

## ADDING GEAR DOORS TO YOUR LONG-EZ

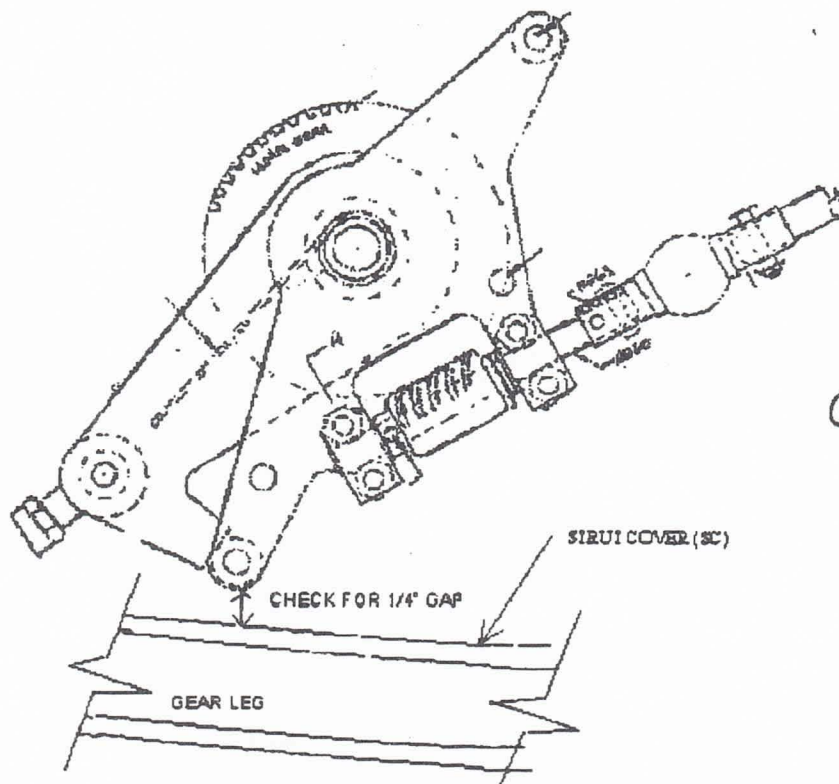
by Verne "Catman" Simon

At this point the caveat of "Don't start vast projects with half vast ideas" should be observed. If you have the expectation that you will see a perceptible increase in speed as a result of this modification you may need a prescription for Haldol. On the other hand if you think gear doors are "cool" and you have weeks to invest in this project, proceed. You may get an increase but it will be in conjunction with other drag reduction efforts such as : burying antennae in your structures, wheel pants, modification to ducting of engine and (of course) more horsepower.

While my airplane languished awaiting repaired cylinders, I decided that I would finally install gear doors. The problem was that the opening was curved and gear doors hinge best along a straight line. My cat "Magneto" and I studied the opening and after due deliberation it was determined that a opening (similar to the one seen below) could be cut into the belly with little damage to paint and none to structure.

### PLANNING

Before launching into this you should check to see if the wheel and fork are above the belly skin. If it is at least 1/4" or better above the belly your in good shape. If not check to see if you have at least 1/4" clearance between the strut and NG 14 (see illustration 1 ). If the strut is touching the retract assembly and the wheel is flush with the belly do not attempt this project unless you are willing to relocate the entire retract mechanism.



*Covered  
in step 3.*

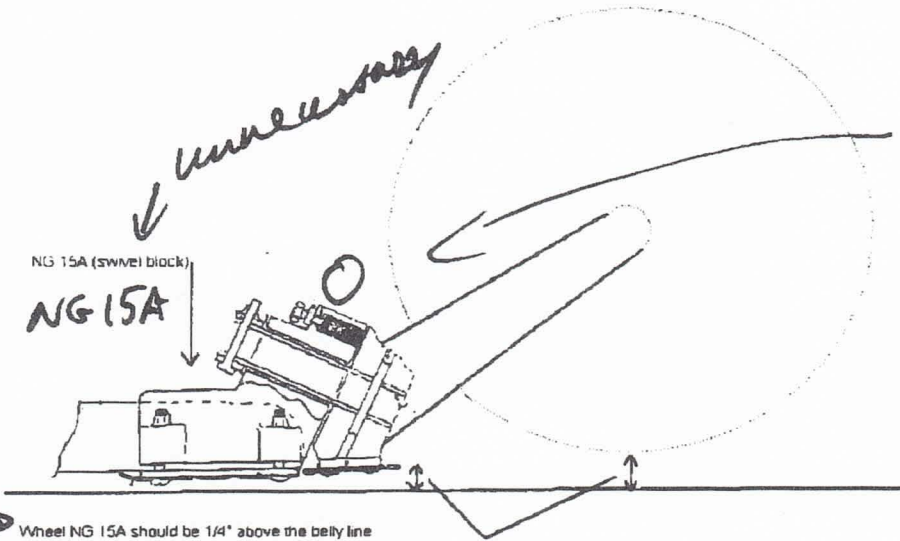
*Doesn't look  
like an  
opening →  
Looks like gear  
to skin measurement  
- Do you mean  
in step 4?*

