[RE]Commissioned

An Indoor Aerodrome and Development Center for Unmanned Vehicles in Tillamook's Iconic Airship Hangar

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Abstract

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This thesis investigates the redevelopment of a WWII airship hangar in Tillamook Oregon as an indoor testing facility and museum for unmanned vehicles. Located on one of the few designated FAA test sites in the country the site gives commercial ventures the opportunity to legally develop, test, and certify their vehicles as the technology seeks to be incorporated into national airspace. Visitors engage the hangar through a series of static and experiential exhibits as a series of platforms and mezzanines that wind up around and through the extensive wooden trusses. The degradation of the current air museum makes a new realignment strategy for the massive structure even more important, in order to preserve the iconic structure for future generations and reconnect to its aviation roots, linking an antiquated technology to that of its contemporary counterparts.

Acknowledgements:

I'd like to thank the professors that helped guide me through the design process, Gundula, AnnMarie, and Rick. Especially Louisa for introducing me to these incredible structures and continued help throughout the research and writing.

The people at the Tillamook Air Museum, Port of Tillamook Bay, and Tillamook Pioneer Museum for their help in researching, documenting, and exploring the hangar. Their support was invaluable to the documentation of the structure.

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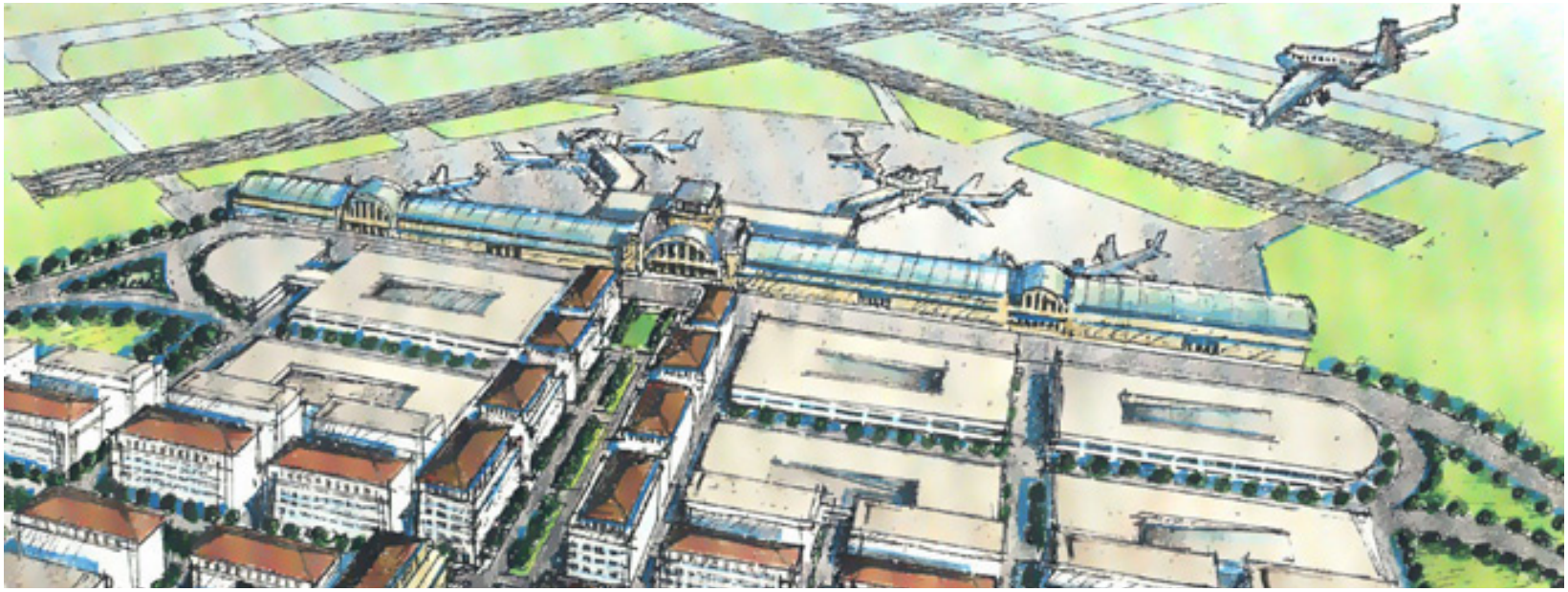
tillamook hangar b
west doors, 2014

The end of World War II brought about the closing and decommissioning of many military sites throughout the United States, a drawdown that has continually sought to convert the country's under-utilized military institutions to private use and civilian ownership. Through remediation efforts, these contaminated landscapes are rehabilitated and existing structures are removed or reassigned public roles. However some of these post-military structures, often utilitarian in nature, are forgotten during these rehabilitation efforts, caught in limbo, between a legitimate reuse and falling into a state of neglect (figure 2). Coastal bunkers, too difficult to demolish or reuse, provide an example where over time these monumental structures have been engulfed by the sea, consumed by the very landscape that they once conquered (figure 3). These utilitarian structures are often viewed as a self contained program, fulfilling their initial role of storage or service but unable to make the transition to civilian ownership. The most common outcome is the erasure of the built forms and their pasts, their sites are transferred to the local government for new development. At best a plaque is left to record the areas original military role.[42] But these decommissioned structures offer rich opportunities for architectural interventions that reflect their current usage while also acknowledging the site's embodied history.

figure 2
rosie the riveter factory

figure 3
sinking pillbox

42 Woods, Lebbeus. *War and Architecture.* Princeton Architectural Press. 1993. Print.



Military construction covers a wide range of building typologies and uses, from the more familiar housing, hospitals, and chapels to the remote bunkers and outposts, that make up networks of infrastructure, unseen by the general public. This thesis will focus on one of those utilitarian types, which cannot be easily reintegrated into civilian life once the conflict that necessitated their construction has passed. These forgotten structures can provide valuable opportunities for retaining a link to the past, standing as a survivor of a former era, and in some cases a relic of antiquated technology. These military warehouses, bunkers, and hangars are, and can be retained as, important components of their context. Recovering those existing structures serves to preserve the history and culture of their communities, and take advantage of an opportunity for economic growth utilizing these existing sites.

figure 4
el toro base realignment
federal base redevelopment

This thesis thus takes an indepth look at a neglected facility, acknowledging its architectural significance and studying its potential for reuse. Historically military structures have often been excluded from architectural history, despite the presence of architecturally significant buildings and revolutionary construction techniques.[43] This thesis builds upon this fields limited research to create an argument for the preservation of the specific typology of the airship hangar, while also studying their history and the reintegration of their base into the local communities.

The invention of lighter than air craft in the early nineteenth century brought about the need for a protective structure to house these delicate vehicles. The massive hangars ultimately replicated the lightweight structures of the airships they housed to create a protective shell up to 1,000 feet long and 200 feet tall. The hangar at Tillamook has seen many different tenants since its decommissioning, who have struggled to fully utilize the unique and iconic structure. At the same time the base in which the hangar sits has been struggling with its transformation into the county's industrial park. The proposed intervention therefore seeks to unify the existing operations of the site to make a more cohesive industrial complex, which also respects its historic integrity and has a positive impact on local economy. The proposed project, a development center for unmanned technologies, seeks to reinvigorate the hangar, connecting contemporary aviation technology to the hallmark of 20th century engineering. The structure transcends generations, no longer left a ruin of an antiquated technology, rather the hangar provides the platform for innovation in the rapidly expanding field of unmanned flight.

43 United States. Department of Defence. Legacy Resource Management Program. *The Architecture of the Department of Defense A Military Style Guide*. By Michelle Michael, Adam Smith, and Jennifer Sin. Department of Defence, Dec. 2011. Web. 20 Apr. 2014.

The military base is established as a means for providing national security, whether through the training of personnel or the storage of materials and munitions. The construction of these facilities brings a new order to the underlying layers present on the sites they occupy, changing the perception of the land in a way that remains long after the military presence is gone. Once it has been outlived its original function, whether due the de-escalation of conflicts or advances in weaponry, the military base must be decommissioned, or removed from service. Since World War II the amount of federally owned land in the United States has been reduced by fifty percent,[44] most of this property has passed through a systemized approach for redevelopment. The history of this adaptation process is often contentious with the local population, especially when initiated at a federal level.

44 Childs, John. *The Military Use of Land: A History of the Defence Estate*. New York: Peter Lang, 1998. Print.

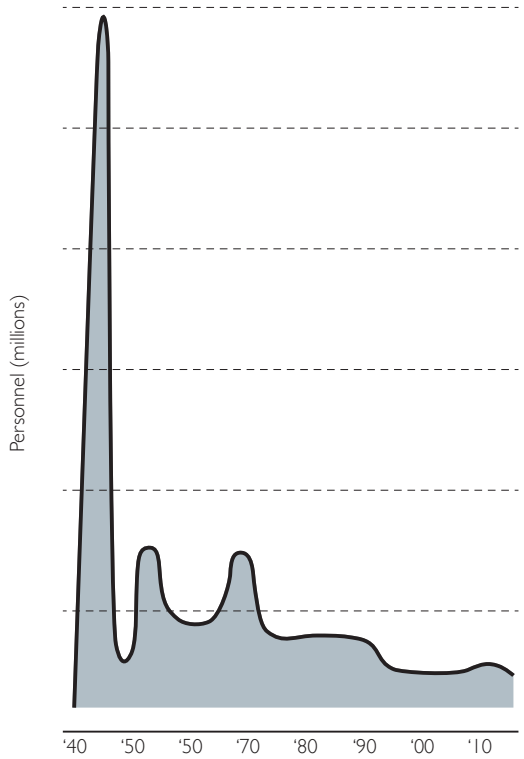


figure 5
united state military enlistment

BASE REALIGNMENT AND CLOSURE

The reuse of military sites has a long history in the United States, dating to the preservation of Revolutionary War battlefields and fortifications as historical markers. But it was not until World War II, with the largest mobilization of resources the world had ever seen, that the nation established a standardized protocol for the decommissioning of unneeded military sites. The first initiative to reduce military property came soon after conflict ended with the Federal Property and Administrative Services Act of 1949. Due to the start of the Cold War and the resulting turbulence in national security, the conversion of base closure throughout the country proceeded only intermittently until the 1960s.[45] In the following decades a multitude of individual acts brought about the closure or realignment of several hundred military outposts across the nation.[46] In 1990, a year after the

45 Federal Property and Administrative Services Act of 1949, amended 29 December 2000
46 Office of Economic Adjustment. *1991, Planning Civilian Reuse of Former Military Bases.* Washington, D.C., November 1991. Print

fall of the Berlin Wall (considered the symbolic end of the Cold War) the Defense Base Realignment and Closure Act [BRAC] was passed, a process by which "excess military facilities are identified and, as necessary, transferred to other federal agencies or disposed of, placing ownership in non-federal entities."[47] The project's initiative was to provide public benefit through the sale of federal lands to state or local authorities for use for low income housing. Under this legislation a new round of bases were slated for realignment every few years with a gap in the late 1990s and early 2000s due to conflict in the Middle East, when military personnel enlistment trends leveled off after years of steady decline.[48]

BRAC represents a federally mandated system for the realignment of multiple bases in a systematized procedure requiring a comprehensive redevelopment plan. The closure of bases is often highly contested by the local communities that rely on them as a source of employment or income including the service industries that benefit from the enlisted personnel stationed there. The Department of Defence [DoD] has argued that these concerns are unfounded, issuing publications that highlight the potential of properly planned reuse projects. This governmental authority states numerous precedents from decades of base closure to show that the number of jobs are subsequently double, with the economy of communities typically rebounding within two years.[49] The approach dictated by the DoD begins with a highly contextual and localized study:

> The developer … must begin by identifying the unique locational characteristics of the site; the types of occupants seeking this location and their space needs; the special physical characteristics of the site to be preserved or enhanced; and the services [needed] to accommodate future occupants … The plan should reflect the unique factors inherent in the site, and the special requirement for the types of industries which might be attracted to this kind of location. [50] [51]

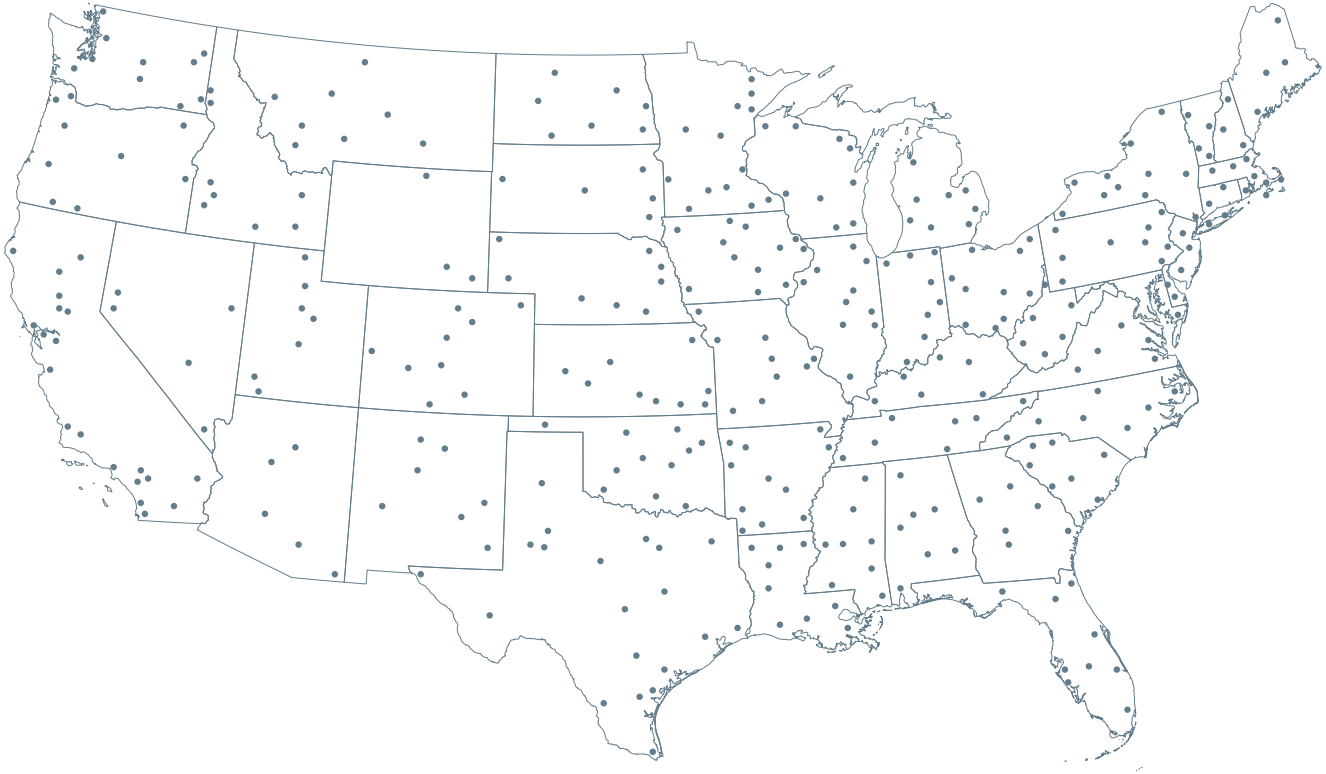
47 Flynn, Aaron M. (February 23, 2005). "Base Realignment and Closure (BRAC): Property Transfer and Disposal". Congressional Research Service Reports. Online. 20 Apr. 2014. pg 6
48 Brasher, Bart. *Implosion: Downsizing the U.S. Military, 1987-2015*. Westport, CT: Greenwood, 2000. Print. pg 218
49 ibid. pg 133
50 Office of Economic Adjustment. 1991, Planning Civilian Reuse of Former Military Bases. pg 2
51 The Nature of Base Facilities, one of 10 areas of consideration for development as identified by the DoD, is relevant to large structures such as airship hangars because the unique typology of the main structure on the site directs the development solution.

This strategy that begins with the understanding of the specific environmental and social conditions of the site is central this thesis investigation of how adaptive reuse projects must be undertaken, with an acute understanding for the specific conditions present in the community and environment that surround the site. This idea is especially relevant in those circumstances of reuse where there are multiple layers of history embedded within the site. This contextual approach becomes more difficult to successfully implement when multiple parties are involved in the redevelopment process, and the post military occupation of land becomes disorganized.

Prior to the implementation of BRAC bases and facilities were commonly turned over to civilian usage without a great deal of thought as to what will happen to them. Often the facilities were simply stripped of classified materials and given back to the local governance to find a use for the now empty land. This was often the case directly following the end of a major conflict with a substantial military buildup, this local realignment process is not as strenuous as the federal BRAC procedure which plays out in the patchwork nature of their sites. This difficult transitional phase is ubiquitous with military projects which historically have large impacts on local economies but the problem can be compounded by the lack of a rigorous reuse process and unique site conditions.

The airbase is one of the most common redevelopments of military complexes undertaken by local authorities following World War II, a simple program that in certain cases contained one of the war's most unique structures. These bases were built in mass numbers across the country during World War II to serve the Air Force, Navy, and Army forces, when technology and training regiments required a dense network of airbases. Typically small in scale these airports were constructed quickly, often with the intention of simply transferring the title to the local government once conflict ended. The transition of airfields from military to civilian use is quite common as technologies advance, allowing for military aircraft to fly farther and innovative offensive armaments require fewer overall aircraft.[52] Following World War II some of these small airstrips transitioned to public airports,

52 Brasher, Bart



creating a network of local transit hubs across the country (figure 6). The majority however have been forgotten, left to be reclaimed by nature, their runways overgrown, only the faint outline of the airstrip's plan remain in the environment or urban fabric. Creating a scar on the landscape as its only enduring effect on the community. For airfields that are larger in scale, and more complex in nature, there are much greater difficulties imposed for local redevelopment procedures. Those which include super sized structures have posed a particular problem which requires unique approaches to realign. It is not only the pragmatic usage of the site that previously militarized facilities embody but also their public perception which can drastically affect how they may be realigned.

figure 6
us airstrips & training schools
1940

In his book Site Planning (1962), Kevin Lynch talks about the importance of "waste ground," which he identifies as the less desirable places, large factories, rail yards, and military reservations. Putting forth the idea that these spaces are actually necessary to a community's present and future, he points to Seattle's Gasworks Park as an excellent example of the reuse of these types of industrial lands for recreation.[53] These landscapes often have negative connotations associations which makes them difficult to redevelop, without first clearing the grounds. Military lands within the United States can be seen as falling into this category once active use has ended and it becomes an dead space, especially in the case of utilitarian structures that fail to evoke a sense of pride and patriotism. When revisited in his 1972 publication What Time Is This Place? Lynch revisits the waste spaces from a preservationist stance. Here he applies the idea of a ruin to waste ground, arguing they often attract attention in a romantic and emotional way, but too often have been wiped clean of their patina.[54] This idea of the usefulness of waste ground is the origin of this thesis and the idea that though viewed initially as ruin these structures can have further use.

The ruin has always been a subject of fascination, seen as a link to a time long past. Even in their derelict and desolate state these structures engaged public imagination in a way that few other experiences in our everyday modern lives can. Tim Edensor describes individual ruins as 'memoryscapes,'[55] which nostalgically form a connection to the past. This study similarly seeks to understand the military ruin as the object which commonly facilitates memory as a connection to the past. The abandoned utilitarian building is embedded with layers of history that make it significant even though it is perceived as functionless, a temporary condition that can be easily reversed. The scale of the airship hangars and the unique technology that necessitated their creation further drives their position in the category of memoryscape. Their current derelict state an effect of ever advancing technologies, a trait which they in and of themselves embody.

53 Lynch, Kevin. *Site Planning*. Third ed. Cambridge: M.I.T., 1984. Print. Pg 357
54 Lynch, Kevin. *What Time Is This Place?* Cambridge: MIT, 1972. Print.
55 Edensor, Tim. Industrial Ruins: Spaces, Aesthetics, and Materiality. Oxford: Berg, 2005. Print.

According to Edensor upon entering such a state of "ruination" the building suddenly expresses more, as its hidden and underlying structures and networks emerge, revealed by a decaying facade.[56] The unique skeletal construction of the hangers let it to achieve this notion without actually falling into a state of decay. But while arguing that the ruin can become an integrated part of the public realm, Edensor does not expand in great detail on the idea of redevelopment. His idea of reuse generally involves very little intervention, allowing the ruin to be viewed in its "true state," where the patina of time can be either left to decay or frozen at its current state. His idea of "redevelopment" is concerned more with the cult of the ruin, leaving them as a landscape for adventurous play, "mundane leisure practices," and art spaces.[57] Though these activities can allow for greater engagement with the past the reality it is not an approach that can be implemented on most sites. None of these activities provide opportunities for active development of the space and fail to address the circumstances of an economic reality. What Edensor neglects to mention is the ability for the ruin to serve as the underlying structure redevelopment and to take on more productive uses through a more selective process of reuse that can reactivate the spaces and have a larger impact on the surrounding community. The insertion of artworks and viewing stations throughout the site allows for an interaction between the past and present use of the site. When the structures in question are within a more populated context an even greater opportunity and emphasis is put on the redevelopment.

The reuse or retention of a military site therefore presents a particularly fine line between the retention and erasure of history. The sites tainted by both memory and contamination, some embedded in urban fabric and others isolated. But large military facilities consist of a complex assembly of structures of different uses that must be carefully considered in terms of what to retain for reuse or as a ruin, in an effort to create a successful redevelopment and retain history where possible.[58] The storage structures are often the first to be disposed of, while, as this thesis argues they may provide the strongest argument for reuse.

56 Edensor, Tim
57 ibid. pg 30
58 Childs, John. pg 245

UTILITARIAN STRUCTURES

Although the ruins of military structures have captivated architects for centuries, militarized buildings are rarely discussed as part of the greater field of architectural history. In the few studies that address the link between civil and military architecture, the emphasis is usually on the use of scientific and construction technologies. Keith Mallory argues that the majority of military buildings embrace the architectural style of the times and therefore are just as worthy of acknowledgement as any other building type.[59] While examining a wide range of military building types, from fortifications to huts, he argues that the support structures form the backbone of any successful campaign. Due to their utilitarian nature, these hangars, huts, and sheds require efficient production and implementation during wartime economies that lead to innovations that were then passed on to civilian construction technologies. These innovations do not have to stop at the decommissioning of a structure however, in Europe flak towers have been successfully reused for imaginative projects that include a power plant and an aquarium.[60] As seen in the Renewable Energy Power Plant in Hamburg, Germany. These massive structures that once stood for oppression can be co opted to serve as monuments of future technologies (figures 7a-7b).

According to Mallory the two main areas of advance created by wartime construction are in prefabricated structures and building standardization, arising from the need for efficient production and implementation under the pressures of a wartime economy. Originally produced to house injured soldiers during the winter in World War I, huts were produced in mass quantities so that they could be shipped flat, carried by only two men and put together with a single wrench.[61] These constraints produced a standard dimension but still allowed for many ingenious variations.[62] The advances in lightweight construction gained through the development of these small huts directly impacted larger scale structures known as blister hangars, which were later implemented

59 Mallory, Keith, and Arvid Ottar. *Architecture of Aggression; a History of Military Architecture in North West Europe, 1900-1945*. London: Architectural, 1973. Print.

60 "Energy Bunker." International Building Exhibition IBA Hamburg. N.p., n.d. Web.

61 During World War I there were many designs created for the military hut. The most successful was a wooden arch hut, the Nissen Hut, which was the predecessor to the Quonset huts of World War II.

