# CHAPTER 7 REVISION LIST

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The following list of revisions will allow you to update the Lancair IV construction manual chapter listed above.

Under the "Action" column, "R&R" directs you to remove and replace the pages affected by the revision. "Add" directs you to insert the pages shown and "R" to remove the pages.

Page(s) affected	Current Rev.#	Action	Description	
7-1 thru 7-7 7-8 7-9	AN1 AN2 AN1	None R&R None	Added part numbers.	
7-10 7-11 thru 7-26	AN3 AN1	R&R None	Modified text in Fig. 7:A:4.	
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# CHAPTER 7 FAST-BUILD FLAPS

### REVISIONS

From time to time, revisions to this assembly manual may be deemed necessary. When such revisions are made, immediately replace all outdated pages with the revised pages. Discard the out dated pages. Note that on the lower right corner of each page is a "revision date". Initial printings will have the number "0" printed and the printing date. All subsequent revisions will have the revision number followed by the date of that revision. When such revisions are made, a "table of revisions" page will also be issued. This page (or pages) should be inserted in front of the opening page (this page) of each affected chapter. A new "table of revisions" page will accompany any revision made to a chapter.

### ARROWS

Most drawings will have arrows to show which direction the parts are facing, unless the drawing itself makes that very obvious. "A/C UP" refers to the direction that would be up if the part were installed in a plane sitting in the upright position. In most cases the part shown will be oriented in the same position as the part itself will be placed during that assembly step. However, time goes on and changes are made, so careful attention should be paid to the orientation arrows.



Chapter 7

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# 1. INTRODUCTION

This chapter will detail the steps necessary to prepare the trailing edge of the wing to accept the flap, installation of the flap track and the roller plates, assembly of the flaps, actuators and inspection panels, and installation of the flaps onto the wings.

Don't be intimidated by the fully slotted Fowler Flap System, it just sounds hard to build. Following instructions and always picturing in your mind how the flaps will work are important factors in building a good flap system. Read the chapter thoroughly (preferably twice) before you begin building your flaps. The figures should show you some of the flap geometry that is difficult to explain. Figure 7:i:1 shows the mechanism of the flaps.

All Lancair IV-FB "A" kits ordered after April 19th, 1998 have the fast build flaps. In the "up" position, the flap has a completely hidden actuation system. The flaps are closed and installed at the factory. The new flap design makes it much easier to remove and install the flaps.

This chapter outlines the final adjustments the builder must make to the flaps. It is important that you, the builder, understand how the flaps geometry and how to make adjustments. The builder also will install the flap access panels and the inboard support rib.



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2. SPECIAL PARTS, TOOLS, AND SUPPLIES LISTS

### A. PARTS

Note: All parts are installed.

### B. TOOLS

Digital "Smart" level (optional) String Line C-Clamps, 4 minimum Drill motor & bits Wrenches, assorted Screwdrivers, assorted Straight edge Rivet squeezer Jig saw or similar for cutting pre-preg Dremel tool and attachments or similar for grinding ribs, etc., to fit. weight base Tape measure Rotary cutter 100° countersink pocket knife



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#### С. **SUPPLIES**

 $\begin{array}{l} Sandpaper, assorted \\ Bondo^{\text{TM}} \end{array}$ instant glue MC plastic release tape paper for making patterns E-Glass roll Micro balloons flox fiber 2 ply per side glass prepreg, 1/4" 3/8" x 2-1/4" x 1/8" wood, 6-7 pieces duct tape 1/4" 3 ply per side prepreg Epoxy pencil Loctite<sup>TM</sup>  $Vaseline^{TM}$  $Hysol^{\text{TM}}$ 



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### 3. CONSTRUCTION PROCEDURE

The flaps have been operated at the factory. However, the final adjustments are to be made by the builder. This also gives the builder an understanding of how the flap system actually works.

The wings are shipped without the flaps attached. The first step in this chapter is to put it all back together. Then you will adjust the flaps to make them work just right.

Next, you will trim the T.E. of the wing skin to obtain a good fit between the flaps and the wing. This includes installing the flap access panels. Finally you will install an inboard support rib in the wing.

> Flap Bracket Installation Fig. 7:A:1.

### A. FLAP MECHANISM ASSEMBLY



Check that the flap tracks are installed with three bolts. There should be at least A1. one complete thread showing through the nut on each of the bolts. There should also be torque seal applied indicating that the bolts have been torqued. Installing Flap Track Bracket, Exploded View Fig. 7:A:2. 6 0 0 Flap track 0 bracket P/N 2-120016 (inbd) P/N 2-120026 (outbd) 0 c20 2ଜ (3)(1)AN3-15 bolt (2) FL8-01 nylon spacer (3)(3) FL8 steel roller (4) AN960-10 washer Flap track 5) AN310-3 castle nut P/N FL157-01 (inbd) (6) MS24665-140 cotter pin P/N FL157-02 (outbd) REV. Chapter 7 AN2/11-25-98

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A2. Install the Flap Brackets as shown in Figures 7:A:2 & 7:A:3. Note that the nylon spacer is only installed on the forward attach point. Don't install the cotter pin yet as you will likely remove the assembly later. The cotter pins must be installed prior to flight!