## SECOND STEP

Remove the strut cover (SC) entirely. Next remove any fairings you may have installed on the nose strut.

## THIRD STEP

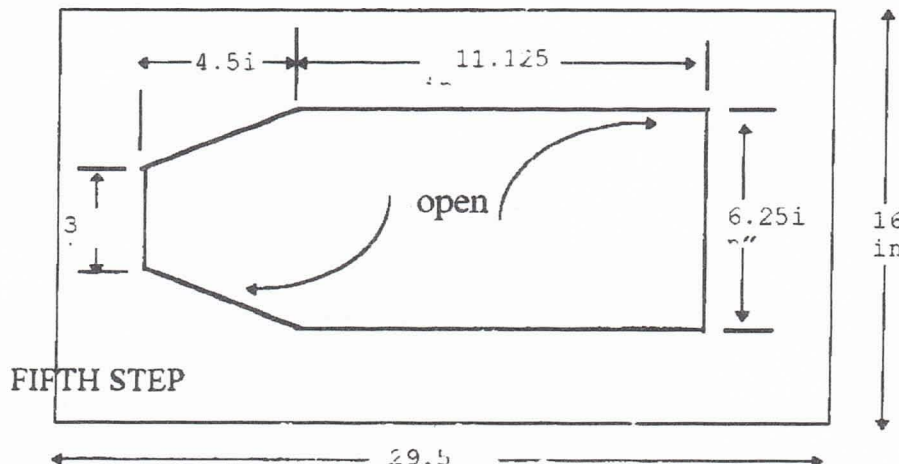
Fully retract the gear. Verify that the wheel is  $\frac{1}{4}$ " or greater above the bottom skin. This will prevent interference with the gear door reinforcements and retraction hardware.



Wheel NG 15A should be  $\frac{1}{4}$ " above the belly line

## FOURTH STEP

Extend the nose wheel. Fabricate a router template as shown in fig 2 ) made up of  $\frac{1}{2}$  MDF . Align the template so that it is centered over the opening and parallel to center line and then secure it to the belly with drywall screws. The Template should be at least a  $\frac{1}{4}$ " wider than the widest part of the gear well. If not, enlarge the template as necessary.



## FIFTH STEP

Bold #5?

If you have never worked with a router before, your airplane is not a good place to learn. Get somebody who has experience to help you. For this part you will need a router (obviously), 1/2" template guide for your kind of router, 1/2" carbide router bit at least 3 inches in length, and goggles (it gets real messy).

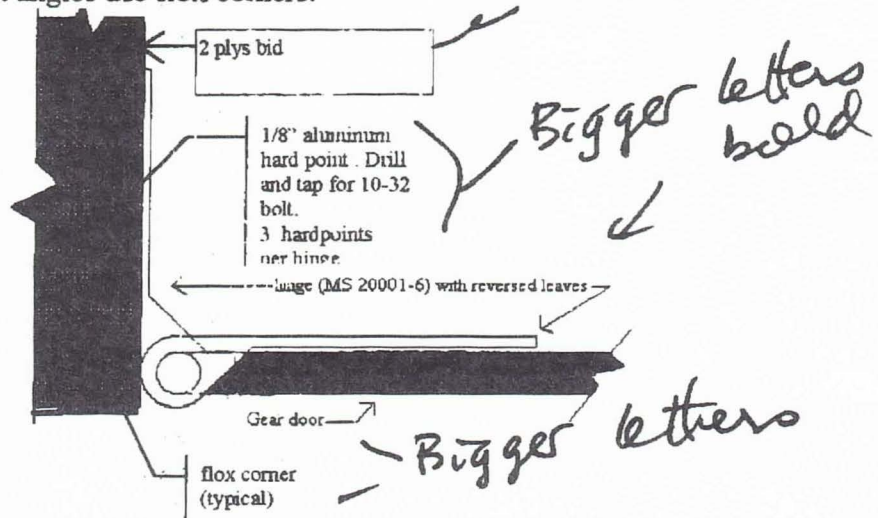
Set the blade so that it extends at 1/2" below the opening of the template guide. Rest the base of the router on the MDF template you made. The blade should be free to rotate. Start the router and then move it around the template so that the template guide touches the edge of the template. Remove all unwanted foam and glass with the router. Reset the depth of the router so that it is at least 1 - 1/4" in depth for your final cut. Once again remove all unwanted foam and glass with the router as before.

