significance. The Hangar was built to house hydrogen-filled observation balloons for the US Air Service to train accurate fire from defense batteries onto targets from out to sea. They were also used to tow targets much further than was possible with airplanes. The program proved to be unsuccessful because of losing balloons in high winds and was eliminated. The function of the building soon changed and subsequently served as a warehouse, an ordnance repair shop, a motor pool garage, a Nike Missile assembly building, storage for anti-aircraft artillery and an indoor riding rink (currently used by the Presidio Stables). The Balloon Hangar is the last remaining balloon hangar on the west coast.

The purpose of this report is to summarize the findings of the evaluation of the building skin and structure by TME and ALCA. To perform the evaluation, existing documents were reviewed, site visits made, existing conditions documented, a rough structural analysis made, schematic rehabilitation drawings and cost estimates were produced and are in the body of this report.

Existing available documents are incomplete. Steel shop drawings for most of the structural steel are the only documents of the original structure. Various modifications are also documented. Three site visits were made; one using a manlift provided by the National Park Service.

The Balloon Hangar is a one story building approximately 9,240 square feet. The Balloon Hangar steel channel roof purlins are supported on seven steel trusses spanning 45'-6" and spaced at 20'-0" on center. These roof trusses are supported in turn on triangular vertical steel trusses which are 15'-6" wide at their bases. Lateral forces in the east-west direction are resisted by the vertical trusses. Lateral forces in the north-south direction are resisted by rod bracing in the planes created by the vertical truss sloping and vertical elements. The truss bases are connected to spread footings. The current slab on grade rests on sand which is over the original slab on grade.

The balloon hangar structure is in good condition. A preliminary structural analysis was performed and it was found that relatively minor enhancements may be made which would enable the structure to resist wind and seismic loadings to current standards.

The major structural deficiency in the structure is that many rods have been removed from the north-south lateral bracing system, greatly weakening the building. Another serious deficiency is the large eccentricity between the horizontal elements and the diagonal rods in the north-south lateral system. Other deficiencies are listed in the report.

The report recommends among other items: replacing missing rod bracing, adding new pipe elements to reduce the eccentricity in the north-south lateral system, replacing damaged cladding and cladding supports, improving the connection of the original cladding, and adding sag rods and sag rod supports at the south wall.

The current building skin described from the top down is:

- Corrugated metal roof.
- A tier of original asbestos covered corrugated sheet metal.
- A tier of translucent corrugated fiberglass panels which replaced a narrower band of windows.
- Another tier of original asbestos covered corrugated sheet metal.
- Another tier of translucent corrugated fiberglass panels which replaced a narrower band of windows.
- A tier of corrugated asbestos-cement panels which replaced the original lowest band of asbestos covered sheet metal panels.

The existing cladding is in poor condition. The existing roofing is in fair condition but with numerous leaks. Three options are given for the rehabilitation of the skin. These are: 1.) complete replacement of all skin; 2.) roof patching and complete replacement of tiers of original material; 3.) roof patching and selective, but substantial replacement of original material.

The Balloon Hangar contains hazardous material such as asbestos and red lead paint. The abatement of these materials required for the rehabilitation of the structure is not part of this report and is excluded from the cost estimate. Other exclusions to the cost estimate are listed in the report. No rehabilitation of the existing wood frame buildings inside the hangar is contained in this report.

The estimates of probable costs herein all contain the recommended structural rehabilitation.

The probable cost at current construction prices for the first option of complete replacement is about \$453,000.00.

The probable cost at current price for the second option of replacement of the tiers of original material is about \$323,000.00.

The probable cost at current prices for the third option of replacing only damaged original panels is about \$291,000.00.

It must be emphasized that these costs do not reflect the difference between in-situ containment of hazardous material plus the cost of working around haz-mat and the removal of hazardous material.

## **SCOPE OF WORK AND PURPOSE**

The Balloon Hangar at Fort Barry was completed for construction in 1921. The building has been changed to various uses over time, although the structure other than the North Wall has not been altered to a great degree. The exterior skin of the building is in poor condition and an evaluation of the skin and the structure was requested by the National Park Service.

Tennebaum-Manheim Engineers was contracted to evaluate the structure and performed the tasks as stated below. In addition, Aviva Litman Cleper Architects performed architectural services to review the corrugated skin. The scope of work included:

- Review of existing documentation. TME reviewed documents from the Presidio Trust Archives, but primarily retrieved documents and correspondence from Jane Lehman of the National Park Service.
- Initial Site Visit and meeting with Steve Turpie, NPS
- Survey and visual inspection, including observation from manlift. Inspection from manlift primarily used at interior of building and north wall. Access was difficult and restricted on south, east and west walls due to existing landscape conditions. Roof was observed from a distance.
- Foundation pit dug at west side (Water level high).
- Documentation of existing conditions on plans and elevations.
- Analysis performed to determine structural deficiencies.
- Schematic design and schematic drawings of structural upgrade for cost estimating.
- Cost estimate for rehabilitation/upgrade.
- Report of findings, assessment and recommendations.

The purpose of this report is to provide the National Park service with an understanding of the condition of the structure and skin of the Balloon Hangar. In addition, we hope that our proposed recommendations and options will lead to the preservation of this important historic structure.

## **SOURCES OF INFORMATION OF FORT BARRY BALLOON HANGAR AVAILABLE IN NATIONAL PARK SERVICE ARCHIVES**

### **LIST OF ORIGINAL DRAWINGS**

**July 27, 1921** – 1 *Partial Drawing*

Title: FORT BARRY – CAL  
SHOWING BALLOON HANGAR , ETC.

**9/29**

Title: Dirigible Balloon Hangars for Aviation Stations – 6 Steel Shop Drawings:

- Vertical Bracing (drawing sheet title and number missing)
- Sheet E3
- Sheet E4
- Sheet 4 of 8
- Sheet 6 of 8
- Sheet 8 of 8

**24 Aug. 1943**

Title: Alterations to Balloon Hangar – 1 Drawing

- Plan 7142-E-155

**Nov. 10- 43**

Title: Offices for Fort Barry Motor Pool  
Inside Balloon Hangar , Bldg. #141 – 1 Drawing

**11/26/43**

Title: Latrine at Bldg. No. 141 Ft. Barry – 1 Drawing

- Sheet 7142-E-178

**20 June 1953**

Title: FORT BARRY – CALIFORNIA - 4 Drawings  
Project No. PE-PSF 63/53

- REHABILITATION & OF BALLOON HANGAR TO HEAVY ARMAMENT SHOP
  - Plan And Profile Of New Sewer Line – *Partial Drawing* (1 of 4)
- CONVERSION OF BALLOON HANGAR FOR USE AS ARMAMENT SHOP
  - Foundation and Floor and Utilities Plans (2 of 4)
  - Misc. Details (3 of 4)
  - Electric and Heating Plan (4 of 4)

**21 May 1954**

Title: Bldg. 907 – Ft. Barry  
Nike Assembly Area – 1 Drawing

- Floor Plan

## **SOURCES OF INFORMATION OF FORT BARRY BALLOON HANGAR “Continued”**

### **LIST OF CORRESPONDENCE**

- Fort Barry Balloon Hangar – Development Timeline Building Number(s): 141; 907; 905
  
- Memorandum
  - Dated: January 21, 1992
  - To: Chief, Division of Resource Management and Planning
  - From: Park Historian
  - Subject: Cultural Resource Assessment of Fort Barry Balloon Hangar (FA-905)
  
- Email
  - Dated: 6/25/97
  - To: Ric A. Borges at NP-GOGA-PRES
  - From: John Martini
  - Subject: Historic Significance of Balloon Hangar & Stables

### **FIELD VISITS FOR OBSERVATIONS**

- Site visits for field survey and visual observation on:
  - October 31, 2003
  - February 17, 2004
  - April 13, 2004
  - April 23, 2004

## DESCRIPTION OF EXISTING STRUCTURE

The Fort Barry Balloon Hangar is a one story steel frame building with a 120'-0" by 76'-6" footprint. The metal deck roof is supported on 6" channel purlins which frame to roof trusses. The trusses span 45'-6" and their top chords have a 2:1 slope. The roof deck is attached to the purlins with ¼" welded stud bolts. The roof trusses are made of double angles (See Roof Plan on Existing Conditions Drawing) and are supported on vertical trusses that are triangular in shape with a base 15'-6" wide and 45'-10" from original floor to bottom of truss. This leaves a column free clear space of 46'-6" wide by 120'-0" long by 45'-10" high. The vertical trusses which are spaced at 20'-0" on center are also made of double angles (See Existing Conditions drawing Section 7).

The floor is a slab on grade over sand fill over the original floor slab. The footings are believed to be 7'-0" x 3'-0" deep spread footings. Excavation in wet conditions showed that the footings are well founded in broken rocky soil.

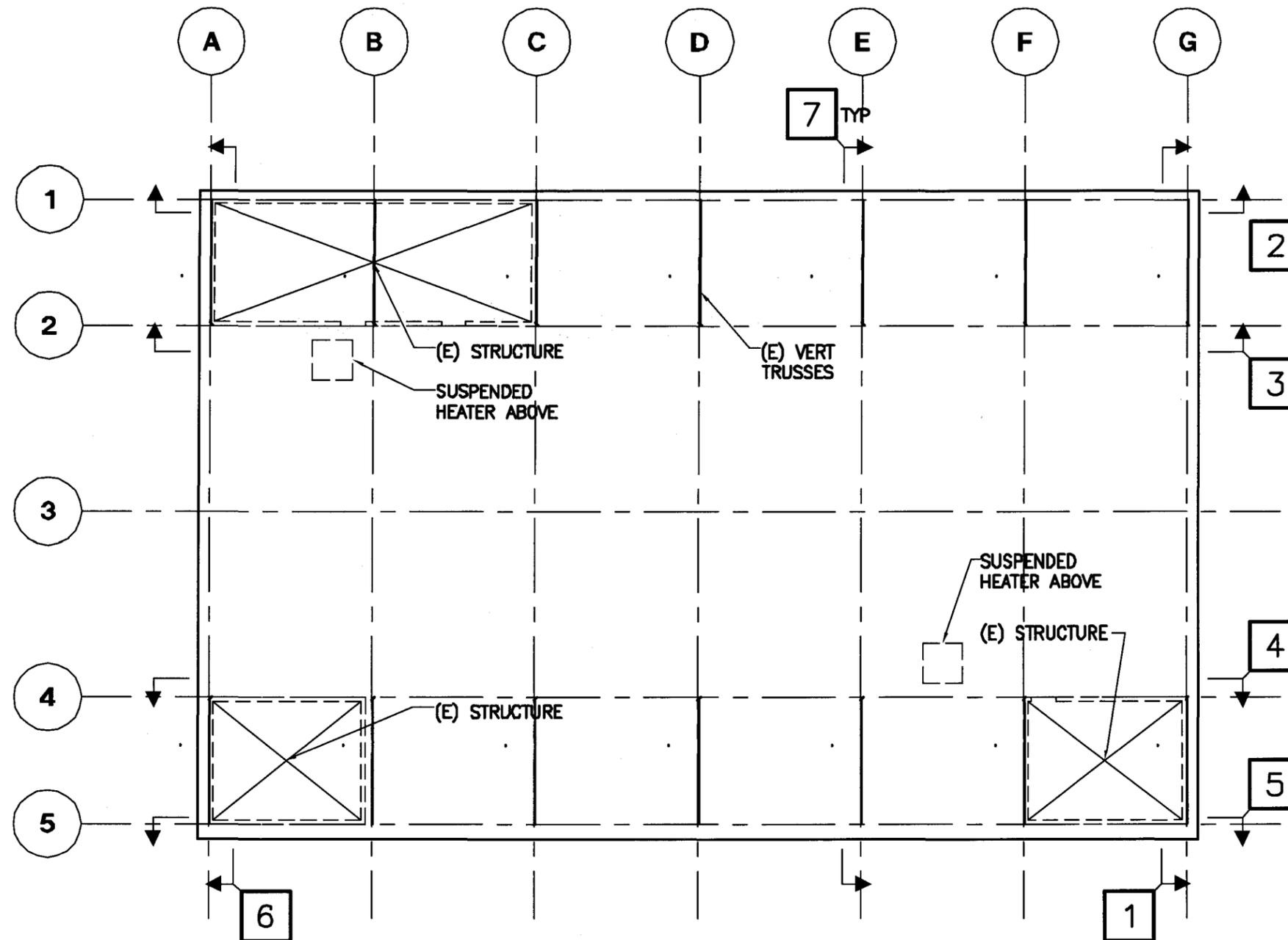
Wind and seismic forces in the east west direction are resisted by the 14 vertical trusses. Wind and seismic forces in the north south direction are resisted by four bays (8 total bays) of 1" rod bracing on each of the sloping east and west faces and a total of four bays of ¾" rod bracing on the interior faces of vertical trusses. These appear to be primarily to stabilize the interior vertical elements of the vertical truss and to resist out of plane loadings on the north and south walls.

The original north wall has changed from large sliding doors to smaller openings in a wood frame wall. There is a steel beam that runs vertically from the ground to the bottom chord of the roof truss at the center of both the north and south wall.

The north and south end bays of the roof have rod bracing. The two northern and southern bays at the lower chord also have rod bracing which provide support to the vertical steel beams in the north and south walls.

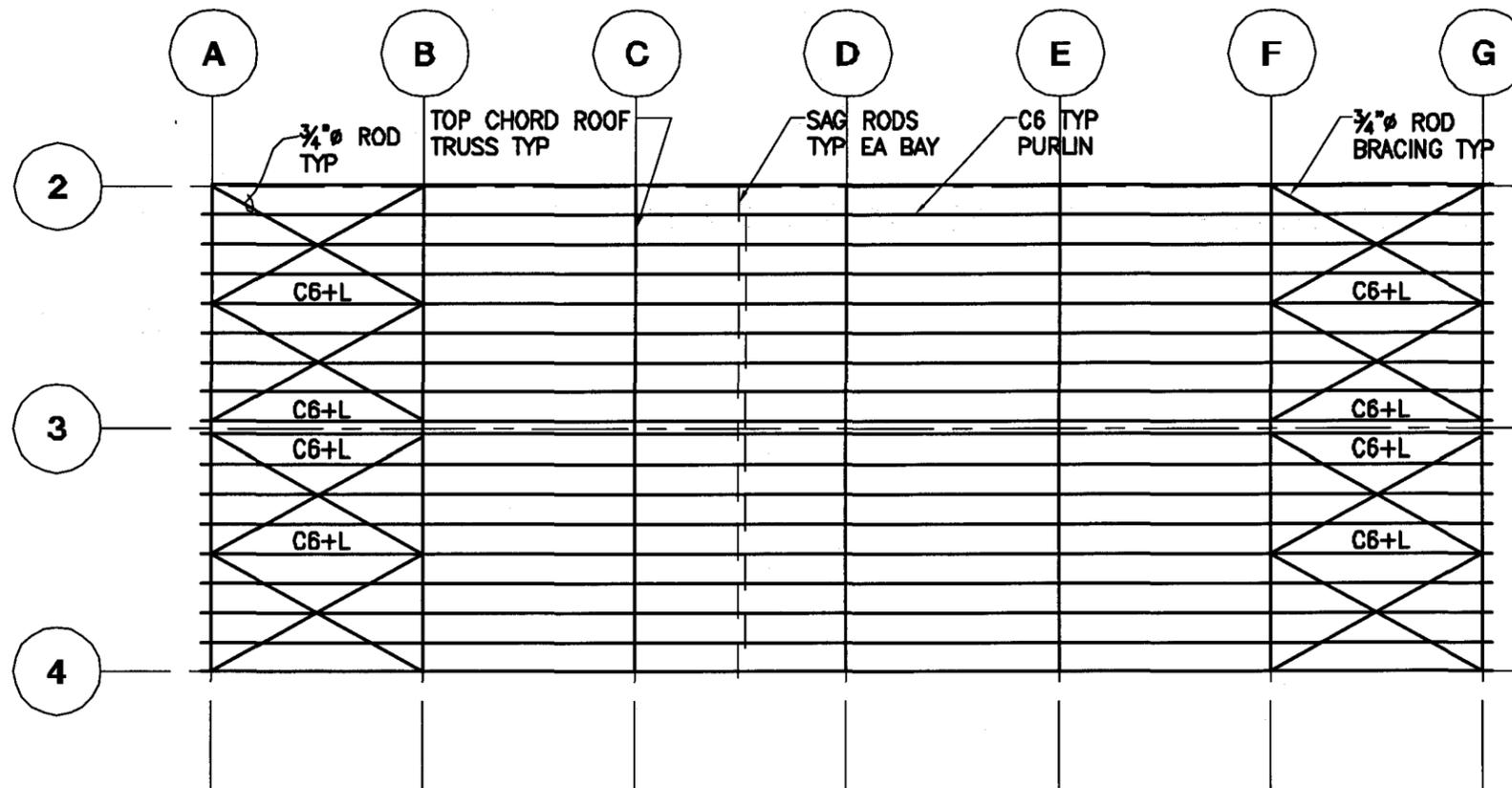
The coated sheet metal cladding was originally connected to the 6" channel wind girts with ¾" wide sheet metal brackets. Subsequently those panels that were replaced with fiberglass panels or asbestos cement panels were attached with ¼" welded stud bolts similar to the roof.

Existing conditions are illustrated on the following sheets.



