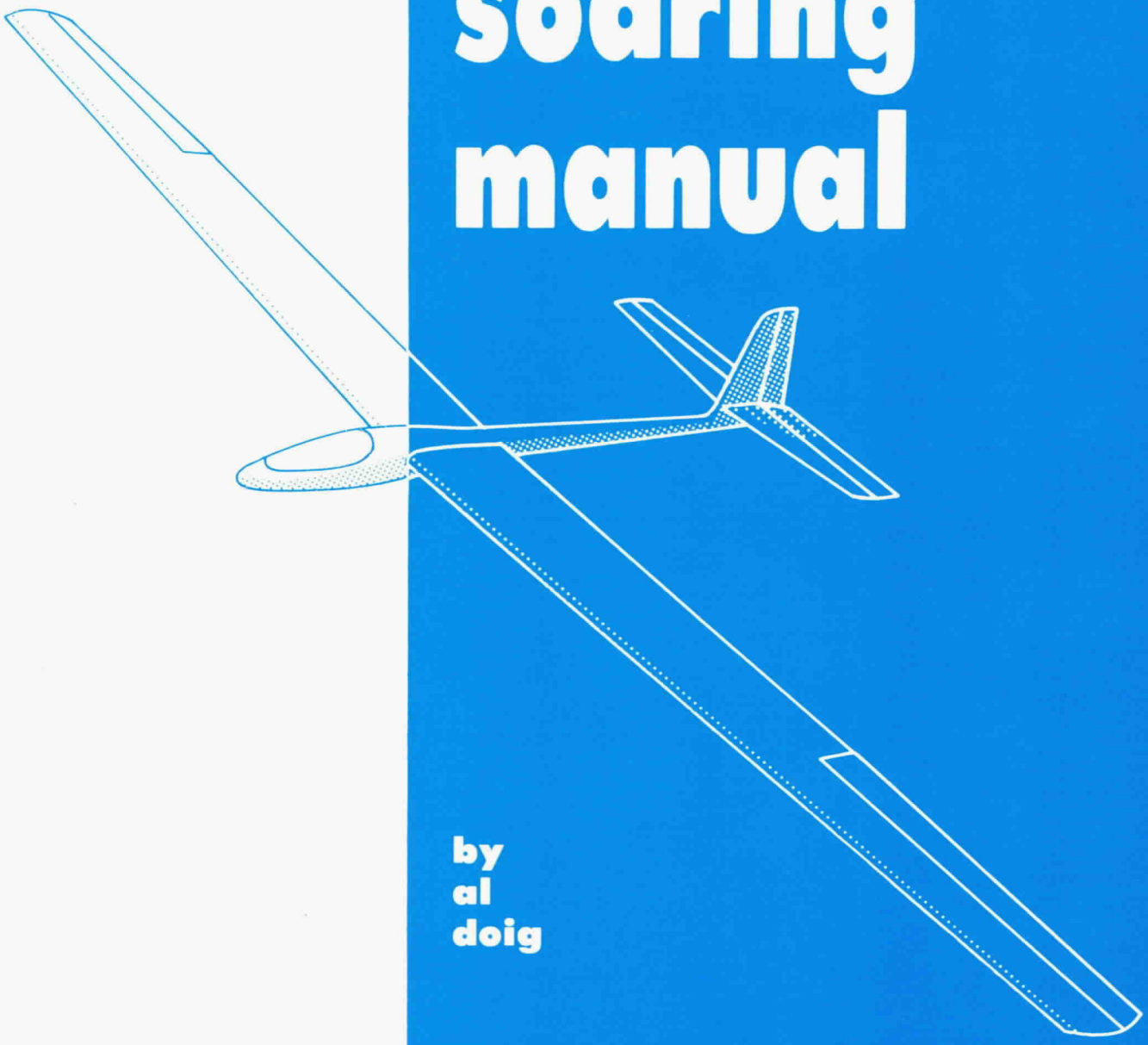
R/C MODELER MAGAZINE

sailplane and soaring manual



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FOREWORD

In starting out in a new hobby, or a new facet of an old hobby, one of the tackiest problems is getting good information. "Learning by doing" is very effective. It is also expensive, and time consuming. For the person who is isolated from actual observation of how things are done, the problem is compounded. An immense help is a step-by-step guide to getting started. It is possible to get this guidance through reading books and magazines on the subject. The problem is, that the information is scattered, and never quite available when you want it. Also, it never seems to quite fit your situation. In addition, just because it's written down, doesn't always mean it is correct — or practical. What you really need is step-by-step information in one place which, if followed, will lead to achievement of a specific goal. This book can be your step-by-step guide into the wonderful world of soaring.

This book describes the many facets of model soaring. Its specific goal — to help the reader achieve successful and consistent flights of a model sailplane. The book describes ways models are flown, the different kinds of sailplanes, and how they are launched. It will help the reader select a beginning aircraft, and tell exactly how to build it. The book will outline proper trimming procedures, and will describe flying techniques designed to teach you to fly, before completely destroying the aircraft. It is written on the assumption that you are all by yourself, but will also tell you how to use help, if it is available. Although the book is written with the beginner in mind, I would hope that the intermediate, or even experienced pilot will find some new ideas nestled between the covers.

I warned you before that you can't believe everything you read. I guess I'd better convince you that I'm trustworthy, loyal, brave, true, and reverent. Well, to start, I've been in R/C for 28 years, and sailplanes for 10 years or so. When I don't know something for sure, I call on someone who does. The late Lee Renaud designed the sailplane described in the book. Lee designed the Aquila, Olympic, Grand Esprit, Sagitta, and a jillion other sailplanes. Ken Banks, who really knows his way around aerodynamics gave guidance in that area. The illustrations were drawn by an excellent sailplane pilot, Ken Raymond. Photography is by Al Doig and Michael Doig. The finished copy was read by several top sailplaners.

Though this book deals with basics in all areas of sailplanes, construction details are quite specific. I tried to stick to a specific goal rather than discuss all possible ways of doing things. Some more general construction ideas, use of tools and jigs, different radio configurations, etc., are covered quite well in another RCM publication, *Flight Training Course,* by Don Dewey. Although it deals primarily with powered flight, it would be a good supplement to this book.

Al Doig

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CHAPTER I

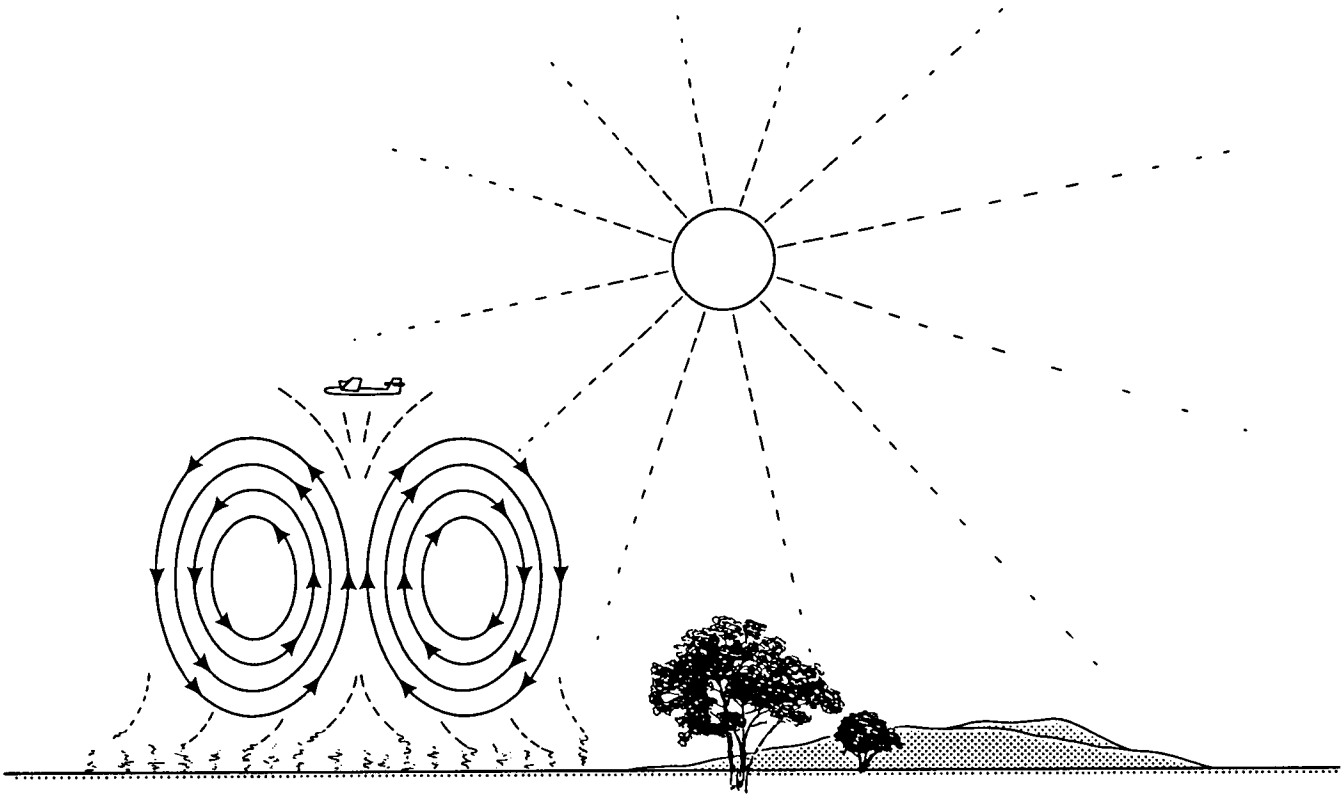
AN INTRODUCTION TO RADIO CONTROLLED MODEL SOARING

Anyone who has not had the opportunity to watch the soaring flight of the Red Tail Hawk, or similar birds of prey, has missed a relaxing experience. It is so peaceful to see them wheeling round against a fluffy cumulus cloud, or against the blue of the sky. Usually there are several, or as many as a dozen, going round and round in a rising current of warm air. They slowly rise higher and higher, nearly going out of sight at times. Once in awhile, one hawk will be going around counter to the rest, and you wonder why. Sometimes the group will begin to sink, as the lift weakens. One by one, the birds peel off and glide swiftly, straight as an arrow, searching for another air current to sustain them. If you are lucky, you will see the lead hawk rise and fall, as though he floated over a wave. Around he goes again, with the rest in tow. Up he goes, in another current of warm air.

