# WACO 10 Build Along #1

Category: Build Alongs
Created on Friday, 29 April 2011 23:07
Written by Ron Peterka

## WACO 10-SCALE BUILD-ALONG WITH RON

Ron Peterka

Recently a good friend offered me a challenge I just couldn't refuse.He had an older Ikon N West Waco -10sport biplane kit he wanted me to look at with the possibility of making the sport-scale model into a reasonably competitive scale model.One kink was that he had already done the basic framing of the complete model.

Over the next several months I propose a running narrative on the Mirimar Flyers Scale articles website of the problems and changes needed to build this model to a nice 1:4.5 scale model.I will be doing the conversion changes and will hand over the model for covering, finishing details, and paint.If you have a comment or suggestion, please write, or call at ron3180x@aol.com or (760) 788-9022.

PRELIMINARY

Documentation:Chuck (the model owner) supplied a well thought out and comprehensive documentation for contest work with three views and photos of the aircraft we are modeling.He also provided the kit plans and a color photo pack with numerous photos taken from various angles and in close up detail.IN other words Chuck did his homework.You can imagine how tough it might be to have a model nearly complete and then find no good documentation available.

ALWAYS start with documentation and make the model match that documentation if you plan on a competition life after building.Having done it both ways, I can tell you it is better, less expensive, and requires much less rebuilding.

Changes:Looking over the plans and comparing them to the photos I started with the fuselage, vertical and horizontal stabilizers, and landing gear.There were many changes needed.Among them…..

- The scale given by the kit manufacturer claimed ¼ scale, but the actual scale worked out to be 1:4.5 compared to the actual wingspan of the model.No big problem, but all measurements will use a 1:4.5 conversion to build the numerous details.The plans are very elementary with very little detail.
- Since many sport models increase the area of the horizontal stabilizer for easier flight handling, I checked the plans and found a reasonable 10% increase in stabilizer area.Scalemaster rules would dictate a full point loss if this discrepancy was noted in static judging, but the rules do allow "up to 5% variation from exact scale" with no point loss.The stab and elevator each had a laminated edge, which had little tolerance for change, so a new structure was built with a redesign of the horiz. Stab inboard structure to show a gap between the forward portion of the stab and the fuselage.The elevator structure was redesigned to tie the two elevators together and hide the control arm inside the fuselage.
- The plans made no provision for engine down-thrust or side-thrust so engine mounting mods were made to include about 2 degrees down and right thrust.This required the engine to be mounted off center so the prop shaft will exit the cowl at the thrust center-line.

Well, this presents some preliminary thoughts and changes.Next time I'll outline some more changes and the considerations I looked at while deciding whether this would make a good competition model in the first place.The landing gear offered some thought provoking design problems to build a scale shock absorbing landing gear.

Ron

# WACO 10 Build Along #2

Category: Build Alongs

Created on Wednesday, 25 May 2011 21:46

Written by Ron Peterka

Hits: 290

## WACO - 10 BUILD ALONG

Recently I have been working on changing the bent music wire landing gear to the bolted on assembly used on the full scale aircraft. It looks like I will be using some heavy wall 1/4 " dia steel tubing I have available to make the legs and braze the two main frames together at the axle with the 3/16 " dia axle fused in there too. This makes up as an 'A' frame with each leg bolting to the fuselage at the bottom center line on heavy bracket.

The shock strut will connect at the axle and I made up from two pieces of the steel tubing and an outer telescoping brass tube with a stout spring in the center that will be covered by the brass tube. It bolts onto the fuselage near the top of the frame. The whole thing telescopes to compress the spring and take up some of the landing shock. The last item will be deciding on how to limit the extension of the shock strut.

Im the meantime I have carved out a pine pattern for the twin exhaust stacks of the original. The next step will be to create a mould to make multiple duplicates. Since the full-scale craft used water cooling and the model uses an air-cooled engine I will have to get creative about finding airflow for cooling. Cooling air will be exit through the hollow fiberglass exhaust stacks and around the edges of the stacks. Some cooling air will flow out of the opening around the forward main landing gear mount. I can also make a lightweight tunnel to carry air through the firewall and out the open forward cockpit.

Scratch building provides nearly infinite challenges to overcome during the build. I love it!