62 Canvas, steel, aluminum, wood and even concrete was used, though this did not match the original guideline of being erected by two men these structures proved very durable for more permanent encampments.

in World War II.[63] But it was World War I that initially spurred the need for standardization, motivated by the shift in battlefield tactics. War was no longer a static conflict where one side sat back and waited within fixed defenses, but now was highly mobile with the tank and airplane. Everything, even the infrastructure had to be able to adapt and move depending on which way the conflict was swaying. With new technologies came the creation of new structures to build, store, and repel the new weapons. Le Corbusier spoke of war as "an insatiable client, never satisfied, always demanding better,"[64] as a way of reaffirming the rapid evolution of design that occurs as part of military development. He too sought to link the innovation of conflict driven engineering to civilian architecture.

figure 7a
abandoned flak tower

figure 7b
energy bunker
architects rendering

63 Mallory, Keith.
64 Corbusier, Le, and Frederick Etchells. *Towards a New Architecture*. London: Architectural, 1946. Print. pg 109

Both prefabrication and standardization in building originate from military techniques brought to civilian projects. This is also true is the approach to material usage, as wartime rationing caused designers to re-examine other materials or create their own. Concrete was extensively studied and applied in a variety of different ways, both in thin shell and pre-stressed structures. What is less recognized is the innovation of laminated timber arches and plywood box beams, the precursor to today's advanced wood members.[65] The largest known example of engineered timber from this era are the airship hangars built in the United States during World War II, the delicacy of their structures matched that of the fragile airships which they housed.

THE AIRSHIP HANGAR

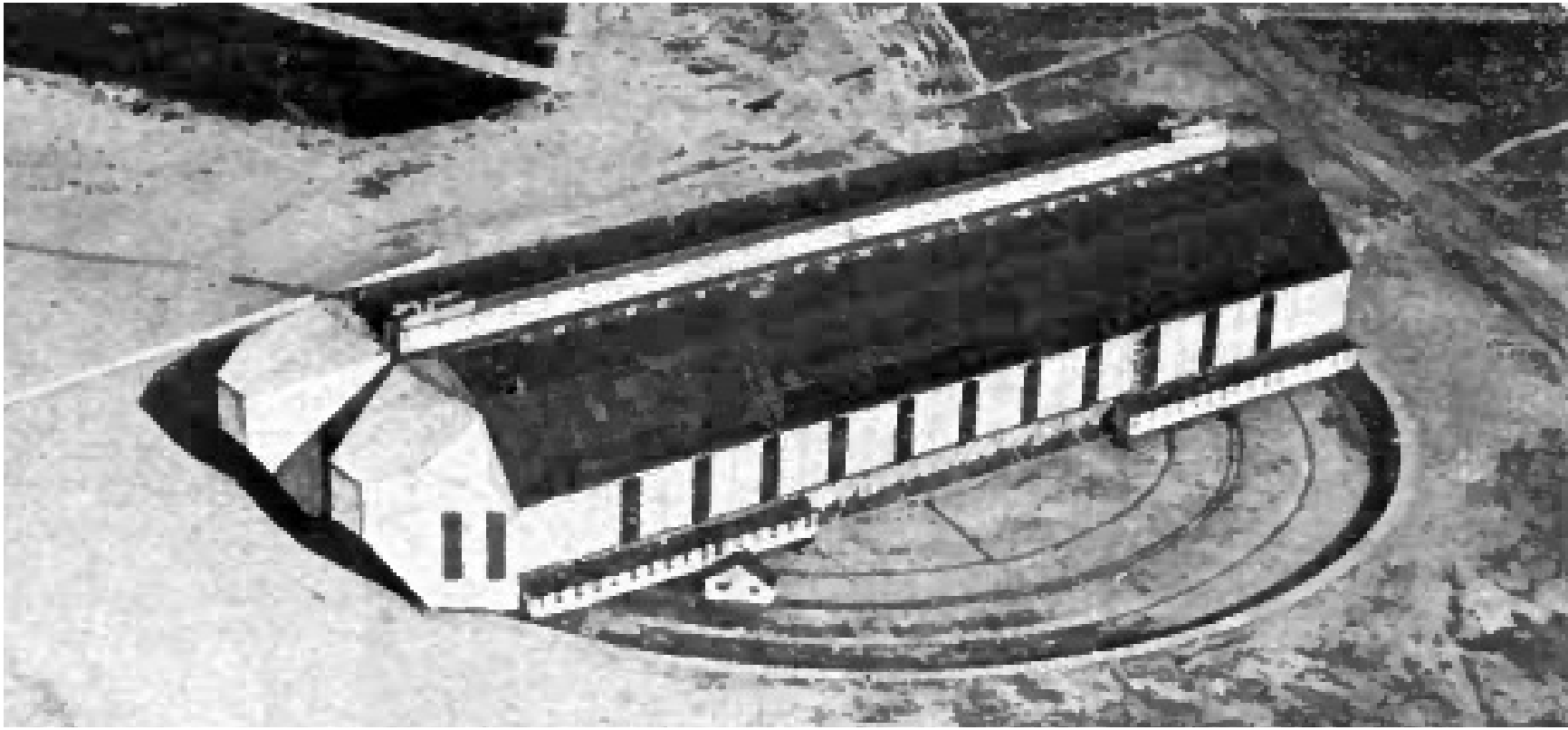
Military use of airship technology was quickly established during in the later half of the nineteenth century when the massive new aircraft were used as much for intimidation as actual tactical missions. Germany's massive rigid zeppelins were the pinnacle of this terror weapon strategy, when for the first time bombing raids could be launched on Britain.[66] Traditional aircraft soon surpassed the dirigibles in distance and speed and their use as bombers discontinued. In the second World War the United States used the airship for surveillance, the balloon's original battlefield function, which dates back to the US Civil War. These airships, though smaller than their German counterparts of World War I, were still extremely large and fragile, requiring an equally immense construct to house the. Compared to its descendants however, the first structure built specifically for the storage of lighter-than-air craft is quite small. Built just outside Paris at the end of the nineteenth century Hangar "Y" was the precursor in its form and technology to structures that reached their heights 1920s and 30s. The hangar was only 230 feet long and spanned 65 feet, but its metal gantry frame was revolutionary. It was at this time that ideas emerged of luxury airships transporting passengers between European nations, and even their distant colonies. While these visions were never fully realized, the popularity of the airship required the construction of new hangars around the world and its adoption as a weapon of war.

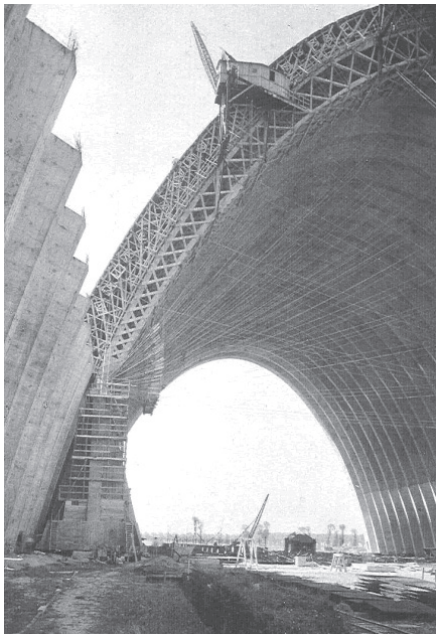
65 Mallory, Keith. pg 269
66 Jackson, Robert. Airships in Peace and War. London: Cassell, 1971. Print.

The layout of a military bases that housed airships were stationed had to be largely designed around these giant vessels. These ships that measured up to 800 feet in length required ample space for their maneuvering as well as tethering them outside away from the apron.[67] Though attempts were made to create "deployable" hangars during World War I, they proved ineffective. The vast majority of structures to house airships had to be constructed where land could be easily acquired in order to allow the design to be oriented in relation to local wind directions. Lighter than air craft are both difficult to maneuver and extremely fragile and like the structures in which they are housed the vessels consist of a rather delicate framework that is then covered in a thin skin. Highly susceptible to changes in wind, the craft can be destroyed by a gust of wind coming from the wrong direction, usually crosswise as opposed to head on or tail wind. Employed in several Florida airbases the floating hangar was able to be positioned into the wind so that landing and takeoff were more controlled. The Germans expanded on this hangar type that they had originated by creating revolving sheds that rotated on a 600 foot diameter turntable, which would be oriented to face the prevailing winds (figure 8).

Following the construction of Hangar "Y" steel continued to be the primary construction material of all airship hangars, that grew increasingly large in scale. While the French structure covered a third of an acre the typical hangar constructed prior to WWII had a over three acres of floor space. These structures however, supersized steel sheds, were often the same design as their earlier predecessors. Some exceptions exist to this model that dominated the first 50 years of hangar construction, in experiments with floating and rotating structures and ones built of fabric and concrete. The engineer Eugene Freyssinet was responsible for a pair of prestressed concrete hangars. Built in d'Orly France in the mid 1920s that used minimal materials both in reusable wood forms and the cast concrete (figures 9a-9b).

67 The apron is the space directly adjacent to the hangars, used as a staging ground for takeoff. Because of the unpredictable nature of airships, highly susceptible to changes in wind direction, mooring circles were created away from the apron so that the ships could be temporarily be tethered. safely outside.





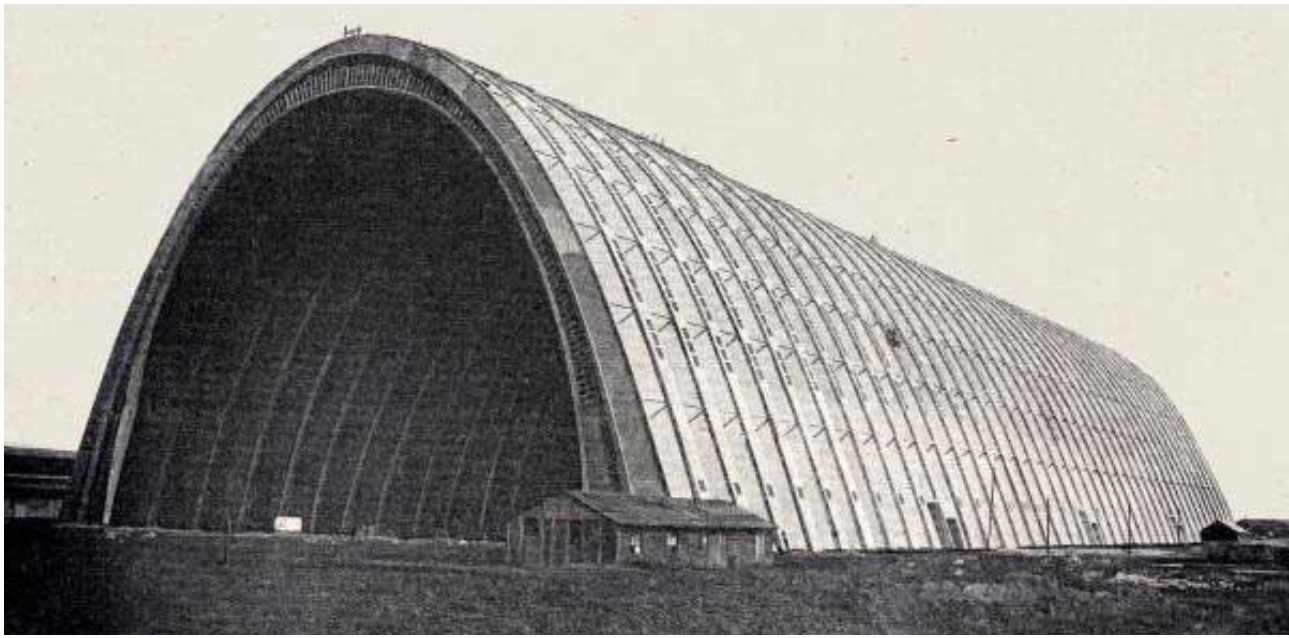
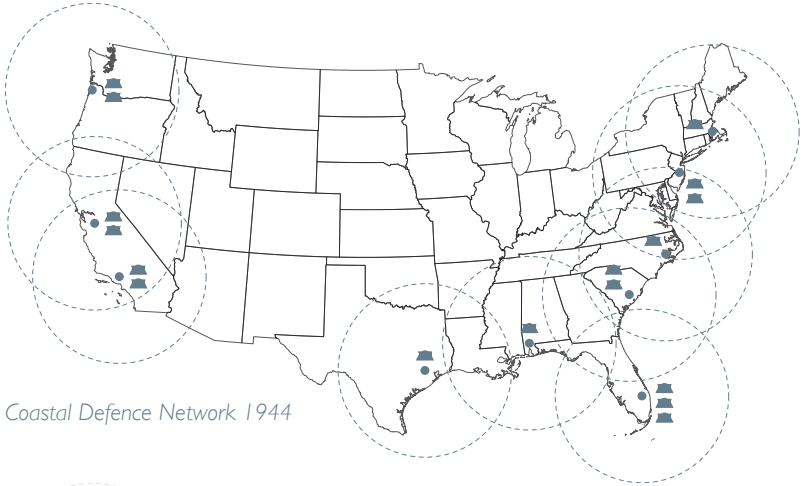


figure 8
german revolving hangar
1920's
figure 9a
orly hangar construction

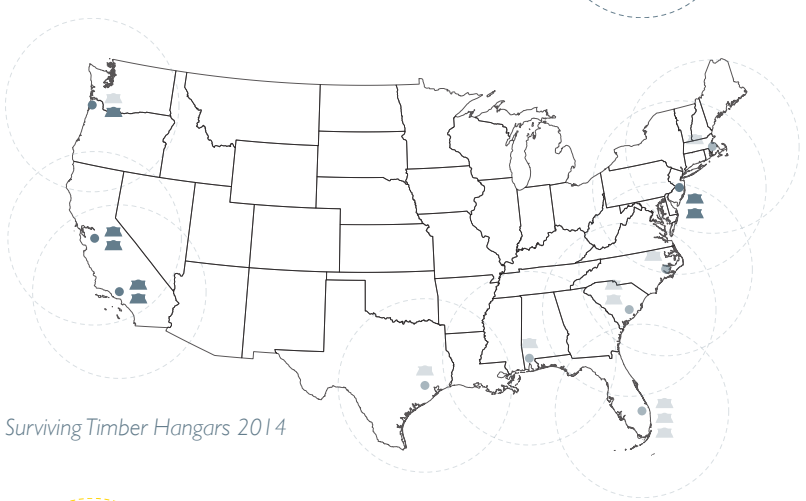
figure 9b
orly hangar

World War II saw the greatest usage of airships in the United States, shortages in material and labor driving the design for new hangars and the airships they housed. The hangars had to be large enough to accommodate the largest rigid airships even though the military regarded them as already obsolete. Eventually the sheds would house a fleet of smaller, less expensive and more manageable, non-rigid airships, commonly referred to as blimps. The United State's Navy's blimp hangars, created as part of the coastal defence network, utilized the latest advancements in wood construction emerging from World War II to create the largest wood structures ever seen. The rapid deployment of the blimps in the United States was crucial as German and Japanese submarines were inflicting heavy casualties on the shipping fleets transporting supplies to the warfront (figure10). These sites for the hangars were carefully chosen in relation to the optimal weather conditions for the operations and the greatest distance that each craft could scout. While some of these hangars, especially on the east coast were constructed at existing air stations, a number of the new hangars were constructed on new air stations, specifically planned for the blimp squadrons (figure 11).

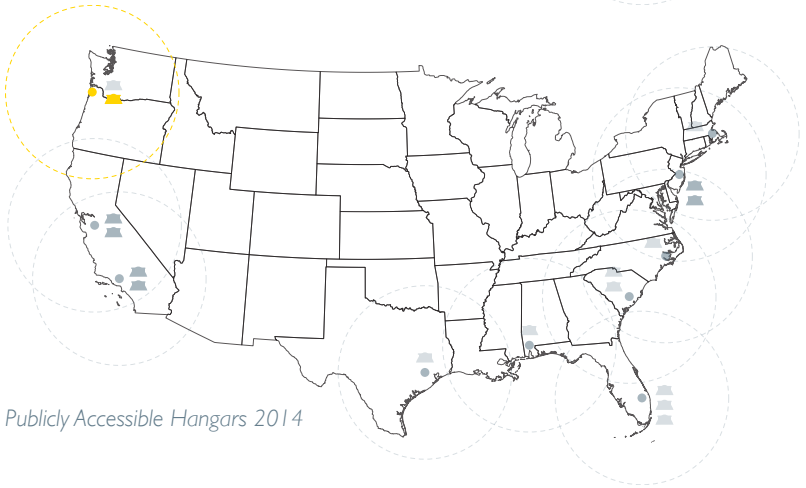
figure 10
k class blimp
wartime escort operations



Coastal Defence Network 1944

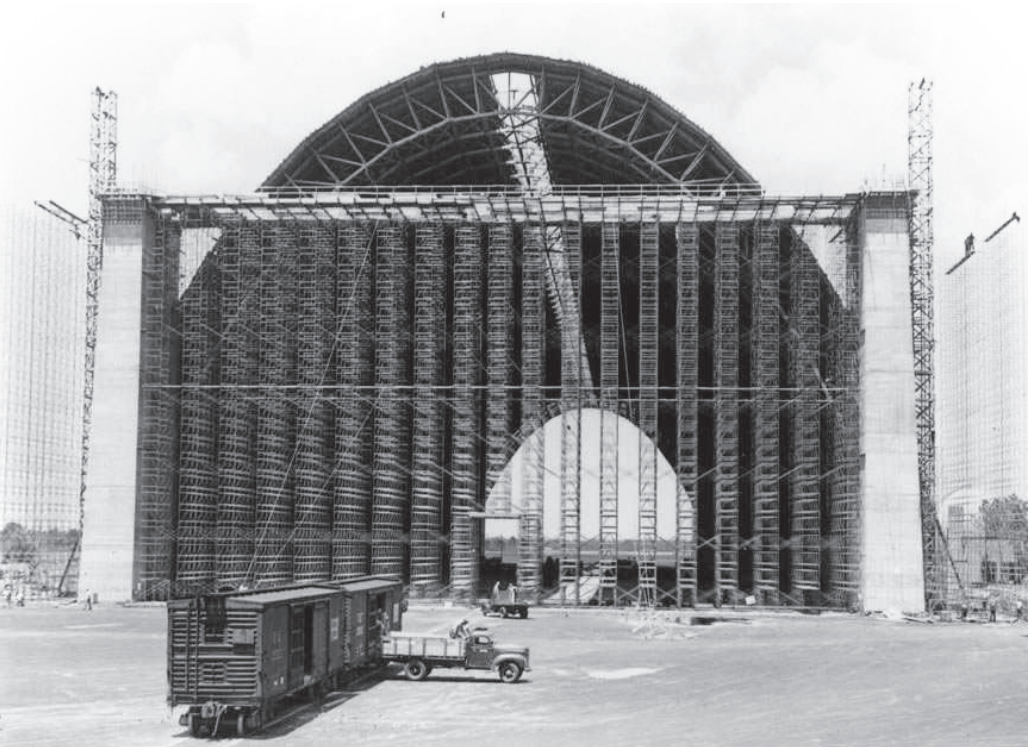


Surviving Timber Hangars 2014



Publicly Accessible Hangars 2014

figure 11
wooden airship hangars
location diagrams



These new timber hangers enclosed over seven acres of floor space under their massive arched roof, 17 times the area of Hangar "Y". The idea for a wood clearspan that allowed for the uninterrupted floor space was the brainchild of Arsham Amirikian, one of the Navy's principal engineers.[68] At over 1000 feet long, 300 feet wide, and 180 feet tall, these structures aside from the concrete door frame, are almost entirely constructed of heavy timber. Nearly two million board feet of Pacific Northwest timber went into each hangar (figure 12a-12b). This was a large departure from common construction practices for structures of this type and scale. The structures utilized this new construction methodology to house, what was at the time, the pinnacle of surveillance technology. However after the war this technology became quickly obsolete with the advent of radar. Along the east coast many of the hangars have been lost to natural disasters and decay, while their west coast counterparts are slowly being dismantled. Of the seven hangars which still stand the only remaining structure of this type, that is publicly accessible, is Hangar B in Tillamook Oregon.

figure 12a
hanging the door header

figure 12b
erecting parabolic arches

68 RBF Consulting and Petrone Communications. *"The Tustin Hangars: Titans of History"*. July 2008. Web. pg 27

figure 13
nas tillamook aerial photo
1946

The selection of a site for this thesis came out of the study of hangar typology, its historic defensive network in the United States and those surviving examples of the unique structure. Of the seventeen wooden hangars built during WWII only seven remain, one being in Tillamook, Oregon. Among this surviving set of hangars, the one at Naval Air Station Tillamook is the only one that has unrestricted access. The structure itself has had a varied history since its decommissioning in late 1947, a cycle of uses that have left the various elements of the site disconnected. The hangar's current tenant set to relocate in 2015, and in need of a new roof, but the primary structure is in good condition. The rest of the site has a lot of potential for growth, with nearly all of its leasable buildings currently occupied it is clear that the area is still active to an extent. The area, retitled as The port of Tillamook Bay, will continue to evolve as Tillamook's regional industries and tourism makes use of the historic site (figure 14).

figure 14
tillamook hangar
site conditions 2012

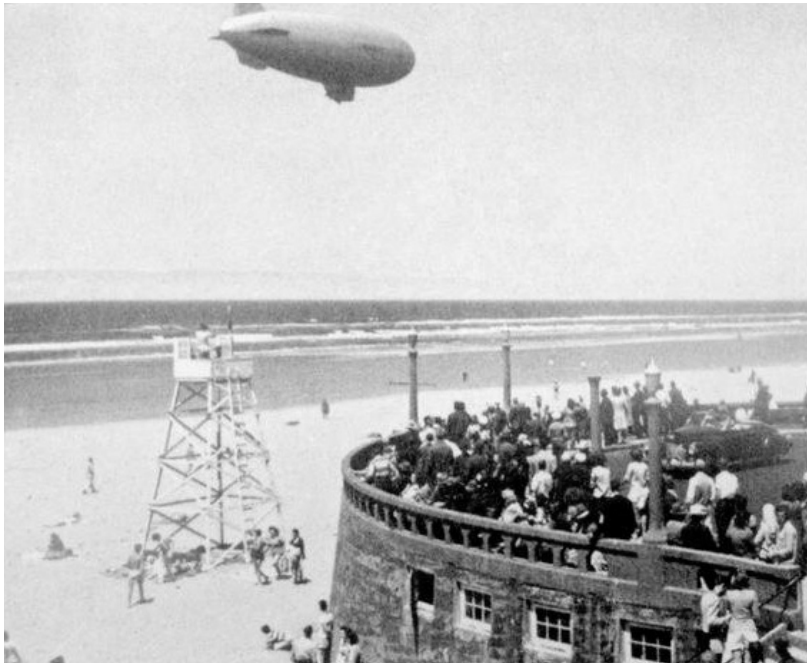
N.A.S. TILLAMOOK

In early December 1942, a year after the attack on Pearl Harbor, ground was broken on a new air station, in Tillamook Oregon. The War Department had decided a base was needed in the Pacific Northwest in order to complete its coastal defense network of lighter-than-air stations. This created a continuous area of surveillance along the Pacific seaboard, similar to that provided by hangars on the Atlantic and Gulf coasts. During the war the Pacific Northwest saw more action than the rest of the continental United States, becoming the target of enemy submarine shelling and of firebombs. Though ineffective, these attacks put the area on high alert, intensified by the immense blimps constantly returning from their convoy escort missions that reminded the locals of the conflict they were engaged in. Hangar B on the Naval Air Station site is visible from nearly anywhere in the Tillamook Valley, it is a looming giant, a reminder of the past war and the Pacific Northwest's contributions to it.

By sheer coincidence the construction of a civilian airport in Tillamook county had been in discussion preceding the war but was opposed by the county due to a lack of funding.[69] The War Department took this opportunity to establish a new naval air station in the area without having to commit to a permanent purchase of the land. Discussions between the War Department, the Civil Aeronautics Authority and the county yielded a plan in which a more financially manageable 200 acres of land in the southwestern part of the valley would be purchased; a week later the attack on Pearl Harbor confirmed the bases construction. Although the location, within a valley, provided some protection from the wind for the delicate ships, crews would have to deal with heavy fog and frequent rain during flights.[70] The base size swelled during the construction to make room for not just the hangars but the barracks and other essential parts of a naval air station, growing to nearly 2000 acres, ten times that of the county's planned airfield. Wartime labor shortages increased the difficulty of completing a project of this scale, with workers being brought in from the entire region to complete it.

