6 Military Hangar Typology

Overview

As stated in the Introduction, *typology* is defined as a systematic classification of items into categories that share specified characteristics or traits. In this document a typology is constructed to classify military aircraft hangars according to historical contexts and physical characteristics. The evaluative criteria vary according to structure. Earlier hangars tend to be unique products of their historical contexts while later types often comprise multipurpose design solutions implemented across multiple historical periods. Some hangar designs are service-specific while others are used DoD-wide. Due to these numerous variables, several aspects of the aircraft hangar as a building type are presented here.

Explanation of Hangar Typology Chart

Figure 6-1 presents a flowchart of military aircraft hangar typology in terms of construction materials and configurations. Tables 6-1 – 6-5 summarize examples of the five major subtypes.*

Hangars are separated into principal material *divisions* based on their primary structural material (i.e., steel, wood, or concrete). Because the large majority of military hangars are steel, this division was further divided into truss, girder, and long-span joist *subdivisions*. Hangar *type* is determined by the form of the structural cross section over the hangar bay (e.g., gable, gambrel, etc.). In Tables 6-1 – 6-5 an icon is used to illustrate each cross-sectional type. Within each hangar type is listed the index number of all major standard hangar plans identified in the hangar database. An illustration of each of these is presented in Appendix B. The year corresponding to the first known use of each plan or design also ap-

* It should be noted that the accuracy of the typology may be affected by the accuracy of the information provided by the military installations responding to the authors' survey. Also, not all standard plans and definitive designs are presented here, and one-of-a-kind hangars and variations on standard designs and plans are not addressed.

pears in the tables. Historical information pertaining to a hangar's period of origin can be cross-referenced with the narrative in Chapters 1 – 5. The discussion that follows provides detail on the variables used to determine hangar types.

Material Divisions

The chief physical characteristic that determines a hangar's type is its structural material. Each material has its own set of design capabilities and constraints that interact to affect the resulting building form. Following are the major hangar divisions as defined by their structural material.

Concrete

This division includes poured-in-place (monolithic) concrete, precast concrete, and concrete masonry units (CMUs). Hangar examples that have non-load-bearing concrete walls attached to the primary structural components belong to the material division that best describes the primary structure. For example, a CMU wall enclosing hangar space protected by steel trusses resting on steel columns would be classified in the steel division. Concrete hangar construction appears to have been prevalent during the 1940s and 1950s.

Steel

This division encompasses the largest number of hangars registered in the database. It includes all structures whose primary load-bearing components over the hangar bay(s) are steel. The popularity of steel is due in part to its high strength-to-weight ratio. Furthermore, steel can readily be fabricated as independent structural steel members that can be assembled to span long distances, and these members are easily transportable.

Steel is an alloy of iron and carbon. Steel of low and medium carbon content is used in building construction because it is weldable and toolable. The specific shapes of structural steel members may vary, but they are generally galvanized. Galvanizing is the process of coating metal with zinc to prevent oxidation. Although galvanization was developed in France in 1836, it was not widely practiced in the United States until the early 20th century. Some examples of ungalvanized steel construction survive today, but in most such cases the steel components of these structures are protected with a substitute coating such as tar. Building 1198 at Fort Sam Houston, TX, is an excellent example of a hangar constructed of ungalvanized steel.

Steel Subdivisions

Steel hangars can be classified within three subdivisions: *truss*, *girder*, and *long-span joist* construction. Most steel hangars fall into the truss subdivision.

Truss technology for hangar construction is based on bridge design, making it highly suitable for long-span design (see examples in Figure 6-2). Trusses are assembled from individual members, or *chords*, joined in structural triangles. The members are generally joined by pinned or riveted connections. Truss types are determined by the arrangement of the individual members. The oldest known standing military hangar is of steel truss construction, and the technology is still in use today.

Girders are the main horizontal members of a post-and-beam structural system. Unlike the truss, the girder is a solid structural member (Figure 6-3). Girder construction is favored for use in prefabricated structural elements. Its use in military hangar design first appeared during World War II and continues today.

Long-span joists are similar to trusses in that they are made up of structural triangles, but they differ in scale. Joists are lighter in weight, made of smaller structural triangles, and have lower load limits. To compensate for what they lack in strength, joist spacing is tighter. The use of long-span joists in hangar design began in the mid-1950s and continues today.[*]

Prefabricated Steel Hangars

Most hangars of steel girder construction are prefabricated or pre-engineered. Prefabricated steel hangar construction first appeared in the late 1940s and continues today. Butler Manufacturing has over time been the predominant producer of prefabricated girder hangars. In the past, offices in Kansas City, MO, Galesburg, IL, Richmond, CA, Minneapolis, MN, and Birmingham, AL, served military installations from coast to coast. Butler remains in the business today and publishes standards books for its own structures. Butler standards cover such topics as machining tolerances, sheet metal shearing, structural strength, brake parts, punching locations, welds, and machining finishes. Other compa-