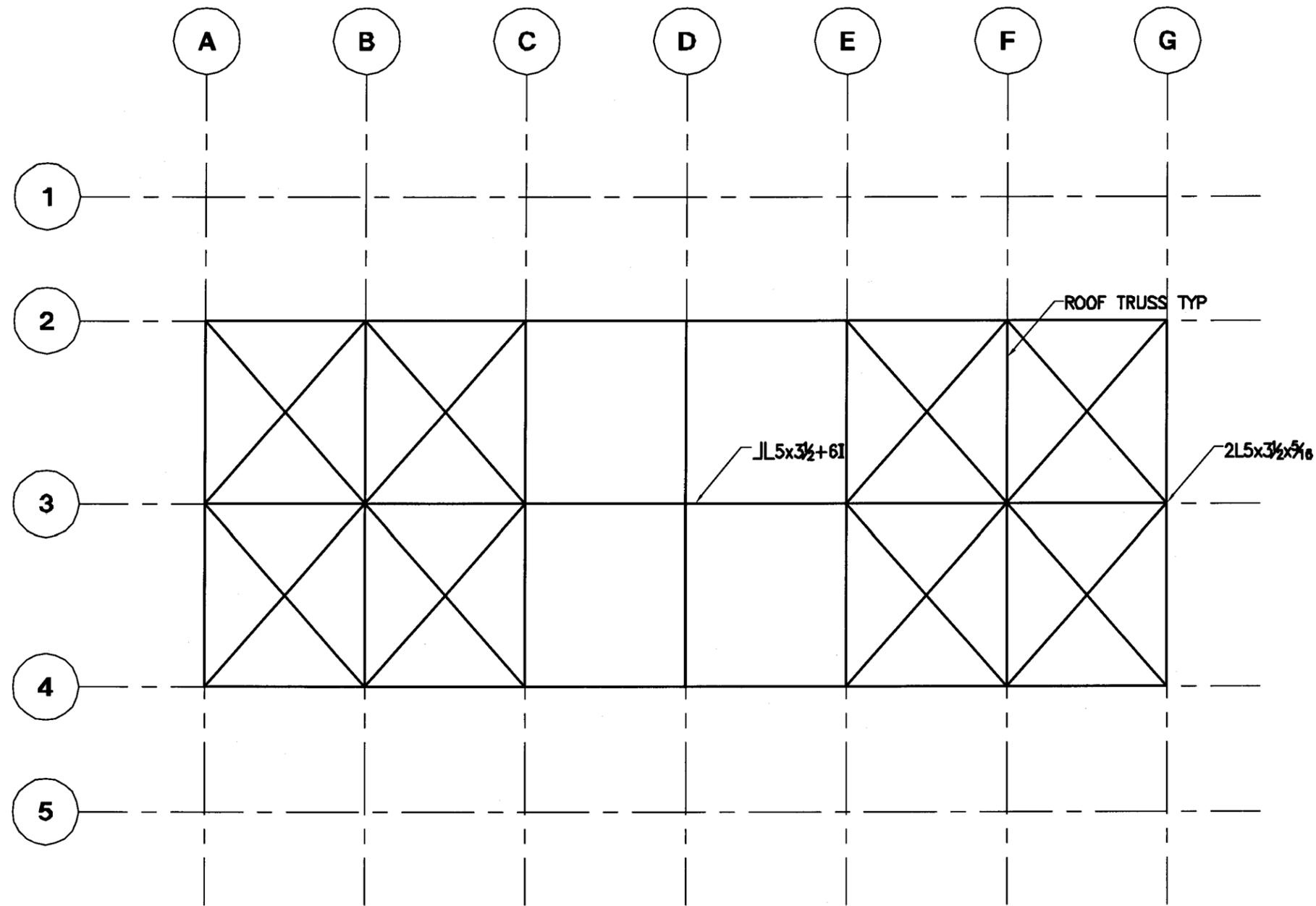
FOUNDATION PLAN

BALLOON HANGAR  
 EXISTING CONDITIONS  
 TENNEBAUM-MANHEIM ENGINEERS



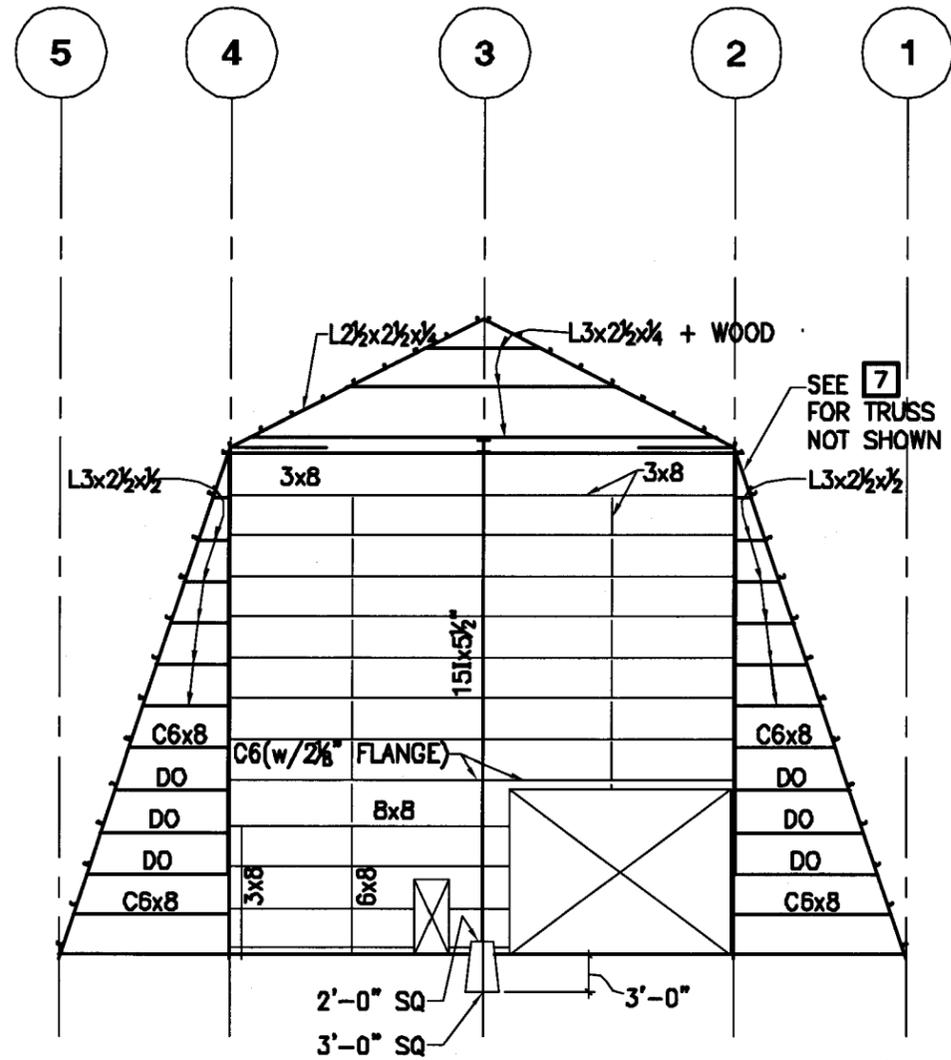
ROOF FRAMING PLAN

BALLOON HANGAR  
 EXISTING CONDITIONS  
 TENNEBAUM-MANHEIM ENGINEERS



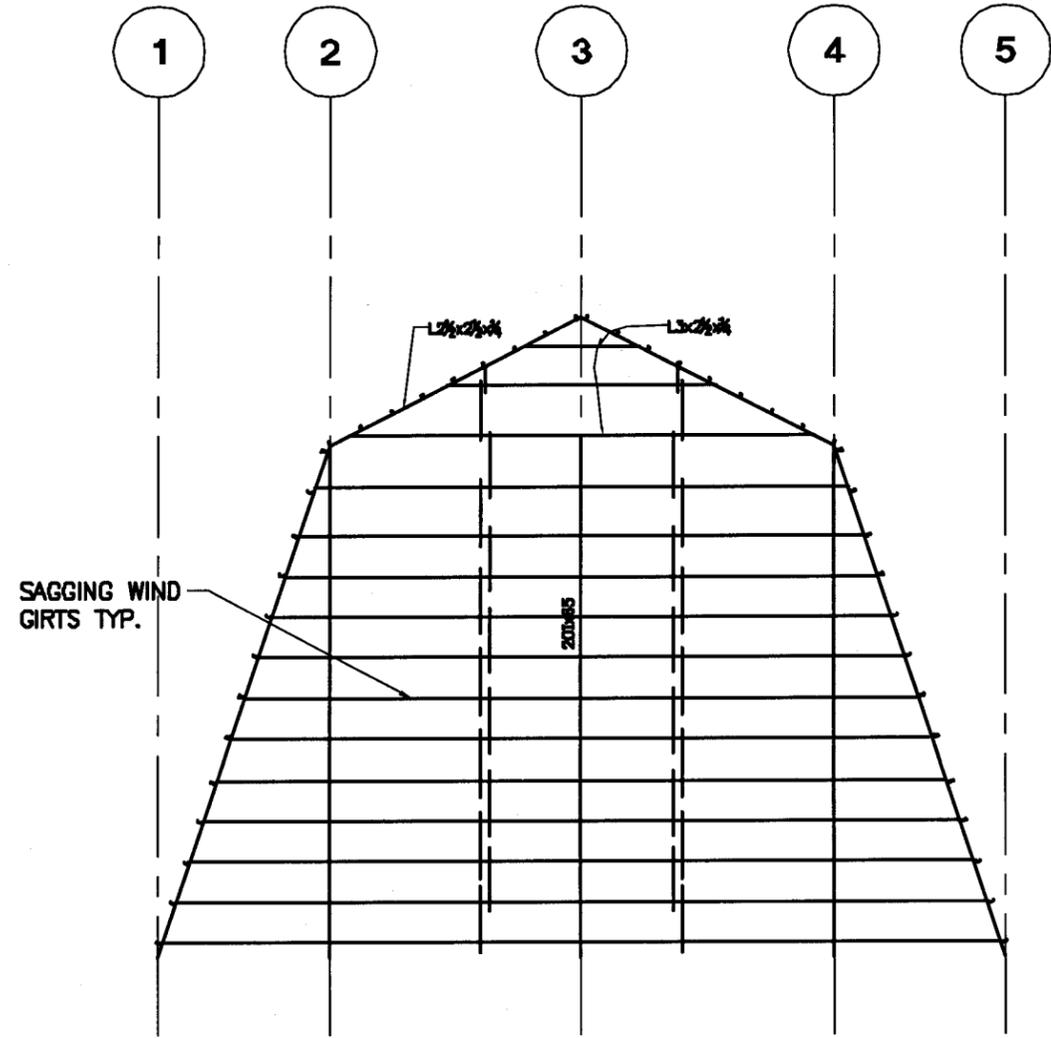
LOWER CHORD FRAMING PLAN

BALLOON HANGAR  
 EXISTING CONDITIONS  
 TENNEBAUM-MANHEIM ENGINEERS



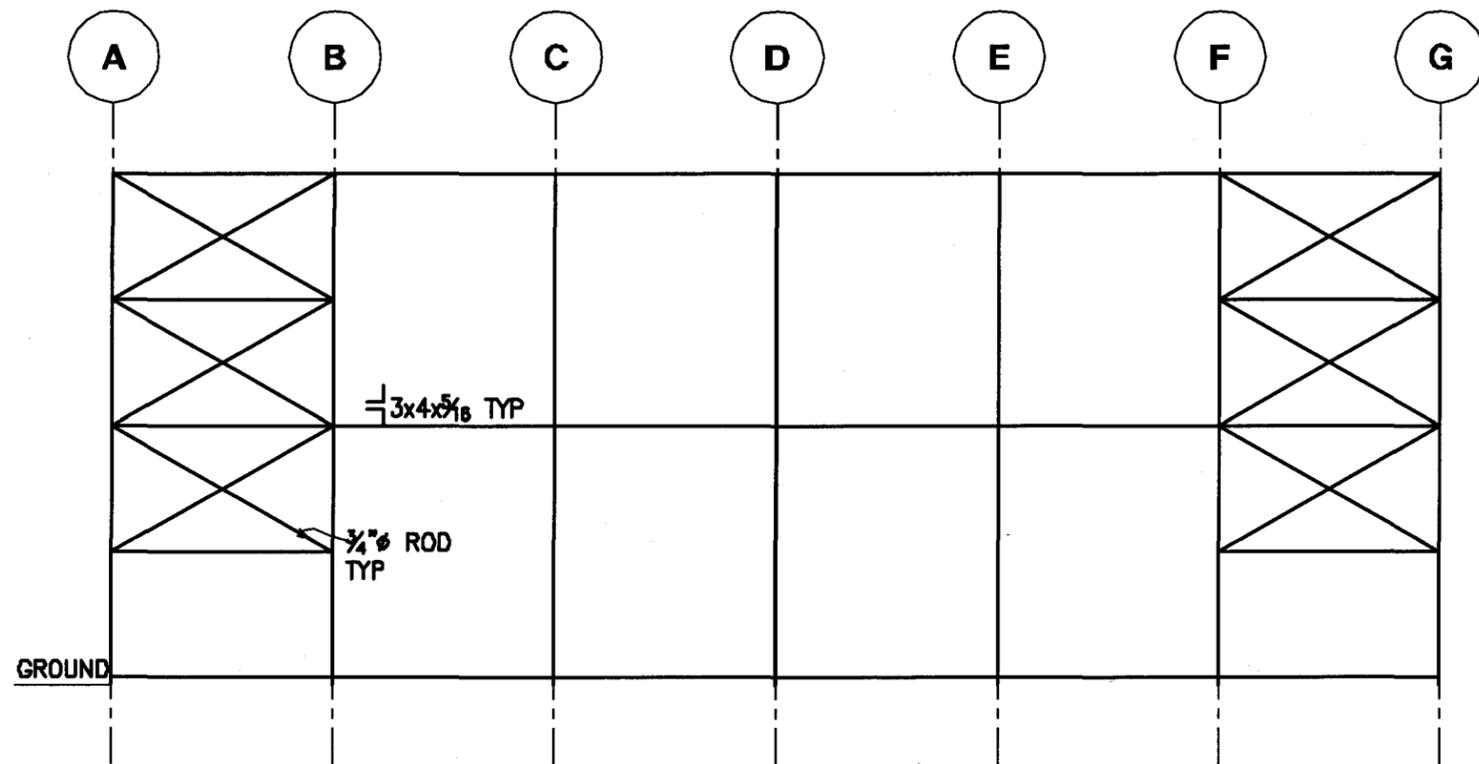
NORTH ELEVATION

1



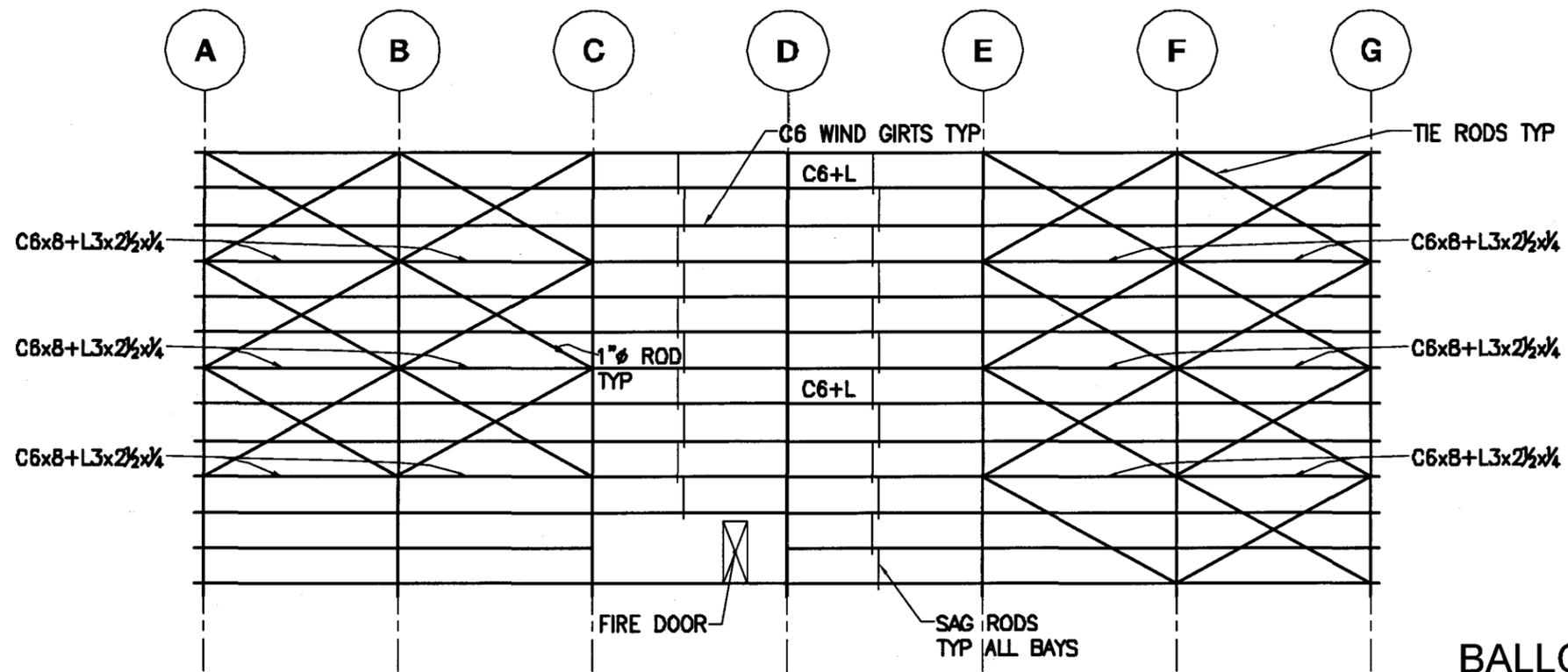
SOUTH ELEVATION

6



WEST INTERIOR ELEVATION

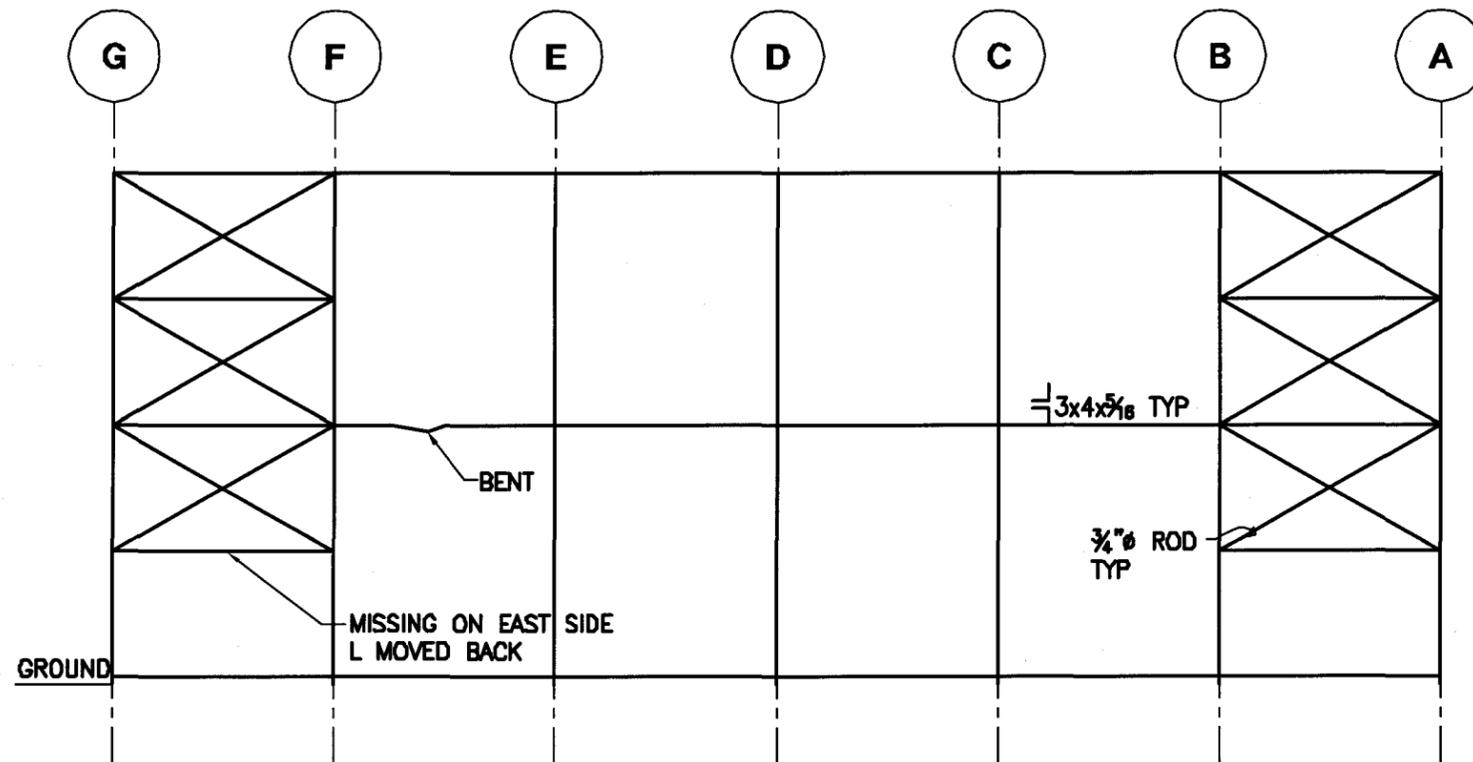
3



WEST EXTERIOR ELEVATION

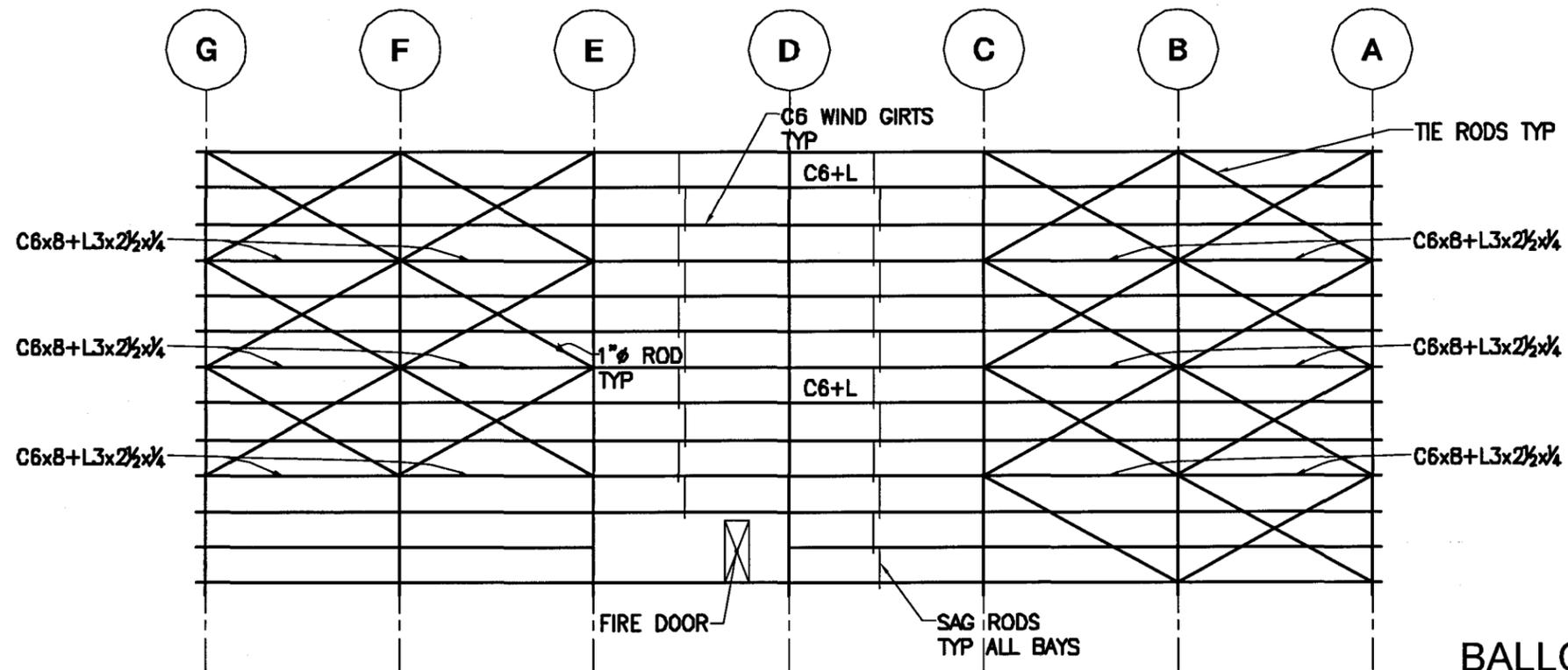
2

BALLOON HANGAR  
 EXISTING CONDITIONS  
 TENNEBAUM-MANHEIM ENGINEERS



EAST INTERIOR ELEVATION

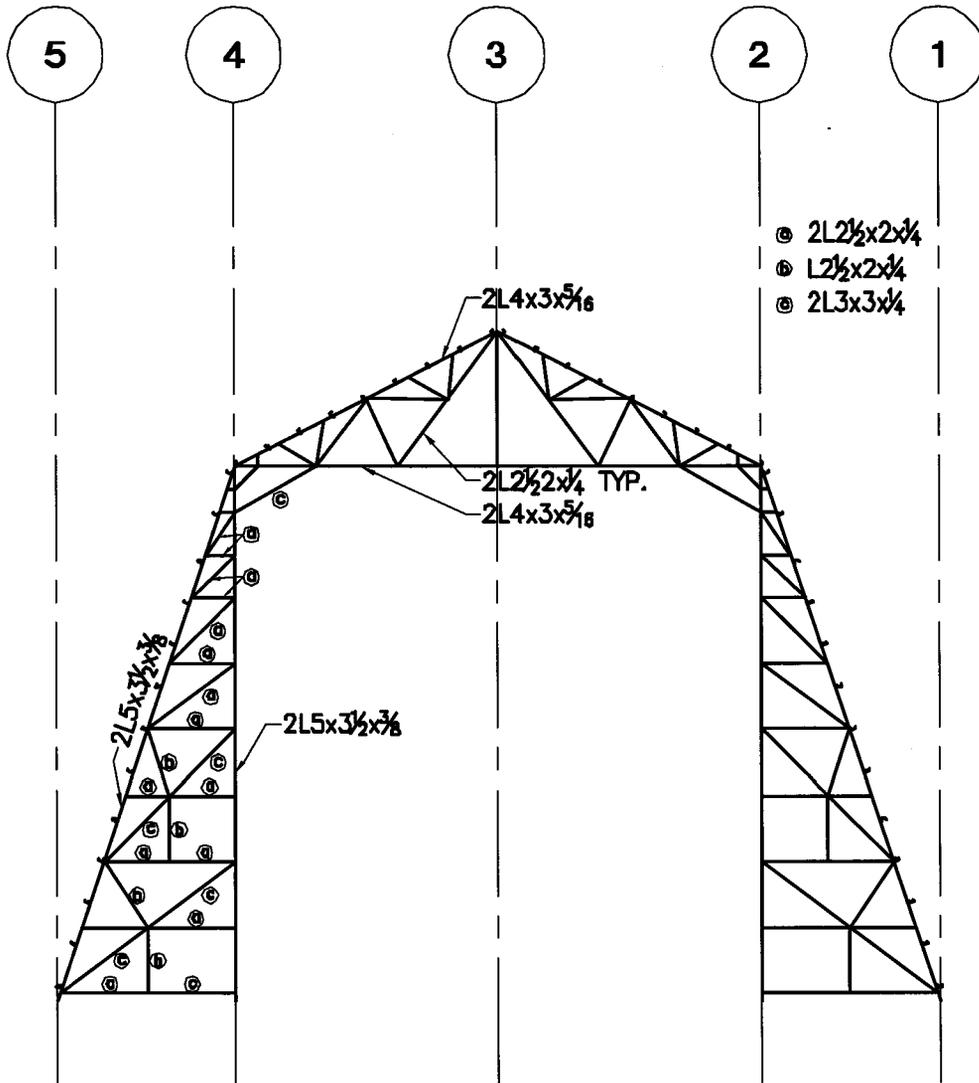
4



EAST EXTERIOR ELEVATION

5

BALLOON HANGAR  
EXISTING CONDITIONS  
TENNEBAUM-MANHEIM ENGINEERS



SECTION

7

BALLOON HANGAR  
EXISTING CONDITIONS

TENNEBAUM-MANHEIM ENGINEERS

## **STRUCTURAL DEFICIENCIES**

Preliminary structural calculations indicate that the existing structural system has sufficient strength to resist code level wind forces and earthquake forces generated by a seismic event with a 10% probability of exceedance in 50 years, except for the deficiencies noted below. (A 10% probability of exceedance means that there is only a 10% chance that the building will experience a larger earthquake in 50 years).

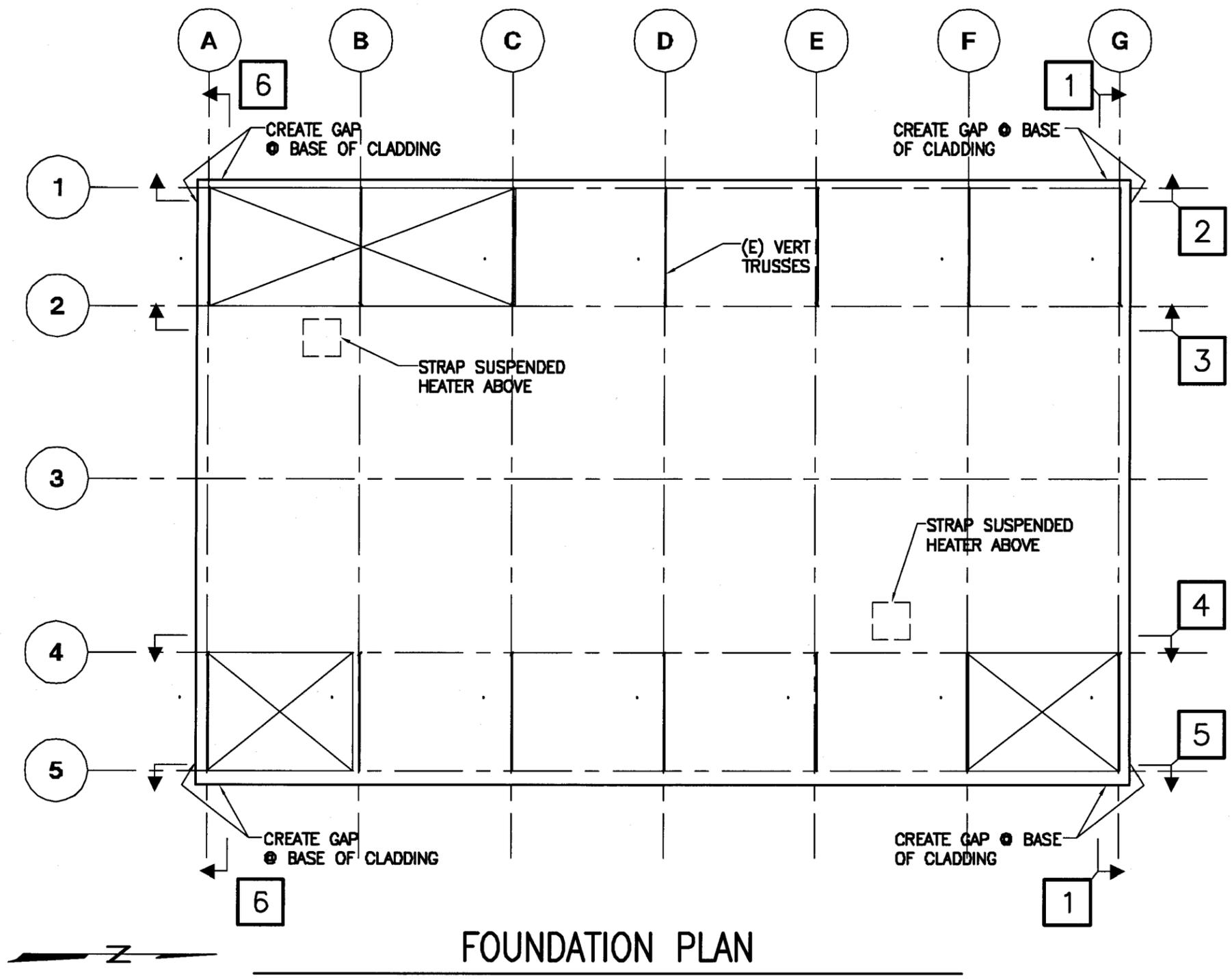
1. Many rods in the braces resisting forces in the north-south direction are missing, greatly weakening the building.
