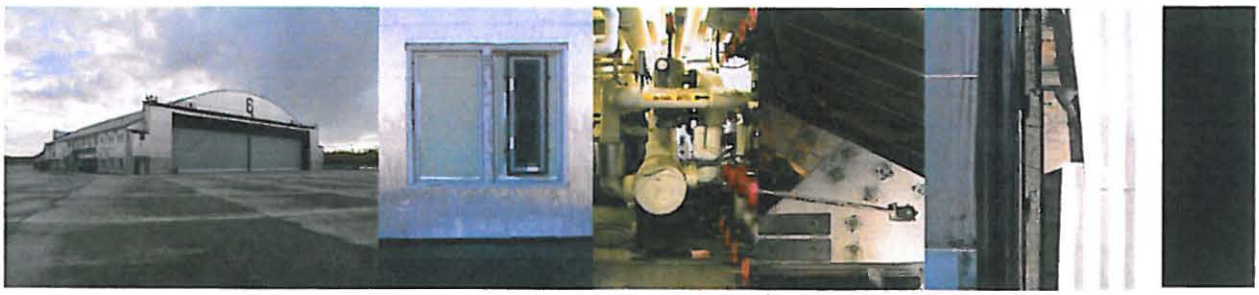
Draft

October 2002

Condition Assessment/Economic Analysis

Hangars 2085, 3005 & 3008



Fort Wainwright, Alaska

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Architecture
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Development

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Renee Blahuta

U.S. DEPARTMENT OF THE ARMY

Fort Wainwright Public Works Engineering
Monica Peede
Public Works, Environmental Department, Conservation Branch
Russ Sackett

CONSULTANTS

ECI/HYER, INC. ..... Architectural
Tryck Nyman & Hayes ..... Structural
RSA Engineering ..... Mechanical/Electrical
HMS, Inc. ..... Cost Estimating

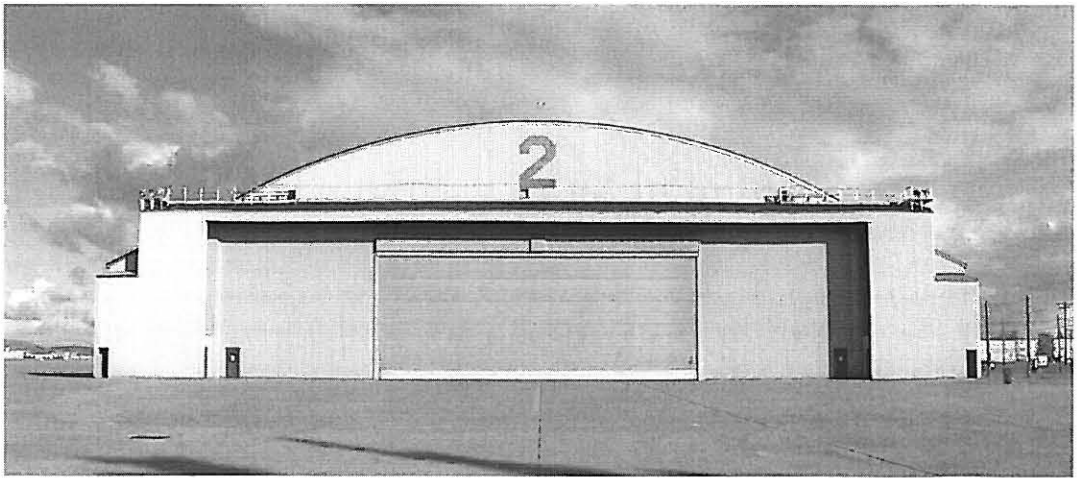
INTRODUCTION / EXECUTIVE SUMMARY

BACKGROUND

Ladd Field was designed as a permanent post in the Beaux-Arts design as a cold weather testing facility just prior to World War II. With Japan's invasion of the Aleutians in June 1942 Ladd Field became home of the Sixth Air Depot Group and the North American terminus of the Alaska-Siberia Lend-Lease program. From 1942 through 1945 building construction changed from permanent garrison to Theatre-of-Operations generic designs such as Quonset huts, 800 Series wood frame buildings, Birchwood hangars, Butler buildings, Kodiak T Type hangars, etc. The Birchwood hangar design took its name from Birchwood Field in Alaska. During this period, approximately 600 Theatre-of-Operations buildings were constructed on Ladd Field. In recognition of Ladd Field's contribution to World War II it was designated a National Historic Landmark in 1984.

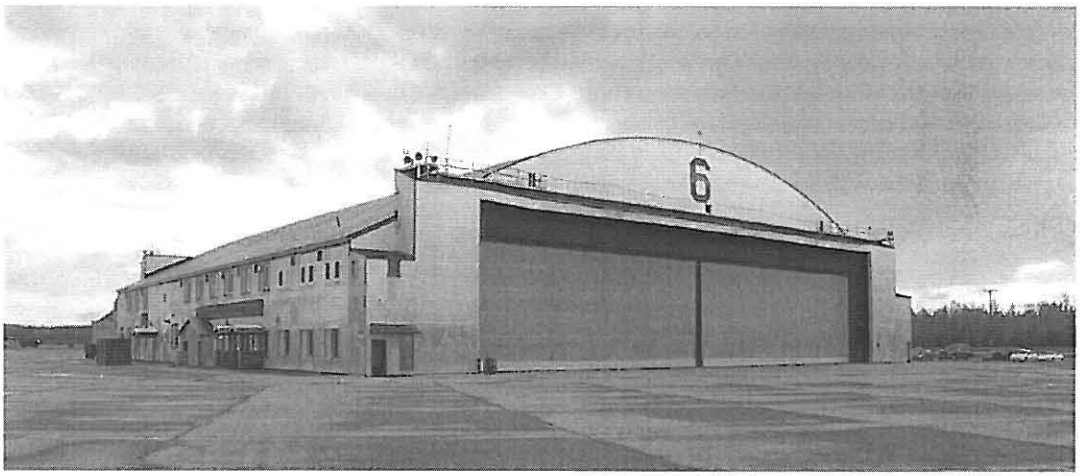
Following World War II, Ladd Field became Ladd Air Force Base. From 1949-1961 the Air Force embarked on a massive build-up of Ladd AFB using generic Cold War era concrete building designs and wood frame Capehart/Wherry family housing. This build-up resulted in the demolition of over 500 of the World War II Theatre-of-Operations buildings. In 1961 Ladd AFB was turned over to the U.S. Army (USARAK) and renamed Fort Jonathan Wainwright. Among buildings remaining from the war years are three hangars patterned after the "Birchwood" design found elsewhere throughout the state.

Hangar No. 2 (Building 3008, FAI-485) is a Birchwood hangar designed by the Seattle district engineer of the Army Corps of Engineers. The overall dimensions are 200 feet by 202 feet. The hangar, which was built in 1944, has a concrete foundation and floor, and wood timbered framing. The main portion of the hangar consists of a bow truss, open floor plan measuring 150 feet by 200 feet. The roof is supported by 150-foot timber bowstring trusses on timber columns. Two-story wings measuring 25 feet by 202 feet on the north and south side walls provide office and workshop space. The wings have shed roofs and pronounced stairwell towers at each end. The north and south elevations have paired windows evenly spaced the length of both floors. The east and west elevations have large hangar door openings covered by fabric curtains.



Hangars No. 3 (Building 3005, FAI-482) and **No. 6** (Building 2085, FAI-487) were also built in 1944. They are of similar design, massing, dimensions and fenestration. Corrugated aluminum siding was added to the exterior walls in 1949; this was replaced in 1973. At the same time, window frames were modified and the exterior stairs were

replaced and covered. New roofs were installed on all three hangars in 1986 and the hangar doors were reduced in size and fitted with fabric curtain doors in 1989. Hangar 6 was retrofitted with two hangar doors on each end. Hangars 2 and 3 were retrofitted with one door at each end.



REQUIREMENTS

The Integrated Cultural Resources Management Plan 2001-2005, Fort Wainwright and Fort Greely (ICRMP) calls for USARAK to assess conditions of buildings that contribute to the Ladd Field National Historic Landmark. The "Memorandum of Agreement (MOA) among the U.S. Department of the Army, the Advisory Council on Historic Preservation and the Alaska State Historic Preservation Officer regarding United States Army Alaska (USARAK) Demolition of Buildings in the Ladd Field National Historic Landmark" requires that USARAK perform a building assessment and economic analysis of the Birchwood hangars prior to considering demolition and replacement of these hangars. This study is conducted in compliance with the ICRMP, the MOA, the National Historic Preservation Act

of 1966, as amended (PL-65-515), the National Environmental Policy Act of 1969 (PL-90-190), Army Regulation 200-4, Cultural Resources Management, and Executive Order 11593 (Protection and Enhancement of the Cultural Environment).

RESTORATION GOALS

The Birchwood hangars are contributing buildings to the Ladd Field National Historic Landmark (NHL). In addition to general building rehabilitation, this report examines the feasibility and cost of restoring certain visual features of the hangars to their original appearance, thereby insuring continued eligibility as contributing buildings to the NHL.

Goals identified by USARAK Cultural Resources Program for the hangar rehabilitation include both visually restoring the building exteriors and interior hangar bays and maintaining a safe, modern, and functional environment for the storage and maintenance of Blackhawk helicopters and the respective missions housed therein.

REHABILITATION GOALS

The restoration of the buildings exteriors and hangar bays is one aspect of this study. The other is to upgrade the buildings to support their use as modern military and rescue support facilities. However, a wholesale removal and replacement of the building interiors and systems is not the approach represented. Items in reasonably good condition which can be refurbished and provide many years of extended service will be retained. Where a component is nearing the end of its useful life, it is scheduled for replacement in-kind or with more up-to-date products. The buildings have not been "programmed" in an effort to reconfigure room layouts and function; walls are assumed to remain in the their current location, except where required for life safety revisions.

COST EVALUATION & CONCLUSIONS

The cost of restoration/rehabilitation for each hangar was compared to the cost of replacing the hangers "in-kind." For the purposes of this comparison, the replacement hangar is assumed to be of the same size, materials and configuration as the existing hangars. While a new hangar would be constructed of noncombustible materials as required by Army regulations (see "Fire/Life Safety"), the requirements of this analysis dictate in-kind replacement for cost evaluation.

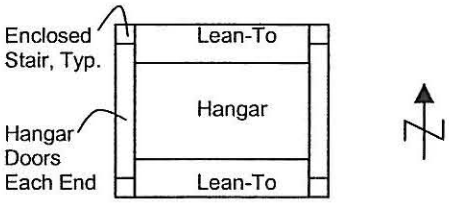
The cost of restoring and rehabilitating the hangars is approximately 60% or less of the cost of the comparative new construction. The costs are estimated as follows and include an allowance for administrative costs, design fees, estimating contingencies and inflation to year 2004 construction:

	Hangar 2	Hangar 3	Hangar 6
Restore/Repair	$6,782,155	$6,605,467	$6,616,717
Replace	11,408,607	10,951,291	11,345,965

Please refer to the Appendix for the detailed cost estimate.

STRUCTURAL

HANGARS NO. 2 (3008), 3 (3005), 6 (2085)



ALL HANGARS

GENERAL

The three hangar facilities are framed with similar structural systems. The hangar is central to each facility. Each side of the hangar is a two-story area referred to as the "lean-to".

Hangar

The hangar is approximately 200 ft Long x 152 ft Wide x 57 ft High with the longitudinal axis east to west. The roof forms an arch from north to south.

Hangar Door Extensions

The hangar roof extends east and west an additional 7 ft. for the original hangar doors. The roof and enclosing sidewalls extend north and south approximately 15 ft. beyond the sidewalls of the hangars. The sloped roof cantilevers off the east and west face of the hangar enclosing the old hangar door steel guide rails above and covering the at grade rails below. The eave of the roof is at approximately 37' above finish floor. The top of the roof is at approximately 40 ft above finish floor. The at grade guide rails are supported by the lid of the concrete crawl space below. The top rails are present above the screened soffit and the bottom rails remain in-place with concrete cast between flush with the top of the rails and surrounding concrete.

2 Story Lean-To(s)

The two story space on each side of the hangar is 200 ft Long x 25 ft Wide with the roof sloping up to the side of the hangar from 25 ft at the eave to 38' at the intersection with the hanger wall and roof.

STRUCTURAL

Evaluation Criteria

Code:	2000 IBC Except as Amended by Ft. Wainwright		
Soil Bearing:	Assumed – 3000 psf (Geotechnical Not Available)		
Design Loads:	Importance – I, Non Essential Facilities		
Dead Load:		Element Wt.	Combined Wt.
Exist. Rf Framing:	2x Decking	4.5 psf	4.5 psf
	Purlins 5 3/8" x 14 ½"	3.5 psf	8.0 psf
	Timber Truss	8.0 psf	16.0 psf
	Misc. Framing, catwalks, bracing, struts	1.5 psf	17.5 psf
	Insulation	0.0 psf	17.5 psf
	½" Batten Boards @ 12" o.c.	1.0 psf	18.5 psf
	Mechanical & Electrical Piping, Fire, Water, ducts, fans, conduit	3.0 psf	21.5 psf
Exist. Rf Framing + Exist. Roofing	EPDM Roofing	1.0 psf	22.5 psf
New Roofing	3/8" sheathing	1.2 psf	1.2 psf
	Polystyrene Foam @ .2lb/in x 6"	1.2 psf	2.4 psf
	5/8" Gypsum	2.5 psf	4.9 psf
	¾" Sheathing	2.4 psf	7.3 psf
	4x Sleepers	2.0 psf	9.3 psf
	EPDM Roofing	1.0 psf	10.3 psf
Exist. Rf Framing + New Roofing	(- Battens 1 psf, Exist. Roofing 1 psf)		30.0 psf
Snow Load	Roof Design Snow Load		
	1987/88 Truss Repair	32 psf	
	2000 IBC	36 psf	
	Ft. Wainwright – Current	50 psf	50 psf
Live Load	2000 IBC		
	Office	50 psf	
	Partitions	20 psf	70 psf
	Corridors/Stairs	100 psf	100 psf
	Light Storage	125 psf	125 psf
Wind Load			
	1987/1988 Truss Repair	70 mph	
	2000 IBC Ref. To ASCE 7	90 mph	
	Ft. Wainwright – Current	90 mph	90 mph
Seismic	2000 IBC		
	W = DL + %Sn		
	Per NPAEN-DB, 1/20/1987 Chief, Design Branch Joseph C. Gianotti Percent Snow (%Sn) =	.70Sn	
	W = DL + .70Sn		.0964W

STRUCTURAL

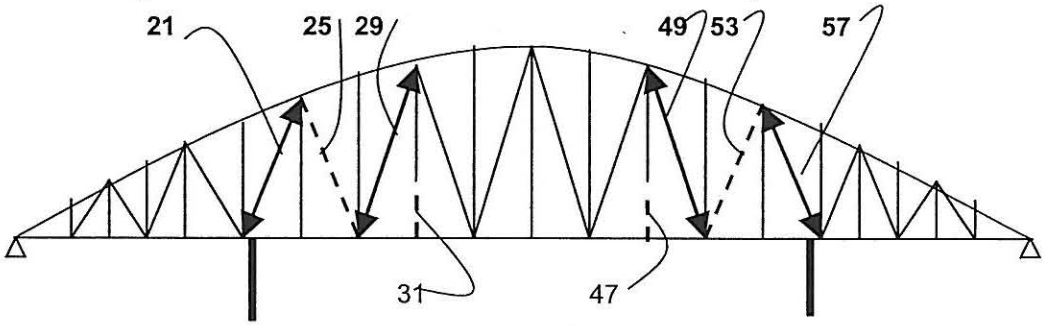
Request for Proposal – Attached Report

Draft - "Truss Inspection Report, 2000, Fort Wainwright, Alaska"
Dated 21-Sep-2000

Comments are included regarding this report to hopefully dispel prejudice toward the existing bowstring trusses and their capacity to support the design loads. The statements made in the report diminish the value of the hangars by indicating severe overstresses in the bowstring trusses. The assessment appears to be based on an incorrect interpretation of the information provided on the 1987/1988 repair documents.

Placing the columns for the new hangar doors inside the span of the truss changed the forces in the existing members. A bowstring truss is unique in that the web members typically have very small forces. The elements noted as overstressed, if not modified to accept the hangar door framing, would experience very small forces. The geometry of the truss eliminates forces in the web members.

The following is from the information in the tables on the truss repair sheets TR1, TR2.



Bowstring End Wall Truss 2-1 and 2-9.
Hangar 2

Table 2-1 includes the following information: (Hangar 2, West End Wall Truss)

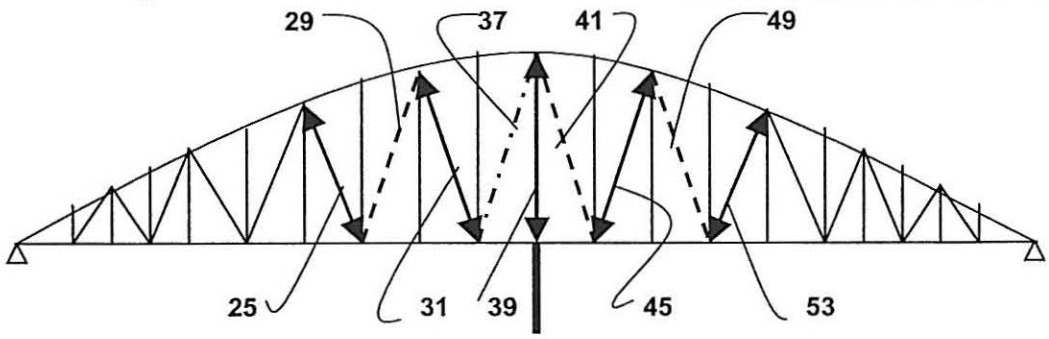
Location	Type of Distress	Repair/ Modification Type	Location/Detail References	Comments
J7	Strut Moderate Check	Replace	T1 to T2	No Comment
M21	Compressive Overstress	Type 4	Det. I-TR7	Doors – New Col. 2x(s) Added to Web
M25	Tension Overstress	Type 3	Det. K-TR6, Det. G-TR8 (Opp.)	Doors – New Col. Stl Rods Supplement Webs
M26, M30, E.	Severe Split	Type 2	Jt. 13/Det.F-TR 7 to Jt. 17/Det. G-TR7	Doors – New Col. Anchor Stl Extends Beyond Problem, Tension Tie
M29	Compressive Overstress	Type 4	Det. I-TR7	Doors – New Col. 2x(s) Added to Web

STRUCTURAL

M31	Tension Overstress	Type 3	Det. K-TR8	Doors – New Col. Loads Transferred Further up Web Anchor Stl
J15	Strut Severe Split	Replace	TR1 to TR2	No Comment
M47	Tension Overstress	Type 3	Det. K-TR8	Doors – New Col. Loads Transferred Further up Web Anchor Stl
M49	Compressive Overstress	Type 4	Det. I-TR7 (Opp)	Doors – New Col. 2x(s) Added to Web
M53, E.	Severe Split, Tension Overstress	Type 3	Det. K-TR6 (Opp), Det. G-TR8	Doors – New Col. Stl Rods Supplement Webs
M57	Compressive Overstress	Type 4	Det. I-TR 7 (Opp)	Doors – New Col. 2x(s) Added to Web
1.	Repair drawings 1987/88 are for end trusses hangar 2 and 6. Interior trusses are not included. Hangar 3 and interior trusses are included in the Paul Bunyan Shop Drawings.			
2.	Truss 9 has similar repairs to Truss 2.			
3.	Overstressed members directly relate to the installation of the new doors.			
4.	Checks and splits are not necessarily due to overstress. The members not directly related to the installation of the new doors may have been overstressed as a result of checks and splits. Checking/splitting are to be expected as the members dry. The timbers likely came from the northwest, a wet environment. Installing them in the interior of Alaska, a dry environment will result in severe shrinkage over a very short period of time. The shrinkage results in significant volume change transverse to the grain. Splitting and checking occurs as a result of the shrinkage. The steel hardware used to connect the truss elements together will interfere with the natural shrinkage resulting in splits at the anchors /fasteners.			
5.	The repairs made during 1988 are 43 years after the timber was first installed. The timber should be relatively stable allowing the modifications to perform as designed.			
6.	Photo – S1-ALL, Bottom Chord Tension Tie, split Repair			
7.	Photo – S2-ALL, Top Chord Split Repair			

STRUCTURAL

The following is from the information in the tables on the truss repair sheets TR3 and TR4.



Bowstring End Wall Truss 6-1 and 6-9
Hangar 6

Table 6-1 includes the following information: (Hangar 6, West End Wall Truss)

Location	Type of Distress	Repair/ Modification Type	Location/Detail References	Comments
M1	Joint Subject to Severe Splits	Type 1	Det. E-TR8	No Comment
M25	Compressive Overstress	Type 4	Det. I-TR7 (Opp)	Similar to Hangar 2
M29	Tension Overstress	Type 3	Det. B-TR8, Det. G-TR8	Similar to Hangar 2
M33	Compressive Overstress	Type 4	Det. I-TR 7 (Opp)	Similar to Hangar 2
M37, M41	Tension Overstress	Type 3	Det. F-TR6	Similar to Hangar 2
M39	Compressive Overstress	Type 4	Det. H-TR7	Similar to Hangar 2
M45	Compressive Overstress	Type 4	Det. I-TR7	Similar to Hangar 2
M49	Tension Overstress	Type 3	Det. B-TR8 (Opp), Det. G-TR8 (Opp)	Similar to Hangar 2
M53	Compressive Overstress	Type 4	Det. I-TR7	Similar to Hangar 2
M66, 70, 74, 77 W, M77 E.	Severe Split·	Type 2	Jt. 33/Det. G-TR7 (Opp) to Jt. 37/Det. J-TR7 to Jt 40/Det. D-TR 6 (Opp)	No Comment
M76	Joint subject to Severe Splits	Type 1	Det. E-TR8 (Opp)	No comment
See Table 2-1 previous sheets.				

STRUCTURAL

GRAVITY SYSTEM/FRAMING

Gravity System

The hangar is typically framed with wood decking spanning north to south from timber purlin to timber purlin. The purlins span east to west and are supported by bowstring clear spanning trusses. The trusses span from south to north and are supported by timber post/column each end. Between the columns at the north and south wall are wood framed stud walls with diagonal sheathing on the hangar inside face with horizontal siding over the sheathing. The outside face of the wall, between the sloped lean-to roof and the lean-to flat roof has diagonal board sheathing applied to the studs. Below the lean-to flat roof and the 1st floor the outside of the face of the wall, inside to the lean-to, is covered with gypsum board. The east and west hangar walls are wood stud walls with exterior diagonal board sheathing and horizontal board siding on the outside face. The walls extend from the curb at the first floor to the top of the hangar door opening. The floor is a concrete slab on grade sloping to interior drains. Around the perimeter of the hangar is a continuous concrete foundation wall and curb supported by a continuous footing. The curb is discontinuous at the hangar doors. The columns bear on concrete pilasters and the pilasters are supported by spread footings.

The lean-to each side of the hangar is typically framed with 2x roof sheathing spanning east to west supported by 2x rafters supported at the load bearing stud wall at the eave and the load bearing high wall, for the lean-to, each side of the hangar. The flat roof below the sloped roof is framed with 2x joists from the outside load bearing wall to the inside hangar load bearing wall, load bearing for the lean-to. The second floor is framed similar to the roof with 2x joists framing from the outside wall to a beam line half way across the depth of the lean-to and from the beams to the inside wall at the hangar. The interior beams supporting the second floor framing are supported by wood post/columns matching the spacing of the columns for the hangar at approximately 25 ft. Knee braces extend from the columns to the beams reducing the span of the beams. The Lean-to outside wall is a wood load bearing shear wall extending from the 1st floor to the flat roof and eave of the sloped roof. At the 2nd floor the walls are platform framed. The first floor is a concrete slab on grade and the perimeter foundation walls are concrete. The foundation walls bear on continuous concrete footings at the exterior and interior. The exterior footings are 4 ft. to bottom of footing and the interior footings are 1' – 8" to bottom of footing. The post/columns are supported by concrete piers supported by spread footings 1 ft. to top of footing below the finish floor slab on grade.

Wood framed buttresses are framed at the outside face of each hangar truss/column line. They extend from the top of the column at the hangar trusses through the lean-to roofs, through the second floor to the interior footings. The inside leg is the column/post supporting the bowstring truss and the outside leg is diagonal extending to the interior column/post line half the distance across the lean-to.

STRUCTURAL

ROOF

Description

Hangar Central Arched High Roof

Decking/Sheathing

The roof is framed with 2x T & G decking from the intersection of the sloped roof on one side, over the arch, to the intersection of the sloped roof on the opposite side. The deck spans 7.3 ft at the eaves to 8.5 ft at the high point. The decking is placed perpendicular to the supporting purlins. The lay-up of the decking, random, single span or two-span is uncertain. The decking was evaluated for all three configurations for comparison with random lay-up used as the controlling configuration. Attachment of the decking to the supporting purlins is unknown, anticipated to be approximately 2 – 16d common nails at each support.

Purlins

Supporting the decking are solid sawn timber purlins. The purlins 5 3/8" x 14 ½" are laid east to west and spaced from 7.3 ft at the eave to 8.5 ft at the ridge. The purlins are single span members spanning 25 ft supported at each end by a bowstring truss. The purlins are placed normal to the radius of the arch. They are vertical at the ridge, as they approach the side roof they rotate from vertical approximately 30 degrees. The rotation from vertical, most significant near the hanger eave – intersection with the low roof – has caused the first two purlins from the eave up each side to deflect, bow, parallel with the slope of the roof 2" to 3" out of plane and in some cases has promoted splits across the width of the member, see S3-ALL. The purlins are water stained. The most significant staining is at the first two purlins up from the eave each side of the hanger, see photo S4-ALL. The staining diminishes the higher the purlin is up the roof slope. This staining is typical to all of the hangars. The degree, extent of the staining, is further defined in the narrative specific to each hangar. The connection of the purlin to the supporting bowstring truss is uncertain. Based on the original drawings for the designed lean-to roof truss they may be bolted into place with an angle one side with bolts through each leg through the purlin and top chord.

Bowstring Trusses

Supporting the purlins are bowstring trusses. The trusses span 152 ft north to south and are spaced 25 ft on center. The depth at the center of the bowstring, out to out, is approximately 21' – 6" and at the eave, intersection with the sloped side roof, 1 ft. The radius of the bowstring is uncertain, older drawings indicate 142 ft. Based on the information provided on the 1987/88 repair drawings a radius of 151 ft to the approximate centerline was determined and used for the analysis of the truss. A larger radius will produce higher forces in the members and is therefore conservative. A bowstring truss, when properly designed has the unusual feature of having very small forces in the web members. The configuration of the typical hangar truss yields the expected results, minimal force in the webs. The construction of the truss radius was achieved by segmenting the top chord between each pair of web members.

STRUCTURAL

The top chord is made up of (3) 5 ¼ " x 11" solid sawn members. The bottom chord is also (3) 5 ¼" x 11" solid sawn members. The webs are typically (2) 3 ½" x 5 ½" solid sawn members.

Connection evaluation for the trusses are based on original drawings of the designed lean-to trusses each side of the hanger. The information provided on the 1987/88-Truss Repair Drawings combined with information gathered from visiting the site was used to assist with the evaluations.

The top chord compression connection is typically spliced with 3 ½" x 11" solid sawn members fit between the chord members and bolted together with ¾" ∅ thru bolts and 4" diameter split rings.

The bottom chord is spliced with 3 ½" x 11" solid sawn sections between the chord members and (2) 5 ¼" x 5 ¼" members, one above the other, on the outside face of the outer chord member, each outside face. This bottom chord tension splice is bolted together with ¾" ∅ thru bolts and 4" ∅ split rings.

The top and bottom chord end connection has the top chord passing over the bottom chord. The bottom chord end is cut on a slope to permit the top chord to pass over. Between the chords are 3 ½" sections similar to the splice connections. Added to these connections are ¼" steel plates fit between each chord face and the face of the 3 ½" member with plates also provided on the outside face of the truss chord. The plates are thru bolted with ¾" ∅ bolts and 4" ∅ shear plates at the face of the wood members. An L4x3x3/8 is welded to the face of each outside plate with (2) ¾" ∅ bolts through the horizontal leg of each angle through a PL ½" thick laid across the supporting column. Vertical ½" plates are welded to the bearing plate each side of the column with 2 – ¾" ∅ through bolts. Welded to the horizontal and vertical plates, to the hangar side of the column, is a triangular PL ½" each side of the column/post.

The two members of each web are typically inserted between the three chord sections each end of the web. (1) ¾"∅ through bolt with 4" ∅ split rings is extended through from one side to the other. The webs have a spacer block at approximately ½ of their length with a through bolt anchoring the block in place.

Bottom chord stabilizing struts 8 x 12 are typically placed transverse to the bottom chord. They are placed at approximately equal distance apart along the length of the bottom chord with one at center span and two each side. They bear on the top of the bottom chord and are attached strut to strut with a 2 x 12 each face with one through bolt each strut and one at the truss web, for (3) ¾" ∅ through bolts each truss.

Bottom chord stabilizing "X" bracing, approximately 3 x 8, occurs at approximately 1/3rd points of the truss span. The 3 x 8 members are from the bottom chord of one truss to the top chord of the next truss. They are spaced between the trusses every other truss.

Interior Catwalks

The interior catwalks typically extend from the east end of a hangar to the west down the middle of each hangar. At the east and west end the catwalk extends from the north to south wall along inside bottom chord of the end truss. Approximately centered between the east and west end is another section of catwalk from the north wall to the south wall. The catwalks are typically accessed by ladder or stairs central to the north or south wall up

the face of the wall to the central section of catwalk. The framing is generally light lumber framing of 2 x 4 and 2 x 6 members with plywood sheathing over the transverse joist sections. The catwalks are suspended from the trusses or bear on the truss bottom chord or truss stabilizing struts.

Sloped Roofs Over East/West Hangar Doors

Decking/Sheathing

The roof is framed with 2x T & G decking from the eave to the intersection of the hangar outside high wall. The decking, similar to the hangar high roof, spans north to south and is supported at approximately 7.3 ft to 8.5 ft. The decking is placed perpendicular to the supporting top chord of the shed roof truss. The lay-up of the decking, random, single span or two-span is uncertain. The decking was evaluated based on the random lay-up configuration. Attachment of the decking to the supporting purlins is unknown, anticipated to be approximately 2 – 16d common nails at each support.