---

[*] Corkill, Philip A., Homer L. Puderbaugh, and H. Keith Sawyers, *Structure and Architectural Design* (Iowa City: Sernoll, Inc., 1965), p 66; Melaragno, Michelle, *Simplified Truss Design* (New York: Van Nostrand Reinhold Company, 1981), p 385.

nies providing designs for steel military hangars over the years included Belmont Iron Works, Philadelphia, PA; Farm-Right Implements Company, Chicago, IL*; Great Lakes Steel Corporation; Pittsburgh Bridge & Iron Works, Pittsburgh, PA; R&D Constructors, Detroit, MI; and the Steelcraft Manufacturing Company, Rossmoyne, OH. McDonnell Aircraft Company, a unit of the McDonnell Douglas Corporation, St. Louis, MO, still manufactures pre-engineered structures for its own aircraft.

Wood

The Wood division encompasses hangars whose primary structural components over hangar bays are of heavy timber construction. Although they may be listed as semi-permanent or permanent construction in real property listings, most wooden hangars were originally considered temporary war mobilization structures. In fact, the design and construction of most of these structures were actually intended for use overseas. Due to steel shortages during World War I, the Navy used wood to construct some of its hangars. It is interesting to note that all hangars in this division are composed of trussed structural members. Few wooden hangars survive; many have been demolished, and many of those still standing are scheduled for demolition. The original wood cladding on most timber hangars has been replaced with contemporary materials such as metal siding. Wooden hangar construction in the military continued through World War II.

Composite Construction Materials

Composite hangars are those whose primary structural components over hangar bays are constructed of more than one structural material. Because this type of structure apparently was rarely used in military hangar construction, it is not included here as a discrete type. A typical example within this category would be a hangar with concrete load-bearing walls topped with steel trusses. Another similar example is one with individual concrete piers topped by steel trusses. Many steel hangar spans rely on adjacent concrete office modules for buttress-like support. However, after viewing numerous photographs of such buildings under construction, it is apparent that structural support offered by the concrete

* The firm of Holabird & Root, Architects (Chicago) appears to have used Farm-Right Implements Company frequently for assistance in their hangar designs.

office modules is secondary to the steel. Therefore, such buildings appear in the steel rather than the composite division.

Hangar Form and Cross Section

In addition to structural material, the other major criterion determining hangar type is its cross-sectional form (e.g., gable, gambrel, etc.) over hangar bays. A cross section is the view that results from a plane cutting through a building perpendicular to a specified axis. A combination of transverse and longitudinal sections should be investigated when typing hangars because of the variety of modular structural systems employed in hangar design.* The cross section of the hangar door opening should not be confused with the cross section of the hangar bay itself. Components that support hangar doors must withstand greater structural loads and operational stress, so they are more substantial than those spanning hangar bays. When considered with primary structural materials, cross sections clearly define types of hangar construction. The symbols in the left column of the cross section typology tables (Tables 6-1 – 6-5) illustrate the simple form of each cross-sectional type.

Procedures for Using the Hangar Typology Tables: An Example

To narrow the search for a possible hangar standard plan or definitive design, follow these steps:

- Identify the primary structural material spanning the hangar bay. Using STEEL as an example, all hangars constructed of a primary material other than steel would be eliminated from the set of possible standard design matches.
- Determine the type of steel system employed: truss, girder, or long-span joist. For the purposes of this example, assume the hangar is a member of the TRUSS subdivision. Reading horizontally along the TRUSS row of the table, the set of possible standard plan matches, for steel truss construction may be identified.

---

* Some modular design systems repeat bays along the longitudinal axis while others repeat bays along the transverse axis.

- Determine the form of the structural cross section cutting through the hangar bay(s) by referring to the structural form icons. If it is not clear which icon best matches the hangar, compare the hangar and icons to the plans reproduced in Appendix B and other figures throughout the document. Assume for this example that the hangar in question has an OPEN ARCH cross section.
- The hangar descriptors established thus far — STEEL, TRUSS, OPEN ARCH — narrows the search considerably. Because there are no Navy and Marine Corps standard plans or definitive designs matching this description, refer only to plan numbers and descriptions listed for Army and Air Force designs.*
- If local records show that the hangar was constructed in 1959, it may be an example of standard plan number 39-01-77 or 39-01-82-R, both of which were used during the Vietnam conflict. If the construction date is not known, compare the hangar with the illustrations in Appendix B. If a match is found, note the historical period in which this type of hangar was prevalent and refer to the appropriate text in Part I for its historical context.

Some users of the typology may find that their hangar is similar to a standard design, but not an exact match. It is important to understand that standard plans and definitive designs are simply intended to be used as the basis for subsequent working drawings. The working drawings often vary from the standard designs to accommodate site conditions and available materials.