2. Large eccentricities exist between the horizontal elements and the diagonal rod braces in the north-south resisting lateral braces. These can lead to severe damage.
3. Sag rods and sag rod supports at the south wall are overstressed. This can lead to excessive damage to the south wall cladding, although the south face is the most sheltered.
4. Large areas of missing cladding can greatly increase wind loading leading to more damage.
5. The sheet metal bracket cladding attachment is too flexible and leads to damage.
6. Attachment of suspended heaters is inadequate and is a falling hazard in the event of an earthquake.
7. Cladding bears on slab on grade, which causes damage if the building moves in wind or earthquake. This can be seen from the damage at the north-east corner.

All in all, however, the building is quite robust.

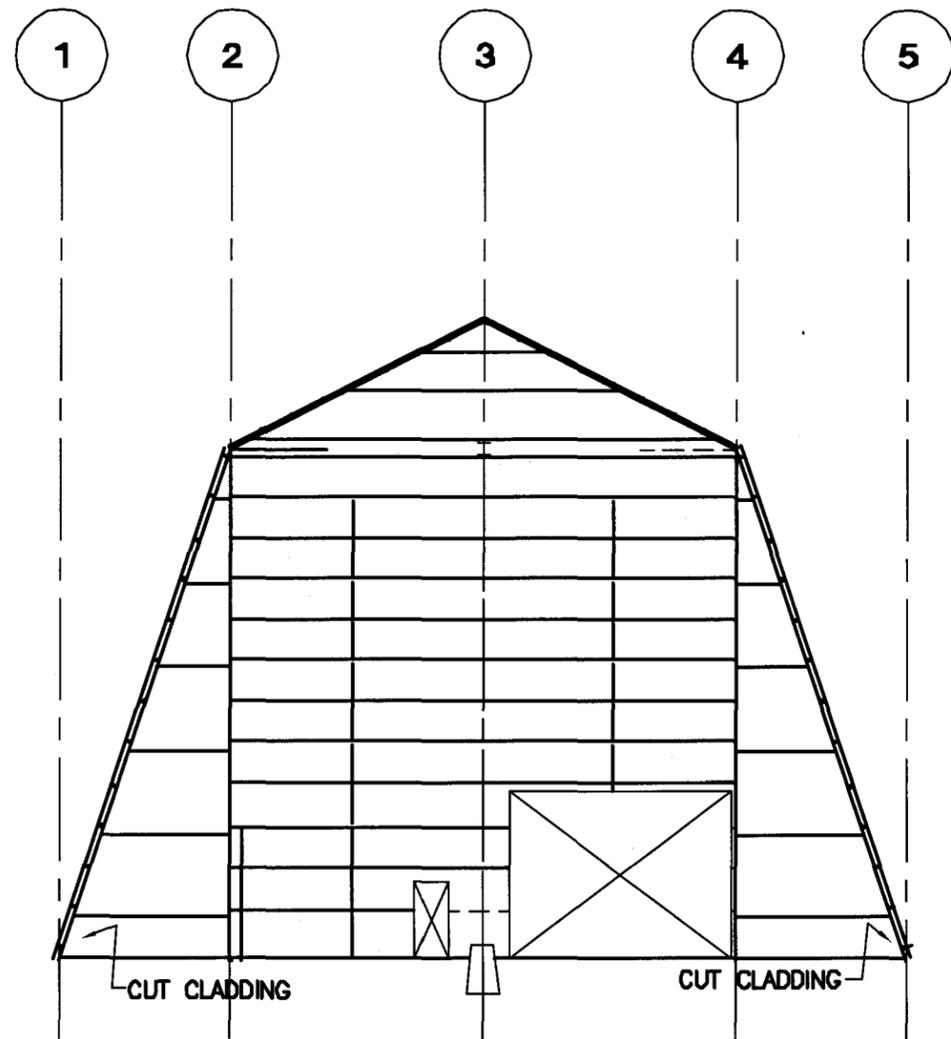
## **STRUCTURAL UPGRADE**

The following recommendations will remedy the deficiencies outlined above:

1. All missing rod bracings should be replaced. In addition, the eccentricity between the diagonals and horizontal elements in the north-south direction can be remedied by the addition of added horizontal pipe elements and new connectors for the rod bracing.
2. Added sag rods can be replaced on the south wall and members can be added to support these sag rods.
3. All damaged or missing cladding should be replaced. Refer to following report on architectural elements.
4. All sheet metal brackets should be replaced with welded stud bolts.
5. Heater supports should be strapped.
6. Cladding should be cut away from ground slab at corners.

