PARTENAVIA P-68 VICTOR
BY IVAN PETTIGREW
CONSTRUCTION NOTES

This model of the Partenavia is intended to be a suitable project for scratch builders who are making their first model of a multi engine plane. With the box type construction of the fuselage, and rectangular wing, it builds up very fast. It is smaller than most electric twins, so is very easy to transport, and just having one nine cell battery to charge makes for real convenience. It uses the same power set up as the Short Sealand flying boat that preceeded it. It has been found that two Magnetic Mayhem motors wired parallel, running at low power off a nine cell battery pack, give great performance and flight duration. The battery should be an SCR of 1700 mAh capacity or greater. The 22 turn Magnetic Mayhems are not considered to be powerful motors, but when run from nine cells at less than 20 amps, they are extremely efficient. This is partly because the armature and can are a little longer than those used in standard car motors. With 3:1 gearbox reduction, they should turn the 11x7 APC-E props at 6,000 RPM static with each motor drawing 16 amps, making for a total current of 32 amps from the battery. If using the single reduction gearbox like that available from Master Airscrew, it is important to use the version of the Magnetic Mayhem motor that is timed for reverse rotation.

FUSELAGE

The fuselage is a simple framed up box. First build the two sides of the fuselage over the plan, and join together. The top cover of the fuselage from the nose block to rear of the cockpit is removable, giving access to the battery and nose wheel steering assembly. Because the wing of a multi is carrying the weight of the motors, the cabin area of the fuselage needs to be reinforced to carry the stresses of a heavy landing. Let's not say the word "crash." For this purpose there are some doublers under the wing cradle and gussets in the area of the wing mount and main undercarriage mounting.

TAIL SECTIONS

These are of conventional construction. Notice that the spar (post) for the fin goes down to a cross piece glued to the sheet covering on the top of the stab centre section. This adds strength to the mounting of the fin. Before starting construction of the tail surfaces, it is best to make all of the spars and hinge them carefully. The tail surfaces have a symmetrical airfoil surface. This type of construction adds depth to the spar which makes for more strength, meaning that the tail surface can be built lighter than if a flat surface was built. It also resists warping better than a flat surface and makes for smoother flying. Lightweight nyrods are used for the rudder and elevator and should be braced at two or three stations along the fuselage to prevent "bowing" under load.

WING CONSTRUCTION

The wing is built in one piece. The basic airfoil is a Selig 7055. The wing construction is different from the usual, but is extremely strong for its weight. A full depth sheet balsa spar is continuous throughout the wing   The ribs are cut into two pieces where they meet the main spar, and are butted to the front and rear surfaces of the spar. First cut the main spar from 3/32 inch sheet balsa and splice the pieces together over the plan so that the dihedral angle is correct. Now glue the hardwood strips to the top and bottom edges of the spar as indicated. These strips should be bass or spruce.

Cut all the ribs in two at the point where they join the spar. Assemble one half of the wing section with the spar of the other half propped up. It is best to start by attaching the rear half of each rib, then the trailing edge and secondary spars including the one used to hinge the aileron. The ailerons may be cut out and hinged later. Next glue the front section of each rib to the front face of the spar. Notice that the leading edge consists of two strips, the inner one of 1/8" sheet balsa, and the outer one of 3/16" balsa. Only the first (inner) strip should be applied at this time. Sheeting is now applied to the lower surface of the wing from the leading edge to the main spar. At this point the motor wiring should be installed running along the wing midway between the leading edge and spar. No 16 gauge wire was used in the prototype. It will be noted at this point that the wing is still not torsionally strong, meaning that it can easily be twisted. After the sheeting is applied to the upper surface from the LE to the spar, the wing will be very rigid and difficult to twist. Hence it is very important when applying the sheeting to the upper surface, to weight the wing down on a surface that is perfectly flat. There should be no washout in the inner section of the wing, so it should be perfectly flat out to the point where the ailerons begin. From this point to the tip there should be 1/4" washout. When the wing is weighted down with this amount of washout at the tip, the sheeting is applied to the upper surface of the wing.   The remaining strip of 3/16 sheet balsa that forms the outer part of the leading edge is now glued to the one in place and contoured to shape. Finally sheeting is added to the centre section and areas where the engine nacelles will join the wing. Because of the construction of the wing, it will be difficult to correct any warps in the wing after it is covered. Check the washout very carefully at this point, and if the wing is not true, it can be re-set by soaking the sheet covering in the area that has to be corrected, and weighting the wing down again with a correction made for the twist. A true wing is the secret to a good flying model, and extra time should be taken at this point rather that after it is covered. It should still be checked after covering of course, but don't wait until the wing is covered to correct a twist that developed in the construction.

The engine mounts are built by first gluing the hardwood motor mounts in place, securing them firmly to the strips glued under the leading edge of the wing, and bottom surface of the main spar. Next the sides of the engine nacelles are cut from 3/32" balsa and glued in place. The top covering of the nacelles is made of 1/16" sheet and is now glued in place with the grain running cross ways. The bottom covering is similar, but can be left until after the motors are mounted. Notice that a section is left open at the back of the lower nacelle to allow for cooling air to exit. The nose block is glued to the front of the nacelles. Access to the motors is from below. A hatch can be made, or a section left open for motor removal.