Standard designs are updated occasionally and numbering systems also change from time to time. Therefore, it is important to consider all variables and available information before concluding that a hangar is of one particular design. The typology is intended to offer probable standard designs and approximate periods of significance, but it should not be treated as comprehensive, rigid fact. Hangars constructed by local contractors during times of national emergency may deviate markedly from previously established standard plans. The same may be true of custom hangar designs by notable architects. In such cases, the hangar typology may offer little assistance.

---

* Symbols in the right-hand column of the typology tables indicate which military service developed each hangar plan. A *star* symbol indicates an Army or Air Force plan; an *anchor* symbol indicates a Navy plan.

Hangar Terminology and Definitions

Many aviation uses and hangar terms are unique to airfield structures. These often determine hangar types by function or by emphasis of unique construction features. While current building uses are shown on most current property records, original uses are rarely indicated. Unfortunately, the latter reflects installation needs, aviation uses, and hangar types required at the time of construction. To help decipher these factors, a partial list of aviation uses and hangar terms is provided here.

Aperture Door. To accommodate large aircraft, the doors of some hangars have been modified with an adjustable opening that closes around the tail of a plane. This opening is called an aperture door because it is similar in design to the adjustable aperture in a camera lens.

Avionics. Avionics facilities are dedicated to electronics applications in aviation.

Balloon. Balloon hangars house kite balloons, which were generally used in the early years of aviation for aerial reconnaissance and artillery spotting.

Corrosion Control. Corrosion control facilities are used to paint aircraft to prevent corrosion of the metal fuselage. Older such structures are often referred to as *paint* or *finish hangars*.

Disassembly. Aircraft and aircraft engines are disassembled and cleaned in a disassembly building. This type appears to have Navy origins.

Door Pocket. The enclosure that receives opened hangar doors is called a door pocket. In some hangar designs, the door pocket is housed in a large architectural corner pier. Other designs feature a simple metal frame extending from the front corners of the hangar and braced by an A-frame component.

Dope. Dope is a varnish-like treatment used to protect and waterproof the cloth- and wooden-wings of early aircraft. Hangars designated as dope shops certainly predate 1940 because the U.S. military service had gone to an all-metal aircraft inventory by the late 1930s.

Draft Curtains. Draft Curtains are metal partitions that run transversely and longitudinally along the ceiling of a hangar bay to prevent the spread of fire. They are one of many hangar features implemented for safety purposes. In arched hangar types, the depth of the draft curtain is proportional to the height of the arch at any point. In other words, draft curtains are deeper at the apex, or high point, of the arch.

Drone. Drone hangars house drone aircraft, also known as unmanned aerial vehicles (UAVs). UAV are used in military aviation training exercises.

Empennage. Empennage refers to the tail of an aircraft. References to empennage enclosures may be found on architectural drawings. The term is also used in general readings on aviation.

Fuel System Maintenance. Fuel system maintenance hangars house technology for the cleaning of aircraft fuel systems. Special fluid drainage and fume-control provisions are made to allow the flushing of aircraft fuel cells.

Landplane. The term landplane was adopted by the Navy and Marine Corps to distinguish aircraft operating from shore facilities from seaplanes operating in water. Landplanes were generally smaller than seaplanes because they did not have floats. Consequently, hangars that housed them tended to have lower hangar bay heights.

Maintenance Hangars. Most maintenance hangars provide a protected area for aircraft maintenance rather than garaging. All hangars constructed after the adoption of all-metal aircraft are considered maintenance hangars. Special hangar doors are usually required as are special systems for fire protection and fluid drainage.

Nose Pocket. A clear space centered at the back of a hangar bay and often flanked by office modules, is referred to as a nose pocket. It accommodates the nose of an aircraft during maintenance. Some nose pockets are visible from the exterior as rear projections.

Overhead Tail Door. In addition to the large doors that front a hangar, there is often an overhead tail door that allows clearance for the tail of large aircraft. Tail doors come in rolling and swing-up varieties.

Portable Hangar. Portable hangars are also referred to as *demountable*. They were devised for wartime use and could quickly be transported and erected where needed. Many of the excess components of portable hangars have been assembled at subsequent sites to form buildings for nonaviation use.

Seaplane. A type of Navy and Marine Corps aircraft with floats for taking off and landing in water. The floats made these craft taller than their landplane counterparts, so hangars that housed them tend to have taller hangar bay heights.

Sound Deadening Board. This is a special interior finish often applied to hangars to reduce noise reverberation caused by loud aircraft engines.

Wash Rack. Wash rack facilities are used to wash aircraft to prevent deterioration of the fuselage. They are equipped with high-pressure detergent delivery systems.

Associated Aviation Structures

For purposes of compliance with NHPA Sections 106 and 110, aviation installations should examine all properties that contribute to their flying mission. Such properties, referred to here as *associated structures*, include all aviation facilities other than hangars. These associated structures have an essential role in a base's air mission, and therefore should be considered an important part of any airfield context. When examining both hangars and their associated structures, the cultural resources manager should keep in mind that, over time, new hangars and flight lines may be set up in front of the original ones. Therefore, older hangars and associated structures may be found in unexpected places, such as facing installation streets that were in the past runways.

