Douglas DC-3

GOLD EDITION™

Wingspan: 82-1/2" [2095 mm]
Wing Area: 750 sq. in. [48.4 sq. dm]
Weight: 8 - 10 Lbs. [3629 - 4536g]
Wing Loading: 24.6 - 30.7 oz./sq. ft. [75 - 94 g/sq. dm]
Fuselage Length: 55.5 in. [1410 mm]

WARRANTY..... Top Flite Models guarantees this kit to be free of defects in both material and workmanship at the date of purchase. This warranty does not cover any component parts damaged by use or modification. In no case shall Top Flite's liability exceed the original cost of the purchased kit. Further, Top Flite reserves the right to change or modify this warranty without notice. In that Top Flite has no control over the final assembly or material used for final assembly, no liability shall be assumed nor accepted for any damage resulting from the use by the user of the final user-assembled product. By the act of using the user-assembled product the user accepts all resulting liability. **If the buyer is not prepared to accept the liability associated with the use of this product, the buyer is advised to immediately return this kit in new and unused condition to the place of purchase.**

Top Flite Models P.O. Box 788 Urbana, Il 61803 **Technical Assistance Call (217)398-8970 productsupport@top-flite.com**

READ THROUGH THIS INSTRUCTION BOOK FIRST. IT CONTAINS IMPORTANT INSTRUCTIONS AND WARNINGS CONCERNING THE ASSEMBLY AND USE OF THIS MODEL.

TABLE OF CONTENTS
AND BUILDING SEQUENCE

PROTECT YOUR MODEL, YOURSELF & OTHERS FOLLOW THIS IMPORTANT SAFETY PRECAUTION

Your DC-3 is not a toy, but a sophisticated working model that functions very much like an actual airplane. Because of its realistic performance, if you do not assemble and operate your DC-3 correctly, you could possibly injure yourself or spectators and damage property.

To make your R/C modeling experience totally enjoyable, get assistance with assembly and your first flights from an experienced, knowledgeable modeler. You'll learn faster and avoid risking your model before you're truly ready to solo. Your local hobby shop has information about flying clubs in your area whose membership includes qualified instructors.

You can also contact the Academy of Model Aeronautics (AMA), which has more than 2,500 chartered clubs across the country. We recommend you join the AMA which will insure you at AMA club sites and events. AMA Membership is required at chartered club fields where qualified flight instructors are available.

Contact the AMA at the address or toll-free phone number below.

Academy of Model Aeronautics
5151 East Memorial Drive
Muncie, IN 47302
(800) 435-9262
Fax (765) 741-0057

or via the Internet at: http://www.modelaircraft.org

Your Top Flite Gold Edition DC-3 is intended for scale and general sport flying including mild aerobatics such as loops, stall turns, rolls, etc. Its structure is designed to withstand such stresses. If you intend to use your DC-3 for more rigorous types of flying such as aggressive aerobatics or flying from rough fields, it is your responsibility to reinforce areas of the model that will be subjected to the resulting unusually high stresses.

INTRODUCTION

Congratulations and thank you for purchasing the **Top Flite *Gold Edition* DC-3**. We are sure you are eager to build and fly your DC-3 just as we were eager to build and fly our prototypes. Although this is a model of a famous civilian transport, the Douglas DC-3, you can easily build your model as the C-47 military version. If this is your choice, all you really need to do is cover your

model in a military trim scheme, add cargo door outlines and a few more antennas here and there! Study your own documentation for more details.

The nice thing about the *Gold Edition* DC-3 is that although it is a highly detailed scale model with all the goodies such as a realistic looking scale outline, built up tail surfaces, retracts and flaps, it *is* a model of a transport plane so you'll have a stable model that you'll look forward to flying often! And with twin engines you're sure to get all the attention when you show up at your flying field!

One last note before you continue, we highly recommend you get some pictures or a book about DC-3's (or C-47's) or send for your documentation package as soon as possible. This way, you can study the drawings and photos to get a feel for how your DC-3 should look when you're done. This will also help you figure out what scale details to add and decide on a trim scheme (you can also dream about how cool your DC-3 is going to look when it's done!). One of the books we recommend is the Squadron Signal Publications *DC-3 in Action* book No. 39 (SSPZ1149). It features lots of historical and technical information as well as detailed drawings, photos, and trim schemes.

Well, this should be enough to get your juices flowing, so get your other projects off your workbench, say goodbye to your significant other for a while and...keep reading!

NOTE: We, as the kit manufacturer, provide you with a top quality kit and great instructions, but ultimately the quality and flyability of your finished model depends on how you build it; therefore, we cannot in any way guarantee the performance of your completed model, and no representations are expressed or implied as to the performance or safety of your completed model.

Please inspect all parts carefully before you start to build! If any parts are missing, broken or defective, or if you have any questions about building or flying this model, please call us at (217) 398-8970 or e-mail us at productsupport@top-flite.com and we'll be glad to help. If you are calling for replacement parts, please look up the part numbers and the kit identification number (stamped on the end of the carton) and have them ready when you call.

PRECAUTIONS

1. You must build the plane **according to the plan and instructions**. Do not alter or modify the model, as doing so may result in an unsafe or unflyable model. **In a few cases the plan and instructions may differ slightly from the photos. In those instances you should assume the plan and written instructions are correct.**

2. You **must** take time to **build straight, true** and **strong**.

3. You must use a proper R/C **radio** that is in first class condition, the correct sized **engines** and correct **components** (fuel tanks, wheels, etc.) throughout your building process.

4. You must properly **install** all R/C and other components so that the model operates properly on the ground and in the air.

5. You must **test** the operation of the model before every flight to insure that all equipment is operating and you must make certain that the model has remained structurally sound.

6. If you are not already an experienced R/C pilot, you must **fly** the model **only with the help** of a competent, experienced R/C pilot.

Remember: Take your time and follow instructions to end up with a well-built model that is straight and true.

DECISIONS YOU MUST MAKE

ENGINE SELECTION

Recommended engine size:
Two .25 to .40 cu. in. [4.0 to 6.5cc] **2-stroke**
Two .40 to .52 cu. in. [6.5 to 6.5cc] **4-stroke**
Two O.S. .30 cu. in [5cc] **rotary**

Your Top Flite Gold Edition DC-3 will perform well with any of the engines within the recommended range, but will handle best in an engine out situation with engines closer to the higher end of the recommended size range. The trade-off with larger engines is that you'll have to throttle back somewhat for your DC-3 to fly in a scale like manner. If you choose to use .25 2-strokes, we recommend stronger 2-strokes such as the O.S. .25 FX. If you choose to use .40 2-strokes, "sport" .40's such as the O.S. LA.40 perform well, but a .40 such as the O.S. FX series will handle an engine out situation better. It's the same for 4-stroke engines; the .40 4-strokes have plenty of power and will fly your DC well, but the .52's will handle an engine out situation better.

The included Great Planes Adjustable Engine Mounts will hold a range of engines from .25 cu. in. 2-stroke through .40 cu. in. 4-stroke. The rotary engines use their own integral backplate engine mounts.

RETRACTABLE LANDING GEAR

You may build your DC-3 either with fixed or retractable landing gear. All the hardware you need for realistic appearing fixed gear is supplied with this kit. We do, however, provide detailed instructions on how to install retractable landing gear available from Top Flite. The Top Flite retractable landing gear recommended and shown in this manual is custom made for this DC-3. They are pneumatic to simplify installation and hookup. You may choose to use another type of retract but it is up to you to make modifications required to fit them.

For Retractable Landing Gear you will need these items:

- ❏ Top Flite DC-3 Retracts (TOPQ8276)
- ❏ Robart #188VR Variable Rate Air Control Kit (ROBQ2302)
- ❏ Robart #164G Hand Pump with Gauge (ROBQ2363)
- ❏ Micro servo to operate air control valve
- ❏ (2) Nylon ball link and 1/16" ball (GPMQ3842)
- ❏ (4) 4-40 x 1/2" socket head cap screws (GPMQ3012)
- ❏ (4) 3/16" wheel collars (GPMQ4308)
- ❏ (4) #4 x 1/2" screws
- ❏ (2) #4 x 1/4" screws
- ❏ (4) 4-40 blind nuts

FLAPS

Your DC-3 is designed to incorporate scale split flaps; however, flaps are **optional** and not necessary for an excellent flying experience. Without flaps, the takeoff roll is longer and the landing speed is faster. If you do not wish to build the flaps, just disregard parts of the manual involving flap construction.

The flaps are not difficult to build, but they do require good craftsmanship to fit and operate well. Flaps add nicely to the model's flight characteristics and scale appearance. Slight trim changes are needed when flaps are extended. The trim corrections are discussed later in the manual during radio setup and you will find more information on the use of the flaps in the *Flying* section.

For Flaps, you will need these additional items:
Two Standard servos
Y-connector
Servo extensions (if not part of the Y-connector)

SCALE RUDDER

You may build your DC-3 with either a standard in-line hinged rudder or a scale appearing offset pinned hinge rudder. The in-line hinged rudder is easier to build and is hinged to the fin the same as any other model with supplied CA hinges. But, the offset pinned hinge features the offset hinge line characteristic of the DC-3. The scale appearing offset hinged rudder does require more craftsmanship to build than the standard rudder, so study the plans carefully and think about it before you begin that part of the model. All hardware required to build either version is included with this kit.

PROPELLERS

Although there is no urgency at this point to decide which propellers to use on your DC-3, we would like to mention that we have had great success during our flight testing using three-blade propellers. The nice thing about using three-blade propellers with your DC-3 is first of all, they provide more clearance between the propeller tip and the fuselage, and second, they are scale! On the O.S. .25 two-strokes we ran 10 x 4 three-blade propellers. On the O.S. .52 four-strokes we ran 10 x 6 three-blade propellers. As with any model, you may experiment with different propellers to find out what type works best for you. We used Great Planes Aluminum Spinner Hubs (GPMQ4630, 1/4-28 thread) which appear scale as well.

COMPETITION-MINDED MODELERS

We designed our DC-3 from scale three-view drawings supplied by Scale Model Research (address follows) and photos taken of various DC-3's. The scale of your Gold Edition DC-3 is 1:14, or one-fourteenth scale.

If you plan to enter your DC-3 in scale competition (it's lots of fun, and the runways are usually paved!), this kit qualifies for **Fun Scale** and the *Sportsman* and *Expert* classes in **Sport Scale**. Fun Scale and Sport Scale have the same flight requirements where you must perform ten maneuvers of which five are mandatory. The other five are up to you—easy stuff like cycling your landing gear, a slow, low "inspection pass" with flaps extended, or maybe a touch-and-go. If you have never competed in a scale contest, you could start out in Fun Scale. In Fun Scale, the only documentation you need for static judging is any proof that a full size aircraft of this type, in the paint/markings scheme on your model, did exist. A single photo, a kit box cover, even a painting is sufficient proof! If you're interested, contact the AMA for a rule book which will tell you everything you need to know. Look in the back of the AMA magazine (*Model Aviation*) for a schedule of events.

The trim scheme we selected for our prototype on the kit box cover is taken from Eastern Air Lines' DC-3-201 NC18124. The last passenger flight of this subject took place on October 12, 1952 after logging over 57,000 hours in the air. It was then displayed at the Smithsonian but now resides at the new National Air & Space Museum in Washington D.C.

If you are not concerned with a scale trim scheme you can make a variation of the one on the box, or design your own. If you are going to compete in scale competition use the photos in your documentation package as a guide for your trim scheme.

DOCUMENTATION

Three view drawings and photo packs of full size DC-3s are available from:

Scale Model Research
3114 Yukon Ave, Costa Mesa, CA 92626
(714) 979-8058
Fax: (714) 979-7279

Other sources of scale documentation include Squadron Signal Publication's book No. 1149 C-47 Skytrain in Action, and various static display models such as Monogram's No. 5610 1:48 scale Eastern Air Lines DC-3.

DESIGNER NOTES

THIS SECTION CONTAINS CRITICAL INFORMATION CONCERNING YOUR DC-3 MODEL

The Top Flite DC-3 is a sport scale model of the Douglas DC-3. The full size aircraft is gentle and forgiving, owing to its excellent design and limited power. It is a classic aircraft that has been flying for over sixty years. But, as an overpowered model, it can be difficult to fly. Past models of the DC-3, from other companies, have had a reputation for unforgiving flight characteristics. Not so the Top Flight DC-3. Built according to the instructions, you will be rewarded with an aircraft every bit as good as the full size DC-3. It is therefore essential that you build your model according to the instructions in this manual.

SCALE ACCURACY

The Top Flite DC-3 is a faithful reproduction of the full size aircraft, with a few exceptions. Flight testing of the prototype models showed the need for some changes to improve stability so that the average sport modeler could handle this twin engine model.

1. The chord at the wing tips has been increased by 8% to improve the stalling characteristics.
2. The scale airfoil blends into an S8037 at the tip to improve the stalling characteristics.
3. The wing tips have washout of 2 degrees.
4. The engine nacelles have been lengthened by 1/2" to allow room for retractable landing gear.
5. The engine nacelles have been moved 1/2" further away from the fuselage to improve prop clearance.
6. The vertical fin/rudder area has been increased by 25% to improve single engine handling.
7. The horizontal stab/elevator area has been increased by 23% to improve pitch control.
8. The engines incorporate 4 degrees of left/right thrust, and 6 degrees of down thrust.

POWER

With two .40 2-stroke engines (or .52 4-stroke) the model will fly very well, but not in a scale-like manner, as it will be overpowered. It will take off in under ten feet and climb like a typical overpowered model. Many modelers will like this, but this is not my idea of a sport scale model of a DC-3. Of course, one could control the throttles to fly the model in a scale-like manner and save the reserve power for times when it could be used effectively.

TWIN ENGINE AERODYNAMICS

A twin engine model flies no differently than a single engine model - as long as both engines are properly tuned and as long as both engines stay running! But - sooner or later, you will lose an engine. I ask you, how often do you lose an engine on your single engine models? You'll lose one **twice** that often on a twin!

If you lose an engine on a twin, there will be a directional control problem! If the right engine fails, the left engine will pull the nose of the aircraft to the right. On a full size aircraft you use rudder to control the yaw and carefully control the airspeed with the remaining engine. **Do not** use the rudder on this DC-3 if an engine quits. Flying at too slow an airspeed with one engine at full power could exceed the ability of the control surfaces to control the yaw.

But with a model, you are standing on the ground and can't really tell which engine quit. About the only thing you will notice from the ground when an engine fails is that the wing will drop slightly on that side and the nose will yaw a bit, much like hitting a bit of turbulence. You simply don't have enough visual clues to know which control inputs will help and which will hurt.

Fortunately, the Top Flite DC-3 flies so well with an engine out that you do not need to make any immediate control inputs to control the model. As long as you maintain adequate flying speed you will hardly notice that an engine failed. This is where your engine selection will have an influence. If you have installed .40 size 2-stroke engines, or .30 Wankels, the model has more than adequate power to continue flying on one engine. It will slow somewhat, but it will fly very nicely. You will have plenty of time to enter the pattern and land. If you have installed .25 size 2-stroke engines the model will slow quickly and you will need to make an immediate landing. Just don't allow the model to get slow as there won't be enough power to accelerate without descending.

HOW TO HANDLE AN ENGINE FAILURE

If you have installed .25 size engines the model will slow rapidly when an engine fails. The DC-3 is after all a high drag aircraft. In this case you should **reduce** power on the remaining engine and then glide back for a landing, just as you would with a single engine model. DO NOT ATTEMPT TO STRETCH YOUR GLIDE BACK TO THE RUNWAY WITH HIGH POWER ON THE REMAINING ENGINE.

If you have installed larger engines you should have adequate power to continue flying almost normally. I say "almost" as there is a very important thing to consider; If you allow the model to get too slow, you will lose control when the yaw from the remaining engine overpowers the effectiveness of the rudder. On twin engine aircraft the fin/rudder will stall long before the wing does - full size or model. The key is don't get slow if the remaining engine is at a high power setting. If you do, the model will do a most beautiful snap roll. Recovery is easy - pull the good engine to idle, lower the nose and glide in for a landing.

For additional information on how to handle your DC-3 in an engine out situation, refer to the "Engine Out" section on page 65.

FLIGHT CHARACTERISTICS

Other than engine-out flying characteristics, there are a few other flight qualities you should be aware of. The engines are placed quite low in relation to the center of the aircraft. This causes a pitch change when power is changed. This is most noticeable when you go from idle power to full power at a low airspeed - such as during a go-around. Be prepared for this, adding a little down elevator until the speed increases. Larger engines make this characteristic more pronounced.

The placement of the fuel tanks in this model is difficult. Although the best location for the tanks is in the nacelles, if you are installing retracts the only available place is in the wing center section. Modern engines have good fuel draw so this should not create a problem, but older tired engines may have difficulties. We did not experience any problems with the many types of engines we tested on our prototypes, but we did note one unusual thing: In a turn the engines will have a slight RPM change. The low engine will decrease RPM by a couple hundred and the high engine will gain a couple of hundred. While slight, this is enough for the aircraft to yaw slightly. It appears that the aircraft is skidding in the turn, and it is! (A skid is where the nose turns into the turn).

TWIN ENGINE TRAINING

Your Top Flite DC-3 represents a substantial investment in time and money. For that reason, I suggest that you start your multi-engine training with a model that you won't be so emotionally involved with. Get a Hobbico TwinStar™ for your training. It's an ARF and will go together in a couple of weekends. It is an excellent twin engine trainer. It will save some **serious** knee knocking time verses risking your Top Flite DC-3 and, it's inexpensive. Use the same engines on it that you will use on your DC-3 so that you may thoroughly break them in.

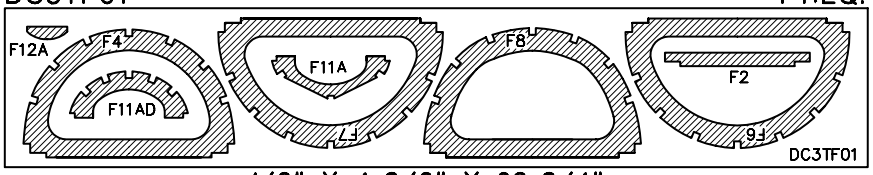
OTHER ITEMS REQUIRED

These are additional items you will need to complete your DC-3 that are *not included* with your kit. Order numbers are in parentheses (GPMQ4130). Our exclusive brand is listed where possible: **TOP** is the Top Flite brand, **GPM** is the Great Planes brand, and **HCA** is the Hobbico brand.

- ❏ 4 to 8 Channel radio with 6 to 9 servos (2 micro servos required for throttle)
- ❏ Y-connector for aileron servos
- ❏ (2) 12" Servo extensions for aileron servos
- ❏ Y-connector or (2) 12" extensions for throttle servos (see page 46 for more info on throttle hookup)
- ❏ (2) 3-1/4" Main Wheels (GPMQ4226)
- ❏ (4) 3/16" Wheel Collars (only required if installing fixed landing gear) (GPMQ4309)
- ❏ 1-1/2" Tail wheel (GPMQ4283)
- ❏ (2) 3/32" Wheel Collars for tail wheel (GPMQ4302)
- ❏ (2) 8 oz. (GPMQ4103) (for smaller engines) or 10 oz. Fuel Tanks (GPMQ4104)
- ❏ Approximately 80" medium silicone fuel tubing (3) 36" pkgs. (GPMQ4131)
- ❏ (2) Fuel filler valves (GPMQ4160)
- ❏ (2) Propeller hubs (GPMQ4630)
- ❏ 1/2" (HCAQ1050) or 1/4" (HCAQ1000) R/C Foam rubber padding
- ❏ 3 rolls of Top Flite Super MonoKote covering, see *Finishing* on page 58
- ❏ Paint, see *Finishing* on page 58
- ❏ Propellers

DIE-CUT PATTERNS

DC3TF01 1 REQ.



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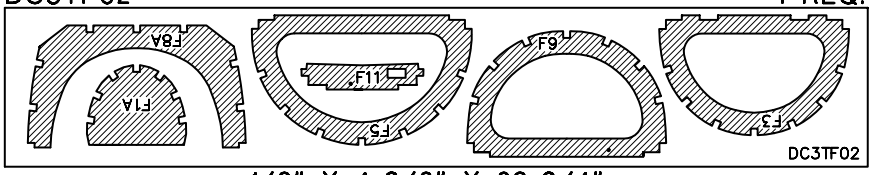

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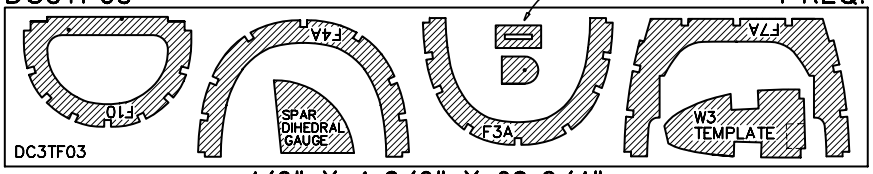

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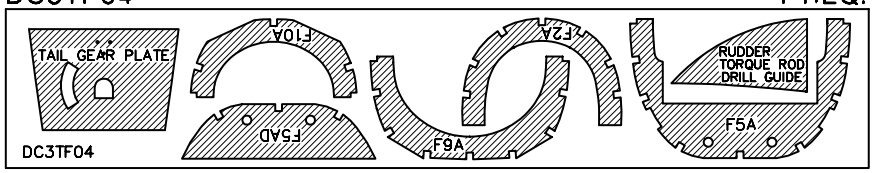

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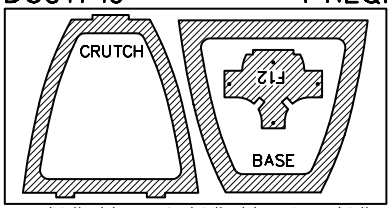

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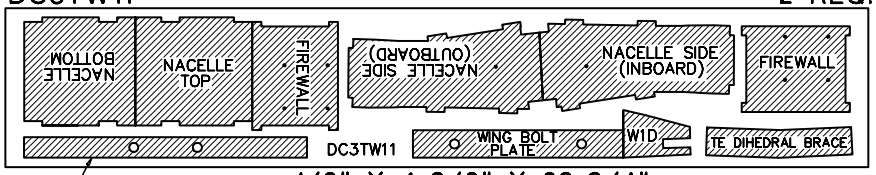

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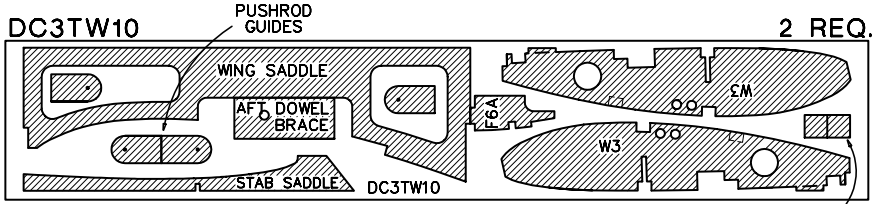

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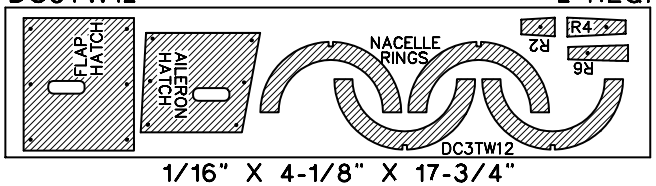

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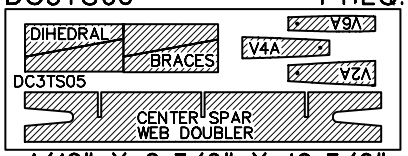

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1 REQ.

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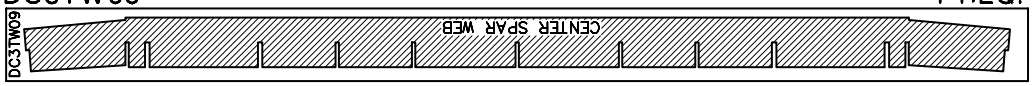
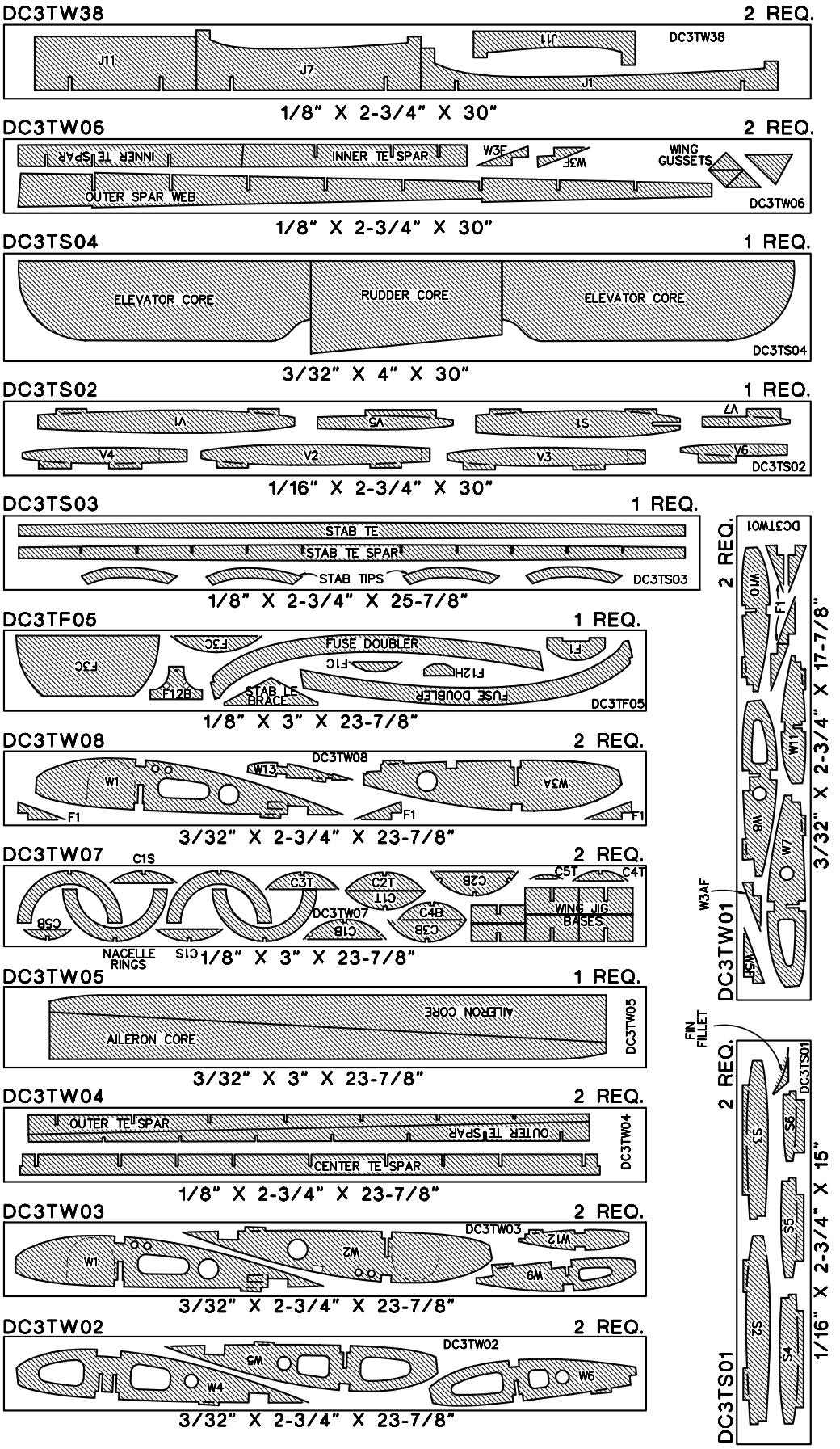


1/8" X 2" X 28-1/8"

DIE-CUT PATTERNS



BUILDING SUPPLIES

Here's a checklist of supplies you should have on hand while you're building. Some of these are optional. Use your own experience to decide what you need. We recommend **Great Planes Pro**™ CA and Epoxy.

GLUE/FILLER

- ❑ 4 oz. Thin CA (GPMR6004)
- ❑ 4 oz. Medium CA+ (GPMR6010)
- ❑ 2 oz. Thick CA- (GPMR6015)
- ❑ CA Accelerator (GPMR6035)
- ❑ CA Debonder (GMPR6039)
- ❑ CA Applicator Tips (HCAR3780)
- ❑ 30-minute (GPMR6047)

  or
- ❑ 45-minute (GPMR6048) epoxy
- ❑ 6-minute epoxy (GPMR6045)
- ❑ Pro Wood Glue (GPMR6161)
- ❑ Microballoons (TOPR1090)
- ❑ Milled Fiberglass (GPMR6165)
- ❑ Lightweight Hobby Filler (Balsa Color, HCAR3401)
- ❑ Auto body filler (Bondo® or similar)
- ❑ Isopropyl Alcohol (to clean up excess epoxy)

TOOLS

- ❑ #11 Blades (HCAR0311, 100 qty.)
- ❑ Single Edge Razor Blades (HCAR0312, 100 qty.)
- ❑ Razor Plane (MASR1510)
- ❑ Hobbico Builder's Triangle (HCAR0480)
- ❑ T-Pins (HCAR5100 (S), HCAR5150 (M), HCAR5200 (L)
- ❑ Drill Bits: 1/16", #41 (or 3/32"), 9/64" (or 1/8"), 5/32", 1/4", #10 (or 3/16") (or 1/4-20 tap and drill set), #43(or 4-40 tap and drill set)
- ❑ 1/4-20 Tap and drill (GPMR8105)
- ❑ 4-40 Tap and drill (GPMR8101)
- ❑ Tap wrench (GPMR8120)
- ❑ Curved Tip Scissors (HCAR0667)
- ❑ Long handle 9/64" ball end hex wrench (GPMR8004)
- ❑ Silver Solder w/flux (GPMR8070)
- ❑ Great Planes Plan Protector (GPMR6167) or wax paper
- ❑ Masking Tape
- ❑ Easy–Touch™ Bar Sanders*****
- ❑ Dremel® #178 cutting bit for countersinking screws in the servo hatch covers

RECOMMENDED COVERING TOOLS AND ACCESSORIES

- ❑ Top Flite Heat Gun (TOPR2000)
- ❑ Top Flite Trim Seal Tool (TOPR2200)

  -and-
- ❑ Top Flite Sealing Iron (TOPR2100)
- ❑ Top Flite Hot Sock (TOPR2175)

  -or-
- ❑ 21st Century Sealing Iron (COVR2700)
- ❑ 21st Century Cover Sock (COVR2702)

EASY-TOUCH™ BAR SANDER

*****A flat, durable, easy to handle sanding tool is a necessity for building a well finished model. Great Planes makes a complete range of **Easy-Touch Bar Sanders** (patented) and replaceable **Easy-Touch Adhesive-backed Sandpaper**. While building the DC-3 we used two 5-1/2" Bar Sanders and two 11" Bar Sanders equipped with 80-grit and 150-grit Adhesive-backed Sandpaper. Here's the complete list of Easy-Touch Bar Sanders and Adhesive Backed Sandpaper.

5-1/2" Bar Sander (GPMR6169)
11" Bar Sander (GPMR6170)
22" Bar Sander (GPMR6172)
33" Bar Sander (GPMR6174)
44" Bar Sander (GPMR6176)
11" Contour Multi-Sander (GPMR6190)

12' roll of Adhesive-backed sandpaper:
80-grit (GPMR6180)
150-grit (GPMR6183)
180-grit (GPMR6184)
220-grit (GPMR6185)

Assortment pack of 5-1/2" strips (GPMR6189)

We also use Top Flite 320-grit (TOPR8030, 4 sheets) and 400-grit (TOPR8032, 4 sheets) wet-or-dry sandpaper for finish sanding.

IMPORTANT BUILDING NOTES

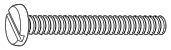
- There are two types of screws used in this kit.

  Sheet metal screws are designated by a number and a length.

  For example #6 x 3/4" [19.1mm]

  Machine screws are designated by a number, threads per inch and a length.

  For example 4-40 x 3/4" [19.1mm]



- When you see the term ***test fit*** in the instructions, it means that you should first position the part on the assembly **without using any glue**, then slightly modify or *custom fit* the part as necessary for the best fit.

- Whenever the term ***glue*** is used you should rely upon your experience to decide what type of glue to use. When a specific type of adhesive works best for that step we will tell you what type of glue to use.

- Whenever just ***epoxy*** is specified you may use ***either*** 30-minute epoxy ***or*** 6-minute epoxy. When 30-minute epoxy is **specified** it is **highly recommended** that you use only 30-minute (or 45-minute) epoxy because you will need the working time and/or the additional strength.

- Occasionally we refer to the *top* or *bottom* of the model or *up* or *down*. To avoid confusion, the *top* or *bottom* of the model is as it would be when the airplane is right side up and will be referred to as the top even if the model is upside down during that step, *i.e.* the top main spar is always the top main spar even if the wing is upside down when you are working on it. Similarly, *move the former up* means move the former toward the top of the fuselage even if the fuselage is upside down when you are working on it.

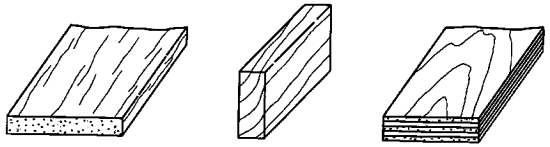
- When you get to each step, read that step **completely through to the end** before you begin. Frequently there is important information or a note at the end of the step that you need to know before you start.

- **Photos** and **sketches** are placed **ahead** of the step they refer to. Frequently you can study photos in **following** steps to get another view of the same parts.

COMMON ABBREVIATIONS

Deg = degrees	Elev = elevator
Fuse = fuselage	" = inches
LE = leading edge	Ply = plywood
Stab = stabilizer	TE = trailing edge
LG = landing gear	mm = millimeters

TYPES OF WOOD



BALSA **BASSWOOD** **PLYWOOD**

METRIC CONVERSION

1" = 25.4mm (conversion factor)

1/64" = .4mm	1" = 25.4mm
1/32" = .8mm	2" = 50.8mm
1/16" = 1.6mm	3" = 76.2mm
3/32" = 2.4mm	6" = 152.4mm
1/8" = 3.2mm	12" = 304.8mm
5/32" = 4mm	15" = 381mm
3/16" = 4.8mm	18" = 457.2mm
1/4" = 6.4mm	21" = 533.4mm
3/8" = 9.5mm	24" = 609.6mm
1/2" = 12.7mm	30" = 762mm
5/8" = 15.9mm	36" = 914.4mm
3/4" = 19mm	

GET READY TO BUILD

1. Unroll the plan sheets. Roll them inside out so they lie flat. Cut the **left fuselage plan** where indicated along the dashed line and tape it to the **right fuse plan** where indicated.

2. Remove all the parts from the box. Use a ballpoint pen (not a felt tip pen) to lightly write the **name** or **size** on each piece so you can identify it later. Use the ***die-cut patterns*** on pages 6 & 7 to identify and mark the die-cut parts **before** you remove them from their die sheets. Many of the parts already have numbers stamped on them, but in some cases the number is located alongside the parts or only on the die drawings on pages 6 and 7. You may remove all the die-cut parts from their die sheets now or wait until you need them. If a part is difficult to remove, don't force it out but cut around it with a #11 blade. After you remove the parts from their die sheets, lightly sand the edges to remove slivers or die-cutting irregularities. Save some of the larger scraps of wood.

3. Separate the parts into groups such as **stab, fin, wing,** and **fuse.** Store smaller parts in zipper-top food storage bags.

BUILD THE TAIL SURFACES

MAKE THE STAB & FIN SKINS

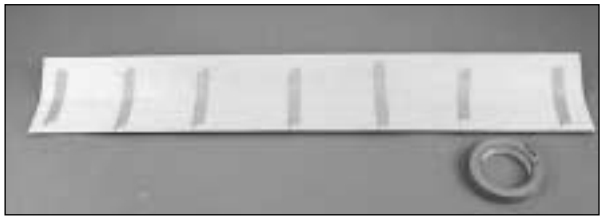
❑ 1. Use the ***Hot Tip*** that follows or your own method to glue two 1/16" x 3" x 30" balsa sheets together to make a 1/16" x 6" x 30" sheet for one of the **stab skins**.

Top Flite selects balsa that is intended for sheeting, though occasionally a few of these sheets may have a small nick or split near the ends. If your kit contains a few of these sheets, arrange them and glue them together so the defects will not interfere with the final shape of the skin.

HOT TIP

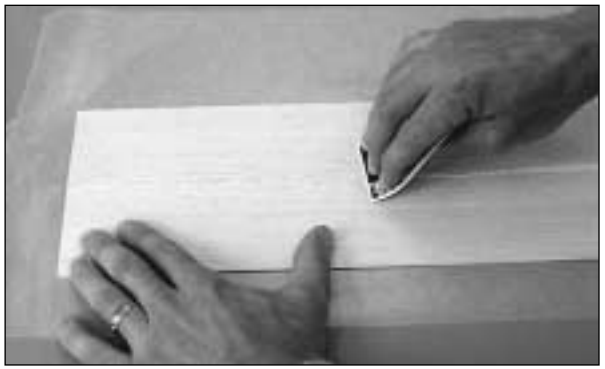
HOW TO MAKE THE STAB SKINS

❑ A. Use a straightedge and a sharp #11 blade to true one edge of both sheets. Do not cut all the way through the first time but make several passes with your knife to prevent the wood from splitting.

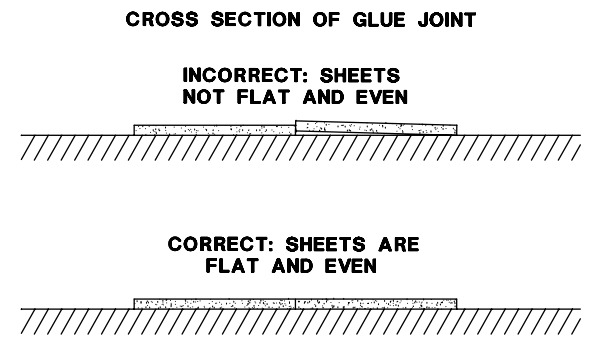


❑ B. Tightly tape the trued edges of the sheets together with masking tape.

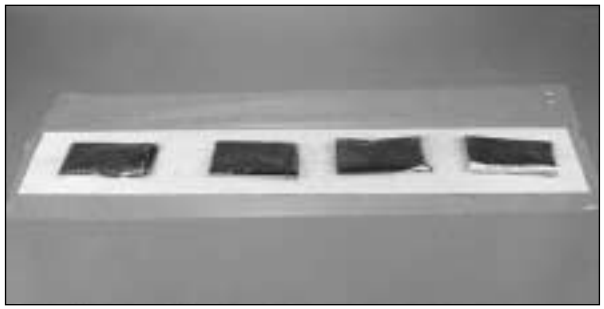
❑ C. Place a sheet of Plan Protector or wax paper on your workbench. Turn the taped together sheets over and apply aliphatic resin (wood workers glue such as Great Planes Pro) to the seams.



❑ D. Use a credit card or something similar to simultaneously press the sheets flat as you squeegee the excess glue from the seam. Wipe the glue off your squeegee so it's ready for the next time. Immediately proceed to the next step.



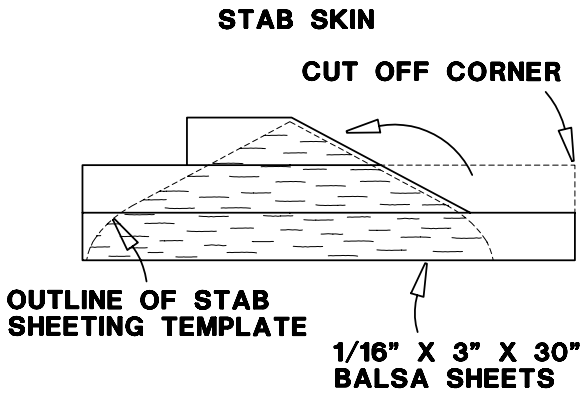
❑ E. Inspect the seam and press the sheets together where they do not align.



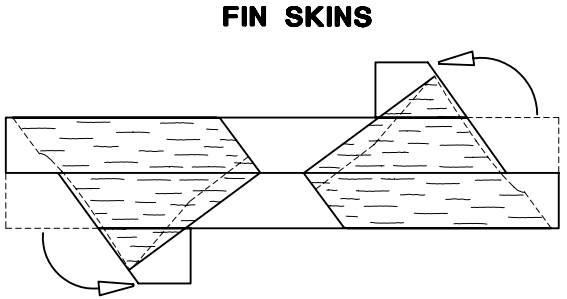
❑ F. Place weights on top of the sheets to hold them down (*see* page 12 on how to make *weight bags*). We prefer plastic bags filled with lead shot, but anything similar will do the job.

❑ 2. Now that you're familiar with making skins (if you weren't so already), make two more skins to be used for the other side of the stab and both sides of the fin (after this step you should have three 1/16" x 6" x 30" balsa sheets).

❑ 3. Cut the **stab sheeting pattern** and the **scale** or **non-scale fin sheeting pattern** from the plan (make sure you use the correct fin sheeting pattern depending on which fin you are going to build). If you're not sure yet which fin to build, you can wait until later to cut the fin skin.



❑ 4. Place the stab sheeting pattern over one of the skins. Cut one of the corners off the balsa sheet as shown in the sketch and glue it to the front of the sheet so it will be large enough to make a stab skin. After the glue dries cut the skin slightly larger than the pattern to allow some room for positioning. Make another stab skin the same way.



❑ 5. Make two fin skins from the last 6" x 30" sheet using the fin sheeting pattern as shown in the sketch. Make sure you accurately cut the bottom of the fin skins where they fit the stab because this helps to set the fin at the correct angle to the stab and fuse.

❑ 6. After your skins are glued together and cut out, remove the masking tape and sand the skins flat with your bar sander and fresh 150-grit sandpaper. The idea is to sand the skins **before** you glue them into place. This minimizes low spots that can occur over the ribs from sanding too much after you glue the sheeting down. Set your fin and stab skins aside for now.

This is the same procedure we will recommend when it is time to make the wing skins.

DC-3 *Fact*

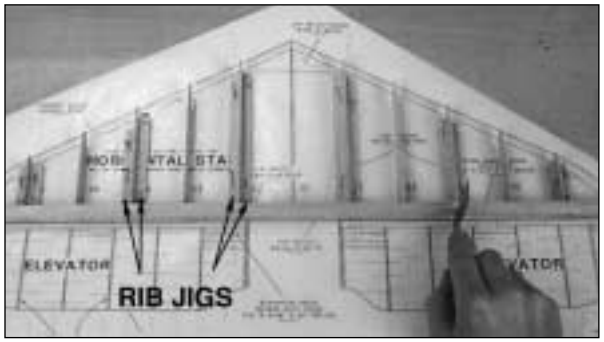
The DC-3 has many names including *Dizzy Three, Dakota, Skytrain, Spooky, Puff the Magic Dragon* and probably the most common, *Gooney Bird*.

