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L I ' L T O A D

A FASCINATING, HIGHLY MANEUVERABLE THIRTY INCH SPAN DELTA ESPECIALLY DESIGNED FOR A SINGLE PULSE PROPORTIONAL ACTUATOR AND .10 TO .15 ENGINES.

BY BOB BENSON AND BOB REUTHER.

The July issue of R/C MODELER MAGAZINE described some of the problems which a beginner faces in using pulse proportional equipment for the control of model aircraft. Typical aircraft chosen by the beginner are relatively stable which allows the beginner to develop confidence as a pilot. Soon after gaining confidence there is always the challenge to experiment with more maneuverable aircraft. An example of what can be done was discussed in the December issue of R/C Modeler which described the use of single actuator and double actuator installations in the Top Dawg airplane. The performance of such an airplane using ailerons and elevator is a challenge even to the highly skilled flyer.

All hobbyists are faced with the cost of upgrading their equipment to the best available performance after they have mastered the fundamentals of their hobby. This is the third in a series of articles which shows the versatility that can challenge the model airplane enthusiast with a minimal investment in equipment. The Super Sport transmitter and receiver is the first pulse proportional system designed to provide equipment which satisfied the needs of the beginner and is yet useful for controlling highly maneuverable aircraft. The equipment incorporates a wide range of pulse rates and widths that are adjustable to all actuator systems working on these principles. The improved performance of the fast pulse rate actuator systems is gratifying to the beginner after mastering flying with the slower pulse rates. The selection of aircraft which is capable of carrying the added weight of double actuators allows for performance such as was achieved in the Top Dawg. This article is concerned

with a fascinating aircraft especially designed for a single actuator unit operating at the slow pulse rate.

The single actuator is a mechanical decoder which responds to two aspects of the radio signal with little interaction of one control on the other. It is reasonable to design a highly maneuverable aircraft around a single control element compatible with the single actuator concept. It features gratifying performance under control of elevons which proved directly compatible with the mechanical action of a single actuator.

Almost everyone is fascinated with the high performance and flight characteristics of the Delta-design aircraft which have emerged over the past few years. The present aircraft is a simple Delta configuration having a wing span of thirty inches. The plans illustrate the simplicity of construction where the basic design is a symmetrical airfoil in the shape of a Delta.

In order to stabilize the Delta wing, two vertical fins are placed on the top of the wing and two additional fins on the bottom of the wing. The bottom fins also serve as skids for the aircraft on the ground. A single fixed wheel is mounted on the front of the aircraft to guide the airplane on take-off.

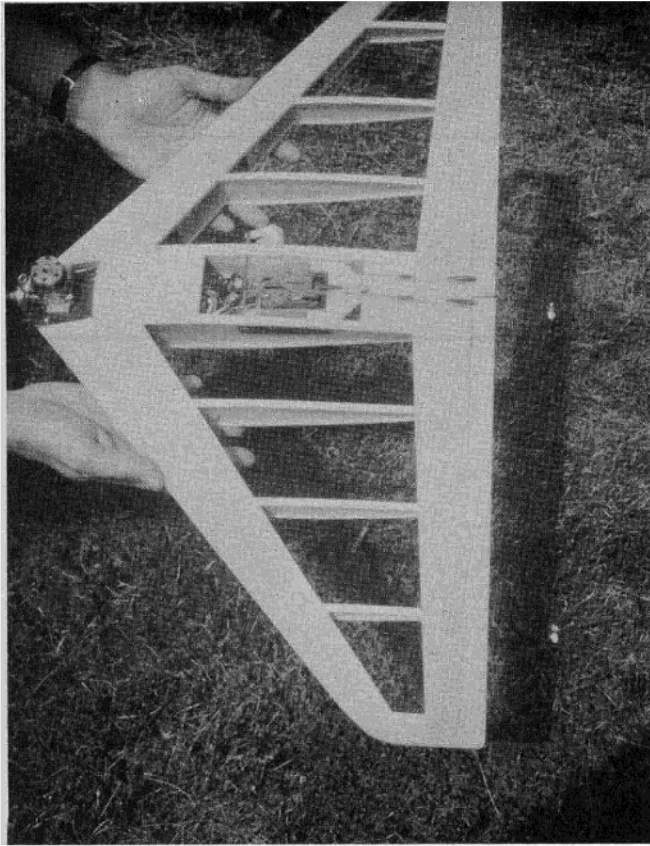
The central compartment of the wing section is designed to contain the engine, the fuel tank, the receiver and battery pack and the actuator. The actuator mount is unconventional in the sense that a special plate is used that is free to move forward and backward in slotted hardwood rail mounts. The take-off, which is normally used for elevator motion, is rigidly anchored to the airplane frame. The resulting motion of the actuator is a back and forth

motion at the normal pulse rate with the rudder action superimposed on the top plate of the actuator.

