

TEXAS MOVER

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The World's Oldest and Largest Recycling Industry!



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AT-6 "Texan" Aircraft ... Move and Suspension From the Bullock Texas State History Museum Ceiling

By John Clegg, President and Owner, Clegg Services, LLC

As Told To Dr. Richard A. Mollicone, PhD., P.E., Lt. Col., USAF, Ret'd.

A Texan On The Move: From the battle fields of WW II to flight schools around the globe to a place of honor in history.

This Texan will be a historic move in more ways than one. The North American AT-6 "Texan," now residing in display on the third floor of the Bullock Texas State History Museum, is a true piece of Texas history. Her next move, after restoration to the full splendor of yester years, will be to the airspace over the Museum's atrium; once again to soar in regal majesty for all to see and marvel. Follow the move in a series of articles chronicling this historic event.

Some Background The North American Aviation T-6 Texan is an American single engine advanced trainer aircraft used to train pilots of the United States Army Air Forces (USAAF), United States Navy, Royal Air Force, and other air forces of the British Commonwealth during World War II and into the 1970s. Designed by North American Aviation, the T-6 is known by a variety of designations depending on the model and operating air force.

The United States Army Air Corps (USAAC) and USAAF designated it as the AT-6 Texan, an advanced trainer; the United States Navy the SNJ, and British Commonwealth air forces the Harvard, the name by which it is best known outside the US. Starting in 1948, the new United States Air Force (USAF) designated it the T-6, with the USN following in 1962.

It remains a popular warbird aircraft used for air show demonstrations and static displays. It has also been used many times to simulate various Japanese aircraft, including the Mitsubishi A6M Zero, in movies depicting World War II in the Pacific. A total of 15,495 T-6s of all variants were built.

The Move – Part 1: Getting started Clegg Services, located in Victoria, TX, was asked to propose a plan to execute the move as part of a competitive process. Clearly, years of experience with successful sensitive moves was a factor in Clegg being selected as the contractor of choice for the rigging and move of the Museum's AT-6.

Clegg Services has transported and sited a wide variety of structures, some massive and some compact during the past



The North American Aviation T-6 Texan is an American single-engine advanced trainer aircraft.



The new home for the "Texan" ... flying three stories over the Museum Atrium

45 years of active business with government agencies and commercial firms. Packaging, loading/unloading, rigging and installation services were involved to some extent in each of our many projects. Our record of customer satisfaction is unparalleled; we plan well and communicate with our clients even better.

With a select group of company experts, John and the team developed a proposed plan to execute the project from start to finish.

John Clegg stated: "As always, our program plan was developed with emphasis on safety during all phases of the project. Then we lay out the major tasks in the most effective, logical order." The following is

.....*CONTINUED*

an overview of Clegg's program plan for this project.

As an interesting side note, one of Clegg Services' more important, and certainly more interesting projects was the move of the salvaged remains of the French ship LaBelle ... from the start on the Gulf Coast to the Texas A&M restoration laboratory to the exhibit preparation and display location at the Bullock Texas State History Museum in Austin, TX. But that's another story.

Clegg Services has moved many huge structures such as a Communications Building for the U.S. Army to the top of the highest point in Puerto Rico. Numerous churches and historic buildings have been prepared, moved and sited over the years. Smaller projects, no less complex or sensitive, also fill out their business resume.

When Clegg Services accepted the challenge to submit a proposed plan to move and suspend the Museum's AT-6, John Clegg, the Team Leader, visited the site to evaluate the physical conditions and challenges to rigging the suspension system as well as how to move equipment into place with the least disturbance to the Bullock's other exhibits.

Our first activity is to complete the traditional three phases of an engineering process; preliminary design and review with the museum staff, then critical design where all major issues are evaluated and resolved with the museum's project team; at this point the design is fixed and fabrication begins. Lastly, everyone has an opportunity to address any outstanding issues during the final design review; this is the final "buy-in" and go ahead to proceed with the plan.

