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Prepared in Conjunction with:

PANAMERICAN CONSULTANTS, INC.
Experts in Cultural Resource Management

TASK ONE:
**ECONOMIC ANALYSIS
OF HANGARS 113, 114, AND 115
NAVAL AIR STATION (NAS)
JACKSONVILLE, FL**

Contract #:
N69450-13-M-4082

SUB-TASK 4:

FINAL ECONOMIC ANALYSIS

Prepared for:
**NAVAL FACILITIES AND ENGINEERING COMMAND
SOUTHEAST
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA**

Prepared by:
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SEPTEMBER 2013

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EXECUTIVE SUMMARY

Crystal Clear Maintenance (CCM) was contracted to prepare an economic analysis (EA) of World War II-era Hangars 113, 114, and 115 located at the Naval Air Station Jacksonville, Florida (NAS JAX). The hangars are part of the Landplane Hangar Historic District, which has been determined eligible for the National Register of Historic Places under Criterion A for its association with World War II Naval aviation history and Criterion C for its architecture as designed by Albert Kahn, a nationally-significant industrial architect. Since the hangars are no longer able to support current air operations, the Navy is conducting an EA to determine the appropriate path forward in compliance with DoDI 4715.16. NAS JAX is also currently evaluating the potential for retaining Hangar 116, which is also a contributing element of the Landplane Hangar Historic District, for possible emergent future use and as a representative historical example of the landplane hangars independent of this analysis.

The costs and implications for seven alternative actions were investigated: No Action; Full Rehabilitation; Minimal Rehabilitation; Relocation; Reconstruction/Replacement; Demolition; and Mothballing. The hangars presently impose serious safety hazards by obstructing the line of vision from the airfield Control Tower to the southwest side of the airfield. Of the five options, only Demolition resolves the airfield safety issues. The Demolition option has the lowest 30-year cost.

Since the hangars are located on an active airfield, alternative uses are limited. The hangars are currently employed as swing space to accommodate miscellaneous temporary uses and this is the only use that the Navy can foresee for them. The No Action, Full Rehabilitation, and Minimal Rehabilitation alternatives are all based on this use. This report includes a building assessment that indicates the hangars appear to be in fair condition and are generally suited for use as swing space in their current state. The Full Rehabilitation and Minimal Rehabilitation options do not significantly improve the suitability of the hangars for this purpose. Mothballing prevents the hangars from being used as swing space and has higher first-year and 30-year costs than the No Action alternative. Mothballing is not a recommended option.

The year one costs summarized in Table I include sustainment costs for the No Action and Mothballing options. Utility and custodial costs are not included. The Full Rehabilitation and Minimal Rehabilitation alternatives are assumed to have a one-year construction period and do not include sustainment costs. Costs listed are for one hangar.

The Federal Energy Management Program requires that the value of the building's embodied energy be considered when accounting for demolition costs. Embodied energy is the sum of all the energy used to extract, manufacture, and transport the materials incorporated into a building as well as the energy used to construct the building. The $3,634,281.95 demolition cost summarized in Tables I and II includes the $1,583,313.00 value of the embodied energy for an existing hangar building. The demolition cost without embodied energy is estimated to be $2,050,968.95 (Table 5).

TABLE I. SUMMARY OF YEAR ONE COSTS FOR ALTERNATIVE ACTIONS	
No Action	$ 164,729.00
Full Rehabilitation	$ 21,117,032.90
Minimal Rehabilitation	$ 9,738,210.85
Demolition & Embodied Energy	$ 3,634,281.95
Mothballing	$ 2,473,418.39

The 30-year costs are summarized in Table II. The No Action and Mothballing alternatives include sustainment costs for years 1 through 30. The Full Rehabilitation and Minimal Rehabilitation alternatives include sustainment costs for years 2 through 30. Utility and custodial costs are not included. Note that all costs for the demolition alternative are incurred in the first year and that there are no additional costs in subsequent years. Costs listed are for one hangar.

TABLE II. SUMMARY OF 30-YEAR COSTS FOR ALTERNATIVE ACTIONS	
No Action	$ 7,837,050.00
Full Rehabilitation	$ 28,789,353.90
Minimal Rehabilitation	$ 17,410,531.85
Demolition	$ 3,634,281.95
Mothballing	$ 10,310,468.39

This report is part of Sub-Task 4, the creation of the EA. The EA contains the following components, including: standards and guidelines, a discussion of NAS JAX including its mission and future, current and potential space utilization and tenants, building condition assessments, definition of case alternatives, analysis of alternatives, cost estimates of alternatives, and summary of alternatives.

The CCM Team thanks Ms. Michelle Michael (Technical Point of Contact), Mr. Troy Thompson (Point of Contact), Ms. Miriam Gallet (Public Affairs Officer), and Ms. Christine Bauer (Cultural/Natural Resources) for their assistance. Mr. Mark Steinback, the CCM Team's Senior Historian, was the editor of this report.

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1.0 INTRODUCTION

Under contract N69450-M-4082, Crystal Clear Maintenance (CCM) teamed with Panamerican Consultants, Inc., to prepare an economic analysis (EA) of World War II-era Hangars 113, 114, and 115 located at the Naval Air Station Jacksonville, Florida (NAS JAX). The hangars are situated on the current operational flight line at NAS JAX and comprise three of four contributing elements to the Landplane Hangar Historic District, which is eligible for the National Register of Historic Places (NRHP) under Criterion A for its association with World War II Naval aviation history and Criterion C for its architecture as designed by Albert Kahn, a nationally-significant industrial architect (Figure 1). Since the hangars are no longer able to support current air operations, the Navy is conducting an EA to determine the appropriate path forward in compliance with Department of Defense Instruction (DoDI) 4715.16 “Cultural Resources Management.” In addition, NAS JAX is also currently evaluating the potential retention of Hangar 116, which is also one of the four contributing elements to the Landplane Hangar Historic District, for emergent future use and as a historical example of landplane hangars independent of this analysis.

The EA of these buildings will evaluate seven treatment alternatives for the hangars. These alternatives include: No Action; Full Rehabilitation; Minimal Rehabilitation; Relocation; Reconstruction/Replacement; Demolition; and Mothballing. Toward this end, the CCM Team has completed Sub-Task 1 as outlined in the Scope of Work (SOW), Phone Meeting and Plan of Action & Milestones (POAM) submittal, on March 5, 2013 (refer to minutes of March 7, 2013). Research was initiated, and the materials requested and received from NAS JAX was reviewed.

Sub-Task 2, Fieldwork, was conducted between March 25 and 29, 2013, at NAS JAX. Ms. Kelly Nolte, M.A., Architectural Historian and Team Leader, and Mr. Richard Simonton, AIA, Historic Architect, surveyed Hangars 113, 114, and 115 and reviewed materials provided by Public Works and Naval Facilities Engineering Command Southeast (NAVFAC SE) staff. In addition, Ms. Nolte visited the Museum of Science and History (MOSH), Jacksonville, and viewed exhibits, "Jacksonville by Design: AIA Celebrates 100 Years of Architecture" and "Currents of Time," related to NAS JAX and Naval aviation. Prior to the site visit, research was completed at the Florida State Historic Preservation Office (SHPO). Internet research was conducted both before and after the fieldwork.

Sub-Task 3, the development of a Work Plan, was completed in May 2013. The Work Plan provided an overview of previous investigations, a description of the proposed methods for conducting documentary research and fieldwork, a description of each of the EA alternatives, key personnel resumes, and project schedule with milestones, durations, and dates of completion.

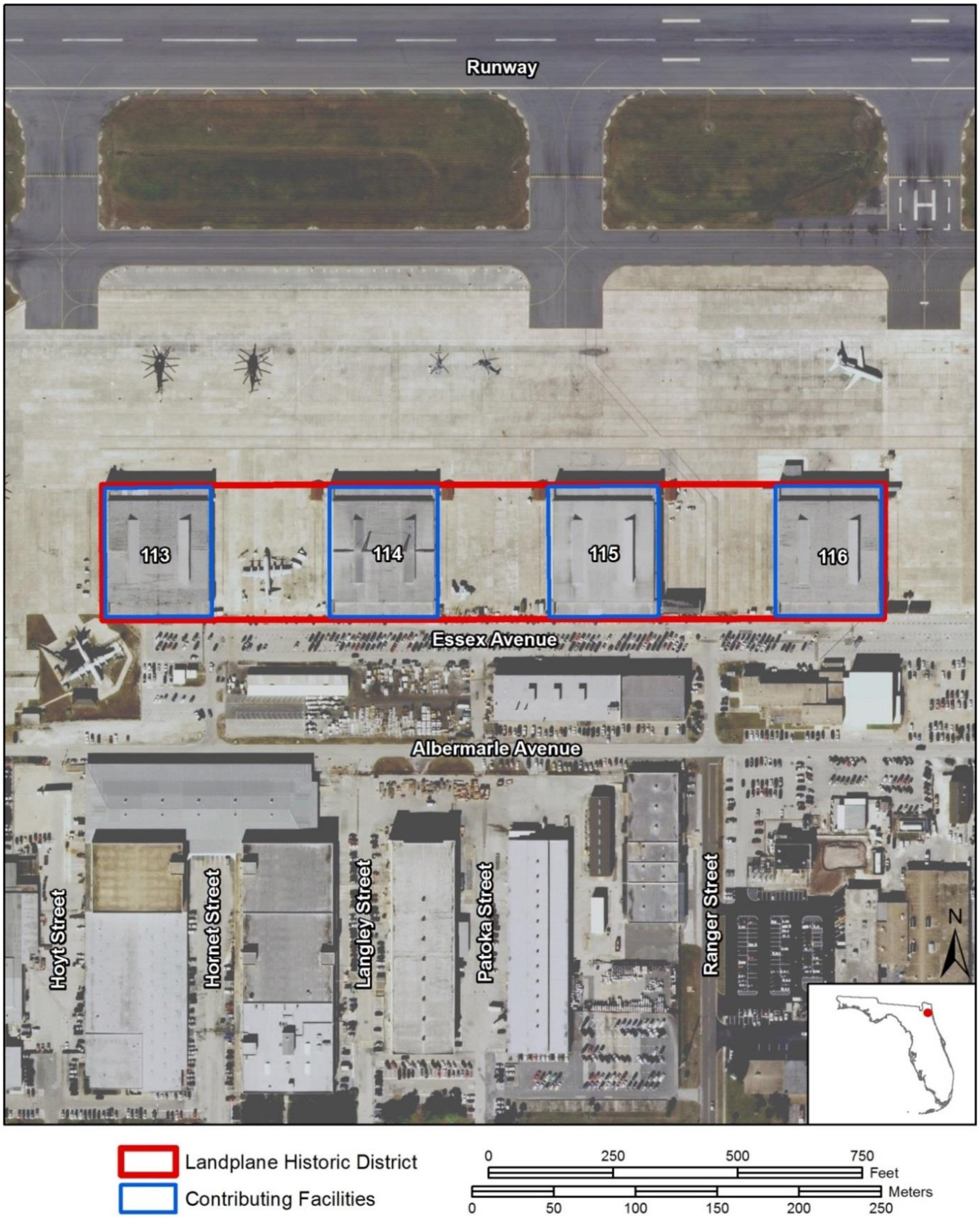

Figure 1. Landplane Hangar Historic District at NAS JAX, Florida, showing locations of Hangars 113, 114, 115, and 116 *(Aerial: Labins.org 2011).*

This report is part of Sub-Task 4, the creation of the Economic Analysis. The EA contains all the following components: standards and guidelines, a discussion of NAS JAX including its mission and future, current and potential space utilization and tenants, building condition assessments, definition of case alternatives, analysis of alternatives, cost estimates of alternatives, and summary of alternatives.

