WAR WING Ultimate Combat Delta

Assembly Instructions

BEFORE YOU BEGIN: Thank you for purchasing this plan set. The plans contained in this set were created after extensive testing and design modifications and have resulted in an R/C airplane that is incredibly inexpensive and more fun than should be allowed by law. These plans took an enormous amount of time to create and are being offered at a very reasonable price so please respect the rights of the designer and adhere to the rules and laws regarding copyrighted materials. The information contained in this plan set including all diagrams and building photographs is the exclusive property of the designer. By purchasing these plans, you agree to use them for your personal use only. Copying, selling or distributing any or all of the information contained in this plan set in any way without the expressed written consent of the designer is strictly prohibited.

These plans were created with the assumption that the builder has had some experience with building R/C aircraft and installing power and control systems. Although we have attempted to be as precise and complete as possible, there may be assembly steps that require the builder to make decisions based on the power and control options that are installed. It is not recommended that changes in the basic design be made. To do so would be the builders' responsibility. This aircraft as with any R/C aircraft should be flown in a safe environment receptive to flying R/C aircraft. Due to the fact that we have no control over the construction or flying environment of any model produced from these plans, we will not be held liable in any way for any consequences arising from the building or flying of any model produced from these plans. Any model produced from these plans is to be considered "Experimental" in nature and handled accordingly.

The WAR WING Ultimate Combat Delta is a unique aircraft capable of incredible maneuvers. It is not recommended for beginners. It will however, offer very smooth and docile flying characteristics at low speeds and can be flown by any pilot that has mastered basic R/C flight. At full power it becomes an incredibly fun aircraft capable of unbelievable maneuvers. These maneuvers should be learned at sufficient altitudes and in a safe environment until mastered. Some of these maneuvers can be seen in the videos below.

This aircraft design is perfectly suited for R/C combat. It is extremely maneuverable but very stable and recovers very quickly. In the event of the unthinkable, a lost plane will cost you approximately $5.00. You can build four planes out of one sheet of foam as described below and after a crash, have a spare fuselage changed over in minutes ready for another round of combat. The Deltas are also very durable. The prototypes have survived prop strikes and mid air collisions with little or no damage. Ones that were damaged were easily repaired. There are scenes of the Deltas in combat action in the second video listed below.

http://www.youtube.com/user/xviper150#p/a/u/1/IjpDk5g_Xnk

http://www.youtube.com/user/xviper150#p/a/u/0/K14gUQYZr9I

LET'S BUILD ONE!

FUSELAGE

The fuselage is cut in two sections, horizontal wing section and vertical profile section. They are constructed from ½ inch blue Styrofoam insulation board that can be purchased at most home improvement stores. (FIG 1) If it is difficult to find in your area, you may order it online from Lowes and have it delivered to your local store. Order item# 42729 – Model# 263063. Cost as of this writing is $11.02 plus tax for a 4' X 8' sheet. This price may vary according to location. One sheet can easily provide four (4) complete Deltas at a cost of approximately $3.00 each. This is a link to the product: http://www.lowes.com/lowes/lkn?action=productDetail&productId=42729-236-263063&lpage=none. The board may be cut in half lengthwise to produce two 4' X 4' pieces making it easier to handle. Two (2) Deltas can be cut from each piece. (FIG 2) Construction is much easier if all cuts and assemblies are made before attaching the vertical fuse section to the wing section. It is much easier to measure, cut and attach the control surfaces and other assembly steps while they lay flat on the building surface. Use the building sequence below for the best results and ease of assembly. Be sure to make all cuts and to assemble the Delta on a FLAT surface. Any warps or twists in either main fuselage section will result in undesirable flight characteristics. Note: the foam board listed above is covered with an ultra thin plastic sheeting on both sides. While it is not necessary to remove it from the entire board, it is necessary to remove it in all areas where components will be glued. It will most likely be necessary to remove all of the plastic if the delta is to be painted or otherwise covered. The original delta was not covered/painted and the plastic was removed regardless. It is recommended however, that the film be left on the board while measuring and cutting the parts. Using a ball point pen or fine marking pen, make all cut lines on the side containing the manufacturers printing and cut all pieces before removing the plastic film. Cutting the foam can be accomplished by various methods. The prototypes were cut using a 48" aluminum carpenter's level which provided a squared surface to slide the cutting blade on resulting in a reasonably squared edge. (FIG 3) This was accomplished using a special blade from the food industry but a segmented "snap and cut" type blade should work. Use the edge of the level to keep the blade squared at 90deg and use multiple passes to make the cut. This is not expanded bead "cooler" type foam and cuts much easier by using multiple shallow passes instead of trying to cut in one pass. Wire type foam cutters could be used but would most likely make shaping the leading edges more difficult. Whatever method you choose to cut the parts, please remember to work safely and take appropriate measures when working with sharp blades or heat type cutters.