69 For the purpose of this thesis I will be assuming that the NAS at TIllamook was not designed around the knowledge that it would, shortly following the conflict be transferred back to county ownership. I am assuming it was first and foremost designed as a military facility that would be later reused as a civilian airstrip.

70 Althoff, William F. Forgotten Weapon: U.S. Navy Airships and the U-boat War. Annapolis, MD: Naval Institute, 2009. Print. pg. 260



The unique geographic location that gave Naval Air Station [NAS] Tillamook a strategic advantage also made construction of the project difficult. The high water table of the area combined with an unusually wet winter made soil stabilization difficult as the ground turned into a quagmire. In September 1942 a rail line was established, allowing the necessary materials and men to be brought in to construct the base's centerpiece, the airship hangars. These 1000 foot long structures are the design of Arsham Amirikian, identical to the fifteen other ones constructed on the nation's coastlines. Beginning in October 1942, the construction of Hangar B took nearly nine months to complete. The knowledge gained during its construction and the drier summer conditions allowed Hangar A to be completed in an astonishing 27 working days.[71]

figure 15
naval air station tillamook
1943
figure 16
airship over oceanside, or
1943

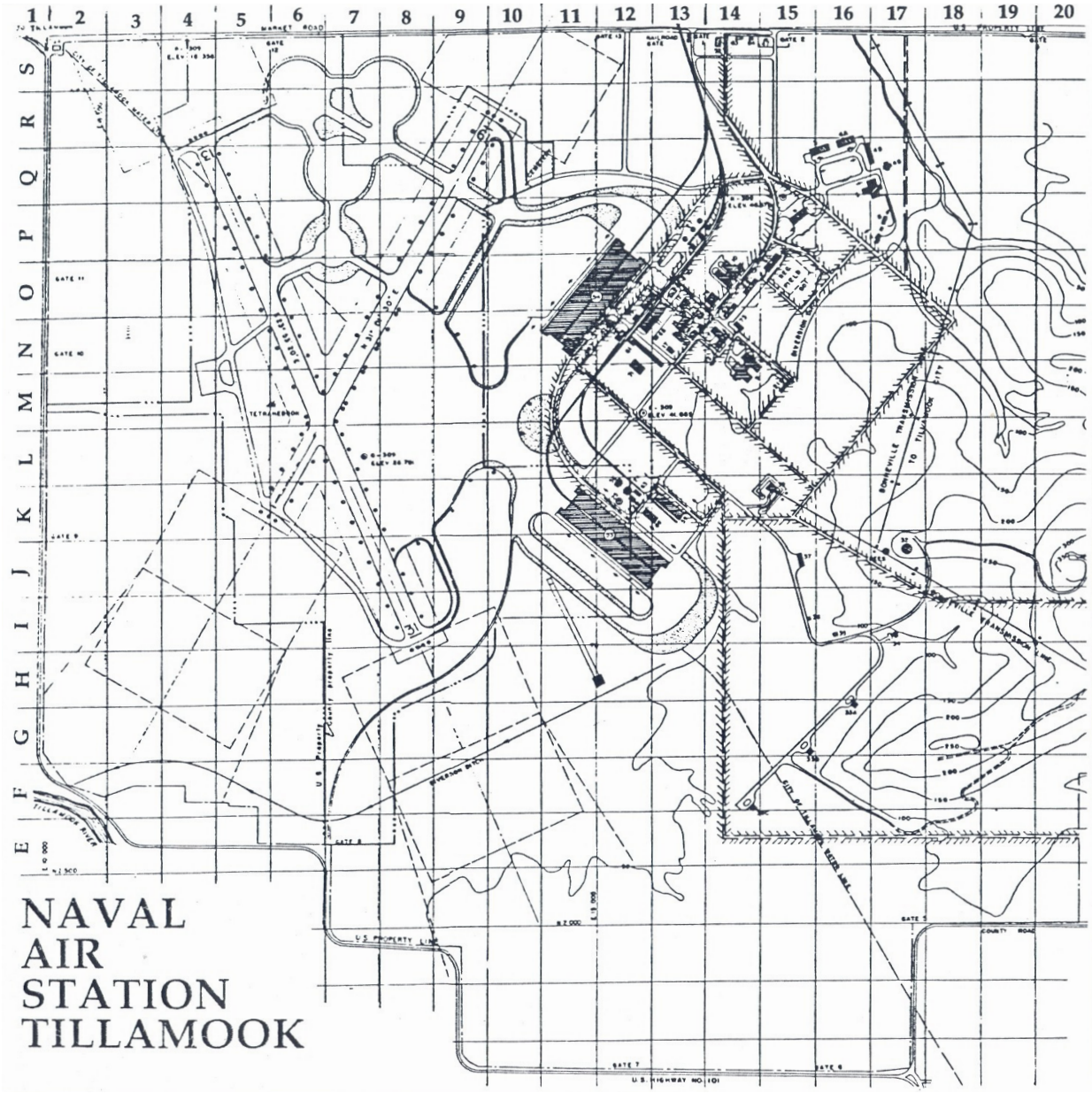
71 Manske, Kenneth A., ed. *The History of NAS Tillamook and Its Role in World War II: A Tribute to Engineering, Patriotism and Courage*. Gresham, OR: M & A Tour, 1995. Print.

The base at Tillamook was arranged similarly to the other LTA stations with two hangars set at a right angle, which facilitated the launching of airships in multiple wind directions, a major factor due to the difficulty of controlling a blimp during takeoff. The hangars formed a line of demarcation between man and machine, to the west were the runways and mooring circles for the airships, and located to the east were the barracks, workshops and mess halls for the 600 men and women stationed on the base.[72] In total the base was comprised of nearly 100 structures, though the two hangars alone could easily house every other building on the base. While the majority of these structures were clustered together around the parade grounds, the munitions bunkers were placed to the south on a slight rise, as a safety precaution. Halfway through the conflict in the Pacific, a heavier than air component was added to the air station, which had earned a good reputation with the Navy. While this brought fixed wing aircraft and more personnel to the base, little else changed at the military base. In the later half of 1947, just six years after its creation, NAS Tillamook was officially decommissioned, its title transferred to the county.[73]

COUNTY HISTORY

Tillamook, meaning the land of many waters, was first settled in the 1850's, 70 years after the first sailors took to its harbor for shelter The mild climate and abundant grasslands of the valley made dairy production the greatest economic opportunity for the early settlers with the nearby market of Portland producing ample demand. Cheese production started a few years later as the farmers sought to create a more stable way to bring their goods to market. By the turn of the century other industries arrived in the area, with the timber industry, capitalizing on Oregon's dense forests, were becoming a major economic factor. Following its incorporation in 1891 the population of Tillamook county steadily increased throughout the years; doubling between the 1940s and 2014, with a current population of about 25,000 inhabitants.[74]

72 "Blimp Museum Soars Through History -- Huge Tillamook Hangars Enshrine A Wartime Idea That Just Didn't Float." The Seattle Times. N.p., 12 July 1992. Web. 18 May 2014.
73 Manske, Kenneth. pg 21
74 "This PageWednesday April 27, 2011 03:18 PM." Population & Demographics. Tillamook County, 27 Apr. 2011. Web. 12 Dec. 2014.



LOCATION	STRUCTURE LIST ASSIGNMENT
P-17	COMMANDING OFFICER'S QTRS.
P-17	EXECUTIVE OFFICER'S QTRS.
P-15	ADMINISTRATION BUILDING
Q-16	SR. BACHELOR OFFICERS' QTRS.
Q-16	JR. BACHELOR OFFICERS' QTRS.
Q-16	JR. BACHELOR OFFICERS' QTRS.
Q-17	OFFICERS' MESS HALL
N-14	BARRACKS
O-14	BARRACKS
O-15	BARRACKS
N-14	MEN'S MESS HALL
S-13	GATE HOUSE
M-14	DISPENSARY
O-14	RECREATION BLDG.
M-13	PUBLIC WORKS SHOP
O-13	COLD STORAGE BLDG.
O-13	LAUNDRY
N-13	GARAGE & SHOP
N-13	FIRE HOUSE
N-13	TRANSPORTATION BLDG.
N-13	PAINT & OIL STORAGE
N-12	CENTRAL STEAM PLANT
N-11	DOPE STORAGE BLDG.
M-15	PIGEON LOFT
M-14	BRIG
K-12	HELIUM MED. PRESSURE STORAGE
K-12	HELIUM LOW PRESSURE STORAGE
K-12	HELIUM PURIFICATION BLDG.
P-13	GASOLINE STORAGE (50,000 gal.tanks)
N-13	GASOLINE STORAGE (4,000 gal. tanks)
N-13	GASOLINE SERVICE STATION
J-17	RESERVIOR (750,000 GAL.)
G-16	HIGH EXPLOSIVE MAGAZINE
G-15	HIGH EXPLOSIVE MAGAZINE
F-14	HIGH EXPLOSIVE MAGAZINE
I-17	FUSE & DETONATOR MAGAZINE
I-16	SMALL ARMS MAGAZINE
I-15	PYROTECHNIC MAGAZINE
J-15	INERT STOREHOUSE
K-15	POWER SUBSTATION
S-15	QUARTERS C
Q-17	QUARTERS G
S-2	QUARTERS D
S-14	BARN
J-12	HANGAR A
O-12	HANGAR B
O-12	TEMPORARY WAREHOUSE
N-12	HELIUM LOW PRESSURE STORAGE
K-12	HELIUM MED. PRESSURE STORAGE
K-13	STOREHOUSE
O-15	RECREATION FIELD
N-12	GARAGE
R-22	TRANSMITTER BLDG.
K-12	HELIUM SMALL CYLINDER BLDG.
N-13	PUBLIC WORKS STORAGE
K-12	GUNNERY TRAINING BLDG.
O-13	QUARTERS M
M-12	MOTOR POOL
N-14	C.P.O. QUARTERS
O-14	TENNIS COURTS
H-11	BORESIGHTING RANGE
N-12	RAILROAD MAINTENANCE
S-14	QUARTERS E &F

Tillamook offered a serene location for those soldiers lucky enough to be stationed there during World War II. Having already experienced combat most were able to appreciate the tranquility of the agricultural valley and all it had to offer. The area at the time of the hangar's construction was, and still is a small farming county, home to a large population of dairy cows that produce its namesake cheese. Located in the northwest corner of the state, the topography of Tillamook county varies greatly, but three categories, the shore, valley, and highlands, can be easily distinguished. The Pacific coast forms the county's western boundary, its beaches and rock outcroppings form a large tourist attraction for the town. During the war these beachgoers would witness convoys of airships as they patrolled the coasts, sailing from the protected valley out over the vastness of the Pacific.

The Tillamook valley, with an average elevation of just twenty feet, is surrounded by dense coniferous forests that rises to 2000 feet above sea level, isolating the county. The resulting high water table, which had made construction of the immense hangars difficult, creates a network of above and underground streams that are woven across the valley floor. After driving over the densely wooded coastal range one is met with the flat agricultural valley, where at certain points you can see the massive figure of the airship hangar against the green foothills. The downtown area, which sits near the center of the valley is dwarfed by the vastness of the agricultural lands that surrounds it, reinforcing the town's small size. The majority of structures in the valley are small, the largest being two story barns and livestock structures associated with the dairy industry.[75] Tillamook is seen as a stopping point on not a destination in its own right. It wasn't until 2013 that the town passed a lodging tax and legislature aimed at retaining tourists. That said there are a few notable attractions within the valley, the Tillamook Cheese factory is a major attraction, bringing in a few hundred thousand tourists a year. Also drawing over one hundred thousand visitors annually is Tillamook Air Museum, housed in Hangar B.[76]

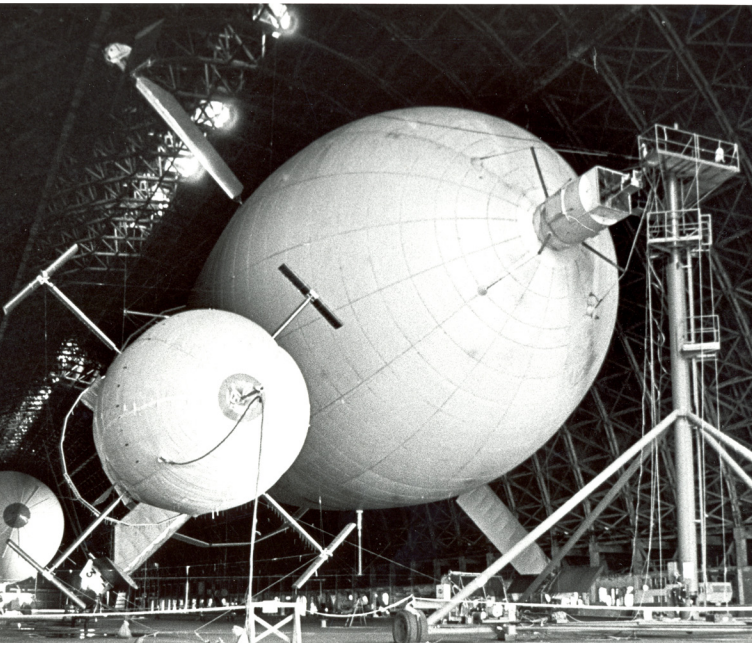
75 On a recent visit to the town it was observed that new pre-engineered structures were replacing the 'traditional' wooden barn on some of the areas farms.

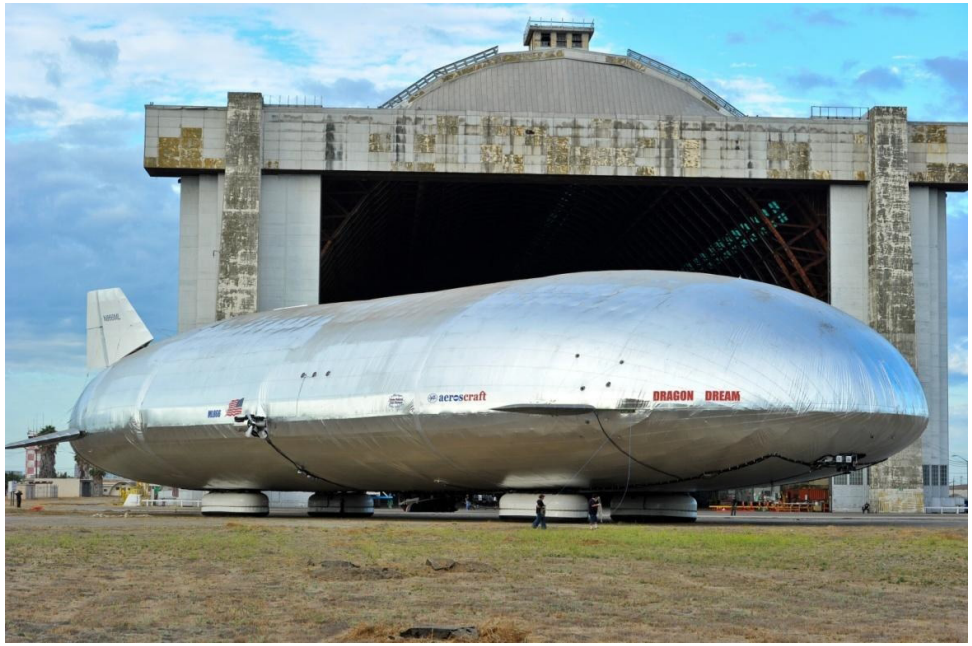
76 Bradley, Michele. "Interview of Port Director." Personal interview. 13 Aug. 2014.

DECOMMISSIONING

The former military base including its hangars and land that surrounds them has been reoccupied multiple time since the end of the war. The owner of the site, the Port of Tillamook, established the former base as the county's industrial park shortly after closing. The large amount of land has allowed many different uses to re occupy the space left by the withdrawal of military forces in 1949. The airfield itself does receives air traffic, it is designated a disaster relief site, that said the primary traffic are private tourist flights during the summer months. The base also has specific areas labeled as FEMA historic districts, which dictates how structures can be rehabilitated. The hangars, which were placed on the historic register in 1989, housed multiple facilities and tenants since the end of the war, the three main tenant types being industry, storage, and aeronautics. Directly following the war two sawmills set up operations in the hangars, with the more successful plywood mill operating in Hangar B. The ownership of this mill changed hands several times between the plant's opening and closure in 1982 following the economic downturn. The current sawmill has located its production facilities in several new structures adjacent to Hangar B, the hangar only used for minimal product storage.


AIR MUSEUM





In keeping with their original function, the hangars have housed multiple lighter than air operations since their decommissioning in 1947. Cross country free balloons, surveillance tethered balloons and experimental airships have been housed within the massive volumes of these structures. The government has some continued interest with the site, appointing it a military drone training facility, though it has yet to be utilized. The hangars, by their very nature, are simply large storage sheds, constructed to house a very specific piece of equipment. Their scale and column free interiors make them suitable for the storage of an endless variety of items. It was the storage of 7,500 tons of hay which caused the loss of Hangar A in 1992, when a fire of unknown origin broke out. Though the flame retardant treated timber initially withstood the fire, eventually the roof structure collapsed, leaving the site in its current state with only the concrete door frames and bents that support the base of the trusses remaining (figures 23-24).[77] But the erection of a low roof over the southern half of the structure has enable the floor area to remain partially in use, occupied by a mulch and compost company. Hangar B would have suffered a similar fate but the flame retardant timber withstood the small fire which broke out on the plywood plant's floor in 1956.

77 "Stored Hay Fueled Fire That Destroyed Wwii Blimp Hangar." The Seattle Times. N.p., 24 Aug. 1992. Web. 18 May 2014.

Around the same time that Hangar A was lost, Hangar B was reoccupied with new tenants and rebranded as the Tillamook Air Museum(figures 25-26). The museum held more than twenty aircraft, many of which are kept in operating condition, a unique trait amongst air museums. Much of the collection is also on loan to the museum resulting in a constantly changing inventory and exhibits. But the hangar does more than just house a collection, it becomes a part of the exhibit, where people can come and experience the magnitude of wartime operations.[78] The museum has been operating in the hangar for over twenty years and has become one of the largest tourist draws in the valley, drawing over 100,000 visitors annually. However the owner of the museum has decided to move to a new facility in Madras, Oregon in 2015 when their lease ends. The new facility is a four hour drive east, on the other side of the Cascade mountain range. According to the museums director the stable climate and new facility will provide a much better environment for the specialists and volunteers who work on the planes. The only planes that would remain on site would be those that are on loan from the Department of the Navy, a collection which the port director is trying to add to. Even with a dwindling aircraft collection the most powerful display, the massive structure remains available for visitors to witness.

78 Dechow, Douglas R., and Anna Leahy. *"Not Just the Hangars of World War II: American Aviation Museums and the Role of Memorial."* Curator: The Museum Journal 49.4 (2006): 419-34. Web.


NAVY

A 2010 study found the underlying structure of Hangar B remains in good condition, though the massive roof has begun to leak, an issue that needs to be dealt with in a timely manner before the primary structure is irreparably damaged. The Port of Tillamook has had problems lining up a new tenant to replace the air museum when it removes its aircraft. While the private storage of RV, boat, and other miscellaneous items could take over the rest of the space it would be difficult to maintain the upkeep costs of the great building. The main doors for example are not in operating condition and can only be opened with the use of a forklift. While many ideas have been formulated to find a way to preserve the building for future generations its fate remains in question. The rest of the base however does have a future plan as the port has been working to create an industrial park on the land, using the historic buildings and constructing new ones for the anticipated tenants, the largest on Oregon's coast. Under construction in fall 2014, a new set of shops were being built by the port to house their machine and service shops. In total the industrial complex currently employs over 400 people, of which 100 are at the Stimson lumber plant alone (figure 29).

figure 27
port of tillamook bay
site conditions 2014

figure 28
port of tillamook bay
new warehouse buildings 2012
figure 29
port of tillamook bay
stimson stud mill operations

Structures added to the former Naval Air Station since its closing include the Port Authority offices and a self storage complex at the entrance to the base, along with an alternative high school and youth correctional facility located where the barracks once stood. Additional new construction includes the aforementioned sawmills and the Tillamook Feed Mill. In an effort to create more attractive commercial space on the property three buildings were erected as "versatile industrial warehouse space"[79] directly across the road from Hangar B. Though not very appealing visually and oddly sited, the tenants that have been brought in have helped to bring more traffic to the site. A brewery and crossfit gym among other commercial presence in these buildings brings people to the site on a frequent basis. Only a few of the original buildings on the base, mostly support structures in between the two hangar sites, remain. The old mess hall was restored in 2012 and is consistently rented out for events. The administration building, which is the most prominent historic building on the site apart from the hangars, has historic designation but has remained empty in recent years failing to find a tenant to restore the interior. Instead, the new construction has housed tenants with a certain level of disconnection from the rest of the site. These new structure, primarily the entry, have a generic feel that does not make use of the iconic structures that sit upon it.

The patchwork approach to redevelopment has set the current status of the former NAS Tillamook stand in stark contrast to the image of discipline and order associated with a military establishment. The division of the property among the multiple industries and organizations that now occupy it, has created layers atop the underlying airfield, that have fragmenting the former structure of the base. The initial base reuse as a timber manufacturing site gave the sites activity a certain presence which helped it live up to its historic nature. The historic icon, the hangar, is the most difficult structure to fully utilize on the site this becomes the main challenge for a successful redevelopment. Although the county and port are areas that this project is situated on, the primary site of the project is the hangar itself, primarily the inside. This 7 acre canopy described in previous sections is the main consideration while designing within the existing structure.

79 Bradley, Michele.

Previous attempts have been limited to the ground plane, and didn't utilize the cavernous volume that it forms. Former tenants had also failed to fully grasp its power to draw people to the site and not just see, but experience the unique building first hand. The proposed program is designed to unify the past interventions on the site and allow for future construction to be done in a manner sensitive to the surrounding context, both contemporary and historic. The redevelopment of the Port of Tillamook industrial center seeks to minimize further fragmentation of the former base and to re-commission and reactivate the iconic hangar, retaining visitors ability to engage with the last public example of this unique typology. This thesis proposes to more fully utilize this historic structure as a testing facility for unmanned air vehicles, a use that will connect the structure to its aviation heritage and bringing new research and development companies to the industrial park.