2.0 STANDARDS AND GUIDELINES

The standards and guidelines listed below were used in the preparation of this report.

- *2010 ADA Standards for Accessible Design*

- *2010 Florida Building Code:*
  - *Building*
  - *Existing Building*
  - *Plumbing*
  - *Mechanical*
  - *Accessibility*
  - *Energy Conservation*

- 1995 *The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring & Reconstructing Historic Buildings*

- *1991 Historic Structures Preservation Manual*, NAVFAC-MO 913

- *1993 Economic Analysis Handbook.* NAVFAC-P442

- *2003 United Facilities Criteria (UFC), DoD Minimum Antiterrorism Standards for Buildings,* UFC 4-010-0, including Change 1, 22 January 2007

- *UFC, Programming Cost Estimates for Military Construction,* UFC 3-730-01

- *UFC, Airfield and Heliport Planning and Design,* UFC 3-260-01; 17 November 2008

- *UFC, DoD Facilities Pricing Guide,* UFC 3-701-01

- *United States Navy Layaway Procedures for Historic Properties*

- *RSMeans Building Construction Cost Data, 71st Annual Edition*

3.0 NAS JAX MISSION AND FUTURE

NAS JAX, one of the largest Navy bases in the Southeast region, is one of the Navy's fastest growing installations. It is a master air and industrial base supporting American and allied forces, specializing in anti-submarine warfare (ASW), anti-surface warfare (ASuW), and the training of aviators. Its mission is to enable Naval aviation war-fighting readiness by supporting the fleet, fighter, and family and supports this mission through innovation, teamwork, process improvements, and transparency (NAS JAX 2013).

Located on 3,896 acres of land lying along the St. Johns River within the City of Jacksonville in southern Duval County, Florida, NAS JAX is a multi-mission installation hosting more than 100 tenant commands. The installation serves as the host for Commander, Patrol and Reconnaissance Wing (CPRW) 11 and the entire Atlantic Fleet complement of maritime patrol aircraft (MPA), including Patrol Squadron 30 (VP-30), the Navy's single-site Maritime Patrol Fleet Replacement Squadron (FRS). In addition, NAS JAX is required to support five helicopter squadrons assigned to Commander, Helicopter Maritime Strike Wing, U.S. Atlantic Fleet (CHSMWL). The base hosts MH-60Rs, SH-60Fs, SH-60Bs, and SH-60Hs. Over time all the SH-60Bs will be replaced with MH-60Rs within CHSMWL and the one HS squadron currently flying SH-60F/Hs will be reassigned to NAS Norfolk (~ 2015).

Most of the developed land on NAS JAX is organized by the functions and activities needed to support the U.S. Navy. Within NAS JAX, the functional land uses can be broadly separated into 12 categories: Airfield Operations; Training; Fuels; Public Works and Utilities; Maintenance; Supply and Warehousing; Ordnance and Ammunition; Hospital and Health Services; Administration/Command and Control; Public Safety; Housing; and Personnel/Community Support (Mohlman et al. 2010:18). Hangars 113, 114, and 115 are located in the Airfield Operations functional land use area in the Landplane Hangar Historic District (see Figure 1).

Landplane Hangar Historic District. Although the Landplane Hangar Historic District is segregated as an isolated historic district, it is actually a part of a larger airfield area that includes the Seaplane Historic District to the northeast; the airfield Control Tower, associated administrative buildings, and the individually eligible Hangar 117 to the east; and a complex of Cold War-era (1949-1989) hangars and buildings to the west. This entire airfield complex runs along the south bank of the St. Johns River.

The Landplane Hangar Historic District was first delineated in 1997 (Adams 1997) and the Florida SHPO concurred with the finding of a historic district in 1998 (Percy 1998). The Landplane Hangar Historic District comprises four contributing elements: Hangars 113, 114, 115, and 116 (Figures 2, 3, and 4). There are multiple, small, ancillary non-contributing buildings, primarily storage sheds, associated with each hangar in the Landplane Hangar Historic District, the primary one being Building 115A, associated with

Figure 2. Landplane Hangar (1940), 113, 8DU11723, designed by Albert Kahn, is a contributing element to the Landplane Hangar Historic District, NAS JAX *(Ms. Kelly Nolte, 2013).*

Figure 3. Landplane Hangar (1940), 114, 8DU11724, designed by Albert Kahn with modifications made at a later date, is a contributing element to the Landplane Hangar Historic District at NAS JAX. It is designated a Maintenance Hangar in the Florida Master Site Files. Note, a 300-foot apron lies between Hangars 114 and 115 *(Ms. Kelly Nolte, 2013).*

Figure 4. Landplane Hangar (1940), 115, 8DU11725, designed by Albert Kahn, is a contributing element to the Landplane Hangar Historic District. The adjacent storage building, 115A, is a non-contributing building. *(Ms. Kelly Nolte, 2013).*

Hangar 115. The runway aprons and any remaining original air strip historically associated with the hangars are not included in the district.

The Landplane Hangar Historic District measures approximately 12 acres running east-west in a line along the southern edge of the current airfield runway. As noted, the district has been determined eligible for the NRHP under Criterion A for its association with World War II Naval aviation history and Criterion C for its architecture as designed by Albert Kahn, a nationally-significant industrial architect. Each hangar is separated by approximately 300 feet of apron which is included in the district.

The NAS JAX airfield has grown significantly since its original establishment during World War II as have the numbers and sizes of planes that use it. In particular, the runways have been reconfigured to accommodate larger, heavier, more powerful planes and to adapt to new safety restrictions. In the process of making the various changes, Hangars 113, 114, 115, and 116 became a line of sight obstacle for the Control Tower and have helped create a glide safety obstacle. NAVFAC Air Safety Clearance Requirements as well as Unified Facility Criteria require an airfield to have a complete line of sight for all air traffic operating at that field as well as specific glide clearances. The airfield is currently operating on a waiver that allows it control of air traffic for which it does not have full visual access and for a field that does not have the proper glide slope clearance. The hangars are also in violation of more stringent airfield safety clearance requirements implemented regarding vertical height proximate to runways.

UFC 3-260-01, Airfield and Heliport Planning and Design, requires a 7:1 glide slope (flight path) clearance[1] from the primary runway centerline to avoid potential collision risk above-ground structures; Hangars 113, 114, and 115 by the their location violate this vertical clearance requirement. These obstacles present a significant safety concern for NAS JAX since they can potentially contribute to aircraft collisions.

Although Hangars 113, 114, and 115 are used for various activities related to the airfield and can accommodate small planes, these World War II hangars cannot hold the larger, heavier, taller planes the Navy uses today. In fact, on the day of the project team's visit, Hangar 113 was only partially in use and Hangar 115 was completely empty. A small plane was in Hangar 114, but in order to bring it in, its tail had to be altered so that it would not catch on the exposed superstructure of the building.

The overall flying mission at NAS Jacksonville has significantly changed over the past 70 years with increased P-3 squadrons, use of C-130 aircraft, and the introduction and transition to the P-8A airframe. The P-8A Poseidon aircraft serves as the Navy's long-range ASW, ASuW, intelligence, surveillance, and reconnaissance (ISR) aircraft. The P-8A is an integral part of both CPRW-11 and VP-30, and is now the controlling[2] aircraft at NAS JAX replacing the P-3 aircraft. The size of the P-8A airframe exceeds the roof height and width of Hangars 113, 114, and 115, making the hangars unsafe operationally in support of the current mission. Further, the P-8A airframe is approximately 130 feet, nose to tail; 124 feet, wing to wing; and 43 feet high while Hangars 113, 114, and 115 only have 28 feet of vertical clearance below the roof trusses and 95 feet of clear width between the side walls and the central support columns for the roof trusses, rendering them impossible to use with these aircraft. If they cannot be used with the P-8A aircraft, then they are not supporting the NAS JAX primary airfield mission. Further, the taxi weight of the P-8A is approximately 189,000 pounds; a weight that cannot be supported by the hangar's concrete slab floor (Mr. Troy Thompson, personal communication 2013).

[1] Ratio reflects distance from runway divided by height of obstruction; a 75-foot building would have to be at least 525 feet from the runway to achieve a 7:1 glide slope clearance.
[2] The aircraft that the installation's air facilities must be able to support in order to satisfy its mission.

4.0 CURRENT AND POTENTIAL SPACE UTILIZATION

Currently, Hangars 113, 114, and 115 are serving a variety of functions. In some cases portions of the hangar space are leased or loaned to a number of agencies which utilize that space for storage, workshops, and offices (Figure 5). In some cases the hangars are used to service small planes associated with the overall flying mission of NAS JAX, but the small size of the space precludes any large-scale operations (Figure 6). These hangars are also used by NAS JAX as "swing space,"[3] primarily for the housing of temporary operations of squadrons assigned to the base for brief periods of time (Figure 7). Additionally, the hangars are used by the airfield for storage, conducting ceremonies, and some aircraft repair work. Hangars 113, 114, and 115 are not used as they were intended because they are too small and their various utility systems are out of date.

The reuse of the hangars by other agencies and departments within NAS JAX is problematic because they are located immediately on an active airfield. Access to the buildings is strictly controlled because of their proximity to active aircraft. Fully or partially rehabilitating them would not make them any more accessible. In addition, the hangars were originally constructed without heating and air conditioning and were later retrofitted for both. While these "luxuries" could be done without during World War II, modern computer equipment presently used to service aircraft and run the Navy requires heating, ventilation, and air-conditioning (HVAC) systems. The retrofitting of HVAC in these hangars has not been completely successful, and it is doubtful that the process would ever be truly successful given the size and construction materials of the buildings.

If Hangars 113, 114, and 115 are left as they are, and fully rehabilitated or minimally rehabilitated (see Section 6.0 for a discussion of Case Alternatives), they would operate as swing space, a use determined by NAS JAX staff, much as they are used at present. Nevertheless, as noted previously, the actual number of people and organizations that could use of the space is limited as a result of their restricted location.