*seems rather  
drastic - reassure*

### SIXTH STEP

At this point you have made an opening which looks like a very odd ironing board. Very impressive! Check to see if the hinge (MS 20001-6) will fit along the vertical wall of the opening. The wall should be 1 - 1/4" in depth. Install three evenly spaced 1/8" aluminum hard points so that they are flush with the foam.

A two ply BID lay-up is used to encapsulate exposed foam; and where new glass joins old at right angles use floc corners.

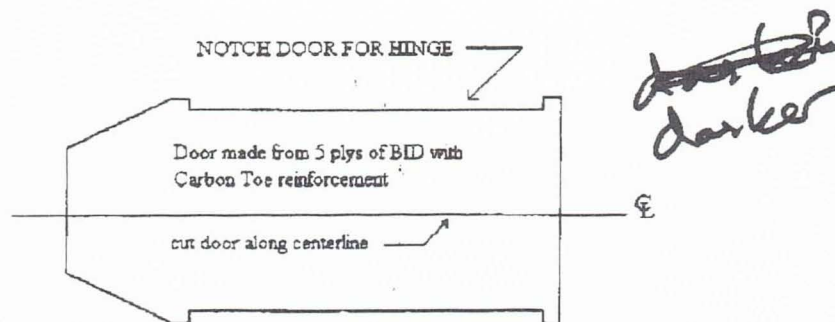


### Seventh Step

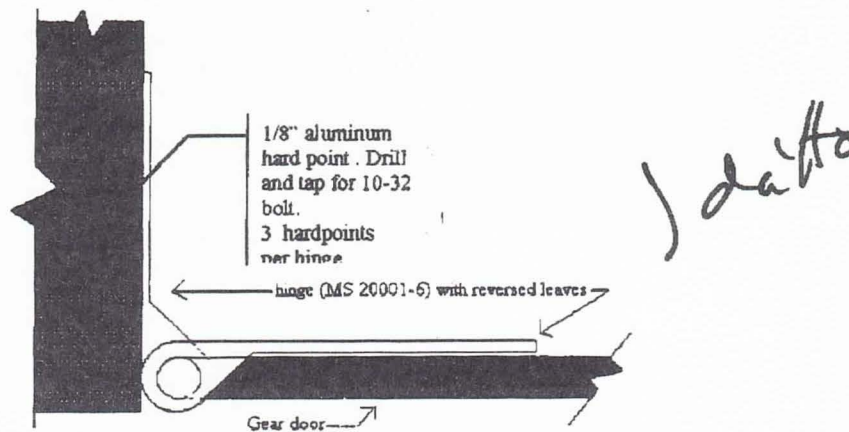
*Caps*

In this step you will construct the gear doors and a new strut fairing. Lay-up 5 plys of bid on a very flat surface approximately 7 "x 16 ". If possible use carbon fiber. After cure trim the door to fit the new well. Cut the piece in half along its length





Reverse one leaf of a MS 20001-6 hinge and then cut it to fit the notch

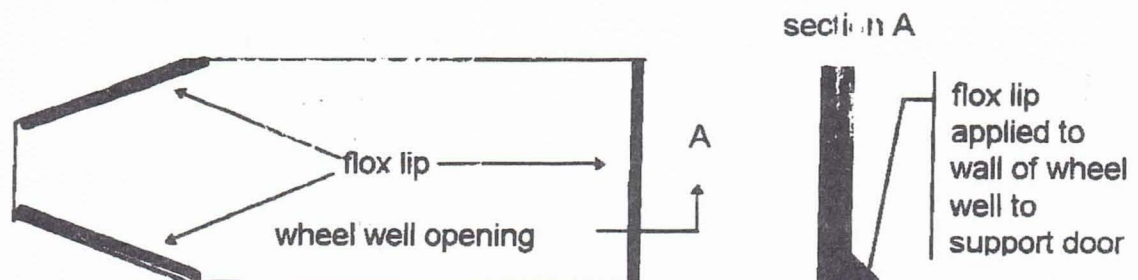


Rivet the gear door to the hinge with flat head rivets. If your door is made from carbon fiber it is recommended that regular fiberglass should be placed between the hinge and the carbon fiber to prevent electrolysis. Use your own judgment in the quantity and size of rivets (I used too many).