Or, have you seen gulls soaring along an ocean cliff; or eagles riding some invisible wave along mountain ridges? Birds have learned to take advantage of every energy available in the air. Man has spent centuries trying to fathom their secrets. The Albatross has been known to soar over the ocean for long distances without flapping its wings, by using wind shear in ways man does not fully understand. Walt Mooney, who is a crack glider pilot, once followed a gull far out to sea, studying the movements of the gull, and trying to duplicate them. Suddenly, the gull started flapping his wings, and flew away. Walt couldn't flap his wings. He began to realize he was too far from land to make it back — splash!

Have you every watched a gaggle of model sailplanes wheeling in the sky, or soaring silently along a wind swept cliff? It's the same relaxed feeling as watching the hawks. And, when you are in control of one of the models, there is a tingling excitement in the relaxation. It's kind of like sailboating. You are in command, using the forces of nature to the best advantage possible. It takes a good ship and lots of skill to stay aloft for very long, with no motive power other than the power of nature itself.

So, where do we get this power to soar in the sky without a motor? One source is thermal activity. This is what the hawks use when they circle over flatlands. Useful thermals are generated by the sun warming the ground, or some heat-absorbing object. Air near the ground is, thereby, warmed, and rises. Cool air then flows in to replace the risen air; is, in turn, warmed, and also rises. As the air rises, it may be cooled when it reaches a few hundred feet, or it may rise thousands of feet. The cooled air then flows away from the rising column of warm air, and falls back to earth. It may again be warmed and rise in the column, forming a funnel of rising air surrounded by areas of falling air.



FORMATION OF A THERMAL

As a sailplane glides through the air, it is always sinking, with respect to the air surrounding it. However, if the surrounding air is rising faster than the sailplane is sinking, the ship will go up, relative to the ground. Therefore, if we were to fly our sailplane into the area of rising air in Figure 1, and tightly circle so as to stay in that area, it would go up, if the air is rising faster than the sinking rate of our sailplane. If we now fly out of the area of rising air and into the area of falling air, our sailplane will sink to earth very rapidly. It will go down at its normal sinking rate **plus** the downward velocity of the surrounding air. The rising current of air is called "lift" and the falling areas of air is called "sink" — but, I'll bet you already suspected that. We will have a lot more to say about thermals in later chapters.

What are these model sailplanes that can soar like birds? Well, mostly they have a balsa wood framework, for lightness. Time was when this framework was covered with silk, and doped. Now, the silk has been replaced by a plastic film, ironed onto the framework. Using either an iron, or hot air blower, the plastic film is heat shrunk, forming a smooth, tight skin over the frame.

Not all sailplanes are built from balsa. Most are, but some are built using a foam core inside the wing, which is then covered with sheet balsa, very thin plywood, or thin plastic, for smoothness. Some fuselages are formed from fiberglass, or molded from plastic.

In size, these models range form a wingspan of six feet to as much as twelve feet. The majority have wingspans from eight to ten feet and weigh two to five pounds. The models are usually built by the flier. Some fliers, pressed for time, or having a dislike for construction, buy their ships from other sailplaners. Most gliders are built from kits of parts, available through local hobby shops, or mail order houses. Many sailplaners, however, like to build from "scratch." That is, they obtain plans, buy the balsa wood and other supplies piece-meal, cut out their own parts, and build their models. Many others find satisfaction in actually designing their own sailplanes, drawing their own plans, then building. One eventually finds his own niche in the hobby.

Control of these sailplanes is by means of rather low cost, surprisingly sophisticated radio sets. Both the transmitting and receiving units are battery operated. The transmitter is held in the hand, and has a "joy stick" to control the model sailplane. Pulling the stick back raises the plane's nose; pushing the stick forward points the nose downward. Moving the stick left causes a left turn, and right causes a right turn. Inside the plane is a radio receiver to receive, and interpret the commands. An electric motor driven device called a "servo" is connected to the receiver and furnishes the "muscle" to move the control surfaces of the plane, such as the rudder, elevator, etc. Control is "proportional," that is, the control surface will follow the exact movement of the stick; move it a little, and the control surface will move a little. The airborne radio system weighs about 8 ounces, or less. The transmitter unit weighs less than 2 pounds. The effective range of the system is farther than one can see the sailplane. Before radio contact is lost, visual contact is so poor as to make control ineffective.

So, once having one of these model sailplanes, how do you get it up in the air? Most thermals are entered at a hundred or more feet in the air. They tend to be funnel shaped, and get bigger the higher you go. Down near the ground they are usually either undefined, or very small. Thermals can actually be entered from a hand launch, but it takes a lot of skill and practice to do this. And, besides, you must be able to recognize one when it comes through — they are almost never painted green, so you can see them. Anyway — the problem is to get the sailplane up three or four hundred feet, in the most painless manner.

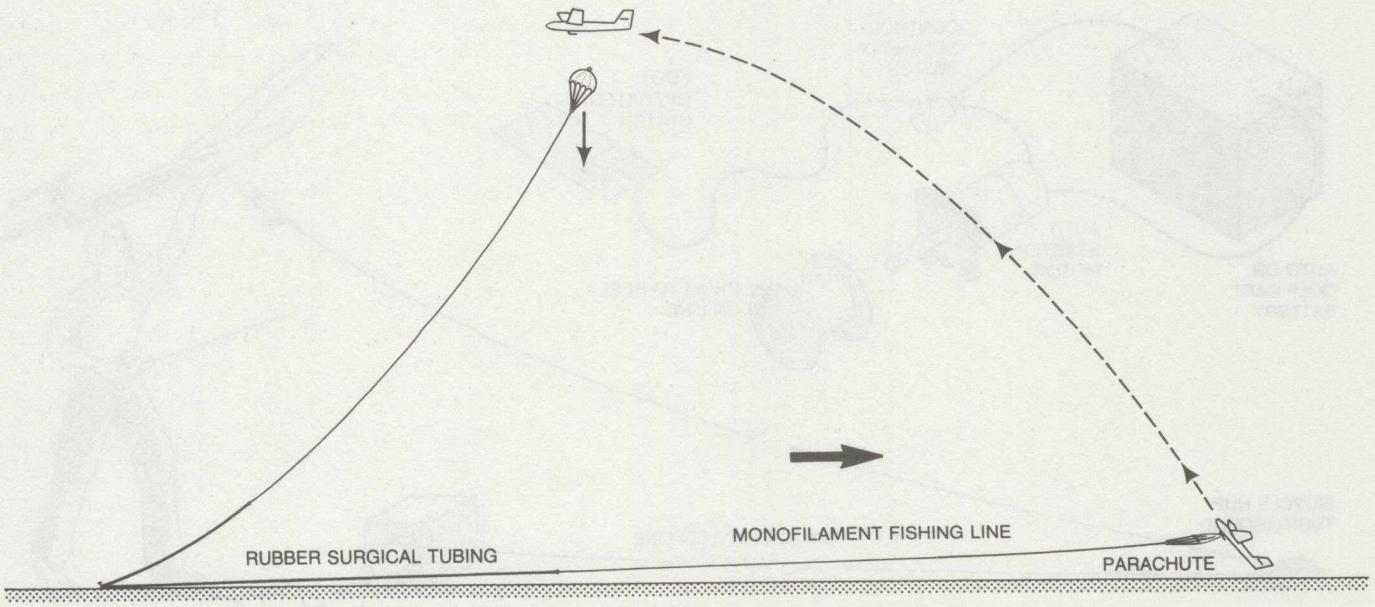
The two most common flatland launching methods are the hi-start, and the electric winch. The hi-start is like a great big slingshot. As shown, it consists of one hundred feet of surgical rubber tubing, staked to the ground at one end. To the other end is fastened about four hundred or so feet of small monofilament fishing line. A parachute comes next. This is mostly so you can find the end of the line. Lastly, there is a small ring on top of the parachute, which hooks to a tow hook on the bottom of the sailplane.

To launch from the hi-start, one grasps the parachute and marches back about two hundred feet, stretching the surgical tubing.

The radio in the sailplane and the controlling transmitter are turned on. The parachute ring is hooked to a towing hook on the bottom of the sailplane. The sailplane is then launched vigorously upward, at about a forty-five degree angle. The ship will go up very steeply. Minor corrections in the trajectory are made by the pilot. If the sailplane is capable of lifting the surgical tubing and line (most are), it will, if properly launched, rise to the full height of nearly five hundred feet. If the nose of the plane is dipped slightly, the parachute ring will slide off the tow hook, and the parachute and line will float back to earth. The sailplane, free of its launch line can now be sent in search of a thermal.



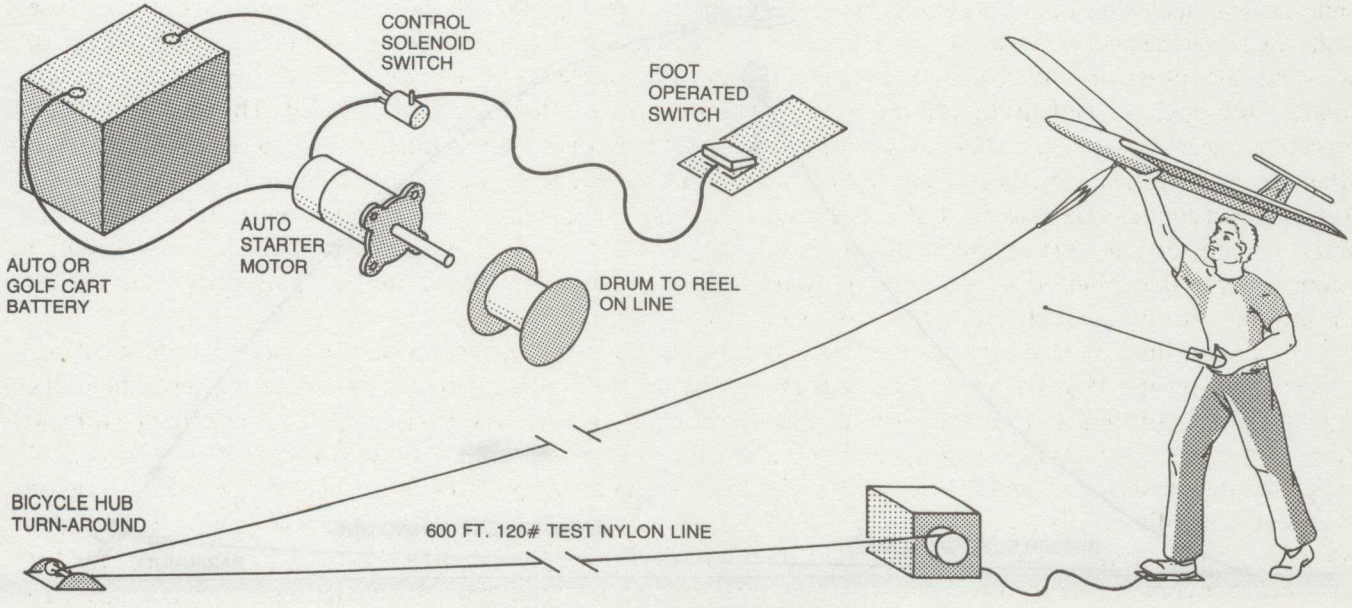
Launching with a hi-start.