One of the most distinct designations that the Port of Tillamook bay currently holds is its selection as a Federal Aviation Administration [FAA] test site for unmanned aerial vehicles [UAVs]. The proposed program takes advantage of this designation while building upon the aviation history embodied at the port. The program introduced accomplishes the unification of the site through the introduction of one predominant industry, similar to that which the timber industry had done in the late 1960's. A combination of manufacturing, testing, and offices, the UAV campus combines commercial development with a public interface, maintaining the hangar as a public tourist draw. A UAV presence has been in place on the site, as part of the NASA Near Space Corporation, but the industries recent wildfire growth lends to a greater presence. Of which Oregon state is already invested in and seeking to capture a large portion of the expanding market (figure 33). This approach to reactivating the hangar further allows for future adaptation and flexibility as aircraft and airship technologies move in unforeseeable directions.

figure 31
conceptual program utilizing hangars volume

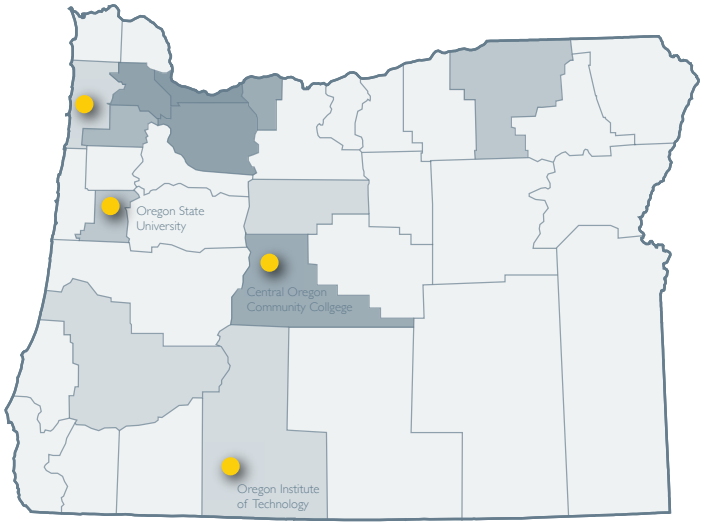


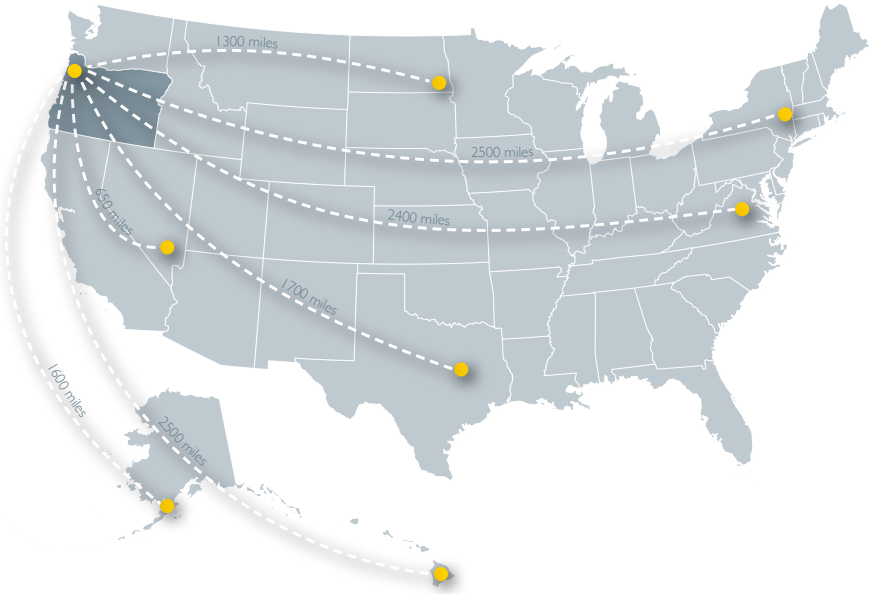
figure 33
uav industry heatmap &
college degree programs

Drones are a contentious subject nationally and the popularity of personal UAVs and their potential commercial applications has led the FAA to regulate their usage and create legislature to ensure the safety of national airspace. Most of the vehicles seen are relatively small and are flown by hobbyists, and as long as they stay within the FAA's legislation for model aircraft these flights are legal. This legislation is extremely prohibitive however to the size of vehicles and types of flights one may undertake, and furthermore the use of the vehicles for commercial purposes is prohibited. There are many fields however that have been identified to benefit from the new technology including land surveying, wildlife management, and agricultural processes, among others.[80]

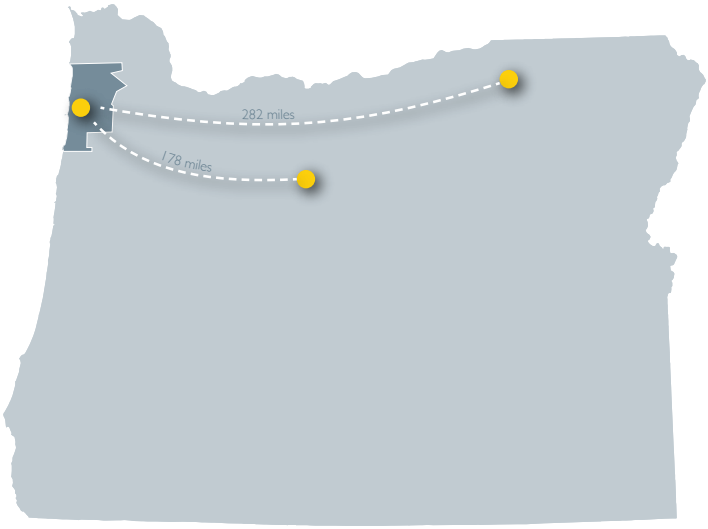
As part of their effort to begin a conversation between UAV commercial developers and federal administration the FAA has established 8 zones across the country where these vehicles may be legally flown. Each zone can contain multiple sites which vary greatly climactically and demographically, some located hundreds of miles from any major metropolitan area.[81] The three sites in Oregon offer a range of climatic conditions that the aircraft can be tested in, with Tillamook sitting the closest to the states tech hub, Portland. Hood River, a hotbed for UAV technology, is also close by along with multiple colleges and universities that offer programs or degrees in unmanned systems. All of which can benefit from a facility designed to meet their needs, which Tillamook offers with an added unique opportunity for the growing industry. Allowing a controlled environment for flying within the hangars massive volume. The weather also conducive to this type of testing as Tillamook's valley is blanket with morning fog regularly and there is a definite rainy season. Conditions that may not be ideal for all pilots and vehicles. The greatest benefit of the indoor flight is as a workaround for the prohibitive legislation and large fees that are required to fly in national airspace under current FAA ruling (figures 34a-34b).

80 Its to be noted that recent exceptions has been granted for the use of UAV aircraft to certain motion picture companies and one Alaskan oil enterprise for pipeline inspection. The freedom for experimental commercial applications that is seen in other countries has not yet been integrated into US legislature.

81 *Integration of Civil Unmanned Aircraft Systems (UAS) in the National Airspace System (NAS) Roadmap.* Federal Aviation Administration, n.d. Web. 11 Dec. 2014.



National UAV Test Zones



Oregon State UAV Test Sites

figure 34a
national uav test zones

figure 34b
oregon state uav test sites

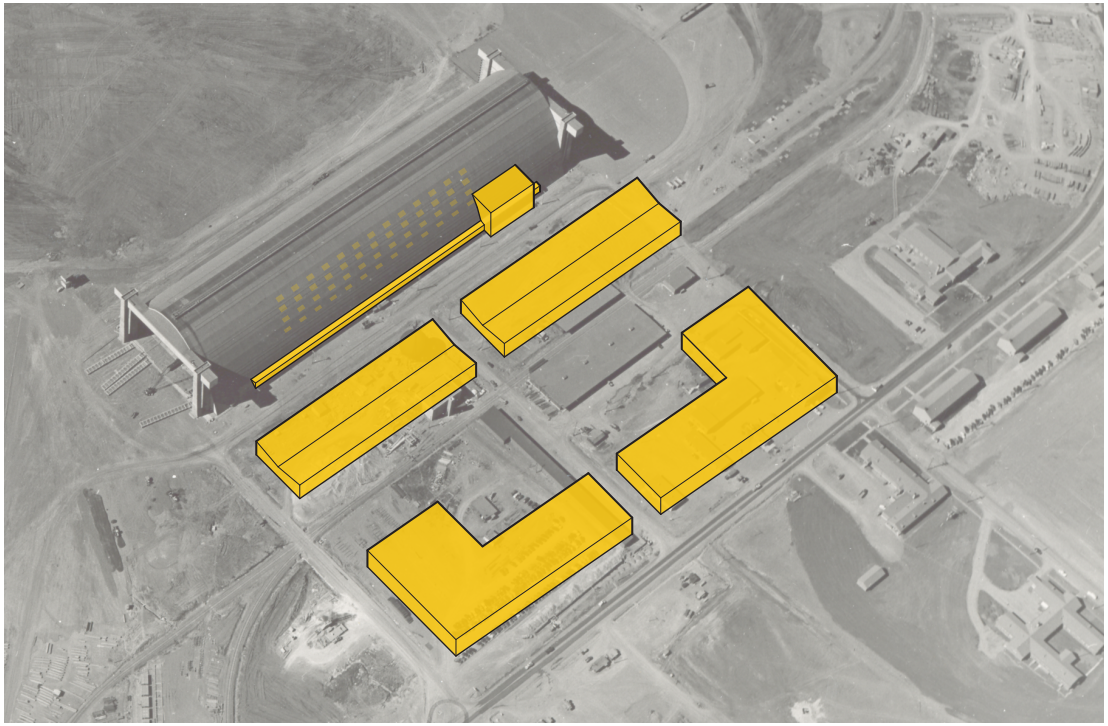
PRECEDENTS

Indoor flight is becoming an established method for testing vehicles, training pilots, and refining autonomous systems. Many institutions offering degrees do indoor flight testing, but are not afforded the space which could let them push vehicle and system design. The controlled environment is ideal for the construction and testing of inflatable, lighter than air, tethered blimps which are commonly used for surveillance but are more susceptible to damage during construction and prototype testing. Some existing US indoor facilities have even garnered international recognition, drawing companies from around the world to work and develop not only for the indoor testing but the ability to work closely with their colleagues. Indoor testing also facilitates observation of the vehicles, a venue for hobbyist gatherings and utilizing architecture to visually mark an otherwise ephemeral experience of flight.

The reuse of aircraft hangars also has precedence though not at the scale of Tillamook's timber hangar. One of the few examples that shows a commercial office environment within a hangar is the H53 Seaplane Hangar in Copenhagen, a rehabilitated World War I seaplane hangar. Located on a landfill created in the early twentieth century, it was re envisioned by Dorte Mandrup Architects in 2001. Similar to engineering feats that produced the wooden airship hangars of World War II in the United States, this hangar was a breakthrough for prestressed concrete shells, at the time one of the largest in Europe.[82] The approach of this project is analogous to the way this thesis approaches the reuse of Hangar B at Naval Air Station Tillamook. The goal is not a total restoration of the historic structures. Rather there historical aspects are expressed as necessary to create a harmonious coexistence with any new additions. The commercial space that has inhabited the hangar is a combination of many individual rooms, stacked to fill its volume. The arrangement of these spaces acts to engage one with the shell and structure of the hangar itself, pushing interaction between new and old elements without cutting into the historic elements wherever possible (figure 35). A similar strategy will be expressed in the intervention within Tillamook's air hangar, especially in the public museum spaces.

82 "Seaplane Hangar." Archi Travel - Online Architecture Guide. Archi Travel, 3 Sept. 2014. Web. 11 Dec. 2014.

figure 35
H53 hangar copenhagen
interior renovation images



PROGRAM

The proposed Center for UAV Development at the Port of Tillamook Bay is comprised of multiple phases and scales of development, both the hangar itself and the surrounding site, which includes a revision to the ports master plan as it relates to the multiple user groups that will be present. The master plan includes an enforcement of historical districts, restricting further building on the periphery of the port, creating a denser commercial area that can benefit from the increased amount of visitors that the center and museum would bring in but also the various shops that a the growing industrial complex would naturally acquire. This organization is present in the greater UAV campus that sits adjacent to the hangar, where linear buildings create avenues for pedestrian movement through the site and its various tenants (figure 36).

figure 36
center for uav technologies
diagrammatic aerial image

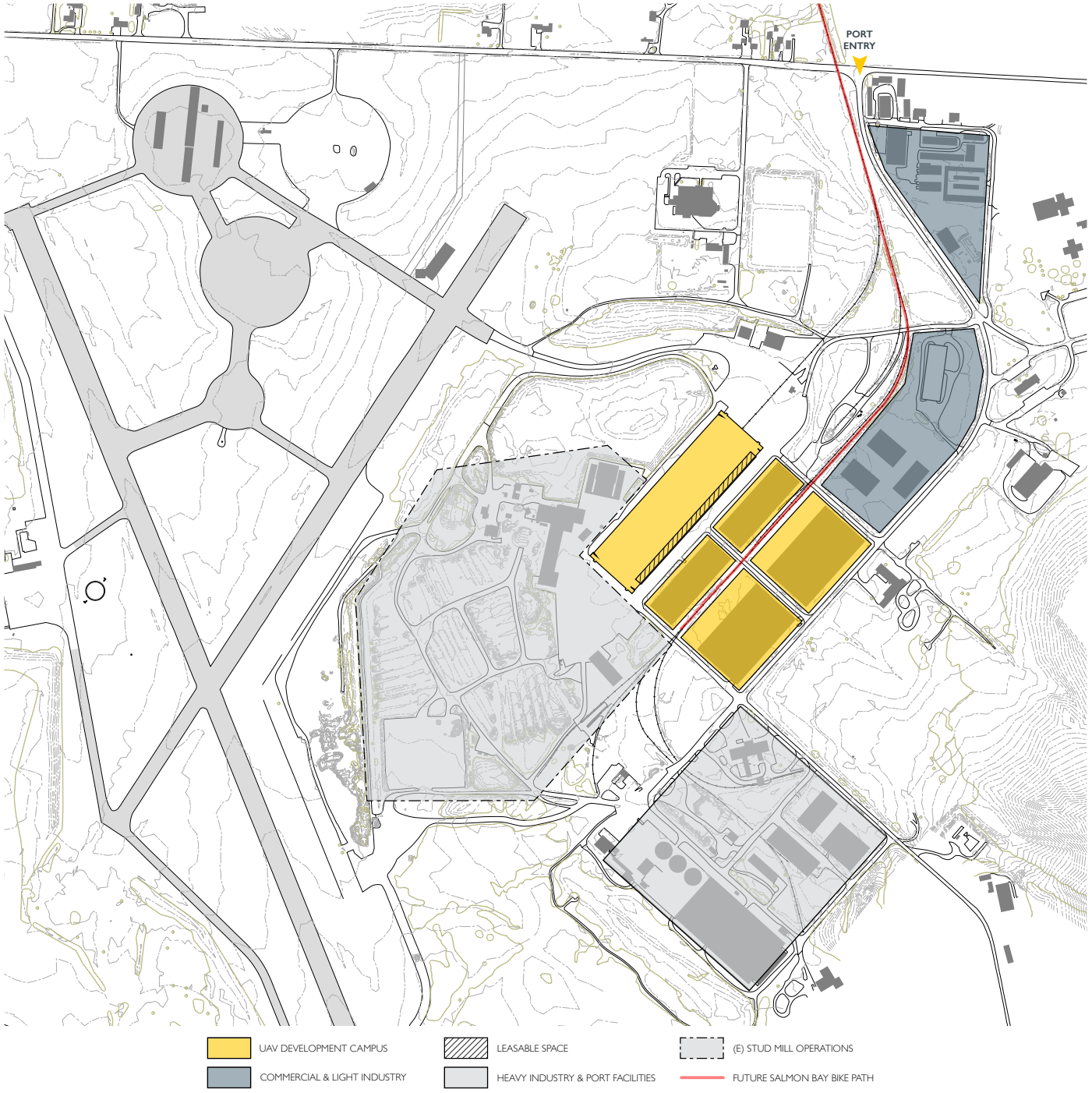
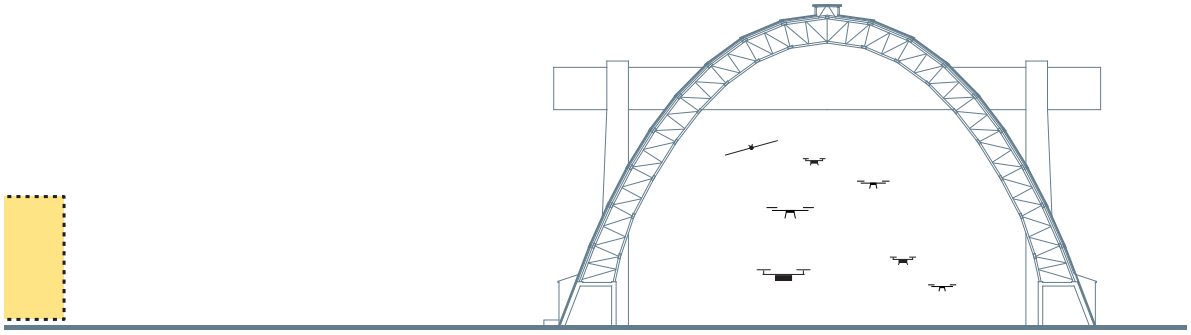
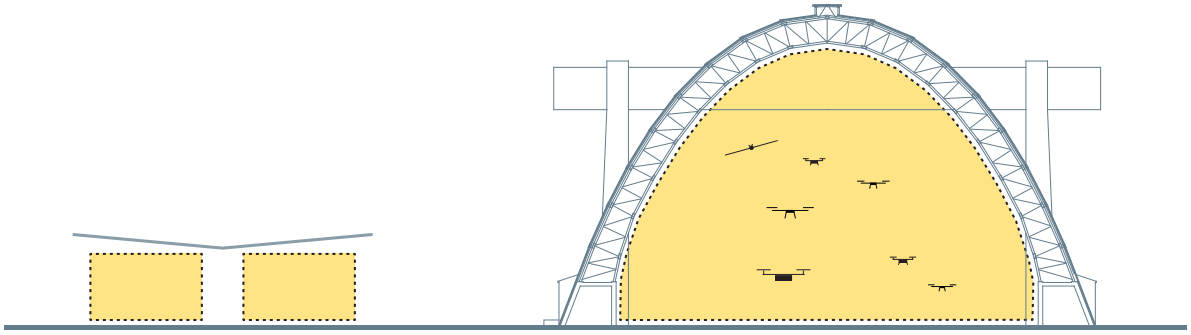


figure 37
center for uav technologies
master plan



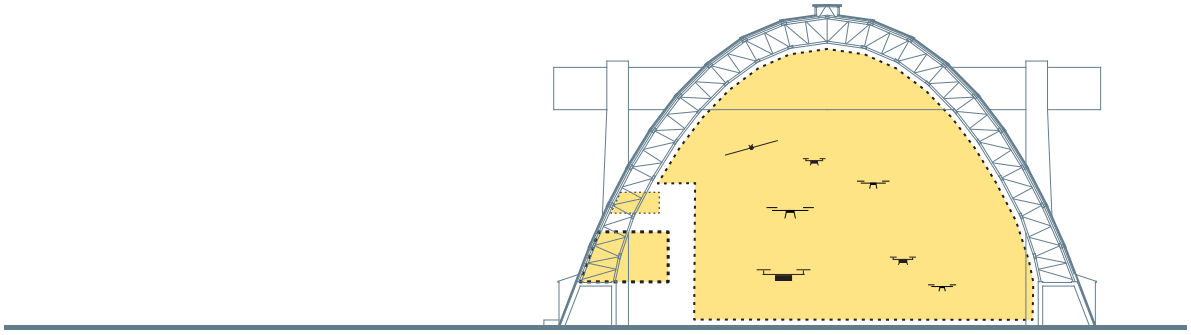
At the heart of this new campus is the relocation of a major government contractor to the site. Their locating here will provide the draw for other ancillary companies and industries to setup operations at the port. This development is based on a proposal for a manufacturing facility for Insitu, a Boeing subsidiary, currently operating in multiple warehouse buildings in Hood River (figure 43). This group would be producing larger aircraft and may not be able to use the hangar for most of their testing, though still legally being able to test in the FAA airspace over Tillamook.

figure 38
programmatic diagram
major manufacturer



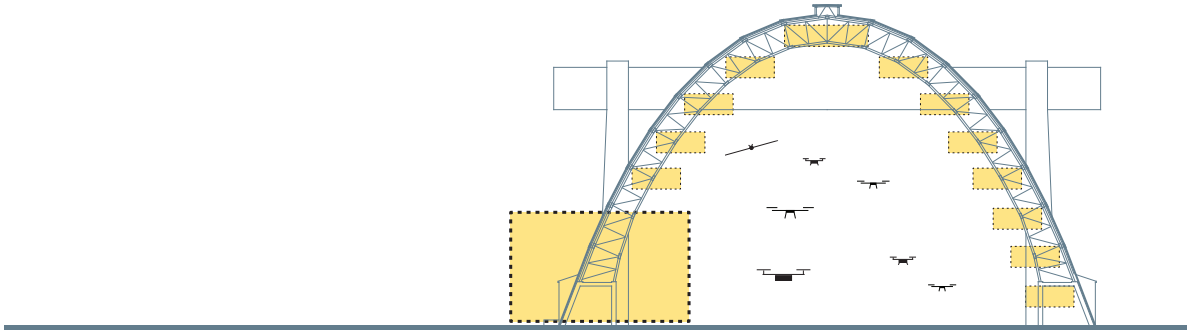
The major manufacturers role is to provide incentive for the next group to locate on the site. These smaller vehicle and component manufacturers are located directly adjacent to the hangar, in a new structure that draws its form from the bay system present in the hangar. This also could include software and systems designers who can support the individual developers. Acknowledging that all of the space may not be filled initially by UAV based companies there are also leasable bays allocated to general development, primarily located in the refurbished support bar at the base of the hangar. By bringing in craft industries and similar ventures that benefit from tourist foot traffic this direction of development benefits both those companies that locate there and the greater site, bringing funding and visitors to the area.

figure 39
programmatic diagram
component manufacturer



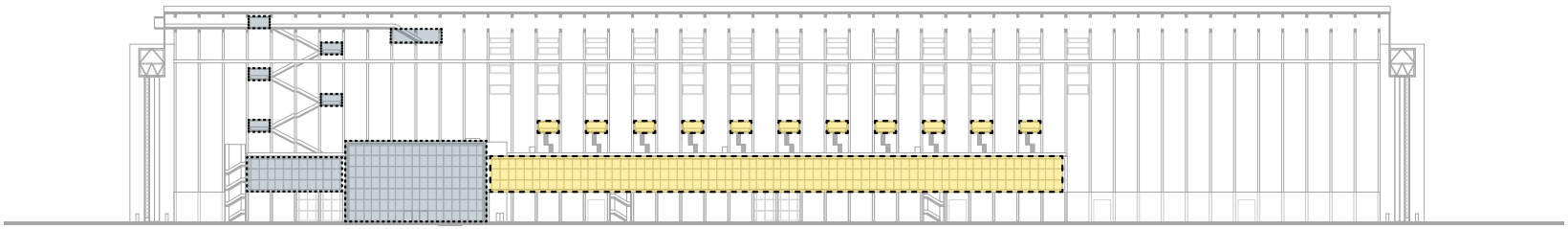
The primary user of the hangar are visiting or individual developers and hobbyists. Here they can fly their vehicles free from FAA regulations, honing skills and developing their aircraft. Some of the could be locally based permanently located at the site while others are a temporary resident. These visiting developers could come in for a length of time to quickly develop their vehicle amongst peers before returning to their companies permanent location. Hobbyists also could rent out space to keep their vehicles and use the communal workspaces or have large convention type gatherings to share ideas and meet other builders and pilots.

figure 40
programmatic diagram
hobbyists & developers



The final group is the everyday visitor, the tourist, who comes to explore the hangar and learn about the vehicles being developed and flown there. The few remaining historic aircraft have been removed, transferred to other historic aircraft museums within the state, leaving the new museum solely displaying unmanned vehicles. Viewing the vehicles and hangar through a series of static displays and interactive exhibits these visitors move up through the structure with views out to the testing within the hangar. These final two groups are those that the hangar intervention is primarily designed for.