A fabrication process begins at this point; materials are delivered and needed parts and structures begin to take shape. At the same time this is taking place an "L-shaped" scaffold system will be erected to a level even with the top of the 3rd floor



Museum plat plan showing location of AT-6 when



The AT-6 will be rolled over the 3rd floor railing

handrail; this will eventually hold the aircraft in place over the atrium until the rigging cables can be attached and suspend the AT-6. Work on renovating the existing fuselage

and wings begins during this phase as well. The engine is to be removed in order to lighten the hanging load. The addition of a missing engine cowl and a new propeller shaft will complete the external look of the aircraft. Since the wings are currently displayed off the fuselage, these will be evaluated and strengthened before assembly on the fuselage. Once all the previous activities have been completed, the AT-6 will be rolled out onto the scaffold and secured with safety cables prior to suspension. Predesigned suspension cables, of such length that the aircraft is out of reach of Museum visitors, will already have been affixed to beam clamps, joined with a structural ring to a single cable ending with another ring which will gather cables from the each of the three aircraft lift points.

At this point the process will be reversed; remove tools and equipment, dismantle the scaffolding and, of course do a thorough job of cleaning up the work area and the first floor of the atrium. Then comes the final step in any successful plan; Inspection and Acceptance.

One of the key aspects of the plan was how to access the Museum's main roof beams from which the aircraft would be suspended and install the initial section of the suspension rigging. Then a task had to be planned to repair the plaster ceiling after the initial section of the rigging system was installed. Each phase of the project was carefully sequenced and designed for safety and efficiency.

Soon after selection as the contractor for rigging and moving the AT-6 aircraft, the Clegg team began refining the project plan, filling in details and preparing for the next step; stabilizing the aircraft structure in preparation for the move and suspension over the atrium.

See the next issue for The Move – Part 2: Renovation and Preparation for Suspending the Aircraft

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- ⇒ Upcoming Events and Dates
- ⇒ The Lemons Company Collinwood House Plano, Texas
- ⇒ Clegg Services, "LLC AT-6 Aircraft Move Part 2"
- ⇒ Obituary Jimmie Davis
- ⇒ House Moving Dollies For Sale



AT-6 "Texan" Aircraft ... Move and Suspension from the Bullock Texas State History Museum Ceiling

By

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As Told To

Dr. Richard A. Mollicone, PhD., P.E., Lt. Col., USAF, Ret'd.

Part 2

A Texan on the Move – the Second of Three Chapters: Getting ready to move the Texan from the third floor Static Display to the Dance Floor three stories over the Museum Atrium

This Texan was a historic move in more ways than one. The North American AT-6 "Texan" resided as a static display on the third floor of the Bullock Texas State History Museum. Her final move, after restoration to the full splendor of yesteryear, will be to the airspace over the Museum's atrium; once again to soar in regal majesty for all to see and marvel. This chapter chronicles the preparation for the historic move.



The new home for the "Texan" flying three stories over the Museum Atrium

Some Background

The North American Aviation T-6 Texan is an American single engine advanced [trainer aircraft](#) used to train pilots of the [United States Army Air Forces](#) (USAAF), [United States Navy](#), [Royal Air Force](#), and other [air forces](#) of the [British Commonwealth](#) during [World War II](#) and into the 1970s.



The North American Aviation T-6 Texan is an American single-engine advanced trainer

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variants were built. Note that most of the background information was excerpted from Wikipedia entries where more detail can be found.

Clegg Services, located in Victoria, TX, was asked to propose a plan to execute the move as part of a competitive process. Clearly, years of experience with successful sensitive moves was a factor in Clegg being selected as the contractor of choice for the rigging and move of the Museum's AT-6.

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As an interesting side note, one of Clegg Services' more important, and certainly very interesting, projects was the move of the salvaged remains of the French ship LaBelle ... from the start on the Gulf Coast to the Texas A&M restoration laboratory to the exhibit preparation and display location at the Bullock Texas State History Museum in Austin, TX. But that's another story.