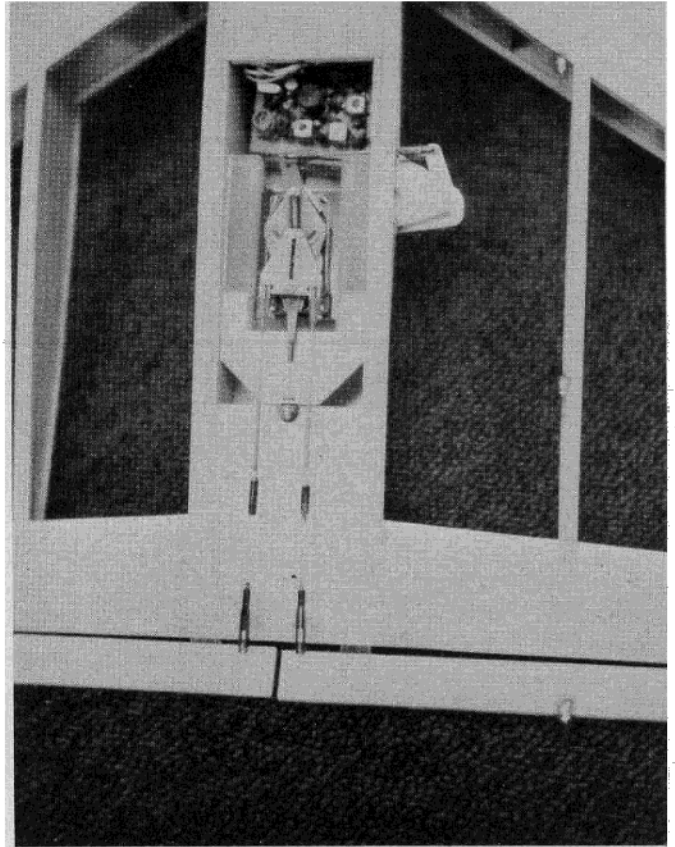
Strip elevons extend across the entire rear of the wing and are connected to the two sides of the rudder take-off by horns mounted on the top of the elevons. In normal pulse proportional systems the actuator is fixed and the pushrods must come underneath the elevator in order that the airplane will fail-safe into up-elevator rather than down. In the present case, since the actuator is free to move, the elevons are connected from the top so that the aircraft will again fail-safe up rather than down. The elevons follow the same motion as the rudder take-off on the actuator which results in both up and down and right and left with single control surfaces.

After finishing the model sufficient suspense was created and considerable comments were available concerning its probable flight characteristics. As those of you who have designed your own conventional models know, there is always some concern about the major question, "will it fly?" Our chief test pilot, Bob Reuther, had the utmost confidence in his design and assured us of success. His caution at the flying field gave some doubt as to the AMOUNT of confidence but, nevertheless, his confidence was rewarded.

The airplane was powered by a .15 engine and the all up weight ready for take-off was just under one-and-one-half pounds. If this seems to be over-powered, it is! The speed is comparable to most 60 powered pattern ships. Prospective builders should not let the speed scare them off because the ship is super stable and groovy with deadstick landings a breeze.



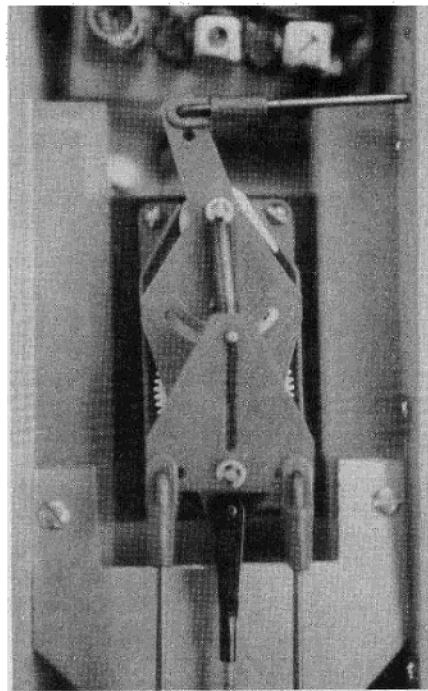
The author holding the quickly built, simple delta framework. Note radio compartment with Bonitron receiver and single Rand LR-3 actuator.



A closer look at the actuator compartment. LR-3 elevator take-off, fastened to framework, allows actuator to move back and forth.

For the first flight the elevons were mechanically set for considerable down trim since the worst thing in flying a new airplane of any sort is to have too much up-stall on take-off and crash. The conservative method is to have too much down and fail to get airborne. This was our course since we really wanted the airplane to fly. On the first attempted take-off, the aircraft skidded approximately fifteen feet with no indication of getting airborne. The mechanical linkages were reset by three to four turns of the linkages on four successive attempted take-offs. On the fifth adjustment, some fifteen turns on the mechanical linkages, Lil' Toad was airborne for about fifty yards. Since Bob was holding almost full-up he decided to let the aircraft settle back to the ground.

Three more turns on the mechanical linkage to compensate for the lack of up motion and the Delta became airborne. By this time he had used most of a tank of fuel but was able to fly for a period of approximately two minutes. It was still necessary to hold about one-half up so that the control surfaces had considerable motion and the aircraft gently rocked about its roll axis at the slow pulse rate. Right and left turns were



Close-up of Rand actuator. Note metal Kwik-Link in foreground. This is fastened to delta framework, allowing actuator to slide. Throttle linkage at top of photo.

accomplished easily and up and down motion appeared sufficiently sensitive. When the fuel ran out the airplane gently settled back and gracefully landed for the completion of our first successful flight.

Having gained confidence, the elevons were trimmed three more turns of up so that the pulse rate could be increased for neutral flight. The take-off was accomplished routinely in about one hundred feet and Lil' Toad climbed like a large jet aircraft at an angle of about 45°. Her performance was truly astonishing, executing turns, climbing and diving like the best Delta designed aircraft. Attempts at performing rolls were somewhat disappointing in the fact that the aircraft lost considerable altitude when upside down. More work with the adjustment of the neutral position of the elevons should correct this maneuver. The speed and handling characteristics of the design were sufficient reward for this challenging application of a single actuator pulse proportional system.

Lil' Toad has proven to be one more application in the pulse proportional field which justifies our choice of the name SUPER SPORT.