Locate the hardpoints you installed in step 6 . Cleco the gear doors to the side of the modified wheel well and check for proper alignment of the doors to one another and to the belly skin. You will note that the front of the doors do not follow the contour of the belly. Use your heat gun and some judicious bending to encourage the doors to align with the curve of the fuselage. Once your satisfied that the doors are where you want them drill the hinge through the hardpoint with a # \_\_\_\_\_ drill and tap for a 10-32 bolt.

*your!*  
*an appropriate*

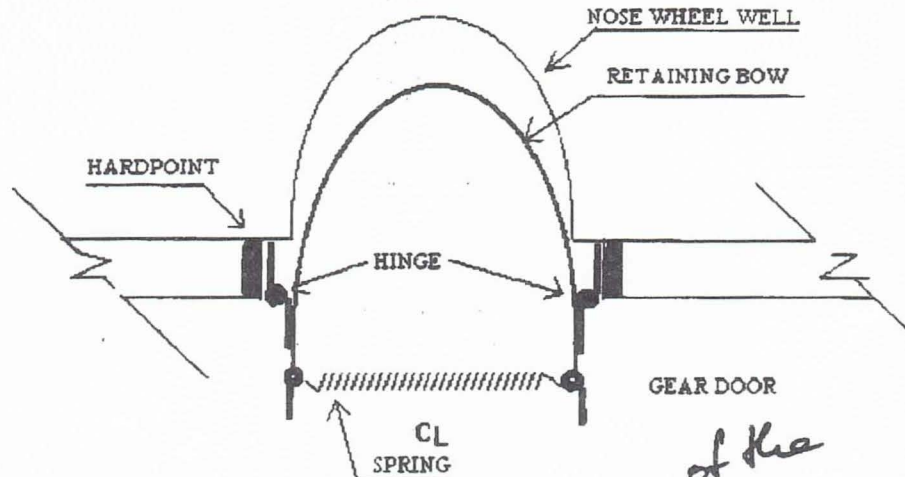
After you have completed the installation of the doors, a lip made from floc should be made to support the door against air loads. During this process gray tape is applied to the doors where it may come into contact with the floc. Only one door at a time can be done