Clegg Services has moved many huge structures such as a Communications Building for the U.S. Army to the top of the highest point in Puerto Rico. Numerous churches and historic buildings have been prepared, moved and sited over the years. Smaller projects, no less complex or sensitive, also fill out their business resume.

THE MOVE – MAKING IT HAPPEN

When Clegg Services was selected to move and suspend the Museum's AT-6, John Clegg, the Team Leader, visited the site to evaluate the physical conditions and challenges to rigging the planned suspension system as well as how to move equipment into place with the least disturbance to the Bullock's other exhibits. Now it was in the hands of the on-site company experts, headed up by "Hoppy" Hopkins the Project Site Manager.

Renovation of the AT-6:

As in many projects, it was no surprise that plans changed along the way. We knew the engine cowling was missing and that we would have to find one to replace it, which we did ... at a premium price.

Parts for the AT-6 Texan are in great demand around the world. Today there are still hundreds of Texans flying in private hands, and their value continues to rise.



Cowling with a dummy engine and prop in place



Used cowling before repair and paint



Refurbished cowling painted to match Museum AT-6

However, there were numerous surprises; missing, damaged and/or non-functioning parts. The original single-row, nine-cylinder, air-cooled, radial engine had to be replaced so the Pratt & Whitney R-1340 "Wasp" engine could be used elsewhere as a standalone museum display. Clegg removed the engine and secured it to a dolly for the museum's future use. A total of 34,966 of these engines were produced. The original plan to fabricate structure to hold the propeller in place and support the engine cowling was scrapped in favor of realism, so a similar engine was found as a substitute. Of course that required an unexpected cleanup and engine re-build before installation. The plan called for the aircraft "flying" with the landing gear in the up position. Another surprise; all



Refurbished substitute engine.



Wing inspected for structural integrity

of the landing gear operating mechanism had been removed. The re-group solution was to permanently wire the gear in the up position while it was "cribbed" up prior to moving it with dollies onto the scaffolding "dance floor."

The wings were another matter. They had been damaged by fire before acquisition more than 17 years ago; this had been confirmed by the museum's original restoration specialist. Since the wings were suspended above the fuselage they couldn't be inspected thoroughly until taken down. Concerns were expressed about structural integrity when reattaching the wings to the fuselage. Would the wings require structural repair? Would additional support in the form of wing

tip cables be needed? Or both? Sparks Engineering, contract consultants, examined them and determined the following: the stringers and main spar were not significantly affected for the purpose of displaying the aircraft, the attachment flange on the starboard (right) wing had significant damage, the main spar attachment angle was missing from the port (left) wing as were many attachment bolts. Clegg fabricated the required parts and the wings are safely reattached to the fuselage.

Erecting Scaffolding:

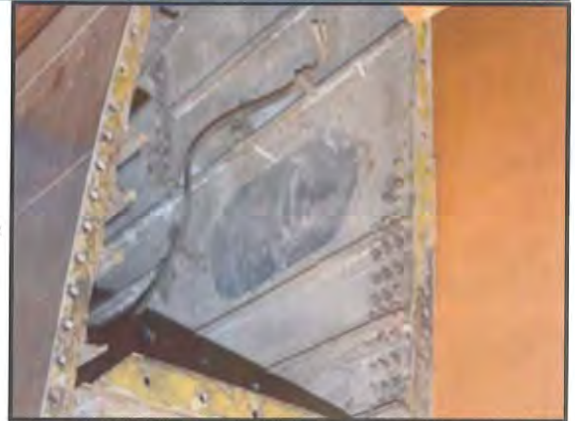
While the preparatory activities were taking place, we worked closely with Bilt-Rite Scaffold, an Austin based company, to plan, be mobilized and ready to meet the Museum's tight window of opportunity for erecting our scaffold "dance floor;" the platform needed to relocate the Texan