BUILD THE STABILIZER

❏ 1. Cut the stab plan along the dashed line and tape it to your building board. Cover the stab plan with Plan Protector.

❏ 2. Glue the die-cut 1/8" balsa **stab TE spar** to the die-cut 1/8" balsa **stab TE**. These pieces are symmetrical so it does not matter how you join them.

❏ 3. Insert all the die-cut 1/16" balsa **stab ribs** except for rib S1 in the TE spar and place the assembly over the plan.



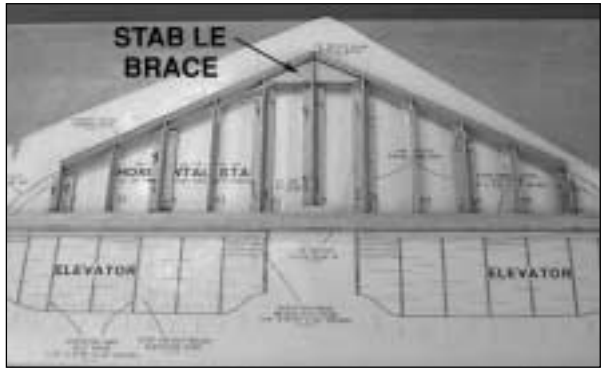
❏ 4. Cut **rib jigs** from two 1/4" x 5/16" x 24" balsa sticks and pin them to the plan on both sides of ribs S6, S4 and S2. Save the leftover 1/4" x 5/16" sticks for use later. Make sure none of the rib jigs or the T-pins extend beyond the front of the ribs. The rib jigs hold the ribs in alignment over the plan without having to stick T-pins through the ribs (which can be difficult). Use a small square to align the trailing edge over the plan.

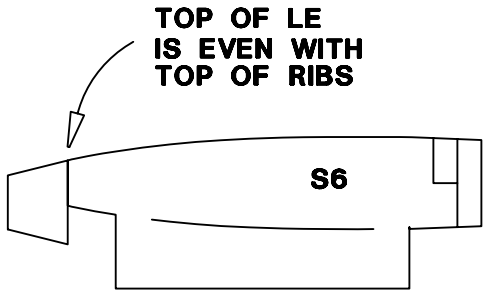
❏ 5. Make sure all the ribs are fully seated into the TE and that the jig tabs are contacting the building board. Use a square to make sure the TE is **perpendicular** to your building board. Glue the ribs to the TE with thin CA.

❏ 6. Cut a 1-1/2" long piece from a 1/4" x 3/4" x 30" balsa stick and glue it to the TE where shown on the plan for the **rudder torque rod block.**

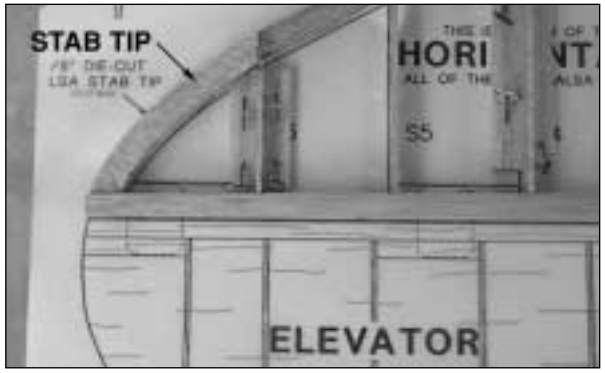
❏ 7. Glue rib **S1** to the rudder torque rod block using two more rib jigs to hold it in place like you did with the other ribs.

❏ 8. Sand a bevel on the front of the ribs to accommodate the aft sweep of the LE. Insert the die-cut 1/8" balsa **stab LE brace** in rib S1 between ribs S2 where shown on the plan. You can see the stab LE brace in the next photo.





❏ 9. Cut the ends of both 5/16" x 15" shaped balsa **stab/fin leading edges** so they match the plan. Position one of the LE's on the front of the ribs so the top of the LE is even with the top of the ribs and glue into place. Glue the other LE to the stab and glue the stab LE brace into place.



❏ 10. Glue two die-cut 1/8" balsa **stab tips** together to make a **stab tip.** Make another stab tip the same way. Glue the stab tips to the stab where shown on the plan. Make sure the tips are centered (vertically) on tip ribs S6 and the trailing edge.

❏ 11. Relocate any T-pins that are protruding above the structure so they will not be in the way when you sand the stab tip and the leading and trailing edges. Use a bar sander and 80-grit sandpaper to bevel the top of the stab tips to accommodate the sheeting. Shape the top of the TE and LE to blend with the stab tips and the ribs. We've marked the centerline of the stab tip and highlighted the top of it so you can see how the stab tip is tapered.

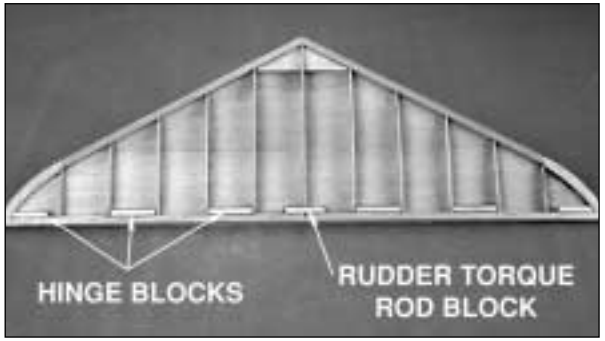
❏ 12. Before you sheet the top of the stab, refer to the photo at step13. Use a ballpoint pen and a square to mark the center of the stab and the root end of both elevators on the TE of the stab. The marks will help you align the stab with the fuse and align the elevators with the stab later on.

HOT TIP

When we glue sheeting to a structure (wing, stab, fin), we use plastic bags filled with lead shot to hold the sheeting down. These plastic bags filled with lead take the shape of the curved surfaces to apply uniform pressure and do not put marks in the balsa wood. You can purchase lead shot at most stores where hunting supplies are sold. We use #6 lead shot. One 25 lb. bag costs approximately fifteen to twenty dollars. You may use small zip lock food storage bags to hold the shot. Tape the bags shut to make sure they don't open. Each bag should hold between two to three lbs. of lead. Ten to fifteen two-to-three lb. bags should be enough for most projects. You can see how we position our "weight bags" further ahead in the manual during wing construction.

❏ 13. Sheet the top of the stab with one of the stab skins you've already prepared. We recommend using aliphatic resin to glue the skin to the ribs and CA to glue the skin to the TE, LE and tips. Wet the outside of the sheeting in the middle near the leading edge. Apply aliphatic resin to the ribs and position the top skin on the stab. Place your weights on top of the stab skin, then use CA to glue the skin to the LE, TE and tips. Leave the weights in position until the aliphatic resin dries—thirty minutes to an hour is enough time.

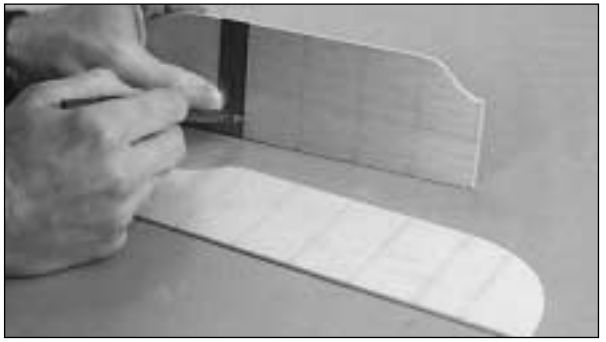
❏ 14. Remove the stab from your building board. Save the rib jigs for building your fin. Turn the stab over and cut the jig tabs from the bottom of the ribs, then trim the bottom of the LE even with the ribs. Trim the stab tips and the bottom of the TE near the tips the same way you did on the top. Trim the bottom of the rudder torque rod block even with the ribs.



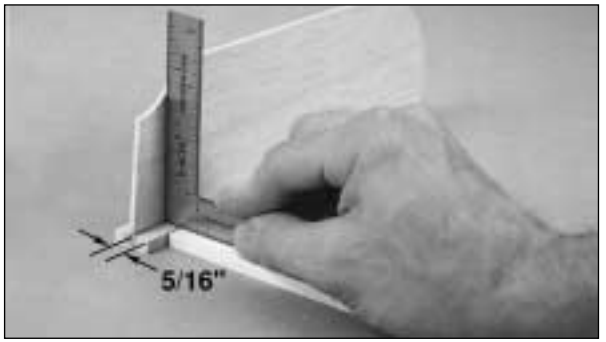
❏ 15. Cut the **stab hinge blocks** from the same 1/4" x 3/4" balsa stick you used for the rudder torque rod block a few steps earlier. Glue the hinge blocks to the TE, ribs, and top sheeting where shown on the plan. Trim the hinge blocks even with the TE and ribs.

❏ 16. Sheet the bottom of the stab with the other stab skin you prepared. Use care not to add any twist to the stab as it is no longer supported by the jig tabs. Once again, we suggest using aliphatic resin to glue the skin to the ribs and medium CA for the rest.

BUILD THE ELEVATORS



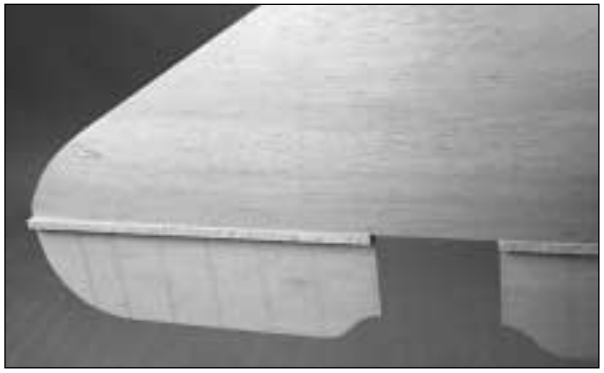
❏ ❏ 1. Mark the location of the elevator ribs on both sides of one of the die-cut 3/32" balsa **elevator cores** where shown on the plan. The easiest way to do this is to mark just the front of the elevator, then use a small square to extend the lines with a ballpoint pen. Note the alternate scale location of the elevator ribs shown on the plan.



❏ ❏ 2. Cut the remainder of the 1/4" x 3/4" balsa stick you used for the stab hinge blocks and an additional 1/4" x 3/4" x 30" balsa stick to the length shown on the plan for the **elevator leading edge.** Use a straightedge to draw line 5/16" from the edge of the elevator leading edge. Glue the elevator core to the LE **along** the line—

not directly on top of the line. Use a square to make sure you glue the LE perpendicular to the elevator core.
Hint: Place a 1/4" piece of balsa under the square to raise it to the level of the LE.

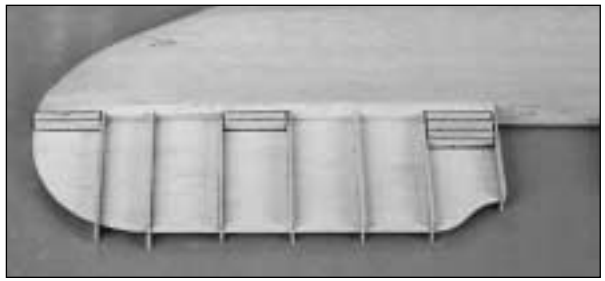
❑ 3. Prepare the other elevator the same way.



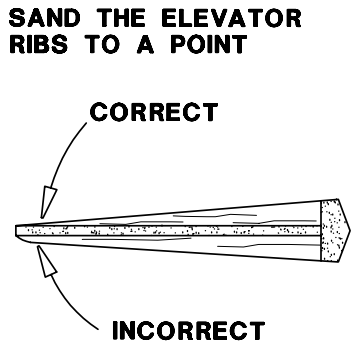
❑ 4. Apply about four small drops of medium CA, evenly spaced, along the LE of one of the elevators and tack glue it to the stab. When in place, the root end of the elevator LE should be 1/16" beyond the mark you made on the TE of the stab to accommodate the elevator root cap ribs (refer to the plan). The elevator LE should also be centered vertically on the stab TE. Practice alignment before you tack glue the elevator. Tack glue the other elevator to the other side of the stab the same way.

❑ 5. Use a razor plane or your bar sander to shape the leading edge of the elevators to match the stab.

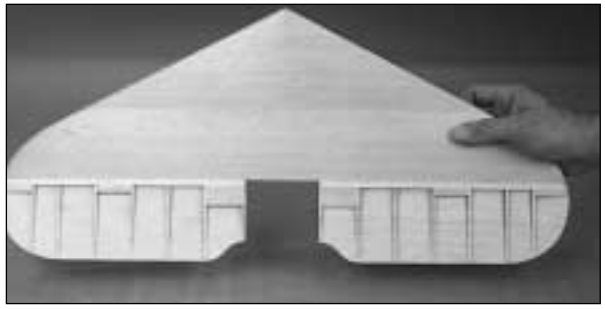
❑ 6. Use four 1/16" x 5/16" x 24" balsa sticks to make the **elevator ribs**, and a piece of leftover 1/16" sheeting to make the **elevator root cap ribs** (refer to the plan) for the root end of the elevators. If you've decided to make the scale location elevator ribs, use leftover 1/16" balsa sheeting to make the additional ribs. Cut the sticks to the correct length, then glue them to the elevator cores only (don't glue the elevator ribs to the elevator LE yet) making sure the cores remain perpendicular to the LE's as you proceed. You can see the ribs in the following photo.



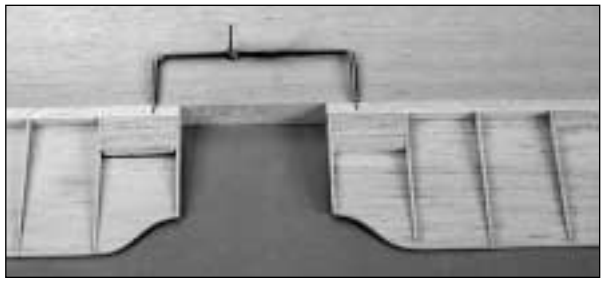
❑ 7. Make the **elevator hinge blocks** from a 1/4" x 5/16" x 24" balsa stick and 1/4" x 5/16" balsa you have leftover from the rib jigs when you were building the stab. Glue the hinge blocks to the elevators as shown on the plan. Now you may glue the elevator ribs to the LE.



❑ 8. Proceed slowly and **carefully**, shaping the elevator ribs and the hinge blocks to match the elevator LE and the cross section on the plan. Make sure you sand the ends of the ribs to a point as shown in the sketch. Otherwise, covering the elevators will be difficult.



There. Now you have a nicely constructed stab with elevators that accurately match. Just a few more things to do and then we'll move on to the fin and rudder *(which version are you going to build?)*.



❑ 9. Determine which side of the stab looks the best. Designate that side as the top. Use a file or a rotary tool with a cut-off wheel to remove sharp edges or burrs on the ends of the **elevator joiner wire.** Position the elevator joiner wire on the top of the stab as shown in the photo. Mark the leading edge of the elevators where the *arm* portion of the joiner wire will enter as shown on the plan

❑ 10. Carefully *break* both elevators free from the stab. Note which elevator matches which side of the stab. Remove any *glue bumps* left from the CA you used to tack glue the elevators to the stab.

❑ 11. Insert T-pins through the **center** of one of the elevators LE's, near the tip and near the root. Place a straightedge across the T-pins and draw the **centerline** on the elevator LE with a ballpoint pen. Draw a centerline along other elevator LE and the TE of the stab the same way.

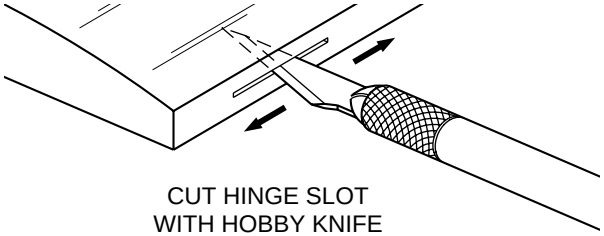
DC-3 *Fact*

After presiding over various projects including the Martin MB-2 bomber at the Glenn L. Martin aircraft company, Donald W. Douglas Jr, born April 6, 1892, co-founded the Davis-Douglas Aircraft Company in the spring of 1920 with help from David Davis, a millionaire with a great desire to fly. By the mid 20's, Douglas designs were well known throughout both the civilian and military aircraft industry.

IMPORTANT NOTES ABOUT CA HINGES

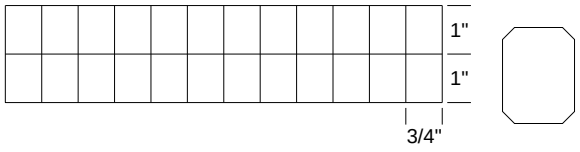
This kit is supplied with a CA hinge material consisting of a 3-layer lamination of Mylar and polyester. It is specially made for hinging model airplane control surfaces. When properly installed, this type of CA hinge provides the best combination of strength, durability and easy installation. We trust all of our Gold Edition war birds to these hinges, but **it is essential to install them correctly**. Carefully follow the hinging instructions in this manual for the best result.

The most common mistake made by modelers when installing CA hinges is making the hinge slots too tight restricting the flow of CA to the back of the hinges; or not using enough glue to fully secure the hinge over its entire surface area. This results in hinges that are only *tack glued* into the hinge slots. The techniques for cutting the hinge slots and gluing in CA hinges (near the end of the manual) have been developed to ensure thorough and secure gluing.



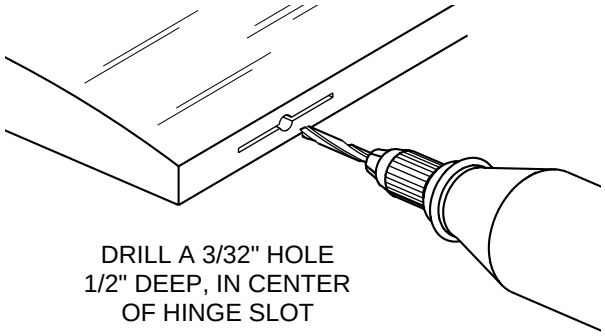
CUT HINGE SLOT
WITH HOBBY KNIFE
AND #11 BLADE

❏ 12. Mark the location of the hinge slots on the elevators and stab where shown on the plan. With a #11 blade, cut the hinge slots in the elevators and the stab along the centerlines you marked earlier



❏ 13. Using the sketch above, cut six hinges from the **CA hinge strip** supplied with this kit. Snip the corners off so they go into the slots easier. You may cut all the hinges now, or cut them as you need them.

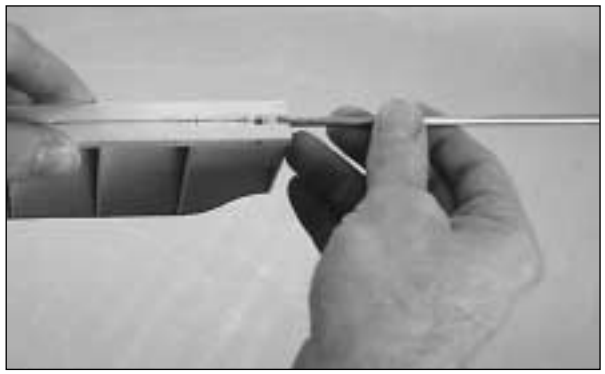
❏ 14. Test fit the hinges into the slots. If the hinges do not slide into the slots easily, work your knife blade back and forth in the slot a few times to provide more clearance (it is really the **back edge** of the blade that does the work here in widening the slot).



DRILL A 3/32" HOLE
1/2" DEEP, IN CENTER
OF HINGE SLOT

❏ 15. Drill a 3/32" hole, 1/2" deep in the center of the hinge slots. Use a rotary tool with a 3/32" drill bit or a carbide cutter for the best results. Reinsert your knife blade to *clean out* the slot after you drill the holes.

❏ 16. Test fit the elevators to the stab with the hinges. If any hinge slots are not wide enough or are misaligned, make adjustments so the elevators accurately fit the stab.



❏ 17. Drill a 9/64" (or 1/8") hole at the marks you made on the centerline of both elevator leading edges for the joiner wire. Cut a groove in the leading edge of both elevators to accommodate the joiner wire.
Hint: Use a 5/32" brass tube sharpened at one end to cut the grooves.

❏ 18. Bevel the leading edges of the elevators to a "V" as shown on the cross section of the plan. Use the centerline on the elevator leading edges as a guide. Test fit the elevators to the stab with the joiner wire and the hinges. Note that the horn on the joiner wire points downward. Cut a small notch in the TE of the stab for the horn on the joiner wire. If necessary, remove the joiner and *tweak* it so both elevators are in the same plane.

❏ 19. Once more, test fit the elevators to the stab with the hinges and the joiner wire. Make sure you can obtain the control throws indicated on page 62 of the manual. If you cannot, increase the "V" on the leading edge of the elevators.

Set the stab and elevators aside.

BUILD THE FIN AND RUDDER

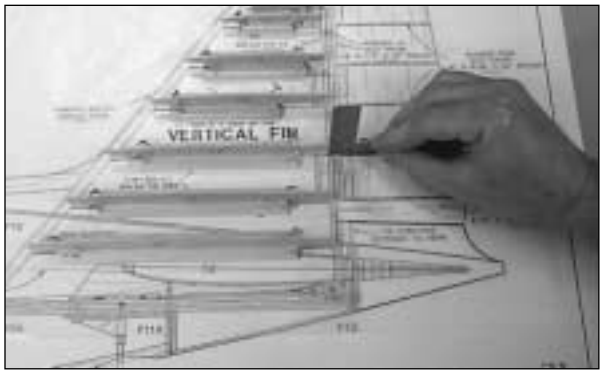
Now it's time to decide which fin and rudder to build. The non-scale fin and rudder is easier to build than the scale fin and rudder while retaining the distinctive DC-3 outline. However, the scale fin and rudder utilize the offset rudder hinge and balance tab. If you go for the scale fin and rudder, we guarantee you'll sit back and grin as you watch others study the offset fin and rudder on your DC-3 and admire your craftsmanship.

If you are going to build the non-scale fin and rudder, proceed with the instructions that follow. If you are going to build the scale fin and rudder, skip to "Build the scale fin and rudder" on page 16.

Build the non-scale fin and rudder

❏ 1. Cut the fin and rudder plan from the fuse plan along the dashed line and tape it to your building board. Cover the plan with Plan Protector.

❏ 2. Apply medium CA to the embossed cutlines near the trailing edge of the die-cut 1/16" **fin ribs V1** through **V7**.

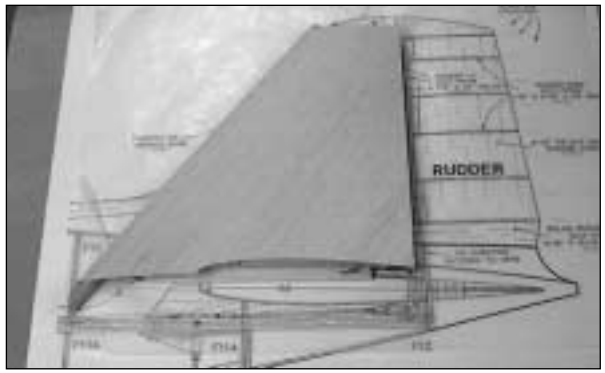


❏ 3. The same way you did for the stab, use your 1/4" x 5/16" rib jigs to hold the balsa fin ribs V1 through V7 over their location on the plan. Use a square to align the ends of the ribs with the TE on the plan.

❏ 4. Cut the **fin TE** from a 1/8" x 1/2" x 24" balsa stick. Align the top of the fin TE with the tops of the ribs allowing the excess to protrude below the ribs (to be trimmed later) and glue the fin TE to the fin ribs with thin CA.

❏ 5. Bevel the front of the fin ribs to accommodate the fin LE. Cut the **fin LE** as shown on the plan from a 5/16" x 15" shaped balsa stab/fin leading edge stick. Glue the fin LE to the fin the same way you did the stab with the excess protruding below the ribs.

❏ 6. Rearrange any T-pins that protrude above the structure so they will not interfere with your bar sander. Lightly sand the top of the LE and TE to match the airfoil shape of the ribs to accommodate the fin skin.



❏ 7. If you haven't yet done so, cut out your fin skins. Sheet the left side of the fin with one of your fin skins (don't forget to use your left skin so the best looking side is out). Make sure you position the skin accurately because the bottom of the skin is what determines the fit of the fin to the stab.

❏ 8. Remove the fin from your building board and trim off the jig tabs. Trim the LE and TE to match the ribs.

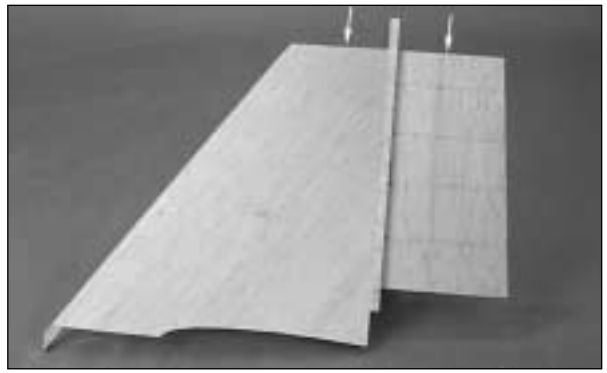
❏ 9. Cut the **fin hinge blocks** from your leftover rib jigs and glue them to the TE of the fin where shown on the plan.

❏ 10. Sheet the other side of the fin with your other fin skin. Be careful not to build any twist into the fin as you press the skin in place.

❏ 11. Use your bar sander to sand the TE and top of the fin square and even.

❏ 12. Trim 1/16" from the top of the die-cut 3/32" balsa **rudder core.** Mark the location of the rudder ribs on both sides of the rudder core.

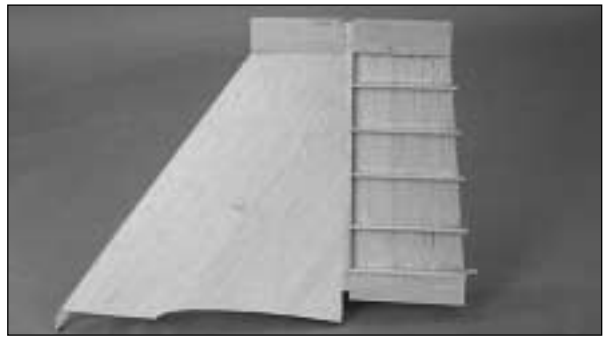
❏ 13. Cut the remainder of the 1/4" x 3/4" x 30" balsa stick you used for the elevator LE's to the length shown on the plan for the **rudder LE**. The same way you did for the elevator LE's, use a straightedge to draw a line 5/16" from one edge of the rudder LE. Glue the die-cut 3/32" balsa rudder core to the LE along the line. Use a square to make sure you glue the core perpendicular to the LE.



❏ 14. Tack glue the rudder LE, centered, to the fin TE with about four small drops of medium CA. Note that the top of the rudder core is aligned with the top of the fin.

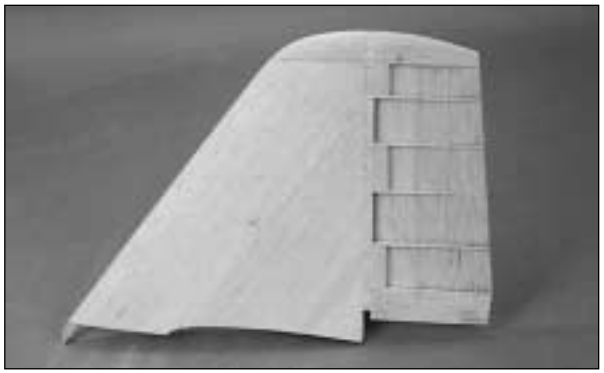
❏ 15. Use a razor plane or your bar sander to shape the leading edge of the rudder to match the fin.

❏ 16. Refer to the following photo. From the 5/8" x 1-1/4" x 13" balsa block cut a 3-3/4" long piece for the **fin tip,** 2-3/4" long piece for the **rudder tip** and a 3-1/2" long piece for the **rudder base.** Glue the tips and base in position (do not glue the fin tip to the rudder LE).

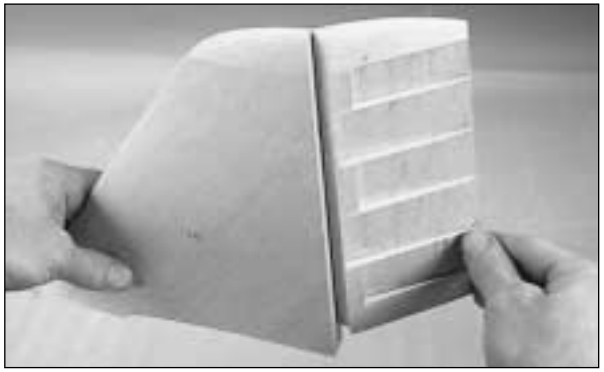


❏ 17. Use two 1/16" x 5/16" x 24" balsa sticks to make the **rudder ribs** and glue them to the rudder core.

❏ 18. See the following photos and carefully taper the rudder ribs and the rudder tip and rudder base toward the rudder TE. Make sure you sand the ends of the ribs to a point the same way you did for the elevator ribs. Carefully shape the fin tip and the rudder tip to match the plan and each other. Finish by rounding the leading edge of the fin, then the fin and rudder tips. Don't worry about shaping the bottom of the rudder at this point. We can do that when we join the tail cone to the fuse and rudder.



❑ 19. Cut the **rudder hinge blocks** from leftover rib jigs and glue them to the rudder core and rudder LE where shown on the plan. Blend the rudder hinge blocks to the rudder.



❑ 20. The same way you did for the elevators and stab, carefully *break* the rudder free from the fin, draw a centerline on the rudder LE and the fin TE, mark and cut the hinge slots, then drill the holes in the hinge slots and test fit the rudder to the fin with the hinges. Bevel the leading edge of the rudder to a "V." Make sure you can achieve the throw recommended on page 62 of the manual.

❑ 21. Mark the location of the **rudder torque rod** on the rudder. Drill a 9/64" (or 1/8") hole at the mark you made and cut a slot to accommodate the vertical part of the rod.

❑ 22. Tape the fin and rudder plan back to the fuse plan, accurately aligning the reference lines.

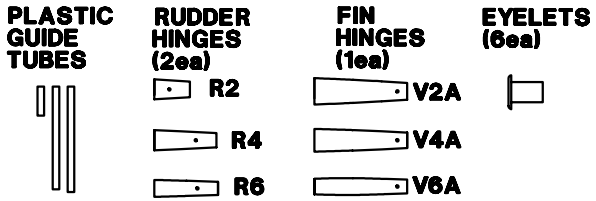
DC-3 *Fact*

By the late 20's the air transportation industry was rapidly expanding with small airline companies springing up everywhere. Though major players such as United, Transcontinental, Western and American Airlines were well established, the aircraft they used featured metal skinned, wooden framed construction—technology leftover from WWI aircraft. This *set the stage* for the demand for an aircraft that could serve the growing industry. Whichever aircraft that would be was surely destined to become famous.

Set the fin and rudder aside. Skip to "Build the Fuselage" on page 20 (there's another **DC-3 *Fact*** within the scale fin and rudder section that you may be interested in).

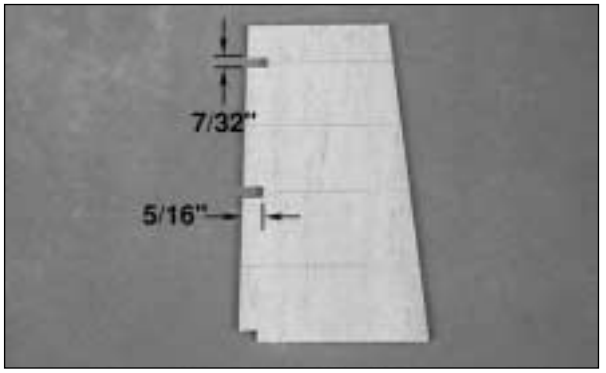
BUILD THE SCALE FIN AND RUDDER

Before you proceed, it will be easier for you to build the fin and rudder if you are able to visualize how the hinge system operates and how all the parts fit together. To do this, study the photos in this section before you continue. Further, if you've ever had aspirations of being a "neat and tidy" builder, now is the time to exercise those thoughts—refrain from using lots of glue and do not build up large fillets that will interfere with sanding or the fit of joining parts. Take your time and you'll end up with a beautiful scale fin and rudder that all of your friends will marvel at.



For easier identification while you proceed, here is a drawing of some of the fin and rudder parts.

❑ 1. Cut the scale fin and rudder plan along the dashed line and tape it to your building board. Cover the plan with Plan Protector.



❑ 2. Accurately cut three 7/32" slots, 5/16" deep, in the die-cut 3/32" balsa **rudder core** in the location shown on the plan to accommodate the rudder hinges. Mark the location of the rudder ribs on both sides of the rudder core.

❑ 3. Accurately cut three **guide tubes** to the length shown on the plan from a 3/16" x 36" **outer pushrod tube**. Use coarse sandpaper to roughen the outside of the guide tubes so the glue will stick.

❑ 4. Cut the die-cut 1/16" balsa **fin ribs V2** through **V7** at the embossed cutline toward the aft end of the ribs.

❑ 5. The same way you did for the stab, use your 1/4" x 5/16" rib jigs to hold the fin ribs V1 through V7 over their location on the plan. Use a square to align the ends of the ribs with the TE on the plan.

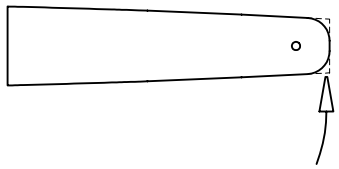
❑ 6. From the 1/8" x 3/4" x 30" balsa stick cut the four **fin TE sections** that fit between ribs V7 and V6, ribs V6 and V4, ribs V4 and V2, and ribs V2 and V1. Don't forget to cut the bottom two sections long enough so you can bevel the ends to the correct angle shown on the plan. All the TE sections must be cut **accurately** and the ends must be square (vertical).

❑ 7. Glue the fin TE sections to the fin ribs as shown on the plan. Make sure the jig tabs of the ribs and each TE section are resting on your building board over their locations on the plan. Make sure you provide the 1/16" space for the three plywood fin hinges where required.

❑ 8. Drill a 1/8" hole at the punch mark through all three sets of die-cut 1/16" plywood **rudder hinges R2, R4** and **R6.** Press down on each piece as you drill to prevent the wood from splitting as the drill goes through.

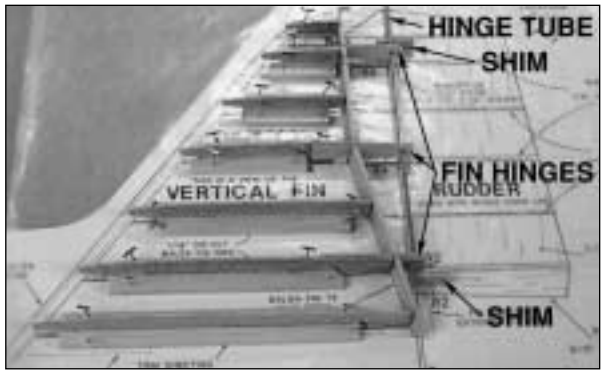
❑ 9. Drill a #41 (or 3/32") hole at the punch mark through the three die-cut 1/16" plywood **fin hinges V2A, V4A** and **V6A.**

TYPICAL FIN HINGE



❑ 10. Round the aft edge of the fin hinges as indicated in the sketch and as shown in the photo at step 13.

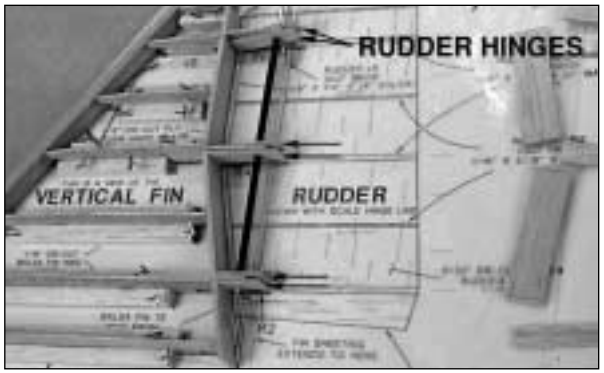
❑ 11. Slide the 3/32" x 10" brass **hinge tube** into the holes of the ply fin hinges. Space the hinges along the hinge tube as shown on the plan and insert the hinges into the fin assembly (refer to the following photo).

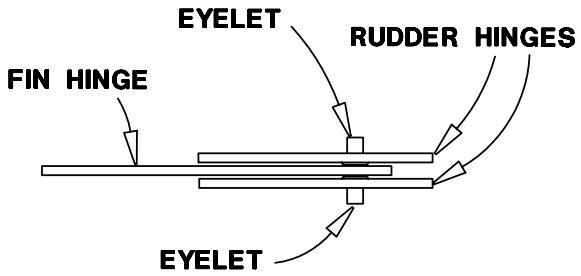


❑ 12. Make sure the hinges and the hinge tube will align with the plan. If necessary, trim parts of the TE sections or glue bumps that interfere. Make two small **shims** from the 3/32" x 7/16" x 24" balsa stick and place them under the hinge tube near the top and bottom hinges. These will hold the tube level and align the fin hinges with the fin.

❑ 13. Make sure the fin hinges are accurately aligned with the fin ribs and that the hinge tube is aligned with its location over the plan. Confirm by measuring the height of the tube at each hinge. Glue the fin hinges to the ribs with thin CA.

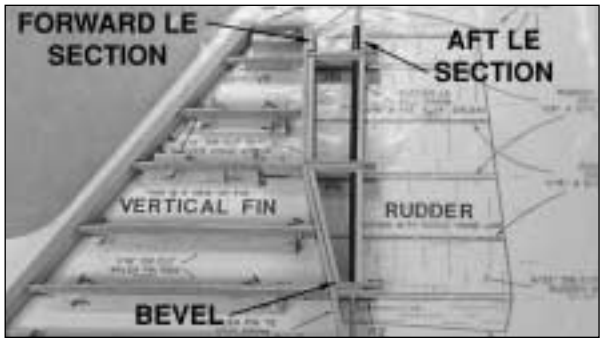
❑ 14. Bevel the front of the fin ribs to accommodate the fin LE. Cut the **fin LE** as shown on the plan from a 5/16" x 15" shaped balsa stab/fin leading edge stick. Glue the fin LE to the fin the same way you did the stab with the excess protruding below the ribs.





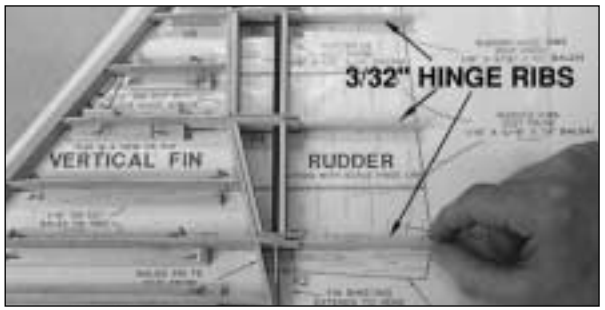
❏ 15. Insert an **eyelet** into each of the six rudder hinges. Glue the eyelets in place with medium CA and allow to fully cure before you proceed. Remove the brass hinge tube from the fin and fit it through the fin and rudder hinges as shown on the plan **with the guide tubes** you cut earlier.

❏ 16. Cut the six **forward and aft rudder LE sections** from the remainder of the 1/8" x 3/4" x 30" balsa stick you used for the fin TE sections. You can see them in the next photo. The same as the fin TE sections, you must cut each rudder LE section accurately. Bevel the bottom front forward LE section as shown on the plan.



❏ 17. Test fit but **do not glue** the rudder LE sections where shown on the plan. Make adjustments as necessary for a good fit. Add the top guide tube. *Are you beginning to see how it works?*

❏ 18. Cut the six **3/32" rudder hinge ribs** (three for each side of the rudder) from the 3/32" x 7/16" x 24" balsa stick and the six **1/16" rudder ribs** from the 1/16" x 7/16" x 24" balsa stick.



❏ 19. Place the three 3/32" rudder hinge ribs between the rudder hinges over the plan. These ribs will set the correct *height* of the rudder core to keep it aligned with the hinge line.

❏ 20. Fit the rudder core, resting on top of the 3/32" ribs, to the hinges.

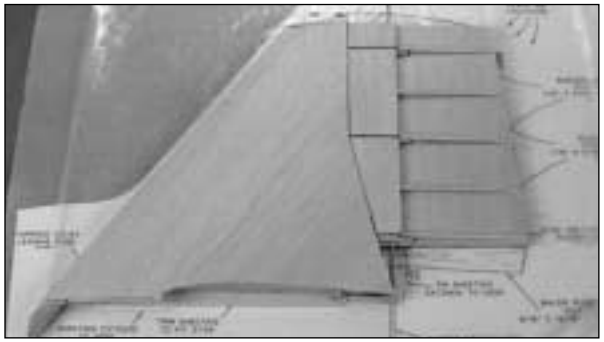
❏ 21. Place approximately 1/32" shims from cardstock or something similar between the forward rudder LE sections and the fin TE section. Carefully view the structure, making sure everything is in alignment, and glue the forward rudder LE sections to the ply rudder hinges and glue the aft rudder LE sections to the rudder core, hinge guides, and rudder hinges. Also glue the rudder core to the rudder hinges. Make sure you do not glue any of the rudder parts to any of the fin parts!

❏ 22. Rearrange any T-pins that protrude above the structure so they will not interfere with your bar sander. Lightly sand the top of the fin LE and TE and the rudder LE sections to match the airfoil shape of the ribs, to accommodate the fin skin.

❏ 23. If you haven't already done so, cut out the fin skins. Sheet the left side of the fin with one of the skins (don't forget to use your left skin so the good side is out). Make sure you position the skin accurately because the bottom of the skin is what determines the fit of the fin to the stab. You may use medium CA for this if you work quickly and carefully. Make sure you don't inadvertently glue the forward rudder LE to the fin TE or fin skin!

❏ 24. Use leftover 1/16" balsa to sheet the LE of the rudder over the rudder LE sections as shown in the

photo. Be careful not to get any glue between the fin hinge and the rudder hinges and don't glue the rudder sheeting to the fin sheeting.