Trusses

Supporting the decking are trusses spaced at 7.3 ft to 8.5 ft matching the spacing of the vertical webs of the high roof end truss. The top chord is a 3 x 8 and the bottom chord is a 3 x 10. Both the top and bottom chord extend, cantilever from the hangar truss's vertical webs outward (east/west) from the outside wall. The top chord intersects the high wall at approximately 40' above finish floor. The bottom chord bears on the top of the hangar truss bottom chord. The top and bottom chord intersect at the eave at approximately 7 ft from the face of the hangar wall. The slope of the top chord is approximately 5:12. Each chord is bolted to the vertical web of the hangar truss with one through bolt. Split rings do not appear to be present. The connection at the eave is unknown, anticipated to be a single bolt through each member with washers similar to the connection at the hangar truss.

Supported from the bottom chord of each truss are the steel guide rails used previously for the original sliding hangar doors. They appear to be suspended from the chords with through bolts and steel straps. Enclosing the truss framing is a soffit and facia framed with 2x 4s spaced at approximately 2 ft o.c. The facia is hung from the end of the trusses. The hangar wall and facia framing support the soffit framing. The soffit restricts access with bird screen.

Lean-To Added Low Sloped Roof

The present low-sloped roof was added above the original Lean-To low flat roof.

Decking/Sheathing

2x decking spans north to south supported by joists at 2 ft o.c. The decking starts at the eave and extends to the intersection of the hangar roof and wall. Attachment of the decking to the supporting purlins is unknown, anticipated to be approximately 2 – 16d common nails at each support.

STRUCTURAL

Roof Rafters

The rafters are indicated as 2 x 12s at 2 ft o.c. They appear to lap with the original roof rafters and bear on the outside stud wall extending out approximately 1 ft. The hangar wall supports the top end of the rafter. The support configuration at the top is unknown; they may lap the sides of studs and bear on an inlet plate or bear on stud wall top plates or bear on a ledger nailed to the face of the wall.

Lean-To Low Original Flat Roof

Decking/Sheathing

The roof decking is uncertain. The original drawings indicate the roof would have been framed with 2x framing similar to the other roofs. A roofing upgrade notes (2) ½" sheathing layers. The roofing upgrade drawings indicate the roof sheathing is supported at 1 ft o.c. and spans east to west. Attachment of either material is unknown.

Field observations do confirm plywood type sheathing does exist below the old flat roof roofing.

Roof Joists

The joists are noted on a re-roofing project as 2 x 12s at 1 ft o.c. They are shown as spanning from the hangar wall to the outside wall of the Lean-To, approximately 25 ft. They appear to bear on the top plates of the outside wall; no clear detail of how they are supported has been found. A girt in the hangar wall occurs at slightly below where the joists would intersect the stud wall. They may bear on stud wall plates, be lapped with the studs, bear on a let-in member or be bearing on a ledger nailed to the face of the wall.

Condition

Hangar Central Arched High Roof

Decking/Sheathing – See individual hangars for specific conditions

The high roof 2x decking is typically covered with a paper type insulation held in place with battens every few feet up and down the slope and across the slope. The insulation is generally intact; there are areas where it is torn away or falling away. The insulation is old and appears to have been wet, likely during the winter months due to condensation on the under side of the roof. In past years, prior to the EPDM roofing being applied, the roofing may have leaked at the joint between the shed roof below over the lean-to and the hangar roof above. The poorly insulated, hot, high roof likely melts the snow causing water to run down the roof until it reaches the shed roof where it freezes. The ice likely extends up from the intersection of the two roofs approximately 15 ft to 20 ft and in that space has penetrated past roofing. The insulation hides most of the 2x decking except for those few areas where it has fallen away or is torn.

The purlins are exposed to view. The purlin faces are water stained, evidence of the moisture problem. The first two purlins up from the hangar north and south walls are water stained similarly in all three hangars. The higher up the roof the less water stains can be seen. Dry rot does not appear to be associated with the water stains, however

STRUCTURAL

from past experience it is very likely that some of the decking at the interface of the purlins and the decking is rotted.

Purlins – See individual hangars for specific conditions

As noted above the old insulation appears to have been wet during past winters and the purlin faces are water stained to varying degrees. The purlins closest to the intersection of the high roof and hangar outside wall show similar water staining in each of the hangars. The higher up the roof the less water stains can be seen. The purlins could not be physically accessed to verify the extent damaged from dry rot. As noted above, past experience with similar conditions, conditions where the sheathing lays directly on the purlin, implies that dry rot to some degree will exist where the two elements interface.

Bowstring Trusses – See individual hangars for specific conditions

1987/88 Repairs:
The bowstring end trusses were repaired in 1987 and 1988 for the replacement hangar doors provided in all three hangars. Around the same time the interior trusses were also repaired in like fashion to the end trusses. The repairs were made for various reasons, appearance, structural integrity compromised by splits and checks at member connections allowing bolts to slip or become ineffective, member overstresses due to the splits and checks, moisture damage (dry rot) and suspension of mechanical piping and equipment from the truss members without proper review of the attachment point or how attached.

The repairs replaced fasteners, increased the number of fasteners, reconfigured the connections, by-passed the existing connections with new connections, added new web elements, replaced severely damaged truss stabilizing elements, repaired splits and checks through the applications of adhesive and steel clamps-permanent, of tube sections and channel sections. A photo record of the repairs made at the time of the repair was not available for comparison to the present condition of the trusses.

"Truss Inspection Report 2000 Fort Wainwright, Alaska" Draft
The report was prepared buy the Corp. of Engineers and provided as part of the request for proposal. The report is fairly general. The report notes the members are severely checked and split, that the effectiveness of the repairs is doubtful, and that some of the trusses were overstressed at the time of the 1987/88 repairs and remain overstressed at the time of the report. (See previous comments regarding the truss repair drawings, 1987/88 and the report, 2000)

Some of the observations made September 16, 17, 18, 2000 regarding the condition of the trusses from visual inspection are noted here. The evaluation of the trusses, including level of stress, etc. is noted under, "Evaluation Results".

The condition of the trusses is evaluated similar to the evaluation information provided to estimate the cost of the repairs and upgrades. See the Condition data provided as part of the estimate for repair. Some of the requirements are not included where not applicable/significant to the structural evaluation.

STRUCTURAL

Condition Key

Good

- The element is intact, structurally sound and performing its intended purpose.
- The element needs no repair and only minor or routine maintenance.
- * A connection where a bolt may pass through a split and a repair has been made. The repair continues to perform without evidence of further distress.

Fair

- There are early signs of wear, failure or deterioration, though the element is generally structurally sound and performing its intended purpose.
- * Noticeable splits and checks are observed requiring regular observation to prevent the structure from becoming classified as poor and becoming a threat to occupant life safety.

Poor

- The element is no longer performing its intended purpose.
- The element is missing.
- The element shows signs of imminent failure or breakdown.
- The element requires major repair or replacement.
- * The element presents a threat to life safety.
- * A connection where a bolt may pass through a split without a repair being evident, requires an immediate repair, requires continual observation until repair is made. The snow load would likely require monitoring with maximum depth of snow defined requiring removal of snow or evacuation of the facility.

Priority Key

Critical

- Advanced deterioration has resulted in failure of the building element or will result in the failure of the building element if not corrected within 2 years.
- There is a threat to the health and/or safety of the user.

Serious

- Serious Deterioration, not corrected in 2 –5 yrs, will result in failure of the building element.
- Threat to user health/safety may occur 2-5 yrs if deterioration is not corrected.

Minor

- Preventative maintenance and building conservation have not been followed.
- There is reduced life expectancy of affected or related building materials/systems.
- There is a condition with long-term impact beyond 5 years.

→The condition of the bowstring trusses generally appears to be good.
→Dry rot of the truss elements was not observed. Likely none exists.
→The repairs appear to be effective.
→The repairs observed do not show signs of overstress.
→The appearance of the truss is not necessarily without blemish or minor splits, checks.

STRUCTURAL

Interior Catwalks – See individual hangars for specific conditions

The condition of the interior catwalks is generally good in all hangars. Broken or damaged members were not observed. Access along the catwalks at the elevation of the bottom chords is good, generally unobstructed, mechanical and electrical intrusions are few and minor where they occur. Handrails are present throughout. Access to the catwalks differed at each hangar; see the individual hangars for specific conflicts.

Hangar East/West Hangar Door Sloped Roofs

Decking/Sheathing

Condition of the 2x decking appears to be good. The underside of the roofing could be seen in one or two places along the length of the roof. Greater access requires removal of the plywood panels placed, nailed in place in what previously were openings provided for access. Insulation is not provided in the roof over the doors. This minimizes icing problems and trapped moisture against the underside of the decking.

Trusses

The condition of the truss framing over the entry doors appears to be good except where the top chord ties back to the vertical web of the end wall truss. Both the top and bottom chord where attached to the vertical web are split at approximately 30 % of the members, see photo S5-ALL. The overhanging roof at each hangar is deflecting downward from the sides of the hangar across the 152 ft space between the enclosed side accesses to the hangars.

Lean-To Added Low Sloped Roof

Decking/Sheathing

Condition of 2x decking is unknown. The decking is hidden beyond fiberglass insulation installed against the bottom to the decking.

Roof Rafters

Condition of the roof rafters is uncertain. The bottom edge of the rafter extends the depth of the insulation and is occasionally visible. The visible portion of the member appears to be in good condition.

Lean-To Low Original Flat Roof

Decking/Sheathing

The type of decking/sheathing is believed to be plywood sheathing similar to what is shown on the reroof drawing for the lean-to. A gypsum ceiling attached directly to the bottom of the roof joist generally restricts the access to the underside of the flat roof. Access to the space was found at the second floor northwest corner open office space of Hangar 6. The access did not provide a clear view of the space above the ceiling. From the condition of the ceiling gypsum board the ceiling space appears to be dry.

STRUCTURAL

Roof Joists

The condition of the roof joists is uncertain. Access to the joist's space is limited as noted above. From the condition of the ceiling and general appearance of the roofing, from above in the attic type space over the lean-to, the joists are likely in good condition. They appear to be sized and spaced as noted on the existing re-roofing drawings.

Evaluation Results

Hangar Central Arched High Roof

Decking/Sheathing – 2x Perpendicular to Supports

Current Wainwright Snow = 50 psf, IBC 2000 Snow = 36 psf						
	Exist. Deck + Exist. Roofing = 6.5 psf (Includes Battens)			Exist Deck + New Roofing 15.0 psf (Includes Sleepers)		
Span / Snow	Single Span	Random Lay-up	Two Span	Single Span	Random Lay-up	Two Span
Balanced Sn = 50 psf L/150	Okay	Okay	Okay	No Good	Okay	Okay
Unbalanced Sn, P_f = 50 psf	No Good	NG 32 ft From Ridge	Okay	No Good	NG 32 ft From Ridge	Okay
Balanced Sn = 36 psf L/150	Okay	Okay	Okay	Okay	Okay	Okay
Unbalanced Sn, P_f = 36 psf	No Good	Okay	Okay	Okay	Okay	Okay

Purlins

Current Wainwright Snow = 50 psf, IBC 2000 Snow = 36 psf				
Exist Purlin + Deck + New Roofing 18.5 psf (Includes Sleepers), L = 25 ft, Deflection L/150				
Existing Purlin 5 3/8" x 14 ½" @ 7.5 ft	P_f = 50 psf Balanced	P_f = 50 psf Unbalanced	P_f = 36 psf Balanced	P_f = 36 psf Unbalanced
	No Good	No Good	Okay	No Good
Additional Purlin G.L. 5 1/8 x 13.5 From Eave to Crown As Noted	1 Purlin 1st Space Alternate Remaining Spaces	4 Purlins 1st 4 Spaces Alternate Spa Next 3 Purlins	No Added Purlins	1 Purlin 1st Space Alternate Remaining Spaces

STRUCTURAL

Bowstring Trusses

Analysis completed for unit load of 1.0. Modified, multiplied for the ratio considering the roof design snow load for Ft. Wainwright of 50 psf. IBC 2000 roof design snow load evaluation is included by inspection.

Truss Members were analyzed for load combinations
1. DL (Existing Roofing) + Sn (Balanced)
2. .67 DL (Existing Roofing) + Wind (Uplift)
3. DL (New Roofing) + Sn (Balanced)
4. .67 DL (New Roofing) + Sn (Balanced)
5. DL (Existing Roofing) + Sn (Unbalanced)
6. DL (New Roofing) + Sn (Unbalanced)

Truss member capacities and connection capacities are sufficient to resist the applied forces. The repairs, from observing the trusses and individual elements are believed to be functioning as intended, restoring the strength of the truss members and connections to an undamaged condition.

Interior Catwalks

Evaluation was not performed specifically for the interior catwalks. The catwalks are evaluated based on observation of their performance during use. No unusual behavior was noted during use of the catwalks. The catwalks were stable and presented no unusual challenges, except as noted for each individual hangar.

<u>Hangar East/West Hangar Door Sloped Roofs</u>

Decking/Sheathing

The roof decking/sheathing is similar to the roof decking/sheathing for the hangar high roof. Similar results to the hangar roof apply to the hangar door shed roofs at the east and west ends of the hangar except the shed roof would not receive an unbalanced snow loading. A snowdrift load might be considered based on the length of the high roof. Drifting from the high roof to the low roofs is believed to be very unlikely. The crown of the arch is historically bare with the roofing presently in place. Modifications to the roofing, as recommended in this report, are not expected to change the amount of drifted snow that might accumulate on the shed roofs. The shed roofs pass by the high roof near the eaves reducing the length of shed roof below the high roof.

Trusses

The truss top chord and bottom chord are believed to be sufficient to support the snow loads as noted above under decking/sheathing.

Shed roofs do require some modifications due to the damaged observed during the site visit. Modifications suggested are noted under recommendations.

STRUCTURAL

Lean-To Added Low Sloped Roof

Decking/Sheathing/Roof Rafters

Existing decking is not evaluated due to the recommendations made in this report to remove the sloped roofs over the lean-to(s). The roofs were added after the original construction was completed.

Lean-To Low Original Flat Roof

Sheathing

The roof sheathing, two ½" layers are sufficient to support the applied design loads individually, including the snowdrift load.

Roof Joists

The roof joists, 2 x 12s at 1 ft. centers are insufficient to support the new roofing plus the snowdrift load. Add 2 x 12s between every other existing 2 x 12 joists. Pavers cannot be supported with the recommended spacing. Additional evaluation will be required.

Recommendations

Recommendations are made based on the roof design snow load of 50 psf for Ft. Wainwright. Recommendations include the weight of the new roofing.

Hangar Central Arched High Roof

Decking/Sheathing

- Replace approximately 3200 sq. ft. of existing 2x decking due to dry rot.
- To support the 2x decking add new purlins between the existing purlins, starting at the eave place the purlins up the roof arch for approximately 48 ft each side of the crown. Number of purlins to add each hangar, 96.

Purlins

- Add new purlins, G.L. 5 1/8 x 13 ½, between existing purlins for the first four spaces from the eave toward the ridge. Add purlins every other space for the remaining spaces to the crown each side of each hangar roof. Number of purlins to add to each hangar, 112.

The purlins being added between the decking/sheathing and the existing purlins totals 112 per hangar.

Bowstring Trusses

- Due to previous damage and subsequent repairs, it is recommended that the trusses be monitored on a regular basis with changes in condition noted and acted upon as appropriate to the changed condition.

STRUCTURAL

Interior Catwalks

- Correct conditions that inhibit access to the catwalks by personnel observing the condition of the trusses. Correct the access as presently exists in conformance with Code safety requirement.

Hangar East/West Hangar Door Sloped Roofs

Decking/Sheathing

- Replace existing decking where rotted. Anticipated to be less than 5%.

Trusses

- Remove existing steel door rails and supports from the roof space.
- Correct the downward tilt of the shed roof, correct to horizontal by means of horizontal or vertical shoring prior to adding the additional members noted here.
- Replace split members with new 3 x 8 members, approximately 30% of the top and bottom chords, approximately (6) members each truss each end for (12) members each hangar. Install shear plates each member, top and bottom chord, between the chord members and the hangar truss vertical webs, approximately (80) shear plates each hangar.
- Replace the bottom chord horizontal struts between the end truss and the 2nd truss in from the outside wall. Replace at 1/3 points with G.L. 8 ¾ x 12. Add diagonal struts from the bottom chord of the 2nd truss from the outside wall to the purlins at the top chord of the third truss, see photo S6-ALL.
- Extend top chord member from the intersection of the top chord with the end wall truss vertical web to the bottom of the roofing beyond the 2nd truss, 4 x 12. Insert intermediate headers, 4 x 12, between the high roof purlins intersecting the diagonal strut from the end wall. Provide (4) 4x12 diagonals and (4) 4x12 intermediate headers each side of roof crown for (8) diagonals and (8) intermediate headers, (16) of each at each hangar.

Lean-To Added Low Sloped Roof

Decking/Sheathing

- Remove existing decking/sheathing and expose the flat roof below.

Roof Rafters

- Remove the existing rafters and expose the flat roof below.

Lean-To Low Original Flat Roof

Decking/Sheathing

- Replace the sheathing along the longitudinal edge of each roof. Approximately 4 ft wide x 200 ft. long each roof, (2) ½" sheets. Include blocking at the outside edge and interface with the existing sheathing.

STRUCTURAL

Roof Joists

- Add between every other roof joists an additional 2 x 12 roof joist. Approximately 200 – 2x12 each hangar.

LEAN-TO 2ND FLOOR

Description

Decking/Sheathing

The floor decking could not be verified without physical demolition of the flooring and therefore was not verified. The original drawings indicate the floor sheathing as 1" x 4" vertical grain fir flooring, laid perpendicular to the floor joist, over 1" x 8" sheathing laid diagonal to the floor joists. Attachment of the diagonal floor sheathing is likely 2 – 16d nails each board, each support. The floor sheathing spans 1.33 ft from floor joist to floor joist.

Joists

The floor joists are noted on the original drawings as 2 x 10s at 1.33 ft o.c. The joists span from the interior hangar wall to post and beam support at approximately 12.5 ft from the hangar wall and from the support at 12.5 ft to the exterior wall. In all cases the joists are shown bearing on the supports, not supported by lapping with the studs or bearing on a ledger nailed to the face of the wall studs/header beam or central beam, platform framing appears to be the framing type.

Beams/Headers

The hangar side of the floor framing, from the original drawings, incorporates (3) 3x8s laminated together between the hangar columns. The floor joists are indicated as bearing on the 3 x 8s. The connection at the end of the floor joists is uncertain. The original documents show the outside wall but not the inside wall. At the outside wall if they had used trusses for the roof and posts to support the trusses the posts may have been cut at the floor and the 3x8s would have rested on top of the lower section. Steel sections would then have extended down the face of the 3x8s tying the 3x8s and the post together. The interior columns are single sections. The 3x8s may bear on a jamb stud or studs nailed to the face of the columns.

Down the center of the space from east to west, from the east end to the west end are beams made up of (3) 3 x 12s and (1) 2 x 12. The beams support the floor joists and are supported by posts at 25 ft centers and knee braces from the posts. The knee braces intersect the beams at approximately 7 ft from the posts each end of the beams.

At the outside wall, similar to the inside wall, (3) 3 x 8s are noted on the original drawings as headers spanning 25 ft and supported by posts. Posts that would have supported the roof trusses designed for this space are not installed. No posts protrude from the walls, the posts were noted as 12" x 12" and would have protruded from the wall, if they were used. If the (3) 3x8s are used they may be continuous from the east end to the west end of the Lean-To or be framed over the openings with jamb studs each side of the openings.

STRUCTURAL

Condition

The floor framing was not accessible for direct observation without demolition of existing materials.

Decking/Sheathing; Joists; Beams/Headers

The condition of the diagonal floor sheathing, the floor joists, the beams and the columns/posts are believed to be good. No soft spots or extensive water staining was noted. Observations of the floor in general did not reveal conditions that might indicate damage to the floor framing.

Evaluation Results

Decking/Sheathing; Joists; Beams/Headers

The existing framing was evaluated based on the information gathered while on site and from the existing drawings. Physical observations of the material confirming sizes and spacing was not made due to the lack of access. The framing based on the observations made and the existing drawings is sufficient to support the anticipated design loads.

Recommendations

- Prior to remodel and upgrade design it is recommended that the framing be verified to the greatest extent possible.

WALLS

Description

Exterior Hangar Walls

Original exterior hangar walls exist on the north and south side of each hangar above the original Lean-To flat roof to the intersection of the hangar roof with the present sloped roof from the east end to the west end of the hangar.

Sheathing

The hangar walls are typically sheathed with 1" x 8" board sheathing applied diagonally to the supporting studs on the outside face. On the inside face is 1" x 8" diagonal board sheathing against the stud face, then ¼" gypsum and over the gypsum is 1x horizontal siding. The attachment of the diagonal sheathing to the studs is uncertain, likely 2 – 16d each board, each stud.

Studs

The wall studs, as originally designed, are generally classified as non-load bearing. They are noted as 2 x 6 spaced at 1.3 ft centers. Field observations generally confirm the size and spacing.

With the Lean-To sloped roof as presently framed they are load bearing.

STRUCTURAL

Columns/Posts

The hangar walls incorporate wood 12" x 12" post/column like pilasters. The columns are spaced at 25 ft centers and extend as a single piece from a small pedestal above finish first floor past the second floor and original flat roof to the bottom of the bowstring trusses 36 ft above finish floor.

Exterior East/West Hangar Door Pocket Walls

The door pocket walls exist on the east and west end of the hanger, are east and west walls approximately 15 ft from north to south each end of the hangar door and include the ends at the north and south ends of the doors.

Sheathing

The hangar door pocket walls are typically sheathed with 1" x 8" board sheathing applied diagonally to the supporting studs. The attachment to the studs is uncertain, likely 2 – 16d each board, each stud.

Studs

The studs appear to be 2 x 6 spaced at 1.3 ft centers. They also appear to be load bearing. The door repair drawings show "X" bracing and girts spaced up the height of the walls and across the face of the walls. From field observations the girts and "X" bracing do not exist. The studs, span full height from a curb at finish floor to the shed roof at 37 ft to 40 ft on the sides. (Clear span on the east and west face should be reduced to 3rds)

Interior Hangar/Lean-To Walls

The interior hangar/lean-to walls separate the hangar from the two-story lean-to side structures from the top of the original flat roof of the lean-to to the slab on grade.

Sheathing

The interior hangar/lean-to walls are similar to the exterior hangar walls above. The hangar side of the wall has 1" x 8" diagonal sheathing against the face of the studs with ¼" gypsum over the diagonal sheathing. Over the gypsum is horizontal siding. The lean-to side of the wall typically has gypsum sheathing applied to the face of the studs. The attachment of the diagonal sheathing is likely 2 – 16d each board, each stud.

Studs

The wall studs, as originally designed, were non-load bearing. They are noted as 2 x 6 spaced at 1.3 ft centers. Field observations generally confirm the size and spacing. Presently it appears the studs may be load bearing. The studs likely support the flat roof joists. The floor joists are detailed to bear on a (3) 3x8 header. They may; however, the bearing condition at this wall could not be confirmed.

Columns/Posts

Similar to the higher section of wall, common to the hangar only, the lower section of wall between the hangar and lean-to incorporate the 12" x 12" post/column like pilasters. The

columns are spaced at 25 ft centers and extend as a single piece from hangar and lean-to first floor to the underside of the bowstring truss. Support of the bowstring is the primary purpose of the columns/posts. Per the original drawings they may support part of the load from the flat lean-to roof and lean-to second floor.

Lean-To Exterior Walls

Sheathing

The exterior lean-to walls have 1" x 8" diagonal sheathing applied to the face of the wall studs. Over the diagonal sheathing is horizontal board siding. Gypsum sheets are applied to the inside face of the studs. The attachment of the diagonal sheathing is likely 2 – 16d each board each stud.

Studs

The wall studs are 2 x 6 at 1.3 ft centers and load bearing. The details from upgrades and repairs imply the roof joist bear onto double top plates and the floor joists bear onto double plates from the floor level down. The framing appears to be platform type. The original drawings indicated the floor joists and roof joists bearing on a (3) 3x8 header. They may; however, the bearing condition at this wall could not be positively confirmed.

Lean-To Interior Walls

Columns/Posts

The lean-to interior load bearing walls consist of timber posts 10" x 12" spaced at 25 ft centers matching the spacing of the hangar columns/posts supporting the bowstring trusses. From the posts to the central beams are knee braces at approximately 9 ft above finish floor first floor. The knee braces extend east and west from the column and intersect the center floor beams at approximately 7 ft from the column.

Condition

Exterior Hangar Walls

Sheathing; Studs

The existing framing was evaluated based on the information gathered while on site and from the existing drawings. Physical observations of the material confirming sizes and spacing was not made due to the lack of access. The sizes were determined based on overall dimension less the materials believed to exist around the member in question.

Columns/Posts

The columns/posts could be observed from the interior of the hangar. Some splitting and checking is present. The splitting and checking observed is typical for a heavy timber framed structure.

STRUCTURAL

Exterior East/West Hangar Door Pocket Walls

Sheathing; Studs

The sheathing and studs were generally exposed for observation. Dry rot or overstressed elements or connections were not observed.

However, the sills can be expected to be dry rotted.

Interior Hangar/Lean-To Walls; Lean-To Exterior Walls; Lean-To Interior Walls

Sheathing; Studs; Columns/Posts

The existing framing was evaluated based on the information gathered while on site and from the existing drawings. Physical observations of the material confirming sizes and spacing was not made due to the lack of access. The sizes were determined based on overall dimension less the materials believed to exist around the member in question.

The material is generally believed to be in good condition.

The sills at the foundation walls are expected to be dry rotted, approximately 100 ft. per hangar.

Evaluation

Exterior Hangar Walls; Exterior East/West Hangar Door Pocket Walls

Sheathing; Studs; Columns/Posts

- The framing based on the general observations made and the existing drawings, is sufficient to support the anticipated design loads.

Interior Hangar/Lean-To Walls

Sheathing; Studs; Columns/Posts

- The framing based on the general observations made and the existing drawings, is sufficient to support the anticipated design loads.

Lean-To Exterior Walls; Lean-To Interior Walls

Sheathing; Studs; Columns/Posts

- The framing based on the general observations made and the existing drawings, is sufficient to support the anticipated design loads.

STRUCTURAL

Recommendations

Exterior Hangar Walls; Exterior East/West Hangar Door Pocket Walls

Sheathing; Studs; Columns/Posts

- Prior to remodel and upgrade design it is recommended that the framing be verified to the greatest extent possible.

Interior Hangar/Lean-To Walls; Lean-To Exterior Walls; Lean-To Interior Walls

Sheathing; Studs; Columns/Posts

- Prior to remodel and upgrade design it is recommended that the framing be verified to the greatest extent possible.

FOUNDATION/1ST FLOOR

Description

Hangar and Lean-To

No notes are provided that might indicate type of fill, if any, below the footings or slab on grade. No information was found regarding compaction requirements for the soils, whether the soils were undisturbed or structural fill.

1st Floor

The first floor for the hangar and lean-to is a concrete slab on grade. The original drawings indicate the slab on grade to be 6" thick at the lean-tos. The hangar slab on grade is not specifically noted, likely 6" thick minimum. Reinforcing for the slab on grade is not noted.

The concrete slabs in the hangars slope to drain. In each hangar a single drain is provided. The original drawings indicated three drains in each hangar.

Exterior Foundation Wall and Footing

The original drawings detail the typical exterior foundation wall. The wall is 7 3/8" wide and extends below exterior grade approximately 40" to the top of the continuous footing. Top of wall is noted as 6" above finish floor and 12" above exterior grade. Field observations noted the height of the wall above finish floor and above grade varied from the design dimensions. The wall is reinforced with ½" ∅ bars spaced at 18" centers each way. The vertical bar appears to be hooked into the continuous footing. Anchor bolts, ½" ∅ x 0' – 8" are placed in the top of the wall and spaced around the perimeter at 2'-0" centers and approximately 3" from the outside face of the wall.

A continuous reinforced concrete footing is cast at the bottom of the wall, 8" Deep x 1' – 3 3/8" Wide. The bottom of footing is indicated to be 4'-0" below grade, minimum. (2) ¾" ∅ longitudinal bars reinforce the footing.

STRUCTURAL

Interior Foundation Walls and Footing

The original drawings detail the typical interior foundation wall. The wall is 7 3/8" wide and extends below the interior finish floor 1'-0" to the top of the continuous footing. The top of wall is noted as 6" above finish floor. Field observations noted the height of the wall above finish floor and above grade varied from the design dimensions. The wall is reinforced with (3) ½" ∅ horizontal reinforcing bars and ½" ∅ vertical reinforcing bars at 18" centers. The vertical bars may hook into the continuous footing; the drawings do not specifically indicate a hook.

A continuous reinforced concrete footing is cast at the bottom of the wall, 8" Deep x 1' – 3 3/8" Wide. The bottom of footing is noted as 1.7 ft. below finish floor. (2) ¾ " ∅ longitudinal bars reinforce the footing.

Interior Spread Footings Between Hangar and Lean-To

Footings supporting the 12" x 12" wood columns spaced at 25 ft centers along the north and south wall of each hangar are 6'-0" x 6'-0" x 2'-6" deep. The footings are 1'-0" below the finish floor to top of footing. The footing is reinforced at the bottom each way with (12) ½" diameter bars. The spread footing is integral with the interior wall continuous footing and reinforcing. From the top of the footing to 6" above grade is a pier, integral with the interior continuous foundation wall. The foundation wall reinforcing extends through the pier. The pier is reinforced with 4 – 1"∅ vertical reinforcing bars. The bars appear to extend to the footing mat reinforcing, hook and extend horizontally into the footing. The vertical reinforcing is tied in place with 2 - #2 rectangular ties. (4) Anchor bolts 1" ∅ x 3.0 ft. are placed east and west of the 12" x 12" wood column/posts. At the base of each pair of bolts are PL ¼" x 3" x 9". The angle clips for the column/posts fit over the anchor bolts tying the columns in place to the pier and footing below.

Interior Spread Footings At Lean-To For Hangar Buttress

Footings supporting the 10" x 12" wood columns spaced at 25 ft centers down the center of the lean-to also support the diagonal or back leg of the buttress at each of the trusses each side of the hangar. The footing is centered north to south on the back leg. The footings are 8'-0" x 8'-0" x 3'-6" deep. The top of footing is 1'-0" below finish first floor. The footing is reinforced at the bottom each way with (6) ½" diameter bars and at the top with (8) – ½" ∅ bars each way. Additionally (36) ½" ∅ diagonal bars are hooked around the bottom reinforcing and extend to the center of the footing at the level of the top reinforcing. From the top of the footing a pier 23 " x 16 " extends 6" above finish floor. The pier is reinforced with 4 – 1"∅ vertical reinforcing bars. The bars appear to extend to the footing mat reinforcing; no hooks at the bottom end of the bars are shown. The vertical reinforcing is tied in place with 2 - #2 rectangular ties. (4) Anchor bolts 1" ∅ x 4'-0" are place east and west of the 12" x 12" wood column/posts. At the base of each pair of bolts are PL ¼" x 3" x 9". Angle clips for the column/posts and back leg as may exist, fit over the anchor bolts tying the column and back leg to the pier and footing below.