AT-6 "Texan" Aircraft Part 2



Attachment flange damage

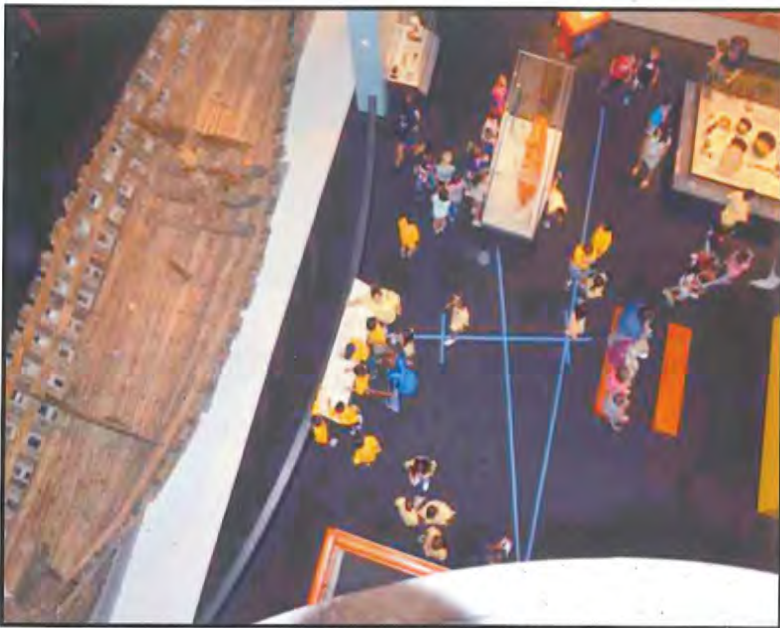
from the 3rd floor to the area over the atrium. Scaffolding was planned to measure approximately 20' wide by 32' long and 40'-5" high. The work deck would be provided with guardrails and toe boards for worker safety.



Missing spar attachment angle

The work deck used steel planking in conjunction with $\frac{3}{4}$ " plywood board and

pin-lock wood board to provide a platform that would withstand the weight of the plane during the relocation. The scaffold, as designed, was free standing and did not need any additional support.



The LaBelle looking down from 3rd Floor.

Note the tape on the first floor indicating the planned orientation of the Texan

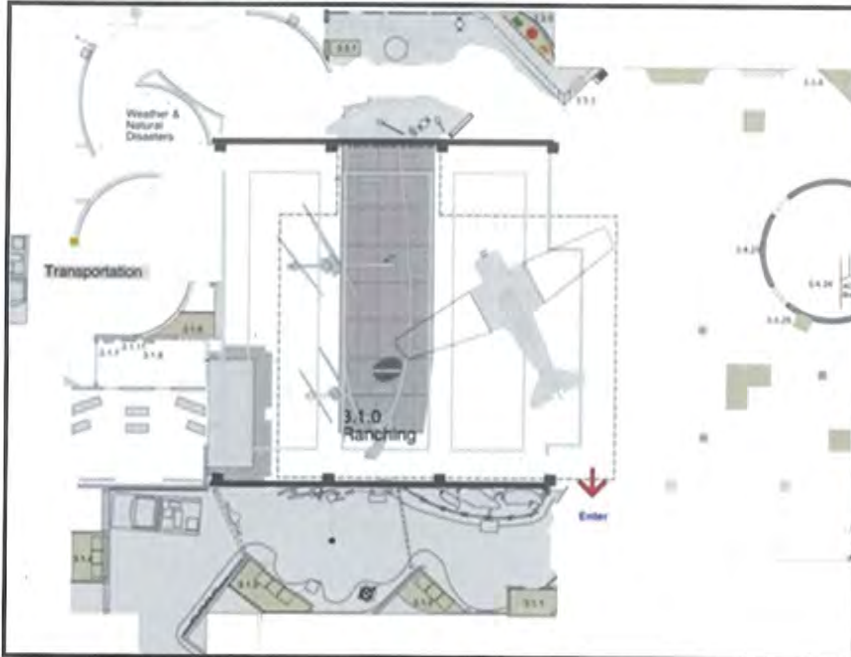


Protective "shell" around LaBelle artifact

Well, the scaffolding plan didn't escape changes either; there were two of them. Before erecting the two story working platform (the "dance floor" as it was called), it was decided a temporary protective "shell" had to be built around the existing LaBelle artifact display which was directly under the area selected to hang the AT-6 Texan. Once this was completed work could start on erecting the main scaffold structure.