OPERATION OF A HI-START



Launching with an electric winch.



OPERATION OF AN ELECTRIC WINCH

The electric winch performs the same function as the hi-start, but is controllable by the flier, and is more powerful. Control is by means of a foot switch. If the switch is held down, the winch runs at full speed, winding the line up on the reel. If the switch is tapped on and off, the reel will take in line at a slower rate, with a jerky sort of rotation. Care must be taken with winch operation, especially in windy weather. As I said, the winch is very powerful and, if run too fast, it may break the sailplane wing, which is very undesirable. Anyway — the sailplane is launched in the same way as with the hi-start. Running a winch, however, is like rubbing your head whilst patting your stomach — it requires a bit of coordination.

Many beginning fliers prefer to let another person run the winch while they guide the airplane. The sailplane on tow will now rise to an altitude, dependent on the length of line and the skill of the operator. At the top, the winch is stopped, and the parachute ring will slide off the tow hook. The sailplane is now soaring.

Hi-starts are preferred by most sport fliers since they are much easier for a lone flier to handle. Also, a winch weighs around seventy-five pounds, so it is not easily set up for casual flying sessions. In addition, the hi-start cost is about twenty percent that of the winch.

As can be seen from the lengths of the launch lines, it takes a fair piece of real estate to get a sailplane in the air. School grounds make an excellent launching site, and are widely used by sailplane pilots. Permission to use school property on weekends is usually easily obtained especially if the fliers belong to the Academy of Model Aeronautics (AMA), with its liability insurance provisions. Lacking a school ground, a large vacant field can be used. A sod farm, with its acres of grass is ideal. At least you need a field that is relatively free of brush. It is a mess to pick the line out of the bushes on every launch. One disadvantage of the hi-start is that it falls from the sky wherever the wind blows it. The electric winch can be run down after the sailplane is released, and the parachute pulled down close to the turn-around hub. This makes it possible to launch from a long, narrow strip of ground, which is clear of bushes. With either launch method, a clear landing place is required --- the bigger the better is the size requirement. Learning to land is the most difficult part of flying. For awhile, the challenge is to set the ship down in the same county. As skill develops, landing accuracy improves until, finally, you will be able to land inside a twenty-five foot diameter circle, with regularity.

Some fliers, who live in wooded areas where there is very little large clear areas, solve the take-off problem by using powered gliders. A small glow engine can either be bolted to the front of the glider, or mounted to a pod on top of the wing. Another solution is to use an electric motor system. Electric motor systems are available, complete with a fast charge unit, operating from the car cigarette lighter. Only fifteen minutes are required to recharge batteries between flights. The electric system, however, is about twelve ounces heavier than the glow engine system. Being considerably heavier, it will not soar as well after the motor stops. Electric systems, however, have the big advantage of being silent. Therefore, they can be flown closer to residential areas without fear of complaint.

Okay, we now have our sailplane in the air. The problem is to keep it there. If you don't find a thermal, the ship will be back on the ground in from one-and-a-half to two minutes.

In a later chapter we will have more to say about where to look for thermals. In general, though, each flying site has most likely areas where thermals can be found. It's like fishing in your favorite bass lake. Although you know generally where the fish will be biting in the morning — or in the afternoon, there are always surprises. It's fun to sniff out a thermal when others are having no luck. A search pattern is flown starting with the most likely areas. The sailplane is watched very closely. It will tell you when conditions are right. A slight rise and fall — or the rise of one wing indicates possible thermal activity. Now you turn and narrow the search until the center of the thermal current is found. Then circle — perhaps tightly, perhaps broadly — staying in the area of greatest lift. Then up, up you go; sometimes nearly out of sight. Normally a thermal will last only five to seven minutes. So, to stay aloft for ten or fifteen minutes, you must find more than one thermal. It takes experience to know when to leave a dying thermal and go search out another one. But that is the challenge of thermal flying. Your skill is tested on each flight. Sometimes when you are about to give up and land, you fly through an ever so slight rise. And it's round and round again for another four or five minutes — sometimes no higher than fifty feet. That's the real thrill — pitting your skill against the existing conditions, and getting the most out of them.

Later on in their flying career, many pilots will want to pit their skill against the skill of other pilots. Contests are a lot of fun. Even if you are not so skilled, just being there and watching others to see how they do it is rewarding. The friendships that are built and the good natured kidding that goes on is well worth the trip. There are many different types of contests. Most contests in the United States are of the precision duration variety. The object is to launch the sailplane, stay up exactly a prescribed number of minutes then landing precisely in the center of a circle. Duration times are normally six, seven, or ten minutes. A shorter version is popular as a contest opener — two minute precision. In this version, scoring is extremely harsh on those missing the two minute time by more than a second or two. Another contest task is to fly exactly fifteen minutes total in three flights — no one flight lasting longer than seven minutes. There are any number of other types of tasks, some giving the flier several options to choose from,



1984 Fall Soaring Festival — Visalia, California.

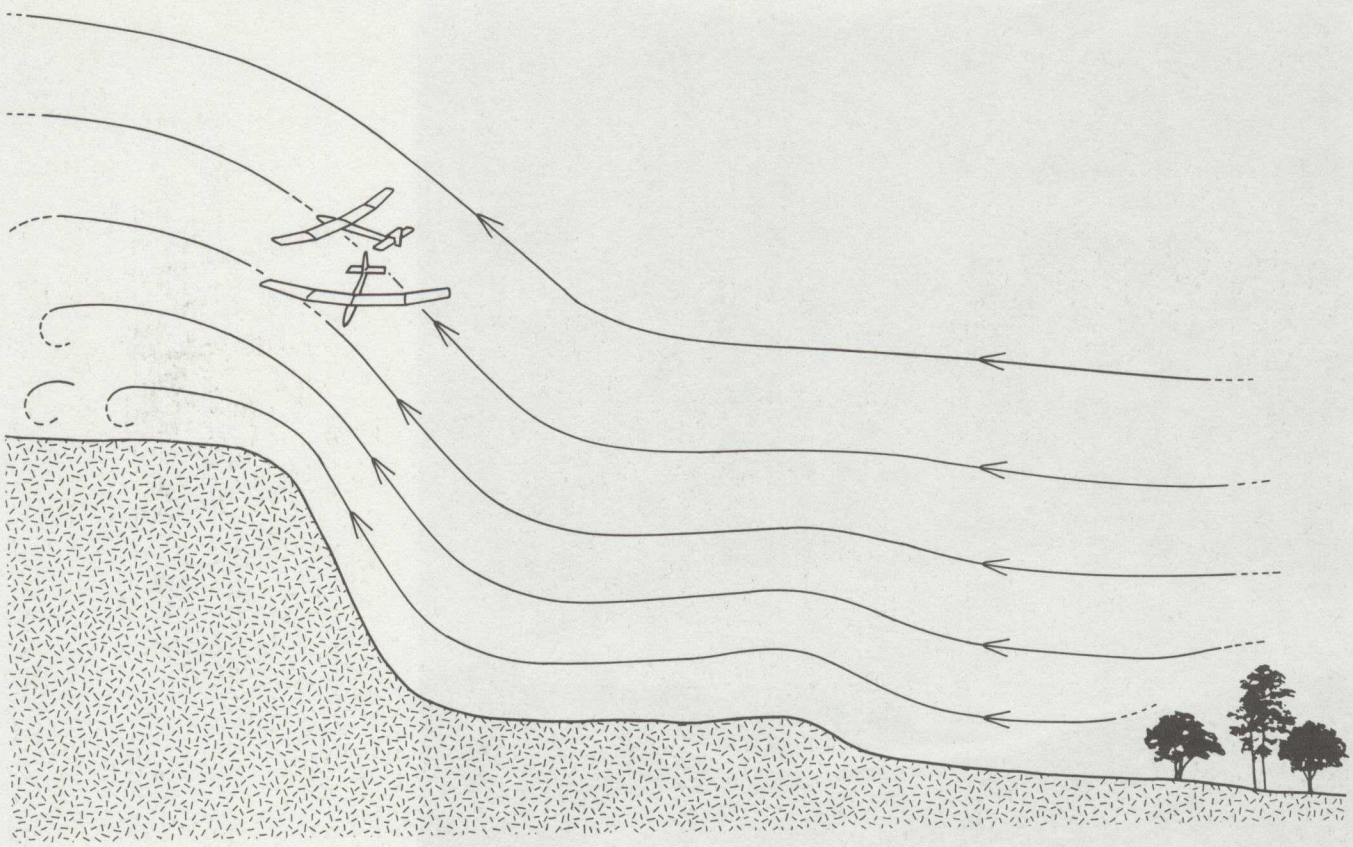
adding another dimension to the judgment.

A quite different type of task is used in international competition. F3B tasks, as they are called, consist of six minute precision duration with scored landing but, in addition, they run speed, and distance. Speed is just that — 150 meters out and 150 meters back for the fastest time. Distance is run on the speed course but is scored on the number of laps completed in four minutes with a maximum of twelve counted. Since the same aircraft must be used for all three tasks, the design must be a compromise between somewhat conflicting requirements. Of course, the tasks were selected for just that reason — to promote technical design. F3B has not been particularly popular in the United States, but has picked up some interest since the United States Soaring Team was beaten decisively in Belgium in 1978.

There is a very fine achievement program that is very popular in the United States, and several foreign countries. This program is administered by the League of Silent Flight. The program has achievement Levels from I to V. The program is self-administered with appropriate witnesses. Level I requires either a five minute thermal duration flight, or a fifteen minute slope duration flight. In addition, it requires that five spot landings be made within a circle three meters in diameter. Required achievement increases in difficulty up to Level V where a two hour thermal duration flight and an eight hour slope duration flight are on the program. In addition, the Level V candidate must complete a ten kilometer (6.21 miles) goal and return flight and win first place in three contests. Information is available on this program from the League of Silent Flight, P.O. Box 647, Mundelein, Illinois 60060. It is a very good way to measure progress, as skill increases.

On the other side of the coin in this model soaring hobby, is slope flying. There are fewer slope fliers than thermal fliers; not because it is less interesting, but because not every community has a good slope. There are, however, more slope sites than is realized. You just need to recognize a slope when you see it.