Surface Structures

The airfield landscape includes surface structures such as runways, overrun pavement, taxiways, parking aprons, arm and disarm pads, and various navigational aids and air traffic control facilities. Views across these surfaces once played an important role in the placement of aviation-related buildings. Older control towers are found in prominent locations along flight lines (such as on the corners of aircraft hangars) for commanding views of the airspace. Recent advances in electronics have replaced the air traffic controller's eyesight as a means of tracking aircraft, so direct views of the airfield are no longer necessary. Modern control towers are often freestanding structures located on hilltops or on remote parcels of land for radar purposes. It is important for cultural resource managers, when considering their airfield landscape, to consider past and present views as well as all aviation surface structures on or away from the flight line.

Vertical Structures and Buildings

In addition to hangars and surface structures, airfields include many types of vertical structures have their place on the flight line. Again, it must be remembered that former flight lines must be examined as well as the newer ones. The list of vertical structures that follows is not intended to be all-inclusive, but provides representative examples of the types of operations and maintenance facilities found on airfields. These associated vertical structures should be considered when developing historical contexts for Section 106 and 110 compliance. Note that some facility types are listed more than once because they are known by more than one designation.

Contemporary associated facilities include the following:

- Accessory Repair (Aircraft) Shop
- Aero Repair Shop
- Aerospace Ground Equipment (AGE) Shop Maintenance
- Air Field Systems Shop
- Air Freight Terminal
- Aircraft Boresite Range
- Aircraft Washrack Shop
- Aircraft Weapons Alignment Shelter
- Aircraft Weapons Calibrations Test Facilities
- Airframes Shop
- Armament and Electronics Shop
- Assembly and Checkout Building
- Aviation Armament Shop
- Aviation Fuel Storage and Dispensing
- Avionics Shop
- Balance Shop
- Base Operations
- Battery (Electric Battery, Ni-Cad) Shop
- Bead Blasting Shop
- Chemical Cleaning Shop
- COMM/NAV (Communication/Navigation) and Instrument Shop
- Control Tower
- Corrosion Control Shop
- Crew Readiness Facility
- Egress Shop
- Electrical (Electronics, Electro-Environmental) Shop
- Emergency Power Building

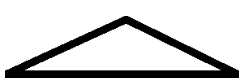
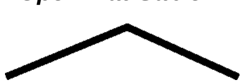
- Engine (Propulsion) Shop
- Engine Inspection and Repair
- Engine Maintenance Shop
- Field Maintenance Shop
- Field Training Detachment
- Fire Station-Crash/Rescue
- Flight Control
- Flight Line Inspection Shop
- Flight Line Maintenance Shop
- Fuel Systems Repair (Fuel Cell, Environmental Fuel) Shop
- General Purpose Aircraft Shop
- Helicopter Operations
- Instrument Trainer Facilities
- Life Support Shop
- Machine Shop
- Maintenance (Aircraft Maintenance) Shop
- Maintenance Control Office
- Metals Technology Shop
- Missile Launch Sites
- Munitions Load Crew Training Facility
- Navigational Aids Building
- Nondestructive Inspection (NDI) Shop
- Nose Docks
- Parachute and Dinghy Shop
- Parachute and Survival Equipment Shop
- Pneudraulics Shop
- Post-Dock Shop
- Precision Measurement Equipment Laboratory (PMEL)
- Primary Radar Station Facilities
- Radar Approach Control Facility
- Radar/Aircraft Guidance Systems
- Repair and Reclamation Shop
- Scheduled Maintenance Shop
- Sound Suppressor
- Squadron Headquarters Building
- Squadron Operations/Flight Training
- Structural Maintenance (Structural Repair, Sheet Metal) Shop
- Test Cell (Diagnostic Center, Hush House)
- Trainer Fabrication Shop
- Trainer Maintenance Shop (Compiled for all Trainer Maintenance)
- Transit Alert (Transient Alert, Transient Maintenance) Shop

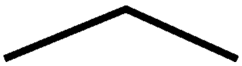
- Unscheduled Maintenance Shop
- Weather Facility
- Welding Shop
- Wheel and Tire Shop

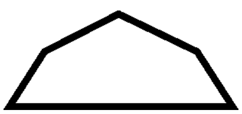
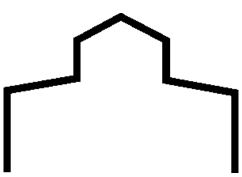
Older structures may go by the following designations.

- Assembly and Repair Building
- Engine (Motor) Test Building
- Engine Overhaul and Machine Shop
- Erection Shop
- Gas Cell Repair and Storage (LTA)
- Gas-Generating or Helium-Repurification Plant (LTA)
- Mooring Masts (LTA)
- Storehouses

Table 6-1. Steel truss cross section typology.