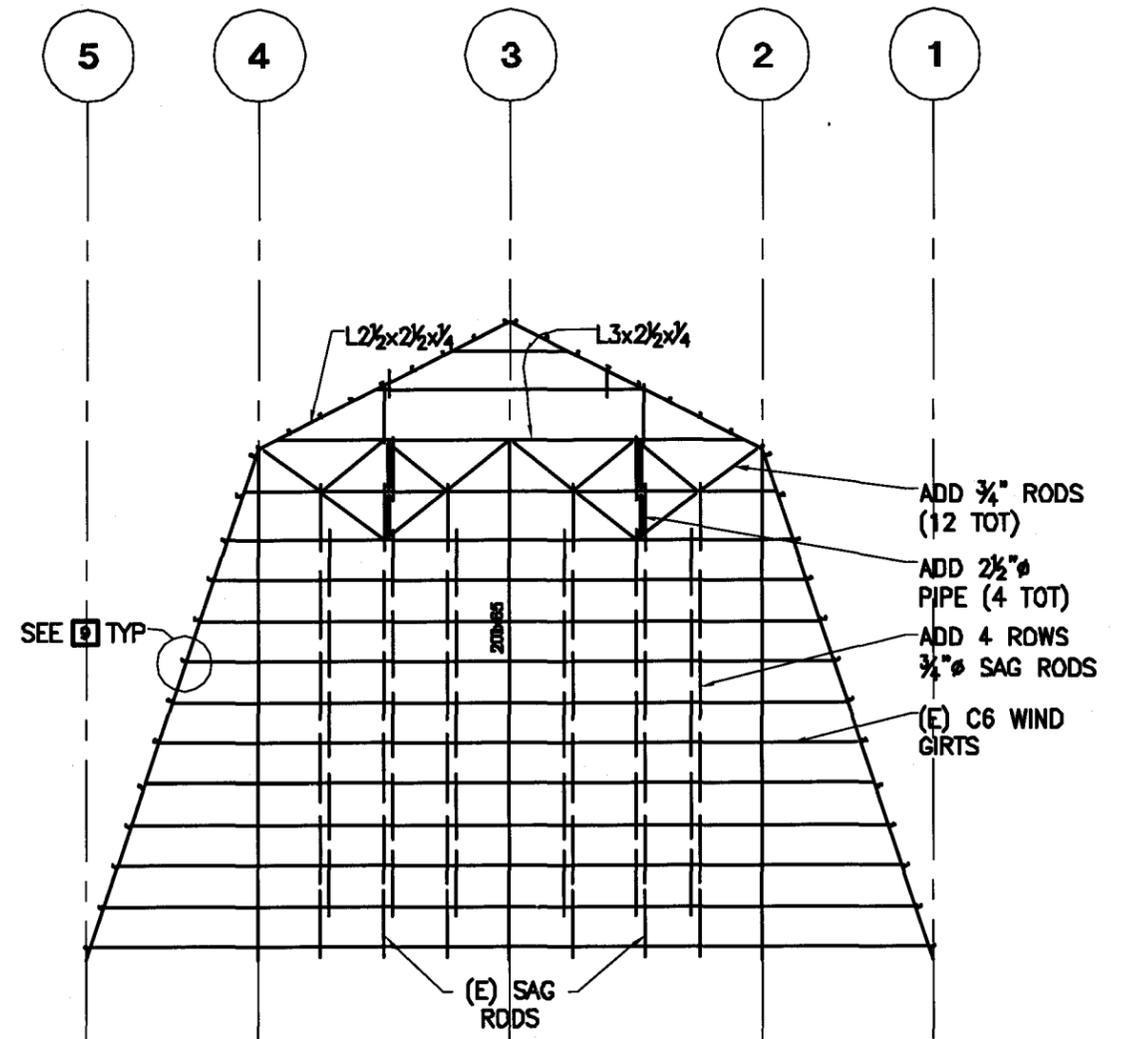


BALLOON HANGAR  
 SCHEMATIC DESIGN  
 TENNEBAUM-MANHEIM ENGINEERS



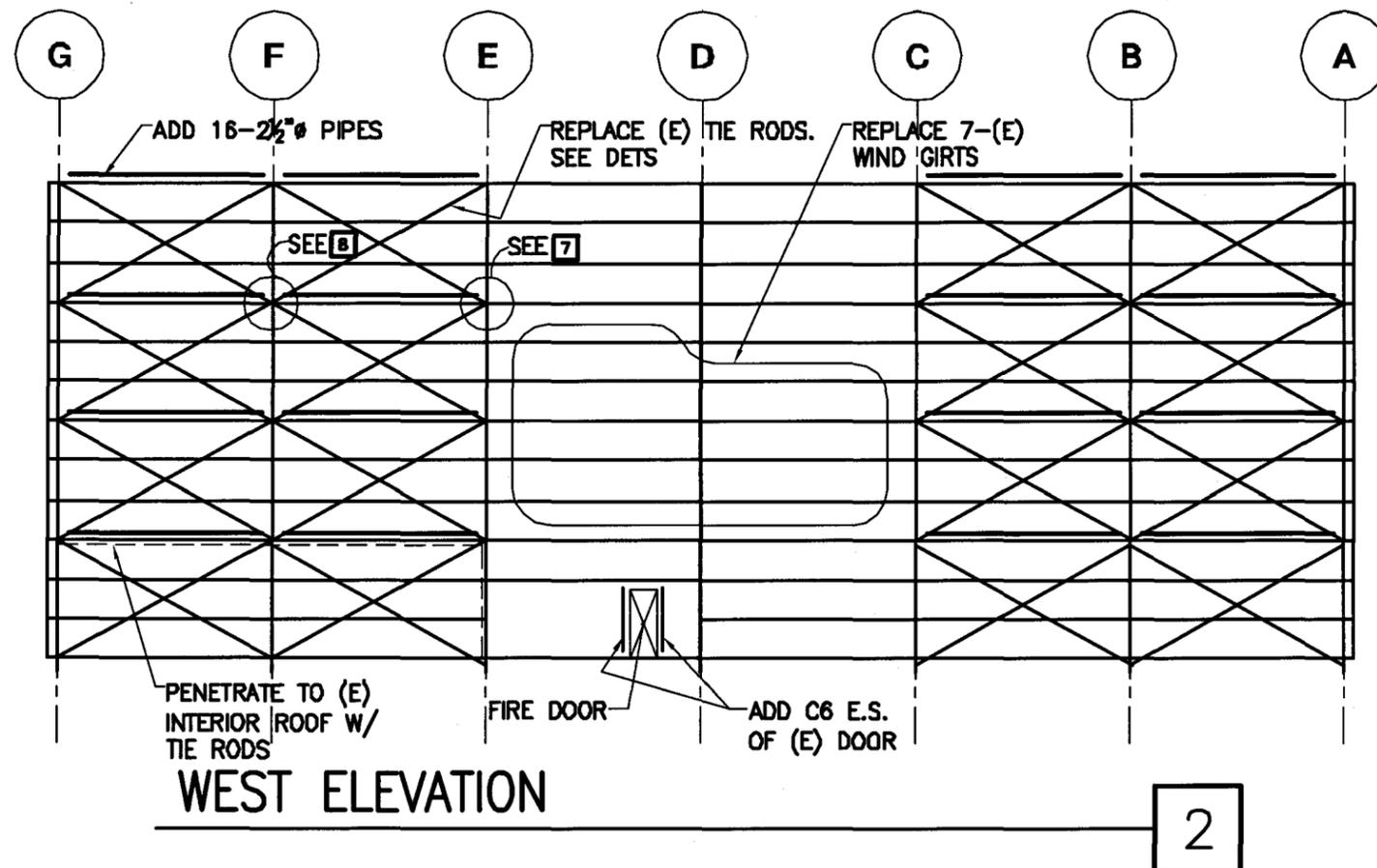
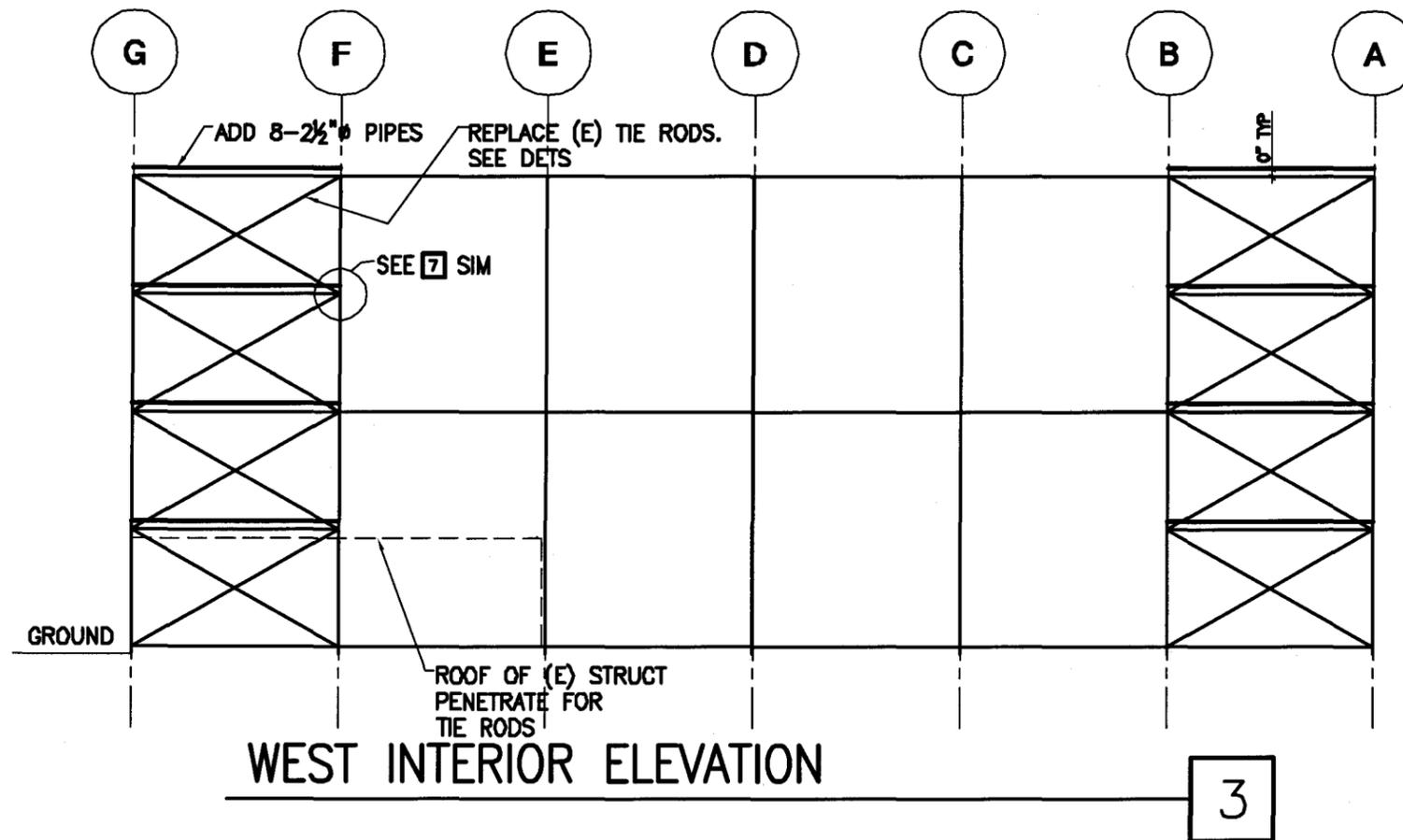
NORTH ELEVATION

1

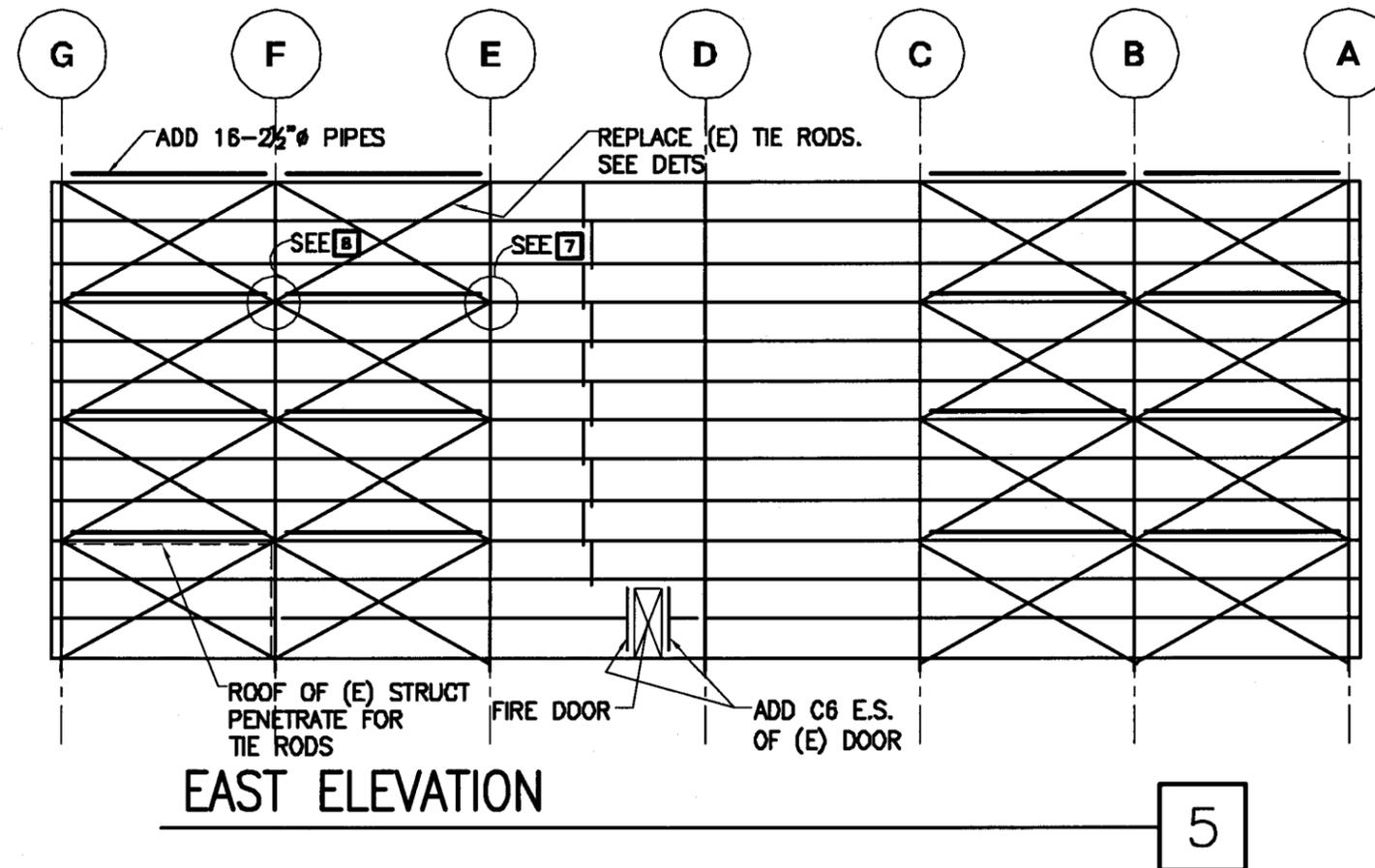
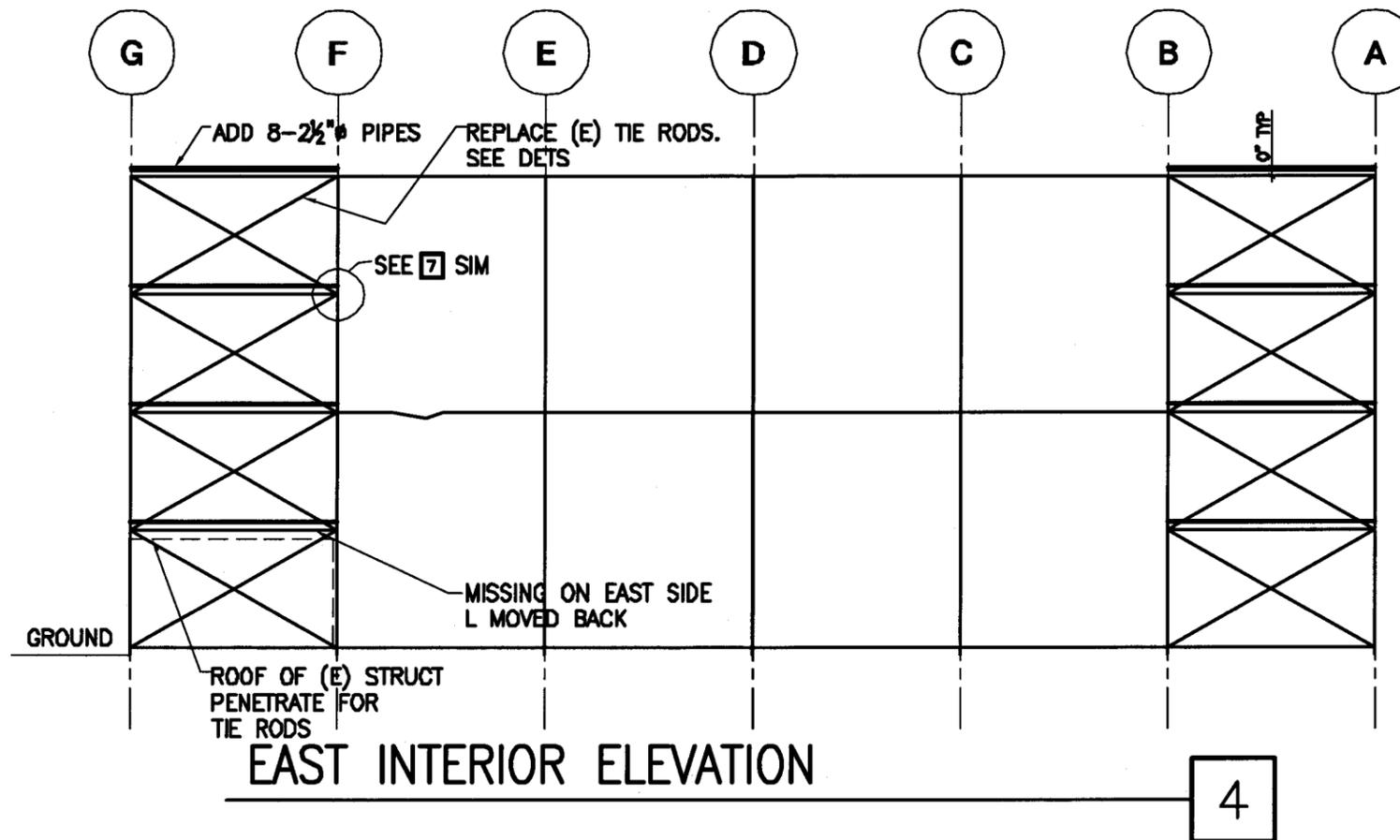


