Experimental Aircraft Models

"Enhancing the Homebuilt Experience"

Scale: 1= 4.65
Wingspan: 80" (2032 mm)
Wing Area: 1103 in^2 (7117 dm^2)
Flying Weight: 14 -15 lbs (6.4 – 8.8 kg)
Wing Loading: 31 oz/ft^2
Length: 50 ¾" (1290 mm)
Radio: 4 Channels with 8 servos
Engines: 1.20 Two Cycle, w/Fuel pump

Velocity XL

Radio Control Scale Model

Assembly Instructions

Warranty

Experimental Aircraft Models, LLC (EAM) guarantees this kit to be free from defects in material and workmanship. The warranty does not cover individual parts damaged by modification or abuse. In no case will EAM's responsibility or liability exceed the original purchase price of the kit. EAM reserves the right to change or modify this warranty at any time.

EAM assumes or accepts no liability for the manner in which this model aircraft is used by the user, in any condition of assembly. By the act of purchasing this kit, the purchaser and any subsequent user accepts full responsibility and all resulting liability.

If the purchaser is not willing to accept the above liability associated with the use of this model aircraft, the purchaser is advised to return this kit immediately to the source from where it was obtained.

Please read this manual thoroughly before starting assembly. It includes critical assembly instructions and warnings in regards to the safe and enjoyable use of this scale aircraft model.

Kondor Model Products / E.A.M.
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Canada

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About Your Model : You have purchased one of a limited production run of Velocity XL RC model kits in the world. You have a very unique model of an Experimental aircraft.

In the United States, 'Experimental Aircraft' are aircraft that are 51% or more built by an individual (usually at home) and are licensed by the FAA under a special "Experimental" certificate, rather than "Certification". The purpose of the Experimental category is to allow private individuals to design and build, and market, their own aircraft typically for the purpose of education. During the past 20 years the most advanced designs in civil aviation aircraft have come from the 'Homebuilt' arena where, without the burden of certification expense and manufacturers liability insurance, aircraft of amazing performance and safety could be designed and offered to the public. The Velocity XL clearly stands out as a supreme example of that type of ingenuity.

In our mission to support the homebuilder with a scale model of an aircraft project that may have consumed hundreds/thousands of hours to complete, we have brought together full-scale aircraft kit airframe manufacturers with a state-of-the-art world class ARF (Almost Ready to Fly) model manufacturer. Our intent is to provide as scale a model as possible that is as ARF as possible - within the confines of limited size production runs, and the knowledge that a full scale builder will likely customize to match their own aircraft. In that sense, this product caters more to the full scale builders, and scale modelers, than it does 'out of the box' flyers. (Translated: There is enough to do to finish the model that you'll feel a sense of pride in ownership!) Specifically with our Velocity there is a small amount of epoxy/glass tape work (supplied), soldering of the nose gear with a propane torch and masking and painting of the canopy and fuselage.

Just as the homebuilder customizes their personal aircraft, we have offered the model in pure white, so that you may do the same.

For those unfamiliar with the Velocity XL design, the original version came (and still does) with a fixed tricycle landing gear. The retractable gear version was developed a few years later by a customer, who later purchased the company(Duane Swing). We have elected to offer the kit in the fixed tri-gear version, simply because it would allow us to focus our development efforts on a good flying model and allow us to bring the model to market in a reasonable amount of time. (Even then it wasn't reasonable!)

Please note that we use aircraft terminology in our instructions. Specifically 'Port' is left and 'Starboard' is Right, and 'Forward' is to the front and Aft is to the rear. No matter how you may have the model turned, Port is always the left side of the aircraft as the pilot sits in the cockpit facing forward. Thus if you are working on the model upside down with the tail facing towards you while installing servos, putting something on the Port side eliminates the confusion that 'left' side might result in.

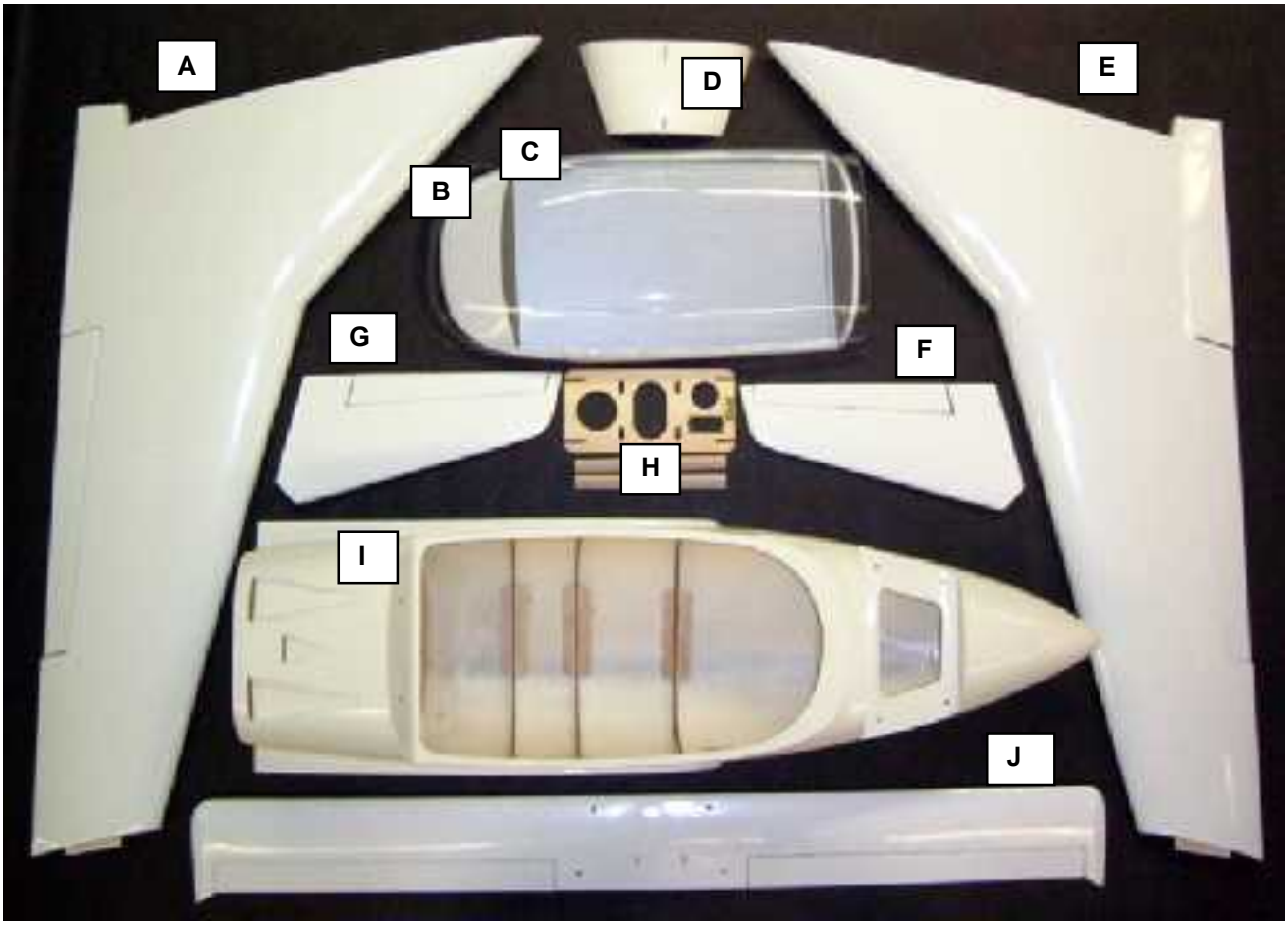
A final point: Because the model is so special and the volumes (by model standards) so low, we need your help. We have tried our absolute best to get everything right the first time. If there is something during the construction and flying of the model that you feel could be done more easily or better, we'd like to know. This is how it's done in the full size experimental aircraft world, and we want to be sure that the same spirit is carried on in smaller scale. Builders are continually finding ways to improve the full size aircraft, and there is no reason why modelers should not have the same ability to contribute to a better product.

Please feel free to e-mail us with kit comments at: info@RCHomebuilts.com We sincerely appreciate your vote of confidence in purchasing our rendition of Velocity Aircraft's Velocity XL, and truly wish you the best of enjoyment.

Andrew Kondor
Managing Director
Experimental Aircraft Models, LLC
Kondor Model Products, INC

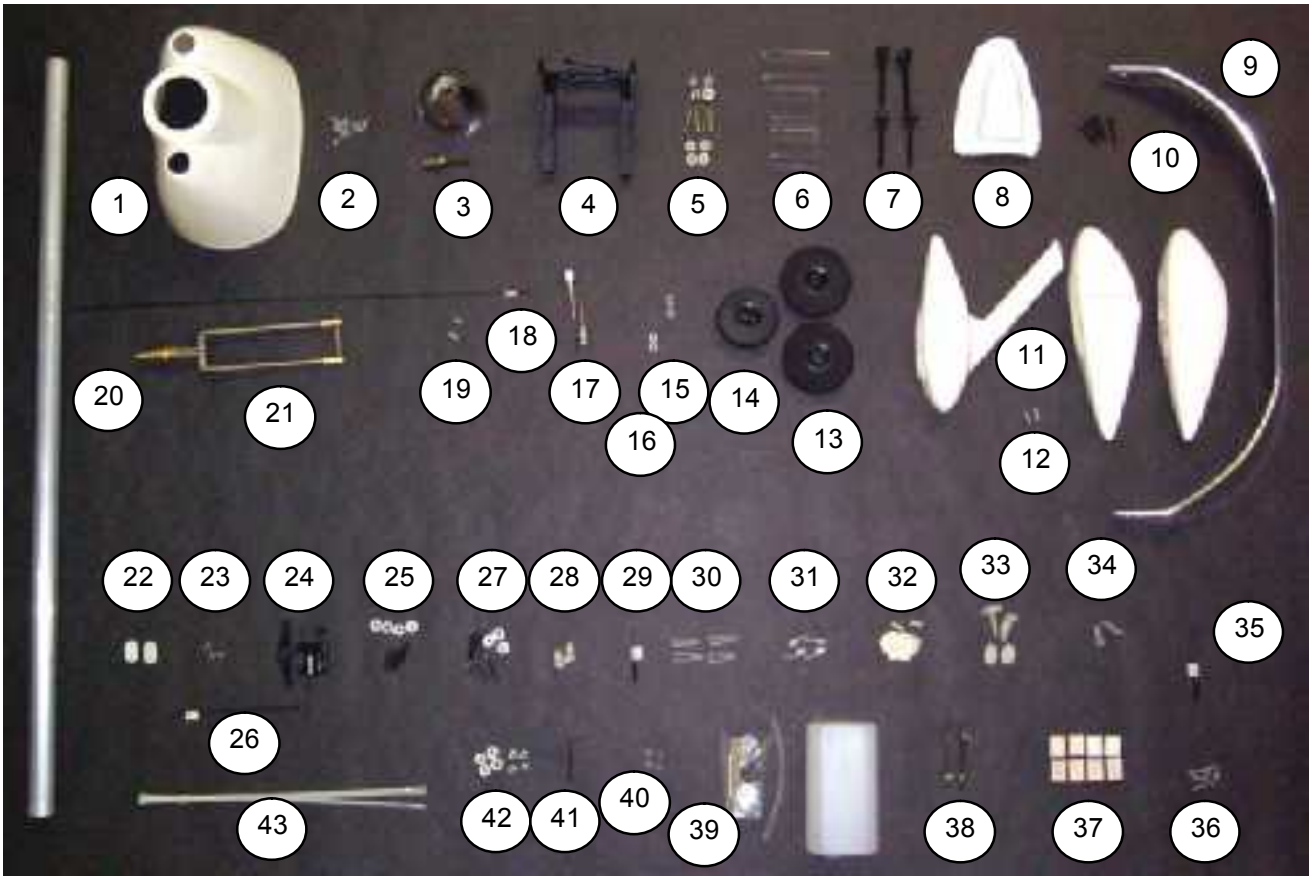
A note about the covering. Your Velocity XL's wings, canard and winglets are covered in White 'Oracover' – commonly known as 'Ultracote' in the U.S. This is a high quality material, but through temperature changes during shipping, the model may show wrinkles. This is normal. This symptom is also more visible in that the model is fully balsa sheeted. The material can easily be tightened by the application of heat from a hair dryer/heat gun or hot iron. If using an iron, a piece of lightweight cotton (e.g. sheeting) placed between the iron and the covering helps to even the heating. Pressing lightly will transfer the heat to the covering, shrinking the material. Piercing a bubble with a pin and rubbing the hot area with a cloth further helps remove the wrinkles.