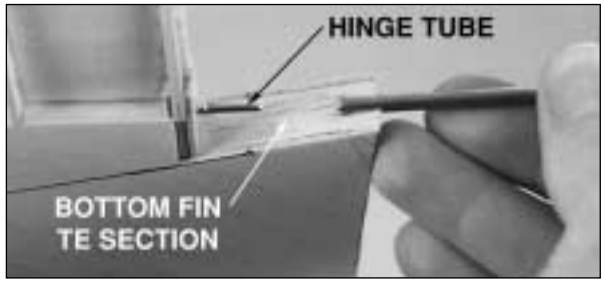
❏ 25. Glue the rudder ribs you cut earlier to the left side of the rudder core. Shape the ribs to match the cross section on the plan and lightly sand the rudder sheeting to match the fin.

Looking pretty good aye? All you have to do now is finish the other side and add the tip blocks!

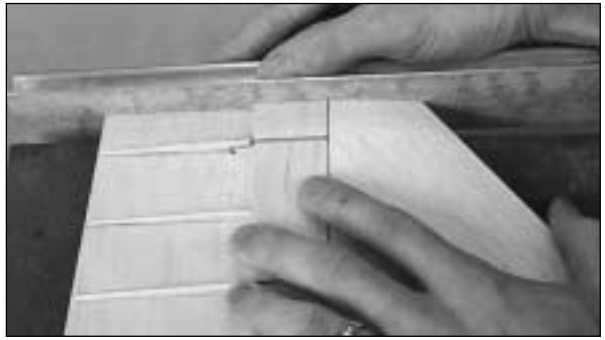
❏ 26. Carefully remove the fin and rudder from your building board. Turn the assembly over and cut the jig tabs from the ribs and trim the LE and TE sections to match the airfoil and the cross section on the plan (the same way you did with the other side of the fin and rudder before you sheeted it).

❏ 27. Sheet the right side of the fin with the other fin skin you prepared earlier. Use leftover 1/16" sheeting to sheet the right side of the rudder leading edge sections as well.

❏ 28. Add the 1/16" and 3/32" balsa rudder ribs to the rudder. Sand the ribs to match the cross section on the plan and to match the left side of the rudder.



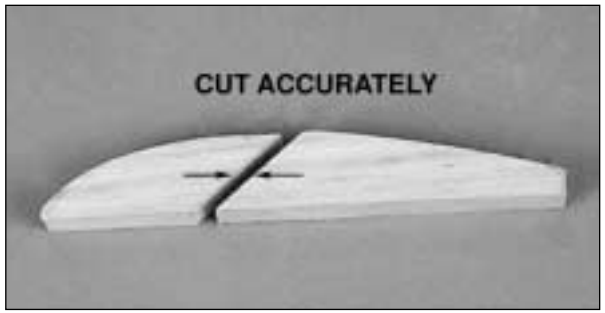
❏ 29. Use a 1/8" drill or a 1/8" brass tube sharpened at one end to cut a small groove in the bottom fin TE section so the hinge tube can pass (and the rudder torque rod later on).



❏ 30. Push the brass hinge tube down into the rudder until the top of the hinge tube is even with the top of the fin. Use your bar sander and 80-grit sandpaper to sand the top of the fin and rudder flat and even.

DC-3 *Fact*

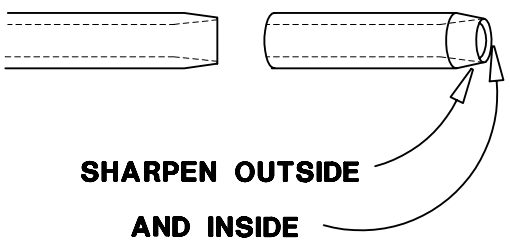
In the early 20's the airline industry giants announced that *the call was out* for an airplane that could satisfy the demands of the growing airline industry. Boeing was first to answer that call with an all metal, twin engine monoplane named the Model 247. United Air Lines ordered sixty 247's locking up the entire Boeing assembly line. The result was that other airlines would have to wait until the United contract was fulfilled before they could "get in on the action."



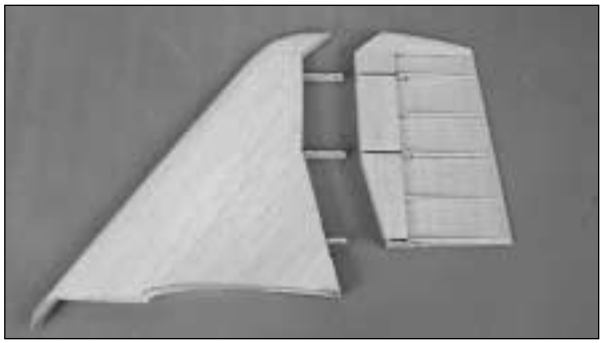
❏ 31. Make the **fin tip** and **rudder tip** from the 5/8" x 1-1/4" x 13" balsa block. At this time, the only parts of the tips you have to cut **accurately** are the opposing ends at the hinge line. The outline of the tips only has to be rough. You can final shape and round them later.

❏ 32. Glue the fin tip to the fin and the rudder tip to the rudder with an approximate 1/16" gap between them.

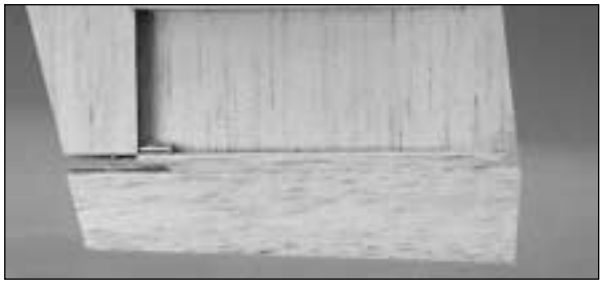
❏ 33. Use your razor plane and your bar sander to shape the fin LE and the rudder and fin tip to match the plan.



❏ 34. Without separating the rudder from the fin (until instructed to do so), carefully remove the brass hinge tube by pulling it out from the bottom. Use a #11 blade and a cut-off wßheel or file to sharpen one end of the brass hinge tube as shown in the sketch and reinsert it with the sharpened end going upward into the rudder. Attach the bottom of the tube to a drill or a rotary power tool and drill a *clean* hole up through the rudder tip block until the brass hinge tube exits the top.



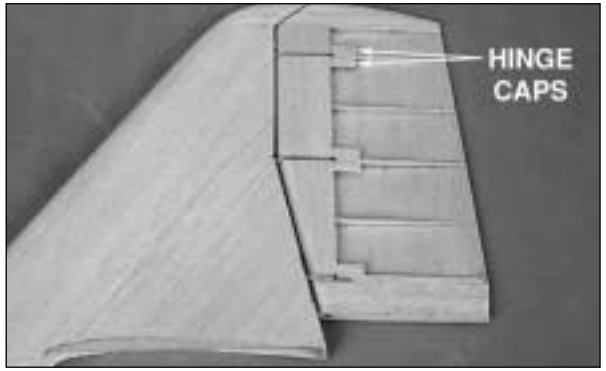
❏ 35. Now for the moment of truth. Pull the hinge tube out and ***carefully*** separate the rudder from the fin. There may be a few spots where you have inadvertently glued the two together so be careful. Separate these spots with a #11 knife if possible.



❏ 36. Glue the leftover piece of 5/8" x 1-1/4" balsa to the bottom of the rudder and sand it to the shape of the **rudder base block** shown on the plan. Fill the space between the base block and the bottom rudder ribs with leftover 1/16" balsa.

❏ 37. Use your sharpened brass hinge tube to drill a hole through the rudder base block the same way you did the rudder tip—only this time go down through the top.

❏ 38. **Round** the LE of the rudder as shown on the plan to allow for control movement. Test fit the rudder to the fin with the brass hinge tube. Move the rudder side to side and look for areas that interfere with smooth movement. Trim where necessary to achieve the control throws in the back of the manual. Make sure the rudder tip and the fin tip do not interfere. If they do, sand the front of the rudder tip until you have achieved enough clearance.



❏ 39. Cut **hinge caps** from leftover 1/16" balsa and glue them to the 3/32" ribs. These provide your covering with something to bond to. Sand the hinge caps flush with the rest of the rudder.

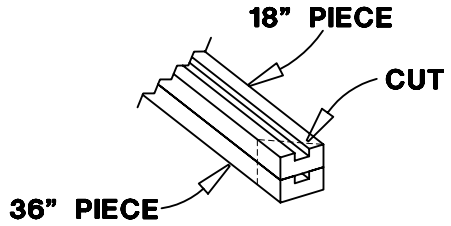
BUILD THE FUSELAGE

FRAME THE FUSELAGE TOP

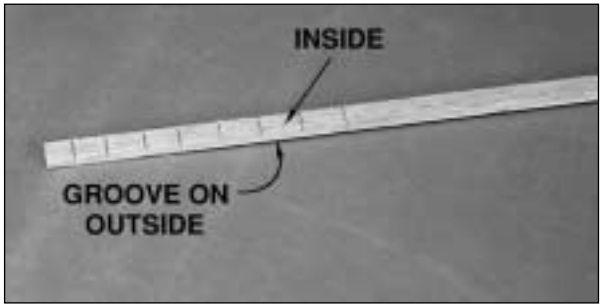
❏ 1. If you haven't already done so, tape the left fuse plan to the right fuse plan so the dashed alignment marks match up. Cut the fuselage top view from the rest of the plan and tape it to your building board. Cover the plan with Plan Protector.

❏ 2. Refer to the photo at step six and glue the die-cut 1/8" balsa former **F1** to the front of the die-cut 1/8" plywood **cabin crutch,** making sure F1 is at a 90 degree angle. After the glue dries, bevel the sides of F1 to match the sides of the cabin crutch.

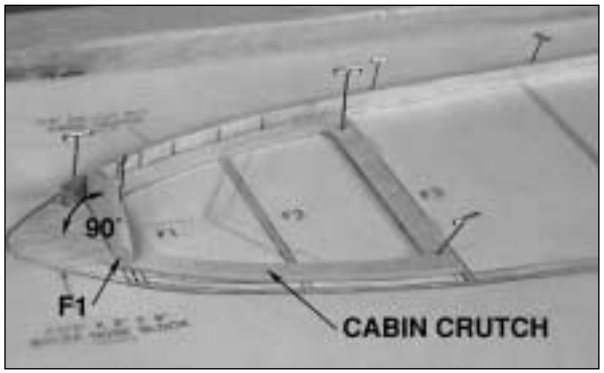
❏ 3. Pin the **cabin crutch** over its location on the plan.



❏ ❏ 4. Gather the three 3/16" x 3/8" x 36" **grooved main stringers.** Cut one of the stringers into two 18" long pieces. Place an 18" main stringer on top of a 36" main stringer so the ends align. Cut the stringers near the ends at approximately a 45 degree angle as shown in the sketch (use your miter box if you have one). The two angled cuts will be spliced together at former F-9.

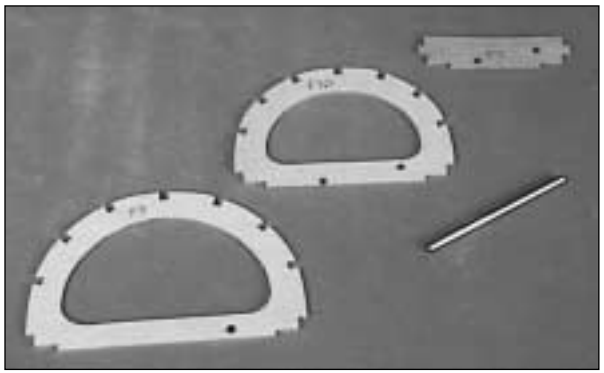


❏ ❏ 5. Use a razor saw to cut small notches, 3/32" deep, in the **inside** of the 36" stringer near the front so it will bend around the cabin crutch.

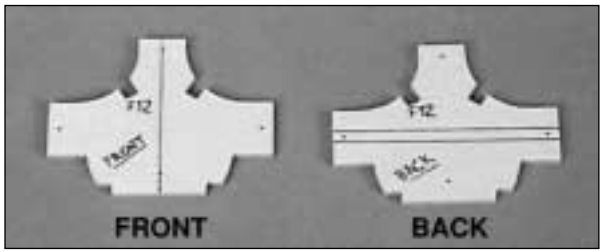


❏ ❏ 6. Pin the two stringers to the plan so the angled *splice* is at former F9 as shown on the plan. Glue the front of the stringer to the cabin crutch and glue the stringers to each other where they meet at F9.

❏ 7. Repeat steps 4, 5 and 6 with an additional 36" long grooved main stringer and the remaining 18" long grooved main stringer.

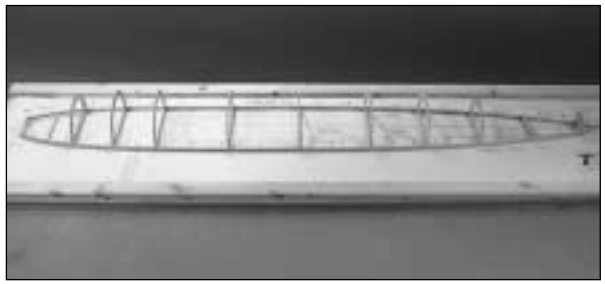


❏ 8. Refer to the *Pushrod Locations* area on the fuse plan and drill 3/16" holes through the punch marks in the die-cut 1/8" plywood formers **F9, F10** and **F11.**

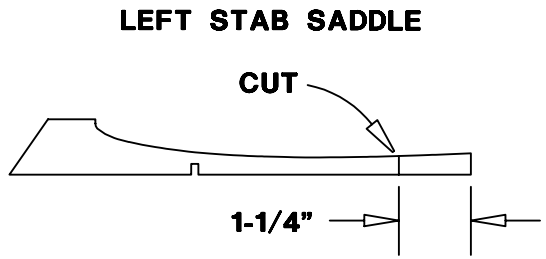


❏ 9. Drill 1/16" holes through the punch marks in the die-cut 1/8" plywood former **F12**. Draw a vertical centerline connecting both punch marks on one side of F12 (this will be the front) and horizontal guidelines 1/16" above and below the punch marks on the other side of F12 (this will be the back). *For illustration purposes the photo shows two F12's.*

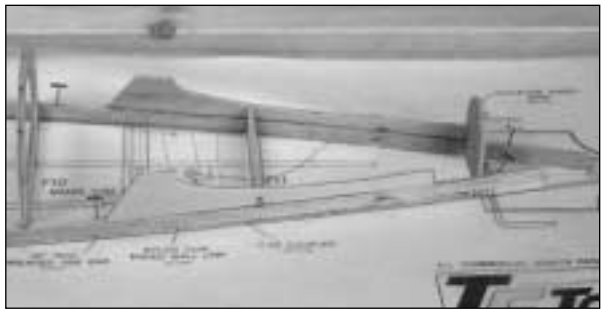
Disregard the shape of F12 in the following photos until you get to step three on page 25. During development of our prototype the shape of F12 was changed. This does not change construction so proceed as the instructions indicate.



❏ 10. Test fit all the die-cut 1/8" plywood formers (**F2** through **F10** and former **F12)** to the main stringers over their location on the plan. You may need to bevel the notches in some of the rear formers to accommodate the angle at which they join the main stringers. Use a small square to make sure the formers are vertical and glue them to the main stringers. Make sure the centerline on former F12 is aligned over the centerline on the plan. Don't be concerned if the formers are slightly warped. You will be able to straighten them when you add the stringers.



❏ 11. Cut 1-1/4" from the aft end of one of the die-cut 1/8" plywood **stab saddles** to accommodate the rudder torque rod arm. This will be the **left** stab saddle.



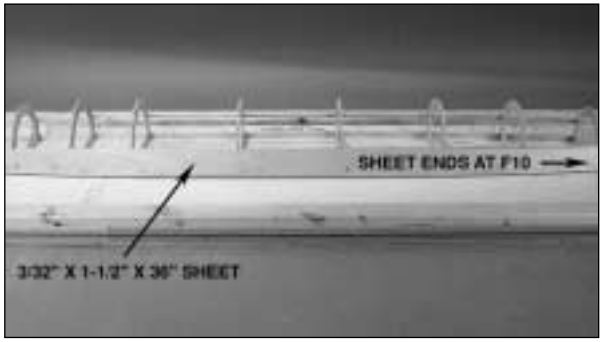
❏ 12. Test fit, then glue the die-cut 1/8" plywood **stab saddles** and former **F11** to the main stringers and former 12. Note that the front of the saddles tilt inward yet the rear of the saddles remain vertical.

❏ 13. Cut one of the three 1/8" x 3/16" x 36" **main sub stringers** into two 18" long pieces. These will be for the front of the fuse. Use your razor saw to cut notches in the front of the 18" sub stringers the same way you did for the main stringers to permit bending. Glue the main sub stringers in the groove of the main stringers on both sides of the fuselage. Glue two additional 1/8" x 3/16" x 36" **main sub stringers** to the main stringer on both sides of the fuse.

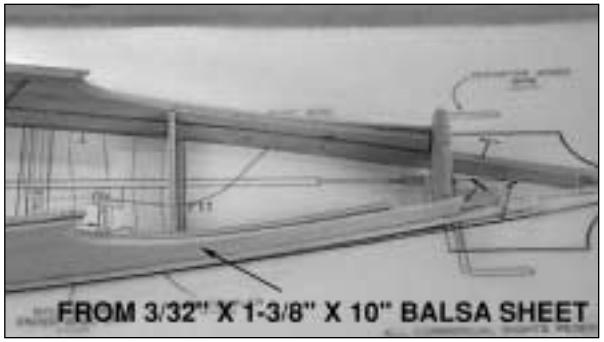
❏ 14. Temporarily place the stab on the stab saddles and hold it in place with weights. Cut the end of a

3/16" x 3/16" x 30" balsa **stringer** so it fits the LE of the stab as shown in the photo (from here forward, all 3/16" x 3/16" x 30" stringers will be referred to as just *stringers*). Cut the other end of the stringer so it *ends* in the **middle** of former F6. Use a small square to hold the formers vertical as you glue the stringer to them and to the top of the stab saddle (but do not glue the stringer to the stab).

❏ 15. Glue another stringer to the other side of the fuse the same way. Cut a third stringer into two 15" pieces. Glue them into the notches on both sides of the fuselage where the other stringers end at former F6. Don't forget to hold the formers vertical with a small square as you glue the stringers in place.



❏ 16. Cut a 3/32" x 3" x 36" balsa sheet into two 1-1/2" x 36" sheets. Trim one of the sheets to fit between the stringer and the sub stringer on the left side of the fuse. Trim the aft end of the sheet so it ends in the **middle** of former F10. Wet the outside of the sheet with water and glue it in place.



❏ 17. Cut a 10" piece from a 3/32" x 2-3/4" x 30" balsa sheet (save the 20" piece for use later), then cut the 10" piece into two 1-3/8" x 10" pieces. Trim one of the 1-3/8" x 10" pieces to fit the aft end of the fuse so it matches the stab saddle and glue it in place. Note that this aft balsa sheet only contacts the stab saddle near the front but not the rear.

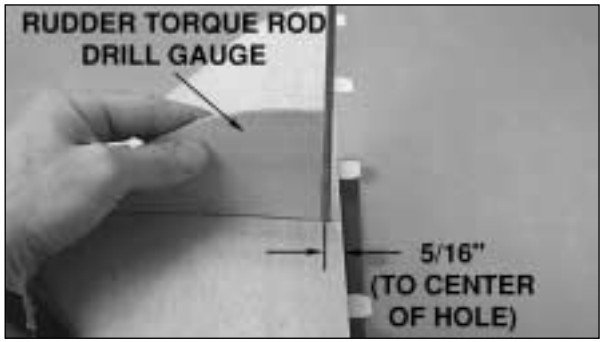
❏ 18. Glue the other 1-1/2" x 36" sheet and the 1-3/8" x 10" sheet on the other side of the fuse the same way.

DC-3 *Fact*

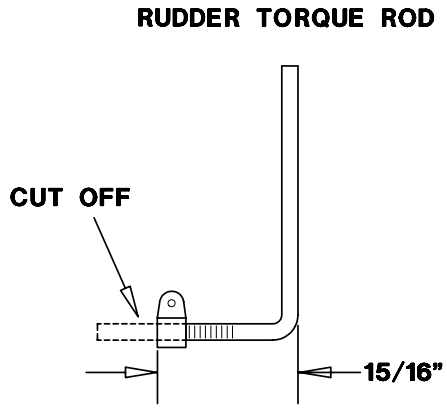
Without a modern passenger plane, TWA was not about to let United Air Lines corner the entire market with Boeing's 247. TWA initiated a program of their own to develop a modern airliner. Douglas responded with the most advanced and the most controversial design, namely the DC-1. TWA ordered one unit and in 1933 the first DC-1 rolled off the assembly line in Santa Monica, California. The DC-1 was bigger and sleeker than any other liner in the industry, including Boeing's Model 247!

MOUNT THE STAB AND FIN

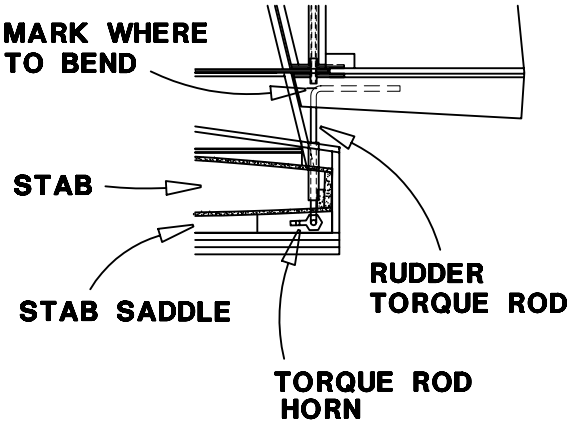
❏ 1. Remove the elevators from the stab. Mark the center of the top of the stab at the TE (using the centerline you marked while you were building the stab as a reference).



❏ 2. Drill a 3/16" hole through the center of the stab 5/16" from the TE for the **rudder torque rod tube**. Use the die-cut 1/8" plywood **rudder torque rod drill guide** to hold your drill at the correct angle and make sure you drill from the top to the bottom. **Hint:** Use a 3/16" brass tube sharpened at one end to drill the hole.



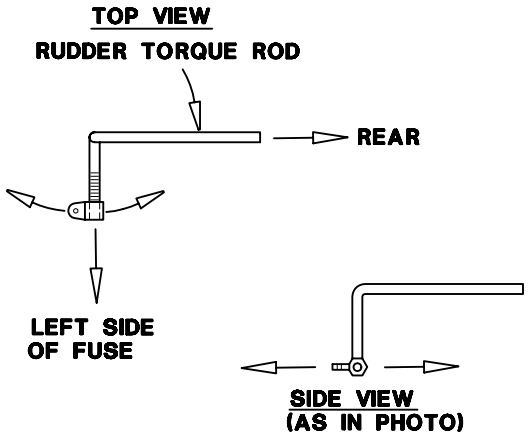
❏ 3. Thread a 6-32 nut (not included) all the way onto the **rudder torque rod.** Cut the threaded portion of the rod and file off the burrs so only 15/16" remains. Unscrew the nut to clean up the threads. Install the nylon **torque rod horn** so it is even with the end of the arm.



REFER TO THIS SKETCH FOR THE NEXT TWO STEPS.

❏ 4. Roughen the outside of the nylon **rudder torque rod bearing tube** with coarse sandpaper. Insert the bearing tube and the rudder torque rod in the hole you just drilled through the stab. Place the stab on the stab saddle. Place your fin and rudder on top of the stab next to the rudder torque rod. Notch the LE of the fin as necessary to accommodate former F10. Align the rudder torque rod with the pivot point of the rudder as shown on the plan for the fin and rudder you are building. The photo that follows illustrates the scale fin and rudder but the procedure is the same for the non-scale fin and rudder.

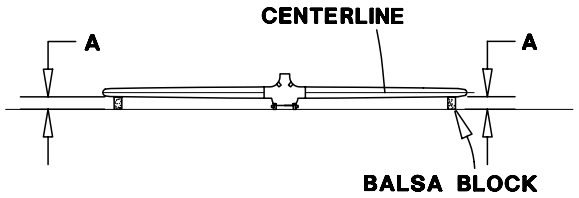
❏ 5. Make sure the threaded portion of the rudder torque rod with the nylon torque rod horn is above the main stringer (as shown in the sketch and on the side view of the fuse plan). Use a felt tip pen to mark where to bend the rudder torque rod as shown on the plan.



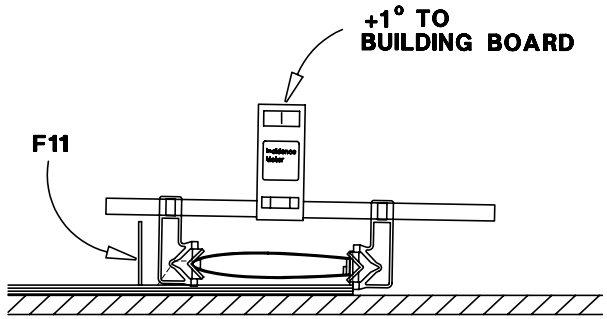
❏ 6. Take the stab off the fuse. With the torque rod and the bearing tube still in the stab, use pliers to bend the torque rod **toward the rear of the fuselage** at the mark you made. Make sure you bend the torque rod **straight back** when the torque rod horn is pointing to the **left** as shown in the sketch.

❏ 7. Return the stab to the fuse and position the fin and rudder on top of the stab next to the torque rod. See if the bend in the torque rod is 90 degrees to the hinge line (or parallel to the rudder ribs). Adjust the bend if necessary.

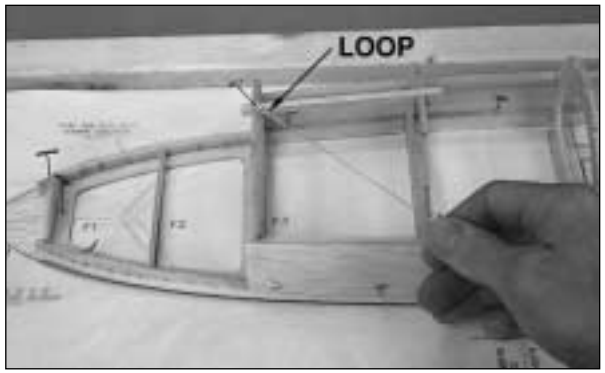
❏ 8. If you haven't already done so, final-sand the stab before you glue it to the fuse. It's easier to do when it's off the fuse than when it is glued in place! Don't sand the mark off the top of the stab near the TE indicating the center.



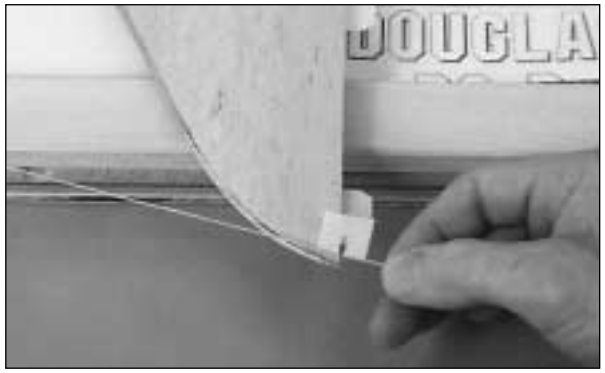
❏ 9. Place the stab on the stab saddle, aligning the centerline mark on the top of the stab with the centerline on the front of former F12. Place weights on top of the stab to hold it in position. View the fuse from the rear and make sure the stab is level. To confirm, place balsa blocks (not included) under both sides of the stab and measure the distance of the centerline on the TE of the stab from your building board. If necessary, reposition the balsa blocks, shift the weight or **carefully** sand the *high* stab saddle until the stab will rest level. Be sure to sand carefully and a little at a time so as not to change the incidence angle of the stab.



❏ 10. With the stab resting on the saddles and weights on top to hold it down, check the stab incidence by placing an Incidence Meter across one side of the stab, then the other side of the stab near the fuse. If necessary, adjust the stab saddles so the incidence is **+1 degree to your building board**.



❏ 11. Place a leftover piece of 3/16" x 3/16" stringer in the top, center notch of formers F3 and F4. Insert a T-pin in the stringer where shown. Tie a small loop at one end of a 48" length of string and slip it over the T-pin.



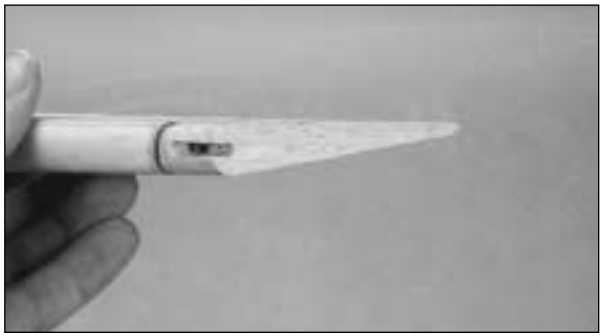
❏ 12. Fold a piece of masking tape over the other end of the string and draw an arrow on it. Slide the tape along the string and align the arrow with one end of the stab. Swing the string over to the other end of the stab. Shift the stab and slide the tape along the string until the distances between both ends of the stab and the front of the fuse are equal. Now your stab is centered and square with the fuse. For future reference, mark the LE of the stab over the stab saddles to help you reposition it.

❏ 13. Recheck to see that your stab is still level.

❏ 14. One last thing before you glue the stab to the fuse. Apply a small dab of petroleum jelly to the rudder torque rod on both ends of the bearing tube to keep glue out when you glue the bearing tube to the stab (later in the manual).

❏ 15. Now that you are sure the stab will align, remove it and apply 30-minute epoxy to the joining areas and glue it to the fuse sheeting and the ply stab saddle. Use the pin-and-string technique to recheck your alignment. make sure your stab is level and the incidence is correct. Wipe away excess epoxy before it cures. Do not build up a fillet between the stab and the fuse. Do not disturb the fuse until the epoxy is fully cured.

❏ 16. Notch the LE of the fin as necessary to accommodate former F10 and reposition the fin and rudder on the stab. Mark the rudder where the rudder torque rod will enter.



❏ 17. Remove the rudder and drill a 1/8" hole through the rudder base at the mark you made. Cut a groove in the rudder LE so you can insert the rudder torque rod. The scale rudder is shown in the photo. The groove in the LE of the non-scale rudder would be similar to the groove in the elevators for the joiner wire.

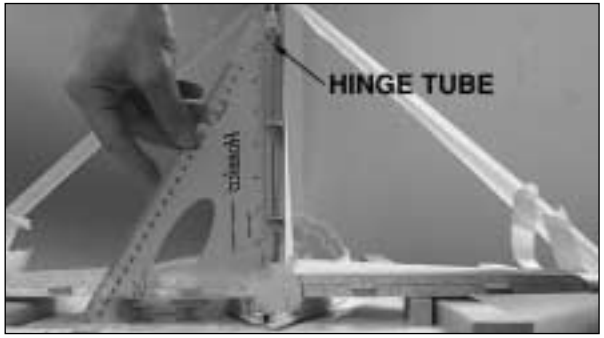
Skip this step if you are building the non-scale fin and rudder.

❏ 18. Enlarge the groove in the bottom of the TE of the fin to accommodate the rudder torque rod and the bearing tube.

❏ 19. Test fit the fin and rudder to the stab with the torque rod. Make adjustments where necessary so the torque rod fits all the way into the rudder and you can freely pivot the rudder side to side.

❏ 20. Remove the rudder from the fin. Refer to the following photo. Align the hinge tube on your scale fin (or the centerline on the TE of the non-scale fin) with a 90 degree triangle on your building board. If necessary, sand the sheeting on the high side of the fin to get it vertical.

❏ 21. After you are satisfied with the fit of the fin to the stab, remove the fin from the stab. Apply a film of 30-minute epoxy to the base of the fin and to the stab sheeting. Reposition the fin on the stab, aligning the rudder torque rod with the center of the fin TE. Align the LE of the fin with the centerline on the plan. Immediately proceed to the next step.



❏ 22. Hold the fin vertical with masking tape strapped across the top of the fin over to both stab tips. Adjust the tension on the masking tape to pull the fin to one side or the other until it is vertical. Temporarily join the rudder to help make sure the fin is aligned with the rudder torque rod. Re-check alignment and do not disturb the fin until the epoxy is fully cured.

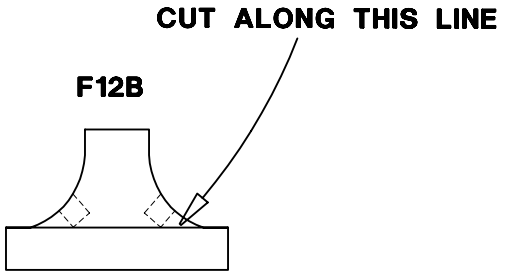
DC-3 *Fact*

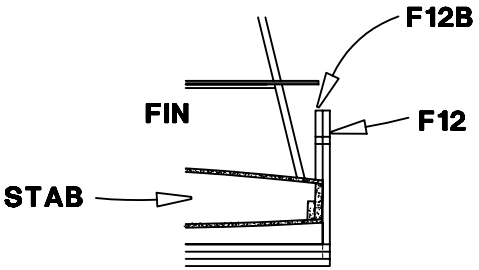
Probably the greatest contributing factor to the acceptance of the DC-1 by TWA officials (and a subsequent purchase order for twenty more "improved" versions—the DC-2) was the ability of the DC-1 to take off on a single engine! TWA paid Douglas $125,000 for that first DC-1, though it cost Douglas $807,000 to build.

Now let's sheet the top of this thing and get it off your building board...

SHEET THE TOP OF THE FUSELAGE

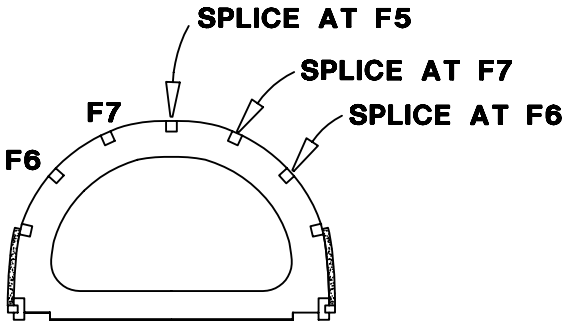
❏ 1. Remove any T-pins you have in the main stringer inside the fuselage and stick them through the main stringer outside the fuselage.

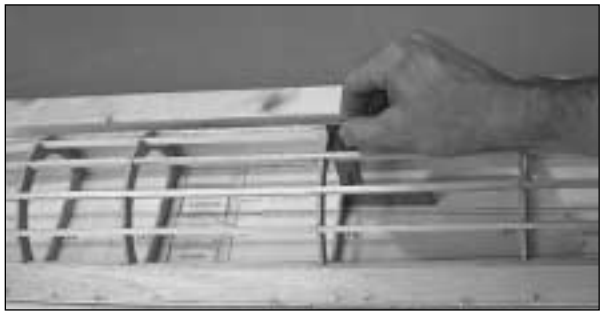




❏ 2. Cut the die-cut 1/8" balsa former **F12B** as shown in the sketch. Glue F12B to the front of former F12 on top of the stab. Note that F12B is slightly smaller than F12. This is to provide a small *ledge* to support the sheeting.

SPLICE THE STRINGERS WHERE INDICATED





❏ 3. Glue the stringers in the rest of the notches in the formers (this should take eight stringers). Splice the stringers (since they are not long enough to go the entire length of the fuselage) in the middle of the formers where indicated in the sketch. Cut the aft end of the top middle stringer so it matches the LE of the fin. *Feather* the stringers to the stab as shown in the photo. Use a small square to hold each former vertical as you glue the stringer to it. **If your formers are twisted, you will see that this procedure pulls them into alignment.**

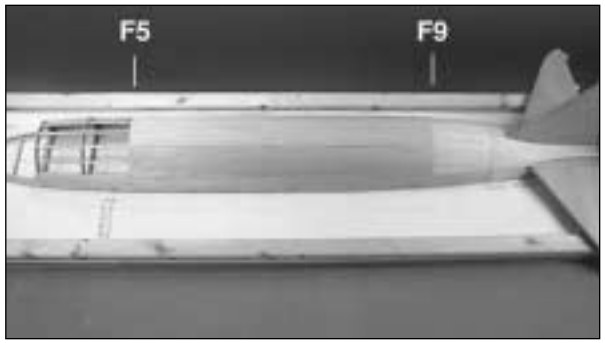
❏ 4. Refer to the photo that follows. Cut the **stab/fin filler pattern** from the plan and use it to cut two stab/fin filler sheets from a 3/32" x 3" x 30" balsa sheet. Cut the filler sheets slightly oversize to allow for trimming and fitting.

❏ 5. Test fit one of the filler sheets to the left side of the fuse and trim where needed for a good fit. If necessary, wet the sheet to make it easier to bend as you fit it to your fuse. Note that the aft end of the sheet ends at former 12 and is glued to F12B.

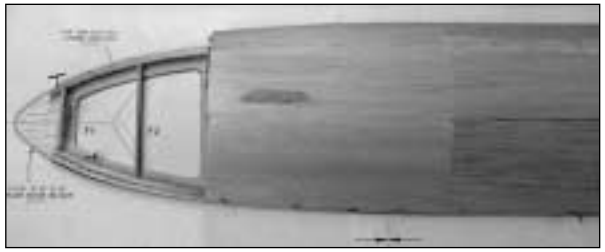
❏ 6. When you are satisfied with the fit of the filler sheet, glue it in position with medium or thin CA. Fill the small space between the filler sheet and the bottom of the rudder with a leftover piece of 1/16" balsa. This filler piece doesn't have to be perfect because it will be covered with balsa filler later.

❏ 7. Test fit and glue the filler sheet to the right side of the fuse the same way.

❏ 8. Use the **aft fuse sheeting pattern** to make two **aft fuse sheets** from the 20" long piece of 3/32" x 2-3/4" balsa (leftover from the piece of balsa fuse sheeting on the stab saddle). The front of the sheet ends in the **center** of F9. Test fit the sheets to the fuse just ahead of the fin to the center of F9 and trim for a good fit. Trim as necessary, then glue the sheets in position.



❏ 9. Use three 3/32" x 2-3/4" x 30" balsa sheets to sheet the fuse from the front of the aft fuse sheets (at F9) to F5.



❏ 10. Use an additional 3/32" x 2-3/4" x 30" balsa sheet to sheet the rest of the top of the fuselage—*no, it's not a dirigible!*

❏ 11. Remove the T-pins and take the fuse top off your building board. Inspect the inside of the fuselage and reinforce glue joints you missed or couldn't reach while the fuse was pinned to your building board. If you wish to do some sanding to the fuse sheeting in order to smooth things out a little, you may do so now but do not final sand the fuse until instructed to do so. **Hint**: If you need to fill any seams with balsa filler, do this before sanding. This way you won't clog seams with balsa dust, so the filler will adhere better.

Don't start drooling over your work yet. You've got a little further to go before the fuse is finished! (It is a beauty though isn't it?).

❏ 12. Trim the side stringers even with F12.

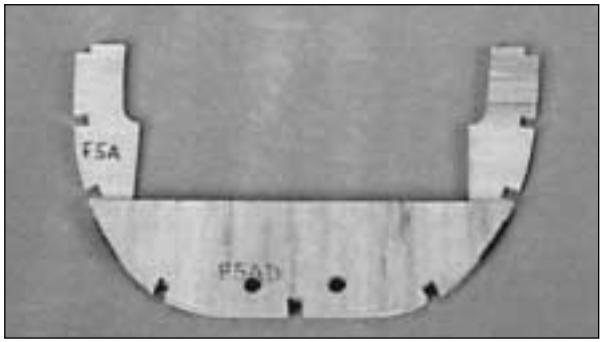
❏ 13. From inside the fuselage, inspect the glue joint between the stab and the stab saddles. If you didn't get a good fit, add a **small** fillet of epoxy and microballoons or epoxy and milled fiberglass to strengthen the joint. Keep it light, don't add too much!

DC-3 *Fact*

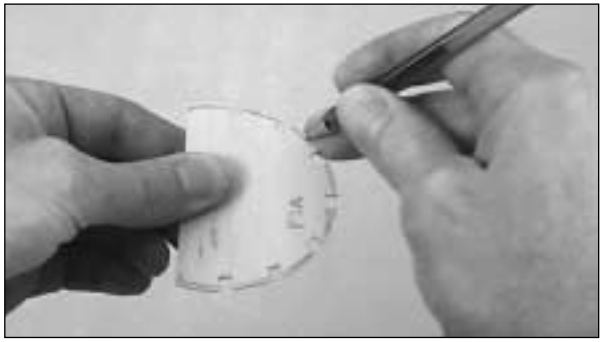
It was not long before the U.S. military became interested in the DC-1. The Army Air Corps had a need for a modern cargo/troop transport aircraft. Although impressed with the DC-1 after test pilots put it through its paces, the military opted to wait for the improved DC-2 before placing orders.

BUILD THE BOTTOM OF THE FUSELAGE

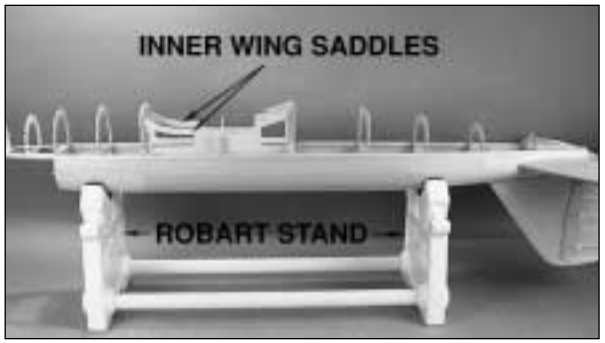
❏ 1. Place your fuselage upside down in a stand so you can work on it. We prefer the Robart *Super Stand*. You can see it in many of the following photos.



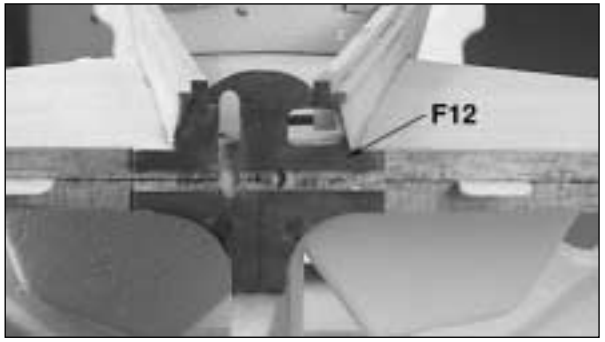
❏ 2. Gather the die-cut 1/8" plywood fuselage **formers F1A** through **F11AD** for the bottom of the fuselage. Glue former F5AD to F5A. From now on the F5A/F5AD assembly will be referred to as **F5A**.



❏ 3. Use a ballpoint pen to mark a line 1/16" inside the edge of former F1A. Bevel the edge of F1A to this line.



