

By Frank Roales

Over the years the most widely produced transport aircraft in the world was the well-known DC-3. Not as commonly known is the fact that the German Junkers Ju52-3m holds down second place with an estimated 4835 of them being built in many different countries. They were used for everything from airliners to bombers, but most of the 4200 military ordered aircraft were transports. Making its first flight in 1932, the Junkers takeoff and landing performance was superior to the DC-3, but it had a lower ceiling and top speed. It was such a good aircraft, however, that it was produced as late as 1952 as the Spanish CASA 352/3m. The very good short field performance and low-slow flight of this aircraft made it a very good battlefield transport.

The same things that made the Ju52-3m a good full size aircraft also make it an excellent choice for a multi-engine model. It is often overlooked, however, because of the difficulty of reproducing the corrugated skin for true scale. This model, however, is not intended to be a true scale project but rather one to sport fly and perhaps enter in a fun scale meet where the lack of skin texture is of little value compared to the fine flying habits of this aircraft.

If you must have a reason for the smooth skin of this model consider this possible scenario. Early in 1941 the Luftwaffe high command saw a need to increase the speed and simplify construction of the Ju52-3m. Because they wanted to do this with a minimum of re-tooling and re-engineering it was decided not to change the basic airframe but only to improve minor aspects of the aircraft. The significant change was to be the use of a smooth skin rather than the corrugated one, also the flying surfaces were enlarged somewhat and the controls were incorporated into them instead of being externally mounted. This one-of-a-kind prototype was designated Ju52-3m(s). The (s) was for smooth, it was given the registration number EKIV for the testing division's (EK) first prototype (IV). While the prototype performed well it did not gain enough performance or ease construction enough to justify a change in production and the Ju52-3m(s) was never produced. It sounds good anyway!

This model aircraft features a few changes to its scale outline to enhance the flying qualities a bit. However, since it still looks like what it is supposed to be, it is a good choice for the A.M.A. fun scale event as well as just sport flying and showing off your multi engine skills. As we learned in the early days of flying, the tri-motor concept is the safest of all the multi engine setups. Therefore, when I was choosing a plane that would be used mainly for sport flying I decided that this was the way to go for a multi. Since the heart of any good multi is good reliable engines, I chose what I think is the best .20 size engine made for power and reliability, the K&B .20 Sportster. It also has the added benefit of being very quiet so that the great multi engine sound is not that unrealistic 2-cycle scream. As with any good flying aircraft, weight must be kept as low as possible so I used the old "stick" type construction as much as possible. This resulted in a three engine, eight servo, 84" model that is just over 10 lbs. ready to fly. So select your wood with an eye toward weight as well as strength according to where it is to be used.

With any worthwhile project the outcome depends a lot on the preparation. Study the plans and materials list before gathering your wood and choose wood according to its use. Some places will require harder balsa than others and, obviously, the wood in the tail must be chosen for weight as well as strength. Also, do not be tempted to substitute balsa for spruce; doing so will weaken the aircraft. After you have chosen your wood, use the plans to make a kit of all the parts that must be cut out. The reason for doing it this way is twofold: first, the actual building time will be much quicker if you don't have to stop and make each part as you need it; and second, since large paper plan sheets will change size with changes in the weather, if you don't cut out all the parts at the same time they may not fit as well as they should. As you build, remember that a strong light aircraft not only flies better but in the event of a crash will suffer less damage. So be sure to make good use of CA adhesives, sandpaper, and mylar covering. Think light...