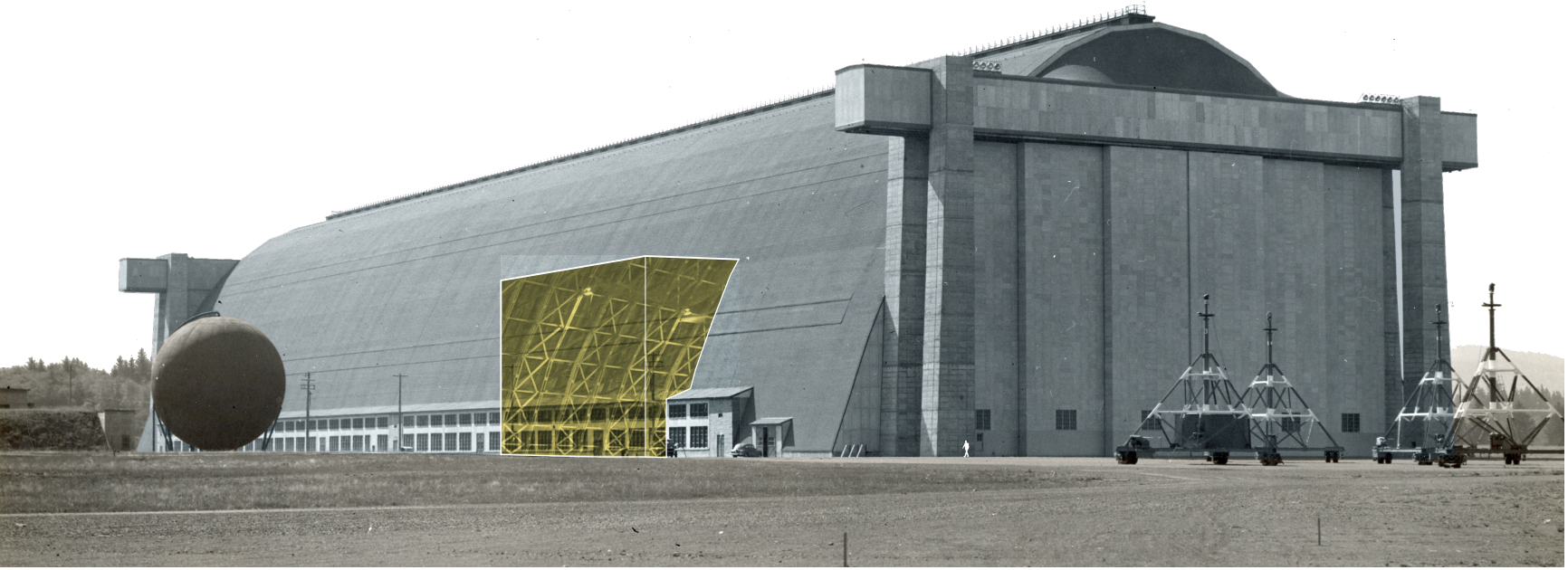
figure 41
programmatic diagram
museum visitors



The hangar intervention's role in this master plan is part research and development lab, and part public interface to the experiential museum. The research and development lab contains individual and group rooms that facilitate working on the aircraft and creates a communal development environment. Attached to these rooms are work spaces that have the special tools and facilities required for the production of these vehicles, and pilot's stands above which look out to the test area. The public interface is a primarily a museum with a combination of static displays and hands on exhibits including flight simulators. A path also brings visitors to the previously inaccessible roof structure of the trusswork. Supporting this museum program is a large administrative area that also functions as an archive for hangars rich history. All elements refocusing the visitors experience back on the hangars structure and out to hangars volume and testing activity.

figure 42
section diagram
building program

figure 43
insitu manufacturing facility
future design



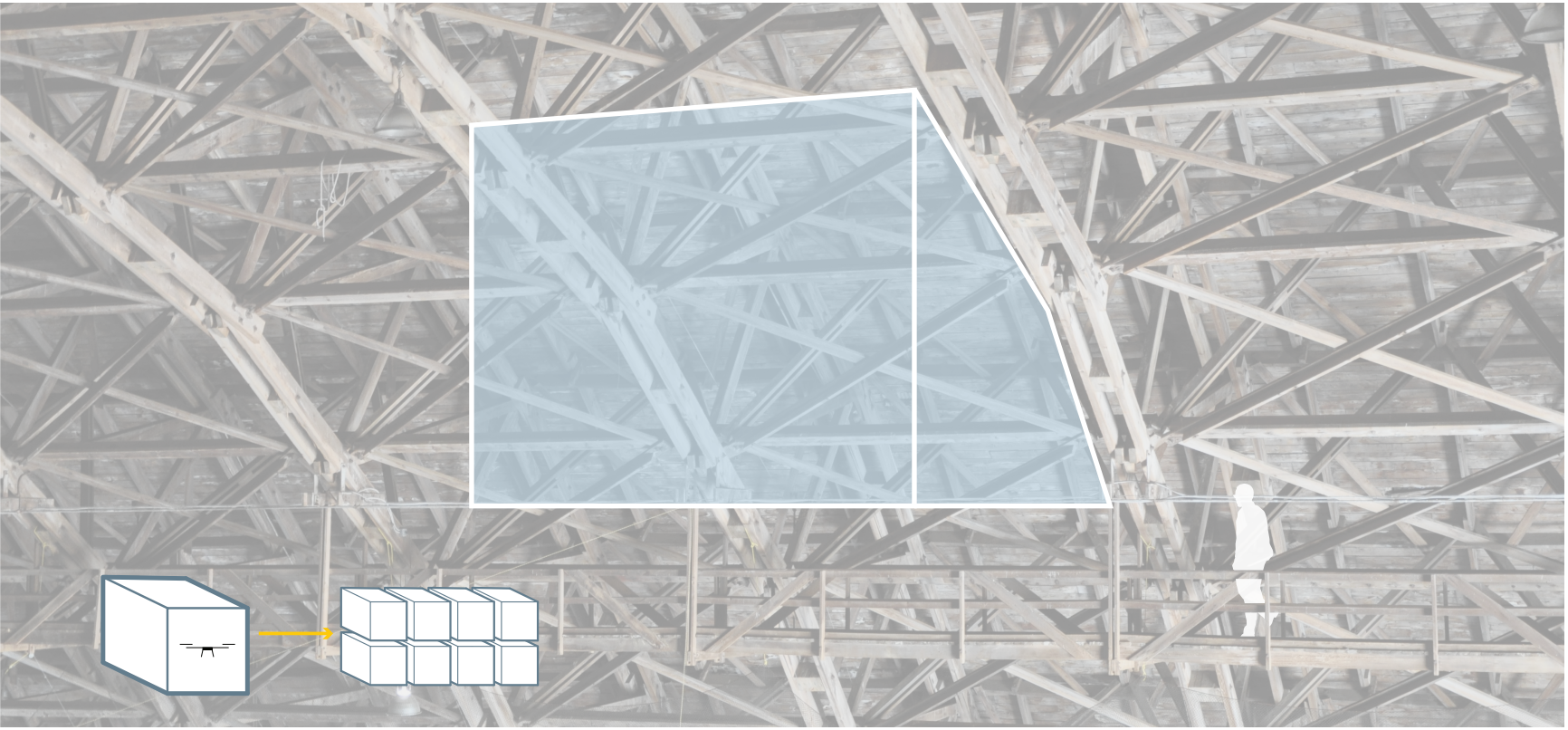
The wooden hangar at Tillamook is one of the largest buildings ever created, and certainly the largest object within the county. It towers over visitors and imposes itself on the landscape which it inhabits. This notion of scale is the driving force behind the intervention, the project has to work on the two distinct scales. There is the established scale imposed by the hangar which relates to its original function for housing airships, the intervention must therefore connect this immense scale with a visitor and the much smaller vehicles that will now be using the space. The function of exterior alterations is to draw people into the hangar, where the real power of the space can be experienced. As displayed in the diagram above this can be relatively small addition to the facade. The hangar is a powerful icon that already draws people too it, freeing the location and expression of the intervention. After it has drawn people inside it then must begin the interaction between visitors and the structure and vehicles within. In effect this main element acts as a portal from one experience and understanding of the building to another.[42] Changing

figure 44
conceptual diagram
addition revealing hangars
existing truss structure

42 See figure 75 for conceptual sketches of this

ones experience with the hangar from one of observation to interaction, and monolithic exterior expression to the captivating complexity that the series of wooden trusses posses. Expanding on the position of a minimal expression of the exterior facade, the building of the new program will primarily be present on the hangars interior where the real power of the structure and the new activity can be fully experienced. The program joining histoic and future aviation practices and providing the platform from which anyone can enjoy and understand both the pure clear form of the building and its subtle complexities.

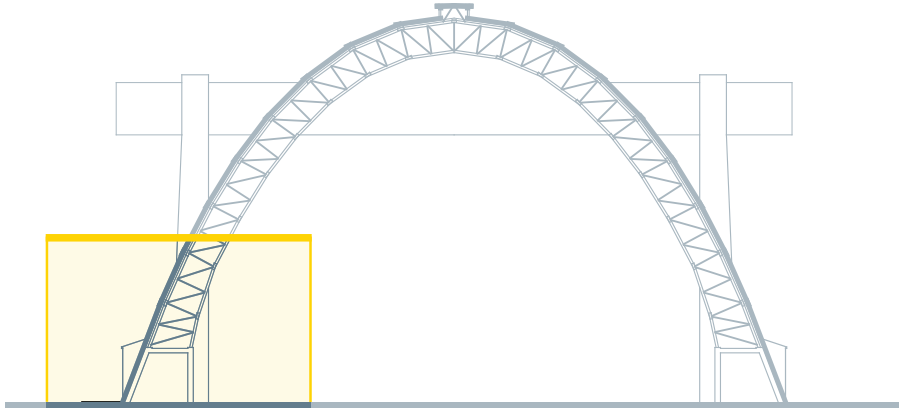
figure 45
conceptual diagram
new program inhabiting
existing truss structure



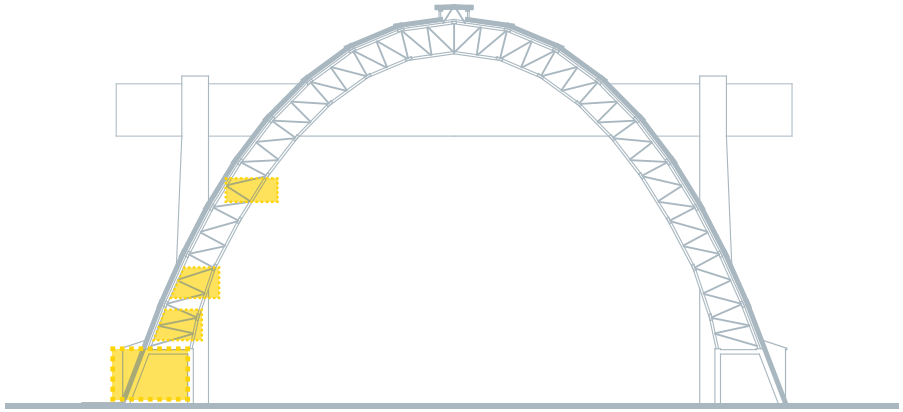
The scale of the UAV interventions is derived not only from the vehicle size but also the origins of their development, as a hobby, garage based, industry. This set up the initial design response of working within the bay system that the hangar has established. In distilling down the program previously analyzed, this small scale of intervention is expressed in three elements: testing and observation, static display, and exploration. The testing and observation activates the main volume of the hangar while static display is interwoven into the truss structure in the primary public space and its adjacencies. Exploration of the hangar opens up a new way for visitors to experience the hangar by bringing the up through the truss work. The three main architectural moves that react to these programmatic elements are of opening facade, inserting program, and piercing the shell, depicted in the diagram to the right.

figure 46
conceptual diagram
scale of hangar platforms

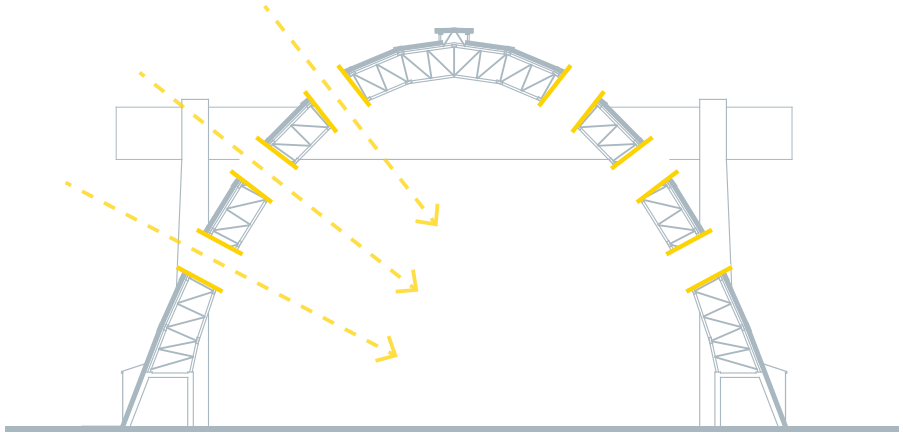
opening up facade - *marks entry for visitors and gives views from exterior of hangars structural system*



inserted program - *designed with a truss bay, larger programmatic spaces push into hangar*



piercing the shell - *brings natural light into the cavernous hangars interior*



figures 47
architectural design strategies

The start of ones experience with the hangar's begins from across the valley, miles away when the hangar first becomes visible against the green backdrop of the valley and surrounding hills. Its landmark presence in the landscape gives the first glimpse of the immense scale that the visitor will find as they get closer too and ultimately engage with the building itself.

figure 48
hangar approach
view from 6 miles across valley

As one continues to approach the hangar other metrics for judging scale begin to appear, buildings dwarfed by the immense structure. Still a few miles in the distance, the isolated location of the hangar in open fields, and its sheer scale extend the approach experience far outside of the actual site.

figure 49
hangar approach
view from downtown, 3 miles

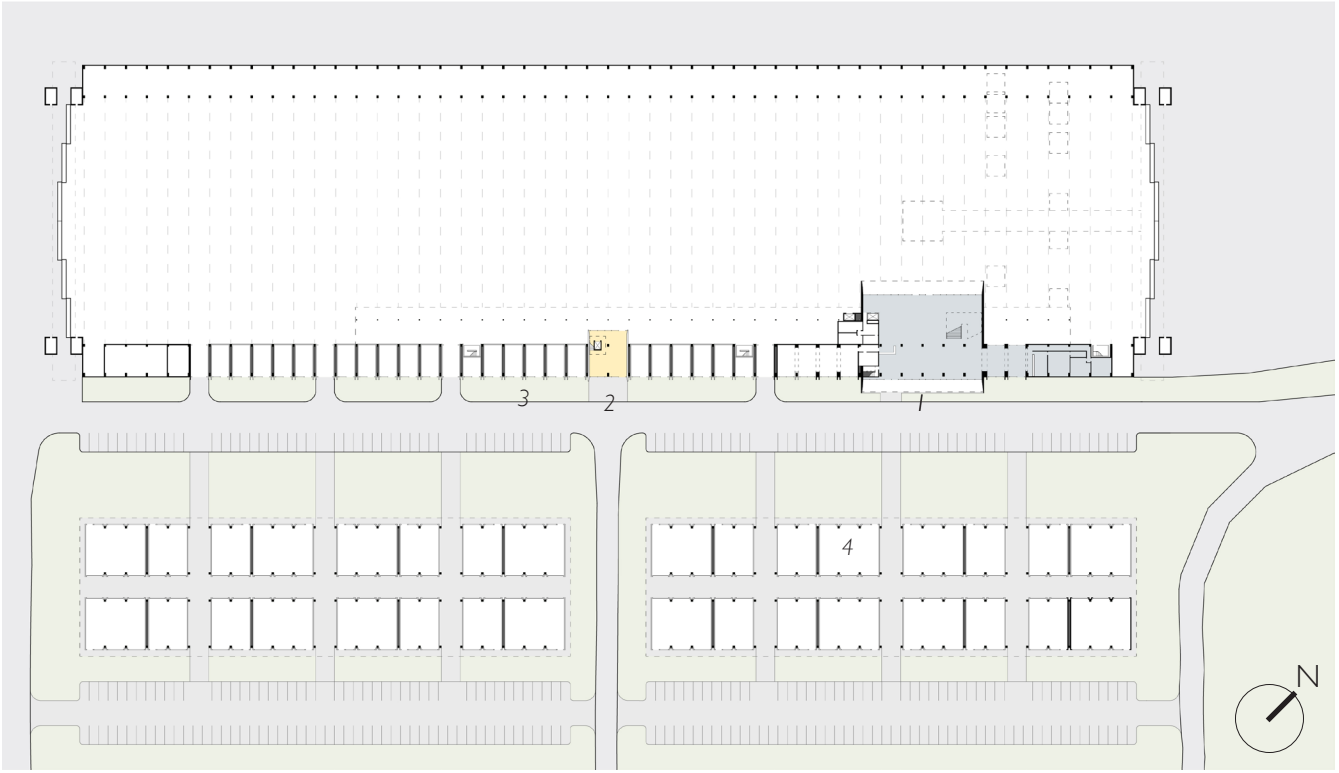
As a visitor approaches the entry to the port itself the airstrip and airports buildings become visible. The hangar now is seen within its immediate context and it is understood as a working component of an active industry. Aircraft from the government contractor utilize the airstrip and fly overhead. The program of its interior and the contemporary intervention still obscured by the pure form of the hangars northwest facade.

figure 50
hangar approach
1 mile away

Upon turning to enter the Port of Tillamook Bay a visitor gets the first glimpse of the new life of the historic structure. The original opaque doors of this existing image replaced with transparent versions. The volumes of the new programmatic elements inserted into the truss structure visible. Lights off of vehicles flying could also be visible at certain times of the day and during larger events and gatherings.

figure 51
hangar approach
entry to industrial park

figure 52
hangar addition
museum entry perspective

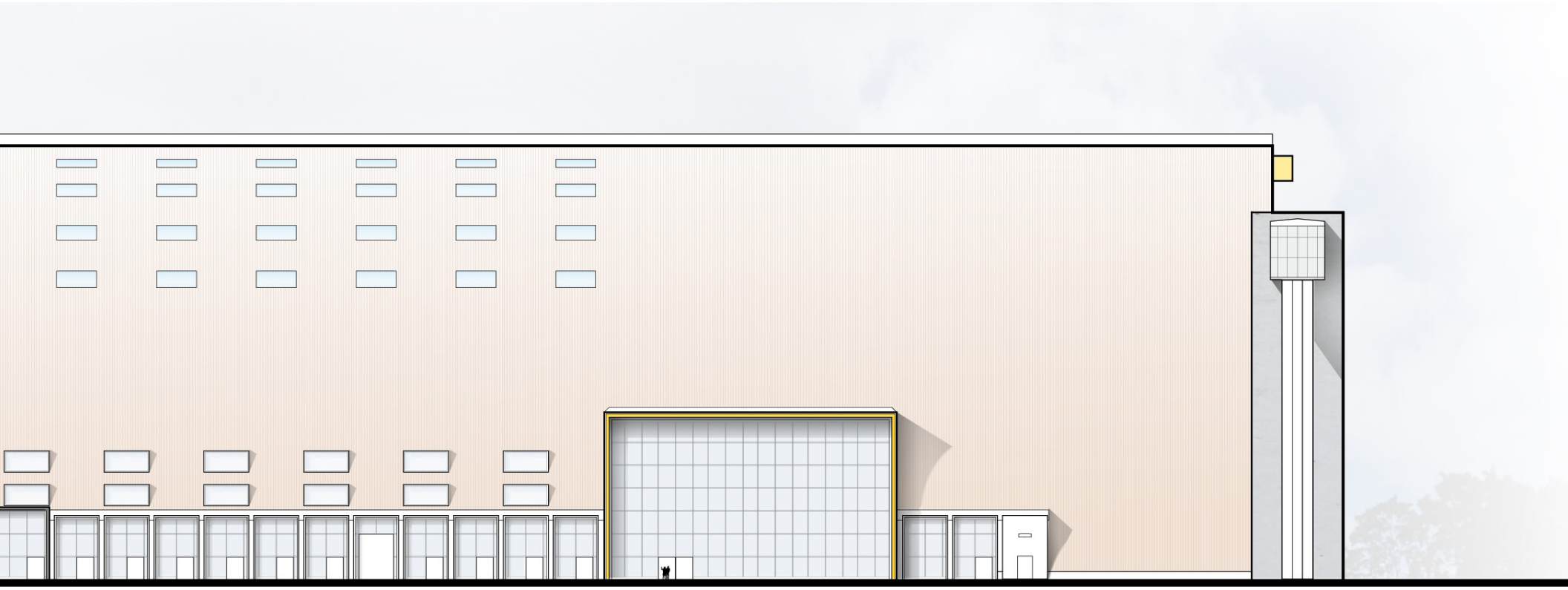


1 museum entrance
2 developers entrance
3 leasable commercial bays
4 component manufacturing

Turning the corner to view the southeast facade reveals the public interface to the new program. From the exterior the exposed trusses of the hangar give a sense of the immense interior structural system that holds up the building envelope. Suspended between the concrete bents at the arches base NASA's impressive solar UAV hints to the new program within. The public's experience of entering through a glazed opening through arches the tin roof is repeated on a smaller scale further down the hangars facade where developers and hobbyists have a separate private entrance to access their offices and workspace. Which express themselves on the facade where they punch through the roof above the lower bar. The leasable bay spaces visible in the perspective (shown left) face the leasable bays of the new small manufacturers structure. The siteplan above clearly shows this relation as the hangars structural grid is imposed on the new building and circulation paths for vehicles and people flow through the industrial building into the hangar.

figure 53
hangar & manufacturing bldg site plan

The skylights that become a major addition to the interior experience are barely expressed on the exterior, a simple change in material allows them to function as skylights but lets the roof form remain intact. These elevations show the transparency that the additions add to the hangar. On the long side each leasable bay, a set of new partition wall slid into each bay between the concrete bents, has a fully glazed facade to receive daylight and so off the individual tenants renovation. In some bays the glazing occurs on both sides, of the space so that views through into the hangars interior and test floor can occur.