Steel Trusses				
Cross section	First known use	Plan description	Plan no.	
Closed Arch 	early 1930s	Air Corps Type A-A 121'-6" x 120' x 28' (2 Bay)	695-322	✪
	early 1930s	Air Corps Type A-A 121'-6" x 120' x 28' (2 Bay) w/ Alternate Doors	695-333	✪
	early 1930s	Air Corps Type D-D Operations	695-340	✪
	early 1930s	Air Corps Type E-E Double (2 Bay)	695-357	✪
	early 1930s	Air Corps Type F-F Shop (2 Bay)	695-371	✪
	early 1940s	184' Demountable Type DH-1 (2 Bay)	24-1-1	✪
Open Arch 	late 1930s	Repair Building Type Shop-B-A	695-675	✪
	early 1940s	Repair Building Type Shop-B-A	1000-790	✪
	mid-1940s	Heavy Bombard HANG-R-A	1000-927	✪
	mid-1940s	Heavy Bombard HANG-O-A & HANG-P-A	1000-1252	✪
	late 1940s	No Lean-To	39-01-06	✪
	late 1940s	1 Story Lean-To	39-01-07	✪
	late 1940s	2 Story Lean-To	39-01-08	✪
	late 1950s	Large A/C Maintenance	39-01-77	✪
	late 1950s	Maintenance	39-01-82-R1	✪
	early 1960s	Organizational Maintenance	39-01-36	✪
	early 1960s	Corrosion Control (Covered)	39-01-83	✪
Closed Flat Gable 	1918	Y&D Standard 151' Type	varies	⚓
	1918	Y&D Standard 110' Type	varies	⚓
	1919	Steel Seaplane 3-Section 100' x 100' x 24'	varies	⚓
	1919	Steel Seaplane 2-Section 150' x 180' x 35'	83819	⚓
	mid-1920s	Steel Seaplane 3-Section 110' x 160' x 24'	varies	⚓
	early 1940s	120' Temporary	695-400	✪
	early 1940s	Air Corps School Type TUH-1 (2-Bay)	695-400.1	✪
	early 1940s	Transport Squadron HANG-E-A (w/ Transverse Monitors)	695-695	✪
	early 1940s	Transport Squadron HANG-E-A (w/ Transverse Monitors)	1000-355	✪
	mid-1940s	Squadron OBH-1 (Steel)	117/5-2	✪
Open Flat Gable 	early 1950s	Readiness w/ Shops	39-01-33	✪
	early 1950s	Readiness w/ Shops	39-01-39	✪
	early 1950s	Maintenance w/ Shops	39-01-41	✪

Steel Trusses			
Cross section	First known use	Plan description	Plan no.
Open Flat Gable 	mid-1950s	Readiness w/ Shops	39-01-39 ✪
	mid-1950s	Maintenance w/ Shops	39-01-41 ✪
	mid-1960s	Weapons Calibration Type A (Closed)	39-01-87 ✪
Closed Gable 	1918	110' x 200' Standard	695-201 ✪
	early 1930s	66' Connecting Two 110' x 200' Standards	695-219 ✪
	early 1930s	Air Corps 1929-A Design 110' x 240'	695-232 ✪
	early 1930s	Air Corps 1929-B Design	695-2?? ✪
	early 1930s	Air Corps 1930-A Design	695-254 ✪
	early 1930s	Air Corps 1930-B Design	695-272 ✪
	early 1930s	Air Corps 1930-D Design	695-283 ✪
	early 1930s	Air Corps 1930-E Design	695-284 ✪
	mid-1930s	Air Corps Double Type H	68-12-120 ✪
	late 1940s	Liaison Type Plane (Type 1 Construction)	39-01-01 ✪
	late 1940s	Liaison Type Plane (Type 2 & 3 Construction)	39-01-02 ✪
Open Gable 	early 1950s	Maintenance w/ Shops	39-01-41 ✪
	early 1950s	Double Unit Arch Type	39-01-49 ✪
	mid-1950s	AAF 4,000 Sq Ft	39-01-60 ✪
	mid-1950s	Organizational Pull-Thru	39-01-65 ✪
	mid-1950s	Organizational Pull-Thru	39-01-65-R1 ✪
	mid-1950s	Reserve Training Type A	39-01-73 ✪
	mid-1950s	Fighter Bomber	39-01-74 ✪
	late 1950s	Maintenance	39-01-22 ✪
	late 1950s	AAF 12,000 Sq Ft 20,000 w/ Shops	39-01-62 ✪
	late 1950s	AAF 20,000 Sq Ft 35,000 w/ Shops	39-01-64 ✪
	late 1950s	Reserve Training Type B	39-01-74 ✪
	early 1960s	Weapons Calibration (Enclosed)	39-01-76-R1 ✪
	early 1960s	Ready Fighter Shelter	39-01-84 ✪
	mid-1960s	Weapons Calibration Type B (Closed)	39-01-87 ✪
	early 1970s	Alert Shelter	39-01-88 ✪
Gable Offset 	early 1950s	Wing Multi-Purpose	39-01-53 ✪
	early 1950s	Wing Multi-Purpose	39-01-54 ✪