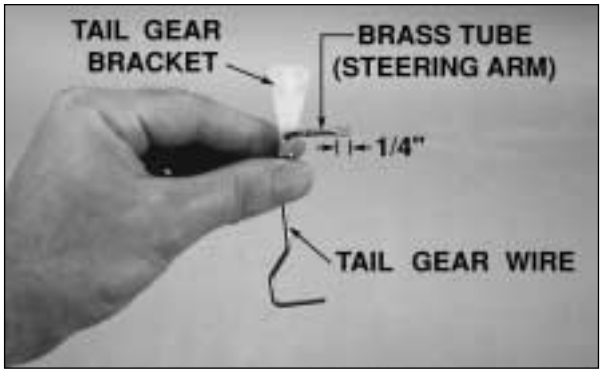
❏ 4. Glue formers F1A through F12A to their respective formers. Use a straightedge to align the "A" formers with the top formers as you glue them in place. From now on the top and bottom former assemblies will be referred to as just *formers* (for example, F4 and F4A will be referred to as F4). Add the die-cut 1/8" plywood **inner wing saddles** to the assembly and glue them in place.



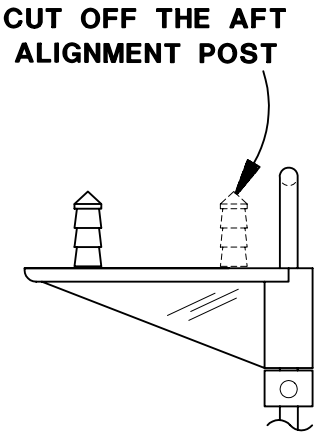
For this photo, we darkened F12 and removed the joiner wire to illustrate how F12 should look when you're done.

❏ 5. Use a rotary tool or a hobby knife to cut former F12 to accommodate the elevator joiner wire and the horn on the joiner wire. Test fit the elevators with the joiner wire to make sure you've allowed enough clearance.

INSTALL THE PUSHRODS



Refer to this photo for step 1 and 2.



❏ ❏ 1. Cut the aft ***alignment post*** off the nylon **tail gear bracket**. Use pliers to flatten 1/4" of one end of the 1/8" x 1-1/8" **brass tube**. Slide the tube onto the **tail gear wire** and place the assembly over the plan to make sure it is the correct length.

❏ 2. Read the Hot Tip that follows and silver solder the brass tube to the tail gear wire.

HOT TIP

SILVER SOLDERING

Use this process when soldering.

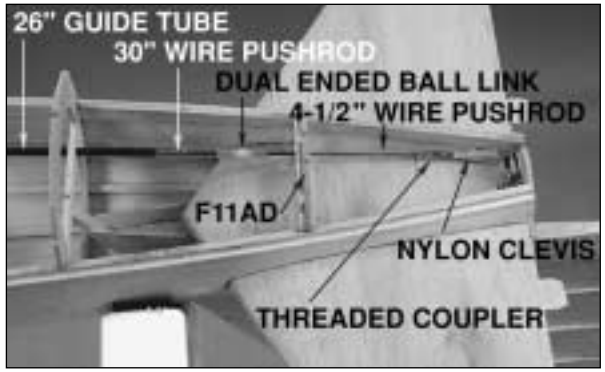
A. Thoroughly clean the parts to be soldered with alcohol or other solvent.
B. Roughen the areas to be soldered with fine sandpaper. Clean again.
C. Apply soldering flux or soldering acid to both parts.
D. *Tin* the joining areas of both parts (heat the part and coat it with a thin coat of solder). Apply more soldering flux.
E. Join the parts as you apply heat. Apply more solder and make sure it flows into the joint.
F. Do not move the parts until the solder has solidified.
G. Test the joint by pulling hard.
H. Remove excess flux with alcohol or other solvent. Inspect the joint. A secure solder joint has a shiny appearance. If the solder is rough appearing or not shiny, reheat and allow to cool.
I. Coat the parts with a thin film of oil.

❏ 3. Drill a 1/16" hole through the end of the brass tube where shown on the plan. From now on this portion of the tail gear wire will be referred to as the ***steering arm***.

❏ 4. Secure a 0-80 **threaded ball link ball** to the steering arm with a drop of thread locking compound and a **0-80 nut.**

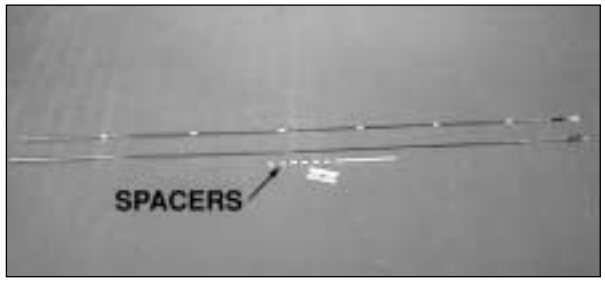
❏ 5. Drill 1/16" holes through the two punch marks in the front of the die-cut 1/8" plywood **tail gear plate** and a 1/8" hole through the aft punch mark. Glue a piece of leftover 1/8" plywood to the top of the tail gear plate over the 1/16" holes (remember: the *top* is the side that faces the top of the fuse even if the fuse is upside down during this step). Re-drill the 1/16" holes through the ply plate you just added.

❏ 6. Mount the tail gear bracket to the tail gear plate with two #2 x 3/8" screws. Set the tail gear plate aside for now.



Use this photo for the next four steps. *Disregard former F11AD until you build the bottom hatch.*

❏ 7. If you built the scale rudder and used part of one of the 3/16" x 36" **pushrod guide tubes** for the guide tubes in the rudder, cut the remainder of that tube to a length of 26". If you've built the non scale fin and rudder, cut one of the 3/16" x 36" **pushrod guide tubes** to a length of 26". Sand the outside of the guide tube with coarse sandpaper so glue will stick. Slide the tube through the holes in the formers for the rudder guide tube as shown on the plan.



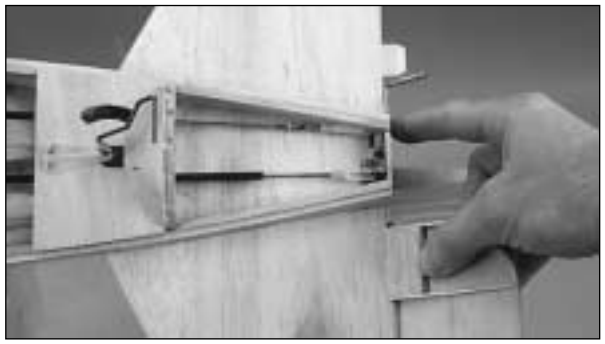
❏ 8. Cut a **.074" x 36" wire pushrod** to a length of 30". This will be the **tail gear/rudder pushrod.** Clean residual oil from the pushrod wire with a cloth dampened with alcohol or other solvent. Cut six 3/8" **spacers** from the white inner pushrod tube, then slide them, evenly spaced, onto the wire. Make sure you position the bushings at the ends of the wire so they will not protrude from the guide tube, or the controls could become jammed during flight. If the spacers slide easily onto the wire, secure them with a drop of thin CA (make sure the CA sets before you slide the pushrod into the guide tube!). If the spacers are difficult to slide on, cut them to a shorter length so they will be a little easier to slide onto the wire. Set the wire aside.

❏ 9. Cut the **.074" x 12" wire pushrod** to a length of 4-1/2". Silver solder a brass **threaded coupler** onto this wire. Screw a nylon **clevis** about 12 turns onto the wire pushrod. Join the threaded coupler to the pushrod you prepared in the previous step with a nylon **dual ended ball link.** Screw both wires into the ball link about 12 turns. Slide the pushrod through the hole in former 11 and into the guide tube. Temporarily connect the clevis to the rudder torque rod.

❏ 10. Move the pushrod back and forth and make sure the rudder can move freely. Enlarge the hole in F12 or shave part of the left stab saddle if necessary.

❏ 11. Position the tail gear plate on the fuse and snap the ball stud onto the ball link. Adjust the nylon clevis so the rudder is centered when the tail gear wire is centered.

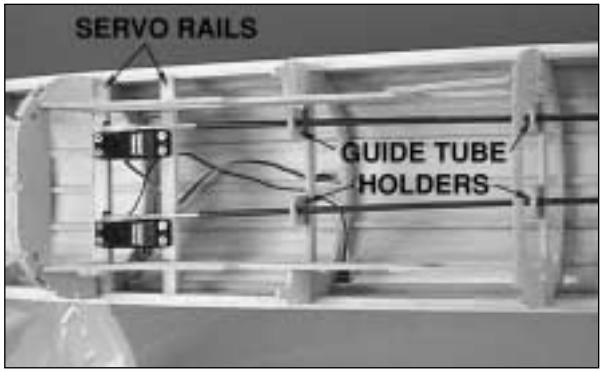
❏ 12. Cut another 3/16" x 36" pushrod guide tube to a length of 31". Sand the outside so glue will stick. Slide the tube through the other holes in the formers as shown on the plan for the **elevator guide tube.**



❏ 13. Make the elevator pushrod with the other .074" x 36" threaded one end pushrod and eight spacers. Thread a nylon clevis onto the rod about 12 turns. Slide the pushrod into the guide tube and connect the clevis to the outer hole

of the horn on the elevator joiner wire. Move the elevator up and down and make sure you can get all the throw recommended on page 62 of the manual. If necessary, enlarge the slot in F12 or the slot in the TE of the stab.

While we're at it, let's mount the elevator and rudder servos.



Refer to this photo for the following six steps.

❏ 14. Use a 1/4" x 3/8" x 36" basswood stick to make the **servo rails.** Glue the front rail between the main stringers and to former F5. Use the servos to set the location of the aft servo rail. Make sure you position the aft rail with enough space to permit you to remove the servos if you need to later on. Glue the aft rail to the side stringers and the inner wing saddles.

❏ 15. Use the screws included with the servos to mount your servos to the servo rails where shown on the plan.

❏ 16. Cut both pushrods to the correct length and silver solder a threaded coupler to them.

❏ 17. Drill a 3/16" hole at the punch mark through the die-cut 1/8" plywood **guide tube holders**. Slide four guide tube holders over the elevator guide tube and two guide tube holders over the rudder guide tube. Connect the pushrods to the servos with a nylon clevis.

❏ 18. Make sure your pushrods are the correct length and your clevises are threaded on the right amount so that when your servos are centered, the rudder, tail gear wire and the elevator are neutral. Now is the best time to make adjustments if any are needed.

❏ 19. Glue the guide tube holders to the formers where shown on the plan so the guide tubes align with the servos. Position the guide tubes so the ends don't interfere with the servos or controls. Glue the guide tubes to the formers and tube holders with medium or thin CA.

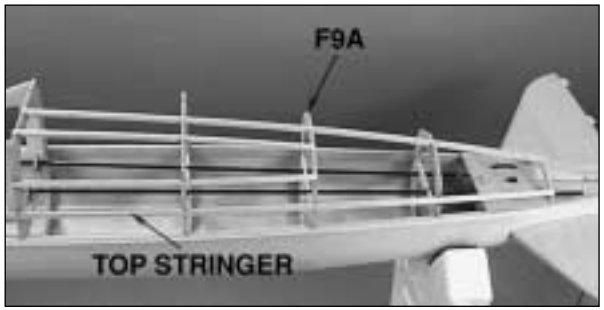
❏ 20. Make sure the ball stud is secure on the rudder steering arm with thread lock and the 0-80 nut. Glue the tail gear plate to the main stringers. Keep the tail wheel centered. Glue the rudder torque rod bearing tube to the stab with medium CA. Be careful not to get any CA into the bearing tube.

❏ 21. Unscrew the #2 screws that hold the tail gear bracket to the tail gear plate and take the tail gear off the plate. Set the tail gear and the screws aside for now.

DC-3 *Fact*

The one and only DC-1 served a full career with TWA, then was sold to Howard Hughes. Hughes sold the airplane to the Spanish government, but the DC-1 met its demise after an engine failure during takeoff in 1940. *(Guess they didn't read the "Engine Out" section in our manual.)*

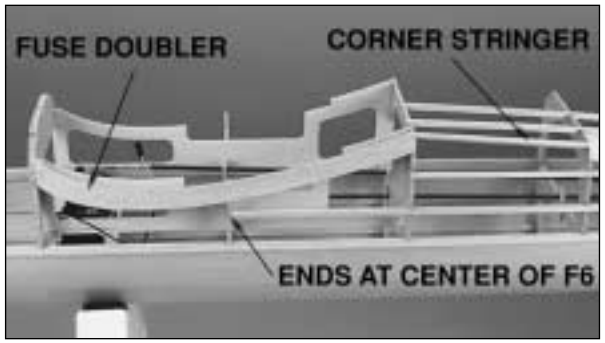
FINISH THE BOTTOM OF THE FUSE



❏ 1. Cut and glue the stringers for the **aft right** side of the fuse bottom from three 3/16" x 3/16" x 30" balsa sticks and glue them in place as shown in the photo. The top stringer ends in the middle of former F6 (refer to the photo at step four).

❏ 2. Sand the aft end of the stringers at F9A to accommodate the **bottom corner fillers.**

❏ 3. Cut two 15" long **bottom corner fillers** from the 1/4" x 1-3/4" x 30" balsa sheet. Trim the aft end of one of one bottom corner filler to fit between the stringers at F11. Glue that corner filler to formers 8 through 11 on the right side of the fuse as shown in the photo and on the plan. Sand the corner filler as shown in the cross sections on the plan.



❏ 4. Glue the die-cut 1/8" balsa **fuse doubler** to formers F5, F6 and F7, then glue a corner stringer between former F7 and the front of the corner filler.

❏ 5. Glue the 3/32" x 3/16" x 30" stringers in the notches of the formers in the front of the fuselage. Note that

these stringers are installed one at a time in **two layers** and the uppermost stringer (nearest the main stringer) extends to F6. Trim the front of the stringers even with F1. *Don't be concerned with the stringers of the aft left side of the fuse, we'll get to them later.*

❑ 6. Use the **lower fuse side skin pattern** on the plan to make two **lower fuse side skins** from three 3/32" x 3" x 30" balsa sheets. Wet one side of one of the lower fuse side skins so you can bend it around the formers and the bottom corner filler. Glue the sheet to the fuse as shown in the photo.

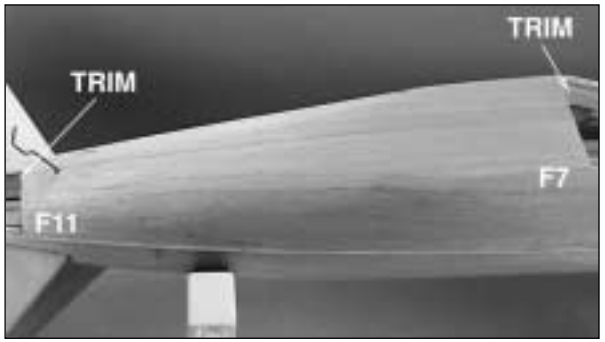
❑ 7. Make an **aft bottom fuse sheet** from a 3/32" x 2-3/4" x 30" balsa sheet. Glue the sheet to the stringers and corner filler. Sand the sheet to match the photo and the cross section on the plan. Note that after sanding the bottom corner filler is partially exposed except near the rear.

❑ 8. Use coarse sandpaper to roughen the nylon **bearing tube** on the tail gear wire.

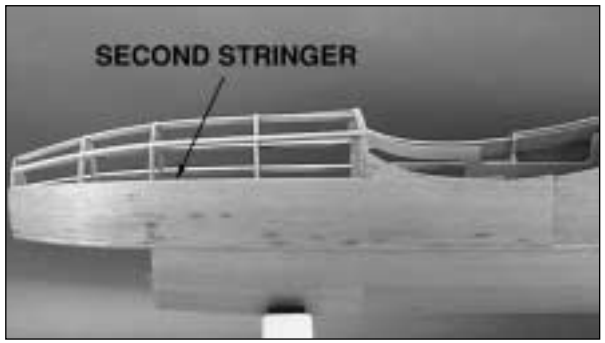
❑ 9. Cut a notch in the bottom middle stringer to accommodate the bearing tube on the tail gear wire. Mount the tail gear bracket to the tail gear plate. Add a drop of medium CA to the two #2 screws and screw them to the tail gear plate permanently holding the tail gear bracket in position. Hold the steering arm *down* with a screwdriver and pull the dual ended ball link *up* with needle nose pliers or hemostat and snap the ball stud onto the dual ended ball link. Glue the bearing tube to the stringer with medium CA.

❑ 10. Secure the wheel collar to the tail gear wire with a drop of thread lock and a small set screw.

❑ 11. Use two 3/16" x 3/16" x 30" balsa sticks for the stringers of the formers on the **aft left** side of the fuse bottom and glue them in place. Glue the other wing fuse doubler, the bottom corner filler and a corner stringer to the left side of the fuse. Sand the corner filler the same as the first.

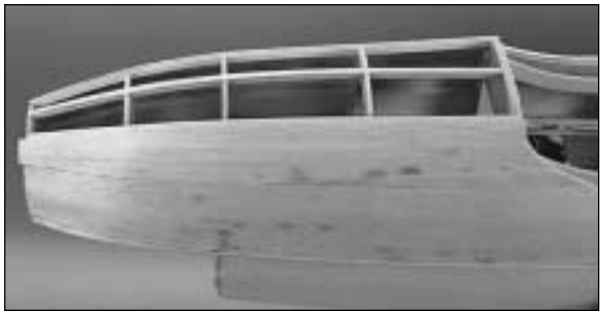


❑ 12. Sheet the aft left side of the fuse with the other aft lower side skin and sheet the left bottom of the fuse with a 3/32" x 2-3/4" x 30" balsa sheet the same way you did the other side. Sand the sheeting to match the right side. Trim the ends of the sheeting even with former F11 and former F7.



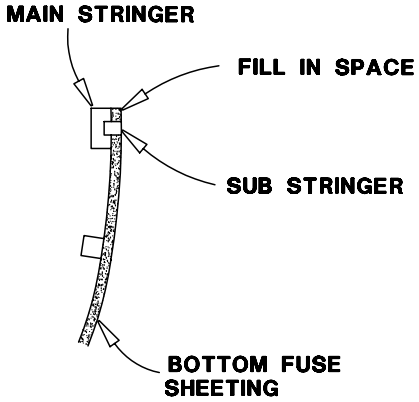
❑ 13. Use a 3/32" x 3" x 36" balsa sheet to sheet one side of the forward front of the fuse from the side stringer down to the middle of the second stringer. Save the leftover piece of sheeting (it should be about 17" long) to be used a few steps later.

❑ 14. Sheet the other side of the fuse the same way with another 3/32" x 3" x 36" balsa sheet.



❑ 15. Use the two leftover 3/32" x 3" balsa sheets to sheet both sides of the fuse from the sheet you just glued in place to the middle of the next stringer.

❑ 16. Use a 3/32" x 3" x 36" balsa sheet to sheet the remaining portion of the bottom of the fuselage.



❑ 17. Fill-in the space where the cabin top is mounted to the fuse, between the sub stringer and the main stringer with leftover balsa. Sand even with the fuse.

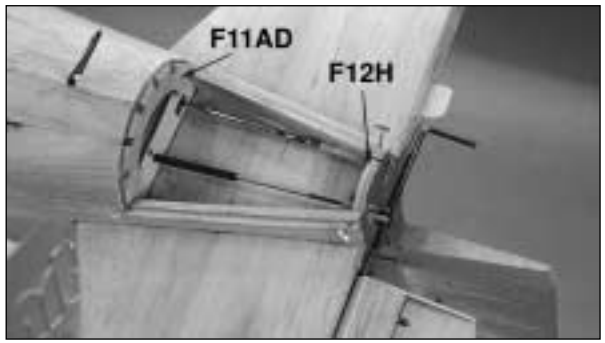
❑ 18. Now that the fuselage is fully sheeted (except for the hatch on the bottom at the aft end of the fuse), use a razor plane to trim the main sub stringers even with the fuse sides. Fill any gaps you see between the sheeting with balsa filler. After the filler dries you may rough sand the fuse to remove high spots and to blend the sheeting, but do not final sand until instructed to do so.

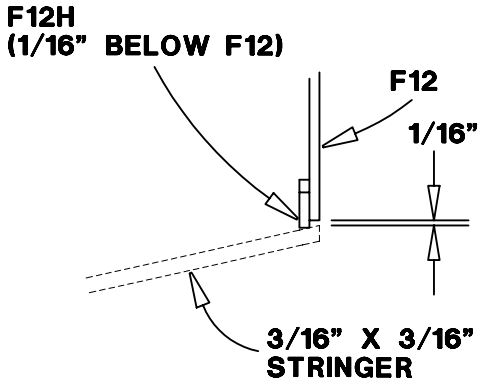
DC-3 *Fact*

In the 1903's the airline industry was still booming and competition was fierce. The DC-3 was born out of American Airlines' need to remain competitive with other *players* in the industry—namely TWA who had the DC-2.

MOUNT THE AFT HATCH

Making the aft hatch removable is optional. It would be easier just to glue all the parts to the fuse, but some prefer not to permanently enclose the rudder and elevator hookups so they can inspect or adjust them later if necessary. Another option is to make the tail cone removable instead. Study the following section to see how you would like to do it. The following instructions show how to make the aft hatch removable.





❑ 1. Fit but do not glue, the die-cut 1/8" plywood former **F11AD** to the main stringers and former F11. Slip a piece of waxed paper between F11AD and F11. Position the die-cut 1/8" balsa former **F12H** to former 12 so it is 1/16" below F12. Hold F12H in place with T-pins.

❑ 2. Use a 3/16" x 3/16" x 30" stick for the stringers that connect F11AD to F12H. Glue the stringers in the notches of F11AD and to the bottom of F12H. Be careful **not** to inadvertently glue F11AD and F12H to the fuse so your hatch can be removable.

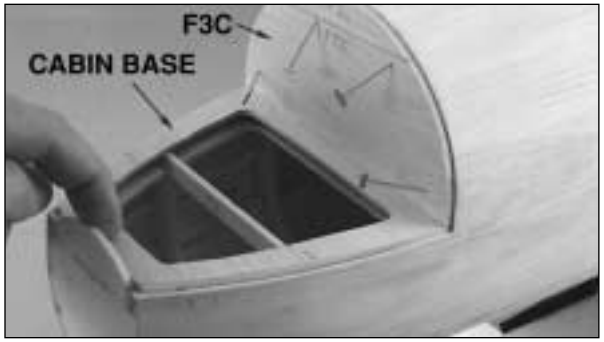
❑ 3. Sand the end of the stringers even with the end of the fuse. Remove the assembly from the fuse to make sure you haven't glued it in place. Replace the hatch to the fuse.

❏ 4. Sheet the hatch with leftover 3/32" balsa. After the glue dries, temporarily remove the hatch (to make sure you have not inadvertently glued it to the fuse) and replace it to the fuse. Sand the hatch to match the fuse.

❏ 5. The method we used to secure the hatch to the fuse was simply to cover the fuse and the hatch as *one* as if there was no hatch. It is not likely that you will ever need to access the connectors inside the hatch but if you ever do, just cut through the covering around the hatch. If you would like to make the hatch more easily removable, you may use your own method to secure the hatch (such as screws or tape).

FIT THE CABIN TOP

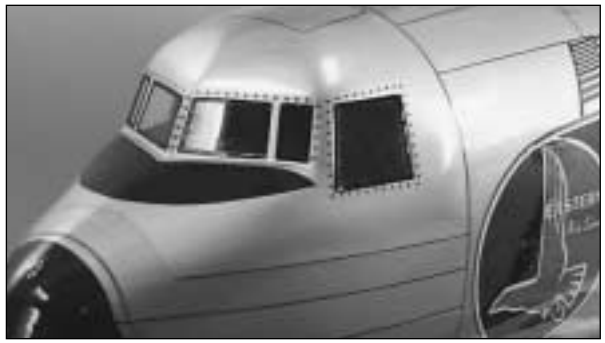
❏ 1. Cut the molded plastic cabin top along the cutlines (always cut about 1/8" beyond the cutlines to allow for trimming).



❏ 2. Bevel the edges of the die-cut 1/8" plywood **cabin base** to match the sides of the molded plastic cabin top and place it on the fuse. Glue the die-cut 3/32" balsa **top aft cabin former F3C** to the **bottom aft cabin former F3C**. From now on this is F3C. Position F3C on top of the cabin crutch against former F3 and shape so it is about 1/32" smaller than fuse sheeting (to accommodate the thickness of the plastic cabin top).

❏ 3. Temporarily hold F3C to the fuse with T-pins.

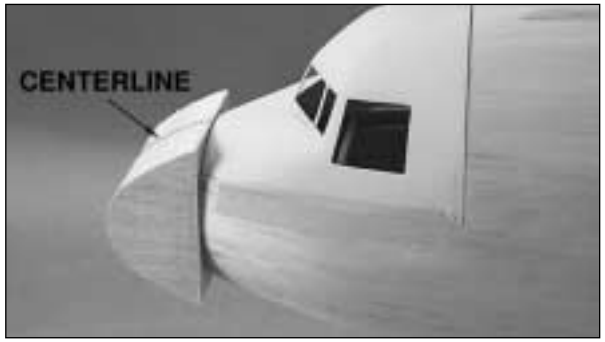
❏ 4. Position the plastic cabin top on the fuse. Note any high spots where the cabin top needs to be trimmed for a good fit. Trim as necessary



A NOTE ABOUT THE WINDOWS

A clear plastic sheet is provided for the windows. You may cut the window openings in the cabin top and install the clear plastic windows, just make stickers or paint on simulated windows. If you decide to install the clear windows, cut the window openings from the cabin top along the cutlines (most easily seen from the inside). Cut the individual clear windows using the cutouts in the cabin top as a guide. You can cut the clear windows slightly oversize and glue them to the inside of the cabin top, or carefully cut them to the exact size and inset them into the cabin top as we did on our prototype (shown in the photo). When it's time to install the windows (after you paint the cabin top), you can carefully glue them in place with a small amount of medium CA or canopy glue. Cover the seams between the windows and the cabin top with 3/32" black striping tape. If the clear windows seem like more work than you are willing to do, make *window stickers* from trim sheet using the window patterns on the plan *(actually, the window stickers don't look bad—there's nothing to see inside the cabin anyway!)*.

❏ 5. Use your bar sander to sand the front of the cabin top even with the front of the fuselage.



❏ 6. Draw a centerline around the front of the shaped balsa **nose block**. Test fit, then glue the nose block to the front of the fuselage.

❏ 7. Roughly carve the nose block to match the fuselage and the shape shown on the plan. Use the centerline you drew as a guide to keep the nose block symmetrical.

❑ 8. Final shape the nose block and blend it to the fuselage with progressively finer grits of sandpaper. You can see the final shape of the nose cone on the plan and in photos throughout the rest of the manual.

❑ 9. If you've cut out the windows, paint the inside of the cabin top, the cabin base and F3C black.

❑ 10. The cabin top is intended to be permanently glued to the fuselage, but if you decide to make it removable, tack glue the cabin top to the cabin base and F3C (without gluing it to the fuse). Remove the glued-together cabin top and formers from the fuse and securely glue them together. For a permanent cabin top, glue the cabin base, F3C and the cabin top to the fuselage.

❑ 11. Blend the cabin top to the fuse with filler, followed by sanding and a light coat of primer to make a smooth transition between the cabin top and the fuse. If your cabin top is removable, fashion a method to hold it in place. You could use a rubber band to hold the cabin top to a wire or a hook glued to the bottom of F3A, or come up with your own method.

DC-3 *Fact*

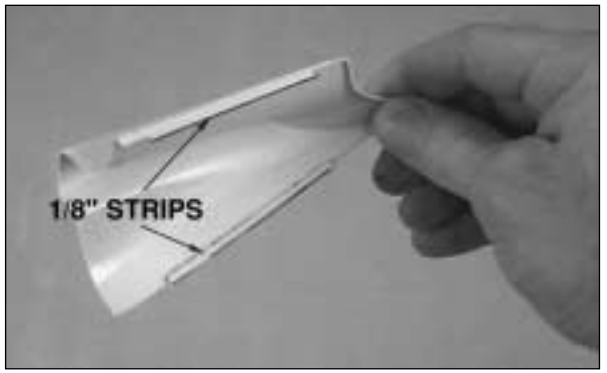
The first incarnation of the DC-3 was the DST, or Douglas Sleeper Transport which was two-and-a-half feet longer and twenty-six inches wider than the DC-2. The new wings were strengthened, had more tapered and rounded tips and featured longer ailerons. The span was also increased by ten feet. The DC-3 was identical to the DST in most ways except that it was purely a daytime transport aircraft accommodating up to twenty-eight passengers.

BUILD THE DORSAL FIN AND FIT THE TAIL CONE

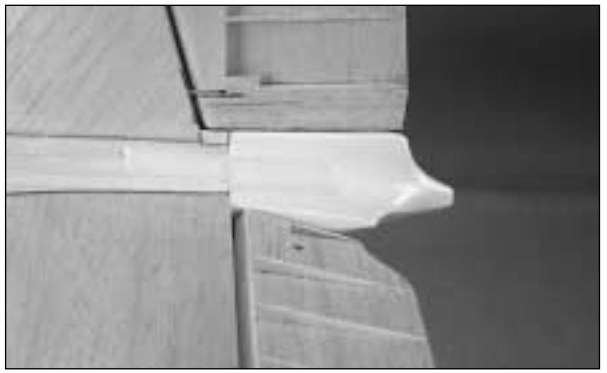
❑ 1. Cut the **dorsal fin LE** from the 15" long tapered balsa stick. Glue it to the top of the fuse and the fin where shown on the plan. Glue the die-cut 1/16" balsa **dorsal fin filler** to the top of the dorsal fin LE and the fin.

❑ 2. Use the **dorsal fin skin pattern** on the plan to make a **dorsal fin skin** for the left side of the fuse from leftover 1/16" balsa. Taper the inside of the aft end of the skin as shown on the pattern so it blends nicely to the fin. Make another dorsal fin skin for the right side and glue the dorsal fin skins in place.

❑ 3. Roughly sand uneven spots on the dorsal fin for now. We'll add the tail cone, then make a fillet around the fin and dorsal fin to blend it all together.

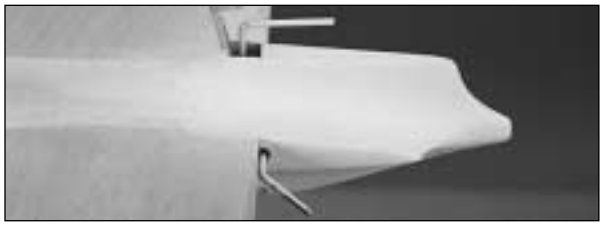


❑ 4. Cut the molded plastic **right** and **left tail cone halves** along the cutlines. Sand the edges so they join. Cut two 1/8" wide strips of leftover ABS and glue them to the inside of one of the halves as shown in the photo.



❑ 5. Glue the two tail cone halves together with thin CA. Test fit the tail cone to the rear of the fuse and trim for the elevator joiner wire. Make further adjustments where needed for a good fit.

❑ 6. It is your option whether to make the tail cone removable or permanent. We elected to make our tail cone permanent so we could use filler for a seamless transition to the fuselage. If you wish to make your tail cone removable, just leave it in position for now. After the tail cone has been painted and the fuse covered, you can glue it to the fuse with RTV silicone so it will be removable if needed. If you choose to permanently glue the tail cone to the fuse, first make sure the elevator and rudder pushrods are connected and there are silicone retainers on the clevises, then glue the tail cone to the fuse.



❑ 7. Blend the dorsal fin to the fin and blend the stab and fin to the fuse with lightweight balsa filler. If your tail cone is permanent, blend it to the fuse with filler as well. Sand the filler after it dries, then blend to the fuse with a light coat of primer the same way you did the cabin top.

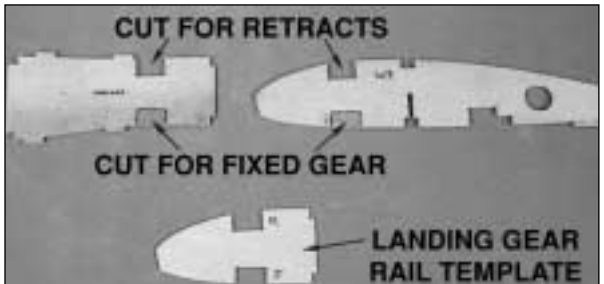
That's all we can do on the fuse until we get the wing done, so... build the wing!

BUILD THE WING

BUILD THE CENTER SECTION

Note: Portions of the manual that **only** apply to fixed landing gear are shaded and begin with an "F". For example: Step F9 is for **fixed gear** only. Steps that apply to **retract landing gear** begin with an "R", such as step R10. It is assumed that most modelers will be installing retracts, so just skip steps that are shaded and begin with an F . If you are building your model for fixed gear, make sure you read the steps that are shaded and skip steps that begin with an R.

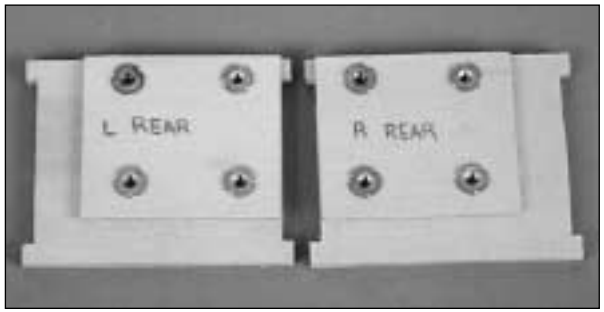
❑ 1. Cut the center section of the wing plan along the dotted line and place it over your building board. Cover the plan with Plan Protector.



❑ 2. Use the die-cut 1/8" plywood **landing gear rail template** to mark the location of the notches for the landing gear rail on the four die-cut 1/8" plywood wing ribs **W3** and both **inboard** and both **outboard nacelle sides.** The notch in the **top** of the template is for retracts (R) and the notch in the **bottom** of the template is for fixed gear (F). Cut the notches in the nacelle sides and ribs to accommodate the rail. The photo illustrates one rib and one nacelle side with the notch cut for retracts. The shaded areas on the bottom of the rib and nacelle side indicate where the notches *would be cut* if you are building fixed gear.

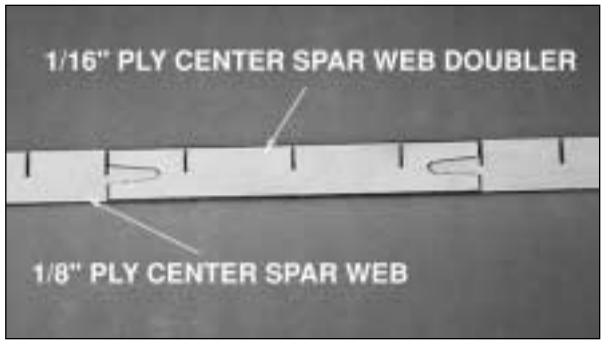
❑ 3. Make two 1/4" **firewalls** by securely gluing together two sets of die-cut 1/8" plywood firewalls making sure the punchmarks are facing **upward**. At this moment both firewalls are the same but we have to make a **right** and a **left** so, after the glue dries drill a 1/16" hole through the punchmarks in **one** of the firewalls and flip it over. Label the upward facing side of this firewall as **left front**. Label the upward facing side of the other firewall as **right front**.

❑ 4. Refer to the following phoho. Glue a die-cut 1/8" plywood **firewall doubler** to the **back** of both firewalls. Note that the firewall doubler is positioned so the edges are even with the **top** and **inside** edges of both firewalls. Also note that the **top** of both firewalls is the edge **closest to the holes** (or punchmarks).

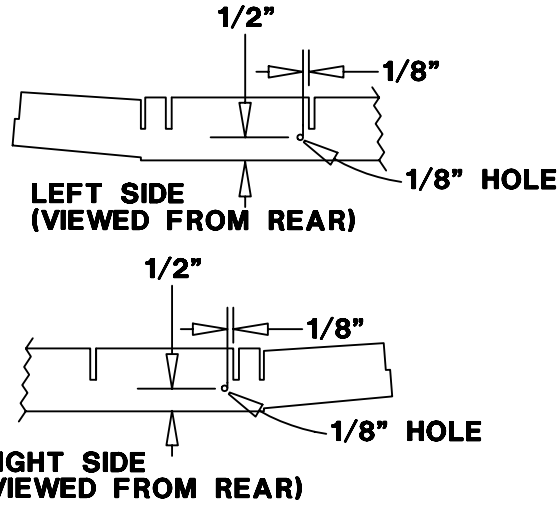


❑ 5. After the glue dries, drill 9/64" (or 1/8") holes through the punchmarks in both firewalls. Install four 4-40 blind nuts into the holes you drilled in the back of both firewalls. Secure the blind nuts with a few drops of thin CA. *For clarity, we've labeled the back of both firewalls in the photo.*

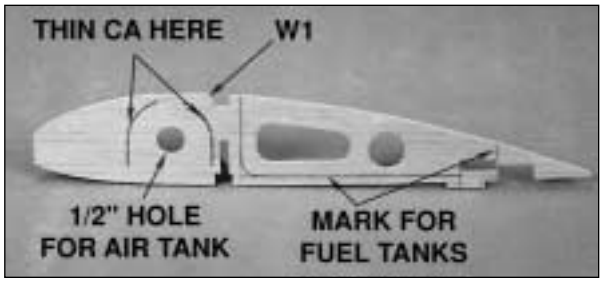
❑ 6. Glue together both die-cut 1/8" plywood **wing bolt plates.**



❑ 7. Glue the die-cut 1/16" plywood **center spar web doubler** to the die-cut 1/8" plywood **center spar web.**



❑ 8. Drill a 1/8" hole for the throttle cable through both ends of the center spar web where shown in the sketch (the **rear** of the center spar web is the side with the 1/16" ply doubler).



Refer to this photo for the following three steps.

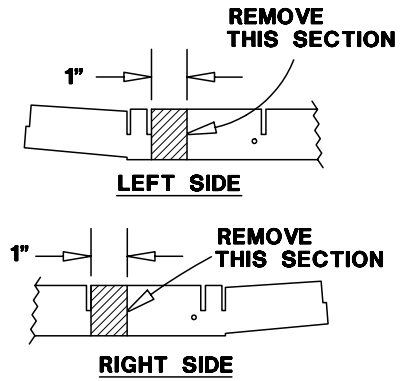
❏ 9. Mark one of the W1's for the fuel tanks as shown in the photo. This is now the **center** W1. Cut partway through the center W1 where marked for the fuel tanks. This partial cut will make it easier to remove this section later.

Remember, "F-steps" are for fixed landing gear only.

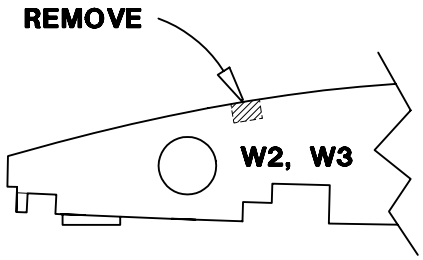
❏ F10. Apply medium CA along the partially die-cut lines of the three W1 ribs and the two W2 ribs.

Remember, "R-steps" are for retracts only.

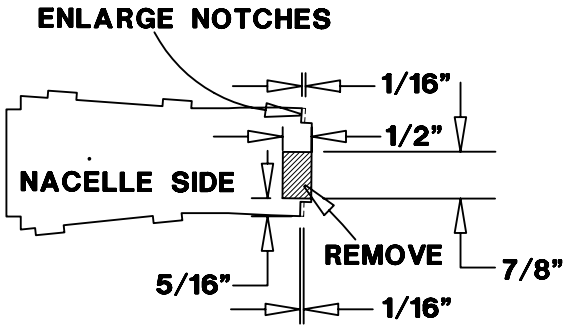
❏ R11. Cut an approximately 1/2" diameter hole through the center W1 for the air line on the air tank. Apply medium CA along the partially die-cut lines of the center W1, an additional W1 and one of the W2's.



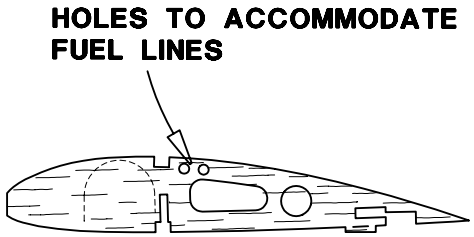
❏ R12. Remove a 1" section from **both ends** of the center spar web where shown in the sketch to accommodate the retract air cylinders.



❏ R13. Cut the two W2 ribs and the four W3 ribs along the partially die-cut lines and remove the shaded area shown in the sketch to accommodate the air cylinder mounting rail.



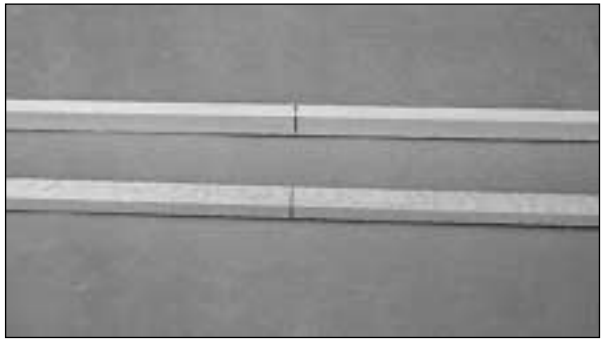
❏ R14. Remove the shaded portion indicated in the sketch from one **inboard** nacelle side and one **outboard** nacelle side to accommodate the air cylinder. Enlarge both spar notches by 1/16" in all four nacelle sides as indicated in the sketch.



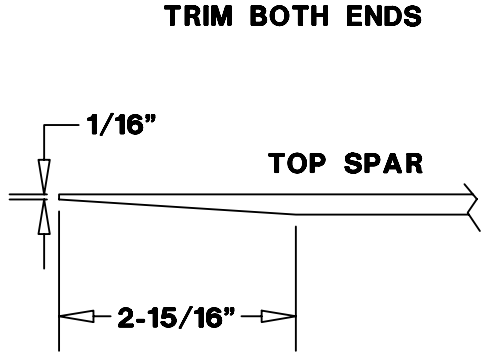
❏ 15. Note the 1/4" holes in W1, W2 and W3 ribs for your fuel lines. Make sure you punch out the balsa and test fit your fuel lines in the holes. Enlarge the holes if necessary so your fuel lines can **easily** pass.

❏ 16. Gather both die-cut 1/8" balsa **center TE spars.** Refer to the center TE spars on the plan. Cut both ends of **one** of the center TE spars to accommodate the dihedral joiner as shown on the plan. Glue the two center TE spars together so the notches align.