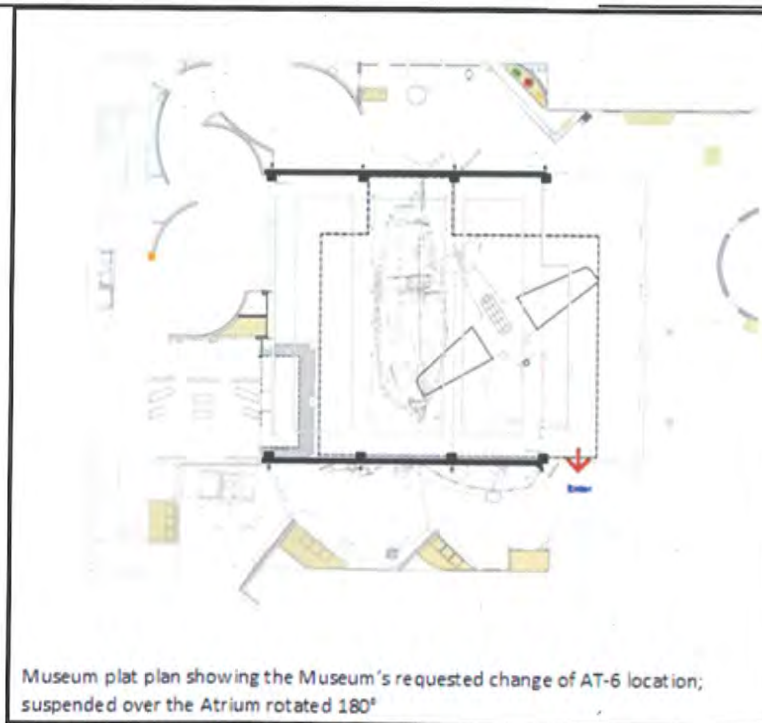
AT-6 "Texan" Aircraft Part 2

Ongoing coordination and discussion between the Clegg team and the museum staff surfaced a concern that the Texan's stabilizer would look "crowded" if suspended as originally envisioned. So a change of plans was agreed upon; one that would have minimal effect on work already completed. In order to provide sufficient room to rotate the aircraft into its new orientation and to ensure worker safety while attaching the wings, the dance floor had to be extended to 32' wide by 32' long. This change was accomplished by Bilt-Rite in a timely manner without adversely impacting the schedule.



Architectural renderings of the museum displays with the planned location of the Texan when suspended is shown at left and final location shown below.

Start of the scaffold system



Museum plat plan showing the Museum's requested change of AT-6 location; suspended over the Atrium rotated 180°

AT-6 "Texan" Aircraft Part 2



Almost to 3rd floor.
"Dance floor" in place ready for the Texan's
move.



At this point everyone was ready to move the Texan, install the
rigging and suspend the display.



**See the next issue for The Move – Part 3 (Final): Physical Relocation over the Atrium
and Suspending the Aircraft**

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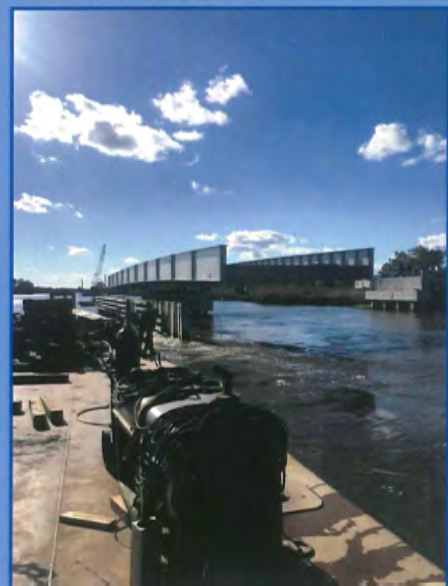