[3] As defined by the Navy, "swing space" is a temporarily occupied space, facility, or area (not directly suitable for full long-term occupancy) away from areas that are undergoing full renovation, repairs, restoration or new construction as to establish and provide for the full complete and usable requirements (facilities, systems, equipment) as to accommodate the required function. Swing Space can be newly constructed space built before modifications of existing space to accommodate a long-term requirement. Without specific waivers from the governing agency, at minimum, swing space must meet all criteria for life safety prior to occupancy on a temporary nature.

Figure 5. Navy hangars have a long tradition of personalization by the groups that utilize the space. These groups paint insignias, mottos, and other identifying information on doors, hallways, floors, and walls, much like some World War II planes that sported nose art. It is a tradition that continues to this day as seen here in the elaborate art work on a door in Hangar 114 showing the "Vikings," Sea Control Wing of the Atlantic Fleet *(Ms. Kelly Nolte, 2013)*

Figure 6. As shown on the wall in Hangar 114, a now decommissioned squadron brags about their Navy-wide achievement, winning the "Golden Wrench" six times between 1997 and 2006 *(Ms. Kelly Nolte, 2013).*

Figure 7. Swing space created for the VS-32 World Famous Maulers Squadron is still in place in Hangar 113 until another group needs the space *(Ms. Kelly Nolte, 2013).*

5.0 BUILDING CONDITION ASSESSMENT

The following observations are categorized to correspond with the Unified Facilities Criteria (UFC) estimating method used in the Cost Estimates section (see Section 8.0) of this report.

Summary of Building Assessment. The substructure and superstructure of the hangars appeared to be in good condition at the time of the inspection. Roofing is at the end of its service life and should be replaced during any rehabilitation project. The exterior closure system needs considerable work to resolve moisture problems and reduce maintenance. The interior construction and interior finishes are marginally acceptable for the present use, but there is little worth retaining outside of the hangar bays if the current configuration does not work for future use. The HVAC, electrical, and plumbing systems do not meet current codes and are limiting factors for the use of the space.

The condition of the buildings varies, with Hangar 113 being in the worst condition and Hangar 114 being in the best condition. The difference in the condition of the buildings, however, should not significantly impact pricing for each of the alternates.

Substructure. The substructure includes the building foundation and concrete floor slabs. The project team's historic architect did not observe any areas with foundation settlement problems and NAS JAX staff did not indicate any foundation issues. Intermittent cracking and spalling was observed in the floor slab (Figures 8 and 9), but those conditions do not significantly impact use of the facility. Floor areas that are in need of repair appear to constitute less than five percent of the floor area.

As previously indicated, the existing slabs will not support the weight of the P-8A aircraft (which also do not fit in the hangars). If the hangars continue to be used as swing space, it is difficult to justify replacement of the floor slab. Continued use for aircraft maintenance may result in additional cracks in the floor slab, but it will be more economical to repair small areas as needed than to replace the entire concrete slab. Upgrades to the superstructure (discussed in next section) could require selective demolition of the floor slab in order to install additional lateral bracing.

Figure 8. Typical example of minor cracking in concrete floor slab *(Mr. Richard Simonton, 2013).*

Figure 9. Typical example of minor spalling in concrete floor slab *(Mr. Richard Simonton, 2013).*

Superstructure. The superstructure includes the structural steel building frame, second level concrete floor slabs, wood tongue-and-groove roof deck, exterior stairs, and catwalks. No problems were observed with the elevated second-story concrete floor slabs. Building elements in the structural steel frame include, columns, floor beams, roof trusses, purlins, and lateral bracing.

The project team's historic architect made general observations of the buildings' structural steel frames from the ground and no attempt was made to conduct a comprehensive visual inspection. No obvious failings or badly corroded steel members were observed. Staff from NAS JAX did not report any problems with the structural frame. Spotted corrosion was widespread on the steel frame in Hangar 113 and to a lesser extent in Hangar 115 (Figure 10). This corrosion is unlikely to indicate structural problems. The steel coatings in Hangar 114 are intact and appear to be well maintained.

Figure 10. Typical example of spotted corrosion and wood roof deck replacement on Hangar 113 *(Mr. Richard Simonton, 2013).*

The area of greatest concern in these hangars is the buildings' lateral load-resisting system. The 2010 edition of the Florida Building Code places the hangars in Risk Category II with a 120-mile-per-hour wind-speed zone. The hangars are not designed to meet this structural requirement. In addition, corrosion in riveted connections or unknown modifications to the structure could be compromising the design. Nearly identical facilities in Corpus Christi, Texas, and Pearl Harbor, Hawaii, have required upgrades to the lateral structural system. We recommend that NAS JAX engage a structural engineer licensed in the State of Florida to evaluate the hangars' structure. This step would need to be taken with the No Action, Full Rehabilitation, Minimal Rehabilitation, and Mothballing alternatives.

The roof structure of Hangar 114 has been modified to provide additional clearance for aircraft below the roof structure. Two steel masts that are used to support the cable suspension system protrude above the original roof and are a prominent visual feature of that hangar (see Figure 3).

These hangars have a history of roof leaks that have resulted in rotting of the wood roof deck. In particular, NAS JAX maintenance personnel have cited problems with leaks at clerestories (Mr. Troy Thompson, personal communication 2013; Figure 11). There are numerous locations where rotten wood is visible from below, but these areas

Figure 11. Peeling paint indicating possible moisture damage at wood deck above sawtooth clerestory *(Mr. Richard Simonton, 2013).*

do not appear to be extensive. From observation of the underside of the deck it appears that the majority of rotted wood has been replaced, however that could be deceptive. Without removing the existing roofing, the top side of the wood decking cannot be visually evaluated. For estimating purposes is prudent to include some wood deck replacement in the Full Rehabilitation and Partial Rehabilitation scopes.

Roofing. Roofing includes roofing membranes, roof insulation, flashing and trim gutters and downspouts, sawtooth clerestory glazing, and soffits. Nearly all of these roofing components are at the end of their useful service life (Figure 12). The roofs do not currently leak, but there are frequent service calls to repair them (Mr. Troy Thompson, personal communication 2013). Uncertainty with the structural integrity of the roof deck and the lack of safety tie-offs creates a safety problem for roof maintenance.

The existing hangars do not have any roof insulation which is in violation of the current Florida Energy Code. The tongue-and-groove wood soffits and fascia boards need repainting (Figure 13). The existing paint in these areas should be tested for lead content.

Figure 12. Existing modified bitumen roof near end of service life on Hangar 113 *(Mr. Richard Simonton, 2013).*

Figure 13. Severe paint peeling at wood tongue-and-groove soffit on north side of Hangar 113 *(Mr. Richard Simonton, 2013).*

The original louvers and glazing are still intact at the large sawtooth clerestories on the roof at each end of the hangars (Figure 14). The project team’s historic architect was not able to get close enough to fully evaluate the condition of the assemblies, but it appears that repainting and re-glazing the assemblies are feasible.

Figure 14. Typical rooftop sawtooth clerestory *(Mr. Richard Simonton, 2013).*

Exterior Closure. The exterior enclosure includes exterior concrete/concrete masonry walls, exterior wall finishes, tongue-and-groove sheathing, steel girt supports for tongue-and-groove sheathing, windows, louvers, exterior man doors, hangar doors, corrugated siding, and exterior painting.

Approximately 80 percent of the wall finish on the north and south walls of the hangar is painted stucco. The stucco is applied over both the concrete masonry units (CMU) and the cast-in-place concrete knee walls. The auxiliary maintenance and administrative spaces flanking the high-bay hangar space were not originally air conditioned, and the hangars' building envelope was not designed to account for the temperature differential and vapor drive created by the subsequent addition of HVAC systems. The HVAC retrofits have caused moisture problems: peeling paint and some mold growth on the interior face of these exterior walls are apparent throughout each hangar (Figure 15). At least four possible contributing factors to the moisture problem are described below.

In several locations stair-step cracks are visible in the stucco (Figure 16). The most likely source of this cracking is differential movement between the structural steel building frame and the CMU wall construction. These cracks can transmit liquid water through capillary action and can also be a conduit for vapor diffusion. The porosity of the CMU and stucco wall system is likely contributing to the problem. Both materials absorb water

Figure 15. Example of moisture problems on interior face of exterior wall *(Mr. Richard Simonton, 2013).*

Figure 16. Example of exterior cracks in stucco and concrete masonry units at south elevation of Hangar 113 *(Mr. Richard Simonton, 2013).*

and will transmit water vapor to the interior of the building. The problem will be exacerbated if no moisture barrier was installed between the stucco and CMU (or if the barrier has deteriorated). Another factor is that the walls are not insulated. This contributes to the problem of water vapor condensing in unpredictable locations in a compromised wall system. The un-insulated walls also do not comply with the Florida Building Code. The last factor could be that windows and doors have been installed without sufficient flashing and are providing pathways for water-vapor entry into the wall system at these openings.

The original clerestory windows for the high-bay hangars on the north and south sides of the building remain and are in fair condition (Figure 17). Since the hangars are not air conditioned, the low performance of the single-glazed windows is not a significant issue. If the hangars are to remain, these windows should be retained as a historic feature.

The original Albert Kahn drawings depict strip industrial windows on the north and south building elevations rather than the existing punched openings in concrete masonry. It is not clear if this deviation is the result of changes in the original construction or the result of subsequent renovation. Additional research could be undertaken to determine the original window configuration if the SHPO determines that documentation is needed for one of the alternative actions. The punched windows into the air-conditioned service and administrative spaces have been replaced with insulated double-glazed windows (Figure 18). These windows are in good condition, but they do not conform to the design of the six-over-six pane windows shown on some record drawings.

Figure 17. Typical example of original clerestory windows remaining north and south sides of hangar *(Mr. Richard Simonton, 2013).*

Figure 18. Typical replacement windows on north and south elevations *(Mr. Richard Simonton, 2013).*

None of the windows appear to be of blast-resistant construction to comply with minimum DoD antiterrorism standards. The windows would require upgrades to comply with current energy efficiency and antiterrorism standards if the hangar's use is changed or if the rehabilitation cost exceeds 50 percent of the Plant Replacement Value (PRV). The DoD defines PRV as the cost to replace facilities at current standards.

The east and west ends of the hangar bays are enclosed by the hangar bay doors and door pockets (Figure 19). The construction of the hangar door pockets on the east and west ends of the hangars consists of steel girts supporting tongue-and-groove wood planks that are covered on the exterior with corrugated wall panels. Spotted corrosion is visible of the steel framing members (Figure 20). Note that on other hangars of this design, the steel framing in the hangar pockets has been subject to severe corrosion—particularly at the top of the door pockets. These areas should be carefully inspected by a structural engineer to evaluate their condition. The wood plank substrate appears to be in generally good condition, but there are isolated areas with damaged or rotted wood (see Figure 20).