STRUCTURAL

Condition

Hangar and Lean-To

1st Floor

The hangar and lean-to concrete slab on grade floors appear to be in good condition. The hangar floor is generally exposed to view; the lean-to floor is partially exposed.

Exterior Foundation Walls and Footing; Interior Foundation Walls and Footing

The material is generally believed to be in good condition. No unusual settlement, cracking or degradation of the surface materials was observed. See hangar 3 for specific concerns.

Interior Spread Footings Between Hangar and Lean-To; Interior Spread Footings At Lean-To Columns/Posts

The material is generally believed to be in good condition. No unusual settlement, cracking or degradation of the surface materials was observed.

Evaluation

Hangar and Lean-To

The evaluation is based on an assumed allowable soil bearing.

1st Floor

Evaluation analysis of the slab on grade at both the hangar and lean-to could not be made. Information regarding depth of concrete and reinforcing size and spacing was not available.

Exterior Foundation Walls and Continuous Footing;
Interior Foundation Walls and Continuous Footing

Evaluation of the exterior and interior foundation walls and continuous footings was completed based on the information provided on the original drawings.

The concrete walls appear generally sufficient to support the applied loads. The detailing of the walls is less than required by today's code requirements. The horizontal reinforcing is less than the minimum required and the vertical bars may not be hooked into the footings, the drawing is unclear.

Interior Spread Footings Between Hangar and Lean-To;
Interior Spread Footings At Lean-To For Second Floor Columns

The interior footing between the hangar and lean-to at the hangar columns is sufficient for the applied gravity loads.

The interior footings at the interior second floor columns/posts are sufficient to support the applied gravity forces.

STRUCTURAL

Recommendations

Hangar and Lean-To

1st Floor; Exterior foundation Walls and Continuous Footings; Interior Foundation Walls and Continuous Footings; Interior Spread Footings Between Hangar and Lean-To; Interior Spread Footings At Lean-To For Interior Columns/Posts

- Footings leave as they are, except as noted under "Lateral Systems/Framing" and for Hangar 3.

STRUCTURAL

LATERAL SYSTEM/FRAMING

Lateral System

The central hangar and lean-to(s) north and south of the hangar use flexible horizontal roof diaphragms to distribute the loads by tributary area to the vertical lateral force resisting systems. The lean-to flat roof below the sloped roof and the floor in each lean-to also resist and transfer lateral force effects with flexible horizontal diaphragms. The vertical force resisting elements transfer the lateral force effects to grade through the exterior north and south shear walls of the lean-tos; through shear walls at the east and west ends of the lean-tos and hangar; through a combination of shear walls and tension bracing at the north and south walls of the hangar, walls shared with the lean-tos and through the buttresses (braces) at the north and south ends of the bowstring trusses. The mass of the structure; self-weight and a percentage of the snow load comparable to the snow load included in the determination of the base shear resist the vertical component generated as a result of the lateral force effects. Force effects not countered by the mass of the structure above grade are further resisted by the mass of the foundations and soil interfaced with the foundations below grade.

ROOFS AND LEAN-TO 2ND FLOOR

Description (Horizontal Diaphragms, Force Resisting Elements)

Hangar Central Arched High Roof

The horizontal diaphragm is constructed with 2x T& G lumber running north to south parallel to the roof trusses, transverse to the roof purlins. The strength of the diaphragm is dependant on the span of the 2x lumber, the spacing and type of fasteners anchoring the lumber to the purlins and number of fasteners. Half the distance between the purlins are placed 2 x 6 members. These members help reduce the span of the diaphragm increasing the lateral strength of the diaphragm.

Hangar East/West Hangar Door Sloped Roofs

The horizontal diaphragm over the hangar doors is also constructed with T & G, 2x lumber spanning north to south between the top chords of the shed roof trusses spaced to match the vertical webs of the bowstring trusses. This diaphragm also gets its strength from the span of the 2x lumber, the spacing and type of fasteners anchoring the lumber to the purlins and number of fasteners. In the case of this roof the 2x that is placed halfway between the purlins is not present, was not observed, between the top chords of the trusses. The aspect ratio of the roof length, north to south, to the roof width, east to west, is favorable. The mass is limited by the small overall size of the roof and the distribution of the force effects from the mass of the roof transverse to the bowstring trusses. The mass, cantilevered out from the truss, is minimized due to the large ratio of the longitudinal/length of the roof to the transverse/width of the roof.

Lean-To Added Low Sloped Roof

The sloped roof diaphragm over the lean-tos is separated from the hangar roof by the wall common to the hangar roof and lean-to roof. The diaphragm appears to be constructed similar to the hangar roof with 2x T & G lumber transverse to the supports. The diaphragm lumber runs east to west. The roof also gets its strength from the span of the 2x lumber,

the spacing and type of fasteners anchoring the lumber to the rafters and the number of fasteners. Compared to the high hangar roof and the hangar end shed roofs this diaphragm achieves greater strength from the spacing of the rafters, the rafters are spaced at approximately 2 ft centers compared to the high roof at approximately 4 ft centers (includes the 2x between the purlins) and the 7 – 8 ft spacing of the truss chords for the hangar end wall shed roofs.

Lean-To Low Original Flat Roof

This roof is similar to the sloped roof that currently exists above. The roof diaphragm, believed to be (2) layers of ½" sheathing, creates a superior diaphragm to the 2x T & G transverse lumber diaphragm of the other three roofs. If the sheathing is not present and 2x T& G lumber is laid transverse to the roof joists the diaphragm will still be stronger than the other three diaphragms due to the tighter spacing of the joists, 1 ft centers compared to 2 ft, 7-8 ft and 4 ft centers (half the high roof purlin spacing with the 2x blocking).

The other advantage of the flat roof over the lean-tos, with the sloped roof above removed, is the vertical distribution of the lateral force effects. Vertical distribution of lateral forces by code design, places mass from the lower levels on the upper levels increasing the shears and overturning forces in the horizontal and vertical lateral force resisting elements. With the continuity between the high and low roof diaphragms disrupted and the tremendous size of the hangar diaphragm to the low flat roof diaphragm the mass of the lean-to(s) will remain with the lean-to(s) with little or no increase to the high roof lateral force effects.

Lean-To 2nd Floor

The second floor diaphragm is noted on the original drawings, to be constructed with diagonal 1x board sheathing. The diagonal sheathing strength comes from the lateral strength of the nails parallel and perpendicular to grain. The diagonally sheathed 1x board diaphragm is superior in resisting lateral force effects than the diaphragm created from laying board sheathing perpendicular to the supports.

Condition (Horizontal Diaphragms, Force Resisting Elements)

See "ALL HANGARS, GRAVITY FRAMING" for condition.

Evaluation (Horizontal Diaphragms, Force Resisting Elements)

Hangar Central Arched High Roof; Lean-To Low Original Flat Roof

The hangar central arched high roof and the lean-to original flat roof diaphragms are insufficient to resist lateral forces during a seismic event.

The high roof requires additional blocking between the purlins over the trusses to complete the load path to the buttresses at the north and south sides of the hangar roof.

The low roof requires the sheathing to be restored along the outside edge of the roof and blocking placed between the joists to complete the horizontal diaphragms at each hangar.

STRUCTURAL

Recommendations (Horizontal Diaphragms, Force Resisting Elements)
Hangar Central Arched High Roof; Lean-To Low Original Flat Roof

- Hangar Central Arched High Roof, add 3/8" sheathing over complete roof.
- Lean-To Original Flat Roof, add two layers of ½" sheathing to match thickness of existing sheathing, block interior and exterior edges.

WALLS

Description (Vertical Force Resisting Elements)

Hangar Central Arched High Roof

The lateral force effects are resisted and transferred through the vertical force resisting elements around the perimeter of the roof and transverse to the roof from north to south at each bowstring truss. The east to west force effects are transferred through a combination of the high roof shear walls and braced frames. The north to south forces are transferred from the roof diaphragm to the purlins and trusses into the top of the buttress each end of the truss.

The north and south high shear walls have diagonal 1x sheathing each face. The diagonal sheathing strength comes from the lateral strength of the nails parallel and perpendicular to grain. Additionally the walls were originally designed to resist lateral forces with tension "X" bracing. Presently the lateral forces are being resisted through a combination of the diagonal sheathed shear walls and the tension "X" bracing.

The lateral forces from north to south are resisted by the buttress/braces each end of the bowstring truss. The buttress behaves similar to a brace with greater resistance to lateral load effects being achieved with the least slope possible of the diagonal outside leg to the horizontal plane. Due to the steep slope of the diagonal leg the brace effectiveness to resist lateral loads is diminished. Much of the force is translated to vertical components resisted by the diagonal leg and the support column for the bowstring trusses. Additionally, the internal webs become less effective as the outside leg becomes steeper. In the present configuration the interior diagonal elements provide minimal resistance to the lateral forces. They primarily provide stability to the chords; shorten their unsupported length.

Hangar East/West Hangar Door Sloped Roofs

The east and west end sloped roofs over the hangar doors cantilever from the east and west hangar walls and end truss above the door opening. The shear forces transferred from the roof to the walls is resisted by the shear wall created by the 1x diagonal board sheathing nailed to the face of the studs outboard of the end trusses in combination with the connections to the end trusses. The forces are then resisted by the interior end wall buttress and surrounding shear wall.

Lean-To Added Low Sloped Roof (Roof is Deleted Per Recommendations)

The lateral force effects are resisted by the shear walls on the north and south sides combined with the "X" bracing at the interior wall, similar to the hangar high roof shears.

STRUCTURAL

Part of the lateral force is transferred to the outside lean-to shear wall. The outside wall is constructed with diagonal 1x board sheathing similar to the other shear walls.

The lateral force effects from north to south add to the high roof lateral force effects applied to the buttresses. At the eave the lateral forces are transferred from the sloped roof rafters to the flat roof joist to the buttress at the flat roof elevation.

Lean-To Low Original Flat Roof

The lean to low roof similar to the sloped roof above transfers the lateral loads to the shear wall and bracing between the hangar and lean-to and the outside lean-to wall in the east to west direction. At the level of the flat roof down to the foundation wall the wall between the hangar and lean-to is diagonally sheathed one side only, the hangar side.

The flat roof, without the sloped roof above, lowers the level that the force effects are applied to the common wall between the hangar and lean-to decreasing the force effects applied to the shear wall and "X" bracing.

Similar to the east to west forces the north to south forces relative to the lean-to are lowered decreasing the impact to the buttress, see photo S7-ALL.

Lean-To 2nd Floor

The lean to second floor transfers lateral forces similar to the low flat roof above to the shear wall and bracing between the hangar and lean-to and the outside lean-to wall in the east to west direction. Both shear walls are constructed with the diagonal 1x board sheathing. The shear walls and bracing below the second floor transfer the lateral force effects to the foundations.

Similar to the low flat roof the north to south forces are transferred from the floor diaphragm to the buttress at the floor level. The buttress transfers the floor lateral force effect to the foundations.

Condition (Vertical Force Resisting Elements)

Hangar Central Arched High Roof

Bracing

The walls each side of the hangar roof has had the bracing removed to some degree, see the individual hangars for conditions specific to each, photo S8-ALL and S9-ALL.

Buttresses

The buttresses at the north and south sides of the hangar are not exposed. The outline of some of the buttresses is visible in the office spaces of the lean-to. In all cases the buttresses are covered, except the vertical leg, the 12" x 12" column/post is partially visible in the hangar space. No evidence is available to indicate damage to the buttresses.

Hangar 6 buttresses have been modified. See Hangar 6 for further information.

STRUCTURAL

Evaluation (Vertical Force Resisting Elements)

Hangar Central Arched High Roof

Bracing

The high roof requires the bracing to be replaced as originally configured; see the individual hangars.

Buttresses

The buttresses in all cases require strengthening. The lateral unsupported length of the buttress elements needs to be reduced thereby increasing the strength.

Load Path

The east to west load path is incomplete between the high roof and the "X" bracing each side of the hangars.

The north to south load path is incomplete between the high roof and the top of the bowstring trusses.

Recommendations (Vertical Force Resisting Elements)

Hangar Central Arched High Roof

Bracing

- See the individual hangars for recommendations specific to each.

Buttresses

- The typical buttress, all hangars, requires the outside leg and intermediate webs of the buttresses to be strengthened. Strengthen the buttresses elements by adding 2 x 12 members to the existing (2) 2x members each element, top and bottom. The strengthened elements will form the shape of a box after the 2x12 members have been added. The elements will be torsion stable and laterally supported.

Load Path

East to West – Existing Stud Wall

- Add blocking plates between studs at approximately 2 ft. below the top of the 12" x 12" columns/posts.

- Add ½" sheathing to the outside face of the wall between the high roof and the original low flat roof. Nail sheathing to the intermediate blocking plates similar to boundary conditions.

- Strap across columns between sections of wall.

STRUCTURAL

- Renail jambs to columns each panel, each end of panel.

North to South – Above the Bowstring Truss

- Add solid blocking between the high roof decking and the top of the trusses between the purlins, every other purlin space.
- Nail through the existing and new roof diaphragm into the blocking and add framing anchors between the blocking and the top chord of the trusses.
- Strengthen latter the connection between the bowstring truss and the buttress through additional strapping.

FOUNDATION/1ST FLOOR

Description (Lateral Force Resisting Elements)

1st Floor

The concrete slab on grade resists the horizontal force effects through mass of the floor combined with the friction between the soils and concrete. The force effects are transferred to the floor typically through bearing against the vertical face of the concrete by the pier or wall anchored/bolted to the elements transferring the lateral forces.

Foundation Walls and Footings

Shear Walls/Foundation Walls and Continuous Footings.

The shear wall transfers their lateral forces to the foundation through sills bolted to the foundation walls with ½" ∅ anchors at 2'-0" centers. Passive earth pressure and friction against the concrete walls resist the horizontal forces. The upward vertical forces are resisted by the mass of the foundation wall and footing combined with the weight of the soil over the top of the footing. The downward forces are resisted by the allowable bearing pressures on the bottom of the footings increased for seismic forces.

"X" Bracing

The "X" bracing is bolted to the hangar columns. The net uplift, the uplift after the self-weight of the structure combined with the % snow used in the lateral analysis, is subtracted from the uplift forces from the bracing, is resisted by the angles at the base of the hangar columns transferred through the anchor bolts into the pilaster/pier and footing. The footings at the columns are substantial in size helping to resist uplift forces. The mass of the continuous foundation wall and footing also contributes to resist the uplift forces.

The horizontal forces are resisted by the bolted connection through the angles, into the pier/pilaster and concrete foundation wall and footing and spread footing.

STRUCTURAL

Buttress

The buttress members and connections are uncertain.

The forces transferred to the base of the hangar column are resisted similar to the "X" bracing.

The forces transferred to the base of the outside leg of the buttress are resisted similar to the columns except the concrete wall and foundation do not exist at the interior of the lean-to.

Footing mass is used to resist the uplift with a small amount of earth and slab on grade.

The passive pressure against the footing resists the horizontal forces; the concrete floor slab cast all sides around the pier and the anchors tying the wood section to the concrete also resist the horizontal forces.

Condition (Lateral Force Resisting Elements)

Hangar and Lean-To

1st Floor; Exterior Foundation Wall and Continuous Footings; Interior Foundation Walls and Continuous Footings; Interior Spread Footings Between Hangar and Lean-To; Interior Spread Footings at Lean-To

See "ALL HANGARS, GRAVITY FRAMING" for condition.

Evaluation (Lateral Force Resisting Elements)

Hangar and Lean-To

1st Floor

The first floor slab on grade is sufficient to resist lateral force effects, based on field observations of the slab condition and the magnitude of the lateral forces.

Exterior Foundation Walls and Continuous Footings; Interior Foundation Walls and Continuous Footings

The foundation walls and continuous footings are sufficient to resist lateral force effects based on the information provided on the original drawings and field observations. The evaluation is based on an assumed allowable soil bearing and 1/3rd increase for seismic forces.

Interior Spread Footings Between Hangar and Lean-To

The interior footing between the hangar and lean-to at the hangar columns is small for the loads applied by the buttress during and earthquake.

Interior Spread Footings at Lean-To

STRUCTURAL

The interior footings at the outside leg of the buttress are small for the uplift forces during an earthquake.

Recommendations (Lateral Force Resisting Elements)

Hangar and Lean-To

1st Floor

- No specific recommendations, if further information is found relative to the concrete slabs on grade an evaluation should be completed as appropriate.

Exterior Foundation Walls and Continuous Footings; Interior Foundation Walls and Footing

- Leave existing foundation walls and footings as they are. If distress is found during remodel/upgrade design the footings should be further evaluated.

Interior Spread Footings Between Hangar and Lean-To

- No recommendations.

Interior Spread Footings at Lean-To for Hangar Buttress

- Interior spread footings at the outside leg of the buttress require modifications. The footings need to be increased in size by 12" width all sides and 3'-6" deep. Concrete should be cast over the existing footing to finish floor. New concrete should be dowelled to the existing concrete.

HANGARS NO. 2 (3008)

GRAVITY SYSTEM/FRAMING

ROOF

Description

Decking/Sheathing – See "ALL HANGARS" for General Description

Condition

Hangar Central Arched High Roof

Decking/Sheathing

The extent of water staining in Hangar 2 is limited primarily to the first two purlins up from the eaves. Due to the limited staining, 10% of the high roof decking is estimated to be damaged from dry rot and will likely need replacing.

Purlins – See "ALL HANGARS" for General Description

As noted above the water staining is generally limited to the first two purlins from the north and south outside wall up the roof. With the staining limited to the first two purlins up from

STRUCTURAL

the high wall, 5% of the purlins are estimated to need replacement. Approximately (8) 5 1/8 x 13 ½ x 25 ft G.L.s, shimmed to fit.

Bowstring Truss

The condition of the trusses in Hangar 2 appears good. There appears to be more splitting and checking of the members than in the other hangars. The condition remains classified as good.

"X" Bracing/Struts Between Trusses

Condition Poor/Priority Critical, See Photo S10-H2

The "X" Bracing/Strut between trusses 4 and 5 from the hangar west end including the end wall truss is severely split at the top at the bolt connection to the vertical web.

Interior Catwalks – See "ALL HANGARS" for General Condition

Access to catwalks in Hangar 2 is locked. Keys were not available to allow access through bottom of cage around ladder. Access was gained via external support and squeezing through the cage. Condition should be fixed to allow normal method of access through bottom of cage.

Evaluation

See "ALL HANGARS" for Evaluation

Recommendations

See "ALL HANGARS" for Recommendations, except

- Replace the "X" Bracing/Strut between trusses 4 and 5 from the hangar west end including the end wall truss.

FOUNDATION/1ST FLOOR

Description

1st Floor

See "ALL HANGARS" for general description of floor.

Condition

1st Floor

The concrete slab on grade in the northeast corner of the lean-to space has settled resulting in the slab being extensively cracked. Approximately 150 square feet of slab is damaged.

STRUCTURAL

Evaluation

Evaluation is based on field observations.

Recommendations

Replace the slab on grade with a new section, match existing thickness, approximately 4", and reinforce with #4 @ 15" centers each way. Approximately 150 square feet. Dowel to existing.

LATERAL SYSTEM/FRAMING

WALLS

Description

Hangar Central Arched High Roof; Lean-To Low Original Flat Roof; Lean-To 2nd Floor

See "ALL HANGARS" for general description of walls.

Condition

Hangar Central Arched High Roof; Lean-To Low Original Flat Roof; Lean-To 2nd Floor

North Wall

Bottom "X" bracing is removed completely or partially at 1 bay.

South Wall

Bottom "X" bracing is removed completely or partially at 3 bays.

Evaluation

Hangar Central Arched High Roof; Lean-To Low Original Flat Roof; Lean-To 2nd Floor

South and North Walls

Four bays of "X" bracing are required at both walls. Connections require upgrading.

Recommendations

Hangar Central Arched High Roof; Lean-To Low Original Flat Roof; Lean-To 2nd Floor

North Wall "X" Bracing

- Replace 1 bay of "X" bracing, replace with 4x12s.

South Wall "X" Bracing

- Replace 3 bays of "X" bracing, replace with 4 x 12s.

STRUCTURAL

Connections

- Replace all connections with steel plates, inside face of bracing matching configuration of bracing. (6) ¾" diameter bolts each brace and (5) 4" diameter shear plates with ¾" diameter through bolts.

HANGARS NO. 3 (3005)

ROOF

Description

Hangar Central Arched High Roof

See "ALL HANGARS" for general description.

Condition

Hangar Central Arched High Roof

Decking/Sheathing

Hangar 3 has more insulation torn or falling away from the decking and the purlins typically show heavier water stains than in the other hangars. Unlike the other hangars, all of the purlins in hangar 3 are water stained.

Additionally, moisture penetrates the roofing around the central, east end access hatch. Stairs extend from the catwalk to the roof framing at the access hatch. Some of the roof framing and ends of the stair framing at the access hatch are rotted. Decking around the access point is also rotted. Approximately 400 sq ft of the decking around the access hatch is estimated to be damaged from dry rot and will likely need replacing. The stair framing, approximately 30ft and the framing at the access hatch supporting the stair framing will also require replacing.

Purlins

As noted above the water staining is more prevalent in Hangar 3 than the other two hangars. All of the purlins show evidence of being wet at one time or another.

Evaluation

Decking/Sheathing; Purlins

Evaluation is made based on the field observations.

Recommendations

Decking/Sheathing

- Due to the water staining inclusive of all purlins, 20% of the high roof decking is estimated to be damaged from dry rot and will likely need replacing.

STRUCTURAL

Purlins

- Due to the greater number of purlins that are water stained the estimated number of purlins requiring replacement due to dry rot damage is 10%. Approximately (15) 5 1/8 x 13 ½ x 25 ft G.L.s, shimmed to fit.

FOUNDATION/1ST FLOOR

Description

Interior Foundation Wall – See "ALL HANGARS" for general Description

Condition

Hangar 3, between the columns supporting the hangar roof trusses, the wall siding is deflecting down 1" to 1 ½" more than the columns each side of the wall, see photo S11-H3.

Evaluation

Evaluation is made based on field observations.

Recommendations

Investigate the foundation during design of the remodel and upgrade to the hangars.

LATERAL SYSTEM/FRAMING

WALLS

Description

Hangar Central Arched High Roof; Lean-To Low Original Flat Roof; Lean-To 2nd Floor

See "ALL HANGARS" for general description of walls.

Condition

Hangar Central Arched High Roof; Lean-To Low Original Flat Roof; Lean-To 2nd Floor

North Wall

Bottom "X" bracing is removed completely or partially at 1 bay.

South Wall

Bottom "X" bracing is removed completely or partially at 1 bay.

STRUCTURAL

Evaluation

Hangar Central Arched High Roof; Lean-To Low Original Flat Roof; Lean-To 2nd Floor

South and North Walls

Four bays of "X" bracing are required at both walls. Connections require upgrading.

Recommendations

Hangar Central Arched High Roof; Lean-To Low Original Flat Roof; Lean-To 2nd Floor

North Wall "X" Bracing

- Replace 1 bay of "X" bracing, replace with 4x12s.

South Wall "X" Bracing

- Replace 1 bay of "X" bracing, replace with 4 x 12s.

Connections

- Replace all connections with steel plates, inside face of bracing matching configuration of bracing. (6) ¾" diameter bolts each brace and (5) 4" diameter shear plates with ¾" diameter through bolts.

HANGARS NO. 6 (2085)

ROOF

Description

Hangar Central Arched High Roof

See "ALL HANGARS" for General Description

Condition

Hangar Central Arched High Roof

Decking/Sheathing

The extent of water staining in Hangar 2 is limited primarily to the first two purlins up from the eaves.

Purlins

Hangar 6 is similar to Hangar 2, as noted above the water staining is generally limited to the first two purlins from the north and south outside wall up the roof.

STRUCTURAL

Evaluation

Decking/Sheathing; Purlins

Evaluation is made based on the field observations.

Recommendations

Decking/Sheathing

Due to the limited staining, 10% of the high roof decking is estimated to be damaged from dry rot and will likely need replacing.

Purlins

With the staining limited to the first two purlins up from the high wall, 5% of the purlins are estimated to need replacement. Approximately (8) 5 1/8 x 13 ½ x 25 ft G.L.s, shimmed to fit.

LATERAL SYSTEM/FRAMING

WALLS

Hangar Central Arched High Roof; Lean-To Low Original Flat Roof; Lean-To 2nd Floor

Description

Hangar Central Arched High Roof; Lean-To Low Original Flat Roof; Lean-To 2nd Floor

See "ALL HANGARS" for general description of walls.

Condition

Hangar Central Arched High Roof; Lean-To Low Original Flat Roof; Lean-To 2nd Floor

North Wall

Bottom "X" bracing is removed completely or partially at 2 bays.

South Wall

Bottom "X" bracing is removed completely or partially at 3 bays.

Buttresses

The second floor corridor is along the wall between the hangar and the lean-to. The outline of the buttress is visible in the corridor. From the existing drawings showing the complete form of the buttress it appears that at least one of the diagonal members has been removed. Later remodel/repair drawings also imply that a diagonal has been removed, see photo S12-H6.

STRUCTURAL

Evaluation

Hangar Central Arched High Roof; Lean-To Low Original Flat Roof; Lean-To 2nd Floor

South and North Walls

Four bays of "X" bracing are required at both walls. Connections require upgrading.

Buttresses

Evaluation based on information provided on the original drawings and field observations.

Recommendations

Hangar Central Arched High Roof; Lean-To Low Original Flat Roof; Lean-To 2nd Floor

North Wall "X" Bracing

- Replace 2 bays of "X" bracing, replace with 4x12s.

South Wall "X" Bracing

- Replace 3 bays of "X" bracing, replace with 4 x 12s.

Connections

- Replace all connections with steel plates, inside face of bracing matching configuration of bracing. (6) ¾" diameter bolts each brace and (5) 4" diameter shear plates with ¾" diameter through bolts.

Buttresses

- Replace missing diagonal web elements.

ARCHITECTURAL

EXTERIOR ENVELOPE

While the basic geometry of the building massing has remained unchanged over the years, all three hangars have undergone appreciable change in their exterior appearance. The buildings were originally clad in horizontal wood siding, and featured larger wood windows, wood doors, shingle roofs and sliding hangar doors.

All three hangars were eventually reclad in aluminum and, later, steel siding (in the case of hangars 2 and 3). The windows were replaced with smaller, more energy efficient units. The doors were replaced with metal doors and frames, and the hangar doors were replaced with vertical-lift fabric and aluminum doors in smaller sizes. The original wall and roof cladding and fenestration required high maintenance and were prone to water infiltration and heat loss. The hangar doors were larger than required for current use, were heavy and the door tracks were susceptible to winter weather. So, while all these exterior modifications were warranted at the time, they did alter the appearance of the structures.

The two-story buildings on each side of the hangar bay (referred to as lean-tos) had flat roofs when constructed *(photo A1-H6)*. Shortly after the war, photographs indicate that a shed roof was added to the lean-tos, presumably to mitigate roof leaks. This began a series of roof modifications revealed in drawings from the late 1960's through present day. The original shingle roof would have been susceptible to ice dams and leakage, and this was no doubt the impetus for many of these "fixes." The roofs were eventually replaced in the 1980's with EPDM membrane. This measure has proven largely effective in eliminating leaks; however, the combination of shed roofs and membrane roofing has resulted in an avalanche of ice and snow *(A20-H3)*. This poses a hazard to both buildings and occupants. The building siding is severely damaged along the lower portions of the wall, and canopies have been added at entries along the drip line to protect personnel from falling debris *(A22-H3 & A23-H6)*. Mechanical hoods have, likewise, been damaged *(A24-H6)*.

The original structures had open fire escapes at each building corner that served as exits from the second floor. These stairs were originally roofed, but were otherwise open to the elements. Uninsulated exterior walls were added in the mid-1970's *(A2-H6)*.

Material Descriptions and Deficiencies

Siding and trim: The original building siding was nominal 1x6 (5 ½ in. exposure) horizontal wood in a "Novelty" or "Dutch Lap" style and was apparently painted camouflage during the war *(A3-H6)*. A full appraisal of the original siding is difficult due to the presence of metal siding. Small portions of wood siding that are exposed have weathered significantly and may not be an accurate representation of its condition *(A4-H6)*. Wood corner trim is similarly weathered where exposed. Wood fascia trim lacks paint and has deteriorated. The metal siding is not in keeping with the period of significance.

The wood siding is secured to diagonal 1x8 wood shiplap on 2x6 wood studs *(A5-H6)*.

The existing concrete foundation extends above finished floor approximately 6 in. and is not insulated on either side. The concrete apron on the north sides of hangars 2 and 6 slopes toward the building, causing ponding and deterioration of the concrete foundation *(A26-H2)*.

ARCHITECTURAL

Recommendations – All hangars

- Remove existing metal siding, original wood siding and sheathing and replace with new cement-fiber horizontal siding over air barrier and ¾ in. plywood secured to wood studs.

  Cement-fiber siding is available in a profile comparable to the existing wood siding (Hardi "Dutch Lap" or equivilant), and has the benefit of greater durability.

- Examine wood studs, sill and plates for deterioration and replace as required.

- Examine glass fiber insulation in exterior walls, replace where wet and add where discontinuous.

- Repair damaged concrete foundation where exposed above grade. Where possible, remove portion of concrete apron along north foundation of hangars 2 and 6 and replace to provide positive drainage away from foundation. Provide exterior rigid insulation and protection flashing to top of curb when apron is replaced.

- Replace all miscellaneous wood trim in matching dimensions.

Windows: There is little documentation on the original window sash, but based on the era of construction and what drawing information is available, they were likely wood double-hung with true divided panes and single glazing. The windows were in three different heights of the same style and width. The tallest of the windows appears to have had a louver located under the window sash.

The original wood window frames remain in many locations. The original sash was replaced with an insulated panel in one half of the window and a smaller "Alaska" brand window with panel surround in the other half *(A6-H6)*. The entire frame appears to have been removed in some locations and a new window and frame of entirely different size installed. The existing windows are not historic, but were no doubt replacements to reduce heat loss and maintenance, and increase comfort.