A3. Install the Flaps.

1) Extend the flap track brackets to the down position.

2. Install the flaps such that the flap track brackets drop into their respective pockets. You may have to lift the wings slightly out of the cradles in order to move the flaps to the "up" position.

3. Install the AN960-416L washers and the AN3-15 bolts. Snug the bolts for now.

Prior to Flight the bolts must be Torqued using a torque wrench!

- Lubricate bolts -Torque to 50-58 inch lbs.

-Apply Torque Seal

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A4. Bolt in the actuator arms and the inboard pushrod crossover tube. Again it is not necessary to install the cotter pins and lock nuts (use non-looking nuts for now). You should now be able to operate the flaps by using the inboard pushrod.



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### B. TROUBLE SHOOTING THE FLAPS

This section will take you through the adjustments necessary to make the flaps operate smoothly with a minimum amount of friction. Prior to making adjustments, apply a light coat of vaseline jelly to the flap tracks. (Vaseline jelly is cleaner and easier to wipe off than grease).

How to determine if the flaps need adjusting:

1. The wings should be upside down in the cradle. The flap crossover tube must be installed.

2. Lift the flaps to the fully extended position. Let go of the flaps and they should fully retract. Note: If the flaps are hitting the cradles, lift the wings a little out of the cradles.

If the flaps retract, don't start adjusting (you don't need to fix them if they aren't broken!).



Bellcrank/Rod, Proper Alignment Fig. 7:B:1.





If the flaps are binding, start by observing the geometry.

1. In the halfway position the bellcrank actuator arm should be parallel to the aft spar (Fig. 7:B:1).

2. The two bellcrank crossover arms should be parallel (Fig. 7:B:2).

3. The rollers should start over the "hump" of the inbd and outbd flap tracks at the same time (Fig. 7:B:3). If necessary, adjust the pushrods to meet the above conditions.

Normally, as the flaps reach full extension, the differential movement will tend to tighten up the rollers, particularly on the inboard tracks. This is normal and is worth the benefits of attaining the differential travel. When fully lubricated, it should cause no problems during operation.

I'm sure you could come up with all sorts of problems in the flap system if you really tried. Just remember this; <u>Use you analytical skills</u>. Stare at the flap mechanism and know how it works and what will affect its proper operation. There's no mystery about the fully slotted Fowler flap system except it's intimidating name.

Once you have everything working, check that you have adequate threads in all rod ends. Tighten all check nuts. Apply torque seal- indicating "Ready For Flight".

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### C. TRIMMING THE TRAILING EDGE

The wing skin T.E. has been roughly trimmed at the factory. Once you have the flaps working properly, it is time to trim the gap exactly. You may want to lift the wings out of the cradles for this step.



# D. FLAP ACCESS PANELS

To gain access to the flap tracks and rollers, three access panels are cut from the bottom wing skin (see Fig. 7:D:1).













D5. For the access panels to be installed, a hole must be ground in them for the actuator rods. Make these holes as close to tolerance as possible, keeping in mind that the nuts and bolts of the actuator rod should always clear the access panel by at least 1/8". Check the clearance through the full range of travel. Also recheck the clearance of the forward flap roller bolt as it passes through the access panel.





- D6. Cut along the line for 8-10" then leave 1/2" uncut, repeating the process down the length of the line. Be absolutely sure that you are not cutting through the rear spar or any other part of the wing.
- D7. Now turn the bottom skin over and apply release tape along the aft side of the cut, on the sharply curve portion of the skin. Note: If you are going to want to paint the flange so it looks professional with the access door off, use tape of a suitable thickness to match the estimated thickness of the paint you intend to use. If you will leave the flange unpainted, then use thin plastic packing tape to give you the minimum separation.
- D8. Sand the area 2" forward of the cut. Clean with MC.
- D9. Lay 2" wide BID centered on the cut, along the length of the flap area.



- D10. Lay the bottom wing skin back into position and retract the flaps so the laminate will dry in correct form. Be careful that the flap tracks don't distort your BID tapes.
- D11. When the BID tapes have cured, CAREFULLY, not cutting through the 4 BID underneath, finish the segmented cut you made in step D6.
- D12. Notice that if the notches you cut in the access panel area for the flap tracks are far enough forward, you will have three access panels. If the notch is low enough, you will have one, big access panel. If you do end up with one panel, cut it at both flap tracks to make three panels. Three are much easier to work with than one.







- D15. The ideal gap between flap and wing skin is about .040". This will leave enough room for primer and paint. Lay 4 layers of duct tape along the leading edge of the flap to simulate the gap.
- D16. Sand the leading edge of the access panels so that when positioned in the joggle, they rest against the duct tape. Of course, the flap must be in the retracted position.
- D17. When the access panels are located properly, drill #28 holes for the MS24693-S26 mounting screws. To avoid interference with flap operation, do not locate any screw closer than 1-3/4" to the centerline of the flap track (see Fig. 7:D:10).
- D18. Install MK1000-06 nutplates at all screw locations using AN426A3-5 rivets.
- D19. Countersink the screw holes in the access panels.
- D20. Mark where the access panels meet the top of the wing skin. Remove the access panels.
- D21. Sand the areas 1" in front of and behind the line to the top wing skin trailing edge.
- D22. Clean with MC.