SOUTH ELEVATION

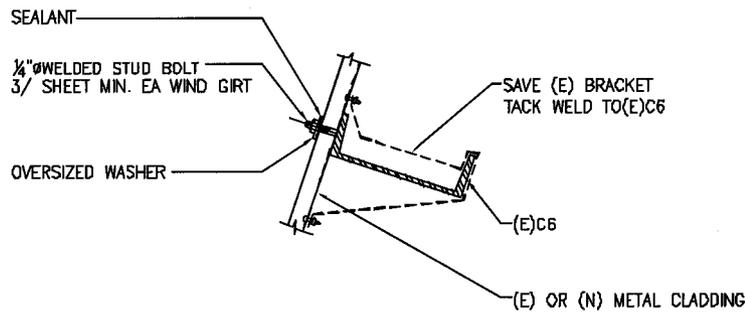
6



BALLOON HANGAR  
 SCHEMATIC DESIGN  
 TENNEBAUM-MANHEIM ENGINEERS

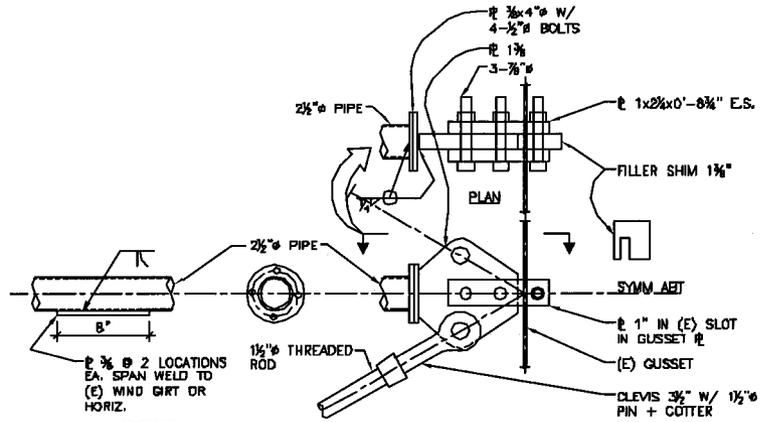


BALLOON HANGAR  
 SCHEMATIC DESIGN  
 TENNEBAUM-MANHEIM ENGINEERS

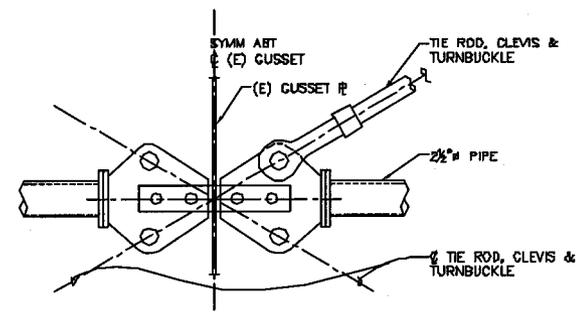


NOTE: THIS DETAIL APPLIES AT ALL (E) BRACKETS AND BROKEN CONNECTORS,

**TYPICAL CLADDING CONNECTION** 9



**DETAIL** 7



**DETAIL** 8

**BALLOON HANGAR**  
**SCHEMATIC DESIGN**  
 TENNEBAUM-MANHEIM ENGINEERS

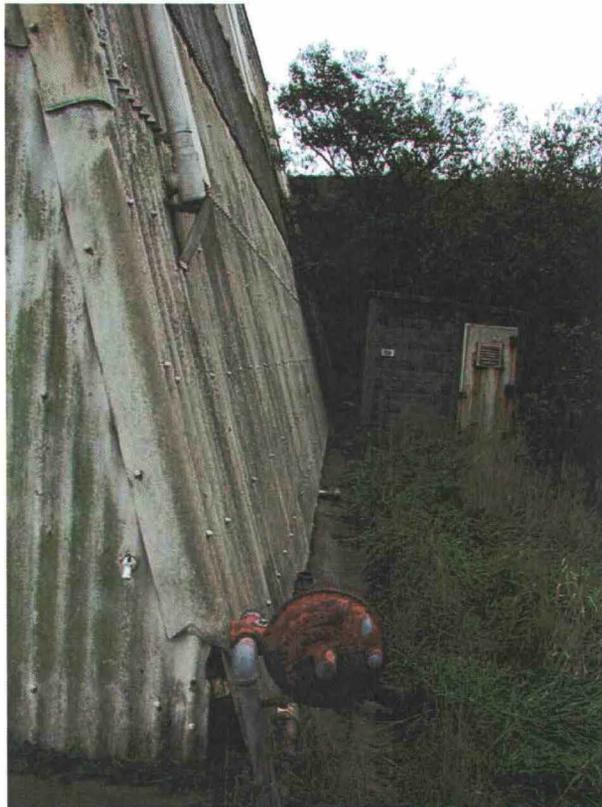
# BALLOON HANGAR PHOTOS



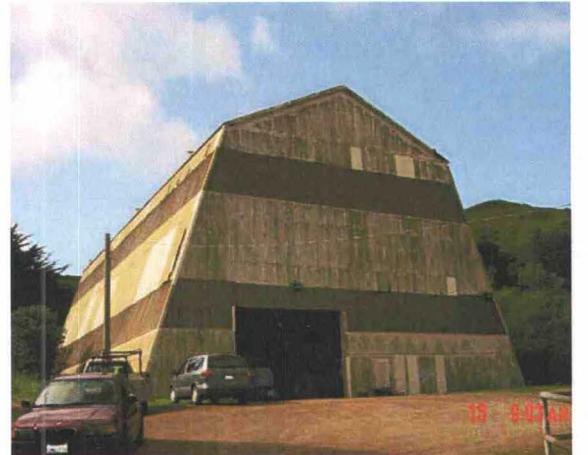
East Side Exterior



South Side Exterior



West Side Exterior



North Side Exterior



Roof Trusses



Typical Roof Truss and Metal Roof Deck

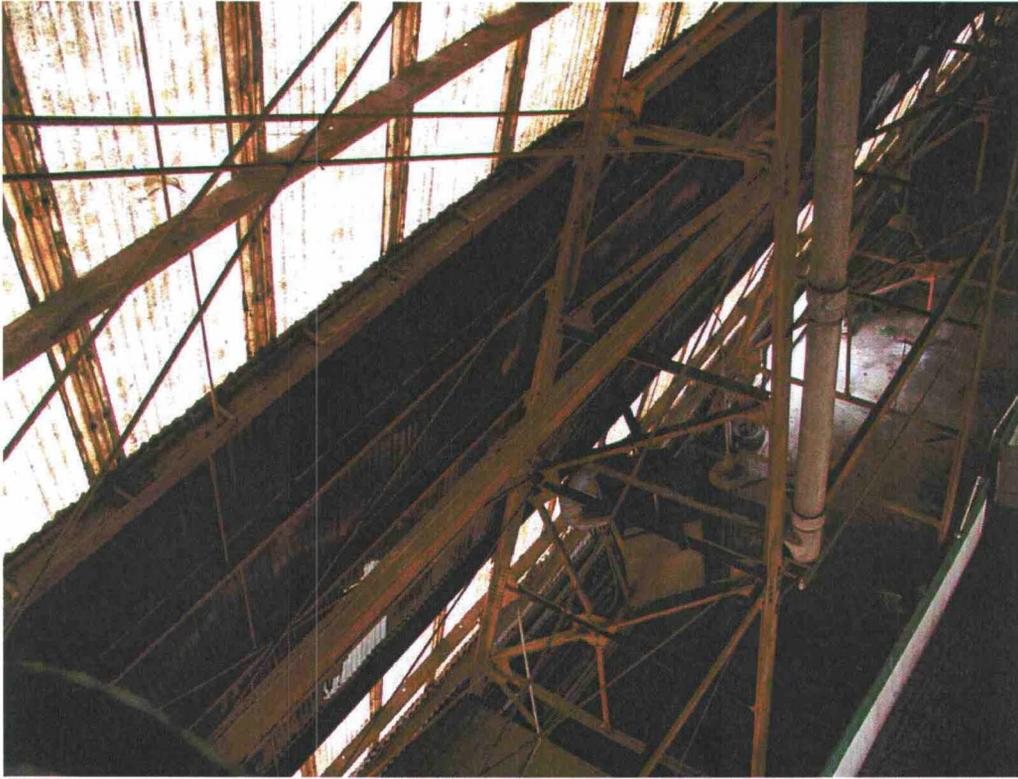


VERTICAL TRUSSES

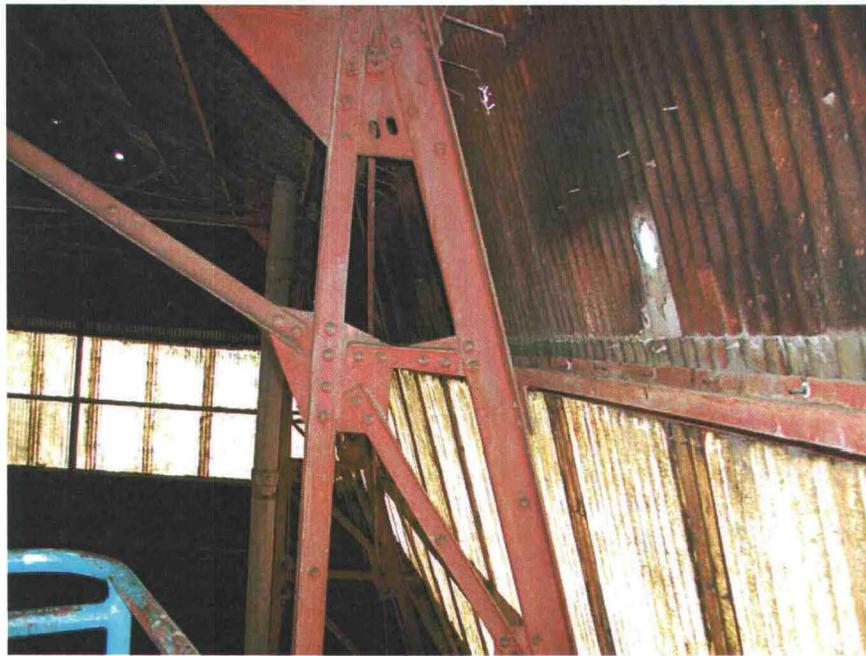


Note:  
Eccentricity  
between rods  
and horizontal  
member

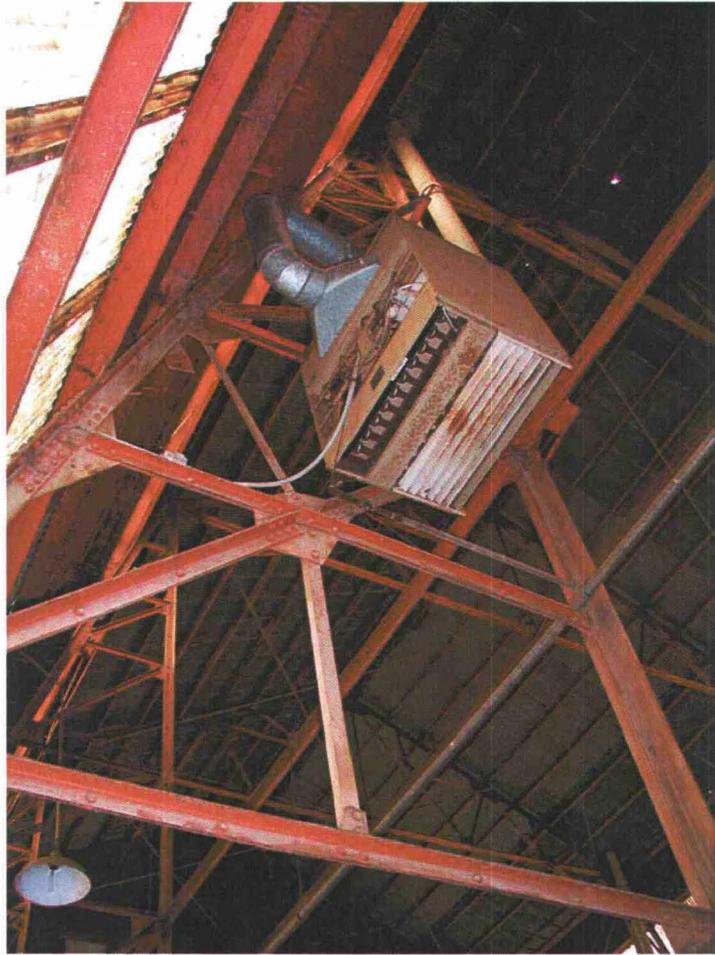
Typical Vertical Truss



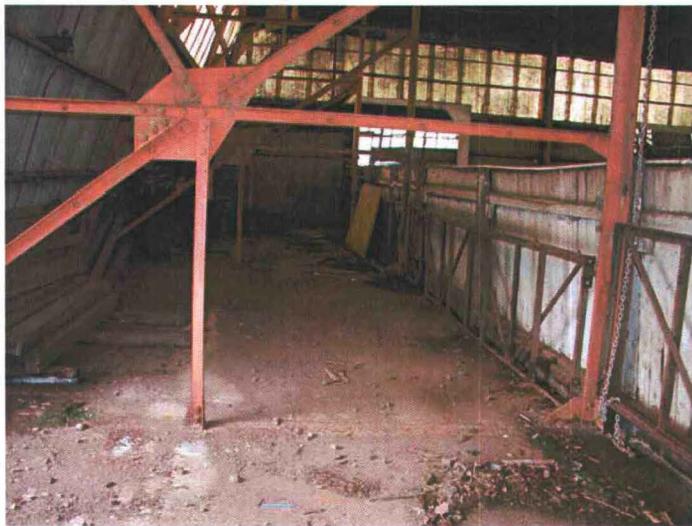
Vertical Truss and Diagonal Rod Bracing



Vertical Truss Gusset Plate



Suspended Heater



Vertical Truss facing South Wall



Vertical Trusses Facing North Wall



Splice Plate at Vertical Truss  
Field Bolts and Shop Rivets



Sagging Wind Girts at South Wall



Interior Facing South Wall



Wall Cladding Bracket Supports



Vertical Splice at Translucent Sheathing



Panel Profile



Panel Corner at Exterior Wall

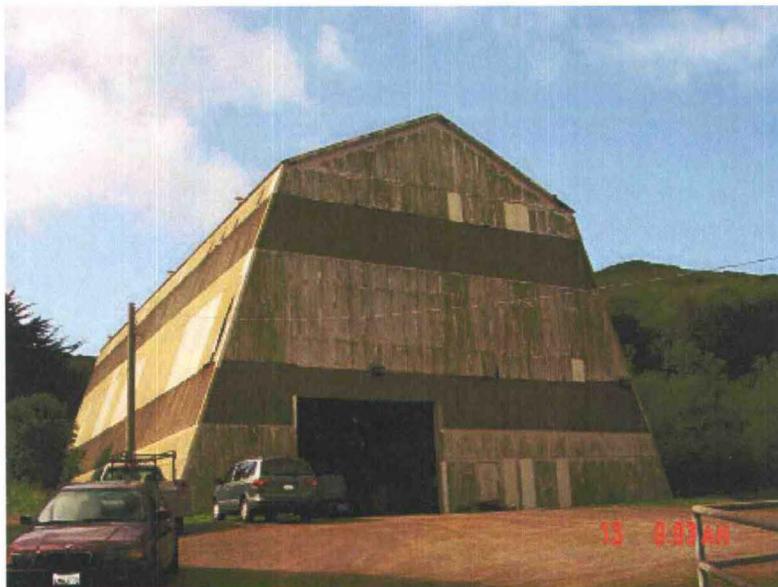
# Balloon Hanger Architectural Evaluation

## Fort Barry

### Golden Gate National Recreation Area

#### Summary

1. Historical Background
  - 1.1 Historical Significance
  - 1.2 Construction Chronology
2. General Architectural Description
  - 2.1 Site
  - 2.2 Typical Existing Conditions and Visual Assessment
    - 2.2.1 Exterior Walls
    - 2.2.2 Roof
3. Conclusions and Recommendations



## **1.0 Historical Background**

### **1.1 Historical Significance**

The Balloon Hangar at Ft. Barry is part of the Golden Gate National Recreational Area, located in the Marin Headlands. Built in 1921 as FA-905 to house hydrogen-filled observation balloons in conjunction with Coast Artillery batteries, it is included in the List of Classified Structures and a part of a National Register District with national significance. Today it is the only preserved observation balloon hangar in California (there were identical structures at Fort Scott and Fort Funston at one time) and one of the two surviving on the West Coast (the other one, at Ft. Worden, WA never actually housed any balloons and was modified from its original appearance to serve as a theater).

Hydrogen-filled observation balloons were first used in the San Francisco area in 1920 by U.S. Air Service to train accurate fire from coast defense batteries onto targets far out to sea that were obscured by haze and fog. The Army's experiment with balloons lasted only about a year, but the balloon hangar became a fixture at Ft. Barry. It is actually the last remaining structure of its type on the West Coast that was actually used as intended.

Historical research conducted by National Park Service Historians, documents the building's subsequent uses: over the years it has been become a warehouse, an ordnance repair shop, a motor pool garage, a Nike missile assembly building, storage for anti-aircraft artillery and an indoor riding rink (currently used by the Presidio Stables).

The Park's management plan for the hangar calls for preservation and maintenance; proposed treatment: stabilization; ultimate treatment; rehabilitation.

## 1.2 Construction Chronology

1921 Completed on June 27, 1921. Designation as “Standard Dirigible Balloon Hangar for Aviation Stations / Construction Division / Washington, D.C.” Total Cost: \$99,893.50

1940 Two vehicle sheds constructed on former landing field

1943 Hangar converted to Motor Pool.

Plan dated 24 August: Large roller doors and supports removed Door opening frame-in and covered with salvaged corrugated asbestos. Two 10’x12’ warehouse-type hanging doors installed. Swing in personnel doors built.

Plan Dated 10 November: 16’x40’buiding with shed roof constructed inside hangar against east wall to house three Offices.

Plan dated 26 November: Latrine room added at south end of Offices.

1953 Hangar converted to Antiaircraft Artillery maintenance facility.

Plan Dated 20 June: “Rehabilitation to Heavy Armament Shop” shows numerous alterations and new construction, among which the following:

- Removal of existing sash and frames, enlargement in height of both courses of windows openings and replacement with fixed corrugated glass fiber sheets, including additional ones on the North façade
- Replacement of the original deteriorated roof with new 22 Ga galvanized corrugated metal; removal of existing gutters and rain
- Replacement of the existing corrugated asbestos-coated sheet iron siding with corrugated cement asbestos siding all around the building under the first row of windows.
- New offices and latrine

- New floor slab
- New roller door and personnel door on the new North Elevation
- Upgraded Utility systems
- New surrounding walkways and concrete apron at North Elevation.

1954 Hangar converted to Nike Missiles Assembly Area.

Plan Dated 21 May shows interior with missile assembly and test equipment in place.

1959 Hangar converted to "Housing for Air Receivers".

Plan Dated 15 September shows housing for new equipment to be added to the building.

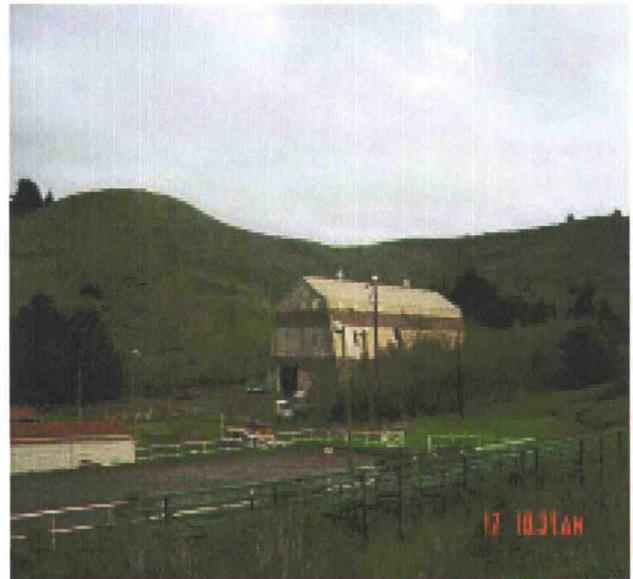
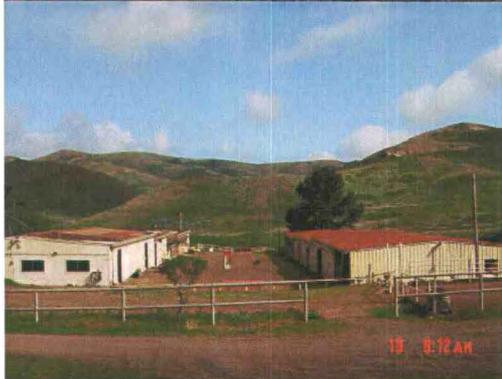
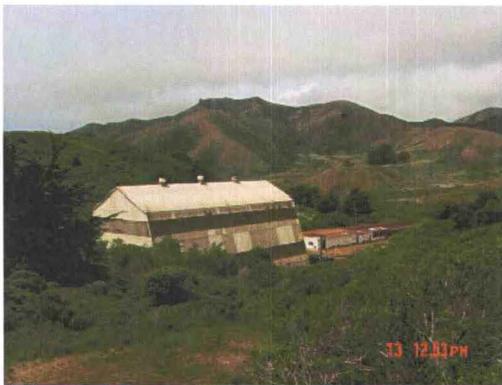
## 2.0 General Architectural Description

The architectural assessment of the Balloon Hangar Existing Conditions is based on our visual building inspection and evaluation and review of the existing documentation: original Site Plan dated July 27, 1921, drawings of subsequent modifications and conversations with National Park Service Historical Architect.

### 2.1 Site

The hangar is a 77 x 120-foot one-story structure, originally shaped to accommodate one fully inflated observation balloon.

The original Complex initially included a hydrogen generator house and a landing field for maneuvering. Since 1940, the landing field became covered with vehicle sheds, currently used as horse stalls by Presidio Stables. The scope of this report does not cover those structures.

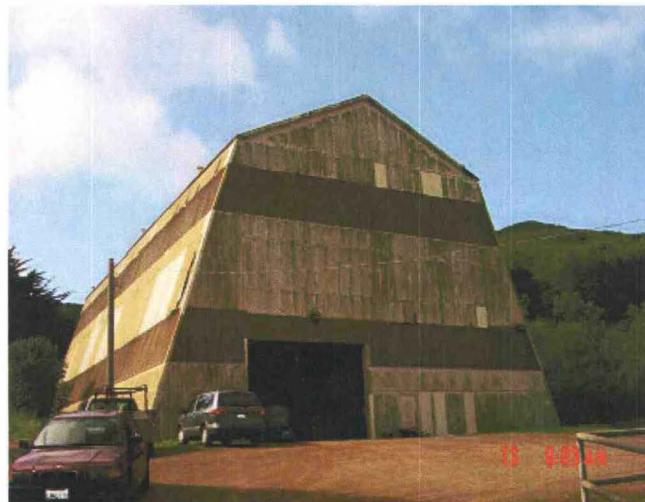


The vegetation has overgrown around three sides of the hangar and is right up against its back side, making it impossible to access for full visual observation.