Steel Trusses				
Cross section	First known use	Plan description	Plan no.	
Gable Offset 	late 1950s	Large A/C Fuel Maintenance	39-01-13	✪
	late 1950s	Type MB-3A/4A/9 for Large A/C	39-05-01	✪
	mid-1960s	Large A/C Maintenance	39-05-12	✪
Gambrel A-Frame 	1917	Y&D Standard 112' x 75' x 24' Seaplane	varies	⚓
Open Shed 	early-1950s	B-36 Maintenance	39-05-01	✪
	late 1980s	Maintenance	varies	⚓
External Structure 	late 1950s	Shore Facility-Module E	varies	⚓
	early 1970s	Type I Maintenance	1291710	⚓
	early 1970s	Type II Maintenance	1291712	⚓
	mid-1970s	Type I Maintenance for Two Carrier AEW Squadrons	1291714	⚓
Closed Gambrel 	1917	U.S. All-Steel 66'-0"	634.2-158	✪
Sawtooth 	early 1940s	B-M Land Plane	varies	⚓
	late 1930s	B-M Seaplane	varies	⚓
Monitor 	mid-1940s	Very Heavy Bomb HANG-T-A	1000-1365	✪
	early 1940s	B-M Land Plane (Alternate)	varies	⚓
	early 1940s	B-M Seaplane (Alternate)	varies	⚓
Flat 	early 1950s	Army Organic Light A/C (4 Bay)	39-01-26	✪
	early 1950s	Alert Fighter A/C 298' x 66' (4 Bay)	39-01-37	✪
	early 1950s	Alert Fighter A/C 303' x 69' (4 Bay)	39-01-38	✪
	mid-1950s	Alert Standard Type (4 Bay)	39-01-01	✪
	mid-1950s	Alert Fighter A/C (2 Bay)	39-01-69	✪
	late 1950s	Alert Fighter A/C (2 Bay)	39-01-69-R1	✪
	late 1950s	Ready Fighter (1, 3, & 4 Bay)	39-01-72	✪
	early 1980s	Fuel Maintenance	39-04-03	✪

Steel Trusses				
Cross section	First known use	Plan description	Plan no.	
Flat Exterior/ Arched Interior 	early 1950s	Double Cantilever Heavy Bomber 600' x 250' (3 Bay)	39-01-27	✪
	early 1950s	Double Cantilever Medium Bomber 350' x 250' (2 Bay)	39-01-28	✪
	early 1950s	Double Cantilever Medium Bomber 350' x 250' (2 Bay)	39-01-44	✪
	early 1950s	Double Cantilever Fighter A/C	39-01-45	✪
	early 1950s	Double Cantilever Medium Bomber A/C	39-01-46	✪
	early 1950s	Double Cantilever Heavy Bomber A/C	39-01-47	✪
	mid-1950s	Double Cantilever Heavy Bomber 600' x 250' (3 Bay)	39-01-43	✪
	mid-1950s	Double Cantilever Medium Bomber A/C	39-01-58	✪

Table 6-2. Steel girder cross section typology.

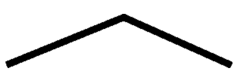
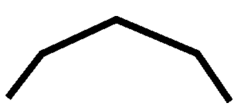
Steel Girders				
Cross section	First known use	Plan description	Plan no.	
Open Flat Gable 	mid-1960s	Small A/C Maintenance (2 Bay)	39-05-14	✪
	early 1970s	Corrosion Control Type A Small	1291764	⚓
	early 1970s	Corrosion Control Type B Large	1291765	⚓
Open Gable 	mid-1970s	Pre-Engineered Maintenance Type A	1403097	⚓
	mid-1970s	Pre-Engineered Maintenance Type B	1403098	⚓
	mid-1970s	Pre-Engineered Maintenance Type C	1403099	⚓
	early 1980s	Small A/C Maintenance	39-04-03	✪
	early 1980s	Small A/C Maintenance	39-04-04	✪
Open Gambrel 	mid-1950s	Alert Butler Type	39-01-03	✪
External Structure 	late 1950s	Shore Facility-Module E	varies	⚓
	mid-1960s	Type I Maintenance	1291710	⚓
	late 1960s	Type II Maintenance	1291712	⚓

Table 6-3. Steel long-span joist cross section typology.

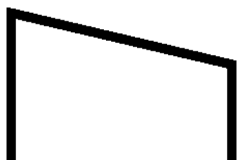
Steel Long-Span Joists				
Cross section	First known use	Plan description	Plan no.	
Open Shed 	mid 1950s	Large A/C Maintenance	39-01-53	✪
	early 1970s	Weapons Alignment Shelter (1 Bay)	1291733	⚓
	early 1970s	Weapons Alignment Shelter (2, 3 & 4 Bay)	1291734	⚓

Table 6-4. Wood truss cross section typology.