Slope lift is generated when wind is deflected upward by some object. The object may be a hill, a cliff, a building, a line of trees, or some discontinuity in the path of the wind. Not all these objects are suitable model soaring conditions, however, although I've seen clever fliers use all these things to sustain flight. Most any hill will work provided the prevailing wind blows onto the face of the hill as shown in the following figure.



DEVELOPMENT OF SLOPE LIFT

The problem with a great many potential slope soaring sites is the presence of trees, houses, etc., on the slope and/or the top of the hill. Regardless of how good the lift is, you still need a place to land and take-off. Also, if the lift dies, or you have problems of some sort and you are forced to land half way up the slope, you don't want it populated by trees, houses, etc. Also, discontinuities in the face of the hill such as trees, etc., can cause turbulent currents that make flying difficult.

One of the classic slope soaring sites in the world is the cliff at Torrey Pines, near San Diego, California. Here a vertical cliff at the water's edge rises over three hundred feet. The prevailing wind is on-shore. The combination of the flat ocean and the homogenious wall of the cliff gives remarkable lift, that is almost entirely free of turbulence.

The average sport flier at the slope will use one of the standard sailplanes built from a kit. It is the same design used in thermal flying. These are sometimes modified with smaller wings and can be heavier than their thermal counterparts. It is best to start with a well-designed, proven thermal ship that is stable and not full of surprises. At the slope you will also find specialty ships, designed for aerobatics as well as others designed for racing. Because of the constant lift (not found in thermal flying) it is practical to fly a series of aerobatic maneuvers. With thermal-type flying, only about one maneuver can be performed with one launch. This makes aerobatics cumbersome and somewhat impractical. With the constant lift of a slope, however, a full aerobatic pattern can be flown in one flight.

Many fliers like the excitement of pylon racing. In this sport the planes are flown back and forth along the face of the slope, turning when signaled by a flagman. They are either raced in groups, or fly singly and are individually timed.

Launching on a slope is generally rather simple. Unlike the thermal launch, the slope launch is slightly down and straight out from the hill.

The sailplane is then flown out to the area of best lift, normally fifty to a hundred feet out from the crest. The pilot is then free to turn and fly back and forth, parallel to the slope face. Turns are made away from the slope. Downwind turns toward the slope can be trouble for the beginning pilot. Some sites provide lift far out from the slope and permit far-ranging exploration. It is possible to find thermal activity out in the valley beyond the slope. The flier then can combine the best of both worlds by starting on the slope and then going thermal seeking. Or the reverse is often done. Sometimes behind a thermal flying site is a slope which can be reached from the thermal flying field. This was the case at the soaring site of the 1977 Nationals Competition at Riverside, California. About a half-mile downwind from the launch area was a large hill. In the afternoons, when the wind was blowing the thermals away, the fliers launched and raced downwind to the slope, where they could easily fly the maximum time, and then return for a landing.



Inland slope site.

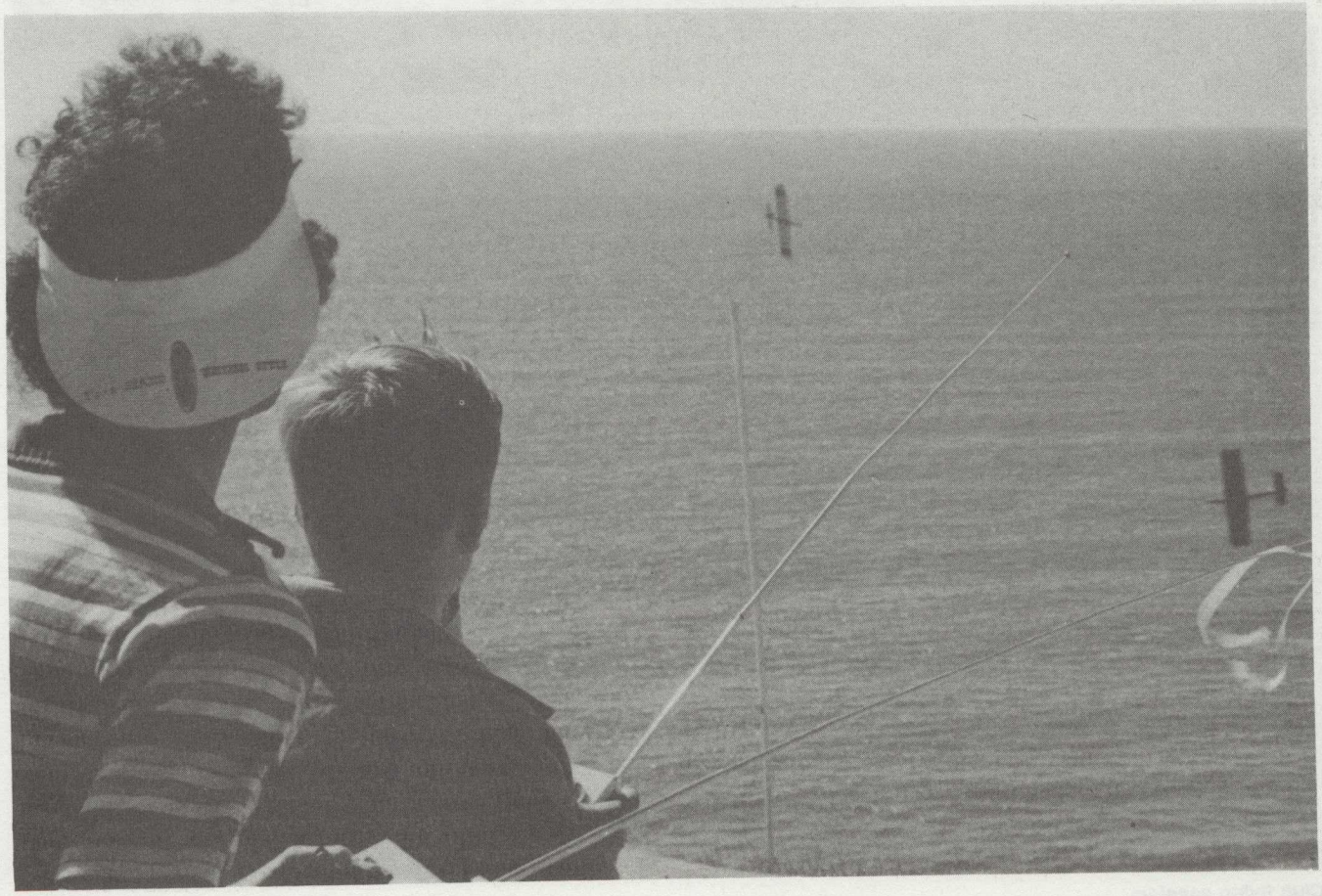


Glider slope soaring — Torrey Pines, Calif.

There seems to be much less competitive slope flying than thermal flying. One reason, of course, is the absence of a good slope in every area to practice on. The perfect precision aerobatic skills seem to be satisfied by power pattern flying and there is very little serious activity in this area. Many clubs, however, hold aerobatic competition, mostly using whatever ships the fliers have. The maneuvers tend to be simple ones that can be done with just rudder and elevator. These tend to be fun-flys rather than serious competition. There is some competitive activity in pylon racing among slope fliers. An International Pylon Race is held each year near San Francisco. The Torrey Pines Gulls also hold yearly pylon racing at the Torrey Pines site near San Diego. The English are quite keen on racing and have many fine slopes suitable for competition.

You see, there is something for everyone in model soaring. Whether you are isolated from other fliers or live in a big city, you can participate. If possible, join a club. Generally club members meet at least once each week at some selected flying site, for informal flying. If you fly regularly with other glider guiders, you will have more fun, and your flying will improve much more rapidly than if you are by yourself. Clubs usually have monthly meetings with technical talks and social activities. They also have at least once-a-year parties and banquets. This social activity with a bunch of really fine people can make the whole thing worthwhile. You can usually find out about clubs in your area at your local hobby shop, or by writing to the Academy of Model Aeronautics, 1810 Samuel Morse Drive, Reston, Virginia 22090.

So, Reader meet Model Soaring, Model Soaring meet our Reader. There — as promised in the title to this chapter — you have been introduced to Model Soaring. I've talked about a lot of things in this chapter. It's been an over-view though; meant only to tell you about everything at once. Many important points were glossed over and many were over-simplified. The following chapters will get down to the nitty-gritty and tell it like it is. So, here we go into the wild, wonderful world of Model Soaring.



Glider slope pylon racing.



Launching a glider at Torrey Pines.



Club flying session.

CHAPTER II

ABOUT THE TYPES OF SAILPLANES

Now that we've found out about the different types of soaring, let's take a look at the different types of sailplanes. We will look at the many different types of models that are available and see how they are the same - - - and how they differ.

First, let's look at the most generally popular type of sailplane. The designer or manufacturer usually says it is for thermal or slope flying. Representative designs are the Wanderers, Gentle Ladys, Sagittas, and on up to the larger Windsongs, Bird of Time, and Panteras. As we look through the advertisements, and plans, we find that though the shapes are roughly the same, sizes vary quite a bit. Dimensions of models tend to be in multiples of 3'. Larger dimensional requirements are grudgingly 4', and, even more grudgingly, 2'. The reason for this is not some exotic law of aerodynamics, but the commonly available lengths of balsa wood. More than one design has been rejected for production because of an uneconomical selection of wood sizes. I even heard of one kit manufacturer who shortened the nose moment of a model because the fuselage sides wouldn't fit in the box --- and he had ten thousand boxes. The smaller models, consequently, have 6' wingspans. If wingspans are reduced much below about 6', very light radio equipment and light construction are required. This is because the wing loading — the number of ounces each square foot of wing area must support — is high, and performance suffers. On the other end, the limit is about 12'. Beyond this size it gets difficult to transport, and handle in general. Accurate landings with very large sailplanes becomes more difficult due to their high inertia. Between these limits we find 99% of all the available designs. In competitive flying, three class sizes are used. 100'' wingspan, and over, is called Open Class. Gliders with wingspans between 2 meters (78¾'') and 100'' are in the Standard Class. Sailplanes with two meter (78¾''), and under, wingspans are, surprisingly, called Two Meter Class. Most designs and kits fit one of these classes.

Typical of the smaller 6' ships that are sold in kit form are the Wanderer, Drifter, 2X4, and Olympic 650. These can be found listed in the various advertisements. These and others like them make good beginning aircraft. They typically have five to six hundred square inches of wing area, and one piece wings. They are low cost and easily built and repaired. They are light enough so that if they land in a bush they sustain only minor tears. The wing is flat bottomed and they fly slowly. Properly built, they are gentle and not full of surprises.