Airframe Components



Item	Description
A	Starboard (Right) Wing
B	Canopy
C	Cockpit Cover
D	Canard Cover
E	Port (Left) Wing
F	Port Winglet
G	Starboard Winglet
H	Fuel Tank Ply Platform
I	Fuselage
J	Canard

Hardware



Item No.	Description	Where Used	Qty.
1	Fiberglass Cowling	Cowling	1
2	2.3 x 6 mm washer head screw	Cowling attach screws & Misc.	22
3	Spinner 76mm Dia	Engine	1
4	Glass filled Nylon Engine Mount	Firewall	1
5	4 x 25mm Pan Hd Phillips Bolt, 4 mm Blind Nut, 4 mm Flat Washer	Engine mount attachment	4 ea.
6	Clear PVC molded boxes	Carve to make 3 Air Ducts	3
7	¼-20 x 2" Nylon Finger Bolts	Wing Retaining Screws	
8	White PVC cowling scoop	Side of Cowling	1
9	Formed & Polished Main Landing Gear	Main Landing gear	1
10	8-32 x 1" socket head screw, washers & Locknuts	Main landing gear attachment	4
11	Wheel Pant Set	(2) Mains (1) Nose gear	1set
12	3 x 12 mm Phillips screw	Wheel Pant Retaining	2
13	4 mm I.D. x 3" (76mm) O.D.	Main Wheels	2
14	4 mm I.D.x 2 3/8" (60mm) OD	Nose Wheel	1
15	4 mm ID collars	Main Wheel Retaining	2
16	4 mm ID Nylon spacers	Nose Wheel Spacing	2
17	4 mm Axle Set	Main Landing Gear Axles	2
18	1.8mm x 500 mm wire	Throttle Pushrod Wire	1
19	EZ Connector	Throttle & Steering Servos	2

Item No.	Description	Where Used	Qty.
20	25 mm O.D x 792 mm Al Tube	Support Wings Thru Fuslg.	1
21	Double Strut Wire Nose Gear	Nose Gear	1
22	Nylon Strap	Secure Nose Wheel Fairing	2
23	2.3 x 8mm Phillips head screw	Secure Nose Wheel Fairing	4
24	Nylon Steering Housing & Control Arm	Nose Gear Pivoting	1
25	4-40 x ¾"" Socket Head Bolt	Secure Nose Gear Housing	4
26	1.8 x 130 mm Nose Wheel Pushrod	Nose wheel steering	1
27	4 – 40 x 1" Socket Hd. Bolt & Washers	Canard & Canopy mount	6
28	Nylon Rod Pivot Ends	Rudder & Elevator arms	4
29	1.8 x 55 mm Pushrods (threaded one end)	Elevator Pushrods	2
30	Clevis	Ailerons & Elevators	4
31	Nylon Kwik Keepers	Ailerons & Elevators	4
32	Nylon Latch Covers & Aileron Hinges	Canard Cover	6
33	Control Horns	Ailerons	2
34	2.3 x 20 mm Machine Screws	Control Horn Attachment	4
35	1.8 x 95 mm Pushrods (Threaded one end)	Aileron Pushrods	2
36	2.3 x 12mm Washer Hd. Screw	Winglet Attachment	8
37	8 x 12 x 16mm Blocks	Servo Mounting Blocks	8
38	1.8 mm Servo Saver Assembly	Rudder Operation	2 set
39	450 CC poly fuel tank	Fuel Tank	1
40	Silicon rings	Clevis Keepers	8
41	2 mm Allen Key	Tighten various set screws	1
42	8-32 Locknuts & Washers	Landing Gear Attachment	4
43	Nylon Tie-wraps	Secure Fuel Tank	3

Items needed to Complete Your Velocity Model

Your Velocity model flies with a four-channel radio. However, do to the relatively 'remote' location of the rudders, one servo is needed to operate each of the port & starboard rudders, and one to operate the steerable nose gear. In addition the elevators attached to the trailing edge of the canard utilize one servo for each elevator.
*** Please note that some of the hardware may not be included with your kit if purchased after November 1st. Please contact KMP toll free 888-968-7251 to make arrangements.

List of recommend servos or equivalent: (Hitec product numbers are shown.)

- (2) HS-85MG 42oz metal gear, ball bearing - Elevators
- (2) HS-85 42oz, nylon gear, ball bearing – Rudders HS-81 also acceptable
- (2) HS-425BB, Nylon gear, ball bearing – Steering & Throttle
- (2) HS-475HB, Karbonite gear, ball bearing – Ailerons

Servo Wire Extensions:

- (2) 36" – Rudder servos
- (2) 18" – Aileron servos
- (1) 6" – Throttle servo
- (2) 12" – Steering and Elevator servos
- (4) 'Y' connectors – (2) for Rudders/Steering, (1) Ailerons, (1) Elevators

Engine, Prop and Muffler
The model has flown successfully on an OS .91FX running a two blade 14x6 APC pusher prop. This proved that the model flies well 'on the wing' and is as efficient as the full-scale aircraft. It is **not** adequate for any aerobatics or short runways. It is not our recommended set-up.

We recommend the OS1.08 or1.20 two cycle engine with a Perry fuel pump. The OS is a tried and true 'bullet-proof' engine and powers the model with authority. Turning a Master Airscrew 3 blade 14x7 pusher prop the model accelerates quickly on grass and is capable of basic aerobatics.

We recommend a fuel pump because the fuel tank sits approximately 20" forward of the engine and changes in aircraft attitude affect mixture.

Do not assume that more power is better, we already did that for you with the 1.20 size engine recommendation. The engine sits well aft of the CG, and any changes in weight of engine are further paid-for by increases in ballast in the nose.

Note that as a 'pusher' the exhaust of a 'normal' Pitts style muffler points in the wrong direction. We have custom Bisson mufflers for the OS engine, which we include in our 'Firewall Aft Kit" and which is available separately.

Other Stuff:

- ❑ CA Adhesive (Thin)
- ❑ CA Adhesive (Medium)
- ❑ 30 Minute Epoxy (4 oz. min.)
- ❑ 5 Minute Epoxy
- ❑ Propane Torch
- ❑ Solder & Flux
- ❑ Foam Servo Mounting Tape
- ❑ Rubbing Alcohol

Building the Wings

Installing Aileron Hinges

The control surfaces on the wings, canard and winglets are not yet permanently attached. In this step you will be positioning the ailerons, remove and prepare them for gluing, and permanently re-installing them on the wings.
Note: At the tip of the wing the plywood winglet mounting plate is shipped already taped in position. Leave this in place because you'll need it there later.

1) Retrieve the hinges (No. 32) from the hardware pack and the right wing.

2) Insert a pin through the middle of the hinges and insert them half way into the pre-cut slits in the wing. Slide the ailerons into place.

   - ❑ Position the hinges side to side so all hinges fit & the space between the aileron ends and the wings is equal – use a razor knife if necessary to widen or deepen the slot if necessary.
   - ❑ Check that the vertical location of the factory cut slot allows the two ends of the aileron to sit flush with the top surface of the wing. Cut a new slot if it does not meet your building standards.

3) Mark the location of the hinges on both the wing and control surfaces so you'll know where they were after you pull the aileron away from the wing. (A felt tip pen works well to make a dot, and cleans up with alcohol.)

4) Trim away the Oracover from around the hinge slots on both the wings and the control surfaces. Our favorite method is to use an old soldering iron with a point on the end. This seals the Oracover to the wood at the same time as it melts back the covering from the slot. Otherwise a razor knife can be used to trim away the material. The objective is to be sure the adhesive can wick into the slot. You don't want an edge of film sitting against the hinge, which may prevent the adhesive from flowing into the slot.

5) Drill a small (1/16" or 1.5mm) hole in the center of each slot which will help 'wick' the adhesive onto the hinge in step 7.

6) Re-insert the CA hinges halfway into the slots in the aileron. (Up to the pin.)

7) Position the aileron up to the wing, inserting the other half of the hinge into the slots in the wing. Check side-to-side alignment so that the spaces between the wing and the aileron are equal. Remove the pins, and place 6 drops of Thin CA into the slot on both the wing and aileron for each hinge, on both top and bottom side of the wing. Wedge a paper towel into the opposite side of the hinge to prevent any excess CA from running down over the wing. Check for free movement.

8) Repeat steps 1 – 7 to secure the aileron on the opposite wing.

9) Pull on the control surfaces to test their strength.

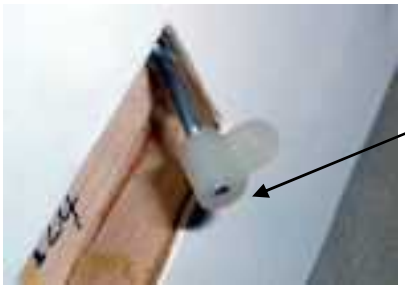
Assembling the Winglets

We're switching to the winglets, rather than finishing up the servo installation for the ailerons, because the rudder servo wires run through the aileron servo bay, and it's easier to feed the wires through when the aileron servo is not yet installed. Aileron servo installation follows this section.

The winglets provide yaw stability for the aircraft. By design each rudder operates independently of the other, and each only moves 'outboard'. You will see that the rudder arm inside the winglet 'bottoms-out' inside the winglet, preventing the rudder from moving inboard. Similarly, the rudder hinge line is designed for this type of action. The full scale aircraft uses a spring loaded rudder against a stop, and uses a cable to pull on the control arm. Rather than use complicated cables (for a model), you will be installing a servo on the bottom plate of each winglet. We will allow the servo to operate in both directions so as to not require separate channels to operate the rudder servos,. To allow this, you will be installing a 'servo saver' type of mechanism (#38) that pulls the rudder in one direction, and pushes against a spring in the other. This simple design also allows for easy removal of the winglet from the wing by removing the four securing screws and unplugging the servo.

1) Retrieve the starboard (right) winglet.

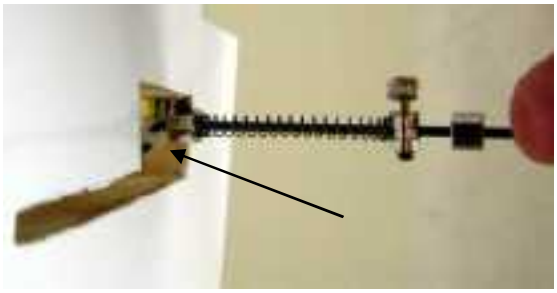
2) Mark the locations of the hinges. Pull the rudder away from the winglet and prepare hinge slots for bonding as you did with the ailerons.



3) While the rudder is removed, retrieve a Nylon Rod Pivot End (#28), open the hole through the barrel to 5/64" and thread onto the arm until flush with the end.

4) Retrieve the Rudder Servo Savers (#38) and the 2 mm Allen key (#41)

5) Snug the setscrew on the collar farthest from the Z bend so the assembly does not fall apart when handling it, and test fit the 'Z' bend end of the Servo Saver pushrod into the Rod Pivot End, inserting from the top side of the Pivot Rod End, and check for smoothness of operation with the pushrod perpendicular to the winglet. You may have to rotate the Rod Pivot End slightly downward and/or adjust the 'Z' bend. When done, remove the pushrod from the Rod Pivot End to simplify the next step.