There is a high degree of integrity associated with the Balloon Hangar original appearance and materials, with the notable exception of the large sliding doors that were modified in 1943. The only other major alteration of the exterior was done in 1953, when the original windows, sash and frames were removed and replaced with larger openings covered with fixed corrugated glass fiber sheets on all four elevations. The two 10'x12' warehouse-type hanging doors installed in 1943 are now missing.



Before 1943



After 1953 to Present

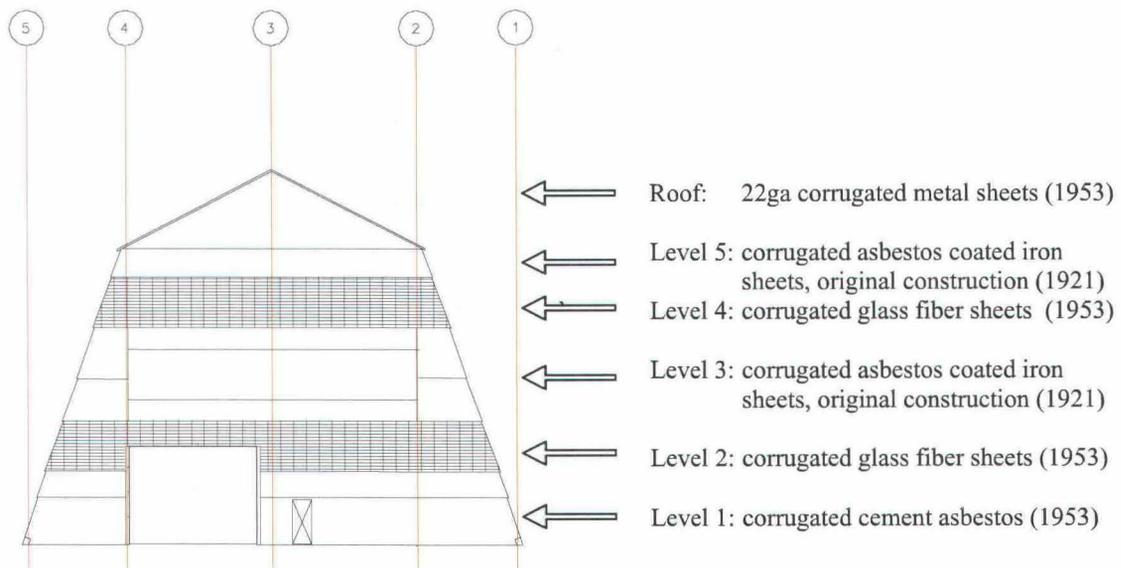
## 2.2 Typical Existing Conditions and Visual Assessment

### 2.2.1 Exterior Walls

The original material at the exterior walls was “Asbestos on Steel”, as noted in the Q.M.C. Form No. 117, dated June 1939. It still exists to a large extent at the upper levels of the structure, including its original attachment brackets. Visual observation indicates that the metal layer was coated with asbestos on the outside, with the current appearance of a bituminous coat on building paper. It was most likely painted on the outside and red lead painted inside. The sheets are about 42-inches wide and vary in height from approx. 2-feet to approx. 8-feet.

On fallen or detached portions, the metal is barely or not at all visible, due to severe rusting and disintegration.

The diagram below illustrates the existing Exterior Walls siding materials and replacement history:

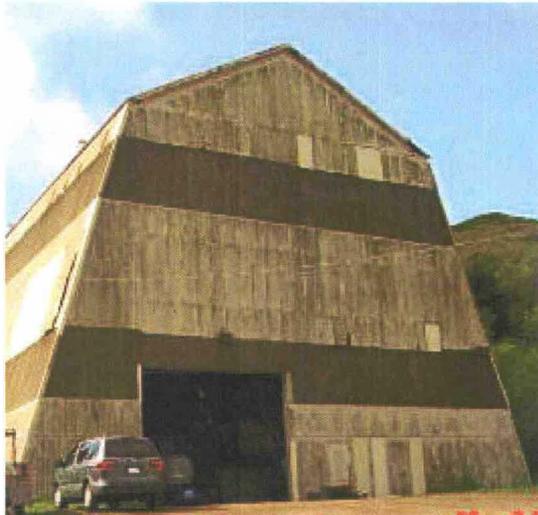


The corrugation radius of the asbestos/iron sheets at the upper levels is similar with that of the glass fiber sheets, but different than the base cement asbestos panels.

A thorough cleaning of the siding throughout is needed, as it appeared covered in rust and moss. (See NPS Hazardous Material Consultants for cleaning of asbestos containing materials).

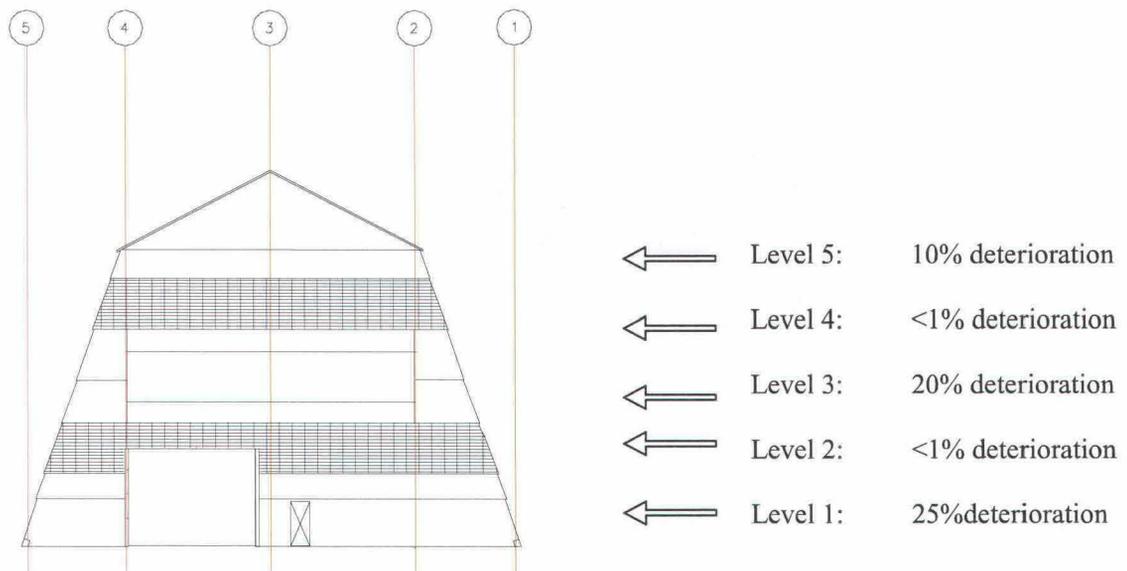
The following pages present a general assessment of the existing siding condition and specific areas of distress at each building elevation, based on visual observation. An estimated percentage of deterioration is given for each siding level.

### North Elevation

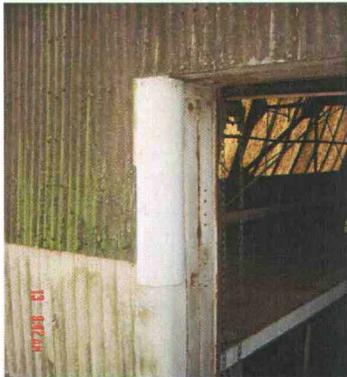
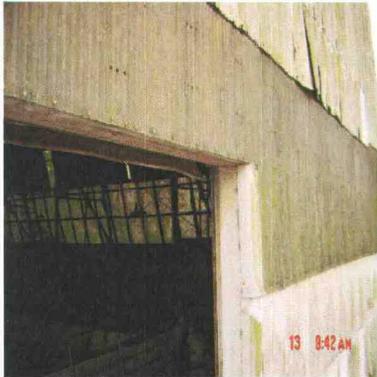


As illustrated by the photos above, the “window rows” (corrugated glass fiber sheets) at level 2 and 4 appear to be in good condition, with less than 1 percent distress.

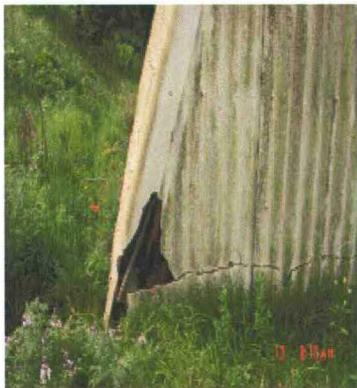
There has been relatively recent repairs at level 5 and 3, where painted corrugated sheet metal replaced some corrugated asbestos coated iron sheets. The material is similar in appearance, but the detailing and workmanship was less than adequate. Repairs at level 1 with corrugated sheet metal were also inappropriately constructed



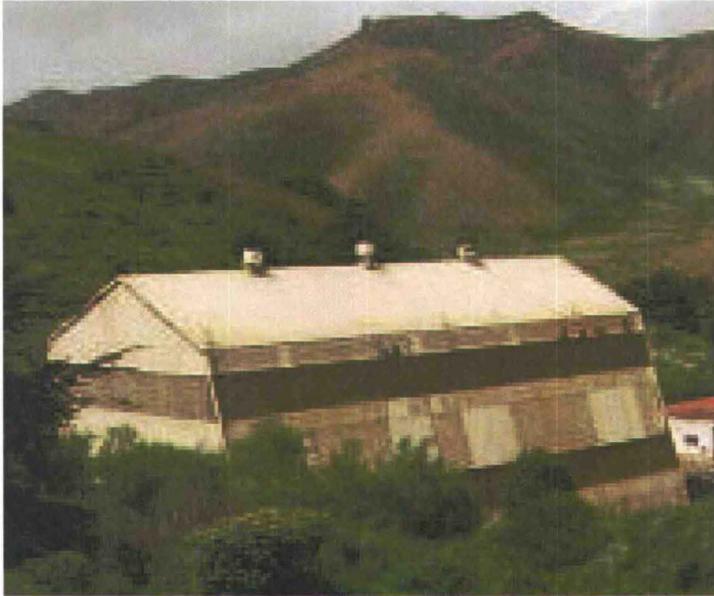
The two 10'x12' warehouse-type hanging doors installed in 1943 are now missing. There is substantial deterioration at the opening frame.



A few sheets at Level 3 became detached from structural brackets and buckled. The most extensive damage occurs at the bottom corners.

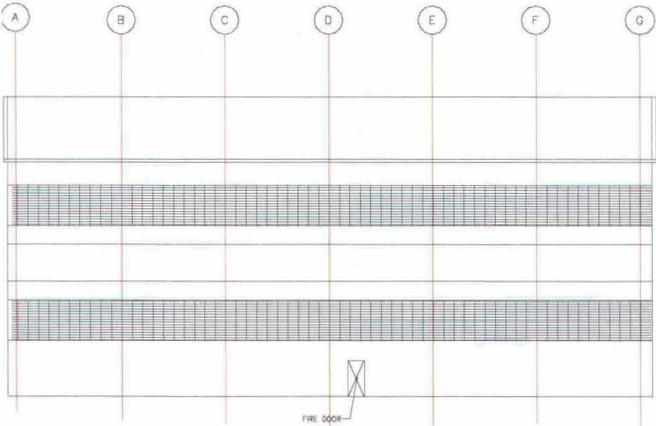


### East Elevation



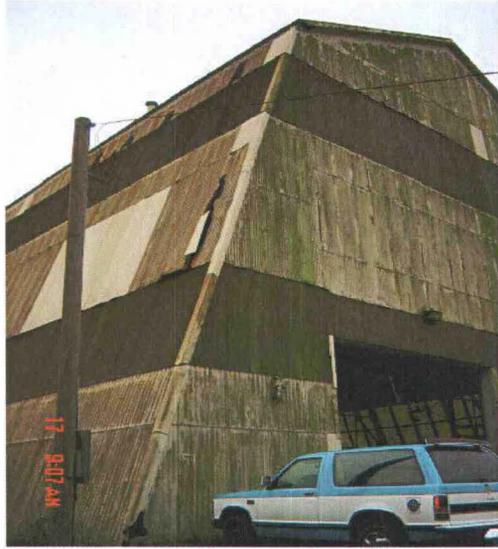
As illustrated by the photos above, the “window rows” (corrugated glass fiber sheets) at level 2 and 4 appear to be in good condition, with less than 2 percent distress. Most of the distress occurs at the bolthole attachment to structure.

There has been relatively recent repairs at level 5 and 3, where painted corrugated sheet metal replaced some corrugated asbestos coated iron sheets. The material is similar in appearance, but the detailing and workmanship was less than adequate.

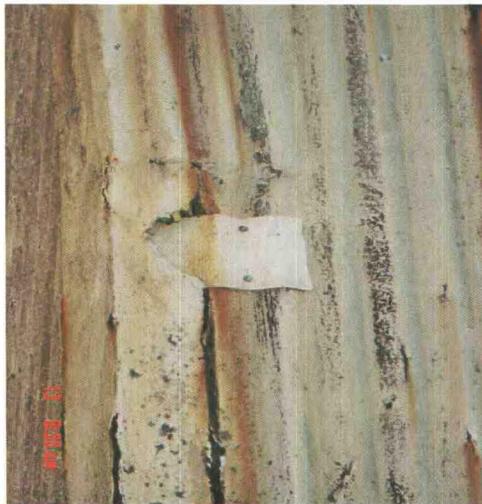


←	Level 5:	40% deterioration
←	Level 4:	<2 % deterioration
←	Level 3:	70 % deterioration
←	Level 2:	<2 % deterioration
←	Level 1:	15% deterioration

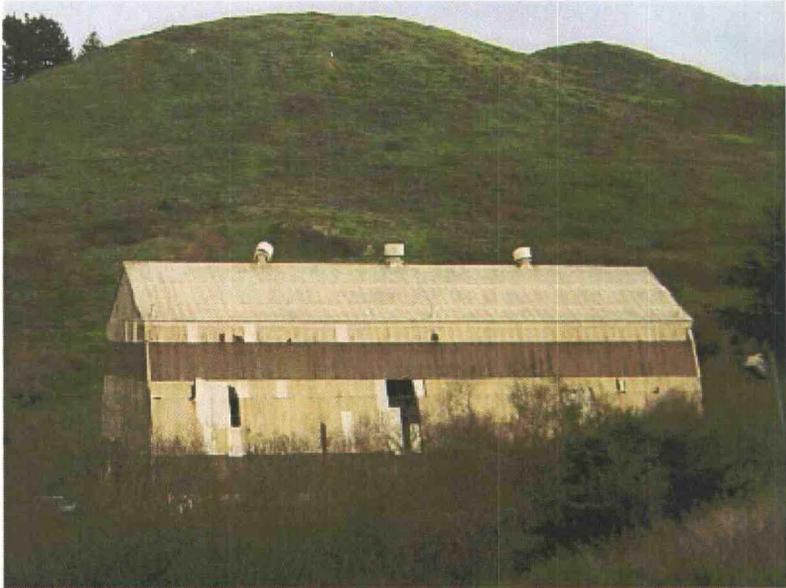
There is substantial deterioration of the asbestos siding mainly at the levels 5: the asbestos layer seems to have been delaminated and rust iron is apparent.



A few sheets at Level 3 became detached from structural brackets and buckled. The most extensive damage occurs at the bottom corners.

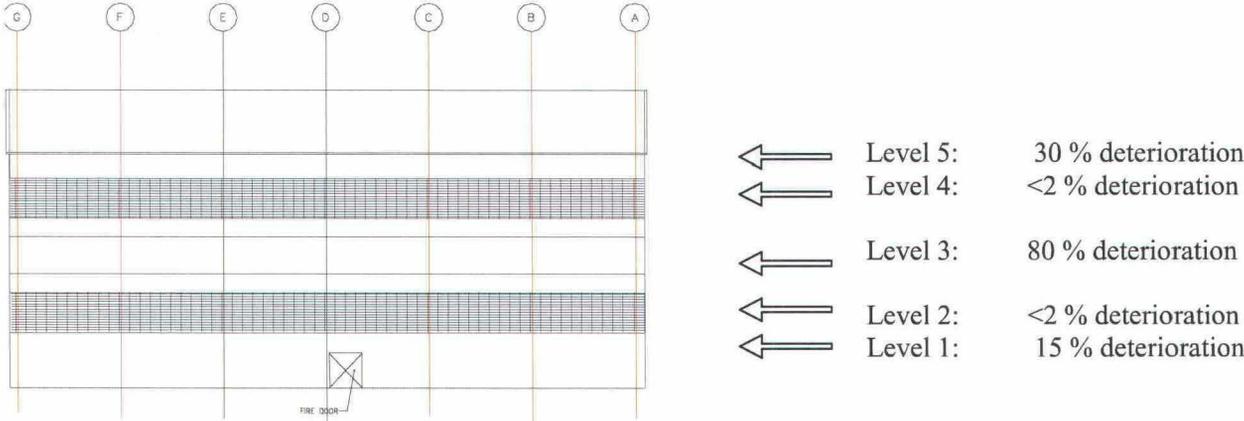


# West Elevation

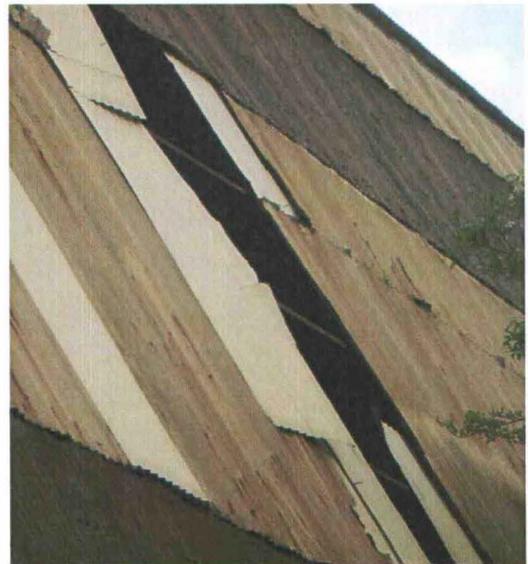
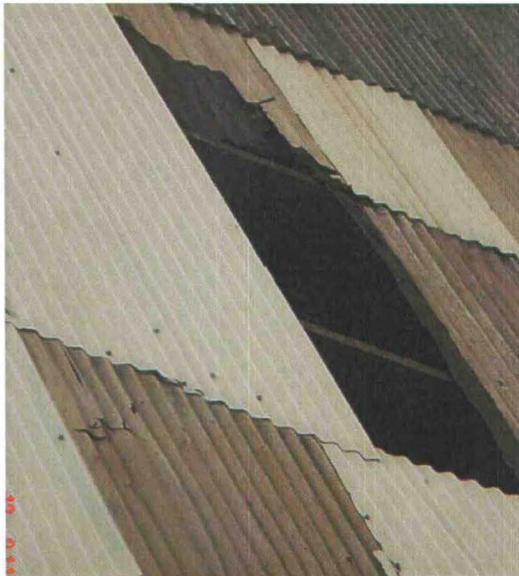
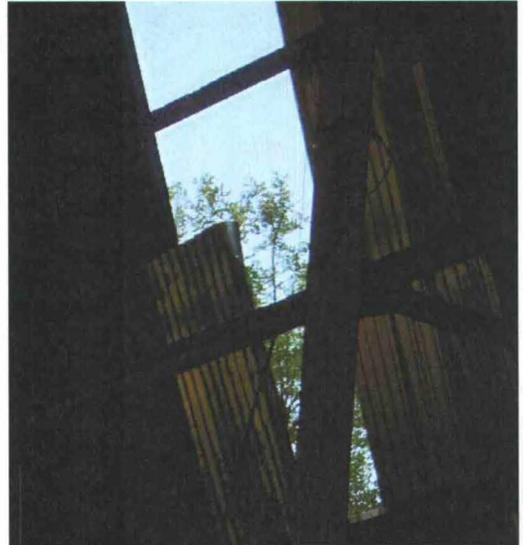
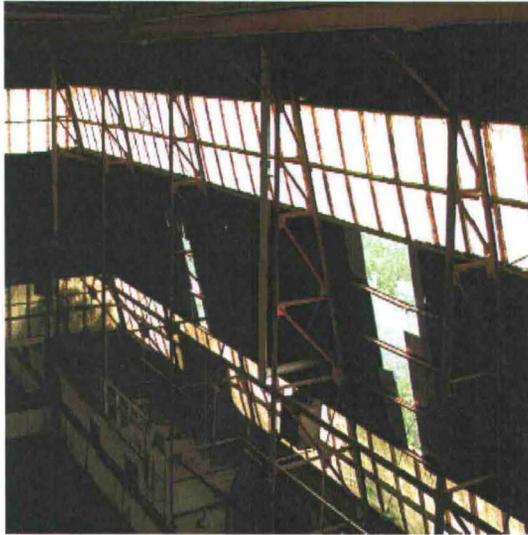


As illustrated by the photos above, the West Elevation presents the most damage. Even though there has been relatively recent extensive repairs at level 5 and 3, where painted corrugated sheet metal replaced some corrugated asbestos coated iron sheets, the inadequate detailing and installation made them temporary only; currently the replacement sheets have been ripped off and this side of the building is open to the environment in numerous places.