The next size up is the Two Meter Class sailplane. Typical kits available are the Metrick, Gentle Lady, El Primero, Sagitta 600, and the Pixy. Most Two Meter size aircraft were designed for Two Meter competition. Presumably, they have some characteristics that the designer thought important to win in thermal contests. Most of them do not fly much different than the six footers. They generally do have a lower wing loading, and the designer has selected a wing airfoil section that he believes will result in a more efficient aircraft. Two Meter planes that are kitted tend to have flat bottom airfoils. This is because the flat bottom airfoil has generally higher lift, flies slower, and results in a more gentle airplane. Although the airplane may have been designed with contest capability in mind, most of the customers who buy the kits are sport fliers --- there are many more sport fliers than contest types. The contest flier may add a wing with a slightly semi-symmetrical airfoil, to improve penetration in windy contest conditions.

Stepping up one more notch, we find a whole herd of sailplanes available in the 99'' to 100'' wingspan size. This is a very popular size of aircraft. Performance shows a noticeable improvement, even over the Two Meter ships. Price and complexity also shows an increase. Also, the bigger they are, the harder they fall. Some of the Standard Class sailplanes have the slow, gentle characteristics for the less experienced flier. These are recognized by their somewhat boxy appearance — with thick, flat bottomed airfoils. The Olympic II and Windrifter are typical. On the other end of the scale are ships like the Sagitta that are designed to be flown fast. Sagittas do not respond well when being flown nose high and slow. A plane like the Sagitta is also a fairly complex piece of machinery and will require about sixty hours of construction time, for an experienced builder. On the other hand, planes like the Windrifter or Olympic II can be assembled by a person of modest skills in about thirty-five or forty hours.

Open Class sailplanes normally have at least 10' wingspans. They are fairly expensive to build, and some require considerable skill to construct. They are also, overall, more difficult to fly than their little brothers. Even more than the Standard Class sailplanes, the Open Class ships vary in flying characteristics. The Paragon is a very slow, gentle ship. The Mirage looks very similar to the Paragon but has a slightly symmetrical wing and is capable of fair penetration, but has a light enough wing loading to be in the floater class. The Pantera, the Bird of Time, Sagitta — each of these has its own flying characteristics but, generally, are meant to fly fast, with good penetration abilities.

At the top of the expense range are the sleek and slippery Adante, Camano, and Windsong. The Windsong and Camanos are unusual in that they have all the bells and whistles — spoilers, flaps, ailerons (flaperons), rudder and elevator. There are only a few kits available with these features. One of the largest of the Open Class sailplanes is the Sailaire, at 12½', with nearly 11½ square feet of wing area. Despite its size, the Sailaire flies very slowly and is remarkable in light air.

Another class of sailplane is developing out of the F3B International Rules competition. As stated before, International competition prefers flying tasks that include not only thermal flights, but one pure speed run, and another which is a flight for distance. The thermal flight is rather short — six minutes — which places a bit of weight on speed. The United States Soaring Team went to York, England in 1983, quite confident of doing well. They were as good as anyone in the world at thermal soaring. They were resigned to giving up a bit in the speed events, but felt their thermaling abilities would pull them through. While luck certainly plays a part in contests, the U.S. team manager said they were just out-planed. The Europeans were flying a different breed of plane. These machines were the epitomy of precision. Molded from fiberglass, the molding was precise to within a hundredth of a millimeter. The West German Team won handily with a combination of flying skill and aerodynamic superiority.

This experience launched many United States designers into a cleanliness campaign. Emerging were several new designs with pencil-thin fuselages and semi-symmetrical wing airfoils. These new designs, such as the Sagitta by Lee Renaud, are definitely not for the beginning flier. They are very fast, and not too easy to fly. Their purpose is to be able to fly fast and yet thermal well. These are thermal machines, compromised for speed. The European machines are speed machines, compromised for thermaling. Though speed events are not too popular in the United States, it is probable that all will benefit by new developments in construction and finishing.

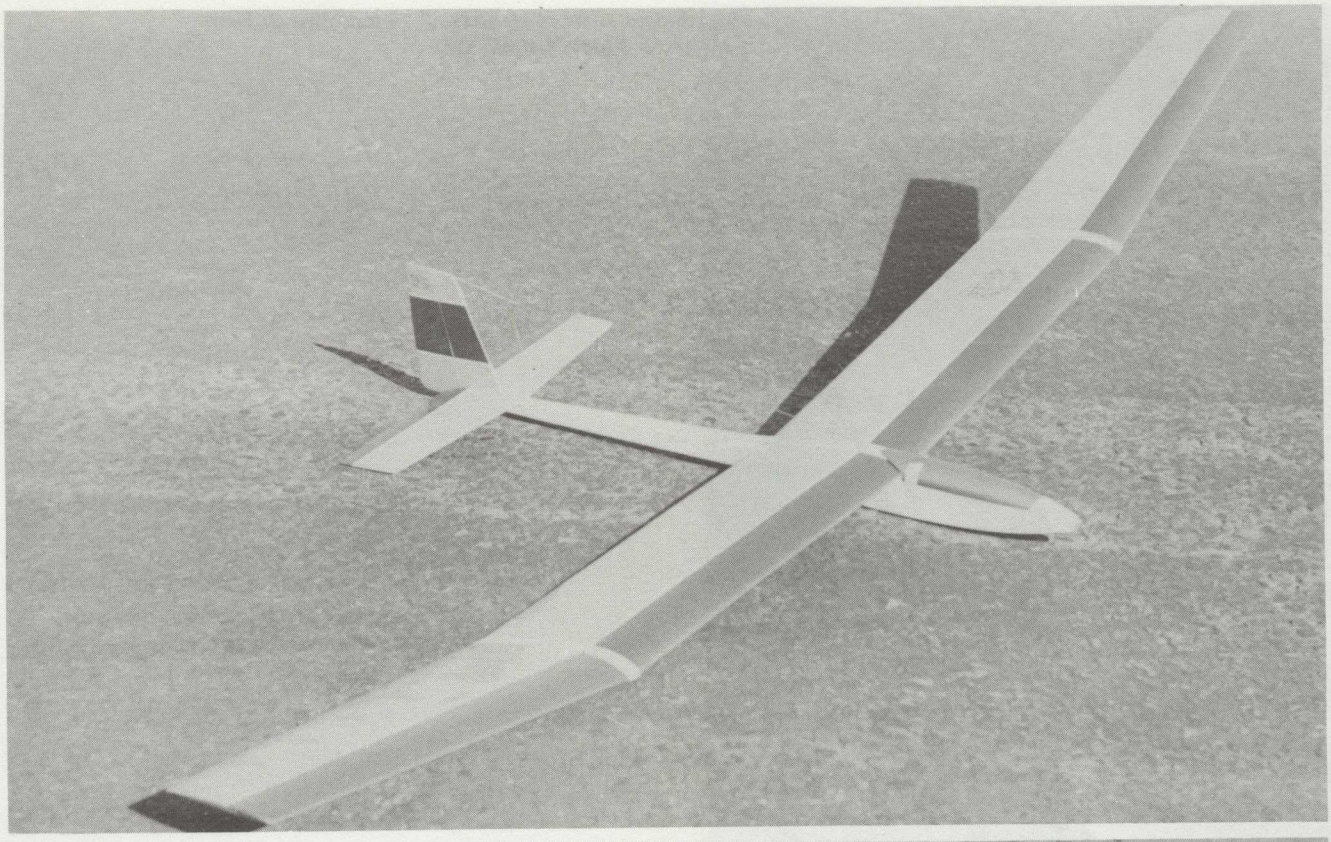
While there are a great many designs and kits available for thermal sailplanes, the number specifically designed for slope soaring is rather small. As an example, in the *RCM Illustrated Plans Guide*, out of fifty-six sailplane plans, only about ten were deliberately designed for slope flying. This ratio seems to hold for fliers also. The Torrey Pines Gulls club has about one hundred twenty members. There are about thirty serious thermal fliers, and about six serious slope fliers in the club. This, despite the fact that one of the best slope sites is in their backyard. However, the club has upward of fifty sport slope fliers. These fliers have fun flying thermal airplanes, modified thermal airplanes, or plastic ready-to-flys. Serious slope flying is nearly all on the West Coast, Denver, and Salt Lake. Most of the suitable slope sites are located in these areas.

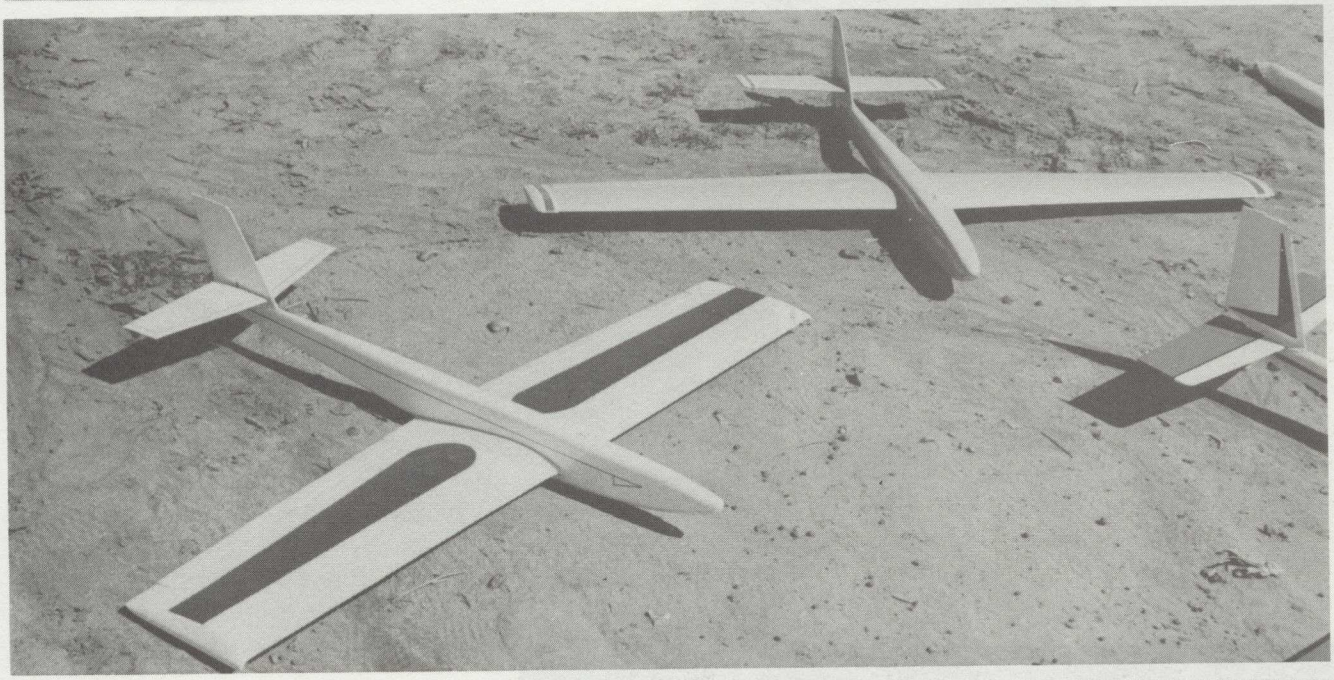
Although most slope fliers enjoy doing simple aerobatics, almost no one is involved with aerobatics of the type seen in powered pattern ships. Most slope fliers use just rudder and elevator control for aerobatics. As a matter of fact, old timers in radio control can remember a rudder-only class in aerobatic competition. Maneuvers such as loops, rolls, Immelman turns, Cuban eights, spins, and stall turns could be performed reasonably well. Some maneuvers were a little hard to recognize, as all maneuvers had to be entered from a spiral dive in order to get enough speed to carry through.