6) Retrieve the starboard wing with the ply winglet attach plate still in place. (Tape it back in place if you removed it!) Read the next few steps below to familiarize yourself with the activity and objective before starting.

- ❑ Slide the winglet over the protruding end of the plate until it is against the wing tip. This ensures that the back edge of the plate is fully seated in the recess, and that the plate is inserted to the proper point in the winglet.
- ❑ On the bottom of the wing, use a razor knife and score/cut the covering on the bottom of the plate, at the surface of the winglet.
- ❑ Remove the winglet/plate from the wing, separate the plate from the winglet and remove the covering on the end of the plate.

- ❑ 30 Minute epoxy the plate into the winglet, using the wing again as a 'positioning fixture'. Place the glue into the slot in the winglet and on the end edge of the plate. Remove from the wing (so it doesn't bond to it!) Clean up any excess epoxy on the winglet and wing with alcohol or vinegar and set aside to dry.

7) Repeat steps 1-6 above to complete the winglet/plate assembly for the port wing.

8) Assuming the starboard winglet/plate assembly is now dry;

   a. Test fit the rudder on the CA hinges. Check that when the rudder is on its hinges and the actuator arm is inserted into the rudder, that the Rod Pivot End can bottom out against the inside of the winglet, while the rudder is flush with the winglet surfaces (i.e. pointed straight ahead.)

b. Attach the rudder to the winglet using 5-minute epoxy in the actuator arm hole and groove and thin CA to secure the hinges. Keep the rudder straight and the arm bottomed out in the winglet while the glue dries. Check to make sure the rudder is not bonded to the winglet with the epoxy!

9) Re-insert the Servo Saver Pushrod (of step 5 above) into the Rod Pivot End.

10) Repeat for the other winglet.

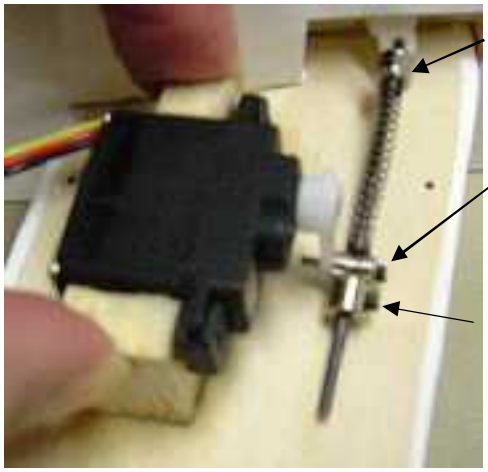
Installing the winglet servos

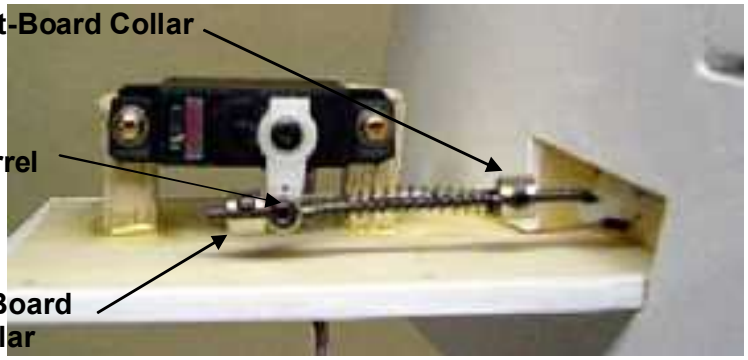
The winglet rudder servos are mounted on the inside/top face of the winglet plate to mounting blocks. Verify that the servo arms are electrically neutral (Stick and trim centered, receiver shut off before transmitter.) Use a single leg output arm or a two-leg arm with one leg cut off.

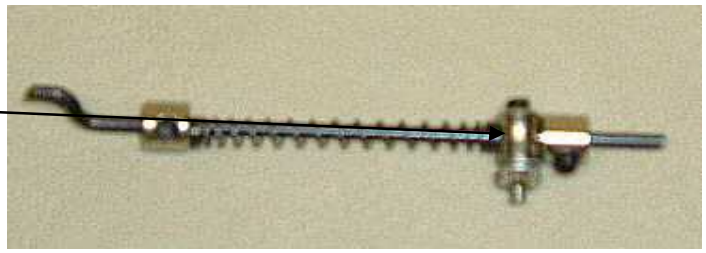
Read the notes below. Then start assembly using the steps that follow these notes.

Operation of the servo saver: In one direction the barrel hits the collar and 'pulls' on the rudder pushrod. In the other direction the barrel pushes against the spring, and allows the pushrod to slide through the barrel as the servo arm rotates towards the winglet.

Notes:







- You can remove the setscrew in the end of the barrel that normally clamps the rod to the barrel (when this part is used to move throttle linkages.) We will allow the rod to slide through the barrel.
- The servo must be high enough off the plate to allow the arm and barrel to clear the plate beneath it. – but just barely.
- Note how the servo is set towards the middle of the plate, away from the edge. No part of the mechanism should be closer than 5/32" from the edge of the plate. This is to allow room for the barrel protruding above the servo arm to clear the ply mounting surface inside the wing after it is installed. Look at the winglet servo bay, at the end of the wing, and you'll see how the ply is notched away to allow some room.
- The barrel should be against the inboard collar when the rudder and servo arm are centered. You'll adjust the inboard collar so that this is the case. The outboard collar is moved to adjust the

spring loading to keep the rudder centered. Compress the spring between the barrel and outboard collar by about 1/4" after everything else is already set up and in position.

Begin Assembly:

1) Using the hardware supplied with the servo, test fit/position the rudder servo on the topside of the winglet plate. Assume a maximum servo arm length of ½" as measured from the center hole to the tip of the arm. Reference the pictures for the general arrangement.

2) While holding the servo in position squeezed between the blocks, apply thin CA to the base of the blocks to hold them in place. (Picture at upper left)

3) Remove the servo and reinforce the bond with 5 Minute epoxy applied at the base of the blocks as a fillet all the way around the base of the blocks.

4) Retrieve the Servo Saver (#38) and insert the Z bend into the Nylon Rod Pivot End. At the other end insert the stud on the barrel into the servo arm from the top. Select a hole that is between 3/8" and 7/16" from the center screw, insert the stud, and thread the knurled finger nut up into place, leaving about ½ turn loose. (The Barrel must be able to rotate in the hole.) Cut off any excess arm length. Secure with Loctite or thin CA.

5) Position and secure the servo in place using the screws supplied with the servo. If you are dedicating these servos to the model, consider applying some thin CA between the blocks and the servo, bonding the servo to the blocks – AFTER you've tested the operation!

6) Adjust the linkage so that when the servo is in neutral, the inboard collar is pressing against the servo arm, and the spring tension keeps the rudder centered. Remove the servo arm center screw, pull off the servo arm and cut off excess pushrod length. Reassemble.

7) Test the operation of the rudder with your Transmitter/receiver.

8) Plug a 36" servo cable extension on to the ruder servo cable. Clamp or tape the connection, but remember the Winglets are removable if you should want to transport the wings without them attached.

9) Snake the servo extension wire through the wing and out the root rib of the wing using the monofilament pull string already inside the wing.
Notes:
   a. *We thoughtfully tack glued the string keeper to the inside rib at the tip to prevent the string from getting lost inside the wing during shipment. It may be stuck on there pretty good! Use a pair of needle nose pliers and pry/break it off.*
   b. *You can't tie a useful knot in the filament, so don't even try! Pass the filament under the plug, between two wires behind the plug and over the top of the plug, and then wrap a piece of tape around the plug. This will trap the filament against the plug and allow you to safely pull on the filament to pull the wire through.*
   c. *You will be pulling the plug end through the center of a number of wing ribs. If you get stuck, loosen the tension on the filament and rotate/shake the wing so the plug can fall away from a rib that it may be caught on.*

11) Test the operation of the rudder again with your radio.

12) Note on the topside of the winglet plates there are four laser cut holes. Using a pin, punch through the covering to leave a mark on the bottom side showing where these holes are.

13) Position the winglet into place on the wing and drill four 1/16" holes at the pin punches, through the winglet plate into the plywood in the wing. Watch to be sure you do not pinch wires as you assemble the winglet to the wing.

14) Secure the winglet in place with four 2.3 x 12mm washer head screws (#36)

15) Test the operation of the rudder again to be sure there is no interference from the mounting plates in the wing.

Mounting Aileron Servos

For installing the aileron servos you can either unplug and remove the winglet from the wing, or work on the wing with the winglet overhanging the edge of the workbench.

1) Locate the aileron servo bay cover on the bottom of the right wing and remove it
   Note that the slots for the aileron servos are 'outboard' from the plane's center line, and are left and right (opposite) to each other. This is because the ailerons operate in opposite directions.
   Note also that the factory used clear tape that is pain to remove. Using the point of a razor knife you can carefully lift an edge. If you dent the balsa surface, re-heating the covering will make the dent disappear. If there is an adhesive residue it is easily removed with 'Goo Gone' or VMP Naptha

2) Trim the slot opening of each servo cover with a sharp razor knife. (Don't use the soldering iron trick, as it will show the melted edge where it would be visible from the bottom side of the plane. When cutting with the razor knife cut on the 'push' stroke – this will give a cleaner edge.)

3) With the covers in place, drill a 1/16" (1.5mm) hole at each corner. Make sure the cover is oriented properly and that the slots are towards the wing tip. Test fit the covers in place with four 2.3mm x 6mm washer head screws (#2), then remove and place a few drops of Thin CA into the holes in the wing to dry and strengthen the threads.

- The standard size servos are mounted directly to the bottom of the servo bay covers. Mounting blocks are provided, or your may use two sided adhesive foam tape.(Not supplied). Verify that the servo arms are electrically neutral and you are using the length of arm you intend to use. (Refer to your Radio owners' manual for techniques for centering the servo arm.)

4) Using the hardware supplied with the servo test fit/position the servos on the back side of each servo cover. Use a single leg output arm or a two-leg arm with one leg cut off. Position the arm on the output shaft to protrude at 90° through the slot. The face of the arm should be parallel to the length of the slot and centered.

5) 5 Minute epoxy two servo mounting blocks (#37) under the mounting lugs on the servo. When dry, secure the servo to the blocks with screws supplied with the servo.

6) Plug a 12" servo cable extension to the aileron servo cable. Use a piece of heat shrink tubing or electrical tape to keep the connection secure.

7) On the starboard wing, snake the servo extension wire into the servo bay and out the root rib of the wing. (The throttle pushrod wire (#18) works well for this – just tape the end of the plug to the end of the pushrod wire and pull it through.)

8) Clearly label both the aileron and rudder servo wires for later connection to the receiver.

9) Repeat the servo installation process for the other wing.

10) Plug the servos into the receiver and test their operation to be sure wire connections inside the wing remained tight and the wires are labeled correctly.

Installing Aileron Horns and Pushrods

Nylon control horns will be fastened to the ailerons. 'U.S. Pack' Sullivan 4" Pushrods with metal clevises are sized and then threaded on to the ends of the pushrods with Sullivan Keepers at the control horns. (Note, assembly pictures show standard kit hardware, not the upgraded hardware additionally provided.)

1) Plug an aileron servo into the receiver, turn the radio 'on', set the trim to center electrically centering the servo. Turn off the radio off, receiver first.

2) With the servo cover in place, but not screwed down, double check that the servo arm exits the slot perpendicular to the cover.

3) Retrieve two clevises (# 30), two Kwik Keepers (# 31), two control horns and backing plates (# 33), four M2.3 x 20mm machine screws (#34) and two 3 ¾" (95mm) pushrods (# 35). (Use the separately packed Sullivan pushrods & clevises.)

4) Looking down at the servo with the trailing edge towards you, lay a pushrod to the right side and alongside the servo arm, square with aileron and position a control horn (# 33) in line with the pushrod. Mark the location of the horn and install with two (2) M2.3 x 20mm machine screws (# 34) and control horn backing plates.

a. If you keep the rods on the right side of the servo arm on all pushrods for both wings, the rod keepers will be more easily installed later.

b. Note that the backing plate on the topside of the wing may require sanding off the pointed edge along one side so as not to interfere with 'up' aileron action.