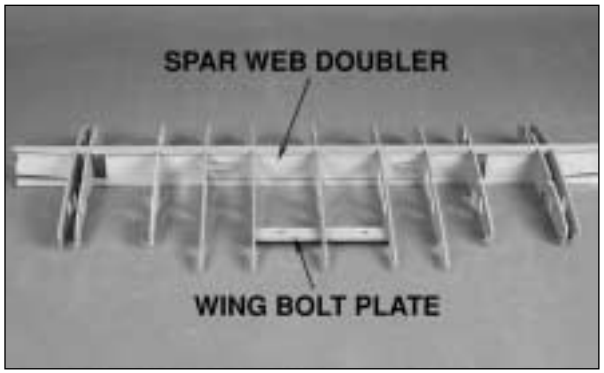
❏ 17. From two 1/4" x 3/8" x 36" basswood sticks, cut two **center section spars** to the length shown on the plan, cut two 5-3/8" long **air cylinder mounting rails** (if you're installing retracts) and cut two 2-7/8" long **spar joiner *wedges*** (to be used later when joining the outer panel to the center section).



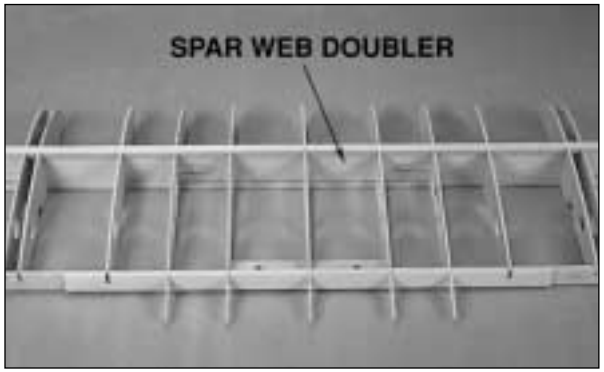
❏ 18. Mark the center of the spars all the way around to help you align them with the center section assembly later on.



❏ 19. Trim both ends of one center section spar as shown in the sketch. This is now the **top** center section spar.



❏ R20. Fit but do not glue the bottom spar and all the ribs of the center section to the center spar web (with the 1/16" spar web doubler facing aft). Join the wing bolt plate and the center TE spar (not shown in this photo) to the ribs. Make sure your *center* W1 is in the center of the spar and make sure the W1 and the W2 with the die-cut lines you filled in with glue are on the **left** side of the center section. Use ribs W3 and W3A to hold the outer sections of the center web in position and make sure the right side of the center web and the corresponding right section of the center web are on the right side of the plan. Finally, join the top spar to the assembly using the centerline you marked for alignment *(no gluing yet!)*.



❏ F21. Fit but do not glue the bottom spar and all the ribs of the center section to the center spar web (with the 1/16" spar web doubler facing aft). Join the wing bolt plate and the center TE spar to the ribs. Make sure your *center* W1 is in the center of the spar. Join the top spar to the assembly using the centerline you marked for alignment *(no gluing yet!)*.

❏ 22. Position the center section assembly over the plan. Use T-pins to hold the ribs down to your building board over their locations on the plan, or use balsa jig sticks leftover from building the tail to hold the ribs over the plan the same way you did for the stab. Make sure the wing bolt plate is centered between the W1 ribs and all the jig tabs are contacting your building board. If you're installing retracts, make sure the outer portions of the spar web are **centered** between the top and bottom spars and that the W3 and W3A ribs are aligned with their location indicated on the plan.

❏ 23. Glue the spar web to the bottom spar and glue all the ribs to the spar web. Pull the TE spar up to fit into the ribs. Glue the center TE spar to the ribs, then glue the wing bolt plate to the center TE spar. Temporarily remove the top spar and apply a bead of thick or medium CA on the top of the spar web. Join the top spar.

❏ 24. Glue both die-cut 1/8" plywood **doublers W1D** to the wing bolt plate and the W1 ribs where shown on the plan.

❏ R25. Glue the 5-3/8" long **air cylinder mounting rails** you cut earlier to ribs W2 and W3 where shown on the plan.

❏ R26. On the **left** side of the center section, cut notches in the outer W3 and W3A ribs to accommodate two 1/16" plywood **spar braces.** On the **right** side of the center section, cut a notch in the innermost W3 rib on both sides of the top spar the same way. From a 1/16" x 1/4" x 10" ply strip, cut two braces to a length of 3-5/8" for the left side. From another ply strip, cut two more braces to a length of 5". Test fit the spar braces. Use 30-minute epoxy to glue the four spar braces to the front and back of the top spar on both ends of the center section. The photo shows the left side of the center section.

Refer to this photo for the next four steps.

❏ 27. Glue both die-cut 1/8" plywood **aft dowel braces** to the W1 ribs where shown on the plan. Make sure the holes in the dowel braces are nearest the bottom and align with the plan.

❏ 28. Locate both die-cut 1/8" plywood **forward dowel braces.** Trim one of the forward dowel braces to the length of the front forward dowel brace shown on the plan. Glue both forward dowel braces together so the holes align.

❏ 29. Glue the forward dowel brace, centered vertically, to the W1 ribs.

❏ 30. Cut two 4-1/4" shaped **LE's** from the 14-7/8" long shaped balsa LE stick. Notch the aft edge of the LE's to accommodate the ply center LE you've already glued in place. Glue the shaped balsa LE's to W2 and the center LE but not to rib W3.

❏ 31. Remove the center section from plan. Turn it over and cut the jig tabs from the bottom of the ribs. Sand the forward dowel braces and the LE's so they match the cross section on the plan and blend them to the ribs. Sand the center TE spar even with the top and bottom of the ribs.

That's all we can do on the center section until we join it to the outer panels so set the center section aside for now.

DC-3 *Fact*

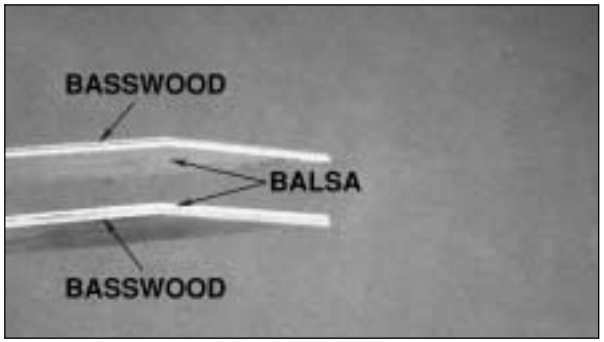
The DC-3 was not only larger than the DC-2, but also much easier and safer to fly. An automatic pilot was installed as standard equipment. The overall design of the DC-3 was so successful that its basic specifications were never changed. Once the first DC-3's entered service, the speed at which the entire industry converted over was limited only by the rate at which Douglas could produce them.

BUILD THE OUTER PANELS

Start with the left panel first so yours will look like the photos. Place the left panel plan over your building board and cover it with Plan Protector.

❑ ❑ 1. Cut a 1/8" x 3/8" x 36" balsa stick into two 18" long **spar doublers.** Cut one end of both spar doublers at the angle shown on the plan at the outer edge of rib 9.

❑ ❑ 2. Make a **top outer spar** by gluing one of the spar doublers to a 1/8" x 3/8" x 30" basswood stick so the square ends align. Make the **bottom outer spar** the same way. Make sure you make a **top** and a **bottom—** they are different because of the angle at rib 9.

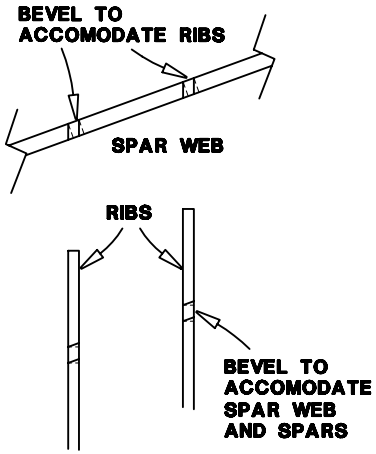


❑ ❑ 3. Refer to the wing plan where the outer panel spars join the center section spars. Bevel the **front** of the **root end** of both outer panel spars to match the plan.

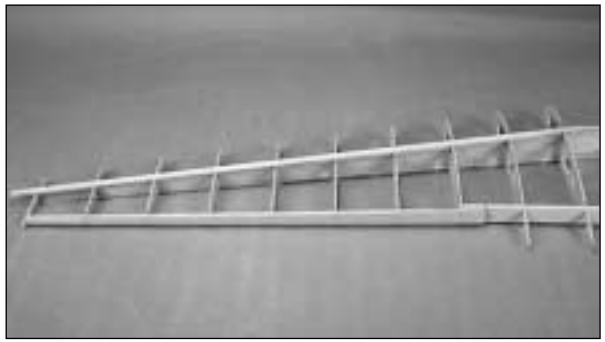
❑ ❑ 4. Bevel the **front** of the die-cut 1/8" balsa **outer spar web** to accommodate the center spar web. You can see the angle by holding the outer spar web over the plan.

❑ ❑ 5. Cut the root end of **one** of the die-cut 1/8" balsa **inner TE spars** the same way you did the center TE spar to accommodate the 1/8" ply TE joiner. Glue the inner TE spar you just trimmed to the back of another inner TE spar.

❑ ❑ 6. Glue two die-cut 1/8" balsa **outer TE spars** together. Bevel the front of the root as shown on the plan so it will fit the inner TE spar at the angle shown on the plan.



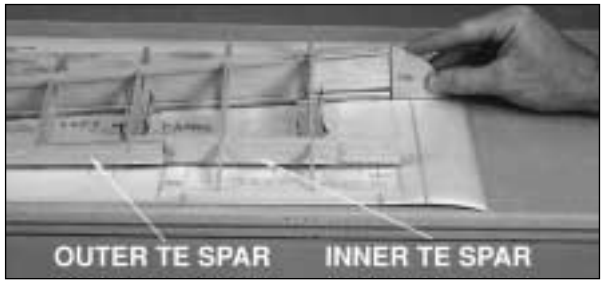
❑ ❑ 7. Bevel the notches in the center spar web and the notches in the die-cut 3/32" balsa **wing ribs** so they will fit at the angle shown on the plan. Similarly, bevel the notches in the ribs to accommodate the top and bottom spars. The easiest way to do this is with a single edge razor blade. Hold the parts over the plan to make sure you are cutting the notches at the correct angle.



❑ ❑ 8. Fit wing ribs W4 through W13 into the spar web. Add the bottom spar, top spar, outer TE spar and inner TE spar but do not use any glue yet. Make the notches wider if necessary so the ribs will fit the center spar and the top and bottom spars at the angle shown on the plan without any stress.

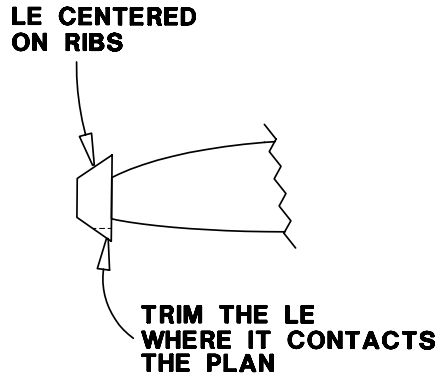
❑ ❑ 9. Place the assembly over the left wing plan on your building board. Pin the ribs to your building board or use the rib jigs leftover from building the tail to hold the ribs in position. Make sure the wing is flat and all the jig tabs are contacting your building board.

❑ ❑ 10. With all the parts accurately aligned over the plan, glue the spar web to the bottom spar. Glue the ribs to the spar web.



❑ ❑ 11. Glue the top spar to the assembly using the die-cut 1/8" plywood **spar dihedral gauge** (DG) to position the top spar (so the wing will have the correct dihedral when you join the outer panel).

❑ ❑ 12. Glue the inner and outer TE spars to the ribs. Note that the end of the outer TE spar butts up against rib 13 and does not rest on top of it.



❑ ❑ 13. Sand the fronts of the ribs to match the angle at which the LE shown on the plan will join them. Trim the

bottom of the LE as necessary at ribs 11, 12 and 13 so you can center the LE vertically on the front of the ribs. Glue the LE to the wing ribs, centered, as indicated in the sketch.

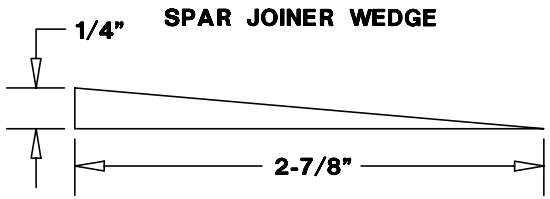
❏ ❏ 14. Remove your wing panel from the plan. Test fit your aileron servo between ribs 8 and 9 where shown on the plan. Make sure the servo you intend to use will fit. Most standard servos will fit but if your servo is too wide (or too *high* when placed on its side), you will have to mount your aileron servo one rib bay inward between ribs 7 and 8. If this is the case, make new notches in the ribs to accept the hatch mounting rails as shown on the plan *(If it's a close fit, some modelers may not be opposed to filing a little off the servo mount—look ahead to the photo at step 14 on page 47.)*

❏ ❏ 15. Cut two **aileron servo hatch rails** from a 1/4" x 3/8" x 36" basswood stick and glue them in the notches of the ribs.

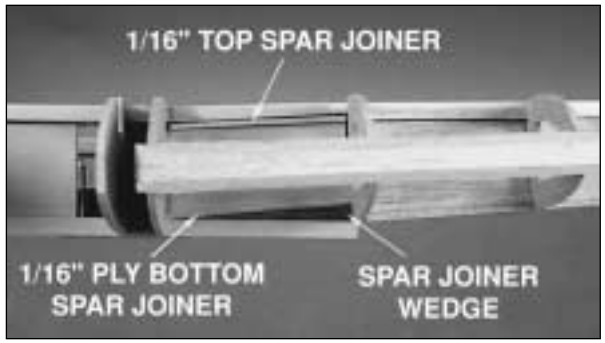
❏ ❏ 16. Cut the jig tabs from the bottom of the ribs. Cut the spars and LE even with tip rib 13. Blend the LE, TE spars and spars to the ribs by sanding.

❏ 17. Return to step 1 and build the right wing panel the same way.

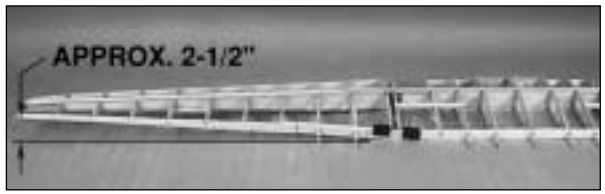
JOIN THE OUTER PANELS TO THE CENTER SECTION



❏ 1. Make two **spar joiner wedges** as shown in the sketch from the two 1/4" x 3/8" x 2- 7/8" basswood sticks you cut earlier.



❏ 2. Test fit the left wing panel to the center section with the spar wedge, a die-cut 1/16" plywood **top** and **bottom spar joiner** and a die-cut 1/8" plywood **TE joiner** (the top spar joiner is shorter than the bottom spar joiner). Make adjustments where necessary so the panels fit well. The photo illustrates the joining panels and associated parts as viewed from the front. We've darkened the bottom spar wedge in the photo so it is easy for you to identify.



❏ 3. Place the center section and left panel on your **flat** building table. The bottom spar at tip rib W13 should be approximately 2-1/2" off your table. Make adjustments if necessary to achieve this.

❏ 4. Test join the right outer panel to the center section the same way. When measuring the distance of the right wing tip from your building table, keep in mind that it doesn't have to be **exactly** 2-1/2" – as long as it's **the same as the other panel.**

❏ 5. Glue the left panel to the center section using 30-minute epoxy. Wipe away excess epoxy before it cures and do not disturb the wing until after the epoxy has cured.

❏ 6. After the epoxy is fully cured, measure the dihedral again. Join the right panel to the center section using 30-minute epoxy, setting the dihedral so it's the same as the left. Clamp the assembly together and wipe away excess epoxy before it cures. Do not disturb the assembly until the epoxy has fully cured.

MOUNT THE ENGINE NACELLES

Remember, steps that start with "R" are for retract builders only.

❏ R1. Notch the bottom of the ribs for the 1/16" ply **spar braces** the same way you did the top (refer to the photo at step R25 on page 35 if you need a reminder). Glue the braces in position using 30-minute epoxy.

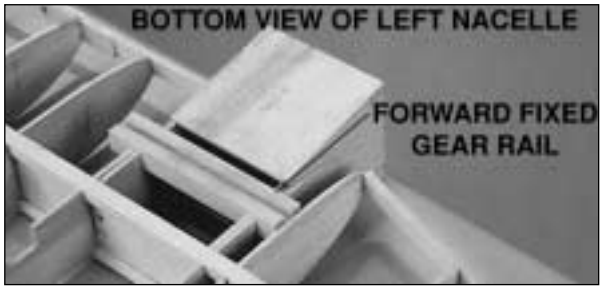
❏ R2. Cut both 1/2" x 3/4" x 4-3/4" grooved basswood **forward landing gear rails** to a length of 3-1/4".

❏ R3. Fit together but **do not glue** both nacelle assemblies using the inboard and outboard nacelle sides, the nacelle tops and bottoms and the firewalls. Fit the nacelles into the wing using the forward landing gear rails to hold them in place. Make sure you have installed the nacelles correctly so the engine thrust is the same as the plan—both engines have *outward* thrust and are mounted on the side of the firewall **closest** to the fuse. The notch you cut in the nacelle sides for the air cylinder should be on the same side as the passage in the center spar web for the air cylinder. The photo at this step shows the **left** engine nacelle viewed from the **top**. Note that the groove in the rail faces upward.

IMPORTANT: Be certain the aft edge of each nacelle side **fully** contacts the center spar web. This is what determines the position of the nacelle sides and therefore determines the degree of outward engine thrust. All four nacelle sides must be positioned in this manner so both engines will have the correct outward engine thrust.

❏ R4. Bevel the top of the rails to match the airfoil shape of the ribs for a nice fit. Make any other adjustments if needed so the nacelle sides fit correctly.

Remember, steps that are shaded and start with an "F" are for fixed gear only.



❑ F5. Fit together but **do not glue** both nacelle assemblies using the inboard and outboard nacelle sides, the nacelle tops and bottoms and the firewalls. Fit the nacelles to the wing using the 1/2" x 3/4" x 4-3/4" grooved basswood **forward landing gear rails** to hold them in place. Make sure you have installed the nacelles correctly so the engine thrust is the same as the plan. Both engines have *outward* thrust and are mounted on the side of the firewall **closest** to the fuse. The photo at this step shows the **left** engine nacelle viewed from the **bottom**. Note that the groove in the rail faces downward.

IMPORTANT: *Be certain the aft edge of each nacelle side fully contacts the center spar web. This is what determines the position of the nacelle sides and therefore determines the degree of outward engine thrust. All four nacelle sides must be positioned in this manner so both engines will have the correct outward engine thrust.*

Before you perform the following steps, be certain you will be gluing the nacelle sides and the firewall in the correct orientation. Study your model carefully and make sure everything matches the plan. Specifically, make sure you have the inboard and outboard nacelle sides in the correct location. The nacelles and firewall incorporate 6Þ of down thrust. The mounting holes in the firewall should be closer to the top of the nacelle.

❑ ❑ 6. Remove the rail, nacelle sides, nacelle top and bottom and firewall of **one nacelle only**. Apply 30-minute epoxy to all joining parts except for the nacelle bottom. Reinstall the nacelle parts and the firewall using clamps where necessary to hold everything in place. Wipe away excess epoxy before it cures.

❑ 7. Glue the other nacelle to the center section the same way. Don't forget to confirm that your nacelle sides are in the correct location so the firewall has *outward* thrust.

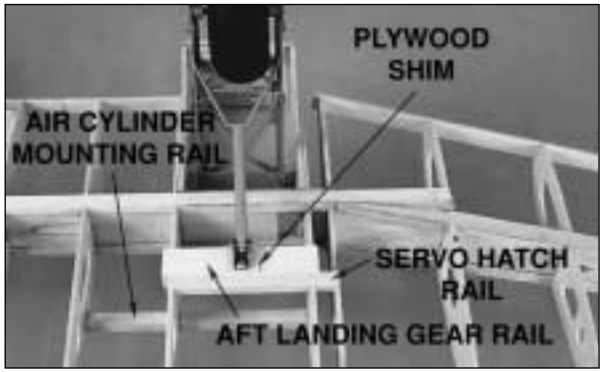
DC-3 *Fact*

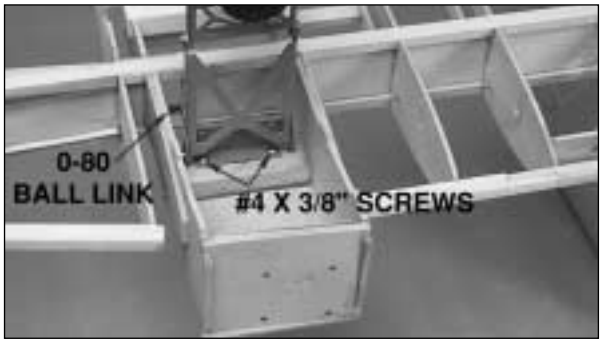
Among many things that made the DC-3 so successful were its ability to survive potentially catastrophic circumstances, its load carrying ability, and its longevity. The DC-3 was the first aircraft that could generate revenue for its operators just by hauling passengers! The DC-3 was the *right plane* that came along at the *right time*.

Proceed to *Build the fixed landing gear* on page 40 if you are installing fixed landing gear.

MOUNT THE RETRACTS

Do the left side first.





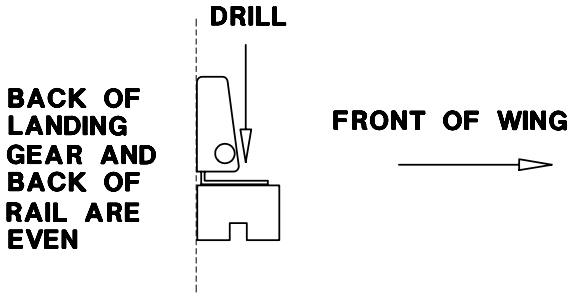
Refer to these two photos for the next seven steps.

❑ ❑ R1. Fit but do not glue the 1/2" x 3/4" x 3-1/2" basswood **aft landing gear rail** in the notches of ribs W3 on the left side of the center section.

❑ ❑ R2. Cut two 3-7/8" long **servo hatch rails** from leftover 1/4" x 3/8" basswood. Fit but do not glue the rails into the notches of the ribs for the servo hatch.

❑ ❑ R3. Mount a 0-80 threaded ball link ball (not included with this kit) on the outside of the arm on your landing gear and secure it with a 0-80 nut and a drop of thread lock. See the picture above step R10 on page 39.

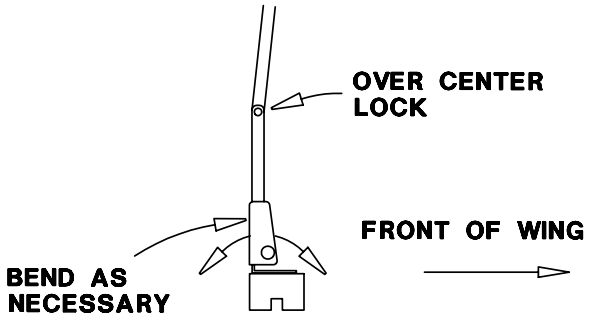
❑ ❑ R4. If you haven't done so already, temporarily mount your wheel to one of your retracts using a 5/32" wheel collar on both sides of the wheel to keep it centered on the axle.



❑ ❑ R5. Place your landing gear in the wing resting on the forward landing gear rail. Center the landing gear on the rail (side to side) and position it so the back is even with the back of the rail. Use the horizontal part of the landing gear mount as a template to drill two 1/16" holes in the landing gear rail and mount the landing gear to the rail with two #4 x 3/8" screws (not included).

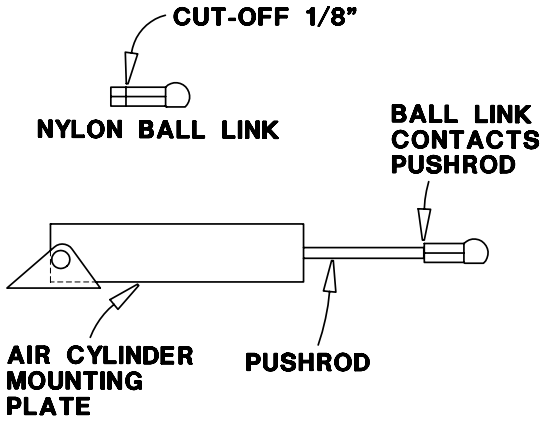
❑ ❑ R6. Temporarily remove the landing gear and add a few drops of thin CA to the holes you just drilled. Allow the CA to fully harden and remount your landing gear.

❑ ❑ R7. Make a 3/4" x 3/4" **shim** for the aft landing gear strut from leftover 1/16" plywood. Mount the aft landing gear strut to the aft landing gear rail with the shim and a #4 x 3/8" screw (not included).



❏ ❏ R8. If necessary, adjust the front retract mount by bending it so you can achieve a **slight** *over center* lock when the gear is extended.

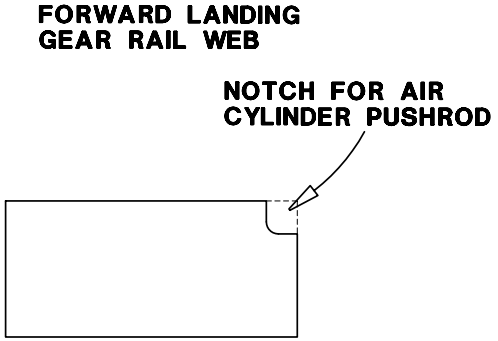
❏ ❏ R9. Retract the landing gear and make sure everything works well and there is no binding or interference with the airframe.



❏ ❏ R10. Cut 1/8" from the end of a nylon ball link (not included). Cut the threaded portion from the threaded brass coupler that came with your ball link package (not included). Screw the nylon ball link all the way onto the air cylinder with the threaded rod (or use a 1" threaded rod purchased separately). Snap the ball link onto the ball on the landing gear. Hold the air cylinder mounting plate to the air cylinder mounting rail with a small C-clamp. Retract and extend your gear by hand. Make adjustments if needed so the air cylinder is in the correct position and none of the moving parts interfere with the airframe.
NOTE: Carefully check the position of the front air fitting. If it interferes with the spar, rotate the air cylinder 90 degrees. **Do not** notch the spar to clear the fitting. Mount the air cylinder to rib W3 instead of the rail. Use leftover 1/4" x 3/8" basswood on the back of the rib to secure the mounting screw.

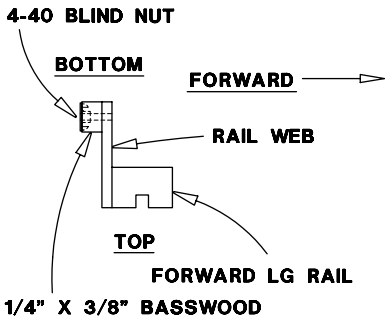
❏ ❏ R11. Mount the air cylinder to the air cylinder mounting rail (or rib W3) with a #4 x 1/4" screw (or cut 1/8" from a #4 x 3/8" screw) (not included).

❏ ❏ R12. Glue the aft landing gear rail and the servo hatch rails in place.



❏ ❏ R13. *Notch* the 1/8" x 1-5/16" x 2-13/16" plywood **forward landing gear rail web** as required so the air cylinder pushrod will not interfere with the web when you fit it in position where shown on the plan.

❏ ❏ R14. Position, then mark the rail web for the outer mounting holes in the vertical part of the landing gear mount (don't bother with the middle hole).



❏ ❏ R15. Remove the rail web. Glue a piece of leftover 1/4" x 3/8" basswood to the back of the rail web over the

location of the holes. Drill 1/8" holes at the marks you made and insert 4-40 blind nuts (not included) into the basswood stick on the back of the rail web. Reinstall the rail web and glue it in place with 30-minute epoxy. Mount the landing gear to the web with two 4-40 x 1/2" screws (not included) before the epoxy cures. Clamp the top of the rail to the forward landing gear rail and allow the epoxy to fully cure.

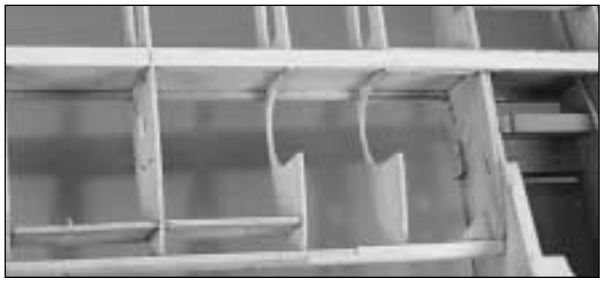
❏ R16. Return to step R1 and mount the other retract and air cylinder to the right engine nacelle the same way.

❏ R17. Fit the die-cut 1/8" plywood **nacelle bottoms** to the nacelles but do not glue them in place yet. Cut the nacelle bottoms so the retracts will clear them. Set the nacelle bottoms aside.

❏ R18. From a 1/4" x 36" triangle stick, cut four 2-1/4" pieces and four 3/4" pieces. Use 30-minute epoxy to glue the 2-1/4" pieces to the back of the firewalls inside the nacelle sides and glue the 3/4" pieces to the back of the landing gear webs as shown on the plan.

❏ R19. Remove the landing gear and fuel-proof the wheel wells and the inside of the nacelle bottoms. Refer to the *Painting* section in the back of the manual for hints on painting.

❏ R20. Glue on the nacelle bottoms.

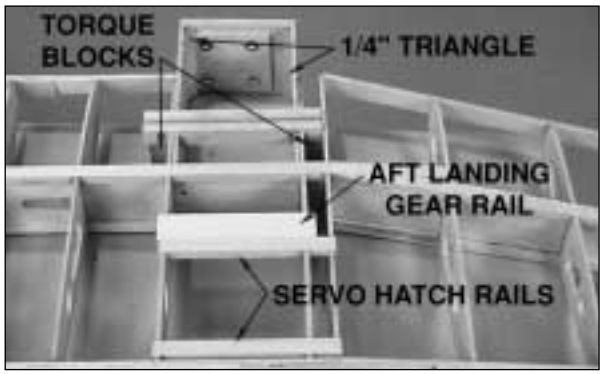


❏ R21. Cut the rest of the way through the partially die-cut lines in ribs W1 and W2 on the right side of the center section and remove the balsa to accommodate your air tank. Trim the ribs further if needed to accommodate your air tank.

❏ R22. Fit approximately 10" of air line onto your air tank and use RTV silicone or epoxy to glue the tank into the wing. Coil the air line for the time being.

Retract builders proceed to **"Prepare the bottom of the wing for sheeting"** on page 42.

BUILD THE FIXED LANDING GEAR



Refer to this photo for the next four steps.

❏ ❏ F1. Glue the 1/2" x 3/4" x 3-1/2" basswood **aft landing gear rail** in the notches of ribs W3 on the left side of the center section.

❏ ❏ F2. Cut two 3-7/8" long **servo hatch rails** from leftover 1/4" x 3/8" basswood. Glue the rails into the notches of the ribs for the left servo hatch.

❏ ❏ F3. Trim a 1/2" x 3/4" x 1" maple **torque block** so it will fit between ribs W3A and W3 on top of the forward landing gear rail. Use 30-minute epoxy to glue that torque block and an additional 1/2" x 3/4" x 1" maple torque block to the top of the forward landing gear rail and the W3 ribs as shown on the plan. Use clamps to securely hold the blocks in position until the epoxy has fully cured.

❏ ❏ F4. From a 1/4" x 24" triangle stick, cut four 2-1/4" long pieces. Glue two pieces to each firewall and the nacelle sides where shown on the plan.

❏ ❏ F5. Glue on the nacelle bottom.

❏ F6. Perform steps F1 through F5 to glue the landing gear rails and torque blocks in the other side of the center section the same way.

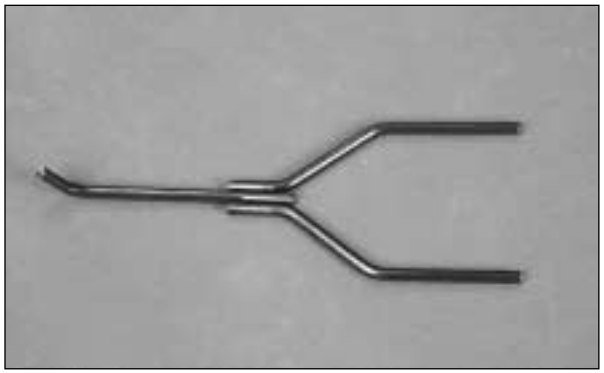
This is another area where it will be helpful if you are able to visualize and understand the assembly before you continue so, read through this section before you begin.

Let's build the landing gear struts...

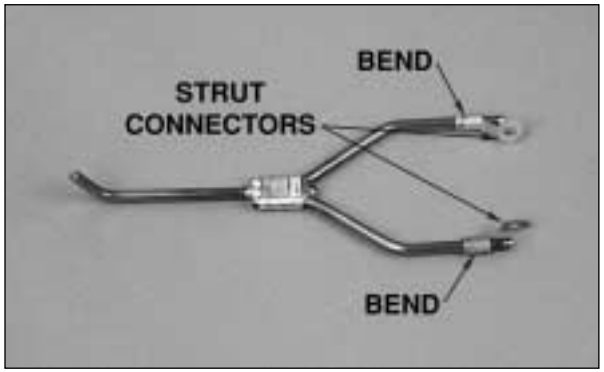
❏ ❏ F7. Before you start soldering, use a cutoff wheel or a metal file to remove burrs from both ends of all the 5/32" landing gear wires. Clean the wires with alcohol or other solvent, then use coarse sandpaper to roughen all the areas of the wires that are to be soldered.

Make the aft strut first...

Note: The aft struts are optional. They add to the scale appearance of your landing gear and they do increase rigidity, but we have flown our prototypes many times without the aft struts.



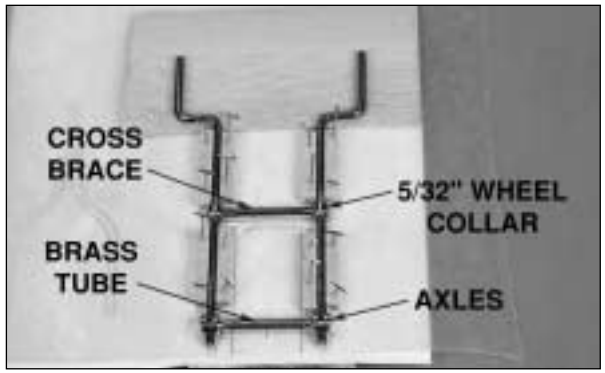
❑ ❑ F8. Place the **landing gear alignment pattern** on the plan over your building board and cover it with Plan Protector. Place the **pre bent wires** of the aft strut over the pattern. Glue the pieces together with a drop of thin CA. If you have difficulty holding the pieces in alignment while you are trying to glue them, hold them together with T-pins.



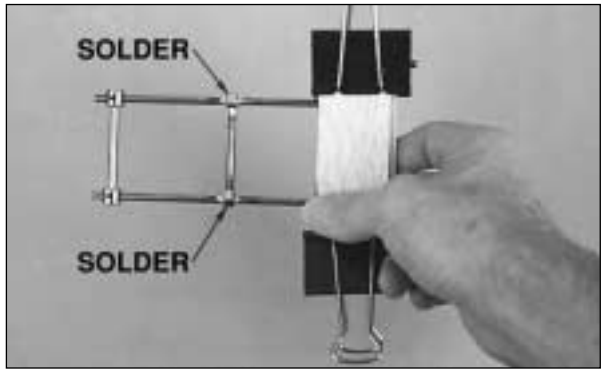
❑ ❑ F9. Wrap the struts with the **wrapping wire** included with this kit and silver solder the struts together. Add the **strut connectors** to the aft strut and bend them around the ends of the struts with pliers.

Now make the front strut...

❑ ❑ F10. Cut one of the 3/16" x 1-11/16" **brass tubes** to a length of 1-1/2". This will be used to align the axles with each other over the plan while you frame the front strut in the next step. Cut both 5/32" **axles** to the length shown on the plan.

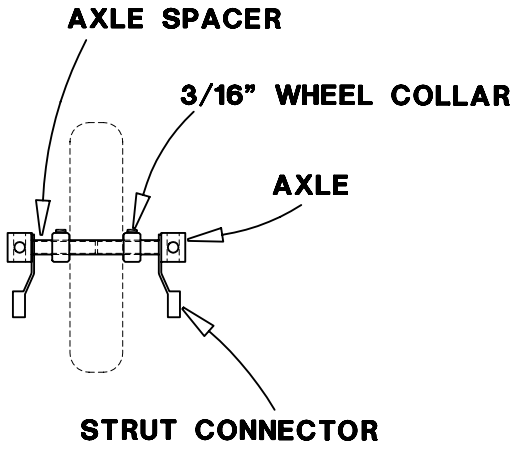


❑ ❑ F11. Enlarge the threaded holes in two 5/32" wheel collars with a 5/32" drill. Slide the wheel collars onto the struts. Insert the 5/32" wire **cross brace** into the holes you just drilled in the wheel collars. Install the axles with the brass tube and pin the assembly to the plan using leftover balsa sticks to hold everything in alignment. Tighten the set screws on the axles to temporarily lock them into position. Temporarily hold the wheel collars and the cross brace in place with thin CA.



❑ ❑ F12. Remove the assembly from the plan using care not to disturb the alignment you've so diligently achieved. Clamp the ends of the struts between two pieces of leftover balsa or plywood to hold them in alignment. Solder the wheel collars and cross brace to the struts. Use a dampened cloth to wipe away residual soldering flux while the joint is still hot but only **after** the solder has solidified.

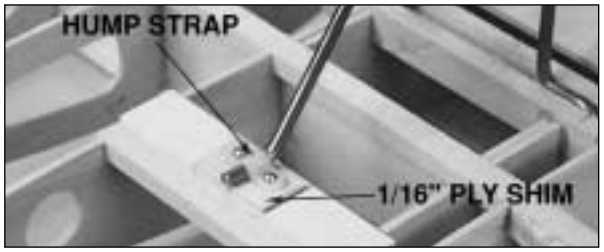
❑ ❑ F13. Drill 5/32" (or #22) holes through forward landing gear rail and torque blocks for the front struts. Temporarily place the front struts in the landing gear rail.



❑ ❑ F14. Remove the axles from the front struts. Make the rest of the axle assembly from a 3/16" brass **axle spacer**, two 3/16" wheel collars and set screws and the strut connectors you previously fit to the aft strut. Trim the axle spacer so it fits between the axles but forces both strut connectors against them.

❑ ❑ F15. If your wheels will not fit onto the 3/16" axle spacers, enlarge the hole in your wheels with a #10 drill.

❏ ❏ F16. Join your wheel to the assembly. Join the axle assembly to the front strut and join the aft strut to the strut connectors. Temporarily lock the axles to the front strut with the set screws and center the wheel on the axle and lock it into position with the 3/16" wheel collars and set screws.



❏ ❏ F17. Make a 5/8" x 1" **shim** from leftover 1/16" plywood and place it in the center of the aft landing gear rail under the aft strut. Drill 1/16" holes for a nylon **hump strap** and screw it to the rail with two #2 x 3/8" screws.

❏ ❏ F18. Temporarily mount the front strut to the landing gear rails with two nylon **flat landing gear straps** and four #2 x 3/8" screws.

❏ ❏ F19. Solder the strut connectors to the aft struts only. A heavy duty soldering iron—around 80 watts—works best for this.

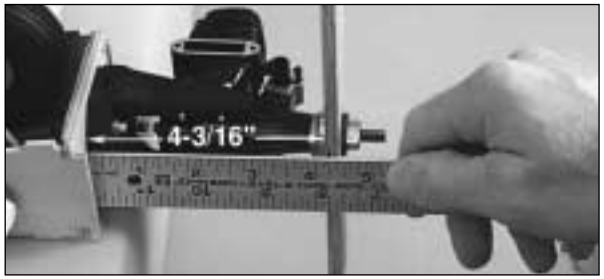
❏ ❏ F20. In the future you can remove your wheels by dismounting the aft strut from the landing gear rail and loosening the axles from the front strut. Then, slide the axles off the front strut and slip the axles out of the strut connectors.

❏ ❏ F21. Remove the axles and file flat spots on the struts for the set screws to lock onto.

❏ F22. Repeat steps F7 through F21 to build the other landing gear strut and mount it to the wing the same way.

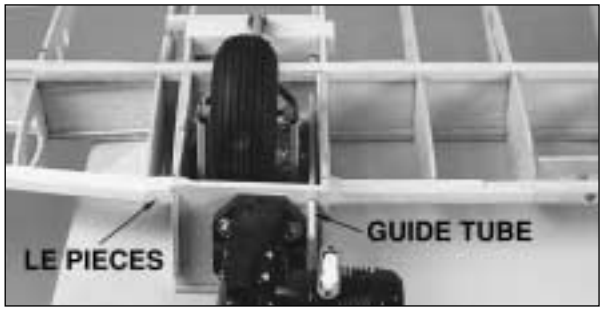
❏ F23. Remove any residual soldering flux from the landing gear. You may paint the landing gear or coat it with a fine film of houshold oil to protect it from rusting.

PREPARE THE BOTTOM OF THE WING FOR SHEETING



❏ ❏ 1. If you are installing 2-stroke engines, place one of your engines on a Great Planes .20-.48 Adjustable Engine Mount so the front of the drive washer is 4-3/16" from the firewall. If you are installing 4-stroke engines, position them on the mounts as close to the firewall as possible. Use your Great Planes *Dead Center* Engine Mount Hole Locator (GPMR8130) or another method to mark the location of the engine mounting holes on your engine mount. Drill the engine mount with a #43 drill. Tap the holes with a 4-40 tap and mount the engine to the mount with four 4-40 x 1" SHCS (socket head cap screws) and #4 lock washers.

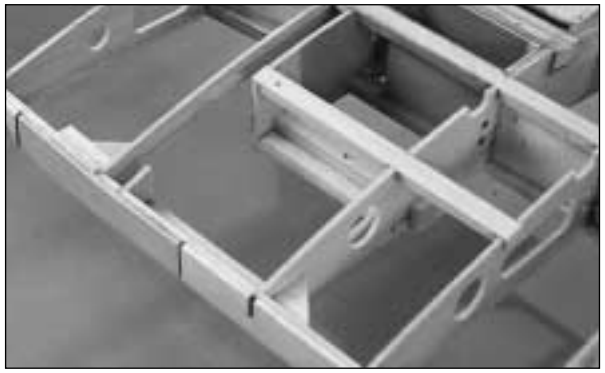
❏ ❏ 2. Mount the engine mount to the left firewall with four 4-40 x 1" SHCS, lock washers and flat washers.