The exterior corrugated panels are still functional, but show signs that they are at the end of their service life. The panels have several coats of paint that are beginning to peel at the edges of the panels. The paint would need to be stripped before the panels were repainted, but it is questionable if paint could be removed without damaging the panels. The panels are starting to rust along the bottom and panel edges (Figure 21).

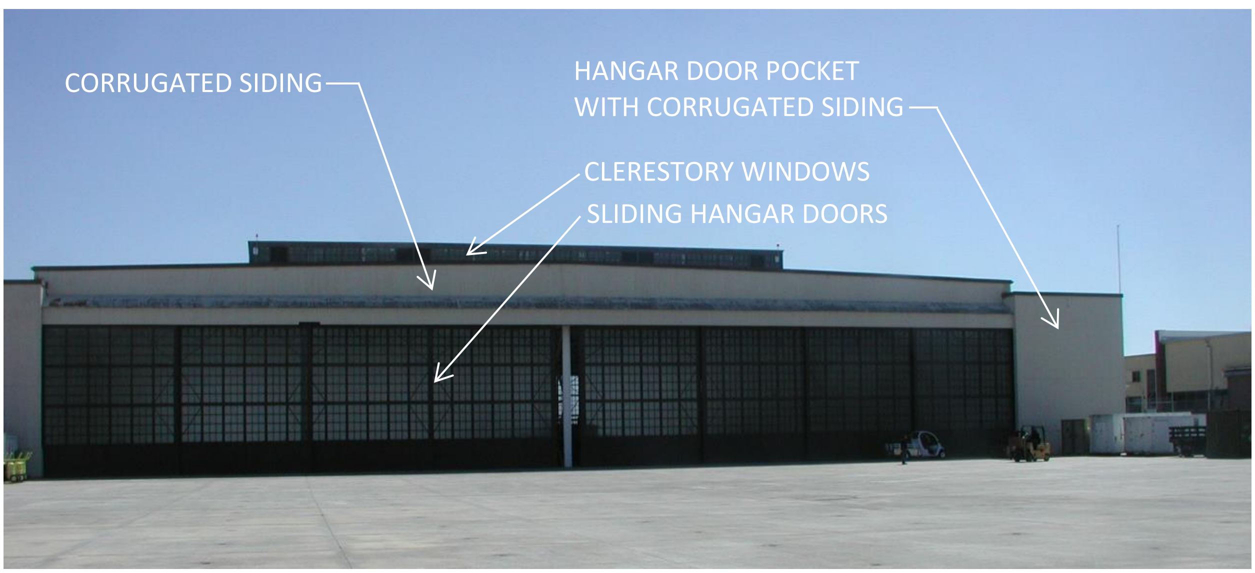

Figure 19. Typical building elements at east and west ends of aircraft bays *(Mr. Richard Simonton, 2013).*

Figure 20. Example of damage to tongue-and-groove wood plank substrate in hangar door pockets and spotted corrosion on steel framing (at upper right) *(Mr. Richard Simonton, 2013).*

Figure 21. Typical deterioration of corrugated wall panels where bottom of panels abut concrete knee walls *(Mr. Richard Simonton, 2013).*

The majority of the exterior man doors are in very poor condition. Rust, holes, dents, and poorly functioning hardware are all problems (Figure 22).

Figure 22. Typical exterior man door that needs replacement *(Mr. Richard Simonton, 2013).*

The large glazed hangar doors are a key historic element in these hangars (Figures 23 and 24). The weight of these hangar doors is supported by steel rollers that move along a steel track that is recessed in the concrete floor slab (Figure 25). The doors appear to be in good condition, but there are issues with the steel rails. All of the steel rails exhibit pitting or some degree of section loss as a result of rusting (Figure 26). Section loss is a severe problem inside the hangar door storage pockets where rails are submerged in standing water for long periods (Figure 27). Deterioration of these rails prevents the hangar doors from fully recessing in the storage pockets.

Because of the deteriorated bottom tracks and uncertain condition of the upper track supports, these hangar doors pose potential safety issues. If the hangars continue to be used, a structural engineer should be engaged to evaluate the structural integrity of the entire hangar door support system including the rails, upper tracks, track supports and rollers.

All painted exterior surfaces and building components need to be repainted. As stated previously, paint needs to be stripped from the corrugated wall prior to repainting. Replacement of the panels with another product that matches the profile of historic panels is likely to be a better solution. The painted concrete and concrete masonry is not preventing moisture problems in the exterior walls. Prior to painting the masonry, insulation, and moisture/vapor barrier issues should be resolved. Wood surfaces need to be prepped and repainted.

Figure 23. Typical hangar door configuration at east and west ends of hangar buildings *(Mr. Richard Simonton, 2013).*

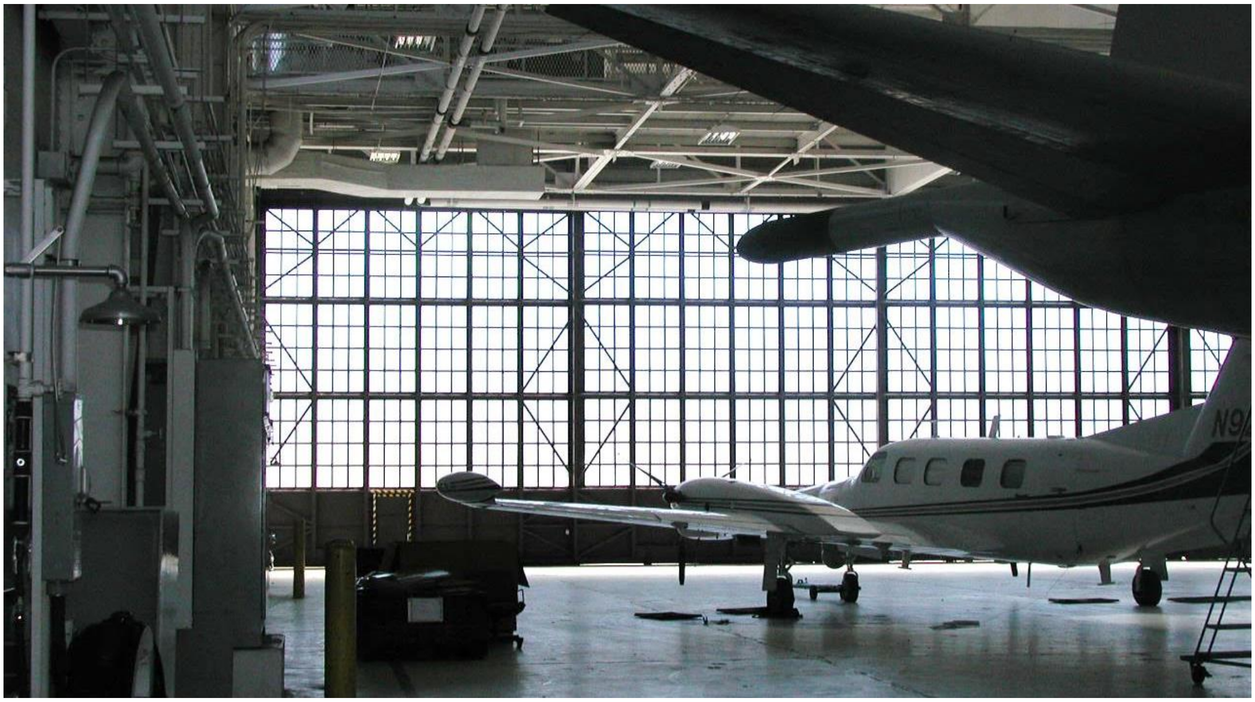

Figure 24. Interior view of hangar looking toward glazed hangar doors *(Mr. Richard Simonton, 2013).*

Figure 25. Typical hangar door roller *(Mr. Richard Simonton, 2013).*

Figure 26. View of hangar door rail with reduced steel section *(Mr. Richard Simonton, 2013).*

Figure 27. Interior view of hangar door pocket showing steel rails with severe section loss and standing water in concrete recess *(Mr. Richard Simonton, 2013).*

Interior Construction. Interior construction includes fixed partitions, demountable partitions, interior windows, doors, chalk/tack boards, signs, lockers, shelving, handrails, and toilet partitions. The interior spaces on each side of the aircraft hangar bays have been configured as shop, office, and meeting space as needed to accommodate varying swing-space requirements (Figure 28 and 29). This interior fit-out construction is generally of moderate quality and in fair to poor condition. Interior doors are in better condition than exterior doors, but could still use replacement.

In the hangar bays there is little interior construction besides railings and man doors opening to the hangar. The asbestos survey did cite transite wall panels that were installed on the roof trusses and sawtooth clerestories (Caviness 1996).

Figure 28. Typical first floor interior fit-out *(Mr. Richard Simonton, 2013).*

Figure 29. Typical second floor interior fit-out *(Mr. Richard Simonton, 2013).*

Interior Finishes. Interior finishes include wall plastering, floor coverings including epoxy paint, suspended ceilings, and painting. Suspended ceilings exhibit sagging panels and water damage in many areas (Figure 30). The majority of spaces outside the hangar bays in Hangar 114 need all surfaces painted (Figure 31). Unless the existing space configuration works well for future needs the vast majority of interior finishes should be replaced.

Figure 30. Suspended ceiling with water damage *(Mr. Richard Simonton, 2013).*

Figure 31. Typical concrete wall in need of repainting *(Mr. Richard Simonton, 2013).*

Plumbing. Plumbing includes plumbing fixtures, domestic water piping, water heaters, floor drains, roof drains, and waste piping. Most of the plumbing fixtures were in fair to poor condition and did not incorporate the water-saving valves required by current building codes. Toilet room fixtures, toilet room layouts, and water fountains were not ADA compliant. The water heaters appear to be beyond their useful service life. Even if the heaters are operational, they are far less efficient than modern alternatives. Portions of the primary domestic water-supply piping and waste piping may be salvable but NAS JAX personnel have reported supply piping leaks from behind walls (Mr. Troy Thompson, personal communication 2013). Replacing the majority of the plumbing systems should be considered part of any rehabilitation project.

HVAC. HVAC includes chillers, boilers, condensing units, exhaust fans, ductwork, mechanical piping, diffusers, window air-conditioning units, and control systems. The buildings employ a patchwork of systems for heating, cooling, and ventilation. Many of the spaces are simply air conditioned with window air conditioners that are in poor condition (Figure 32). Property Records indicate that the latest upgrade was to Hangar 114 in 1990. Given the age and apparent condition of the HVAC systems the majority of these systems should be replaced in any rehabilitation project.