Any of the simple airplanes will perform enough maneuvers to keep the average sport flier happy. Some fliers may want to advance to aileron control as their skill increases. There are several aileron sailplanes available designed for slope aerobatics and racing. A number of good slope ships are available such as Savage, Son of Savage, and the Ridge Rider, Ridge Recruit and Ridge Rover, from Solent as well as the Xingu family from Victor Stubs. Plans are available from RCM Magazine for the Puranas sloper (RCM Plan #775).

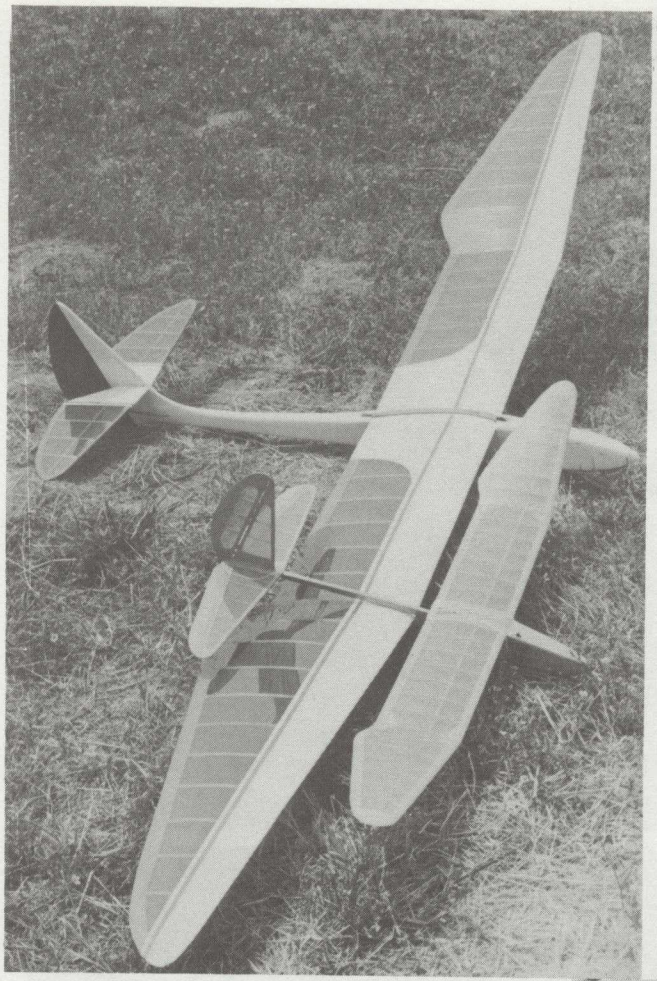
Each year new designs appear. Some are brought to the market as a result of contest success; some to fill the need for something a little different. There are fliers who always appear at the field with "the plane of the month." Some just plain like to build, which is fine. Some are looking for that magic that will put them head and shoulders above the crowd. If you want to become proficient at flying a sailplane, find a design you are comfortable with, and stick with it. Until you really know that ship, you will not be consistent. Eventually you may grow out of that particular design, but this does not happen in a month or two.

OPPOSITE PAGE, TOP: 10' Paragon MIDDLE: "Swallow" club design by Torrey Pines Gulls for one-class pylon racing. BOTTOM: "Hyper Locus" designed for slope speed.





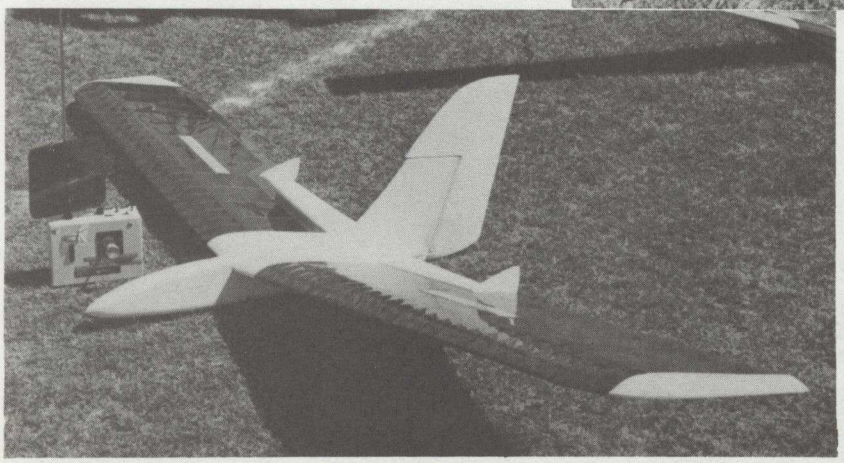




Gliders come in all sizes. A 10 foot Bird Of Time and a 3 foot Thermic 50.

Two Meter Icarus.





Windlord Flying Wing.

CHAPTER III

SELECTION OF THE FIRST SOARING SYSTEMS

A. Selection of a Beginning Glider

The first thing to resist is any temptation to build a big, beautiful, scale sailplane. The chances are excellent that it wouldn't last long enough to provide much training. While these ships look great in the air, it is difficult to keep them there. The long, narrow wings are very efficient on a full sized sailplane. When reduced to model size, they become increasingly inefficient. The very narrow wingtips are especially a problem. They are particularly susceptible to a condition known as tip stall. This causes an instability that makes flying, especially at slower speeds, very difficult. It is also difficult to make the long thin wing strong enough to withstand the rigors of training flights. If the size of the model is reduced, the wing area may become too small for proper flight. As wing area goes down, it becomes increasingly difficult to reduce the weight of the model proportionately. As the weight per unit of wing area (wing loading) goes up, the model will fly faster and faster to generate enough lift to keep airborne. This leads to a model that is very hard for the novice flier to handle.

Perhaps it would be helpful to list a few characteristics that would be desirable in a ship for a relatively new flier.

(1) It should be a gentle, slow flying airplane. It should be stable enough to fly by itself.

(2) It should be easy to build using simple tools and available materials. Construction of the wing center section should be foolproof so that it will be strong even if the builder is inexperienced. If the wing is capable of being taken apart, the joint should be simple to construct.

(3) In order to reduce cost and damage it should be small, strong and light. The maximum wingspan should be 2 meters (78") with a minimum of wing area of 600 square inches. It should weigh about 2 pounds, having a maximum wing loading of 8 ounces per square foot of wing area.

(4) It should break down to a reasonable size for transport. A one-piece wing is unacceptable. With the trend toward smaller cars, getting a 72" or 78" wing inside can be a trying task. It is also nice to be able to take the plane on holiday and try new flying sites outside your area. If it could be carried on an airplane as baggage, so much the better.

(5) It should be capable of performance above that of a simple trainer. It should have contest capability in the Two Meter class. It must be a proven design.

When a design for presentation in this book was being examined we looked at many existing kits. Three or four would have been quite suitable but each seemed to lack some quality which was required. Finally, we started looking hard at a design I had been flying in Two Meter competition for about two years. Several prototypes had been built by members of the Torrey Pines Gulls Soaring Club because of its fine flying characteristics. It proved to be a perfect machine for several fliers who had difficulty keeping other gliders flying. Pepper Kay of the TPG Club took his model to Hawaii several times during vacations there.