Eighth Step

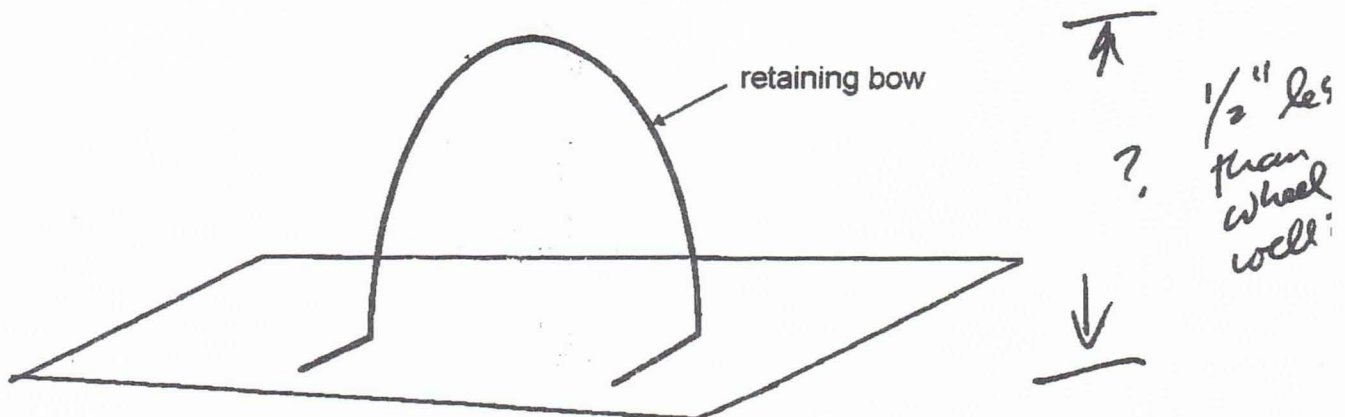
*Caps*

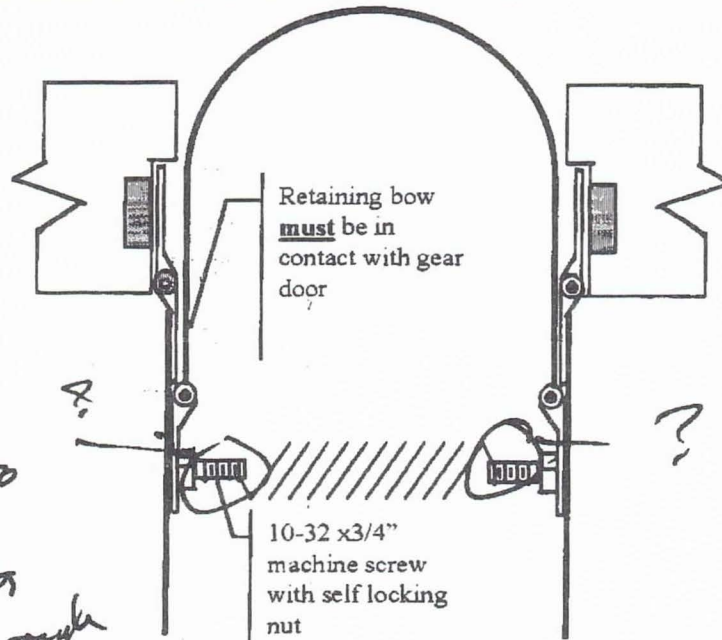
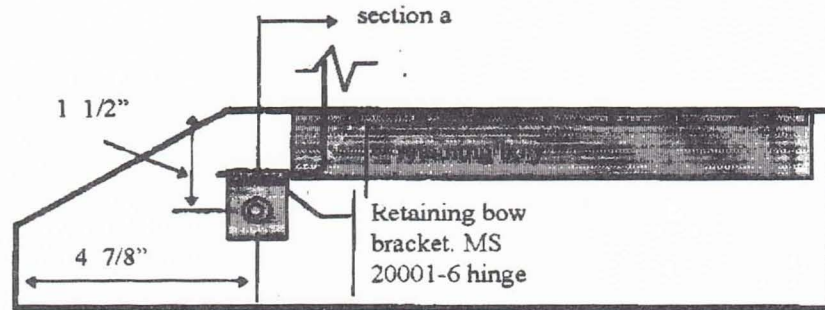
The gear door is aligned with the slip stream and kept from closing inadvertently with a simple piano wire bow (see illustration)



The door is pulled closed by the action of the nose strut engaging a spring at the swivel block (NG 15A-R). The spring stretches and then pulls the doors closed as the gear is retracted (usually when the majority wheel is inside the wheel well. I experimented with a number of springs and found that a spring with .037 wire size and approximately 25 windings per inch works well in this application. If you are unsure about the spring you've selected, you only need to know that it should be easy to stretch by hand. If it isn't, then you have the wrong spring. *of the you are yours*

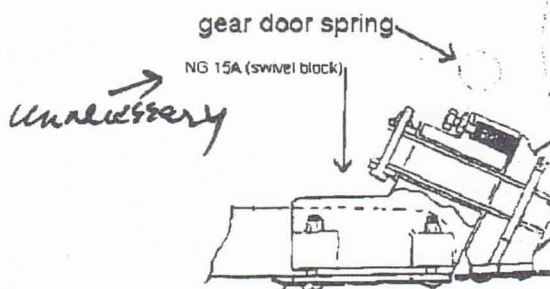
The retaining bow is fashioned from .093 piano wire and is attached to each door with a small piece of MS 20001-6 hinge.





Spring to under ~~under~~ bolt  
Hole through belt?  
why so long on bolt 3/4"?

Section A



← Darker wheel

*Says*  
Ninth Step

At this point you are nearing completion. All that remains is a few adjustments to the retract mechanism. The spring should engage NG 15 A at the point shown in the illustration above. The retaining bow should be in contact with the gear door to prevent the doors from ~~swaying~~ - ? *Rattling*

Retract the gear and watch the gear enter the wheel well. The gear doors should not begin to close until the fork is near or above the hinge line. If the doors close prematurely, replace the spring with one with less tension. If after the wheel is retracted the doors remain open or partially closed check for the following:

1. The wheel does not go up high enough into the well
  - A. The wheel is touching the top of the wheel well.
  - B. The retaining bow is too tall and is touching the top of the wheel well.
  - C. The strut is touching the retract mechanism at NG 14
  - D. The retraction spring is too weak.

When actually operating this device you should encounter a little more resistance in the operation of your retraction handle. If you do not have a ratchet assembly on your retraction handle I would strongly urge you to consider it. The spring loads the gear so that it forces it down. If your system is old the gear may extend inadvertently ( a real bummer during a race) . Fix that and good flying