Figure 32. Example of window air-conditioning unit for offices *(Mr. Richard Simonton, 2013).*

Electrical. Electrical includes electrical service and distribution, transformers, wiring, lighting, electrical devices, fire-alarm systems, telephone systems, local area networks, emergency lighting, and generators. The existing electrical systems are marginally serviceable for the current use, but they will not support additional expansion. The existing primary service for the buildings will not support additional electrical loads (Mr. Troy Thompson, personal communication 2013). The fiber data network is not sufficient for full use of available technology throughout the facilities. Most of the light fixtures and lighting controls, with the exception of new high-bay lighting in the hangar spaces, need to be replaced to meet current Florida Energy Code requirements.

Asbestos. An asbestos survey of Hangars 113, 114, and 115 was conducted in April of 1996. The survey documents indicate that asbestos was found in 9”x9” floor tiles, 12”x12” floor tiles, floor mastic, and transite wall panels installed in upper areas of the high-bay hangar spaces (Caviness 1996). No other surveys of hazardous materials were available.

Antiterrorism Force Protection. The ATFP standards that apply to the full rehabilitation options are standoff distance, glazing, controlled HVAC ventilation intake, and mass notification. Standoff distance and glazing are mandatory while ventilation and mass notification are recommended. The structures are less than three stories so the progressive collapse criteria do not apply.

For existing buildings, implementing ATFP standards is triggered when monetary investments are made into the facility that exceed 50 percent of the replacement cost of the facility. If the investment is less than 50 percent of replacement cost implementing the standards is recommended.

The minimum standoff distance required in locations without a controlled perimeter or parking is 82 feet (Figure 33). Keeping this clear distance would displace the Albermarle Avenue parking lot on the south side of the hangars. If the parking lot was changed to controlled access then the standoff distance could be reduced to 33 feet.

The glazing provisions of the ATFP standards must be followed whenever doors or windows are replaced (DoD, UFC 4-010-1). All glazing, including the historic glass in the hangar doors and clerestory windows, would have to be replaced with laminated glazing with a PVB interlayer.

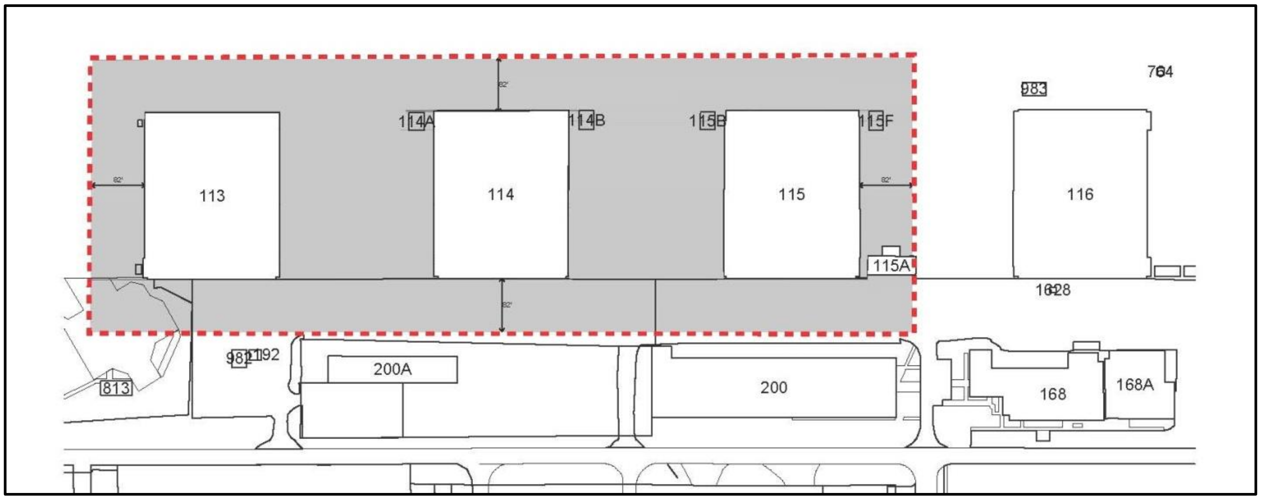

Figure 33. Shaded area depicting required 82-foot standoff distance *(Simonton Swaika Black 2013)***.**

6.0 CASE ALTERNATIVES

The historical or architectural significance of a historic property requires a careful decision-making process in the choice of an appropriate treatment. A number of considerations must be taken into account including: the property's relative importance in history, its physical condition, its proposed use, and any mandated code requirements (National Park Service [NPS] 1995). NAS JAX is considering seven alternatives for the treatment of Hangars 113, 114, and 115. These are:

1. **No Action.** The National Environmental Policy Act (NEPA) and its implementing regulations require the development and environmental analysis of alternatives including a "No Action alternative." This No Action alternative is required to serve as the benchmark against which change or effect associated with each of the project alternatives can be assessed. Under the No Action alternative, Hangars 113, 114, and 115 will remain as they are, thereby maintaining their current condition at the airfield. NAS JAX has essentially been implementing this alternative for a number of years, and current uses would continue under this alternative.

2. **Full Rehabilitation.** Rehabilitation is defined as the act or process of making possible a compatible use for a property through repair, alterations, and additions while preserving those portions or features which convey its historical, cultural, or architectural values (NPS 1995). Hangars 113, 114, and 115 will fully operate as swing space, a use determined by NAS JAX staff, and will meet the specifications for rehabilitation as determined by the Secretary of the Interior's Standards of Rehabilitation.

3. **Minimal Rehabilitation.** Hangars 113, 114, and 115 will be returned to a state of utility in accordance with the Secretary of the Interior's Standards of Rehabilitation. Only the minimum rehabilitation will be completed in order to make the hangars safe and serviceable.

4. **Relocation.** Hangars 113, 114, and 115 will be moved to another, more accessible but equally evocative site on NAS JAX. While this is a legitimate alternative for the treatment of a historic property, it is unlikely that it will be used in this instance as a result of the size of the buildings and the lack of usable vacant space on the installation for their relocation. Hangar 116 is currently being evaluated for retention at the airfield, its original site and the current locations of Hangars 113, 114, and 115. As a result, Hangar 116 would serve as a representative of the other three hangars, and it would not be necessary to use Hangars 113, 114, or 115 to evoke the site in another place.

5. **Reconstruction/Replacement.** Reconstruction is defined as the act or process of depicting, by means of new construction, the form, features, and

detailing of a non-surviving site, landscape, building, structure, or object for the purpose of replicating its appearance at a specific period of time and in its historic location (NPS 1995). While this is a legitimate alternative for the treatment of a historic property, it is doubtful that it will be used in this particular instance for Hangars 113, 114, and 115. The size of the hangars and the lack of usable vacant space on the installation render reconstruction unlikely as a feasible alternative. Hangar 116 is being considered for retention at the airfield and the reconstruction of a hangar of this type will, therefore, not be necessary.

6. **Demolition.** The demolition of a historic property in many cases cannot be avoided and is considered a treatment alternative. Nevertheless, this is not done lightly and never without consultation with the SHPO and the Advisory Council on Historic Preservation (ACHP) (NAVFAC 1991).

7. **Mothballing.** Mothballing is the securing of a building and placing it in a temporary layaway status according to the National Park Service standards as delineated in Preservation Brief 31, *Mothballing Historic Buildings* (Park 1993) and the Department of Navy procedures (John Cullinane Associates 1996). Mothballing is a temporary status that involves three steps: documentation of the building; stabilization of the building; and securing the building to reduce vandalism, to provide adequate ventilation to the interior, to modify utilities and mechanical systems, and to develop and implement a monitoring maintenance program (Park 1993).

Since the Case Alternatives of Relocation and Reconstruction are not being considered at this time, a detailed Analysis of Case Alternatives (Section 7.0) will include only: No Action, Full Rehabilitation, Partial Rehabilitation, Mothballing, and Demolition.

7.0 DETAILED ANALYSIS OF CASE ALTERNATIVES

No Action (Continued Operation as Swing Space)

- The hangars appear to be in stable condition. If maintenance is continued and the integrity of the roof is maintained, then there is no imminent threat to the properties.
- The hangars will continue to interrupt the continuous line of site required by air traffic control and the safety concerns with the obstructions will not be diminished.
- There are numerous items that do not meet current code requirements; however, without a change of use or significant capital outlays code upgrades are unlikely to be triggered. Potentially, ***the most significant life safety issue is ensuring that the lateral bracing system is structurally sound.***
- Without a change of use or significant capital outlays ATFP requirements are not triggered.
- The Navy will continue to incur significant annual costs for maintenance outlined in the Cost Estimate section (Section 8.0) of this document.
- In their present condition the hangars are serviceable for their current use as swing space.

Full Rehabilitation

- The hangars would be fully renovated according to the Secretary of the Interior's Standards of Rehabilitation. With full rehabilitation all of the hangar's building systems would be renovated or replaced (see the Cost Estimate section [Section 8.0] for proposed scope of rehabilitation).
- The hangars will continue to interrupt the continuous line of site required by air traffic control and the safety concerns with the obstructions will not be diminished.
- The hangars would be brought up to current life safety, structural, energy, mechanical, plumbing, and electrical codes.
- The cost of the rehabilitation would trigger ATFP requirements. The existing parking on the south side of the hangar would have to be partially or fully eliminated to meet ATFP standoff requirements. The historic windows would have to be retrofitted with laminated glazing.

- The fully rehabilitated hangars would still not accommodate the new P-8A aircraft. The monetary investment does not support the airfield's primary mission.

- The use of the hangars as swing space is not greatly enhanced with rehabilitation.

Minimal Rehabilitation

- The hangars will be returned to a state of utility in accordance with the Secretary of the Interior's Standards of Rehabilitation. Only the minimum rehabilitation will be completed in order to make the hangars safe and serviceable. Since the hangars are already serviceable as swing space in their current state, the goal would be to reduce maintenance and preserve the integrity of the historic properties (see the Cost Estimate section [Section 8.0] for proposed scope of rehabilitation).

- The hangars will continue to interrupt the continuous line of site required by air traffic control and the safety concerns with the obstructions will not be diminished.

- The hangars would be brought up to current life safety, structural, energy, mechanical, plumbing, and electrical codes only as required.

- The capital outlay for this option can be kept below the threshold for triggering ATFP requirements.

- The minimally rehabilitated hangars would still not accommodate the new P-8A aircraft. The function of the hangars as swing space is not greatly enhanced with rehabilitation.

Relocation

- It is unlikely that this will be considered as an alternative because of the size of the buildings and the lack of vacant space at the installation. In addition, Hangar 116 is being considered for retention at the airfield.

Demolition

- Demolition of the hangars is the only alternative that resolves the airfield safety issues.

- According to Navy personnel there is no current or future need anticipated for the hangars (Mr. Troy Thompson, personal communication 2013).

- There are other examples of this hangar design on the NAS JAX installation and other locations around the country. Since the hangar door rollers are not available as stock parts, they should be salvaged and stored for use on other hangers of similar design.