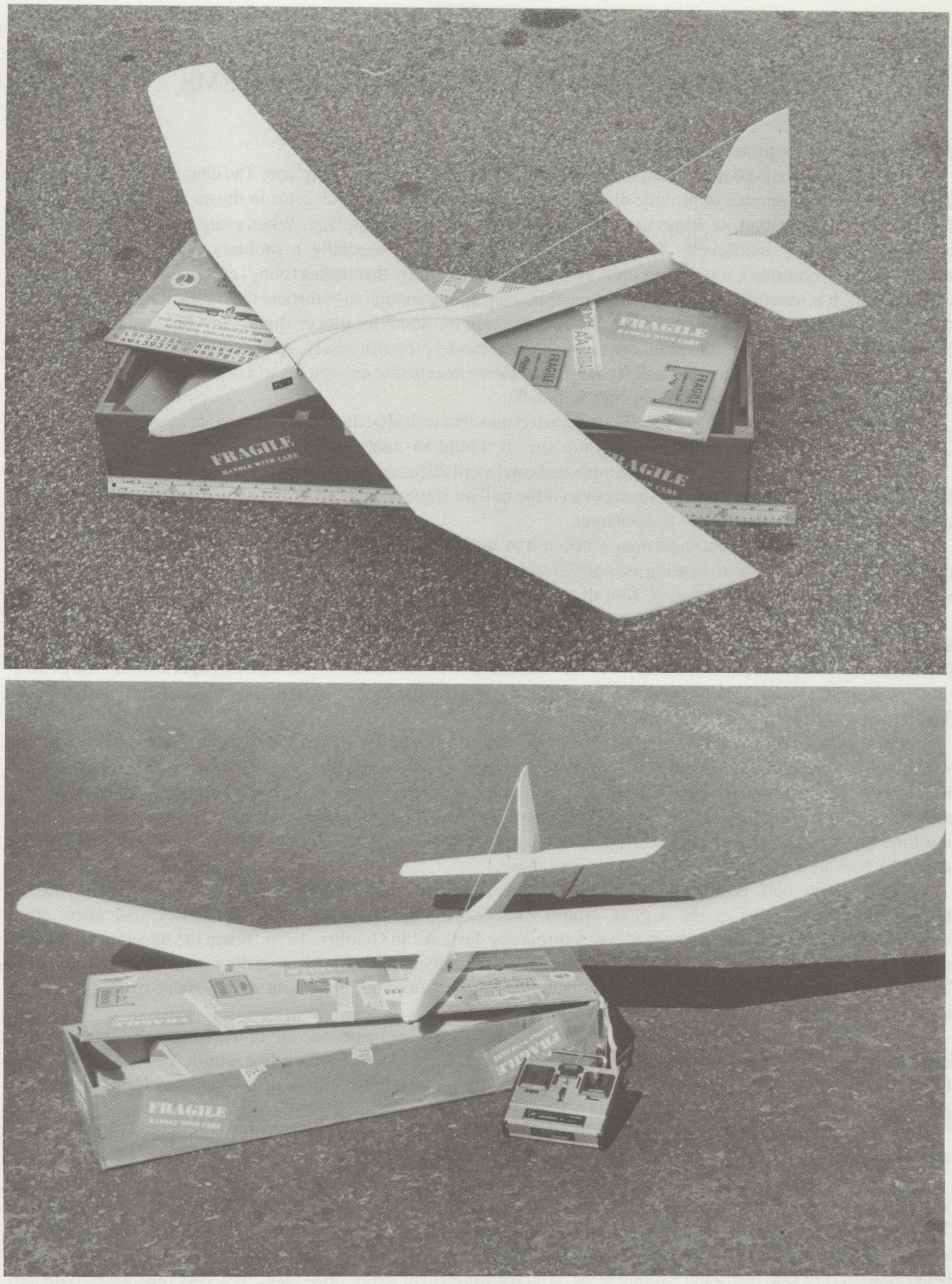
The Olympic 650, presented in Chapter IV, was designed by Lee Renaud, President of Airtronics. Lee is famous for such designs as the Aquila, Aquila Grande, Olympic II, Grand Esprit, Sagitta, and many other well-known sailplanes. The Olympic 650 was originally designed in October, 1976. When the design was selected for presentation in this book, in mid-1980, the design was slightly modified; a result of the considerable testing by the TPG group. The modifications were a lengthening of the aft fuselage and slight enlargement of the horizontal stabilizer to improve the pitch stability.

The Oly 650 is a super simple ship to build. The flat, one-piece center section of the wing makes construction easy, even for those with no previous model building experience; and it's strong like a bull! Yet, the whole thing breaks down to fit in a box with inside dimensions of 5½" x 11½" x 38½". Built of 1/4" plywood, this box will go everywhere.

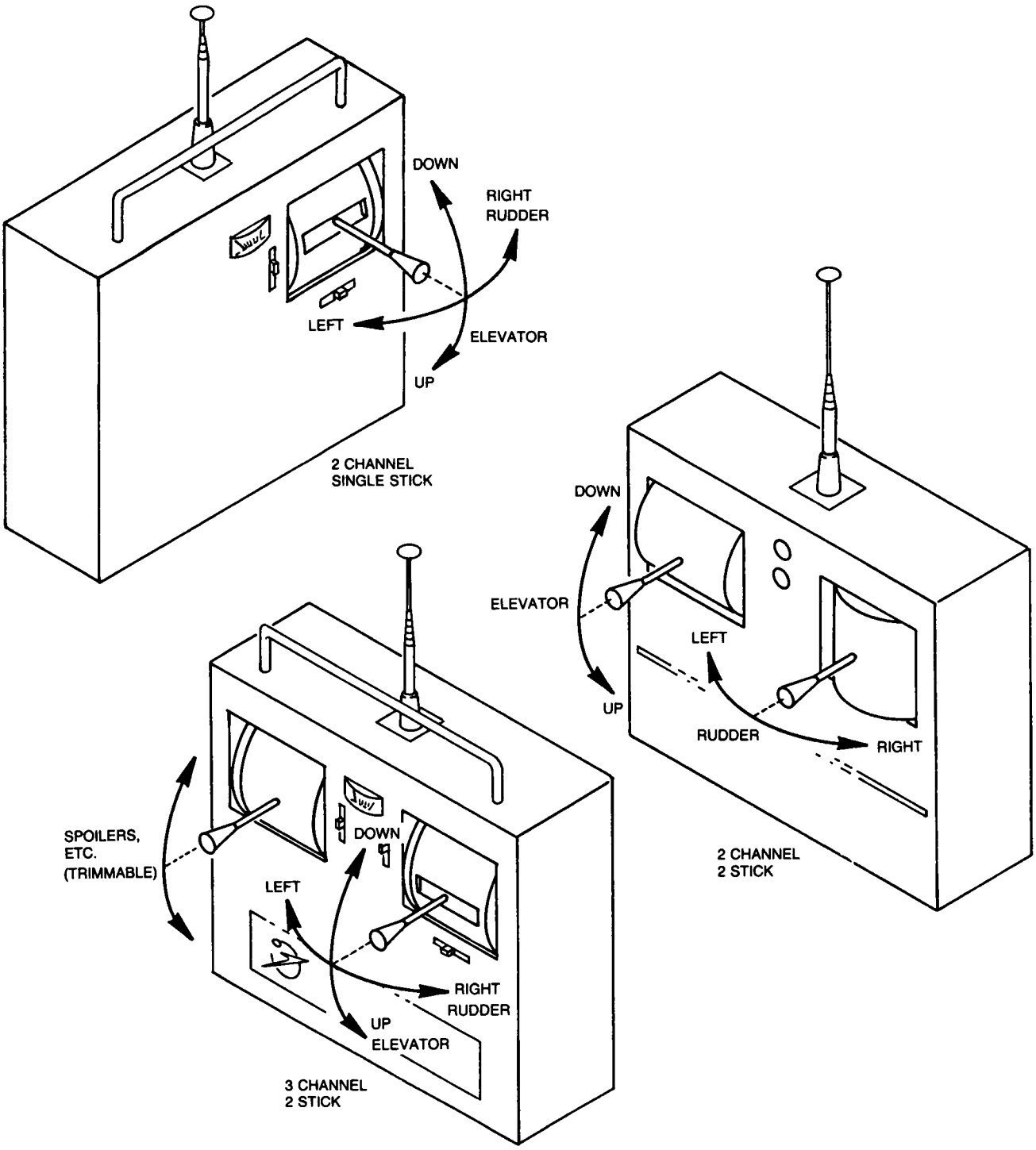
Only standard materials were used in the construction, as well as readily available hardware. Any well-equipped hobby shop should be able to supply all material.

In the flying department, the Oly 650 won't win too many speed contests but in thermal flying and slope flying it is just super. It will stay up in the lightest lift. It will out-launch most gliders of its class. It has won many awards in Two Meter contests. But, the place it really shines is just plain fun flying on a lazy Sunday afternoon, wheeling under the fluffy cumulus clouds. Or, back and forth on a slope, ranging far out into marginal lift. It also has the advantage of being able to come into restricted landing areas, which are typical of many slope areas. It is very responsive, and will turn on a dime.

I hope you will decide to build and fly the Oly 650; it's a neat glider. The next few chapters tell exactly how to build it and fly it. Almost anyone can do it, so give it a go.



The Olympic 650 with travel box.



TRANSMITTER STICK CONFIGURATION

B. Selection of a Radio

There are many factors which, in varying degrees, affect the decision about which make and model to buy:

(1) Do you insist on a locally made product as opposed to an import?

(2) Does the manufacturer seem to have adequate repair stations?

(3) Do you prefer buying from a discount house or a local hobby shop?

(4) How many functions, or channels, will you need?

(5) How about dry battery power versus rechargeable nicad batteries?

(6) What "mode" should you buy, i.e., single stick versus two stick?

(7) Which of the 18 (49 in 1991) available frequencies should you order?

Most of these factors are related to how much money you have to spend. If you are a young person whose total income is from a paper route, perhaps all you can scrape together is just enough to buy a two channel radio powered

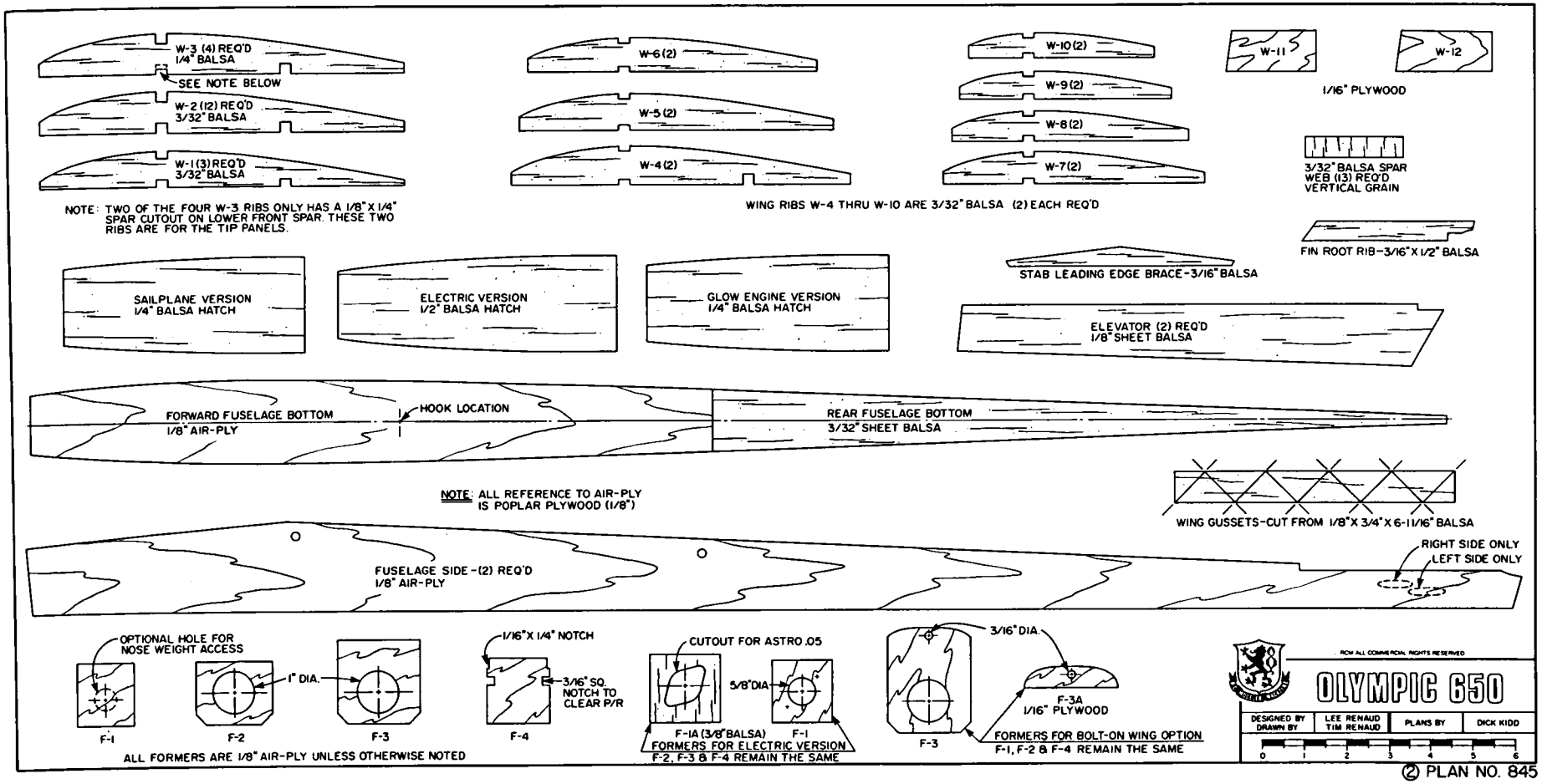
by dry batteries. You can do just as well, and have just as much fun, as the guy with the chrome plated Zilch 8 system. Fortunately, with today's technology, for glider control, low cost radios will operate just as well as their high cost big brothers. In fact, no matter how fat one's wallet, many of the features of the high priced radios have no function in flying gliders.