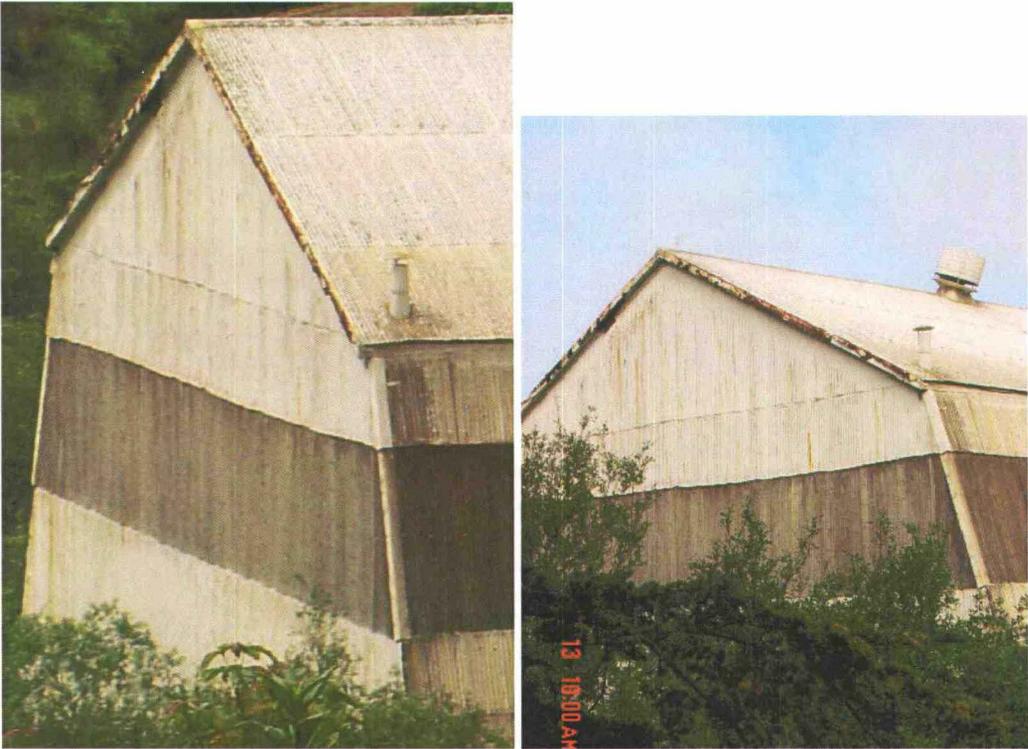
The “window rows” (corrugated glass fiber sheets) at level 2 and 4 appear to be in good condition, with less than 2 percent distress. Most of the distress occurs at the bolthole attachment to structure.



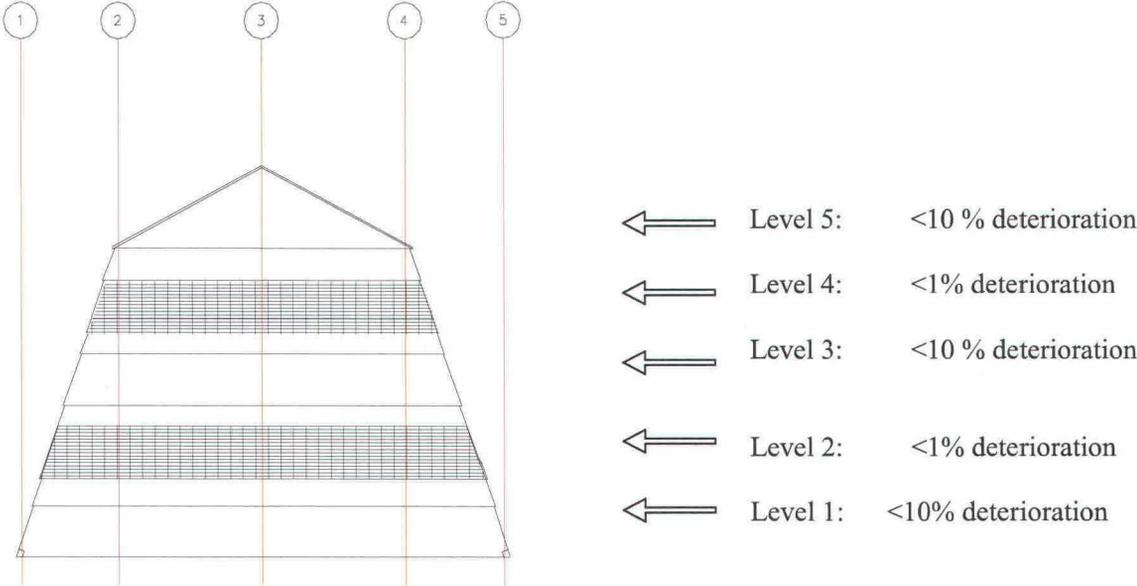
Presently, some remaining replacement panels are unstable and only partially attached to structure, thus constituting a hazardous condition, as they may fall down at any moment.



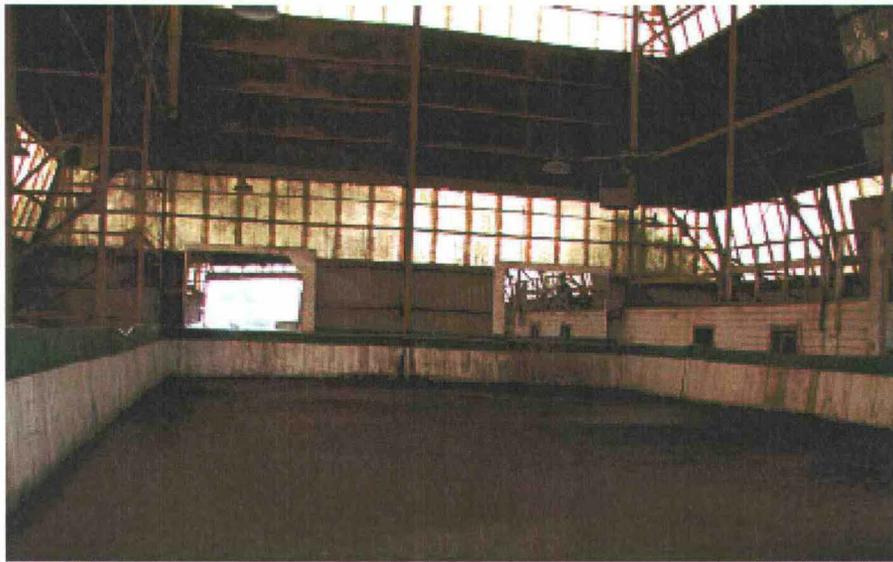
**South Elevation**



As illustrated by the photos above and insofar as the outgrown vegetation permitted full visual observation, the South Elevation presents the least damage.



Visual observation from inside out was instrumental in assessing the limited degree of deterioration on this elevation:



The details below illustrate typical siding installation details:



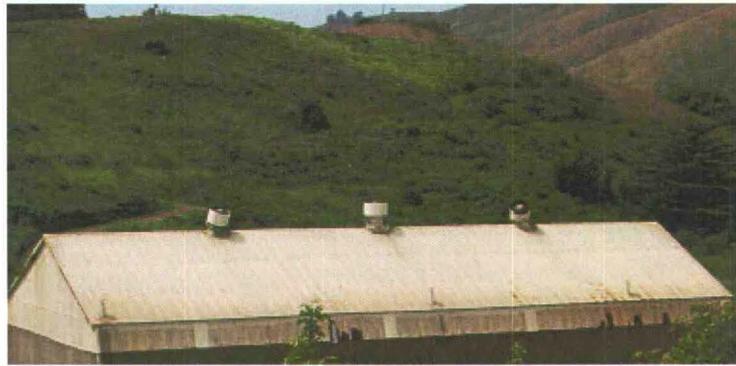
Original attachment brackets



Corrugated fiber glass panel seams

## 2.2.2 Roof

Replacement of the deteriorated roof (originally “same as walls”, i.e asbestos coated sheet iron) with new 22 Ga galvanized corrugated metal and removal of the original gutters and rain leaders were first noted on plans dated 20 June 1953. It appears that the roof was painted on the exterior just like Level 3 and 5 of the siding and left exposed on the interior.



As illustrated by the photo above and insofar as visual observation was possible from the distance, the roof does not present substantial deterioration, despite being over 50 years old. A thorough cleaning of the roof is needed, as moss is present, especially toward the eaves. In addition, rust is present at seams.

The fascias on both South and North Elevation are severely rusted and should be replaced. There are no fascias or gutters on the East and West Elevations, and those should be installed to prevent water penetration. (Historic Photos shows gutters and 3 downspouts on each side).

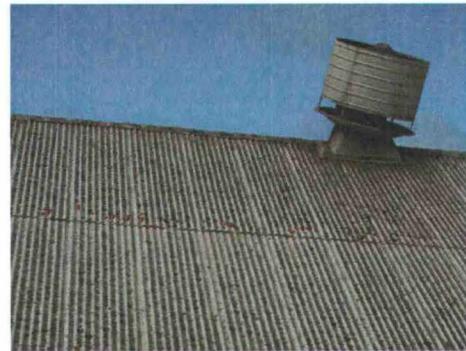


North Elevation

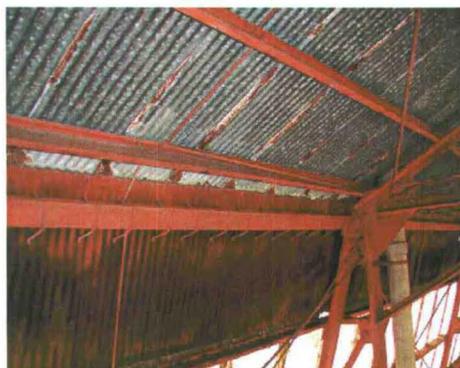


South Elevation

There are three large vents installed at the ridge and six smaller ones located at ridges, three on each side. There is no visible damage around them.



Visual observation from inside out was instrumental in assessing the roof's extent of deterioration: when looked at from inside, various size openings are visible, occurring mostly at seams, allowing water inside the structure. A larger amount of rust is present on the underside, primarily at seams. Past roof repairs are also noticeable.



### **3. Conclusions and Recommendations**

Based on visual observation and previous chapter's assessment of the existing siding condition, the following three alternative Options have been identified as for further study:

- 3.1 Historic Replication - Total Replacement
- 3.2 Partial Replacement, Repair and Cleaning.
- 3.3 Historic Preservation- Total Preservation, Repair and Cleaning

#### **3.1 Historic Replication - Total Replacement**

See Drawing A – 1

This Option recommends the complete replacement of the entire exterior siding and roof with new materials, similar in appearance and with similar installation procedures, to replicate the existing conditions. It involves no Preservation, no Repair and no Cleaning of the existing materials.

Some of the advantages this Option presents are the complete elimination of exterior siding materials containing asbestos and facilitation of constructibility, which results in reduced construction time and subsequent overall cost. It also ensures the best future durability.

Replication of the historic siding, as opposed to its preservation, is obviously detracting from the Balloon Hangar's authenticity.

### **3.2 Partial Replacement, Repair and Cleaning**

See Drawing A - 2

This Option attempts to reach the right balance between preservation and authenticity on one hand - and future durability and facilitation of constructibility on the other hand.

It consists of maintaining, cleaning and repairing what is easy to maintain and repair, as they present reduced degrees of deterioration and distress. These are the roof , the “Window Rows” and the Level 1 (asbestos cement sheets). The corrugated asbestos coated iron sheets, Levels 3 and 5, as the most deteriorated, are to be completely replaced with materials similar in appearance and installation techniques.

We recommend consulting with NPS and Hazardous Material Consultants for cleaning and repair of asbestos containing materials.

Further research and investigation is required to determine repair techniques. For the purpose of this report, it is assumed that connections can be repaired as needed, (subsequent to Materials Testing agency review), caulking can be replaced and holes in the corrugated glass fiber sheets can be filled. It is also assumed that the corrugated sheet metal of the roof can be patched locally to make it waterproof.

The current information and assumptions in regard to repairs of the existing materials will have to be verified during subsequent phases of the project and detailed methods and techniques further refined to meet specific needs and conditions.

### **3.3 Historic Preservation- Total Preservation, Repair and Cleaning**

See Drawing A - 3

This Option is obviously achieving the most in preserving the Balloon Hangar's historical authenticity, by providing minimal Replacement, maximum Repair and Cleaning.

It basically consists in retaining, cleaning and repairing the South Elevation and the adjoining last bay on East and West Elevations, the roof and the and "Window Rows".

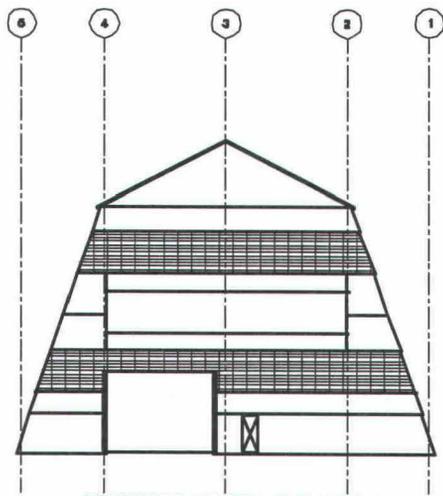
There will be substantial repairs of the level 1, 3 and 5 of the North Elevation, replacing only locally damaged sheets, as needed.

To facilitate the constructibility, while also providing a more durable solution, Levels 3 and 5 of East and West Elevations are to be replaced completely, with the exceptions of the last bay adjoining South Elevation.

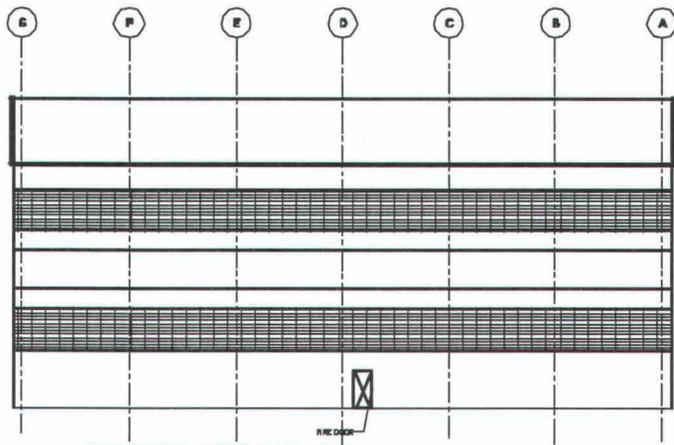
We recommend consulting with NPS and Hazardous Material Consultants for cleaning and repair of asbestos containing materials.

Further research and investigation is required to determine repair techniques. For the purpose of this report, it is assumed that connections can be repaired as needed, (subsequent to Materials Testing agency review), caulking can be replaced and holes in the corrugated glass fiber sheets can be filled. It is also assumed that the corrugated sheet metal of the roof can be patched locally to make it waterproof.

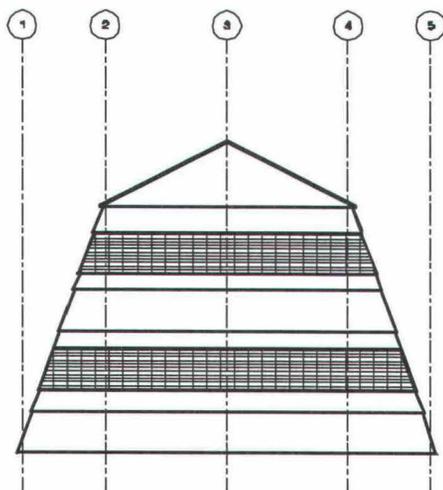
The current information and assumptions in regard to repairs of the existing materials will have to be verified during subsequent phases of the project and detailed methods and techniques further refined to meet specific needs and conditions.



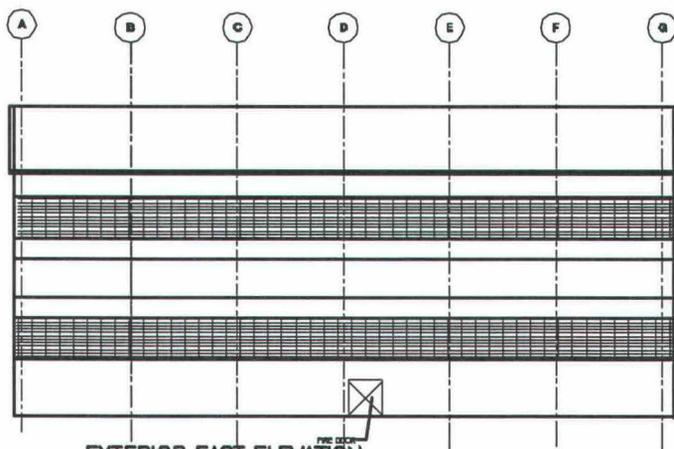
EXTERIOR NORTH ELEVATION



EXTERIOR WEST ELEVATION



EXTERIOR SOUTH ELEVATION



EXTERIOR EAST ELEVATION

NOTE: REPLACE EXTERIOR SIDING AND ROOF ENTIRELY WITH NEW MATERIALS, SIMILAR IN APPEARANCE AND WITH SIMILAR INSTALLATION PROCEDURES, TO REPLICATE THE EXISTING CONDITIONS.