- Asbestos remediation should be conducted prior to demolition to prevent all demolition waste from being categorized as hazardous.

- Under Section 106 of the National Historic Preservation Act (NHPA), demolition of a historic property is an adverse effect. In compliance with Section 106 of the NHPA consultation with the SHPO is required to avoid, minimize or mitigate the adverse effect. If an adverse effect cannot be avoided, a Memorandum of Agreement is required to minimize or mitigate.

Mothballing

- The reason for mothballing a structure is to preserve it for future use. The Navy does not anticipate any future need for these hangars. Unless the airfield is decommissioned, the location on an active airfield makes alternative uses very unlikely. Mothballing the buildings would be both long term and speculative.

- The cost for mothballing the hangars will be greater than the No Action alternative since it entails not only the initial costs to mothball the hangars but also much of the reoccurring maintenance and operational costs associated with the no action alternative.

- In some respects mothballing the hangars puts the properties at greater risk than the No Action plan. Mothballing will be dependent on the periodic inspections specified in the Mothballing plan to discover leaks or other threats to the building. Problems are more likely to get reported when a building is in regular use.

- If the hangars are mothballed, they will require re-roofing to protect the historic properties for the duration of the lay-away. This cost has been incorporated into the cost estimate.

- The buildings will have to be ventilated while mothballed. The hangar bays are already designed with louvers in the sawtooth clerestories. An effective ventilation strategy would be to place small exhaust fans in those clerestory windows and replace some of the windows with intake louvers on the south and north sides of the buildings. Ventilation would be improved and the risk of mold growth reduced if partition walls and suspended ceilings that were not part of the historic fabric were removed.

- The hangars will continue to interrupt the continuous line of site required by air traffic control and the safety concerns with the obstructions will not be diminished.

8.0 COST ESTIMATE OF EACH ALTERNATE

The cost estimates incorporate Unified Facilities Criteria standards and data published by the DoD. The methodology prescribed in the Estimating Alteration Projects section of the publication UFC 730-01, *Programming Cost Estimates for Military Construction,* is used for both the Full Rehabilitation and Minimal Rehabilitation alternatives. This method allows the estimator to incorporate historical cost data on military buildings (including hangars) and to make adjustments to those costs based on project size, location, year, and contingencies. There is also an adjustment factor to accommodate historic projects.

No Action. A course of No Action will require significant capital input each year for routine maintenance. The DoD categorizes this as "Sustainment" and every fiscal year the DoD publishes *Sustainment Unit Costs* (SUC) for many types of military facilities. Sustainment provides for "maintenance and repair activities necessary to keep a typical inventory of facilities in good working order over their expected service life" (DoD, UFC 3-701-01).

Typical sustainment activities include scheduled maintenance and inspections, preventative maintenance, emergency calls for minor repairs, and replacement of building systems that have reached the end of their service life. Roofing, interior finishes, and HVAC components are examples of systems typically covered under sustainment. Structural upgrades, modernization, historic preservation, custodial services, and environmental remediation are not included.

For Fiscal Year 2013, the published SUC for Aircraft Maintenance Hangars is $2.74 per square foot. The location adjustment for Jacksonville yields a cost of $2.52 per square foot; therefore the annual sustainment cost for each hangar is projected to be at least $164,729. Assuming a three percent annual cost escalation for sustainment services, the 30-year sustainment cost is $7,837,050. The cost could be significantly higher since the buildings are older than their expected service life and repairs may be required that are not typically included in sustainment budgets.

Spreadsheets documenting service calls for Hangars 113, 114, and 115 were provided by NAS JAX for review. The data covered a period of approximately one year from July 2012 to August 2013. Since the data was incomplete and covered such a brief time period it was not possible to determine actual sustainment costs for the facilities.

Full Rehabilitation. The cost estimate for Full Rehabilitation is based on the assumptions listed below (Tables 1 and 2).

1. Foundations are sound and will require minimal work, if any. Existing floor slabs are to be repaired rather than replaced since a thicker slab will not improve the functionality of the building.

2. The buildings' structural frames will receive minor upgrades and the wood roof deck will be completely replaced.

3. The building will receive new roof, flashings and gutters. Roof insulation will be added to meet the current Florida Energy Code.

4. Corrugated panels at sliding door pockets and sawtooth clerestories will be replaced. Wood plank sheathing will be repaired and steel girt supports repaired or replaced as needed.

5. Exterior man doors will be replaced. Non-original insulated windows in punched openings will be replaced with ATFP compliant windows that match design of historic windows.

6. Original windows in clerestories and hangar doors will be renovated and retrofitted to accept ATFP compliant laminated glazing.

7. Exterior masonry walls will be repointed and insulated. A moisture barrier will be added to exterior of block and stucco finish will be replaced.

8. Building interior will be fully renovated and walls relocated. New ceiling and floor finishes will be installed. All painted surfaces will be repainted. Asbestos will be removed.

9. Plumbing systems will almost totally replaced—new piping, water heaters, and toilet room fixtures. Toilet rooms will be reconfigured to be ADA compliant.

10. HVAC systems will be totally replaced.

11. Nearly all of the electrical systems will be upgraded including primary service. Lighting and lighting controls will be upgraded to meet the current Florida Energy Code. Data service will be upgraded.

TABLE 1. COST ESTIMATING WORKSHEET – FACILITY ALTERATION: FULL REHABILITATION OPTION

1. CONTRACT NUMBER: N69450-M-4082	2. PROJECT TITLE: ECONOMIC ANALYSIS OF HANGERS 113,114,115		3. FY: 2013
4. BUILDING NUMBER: 113,114,115	5. LOCATION: NAS JACKSONVILLE		6. HISTORICAL [X] YES [ ] NO
7. FACILITY TYPE: HIGH BAY AIRCRAFT HANGER	8. CATEGORY CODE: 7b (from Table 2, FY10)	9. FACILITY SIZE 65,369 *(SF)*	10. AREA TO BE ALTERED: 65,369 *(SF)*

16. REMOVAL/DEMOLITION PORTION OF PRIMARY FACILITY

BUILDING SYSTEM WORK BREAKDOWN	PERCENT OF SYSTEM ALTERED *a*	PERCENT OF LABOR TO REMOVE *b*	LABOR PERCENT TO INSTALL *c*	SYSTEM PERCENT OF TOTAL *d*	TOTAL PERCENT REMOVAL *e*
01 - SUBSTRUCTURE	15	50	35	7.2	0.19
02 - SUPERSTRUCTURE	35	50	35	16.16	0.99
03 - ROOFING	100	50	35	13.88	2.43
04 - EXTERIOR CLOSURE	85	50	35	15.84	2.36
05 - INTERIOR CONSTRUCTION	85	50	35	12.06	1.79
06 - INTERIOR FINISHES	95	50	35	7.86	1.31
07 - SPECIALTIES	95	50	35	1.44	0.24
08 - PLUMBING	95	50	35	3.64	0.61
09 - H.V.A.C.	100	50	35	6.59	1.15
10 - SPECIAL MECHANICAL	100	50	35	2.5	0.44
11 - ELECTRICAL	90	80	35	8.76	2.21
12 - SPECIAL ELECTRICAL	80	80	35	2.32	0.52
13 - EQUIPMENT	80	50	35	1.75	0.25
REMOVAL/DEMOLITION FACTOR (RDF)				17. RDF	14.47

21. REPLACEMENT/NEW PORTION OF PRIMARY FACILITY

BUILDING SYSTEM WORK BREAKDOWN	PERCENT OF SYSTEM REPLACED *a*	SYSTEM PERCENT OF TOTAL *b*	TOTAL PERCENT REPLACED *c*
01 - SUBSTRUCTURE	15	7.2	1.08
02 - SUPERSTRUCTURE	35	16.16	5.66
03 - ROOFING	100	13.88	13.88
04 - EXTERIOR CLOSURE	85	15.84	13.46
05 - INTERIOR CONSTRUCTION	85	12.06	10.25
06 - INTERIOR FINISHES	95	7.86	7.47
07 - SPECIALTIES	95	1.44	1.37
08 - PLUMBING	95	3.64	3.46
09 - H.V.A.C.	100	6.59	6.59
10 - SPECIAL MECHANICAL	100	2.5	2.50
11 - ELECTRICAL	90	8.76	7.88
12 - SPECIAL ELECTRICAL	80	2.32	1.86
13 - EQUIPMENT	80	1.75	1.40
REPLACEMENT NEW FACTOR (RNF)		22. RNF	76.85

TABLE 2. COST SUMMARY - FULL REHABILITATION OPTION		
ADJUSTED GUIDANCE UNIT COST (GUC)* - HANGER COST PER SQUARE FOOT		$ 288.03
*SIZE ADJUSTMENT FACTOR (S)=0.99; AREA COST FACTOR (ACF)=0.92; COST ESCALATION FACTOR (CE)=1.05; DESIGN CONTINGENCY ADJUSTMENT FACTOR (DC)=1.1; SPECIAL ADJUSTMENT FACTOR (SAF Historic)=1.05; SPECIAL ADJUSTMENT FACTOR(SAF Site)=1.06		
REMOVAL DEMOLITION COST		$ 2,724,850.13
NEW WORK COST		$ 14,470,250.24
ASBESTOS REMOVAL (from costs documented in survey adjusted to 2013 dollars)		$ 80,179.84
SUPPORTING FACILITIES COST		$ 500,000.00
10% CONTINGENCY		$ 1,777,528.02
8% SUPERVISION, INSPECTION, & OVERHEAD (SIOH)		$ 1,564,224.66
	TOTAL COST	$ 21,117,032.90

Minimal Rehabilitation. The cost estimate for Minimal Rehabilitation is based on the assumptions listed below (Tables 3 and 4).

1. Existing floor slabs will by selectively patched.
2. The buildings’ structural frames will receive minor upgrades and portions of the wood roof deck will be replaced as required for structural integrity.
3. The building will receive new roof, flashings and gutters. Roof insulation will be added to meet the current Florida Energy Code.
4. Corrugated panels at sliding door pockets and sawtooth clerestories will remain. Wood plank sheathing and steel girt supports will be inspected and repaired as needed for safety.
5. Exterior man doors will be repaired and weather-stripped.
6. Exterior masonry walls will be selectively patched and repointed to mitigate water intrusion. After proper preparation of the existing substrate, a finish coat of synthetic stucco will be applied to mitigate moisture issues. The synthetic coating shall have elastomeric properties and shall be vapor permeable so that moisture is not trapped within the wall assembly.
7. Building interior will be partially renovated. Interior construction alteration will be limited to 15 percent. Interior finish renovation will be limited to 30 percent. Asbestos will be removed.
8. Plumbing piping will be selectively replaced or repaired. New water heaters will be installed. Toilet rooms will be partially reconfigured to meet minimum ADA requirements.