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- ⇒ At the Cross Church Move
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- ⇒ Scholarship Winners
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- ⇒ Cow Bayou Swing Bridge
- ⇒ Port Aransas Historical House Move



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Part 3

A Texan on the Move – the Final Chapter:

From a Static Display to a place of honor in history ... flying three stories over the Museum Atrium

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AT-6 "Texan" Aircraft Part 3

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Phases I & II of the AT-6 Project

As in many projects, it was no surprise that the Phase I plans changed along the way. Good planning always includes flexibility; a Clegg hallmark. Phase II followed; preparation for the move, which involved renovation of the AT-6, putting scaffolding in place and positioning the aircraft for the final move.



AT-6 in position on 3rd floor level ready to move up over the railing

Phase III: Getting the AT-6 into Place

Now that the prep was completed and the AT-6 positioned, it had to be "moved" from the third floor display area, over the railing and on to the scaffold "dance floor."



Preparing a wing for move on to the "dance floor."



Lifting the aircraft with engine jacks prior to setting cribbing in place

AT-6 "Texan" Aircraft Part 3



First stages of cribbing up to railing height



The aircraft was lifted in stages using a pair of large engine jacks, then supported with floor jacks while the cribbing was completed and the ramp put in place. Next step would be to install the dollies with custom cradles under the aircraft.

Cradles had to be custom made from templates traced from the fuselage in order to prevent any crushing or denting. These cradles, mounted on moving dollies, enabled the Clegg team to move the aircraft sideways across the railing and onto the dance floor. At that point, the AT-6 could be positioned for "flight" and the wings and propeller re-mounted.



Placing the dollies and fuselage support cradles.



Maneuvering plane on dance floor

The originally planned position appeared to "crowd" the stabilizer, so the museum Exhibit Production Director asked if we could re-orient it 180°. Re-orientation required a modified gantry system; fortunately the pre-planned, designed flexibility was enough to allow this change easily. However, the size of the dance floor had to be enlarged to accommodate the rotation and need for work space.