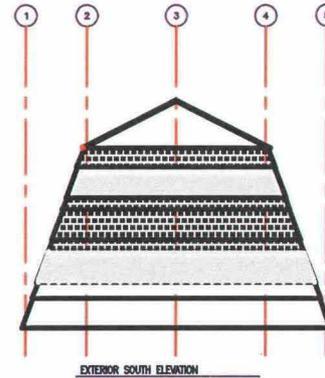
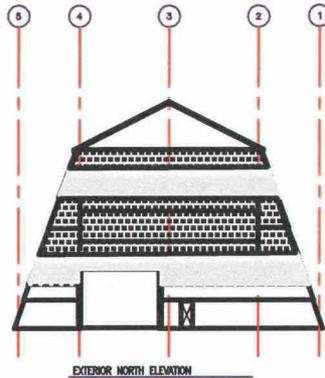


BALLOON HANGER  
OPTION 1  
REPLACEMENT

A - 1

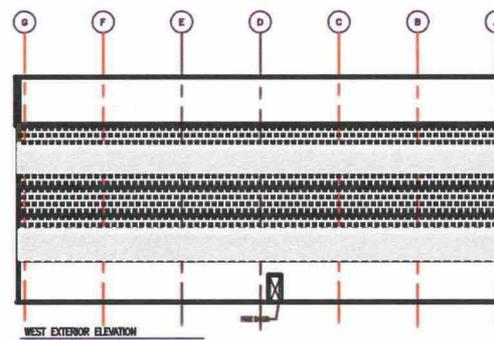
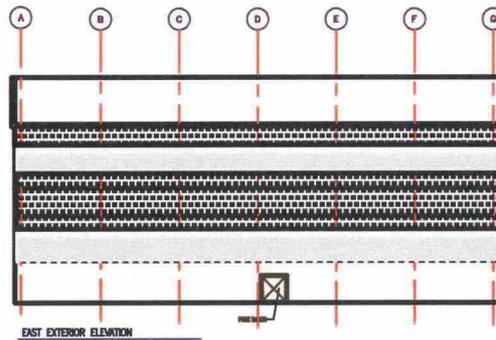
AVIVA LITMAN CLEPER ARCHITECTS

- ROOF: CLEAN AND REPAIR
- Level 5: 10 % deterioration  
REPLACE
- Level 4: <1% deterioration  
CLEAN AND REPAIR
- Level 3: 20 % deterioration  
REPLACE
- Level 2: <1% deterioration  
CLEAN AND REPAIR
- Level 1: 25% deterioration  
CLEAN AND REPAIR



- ROOF: CLEAN AND REPAIR
- Level 5: <10 % deterioration  
REPLACE
- Level 4: <1% deterioration  
CLEAN AND REPAIR
- Level 3: <10 % deterioration  
REPLACE
- Level 2: <1% deterioration  
CLEAN AND REPAIR
- Level 1: <10% deterioration  
CLEAN AND REPAIR

- ROOF: CLEAN AND REPAIR
- Level 5: 30 % deterioration  
REPLACE
- Level 4: <2% deterioration  
CLEAN AND REPAIR
- Level 3: 80 % deterioration  
REPLACE
- Level 2: <2% deterioration  
CLEAN AND REPAIR
- Level 1: 15% deterioration  
CLEAN AND REPAIR



- ROOF: CLEAN AND REPAIR
- Level 5: 40 % deterioration  
REPLACE
- Level 4: <2% deterioration  
CLEAN AND REPAIR
- Level 3: 70 % deterioration  
REPLACE
- Level 2: <2% deterioration  
CLEAN AND REPAIR
- Level 1: 15% deterioration  
CLEAN AND REPAIR



REPLACE AS SHOWN

NOTE: See NPS Hazardous Material Consultants for cleaning and repairs of asbestos containing materials

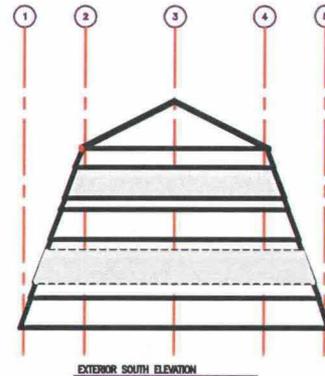
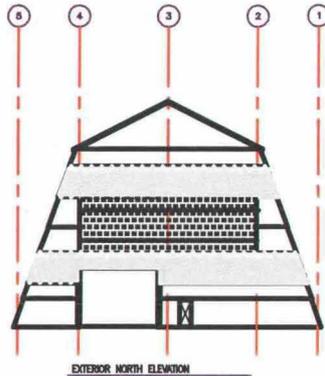


**BALLOON HANGER  
OPTION 2**

**PARTIAL REPLACEMENT,  
REPAIR AND CLEANING**

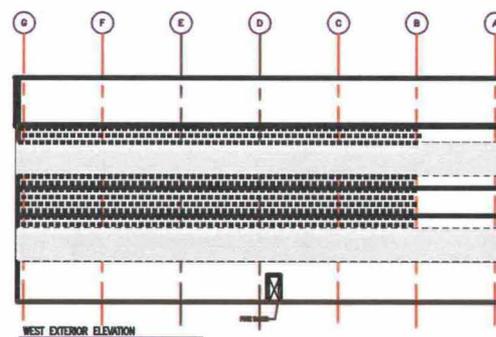
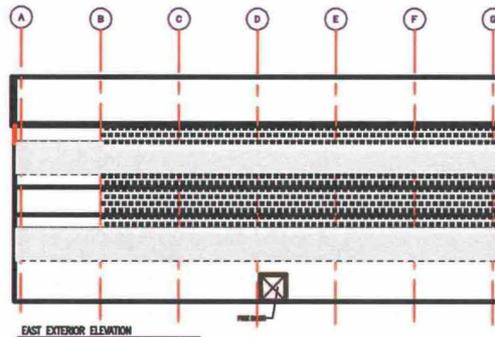
**AVIVA LITMAN CLEPER ARCHITECTS**

- ROOF: CLEAN AND REPAIR
- Level 5: 10 % deterioration  
CLEAN AND REPAIR
- Level 4: <1% deterioration  
CLEAN AND REPAIR
- Level 3: 20 % deterioration  
REPLACE AS SHOWN
- Level 2: <1% deterioration  
CLEAN AND REPAIR
- Level 1: 25% deterioration  
CLEAN AND REPAIR



- ROOF: CLEAN AND REPAIR
- Level 5: <10 % deterioration  
CLEAN AND REPAIR
- Level 4: <1% deterioration  
CLEAN AND REPAIR
- Level 3: <10 % deterioration  
CLEAN AND REPAIR
- Level 2: <1% deterioration  
CLEAN AND REPAIR
- Level 1: <10% deterioration  
CLEAN AND REPAIR

- ROOF: CLEAN AND REPAIR
- Level 5: 30 % deterioration  
REPLACE AS SHOWN
- Level 4: <2% deterioration  
CLEAN AND REPAIR
- Level 3: 80 % deterioration  
REPLACE AS SHOWN
- Level 2: <2% deterioration  
CLEAN AND REPAIR
- Level 1: 15 % deterioration  
CLEAN AND REPAIR



- ROOF: CLEAN AND REPAIR
- Level 5: 40 % deterioration  
REPLACE AS SHOWN
- Level 4: <2% deterioration  
CLEAN AND REPAIR
- Level 3: 70 % deterioration  
REPLACE AS SHOWN
- Level 2: <2% deterioration  
CLEAN AND REPAIR
- Level 1: 15% deterioration  
CLEAN AND REPAIR



REPLACE AS SHOWN

NOTE: See NPS Hazardous Material Consultants for cleaning and repairs of asbestos containing materials



**BALLOON HANGER**  
**OPTION 3**

**HISTORIC PRESERVATION**  
**AVIVA LITMAN CLEPER ARCHITECTS**

**RUDY CARRASQUILLA**

Construction Consultant

June 29, 2004

**BALLOON HANGAR**

Fort Barry, Marin Headlands

Golden Gate National Recreation Area, CA

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**ARCHITECT:** Aviva Litman Cleper Architects (ALCA)

444 Spear Street, Suite 201

San Francisco, CA 94105

TEL 415.977.0799

FAX 415.977.0999

**STRUCTURAL:** TENNEBAUM-MANHEIM ENGINEERS

414 Mason Street, #605

San Francisco, CA 94102

TEL 415.772.9891

FAX 415.772.9893

- CRITERIA:**
1. Architectural plans by ALCA entitled "Balloon Hanger Option 2 and Option 3" undated with three options outlined in text, with a small revision e-mailed 6/22/04 (4 pages).
  2. Structural sketches by Tennebaum-Manheim Engineers (TME) received 6/15/04 (8 pages).
  3. Undated ALCA preliminary report entitled "Balloon Hanger at Ft. Barry" (24 pages)
  4. Typical cladding connection detailed e-mailed by TME (1 page)

- PROJECT DATA:**
1. The project includes exploring three restoration options to a one story Balloon Hangar, originally built in 1921. The hangar is roughly 77 x 120 feet (9,240 sq.ft.). **Option 1:** Complete replacement of the exterior siding and roof with new materials. **Option 2:** Partial replacement, repair and cleaning. **Option 3:** Total preservation, repair and cleaning. All options will include structural upgrades as outlined by the TME sketches.

- CLARIFICATIONS AND EXCLUSIONS:**
1. **General Conditions:** The assumed construction schedule is 9 weeks (2 months). During the course of construction, the Owner will provide and pay for the cost of temporary water. The estimate includes a part-time project manager, full-time supervision, temporary sanitary facilities, progressive and final clean-up.
  2. **Exclusions:** Permit costs; builders risk insurance; utility fees; architectural or engineering fees and connections; development costs; municipal taxes or fees; hazardous material removal or abatement (Excludes all cleaning and demolition of siding materials); material testing and inspection.
  3. **Sitework:** The preliminary report does not identify the site scope of work. No work anticipated.
  4. **Site Utilities:** The site utility scope of work assumes that existing utilities are adequate for the new building. No work anticipated.
  5. **Structure:** We do not anticipate any work to the substructure, i.e., footings, slab-on-grade. The structural work includes structural bracing and façade reinforcement.

**RUDY CARRASQUILLA**

*Construction Consultant*

*June 29, 2004*

**BALLOON HANGAR**

*Fort Barry, Marin Headlands*

*Golden Gate National Recreation Area, CA*

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6. **Enclosure:** The existing building exterior is a combination corrugated metal, corrugated fiber sheets, and corrugated cement asbestos siding. The sloped roof is corrugated metal sheets.

7. **Interior:** The estimate excludes all interior finishes.

8. **Miscellaneous Specialties and Equipment:** No work anticipated.

9. **Fire Sprinklers:** No work anticipated

10. **Plumbing:** No work anticipated.

11. **Heating and Ventilation:** The estimate includes strapping existing suspended heaters. The existing vents are to remain--no work anticipated.

12. **Electrical:** We include an allowance for temporary power set-up, safe-off, and potential minor electrical conduit relocation.

**RUDY CARRASQUILLA***Construction Consultant**June 29, 2004***BALLOON HANGAR***Fort Barry, Marin Headlands**Golden Gate National Recreation Area, CA*

<b>Areas</b>	<b>Total</b>	<b>Unit</b>	<b>Ratio to Gross Area</b>
<b>1. Building</b>			
Building Enclosed Area	9,240	SF	1.00
Covered-Not-Enclosed (Overhangs & Canopies @ 1/2 Area)	0	SF	0.00
Total Gross Building Area	9,240	SF	1.00
Gross Façade Area	17,546	SF	1.90
Asbestos Cement Panels	3,670	SF	0.40
Corrugated Asbestos Metal Panels	7,334	SF	0.79
Corrugated Window Panels	6,262	SF	0.68
Roof Area (measured flat)	9,240	SF	1.00
Sloped Roof	5,760	SF	0.62

**RUDY CARRASQUILLA**  
*Construction Consultant*  
*June 29, 2004*

**BALLOON HANGAR**  
*Fort Barry, Marin Headlands*  
*Golden Gate National Recreation Area, CA*

	<b>Quantity</b>	<b>Unit</b>	<b>Unit Price</b>	<b>Total \$</b>
<b><u>CSI SUMMARY</u></b>				
Gross Building Area	9,240	SF		
1.000 GENERAL CONDITIONS			6.49	59,926
5.000 METALS			9.53	88,080
7.600 ARCHITECTURAL SHEETMETAL			22.78	210,474
7.900 CAULKING & SEALANTS			0.35	3,234
8.100 DOORS & FRAMES			0.87	8,050
8.700 FINISH HARDWARE			0.11	1,000
9.800 PAINTING			0.06	560
16.000 ELECTRICAL			0.50	4,620
<b>SUBTOTAL</b>			<b>40.69</b>	<b>375,944</b>
CONTRACTOR'S FEE	8.00%		3.25	30,076
GENERAL LIABILITY INSURANCE	1.50%		0.61	5,639
CONTINGENCY	10.00%		4.46	41,166
MISC. FEES & PERMITS				
MATERIALS TESTING & INSPECTION				
<b>RECOMMENDED BUDGET (3rd Quarter 2004)</b>			<b>49.01</b>	<b>452,825</b>
<b>ALTERNATES:</b>				
1 OPTION #2--Partial Replacement			(14.09)	(130,226)
OPTION #3--Historic Replication			(17.49)	(161,631)

**RUDY CARRASQUILLA**  
 Construction Consultant  
 June 29, 2004

**BALLOON HANGAR**  
 Fort Barry, Marin Headlands  
 Golden Gate National Recreation Area, CA

	Quantity	Unit	Unit Price	Total \$
<b>1.000 OPTION #2--Partial Replacement</b>				
Siding				
Delete new siding and roofing	(1)	LS		(207,234)
Replace levels 3 and 5	7,334	SF	12.00	88,008
Repair level 1	550	SF	15.00	8,250
Repair levels 2 and 4	100	SF	20.00	2,000
SUBTOTAL				<b>(108,976)</b>
Contractor's Fee	8.00%			(8,718)
General Liability Insurance	1.50%			(1,635)
Contingency	10.00%			(10,898)
Misc. Fees, Permits, Allow Materials Testing and Inspection				
TOTAL OPTION #2--Partial Replacement				<b>(130,226)</b>
<b>OPTION #3--Historic Replication</b>				
Siding				
Delete new siding and roofing	(1)	LS		(207,234)
Levels 3 and 5, replace	4,644	SF	12.00	55,728
Levels 3 and 5, repair	300	SF	20.00	6,000
Repair level 1	550	SF	15.00	8,250
Repair levels 2 and 4	100	SF	20.00	2,000
SUBTOTAL				<b>(135,256)</b>
Contractor's Fee	8.00%			(10,820)
General Liability Insurance	1.50%			(2,029)
Contingency	10.00%			(13,526)
Misc. Fees, Permits, Allow Materials Testing and Inspection				
TOTAL OPTION #3--Historic Replication				<b>(161,631)</b>

**RUDY CARRASQUILLA**

Construction Consultant

June 29, 2004

**BALLOON HANGAR**

Fort Barry, Marin Headlands

Golden Gate National Recreation Area, CA

	Quantity	Unit	Unit Price	Total \$
<b>1.000 GENERAL CONDITIONS</b>				
Start-up & Closeout	1	LS	1,950	1,950
Project Staff				
Project Manager, 20%	9	WKS	600	5,400
Superintendent	9	WKS	2,600	23,400
Scheduling				
Schedule and updates		By Project Staff		
Life Safety				
Safety Coordinator	2	MO	700	1,400
Safety kit and signs	1	LS	500	500
Miscellaneous safety	2	MO	750	1,500
Temporary utilities				
Electricity	2	MO	150	300
Phone and FAX	2	MO	450	900
Water		NIC-by Owner		
Temp Toilets	2	MO	200	400
Construction Clean Up				
Progressive clean-up	9	WKS	600	5,400
Final clean-up	9,240	SF	0.20	1,848
Debris boxes	4	EA	650	2,600
Field Expenses				
Set-up, on-site field office	1	LS	1,450	1,450
Field Office with furnishings	2	MO	750	1,500
Field misc. consumables	2	MO	150	300
Printing and messenger service	2	MO	1,000	2,000
Office Equipment	1	LS	1,200	1,200
Miscellaneous Equipment				
Small tools	2	MO	150	300
Miscellaneous hoisting	1	LS	1,500	1,500
Automobiles, gas, maint.	2	MO	160	320
Pick-up trucks, gas, maint.	2	MO	800	1,600
Finish Protection / Damage				
Misc. protection	9,240	SF	0.45	4,158
<b>TOTAL GENERAL CONDITIONS</b>	<b>2</b>	<b>MO</b>	<b>29,963</b>	<b>59,926</b>

**RUDY CARRASQUILLA**  
*Construction Consultant*  
*June 29, 2004*

**BALLOON HANGAR**  
*Fort Barry, Marin Headlands*  
*Golden Gate National Recreation Area, CA*

	<b>Quantity</b>	<b>Unit</b>	<b>Unit Price</b>	<b>Total \$</b>
<b>5.000 METALS</b>				
Furnish and Install:				
Man door frames	3	EA	450	1,350
Hanging door opening frame	1	LS	3,500	3,500
End elevation rods and pipe	60	EA	78.00	4,680
East elevation brace and pipe	16	SET	2,200	35,200
West elevation brace and pipe	16	SET	2,200	35,200
Replace West elevation girts	7	EA	500	3,500
Penetrate (E) interior roof structure	16	LOC	75.00	1,200
Field welding, allow	1	LS	3,000	3,000
Strap suspended heater	2	EA	225	450
<b>TOTAL METALS</b>				<b>88,080</b>
<b>7.600 ARCHITECTURAL SHEETMETAL</b>				
Metal Panels (Demolition by Others)				
New siding	17,266	SF	9.00	155,394
New roof panels	5,760	SF	9.00	51,840
Add for ridge cap and rake edge	216	LF	15.00	3,240
<b>TOTAL ARCHITECTURAL SHEETMETAL</b>				<b>210,474</b>
<b>7.900 CAULKING &amp; SEALANTS</b>				
Caulk and seal building	9,240	SF	0.35	3,234
<b>TOTAL CAULKING &amp; SEALANTS</b>				<b>3,234</b>
<b>8.100 DOORS &amp; FRAMES</b>				
Exterior doors				
Hollow metal, 3070	2	EA	600	1,200
Hollow metal, 6070	1	PAIR	850	850
Roll-up door, 20 x 12	1	LS	6,000	6,000
<b>TOTAL DOORS &amp; FRAMES</b>				<b>8,050</b>
<b>8.700 FINISH HARDWARE</b>				
Door hardware (material only)				
Exterior doors	4	LEAF	250	1,000
<b>TOTAL FINISH HARDWARE</b>				<b>1,000</b>

**RUDY CARRASQUILLA**  
Construction Consultant  
June 29, 2004

**BALLOON HANGAR**  
Fort Barry, Marin Headlands  
Golden Gate National Recreation Area, CA

	<b>Quantity</b>	<b>Unit</b>	<b>Unit Price</b>	<b>Total \$</b>
<b>9.800 PAINTING</b>				
Building Exterior:				
Siding (Pre-finished panels)				
Add for doors	4	LEAF	140	560
Interior:				
No work anticipated				
<b>TOTAL PAINTING</b>				<b>560</b>
<b>16.000 ELECTRICAL</b>				
Miscellaneous				
Temp power and lighting	9,240	SF	0.35	3,234
Remove and relocate, allowance	9,240	SF	0.15	1,386
<b>TOTAL ELECTRICAL</b>				<b>4,620</b>

**National Park Service**  
**U.S. Department of the Interior**



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**Golden Gate National Recreation Area**  
Fort Mason, Building 201  
San Francisco, CA 94123