Tests were made with various chemicals to remove the remaining ink after removing the plastic film. Denatured alcohol appears to work best to remove most of the ink without damaging the foam. If you experiment with other chemicals, test on a piece of scrap foam first and of course be sure to use all chemicals in a safe environment with adequate ventilation and free from ignition sources. It may not be

possible to remove all traces of the manufacturers markings but remember that this is a very economical aircraft designed to be cheap, easy to build and incredibly fun to fly!

POWER/CONTROL SYSTEM

The prototype delta is powered by a BP Hobbies A2814-6 brushless out runner motor (described by BP as equivalent to an Eflite Park 480) http://www.bphobbies.com/view.asp?id=V450327&pid=B1898545 with an APC 10X5E composite propeller using a 3S 11.1V lipo battery. The ESC is 35 amp. Overall flying weight including a TP 2250mah 30C Pro Power battery is 30 ounces. The receiver is a standard size 72mhz FM type and the three servos are standard size Futaba S148 or equivalent. Mini servos may work with good results but micro size servos are not recommended. With this gear installed, the delta is capable of vertical launch from the ground. We have set it on the tail and applied power for a true vertical takeoff. (See videos linked above) It has plenty of speed and excellent vertical performance. Using smaller and lighter gear may increase performance but is not necessary.

CONSTRUCTION

Wing Section:

1. Cut out the wing section according to the measurements shown on the plans. (FIG 4) Draw a centerline from nose to tail on the wing before cutting it out. Do not discard the excess foam pieces. They will be used to create the 3" X 3" firewall support pieces (FIG 5) and the bottom skid. (FIG 31)
2. Mark and cut out the four ½" X 2" mounting tab slots from the wing center. (FIG 6&7) Make the cuts as straight and square as possible as these will accept the alignment tabs from the vertical fuse section. Try not to "overcut" the corners as this may weaken the joint. An Xacto #11 or similar blade should work well to make these cuts. Again, use multiple passes to make the cuts.

Note: At this time, remove the plastic film from all fuselage and control surface pieces. Also, this would be a good time to remove the manufacturer's markings if desired. Complete these steps before gluing any parts or servo mounting tabs. Finally, shape the leading edges of the wing and vertical fuse sections. A rounded cross section is the most desirable. Take care to place the parts on a smooth surface when sanding. If this is done on plywood or other rough surface, any imperfection in the building surface will transfer to the foam especially if the foam is allowed to move. It is suggested that these edges be covered with packing tape or other means to prevent damage from landings and to avoid "hanger rash" when handling.

3. Mark and remove the elevons from the wing section. (FIG 8) Be very careful not to "overcut" the corners on these cuts. Instead, make the main cut just short of the corner and then use the blade following this cut to finish. (FIG 9) Make sure to keep

each elevon in the same position that it was cut from. This can normally be accomplished by matching up the manufacturers markings.