# WACO 10 Build Along #3

Category: Build Alongs
Created on Monday, 13 June 2011 20:04
Written by Ron Peterka
Hits: 281

Well, if you build scale models from plans, either purchased or your own you will be constantly checking to see if the plans are consistent from one drawing to the next. On the Waco I found, among other errors, that the side view showing the wing support struts had a wing chord 1/2 inch longer than the top view of the wings. This changed the angle of one support strut location by 1/2 inch. This caused a comprehensive review of the other dimensions of the center section. Better to find a problem early rather than later.

Another problem came up when I noticed that the kit plans used planked leading edges about 2 inches back from the leading edges. Comparison with the three views and documentation photos showed false ribs between each wing rib. Not just one, but two false ribs between each full rib! Not just false ribs, but false ribs showing on the upper leading edge only. Several beers later I decided I would have to ignore the sheeting and install the false ribs to get the real scale 'look'. Over one hundred new false ribs later I was ready to complete the wing panels. IF YOU DON'T LIKE BUILDING WINGS, DO NOT BUILD BIPLANES, OR, GOD FORBID, TRI-PLANES. I had forgotten how much longer a biplane takes to build than a mono-plane.

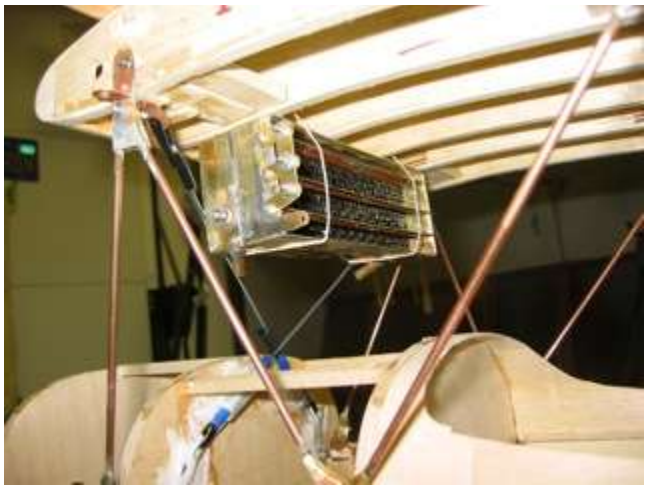
The landing gear re-design from the sport scale version looks like it works. A friend who is a great welder has welded the main gear struts into a reinforced vee and I am preparing the preliminary structure for welding in the 3/16" axle and the attach point for the shock strut. It will look very scale and still be sufficiently strong to handle landing and take-off loads. Photos will follow when the gear is finished.

Until next time try scale building. Your Psychologist will welcome the additional treatment sessions occasioned by this obsession.

# WACO 10 Build Along #4

Category: Build Alongs

Created on Saturday, 02 July 2011 22:44
Written by Ron Peterka
Hits: 236



The Waco moves along. The center section cabane struts are built using welding rod, brass plates and silver solder to mimic the scale struts. Balsa or spruce fairings go on next. The radiator is built up from soda straws for the honeycomb core and sheet brass enclosure just like the full-scale aircraft. The three vanes at the rear of the radiator were used to control the engine coolant temperature by controlling how much air went through the radiator. Anti-freeze kept the coolant from freezing in cold weather. The photo shows the first trial fit and wood spacers and hold down bales need to be completed yet. The cable strut supports (see the blue guide tubes) are removable for installing the fuselage turtle deck. They are adjustable.

Until next time.... keep building, keep flying.

## WACO 10 Build Along #5

Category: Build Alongs
Created on Wednesday, 20 July 2011 03:31
Written by Ron Peterka
Hits: 174

Recent work has been to design and build the servo mounts for the elevator and rudder. The servos are mounted on a light ply base which is screwed in place to make it removable for servicing, adjustment, or replacement. The elevator pushrod is a carbon fiber arrow shaft with a heavy duty arm on the HD servo.

The rudder servo is set up to drive a home made fiberglass bellcrank which in turn carries any tension from the pull-pull rudder cables. The cables will be left unfinished until the rudder is covered and mounted.

One of my big things is to design all installations of possible serviceable items to be, in fact, serviceable. So the switches, batteries, fuel tank, servos, and battery/transmitter tray are all removable with a few screws and plugs. The model will have dual battery packs with a "battery backer" electronic switch that chooses the better pack if one fails. The batteries are charged and switched separately. The model has a choke and throttle servo mounted next to the fuel tank with non-metallic pushrods to minimize electronic interference from the gas engine magneto.