CONSTRUCTION

Fuselage:

Lay the plans out on your flat building board and cover them with waxed paper or some other kind of clear covering. I find that the backing you remove from Super MonoKote does a really good job for this. First laminate the wing saddles and nose filler side blocks of 1/8" ply and 1/8" balsa being sure to make a right and left of each. Using the wing saddle with the ply side up for a starting point, build the right fuselage side directly on the plans using 1/4" spruce for the longerons and noted uprights, and 1/4" hard balsa for the rest. Be sure that the wing saddle and nose filler have their balsa side flat on the plans. When this side is dry, and while still on the plans, run a sanding block over the side to true it. Without removing the left side, place a layer of whatever you covered the plans with over the completed side. You will now build the left side directly over the right one thus insuring that both sides are the same. Just be sure that this time the wing saddle and nose filler have their ply side down. Using spacers as needed, add the elevator pushrod exit guide making it flush with the surface. Then run your sanding block over this side. Remove both sides from the building surface and turn them over so you can true up this side with your sanding block. Place them top to top so you will have one right side and one left side. Using 1/32" plywood, install the gussets as shown on the inside of each joint except for those using the 1/4" balsa filler gusset. **Do not** omit any of these gussets as they add no weight to speak of, but add quite a bit of strength and rigidity to the fuselage structure.

Before joining the fuselage sides make up the firewall assembly using the 1/4" ply sub-firewall and engine mount plate. The length of the mount plate sides can be adjusted to suit the engine you are using; the bottom also can be changed to suit. All firewall joints on both the fuselage and the nacelles are made with epoxy. Be sure to note the location of the triangle stock for bracing. Mark and drill the mount plate for the engine mount you are using and install the blind nuts. You can then drill the holes for the fuel line and throttle linkage as needed at the correct location.

Place the completed fuselage sides top down over the top view on the plans and add the cross braces; note if they are balsa or spruce and check to be sure that the ply gussets are on the inside. Using a square and/or builders triangles, add the firewall assembly and lower cross braces keeping everything square. Next add the 1/4" ply wing hold-downs, 1/2" filler block and the top and bottom balsa/ply filler blocks with the balsa to the outside. Now add the 1/4" balsa cross gussets at the cross braces fitting them carefully, as the better they fit the stronger the joint will be. Remove the assembly from the plans and add the formers for the fuselage top if you plan to use the balsa top. If you plan to use the foam top, add it now. I used foam at first but found that I had trouble when it came time to cover so I switched to balsa and found that a built-up top was just as light and much easier to cover — but suit yourself.

Fiberglass Fuselage Nose:

The fiberglass nose of the fuselage is made by what I call a "lost from process." Start by blocking up a rough shape using 2" blue insulation foam glued together with white glue. Mark the location of the front opening and glue a copy of the fuselage sub-firewall (made 1/16" smaller all around) to the rear. (The 1/16" is to allow for the thickness of the fiberglass.) Now shape the foam to the outline shown on the plans keeping it 1/16" smaller all over. I used a sureform tool and 80 grit sandpaper for shaping. When you are satisfied with the shape, coat the mold with a mixture of micro-balloons and epoxy, making sure that all the foam is covered. After it is dry, give it a final sanding and a good coat of paste wax. Put a handle on the wood end so you can hold it in a vise. Using 2 oz. K&B glass cloth and resin, proceed as follows: Cover the mold dry with the cloth and brush the resin through the cloth smoothing it as you go. When it is semi-dry do it again adding a second layer of 2 oz. cloth and resin. When dry, cover with a mixture of resin and micro-balloons letting it all set up. When set up, trim off the excess flush with the backplate and sand smooth. Remove the wood back and dissolve the foam with a solvent (be sure to do this outside). After sanding smooth, make the cutouts for your engine and clean the surfaces and you will have a very good looking fiberglass nose ready for paint.

Cowlings:

The cowlings on this aircraft are made from the bottom of any 2-liter soft drink bottle (I used RC Cola of course). The one on the fuselage is just the bottom cap while the ones on the nacelles use part of the bottle also. The easy way to get the bottom caps off the bottle is to place the bottle in a microwave for about 25 seconds or so and the cap will pull right off. All that is required then for the main cowling is to make the cutouts to suit your engine. For the nacelle engines, cut the bottle to length before making the cutouts, then paint it to match on the inside. That way, the cowling will remain the same as the main one and the paint will be protected. Make up spruce stand-off blocks to mount the cowls to the firewalls.