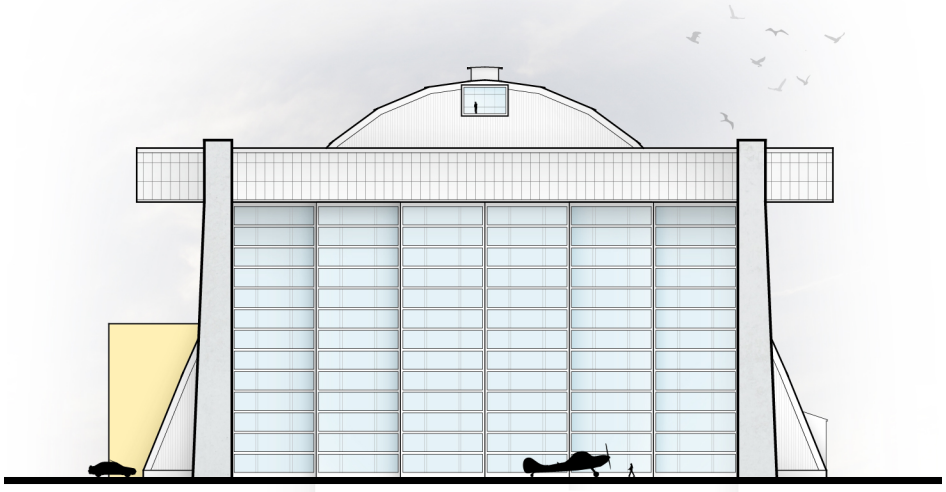
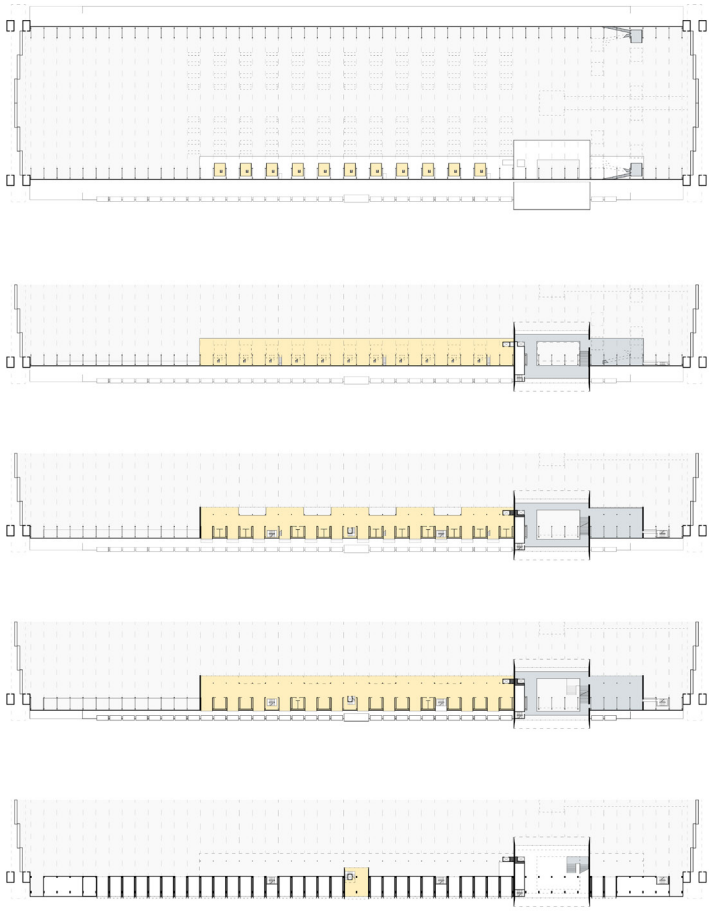
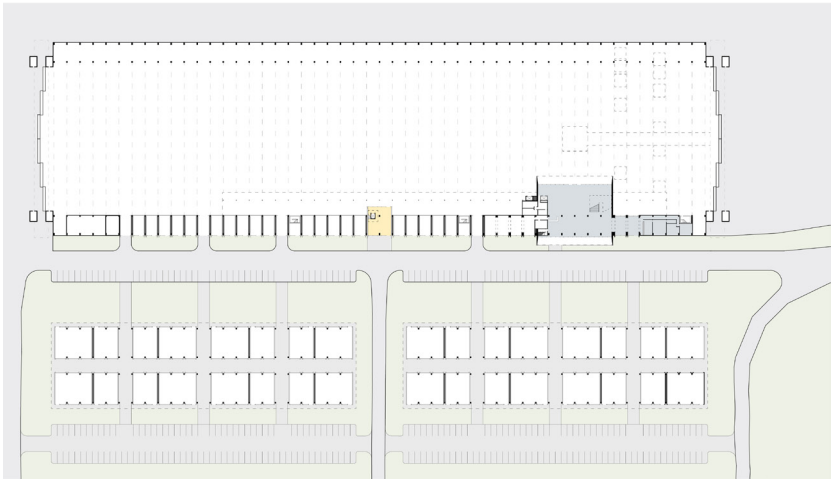


figure 54
southeast hangar elevation

figure 55
east end hangar elevation



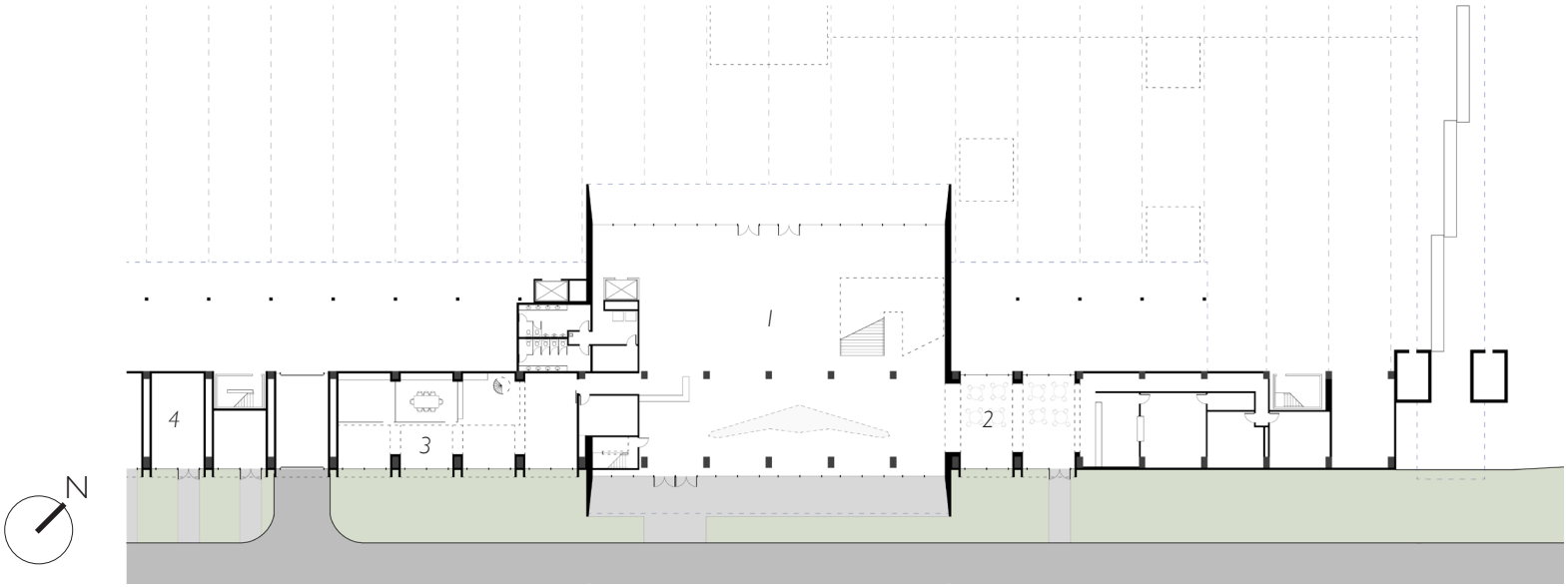


this set of diagrammatic plans shows the delineation between public and private program elements. yellow representing the developer and hobbyist areas while blue represents the visitors museum and experience pathway through the hangar.

figure 56
diagrammatic floor plans

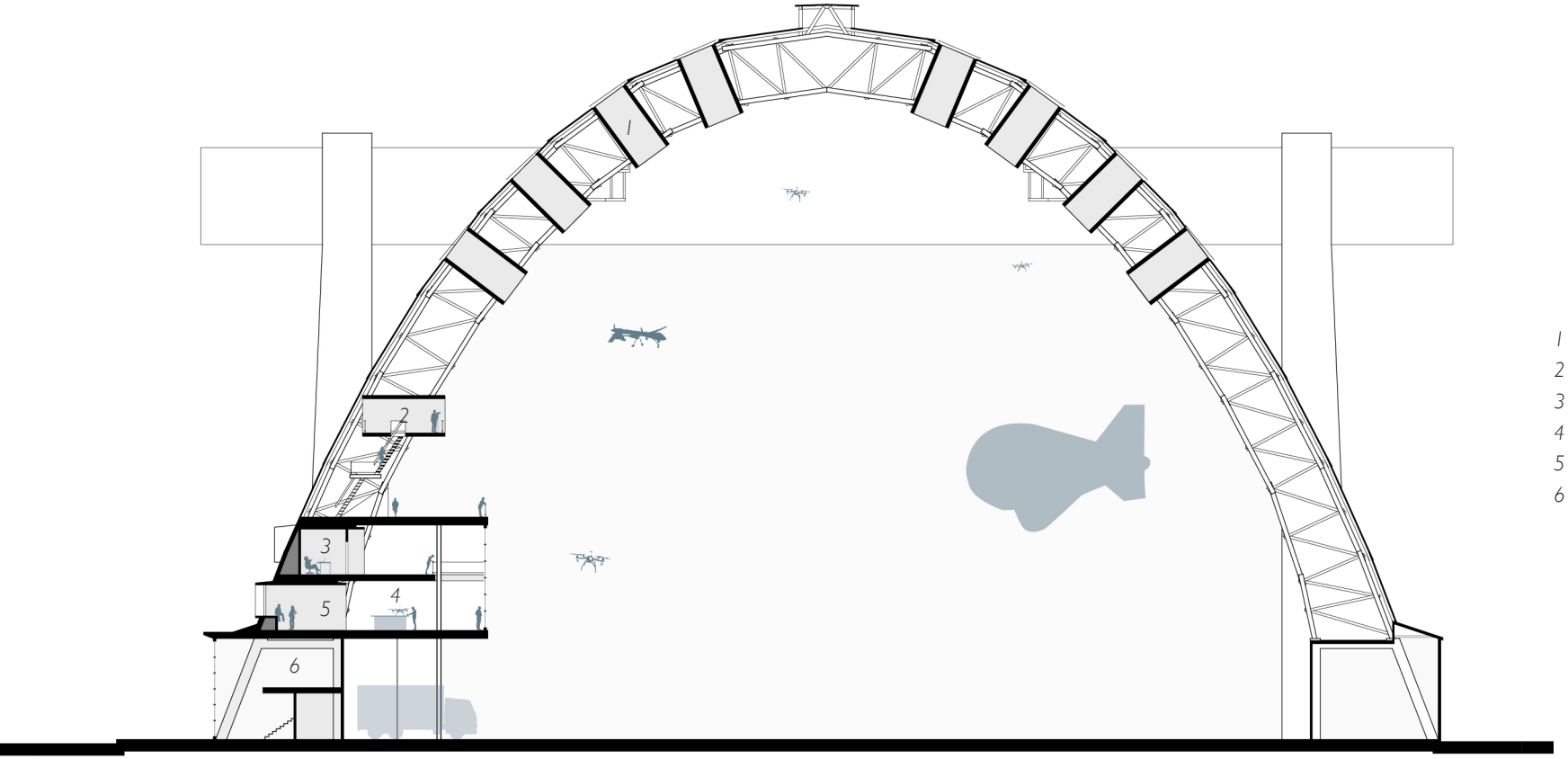
figure 57
view up existing truss structure

1 museum lobby
2 museum cafe
3 hangar administration offices
4 leasable commercial bay



The ground floor of the hangar is primarily open with the ability for visitors to proceed immediately out to the hangar floor or begin the procession through the various levels of the museum above. Free standing exhibits, museum shop, and cafe are also located at this level but the emphasis is on the vehicles and trusses. The path of the trusses cutting openings through the various floors of the museum drawing ones attention upward (figure 57), the ascent of these different levels showcasing the history of UAV technology, while the next generation of the vehicles can be witnessed first hand flying throughout the hangars interior. These new spaces with their unique structural requirements for suspended aircraft require them to be independent of existing truss system. Visible in the previous perspective a new truss spans between the major load bearing walls of the opening which supports two floors. Two sets of these trusses allow the interior of the addition to be open for aircraft and the original arches to continue uninterrupted through the space.

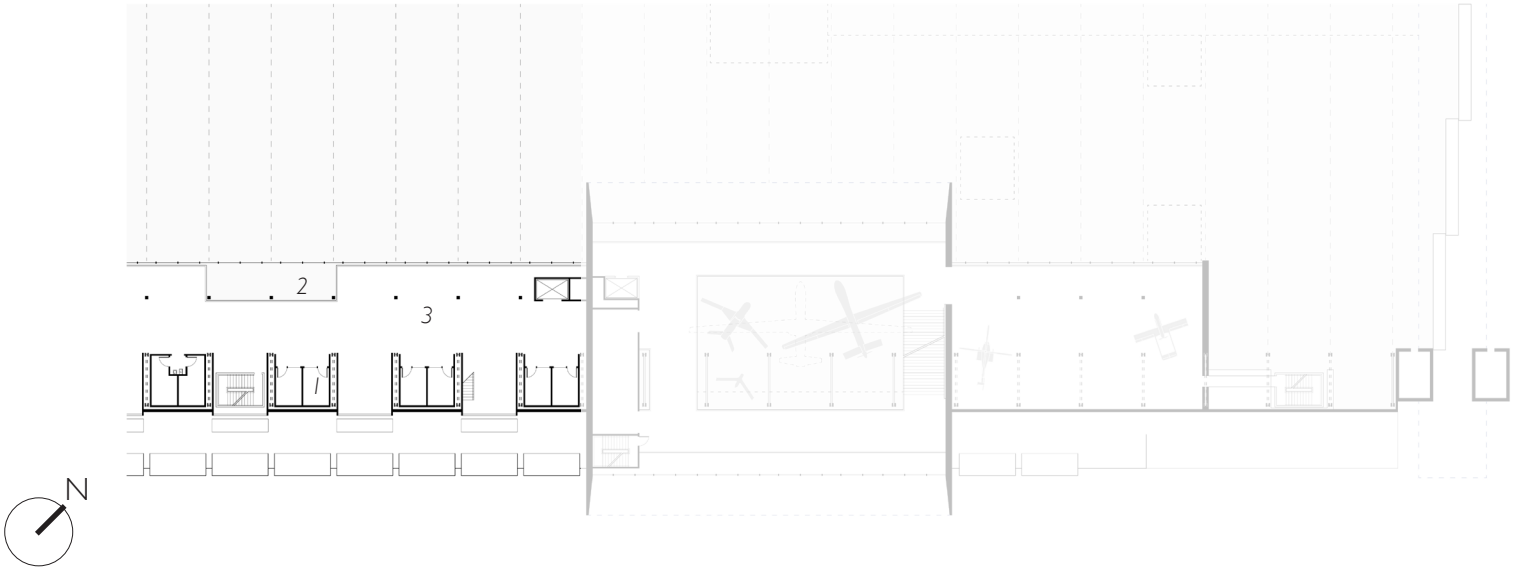
figure 58
enlarged floor plan
museum entry level



1 *skylights*
2 *pilots stand*
3 *developers office*
4 *workroom*
5 *composites shop*
6 *leasable commercial bay*

figure 59
hangar section
developer workshop spaces

1 developer office
2 workroom below
3 flexible working space



The pilots after moving through their own lobby space at the center of the hangars facade move up into their workspace. The section left and plan above show their areas of the new program, split on two different levels. The upper level of consists of smaller offices and conference spaces tucked in between the existing trusses. The multilevel area gives opportunities for these spaces to be visually connected with the lower level and out into the hangar. Workshops on the lower level extend out into the hangar further allowing for more open floorspace which can be configured to meet the requirements of the individuals and groups working there. On this level clean rooms and other programs that support the manufacturing and prototyping of various vehicles. This program, which sits within a horizontal bar that runs along the interior of the hangar, is also structurally separate from the existing hangar structure, it uses a series of columns to support the component that extends out into the hangars interior while the rest of the addition rests atop the new leasable bays sitting within the concrete bents. Small stands, inserted rooms suspended in the trusses give elevated areas for pilots to fly from, these areas sized to work with the existing structure.

figure 60
enlarged floor plan
upper level of developer floor

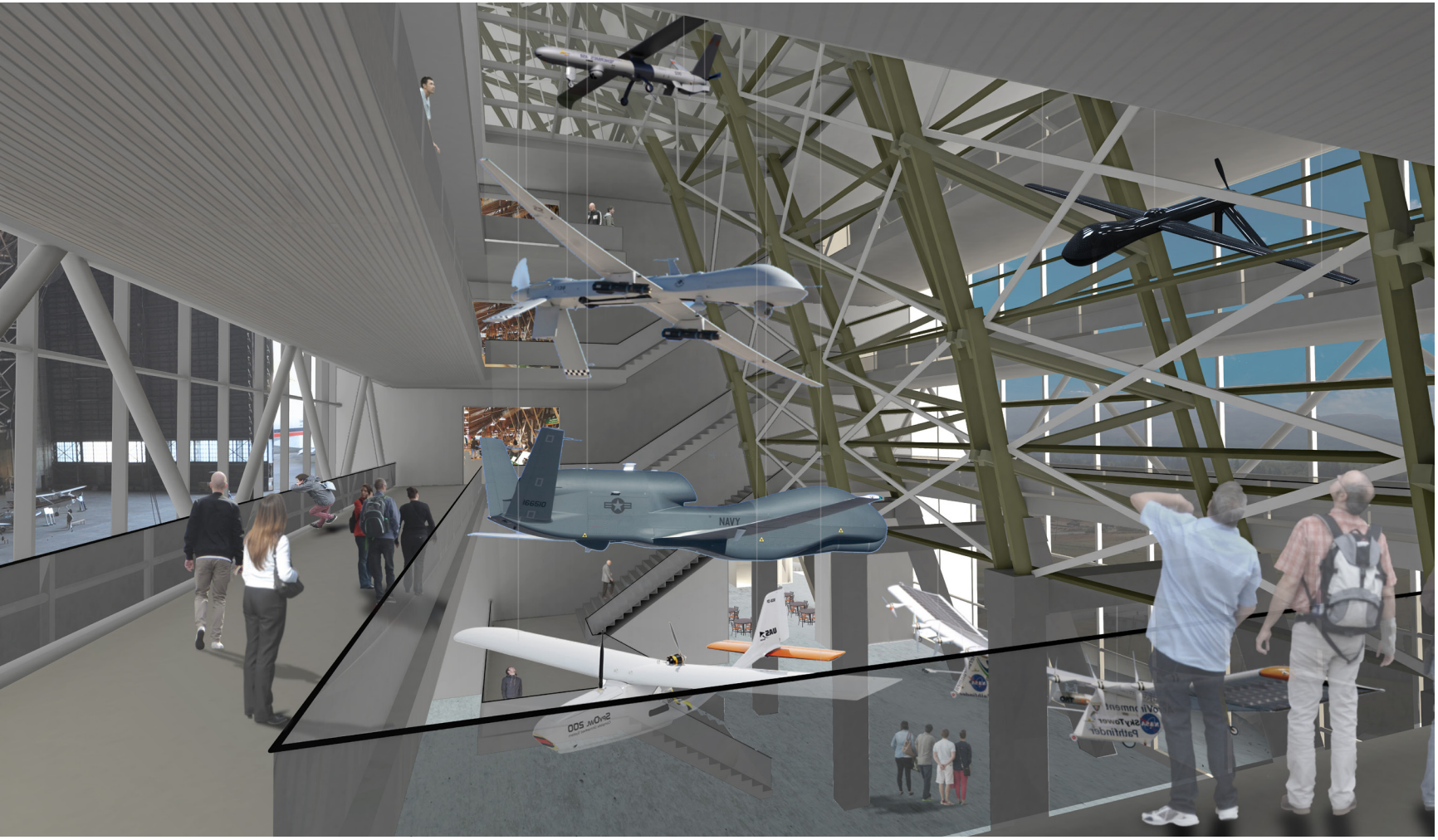
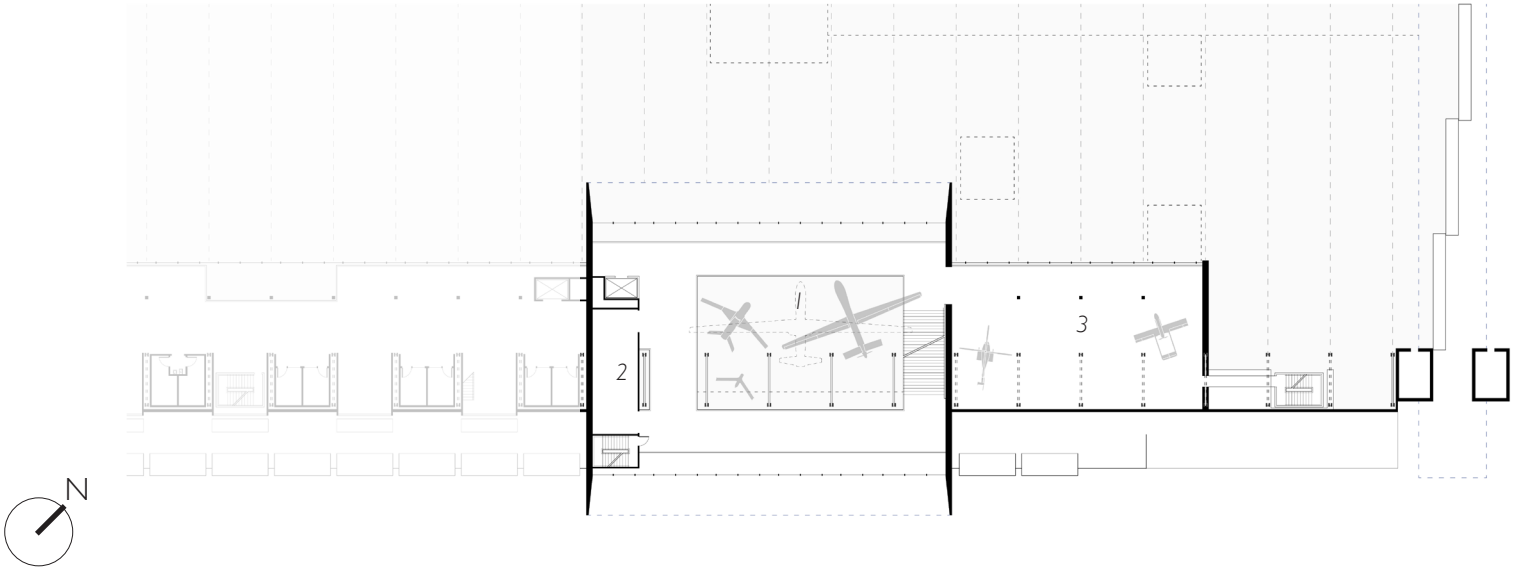


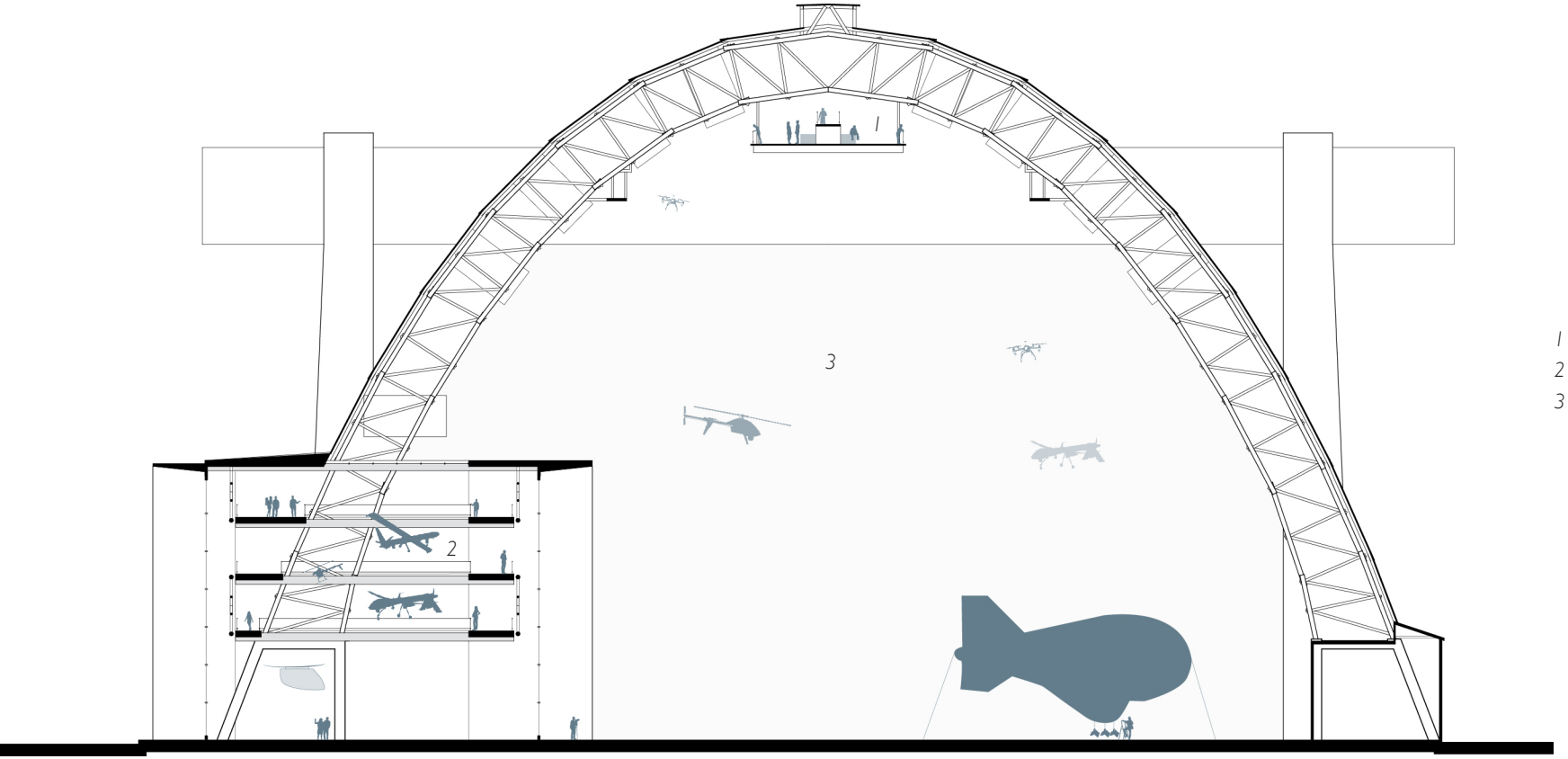
figure 61
main aircraft exhibit space

1 primary exhibit area
2 flight simulator room
3 small vehicles exhibit



After having witnessed the hangar at multiple distances, and entering through the glazed opening which reveals the historic structure the upper levels of the museum are where the scale of experience begins to decrease. What is initially seen as simply an immense building can now be understood at a finer level. The thousands of individual wood members that make up the arches are clearly visible and close enough to touch. The main exhibit space (shown left) displays the larger aircraft while smaller rooms that flank it house smaller individual exhibits and experiences such as flight simulators and construction displays where the vehicles are broken down into components. Additional exhibits about the other uses of the aircraft help to educate visitors of the many additional uses that can benefit from UAV technology, helping to educate visitors about the increasingly common and often misunderstood technology.