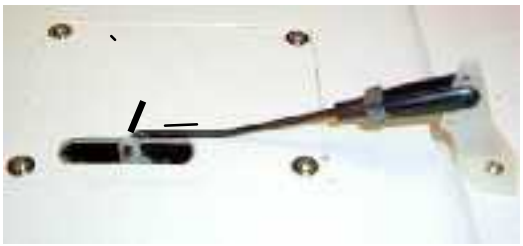
5) To size and cut the pushrod to length, thread a clevis on to the end of a pushrod. Temporarily attach the clevis to the horn and lay the rod along side the servo arm.

a. If you have used a short servo arm you will need to make a shallow bend in the pushrod so that it can enter the slot and still have room for the keeper. Bend a shallow (10 to 15 degrees) angle midway between the horn and servo arm. You will likely have to widen the slot in the servo cover to allow room for the keeper to enter the cover.

b. Rotate the rod 180 degrees so that the bend lays flat along the wing – allowing you to determine where to mark, and in the next step bend, so as to fit the servo arm hole.

Pushrod shown already cut to length with leg bent and upside down. Piece gets turned over and leg inserted into servo arm hole.

6) Mark the location of the servo arm hole on the wire and subtract 1/16" (1.5mm) for a bend allowance. Carefully bend a right angle (pointing away from the servo arm!), so that when you rotate the rod back into position it will fit into the arm. Cut the leg to 5/16" (6mm).



7) Rotate the pushrod back to the correct position and install into the servo arm using a (# 31) Kwik Keeper.

8) Repeat the above steps to install the other aileron servo.

9) Finish all servo installations by making sure there is a screw securing the servo arm to the servo and in each of the four corners holding the servo covers in place.

Canard Assembly

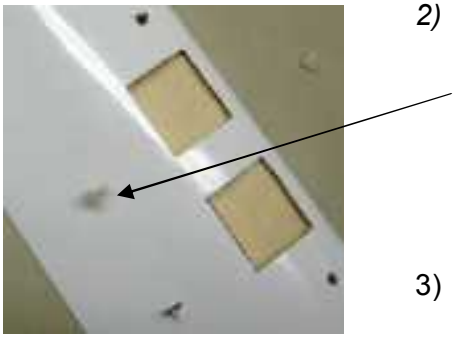
The canard is designed to 'stall' before the main wing. This is accomplished in three ways: 1) The angle of incidence is higher than the main wing i.e. + 3.5° 2) We choose an airfoil that stalls before the main wing (note the sharper leading edge and thinner relative section 3) The wing loading is higher on the canard than the main wing. You may also notice that the canard is disproportionately heavier than the main wing(s). This is because strength is must, and weight is not a problem in the nose of the aircraft (you'll be adding lots of it to bring the model into balance). Similarly, the wing is very light because much of it is behind the CG. Your Velocity's canard has twin hardwood spars with a double shear web and was statically stressed in development to 7 g's. We chose to use two small elevator servos laid on their side so that they do not interrupt the balsa bottom sheeting along the length of the canard (helping to maintain structural integrity) and so that they fit under the canard cover.

At the trailing edge of the canard are the elevators. These operate in unison, both moving the same direction at the same time. They operate (almost) identically to normal elevators and control only

pitch, no roll. We say 'almost' because they are in front of the aerodynamic center of lift, and therefore 'down' elevator acts to raise the nose, and 'up' acts to lower the nose. (If confusing, the good news here is that the worst that can happen if you get it wrong on your initial flight is that the nose will stay on the runway when you try and take off!)

Hinging the Elevators & Installing the Elevator Servos

1) Retrieve the canard & mark the locations of the elevator hinges, remove the elevators and prep the slots for bonding, similar to the ailerons and rudders.



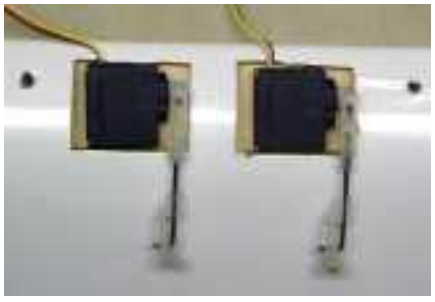
2) Retrieve the remaining two Nylon Rod Pivot Ends (#28) and drill out the hole in the barrel to 3/32". Thread them on to the threaded ends of the elevator actuating arms. (Holding the actuator arms flat on the workbench will keep them from moving around as you thread on the Ends.) *Picture shows step 4 below completed with the covering removed from the servo bays.*

3) Using the same technique that you used to hinge the ailerons and rudders, CA hinge and epoxy bond the actuating arms into the elevators.

- ❑ Double check that the elevators are centered in their openings.
- ❑ Make sure you can get at least 3/8" upward deflection and 7/8" downward deflection when operating each elevator using the actuating arms. Lengthen the notch in the top skin of the canard (in which the actuating arm exiting the canard moves) if necessary. The elevators are intentionally hinged closer to the bottom edge of the elevator to increase their effectiveness, so be careful not to install them upside down!
- ❑ Some builders like to reinforce the bonding of the hinge with a pin that is run through the wood and into and through the CA hinge, mechanically tying the hinge into the components. You can cut a pin shorter than the thickness of the trailing edge of the canard or elevator and insert from the bottom so that it is flush or just below the surface and does not protrude through the top.

4) Using a razor knife open/remove the Oracover that covers the servo bays. Increase the width of the opening on both servo bays to the port side by ¼" - to allow the servo arms to align with the elevator actuator arms. (Our apologies, we missed this in manufacture.)

5) Prepare two Hitec HS-85MG or equivalent micro servos for mounting to the canard by cutting the mounting lugs off the sides of the servos, so that they fit in the space provided.



(Note: The HS-85MG's put out 46 oz/in of torque @4.7 V. Since the arm length you'll be using is approximately ½", the effective power of the servo is doubled, yielding almost 6 lbs of thrust, on each elevator – more than enough power for reliable control.)

6) Electrically center the servos with your radio, trims centered so that the control arms are perpendicular to the body of the servo, pointing upwards with the servo positioned as shown. Trial fit. (Actually move them to the left so that the pushrods line up!) It will appear that the servo is not in line with the elevator actuator arms. This is intentional, as the pushrod will have a bend in it and enter the actuator arm from one side.

7) Retrieve the two #29 elevator pushrods, two #30 Clevises, two #31 Kwik Keepers and two #40 silicon rings. Thread the clevises to the ends of the pushrods a minimum of ¼" (If your kit has been supplied with the optional Sullivan 2-56 metal clevises and pushrods, use these.)

8) Attach the clevis to the Nylon Rod Pivot End and position the pushrod up alongside the servo. Bend a right angle in the pushrod to allow insertion into the servo output arm. Cut the leg to ¼" and install a Nylon Kwik Keeper (# 31)

9) Double check that the center screws securing the servo output arms are in place. Pre-adjust the length of the pushrod arm by screwing or unscrewing the clevis so that both elevators are flush with the surface of the canard.

10) Using Silicone or Flexible CA securely fasten your servos to the balsa framework.

Fuselage Assembly

Installing the Air Ducts

The NACA air inlets on the top of the fuselage are functional to assist with engine cooling. We have included vacuumed formed channels (they look like boxes before you cut them) to allow the incoming air to be directed through the firewall, which we've already cut away for you.

1) Retrieve the three clear PVC molded 'boxes' (#6).

2) Note the general orientation in which they will be used.

3) With a sharp razor knife gently score (until cut through) the inside corner of each box so that two sides can be removed.

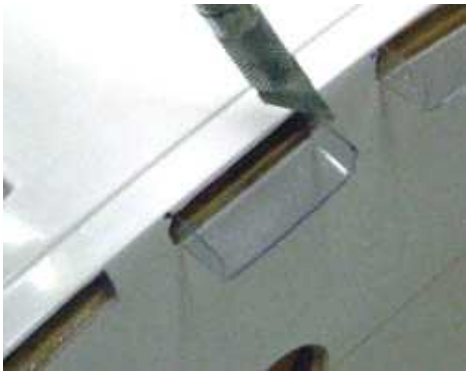
4) On the two shorter boxes you'll be removing the long sides. On the longer box you'll be removing the shorter sides. Again, score gently along the 'fold' – you can actually break away the side cleanly after a few score lines are made. You should end up with two wide, short channels, and one long narrow channel. *The pieces are longer than necessary. Be sure to remove any lip which will 'trip up' the incoming air.*

5) You will be sliding the channel into the opening in the firewall and bonding it in place. To fit, you will need to cut the height of the 'legs'. Position the channel up to the opening in the firewall with the bottom resting on the bottom of the opening. Mark the legs and cut the channel to fit. (You may want to square up the upper edges of the opening.)

6) Slide the trimmed channel into place to test fit. It should touch the back edge of the NACA inlet and sit on the bottom of the opening in the firewall. While in place, score a mark along the bottom of the channel flush with the outer edge of the firewall (This will help you determine where to apply the adhesive and you'll trim off the excess after it's bonded.)

7) Remove the piece. Apply Medium CA parallel to, and inside, the scored line you made so that it will bond to the firewall plywood.

- Position the duct in place and hold in position until the CA sets.
- Turn the fuselage over and apply some thin CA to flow into the joint between the bottom of the duct and the fuselage.
- Mix up a little epoxy and dab into the seam between the duct and the NACA vent to support the front edge.



8) Trim the excess length flush with the firewall

9) Repeat for the remaining two inlets.

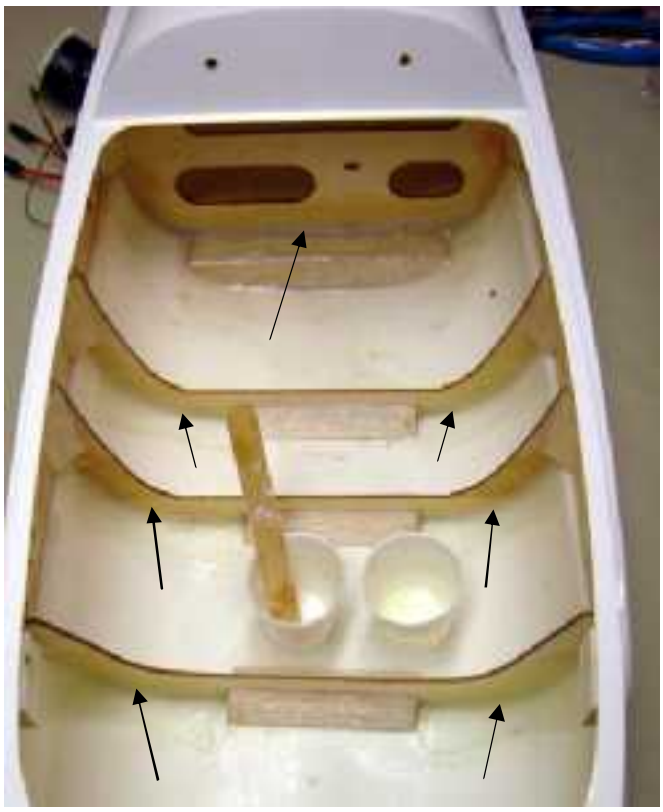
Reinforcing the Bond of the Interior Frames

The bonding of the interior frames needs reinforcement. While we increased the contact area with large balsa triangular 'gussets', we still recommend reinforcing the bulkhead to fuselage joints with epoxy/glass cloth. We have included two yards of glass cloth tape, an application brush and filler material with your kit. You'll need about 4 oz of 30 minute epoxy, rubbing alcohol and a mixing stick to complete this reinforcement.