Recommendations – All hangars

- Remove existing window sash and infill panels. Remove all non-conforming windows. Repair or replace existing window frames where required and provide new aluminum-clad, wood, double-hung sash with true divided panes. Glass to be insulated, low-E type. Provide new flashing and sealants. Window color is to conform to base standard.

Personnel doors: The doors are only documented by schematic elevations in the original 1944 drawings, but are presumed to have been wood with wood frames. The existing hollow metal doors and frames are not historic, but are durable and provide a level of security.

ARCHITECTURAL

Recommendation – All hangars

- Replace existing doors with new hollow metal doors and frames. Paint to conform to base standard.

Hangar doors: The original hangar doors covered the full extent of the end walls of the hangar bays and were composed of overlapping 12-foot wide, full-height panels. The lead panel had a motor drive and the panels ran on railroad style tracks. Each door section had relites (see HABS drawings in Appendix).

The current use for Blackhawk helicopters requires smaller door openings than the original door, and the existing fabric doors seem to work adequately. Hangers 2 and 3 have a single 72-foot wide door at each end of the bay. Hanger 6 has two 72-foot wide doors at each end. The surrounding wall is wood framed with metal siding. While the existing doors are a departure from the original appearance it is not intended to restore the original hangar doors at this time. The fabric has detached from the aluminum frame in the lower corners of the doors, either as a result of friction on the vertical track or other damage *(A8-H2)*.

Recommendations – All hangars

- The fabric should be reattached. If visibility to the exterior is desired, provide a small window in the wall adjacent to the hangar door at the door operator station. If there is no wall space available, it may be possible to provide a small closed-circuit LCD video monitor with camera to the apron outside the hangar doors. This would be mounted at the door control station.

Fire escapes: The original fire escapes were open to the weather. While the existing wall enclosures were added later, there are no plans to remove the enclosures and recreate a problem of ice and snow removal throughout the winter.

Roofs/Insulation: The hangar bays have only a thin layer (<1 in.) of a fiber-type insulation secured with batten strips to the underside of the roof deck *(A8-H3, A9-H3)*. There was an attempt to add insulation in 1977, but the bid alternate for this work was not accepted at the time. The proposed solution was questionable since it added unvented batt insulation to the underside of the roof deck. The EPDM roof covering is not historic, but is functional. The original shingle roof required periodic maintenance and was certainly susceptible to leaks near the eaves. The roof slope near the ridge of the barrel roof is rated too low for shingles.

The "eyebrow" roofs over the hangar doors have asphalt shingle covering. While not the original shingles, the use of material is historic. Many shingles have lifted or are missing *(A10-H3)*. The entire roof covering should be replaced. The shingles do have the benefit of retaining snow. This is an advantage in the vicinity of the hangar doors. It was mentioned that these roofs form icicles along the leading edge. This is unusual since the roof is uninsulated. However, when the hangar doors open, a considerable amount of warm air rises toward the roof, partially melting any snow.

The shed roofs over the lean-tos are not in keeping with the target period of restoration.

ARCHITECTURAL

Recommendations – All hangars

- Remove shed roof over lean-tos and provide new protected-membrane roof system consisting of plywood sheathing, gypsum sheathing, roof membrane, 8 in. rigid insulation and 2 in. concrete pavers. Utilize existing roof/ceiling slope with new backslopes as required to internal drains. Extend existing exterior wall to form new parapet. Remove original siding and sheathing on wall between hangar bay and lean-tos above roof surface and re-side and insulate as indicated for typical walls above.

The inverted roof membrane (IRMA) roof system was selected to provide protection for the roof membrane from ice and snow falling from the hangar roof. We have received comments from the base concerning problems they have had with IRMA roofs. We will investigate these claims further and formalize a recommendation for the final report.

The availability of storm sewers to accommodate roof drainage is as follows:

Hangars 2 and 3: There is open drainage on south side of Montgomery Road with an 18" drop inlet on the north side of the road, approximately halfway between the two hangars and tied to the open drainage to south.

Hangar 6: There is a storm sewer (size unknown and condition are unknown) on the north and south sides of hangar with a catch basin just north of the hangar. The storm sewer runs to open drainage west of the hangar. This open drainage feeds into open drainage on south side of Montgomery through culvert under road.

Roof platforms: The existing equipment access platforms have been condemned from disrepair, but are historic and support floodlights and antennas *(A11-H3, A12-H6)*.

Recommendations – All hangars

- Remove existing roof walkways and equipment platforms and reconstruct in-kind.

Soffits: When the original hangar doors were replaced, the soffit above the hangar doors including the door tracks was covered in bird screen. Unfortunately access doors are missing or have been left ajar and other openings allow access for birds into the space above the screens in some locations. This has resulted in large areas of bird droppings and is an ongoing nuisance *(A13-H6)*.

Recommendation – All hangars

- Repair and close access doors to eyebrow roofs over hangar doors. Remove contaminated bird screen and replace as required. Investigate and seal all remaining openings currently allowing bird access.

General Recommendations – All hangars

- Refurbish and paint large numerals "2", "3" and "6" located above the hangar doors.
- Remove existing, non-historic canopies at personnel doors.

ARCHITECTURAL

- Paint all exterior cement-fiber siding, wood trim and hollow metal doors and frames with 3-coat paint or solid-body stain.

INTERIOR

As with the building exteriors, the interior spaces have evolved with the changing demands of use and wear. Functions have been adapted to the old structures with few changes in the layout of partitions and stairs since the hangars were originally constructed. It is not within the scope of this study to revise room layouts to better accommodate program uses. If and when the hangars are rehabilitated, these modifications, if desirable, could be accommodated in the work. The hangar interiors are in varying degrees of wear, with Hangar 6 in the best overall condition.

Material Descriptions and Deficiencies

Walls: Much of the *appearance* of wear is in the floor and wall finishes. Walls are typically gypsum wallboard on wood studs. Given the heavy use, especially on the first floor, the wallboard finish is easily susceptible to damage. It does have the advantage of easy repair and the walls can be relocated or modified easier than other forms of construction. A surfacing material more suitable to high abuse should be considered, possibly as a wainscot treatment. The wall base is both wood and resilient vinyl or rubber. The wood base needs repair and paint. The resilient base, in many cases, has been partially painted when the walls were painted.

The larger latrines are finished with ceramic tile floors and wainscots with gypsum wallboard walls and ceilings *(A25-H2)*. The smaller latrines have gypsum wallboard walls and VAT flooring. The VAT flooring is substantially missing in some instances *(A14-H2)*. It is probable that much of the vinyl tile contains asbestos given the era the flooring was installed. The wallboard walls behind plumbing fixtures and plywood floors do not meet code.

The walls between the hangar and lean-tos are sheathed on the hangar side with horizontal 1x6 boards covering a layer of gypsum board and a base layer of 1x6 sheathing on wood studs. The wood surfacing requires patching and painting. There are numerous mechanical and electrical conduits, panels and piping on these walls and pipe penetrations through the wall are not firestopped *(A15-H2)*. The original structural "X" bracing along these walls has been removed or truncated to accommodate many of these services *(A16-H2)*. This detracts from the historic character of the building and, more importantly, reduces the lateral design capacity of the structure (see "Structural" commentary).

Recommendations – All hangars

- Patch existing gypsum wallboard where damaged. Add MDO plywood wainscoting in first floor lean-to shops, storage, crew areas and other high-use areas on first floor.

- Extensive work is required in latrines (see also "Handicapped Accessibility" and "Plumbing"). Remove existing ceramic tile and provide new tile floors and wainscots.

- Patch wood siding on interior hangar bay walls (see also "Fire/Life Safety").

ARCHITECTURAL

Hangar floors: The concrete hangar floors are unfinished except for a possible sealer. We observed some water ponding in Hangar 3 while on site *(A17-H3)*. Although new light fixtures have been installed in the hangar bays and staff has noted the improvement, the lighting is somewhat dim.

Lean-to floors: First floor lean-to floors are either concrete or VAT tile. There is evidence of tile adhesive in some areas where VAT has been removed from concrete. The slab-on-grade also shows evidence of paint. second floor corridors and some rooms have VCT or VAT coverings from good to poor condition *(A21-H2)*. Carpet has been installed in a somewhat ad-hoc manner in second floor offices and classrooms.

The concrete slab-on-grade has settled and cracked in the northeast corner of hangar 2 *(A18-H2)*.

Stair coverings: Rubber stair treads and skirting were installed circa 1975 and are worn to varying degrees *(A27-H2)*.

Recommendations – All hangars

- Consider the installation of an epoxy mortar system. This is a thicker, heavier duty installation than conventional epoxy coatings. The tugs used for moving helicopters in and out of the hangar are frequently chained up in winter and would tax a conventional epoxy coating. A light colored epoxy would increase the ambient lighting in the hangars. This surfacing is included as an additive alternate in the cost estimating portion of this study.

- Clean and seal concrete floors in the lean-tos. Acid wash and/or grind existing concrete to remove paint, adhesives and stains.

- Abate existing VAT throughout and provide new VCT tile in second floor corridors and storage rooms. Remove existing carpet and install new in offices, classrooms and dormitory areas.

- Replace existing wood and resilient base at carpet, VCT and concrete flooring.

- Replace existing rubber stair coverings and skirting where worn.

Recommendation – Hangar 2

- Remove portion of slab-on-grade in northeast corner, fill and compact subgrade and cast new slab.

Ceilings: All ceilings in the lean-to areas are gypsum wallboard and are in fair condition Portions of the second floor along the exterior walls are water-damaged and require replacement *(A19-H2)*.

Recommendations – All hangars

- Replace water damaged gypsum board ceilings. Patch other damaged GWB.

ARCHITECTURAL

Personnel Doors: Interior doors were replaced circa 1975 with new hollow metal doors and frames. These were rated assemblies where required in rated partitions. The doors range from good to poor with the poorest condition on the first floor where they see the most use. (See also "Fire/Life Safety")

Recommendations – All hangars

- Replace doors and frames with new hollow metal assemblies. Provide relites where beneficial for vision, and with wire glass where rated. Provide half-height stainless steel kickplates on exit and first floor doors.

FIRE/LIFE SAFETY

CODE ANALYSIS AND HIGHLIGHTS

We have been directed to use the current editions the 2000 International Building Code (IBC) and the Uniform Fire Code in the analysis of the existing hangars. In addition, the Department of the Army Engineering and Design Technical Letter 1110-3-485 "Fire Protection for Helicopter Hangars" is cited for application. Where conflicts exist between code requirements the most restrictive requirement is to be used.

The hangars were analyzed using both the requirements for new construction and under the existing building provisions of the 2000 IBC. As a new building, the following occupancy classifications would apply:

Use	Occupancy Classification
Hangar	S-1
Office/Support	B
Dormitory	R-2 (Hangar 6)
Hazardous Storage	Depends on material/quantity stored

Construction and Separations

For new construction a 2-hour separation would normally be required between the hangars and lean-tos in a sprinklered building. Where sprinklered and separated with yards of 60 feet or greater, the IBC permits a two-story building housing B and S occupancies to have unlimited floor area. The unlimited area would permit *non-rated* construction and *non-separated* occupancies. This provision is more lenient than ETL 1110-3-485 which requires one-hour separations between the hangars and lean-tos, so the ETL provision will apply. The ETL requires noncombustible construction for new work, so this provision would not apply to the existing wood-framed buildings.

The hangars underwent a significant code upgrade around 1975-77. Fire doors were installed and gypsum wallboard was added to walls and ceilings. This work would seem to place the hangars into a one-hour construction type classification (Type V-A, or wood-framed, one-hour construction).

Under the 2000 IBC, aircraft hangars of type V-A construction require one-hour roof construction. There is typically an exemption for protection of roof structures more than 20 feet above the floor, but this is not the case for aircraft hangars (S occupancy). This has bearing on the protection of the wood bowstring trusses. As a new building, protection of these trusses would be required, probably in the form of spray fireproofing or membrane protection of the bottom chord. This has obvious impact on the historical character of the hangar bay; the trusses contribute significantly to the historic period of significance. This is one area where the code provisions for existing buildings might be justified. Chapter 34 of the IBC (3409.2.4) permits alteration or repair of existing buildings without complying fully with the requirements for new construction if it does not make the building less safe than it currently is. Since there is no change in occupancy and the upgrades do not reduce building safety, the trusses could be left unprotected under this provision. As indicated above, the two-story, separated buildings could even be classified as non-rated construction, but this would be a step back in safety, given the current level of protection.

The building area including allowance for mixed occupancies is acceptable when calculated as one-hour construction.

FIRE/LIFE SAFETY

The building height is approximately 60 feet at the ridge of the barrel roof and averages approximately 50 feet. This is within an acceptable range, even for a non-rated, sprinklered building.

The wall separating the hangar and lean-tos is not without its problems. The original construction documents from 1944 indicate two layers of 1x wood sheathing with a layer of ¼ in. gypsum board between them on one side of the stud. The 1970's upgrades included one layer of 5/8 in. gypsum board on the lean-to side of the stud. Field observations suggest that ½ in. gypsum board was substituted for the ¼ in. as specified *(F1-H3)*. This would benefit the overall wall rating.

The hollow metal doors in this wall were retrofitted into place the 1970s work; however, the frames do not engage the wall properly to achieve the required rating; one can see light between the frames and walls, and the frame anchors are clearly visible in some locations *(F2-H6)*. Smoke seals, closers and panic hardware are missing in many locations.

The wall has a large number of penetrations for piping and conduit, and these penetrations do not appear to be firestopped *(A15-H2)*. There are unprotected openings between the hangar and rooms and corridors to the second floor. These are convenient for supervision and communication between the spaces, but violate the one-hour separation requirement.

Recommendations – All hangars

- Classify the existing hangars as Type V-A, one-hour rated construction. Leave the hangar roofs unprotected under the provisions of IBC Chapter 34 and in deference to the historic character of the buildings.
- Replace all rated doors and frames and fit to surrounding walls as required. Provide panic hardware devices where required on exits.
- Firestop all mechanical and electrical penetrations through the wall between the hangar bay and lean-tos required by code.
- Install fire shutters in openings between hangar and second floor spaces. Provide 45 minute wire glass assembly where audible communication is not required.

MEANS OF EGRESS

Hangars: The hangar bays have sufficient exit capacity provided by four doors to the exterior, one in each corner of the hangar floor. Travel distances are within the maximum allowed.

Lean-tos: Most of the first floor spaces in the lean-tos exit into the hangar bay, making the hangar an intervening room. This is permitted since the spaces may be considered accessory to the hangar space.

The second floor rooms currently exit to a corridor or directly to fire escapes in the four corners of the buildings (see below). Many of the corridors have dead-ends exceeding the maximum permitted. Some exits are signed from the corridor through intervening rooms to access fire escapes. This is not permitted.

FIRE/LIFE SAFETY

Interior stairs were reconstructed in the 1970's. The riser and tread dimensions do not meet current requirements, but are permitted as an existing condition and where space restricts changes in rise and run. Existing treads are nominally 10 ¼ in. and risers are nominally 7 in. (slightly exceeding 7 in. in some cases). The current requirement is 11 in. minimum treads and 7 in. maximum risers. Stair widths are adequate.

Stairs from the second floor to the first floor are, in some cases, unenclosed at the top (open to the corridor) or exit into the hangar bay and therefore do not form a continuous exit enclosure to the exterior. Up to 50% of the vertical exits may be unenclosed.

Many corridor doors lack panic devices, closers and smoke seals.

Fire Escapes: Each of the hangars has exterior fire escapes in each corner *(F3-H2)*. Fire escapes are not permitted in new construction, but are permitted, if existing, under the provisions IBC Chapter 34 and not serving more than 50% of the exit load.

Recommendations

- Eliminate dead end corridors by adding corridor extensions to fire escapes or adding new stair (see floor plans).
- Retain existing stair rise and run.
- Enclose stairs at second floor (see floor plans).
- Provide new corridors from first floor stair terminus to exterior (see floor plans).
- Replace existing doors, frames and hardware.
- Retain existing fire escapes. Repair damaged components and resurface treads. Add one layer of rated 5/8 in. gypsum sheathing to exterior of studs separating fire escapes from building.

HAZARDOUS OCCUPANCIES

There are several existing rooms with signage indicating hazardous contents *(F4-H6)*. The following is a brief survey of materials in each of the hangars:

Hangar 2: lube oil, adhesives, flammable liquids, propane and radioactive (ALSE compasses)
Hangar 3: lube oil, adhesives, flammable liquids and propane
Hangar 6: lube oil, cleaning compounds, paint, alcohol, adhesives and radioactive

Hangars 2 and 3 require more storage space.

Since quantities have not been cataloged in detail, the level of hazard has not been identified. It is possible that some of the spaces storing these materials may require an H-2 classification under the IBC. A 2-hour separation is required between H-2 and B or S occupancies. The existing rooms would likely have no more than 1-hour separation.

FIRE/LIFE SAFETY

Recommendations – All hangars

- Upgrade wall and floor-ceiling assemblies to the required ratings.
- Where possible, the hazardous occupancies should be consolidated on the first floor, and exits directly to the exterior should be evaluated.

EMERGENCY LIGHTING

Description

Each of the hangars appears to comply with code requirements for emergency lighting in the lean-to areas. The fixtures, however, vary in age and condition, and many different brands and models are represented. A few fixtures did not work when put into the test mode, and this is probably due to the fixture batteries being very old and beyond their shelf life. The fact that so many different types and model fixtures are installed creates a problem with stocking and maintaining the fixtures.

Recommendations

- Replace all emergency light fixtures in all three hangars with new fixtures and new batteries, all of the same make and model so replacement batteries, lamps, lenses and spare parts are common. This action would also address the inoperative fixtures.
- During the emergency light fixture replacement process, review the location of all fixtures for compliance to code, and add or reposition fixtures as necessary to comply with current code.

EXIT SIGNAGE

Description

Lighted exit signs are typically installed where required by code, but the condition of the fixtures varies considerably. Some of the fixtures are very old, with no replacement parts available for maintenance, and some are not operating properly.

Recommendations

- Replace all exit signs in all three hangars with new fixtures and new batteries, all of the same make and model so replacement batteries, lamps, lenses and spare parts are common. This action would also address the inoperative fixtures.
- During the exit sign fixture replacement process, review the location of all fixtures for compliance to code, and add or reposition fixtures as necessary to comply with current code.

FIRE/LIFE SAFETY

FIRE ALARMS

Description

Each of the hangars has a fairly new fire alarm system. All of the systems appear to be operational and of current production.

Recommendations

- Ensure that the fire alarm system is checked and maintained by certified people.

FIRE SUPPRESSION SYSTEM

Description

Each hangar is protected by two types of fire suppression systems. The hangar area itself has a deluge type, open head fire system, while the lean-to areas have a wet pipe system that uses fusible heads that open only when they heat to the melting point. There have been floods reported in each of the hangars caused by the unintentional tripping of the deluge system. Furthermore, the Dept. of Army Technical Letter (ETL 110-3-485) prohibits the use of deluge (open head) systems. We assume that this document is applicable, because it is titled "Fire Protection for Helicopter Hangars," and all three hangars are used exclusively for helicopters. Assuming that the ETL is applicable, the deluge system would have to be changed out with a foam-water AFFF system or with an Early Suppression Fast Response (ESFR) system. Also, the IBC refers to NFPA 409, which lists still other sprinkler system requirements. The ETL 110-3-485 takes the position that NFPA 409 is not applicable to hangar facilities housing helicopters, since NFPA 409 is intended only for airplanes according to the ETL. If this is correct, we can and should review the project fire protection system per the ETL letter only. See photo F/LS-1 H-6 for a sample of the typical sprinkler header.

The sprinkler systems are in need of maintenance as well. The drain for the H-6 sprinkler header has been dripping for so long that some sort of fungus has grown in the discharge pipe. See photo F/LS-2. This will cause the piping to freeze up this winter, which will cause the dripping to discharge onto the floor of the sprinkler room.

The exterior fire department connection (FDC) has a protective steel shield over the outlet to protect the piping from falling ice or snow from the roof, but falling snow or ice has crushed the steel protector down onto the pipe, so the fire department will not be able to attach a hose to the FDC. See photos F/LS-3, 4 H-6.

Recommendation

- The deluge system in most of the hangars has been tripping occasionally, seriously flooding the facility. This is typically caused by a loss of air pressure on the deluge valve, or by tripping of the deluge valve due to a loss of power at the fire alarm panel, which may cause a momentary loss of power to the solenoid valve that keeps the air pressure in the deluge valve. The deluge system is in need of major maintenance, which we recommend if it remains in use. There is corrosion on the valves, and some of the valves are continuously leaking. Replacement of the air compressors with duplex compressors or with different compressors wired to separate circuits would

help improve reliability. For continued use as a helicopter hangar, we recommend that the existing hangar sprinkler system be retrofitted with Early Suppression Fast Response (ESFR) sprinkler heads, and do away with the deluge system that is prohibited anyway per the technical letter. In order to use ESFR sprinkler heads, the distance from the floor to the underside of the roof may not exceed 40 ft, and the roof slope may not exceed 2" per foot. Also, the sections of the ETL document will require draft curtains (section 3.8) and floor drainage.

- Provide full service maintenance on all of the sprinkler systems to stop all drips and leaks before they freeze and cause a backup into the building.

- Repair the fire department connection steel shield to allow connection of the fire department hose.

HANDICAPPED ACCESSIBILITY

GENERAL DESCRIPTION

The existing hangars, with the exception of the hangar bays themselves are not fully accessible. The activities that take place in the hangars typically require able-bodied, military personnel. Accessibility would be restricted to visitors or injured, active-duty personnel. Through discussions with Army representatives, it was determined that the entire first floor and the second floor on only one side of the buildings would be upgraded for accessibility for the purposes of this study. If and when a final design would commence, this topic should explored in detail with Army staff to determine the extent and location of accessible components.

ACCESSIBLE ROUTE

There are existing violations along possible building routes including door clearances, threshold heights, and the lack of an elevator between floor levels. The concrete slab-on-grade elevations between the hangars and lean-tos shows differential settlement, creating a non-conforming threshold condition in several locations.

Recommendations – All hangars

- Add a conventional 2-stop hydraulic or limited-use, limited-access (LULA) elevator on one side of the building within the lean-to floor area. If the elevator overhead clearance height exceeds roof height, locate the elevator on the north side of the building to conceal the roof projection.

- Relocate doors or modify partitions to provide required door clearances on push and pull side along accessible routes.

- Remove portion of concrete foundation in door openings where differential settlement has resulted in slab offsets of greater than ½ in. Install new concrete filler.

DRINKING FOUNTAIN

Description

None of the hangar buildings are handicap accessible, and where drinking fountains do exist, they are not handicapped accessible.

Recommendation

- Replace all drinking fountains with handicap accessible fixtures in those spaces that are determined to be accessible.

RESTROOM

Description

None of the lavatories, toilets, or showers in any of the hangar locations are accessible to the handicapped.

HANDICAPPED ACCESSIBILITY

Recommendation

- Remodel the toilet rooms and bathrooms to have handicapped fixtures in those locations of the building determined to be handicapped accessible.

HVAC

HVAC – HVAC System

Description

The hangars are all supplied with thermal energy by a central steam plant via steam supply and condensate piping through a utilidor that has a branch into each hangar. Once inside the mechanical room at each hangar, the steam energy is converted to glycol using a heat exchanger. See photos HVAC1, 2, 3, 4-H3, HVAC7-H2. All heating functions use this heated glycol as the medium except for the production of domestic hot water, which is done using electric water heaters. The condition of the steam supply system beyond the building is assumed to be good, but investigation into this system is beyond the scope of this project. The heating systems within the hangar areas have been replaced at all three buildings in 1993, and they appear to be in operable condition and in good repair. The pumps and headers in the mechanical rooms all appear to be in good condition. See HVAC5-H6, HVAC6-H3, HVAC8-H3, HVAC9-H3 and HVAC10-H2. These systems are functioning well, with no complaints of heat problems in the hangars themselves. The adjoining offices and shops, however, were retrofitted to hydronic heating terminal devices in 1977. These devices are generally in bad shape with trim missing and bent or missing covers. See HVAC11-H2, HVAC15-H3. There is no mechanical ventilation system in any of the offices or accessory spaces as required by code. This causes stuffy, overheated, unhealthy and unproductive conditions.

Recommendation

- Continue to use the hydronic heating systems in the hangars. Replace all of the terminal devices in the offices and adjacent spaces. Install a new, ducted ventilation system in all lean-to office and accessory spaces that are normally occupied. Even spaces that technically meet code with operable windows to the outside do not get required ventilation due to the severe Fairbanks winter climate.

HVAC System - Hangar #2

Description

The exhaust fan is inoperative in the male latrine and noisy in women's. See HVAC12-H2. The exhaust duct to the outside from the women's exhaust fan is plugged with insulation, so it is ineffective. See HVAC13-H2.

Recommendation

- Replace all exhaust fans per typical suggestion.

HVAC System - Hangar #3

Description

QC room fan bearings are shot and very noisy. Toilet room exhaust fans are inoperative. The steam/glycol heat exchanger leaks.

Recommendation

HVAC

- Provide new ventilation system to all offices per typical recommendation. Replace all toilet exhaust fans per typical recommendation.

HVAC System - Hangar #6

Description

There are four bedrooms for sleeping, but no outside air ventilation per code. Exhaust fan outlets are crushed outside.

Recommendation

- Provide code ventilation to each bedroom. Replace exhaust fan outlets.

HVAC – HVAC Equipment

Description

Not including terminal units discussed above, the HVAC equipment appears to be in good condition, including the unit heaters and door heaters that were installed in 1993. The headers in the mechanical room and the circulators appear to be in good condition. The toilet exhaust fans in all of the restrooms are worn out, with most inoperative, and the remainder are too noisy to run.

Recommendation

- The HVAC equipment appears to be serviceable as noted. Replace all toilet exhaust fans.

HVAC Equipment – Hangar #2

Description

Baseboard sections are missing end caps.

Recommendation

- Replace baseboard with new per typical recommendation.

HVAC – Temp Control System

Description

The controls for the baseboard in the office and accessory spaces are wireless, wax type controls, which are not responsive to temperature changes. Controls in the mechanical rooms appear to be current. See HVAC14-H3.

Recommendation

- Replace all controls with new 24-volt control valves and thermostats.

HVAC

HVAC – Hydronic Piping

Description

The hydronic piping for the hangars appears to be in good condition. The piping that serves the lean-to spaces is un-insulated. See HVAC16-H3, HVAC17-H3. The internal condition of the piping is unknown and would require a destructive test to measure for clogging, corrosion or wearing of the pipe walls. The pipes are not insulated, however, which is causing overheating in the spaces. Piping not labeled.

Recommendation

- Replace all heating piping in lean-to areas or perform destructive testing on samples of the hydronic heating piping to determine remaining life. Insulate all hydronic heating piping serving the lean-to spaces, including offices and accessory spaces. The hangar piping is insulated and appears to be serviceable. Label all piping as to contents and flow.

HVAC – Steam Piping

Description

Steam piping was removed and replaced with hydronic in 1977. The only steam piping at the facility would be the steam service to the mechanical room, and its condition is unknown.

Recommendation

- Perform destructive testing on samples of the steam piping to determine useful life and replace if necessary. This is only the steam service, since the service is the extent of the steam piping.

HVAC – Special Systems

Description

Ice builds up in front of the hangar doors, making it difficult to move helicopters over ice mounds. Ice forms from drips off of roof.

Recommendation

- Add additional snowmelt piping in front of hangar doors for 20' away from building to ensure no ice forms at the entry. It may be possible to heat the space under the hangar doors and achieve snow melting above. See HVAC18-H6. If additional snow melt is added, it could be tied to the existing header. See HVAC19-H2.

PLUMBING

PLUMBING – Water Supply System

Description

There is no indication that the plumbing water system was ever replaced. During prior plumbing remodels, plans showed only piping within the latrine being replaced back to the branch feeder. Piping observed is galvanized, which is subject to corrosion with subsequent discoloration, bad taste and odor in the water. The water is staining some of the fixtures. See P1-H2. Hot water heaters are electric and are not strapped to walls for seismic bracing as required by code. See photos P7-H2, P8-H6.

Recommendation

- Replace all hot and cold plumbing piping in the facility with new copper or PEX tubing.

PLUMBING – Waste Water System

Description

There is no indication that the waste and vent piping has ever been replaced. The useful life of the system is at its end, and the piping should be replaced. Complaints of foul smells from the oil separator pit indicate that the floor drain piping may have failed.

Recommendation

- Replace all waste and vent piping with new.

PLUMBING – Plumbing Fixtures

Description

There is a variety of plumbing fixtures, all of which need to be replaced. None of the fixtures are water-conserving types. Many of the toilets are round bowls rather than code required elongated bowls with split seats. Some of the toilets have no lid at the tank. The showers observed in hangar H-6 are an add-on type and need to be permanent. See P9-H6. The lavatories need new faucets. There are no women's latrines in H-6, although women work at the facility. See photos P4-H6 and P5-H2.

Recommendation

- Replace all of the plumbing fixtures with new water conserving type. Install new faucets with automatic shutoff feature. Utilize new elongated toilets with split seats per UPC code. Provide handicap accessible fixtures in those locations designated at accessible to the handicapped. Provide a women's latrine.

Plumbing Fixtures – Hangar #2

Description

Water was found leaking on the floor at toilets, probably due to faulty wax ring. See photo P2-H6. Toilets are not 15" away from wall per UPC. See photo P3-H6. Lavs are loose at wall.

PLUMBING

Recommendation

- Replace wax ring or troubleshoot cause of failure. Re-pipe and replace toilets to UPC location and access standards. Reattach lavs.

Plumbing Fixtures – Hangar #3

Description

Emergency shower only has cold water. UPC requires tempered water to emergency showers. The drinking fountain is inoperative.

Recommendation

- Provide tempered water to emergency shower. Replace drinking fountain.

Plumbing Fixtures – Hangar #6

Description

One urinal is missing in lower latrine. See photo P6-H6. Inadequate number of water fountains. Water heater is not seismically strapped. Failed wax ring, sewage on floor of latrine.

Recommendation

- Replace urinal. Add water fountains to each side of hangar and to upstairs offices. Strap water heater. Replace wax ring.

PLUMBING – Oil-Water Separator

Description

New oil-water separators have been installed in each of the hangars. The units have not been serviced regularly and need to be pumped out. Users complain of a foul odor at the floor drain collection pit when the unit is operated.

Recommendation

- Pump out the oil-water separators on a monthly scheduled basis, more often if required. Steam clean all floor drainpipes.

Oil-Water Separator – Hangar #2, #3, #6

Description

There are relatively new oil water separators installed in each hangar. The staff at each hangar complains that each of the separators smells of sewage. We observed that the holding tanks in each of the separators has not been pumped out or serviced as required for proper operation. See Photos P7-H6, P8-H6, and P9-H2.