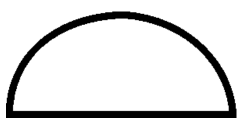
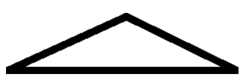
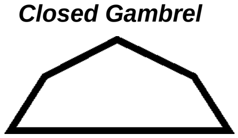
Wood Trusses				
Cross section	First known use	Plan Description	Plan no.	
Open Arch 	mid-1940s	Lighter-Than-Air	varies	⚓
Closed Arch 	unknown	Squadron OBH-2	117/6-3	✪
	mid-1940s	Type HANG-N-A	1000-1222	✪
	unknown	Squadron Type HANG-A-A	1000-1328	✪
	mid-1940s	A.T.C. Birchwood Type 202' x 200'	varies	✪
Closed Flat Gable 	unknown	Air Corps School Type TUH-2 (2 Bay)	695-611	✪
	early 1940s	Air Corps School Type HANG-A-A & C-A (2 Bay)	1000-292	✪
Closed Gambrel 	1917	Kahn’s Signal Corps Mobilization	varies	✪
	1918 or 1916 (?)	Army Type Portable 110' x 180'	varies	✪

Table 6-5. Concrete arch cross section typology.

Concrete Arches				
Cross Section	First Known Use	Plan Description	Plan No.	
Open Arch 	early 1940s	Shore Facility – Denver Type Reserve Station	486581 520026	⚓
	early 1940s	Monolithic Concrete Seaplane	varies	⚓
	unknown	Shore Facility-Miramar Type	varies	⚓
	mid-1940s	Squadron Operations	varies	✪
	late 1940s	Monolithic Concrete	35-04-01	✪
	mid-1950s	Organizational Pull-Thru	39-01-65	✪
	mid-1950s	Organizational Pull-Thru	39-01-66	✪
	mid-1950s	Organizational Pull-Thru	39-01-67	✪
Transverse Arch 	late 1930s	Monolithic Concrete Seaplane	varies	⚓

Note: The *star* symbol in the right-hand column indicates an Army or Air Force plan; the *anchor* symbol indicates a Navy plan.