Read the bulleted items below first and then use the accompanying pictures:

- The most important frames/bulkheads to reinforce are the nose wheel bulkhead and the bulkhead over the rear landing gear mount.
- Scuff sand the areas of fiberglass next to the frames where you'll be bonding the fiberglass tape into place.
- Create an epoxy paste by mixing 30 minute epoxy (thinned with alcohol to about the viscosity of motor oil) with the supplied cotton Flox filler to a medium/thin past. It should stick to the end of your mixing stick and not flow off, but not be too stiff.

- Using a tongue depressor, ice cream stick or back of a plastic or old spoon, apply a fillet of this paste along the joint of the frames to the inside of the fiberglass fuselage. It will support the fiberglass cloth when you lay it into the joint.
- While still wet, lay a strip of glass cloth and 'stipple' an alcohol thinned epoxy solution (no Flox mixed in) into the fiberglass tape so as to bond the fiberglass to the frame, over the fillet and to the fuselage.
- Do this to the aft side of the forward most frame (where you can reach it through the canard mounting location.) This is the most important frame to reinforce and you can consider laying a few overlapping pieces in the area and up the sides. Be careful not to build up the area more than one layer thick directly under the nose gear mounting holes.
- Do the forward side of the next five frames, both sides of the balsa gusset.
- 'Paint' the joints of the nose wheel steering servo mount with the epoxy mix to ensure good bonding of these notched pieces.



Congratulations! You've just done a technique of reinforcing corner joints (with flox and glass tape) that is identical to the way it's done on the full scale Velocity.

Painting the Fuselage

Your Velocity model was intentionally supplied in all white so that you can customize it. If you'd like to paint the fuselage before assembling, then now is a good time. However, it is not difficult to mask off areas of the model after assembly, and waiting prevents you from damaging the paint job while you finish assembly.

The fastest way to the flight line is to leave the fuselage in it's white gel coat finish and simply apply the decals supplied in the kit to the cleaned fuselage. You'd be surprised how far they go to dress up the model.

However, gel coat batches vary in color, so to get a good match, you can wash the exterior of the fuselage with soap and water to remove the mold release, and paint the fiberglass. If you bought the model because you're building it to scale, most full scale Velocities are painted white, so that the composite structure does not overheat when exposed to long periods of sun sitting at the airport. If you bought the model because it's just an awesome looking airplane, you can get as creative as you'd like with the color of the model. This will certainly make it easier to see from the ground when flying.

If you choose to paint the fiberglass pieces:

- Prep the fiberglass by washing in warm water and scuff sanding with 360 or 400 grit wet sandpaper.

- Consider smoothing the seams, grinding and filling any cracks or low spots with lightweight body filler if necessary.
- The top of the cabin is formed by the clear canopy. Consider having this in place when you paint the model so that the color is consistent, although it is easily painted separately. Painting of the canopy is discussed separately later for those builders not choosing to paint the fiberglass fuselage. We painted the interior under the canopy with Stone fleck paint.
- You will be doing additional work to the cowl, so do not paint it at this time.

If you have a spray gun, our favorite paint is Nelson Hobbies water reducible two part epoxies. These are actually 'System Three' paints (sold to the full scale builders) that are non-toxic, have a high gloss, are tough, fuel proof (when catalyzed) and clean up with water. The white matches the Oracover white. If you do not have spray gun then Top Flight's Lustrekote, Krylon 'Fusion' or Rustoleom plastic primer followed by their gloss paints all work well. For any paints other than the catalyzed Nelson paints we recommend a top coat of Minwax Clear Acrylic Urethane for glo fuel protection.

Engine & Fuel Tank Installation

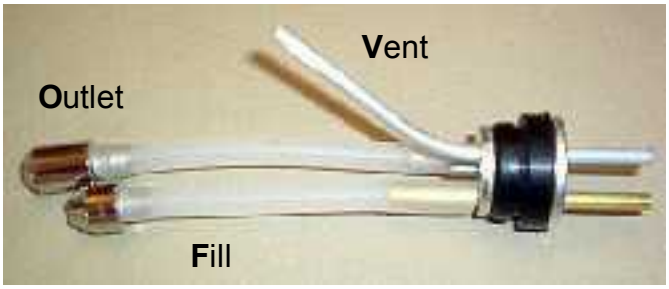
Additional components you may need from the hobby store:

We offer a special Bisson pusher muffler for the Webra Speed 1.20 engine. If you fit a normal 'Pitts' style muffler, the exhaust stacks will point forward into the slip stream. If you are installing a four stroke engine, with its corresponding heavier weight, make sure you rotate the exhaust to point aft.

Installing the fuel tank

1) Referencing the pictures below and following steps, assemble the fuel tank so that a flat side becomes the top. (Mark it as such) Replace the fuel line supplied with the tank (which may be hidden in the tank) with a piece of the fuel line supplied with the U.S. Pack. (It's better quality.)

2) You will need to gently bend one long piece of tubing to reach up to the inside top of the tank to create the vent line. The short fuel pickup piece enters straight in. Mark the large outside metal disk with (O)utlet and (V)ent and (F)ill so you know which tube is which. Do not tighten the plug screw yet.



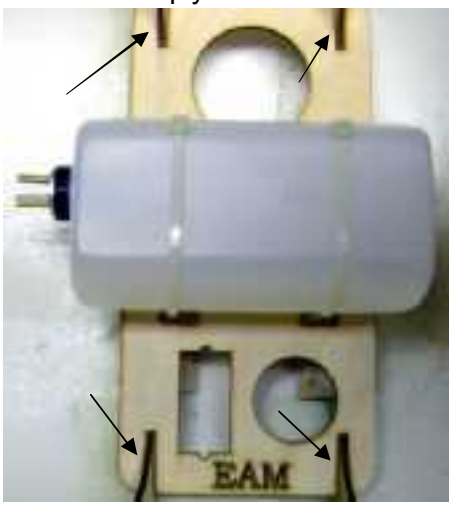
- Your kit was supplied with the optional DuBro 'Fill-it Fueling System' in the U.S. Pack. Use the DuBro third piece of brass tubing to enable remote refueling. Follow the installation directions on DuBro's package to install the filler.

- Use the DuBro clunk on the fuel pick-up line (**O**utlet), and the clunk packed with the tank for the **F**ill line.

3) The rubber plug fits tightly and a flat blade screwdriver (used carefully) around the groove helps to get it in the hole.

4) Making sure that the vent tube is pointing to the top of the tank and the clunk does not hit on the inside back end of the tank, tighten the plug screw until it is snug and the plug is firmly held in place. The plug expands between the two metal disks to create the seal.

5) Retrieve the plywood tank and throttle servo platform. Because we strengthened the frames inside the fuselage with glass cloth and epoxy, you will need to widen the slots that straddle the frames.



- Using a razor knife widen the slots, on the forward edge by 1/16" (1.5mm) to allow the platform to fit into place. Trial fit, but do not bond in place yet. Retrieve the two nylon tie wraps (# 44) and remove the platform to mount the tank.
- Note that the tank platform has slots in it. Position the fuel tank between the slots, with the inlet/outlet tube pointing to the left with the 'EAM' at the bottom (This will 'point' the tank forward and have the fuel pick-ups at the rear of the tank, where the forward motion of the airplane will tend to push the fuel. **Do not point the tank in the other direction to shorten the fuel lines!** (Trust us, we have the pieces, uh experience . . .)
- Wrap the tie wraps around the tank, snug them down and cut off the excess.

6) Bond the tank platform into place with 30 minute epoxy. Place a weight on top of the fuel tank to hold it down while the epoxy dries.

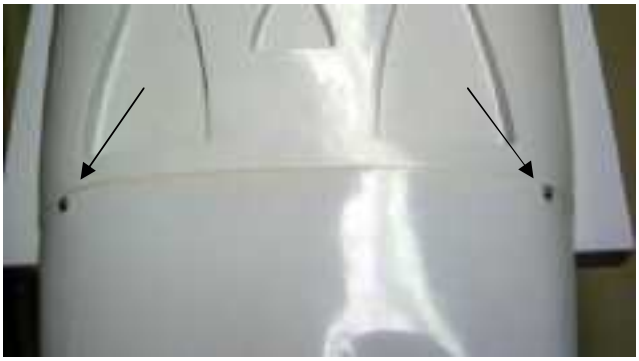
7) Install the DuBro 'Fill It Fuel System' (Fuel Dot) in the U.S. pack. We like positioning the fuel dot just forward of the third bulkhead under the leading edge of the wing. This puts it in a place where the fuselage has been reinforced by the glass tape, does not make it too difficult to reach, and hides it somewhat under the aircraft.
   - Make a small pilot hole in your desired position and then open to 7/16" dia. Follow the instructions on the 'Fill It' packaging to complete the installation.

Initial Cowl Fit

1. Place and tape the cowl into position (making sure it is on square by sighting from the rear.)

- If the cowl does not seat fully along the bottom, don't panic. Much of the bottom is cut away for muffler clearance and will 'widen' later. Concentrate on the top and sides to have a minimal gap.

2. Plan to secure the cowl with four, 2.3 x 6mm (#2) washer head screws. Decide where you want these around the circumference of the cowl, and place a 'dot' with a felt tip pen 5/32" (4 mm) aft of the 'joggle' on the cowl.
    a. We like about ¼" (6 mm) to the outside of each large air inlet and about ¼" below the trailing edge of the wing fairing.



3. When comfortable with the fit, drill a 5/64" (2 mm) hole at each dot,

4. Install a #2 x3/8" washer head screw in each hole to verify fit. Then remove the cowl.

5. Now is a good time to finish the openings in the cowl. A fine rat tail file or flexible shaft tool (e.g. Dremel$_{TM}$) with a small milling bit works great. We recommend opening the round air outlet holes to the outer circumference, flush with the surface of the cowl to allow smooth exit flow of air. Also open the large center hole. Leave about 1/8" lip around the circumference for support.

Positioning and Installing the Engine

The objective of this section is to place the engine on the firewall so that the back of the spinner clears the rear of the cowl by 1/8" (3mm), and the spinner is centered on the cowl. Our instructions will work for all brands of engines.

Positioning the engine fore/aft (front to back) on the motor mount

1) Place the cowl on the model and secure with a few screws.

2) Measure from the firewall to the front edge of the cowl through the center opening. It is approximately 5 1/4" (133 mm)

3) Place the motor mounts on a couple pieces of wood so that the engine sits high enough to not bottom out on the bench.

4) Position a wood block behind the engine mount and make sure the back of the engine mount is horizontal to the bench and firmly against the wood block. Separate the engine mount halves to allow the engine to slip between the rails. Place the engine squarely between the rails and position it so that the distance from the rear of the engine mount to the front face of the thrust washer is the same as you measured in step 2 above, and then move the motor in the direction of the thrust washer 1/8" (3mm). You are better to err moving away from the face of the cowl too much, than too little. (We recommend a 1/8" gap to assist with cooling. Normally you would have a gap half that width on conventional 'tractor' aircraft.)

5) Mark the engine hole locations (we like using a 'Transfer Punch') and drill straight through the engine bearers with a 1/8" dia. drill.

6) Secure the engine to the motor mounts with the four #8 x 1 ¼" bolts, & locknuts supplied in the U.S. pack.

Positioning the Engine Assembly on the Firewall

We like the direct method of positioning the engine/mounts, as opposed to measuring. That is, we'll put the engine/mounts assembly under the cowl, position it and mark the location. (This is easier with a second set of hands.)

First test that the back plate for the aluminum spinner slips over the prop shaft - be sure it's a close fit, and easily removed. (A bushing is packed with the spinner nut.) Then **read '1 through 10' below before starting.**

1) Remove the cowl and stand the model on its nose (on a carpet or pad.).

2) Retrieve a pencil, the spinner back plate & bushing, and the cowl. Place the engine/mount assembly on the firewall so that the cylinder exhaust faces the bottom of the aircraft (i.e. laying 'sideways') and the prop shaft is somewhat centered.

3) Place the cowl over the engine and ensure correct position with at least two screws.