Tail Surfaces:

Build the fin, rudder, stabilizer, and elevator over the plans as you did the fuselage sides. The only thing worthy of note here is the use of a 1/8" spruce stiffener on the leading edge of the fin and stabilizer. The 1/8" x 1/2" ribs will have to be notched at the front to fit. The elevator is made from 1/2" x 2" aileron stock using 1/2" balsa for the "ears." If you wish you may use 1" holes in the elevator to lighten it. Remember to use light but firm wood for all tail surfaces. After all of these parts are finished, sand each one on both sides by laying the part flat on your building board and using a sanding block to true it up. Then taper the hinge lines and round the leading edges. After shaping the trailing edges you are ready to cover, hinge, and add the control horns to these parts before final assembly.

Wing:

I will describe the building of the wing in separate parts since we will build five panels before we begin to join them all up. We will start with the outer panels first since they are the simplest.

The whole wing is shown on the plans so all panels can be built right side up directly on them. To build the outer wing panels start with the 3/32" balsa D tube sheet, place it on the plans as shown (you did remember to cover the plans didn't you?), add the 1/8" x 1/4" spruce front spar and CA it in place. Now position the rear spar as shown shimming it up with 3/32" scrap. You can then add the ribs making sure that they are vertical. CA the ribs to the spars and D tube sheeting and trim the front edge of the sheeting to match the ribs in preparation for the leading edge. Add the shear webbing at this time if you didn't use it to space your ribs, (a good idea) but be sure to omit it at the wing joiner locations. This will be done later when the wing attachment system is installed. Next, the leading and trailing edge stock is CAed in place making sure that the wing remains flat. The upper spar is now installed. Make sure that you have a good fit at all joints and add the gussets now, but not the top sheeting. The other outer panel is now constructed in a similar manner.

The outer part of the center section will be built next. These will be very much like the outer ones with only a few differences. Again, lay down the D tube sheeting and add the 1/4" x 3/8" bottom spar and sheeting for the inner ribs. Then add the rear spar as shown using 3/32" scrap as necessary to maintain the correct height. Add the ribs and shear webbing remembering to leave it out of the outer bays for now. The leading and trailing edge stock is now added; be sure to keep everything true and flat. Cut rib R1B for the dihedral brace if you have not already done so. Build the other side in a similar manner. With these panels at this stage of construction we are now ready to install the wing attachment system.

Wing Attachment System:

I also fly sailplanes and in fact am very close to getting my Level 4 with L.S.F. so it was quite natural that I would use some glider technology in this area. The method I chose and the one described here has proven itself in gliders for many years. It has also proven itself on my prototype Junkers by virtue of many flights without any problems or failures. With that background, let's get to it.

Cut your 36" piece of 7/32" brass tubing into four 9" pieces and plug both ends of each piece with balsa to a depth of about 3/8"; CA this in. Now using two of these for each wing panel, push them into the holes in W4 and W5 to one half their length, then slide the outer wing panel on for a test fit. You must be very sure that the two panels are lined up exactly. It may be necessary to adjust the holes in the ribs to insure that the tubes are exactly parallel to each other and to the bottom of the wing. This will insure that the 3/16" wing rods will fit as they should. Now tack the inner ends of the tubes in place and fill the void between the tubes and spars with 1/4" balsa. Check again that everything is square and then push the outer panel onto the tubes. When you are satisfied that everything is right, fill the spaces in the outer panel as you did the inner one and tack glue. Using a razor saw cut the two brass tubes between W5 and W6 and separate the panels. De-burr the ends of the brass tubing and cut four 8" pieces of 3/16" music wire for the joiner rods. Slide the rods into the tubes in one side and test fit the other to it. If you have done everything correctly it should slide right together and everything will line up exactly. If this is so, then leave it together and use epoxy to glue in all tubes and fill in their present locations, being careful not to get any epoxy into the tubes. If the fit is not quite right make any adjustments necessary before you epoxy the tubes in place.