4. Remove approximately 1/8" inch from **one** end and 1/8" lengthwise from each elevon for clearance. (Note: This step is important if you intend to perform vertical takeoffs. The clearance will allow the elevons to function during the takeoff maneuver as described in the "Flying" section)Remove the lengthwise material from the trailing edge which should be the manufactured end and normally has minor dings from handling. It is very important to make several light cuts with the blade here or the edge of the foam will distort the blade resulting in an uneven and unpleasant looking trailing edge.
5. Bevel the leading edge of each elevon 45 degrees and attach to the wing section. (FIG 10) These were attached on the original using a good quality packing tape. A strip was applied to the top surface, (FIG 11) then the elevon was folded over and a second strip applied to the bottom. (FIG 12&13) A third strip was then applied again to the top. This created a very strong yet flexible hinge that has never failed to date. (FIG 14)
6. Cut out the area for the elevon servos and epoxy basswood servo mounting tabs to the top side of the wing section. While there really isn't a top or bottom until assembled, the Delta is more appealing if the side with the remaining manufacturers marking is placed on the bottom. (The servo mounting tabs are shown on the bottom view on the plans for reference only) The servo size and locations shown in the plan are for reference only. Your cut out areas will be sized according to the servos that will be installed. The servos were located as close as possible to the center line of the fuselage to reduce the effect of the servos during rolls and other maneuvers. This also served to make the receiver installation easier as no extension wires were necessary. The foam elevons appear to be stiff enough to locate the control rods near the inboard end as show in the assembly photos without distorting in flight. There is no need to locate them near the center of the control surface which would require the servos to be moved further outboard. This setup has worked very well on all of the prototypes.
7. Attach the fiberglass reinforced packing tape to the top and bottom of wing section at this time.

Vertical Fuse Section:

1. Cut out the fuse top section according to the measurements shown on the plans. (FIG 4)
2. Cut and remove the areas at the bottom to create the ½"H X 2"W mounting tabs. (FIG 15&16) They are colored on the plans only for clarity and are cut after the fuse section is removed from the foam board. Make sure that the material around the tabs are removed and not the tabs themselves. These tabs provide alignment during

assembly as well as strength for the wing section. It is advised that these tabs be used as described. No additional means of reinforcement to the wing/fuse joint is necessary using this method.

3. Cut out sections for the battery and receiver. The areas on the plans were according to the original delta using a 3S 2250mah lipo battery and a standard size 72mhz receiver. These sections may be adjusted for your flight system.
   Note: While it is recommended that the receiver be installed as shown for protection, prototypes have been constructed without the cutout area for the battery and instead, the battery was secured to the right side of the vertical fuselage section. Both methods have worked satisfactorily. Whichever method is chosen, be sure to use a retaining strap such as the hook and loop type strap shown in FIG 33 and 35 to keep the battery in place. <u>DO NOT rely solely on hook and loop type fasteners attached to the fuselage to secure the battery.</u> The roll rate and violent maneuvers this aircraft is capable of doing will almost certainly cause the battery to depart from the plane if no physical means to secure it are used.
4. Remove the rudder from the vertical fuse section. (FIG 17)
5. Remove approximately 1/8" from **<u>one</u>** end and 1/8" lengthwise from the rudder for clearance.
6. Bevel the leading edge of the rudder and attach to the fuse section. (FIG 10&18)These were attached on the original using a good quality packing tape as described in the wing section assembly notes.
7. Cut out the area for the rudder servo and epoxy basswood servo mounting tabs. The servo size and locations shown in the plan are for reference only. Your cut out areas will be according to the servos that will be installed. Standard size servos were used on the original. Be sure to remove any "hinge" tape from an area where mounting tabs will be glued.
8. Epoxy basswood servo horn mounting plates to the control surfaces according to the location of the servos installed. Install control horns. Remove any "hinge" tape from the area to be epoxied.

Assembly:

1. Dry fit the fuselage sections ensuring that the alignment tabs fit properly. (FIG19)
2. Epoxy the vertical fuselage section to the bottom wing section using the tabs for alignment. (FIG 20) Be sure to align the fuse section at 90 degrees to the wing section. Mark the area where the receiver will mount corresponding to the cut out made earlier on the vertical fuse section and do not apply glue to that area.
3. Cut and install bottom skid piece under wing section. (FIG 21) While no alignment devices were designed for the skid, try to mount it as straight and as perpendicular to the fuse bottom as possible.