Recommendation

- Clean unit, pump out oil. Troubleshoot for possible sewage cross connect.

PLUMBING – Floor Drains

Description

The floor drains in the hangar areas are small round fixtures that are not draining the floor well. Technical letter ETL 1110-3-485 requires floors to be sloped to trench drains at the main hangar doors or other locations as required. The size of the drainage piping must include the calculated maximum demand of the installed fire protection systems. The floor drain in hangar H-3 latrine has no strainer. See photo P10-H3.

Recommendation

- Install trench drains at all hangar floors, cut out sufficient floor area and re-pour concrete to permit drainage to the trench drain.

ELECTRICAL

ELECTRICAL – Electrical System

Description

Overall, the electrical systems are a mix of some original equipment and many new panels that were installed in 1975 - still 27 years ago. See Photos E1-H3, E2-H2, E3-H2, E4-H2, E5-H6, E6-H6, E7-H2, E8-H2, E9-H2 and E10-H2. Motor starters observed are of current production and appear to be in good condition. See photos E11-H2, E12-H2, E13-H3 and E14-H3.

Recommendation

- Replace all panels with new panels of like manufacturer. All new breakers will then be rated to current standards and have listed fault current interruption values.

ELECTRICAL – Incoming Service

Description

The incoming service was replaced in 1975. There are no indications of inadequate power availability or of service problems. The power is not metered, so actual use is unknown.

Recommendation

- We suggest adding a meter base to the service of each hangar to account for building electrical use.

ELECTRICAL – MDP

Description

The MDP for hangar #2 appears to be fairly new, (See photo E15-H2) although we could not locate plans that replaced that MDP. We did not see new MDP units in the other hangars, although there could be new units behind doors that were locked that we could not access. The 1975 electrical remodel plans show reuse of the distribution panels, and some of the distribution panels we saw appear to be very old.

Recommendation

- If the MDP in hangar #2 is the only new MDP, we suggest replacing the MDP in Hangars #3 and #6 with new, current production main distribution panels that have NEC required short circuit interruption capacity.

ELECTRICAL – Sub Panels

Description

Most of the sub-panels were replaced in 1975, but the majority of the feeders to those panels were not replaced.

Recommendation

ELECTRICAL

- Since the majority of the sub-panels are 27 years old and some are much older, we suggest wholesale replacement of all of the panels to provide a standardized panel make and model for easier breaker replacement, and for known condition of the electrical system.
-

Sub Panels – Hangar #2

Description

Panel B directory not current. Many panels are unmarked and may be original equipment. Panels may have been abandoned in place.

Recommendation

- Update directory. Remove panels if they are no longer operational. Label all panels.

Sub Panels – Hangar #6

Description

The directory at the panels do not match the actual loads. Panel Q1 and Q2 have no directory.

Recommendation

- Update the directory or replace panel as suggested in typical recommendations.

ELECTRICAL – Power Wiring

Description

Power wiring condition is questionable. As noted above, when a major electrical upgrade was performed in 1975 the feeders to the majority of the sub-panels were reused, and apparently judged to be in satisfactory condition. The present condition may well be unacceptable. Also, all of the conduits that are routed down through the hangar floor are required to have explosion proof seal-offs per NEC, but only a few recently installed conduits (those serving the new oil separator) have the required seal-offs. See photos E16-H2, E17-H6.

Recommendation

- We recommend replacing all of the feeder wiring to all of the panels, since the insulation is a minimum of 27 years old and could be original equipment. Wiring to the fixtures is also at least 27 years old and while it may be in acceptable condition, if a major remodel is performed to bring another 30 years of service to the building, we would suggest replacing all of the wiring with new. Install seal-offs on all conduits that run down to within 18" of the hangar floor, since that is a class 1, division 2 hazardous area.

ELECTRICAL – Power Receptacles

Description

ELECTRICAL

Power receptacles and light switches were changed in 1975 during a major upgrade. The devices are subject to wear and have exceeded their useful life.

Recommendation

- Replace all power receptacles and light switches with new devices.

Power Receptacles – Hangar #2

Description

Light switch device covers were found broken in several places.

Recommendation

- Replace all devices per typical recommendation.

ELECTRICAL – Data Cabling

Description

Data cabling has been added as the need arises and appears to be current.

Recommendation

- The communications technicians should be queried to see if updated cables are needed. If an upgrade is appropriate, we suggest using fiber cable or Cat 5e minimum.

ELECTRICAL – Data Receptacles

Description

Data receptacles have been added as needed and are assumed to be up to current requirements since technology dictates replacement of terminals as new devices evolve.

Recommendation

- Replace data receptacles only as required by users.

ELECTRICAL – Exterior Light Fixtures

Description

There are virtually no exterior lights around any of the hangars. The exterior spotlights are old and do not appear to be effective. See photo E18-H6 as an example.

Recommendation

ELECTRICAL

- As a minimum, parking lot lighting should be installed unless the airfield prohibits it for security reasons. Apron area light fixtures should be replaced with new fixtures that have superior cutoff and reduced glare.

Exterior Light Fixtures – Hangar #6

Description

There are still incandescent light fixtures at the exterior of the building at the emergency exit. These bulbs burn out at 700 hours, are maintenance intensive, and waste energy. See E18-H6 and E22-H6.

Recommendation

- Replace all exterior incandescent light fixtures with HID and put on photocells.

ELECTRICAL – Interior Light Fixtures (Fluorescent)

Description

The office and accessory areas had new light fixtures replaced in 1957 and again in 1975. New T-8 lamps and ballasts were put in the old fixtures in the last few years. The fixtures are in bad shape, with most of the lenses missing or with paint on the lenses, and with some fixtures falling off the ceiling. See Photos E19-H2, E20-H2, E21-H2 and E23-H2.

Recommendation

- Replace all of the light fixtures in all offices and office areas with low glare, energy efficient ballast and lamp fixtures.

Interior Light Fixtures – Hangar #2 (Fluorescent)

Description

Light fixtures in upstairs offices are damaged by water due to roof leaks. Some attachments are failing. Several light fixtures are missing lenses, others have paint on the lenses.

Recommendation

- Replace fixtures as per typical recommendation.

ELECTRICAL – Interior Light Fixtures (HID)

Description

The hangars all had new HID metal halide light fixtures installed in 2002. See Photos E24-H6 and E25-H6. The fixtures do not have prismatic translucent lenses, so all of the light is directed downward. The floors are unpainted, except for one or two small areas, so the reflection is poor. Light levels were measured over several areas where the floor is unpainted and were 2-4 FC close to the door and 15-25 FC over the majority of the hangar

area. In one area where there was a section of floor painted white in hangar #3, we measured 30-36 FC, attesting to the value of a light colored floor.

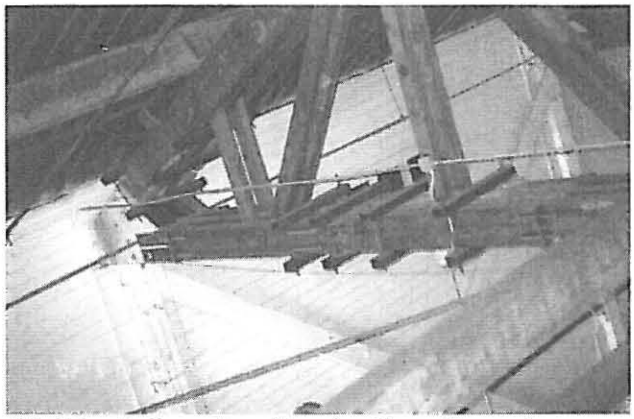
Recommendation

- Since the light fixtures are all new, the preferred fix to improve light levels is to paint the hangar floor.

APPENDIX

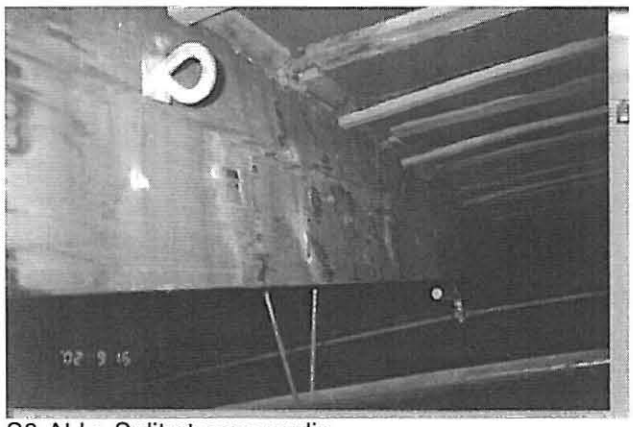
REFERENCED PHOTOS

PHOTOGRAPHS

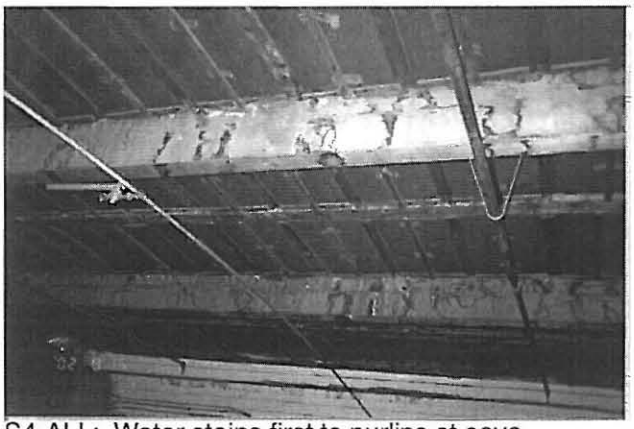


S1-ALL: Bottom chord tension tie; split repair

S2-ALL: Top chord split repair



S3-ALL: Split at eave purlin



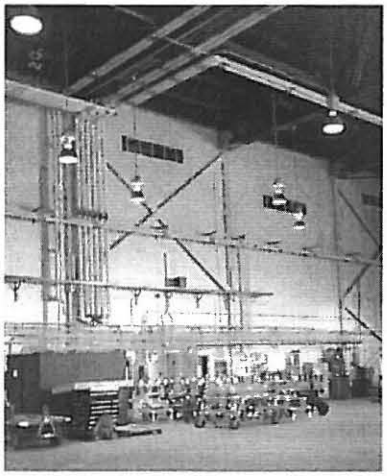
S4-ALL: Water stains first to purlins at eave

S5-ALL: Hangar door shed - top chord split

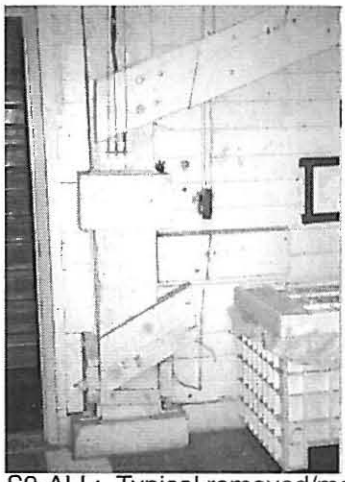
S6-ALL: Horizontal strut between first and second truss from wall

PHOTOGRAPHS

S7-ALL: Buttress above lean-to at flat roof

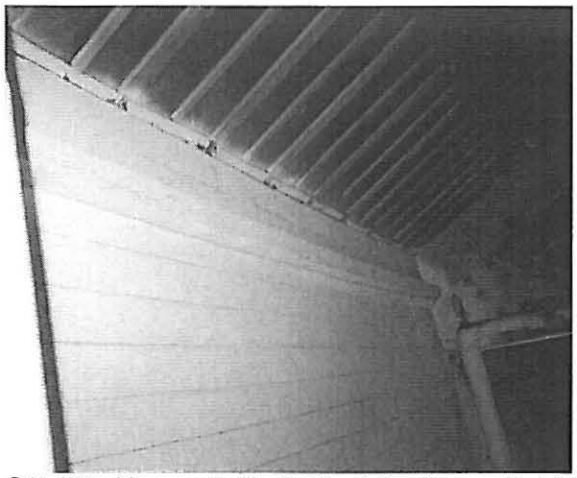


S8-ALL: Typical removed bracing - bottom



S9-ALL: Typical removed/modified bracing at column

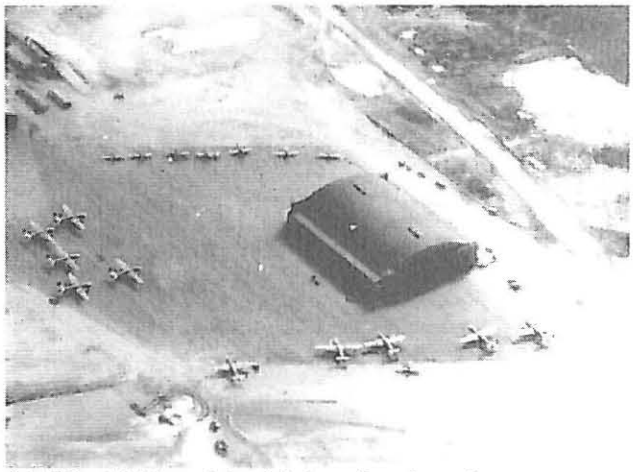
S10-H2: Hangar 2, Split "X" strut between truss 4 & 5 from west end at top



S11-H3: Hangar 3, Vertically deflecting wall siding

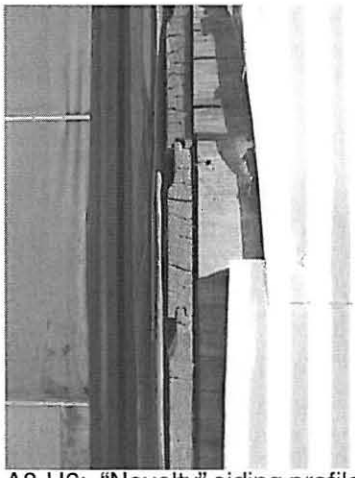
S12-H6: Removed buttress strut in second floor corridor

PHOTOGRAPHS



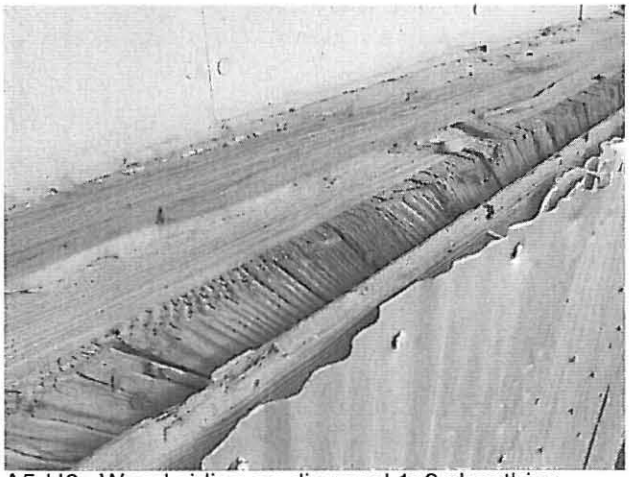
A1-H6: 1944 - original flat roof on lean-tos

A2-H6: Fire escape enclosure

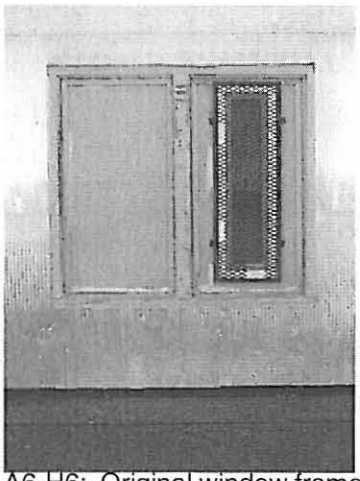


A3-H6: "Novelty" siding profile

A4-H6: Aluminum siding over original wood siding

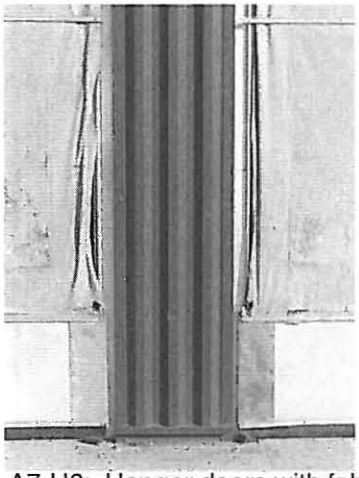


A5-H6: Wood siding on diagonal 1x8 sheathing

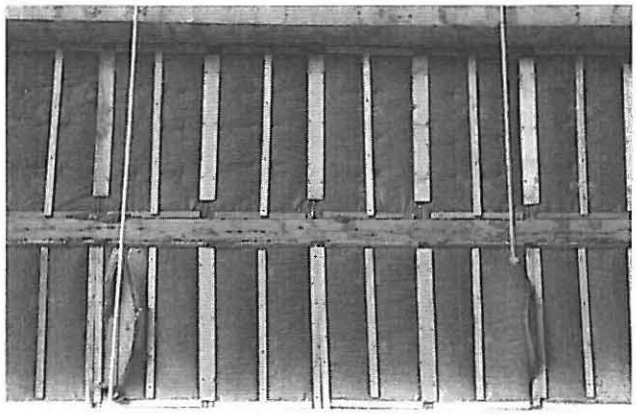


A6-H6: Original window frame with retrofitted window infill and sash

PHOTOGRAPHS



A7-H6: Hanger doors with fabric separation

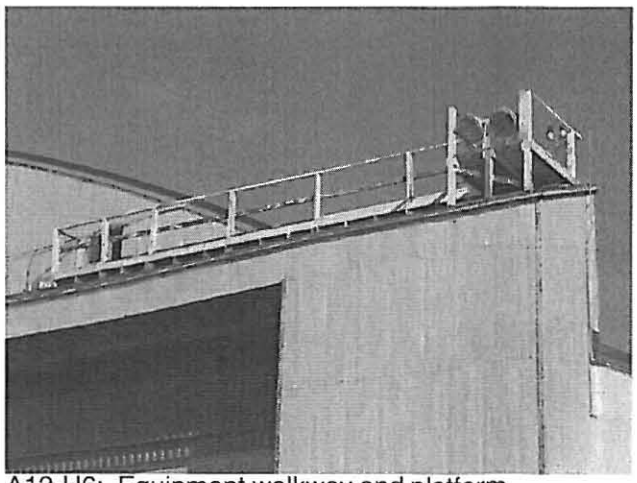


A8-H3: Nominal roof insulation and batten strips on underside of barrel roof

A9-H3: Detail of hangar roof insulation

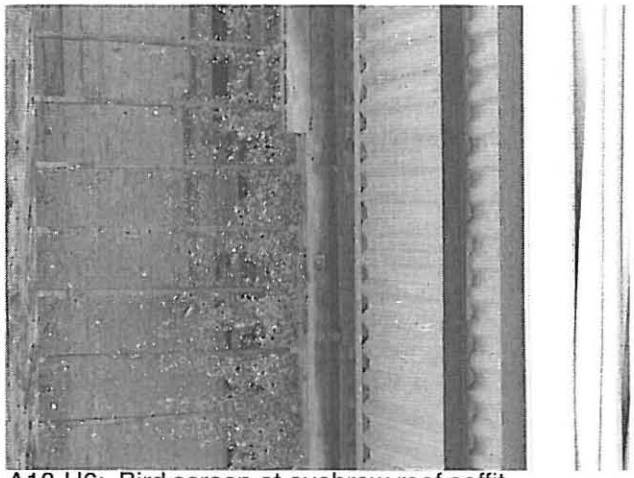
A10-H3: Shingles on eyebrow roof

A11-H3: Equipment walkway



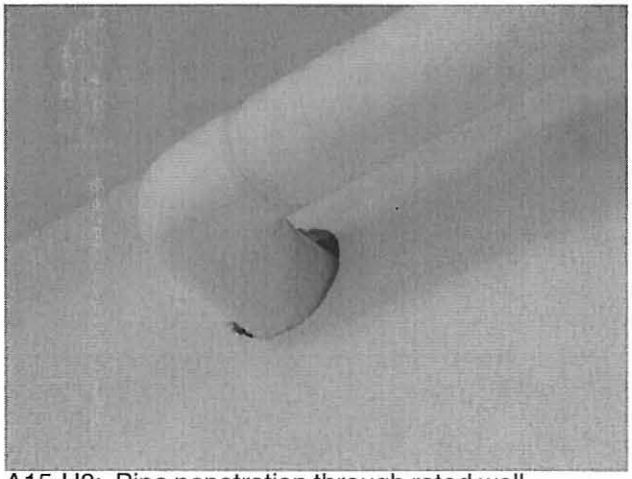
A12-H6: Equipment walkway and platform

PHOTOGRAPHS

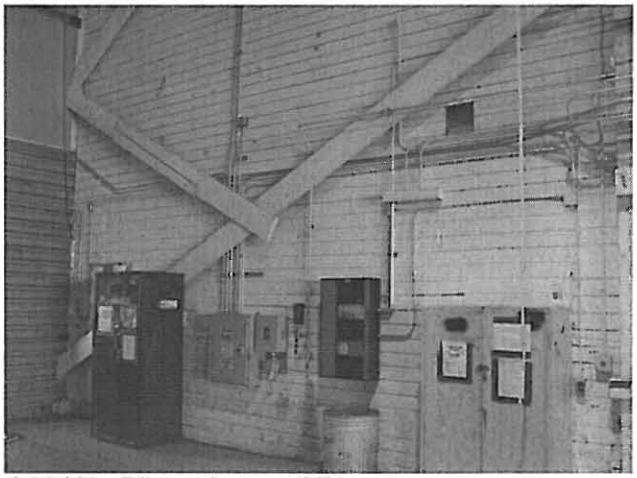


A13-H6: Bird screen at eyebrow roof soffit

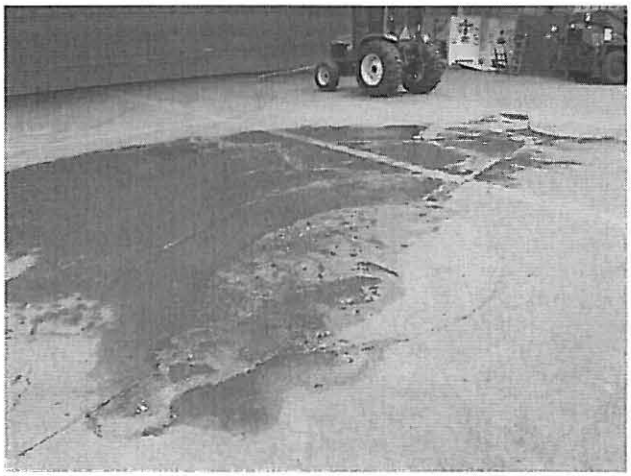
A14-H2: Latrine floor



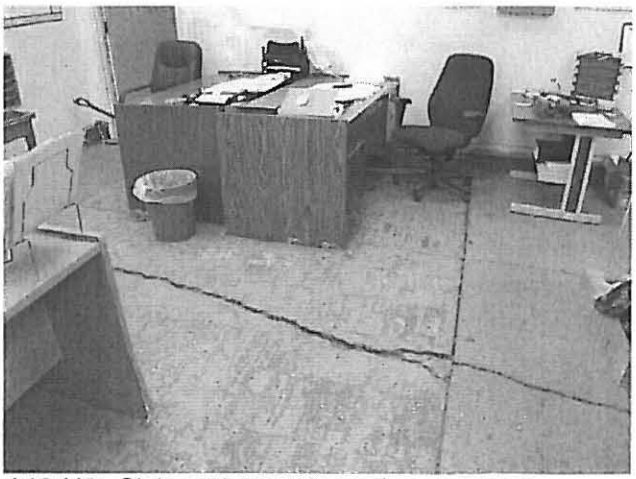
A15-H2: Pipe penetration through rated wall



A16-H2: Discontinuous "X" bracing



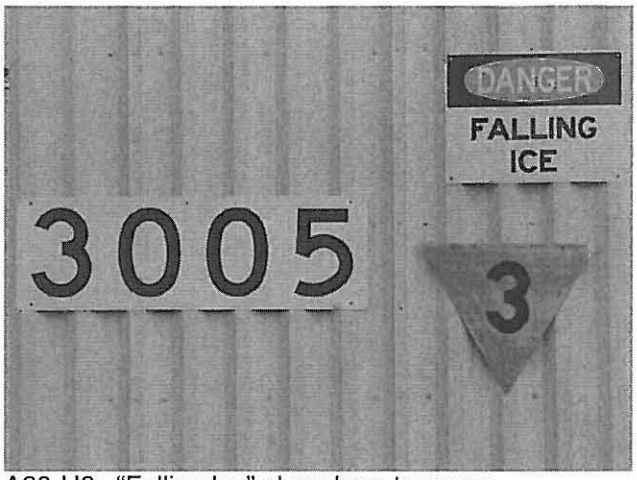
A17-H3: Ponding on hangar floor



A18-H2: Slab settlement in northeast corner

PHOTOGRAPHS

A19-H2: 2nd floor ceiling - water damage

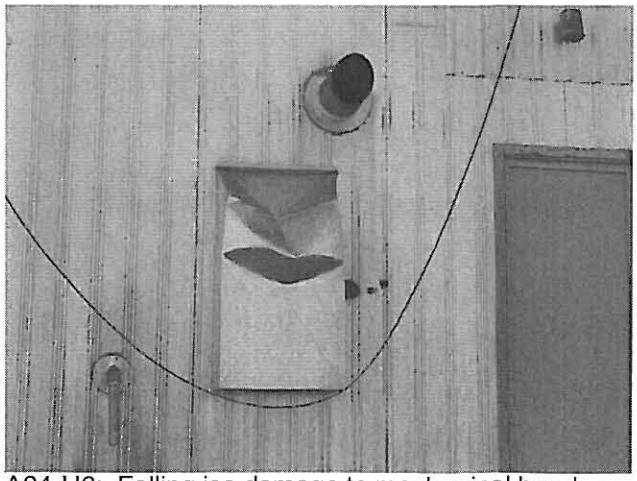


A20-H3: "Falling Ice" along lean-to eaves

A21-H2: Damage and dissimilar VCT

A22-H2: Protection canopies along buildng eaves

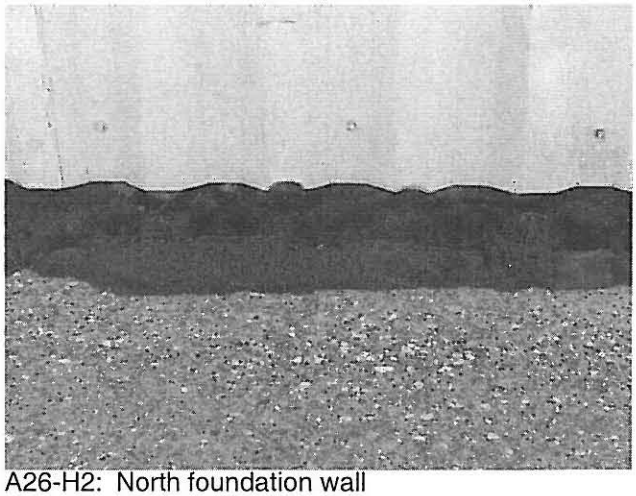
A23-H6: Protection canopies



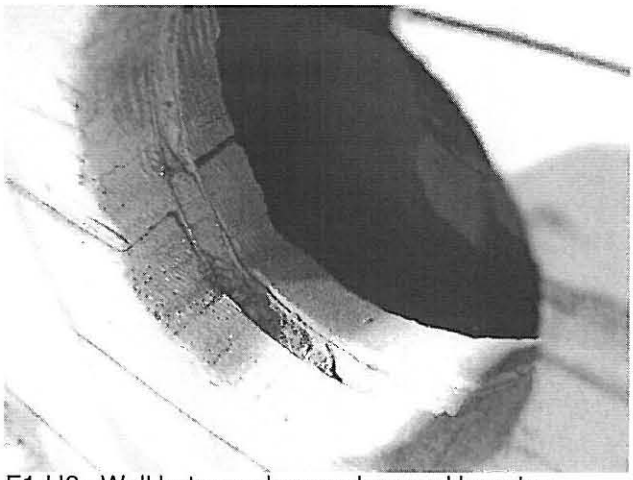
A24-H6: Falling ice damage to mechanical hood