Using the holes in W5 and W6 and the instructions supplied with the Ace R/C Wing Attach System, install as shown making sure everything fits as it should and latches up well. You will note a slight gap when it is installed between W5 and W6 which will be taken care of later with 1/16" balsa fill rib as shown in the Ace instructions.

Center Section Continued:

Finish up the outer center section by installing the dihedral brace and top spars, being sure that the braces are fitted well and at the correct angle before epoxying them in.

Wing Center:

Place the front lower 3/32" balsa sheeting over the plans and glue on the 1/4" ply landing gear plate as shown and add the lower spars and leading and trailing edges. Note that the rear spar is spaced up 3/32" and the front sheeting is cut at the edge of the ply landing gear plate to fit the curve of the outer ribs W1A and W1B. Add ribs W1A making sure they are vertical and then W1B. When installing W1B use the rib angle template on the plans to get the correct angle for the outer center panel connection at the dihedral break. If you haven't already done so, cut ribs W1B for the dihedral braces. Now add the 1/2" triangle stock at the ply landing gear plate and the 1/2" filler blocks at the rear. Rib W1 can now be installed and the 1/4" dowels and mounting holes located. Glue the shear webbing in the center bays and then the upper spars. Test fit all panels together and obtain the correct 3 1/2" dihedral at each tip. When this is correct, epoxy the panels together at the dihedral break. Before we put the top sheeting on, run the tubes for the flap nyrod, ailerons, and throttle wires as shown. The upper sheeting is then installed. You may also sheet the upper portion of the outer panels at this time.

Place the 1/16" balsa fill rib between W5 and W6 and put on the outer panel. Carve and shape the leading edge using the template on the plans. Sand these panels to match with a long sanding block and then remove the outer panels. CA the fill rib in place on W5. Using the plans as a guide, cut the leading edge and top sheeting to fit.

The final step in the wing construction is to install the nacelles. Each nacelle is built as a sub-assembly and then fitted to the wing center section. Use epoxy on all of these joints and be sure to note the use of 1/8" dowels at the leading edge. Both firewalls will be at 0° to the bottom of the wing and 90° to the leading edge. This will give you the proper thrust. While this may look like a lot to you let me assure you that it is scale and it works! You can then use a built-up or balsa block method to complete the shape of the nacelle.

Final Assembly:

Now is the time to fit everything together and check that all is okay before you put on the finish. Everything must be checked for proper alignment. Make sure that the stab and fin are at 90° to each other and that the stab is square to the fuselage and sits flat. Install the wing and check for proper fit and incidence. (0°). Install the Halco landing gear by drilling three holes in the landing gear plate and using 1/4-20 blind nuts. The front edge of the landing gear is located 1 1/2" aft of the wing leading edge. After you are sure everything fits well (but before you cover or finish anything) is the the best time to do your radio installation because it is much easier to get to everything now than after it is all covered up. I find that the weight of the covering makes no difference in the location of the C.G. So go ahead and install everything and balance the aircraft.

Finish:

You will find that there are many ways of marking your Ju52-3m. This aircraft was used not only by the military but also by many airliners and private companies. Therefore, there are many options for marking your aircraft if "fun scale" is your thing. Whatever markings you use, remember a light aircraft and one that looks good depends on one thing more than anything else — sandpaper.

The prototype was covered completely with Super MonoKote except for the nacelles and sub-cowls which were painted.

Radio Installation:

I did not use any special heavy duty servos in this aircraft. The only somewhat special equipment used was two long "Y" harnesses with Ace R/C noise traps and a 1200 mA 5 cell battery pack. The receiver was a standard Ace Model 91 and servos were six standard size and two minis of assorted makes.

The receiver is mounted in foam in the wing center section. The battery pack is located on a shelf in the fuselage, positioned to obtain the correct C.G. My on/off switch is hidden by making a false Direction Finding loop on top of the fuselage.