4. Form and epoxy the motor mount to the front of the plane. (FIG 22-26) First, dry fit to ensure that the mount is squared to the fuselage vertically and horizontally. Carefully remove material from the nose sections until a square and level mounting surface is achieved. No offset thrust was used on any of the prototypes. Mark vertical and horizontal centerlines on the mount. (This should be done when marking out the cut lines for the mount) Align the center lines to the center of the wing and vertical fuse sections as shown in the plan. Note: It is not uncommon to attach the bottom skid in less than perfect alignment. Align the motor mount using the vertical fuselage section for alignment purposes. Reinforce the top and bottom of the mount with 3" X 3" foam stock as shown on the plan. Bevel the corners wherever epoxy is present so that the foam sits squarely against the fuselage. (FIG 27) Remove any leading edge tape where the brace will mount. Remove any plastic film covering from the braces. Epoxy the braces and trim. Shape as desired to blend with the fuselage. (FIG 28) A medium or fine grit "sponge" type sanding block found at most hardware and home improvement stores works very well for shaping the foam without removing too much material or removing "chunks" of foam as with sandpaper. (FIG 29) Add epoxy to the cavities between the motor mount and braces to provide added strength. (FIG 30&31)
5. Figure 32 shows a completed fuselage ready for installation of the power and control systems.
6. The remaining assembly includes installing the power system, radio system and control linkages. These items will vary according to the type of equipment used and the remaining procedures will be left to the builder. The balance point shown on the plan is approximate and was determined using the equipment listed. This position has proven to work well but if you choose to experiment with the CG to suit your flying abilities, please make minor changes until the position that you are comfortable with is reached. Figures 33-36 show the power and control system installed on a prototype.

FLYING

When all components have been installed and the Delta is ready to fly the following guidelines are recommended.

1. Dual rates are recommended. Use low rates for taking off. Performing a takeoff with high rates has at times caused excitement to some spectators. You are advised to use low rates during launch. Use high rates for maximum performance and for landing. High rates are recommended for landing to allow for the slowest and most controlled landing. It is not necessary to make a speedy approach and flare such as with a typical R/C plane. Instead, approach the landing area

at low level with minimum speed, cut the throttle and input full up elevator just before touching town which should produce a high angle flare and allow the Delta to set down tail first and flop on the nose. This method has saved many propellers.

2. Set low rates so that the edges of the control surfaces are even with the opposite fuselage surface. Example: set the bottom of elevon even with top of wing. This setting should produce very controllable and docile flight characteristics.
3. Set high rates as desired. The prototypes were set for maximum throw with very desirable results. For ***highly experienced pilots*** – more is better. You can always program in expo if necessary.
4. The Delta can easily be hand launched by holding the top of the vertical fuse or the lower skid. It does not need to be **thrown.** Simply let it fly out of your hand. (assuming that the recommended power system or equivalent was installed) If performing a vertical takeoff, a small bit of down elevator will usually be necessary as it has a slight tendency to loop upon leaving the ground. You can input a very small amount of down elevator before lifting off if desired. Try this first in a safe environment free of onlookers. If it becomes uncontrollable, simply cut the throttle and regain control. It will recover very easily and resume flight with minimum power. Again, use low rates for vertical takeoff maneuvers as well as hand launches.
5. The prototypes have been subjected to incredible maneuvers. The Delta will perform loops almost within its own length. It rolls very fast on high rates with just a touch of a wobble and adding opposite rudder seems to smooth out the roll even more. The more it is flown, the more you will discover the crazy maneuvers it will do. Some of these can be seen in the video referenced above. One maneuver I like to perform is to make a high speed low pass and at mid field, cut the throttle and input full up elevator causing it to come to a complete halt (yes just like Maverick in Top Gun) and then give it full throttle putting it into a tight loop. After a few revolutions I speed away and continue the high speed pass. The Delta will achieve a noticeable top speed and climb out of sight vertically very quickly. It will also hover with almost no wind and is very docile and stable when flown at low speeds. The flight characteristics are only limited by your imagination. Feel free to experiment as the Delta will, if built as indicated, take almost any abuse that you can give it. None have been lost due to structural failure except prototype number one which was built very differently and served to discover weaknesses that were redesigned resulting in the current model. If you have any questions, comments or suggestions, please feel free to contact us. Fly safe and HAVE FUN!!