- D23. Apply 2" wide strips of release tape to the inside and outside surfaces of the access panels. Apply the tape only to the aft side of the panels (see Fig. 7:D:12).
- D24. Mix a thick batch of micro and apply a buildup on the top wing skin so that when the access panels are screwed in place they will leave a contour in the micro (see Fig. 7:D:12).
- D25. With the access panels screwed in position, lay a 2 BID flange along the trailing edge of the top wing skin overlapping the access panel about 3/4" (see Fig. 7:D:12).
- D26. After the micro and 2 BID flange have cured, remove the access panel and trim the flange straight.
- D27. To keep the airflow smooth, apply micro over the 2 BID so the flange will fair nicely into the trailing edge.
- D28. You can also grind down the micro buildup so there's just enough to support the aft edge of the access panels.
- D29. Only one more release to go. Cover the 2 BID flange with thin plastic release tape and sand the access panels just ahead of the flange. Clean with MC.
- D30. With the access panels screwed into position, spread micro onto the access panel so there will be a smooth transition from the panel, over the 2 BID flange, and off the trailing edge. There's no top secret shape for this curve, just a smooth transition. A good method for getting a clean separation line is to use a small pocket knife. Spread on micro, run the pocket knife blade (or tongue depressor) along edge. The micro will tend to roll up a bit along the line- that's OK., leave it since it will sand flat very easily (see Fig. 7:D:11).

Note: Some additional trimming will be required in the next section to clearance the panels for the actuator rod.

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track attachments

In the previous chapter you checked the fit of the lower wing skin to the rest of wing structure. Before closing the wings you should also release the premolded flap track attachments.

Apply 1 Layer of duct tape to the lower wing skin in the areas of the premolded flap track attachments.

Thoroughly sand all bonding surfaces with 40 grit. Apply a thin coat of epoxy to the flap track attachment.

Apply an epoxy/flox mixture to the flap track attachments. Positon the wing in the cradles and weight down as necessary.

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- E. INBOARD SUPPORT RIB This rib will support both the flap access panel and the top skin in the aft area of the wing walk.
- E1. Cut the rib out of 1/4", 2 PPS fiberglass prepreg. Fit the rib at BL 27.5, outboard of the first access panel screw.
- E2. Sand the area of the top wing skin and rear spar where the support rib will be installed. Also sand the rib itself.
- E3. Clean all areas with MC.
- E4. Remove the standard 1/8"-1/4" core around the rib.
- E5. Bond the rib into position with micro.
- E6. Secure the rib with 2" wide, 1 BID strips to the rear spar and top wing skin. On the right wing, you'll have to cut the BID around the bellcrank bracket. If you don't have room to get 1" overlap onto the rear spar, just get as much overlap area as possible.
- E7. The areas where the rib will contact the bottom wing skin and the access panel should be trimmed back so you can do a micro fit in these locations.
- E8. Apply release tape to the bottom wing skin and access panel in the support rib area.
- E9. Build up micro in the support rib troughs and place the bottom wing skin and access panel in position.
- E10. After cure, remove the bottom wing skin and sand off excess micro from the support rib in the fillet area. The rib will be secured to the bottom wing skin after the wing is closed out.
- E11. Grind a hole in the support rib for the flap pushrod to run through (see Fig.

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7:E:1:b). The hole may require additional clearancing in the next section when you install the inboard flap pushrods. Refer to full size pattern 7:E:1:a, and make a full size pattern with the hole shown.

Full Size Pattern of Support Rib Showing Pushrod Hole Fig. 7:E:1:a.





## F. BODY WORKING FLAPS

Finally the flaps require some body work. The inboard and outboard ends will be trimmed and body worked. Also the area around the flap track brackets is body worked.



F1. Trim the inboard end of the flaps flush with BL25.5. Use the inboard face of the BL25.5 cradle (be sure the wing is positioned correctly). Fill the inboard end as necessary.



F2. Trim the outboard edge of flaps. Note that the angle of the outboard edge of the flaps is perpendicular to the leading edge of the flaps in order to finalize the fit. The aileron must be installed.
Move the flaps and ailerons up and down. No combination of flap/aileron deflections should produce less than .1" gap between the two. Check this and trim as necessary (Note: It may be necessary to trim the inboard end of the ailerons). Finish the inboard end of the aileron in a similar fashion.





# G. WHAT TO CHECK

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1. Check that the flaps are vented. There should be 4 small holes 1/8" inside the flap track pockets: 2 on each side, 1 forward and 1 aft of the spar.

2. Check that all rod ends have sufficient thread. All check nuts should be tightened.

3. Torque the bolts securing the flap track brackets.

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