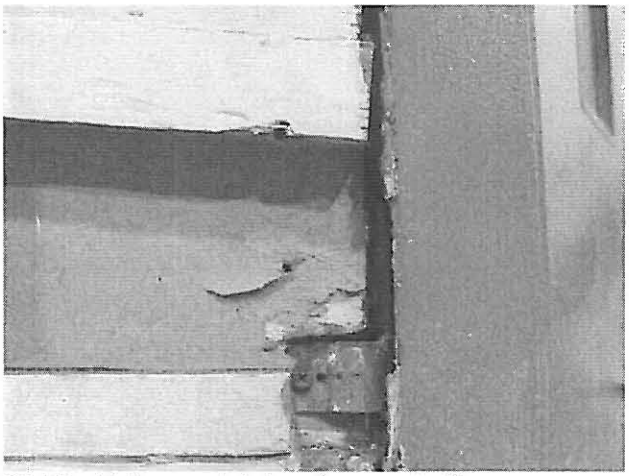
PHOTOGRAPHS

A25-H2: Latrine


A26-H2: North foundation wall

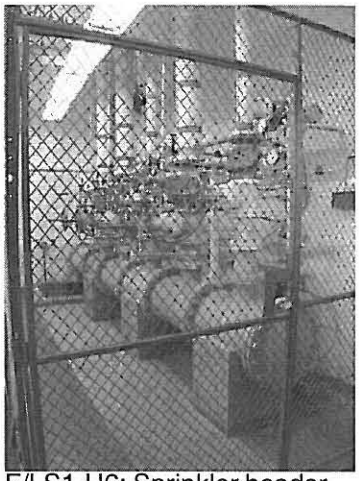
A27-H2: Stair covering

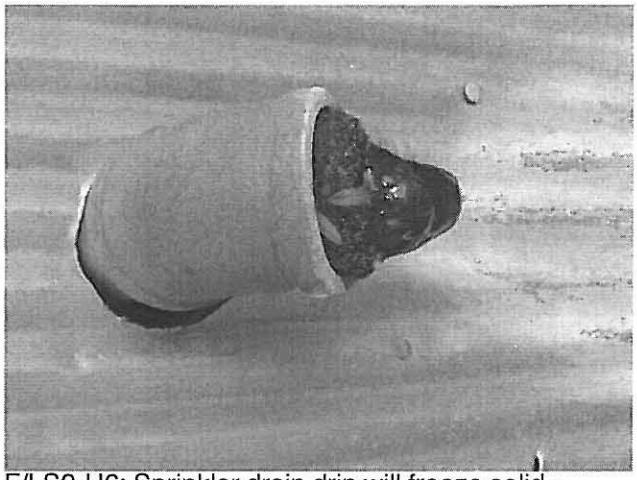

F1-H3: Wall between hangar bay and lean-to - hangar side of stud

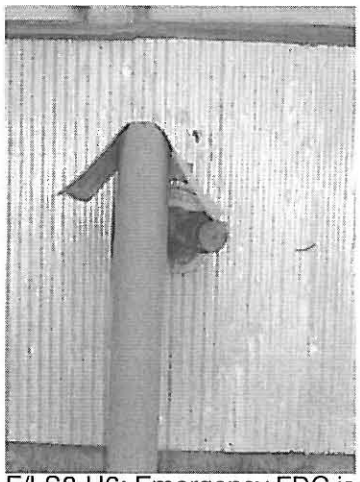

F2-H6: Hollow metal door frame retrofit

F3-H2: Fire escape

PHOTOGRAPHS

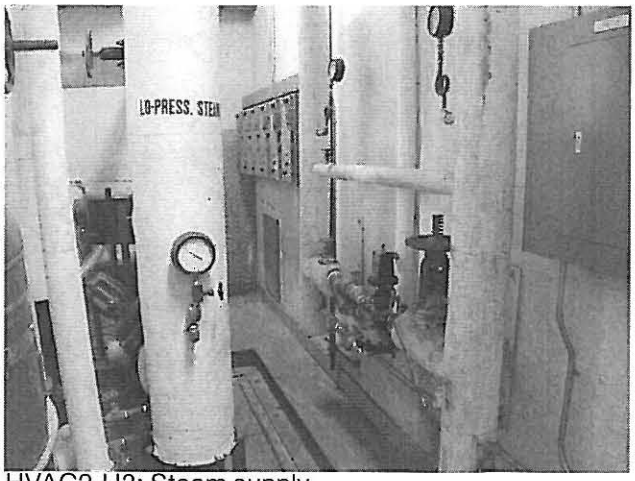

F/LS1-H6: Sprinkler header


F/LS2-H6: Sprinkler drain drip will freeze solid - needs service


F/LS3-H6: Emergency FDC ice protector crushed on to outlet

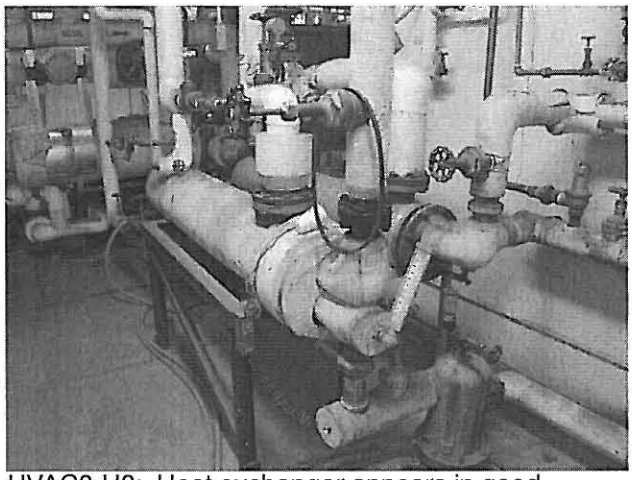
F/LS4-H6: FDC protector crushed on to pipe

HVAC1-H6: Steam piping

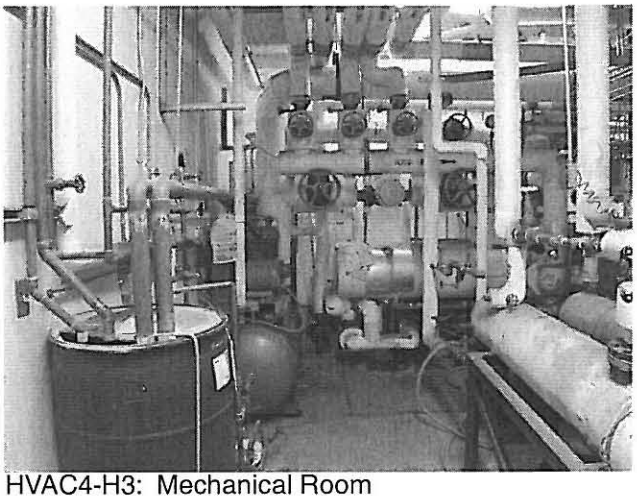


HVAC2-H3: Steam supply

PHOTOGRAPHS

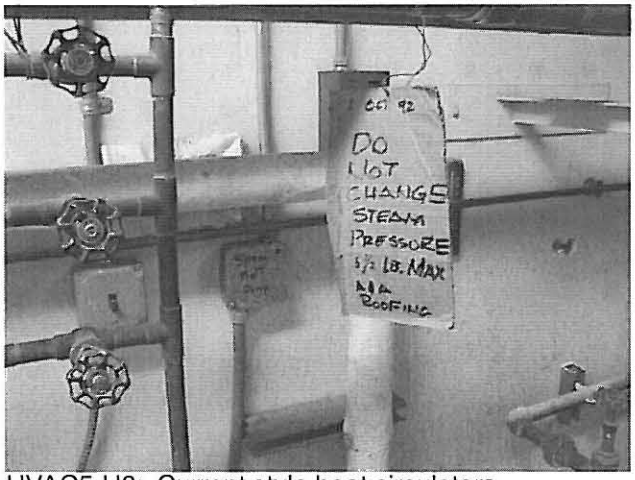


HVAC3-H3: Heat exchanger appears in good condition

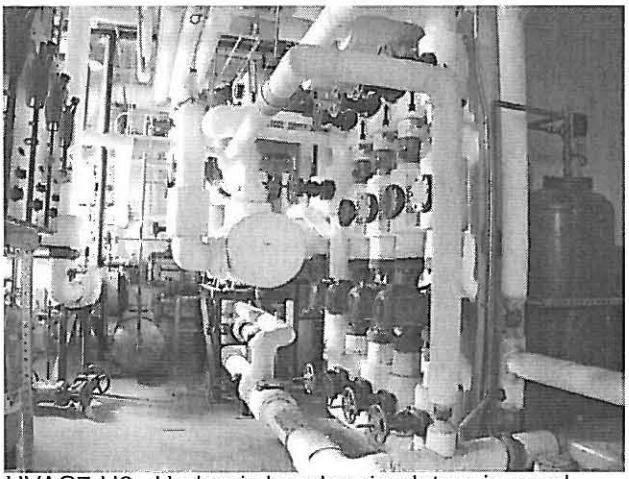


HVAC4-H3: Mechanical Room

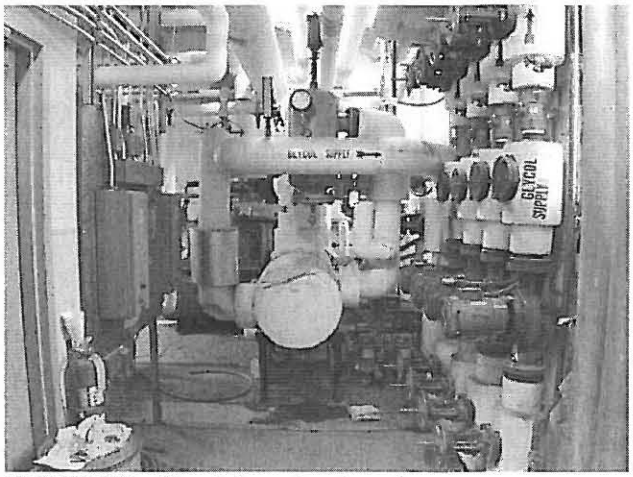
HVAC5-H6: Heat circulators in good condition



HVAC5-H3: Current style heat circulators

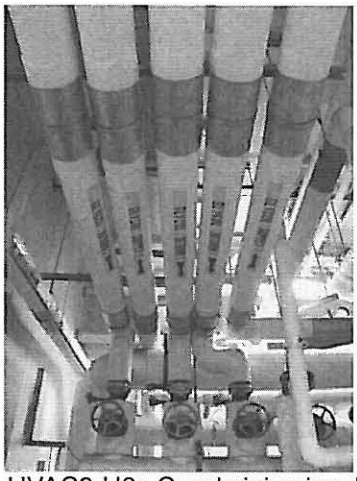


HVAC7-H2: Hydronic header circulators in good condition

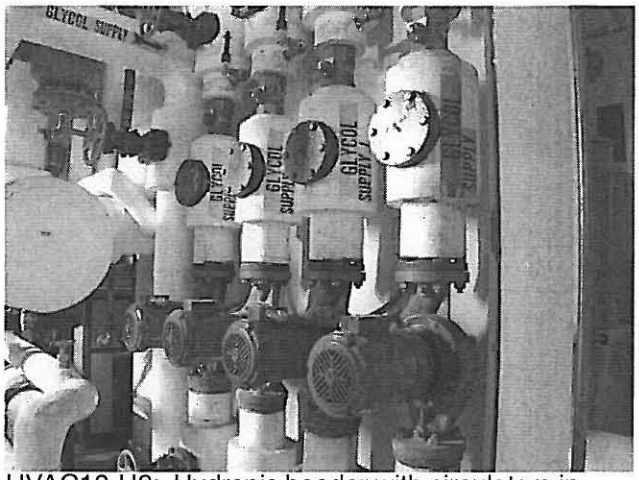


HVAC8-H3: Circulators, heat exchanger

PHOTOGRAPHS

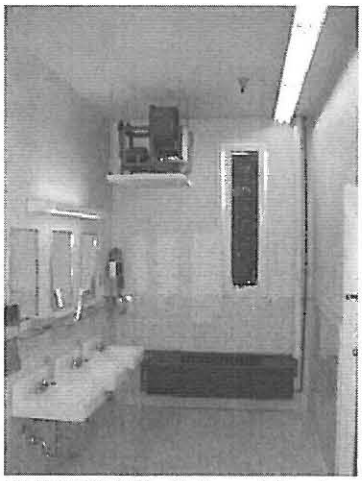


HVAC9-H3: Good piping insulation



HVAC10-H2: Hydronic header with circulators in good condition

HVAC11-H2: Baseboard missing end cap

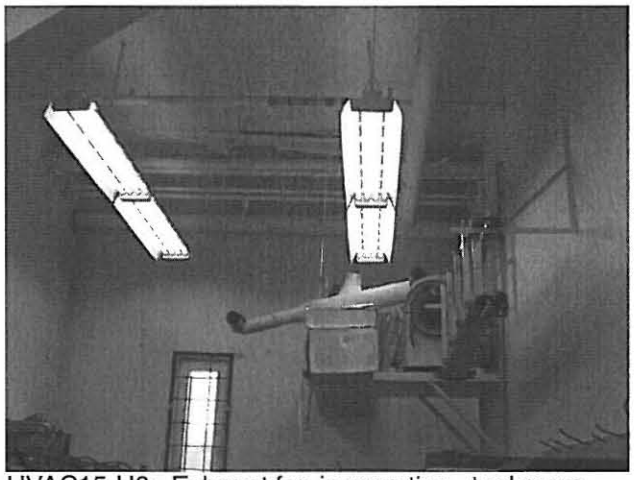


HVAC12-H2: Exhaust fan inoperative, no handicapped access

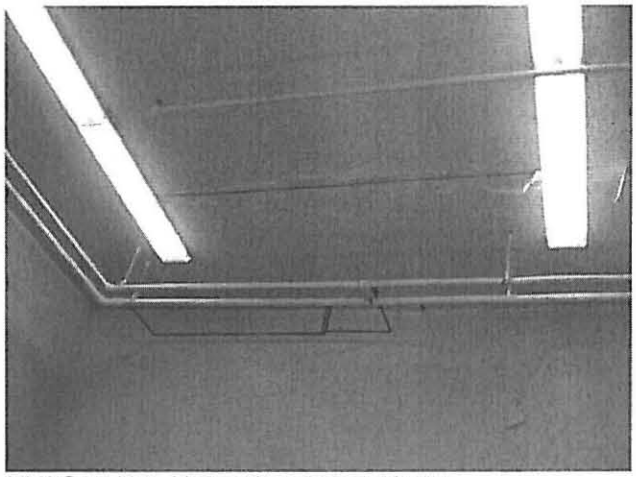
HVAC13-H2: Exhaust fan outlet plugged with insulation

HVAC14-H3: Control panel

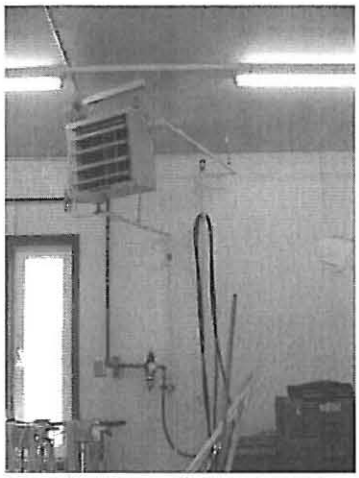
PHOTOGRAPHS



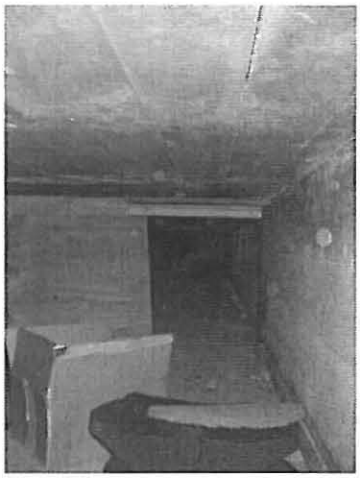
HVAC15-H3: Exhaust fan inoperative - tool room



HVAC16-H3: Uninsulated heat piping



HVAC17-H3: Uninsulated heat piping



HVAC18-H3: Tunnel under hanger door could be heated for snow melt

HVAC19-H2: Snow melt at doors not adequate (typical)

PHOTOGRAPHS

P1-H2: Water stained fixtures from galvanized piping

P2-H6: Flooded floor at toilet

P3-H2: Women's toilet too close to wall

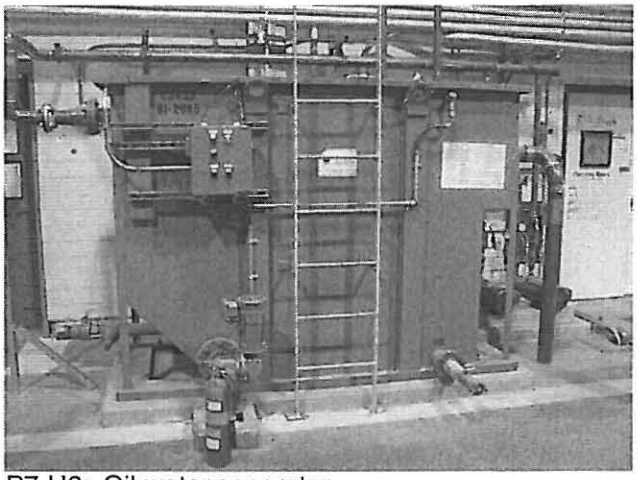
P4-H6: Closed seat; toilet plugs; raw sewege on floor

P5-H2: Wrong lid on water closet tank; wrong seat at water closet (split required)

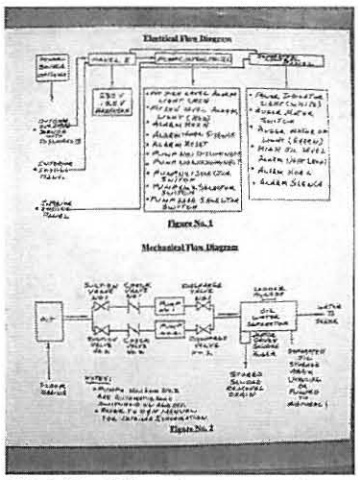
P6-H6: Missing urinal

PHOTOGRAPHS

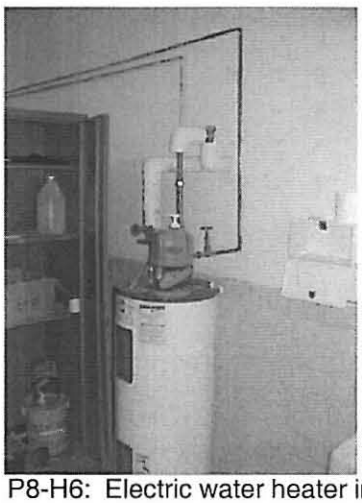
P7-H2: Water heater in latrine not anchored



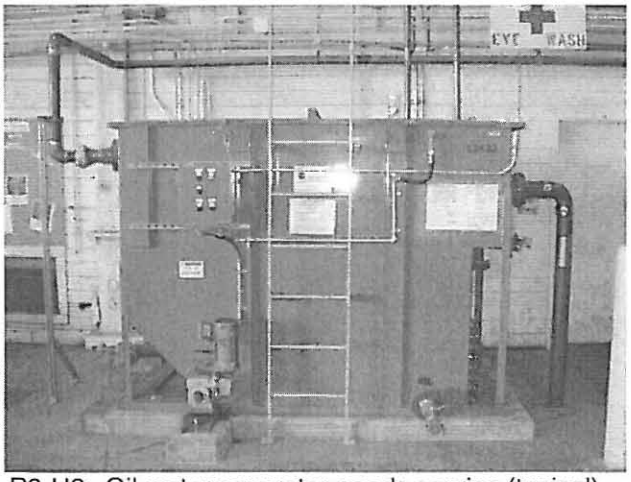
P7-H6: Oil-water separator



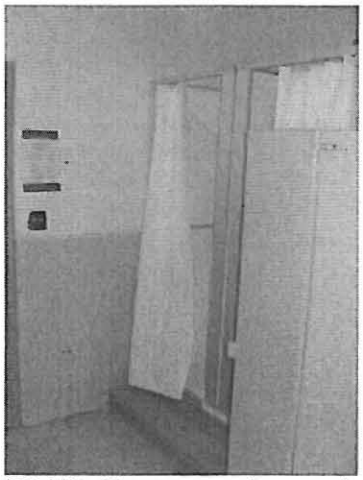
P8-H6: Oil-water separator schematic



P8-H6: Electric water heater in latrine not strapped to wall

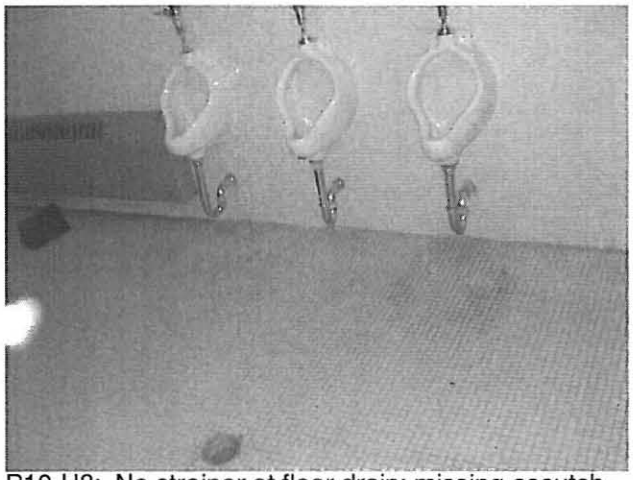


P9-H2: Oil-water separator needs service (typical)

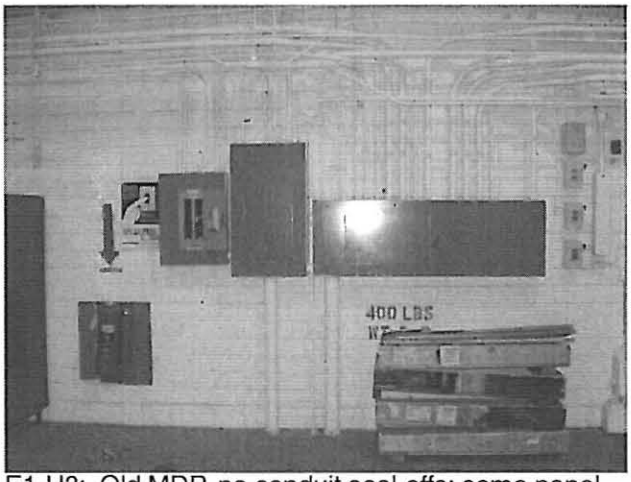


P9-H6: Temporary showers in latrine - no women's shower/toilet

PHOTOGRAPHS

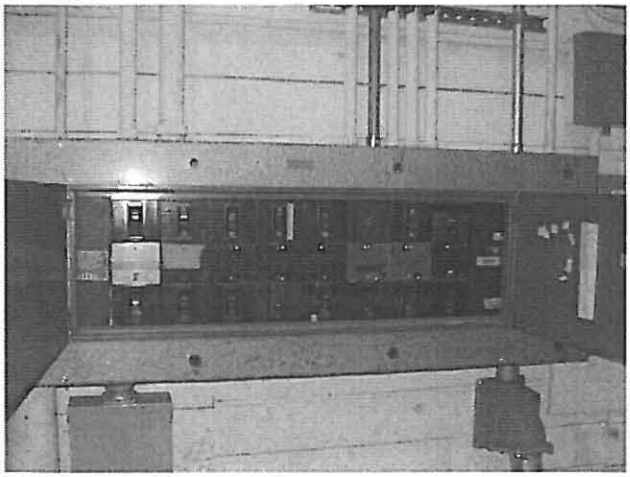


P10-H3: No strainer at floor drain; missing escutcheons at urinal drains

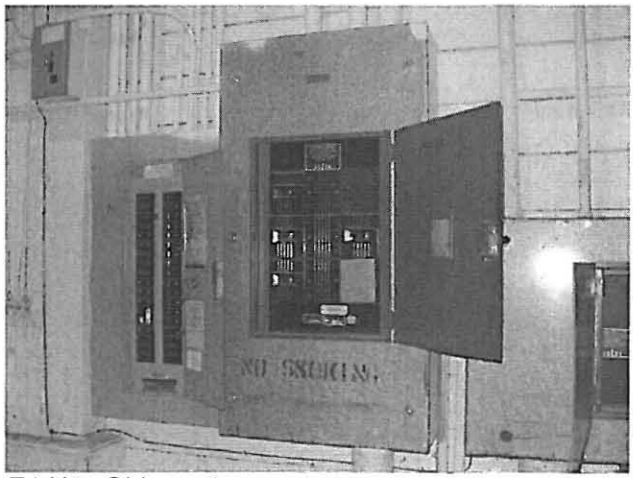


E1-H3: Old MDP, no conduit seal-offs; some panel conduit may be abandoned; panel directories not up to date

E2-H2: Old MDP panel

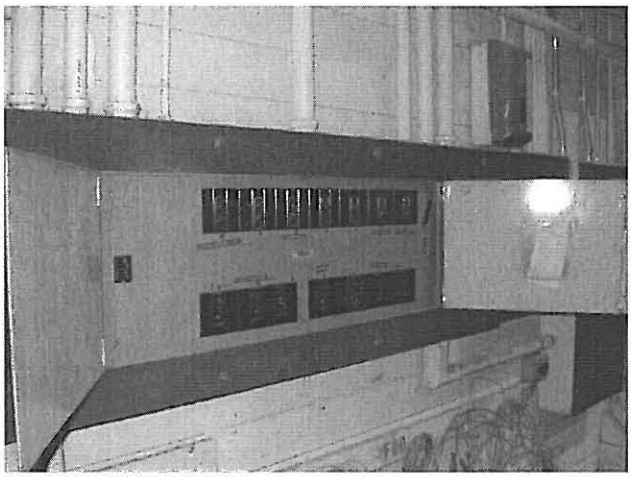


E3-H2: Old MDP panel

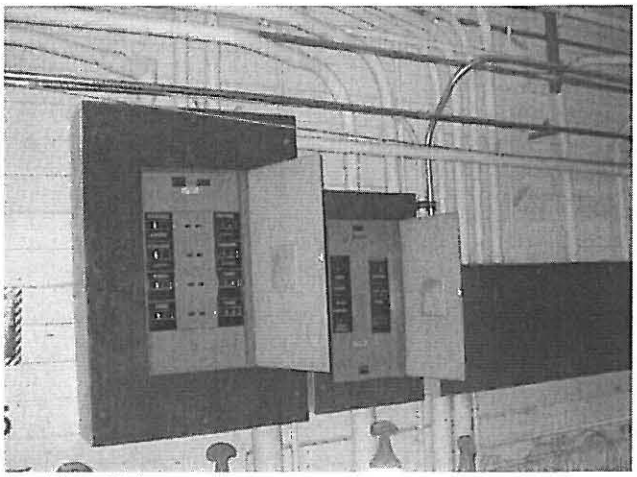


E4-H2: Old panel

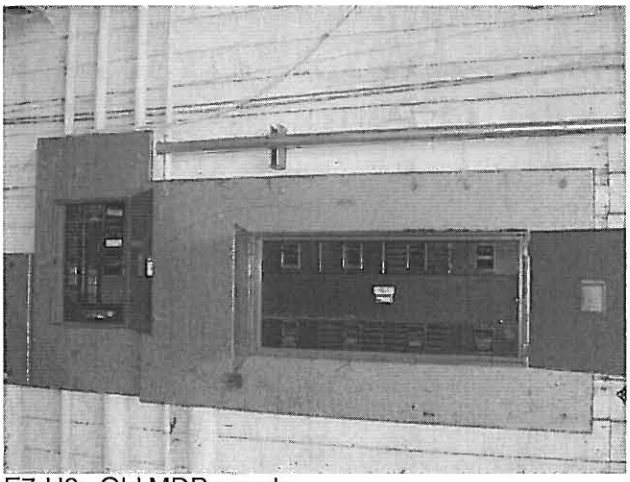
PHOTOGRAPHS



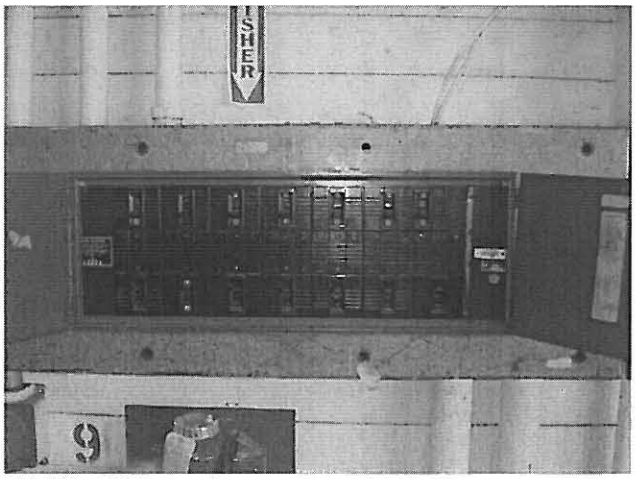
E5-H6: Old MDP Panel



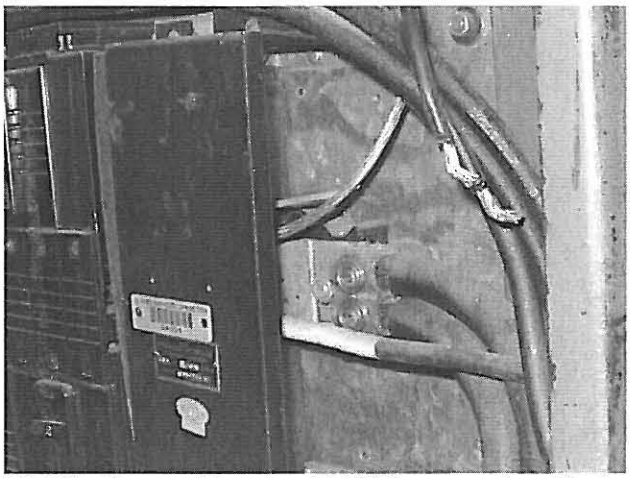
E6-H6: Old panels



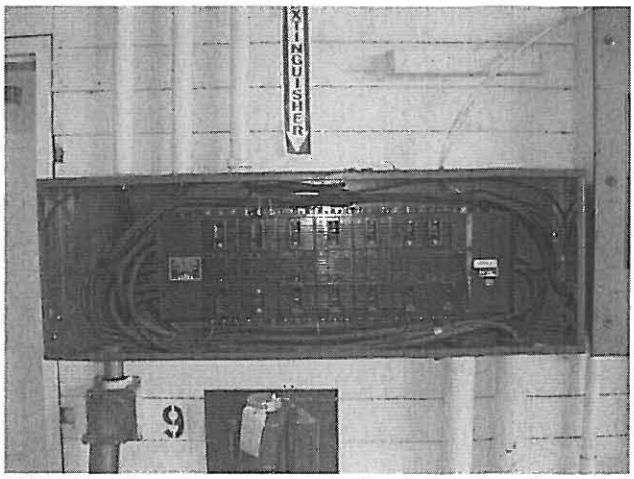
E7-H2: Old MDP panels



E8-H2: Old panel

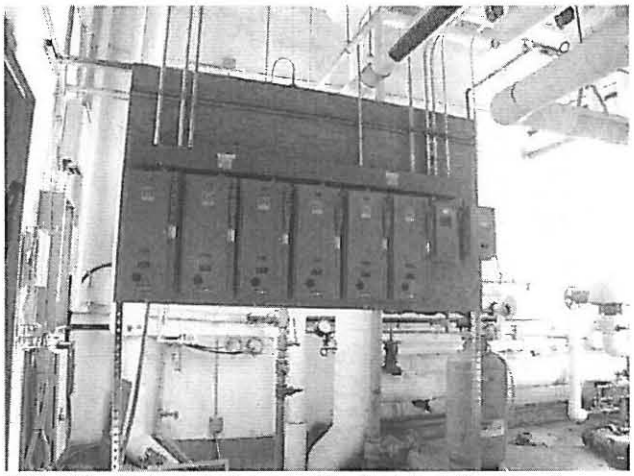


E9-H2: Power at lugs to old MDP, some wires lifted

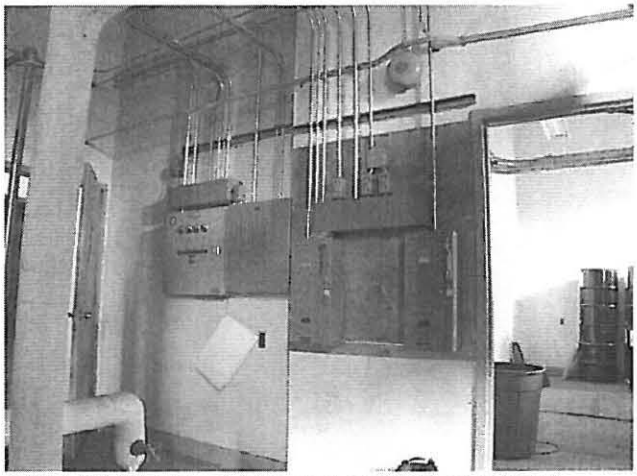


E10-H2: Panel cover removed, mostly abandoned

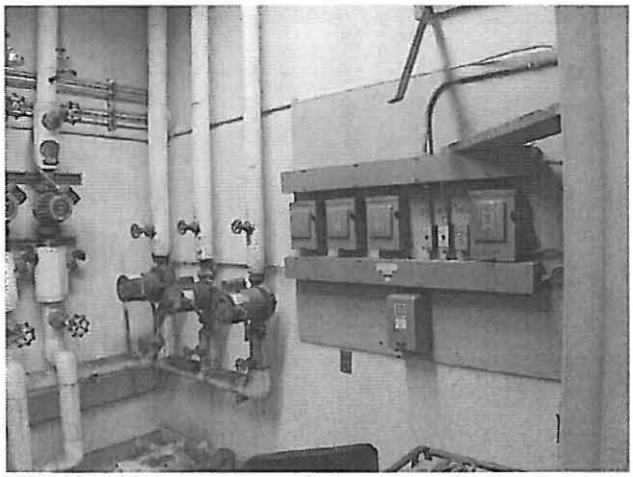
PHOTOGRAPHS



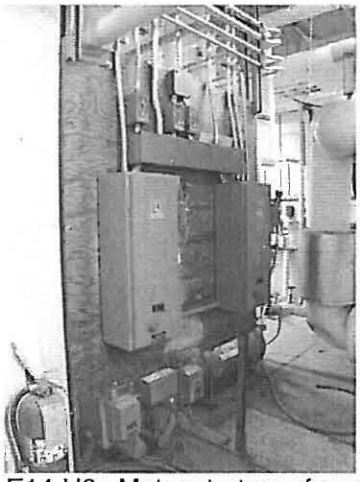
E11-H2: Motor starters in Mechanical Room of current production