Another item under construction, but not yet finished is a scale landing gear that will look scale and have shock absorbing action.

So, until the next installment, keep building and flying.

## WACO 10 Build along #6

Category: Build Alongs
Created on Sunday, 11 September 2011 19:22
Written by Ron Peterka
Hits: 124

Well, there is finally some progress on the landing gear. The shock struts have been designed and preliminary construction is complete. The lower Vee struts are 1/4"OD heavy wall stainless steel tubing welded into a plate at the outboard end. The vertical shock strut is bolted onto a tab that is bolted to the welded plate at the outboard end of the gear. Movement is controlled by springs inside the brass outer sleeve and is about 3/4 inch limited by two press fit steel 'roll pins'. The compression can be controlled by the length of springs in the shock strut.

The wheels shown in the picture are just for building and the scale wheels will be larger six inch diameter and very narrow, as the wheels in the good old days often were. All six struts will have wooden aerodynamic fairings added also. It's been quite a bit of work to come up with this design because the full scale hydraulic struts were so narrow.

Both sets of wings have been sanded and the hinges and servos installed in the lower wings with scale linkage. The next step will be to design and install the wing to fuselage/center section with the plan to be able to remove each pair of upper and lower wings as a unit for storage and transportation. The model will have a full set of flat steel flying and landing wires that will be hand made to fit. I hope to remove a hand-full of screws, disconnect a servo lead, and install a foam or plywood spacer to maintain the wing spacing. I'll put an article in the Scale Articles section when I get that going. It requires silver soldering modified screws to 1/8 inch wide flat steel material. The flat steel is available from Proctor models in rolls.

## WACO 10 Build along #7

Category: Build Alongs
Created on Monday, 05 December 2011 18:01
Written by Ron Peterka

Well, it’s been some time since the last build along. It’s November now and work on the Waco has been sporadic since my buddy Curtis and I competed at the Scalemasters National Championships (4th in Team Class) at Fresno. The model was damaged slightly and I have been working on repairing it to contest standards.

Another problem for writing this build-along is that the current part of the build is attaching the four wing panels to the two center sections in a way that the wings can be removed if necessary for travel without completely re-rigging the flying and landing wires each time the wings need to be removed. This took some engineering because the plans have no detail and it appears the original model had the upper wing in a one-piece configuration.

After some experimentation and trial fitting I came up with a set of eighteen brass fittings so the flying and landing wires will be left on the wings and only one pair of wires will need to be removed from the fuselage attachment on each side to remove the wings. Oh, the lower wing servo leads will need to be removed also.

I plan to have a foam spacer that will fit between the wings at the root end that, along with the inter-plane 'N' struts will hold the wings in alignment while removed from the fuselage.

These fittings are pretty small and don't photograph very well so this report has no photos. Maybe Santa will have a new fancy camera for me at Christmas so I can get better close-up photos.

The flying wires will be made from 1/8" wide steel strips silver soldered to 3/32 inch welding rod that have 2-56 threads on each end. DuBro fittings will with 2-56 female threads then bolt onto tabs mounted in scale locations on the wing surfaces. These flying wires are absolutely functional and required to keep the wings in place and attached to the fuselage to carry the flight loads.

As soon as the flying wire mounts are done and I can actually mount the wings to the fuselage I will have to manufacture the 'N' strut assemblies, and they will need to be adjustable for flight trimming

Building the mounting points for the flying wires took some time too, as did adding the control horn connections between the ailerons on each pair of wings (4 more fittings and mounts). A servo in each bottom wing actuates both the ailerons for the upper and lower wing.

To tell the truth, if I never build another biplane, it won't break my heart even a little bit. But then, I've said that before after building a smaller biplane years ago. This model had an additional challenge in that it had been framed out before the decision was made to make it a more precision scale model. A lot of the design work could have been done before construction started and the bits added during framing that would have reduced the required labor considerably.

There has been progress and the model should be ready for covering in a not too distant future.