❏ ❏ 3. Drill a 1/8" hole for the **throttle cable** where it will exit the firewall. Slip the 12" **cable guide tube** through the firewall and the hole you previously drilled in the center spar web, making sure the guide tube won't interfere with the retracts. Cut the guide tube to the approximate length required.

❏ ❏ 4. Mount the other engine and guide tube to the right firewall the same way.

❏ ❏ 5. If you haven't already done so, glue the leading edges on the center section to the inboard nacelle sides and the W3 ribs. Glue the four die-cut 1/8" balsa **gussets** to the center section where shown on the plan. Use a piece of leftover shaped balsa LE to make the small LE pieces that fit between the outer panel and inner panel nacelle leading edges and glue them in place (refer to the preceding photo).



❏ ❏ 6. Cut out the portion of the outer W3 rib on both sides of the center section to accommodate your throttle servos.

❏ ❏ 7. Cut the **aileron** and **flap** (only if you're building working flaps) **hinge blocks** from two 1/4" x 1/2" x 24" balsa sticks and glue them in place where shown on plan. The aileron hinge blocks are **centered** on the TE spar and the flap hinge blocks are on the **bottom** of the TE spar. From leftover 1/8" balsa, make hinge blocks to fill the space between the aft flap servo hatch rail and the TE spar. Glue them in place where shown on the plan.

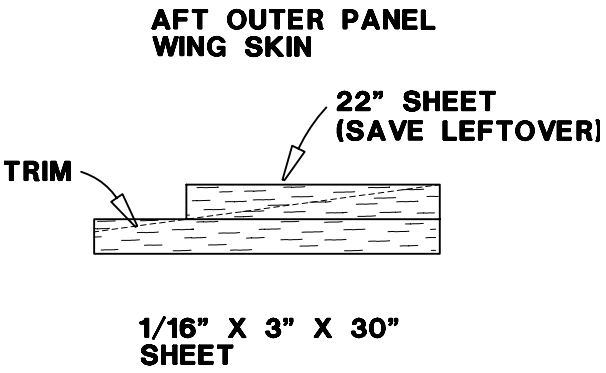
❏ ❏ 8. Glue the rest of die-cut 1/8" balsa gussets (for outer panels at rib W3A) in position where shown on the plan.

❏ ❏ 9. Trim the ends of the bottom center section spars, then sand the bottom of the wing so the ribs, spars, LE's and TE spars blend.

DC-3 *Fact*

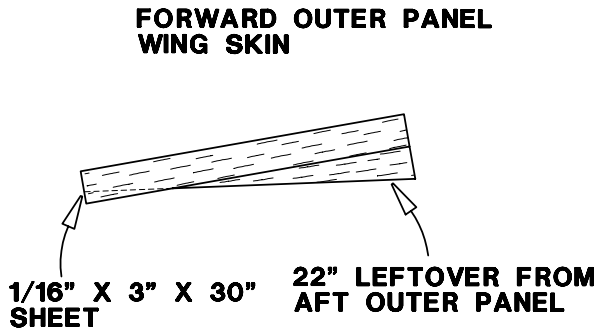
The 2,000th C-47 Skytrain rolled out of the Long Beach, California plant on October 2, 1943. Determined to make this occasion a spectacular one, Joe Messick, the Public Relations Manager for Douglas, decided it would be good publicity and boost employee morale if he were to autograph the fuselage for everyone to see. By the end of the day, hundreds of production workers had done the same. Though the chalk signatures and messages were rubbed off before the Army Air Force would accept the plane, many names, addresses and messages left by "Rosie Riveters" remained in the wheel wells and other hidden compartments. This led to several pen-pal romances started by the mechanics who discovered the messages much later.

MAKE THE WING SKINS



❑ 1. Start by making an **aft outer panel wing skin** which covers the wing from the center of the main spar aft. Cut 22" from a 1/16" x 3" x 30" balsa sheet. True the joining edges and glue the 22" sheet to another 1/16" x 3" x 30" balsa sheet. Trim the front of the skin with a straightedge along the dashed line shown in the sketch. Make the skin oversize to allow for positioning and trimming.

❑ 2. Make three more aft wing skins the same way.



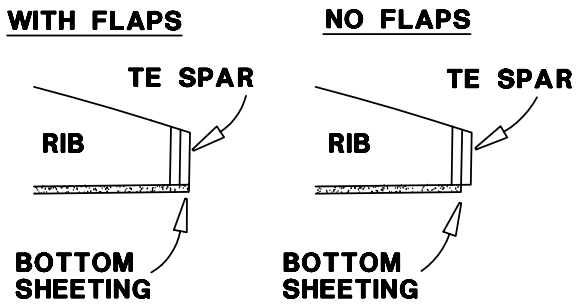
❑ 3. Make the **forward outer panel skins** by gluing the four leftover pieces you cut from the aft outer panel skins to four 1/16" x 3" x 30" sheets. After the glue dries, trim the sheets to cover the wing from the center of the spar to the LE—don't forget to make the forward skins slightly oversize to allow for positioning and trimming. The grain should run parallel to the LE of the wing.

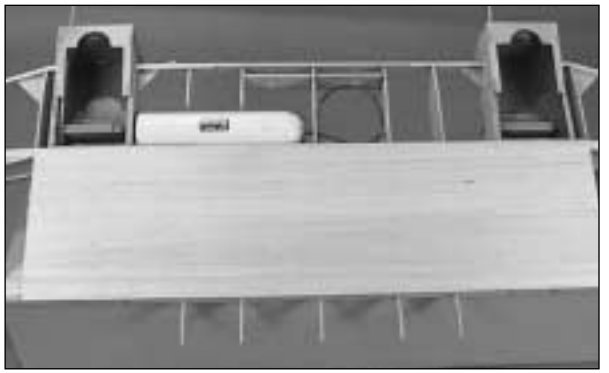
❑ 4. Glue the forward outer panel skins to the aft outer panel skins. After the glue dries, sand all four skins flat and smooth.

❑ 5. Make two 3/32" x 6" x 15" **forward center section wing skins** from two 3/32" x 3" x 30" balsa sheets. Make two 3/32" x 6" x 22" **aft center section wing skins** from four 3/32" x 3" x 24" balsa sheets. After the glue is dry, sand the sheets flat and smooth.

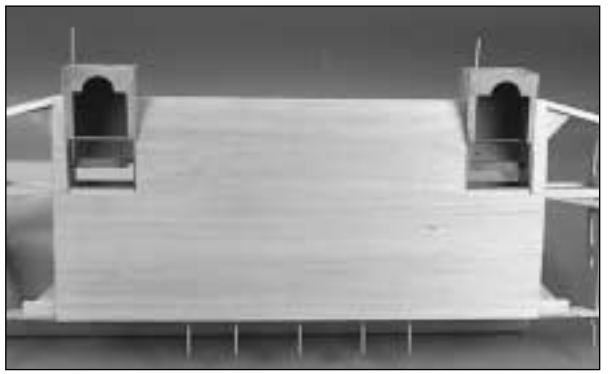
SHEET THE BOTTOM OF THE WING

Do the center section first...

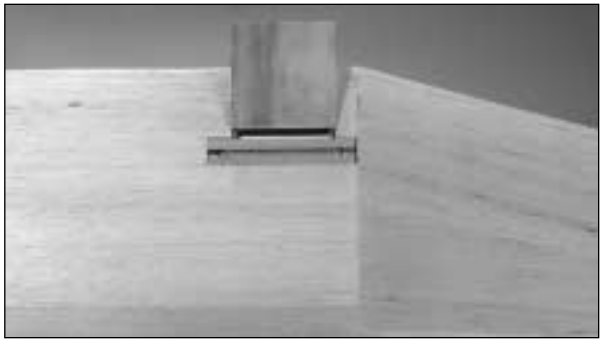




❑ 1. Trim one of the 6" x 22" aft center section skins to fit the **bottom** of the center section. The ends of the sheet should extend to the **center** of both W3A ribs and the front of the sheet should align with the middle of the bottom spar. If you are building **working flaps**, the TE of the sheet should end at the aft edge of the center TE spar. If you are **not** building working flaps, the TE of the sheet should end in the **middle** of the center TE spar. Glue the sheet to the bottom of the wing but **do not** glue the sheeting to the ribs of the servo hatch, the servo hatch rails and the aft landing gear rail. This will make it easier to cut out the servo hatches later.



❑ 2. Trim one of the 6" x 15" forward center section skins to fit the bottom of the center section. The sheet should fit between the nacelles and extend from the leading edge to the aft sheet over the spar. Use leftover 3/32" balsa to sheet the sections between the outer edge of both nacelles and the middle of both W3A ribs. If you are installing fixed landing gear you'll have to sheet around the forward landing gear rails so the rails protrude below the sheeting as shown in the following photo. After you glue the sheeting in position, trim the front even with the LE.



*This is what the bottom of your wing will look like if you're installing **fixed** landing gear. Disregard the sheeting on the outer panel in this photo.*

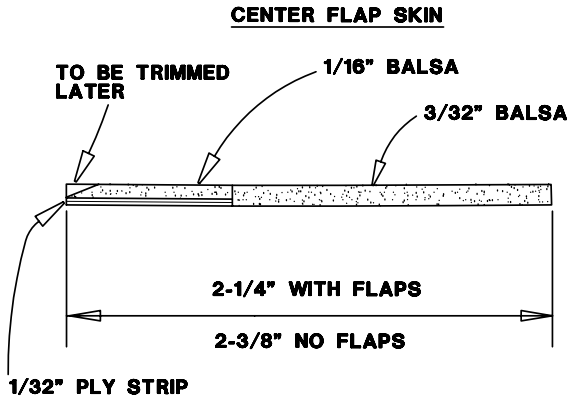
❑ ❑ 3. Test fit an outer panel skin to the bottom of your wing. Trim where necessary but make sure you leave the skin a little oversize to allow for positioning and trimming later. Temporarily hold the skin to the wing with a few T-pins, then flip it over and start gluing. Do not glue the sheeting to the aileron servo hatch rails or to the ribs on both sides of the servo hatch. As you glue, handle your wing **carefully** so you don't build in any twist. We used thin CA to glue the skin to the ribs and main spar and used medium CA to glue the skin to the LE.

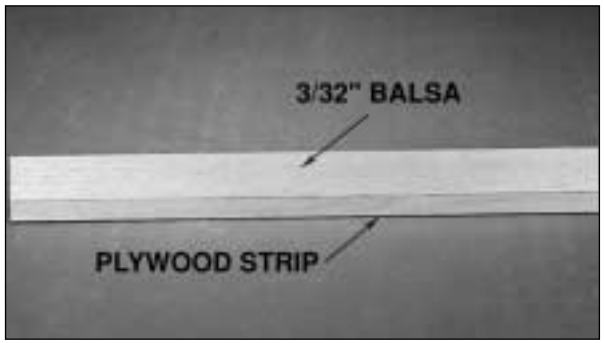
❑ ❑ 4. Trim the sheeting even with the LE, the wing tip and the outer TE spar. If you are building **working flaps**, trim the sheeting even with the inner TE spar, but if you are **not** building working flaps, trim the sheeting to the **middle** of the inner TE spar making a small *ledge* to accommodate the bottom flap skin.

❑ 5. Sheet the bottom of the other panel the same way.

BUILD THE FLAPS

Follow these instructions even if you are **not** building working flaps. You still need to make the flap skins.



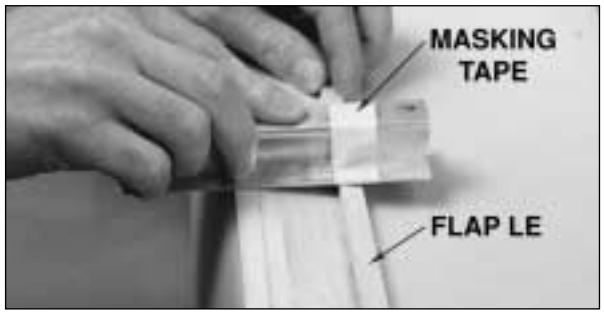


❑ 1. Refer to the sketch above. Use medium or thick CA to glue a 1/32" x 3/4" x 21-9/16" plywood strip on top of a 1/16" x 3" x 24" balsa sheet. Trim the balsa even with all edges of the plywood strip. Glue one edge of the balsa/ply sheet to the edge of a 3/32" x 3" x 24" balsa sheet.

❑ 2. If you are building **working flaps**, trim the glued together pieces to make a **bottom center flap skin** that is 2-1/4" wide. If you are **not** building working flaps, trim the glued together pieces to make a **bottom center flap skin** that is 2-3/8" wide. Sand the bottom flap skin flat and even.

Perform step 3 only if you are building working flaps.

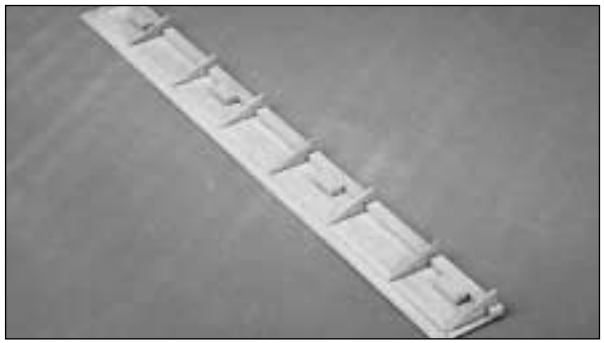
❑ 3. Place the bottom center flap skin over the plan and mark the location of the flap ribs. Cut the **flap LE** from a 1/4" x 3/8" x 24" balsa stick and glue it to the inside (top) of the flap skin. The inside of the skin is the side **without** the ply strip.



❑ 4. Wrap a piece of masking tape around your bar sander so you do not sand the flap LE, then bevel the TE of the flap skin using the flap LE as a guide. If you are **not** building working flaps, just position but **do not glue** the flap LE (see previous step) on the flap skin and use it as a guide for sanding the bevel. Stop sanding when you get to the plywood leaving the trailing edge of the flap 1/32"—the thickness of the ply.

Perform step 5 only if you are not building working flaps.

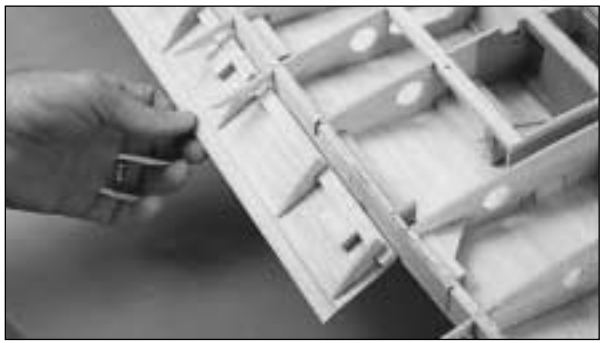
❑ 5. Glue the bottom center flap skin to the bottom of the wing. Proceed to step 10.



❑ 6. Cut the 1/4" x 1/2" x 1" **flap hinge blocks** from leftover 1/4" x 1/2" balsa. Glue the die-cut 3/32" balsa **F1 flap ribs** and the flap hinge blocks to the flap skin. This assembly is now called the **center flap**.

❏ 7. Accurately align the center flap with the center TE spar and clamp it in position. Drill 1/8" holes through the flap hinge blocks in the flap and the wing. If your drill bit is not long enough, drill the holes as far as you can, then remove the flap and continue drilling holes the rest of the way through the wing.

❏ 8. Remove the center flap from your wing and enlarge the opening of the holes to accommodate the flap hinges. Test fit your hinges in the flap and the wing. Enlarge the holes if necessary so the hinges will fit up to the centerline of the hinge pin.



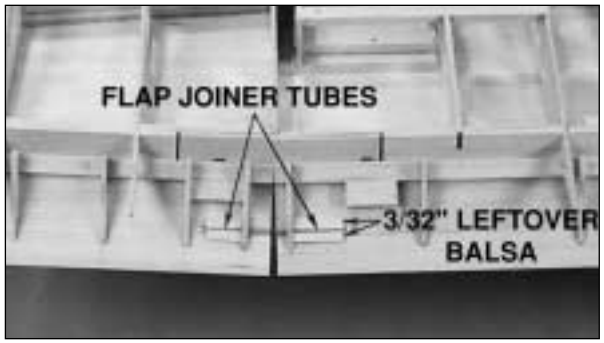
❏ 9. Bevel the LE of the flap as shown on the cross section of the plan and test fit it to the wing with your hinges. Test the movement of the flap and make sure everything works. *Nice isn't it!*

Skip step 10 if you are building working flaps.

❏ 10. Refer to the wing plan and build the **bottom outer flap skins** the same way you built the center flap skins using the 1/32" x 3/4" x 15" plywood strip and 3/32" and 1/16" leftover balsa. Glue the bottom outer flap skins to the wing the same as the center flap skin. Proceed to *Mount the servos in the wing*.

❏ 11. Refer to the wing plan and build the **outer flaps** the same way you built the center flap using the 1/32" x 3/4" x 15" plywood strip and 3/32" and 1/16" leftover balsa. Temporarily fit the outer flaps to the wing with the hinges the same as you did the center flap.

Let's connect the outer flaps to the center flap. It's easy...



Refer to this photo and refer to the flap detail on the wing plan while you join the flaps.

❏ 12. Roughen the outside of the 3/32" x 1-1/4" brass **flap joiner tubes** and remove burrs from the ends. Use a file to remove burrs from the ends of both 1/16" x 2-3/4" **flap joiner wires** as well. Bend the flap joiner wire in the middle to match the bend in the wing.

❏ 13. Drill a 3/32" hole in the flap ribs at the joining ends of the flaps to accommodate the joiner tubes. Move your drill in and out to slightly enlarge the hole in one of the ribs to allow for positioning.

❏ 14. Insert the joiner wire and both joiner tubes. Hold them in place with your fingers as you actuate the flaps. Check for smooth movement. Bend or straighten the joiner wire or adjust the position of the joiner tubes as necessary.

❏ 15. Glue the joiner tubes to the flap with a dab of medium CA. Actuate the flaps once again to check for smooth operation. Glue pieces of leftover 3/32" balsa to both sides of the joiner tubes with medium CA.

❏ 16. Join the other outboard flap to the other end of the center flap the same way. From now on, you will have to remove all three flaps from the wing together. You may leave the flaps in position for the rest of the wing construction *(that gives you a chance to show them to your friends when they come over to check your progress).*

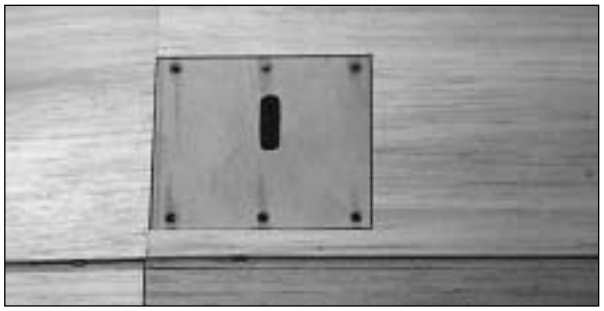
DC-3 *Fact*

It usually took about five days or less to build a DC-3. Between 1935 and 1947, the Santa Monica, Long Beach, and Oklahoma City plants produced a total of 10,654 DC-3 and C-47 variants—a success well beyond the wildest dreams of Douglas.

MOUNT THE SERVOS IN THE WING

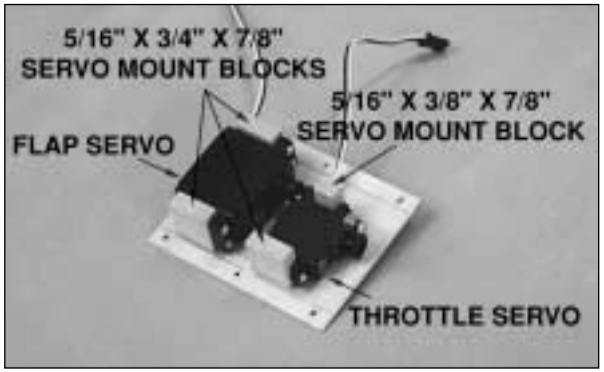
❏ ❏ 1. Cut the opening in the bottom of the left side of the center section for the die-cut 1/16" plywood **servo hatch cover.** Start by cutting the opening under size and carefully enlarge it using a fresh #11 blade and a straightedge until the hatch cover fits.
Hint: As you *zero-in* on the final shape of the hatch opening, use the hatch cover itself as a template to finalize the exact shape and size of the opening.

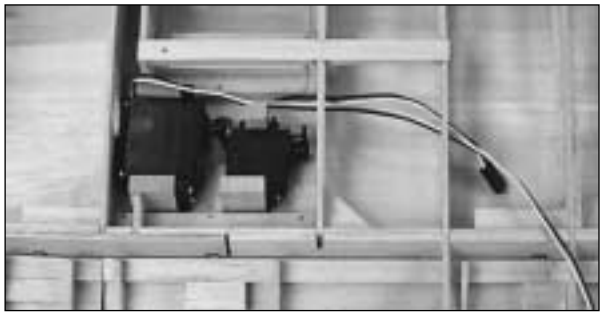
❏ ❏ 2. Place the hatch cover on the servo hatch rails making sure it is in the correct orientation as shown on the plan. Drill 1/16" holes through the punch marks in the hatch cover into the rails.



❏ ❏ 3. Enlarge the holes **in the hatch cover only** with a 3/32" drill bit. *Countersink* the holes for the #2 x 3/8" flat head screws with a countersink or Dremel #178 bit. Test fit the hatch cover to the rails with the screws. If necessary, sand the edges of the hatch cover so they align with the edges of the hatch opening.
Note: If you find it difficult to countersink the holes in the hatch cover for the flat head screws, you could use regular #2 x 3/8" screws (not supplied) and not countersink the holes.

❏ 4. Fit the right hatch cover the same way.





Refer to these photos to mount the flap and throttle servos to the hatch cover. We'll mount the flap servos first because there's only one place you can mount them (which is determined by the hole in the hatch covers). Whatever room left is for the throttle servo. The photos show the left hatch. If you're not building flaps, disregard parts of this section that involve the flap servos.

❏ ❏ 5. Mount one of your flap servos to two 5/16" x 3/4" x 7/8" basswood **servo mount blocks.** Position the servo with the mount blocks on the left throttle/flap servo hatch cover (which should still be in the wing). Mark the location of the mount blocks on the hatch cover so you will know where to glue them. Remove the hatch. Scuff the hatch cover where the blocks will go with coarse sandpaper so the glue will adhere. Use 30-minute epoxy to glue the servo mount blocks to the hatch cover.

❏ 6. Mount your other flap servo to the right hatch cover the same way.

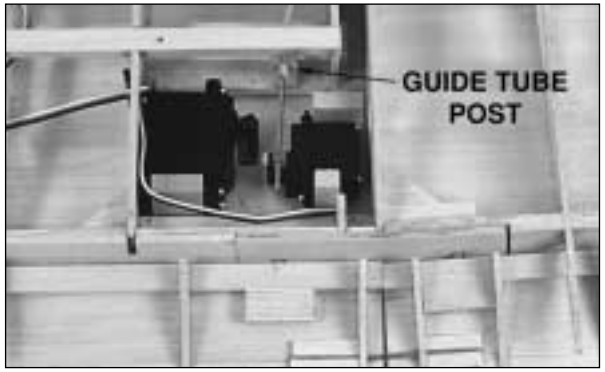
Note: For convenience of hookup, the throttle servos shown in the photo and on the plan are not mounted in the same direction. This requires that the servos be mixed electronically (instead of using a Y-connector, since one of your servos will have to be reversed in order for both carburetors to open and close simultaneously). Refer to *Setup your throttles* on page 62 to electronically mix your throttles. If the radio you plan to use is not capable of mixing the servos electronically, mount both servos the same way. In any regard, the servo mounting location shown on the plan and in the manual is our suggestion but there are other ways to hook up your throttle servos. Whatever method you decide upon, plan carefully and test your setup before you proceed.

❏ ❏ 7. Make a 5/16" x 3/8" x 7/8" **servo mount block** from a 5/16" x 3/4" x 7/8" servo mount block. Mount one of your throttle servos to a 5/16" x 3/8" x 7/8" servo mount block and a 5/16" x 3/4" x 7/8" servo mount block.

❏ ❏ 8. Position the throttle servo with mount blocks on the left hatch cover (temporarily placed in the wing) to determine its mounting location on the hatch. Make sure you position the servo so that it will not interfere with the mounting screws on your flap servo (so you will be able to unscrew the screws and remove your servos later if needed).

❏ ❏ 9. Remove the hatch cover and glue the servo mount blocks to the hatch cover in your predetermined location.

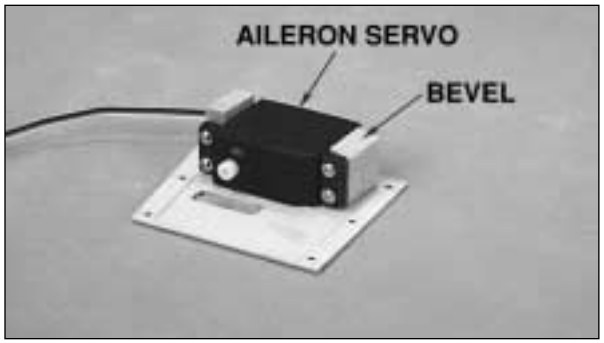
❏ ❏ 10. Place the hatch cover with the servos in the wing. Cut the throttle cable guide tube to the correct length. Cut the 36" **throttle cable** to the correct length, then slide it through the guide tube and connect it to the servo with a **screw-lock pushrod connector**.



❏ ❏ 11. Mount your other throttle servo to the servo mount blocks, determine the mounting location and glue the blocks to the right servo hatch cover. Mount the hatch cover and connect the servo to the throttle cable. On our model, we made a **guide tube post** from leftover balsa to align the throttle cable with the servo.

❏ ❏ 12. Cut your throttle cables to the correct length and connect them to your engine with screw-lock pushrod connectors. Some may prefer to hook up the carburetors after the model is finished but we recommend you finalize your throttle setup now before you begin sheeting. It's easier to view everything and fix it now instead of when the wing is fully sheeted.

❏ ❏ 13. Cut the openings in the outer panels for the die-cut 1/16" plywood **aileron servo hatch covers** and mount the hatches to the rails the same way you did for the flap/throttle hatch covers.



❏ ❏ 14. Mount your aileron servos to the hatches with 5/16" x 3/4" x 7/8" servo mounting blocks. Bevel the aft block (and a bit of the servo mount if needed) so it will not interfere with the top wing sheeting.

❏ ❏ 15. Remember we told you not to glue the bottom sheeting to the servo rails or the ribs on both sides of the servo compartment so it would be easier to cut the openings for the hatch covers? Now you can remove your hatch covers and glue the sheeting to the rails and ribs. After the glue dries, temporarily fasten your hatch covers to the wing with the #2 x 3/8" flat head screws.

PREPARE THE WING FOR THE TOP SHEETING

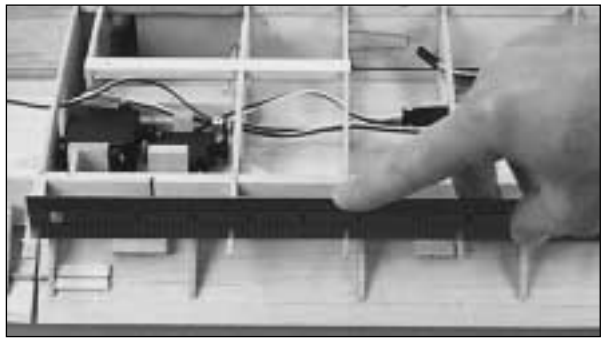
❏ 1. Cut along the lines you marked on the center W1 rib and remove that section of balsa to accommodate the fuel tanks.

❏ 2. Glue leftover 1/16" plywood **fuel compartment floor reinforcement strips** to the bottom sheeting as shown on the plan. You can see the strips in one of the following photos.

❏ 3. Make two **fuel tank hooks** by bending both 1/16" x 4" wires as shown in the sketch located on the wing plan.

❏ 4. Use 30-minute epoxy (and mix in some milled glass fibers if you have any) to glue the fuel tank hooks to the fuel compartment floor and the ribs as shown.

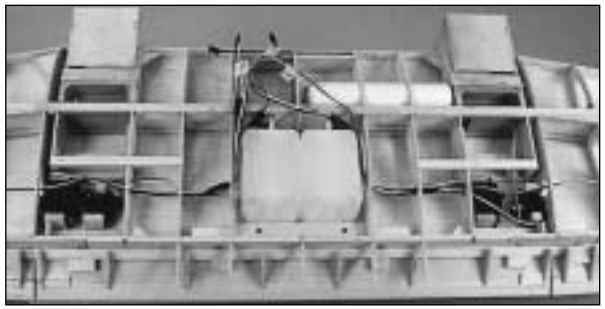
❏ 5. Glue a piece of leftover 1/4" x 3/8" balsa to the top center section spar between ribs W4 and W3. Sand the balsa piece to match the shape of the top of the wing.



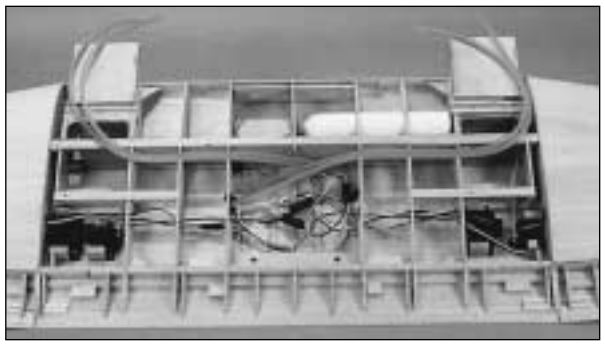
❏ 6. Glue the die-cut 3/32" balsa **TE ribs W3F, W3AF** and **W5F** to the center TE spar and outer TE spars over the flaps. Use a straightedge to make sure the ribs align. Cut 1/8" off the front of the W3F that glues to the ply brace.

❏ 7. Reinforce any glue joints you missed or that don't look strong.

❏ 8. Sand the top of the wing to accommodate the top sheeting. Sand the aileron hinge blocks even with the ribs and the outer TE spar and sand the TE spar, top spar and LE even with the ribs.



❏ 9. Connect your servo extension cords and Y-connectors to the servos and route them through the wing. We temporarily set the fuel tanks in the fuel tank compartment to see how all the wires would be routed over, around and past them. Secure all the connections with vinyl tape or heat shrink tubing and label the wires so you will know where to plug them into your receiver. If you have to take your servos out of the wing in the future, tie a piece of string to the connector and pull the cord out of the wing leaving the string in the wing. When it is time to route the servo cord back through the wing, pull it back through with the string. You may make paper tubes which you could install in the wing to help guide your servo cords. If you're installing retracts, route your air lines too. We suggest you connect both "up" lines to each other with a T-fitting and both "down" lines together with another T-fitting. Plug the remaining "up" and "down" fittings on your air valve.



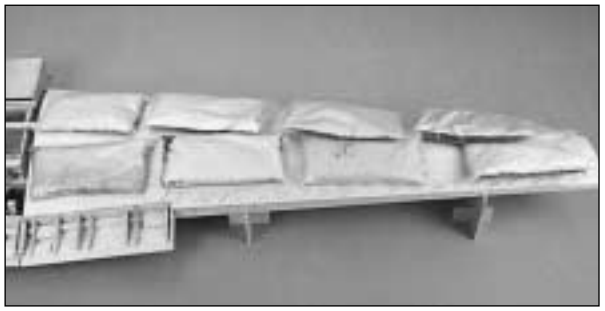
❏ 10. Route your fuel lines through the holes in the ribs. Each fuel line should be approximately 20" long so you can work with them for now. You'll trim them to a more reasonable length later.

❏ 11. Use the holes in the wing bolt plate as a guide to make the holes in the bottom sheeting for the wing bolts, using a 1/4" brass tube sharpened at one end or a 1/4" drill.

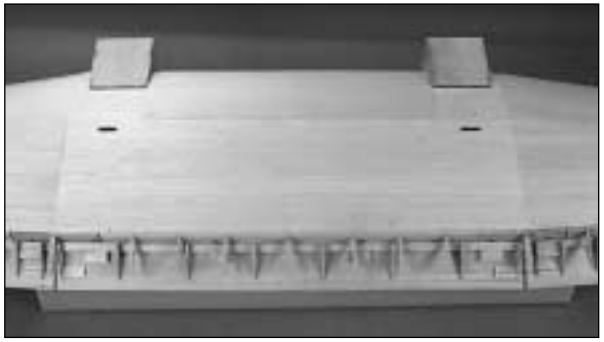
SHEET THE TOP OF THE WING

❏ 1. Build the **wing jigs** from die-cut 1/8" balsa. Place the wing on the wing jigs. You can see the wing jigs in following photos. Note that the wing jig (J11) is in two halves and must be glued together.

❏ 2. If you haven't done so already, make the top wing skins.



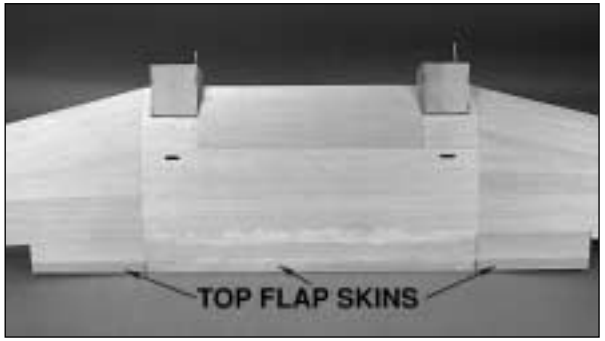
❏ 3. Sheet one outer panel, then sheet the other outer panel. Use aliphatic resin to glue the sheeting to the ribs and spar but use thin CA for the LE. Position your weights and do not disturb the wing until the glue dries.



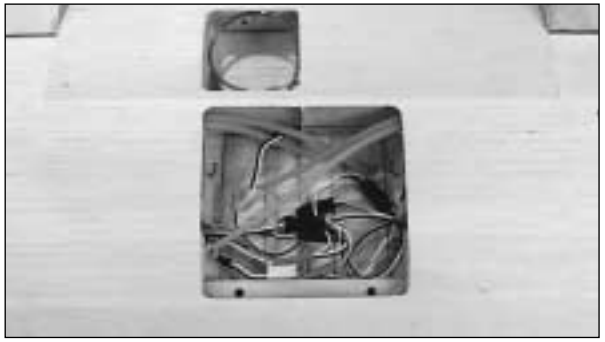
❏ 4. Trim the largest center section sheet you made earlier to fit the aft center section. The TE of the sheet should align with the **middle** of the center TE spar. Coil your fuel lines in the wing so you will be able to retrieve them after you glue the sheeting in place. Cut holes in the sheeting for your fuel lines and glue the sheet in position.

❏ 5. Sheet the forward center section and the small space on the outside of the nacelles with the rest of your 3/32" balsa.

❏ 6. Trim the top wing sheeting even with the LE, the tips and the outer TE spars. Trim the sheeting so it ends in the middle of the inner and center TE spars to form a *ledge* to accommodate the top flap skins.



❏ 7. Perform steps 1 and 2 on page 44 and taper the trailing edges. Make the center and outer **top flap skins** the same way you made the bottom flap skins, but make the **outer** top flap skins from **1/16"** balsa—**not** 3/32" balsa. Also, make the flap skins slightly oversize to allow for positioning, trimming and alignment with the flaps (or bottom flap skins if you have **not** built working flaps). Glue the top flap skins to the wing so the aft edges align with the flaps (or flap skins). After you glue the top flap skins in place, temporarily hold the flaps closed with masking tape.

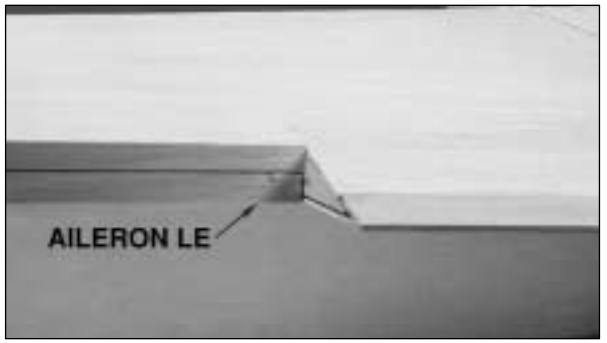


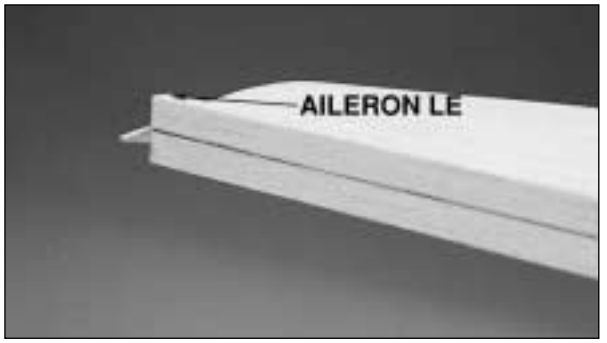
❏ 8. Cut the sheeting from the top of the center section for the fuel tank compartment and receiver compartment leaving the corners round for a finished appearance. **Use caution** to avoid cutting the servo cords and fuel lines.

BUILD THE AILERONS

Build left aileron first...

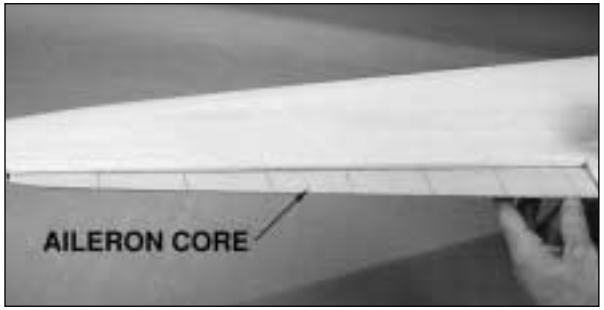
❏ ❏ 1. Cut the 1/4" x 3/4" x 24" balsa **aileron LE** to the length shown on the plan and draw a straight line down the center.





❏ ❏ 2. Use T-pins or medium CA to temporarily tack glue the aileron LE to the TE spar. The **root** of the aileron LE should be **centered** between the top and bottom of the wing but the **tip** of the aileron LE should be positioned so the line is approximately 1/16" **below** the **top** of tip rib W13.

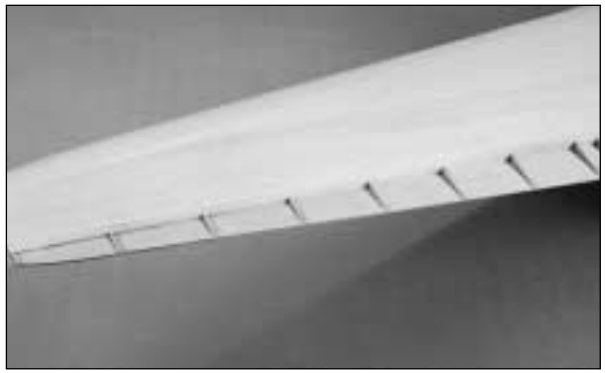
❏ ❏ 3. Shape the aileron LE to match wing.



❏ ❏ 4. Place a die-cut 3/32" balsa **aileron core** over the plan and mark the location of the aileron ribs on both sides. Test fit the aileron core to the wing. *Square up* the ends of the aileron core so they match the wing.

❏ ❏ 5. This step will be much easier if you set the wing on the firewalls so the TE is facing upward. Using the line you drew on the aileron LE as a reference, position but **do not glue** the aileron core on the aileron LE. Use a straightedge across the bottom of the wing to set the position of the TE of the aileron core. When the aileron core is in the correct position, it may not be **exactly** on the straight line on the aileron LE but it should be near it.

❏ ❏ 6. After you have carefully set the angle and location of the aileron core, glue it to the aileron LE. Glue a small section at a time using your straightedge across the bottom to make sure it remains at the correct angle.

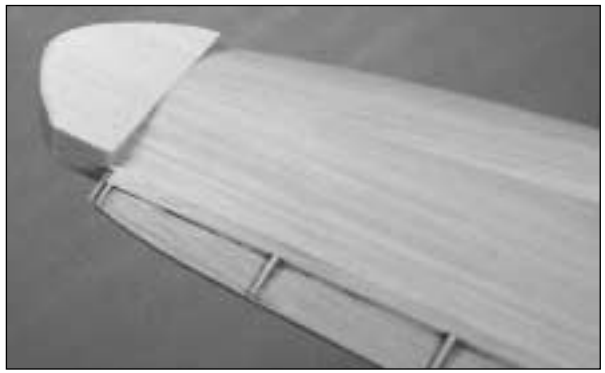


❏ ❏ 7. Cut the **aileron ribs** from a 3/32" x 3/8" x 24" balsa stick and glue them to the aileron core and the aileron LE. Shape the ribs to match the shape of the wing.

❏ 8. Fit the other aileron to the right side of the wing the same way. (Steps 1-7)

Let's make the wing tips while the ailerons are "locked" in position. This way your wing tips and ailerons will accurately match. Do the left one first so yours matches the photos.

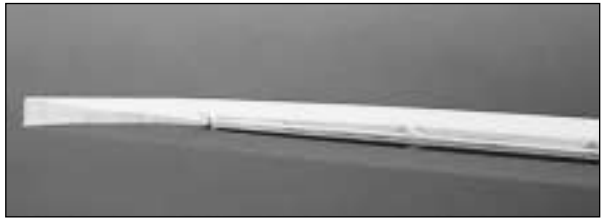
❏ ❏ 9. If you haven't done so already, sand the sheeting, spars and LE even with tip rib W13 to accommodate the left wing tip.



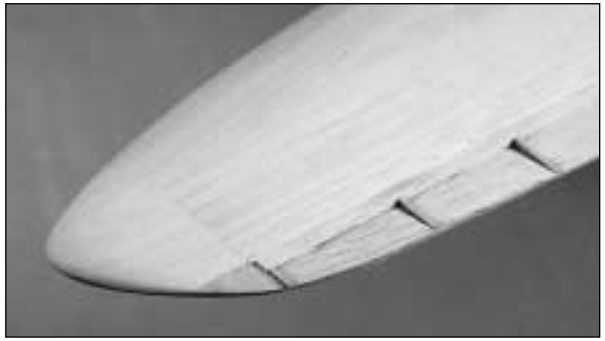
❏ ❏ 10. Glue a shaped 3/4" balsa wing tip to the left wing. Study the plan and the wing tip carefully to make sure you glue it on the right way.

❏ ❏ 11. Use a razor plane or a hobby knife with a carving blade to roughly shape the wing tip.