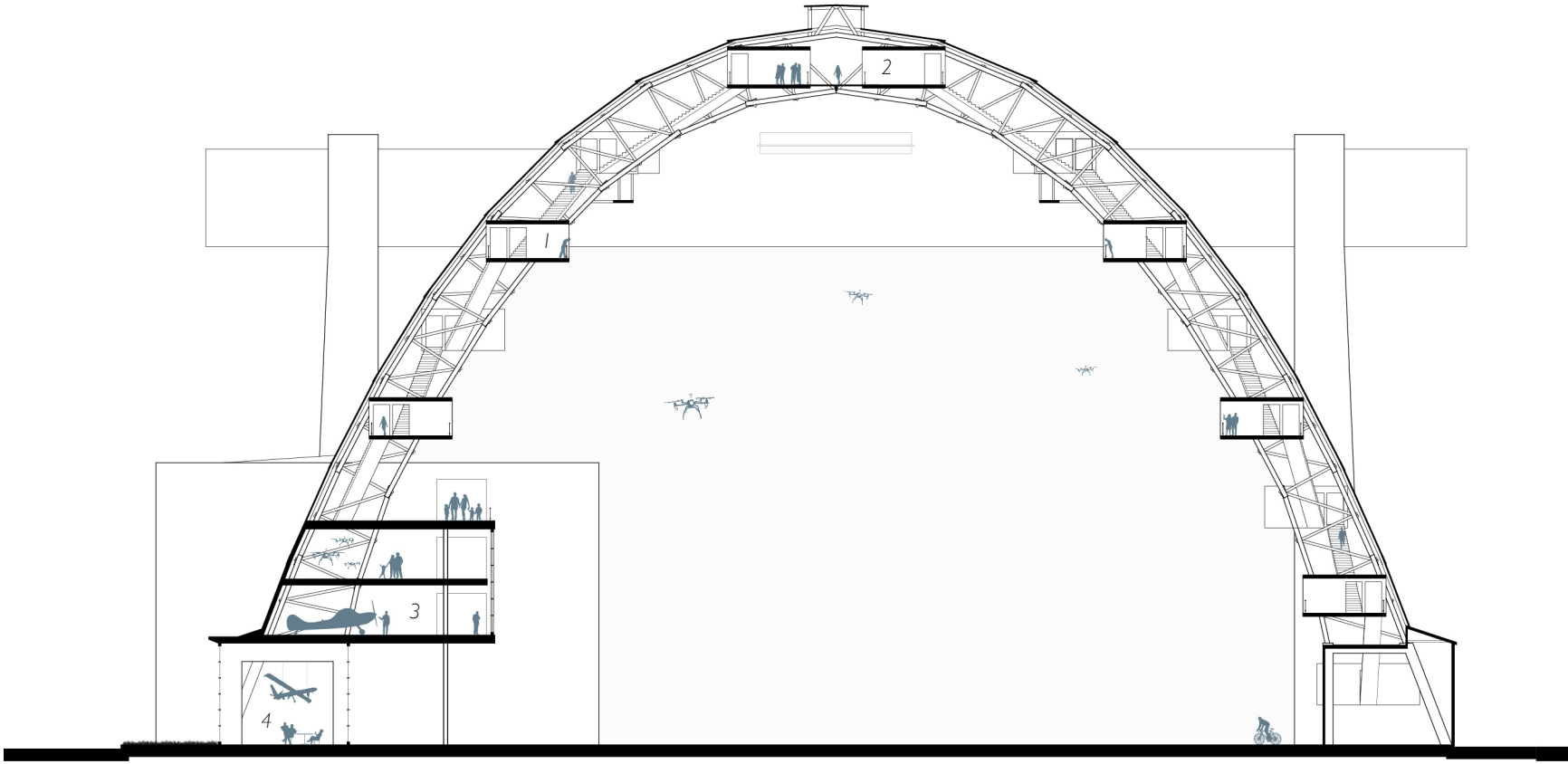
figure 62
enlarged floor plan
upper level of museum



1 suspended apex platform
2 primary vehicle exhibit
3 vehicle testing space

A section through the main exhibit space shows how the floor plates of the museum relate to the path of the truss and allow for a view straight up through the addition, a glazed ceiling thermally encloses the addition but maintains a thermal break between the unconditioned hangar and the conditioned exhibit spaces.

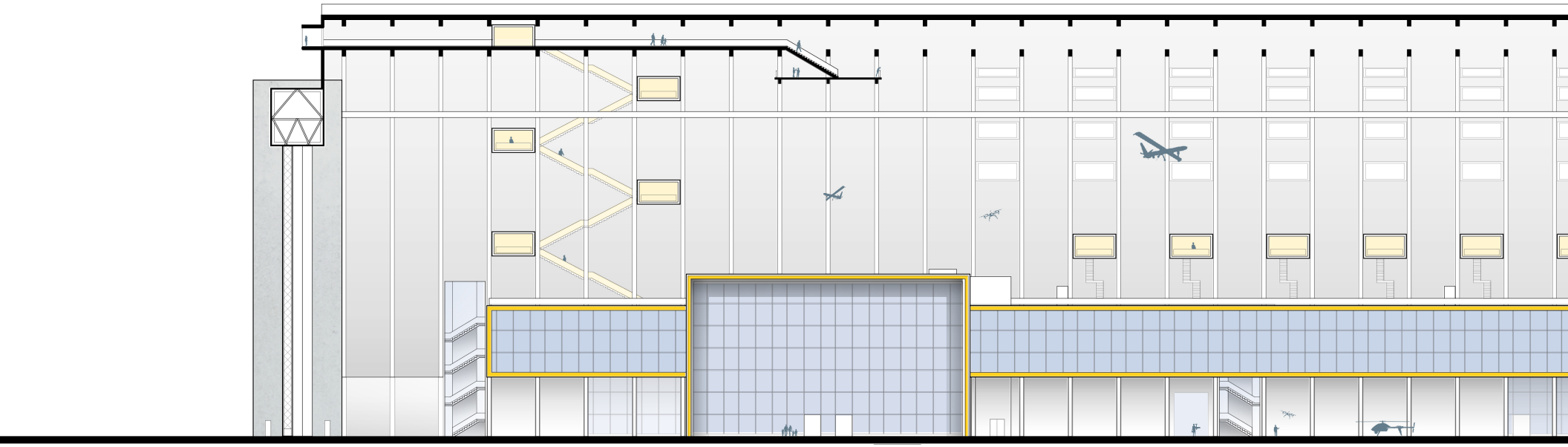
figure 63
hangar section
aircraft exhibit space



1 truss pathway platform
2 apex walkway
3 small vehicle exhibits
4 museum cafe

The most prominent experience a visitor encounters comes after they have completed the ascent of the museum component. The final exhibit of the museum open up onto an interior rooftop where visitors can continue up a series of steps and move between the platforms up and over the truss. Learning more about the structure and getting new vantage points of the hangar, the testing vehicles and the contemporary addition in the smallest scale elements of the addition.

figure 64
hangar section
truss platform pathway



On the interior of the hangar the various components of the new program are clearly visible. The main museum space to the left separating the two horizontal components, additional exhibit spaces to the left and the developers areas to the right. Above the developer bar, individual pilot stands and the skylights that along with the glazed doors help to bring daylight into the cavernous interior. Above the exhibit space the afore mentioned procession of platforms culminate in a catwalk at the apex.

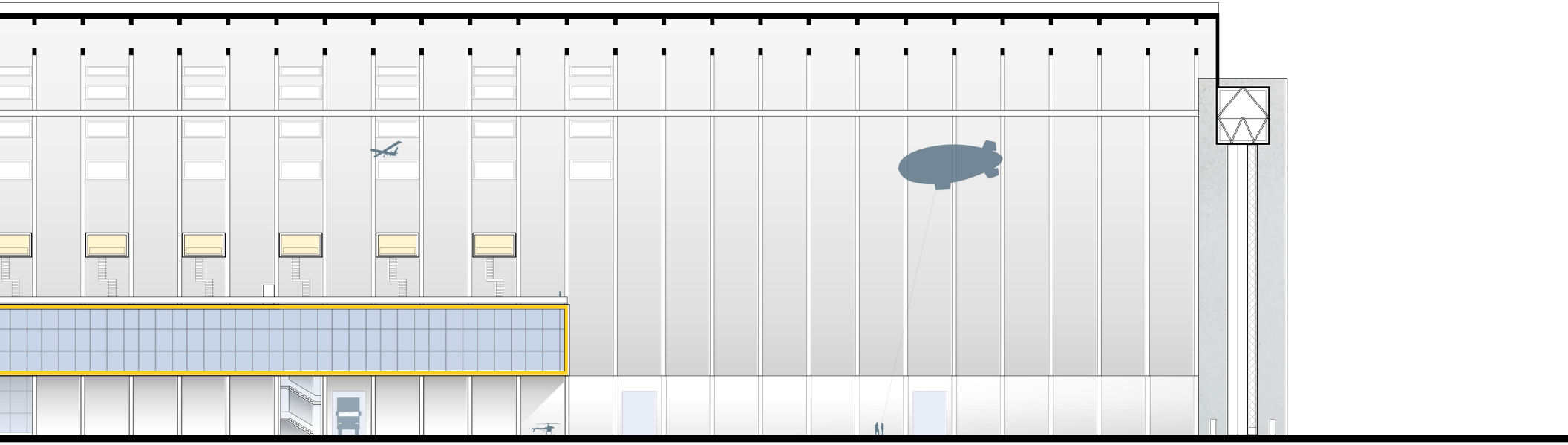


figure 65
hangar section
interior addition elevation

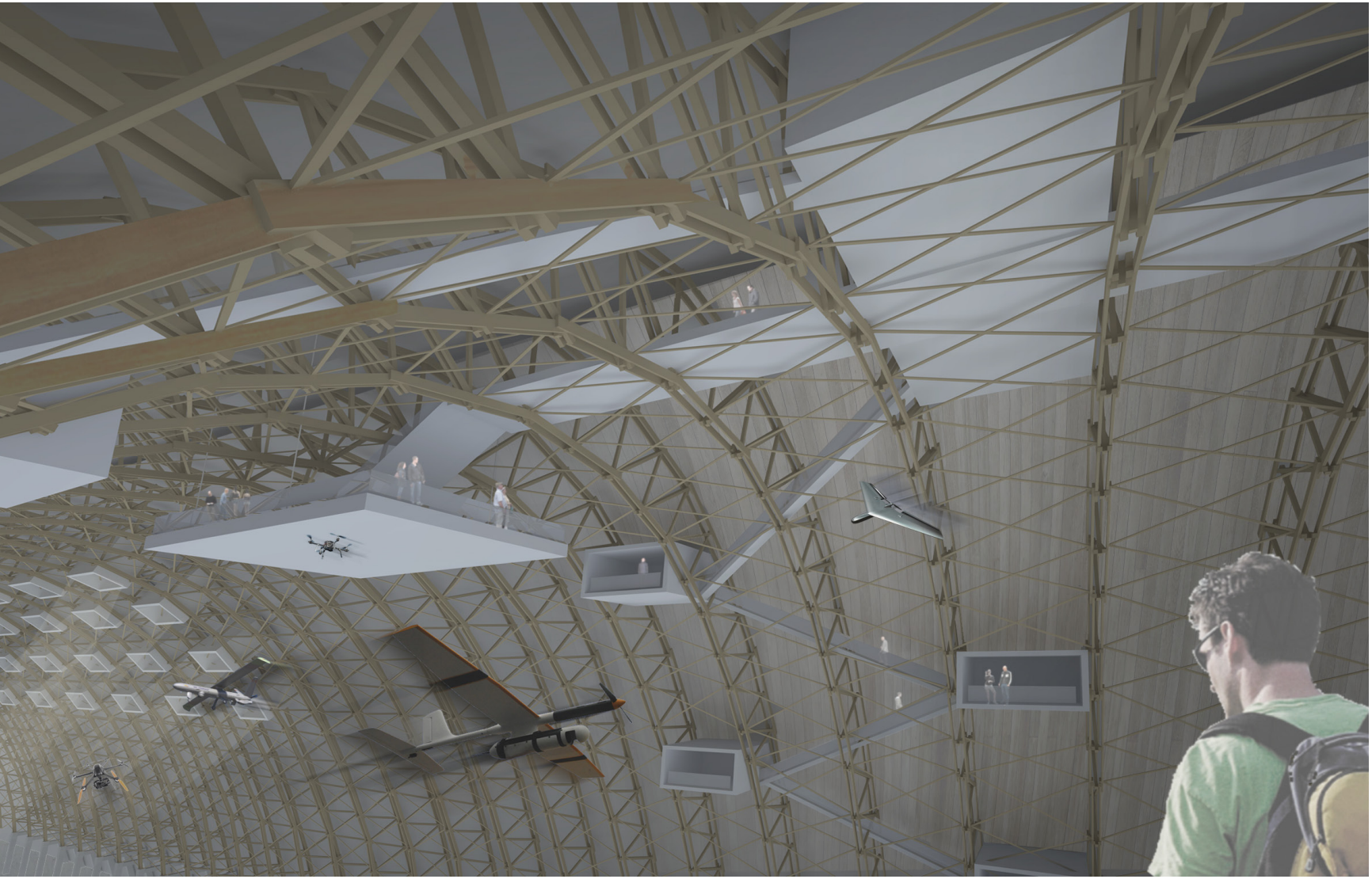
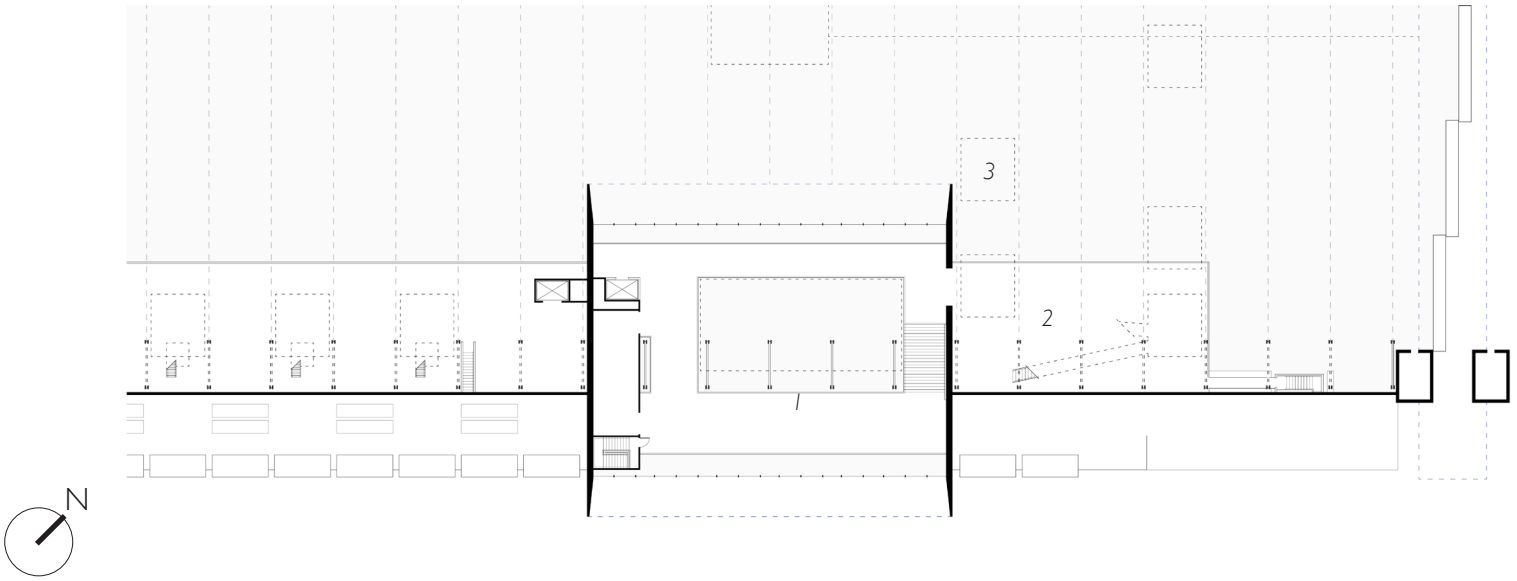


figure 66
truss pathway and suspended platform perspective

1 exhibit space
2 interior rooftop
3 platforms above



The plan above shows the museum's top floor, interior rooftop, and the beginning of the stairs leading up to the platforms dashed in above. The perspective left depicts the view from one of the higher platforms out into the volume of the hangar, vehicles testing, and pathway down the far side of the truss. Similar to the pilot stands these insertions are sized to work with the existing structure, minimizing point loading the trusses through a distributed network. The platforms offering a place of rest on the path to the final catwalk and suspended platform, hanging 180 feet above the floor below. The walkways are constructed to be clearly materially different from the wooden structure, expressing the distinction between new and old.

figure 67
enlarged floor plan
museum rooftop & pathway

view up access ladder
view down length of hangar
upper level catwalk

This pathway brings visitors through the maze of members that make up the truss, that promotes an intimate interaction with the construction methodology that went into making this incredible structure over 70 years ago. Once at the apex, views of the vast interior can be taken in from the pathway in addition to a punched opening that offers a look back out to the landscape from the highest point in the are, out over the pastures, fields and the foothills that encircle the valley. These two experiences reconnecting to the larger scale of the project and site. The decent through the remaining platforms again focuses back on the smaller platform spaces and scale of the individual members of the truss before returning to the hangars ground plane.

figures 68
existing truss images

connection detail at apex

cavernous interior volume

Here the full cavernous interior, the full scale of the hangar, is again experienced and understood after a visitor has inhabited the rafters. After learning the history and seeing the testing aircraft the ground plane offers visitors the ability to fully engage with the unmanned vehicles that utilize the hangar. The museum experience, built around up close interaction with the hangar and the aircraft, is completed by a hands on activity. Visitors are given the opportunity to see what the autonomous craft can do, and test their own skills by flying through obstacles and around courses with multiple types of small aircraft. Areas of the floor are marked off to designate landing and takeoff areas, flight paths overhead, and other maneuvering space. This simulated airspace and its ground level markings adding to the depth of the space and its activity.

figure 69
view from top of hangar
out over tillamook valley

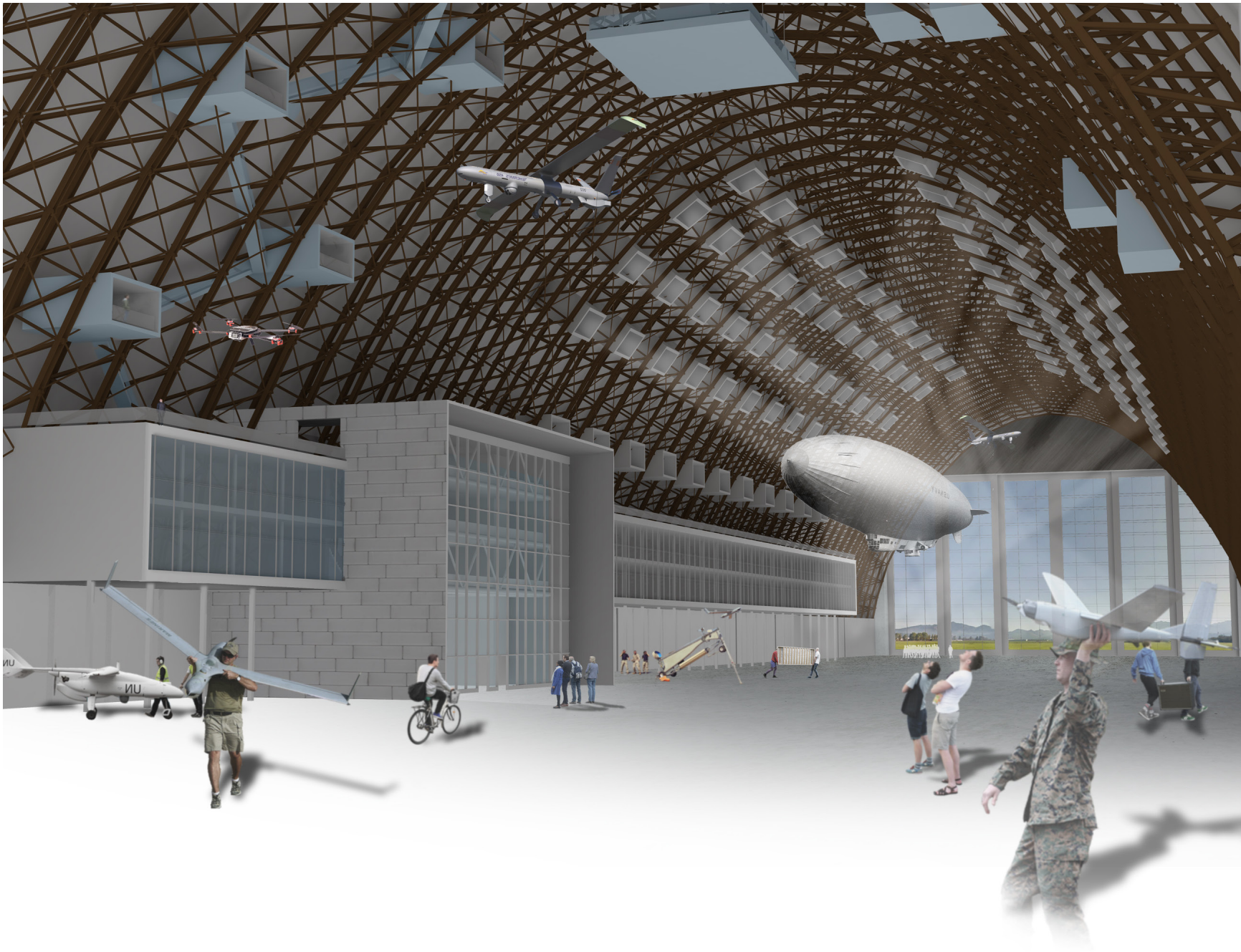


figure 70
hangar interior floor

The architectural problem posed by such a large building forced the discussion of not only how adaptive reuse in historically significant structures could be carried out but how to interact with a building that sits so out of scale with its context and the contemporary technologies of a system that now are seen as antiquated. A building that is already a powerful and iconic structure required a careful approach to the intervention that was powerful enough to not be diminutive, but did not try to compete with the monolithic form of the buildings exterior or detract from the intricate patterning of the structural system inside. The designed intervention sought to do this through a series of smaller interactions rather than a one large gesture. Allowing the sum of the smaller pieces to add to the experience of the rhythmic interior structure rather, the one large move used strategically to mark entry and begin the dialog between visitor and the experience of moving through the varying scales of the hangar and museum's spaces.