AT-6 "Texan" Aircraft Part 3



Setting aircraft in position to attach propeller and wings



Re-installing wings onto the fuselage

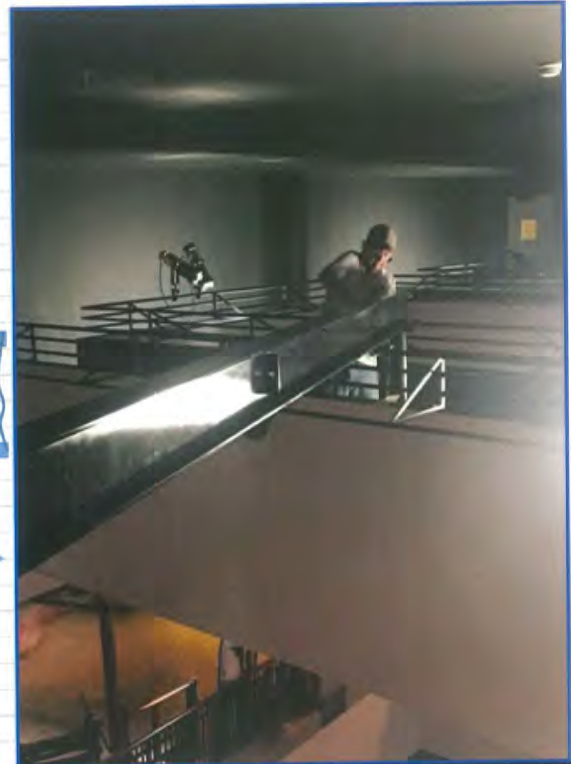
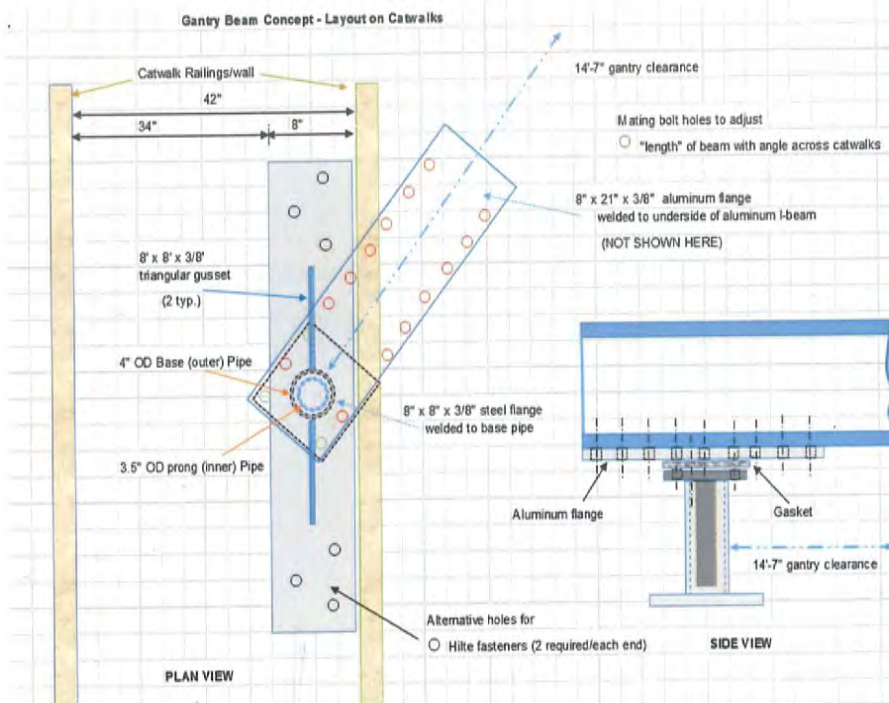


Ready for the rigging process

AT-6 "Texan" Aircraft Part 3

Our gantry beams were designed to rotate on a post which was floor mounted to the catwalk at an appropriate location to provide hang points to suspend the aircraft. The effective beam "length" could be modified on site to accommodate minor changes in the final orientation of the AT-6. (See concept sketch of the gantry beam setup below).

With the change in position of the airplane and the unstated walkway floor clearance, we had to do just that, and more.



Securing the beam supports.



Re-located gantry beam in place, spanning the atrium

Attaching the Rigging System

Here too changes were made. Based on recommendations of a contractually required, independent engineering firm (Sparks Engineering, Inc.), the support structure and rigging design were changed from a single point suspension of the fuselage to a double point suspension; see the following sketches.

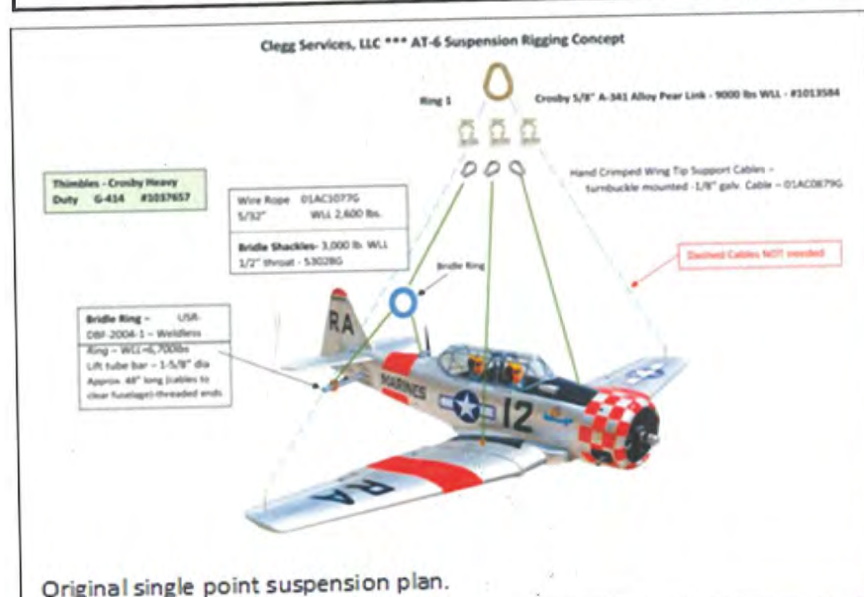
AT-6 "Texan" Aircraft Part 3



On floor jacks ready for rigging fixtures and cables.