❏ ❏ 12. Glue pieces of leftover 3/4" x 1/4" balsa to the end of the wing tip and the wing as shown in the photo. Note the grain direction.



❏ ❏ 13. Use the top and bottom sheeting to guide your bar sander with 80-grit sandpaper to shape the top and bottom of the wing tip so it matches the wing. Rest your bar sander on the wing sheeting but only apply pressure to the wing tip—not to the sheeting.



❏ ❏ 14. Final sand the wing tip by rounding the edges. Round the LE of the wing to match the cross section on the plan.

❏ 15. Make the right wing tip the same way.

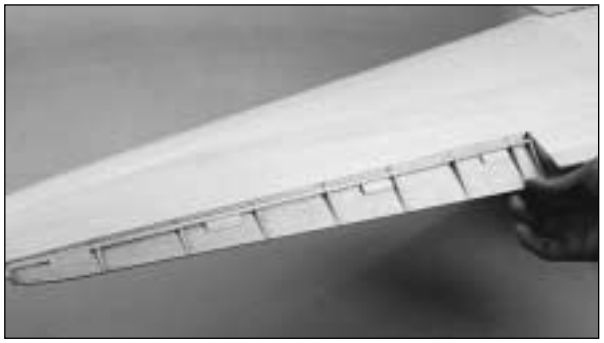
Okay, back to the ailerons...

❑ ❑ 16. Carefully *break* the left aileron free from the wing.

❑ ❑ 17. Mark the centerline on the LE of the aileron using the *T-pin and straightedge method* we showed you for making the centerline on the LE of the elevators on page 13.

❑ ❑ 18. Cut the hinge slots in the wing where shown on the plan. Transfer the location of the hinge slots on the wing to the aileron by marking them with a ballpoint pen. Glue pieces of leftover 3/32" balsa to both sides of the aileron core at the hinge slots (just in case your hinge slots wander off center a bit). Bevel the end pieces of balsa so they won't contact the covering.

❑ ❑ 19. Cut the hinge slots in the aileron. Test fit the aileron to the wing to make sure your hinge slots align. Make adjustments if necessary.



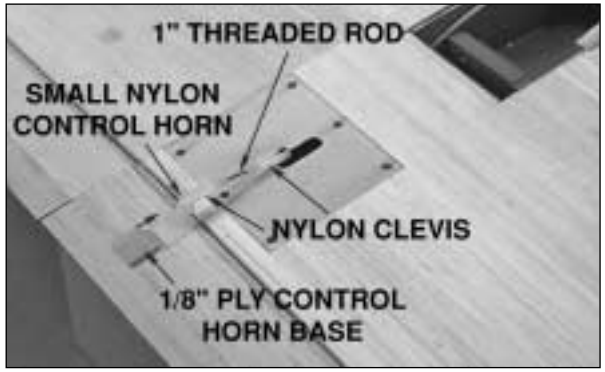
❑ ❑ 20. Bevel the LE of the aileron to a "V" as shown on the plan, using the centerline as a guide. Test fit the aileron to the wing once more and make sure you can get enough throw.

❑ 21. Fit the right aileron the same way. (Steps 9-20)

DC-3 *Fact*

In 1942 the Civilian Aviation Agency stated it would revoke the airworthiness certification of the DC-3 by 1948, but the transports were "grand fathered in" and in 1953 the agency declared that the DC-3 certificate was "good until it wore out."

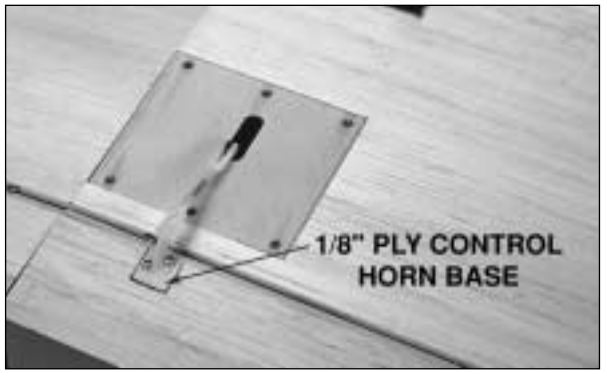
HOOKUP THE FLAPS AND AILERONS



❑ ❑ 1. Make a **flap pushrod** from two nylon clevises and a 1" **threaded rod**. Connect one end of the pushrod to the control arm on one of your flap servos and connect the other end to a **small** nylon **control horn.** Adjust the length of the pushrod so the flap will be in the *up* position when the servo arm is all the way back. Rest the control horn on the flap and mark where to position the die-cut 1/8" plywood **control horn base** on the flap.

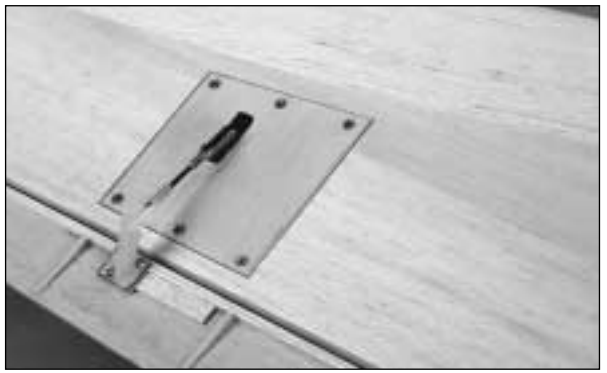
❑ 2. Repeat the previous step for the other flap pushrod.

❑ 3. Cut along the lines you marked on the flap for both control horn bases and remove balsa from the flap to inset the bases. Glue both bases to the flap.



❑ 4. Drill 1/16" holes in the flap bases and mount both control horns to their respective flap bases with #2 x 3/8" screws.

❑ ❑ 5. Glue a piece of leftover 1/8" balsa to the bottom of the aileron core directly behind the aileron servo arm where the aileron control horn will rest. Notch the LE of the aileron and the balsa piece you just glued in to accommodate the die-cut 1/8" plywood **aileron control horn base.** Glue the base in position—you can see it in the next photo.

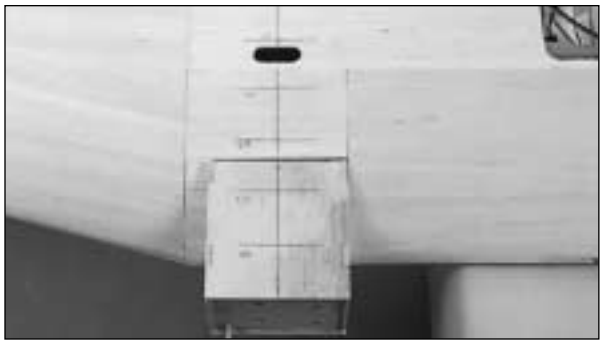


❑ ❑ 6. Make an **aileron control rod** from a nylon clevis, a solder-on metal clevis and .074" x 4" threaded one end rod. Mount a **large nylon control horn** to the control horn base on the aileron with two #2 x 3/8" screws. Connect the aileron to the servo with the control rod you made.

❑ 7. Repeat the previous two steps for the other aileron.

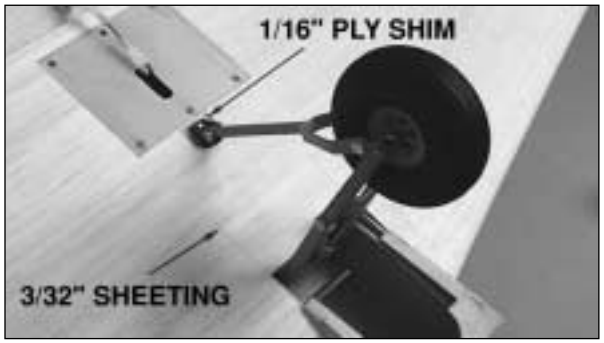
SHEET THE NACELLES

Some of the steps and photos in this section apply only to the fixed landing gear and some apply only to retract builders. Remember, fixed gear steps start with an "F" and retract gear steps start with an "R".



❏ ❏ 1. Use a ballpoint pen to draw a centerline on the top of the wing over one of the nacelles. Similarly, mark the location of the nacelle formers as shown on the plan.

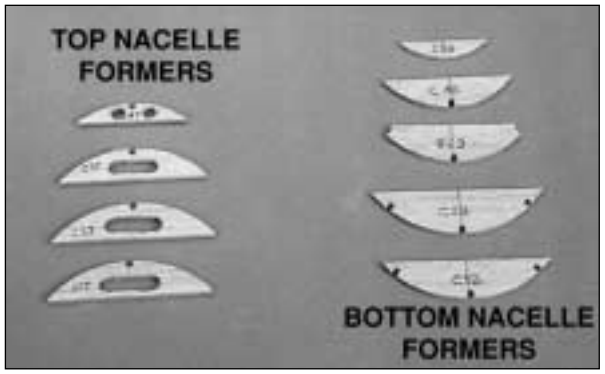
❏ ❏ R2. Turn the wing over. Mount the front of your retract to the forward landing gear rail. Cut the sheeting from the aft landing gear rail for the 1/16" shim you made earlier and glue the shim in place. Mount the aft strut to the rail.



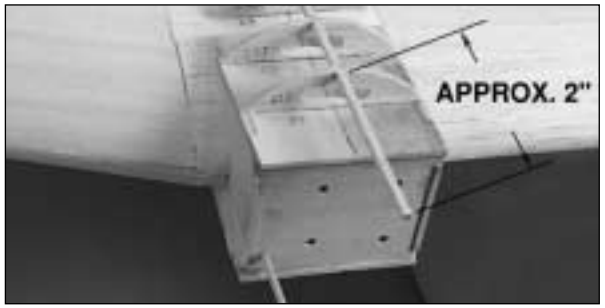
❏ ❏ R3. Cover the aft portion of the landing gear well with 3/32" sheeting.

❏ ❏ 4. Draw a centerline and mark the location of the bottom nacelle formers on the bottom of the wing the same way you did the top.

❏ ❏ 5. Gather all the die-cut 1/8" balsa **top** and **bottom nacelle formers**.



❏ ❏ 6. Draw centerlines on the top and bottom nacelle formers. Cut holes for the fuel lines in the top formers by useing a sharpened brass tube or a rotary motor tool.

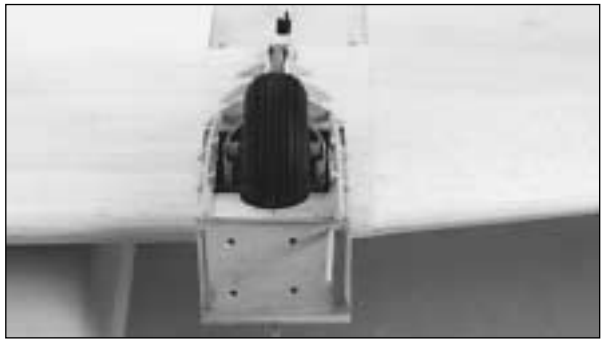


❏ ❏ 7. Glue the top nacelle formers to the wing. Glue an 1/8" x 1/8" x 24" stringer in the notches of the top nacelle formers allowing approximately 2" to extend from the front cowl former.

Remember, these three steps are for retract gear builders only.

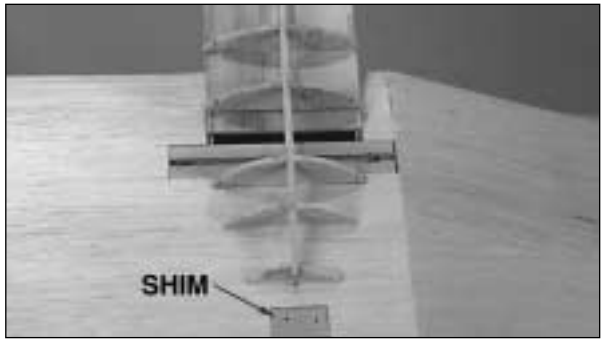
❏ ❏ R8. Turn the wing over. Glue on only the bottom nacelle formers 3, 4 and 5. Cut out the 1/8" notches in the formers, along the embossed lines.

❏ ❏ R9. If not in position already, temporarily mount one of your retracts. Retract the gear and trim the cowl formers as necessary for the aft strut. Make a small *passage* for the strut from leftover 1/16" balsa.



❏ ❏ R10. Glue on the remaining bottom nacelle formers. Glue 1/8" x 1/8" stringers in the side notches only. Cut the formers to accommodate the landing gear when you retract it into the wing.

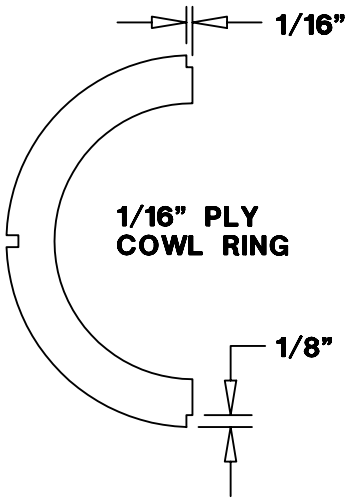
Remember, these two steps are for fixed gear builders only.



❏ ❏ F11. Turn the wing over. Glue the bottom nacelle formers to the bottom of the wing. Glue 1/8" x 1/8" stringers in the notches the same way you did the top nacelle formers.

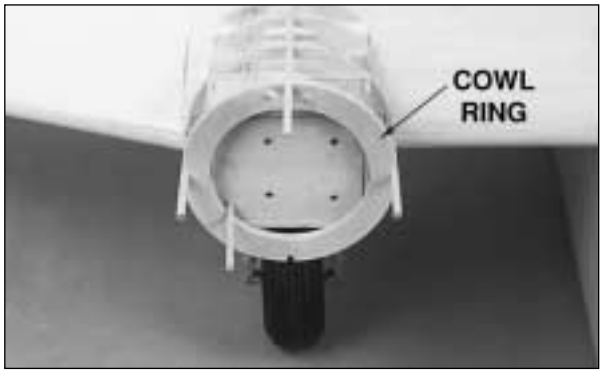
❏ ❏ F12. Cut the bottom sheeting over the aft landing gear rail for the 1/16" plywood shim you made earlier. Glue the shim to the rail in the same location it was before. Sand the bottom sheeting even with the shim.

❏ ❏ 13. Glue the **side nacelle formers (C1S)** to the nacelle sides. Glue 1/8" x 1/8" stringers in the notches.



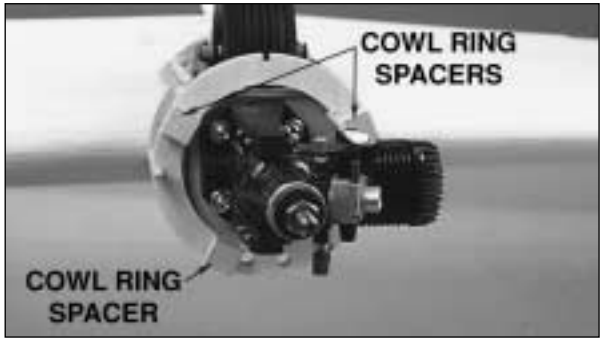
❏ ❏ 14. Gather four die-cut 1/16" plywood **cowl ring doublers**. Cut 1/16" *half notches*, 1/8" deep, on both ends of all four ply cowl rings as shown in the sketch.

❏ ❏ 15. Build a **cowl ring** from two die-cut 1/8" **balsa ring doublers** and two die-cut 1/16" plywood cowl ring doublers. Cut notches in the balsa cowl ring using the notches in the ply cowl ring as a guide. Build a second cowl ring the same way. Drill holes in both cowl rings for your fuel lines. You can see the cowl rings and the holes in the following photos.



❏ ❏ 16. Glue one of the cowl rings, with the ply side facing the front, centered, to the front of the nacelle with the notches keyed in the stringers. If necessary, notch the inside of the cowl ring for the throttle guide tube. Temporarily mount your engine and engine mount.

❏ ❏ 17. Determine where to position the three 1/2" x 1/2" x 1-1/16" basswood **cowl mounting posts** (refer to the photo at step 5 on page 54). You must locate them where they will not interfere with the needle valve, muffler, fuel lines or engine. Try to space them as evenly as possible.



❏ ❏ 18. Mark the locations you have determined for the cowl mounting posts on the aft cowl ring on the nacelle. Cut three 1/2" long **cowl ring spacers** from the 3/8" x 1/2" x 9" long basswood stick and glue them to the nacelle where you have marked the cowl ring for the mounting posts (the cowl ring spacers support the cowl mounting posts).

❏ ❏ 19. Remove your engine. Temporarily place the front cowl ring on the stringers (balsa side facing forward) resting on the cowl ring spacers. Mark the location of the cowl mounting posts over the cowl ring spacers. Remove the cowl ring. Notch the balsa down to the plywood for the cowl mounting posts.

❏ ❏ 20. Reposition the front cowl ring and glue it in place. Add 1/8" x 1/8" side stringers.

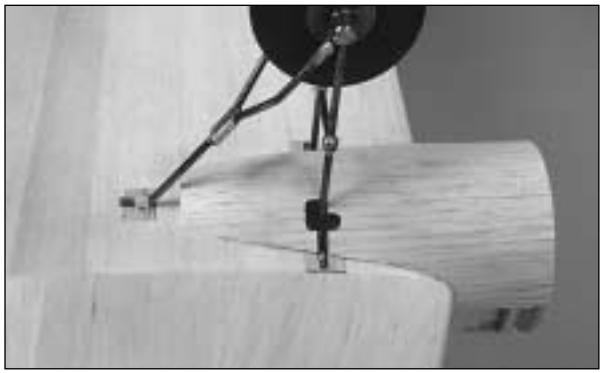
❏ ❏ 21. Sand the stringers and formers so they blend.

❏ ❏ R22. Use the **nacelle bottom sheeting pattern** on the fuse plan to make a skin for one half of the **bottom** of the nacelle from a 1/16" x 4" x 24" balsa sheet. Remember to make your skin slightly larger than indicated to allow for trimming and positioning. Wet the outside of the skin with water and bend it into position as you test fit and trim it for a good fit. Once you get the correct shape, use the first skin as pattern to make the second skin before you glue it in place.

❏ ❏ R23. Glue the skin to the nacelle formers. It’s easiest to glue sheeting to the wing first, then bend and glue it to the formers. Trim the skin as necessary so the wheel will fit when you retract the gear.

❏ ❏ R24. Glue the skin to the bottom of the other side of the nacelle the same way.

❏ ❏ F25. Use the **nacelle bottom sheeting pattern** on the plan to make a skin for one half of the **bottom** of the nacelle from a 1/16" x 4" x 24" balsa sheet. Remember to make your skin slightly larger than indicated to allow for trimming and positioning. Wet the outside of the skin with water and bend it into position as you test fit and trim it for a good fit. Once you get the correct shape, use the first skin as pattern to make the second skin before you glue it in place.

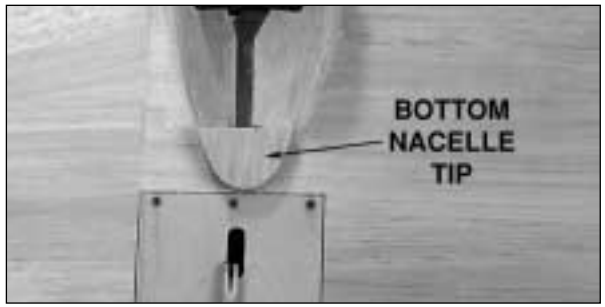


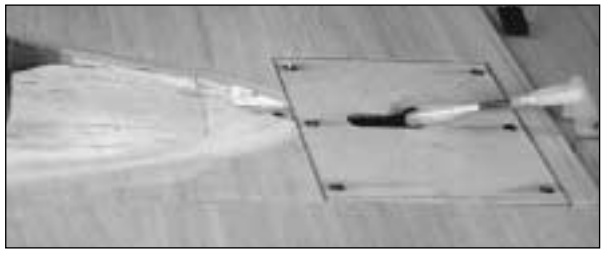
❏ ❏ F26. Glue the skin to the nacelle formers. It's easiest to glue the sheeting to the wing first, then bend and glue it to the formers. Trim as necessary so the front landing gear strut and the landing gear straps will fit.

❏ ❏ F27. Glue the skin to the bottom of the other side of the nacelle the same way.

❏ ❏ 28. Route the fuel lines through the top nacelle formers and the cowl rings.

❏ ❏ 29. Make the skins for the top of the nacelle using the 1/16" x 4" balsa sheet you used for the nacelle bottom skins and the nacelle **top sheeting patterns** on the plan. Glue the skins to the nacelle top.





❏ ❏ 30. Turn the wing over. Use the **bottom nacelle tip pattern** on the plan to make the **bottom nacelle tip** from the 1/2" x 2" x 8" balsa stick. Glue the bottom nacelle tip to the wing. Trim as necessary for the aft strut. Shape the nacelle tip to match rest of nacelle.

❏ ❏ 31. Make the **top nacelle tip** the same way using the **top nacelle tip pattern** on the plan and the remainder of the 1/2" x 2" balsa stick. Glue the top nacelle tip in position.

❏ ❏ 32. Apply lightweight balsa filler all around the edges of the nacelle where it meets the wing. After the filler dries, blend the nacelle to the wing by sanding. Round the nacelle front around the front cowl ring.

❏ 33. Return to step one and sheet the other nacelle the same way *(aren't you glad you're not building a B-17?).*

DC-3 *Fact*

Though technological advances in aviation have relegated the "Gooney" to second and third line tasks, approximately 1,500 of them are flying today. Some are still in service but many are recognized as collectors items. In increasing numbers variants of the DC-3 are appearing at air shows across the world.

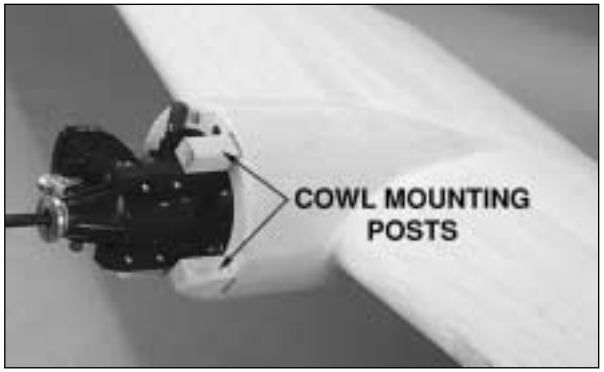
MOUNT THE COWLS

❏ ❏ 1. Cut one molded **right** and **left** ABS **cowl half** and a **cowl rear** along the cutlines (the cutlines can be most easily seen from the inside). Hobbico (HCAR0667) or Kyosho (KYOR1010) curved plastic cutting scissors work well for this. True the edges with a bar sander and 80-grit sandpaper.

❏ ❏ 2. **Thoroughly** roughen the inside and the outside of the joining edges of both cowl halves with 150 to 240-grit sandpaper. Basically, you should sand everywhere you want glue and filler to adhere, including a 1" wide strip along the joining edges on the inside of both cowl halves.

❏ ❏ 3. Join the cowl halves and hold them together with masking tape. Glue the cowl halves together with thin CA. Avoid using accelerator, or use it sparingly because it may soften the plastic.

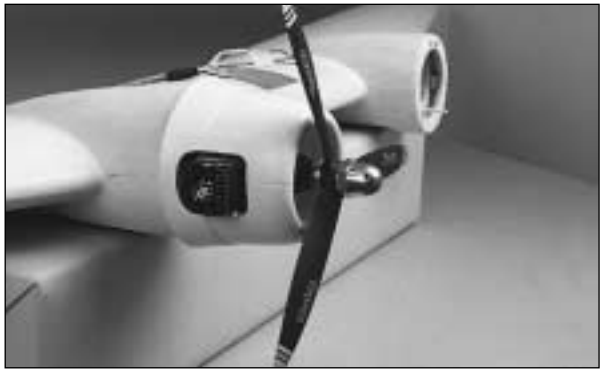
❏ ❏ 4. Join the cowl halves to the cowl rear.



❏ ❏ 5. Mount your engine to one of the nacelles (we did the right side first). If necessary, trim part of the cowl rings to accommodate the engine mount. Glue the 1/2" x 1/2" x 1-1/16" basswood **cowl mounting posts** in the notches you cut in the balsa cowl ring. Slightly round the outer edge of the cowl mounting posts to accommodate the cowl.

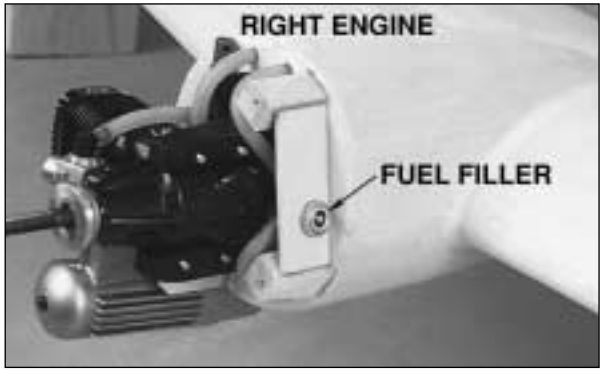
❏ ❏ 6. Determine where to trim the cowl to accommodate your engine. Start by cutting a small hole, then enlarge the hole until you can fit the cowl over your engine. After you mount the cowl, you can accurately finish cutting the rest of the hole for the best appearance.

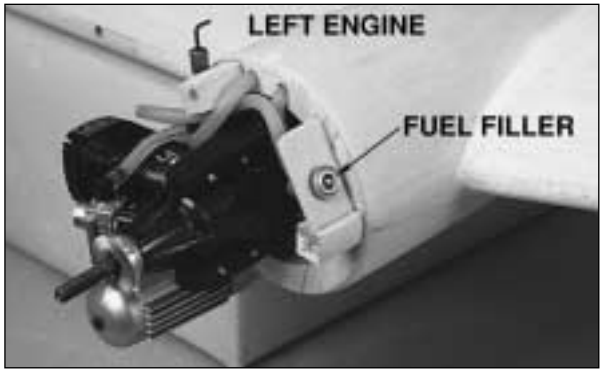
❏ ❏ 7. Position the cowl on the cowl mounting posts and center it over the nacelle and your engine. Mark the cowl rear over the cowl mounting posts where to drill the holes for the mounting screws.



❏ ❏ 8. Remove the cowl. Drill 3/32" holes in the cowl at the marks you made. Reposition the cowl and mark the cowl mounting posts for the mounting screws. Remove the cowl and drill 1/16" holes in the cowl mounting posts. Mount the cowl with three #2 x 1/2" screws *(we installed a propeller and a spinner hub on ours just to see how it looks!).*

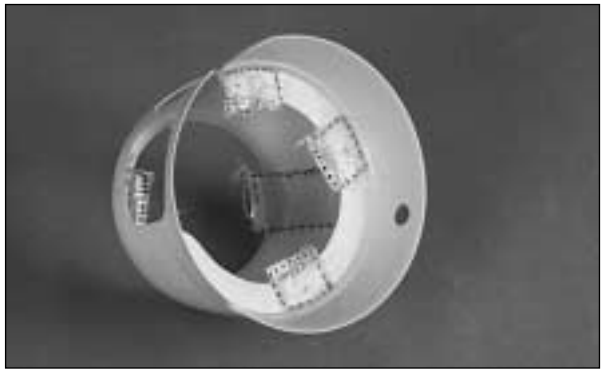
❏ ❏ 9. Cut your cowl for the muffler and needle valve.





❏ ❏ 10. Make a **fuel filler mount** from leftover 1/8" plywood and mount your fueling system. Cut your fuel lines to the correct length and connect them to your engine, fueler and the pressure tap on your muffler. Cut a hole in the cowl to access your fuel filler.

❏ 11. Fit and mount the cowl to the other nacelle the same way.



❏ 12. If you haven't done so already, roughen the inside of both cowls along the seams so epoxy will adhere. Also roughen the back of the cowl rear where the mounting screws go through. Use 30-minute epoxy to apply strips of 1" glass cloth over the seams and the holes where indicated.

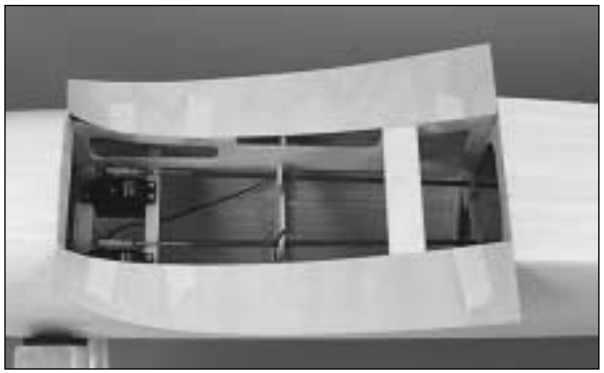
❏ 13. Allow the epoxy to cure overnight and trim the excess off. Fill the seams between the right and left cowl halves with filler. We use Bondo automotive filler or Squadron Green or White putty. Allow the filler to fully harden, then wet sand smooth.

FINAL CONSTRUCTION

MOUNT THE WING TO THE FUSELAGE

❏ 1. Cut the 1/4" x 2-3/4" dowel into two 1-3/8" long **wing dowels**. Round one end of both wing dowels and glue them into the wing with 30-minute epoxy.

❏ 2. Trim the ends of the 1/4" x 1" x 5-3/8" plywood **wing bolt block** so it fits between the fuse sides in the inner wing saddles. Securely glue the wing bolt block to the saddles and fuse sides with 30-minute epoxy.



❏ 3. Trim the balsa fuse sides so they are even with the ply inner wing saddles. Make the **wing fillet bases** from the 5" x 13" x 1/32" plywood sheet using the pattern on the fuse plan. Tape both wing fillet bases to the inner wing saddles in the fuselage.

❏ 4. Test fit the wing to the fuselage. If necessary, slightly enlarge the holes in former F5 to accommodate the wing dowels.

❏ 5. Use the *pin-and-string technique* to align the wing the same way you did the stab, only this time stick the T-pin in the center of the fuselage at the rear.

❏ 6. See the **Hot Tip** and the photo that follows and use a #10 (or 3/16") drill to drill holes in the wing bolt blocks in the fuselage. The wing **must not shift** during this procedure or you will lose your alignment and you must hold your drill perpendicular to the bottom of the wing. Secure the wing to the fuselage with masking tape or weights if necessary. Steady your hands and drill the first hole. If you seem to have had difficulty with this procedure in the past, you could just *dimple* the wing bolt block by letting the spinning drill bit *barely* contact it and *backing off* before you actually drill a hole. Remove the wing and make sure you will be drilling near the center of the block. Reinstall the wing, check alignment and drill the other hole.

HOT TIP

HOW TO MAKE A DRILL JIG

If you have a drill press (or if a friend will let you use his), make a *drill jig* by drilling a #10 hole through an approximately 1" x 1-1/2" x 2" hardwood block. Use the block to hold your drill bit perpendicular to the bottom of the wing as you drill the holes. This will help you *aim* the drill directly toward the wing bolt blocks so the heads of your wing bolts will rest **flat** on the wing bolt plate in the wing. You can use this drill jig on all your models.

❏ 7. Take the wing off the fuse. Tap threads in the wing bolt block with a 1/4-20 tap. Saturate the threads in the wing bolt block in the fuse with thin CA. Allow the glue to cure **thoroughly**, then re tap the holes. Enlarge the holes in the bottom sheeting to accommodate the heads of the wing bolts. Bolt the wing to your fuselage with 1/4-20 nylon **wing bolts**.

BUILD THE WING FILLET

❏ 1. Bolt the wing to the fuselage and view the model from the rear. Observe the horizontal alignment between the wing and the stabilizer. If necessary, loosen the wing bolts and insert shims from leftover balsa between the wing fillet bases and the fuselage to bring the wing into alignment with the stab. Tighten the wing bolts.

❏ 2. Make sure the aft edge of both wing fillet bases *end* at the trailing edge of the wing. If necessary, reposition or trim the fillet bases to achieve this.

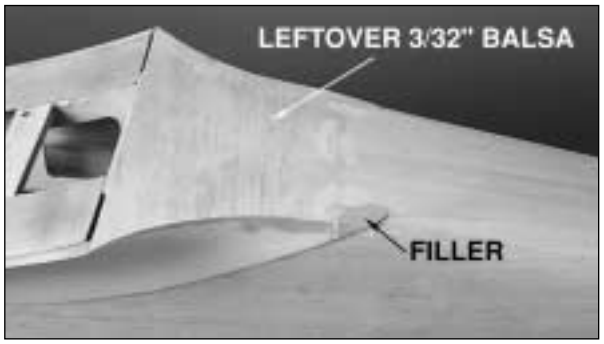
❏ 3. Cut the molded plastic **wing fillets** along the cutlines. With the wing bolted to the fuselage, test fit the wing fillets to the fuselage so you can see how they fit.

❏ 4. Turn the fuselage over and remove the wing. Keep track of any pieces of balsa you may have used for shims so you can put them back in position when you are gluing the fillet bases to the fuse. Cover the middle of the wing with Plan Protector so glue will not stick.

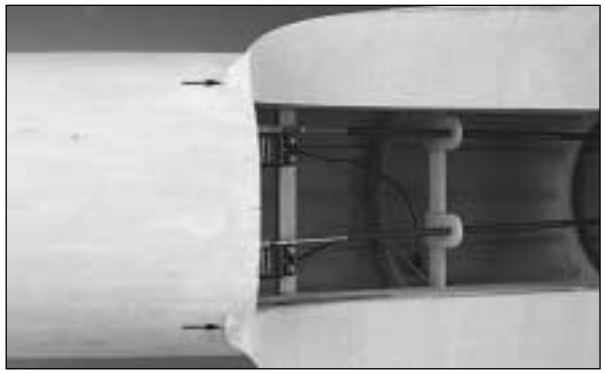
❏ 5. Remove the fillet bases and apply a mixture of 30-minute epoxy and microballoons to the inner wing saddles and the fuse side. Tape the fillet bases to the inner wing saddles and bolt the wing to the fuselage. Insert balsa shims if you used any and recheck the alignment of the wing and stab. Wipe away excess epoxy and allow it to fully cure before you proceed.

❏ 6. Position the plastic wing fillets on the fuselage and glue them to the saddle bases and fuse with medium and thin CA as needed. Don't worry if you can't get the plastic fillets to fit perfectly all around the leading edge of the wing. You can finish that later with filler.

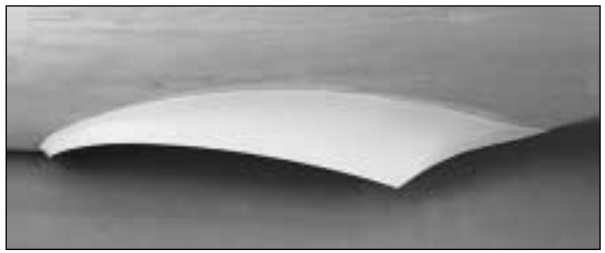
❏ 7. Remove the wing and take off the Plan Protector. Trim the edges of the fillet base to within approximately 1/8" from the plastic fillet. This will leave a *ledge* for the filler so you can sand it to a thin edge.



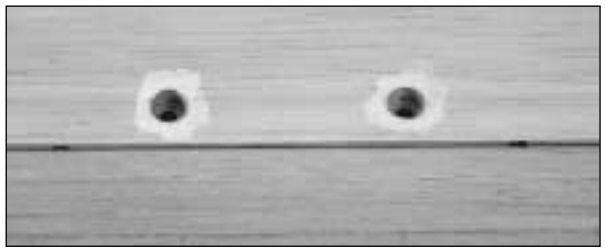
❏ 8. Bolt the wing to the fuselage. Make the aft portion of the fillet base from leftover 3/32" balsa, connecting the rest of the fillet to the fuselage. The balsa is cross grain and extends from the TE of the wing to the end of the fillets. Sand the aft end of the balsa flush with the fuse. Finish the aft tip of the fillet by blending the balsa and plastic to the fuselage with filler. We used Bondo body filler because it adheres well to plastic and wood.



❏ 9. Blend the front of the wing fillet to the fuselage and to the fillet base with automotive Bondo, Squadron white or green putty or other suitable filler. Sand when dry.

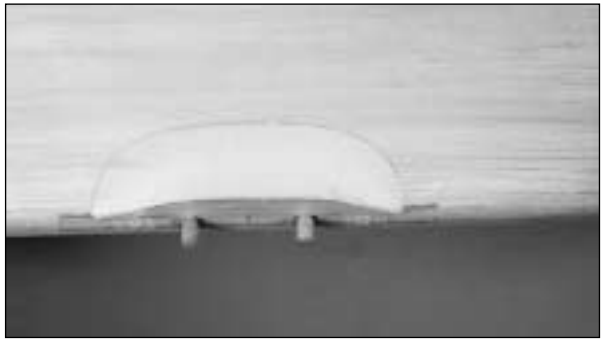


❏ 10. Paint the fillet base with a coat of primer. We brushed on a layer of primer over areas that had filler (because filler needs more primer than bare plastic), then masked off the fuselage and sprayed on a coat of primer.



❏ 11. Bolt the wing to the fuselage. Trace around the wing bolts on the bottom sheeting with a ballpoint pen. Remove the wing bolts and cut out the wood. Glue in pieces of **paper tube** and sand them flush with the wing.

❏ 12. With the wing bolted to the fuselage, fit a piece of leftover 3/32" balsa between the fuse and the wing. This will be the **wing fairing former**. Trim the wing fairing former even with the bottom of the fuselage. Use the **front wing fairing pattern** on the plan to trace the outline on the wing as shown in the photo.

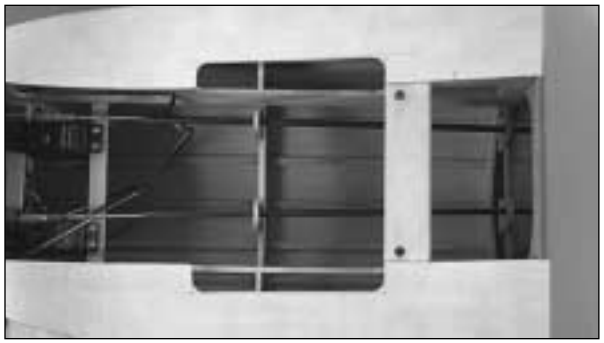


❏ 13. Remove the wing from the fuse and fill the area between the wing fairing former and the outline you made with lightweight balsa filler. Sand smooth.

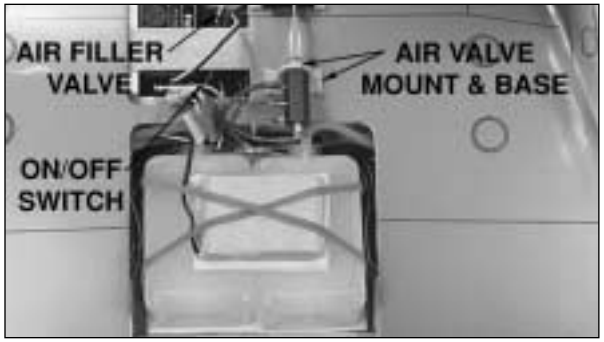
MOUNT THE FUEL TANKS AND RECEIVER

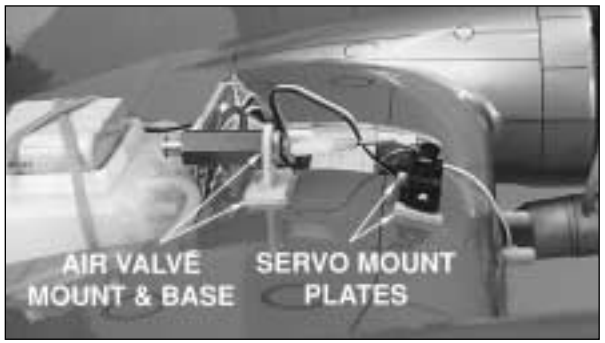
If you prefer to do this after you cover your model, skip this section, then return after you cover the wing.

❏ 1. Cover the bottom of the fuel tank compartment with R/C foam rubber (make sure you have fuel proofed the fuel tank compartment first).



❏ 2. Trim the wing fillet bases as shown to accommodate the fuel tanks.





Refer to these photos for the following steps.

❏ 3. Connect the fuel lines and secure the fuel tanks with two #64 rubber bands connected to the fuel tank hooks in a crisscross fashion. The battery pack is shown in the suggested location. You may relocate the battery pack to the fuse if you need to adjust the C.G. or if it interferes with the pushrods in the fuselage when you mount the wing.

❏ 4. Line the receiver compartment with R/C foam and position your receiver. Route the servo cords in the wing around the fuel tanks and connect them to your receiver.

❏ 5. Mount your on/off switch and the air filler valve in the location of your choice. We mounted ours next to the receiver in the receiver compartment so they can be accessed from the bottom of the wing.

❏ 6. Cut a hole in the top wing sheeting to accommodate your air valve servo. Make **servo mount plates** from leftover 1/8" plywood and glue them to the wing sheeting. Mount your air valve servo to the mounts with the screws included with your servo.

❏ 7. Mount the air control valve to the wing as shown, using the die-cut 1/8" plywood air **control valve mount** and **base** with 30-minute epoxy. Connect the air valve to your servo.

❏ 8. Once you have finalized your installation, secure your receiver in the wing with a piece of leftover 1/8" balsa with 1/4" foam underneath.

❏ 9. Cut a hole in the bottom of the receiver compartment for the receiver antenna. Put a strain relief on the antenna and route it out the bottom of the wing. When you're at the flying field, you can connect the end of the antenna to the bottom of the fuselage after you mount the wing. We used a small rubber band looped over the tail gear wire.

DC-3 *Fact*

Donald W. Douglas received his secondary education from the U.S. Naval Academy at Annapolis in 1909. Three years later he enrolled at MIT (Massachusetts Institute of Technology). Douglas completed the four year program in two years at MIT earning a degree in aeronautical engineering. Following that, Douglas went to work at MIT as a Graduate Engineer until he was hired by Glenn L. Martin aircraft company as their chief engineer.

PREPARE THE MODEL FOR COVERING

❏ 1. At this stage, there shouldn't be much left to do. We've installed the radio system along the way, all the hinge slots are cut and the control surfaces are all temporarily connected, the engines are mounted and the retracts (if you are installing them) have been fitted. If there are any areas left that you haven't fuelproofed, now is the time to do it. We recommend taking off the engines, landing gear and any other systems that may get in the way of painting or fuel proofing. Make sure you fuelproof the inside of the flaps and the flap area in the wing, the wheel wells, the fuel tank compartment, the wing saddle and the front of the wing, etc. For fuelproofing, we recommend any kind of fuelproof model airplane paint but, of course, we prefer Top Flite LustreKote. See the Hot Tip that follows on how to use LustreKote to fuelproof these important areas.

Note: You should always fuelproof the model **before** you cover it. Otherwise, some types of paint may soak through the wood and cause blemishes that may show through the covering.