Standard sized rudder and elevator servos are used and control surface travel deflection amounts are shown on the plans. The ailerons are driven by one servo in each outer wing panel and are connected together with a "Y" harness with noise trap. Be sure to watch the rotation of these servos. The ailerons have differential throw with more up than down. This is accomplished with a rearward location of the control horns. Do not omit this differential throw as it eliminates adverse yaw and, together with rudder mixing, makes for a very smooth and stable flying aircraft. Rudder mixing can be either electronic in your transmitter or manually when you fly, but do use it. The throttles are all controlled by servos located directly behind the firewalls. The nacelle servos are "minis," connected with another "Y" harness and noise trap plugged into the normal throttle channel. The main engine uses a separate servo controlled by any proportional channel that is convenient for your use. Flaps are controlled by one servo, just be sure that they retract completely and together. As always, make all linkage hookups as short and straight as possible and use support on long pushrods such as the rudder and elevator. Also, keep all moving surfaces free of any slop.

Engines:

As with full size aircraft the heart of any good multi is the reliability of the engines used. I think that the engines I have chosen for this aircraft are the best .20 size engines available, bar none.

The K&B .20 Sportster is a very quiet, easy to start engine that produces very good power --- but the icing on the cake is its total reliability. These little, made in the U.S.A., jewels do require a longer break-in time than we have gotten used to but once they have 1-1 1/2 hours of rich running on them, they are just a pure joy to use. I have found the following to be true of all of my K&B .20's (I have 5): (1) They do require at least one hour of break-in. (2) They run fine without pressure. (3) They are quite tolerant of tank location. (4) Best prop seems to be a 9X4 Master Airscrew. (5) They all seem to run well and reliably at about 2 3/4 turns out which gives me about 10,500 rpm. (6) Do use the muffler; removing it doesn't make enough rpm difference to justify butchering this quiet little gem.

Pre-flight Notes:

The prototype was one of those rare birds that designers dream of --- one that flew as good as it looked. I had made all the right choices and all that was required before the second flight was two turns of down trim to center the elevator trim.

I fly with an Ace Silver Seven Single Stick and have my transmitter set up as follows: The nacelle engine throttles are by way of the "Y" harness both controlled by the normal throttle channel. The nose engine is controlled from the Aux. 1 channel which is located on the top right of the transmitter directly above the normal throttle. In this way, it is easy to reach and use and I have separate control of the nose engine which gives me a greater margin of safety in case of an outer engine flame-out. If that does happen, I can throttle back the other outer engine and go to full power on the nose engine. This aircraft will fly in that configuration and you will have no trouble getting back to the field from anywhere if you just keep every turn wide and easy.

Control throws are shown on the plans and I have the mixer of my Silver Seven set up so when full aileron is reached the rudder is at max also. The C.G. location shown on the plans has proven very good and this aircraft can be slowed down with or without flaps despite the highly tapered wing.

Pre-flight:

Perhaps the best way to tell about the flying of this aircraft is to describe a typical flight.

After arriving at the field and completing the assembly of the aircraft, I fill all tanks and start each engine one at a time warming it up and going to full power while I hold the nose vertical for about 10 seconds to make sure that it is not set too lean. Returning the aircraft to the ground, I richen the needle valve 1 or 2 clicks in order to obtain the most dependable rpm for my K&B .20s which seems to be about 10,000 to 10,500 rpm on a 9X4 Master Airscrew. While this is not max rpm it will give more than enough power and is highly dependable. After this is done on each engine (one at a time) they are shut down and the aircraft is refueled. Now all engines are started and warmed up. Do not readjust any one engine or attempt to synchronize them. If you have followed this procedure all will be well and they will tend to self-synchronize in flight. If all is not well then shut down completely and start over. Remember, do not adjust any one engine during the final run-up and don't try to get maximum power out of the engines, three .20's are plenty of power for this aircraft and you want dependable engines even at the cost of slightly reduced power. This is not a fast flying fighter but a low and slow transport.

Flying:

With all engines running well and idling, I start my taxi out to the runway with the nose engine only. If you are flying from a hard surface or very short grass this is all the power you will need to taxi, but if the grass is long you may need to use the outer engines also at low settings. In either case, taxi at low speeds and hold the tail down with full up elevator. You will really enjoy seeing and hearing this bird taxi.