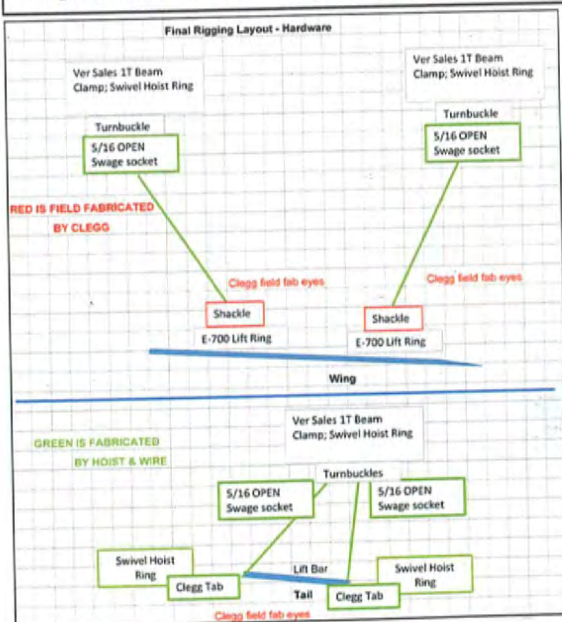
Measuring the primary cables.



Beam clamps provide attachment points for the 5/16" steel rigging cables. Open swage sockets pin the cable to the beam clamps. The lower end of the main cables connect to the aircraft near the wing stubs by means of shackles and the original hardware (E-700 Lift Rings) mounted into the threaded lifting structure.



Main beam clamps with cable ready to install



Pictures of the hardware are shown



Open Swage Socket



E-700 Lift Ring



Primary cables rigged in place. Getting ready for the tail plane

AT-6 "Texan" Aircraft Part 3



Cables fastened with a swaged socket to beam clamps on gantry beam

The tailplane section was rigged to a third point, stabilizing the aircraft while suspended over the atrium.



Close up of tail plane rigging; sling attached to lift bar inserted through aircraft lift tube.



Tail plane cable rigged in place to beam clamp.

The tailplane rigging was accomplished using a lift bar inserted into the structural tube designed for that purpose. A transfer plate is fastened to the lift bar which also holds the bridle shackle. The cable end consists of a field crimped loop around a thimble.

Removing Scaffolding

This step of the process was critical. In order to take the scaffolding out from under the aircraft we used 1.5 ton chain hoists to lift the aircraft off the "dance floor." After securing the hoists, Bilt-Rite Scaffold company hands lowered the scaffold enough to allow the Clegg team to let the AT-6 down and hang freely from the gantry beams by the pre-determined cable lengths for the specified orientation; nose down in



View of scaffold with aircraft lifted off the floor surface.



The AT-6 in place ready for the scaffold to be partially removed.

AT-6 "Texan" Aircraft Part 3



1.5 ton chain hoist lifting aircraft off the "dance floor."



Scaffolding tear down in process; aircraft fully suspended.



The Bullock Texas State History Museum Staff – Austin TX

After a thorough clean up, we were done!

John Clegg stated: "As always, our program plan was developed with emphasis on safety during all phases of the project. Then we lay out the major tasks in the most effective, logical order; but remain flexible."

"Thanks to **Toni Beldock**, Head of Exhibit Production, and her staff for their cooperation and guidance during this project." *The Clegg family*



A Texan on the Move ... now flying three stories over the Bullock Museum Atrium