4) Move the engine by the prop shaft so that the spinner back plate is centered on the cowling and the cylinder is either horizontal or clears the inside of the cowl. (You may need to temporarily remove the needle valve and the spring clip that prevents the valve from turning.)
   - Look for parts of the engine that may be touching the inside of the cowl preventing proper placement and mark and cut an opening as necessary. (The Webra 1.20 will need clearance for the needle valve housing easily visible to mark through the large prop shaft

center hole with the spinner back plate removed.)

5) Press down on the shaft to prevent the engine from moving and using a pencil through the cowl air outlet, mark the corners of engine mount against the firewall.
   - This is also a good time to verify the spinner back plate clearance with the cowl, i.e. the engine fore/aft positioning.
   - Some modelers like using a few dabs of 'GOOP' to hold the mount in place so that they can remove the cowl and mark the location more easily. The 'Goop' is removed by 'slicing', with a razor knife, and rubbing it off.

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6) Remove the cowl. Reposition the engine/mounts at the marks, and mark the engine mount holes.
   - This can be done easily by placing some paint (nail polish works well) on the end of an Allen key.
   - Remove the engine mount.
   - Then drill a small pilot hole through the firewall, followed with a 3/16" (4.5mm) drill in 4 places.

7) Test the engine position by inserting four 4 x 25 mm machine screws (#5) through the engine mounts, into the holes. If all is good, remove the engine mount and using one of the 4 x 25 mm machine screws and a washer:

   - Put some medium CA on the outside of the barrel of a blind nut, insert the blind nut from the inside of the fuselage (using inside-out masking tape on the end of your finger is a good trick) into the hole and pull tight with the screw against the washer.

   - Remove the screw and washer and repeat for the remaining three blind nuts.

8) Cut a piece of fuel line 24" (530mm) (for the Webra pumped engine – otherwise check the length with your engine) and secure to the fuel pump inlet on the back of the engine. Thread the tubing through the hole in the center of the firewall up towards the tank and install the engine mount and engine on the firewall with #5 Machine screws and washers but do <u>not</u> tighten – leave a little loose.

9) Locate and drill a 5/32" (4 mm) passage hole for the throttle pushrod. For most two cycle engines, a good place to put the hole is right next to the port side of the engine mount. Make sure it is in line with the throttle arm on the engine and low enough to just clear the cylinder. The exact location will depend upon your choice of engine and muffler. We strongly suggest you temporarily mount your muffler at this point, to allow you to plan the path of the throttle wire. Four stroke engines will have the hole in an entirely different location.

10) Refit the cowl and spinner back plate to double check location. Slide the engine mount in the slots as

appropriate to center the engine shaft. Snug at least one bolt.

11) Remove the cowl and without moving the engine, one by one remove each motor mount screw, place a drop of Loctite or medium CA on the threads and replace and tighten. (These screws **must** have some thread locking compound on them or they will loosen with the engine vibration.)

12) Apply a coat of sealing epoxy to any exposed wood in the holes (thinned with alcohol so that it can be brushed.) Then secure the motor mount in place.

13) Install the rest of the fuel lines

a. Thread the fuel line from the engine pump inlet, alongside the tank and under the mounting straps. Connect the tube to the tank (O)utlet

b. Cut a piece of silicon tubing 7" (165 mm) to fit on the (V)ent line. We like to run this out through a hole 5/64" dia. hole in the fuselage next to the filler valve. Drill a smaller pilot hole and then open by hand file to not chip the gel coat. (This hole is undersize for the fuel tubing so that it 'wedges' in place. Cut a diagonal end on the fuel line to start it in the hole and then pull it through from the outside. Cut off with about 3/8"+ extending from the fuselage.

c. The remaining tubing (13") goes between the (F)ill tube of the tank and the DuBro 'Fill It Fuel System' 'Dot' previously installed. The extra length is so you can easily pull the dot out to fill the tank. When the tank it full it will 'pee' out the vent tube under the model.

Nose Gear Installation

During the development of the Velocity model we opted to supply a more expensive (non-scale) double strut nose gear. There were two reasons for this: 1) A canard aircraft carries more weight than conventional aircraft on the nose wheel, and 2) we assume you'll go through the same learning curve we did relative to learning not to flare too much on landing. If you over rotate on landing, you'll stall the canard, and bounce the nose wheel on the ground.

Items you will need to complete this assembly include items you'd use to solder copper piping:

- Propane torch
- Solder
- Acid Flux
- 7/64" Allen key

Our nose gear design uses double wires all the way up into the pivot, minimizing the tendency to prematurely bend between the top of the coils and pivot point for steering. . It also cleverly locks in place by inserting at 180 degrees to forward, and rotating in place to lock. In this way no collars are needed and the bearing surface is much larger than a 3/16" (5mm) dia. wire would be. During installation the brass barrel is inserted through the nylon steering arm and firmly held in position by the brass nut. (Eliminating that pesky problem of steering arms that loosen and rotate on the nose gear shaft!)

1) Retrieve the Nose Gear (#21) and secure the wires into the brass pivot barrel.
   - ❑ Check that the gear is set up as shown in the picture. I.e the flat side of the pivot shaft on the brass barrel is to your right when the gear is laid on the bench, coils away from you.
   - ❑ Position the brass pivot barrel square with the landing gear wires, and tighten the setscrews.
   - ❑ Using a propane torch, acid flux and solder, evenly heat the area until the flux melts and the solder flows into the joint when touched to the parts. (No cheating and melting the solder with the flame!)
   - ❑ Allow cooling before handling.

2) Install the nose gear nylon steering bracket (#24) with four 4-40x3/4" socket head cap screws & washers (#25) Be sure this is mounted with the extended center section facing the bottom of the aircraft.
   - ❑ Cut off one side of two of the washers to allow the washers to fit alongside the center section of the housing. (We like using a pair of Diagonal wire cutters for this.)
3) Mark the location for a hole in the bottom of the fuselage directly beneath the hole in the housing and drill a 5/32 or ¼" pilot hole.

   - ❑ From the bottom of the model, gradually open the hole and 'move it' as required so that the brass barrel of the nose gear can be inserted into the nylon housing through the bottom of the aircraft, in line with the pivot hole in the bracket.

   - ❑ Note that the entire brass barrel will be inside the fuselage, leaving only the wire portion extending from the bottom. The hole needs to be no larger than to fit the brass piece into the bottom. (Temporarily remove the brass nut to allow it to fit in a minimal size hole -just under 5/8" dia.. The extra clearance left after the barrel passes through allows for possible flexing and will eliminate damage to the fiberglass during use.

   - ❑ Test fit the nose gear by inserting into the housing with the coils of the springs facing forward (this is 'backwards), then rotate to have them face aft. If the operation is stiff, check that the fillet you made when reinforcing the nose bulkhead to fuselage joint does not interfere with the brass barrel. Trim as necessary. Remove the nose gear.

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4) Retrieve the nylon steering arm (part of #24) and drill out the second hole on the starboard side to 5/64" and insert the Z bend end of the steering pushrod exiting from the side with the hub flush with the surface.

5) With the nut still removed, install the nose gear back into the bottom of the fuselage, but this time:
   - ❑ As the barrel enters from the bottom, with the coils pointed forward, slide the steering arm and the nut over the threads (with the pushrod pointed aft) before the shaft enters the bracket. The steering arm is "V" shaped and the "V" should point forward.

- Seat them down to the flange on the barrel as you slip the shaft all the way up into the housing.
- Rotate the nose gear 180 degrees to the 'forward' position, i.e. coils facing aft.
- Leave the steering arm nut a loose until you install the steering servo and pushrod.

6) Check and tighten the nose gear cap screws (#25) to secure the nylon steering bracket.

Installing the Main Landing Gear

We have supplied an aircraft grade formed and polished aluminum landing gear. The full scale aircraft utilize a composite laminate, which is typically painted the same color as the airframe. If you choose to paint the aluminum landing gear (#9), scuff sand it with 320 to 400 grit sandpaper (wet sanding is best.) Clean the gear well to remove all polishing compound left from the factory. Prime with an aluminum primer and top coat with choice of a high gloss white finish.

1. Retrieve the landing gear (#9), Axle set (#17), Main Wheels (#13), wheel retaining Collars (#15), Wheel Pant Retaining Screws (#12) and main Wheel Pants. (#11)

2. When installed, the landing gear sweeps forward, Fit the recess molded into each wheel pant to the correct end of the landing gear and mark the location of the main axle hole and smaller retaining hole. Our 'manual' model needed the ends of the gear trimmed to the correct angle.) (Make sure you put the port wheel pant on the left leg and starboard wheel pant on the right!)

3. Pilot drill all holes to 1/16" (1.5mm) Use moderate pressure to start the drill - don't let the drill 'walk'.

4. Open the small holes to 3/32" pressing gently on the drill to minimize gel coat chipping.

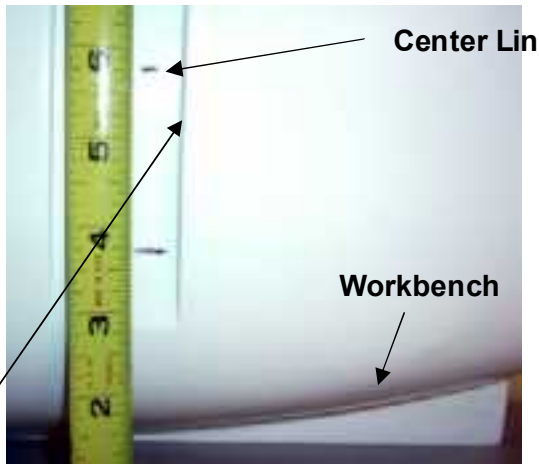
5. Open the larger holes to 5/16" pressing gently on the drill, or drill undersize and file to enlarge.

6. On the bottom edge of the wheel pants, grind/file away a portion of the lip directly opposite the axle hole so that you will be able to insert the wheel collar to assemble. (Don't go up the side.)

7. Assemble the wheel pant and axle to the landing gear by:
   - Inserting the axle through the gear from the inside, then
   - Into the wheel pant then

- Put a drop of medium CA, Loctite or nail polish on the threads & slip the nut over the axle (don't run the nut up, we're still poking things through here) then
- Into a 3" wheel . .
- . .and now you can tighten the nut to bring everything into position.

8. Insert the Allen key (#41) into the setscrew of a collar and place a collar on the end of the axle. Position so that the wheel can turn freely and tighten.



9. Turn the fuselage on its side on the workbench. Locate the center of the fuselage in the main gear mounting recess by measuring 5 ¾" up from the bench. Make a mark near the front edge. 'Eyeball this to make sure it is correct.
10. Measure between the mounting holes of the landing gear and locate the center of the landing gear between the holes
11. Place the landing gear into the recess, rear edge against the lip of the recess. (This will give you the most amount of room for nut clearance of the frame inside the fuselage.) Line up the centerline marks and mark the location of the mounting holes. Drill the holes 11/64 dia. (4.5mm)
12. Secure the landing gear using four 8-32 x 1" Socket Head screws (#10) and four locknuts and washers (#42). If clearance is a problem for the nut with the interior frame, reverse the installation and insert the bolts through the fuselage and place the nuts on the outside against the landing gear. (This is actually much easier to tighten as you can slip a 9/64" Allen wrench behind the frame.)

Install the Nose Wheel Gear and Fairing

1) Retrieve the 2 mm Allen Key and, to remove the nose gear axle, loosen the setscrews at the bottom of the brass pieces on the nose gear. Remove the axle and brass tube bushing.

2) Retrieve the nose gear wheel pant/fairing and position the bottom flush with the bottom of the nose gear. Be sure the fairing leg is vertical and not tilted. Mark the axle holes with a pencil.

3) Pilot drill 1/16 dia. and open to 5/32”

4) Retrieve the nose wheel and drill the center hole to 11/64” to fit the brass tube.

5) Slide the brass tube into the nose wheel and place a Nylon Spacer (#16) on each side of the wheel over the tube.