When you reach the runway turn into the wind and restrain the aircraft while you run the engines up to full power for a final check and to clear them out. With the engines back to idle start the takeoff by advancing the nose engine while holding the tail down. When you have full power on the nose engine bring up the outboards and let the tail come up. Maintain directional control with the rudder and by the time you have all engines up to full power Annie will be skipping lightly on her main gear wanting to fly. When enough airspeed has been established, just a touch of up will lift her into the air. Don't attempt to horse her off as she will fly off quite well when she is ready. Climb out straight ahead at a low angle (a transport remember?) and when you reach about 50' bring the outer engines back to about 2/3 power and continue your climb out. When you reach flying altitude reduce power on the nose engine to about that of the outboards. Then adjust your throttles to obtain the airspeed you want to fly at. I normally fly at about one half throttle in cruise. Remember this is not a fighter so fly it as it should be flown.

Keep your turns shallow and all your flying smooth and when you change altitude add or reduce power. (I always add power with nose engine first and reduce power with the outboard engines first.) This aircraft really loves to fly and is very realistic in flight with its graceful slow flying.

I set up my normal landings like this: On down wind about even with the landing spot I bring the outboard engines back to 1/4 throttle (or less) and bring up the nose to maintain airspeed. I then use the nose engine throttle to control the descent of the aircraft on base and final. When the landing is assured, I pull the power off all engines at about 4' or 5' and Annie will make a perfect wheel landing with the tail remaining in the air for quite a while until she slows way down. If you want to make a go around just add power (nose engine first) and do so — no problem.

As with any multi engine aircraft, don't take chances. If you lose any engine, **land**. I have no doubt that this aircraft will fly on any two engines; in fact, I have flown it and maintained altitude with both of the outer engines at idle using the nose engine only. A good saying is: "If they all ain't going around put it on the ground!"

As a final thought, remember what you are flying and keep all flying prototypical and your landing approach wide and long. You will find Annie is a joy to fly and the sound of those three engines is music to the ear.

If you have any comments or questions or just want to share a picture of your Annie with me send a SASE to Frank Roales, R.R.#3, Box 49B, Vincennes, Indiana 47591.

JUNKERS Ju52-3m

Designed By:
Frank Roales
TYPE AIRCRAFT
Tri Motor Fun Scale, Sport
WINGSPAN
84 Inches
WING CHORD
11 1/4 Inches (Avg.)
TOTAL WING AREA
972 Sq. In.
WING LOCATION
Bottom of Fuselage
AIRFOIL
Clark Y
WING PLANFORM
Double Taper
DIHEDRAL EACH TIP
3 1/2 Inches
OVERALL FUSELAGE LENGTH
53 Inches
RADIO COMPARTMENT SIZE
(L) 16" x (W) 5" x (H) 4"
STABILIZER SPAN
30 Inches
STABILIZER CHORD (incl. elev.)
6 1/2 Inches (Avg.)

STABILIZER AREA
182 Sq. In.
STAB AIRFOIL SECTION
Flat
STABILIZER LOCATION
Top of Fuselage
VERTICAL FIN HEIGHT
8 1/2 Inches
VERTICAL FIN WIDTH (incl. rud.)
7 Inches (Avg.)
REC. ENGINE SIZE
(3) .20 2-strokes
FUEL TANK SIZE
(2) 4 oz.; (1) 6 oz.
LANDING GEAR
Conventional
REC. NO. OF CHANNELS
6

CONTROL FUNCTIONS
Rud., Elev., Ail., Throt (2), Flaps
BASIC MATERIALS USED IN CONSTRUCTION
Fuselage Balsa, Ply, Spruce
Wing Balsa & Ply, & Spruce
Empennage Balsa
Wt. Ready To Fly .. 162 Oz. (10 Lbs. 2 Ozs.)
Wing Loading 24 Oz./Sq. Ft.