HOT TIP

If you plan to cover your model with Top Flite MonoKote film and you will be using Top Flite LustreKote spray paint for parts that require painting and/or fuelproofing, you may find it easier to apply LustreKote to some of those areas with a paint brush instead of spraying it from the can. To apply LustreKote with a brush, hold a tube (such as a drinking straw) to the spray nozzle, with the other end of the tube emptying into a container. Depress the spray nozzle until you have enough paint in your container to do the job. Spraying LustreKote into a tube will keep most of it from becoming airborne. Allow the paint to stabilize for about ten minutes before you brush it on. This is a handy method for painting visible areas on the outside of the model that require fuelproofing and must match your MonoKote finish (such as the wheel wells and the insides of the flaps). To simulate the Zinc Chromate used on the inside of aluminum airplanes, mix yellow and blue.

❏ 2. Inspect all surfaces for uneven glue joints and seams that require filler. Apply filler where needed. Many small dents or scratches in balsa can be repaired by applying a few drops of water or moistening the area with a wet tissue. This will swell the wood so you can sand it when it dries.

❏ 3. Final sand your entire model with progressively finer grits of sandpaper, finishing with 320 or 400-grit sandpaper.

❏ 4. Use a large brush, compressed air or a Top Flite Tack Cloth to remove dust from the model.

BALANCE THE AIRPLANE LATERALLY

❏ 1. Mount your wing.

❏ 2. With the wing level, **carefully** lift the model by the nose and the aft end of the fuselage under the stab (this may require two people). Do this several times.

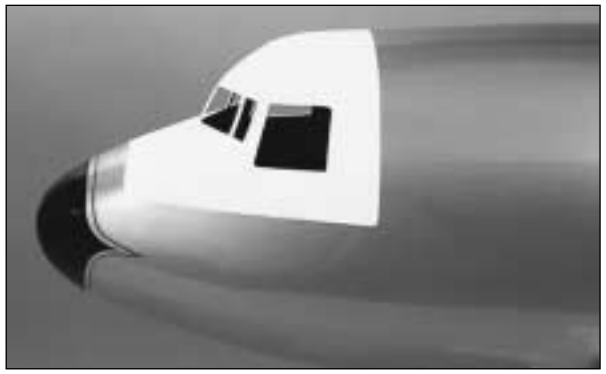
❏ 3. If one wing always drops when you lift the model, that side is heavy. Balance the airplane by gluing weight inside the other wing tip. Do this by carving a cavity in the bottom of the balsa wing tip and filling it with the amount of weight required to balance the model laterally. Glue the weight in place with epoxy and cover the rest of the cavity with balsa filler. **An airplane that has been laterally balanced will track better in certain maneuvers**.

FINISHING

COVER YOUR MODEL WITH MONOKOTE

It is assumed that you are an intermediate to advanced modeler, so we won't go into many details on covering techniques, but here are some tips you should consider:

❏ 1. Most importantly, **NEVER CUT THE COVERING DIRECTLY ON THE SHEETING.** The DC-3 depends upon the wood sheeting for some of its strength. Modelers who cut through the covering tend to cut into the sheeting and this will weaken the structure.



❏ 2. We recommend that you prime the plastic wing fillets, the cabin top and the tail cone **before** you cover the fuse, then apply color **after** you cover the fuse. This way you can "build up" the paint to nearly the same level as the covering for a nearly invisible transition between the two. Whenever you are ready to begin painting, refer to the *Painting* section on the next page.

❏ 3. Use a Top Flite™ Hot Sock for your Top Flite covering iron or a Cover Sock if you are using a 21st Century iron to minimize dents in the wood from your covering iron. You'll probably go through three or four socks by the time you finish covering your DC-3. The 21st Century iron is highly recommended for this model due to the curved lines and fillets in the nacelles and fin area.

❏ 4. Some modelers have three irons going at once: one on high heat without a Hot Sock for stretching the covering around curves like wingtips; one on medium heat with a Hot Sock for bonding the covering to large sheeted areas like the wing and stab; and a Trim Iron for small areas.

❏ 5. When you cover large sheeted surfaces such as the wing, bond the covering in the middle and work outward, pushing out air as you proceed. Do not move the iron in a circular motion, but move it span-wise with the grain of the wood.

❏ 6. Areas that require an extraordinary amount of shrinking (such as the nacelles and bottom of the fuse at the front) can be attacked with a heat gun. Use a glove to avoid burning you fingers.

❏ 7. When you cover smaller parts with square edges such as the elevators and ailerons, cover the ends first with separate pieces of covering. Then, all you have to do is wrap the covering around the top and bottom and iron it down.

❏ 8. One method we like to use is to "pre-cut" the covering when possible to accurately fit the part, leaving "handles" in curved areas like the dorsal fin and the tip of the fin as shown in this example. Cover the main surface of the part and the straight lines of the leading and trailing edges first. Hold onto the handles as you heat the covering and wrap it around. Cut the handles off when you're done. You can use this method for the wing and stab too.

❏ 9. We recommend you drill or cut small vent holes through the ribs in the ailerons, rudder and the stab with holes on the ends of those parts to allow expanding hot air to escape while you cover. Otherwise, air sealed inside the control surfaces will expand and never allow the covering to fully shrink.

COVERING SEQUENCE

Refer to the painting section that follows before you cover the fuse.

FUSELAGE

1. Stab bottoms, then stab tops
2. Fin
3. Aft fuse bottom
4. Forward fuse bottom (two pieces)
5. One fuse side, then the other (with the two halves joining in the middle of the top)
6. Nose cone (this was done in four pieces)
7. Bottom, then top of elevators
8. Rudder

WING

1. One side, then the other of nacelle bottoms
2. One side, then the other of nacelle tops
3. Bottom of center section
4. Bottom of one, then the other outer panel
5. Top of center section
6. Top of one, then the other outer panel
7. Bottom, then top of ailerons
8. Bottom of flaps

PAINTING

Earlier in the manual we recommended you primer the cabin top, wing fillet and the tail cone before you cover the fuselage and add the color paint after you cover the model. To do it this way, first roughen the plastic parts attached to the fuse with 320-grit sandpaper, then spray on a coat of primer. We used Top Flite LustreKote for everything that needed to be painted or fuel proofed. After the primer dries, sand with 400-grit. Wet sanding works best because it keeps your sandpaper from becoming clogged, but of course you want to avoid getting the rest of the balsa fuse wet. You may wet sand if you are careful by shaking most of the water off your sandpaper after you wet it. Keep a cloth handy to wipe water from the balsa. After you are done wet sanding, allow the fuse to dry for a while, then dry sand it once more to smooth surrounding balsa that may have been wetted. Wet sand and prime the engine cowls too. Now the fuse is ready for covering.

For masking fine lines, use Top Flite Fine Line Masking Tape (TOPR8012) and use Kyosho Masking Cover Sheet (KYOR1040) for masking large areas. Lightly use a Top Flite Tack Cloth (TOPR2185) to remove dust just before you paint.

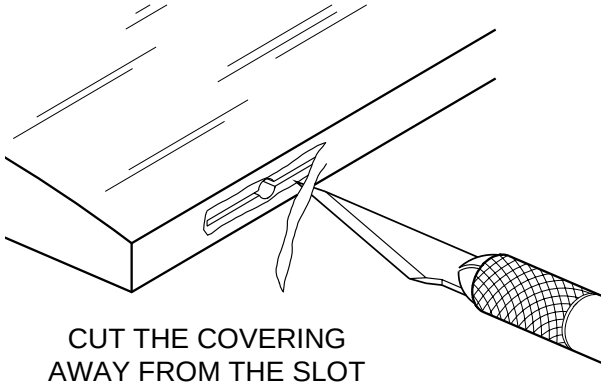
After the cabin top, wing fillets and tail cone are primed and the fuse is covered, spray on your colors to the plastic. Mask the seam between the covering and the plastic parts so you don't get paint on the covering. You can cover the small seam between the paint and the covering with a panel line.

HOT TIP

The finer a layer of paint you can apply to the plastic on the fuselage, the smaller and therefore the less visible the seam between the paint and the covering will be. To apply the finest possible amount of LustreKote to the plastic parts on the fuselage, we've found that you can apply LustreKote with an airbrush. Of course, LustreKote is only available in a spray can. To get LustreKote into your airbrush, use the method described earlier to get it into a container (spray it through a tube). You should be able to spray unthinned LustreKote directly through your airbrush, but if it does require thinning, experiment with different kinds of thinner. We've had great success with K&B thinner. Of course, you should test a small area first. We also recommend you spray on a final coat of clear to bring the LustreKote to the same shine as the MonoKote— especially over aluminum.

Important: If you are using aluminum paint (as we did on our prototype), **do not** sand the paint before you apply your clear coat. Sanding aluminum adds a *scuffed* appearance that the clear coat will **not** remove. Apply your clear coat directly over the aluminum paint and it will match the MonoKote aluminum well.

JOIN THE CONTROL SURFACES



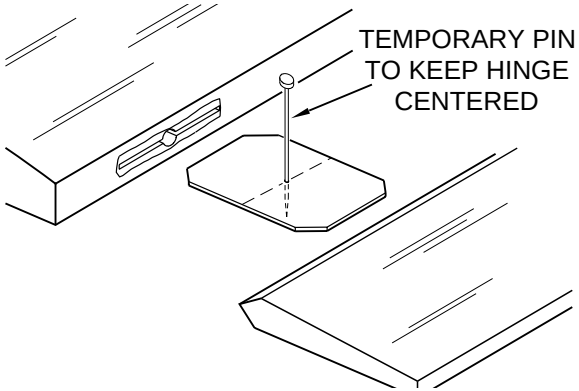
CUT THE COVERING AWAY FROM THE SLOT

❑ 1. Start with the stab and elevators. Remove a small strip of covering from the hinge slots.

HOT TIP

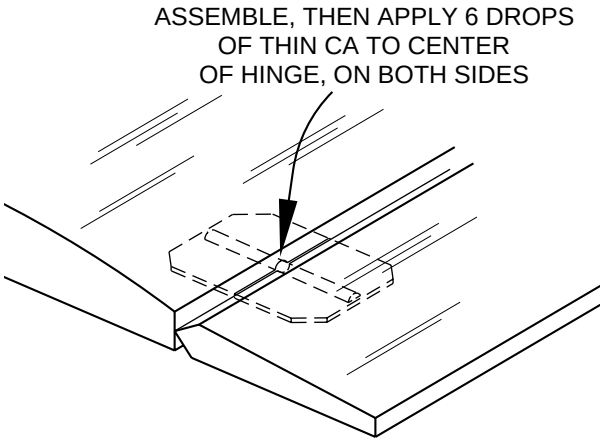
Before you glue in the hinges, apply a few drops of household oil to a tissue. Wipe the tissue over the trailing edge of the stab and the leading edge of both elevators coating them with a fine film of oil. This will prevent excess CA you use for gluing in the hinges from sticking to the elevator and stab at the hinge gap.

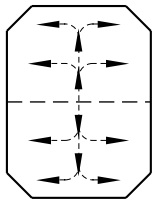
❑ 2. Fit the hinges in the stab or elevators only (without glue). Fill the torque rod holes in the elevators with epoxy.



❏ 3. Join the elevators to the stab with the hinges, simultaneously installing the joiner wire in the elevators. If the hinges don't remain centered as you join the elevators to the stab, remove the stab and insert a pin in the center of the hinges to keep them centered. Use a tissue dampened with alcohol to remove excess epoxy that comes out of the elevators. Make sure there is approximately a 1/64" gap between the elevators and the stab so you do not glue them together.

Do not use CA accelerator on any of the hinges and do not glue the hinges with anything but thin CA. Do not attempt to glue one half of the hinge at a time. The hinges will not be properly secured and could come out while the model is in flight.





❏ 4. Cut a paper towel into approximately 2" squares. Add six drops of thin CA to the center of the hinges on **both the top and bottom**. The *tunnels* you drilled will *wick* the CA into the entire hinge surface. Use the paper towel squares to absorb excess CA from the hinge gap before it cures.

❏ 5. Use the same hinging method to join the rudder to the fin (if you've build the non-scale stab and fin) and the ailerons to the wing.

❏ 6. If you've built the scale rudder, cut the covering from the hole in the top of the rudder for the hinge tube. Cut the hinge tube so the top end will be just below the top of the rudder when it is fully inserted.

❏ 7. Fill the rudder torque rod hole in the rudder with epoxy. Join the rudder to the fin and insert the hinge tube. Use a piece of leftover 1/16" pushrod or something similar to push the hinge tube so the top rests about 1/32" below the top of the rudder. The hinge tube will not come out, but seal the hole in the top of the rudder with a piece of MonoKote.

❏ 8. If you've built working flaps, use a toothpick to apply a small amount of petroleum jelly to the pivot points of the hinges to keep epoxy out.

❏ 9. Use a piece of wire or a toothpick to thoroughly coat the holes for the flap hinges in the wing and the flap with the epoxy. Coat one side of the flap hinges with epoxy and insert them into the wing. Coat the other side of the hinges with epoxy and join all three flaps with the flap joiner wires to the wing. Wipe away excess epoxy before it cures.

❏ 10. Tape the flaps in place and use tape or clothes pins to hold the flaps into alignment with the TE spar until the epoxy has fully cured.

❏ 11. Reinstall all the pushrods and mount the control horns to the ailerons and flaps. Reinstall any hardware and other components you may not already have in place such as the engines and mufflers, retracts, fuel tanks, servos, on/off switch, fuel filler valves, air filler valve, etc.

❏ 12. Mount a 1-1/2" tail wheel on the tail gear wire and secure it with a 3/32" wheel collar and a drop of thread lock.

FINISHING TOUCHES

DECALS

❏ 1. Study the photos on the box to decide where to place the decals.

❏ 2. Thoroughly clean your airplane before you apply the decals.

❏ 3. Trim the decals as close as practical and carefully apply them to your model. You can *float* the decals into position by first applying soapy water to the model's surface (just a teaspoon of dish detergent to a quart of water), then *squeegeeing out* the water and soap with a piece of soft balsa or a credit card wrapped with a tissue. Blot the surface dry and let the decal adhesive cure for at least 12 hours before running the engines.

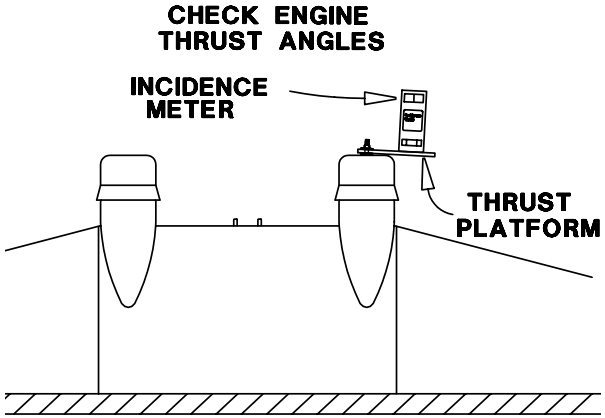
PANEL LINES

No scale model is complete without panel lines. Panel lines really *finish* the job and set your model apart from others (besides, they tend to distract the eye from any building imperfections and uneven surfaces—not that **your** model has any!). Study the photos and documentation you have gathered and decide which panel lines to add. There are two methods for adding panel lines. The first method is to use a Top Flite **Panel Line Pen** (TOPQ2510) with a flexible straightedge. We used a piece of thin plastic so we could curve it around the fuselage. Apply a few strips of masking tape to the back of your straightedge about 1/8" from the edge to raise it off the surface so the ink won't *bleed* underneath. Place the straightedge directly on your model and use it as a guide to mark your panel lines. Use the Top Flite **Scale Template** (TOPR2187) for rivets, hatches, fuel caps and other details. You can make your own templates from thin plastic or cardboard for special areas like the exit door or other hatches. Some cleaners will remove the ink lines, so test your cleaner on the ink before spraying it on your model. The inked on panel lines stay well but have to be "freshened up" from time to time due to spilled fuel or exhaust residue.

The second method for applying panel lines is to use a Top Flite **Smart Stripe** to cut narrow strips of MonoKote film. Iron the panel lines in position. Black or Charcoal MonoKote film is recommended.

GET YOUR MODEL READY TO FLY

CHECK ENGINE THRUST ANGLES



In order for your DC-3 to handle well when one engine quits, it is **important** that the **outward** thrust of **both engines** is correct. To check this, make a ***thrust platform*** by drilling a hole through an approximately 1/4" x 1" x 6" piece of plywood and mounting it to one of your engines. Stand your wing on its trailing edge and place your Robart Incidence Meter on top of the thrust platform. Read the outward thrust. This should be 4 degrees (if your work surface is level). If necessary, place washers or thin pieces of plywood behind the engine mount until you can achieve the correct outward engine thrust. Measure and adjust the outward engine thrust of the other engine the same way.

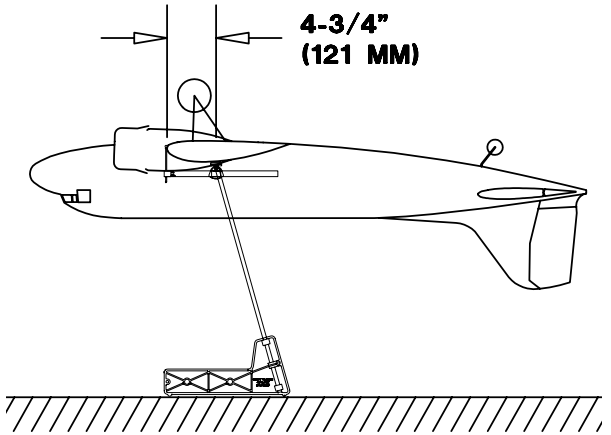
BALANCE YOUR MODEL

NOTE: This section is VERY important and must NOT be omitted! A model that is not properly balanced will be unstable and possibly unflyable.

❑ 1. See the **Expert Tip** that follows to accurately mark the balance point on the **top** of the wing on both sides of the fuselage. The balance point is shown on the plan **(CG)** and is located **4-3/4" [121mm] back from the leading edge of the center section of the wing** as shown in the sketch and on the plans. This is the balance point at which your model should be balanced for your first flights. Later, you may experiment by shifting the balance up to 1/4" [6mm] forward or back to change the flying characteristics. If you move the balance point **forward** it may improve the smoothness and tracking, but your DC-3 may then require more speed for takeoff and become more difficult to slow for landing. If you move the balance **aft** it may make your DC-3 more agile with a lighter *feel* and allow you to slow the model more for landing. In any case, **please start at the location we recommend and do not at any time balance your model outside the recommended range.**

HOT TIP

HOW TO MARK THE BALANCE POINT



If you have a Great Planes C.G. Machine™ (shown above), you don't need to perform this procedure. The balance point is measured from the **center section leading edge.** Mark the balance point outward a few

inches so you can see where to lift the wing when it's bolted to the fuse. To do this, mark the balance point with a felt tip pen or tape on **both ends** of the center section. Place a straightedge across the marks. Mark the balance point along the straightedge further out on the wing. Mount the wing to the fuselage.

❏ 2. All components should be in the model and it should ready-to-fly but with empty fuel tanks.

❏ 3. With the wing attached to the fuselage, the landing gear extended (if you have retracts) and an **empty** fuel tank, lift the model at the balance point or place it on your C.G. Machine (shown in the sketch). If the tail drops, the model is tail heavy and you must relocate your battery pack or other components forward or add weight to the nose. If the nose drops, it is nose heavy and you must relocate your battery pack or other components aft or add weight to the tail. In order to save weight, relocate your battery pack and/or receiver or other components before you add additional weight to arrive at the correct C.G. You may install nose or tail weight by gluing lead weights inside the fuselage where necessary.

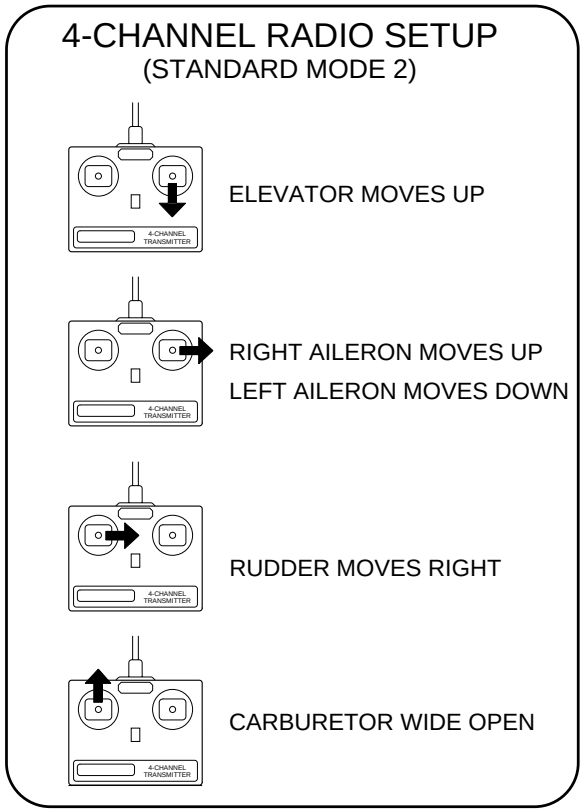
Note: The amount of weight required will depend on the engines you are using and how heavily or lightly you built the tail.

FINAL HOOKUPS AND CHECKS

❏ 1. Take the servo arms off your servos, turn on your transmitter and center all the trims. Reinstall all the servo arms and secure them with the screws.

❏ 2. Double-check all the servos and make sure the servo arms are secure and all the clevises have a **silicone retainer**.

❏ 3. Make sure the control surfaces move in the proper direction as illustrated in the following sketch.



❏ 4. Adjust your pushrod hookups and set up your radio to provide the control surface movements as follows. Use a ruler or a Great Planes Accu Throw Control Surface Deflection Meter (GPMR2405) to measure the throws.

CONTROL SURFACE THROWS

NOTE: Throws are measured at the **widest part** of the control surface.

We recommend the following control surface throws:

	High Rate	Low Rate
ELEVATOR:	**5/8"** [19mm] up **5/8"** [19mm] down	**1/2"** [13mm] up **1/2"** [13mm] down
RUDDER:	**1-1/2"** [38mm] right **1-1/2"** [38mm] left	**7/8"** [22mm] right **7/8"** [22mm] left
AILERONS:	**5/8"** [13mm] up **5/8"** [13mm] down	**5/16"** [8mm] up **5/16"** [8mm] down
FLAPS:	(Takeoff/half-flap) (Landing/full-flap)	1/2" [13mm] 1" [25mm]

TRIM MIXING: If your transmitter has Flap to Elevator mixing, we recommend mixing 1/16" [1.5mm] of up elevator at half flaps and 3/32" [2.5mm] of up elevator at full Flaps. This will keep the nose level when you extend the flaps.

The balance point and control surface throws listed in this manual are the ones at which the DC-3 flies best. Set up your aircraft to those specifications. If, after a few flights, you would like to adjust the throws or C.G. to suit your tastes, that is fine. Too much control surface throw can make your model difficult to control or force it into a stall, so remember...More is not better.

SET UP YOUR THROTTLES

There are three reasons we recommend you mix your throttle servos electronically instead of mixing them mechanically (with a Y-connector). The first and most important reason you should mix your throttle servos electronically is so each engine can have **its own** ATV allowing you to set the throws (idle and full throttle) independently instead of having to adjust the linkages to set the throws. This will make it much easier to set up your throttles. The second reason we recommend you mix your throttle servos electronically is so you can mount

them in the wing in any position you like. This makes building your model easier because both servos don't have to be mounted in the same direction. Lastly, mixing your throttle servos electronically allows you to start one engine, run it up and tune it as needed, then set it at idle (by turning the mixing off) and start the other engine while the first engine stays at idle. This method of mixing requires a mixing function that can be used with a trim so you can use your throttle trim as you normally do. Most mixing functions do not automatically have a trim assigned—you have to activate a trim yourself.

Following are guidelines on how to set up your radio so you can mix your servos electronically. We recommend you set up your radio on your workbench first with your throttle servos out of the model. We also recommend you refer to the owners manual that came with your radio as you proceed.

Connect the right throttle servo to the throttle output (usually No. 3) in your receiver. This will be the *master* servo. The reason your right servo (and right engine) is the master is because when you get to the flying field, you will start the left engine (the *slave*) first. With the mix on, run up and tune the left engine. You can use the ATV for that channel. Once the left engine is warmed up and tuned, turn the mix off. This will *hold* the left engine at idle while you start and tune the right engine.

Check the direction your master servo moves. If it moves the wrong way, use your servo reversing to change the direction.

Connect the left throttle servo to an available channel. This will probably be channel seven because your gear is probably on channel five and your flaps are probably on channel six.

Assign the mix to a switch so you can turn the mix on and off. You won't be using this switch during flight so it doesn't have to be easily accessible.

Relocate the *offset* of your master channel to high throttle (forward stick) on the throttle stick (most offsets are factory set to begin at center stick). Now, the slave servo will be mixed to the master servo through the entire range of throttle stick movement (while the mixing switch is turned on).

Set your mix to +100%. Observe the direction of the slave servo. If the slave servo moves in the wrong direction, change the mix to -100%.

Now you have to deactivate the control (it will be either a knob or a switch) that operates the slave because you won't be using it. If your radio does not allow you to deactivate the control, mix the slave to itself at 100% in both directions testing to make sure the control (the knob or switch) no longer operates the slave servo.

One last thing; if your radio has a *throttle cut* switch, you must mix the switch to the slave servo (at this time, the throttle cut switch is mixed only to the master servo). To do this, use yet another mix to mix the throttle to the same channel as your slave (channel seven in this case). Use the throttle cut switch as the switch that activates this mix.

Now your mix is setup correctly and you may adjust your ATV's to set the idle and full throttle for both servos independently.

PREFLIGHT

IDENTIFY YOUR MODEL

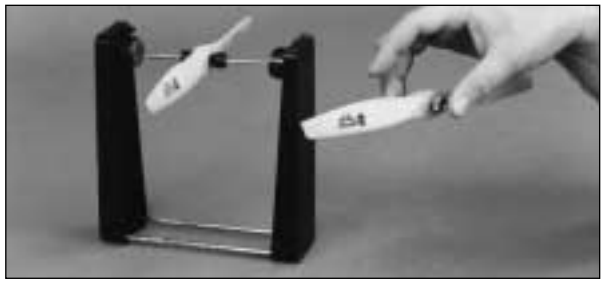
No matter if you fly at an AMA sanctioned R/C club site or if you fly somewhere on your own, you should always have your name, address, telephone number and AMA number on or inside your model. It is **required** at all AMA R/C club flying sites and AMA sanctioned flying events. Fill out the identification sticker included with this kit and place it on or inside your model.

CHARGE YOUR BATTERIES

Follow the battery charging procedures in your radio instruction manual. You should **always** charge your transmitter and receiver batteries the night before you go flying and at other times as recommended by the radio manufacturer.

BALANCE YOUR PROPELLERS

Carefully balance your propellers before you fly. This is especially important on a twin engine model. An unbalanced prop is the single most significant cause of vibration that can damage your model. Not only will engine mounting screws and bolts loosen, possibly with disastrous effect, but vibration may also damage your radio receiver and battery. Vibration can also cause your fuel to foam, which will, in turn, cause your engine to run hot or quit.



We use a Top Flite Precision Magnetic Prop Balancer™ (TOPQ5700) in the workshop and keep a Great Planes Fingertip Prop Balancer (GPMQ5000) in our flight box.

SYNCHRONIZE YOUR ENGINES

In order for your DC-3 to fly correctly and handle well, it is important that your engines are synchronized—they both should turn the same R.P.M. This is especially critical at full throttle where you will be doing most of your flying (and takeoffs). There can be a **considerable** variance in the pitch between different propellers of the same size and brand. Don't assume that if you have two *Brand "X"* 10 x 6's they will turn the same R.P.M. The variance in propeller pitch from prop to prop will greatly affect the R.P.M. a given engine can turn. A variance of no more than 500 R.P.M. is acceptable.

So, because of the importance of synchronized engines and the variance between propellers, you should own a tachometer to check this. Select propellers by checking the R.P.M. of each one. To do this, mount a propeller on one of your engines, open the throttle all the way and read the R.P.M. on your tachometer. Record the R.P.M. of that propeller on a note pad or write it directly on the propeller with a felt tip pen. Do this for all of your propellers **on the same engine**, then make pairs that have the closest R.P.M.'s *(did we mention earlier that you should be glad you're not building a B-17?).*

After you have selected a matched set of propellers, use your tachometer to check the R.P.M. of both engines. Tune your engines as necessary so they both turn the same R.P.M. at full throttle.

FIND A SAFE PLACE TO FLY

The best place to fly your model is an AMA chartered R/C club flying field. Contact the AMA (their address is on page 2) or your hobby shop dealer for the club in your area and join it. Club fields are intended for R/C flying, making your outing safer and more enjoyable. The AMA also provides insurance in case of a flying accident. If an R/C flying field is not available, find a large, grassy area at least six miles from buildings, streets and other R/C activities. A schoolyard is usually not an acceptable area because of people, power lines and possible radio interference.

GROUND CHECK YOUR MODEL

If you are not thoroughly familiar with the operation of R/C models, ask an experienced modeler to inspect your radio installation and control surface set-up. **Follow the engine manufacturer's instructions to break-in your engine.** After you run the engine on your model, inspect your model closely to make sure all screws remain tight and your pushrods and connectors are secure.

RANGE CHECK YOUR RADIO

Ground check the range of your radio before the first flight of the day. With the transmitter antenna collapsed and the receiver and transmitter on, you should be able to walk at least 100 feet away from the model and still have control. Have an assistant stand by your model and, while you work the controls, tell you what the control surfaces are doing.

Repeat this test **with the engines running** at various speeds with an assistant holding the model, using hand signals to show you what is happening. If the control surfaces do not respond correctly, **do not fly!** Find and correct the problem first. Look for loose servo connections or broken wires, corroded wires on old servo connectors, poor solder joints in your battery pack or a defective cell in your battery pack, or a damaged receiver crystal from a previous crash.

CHECK LIST

During the last few moments of preparation your mind may be elsewhere, anticipating the excitement of your first flight. Because of this, you may be more likely to overlook certain checks and procedures you should perform after your model is built. To help you avoid this, we've provided a checklist to make sure you don't overlook these important areas. Many are covered in the instruction manual so, where appropriate, refer to the manual for complete instructions. Be sure to check the items off as you complete them (that's why we call it a *check list*!).

- ❏ 1. Fuelproof all areas exposed to fuel or exhaust residue such as the firewall/engine compartment, fuel tank compartment, wing saddle area, trailing edge of the wing and the flap area and wheel wells (if your model has flaps and retracts), etc.
- ❏ 2. Check the C.G. according to the measurements provided in the manual.
- ❏ 3. Secure the battery and receiver with a strip of balsa or plywood. Simply stuffing them into place with foam rubber is not sufficient.
- ❏ 4. Extend your receiver antenna and make sure it has a strain relief inside the fuselage to keep tension off of the solder joint inside the receiver.
- ❏ 5. Balance your model *laterally* as explained in the instructions.
- ❏ 6. Secure critical fasteners with thread locking compound (the screws that hold the carburetor arms, set screws on wheel collars, screw-lock pushrod connectors, etc.).
- ❏ 7. Add a drop of oil to the axles so the wheels will turn freely.
- ❏ 8. Make sure all hinges are securely glued in place.
- ❏ 9. Reinforce holes for wood screws with thin CA where appropriate (control horns, servo hatches, etc,).
- ❏ 10. Confirm that all controls operate in the correct direction and the throws are set up according to the manual.
- ❏ 11. Make sure there are silicone retainers on all the clevises.
- ❏ 12. Fasten all servo arms to the servos with the screws included with your radio.
- ❏ 13. Secure connections between servo wires and Y-connectors or servo extensions and the connection between your battery pack and the on/off switch with vinyl tape or heat shrink tubing.
- ❏ 14. Make sure any servo extension cords you may have used do not interfere with other systems (servo arms, landing gear, pushrods, etc.).
- ❏ 15. Make sure your fuel lines and pressure lines are connected and are not kinked.
- ❏ 16. Use an incidence meter to check the wing for twists and correct before flying.
- ❏ 17. Balance your propellers (and spare propellers).
- ❏ 18. Tighten the propeller nuts.
- ❏ 19. Place your name, address, AMA number and telephone number on or inside your model.
- ❏ 20. Cycle your receiver battery pack (if necessary) and make sure it is fully charged.
- ❏ 21. If you wish to photograph your model, do this before your first flight.
- ❏ 22. Range check your radio when you get to the flying field.

ENGINE SAFETY PRECAUTIONS

NOTE: Failure to follow these safety precautions may result in severe injury to yourself and others.

Store model fuel in a safe place away from high heat, sparks or flames. Do not smoke near the engine or fuel as it is very flammable. Engine exhaust gives off a great deal of deadly carbon monoxide so **do not run the engine in a closed room or garage**.

Get help from an experienced pilot when you are learning to operate engines.

Use safety glasses when you operate model engines.

Do not run the engine near loose gravel or sand; the propeller may throw loose material in your face or eyes.

When you start and run the engines, keep your face and body as well as all spectators away from the plane of rotation of the propeller.

Always be **aware** and very **conscious** of hand movements and be **deliberate** in your reach for the needle valve, glow plug clip, or other items near a spinning propeller.

Keep loose clothing, shirt sleeves, ties, scarfs, long hair or loose objects away from the props. Be conscious of pencils, screw drivers or other objects that may fall out of your shirt or jacket pockets.

Use a *chicken stick* or electric starter and follow the instructions to start your engines.

Make certain the glow plug clip or connector is secure so that it will not pop off or get into the running propeller.

Ask an assistant to hold the model from the rear while you start the engines and operate the controls.

Make all engine adjustments from **behind** the rotating propeller.

The engines gets hot! Do not touch the engines during or immediately after you operate it. Make sure fuel lines are in good condition so fuel will not leak onto a hot engine and cause a fire.

To stop the engines, close the carburetor barrel (rotor) or pinch the fuel line to discontinue the fuel flow. Do not use your hands, fingers or any body part to stop the engine. Never throw anything into the prop of a running engine.

AMA SAFETY CODE (EXCERPTS)

Read and abide by the following Academy of Model Aeronautics Official Safety Code:

GENERAL

1. I will not fly my model aircraft in sanctioned events, air shows, or model flying demonstrations until it has been proven to be airworthy by having been previously successfully flight tested.

2. I will not fly my model aircraft higher than approximately 400 feet within 3 miles of an airport without notifying the airport operator. I will give right of way to and avoid flying in the proximity of full scale aircraft. Where necessary an observer shall be used to supervise flying to avoid having models fly in the proximity of full scale aircraft.

3. Where established, I will abide by the safety rules for the flying site I use and I will not willfully and deliberately fly my models in a careless, reckless and/or dangerous manner.

7. I will not fly my model unless it is identified with my name and address or AMA number, on or in the model.

9. I will not operate models with pyrotechnics (any device that explodes, burns, or propels a projectile of any kind).

RADIO CONTROL

1. I will have completed a successful radio equipment ground check before the first flight of a new or repaired model.

2. I will not fly my model aircraft in the presence of spectators until I become a qualified flier, unless assisted by an experienced helper.

3. I will perform my initial turn after takeoff away from the pit or spectator areas and I will not thereafter fly over pit or spectator areas, unless beyond my control.

4. I will operate my model using only radio control frequencies currently allowed by the Federal Communications Commission...

FLYING

ENGINE OUT

One thing that comes to mind when thinking of a twin engine model is "what do you do when one engine quits?" We all know that on some twins, if one engine quits, the offset thrust caused by the remaining running engine can cause the plane to bank suddenly, spiral, or worst of all, stall one wing and snap roll. On the Gold Edition DC-3, the only time these tendencies become evident is when the model is flying slowly. If you are flying slowly (say, performing a slow *inspection pass* or taking off) and an engine quits, just think of your DC-3 as a single engine plane. When one engine quits on your sport models, you don't (shouldn't) panic do you? All you do is point the nose down slightly to maintain airspeed and bring 'er in. You can do the same with your DC-3, only you have to cut the "good" engine first. When you are flying slowly and an engine quits, **cutting the throttle immediately** is your first priority. This will eliminate the offset thrust caused by the lone running engine. After you've cut your engine, point the nose down slightly and land just the same as you would with any other model. Be careful in your decision to use flaps on a dead stick landing. When you extend the flaps you will lose much airspeed. Without power it is difficult to recover lost airspeed. Therefore, you may extend your flaps halfway to shorten your landing approach, but do so only when you are on your final leg and are lined up with the runway. Basically, during a dead stick landing flaps should be used only to avoid an *overshoot*.

The good news is, if you are flying at *normal* speed and you lose an engine, all you need to do is continue flying your DC-3 using **only** elevator and aileron. In all situations refrain from using the rudder when an engine quits. Otherwise, you may induce a spin. Though you may want to get your model down on the ground quickly, you don't have to panic while doing it. You'll have plenty of time to get into your landing pattern, make sure the runway is clear and land. However, with one engine out, you'll only have one chance to land since you won't be able to *power up* and make another go-around. As you may have already concluded, during your first few flights we recommend maintaining higher throttle settings as much as possible. This will help avoid the low speed engine out situation until your engines are broken-in and you are confident in their performance.
Let's review:

Flying slowly: engine quits → cut throttle, **don't** use rudder, land.

Flying at normal speed: engine quits → **don't** use rudder, get into landing pattern, land.

TAKEOFF

With most tail draggers, engine torque will cause the nose to turn to the left as you initially accelerate and roll down the runway for takeoff. With a twin, what determines the direction of yaw as you roll down the runway is **uneven thrust** between the two engines. If your engines are *in sync,* your DC-3 will roll straight down the runway! But, just because both engines idle at the same RPM and run wide open at the same RPM, doesn't mean they will **accelerate** at the same RPM. Use your throttle curves (if your transmitter has them) or make sure your throttle linkages are identical so your engines will accelerate as uniformly as possible. If necessary (nobody's going to get it perfect), use rudder to keep your DC-3 on the centerline of the runway as

you roll out for takeoff. Due to the small amount of prop blast over the rudder, you will not begin to realize effective rudder control until your DC-3 approaches flying speed. Advancing the throttles slowly only gives your DC-3 more time and distance to turn. To correct this, the first thing you can do is...be prepared for it. The second thing you can do is advance the throttles more rapidly than you would with other models. This will allow you to reach flying speed faster where your rudder will become effective. This does not mean, however that you should "horse" your model into the air. Just get your DC-3 to a speed where you have rudder control and continue to build ground speed until the tail lifts into the air. Build up as much speed as your runway and flying site will permit and gently lift your DC-3 into the air, establishing a gentle climb. Keep in mind that a **steep** climb with little airspeed is the worst time to lose an engine, so be smooth and climb gently (as you should with any model!). After you have reached a safe altitude, begin your initial turn away from the runway, retract the flaps (if you've used them) and get into the traffic pattern. After you've become more familiar with your DC-3, you can takeoff using flaps. We recommend the half-flap setting for takeoffs.

FLIGHT

We recommend that you take it easy with your DC-3 for the first several flights, gradually getting acquainted with this realistic model as you gain confidence in your engines and they get fully broken-in. Adjust the trims so your DC-3 will fly straight and level at cruise speed. Climb to a comfortably high altitude and fly at different throttle settings to see how your model will behave and to see what kind of trim changes are required at different speeds. Still at altitude, try some practice landing approaches, seeing how your DC-3 handles at low speeds. Do the same with the flaps extended so you know what to expect when you're in a real landing approach. If you've got retracts, cycle the gear a few times to make sure everything operates okay and to see if there are any trim changes required. Try flying around and executing various maneuvers, making mental notes (or having a friend standing by with a note pad) on how she behaves. Note what might be required to fine tune your DC-3 so it handles just the way you like. Lower the throttle to approximately 1/4, and extend the flaps. Observe how your DC-3 reacts and get a feel for how she handles with the flaps extended. Add power and see how she climbs with flaps as well. Do this exercise a few times and decide whether or not you will be using flaps for your first landing. Use this time and altitude to become as familiar as possible with your DC-3 before your first landing.

CAUTION (THIS APPLIES TO ALL R/C AIRPLANES): If, while flying, you notice any unusual sounds, such as a low-pitched "buzz," this may indicate control surface *flutter.* Because flutter can quickly destroy components of your airplane, any time you detect flutter you must **immediately** cut the throttle and land the airplane! Check all servo grommets for deterioration (this may indicate which surface fluttered), and make sure all pushrod linkages are secure and free of play. If the control surface fluttered once, it probably will flutter again under similar circumstances unless you can eliminate the free-play or flexing in the linkages. Here are some things which can cause flutter: Excessive hinge gap; Not mounting control horns solidly; Poor fit of clevis pin in horn; Side-play of pushrod in guide tube caused by tight bends; Poor fit of Z-bend in servo arm; Insufficient glue used when gluing in the elevator joiner wire; Excessive *play* or *backlash* in servo gears; and Insecure servo mounting.

Landing

Don't forget to extend your landing gear! When you throttle back for landing, the DC-3 slows relatively quickly and the sink rate is rather high. To initiate your landing approach, make your final turn toward the runway (always into the wind) keeping the nose down to maintain airspeed and control. When your DC-3 reaches the threshold of the runway raise the nose slightly to level her flying attitude. When you're over the runway and just a foot or so off the deck, apply more elevator and make your flare. When you're ready to land with flaps, extend them on the downwind leg after you've reduced throttle and lost a little air speed. If you extend your flaps at too high an airspeed, the nose may pitch up strongly. With the flaps extended, you'll need to add a little more throttle than usual to overcome the increased drag and maintain airspeed—but she'll still come in nice and slow. Mind your fuel so you can make as many attempts as required so you can bring your baby home safely.

Have a ball! But always stay in control and fly in a safe manner. GOOD LUCK AND GREAT FLYING!

If you enjoyed building the Top Flite DC-3, try one of these other outstanding .60 size Gold Edition kits as your next project:

(TOPA0305) Top Flite Beechcraft Bonanza
81" Wingspan, 11-13 Lbs.

(TOPA0110) Top Flite P-51D Mustang
65" Wingspan, 8–10 Lbs.

(TOPA0130) Top Flite AT-6 Texan
69" Wingspan, 7.5–10 Lbs.

(TOPA0135) Top Flite P-47D Thunderbolt
63" Wingspan, 8.5-10.5 Lbs.

(TOPA0120) Top Flite P-40E Warhawk
64" Wingspan, 8–10.5 Lbs.

(TOPA0300) Top Flite Cessna 182 Skylane
81" Wingspan, 10-12 Lbs.

2-VIEW DRAWING

Use this layout for trim scheme planning only. Not suitable for scale documentation.