6) Place wheel pant/fairing between the gear legs and place the tube/wheel/spacer assemble inside the wheel pant in line with the axle hole. Insert the axle through a gear leg, through the wheel assembly and into the other leg.

7) Gently squeeze the gear legs together and tighten the axle set screws with Loctite or similar.

Throttle Servo and Pushrod Installation

The throttle is operated by a .067” (1.7mm) dia. pushrod wire. Installation will vary, particularly if you are installing a 4 cycle engine.

1) Retrieve your servo throttle (standard servo) and remove the servo arm. Retrieve and assemble the EZ Connector (#19) to the servo arm. Be sure to use a washer on the bottom side of the servo arm (even if you leave the top one off) and secure with Loctite or similar thread locker. Set aside. (This part rotates as the arm moves, so the nut must <u>not</u> be tight, but close and prevented from loosening.)

2) Install the servo with the mounting hardware supplied by the radio manufacturer. Position the servo with the output shaft oriented towards the centerline of the aircraft.

3) Retrieve the throttle pushrod (Approx 20” – 500mm) and remove the throttle arm from your engine. Insert the Z bend end of the pushrod into engine throttle arm from the ‘outside’ so that the pushrod gets the most clearance from the base of the engine.
   - Be sure the clearance is sufficient so that the pushrod cannot vibrate against the base of the engine.

4) Insert the opposite end into the passage hole in the firewall (previously drilled) and bend the pushrod as appropriate to clear the base of the engine, pass through the interior frames and line up with the throttle servo.

5) With the radio on, move the throttle stick to idle and turn off the radio, transmitter last. (Be sure to verify direction of travel required for your engine throttle operation and reverse the servo operation as necessary with your transmitter settings.)

6) Slide the connector/servo arm over the throttle wire and position the servo arm on the servo output splines so that the engine is at idle, and full travel with trim down will completely close the throttle. Replace the center servo arm screw. Snug the Allen screw in the top of the barrel that secures the pushrod wire. Test the entire installation with your radio on to be sure the throttle moves full travel and full down trim closes the throttle entirely. If you must err in one direction, slight over-travel when pushing the rod will spring the rod slightly, which is more acceptable than straining on the rod when pulling. Adjust throws by selecting appropriate servo arm and engine throttle arm holes. If you have a computer radio set the throw electronically.

Nose Wheel Steering Servo and Pushrod Installation

1) Retrieve a #19 EZ Connector and install in the servo arm, Loctite the knurled nut ½ turn loose so the barrel can rotate in the arm.

2) Plug in a 'Y' connector to the Rudder output of the receiver and temporarily connect one rudder servo (on a winglet) and the steering servo to the other leg of the 'Y'.
   - ❑ Check that the rudder servo is electrically centered, which will drive the steering servo to the centered position also. Switch the radio off, receiver first.

3) Secure the steering servo using the mounting hardware supplied by the radio manufacturer.

4) Slip the steering pushrod through the hole in the EZ connector/servo arm and mount the servo arm perpendicular to the pushrod. Install the servo arm center screw.

5) Set the nose wheel straight, the steering arm square, and secure the pushrod in the EZ Connector by tightening the setscrew.
   - ❑ Tighten the nut securing the nose wheel steering arm.

6) Test the operation of the nose wheel with the radio.

Completing the Radio Installation

In this section we secure the receiver, discuss the connections of the servos, install the switch/charging harness, and run the antenna. For labeling the wires we like to use masking tape folded around the wire to create a 'flag' and trimmed nicely square.

1) To complete the wiring of the servos you'll need the balance of the wire extensions and 'Y' connectors previously mentioned:
   - ○ (1) 6" Extension for the throttle servo

- (2) 12” Extensions for the steering and elevator servos
- (4) ‘Y’ connectors – (2) for Rudders/Steering, (1) Ailerons, (1) Elevators

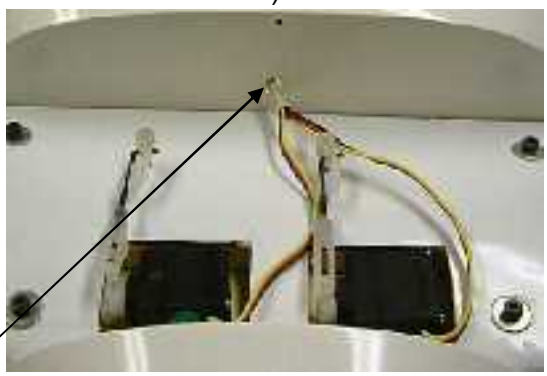
2) Plug-in the wires to the receiver outlets as follows:
   - Rudder outlet – a ‘Y’ connector. Label both ends ‘R’
   - Elevator outlet – a 12” extension. Label the servo end ‘E’
   - Throttle outlet – a 6” extension. Label the servo end ‘T’.
   - Aileron outlet – a ‘Y’ connector. Label both ends ‘A’.

3) Into one end of the Rudder ‘Y’, plug in another ‘Y’.

You will now have thee available ends into which servos will plug.
   - Two will receive the rudder extensions, (which will enter from the sides of the fuselage, aft of the cockpit, from the wings.) Label these ‘R’
   - In the remaining third end, plug in a 12” extension. Label the far end (S)teering.
     - Plug that free end into the steering servo.

4) Into the end of the Elevator 12” extension, plug a ‘Y’.
   - When the canard is installed the ‘Y’ will connect to the two servos mounted in the canard.

5) Into the Aileron ‘Y’ will plug the ends of the aileron extensions (Which will also enter the fuselage from the sides, aft of the cockpit along with the rudder wires.)



6) Plug the throttle servo into the 6” extension.

7) Temporarily install the canard using four 4-40 x 1” socket head bolts (#25). Drill/file a clearance hole in the fuselage above the trailing edge for the elevator servo wires to enter.

   - Look from the inside of the fuselage and you will see there is an open section in the frame. Place the hole in this area so as to not weaken the frame.
     a. You can make the hole oblong to allow the wire connectors to fit through.
     b. This hole will have a fairly sharp edge, from which you’ll want to protect the servo wires, possibly wrapping them in tape where they enter through the hole. You can tape them together if you stagger the ends, so your hole won’t need to be too large.

8) With the wings not yet on, plug in the elevators turn on the radio and make sure the elevators, throttle and steering all work properly. (Remember, elevators go down to make the plane go up!)

9) Wrap the receiver in foam and secure the foam with duct tape or equivalent. The receiver should be able to ‘float’ a little inside the foam.

10) Position and secure the receiver with tie wraps or Velcro[tm] (not supplied) in the position shown in the picture.

11) Route the receiver antenna. You have many choices here. We chose inside the fuselage, going aft and then forward along one side. We drilled a 5/64" hole in each of the frames and threaded the antenna through. To keep it from pulling back we like to use a clipped off servo arm 'buckle'.

12) Install the switch harness. We like positioning it on the starboard side of the model just aft of the leading edge and below the wing.

13) Use the battery mounting to assist with the weight and balance of the aircraft. As such, you will want to mount the battery as far forward as possible. You will be adding weight into the nose cone, so we recommend securing the battery in the area forward of the steering servo. You will want to wrap the battery in foam, and tape, again allowing 'float' for vibration isolation. You can secure the battery in your choice of location using Velcro, Tie-Wraps, adhesive backed wire tie anchors, etc. Just remember that it has a certain amount of mass, and you don't want it coming loose in the cockpit during your, no doubt perfectly coordinated, ball centered, aerobatic routines!

Canard Cover Fitting

1. Retrieve the canard cover and epoxy the latch arm covers (#32) in place. Be careful that you don't get epoxy into the latches or bond them to the canard cover!
   - You might try putting a piece of paper towel over the latch arm by poking the arm up through the towel before you put glue on the arm. When in place your can rip the towel away along with the overflow epoxy.

2. With the canard still in place from above, fit the canard cover in place. You will likely need to trim some of the balsa stiffener from the contoured edge to allow clearance for the heads of the canard mounting bolts. The cover should sit in place with the spring latches.
   - Placing the cover in approximate place and pressing down on the corners to leave an indent in the balsa is a convenient way to determine where clearance is needed.
   - On our model for this manual we found that the latch holes in the fuselage were not quite positioned properly to center the cover. You can safely slot the holes

horizontally to allow some side-to-side positioning or fill the existing hole with epoxy/flox and re-drill.

Fitting the Wings

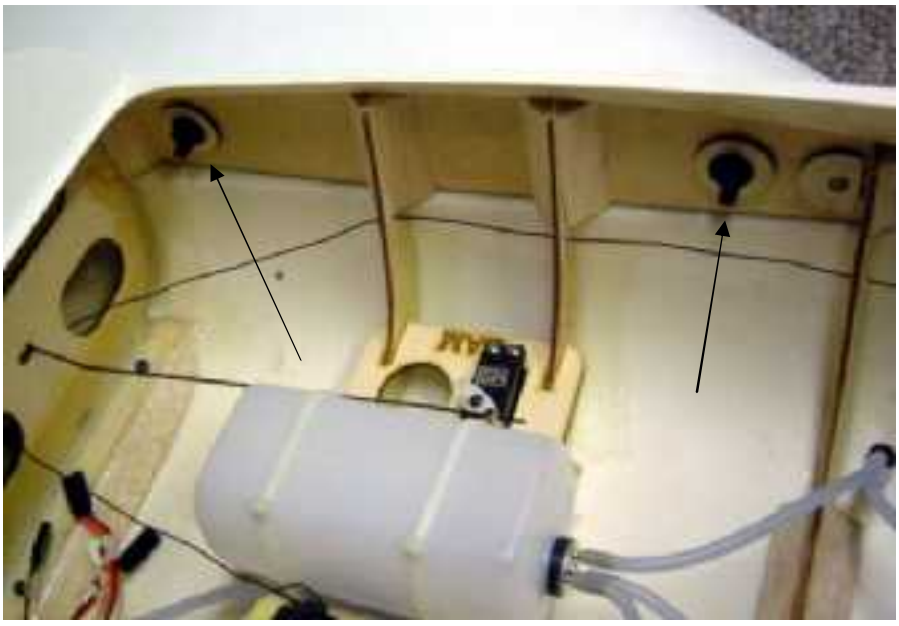
1. Test fit the wings by first test sliding the Aluminum Spar Carry-through (#20) into each wing. The fit should be very close, but smooth – not too tight as it will stress the wing every time you field assembly the model and have to manhandle the wing. Sand the tube evenly if necessary

2. Slide the spar carry-through into the fuselage and slide the wings into place, routing the servo wires into the cockpit area:

3. Observe the fit of the 'anti-rotation' dowels. If they are too tight carefully open the holes in the fuselage to fit. Do this carefully, do not make the holes any larger than needed to easily slip the wing in place. Creating a slot horizontally is more acceptable than a vertical opening. You want the dowels to prevent rotation of the wing around the aluminum carry-through, not have the nylon bolts to do that. Oversize holes in the vertical direction would allow rotation

4. Retrieve the four ¼-20 x 2" Nylon Finger Bolts. Measure from the base of the flange and cut them to 1" (25 mm). (An easy way to do this is to snip them with a pair of diagonal wire cutters – no thread clean-up will be needed.

5. Test fit the bolts into the wings through the sides of the fuselage into the holes provided. They will line up with blind nuts already installed in the wings. Snug the bolts gently and watch for opposite wing movement.



- The wings should pull-up right against the fuselage. If you tighten one wing, and the other has a gap near the back of the wing (or they both have a gap if you tightened them evenly) then the aluminum spar carry-through may be just a little to long. The cutting tolerance on this tube was designed to be on the 'plus' side to ensure proper seating of the tube at the ends inside the wing – where there is a plywood doubler surrounding the tube. Trim the length of the tube if necessary by an amount equal to the width of the gap.

Final Cowl Fitting

Verify that the cowl fits over your selected engine, and provide openings as necessary for glow plug ignition access, needle valve access and chosen muffler configuration.