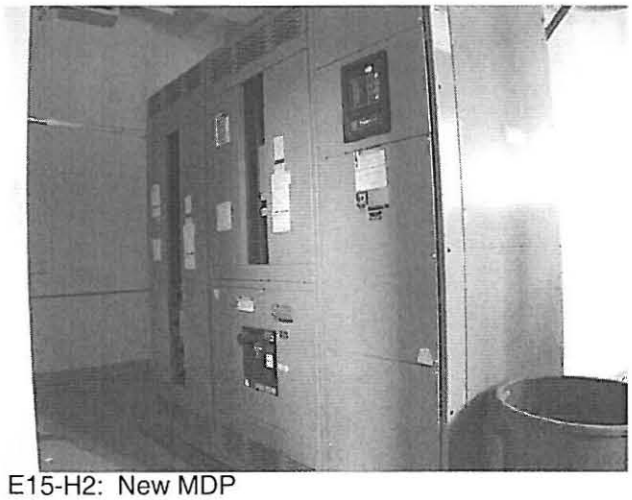
E12-H2: Motor starters and controls of current production



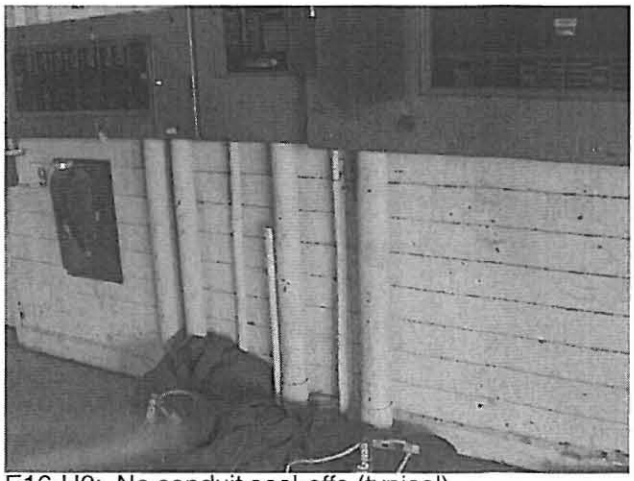
E13-H3: Motor starters of current production



E14-H3: Motor starters of current production

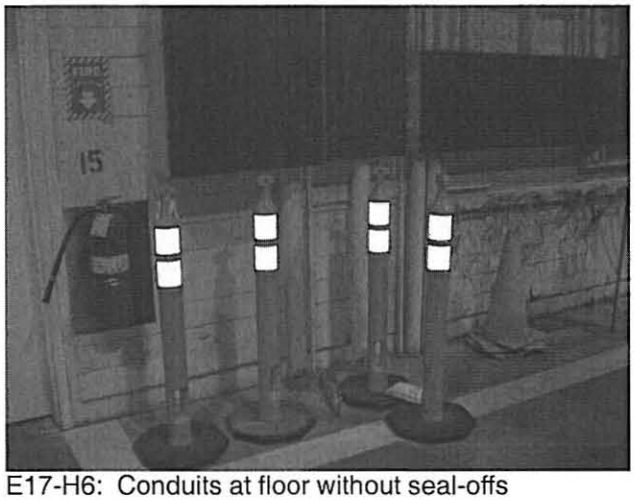


E15-H2: New MDP



E16-H2: No conduit seal-offs (typical)

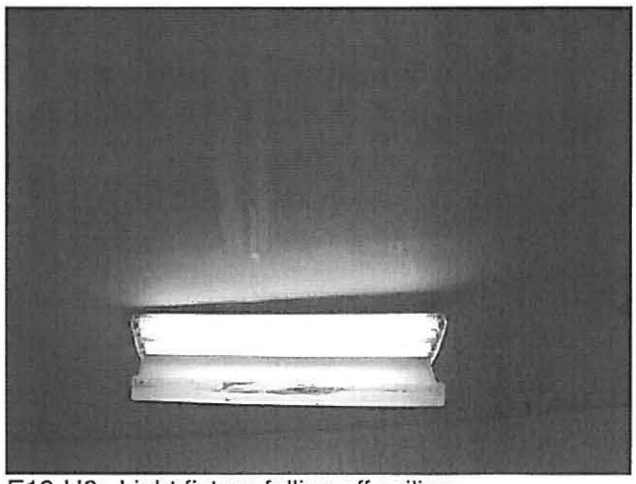
PHOTOGRAPHS



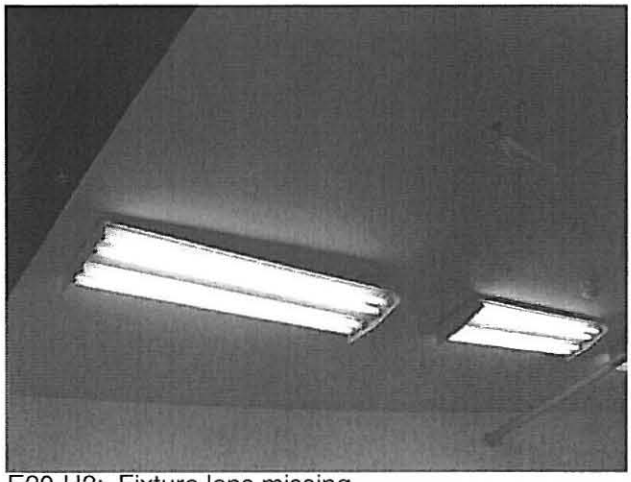
E17-H6: Conduits at floor without seal-offs

E18-H6: Incandescent lighting at emergency exit

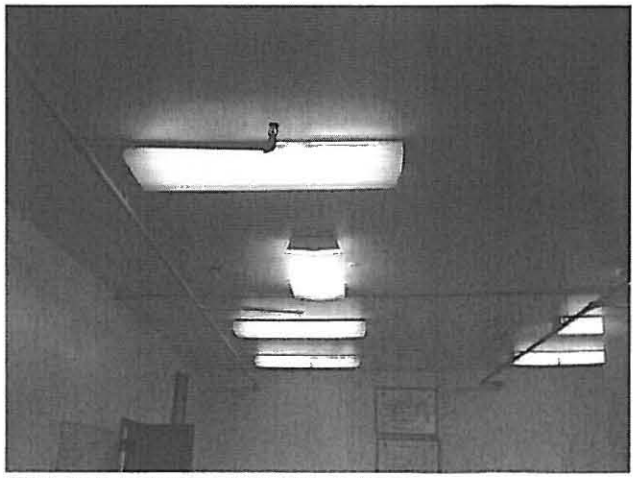
E18-H6: Poor to nonexistent exterior lighting



E19-H2: Light fixture falling off ceiling



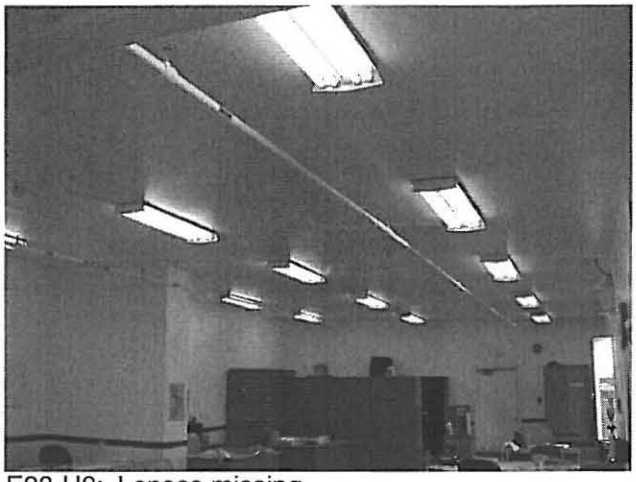
E20-H2: Fixture lens missing



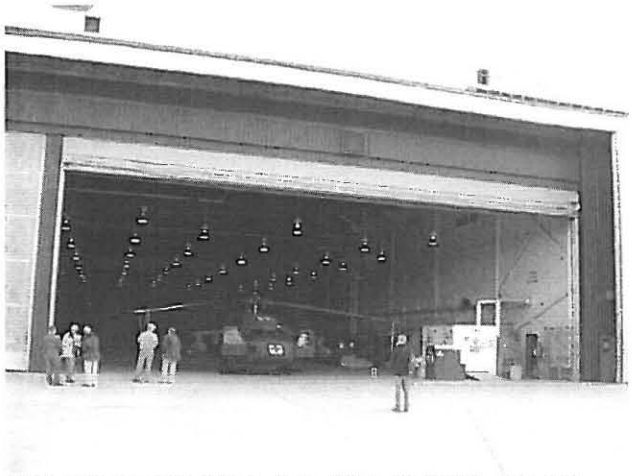
E21-H2: Paint on light fixture lens

PHOTOGRAPHS

E22-H6: Incandesent fixture should be replaced



E23-H2: Lenses missing



E24-H6: New lighting, but still dark inside hangar

E25-H6: New hangar lights, but still low footcandle

APPENDIX

DETAILED DEFICIENCY & RECOMMENDATION TABLE

Ft. Wainwright "Birchwood" Hangars

11/11/02 9:50 AM

Facility Condition Survey & Recommendations - All Hangars

Hangars No: 2 (3008); 3 (3005); 6 (2085)

Hangar	Code	Component/Location	Material/Type	Deficiency	Recommendation	Condition	Priority	Quantity or %	Units
SITE									
				See specific hangars					
STRUCTURE									
ALL	2-STRUC SK-1	Interior - outside leg of buttress footing	Concrete	Insufficient mass to resist seismic uplift	Remove 4" SOG and 0'-8" of soil over existing footing. Excavate around footing, cast concrete around footing all sides 12" wide by 3'-6" depth. Cast concrete over footing and new concrete to top of existing SOG. Dowel new concrete to existing.	Unknown	Serious	18 ea hangar @ 7 cu yds ea, 54 total	Cu yds
ALL	2-STRUC	Ext-Wall sill plates	Wood	Untreated - rotting	Shore floor, replace sill with treated lumber	Unknown	Serious	100 per Hangar, 300 total	In ft
ALL	2-STRUC SK-2	Interior hangar bracing, connections	wood	Strength of connections brace to column, brace to brace.	Add steel plates between columns and braces. Bolt brace to plates and plates to columns with 3/4" diameter bolts and shear plates. 6 - 3/4" diameter bolts brace to plate, 5 - 3/4" diameter bolts with 4" dia. **Shear** plate to column. Each pair of columns - 3 each column, 6 each pair.	Fair	Serious	24 ea. Side of hangar. 48 each hangar. 144 total	each
ALL	2-STRUC SK-3	Buttress framing	Wood	Members removed	Replace all removed members Approximately 2 3 x 8 x 12 ft ea buttress	Fair	Serious	36 ea hangar, 108 total	each
ALL	2-STRUC SK-3	Buttress framing	Wood	Strength and stability of framing to resist seismic lateral loads	Reinforce diagonal element of buttress. Add (2) 2x12 DF No.I to top and bottom of each diagonal. Outside leg 38 ft, bottom horizontal leg 12 ft, Intermediate diagonal legs 42 ft	Fair	Serious	92 ft ea buttress, 18 buttress per hangar, 54 total	In ft
ALL	2-STRUC SK-4	Low roof decking/shtg	Wood	Previous reroof removed sheathing along outside edge of low roof.	Remove sloped roof, replace 4ft wide x 202 ft of roof sheathing ea low roof. Replace blocking between existing 2x12 roof joists. Joists at 1'-0" o.c.	Fair	Serious	3/4 " thk shtg, 1600 sf ea. Hangar. 404 ft of 2 x 12 blkg ea hangar	In ft
ALL	2-STRUC SK-4	Low roof framing	Wood	existing framing insufficient to support drifting snow without excessive deflection	Add new joist between existing. Add 2 x 12 every other space between existing 2 x 12 at 12" o.c. 2 x 12 x 26 ft DF No. 1 ea.	Fair	Serious	(100) 2 x 12 x 25ft ea low rf, 200 per hangar, 600 total	each

Ft. Wainwright "Birchwood" Hangars

11/11/02 9:50 AM

Facility Condition Survey & Recommendations - All Hangars

Hangars No: 2 (3008); 3 (3005); 6 (2085)

Hangar	Code	Component/Location	Material/Type	Deficiency	Recommendation	Condition	Priority	Quantity or %	Units
ALL	2-STRUC SK-5, 6	Shed roof over hangar doors	Wood	Members unstable	Remove existing steel door rails and supports in roof space. Correct roof toe downward shift and inward rotation. Adjust end wall trusses to plumb. Replace Bottom chord struts/supports, at approximately 1/3 points with G.L. 8 3/4" x 12" between first and second truss. Add additional strut at ctr point. Provide Provide 8 3/4' x 12" diagonal strut from bottom chord of second truss to top chord of third truss. Each strut Extend roof sloped framing members from intersection of framing member with end wall truss to roof. Frame to intermediate header between high roof purlins. Use 4 x 12 at approx. 7'-6" O.C. each side of crown for 30 ft each side of crown. **8 diag. each end, 8** intermediate headers each end. **l ~ 48 ft.**	Poor	Serious	6 struts x 25 ft, 6 struts x 34ft ea hangar **4 x 10, 16 ea hangar x 48 ft** **16 4x10 ea hangar x 8'**	In ft each
ALL	2-STRUC SK-5	Shed roof over hangar doors	Wood	Split top chord members at first truss.	Replace split members. Install shear plates each member to truss web. 30% or 6 members each end, 12 members 3x8 x 15 ft each truss. 80 shear plates each hangar	Poor	Serious	30%, 12 members ea hangar. 80 shear plates each hangar	each.
ALL	2-STRUC SK-7	High roof-2x decking	Wood	Ft. Wainwright Roof Dsgn snow - 50 psf. 2x decking is overstressed from approximately 32 ft each side of the crown or 48 ft up from the seperation wall between the office space and the Hangar each side of the hangar. The arc is 159.5 ft +/	Add new purlins between existing purlins, G.L. 5 1/8 x 13 1/2 x 25'-0"	Fair	Serious	96 - G.L.5 1/8" x 13 1/2	Each Hangar
ALL	2-STRUC SK-7	High roof - purlins	Wood	Purlins - Overstressed for 50 psf roof snow load	Add new purlins between existing purlins, G.L. 5 1/8 x 13 1/2 x 25'-0". Place one purlin between existing purlins four places from the Hangar wall toward the ridge. Add three more purlins - skip a space between each Typ ea. side of crown.	Fair	Serious	112 - G.L.5 1/8" x 13 1/2	Each Hangar
ALL	2-STRUC SK-8	High roof diaphragm, existing 2x decking	Wood	Existing 2x transverse decking is insufficient to resist lateral design force effects.	Remove existing roofing to 2x decking, replace any rotted or damaged roof structure, place back new 3/8" sheathing over existing 2x decking.	Fair	Serious	Shtg. 32300 2x decking 3200	SF
ALL	2-STRUC SK-9	High roof - load path. North to south, btwn purlins, 2x decking and truss top chord	Wood	N-S Load Path is Incomplete. Existing framing does not include elements or connections to transfer lateral force from horizontal diaphragms to vertical resisting elements.	Parallel with Truss: Add solid 2x blocking between underside of 2x decking and top chord of truss. Add light gauge framing anchors every few feet, A35 etc. **Every other purlin space.**	Fair	Serious	**2-2x6, 1-2x12, 400**	In ft each Hangar

Ft. Wainwright "Birchwood" Hangars

11/11/02 9:50 AM

Facility Condition Survey & Recommendations - All Hangars

Hangars No: 2 (3008); 3 (3005); 6 (2085)

Hangar	Code	Component/Location	Material/Type	Deficiency	Recommendation	Condition	Priority	Quantity or %	Units
ALL	2-STRUC SK-10	High roof - load path. East to west, btwn 2x decking at eaves and column/brace connection	Wood	E-W Load Path is Incomplete. Existing framing requires additional framing elements to transfer lateral force from the horizontal diaphragms to the vertical resisting elements.	Add blocking plates between studs approx. 2ft below top of column. 1/2" sheathing outside face of wall from High roof to low roof. At top plate renail roof diaphragm to plates. Nail sheathing to top of wall and at plate 2 ft below top of column as if at a boundary element. Strap across outside face of column from/to blocking each side of column. Renail jamb studs each side of column to column. Shear Panel 202 ft x 4ft each wall each hangar.	Fair	Serious	800 sq ft each wall, 1600 sq ft each hangar, 4800 sq ft total	LF/ SF
ALL	2-STRUC SK-8	N & S low roofs, diaphragms	Wood	Existing 2x decking - Transverse to (E) Joists.	Add new 3/8" sheathing, each low roof each hangar.	Fair	Serious	5300 ea roof. 10600 ea hangar. 32000 total	SF

Ft. Wainwright "Birchwood" Hangars

11/9/02 5:48 PM

Facility Condition Survey & Recommendations - All Hangars

Hangars No: 2 (3008); 3 (3005); 6 (2085)

Hangar	Code	Component/Location	Material/Type	Deficiency	Recommendation	Condition	Priority	Quantity or %	Units
EXTERIOR ENVELOPE									
ALL	3-A/EXT	Ext-Wall Covering	Metal	Existing metal siding is **not historic.**	Remove existing metal siding, original wood siding and diagonal sheathing and replace with new 3/4" plywood sheathing, air barrier and horizontal "Novelty" or "Dutch" lap cement fiber planks (Hardi or sim.) with exposure to match existing nominal 6" - all vertical wall surfaces except hanger door wall and interior of fire escape enclosures not currently surfaced. 3/4" plywood sheathing is recommended to reconcile opening dimensions with original 3/4" board sheathing.	Poor	Critical	20,150	SF
ALL	3-A/EXT	Ext-Wall Covering - hanger door wall		Original hanger doors were replaced with smaller doors and adjacent infill walls with metal siding - **not historic.**	Remove existing metal siding and air barrier on walls adjacent to hanger doors. Replace with nominal 4'x8' fiber-cement panels to simulate original hanger door finish (pattern TBD) and new air barrier. See "Ext-Door-hanger doors" below.	Poor	Critical	8004 (2) 8004 (3) 3154 (6)	SF
ALL	3-A/EXT	Ext-Wall Covering	Wood	Original wood siding-condition unknown - covered by metal siding	See "Ext-Wall Covering" above	Unknown	Critical		
ALL	3-A/EXT	Ext-Wall Trim	Wood	Original wood trim-condition unknown due to metal siding coverage. Where exposed, trim has deteriorated.	Replace exterior wood trim with new cedar in matching profiles.	Poor	Critical	100%	
ALL	3-A/EXT	Ext-Eave/Soffit	Wood	Misc. eaves and overhangs aged.	Replace all exterior wood eaves and soffits in-kind		Critical	100%	
ALL	3-A/EXT	Ext-Soffit Covering - over hangar doors	Wire Mesh	Bird screen installed following removal of original hangar doors - **not historic.** Evidence of bird infiltration into cavity above bird screen due to openings in walls and access doors ajar.	Replace bird screen where deteriorated from bird droppings. Repair openings and secure access doors.	Fair	Minor	1,900	SF
ALL	3-A/EXT	Ext-Canopy structures at exterior doors	Wood/Metal	Canopies added to protect building occupants from falling ice/snow from roofs above - **not historic.**	Remove canopy structures. Falling ice/snow to be mitigated with roof modifications (see below)	Poor	Critical	100%	
ALL	3-A/EXT	Ext-Window Frame		**Not historic.** Original windows have been removed and infilled with solid panels and smaller, "Alaska" brand windows.	Remove existing casement windows and infill panels. Replace with new clad wood windows with low-E, insulating glass double-hung units in style and dimension to match original with true divide lites	Poor	Critical	64	Units
ALL	3-A/EXT	Ext-Window Sash		**Not historic**	See window frame	Poor	Critical		
ALL	3-A/EXT	Ext-Window Trim		Original trim has been removed or where existing has deterioration	Survey existing trim; restore existing where feasible; replace in-kind as required	Poor	Critical	100%	
ALL	3-A/EXT	Ext-Window Glazing		**Not historic**	See window frame	Poor	Critical		
ALL	3-A/EXT	Ext-Window Hardware		**Not historic**	See window frame	Poor	Critical		
ALL	3-A/EXT	Ext-Window Sill	Wood	Deteriorated condition	Restore or replace in-kind	Poor	Critical		
ALL	3-A/EXT	Ext-Door	Metal	**Not historic**	Replace doors and frames				
ALL	3-A/EXT	Ext-Door-hanger doors	Fabric	**Not historic,** but will be retained for functional consideration. Fabric is separated from aluminum frame in small areas, possibly to provide visual observation to exterior.	Reattach fabric where required. Suggest adding camera and small LCD monitor or other means to observe exterior from door operator stations.	Good	Minor		
ALL	3-A/EXT	Ext-Door Trim	Metal	HM door frames not historic.	Replace with new HM frames for functional consideration	Fair			

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Hangars No: 2 (3008); 3 (3005); 6 (2085)

Hangar	Code	Component/Location	Material/Type	Deficiency	Recommendation	Condition	Priority	Quantity or %	Units
ALL	3-A/EXT	Ext - flashings/sealants	Metal		Replace all flashings and sealants as part of residing and reroofing operations	Fair	Critical	100%	
ALL	3-A/EXT	Ext-Finish	Paint	Condition not observable due to metal siding coverage. Paint not present due to wear where siding is currently exposed.	Hangars were reported to have been painted in camouflage patterns during WWII. Paint new cement-fiber boards and panels and wood trim per current Ft. Wainwright color requirements. 3-coat paint or solid body stain system.	Unknown	Critical	23,320 (2&3) 18,470 (6)	SF
ALL	3-A/EXT	Ext-Stair/Ramp Coverings - fire escapes	Wood	Wood treads, stringers and landings; peeled paint and misc repairs needed.	2000 IBC permits existing fire escapes to remain. Patch and paint existing. *Alternative:* remove fire escapes, revise septum wall location and construct new metal stairs to meet code requirements. Provide 1-hour wall construction between building and stair.	Fair	Serious	100%	
ALL	3-A/EXT	Ext-Stair/Ramp Structure		See above	See above	Fair			
ALL	3-A/EXT	Ext-Stair/Ramp Railing	Metal	Fire escapes - Pipe railings rusted; peeling paint	Clean and paint existing or provide new galvanized pipe railings if new stair is constructed	Fair		100%	
ALL	3-A/EXT	Ext-Roof Walkways	Wood	Flood lighting and antenna access platforms in disrepair and unsafe condition.	Replace in-kind	Poor	Critical	400	SF
ALL	3-A/EXT	Ext-Wall Insulation	Glass Fiber	Condition unknown.	Inspect insulation on removal of exterior siding and sheathing. Replace water damaged or discontinuous insulation.	Unknown	Serious	11,480 (max)	SF
ALL	3-A/EXT	Ext-Roof Insulation - hangar bay		Roof appears to be only insulated with thin (<1") fibrous insulation on underside of roof deck and held in place with wood battens. There was an additive alternate in work undertaken circa 1977 to add batt insulation and vapor barrier between roof purlins; the alternate was apparently not taken. This approach is questionable due to the lack of venting of the space above the batts.	Since structural upgrades require new roof diaphragm, remove existing EPDM roofing and any substrate that may exist down to the structural roof deck. Remove insulation and batten strips on underside of deck. Add 1/2" plywood diaphragm to top of existing roof deck with 5/8" Type "X" gyp sheathing 6" rigid insulation 3/4" plywood protection board and new EPDM roofing. Secure plywood cap sheet through insulation to wood deck with washers and screws. If there is existing plywood on the original roof deck, review sample area for structural diaphragm capacity and refasten to required specification. If there is existing plywood diaphragm and since the EPDM roof should have several years of service life, this work could be delayed until reroofing is necessary. Cost estimate to assume new roof assembly since new construction would feature similar assembly.	Poor	Critical	32,300	SF
ALL	3-A/EXT	Ext-Roof Insulation - lean-tos	Glass Fiber	Lean-to roofs insulated between rafters. Batts appear to be unvented. Vapor retarder on underside of rafters. Not part of historic assembly.	Lean-to sloped roofs to be removed (See Ext-Drainage System) below.				

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ALL	3-A/EXT	Ext-Roof Covering - hangar bay	EPDM	Not historic, however original shingle roofing is not deemed practical. Roofs of hanger 2 and 3 were apparently replaced in 1996.	Existing roof appears serviceable, however, close-up inspection not performed. Since they are apparently 6 years old, no work is required at this time. However, structural upgrades require new plywood sheathing if none exists (see "insulation" above)	Fair	Critical		
ALL	3-A/EXT	Ext-Roof Covering - sloped roofs over hanger doors and fire escapes	Asphalt Shingle	Lifting and deteriorated shingles	Replace shingle roofing with 3-tab asphalt shingles & "ice and water shield" membrane	Poor	Critical	3,060	SF
ALL	3-A/EXT	Ext-Roof Flashing	Metal	Flashing associated with metal siding - **not historic**	Replace with new metal flashing when siding is replaced	Poor	Critical	100%	
ALL	3-A/EXT	Ext-Drainage System	None	Significant problem with ice and snow falling from north and south eaves, posing health hazard and damaging building siding, hoods and vents. Non-historic roof structures have been added along eaves at door locations to protect occupants.	Remove sloped roofs over lean-tos. Provide new IRMA roof with internal drains to storm sewer (location of nearest storm sewer TBD). New plywood roof sheathing, gypsum sheathing, EPDM membrane with 8" rigid insulation and 2" ballast pavers. Pavers to protect roof membrane from falling ice and snow. If there is no storm sewer in the road, than drain the roofs to the surface. Remove existing batt insulation and vapor retarder in ceiling rafters of lean-tos	Poor		9,900	SF
ALL	3-A/EXT	Ext-Signage	Wood	Aged	Repair and repaint large hangar numerals			6	Units

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Hangar	Code	Component/Location	Material/Type	Deficiency	Recommendation	Condition	Priority	Quantity or %	Units
INTERIOR									
ALL	4-A/INT	Int-Wall Covering - lean-tos	GWB	Significant abuse in maintenance, repair, crew and storage areas. Varying degrees of damage in office spaces. Hangars 2 and 3 generally require more repair than hangar 6.	Replace severely damaged areas and repair minor damage. Add MDO plywood wainscot (7ft high) in shops, storage, and high-use areas in 1st floor lean-tos.	Fair	Minor	43,800 total	SF
ALL	4-A/INT	Int-Wall Covering - wall between hanger bay and lean-tos	Wood	GWB and wood siding added to hangar side of stud; probably added when fire rating of wall was upgraded - appears to simulate original wall sheathing.	Repair damaged wood, patch misc. holes and paint. Infill rectangular openings into lean-to attic spaces with new studs, GWB and wood finish to match existing. (See also Fire/Life Safety)	Fair	Minor	15,400 total	SF
ALL	4-A/INT	Int-Wall Covering - Latrines	Ceramic Tile	Existing latrines are showing their age and are not handicapped accessible. All new fixtures, partitions and layout are recommended, so extensive repair of tile would be required.	Remove existing tile and replace with new ceramic tile.	Fair	Minor	100%	
ALL	4-A/INT	Int-Wall Base - lean-tos	Resilient	Aged	Remove existing and provide new rubber base at new VCT, carpeted and concrete floors in the lean-to areas.	Fair	Minor	100%	
ALL	4-A/INT	Int-Wall Base - lean-tos	Wood	Aged	Remove from lean-to spaces; retain and repair in hangar bay.	Fair	Minor		
ALL	4-A/INT	Int-Ceiling Covering - lean-tos	GWB	Water damage at 2nd floor along exterior wall	Replace damaged GWB and repair minor damage to other areas.	Poor/Fair	Minor / Serious		
ALL	4-A/INT	Int-Floor Covering - hangar bay	Concrete	No existing floor finish on concrete.	***Additive Alternate***: Install new epoxy mortar system to provide cleanable surface and to increase ambient light levels.	Good	Minor	30,100	SF
ALL	4-A/INT	Int-Floor Covering - lean-tos	Concrete	Existing concrete; evidence of former paint and VAT finishes, but they have been removed or worn significantly.	Clean and seal existing concrete where exposed. Preparation may require acid wash and/or grinding of old paint and adhesive where exists.	Fair	Minor		
ALL	4-A/INT	Int-Floor Covering - lean-tos	VAT/VCT	Original tile and possibly new tile installed circa 1977 would contain asbestos. Tiles are worn, broken or missing.	Remove existing tile. Abate VAT. Replace with new VCT in corridors, maintenance areas.	Fair/Poor	Critical		
ALL	4-A/INT	Int-Floor Covering - lean-tos	Carpet	Carpet is installed in office-type spaces and is in varying condition and style due to ad-hoc installation.	Remove existing carpet. Install new carpet in offices, classrooms, crew lounges, bedrooms and similar spaces on 2nd floor.	Good/Fair	Minor		
ALL	4-A/INT	Int-Floor Covering - latrines	Ceramic Tile	See wall covering - ceramic tile	See wall covering - ceramic tile				
ALL	4-A/INT	Int-Stair Covering - lean-tos	Rubber	Aged	Replace with new rubber treads and skirting	Good/Fair	Serious		
ALL	4-A/INT	Int-Catwalks	Wood			Fair			
ALL	4-A/INT	Int-Door Unit	HM	Not historic. Original doors appear to have been wood and included flush, relite and large (12' high) units. Fire separations and use have resulted in the replacement and relocation of all interior doors with new HM doors and frames circa 1977. Virtually all doors on the first floor have significant wear from 20+ years of use.	Replace existing doors, frames and hardware.	Fair	Serious	See plans	