9. Existing HVAC systems will be renovated and selective components replaced.
10. Electrical systems will be selectively upgraded to meet minimum code requirements. Primary electrical service will not be upgraded.

TABLE 3. COST ESTIMATING WORKSHEET - FACILITY ALTERATION: MINIMAL REHABILITATION OPTION

1. CONTRACT NUMBER: N69450-M-4082	2. PROJECT TITLE: ECONOMIC ANALYSIS OF HANGERS 113,114,115			3. FY: 2013
4. BUILDING NUMBER: 113,114,115	5. LOCATION: NAS JACKSONVILLE			6. HISTORICAL [X] YES [ ] NO
7. FACILITY TYPE: HIGH BAY AIRCRAFT HANGER	8. CATEGORY CODE: 7b (from Table 2, FY10)	9. FACILITY SIZE 65,369 *(SF)*	10. AREA TO BE ALTERED 65,369 *(SF)*	

16. REMOVAL/DEMOLITION PORTION OF PRIMARY FACILITY

BUILDING SYSTEM WORK BREAKDOWN	PERCENT OF SYSTEM ALTERED *a*	PERCENT OF LABOR TO REMOVE *b*	LABOR PERCENT TO INSTALL *c*	SYSTEM PERCENT OF TOTAL *d*	TOTAL PERCENT REMOVAL *e*
01 - SUBSTRUCTURE	10	50	35	7.2	0.13
02 - SUPERSTRUCTURE	20	50	35	16.16	0.57
03 - ROOFING	95	50	35	13.88	2.31
04 - EXTERIOR CLOSURE	35	50	35	15.84	0.97
05 - INTERIOR CONSTRUCTION	15	50	35	12.06	0.32
06 - INTERIOR FINISHES	30	50	35	7.86	0.41
07 - SPECIALTIES	20	50	35	1.44	0.05
08 - PLUMBING	50	50	35	3.64	0.32
09 - H.V.A.C.	15	50	35	6.59	0.17
10 - SPECIAL MECHANICAL	10	50	35	2.5	0.04
11 - ELECTRICAL	35	80	35	8.76	0.86
12 - SPECIAL ELECTRICAL	25	80	35	2.32	0.16
13 - EQUIPMENT	15	50	35	1.75	0.05
REMOVAL/DEMOLITION FACTOR (RDF)				17. RDF	6.35

21. REPLACEMENT/NEW PORTION OF PRIMARY FACILITY

BUILDING SYSTEM WORK BREAKDOWN	PERCENT OF SYSTEM REPLACED *a*	SYSTEM PERCENT OF TOTAL *b*	TOTAL PERCENT REPLACED *c*
01 - SUBSTRUCTURE	10	7.2	0.72
02 - SUPERSTRUCTURE	20	16.16	3.23
03 - ROOFING	95	13.88	13.19
04 - EXTERIOR CLOSURE	35	15.84	5.54
05 - INTERIOR CONSTRUCTION	15	12.06	1.81
06 - INTERIOR FINISHES	30	7.86	2.36
07 - SPECIALTIES	20	1.44	0.29
08 - PLUMBING	50	3.64	1.82
09 - H.V.A.C.	15	6.59	0.99
10 - SPECIAL MECHANICAL	10	2.5	0.25
11 - ELECTRICAL	35	8.76	3.07
12 - SPECIAL ELECTRICAL	25	2.32	0.58
13 - EQUIPMENT	15	1.75	0.26
REPLACEMENT NEW FACTOR (RNF)		22. RNF	34.10

TABLE 4. COST SUMMARY - MINIMAL REHABILITATION OPTION		
ADJUSTED GUIDANCE UNIT COST (GUC)* - HANGER COST PER SQUARE FOOT	$	288.03
*SIZE ADJUSTMENT FACTOR (S)=0.99: AREA COST FACTOR (ACF)=0.92: COST ESCALATION FACTOR (CE)=1.05: DESIGN CONTINGENCY ADJUSTMENT FACTOR (DC)=1.1: SPECIAL ADJUSTMENT FACTOR (SAF Historic)=1.05: SPECIAL ADJUSTMENT FACTOR(SAF Site)=1.06		
REMOVAL DEMOLITION COST	$	1,195,786.73
NEW WORK COST	$	6,421,180.61
ASBESTOS REMOVAL (from costs documented in survey adjusted to 2013 dollars)	$	80,179.84
SUPPORTING FACILITIES COST	$	500,000.00
10% CONTINGENCY	$	819,714.72
8% SUPERVISION, INSPECTION, & OVERHEAD (SIOH)	$	721,348.95
TOTAL COST	$	9,738,210.85

Rehabilitation Case Studies. Two recent construction projects may be useful as a point of reference for an order of magnitude cost comparison. Both of these projects include Alfred Kahn hangars of the same design as Hangars 113, 114, and 115.

First, in August 2010, a construction contract was awarded to the Ross Group for renovations to Hangar 58 at NAS Corpus Christi. This 75,000-square foot (sf) renovation included approximately 23,850 sf of offices. The scope incorporated new HVAC systems, blast mitigation for windows, and structural repairs. The construction cost was $8,192,654, which is $9,752,384 in August 2013 NAS JAX construction dollars (Mr. Jake Bixby, Project Manager, Ross Group Construction Corporation, personal communication, July 2013).

Second, the National Oceanic and Atmospheric Administration (NOAA) Pacific Regional Center project is located on the historic Ford Island Naval Station in Pearl Harbor (Figure 34). The project incorporates 350,000 sf of construction including the renovation and adaptive reuse of two Albert Kahn hangars. The building program includes marine, tsunami, and weather research facilities as well as administrative offices. A second floor level was added over much of the building footprint in each hangar. The project included extensive site work and is designed to receive LEED Gold certification. The low bid of $131.1 million for the construction of this project was also received in August 2010 (Mr. Paul Woolford, Senior Vice President, HOK, Inc., personal communication, July 2013).

Using *RSMeans* tables to adjust this cost to 2013 Jacksonville, Florida, dollars yields a cost of $102.3 million (Waier 2012). Since the two Kahn hangars are approximately 130,700 sf in area, the project includes about 219,000 sf of additional new construction. Given the complexity of the NOAA building program and the extent of additional new construction, this construction cost should significantly exceed the cost for flex-space adaptive reuse of two hangars at NAS JAX.

Figure 34. Ford Island: Facility 175 interior detail and exterior oblique view of Albert Kahn land plane hangars at Pearl Harbor *(Historic American Buildings Survey, HABS HI-400).*

Demolition. Demolition costs are summarized in Table 5 below.

TABLE 5. DEMOLITION COST		
DEMOLITION @ $25.00 SF	$	1,634,225.00
ASBESTOS REMOVAL (from costs documented in survey adjusted to 2013 dollars)	$	80,179.84
DEMOLITION PLAN	$	12,000.00
10% CONTINGENCY	$	172,640.48
8% SUPERVISION, INSPECTION, & OVERHEAD (SIOH)	$	151,923.63
TOTAL COST	$	2,050,968.95

Executive Order 13423 outlines energy conservation requirements for federal properties and requires that decisions made regarding federal properties are "life-cycle cost-effective." One aspect of this calculation is to consider the amount of embodied energy contained in an existing building when evaluating the cost to demolish the property. Embodied energy includes the sum of all the energy used to extract, manufacturer, and transport the materials incorporated into a building as well as the energy used to construct the building.

There have been numerous studies undertaken to determine the value of embodied energy in buildings, but the dominant reference standard is from the 1976 report, *Energy Use for Building Construction* (Jackson 2005). This report established the energy used, expressed in British Thermal Units (Btu), for different building types. The

NAS hangars are closest in type to the *industrial* category in that report and Table C1 in that publication lists 972,551 Btu per square foot for that category (Hannon and Stein 1976).

Once the Btu value is determined it can be converted to kilowatt hours (kWh) of power using a conversion factor of 3.413 Btu for each kWh of power. The monetary value for those kWh can then be determined by multiplying the kWh by the local electrical company's kWh rate. This rate for NAS JAX, as of August 2013, is $0.085 per kWh (Mr. Troy Thompson, personal communication 2013). The embodied energy value for one hangar is summarized in Table 6. The combined cost for demolition and embodied energy is summarized in Table 7.

TABLE 6. EMBODIED ENERGY CALCULATIONS FOR ONE HANGAR		
A. BUILDING AREA (SF)		65,369
B. MILLION Btu (Mbtu): 65,369 x 972,551 Btu		63,574,686
C. MILLION KILOWATT HOURS (MkWh): 63,574,686 / 3.413 Mbtu		18,627,215
D. AVERAGE COST PER kWh (Dollars)		0.085
	EMBODIED ENERGY (Line C x Line D)	$ 1,583,313.00

TABLE 7. COST SUMMARY - DEMOLITION OPTION WITH EMBODIED ENERGY (ONE HANGAR)		
VALUE OF EMBODIED ENERGY (from Table 6)		$ 1,583,313.00
DEMOLITION COST (from Table 5)		$ 2,050,968.95
	TOTAL COST	$ 3,634,281.95

Mothballing. The following cost summary (Table 8) accounts for the mothballing requirements described in Detailed Analysis of Alternatives section of this report (see Section 7.0). Cost is for each hangar.

TABLE 8. COST SUMMARY - MOTHBALLING OPTION		
ASBESTOS REMOVAL (from costs documented in survey adjusted to 2013 dollars)		$ 80,179.84
NEW ROOF @15.50 SF		$ 837,930.00
MOTHBALLING PLAN		$ 5,000.00
INTERIOR DEMOLITION & PREPARATION @ 13.50 SF		$ 882,481.50
LOUVERS AND VENTILATION @ 2.10 SF		$ 137,749.90
10% CONTINGENCY		$ 194,334.12
8% SUPERVISION, INSPECTION, & OVERHEAD (SIOH)		$ 171,014.03
SUSTAINMENT COSTS		$ 164,729.00
	TOTAL COST	$ 2,473,418.39

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10.0 PREPARERS' QUALIFICATIONS

Kelly Nolte, M.A.
Vice President, Director Architectural History Division

EDUCATION

M.A., Humanities (Architectural History), Old Dominion University, Norfolk, VA
B.A., Humanities, Cum Laude (Architectural History), University of West Florida, Pensacola

EXPERIENCE

Director, Architectural History Division, Panamerican Consultants, Inc.