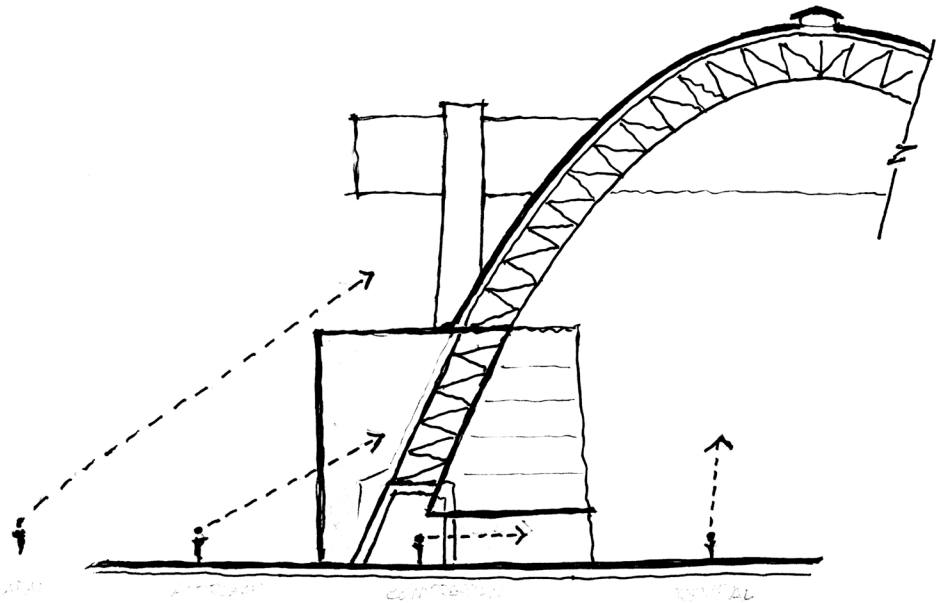
As a design approach this holds merit but there are elements of the design that upon further reflection could be reworked to reinforce the ideology behind the design strategies. The design strategy of opening up the facade, exposing the hangars structure and drawing in visitors through the side of the hangar as an strategy works well but the idea did not develop enough. The structure that was inserted to support the new exhibit space could end up competing with the alluring wooden trusses of the hangar. Stripping the form of this element down to a more elementary form would take some of the emphasis off of it that it currently demands with its structural expression. The inserted platforms and their sequencing could be refined to provide a more comprehensive experience of the space while not restricting visitors to the one rigid path of travel. Additionally some way of creating an accessible pathway to bring people to the apex would add a level of reality to the project. The final aspect of the project that had the most promise to add to the interior experience but never made it to the level of development is the skylights. The regular grid of skylights does not react to the buildings orientation, because of its diagonal orientation this can be used to simply add to the interior environment. Their tectonics again are over structured, a simple change in roof skin allowing light to diffuse through the trusses could bring a similar effect to the interior lighting. This would also free up more space for the platforms to run through the ceiling.

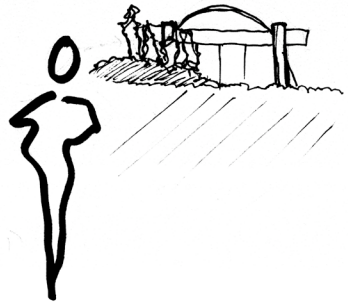
figure 71
tillamook hangar a ruins
2014

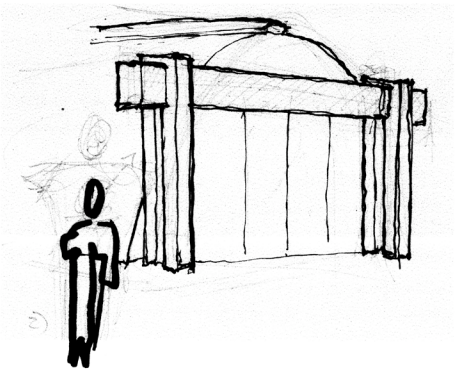
The proposal for a Center for Unmanned Technologies sought to reactivate the derelict volume of the airship hangar wile engaging with its aviation past. The recommissioning of the building as a test facility for vehicles typically though of for their surveillance capabilities is in line with the hangars history and provides a facility for the rapidly growing field of unmanned flight. It created an enduring industry and economic presence at the Port of Tillamook Bay industrial park that directly benefits from the hangars iconic image and the visitors that it draws. Its benefits extends past its value to a specific industry, where the project further maintains and expands the visitor experience with the hangar. Preserving the last public accessible example of this unique typology for future generations. It encourages not only static observation but an active engagement with the former and future applications of unmanned vehicle technology and the hangar alike, it provides a museum experience that can evolve along with the technology that it houses, ensuring that future generations have the ability to experience the powerful structure, a relic of past technology and icon of future development.

figure 72
tillamook hangar b
2014

Appendix







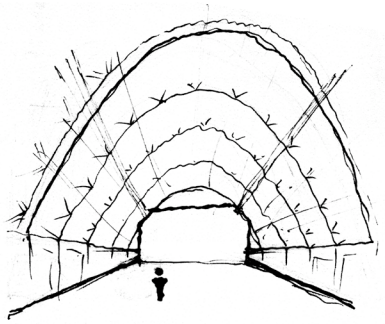


figure 73
initial concept sketches
hangar approach and scale

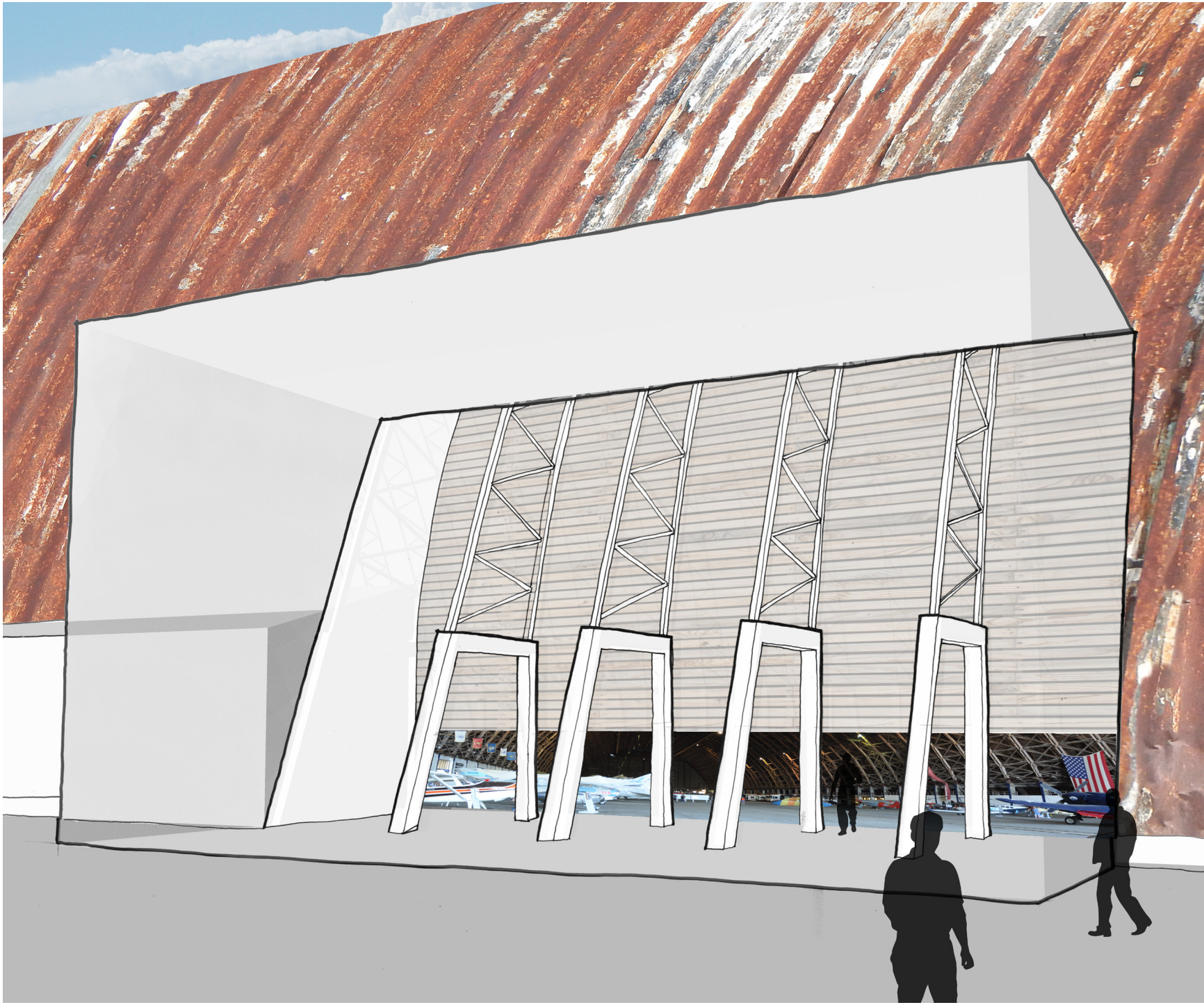


figure 74
early vignette study
exposing hangar structure

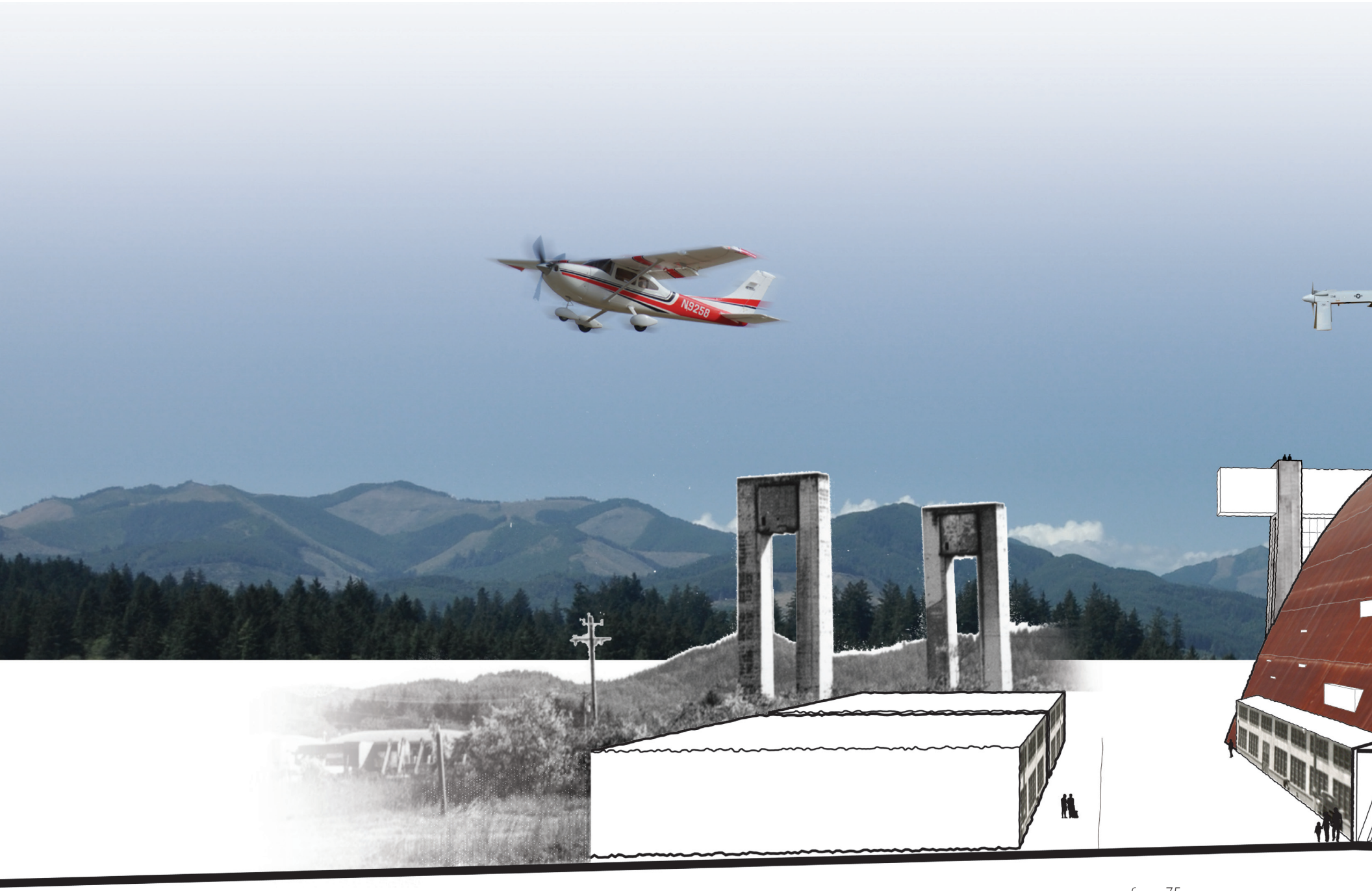
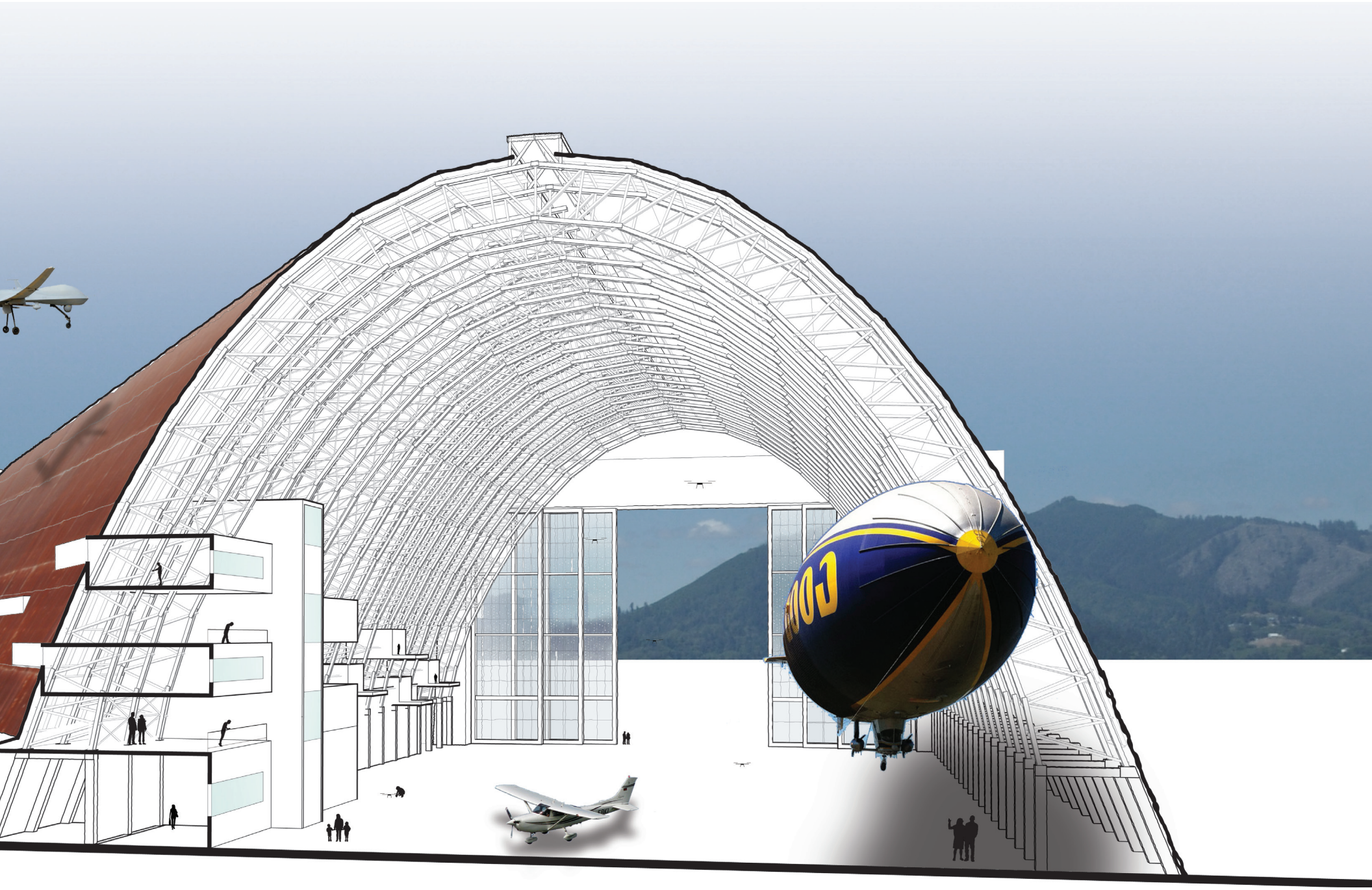
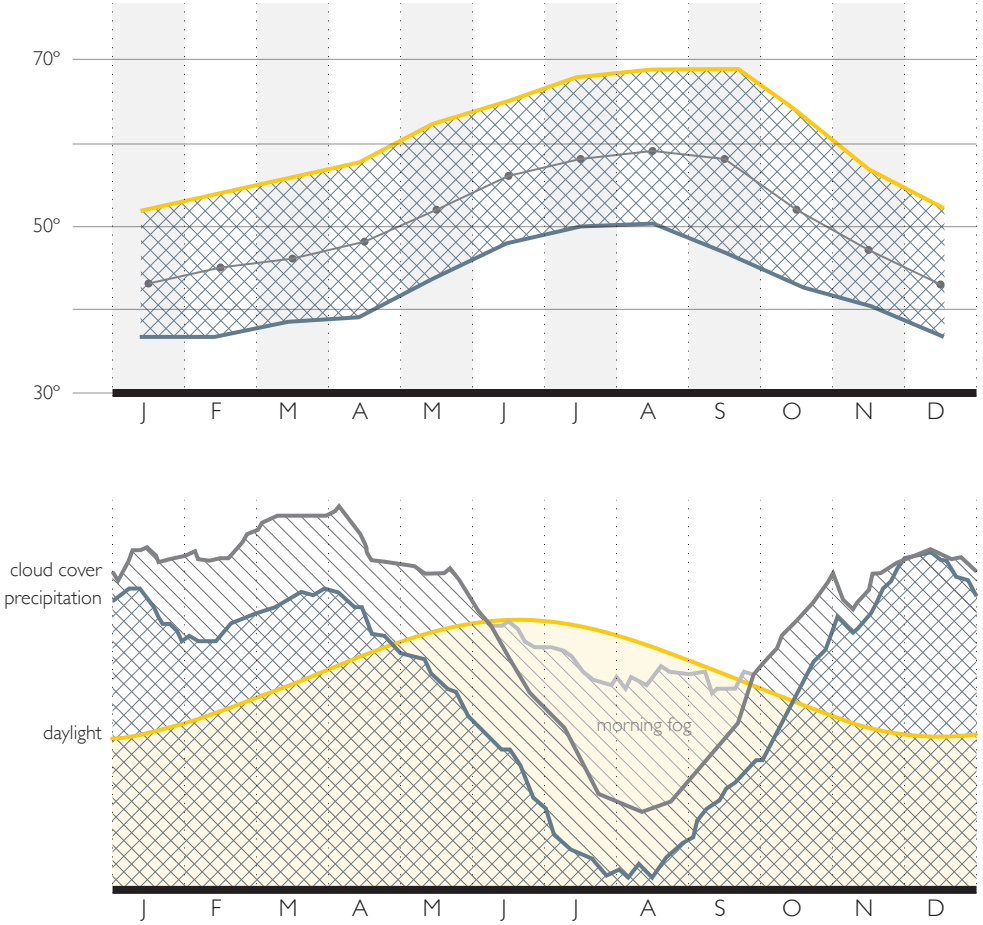


figure 75
early section perspective
hangar & adjacent relationships





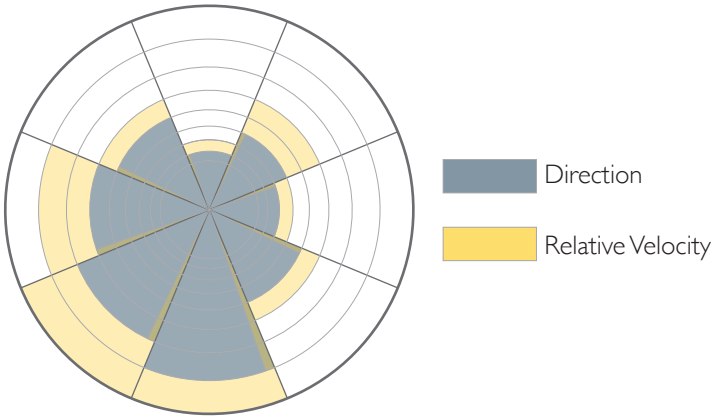


figure 76
tillamook climate diagrams

1 Evergreen Air & Space Museum

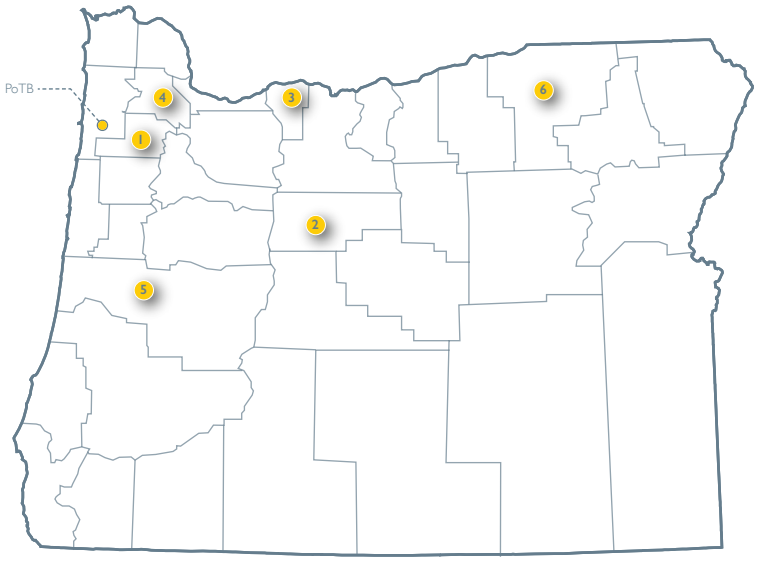
2 Erikson Air Museum (formerly located in Tillamook)

3 Western Antique Aeroplane and Automobile Museum

4 Classic Aircraft Aviation Museum

5 Oregon Air & Space Museum

6 Pendleton Air Museum



VISITORS

HANGAR
MUSEUM & EXPERIENTIAL PATH

25,000 sf

— hangar museum (urban exploration)

— UAS museum (exhibit & experience)
- history of UAS (1940 on)
- flight simulator
- manufacturing tours
- hands on flight

DEVELOPERS & HOBBYISTS

HANGAR
MEETING & WORK AREAS
WORKROOM& SHOP FACILITIES

10,000 sf

— hangar used for varying levels of model and rc aircraft

— workshop & seminar spaces

— workrooms and other site facilities

— foster community of enthusiasts

COMPONENT MANUFACTURERS

HANGAR
WORKROOM& SHOP FACILITIES

2,000 - 3,000 sf each

— visiting developers with short term use of facilities, work on project here
- downtown lodging annex
- shared workrooms
- test facilities

— small component manufacturers
- engine producers
- composite facilities
- platform fabricators
- software developers

— primarily indoor testing

— pilot training and certification

MAJOR MANUFACTURER

HANGAR
WORKSHOP & SHOP FACILITIES
RESEARCH & ADMIN AREAS

120,000 sf

— major aerospace (gov. contractor)

— producing large drones for high altitude research & surveillance
- engineers rooms
- assembly and clean rooms
- electrical harness assembly
- office & admin. areas

— primarily outdoor testing
- chase aircraft
- FAA certification

figure 77
existing location diagram
oregon aviation museums
figure 78
center for uav technologies
program user groups

figure 79
center for uav technologies
site plan

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