Ron Peterka

## WACO 10 Build along #8

Category: Build Alongs
Created on Monday, 09 January 2012 16:42
Written by Ron Peterka
Hits: 141

Well, I agreed to do an upgrade on the Waco airframe from a 'sport' model to a 'competitive' level and the job is close to being finished. The last big hurdle of making all the cable and aerodynamic flying, landing, and bracing wires is complete. You can see from the the detail photo that it gets pretty crowded between the wings. Four 'flying' wires for each side and two 'landing wires for each wing. two wire braces on each inter-plane strut. That comes to a total of twenty four manufactured ends and eight clevis ends plus almost twenty five feet of 1/8 inch wide flat steel material and a couple of feet of steel fishing leader for the strut braces.

Flying wires are the cables or rolled aerodynamic steel supports that run to the bottom of the wing(s) that take up the flight loads lifting the wings. Landing wires are generally the same materials leading to the top of the wing to absorb downward loads during landing and inverted flight loads. Between the two sets of 'wires' the wings are very rigidly supported and can be rigged to balance wing lift from side to side,or set wing dihedral. In some old-timers there are paired wires side by side to make a stronger brace. ON full scale aircraft the wire ends are threaded one end 'right hand' and the other end 'left handed' so the 'wire' can be installed slightly loose and then rotated to tighten or loosen the rigging. On models finding left handed threaded dies or taps is not a readily available option so we have to make do with adjustable clevis ends and install the clevis to the airframe as tight as possible.

Each flying wire end was made from a 1 3/4" length of 1/8" dia. welding rod. A 1/2" section is threaded by using a 5-40 die, and then going over that with a 4-40 die to finish the threads. A section of about one inch was ground to create a flat section on the end opposite the threaded end to about the center of the rod. A DuBro #335 steel 4-40 threaded end clevis that uses a 2-56 bolt to attach the end to the airframe. This model required designing and manufacturing a large number of brass or aluminum fittings and brackets.

With the wings attached and supported close to their final position the two ends of each wire are bolted into place and the length of the wire is set by the distance overlapping the two ground flats. After removing the ends, the 1/8" wide spring steel material, available from Proctor models in 25 ft coils, is then silver soldered. Silver solder is a mix of about 2% silver and tin. It is much stronger than common lead free solder and requires an acid flux hta must be removed after soldering to prevent severe rusting.

Most of the flying and landing wires are attached only to the wings themselves, unlike on the full scale airframe where the wires would attach to the fuselage or cabane structure. On the model you can remove one wing set by removing two flying wires at the fuselage and four screws at the wing root. A thick foam filler can be inserted between the wing roots for transport.

Assembly at the field should take minimal time and effort. The DuBro clevis ends look more 'scale' than the pin type control clevis. The flying wires make a very rigid assembly resisting flight and landing loads efficiently.

This challenge has been an interesting and satisfying effort that makes modeling such a joy to me. At this point it is impossible to say how the model will actually fly, but the original sport scale model is said to fly nicely. I'll try and return with a progress after the model is covered and test flown. It is intended to be flown in the U.S. Scalemasters Open Class which allows the pilot to enter an aircraft exempt from the "builder of the model" rule where it would be qualified.

## WACO -10 Build along (Correction)

Category: Build Alongs
Created on Wednesday, 11 January 2012 23:52
Written by Ron Peterka
Hits: 159

CORRECTION

This is a correction to the last Build Along #8. In that article I stated that the Waco was to be flown in Open Competition. I was wrong!

The work I did does not constitute a major part of construction since it was framed before I added changes and the owner plans to cover, finish, and add final detail so the model will qualify properly for Team Scale under the AMA and U.S. Scalemasters rules.

I apologize for the misunderstanding.

Ron Peterka

## WACO -10 Build along #4

Category: Build Alongs
Created on Thursday, 16 August 2012 18:11
Written by Ron Peterka
Hits: 250

Well, the Waco is now essentially completed. Final assembly was a race to see if it could be flown at the Scalemasters Championships in September 2012. That will not happen because the major builder and owner, Check Maitre passed away on August 15 of this year. Ironically, the final details were being added on the night before he died.

Chuck had covered the model and painted it, and due to his illness, had asked me to add the registration numbers and logo decals. I was then to do the final assembly in preparation for first flights.

The model weighs just under 18 pounds dry. The span is 73.5 inches and length is 56.5 inches. 1600 sq in of wing and 25 oz/sq ft loading. The Fuji BT24 engine is 24cc, or 1.46 cu inch displacement. The flying and landing wires are fully functional. The model should fly very realistically.

There are many who will miss Chuck and the model will be flown in his honor and memory.


I wish you fair weather and safe landings Chuck