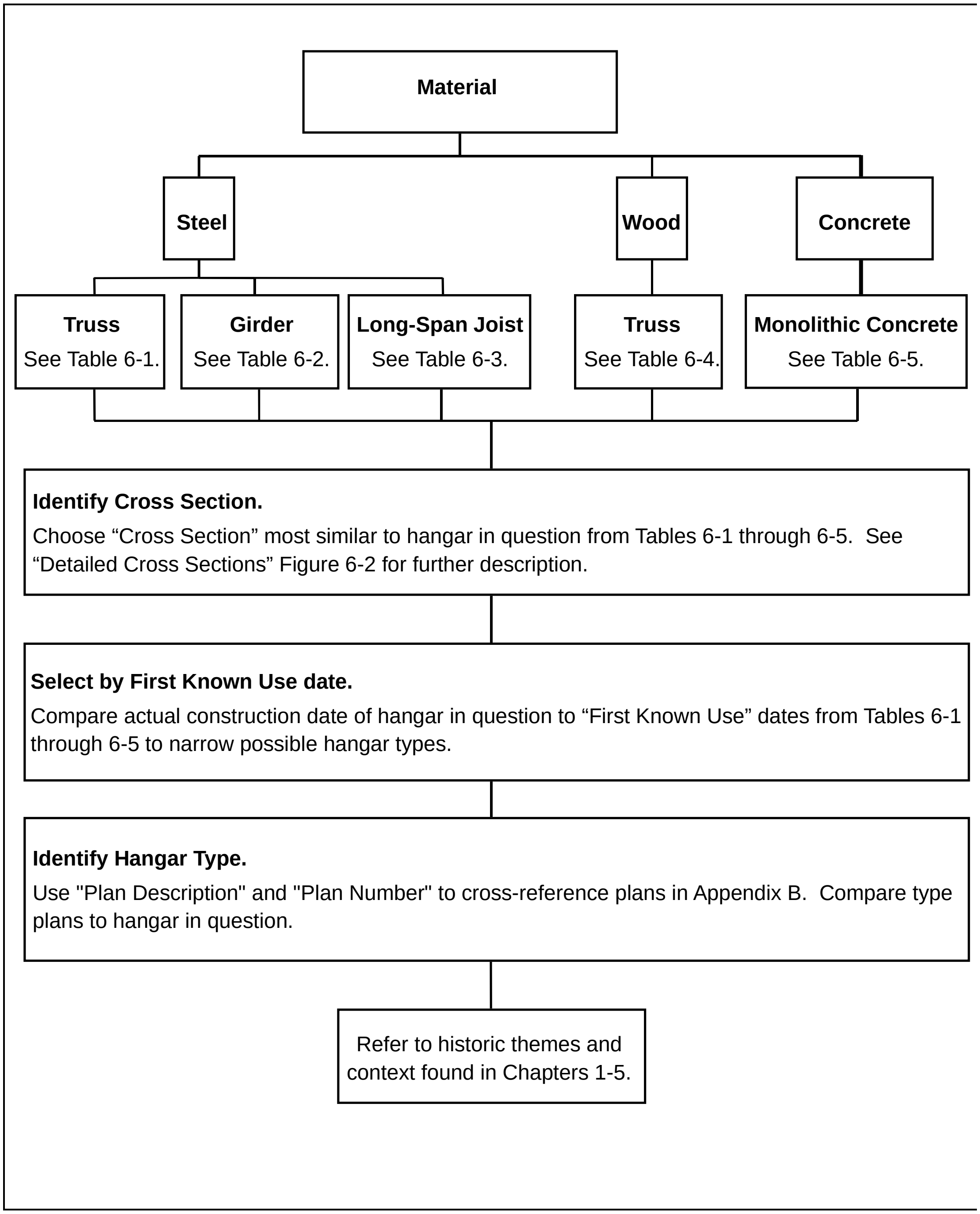


Figure 6-1. Hangar typology flowchart.

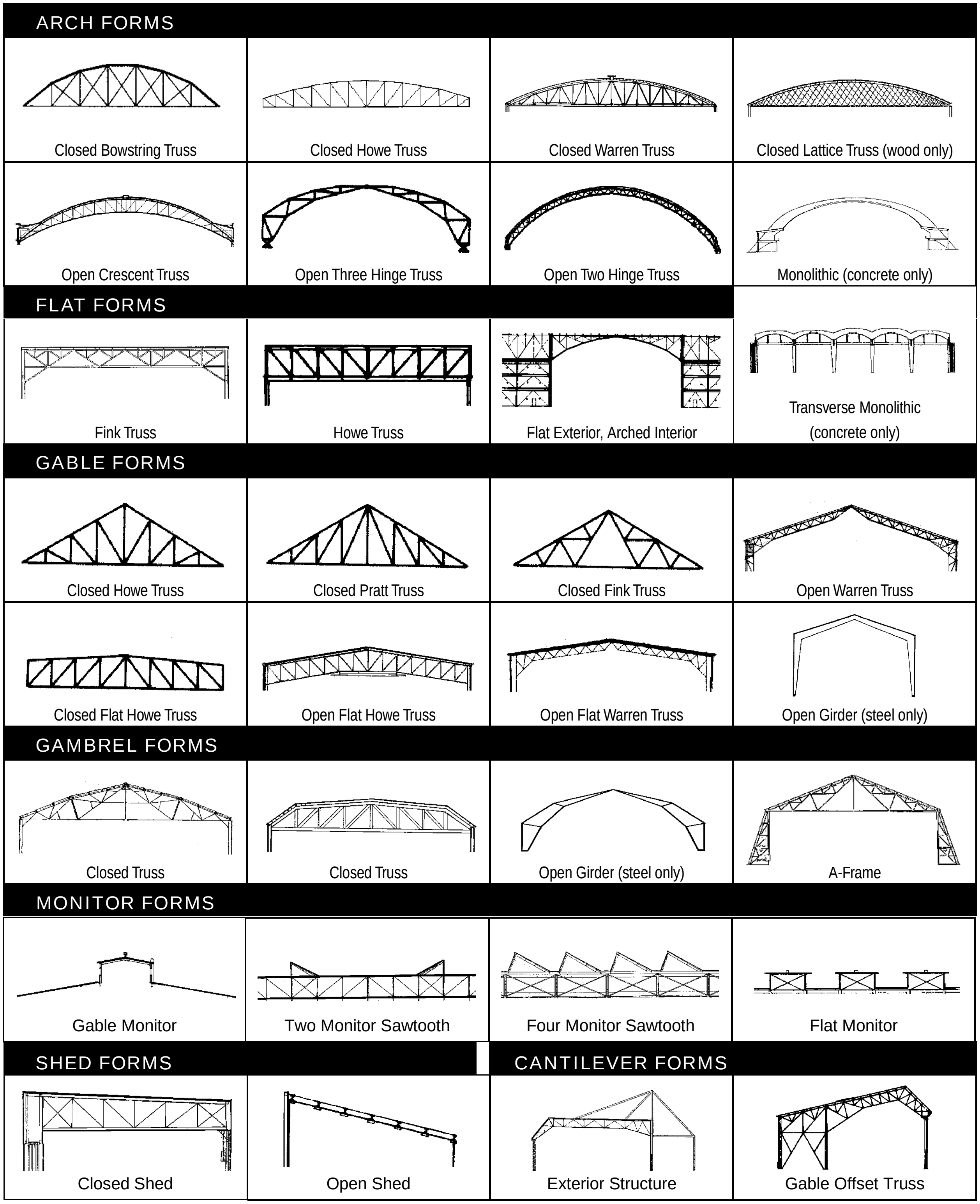


Figure 6-2. Detailed cross sections.

Figure 6-3. Example of steel girder (or rigid frame) construction.