Ms. Kelly Nolte is Vice President/Senior Architectural Historian with Panamerican Consultants, Inc. and Director of Panamerican's Architectural History Division. She has more than 25 years of experience in analytical and historic research, field direction, and report writing as an architectural historian throughout the continental United States and U.S. Virgin Islands. She has completed more than 200 cultural resources investigations including: conducting small and large architectural surveys (both exterior and interior surveys); evaluating and recording National Register of Historic Places eligibility; completing National Register nomination forms; preparing HABS/HAER (Historic American Building Survey/Historic American Engineering Record) documentation; preparing architectural histories and historic contexts; conducting historic landscape surveys and preparing treatment plans; preparing preservation planning documents that include the completion of environmental impact statements, environmental assessments, integrated cultural resource management plans, Army Alternate Procedures, and preparing historic building treatment plans; overseeing the preparation of measured drawings; and conducting and overseeing all levels of photography (35mm, digital, medium-format and large-format) and archival-quality processing of photographs and documents. This work has been completed for more than 75 military installations across the continental United States, various U.S. Army Corps of Engineer districts, the National Park Service, numerous state departments of transportation, as well as private industry.

Ms. Nolte oversees a staff of five architectural historians within the Architectural History Division. Panamerican's staff of architectural historians and historians exceeds the minimum standards for their disciplines delineated in 36 CFR Part 61. During her 15-year tenure with Panamerican, the Architectural History Division has completed more than 75 HABS/HAER documentations at all levels, including more than 40 of which she alone has completed. These documentations have included single houses, industrial complexes such as water systems and rocket facilities, bridges, and building complexes such as warehouse annexes. The Division has also completed numerous National Register nominations including a school house, an Army general's quarters, and historic districts and has surveyed more than 8,000 buildings, structures and landscapes during her tenure.

Museum Education Experience

Ms. Nolte spent the first years of her career as a museum educator. She held successively higher positions in the museum education field ending her museum career as Director of Public Programs, a position responsible for education, collections, and exhibition design at a new 60,000 sq. ft. museum. During her museum-education years, she undertook a wide variety of responsibilities including the creation of exhibitions, the writing of museum signage and brochures, the creation of museum policy, and the design and implementation of education programs for children and adults.

Projects

- *HABS, Level III-type Documentation of Selected Buildings at Naval Air Station (NAS) Norfolk Historic District at the Naval Station Norfolk, Virginia*. Prepared for the Atlantic Division Naval Facilities Engineering Command, Norfolk (under subcontract to Allen Hoshall) by Panamerican. Ms. Nolte was Principal Investigator and Architectural Historian for a HABS, Level III-type documentation of selected buildings at NAS Norfolk Historic District at the Naval Station Norfolk. The buildings included the Air Operations-Control Tower; six landplane hangars; three seaplane hangars; 13 ammunition magazines; a squadron storehouse; a torpedo shop; an operations building; four seaplane ramps; and a transformer vault. The purpose of the study was to implement a mitigation strategy designed to document the historic structures at the decommissioned facility through an in-depth historical and archival background search combined with a detailed photographic and architectural recordation process.
- *Historic American Engineering Record: Documentation of the Control House (Building 3617) and the Static Rocket Test Stand (Building 3618), Test Area E Historic District, former Naval Air Rocket Test Station (NARTS), Picatinny Arsenal, Morris County, New Jersey.* Prepared for the U.S. Army Environmental Center, Aberdeen Proving Ground, MD under a cooperative agreement with the U.S. Army Medical Research Acquisition Activity, Fort Detrick, MD, and Picatinny Arsenal by Panamerican. Ms. Nolte was Principal Investigator and Architectural Historian for the HAER documentation of Buildings 3617, the Control House, and Building 3618, the Static Rocket Test Stand, within NARTS Area E Historic District within Picatinny Arsenal. She conducted a site and structure reconnaissance, conducted archival and documentary research, and wrote the text of the documentation.
- *Military Historic Context Emphasizing the Cold War including the Identification and Evaluation of Above Ground Cultural Resources for 13 Department of Defense Installations in the State of Georgia.* Prepared for Legacy Resources Management under a cooperative agreement with Fort Benning, by Panamerican. She was Principal Investigator, architectural historian, and primary author for a Cold War military context for the State of Georgia discussing all service branches for use in identifying and evaluating aboveground Cold War cultural resources at the installations. Her duties included background research, coordinating project, contacting Cultural Resources Managers at the installations surveyed, creating annotated Cold War bibliography geared to specific installations, creating installation specific histories highlight specific architectural, infrastructure and landscape information, and creating a cross-referenced analysis of the installations.
- *Historic Elyton Village Exhibition Display.* Created for the Birmingham Housing Authority Development, Birmingham, AL, by Panamerican. Ms. Nolte served as Principal Investigator and Senior Architectural Historian for design of permanent exhibit panels as mandated by the Alabama Historical Commission (SHPO) as a mitigation effort against the planned demolition of portions of the NRHP-eligible Elyton Village public housing. Her duties included background research, coordinator of project, building survey, contracting the exhibit design company, writing exhibition panel text, choosing graphics, and serving as intermediary between SHPO, the residents of Elyton Village, and the Birmingham Housing Authority Development, the agency that serves as the property manager.

Richard F. Simonton, AIA
Senior Project Architect

Education
B/Architecture
Auburn University

Registration
Alabama
Georgia
California

Affiliations
American Institute of Architects

National Council of Architectural Registration Boards

US Green Building Council – LEED Accredited Professional

Mr. Simonton has more than 20 years of experience in the design and management of architectural projects ranging in scale from an artist's cottage in the Berkeley, California, hills to a six-city-block convention center in Richmond, Virginia. He has a particular interest in historic preservation and has completed post-graduate study in historic southern architecture, cultural geography, and community preservation at Louisiana State University. Mr. Simonton has been active in the field of sustainable design since 1993, is a founding board member of the Atlanta chapter of the U.S. Green Building Council, and was the *sustainability coordinator* at Krebs Architecture & Engineering. He recently formed his own firm, Simonton, Swaika, Black Architects, Inc.

Selected Projects:

First National Bank – Louisville, GA

Phased adaptive reuse project for 1919 bank building located within downtown district listed on the National Register of Historic Places. The first phase of building weatherproofing included restoration of the original steel windows and hand-cast, red bronze window hardware. Produced drawings and specifications for window restoration, new energy efficient glazing, and site cast weatherproofing gaskets.

The Geological Survey of Alabama – Tuscaloosa, AL

Replacement of 240 windows in a 1960 neoclassical-style building located at the University of Alabama. Produced drawings and specifications for new energy efficient windows that adhered to the University's standards for preserving the historic campus character.

Buntyn Farm – Griffin, GA

Extensive renovation of a 3,700 sf, 1898 southern vernacular farmhouse. Project included complete restoration of large double-hung wood windows with copper chain and modern weather-stripping.

Panamerican Consultants, Inc.

Currently retained as Historic Architect consultant for Columbus, GA, and Buffalo, NY, offices of this prominent cultural resource management company.

Hilltop Montessori School - Birmingham, AL

Sustainable design consultant to ArchitectureWorks for new 12,000 s.f. elementary school. First LEED-registered project in Alabama.

Cahaba River Camp & Conference Center - Birmingham, AL

Sustainable design consultant to Davis Architects during concept phase for a new camp and conference facility.

Auburn University – Office For Information Technology

Project Architect for new $13.5 million, 57,200 sf. main computer facility for the Auburn campus. Building is seeking LEED certification. Design in progress.

APPENDICES

Appendix A.

PREVIOUS INVESTIGATIONS

Descriptions of Previous Investigations

In preparing the Economic Analysis the CCM Team consulted a number of resources related to Hangars 113, 114, and 115 at NAS JAX. These resources are discussed in four general categories: Surveys at NAS JAX; Surveys at DoD/Navy; Florida SHPO files; and General technical reports.

1. **Surveys at NAS JAX.** Historic architectural surveys that include Hangars 113, 114, and 115 at NAS JAX are few in number. The primary survey is *Historic Architectural Survey of the Jacksonville Naval Air Station, Duval County, Florida, Inventory of Historic Buildings and Districts* (Adams 1997). This survey identified the Landplane Hangar Historic District, delineated its boundaries, and identified its four contributing resources—Hangars 113, 114, 115, and 116. Since the Adams survey, the Landplane Hangar Historic District has been included in the 2002 and 2010 Integrated Cultural Resources Management Plans (ICRMP) (Johnson and Basinet 2002 and Mohlman et al. 2010), and the 2012 NAS JAX Short Range Master Plan (CCM and S&R Solutions 2012), a component of the larger master planning process.

   One technical document, *Asbestos Survey of Selected Buildings at Naval Air Station Jacksonville, Florida* (Caviness 1996) was useful. This document included an asbestos survey of Hangars 113, 114, and 115. In all three buildings, asbestos was found in the floor tile, mastic, and transite panels. Remediation cost estimates were provided in 1996 dollars for each hangar.

   Other helpful historic documents held at various locations on NAS JAX and consulted include: original and as-built blueprints, installation maps from various periods, and photographs.

2. **Surveys at DoD/Navy.** Although there are no DoD or Navy studies that specifically name Hangars 113, 114, or 115, a number of general studies cover hangar typologies, World War II permanent construction, and general World War II aviation history. Many of these studies are exceptionally helpful in assessing the hangars at NAS JAX. These studies include: *Historical and Architectural Overview of Military Aircraft Hangars* (Pedrotty et al. 1999); *Building the Navy's Bases in World War II: History of the Bureau of Yards and Docks, 1940-1946*, Vols. 1-3 (Bureau of Yards and Docks 1946); and *National Context for Department of Defense Installations, 1790-1940* (Cannan et al. 1995).

3. **Florida SHPO Files.** The SHPO maintains a Florida Master Site File (FMSF) on each of the hangars and a general information file on the Landplane Hangar Historic District. Hangar 113 is designated as 8DU11723, a Landplane Hangar. Hangar 114 is designated as 8DU11724, a Maintenance Hangar. Hangar 115 is

designated as 8DU11725, a Landplane Hangar. The Landplane Hangar Historic District does not have a separate FMSF number, not an unusual occurrence.

A *Multiple Property Listing for Florida's Historic World War II Military Resources* (Johnson and Mattick 2001) is listed on the NRHP (2002). This listing includes NAS JAX and creates a context for the World War II years as well as pre- and post-war years, 1938-1947, in Florida. It also creates a Florida context for the Bureau of Yards and Docks (BuDocks), the primary design and construction agent for Navy during World War II.

4. **General Technical Reports.** A number of technical reports will provide guidance in preparing the final report. These are: *Historic Structures Preservation Manual,* NAVFAC-MO 913, 1991; *Economic Analysis Handbook,* NAVFAC-P442, 1993; *United States Navy Layaway Procedures for Historic Properties* (John Cullinane Associates 1996); *United Facilities Criteria (UFC), DoD Minimum Antiterrorism Standards for Buildings,* UFC-4-010-01 (DoD 2003); and *Mothballing Historic Buildings,* Preservation Brief 31 (Park 1993). The economic analyses for a number of hangars within the DoD were also consulted for comparison. These include the hangars at Fort Wainwright, Alaska (Tanaea-Yukon Historical Society, JCA and Design Alaska 2011).