We have supplied an additional air inlet (# 8) for engine cooling which is necessary for adequate lower cylinder engine cooling if you plan to fly the model. (Full scale Velocities also can be found with a variety inlet scoops.) We did not mold it in because engine installations can differ.

1) Carefully clean the cowl and molded PVC air scoop (#8) with warm soapy water to remove any mold release.

2) Trim around the base of the scoop leaving a 1/8" 'flange' around the bottom. It will be CA bonded later to sit against the surface of the cowl.
    a. Trim open the front of the inlet, leaving no lip in this area.
        i. A sanding board works well to do this, as well as smoothing the 1/8" trimmed portion around the outside edge.
        ii. Using the side of a razor knife to shave the edge of the part is a great way to also smooth the edge and remove any hanging-on excess from sanding.

3) Place the inlet against the cowl in the desired position and mark/trace around the outside of the scoop..
    a. If you're placing the inlet beneath the wing (to cool the lower half of the cylinder), place it as high as possible without interfering with the wing. You'll be cutting clearance for the muffler later and you don't want the scoop position interfering with muffler location.

4) Cut away an opening in the cowl, 3/16" inside your traced line. (No point in putting the scoop on if the air can't get into the cowl!)

5) With the cowl in place, position the inlet over the opening and verify fit. If OK, tape the inlet in place.

6) Remove the cowl and flow thin CA into the inlet/cowl joint. Remove the tape and where the bond did not take, use medium CA and hold the inlet edge in place until the CA sets (about 10 sec.)
    - The edge of the inlet may be filled with epoxy/micro balloons or lightweight body filler if you desire to fair it in before painting the cowl.

7) Trial fit the cowling to determine the location(s) where you may need to drill/file a hole for your glo plug ignition access, needle valve, carburetor, and cylinder head clearance as appropriate.
   - ❑ Drill/open the glo ignition hole undersize and file to final size (Typically about ½" dia.). Make the other openings in the cowl as you identified in step 6 above.

8) Remove the cowl and install your muffler. Refit the cowl and trim the cowl as necessary to allow room. In the picture we show the cut-out for a Bisson muffler as attached to the Webra 1.20 engine. Leave no more than 1/8" clearance along the sides of the muffler and at least 3/8" at the aft edge.

   - ❑ The gap at the trailing edge of the muffler helps to exhaust cooling air. As the air flows along the bottom of the fuselage it meets the flat bottom of the muffler, both cooling the muffler and then 'falling off' the sharp edge, creating a low-pressure area. (Similar to the function of a cowl flap.) Heat from the engine compartment is drawn out through this gap, as well as through the outlet holes at the back of cowl.

Canopy Installation, Painting and Trim

The top of the canopy is painted to complete the look of the Velocity cabin area. The canopy is masked and painted on the outside. (The butyrate the canopy is molded from is slightly tinted, so painting the inside will result and an 'off color' non-match.)
We have supplied computer cut window masks, which you can lay in place to simplify this step. Spray the back side of the mask pieces with soapy water to allow 'floating' them into place and let them dry. As mentioned previously we suggest using either Krylon 'Fusion' or Rustoleum plastic primer/paint. The Rustoleum covers well. Both will benefit from a clear top coat of Minwax clear Acrylic Urethane available at most hardware or home improvement stores.

1) Retrieve the formed canopy and trim the back edge 5/16" outside the molded score line. This is important that you 'go wide'. In the redesign of the cockpit we made it easy to access the interior of the model, but the canopy mold in this area was not changed. By cutting 'wide' you will match up the door line on the right side.

2) Pre-trim around the rest of the canopy 1/8" outside the score line.

3) Retrieve the cockpit cover and test fit onto the fuselage. The entire cockpit/canopy assembly is secured to the fuselage by inserting the two dowels at the rear of the cockpit cover into the holes in the bulkhead at the rear of the cockpit, and securing the front with the two remaining 4-40 x 1" socket head bolts (# 27).

4) Position the canopy over the cockpit cover in the best-centered position, aft end flush

with the aft end of the cockpit cover. Mark the canopy along the top edge of the fuselage at the sides, and cut the bottom edge of the canopy so it will just touch the fuselage when it is attached to the cockpit cover.

5) Note that at the windshield you will extend the side to meet with the score line for the base of the windshield. Cut along this score line – the windshield overhangs beyond the canopy cover to touch against the fuselage.

- When you paint the canopy you will have a band of color along the base of the windshield, which will hide the joint of the cockpit cover to the fuselage at the base of the windshield. Use the masks to cover the windows as shown in the picture.
- The front windscreen is divided into two halves (T)op and (B)ottom. They have slits to ease positioning. Be sure to apply masking tape over the joint between the two halves and the slits.

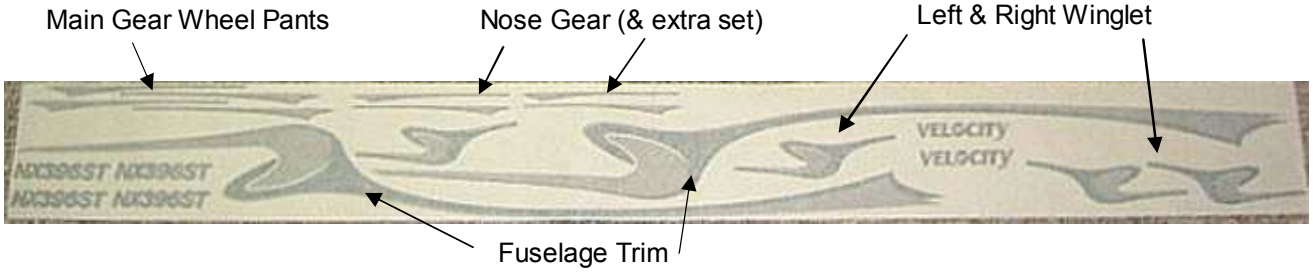
6) Finish the interior of the cockpit as desired.
- You may wish to consider painting the interior of the cockpit area with a 'stone' flec paint available at you local hardware store. This gives a nice finish to the interior. Follow-up by installing your choice of pilot figures. 1/5 scale give a good size.

7) Secure the the canopy to the cockpit cover with six 2.3 x 6 mm washer head screws. (#2)

Trim and Painting

Your model is covered with a premium quality polyester covering made in Germany known as Oracover. In the U.S. it is popularly known as Ultracoat$_{TM}$.

If you wish to paint the Oracovered portions of the model there is a 'best practice' technique for ensuring the best possible bond to the polyester film. Our recommendation is to visit the Top Flight Models web site and read/print their instructions for painting Monocote (a similar product). The address for their instructions is: http://www.monokote.com/lustrekote/painting-tips/topr7200tip1.html In a nutshell, the process is to scuff sand the film with 00 steel wool so that a mechanical bond can be made to the film. A primer may be applied and then the top coat. They recommend the use of their Lustrekote paints, which have been tested for adhesion and glo fuel resistance, but you can also use the paints and top coat discussed above.



If you are not modeling a specific aircraft, you may choose to finish off the model using the trim colors we have supplied. See the box picture and the pictures below. The model comes with sheets of vinyl trim, which transforms the model significantly! We have supplied the trim on 'carrier tape'.

- Cut around each decal to separate it from the rest.
- Peel away the bottom piece; the vinyl will stay attached to the carrier tape.
- Spray the sticky side with a mix of a few drops of dish soap in a bottle of spray water.
- Apply and slide the graphics into their desired position.
- Wait until the water dries (about an hour) and remove the paper carrier tape covering the graphic. If the graphic still peels up wait another 15 minutes, or heavily soak the backing paper.

Recommended Propeller Sizes

The aircraft requires a pusher prop. We recommend a three blade Windsor Propeller 'Airmaster 14 x 6 P' on a 1.20 size engine. The prop is available either through EAM or from Windsor Propeller directly. The maximum deck angle on departure is 17 degrees before a prop strike, so we suggest caution if your are using a larger engine and wish to use a larger prop.

Control Throws

We recommend the following control surface movement for the initial flights:

Rudders, measured at the bottom of the Rudder trailing edge, ½" to 5/8" (12 -16mm) in the only direction it will go.
Elevators, measured at the trailing edge at the tips, 3/8" (10 mm) up deflection, ¾" (19 mm) down deflection from centered
Ailerons, measured at the inboard end, each side of center: 3/4" (19mm).

Weight and Balance – **This is probably the most critical assembly step you do!**

Place the fully assembled model on a table or on the floor; nose touching and square to a wall. Double-check squareness by measuring an equal distance from the wall to each wing tip.

Measure back from the wall **26 ¼" (667 mm)** No exceptions on your first flights! - and place a mark on the leading edge/strakes where you can lift the model to verify balance. The model will require almost two pounds of lead in the nose.

- In our prototype models we opened the hatch up-front using a razor knife to repeatedly score the hatch lines until we cut through. We then loaded lead shot in baggies through the hatch and stuffed foam to hold in place. We then taped the hatch back in place.
- Alternatively, after verifying the amount of weight you need right at the tip of the nose, you can mix up a slurry of lead shot and epoxy and pour it into the nose cone by standing the model on its' nose and pouring in through the openings in the nose gear bulkhead.

Bench Pre-Flight

In case we didn't mention it before:

- Make sure all clevises have their silicone keeper rings or locks in place and as close to the servo or control arm as possible.
- Make sure all servos have their output arms held in place by the center screw
- Be sure the steering arm has been tightened
- Check that all control surfaces move freely
- Check that control surfaces are at the same relative angles – i.e. in line with the flying surface to which they are attached.
- Check that all control horns are firmly attached
- Check that all control surfaces are firmly hinged by tugging on them
- Put some fuel in the tank and make sure the plumbing is correct
- Check correct operation of control surfaces with your radio – that left is left, etc..
- Go have fun and enjoy safely!

Flying tips:

The full scale Velocity was designed as a high speed, efficient, four passenger cross country aircraft utilizing the inherent stall safety characteristics of a canard type stabilizer. What this means in terms of model flight is the following.

- Runway departure is longer than traditional aircraft, as the elevator needs to be at flying speed (27mph at 14 lbs) to begin to lift the nose off the runway. Don't force the nose off. Depart with just a little back-pressure on the stick and let it fly off. If you try and force it off the nose will come up, drop back down and come back up when it's ready.
- You'll find the model to be amazingly stable. Wing sweep acts like dihedral and those little rudders are incredibly effective due to the tremendous moment arm they have way out at the end of the wings.
- We recommended excess power in the form of the 1.20 size engine to assist with rapid speed build-up for departure, and to help the model up through loops.

UNDER NO CIRCUMSTANCES SHOULD YOU TRY AN ACCELERATED STALL WHERE THE ANGLE OF ATTACK WOULD STALL BOTH THE CANARD AND MAIN WING. IF YOU ARE HEADED UPWARD TO DO A LOOP KEEP THE POWER ON ALL THE WAY UP TO THE TOP. DO NOT DO ANY AEROBATIC MANEUVER THAT RESEMBLES A TRADITIONAL STALL (EG. HAMMERHEAD.) AS LONG AS YOU KEEP AIR MOVING OVER THE FLYING SURFACES YOU'LL HAVE A GREAT TIME. IF NOT, YOU CAN WITNESS THE CANARD EQIVALENT OF A FLAT SPIN CALLED A 'DEEP STALL' WHERE BOTH THE CANARD AND THE MAIN WING STOP FLYING. YOUR MODEL WILL BECOME A PARACHUTE AND GENTLY FLOAT TO THE GROUND – but not gently enough.

- IN LEVEL FLIGHT YOU CAN SLOW UP AND TRY A GENTLE STALL, and watch the famous 'Canard Bobbing' where the nose rises and falls as the Canard stalls and recovers.
- Landings should keep up speed as though you were doing a forced landing. As you rotate to land, just raise the nose slightly. Over rotating to flair can stall the canard and you'll bounce the nose wheel as the nose drops on to the ground. Basically just fly/glide the model on to the ground.

ENJOY this Awesome Model!