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ALL	4-A/INT	Int-Finish	Paint	Paint in varying degrees of condition	Prep and repaint all painted surfaces including GWB, interior wood siding, HM doors and frames, wood base and trim.	Fair	Serious	100%	
ALL	4-A/INT	Int-Stair Railing	Steel		Repaint	Good	Minor	100%	

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FIRE/LIFE SAFETY									
ALL	5-FIRE/L	Means of Egress - hangar bay		No deficiencies in exit capacity or travel distance.	No work required.	Good			
ALL	5-FIRE/L	Means of Egress - lean-tos		Dead-end corridors and use of intervening spaces as means of egress from corridors.	See specific hangar recommendations.				
6 (ALL?)	5-FIRE/L	Fire Ratings - separation between hangar bay and lean-tos		Existing building appears to have undergone a significant upgrade circa 1977 to 1-hour construction by the installation of GWB to interior walls and ceilings, and new HM doors and frames. There is one layer of GWB over wood sheathing on lean-to side and one layer of 1/2" GWB between two layers of wood sheathing on hanger side. There are numerous, unprotected pipe and opening penetrations in the wall between the hanger bay and lean-tos. HM door frames do not engage the wall properly to achieve ratings. Fire doors lack proper hardware, gaskets and closers. COE TL 1110-3-485 "Fire Protection for Helicoptor Hangers" requires 1-hour rating for the wall between hanger bay and lean-tos; 2000 IBC requires 2-hour, except S and B occupancies in sprinklered and separated buildings may have unlimited area and non-separated uses. Directive is to use the most restrictive requirement, so 1-hour will be used	Patch all misc. holes and firestop all penetrations. Replace all HM doors and frames and fit to wall to achieve rating. Provide 1-hour wire glass relites in existing openings between 2nd floor and hangar bay. If window openings are used for verbal communication between hanger and lean-tos, provide 1-hour fire shutters (Also see "Int-Wall Covering-Wood" above)	Poor	Critical	15,400	SF
ALL	5-FIRE/L	Fire Stair/Ramp - lean-to stairs		Existing stairs were reconstructed circa 1977 to code in effect at the time. Risers and treads do not meet current code requirements, but would be permitted under provisions for existing buildings. Few stairs are enclosed in rated vertical enclosures (where open to 2nd floor corridors) and some do not provide continuous, direct egress to the exterior at the 1st floor because they exit into the hangar bay. 2000 IBC permits up to 50% of stairs to be open in certain	See specific hangar floor plans for new corridor and stair modifications.				
ALL	5-FIRE/L	Fire Stair/Ramp - lean-to fire escapes		Existing fire escapes would not be permitted in new construction under 2000 IBC if space permits construction of code-compliant stair. Riser and tread dimensions are non-compliant.	2000 IBC permits existing fire escapes to remain. Patch and paint existing. Preferred *alternative:* remove fire escapes, revise septum wall location and construct new metal stairs to meet code requirements. Provide 1-hour wall construction between building and stair. This, in combination with extending the corridors to the east and west walls would permit the existing open stairs to remain as non-exits.				
ALL	5-FIRE/L	Fire Door/Hardware		See above. Missing closers, smoke seals, panic devices.	Replace existing doors, frames and hardware	Poor	Critical	See plans	

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ALL	5-FIRE/L	Emergency Lighting		Emergency lighting is present in most required locations, however the fixtures vary from being inoperative to very old. The battery shelf life is likely used up on many of the fixtures.	We recommend replacement of all of the emergency light fixtures with new so one brand can be maintained, and all batteries start with a fresh shelf life.				
ALL	5-FIRE/L	Exit Signage		Lighted exit signs are generally installed as required, but the fixtures are old, all types and models of fixtures are used, and some not operating properly.	We recommend installing all new exit signs throughout the facility so all fixtures are the same make and model, and get the same batteries, and all have the same shelf life for easier group maintenance.				
ALL	5-FIRE/L	Intrusion System	None		Not included in scope.				
ALL	5-FIRE/L	Fire Alarm		The fire alarm system in all three hangars appears to be of current production, and appears to be fully operational.	Recertify that all fire alarm devices are operational per NFPA 72 requirements.				
ALL	5-FIRE/L	Fire Suppression System		Each hangar is protected by a combination of a deluge type wet system with open heads for the hangar itself, and a wet system with fusible link heads for the accessory areas. Dept of Army Technical Letter (ETL 110-3-485) prohibits the use of Deluge (open head) systems. If this document is applicable (It is titled "Fire Protection for Helicopter Hangars), than the deluge system would have to be changed out with a foam-water AFFF system or with an Early Suppression Fast Response (ESFR) system. Also, the IBC refers to NFPA 409, which lists still other sprinkler system requirements. The ETL 110-3-485 takes the position that NFPA 409 is not applicable to hangar facilities housing helicopters, since NFPA 409 is intended only for airplanes according to the ETL. If this is correct, we can review the project per the ETL only.	The deluge system in most of the hangars has been tripping occasionally, seriously flooding the facility. This is typically caused by a loss of air pressure on the deluge valve, or by tripping of the deluge valve due to a loss of power at the fire alarm panel which may cause a momentary loss of power to the solenoid valve that keeps the air pressure in the deluge valve. The deluge system is in need of major maintenance, which we recommend if it remains in use. There is corrosion on the valves, and some of the valves are continuously leaking. Replacement of the air compressors with duplex compressors or with different compressors wired to separate circuits would help improve reliability. For continued use as a helicopter hangar, we recommend that the existing hangar sprinkler system be retrofitted with Early Suppression Fast Response (ESFR) sprinkler heads, and do away with the deluge system that is prohibited anyway per the technical letter. In order to use ESFR sprinkler heads, the distance from the floor to the underside of the				
ALL	5-FIRE/L	Fire Extinguisher							
ALL	5-FIRE/L	Hazardous Occupancies		Hazardous materials include: Hangar 2: lobe oil, adhesives, flammable liq, propane, radioactive = ALSE(compasses). Hangar 3: lube oil, adhesives, flammable liq, propane. Hangar 6: lube oil, cleaning compounds, paint, alcohol, adhesives, radioactive = NBC rooms. Quantities have not been determined for final classification. Occupancy separations are suspect since many of the spaces used for storing these materials are	Finalize material types, quantities and anticipated future storage requirements. Provide required separations in wall and floor construction. Suggest consolidating hazardous occupancies in one area of the building to simplify separation and exiting issues.				

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HANDICAPPED ACCESSIBILITY									
ALL	6-HCP	Access Parking			Not included in study, but adequate space exists to provide.				
ALL	6-HCP	Access Entry/Route							
ALL	6-HCP	Vertical Route		No elevator is provided to 2nd floor lean-to areas. Owner has requested new elevator access to one side only to accommodate access to needed functions.	Add 2-stop holeless hydraulic or limited-use limited-access (LULA) elevator on one side of building within lean-to floor area; location TBD. Provide rated shaft enclosure.	Poor	Critical	1	Elev
ALL	6-HCP	Door hardware		Existing hardware is of knob-type and does not accessible	(See "Int-Door Unit")			100%	
ALL	6-HCP	Access Restroom		Existing latrines are not accessible in fixture type, toilet partitions and clearances	Reconstruct latrines with accessible components	Poor	Critical	100%	
ALL	6-HCP	Access Drinking Fountain		The drinking fountains are not accessible.	Replace all drinking fountains with handicap accessible fixtures in those spaces that are determined to be accessible.	Poor	Critical	100%	

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HVAC									
ALL	7-HVAC	HVAC System		The heating system in the hangar areas have been replaced at all three buildings in 1993. These systems appear to be functioning well, with no complaints of heat problems in the hangars themselves. The adjoining offices and shops, however were retrofitted to hydronic heating terminal devices in 1977. These devices are generally in bad shape, with trim missing, bent or missing covers. There is no mechanical ventilation system in any of the offices or accessory spaces as required by code. This causes stuffy, overheated, and unhealthy conditions	Continue to use the hydronic heating systems in the hangars. Replace all of the terminal devices in the offices and adjacent spaces. Install a new ducted ventilation system in all lean-to office and accessory spaces that are normally occupied. Even spaces that technically meet code with operable windows to the outside, do not get required ventilation due to the severe Fairbanks winter climate.				
ALL	7-HVAC	HVAC Equipment		Outside of the terminal units discussed above, the HVAC equipment appears to be in good condition, including the unit heaters and door heaters that were installed in 1993. The headers in the mechanical room and the circulators appear to be in good condition. The toilet exhaust fans in all of the restrooms are worn out, with most inoperative, and the balance too noisy	The HVAC equipment appears to be serviceable as noted. Replace all toilet exhaust fans.				
ALL	7-HVAC	Temp Control System		The controls for the baseboard in the office and accessory spaces are wireless, wax type controls which are not responsive to temperature changes	Replace all controls with new 24 volt control valves and thermostats.				
ALL	7-HVAC	Hydronic Piping		The hydronic piping for the hangars appears to be in good condition. The piping that serves the lean-to spaces is uninsulated. The internal condition of the piping is unknown, and would require a destructive test to measure for clogging, corrosion, or wearing of the pipe walls. The pipes are not insulated, however, which is causing overheating in the spaces. Piping not labeled	Replace all heating piping in lean-to areas, or perform destructive testing on samples of the hydronic heating piping to determine remaining life. Insulate all hydronic heating piping serving the lean-to spaces, including offices and accessory spaces. The hangar piping is insulated and appears to be serviceable. Label all piping as to contents and flow.				
ALL	7-HVAC	Steam Piping		Steam piping was removed and replaced with hydronic in 1977. The only steam piping at the facility would be the steam service to the mechanical room, and its condition is unknown.	Perform destructive testing on samples of the steam piping to determine useful life, and replace if necessary. This is only the steam service, since the service is the extent of the steam piping.				
	7-HVAC	Special Systems		Ice builds up in front of the hangar doors, making it difficult to move helicopters over ice mounds. Ice forms from drips off of roof.	Add additional snow melt piping in front of hangar doors for 20' away from building to assure no ice forms at the entry.				

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PLUMBING									
ALL	8-PLMB	Water Supply System		There is no indication that the plumbing water system was ever replaced. During prior plumbing remodels, plans showed only piping within the latrine being replaced back to the branch feeder. Piping observed is galvanized, which is subject to corrosion, with subsequent discoloration of the water, and bad taste and odor being put into the water. The water is not yet staining fixtures.	Replace all hot and cold plumbing piping in the facility with new copper or PEX tubing.				
ALL	8-PLMB	Waste Water System		There is no indication that the waste and vent piping has ever been replaced. The useful life of the system is at its end, and the piping should be replaced. Complaints of foul smells from the oil separator pit indicate that the floor drain piping may have failed.	Replace all waste and vent piping with new.				
ALL	8-PLMB	Plumbing Fixtures		There is a variety of plumbing fixtures, all of which need to be replaced. None of the fixtures are water conserving types. Many of the toilets are round bowls rather than code required elongated bowls with split seats. Some of the toilets have no lid at the tank. The lavs need new faucets. There are no women's latrines, although women work at the facility.	Replace all of the plumbing fixtures with new water conserving type. Install new faucets with automatic shutoff feature. Utilize new elongated toilets with split seats per UPC code. Provide handicap accessible fixtures in those locations designated at accessible to the handicapped. Provide a women's latrine.				
ALL	8-PLMB	Oil-Water Separator		New oil-water separators have been installed in each of the hangars. The units have not been serviced regularly, and need to be pumped out. Users complain of a foul odor at the floor drain collection pit when the unit is operated.	Pump out the oil-water separators on a monthly scheduled basis, more often if required. Steam clean all floor drain pipes.				
ALL	8-PLUMB	Floor Drains		The floor drains in the hangar areas are small round fixtures that are not draining the floor well. Technical letter ETL 1110-3-485 requires floors to be sloped to trench drains at the main hangar doors or other locations as required. The size of the drainage piping must include the calculated maximum demand of the installed fire protection systems.	Install trench drains at all hangar floors, and cut out sufficient floor area and re-pour concrete to permit drainage to the trench drain.				

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ELECTRICAL									
ALL	9-ELECT	Electrical System	NA	Overall, the electrical systems are a mix of some original equipment, and many new panels that were installed in 1975 - still 27 years ago.	Replace all panels with new panels of like manufacturer. All new breakers will then be rated to current standards, and have listed fault current interruption values.				
ALL	9-ELECT	Incoming Service	NA	The incoming service was replaced in 1975. There are no indications of inadequate power availability or of service problems. The power is not metered, so actual use is unknown.	We suggest adding a meter base to the service of each hangar to account for building electrical use.				
ALL	9-ELECT	MDP	NA	The MDP for hangar #2 appears to be fairly new, although we could not locate plans that replaced that MDP. We did not see new MDP units in the other hangars, although there could be new units behind doors that were locked that we could not access. The 1975 electrical remodel plans show reuse of the distribution panels, and some of the distribution panels we saw appear to be very old.	If the MDP in hangar #2 is the only new MDP, we suggest replacing the MDP in Hangars #3 and #6 with new, current production main distribution panels that have NEC required short circuit interruption capacity.				
ALL	9-ELECT	Sub Panels	NA	Most of the sub-panels were replaced in 1975, but the majority of the feeders to those panels were not replaced	Since the majority of the sub-panels are 27 years old, and some are much older, we suggest wholesale replacement of all of the panels to provide a standardized panel make and model for easier breaker replacement, and for known condition of the electrical system.				
ALL	9-ELECT	Power Wiring		Power wiring condition is questionable. As noted above, when a major electrical upgrade was performed in 1975, the feeders to the majority of the sub-panels were reused, apparently judged to be in satisfactory condition 27 years ago. The present condition may well be unacceptable. Also, all of the conduits that are routed down through the hangar floor are required to have explosion proof sealoffs per NEC, but only a few recently installed conduits (those serving the new oil separator) have the required sealoffs.	We recommend replacing all of the feeder wiring to all of the panels, since the insulation is a minimum of 27 years old, and could be original equipment. Wiring to the fixtures is also at least 27 years old, and while it may be in acceptable condition, if a major remodel is performed to bring another 30 years of service to the building, we would suggest replacing all of the wiring with new. Install sealoffs on all conduits that run down to within 18" of the hangar floor, since that is a class 1, division 2 hazardous area.				
ALL	9-ELECT	Power Receptacles		Power receptacles and light switches were changed in 1975 during a major upgrade. The devices are subject to wear, and have exceeded their useful life	Replace all power receptacles and light switches with new devices.				
ALL	9-ELECT	Data cabling		Data cabling has been added as the need arises, and appears to be current.	The comms technicians should be queried to see if updated cables are needed. If an upgrade is appropriate, we suggest using fiber cable or Cat 5e minimum.				
ALL	9-ELECT	Data Receptacles		Data receptacles have been added as needed, and are assumed to be up to current requirements, since technology is dictating replacement of terminals as new devices evolve.	Replace data receptacles only as required by users.				

Ft. Wainwright "Birchwood" Hangars

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Facility Condition Survey & Recommendations - All Hangars

Hangars No: 2 (3008); 3 (3005); 6 (2085)

Hangar	Code	Component/Location	Material/Type	Deficiency	Recommendation	Condition	Priority	Quantity or %	Units
ALL	9-ELECT	Exterior Light Fixtures	HID	There are virtually no exterior lights around any of the hangars. The exterior spot lights are old and do not appear to be effective.	As a minimum, parking lot lighting should be installed unless the airfield prohibits it for security reasons. Apron area light fixtures should be replaced with new fixtures that have superior cutoff and reduced glare.				
ALL	9-ELECT	Interior Light Fixtures	Fluorescent	The office and accessory areas had new light fixtures replaced in 1957 and again in 1975. New T-8 lamps and ballasts were put in the old fixtures in the last few years. The fixtures are in bad shape, with most of the lenses missing or with paint on the lenses, and with some fixtures falling off the ceiling.	Replace all of the light fixtures in all offices and office areas with low glare, energy efficient ballast and lamp fixtures.				
ALL	9-ELECT	Interior Light Fixtures	HID	The hangars all had new HID metal halide light fixtures installed in 2002. The fixtures do not have prismatic translucent lenses, so all of the light is directed downward. The floors are unpainted, except for one or two small areas, so the reflection is poor. Light levels were measured over several areas where the floor is unpainted, and were2-4 FC close to the door, and 15-25 FC over the majority of the hangar area. In one area where there was a section of floor painted white in hangar #3, we measured 30-36 FC, attesting to the value of a light colored floor.	Since the light fixtures are all new, the preferred fix to improve light levels is to paint the hangar floor.				

Ft. Wainwright "Birchwood" Hangars

Facility Condition Survey & Recommendations - All Hangars

Hangars No: 2 (3008); 3 (3005); 6 (2085)

Hangar Code	Component/Location	Material/Type	Deficiency	Recommendation	Condition	Priority	Quantity or %	Units

Condition Key

An element is evaluated as **good** when:
- the element is intact, structurally sound and performing its intended purpose
- there are few or no cosmetic imperfections
- the element needs no repair and only minor or routine maintenance

An element is evaluated as **fair** when:
- there are early signs of wear, failure or deterioration, though the element is generally structurally sound and performing its intended purpose
- there is failure of a sub-component of the element
- replacement of up to 25% of the element or replacement of a defective sub-component is required

An element is evaluated as **poor** when:
- the element is not historic. Replacement is necessary to achieve historic appearance on building exterior or hanger bay
- the element is no longer performing its intended purpose
- the element is missing
- deterioration or damage affects more than 25% of the element and cannot be adjusted or repaired
- the elements shows signs of imminent failure or breakdown
- the element requires major repair or replacement

Priority Key

A **critical** deficiency of an element exists where:
- the element is not part of the historic fabric and it's replacement is significant in restoring the original appearance
- there is advanced deterioration which has resulted in the failure of the building element or will result in the failure of the building element if not corrected within 2 years, and/or
- there is accelerated deterioration of adjacent or related building materials as a result of the element's deficiency, and/or
- there is a threat to the health and/or safety of the user, and/or
- there is a failure to meet legislative requirement.

A **serious** deficiency of an element exists where:
- there is deterioration which, if not corrected within 2-5 years, will result in the failure of the building element, and/or
- a threat to the health and/or safety of the user may occur 2-5 years if the deterioration is not corrected, and/or
- there is deterioration of adjacent or related building materials and/or systems as a result of the element's deficiency.

A **minor** deficiency of an element exists where:
- standard preventative maintenance practices and building conservation measures have not been followed, and/or
- there is reduced life expectancy of affected or related building materials and/or systems, and/or
- there is a condition with long-term impact beyond 5 years.

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Facility Condition Survey & Recommendations - Hangar 3008 (2)

Additional Deficiencies & Recommendations

Hangar	Code	Component	Material/Type	Deficiency	Recommendation	Condition	Priority	Quantity or %	Units
SITE									
3008	1-SITE	Site Drainage	Concrete	Drainage against building foundation on north side	Remove concrete paving 5' out from building; cast new slab with positive drainage	Poor	Serious	216	LF
STRUCTURE									
3008	2-STRUC SK-1	Int-Slab-on-Grade	Concrete	Settlement in NE corner has cracked the slab	Saw cut rectangular area and remove damaged slab; fill and compact as required and cast new slab, dowelled to existing.	Good	Minor	150	SF
3008	2-STRUC SK-8	High roof - 2x decking	wood	Dry-rot at decking near eaves. Water stain occurs primarily at the eave of the high roof for the first two purlin spaces. Not heavy	Replace 2 x decking at approximately 10 % of high roof, 3200 sq ft	Fair	Serious	3200	SF
3008	2-STRUC SK-7	High Roof - Purlins	Wood	Dry-rot at top of purlins. Water stains mostly at first two purlins from eaves.	Replace approximately 5% of high roof purlins, 8 purlins, G.L. 5 1/8 x 13.5	Fair	Serious	8	each
3008	2-STRUC SK-11	High Roof - Cross Bracing Between Trusses	wood	"X" bracing from bottom chord of one truss to top chord next truss, severly split at bolt connection to truss	Replace 2 cross braces. 3x8 sections, DF No. 1 x 34 ft	poor	Critical	(2) 3 x 8 x 34 ft	ln ft
3008	2-STRUC SK-11	"X" bracing btwn high roof and finish floor.	Wood	South wall, bottom "X" removed 3 bays. North wall, bottom "X" removed 1 bay.	Replace existing bracing where damaged, missing or split with new solid sawn, micro lam or glulam members. 4 x 12 SS DF No. 1, Micro Lam 3 1/2" x 11 1/4", G.L. 3 1/8" x 12" Top "X" member length ea. At 34ft Bottom "X" member length ea. At 30 ft	Poor	Serious	6 @ 30 2 @ 30	ln ft
EXTERIOR ENVELOPE									
3008	3-A/EXT	Ext-Foundation Insulation	Unknown	Presence or condition of insulation unknown	Add rigid foundation insulation to north wall of hangar 2 during apron work.	Unknown	Serious		
FIRE/LIFE SAFETY									
3008	5-FIRE/L	Means of Egress - lean-tos		Dead-end corridors and use of intervening spaces as means of egress from corridors.	See floor plans for corridor and stair modifications.				
HVAC									
3008	7-HVAC	HVAC System		Exhaust fan is inoperative in male latrine, and noisy in women's.	Replace all exhaust fans per typical suggestion.				
3008	7-HVAC	HVAC Equipment		Baseboard sections are missing end caps	Replace baseboard with new per typical recommendation				
PLUMBING									
3008	8-PLMB	Plumbing Fixtures		Water was found leaking on floor at toilets, probably due to faulty wax ring. Toilets are not 15" away from wall per UPC. Lavs are loose at wall.	Replace wax ring or troubleshoot cause of failure. Repipe and replace toilets to UPC location and access standards. Reattach lavs.				

Ft. Wainwright "Birchwood" Hangars

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Facility Condition Survey & Recommendations - Hangar 3008 (2)

Additional Deficiencies & Recommendations

Hangar	Code	Component	Material/Type	Deficiency	Recommendation	Condition	Priority	Quantity or %	Units
3008	8-PLMB	Oil-Water Separator		Unit smells of sewage.	Clean unit, pump out oil. Troubleshoot for possible sewage cross connect.				
ELECTRICAL									
3008	9-ELECT	Sub Panels	NA	Panel B directory not current. Many panels are unmarked, and may be original equipment. Panels may have been abandoned in place.	Update directory. Remove panels if they are no longer operational. Label all panels.				
3008	9-ELECT	Power Receptacles/switches		Light switch device covers found broken in several places	Replace all devices per typical recommendation.				
3008	9-ELECT	Interior Light Fixtures	Fluorescent	Light fixtures in upstairs offices are damaged by water due to roof leaks. Some are falling off attachment. Several light fixtures are missing lenses, others have paint on the lenses.	Replace fixtures as per typical recommendation.				

Ft. Wainwright "Birchwood" Hangars

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Facility Condition Survey & Recommendations - Hangar 3005 (3)

Additional Deficiencies & Recommendations

Hangar	Code	Component	Material/Type	Deficiency	Recommendation	Condition	Priority	Quantity or %	Units
SITE									
3005	1-SITE	Site Drainage	Concrete	Drainage against building foundation on north side	Remove concrete paving 5' out from building; cast new slab with positive drainage	Poor	Serious	216	LF
STRUCTURE									
3	2-STRUC	Int-foundation wall & footing	Concrete	Not exposed to view. The interior wall between the hangar and office space has settled more than the columns placed in the wall. The deflection across the 25 ft between columns is approximately 1" to 1 1/2". The deflection occurs between the slab on gr	Shore office floor and roof. Remove the interior siding and diagonal sheathing. Remove the electrical and mechanical elements from the walls. Shim the sill at grade. Reapply the diagonal sheathing and siding.	Fair	Serious	3300 sq ft of wall btwn SOG and 2nd floor. 202 ft of sill	SF/In ft
3	2-STRUC SK-11	High roof-2x decking	Wood	Dry-rot at central catwalk stair to roof east end.	Replace existing decking and 30ft of catwalk stair to roof.	Poor	Critical	400, 30ft	SF, Stair
3	2-STRUC SK-8	High roof - 2x decking	wood	Dry-rot at decking near eaves. Water stain most prevelant in hangar 3 from ridge to eave.	Replace 2 x decking at approximately 20 % of high roof, 6400 sq ft	Fair	Serious	6400	SF
3	2-STRUC SK-7	High Roof - Purlins	Wood	Dry-rot at top of purlins. Water stains most prevelant in hangar 3 from ridge to eave.	Replace approximately 10% of high roof purlins, 15 purlins, G.L. 5 1/8 x 13.5	Fair	Serious	15	each
3	2-STRUC SK-11	"X" bracing btwn high roof and finish floor.	Wood	South wall, bottom "X" removed 1 bay. North wall, bottom "X" removed 1 bay.	Replace existing bracing where damaged, missing or split with new solid sawn, micro lam or glulam members. 4 x 12 SS DF No. 1, Micro Lam 3 1/2" x 11 1/4", G.L. 3 1/8" x 12" Top "X" member length ea. At 34ft Bottom "X" member length ea. At 30 ft	Poor	Serious	4 @ 30	In ft
3005	2-STRUC	Int-Floors - lean-to	Wood	Floor slopes at exterior wall causing doors to bind and latches and strikes to misalign.					
EXTERIOR ENVELOPE									
3005	3-A/EXT	Ext-Foundation Insulation	Unknown	Presence or condition of insulation unknown	Add rigid foundation insulation to north wall of hangar 2 during apron work.				
FIRE/LIFE SAFETY									
3005	5-FIRE/L	Means of Egress - lean-tos		Dead-end corridors and use of intervening spaces as means of egress from corridors.	See floor plans for corridor and stair modifications.				
3005	5-FIRE/L	Emergency Lighting		Emergency light inoperative at womens latrine.	Replace emergency lights.				
HVAC									
3005	7-HVAC	HVAC System		QC room fan bearings shot, very noisy. Toilet room exhaust fans inoperative	Provide new ventilation system to all offices per typical recommendation. Replace all toilet exhaust fans per typical recommendation.				

Ft. Wainwright "Birchwood" Hangars

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Facility Condition Survey & Recommendations - Hangar 3005 (3)

Additional Deficiencies & Recommendations

Hangar	Code	Component	Material/Type	Deficiency	Recommendation	Condition	Priority	Quantity or %	Units
PLUMBING									
3005	8-PLMB	Plumbing Fixtures		Emergency shower only has cold water. UPC requires tempered water to emergency showers. Drinking fountain inoperative	Provide tempered water to emergency shower. Replace drinking fountain.				

Ft. Wainwright "Birchwood" Hangars

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Facility Condition Survey & Recommendations - Hangar 2085 (6)

Additional Deficiencies & Recommendations

Hangar	Code	Component	Material/Type	Deficiency	Recommendation	Condition	Priority	Quantity or %	Units
SITE									
2085	1-SITE	Drive-Unpaved	Gravel	Ponding in parking lot creates unsafe conditions in winter	Sitework >5' outside the building is not included in this study				
STRUCTURE									
6	2-STRUC SK-8	High roof - 2x decking	wood	Dry-rot at decking near eaves. Water stain occurs primarily in the first two purlins from the eaves.	Replace 2 x decking at approximately 10 % of high roof, 3200 sq ft	Fair	Serious	3200	SF
6	2-STRUC SK-7	High Roof - Purlins	Wood	Dry-rot at top of purlins. Water stains primarily at first two purlins from eaves.	Replace approximately 5% of high roof purlins, 8 purlins, G.L. 5 1/8 x 13.5	Fair	Serious	8	each
6	2-STRUC SK-11	"X" bracing btwn high roof and finish floor.	Wood	North wall, bottom "X" removed 2 bays. South wall, bottom "X" removed 3 bays.	Replace existing bracing where damaged, missing or split with new solid sawn, micro lam or glulam members. 4 x 12 SS DF No. 1, Micro Lam 3 1/2" x 11 1/4", G.L. 3 1/8" x 12" Top "X" member length ea. At 34ft Bottom "X" member length ea. At 30 ft	Poor	Serious	4 @ 30 6 @ 30	ln ft
FIRE/LIFE SAFETY									
2085	5-FIRE/L	Means of Egress - lean-tos		Dead-end corridors and use of intervening spaces as means of egress from corridors.	See floor plans for corridor and stair modifications.				
2085	5-FIRE/L	Fire Suppression System		The sprinkler drain is leaking outside of the building, and has grown moss around the through-the-wall drain, indicating an ongoing problem. This well freeze in winter and create a backup inside the building. Also, the fire department connection has a protective cover over it that has crushed down onto the FDC. making it difficult or impossible for the fire dept to connect to the openings. Sprinkler heads in the bedroom areas need to have fast response residential heads.	Service the sprinkler deluge valves and repair all leaks. Replace the protective cover over the FDC. Install fast response heads in the sprinklers at the bedroom areas.				
HVAC									
2085	7-HVAC	HVAC System		There are four bedrooms for sleeping, but no outside air ventilation per code. Exhaust fan outlets crushed outside.	Provide code ventilation to each bedroom. Replace exhaust fan outlets.				
PLUMBING									
2085	8-PLMB	Plumbing Fixtures		One urinal is missing in lower latrine. Inadequate number of water fountains. Water heater is not siesmically strapped. Failed wax ring, sewage on floor of latrine.	Replace urinal. Add wate fountains to each side of hangar, and to upstairs offices. Strap water heater. Replace wax ring.				

Ft. Wainwright "Birchwood" Hangars

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Facility Condition Survey & Recommendations - Hangar 2085 (6)

Additional Deficiencies & Recommendations

Hangar	Code	Component	Material/Type	Deficiency	Recommendation	Condition	Priority	Quantity or %	Units
ELECTRICAL									
2085	9-ELECT	Sub Panels	NA	The directory at the panels do not match the actual loads. Panel Q1 and Q2 have no directory.	Update the directory, or replace panel as suggested in typical recommendations.				
2085	9-ELECT	Exterior-Light Fixtures	Incandescent	There are still incandescent light fixtures at the exterior of the building.	Replace all exterior incandescent light fixtures with HID, and put on photocells.				

APPENDIX

DRAWINGS:

Historical Drawings
Architectural Drawings
Structural Sketches