CONTROL THROWS
The control throws shown on the plan provide for a good rate of roll. For flyers not intending to do aerobatics, the aileron throw could be reduced.

In multi motor electric models, there is an increased risk of problems with radio interference from motor brush noise and also the increased length of wiring used for the motors. While it is always recommended to put a Schotky diode across the terminals of each motor when they are wired in series, it is not so critical in this application where the motors are wired parallel. The normal capacitors should of course be used across the motor terminals, whether or not Schotky diodes are used. The wires carrying current to the motor should be kept touching each other, and twisted about one turn to the inch. The radio and servos should be kept as far as possible from the motors and motor wiring, but this is taken care of with the layout shown in the plans. Servo leads must be kept short. Do not use outboard servos for the ailerons. These would require long leads running along the wing parallel to the motor wiring, and they would be very prone to picking up interference. At the low airspeed of this model, one standard servo is ample to operate the ailerons.

Most film coverings are suitable for this model. Low temperature films are light and easy to work with. The heavy fabric type coverings ending in "…tex" have not been found to be so suitable for lightweight electric models.

The model does very good loops, rolls and Cuban eights etc. Be sure to secure the battery well before trying inverted flight or eight point rolls. It will do spins, but takes a full turn for the spin to fully develop. There is no tendency for the model to tip stall, so in this regard it is a very safe flyer.

Summary
Partenavia P-68 Victor. May 2004 Scale 1:6.6 Span 70 in. Wing area 730 sq in. Length 56½ in. Airfoil, Selig 7055. Weight with nine N1900 SCR nicads, 77 ounces. Wing loading, 15.2 oz/sq.ft. Two Magnetic Mayhem 22 turn motors, reverse timing, wired parallel, with Master Airscrew 3:1 ratio gear boxes turning 11 x 7 APC-E props. Static thrust 52 ounces drawing 32 amps, 16 amps to each motor. Basic entry level twin, very easy to build, with good flight characteristics and quite aerobatic. Performs extremely well at lighter wing loading with Sanyo CP-1700 SCR nicads. Flies for 15 minutes with 3000 NiMH cells. The motors are running at maximum efficiency with this relatively low power, so are far below what they are capable of producing. This makes for long motor life. In view of this, the motors can be operated on 10 cells for enhanced performance, but watch the limitations set by the BEC, if used, for the number of servos that are allowed.

Enjoy building and flying your Partenavia

Ivan Pettigrew www.ivansplans.com

September 2005 update. As of mid 2005, the Kyosho Magnetic Mayhem motors are no longer available in most countries. Other racing car or buggy motors of 23 turns give an almost similar performance. The Peak Racing 23 turn Jaguar is a possibility. It has ball bearings and adjustable timing, so can be timed for reverse rotation. If motors of less winds are used, the gear ratio will have to be increased or the prop size decreased. Both of these changes have their disadvantages since gearboxes of higher ratios are more expensive and smaller props are less efficient.

In the Multi motor models that use the Magnetic Mayhem motors in parallel, it has been found that the Jamara Pro 480 HS BB and Permax 7.2 volt Speed 480 motors can give the same performance as when using the Magnetic Mayhem motors. The weight saving with these motors is considerable, and reduces the landing speed quite a bit. These Speed 480 motors are sometimes referred to as "long can speed 400" motors, and are not to be confused with the Graupner series of Speed 480 motors which have a different configuration and thicker shaft, apart from being quite a bit more expensive.

Because the diameter of the motor can and the shaft thickness of the Jamara 480 and Permax 480 motors are the same as for Speed 400 motors, they use a Speed 400 gearbox. It is claimed by some that these Speed 480 motors can be run up to 170 watts input. In the applications given for the Sealand 480 and Albatross, the input is closer to 125 watts which is a conservative figure that results in better efficiency and longer motor life. The Permax motor has more turns than the Jamara, but of thinner wire. Hence if maximizing the performance, the Permax could be run on more cells than the Jamara, but the Jamara with its winding of thicker wire can take more amps. The efficiency of the Jamara motor is higher than that of the Permax. If a higher ratio gear box is available, the Jamara performance could be improved by using a larger prop, up to 12x8 in size. The Jamara motors are available from John Swain of www.fanfare.f9.co.uk at Eight Pound each. He sends overseas orders by airmail at a reasonable cost, and can supply the MP-Jet gearboxes and 3mm "long shaft" prop adaptors that are necessary with these gearboxes. Multiplex Permax 7.2 volt Speed 480 motors are available in the USA from Tower Hobbies for $9.50.

Any model listed as suitable for nine cells can be upgraded to the use of Li-Poly battery packs with "three series" combinations. The weight saving will enhance the performance of the model considerably.

With the price of brushless motors and controllers coming down all the time, it is getting more reasonable to think of using these in Multi motor models, but remember that a separate controller should be used for each motor. Try to use the same size props as used in the model previously, and choose a motor/gearbox combination that will turn the props at about the same speed as when used with the brushed motors. Some of the cheaper brushless motors are not that much more efficient than brushed motors that are used with the right loading, so don't expect wonders. My personal feeling is that for the dollar spent, the biggest improvement in performance is achieved by first going with Li-Poly batteries.