With respect to the decision of where to buy your radio, this is a matter of price versus personal service. The big discount houses have their own name brand radios. These are built by a big-name radio manufacturer and are quite reliable. They have such features as servo reversing switches and servo throw adjustment. These features were unknown in any radio, however, a few years ago. The big advantage of the discount house radio is its price. It is about 20% to 30% less than the big-name brand, which the discount house also carries. Local hobby stores cannot usually compete with these prices. What the local hobby dealer **does** offer, though, is personal service. A professionally run hobby shop can offer invaluable aid in equipment selection, construction tips and a good selection of balsa wood and hardware items. He can't stay in business, though, just selling balsa wood. It might be worth your while to discuss your equipment needs with your friendly hobby dealer, early on.

The question of dry batteries versus rechargeable nicads is one of pure economics. If at all possible, get a system with all nicads. Although a dry battery system is cheaper initially, about four sets of new alkaline cells equals the system nicads and charger. Don't forget, you must lay out about 12 bucks for the required alkaline cells before the dry system will play. Anyway — it's your choice; and you do what you must do.

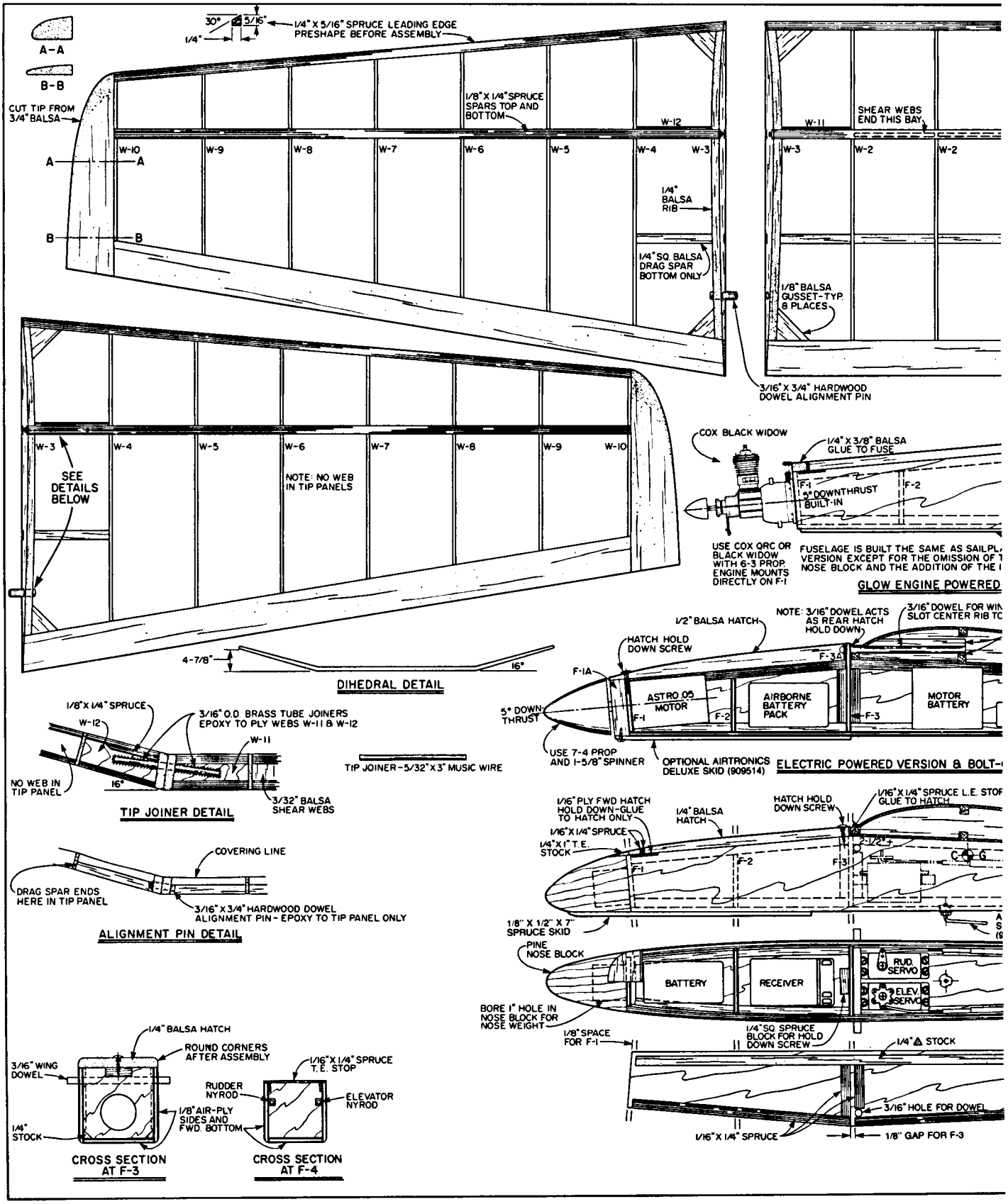
In the transmitter mode department, mode II is most popular overall for gliders. This means that the rudder and elevator are controlled from a single stick on the right side of the transmitter. The importance of conformity here is because if help is available from an experienced flier, he will be more comfortable flying a familiar stick configuration.

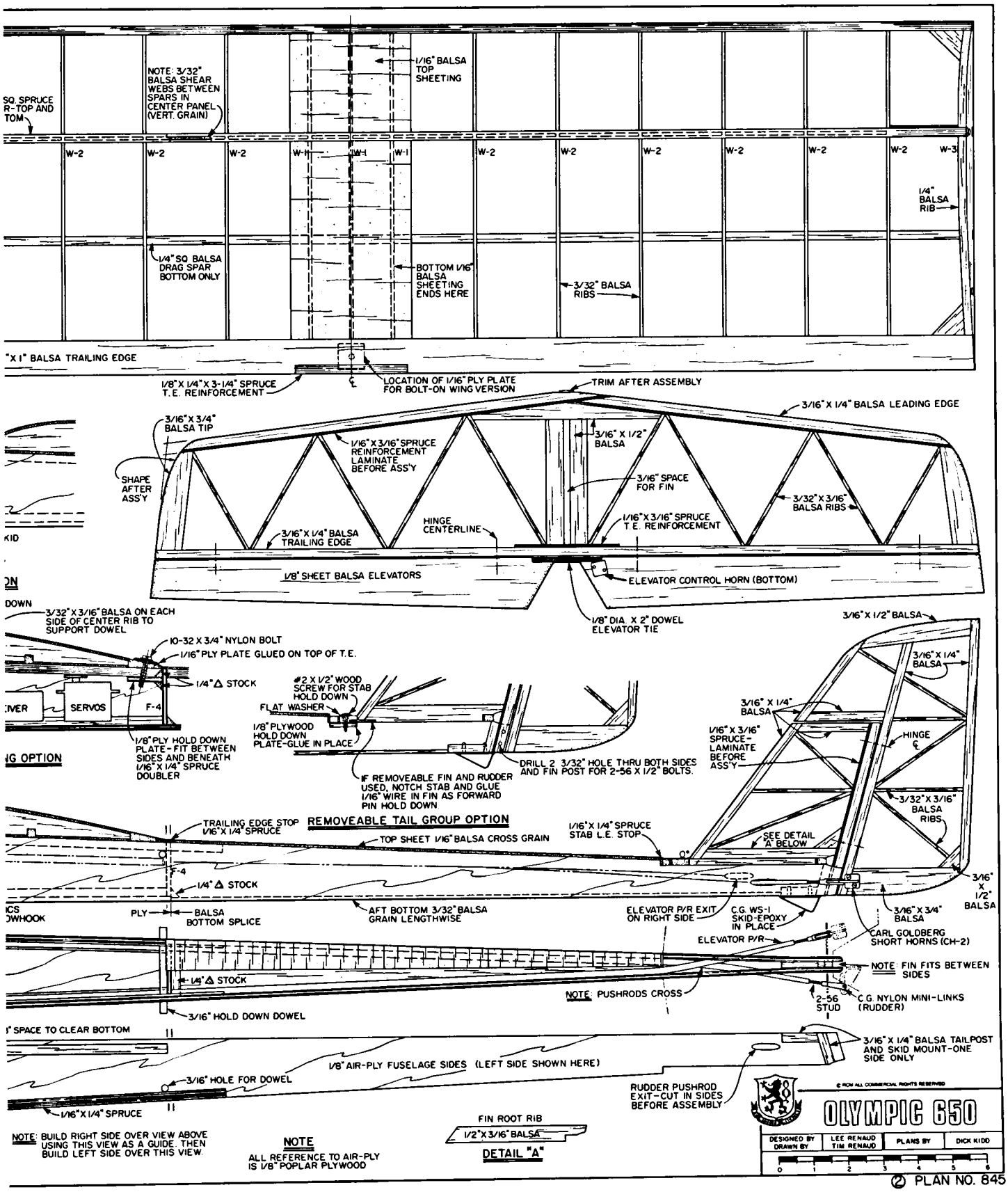
The number of channels, or function capability of the equipment is, again, a question of economics. I have owned only one glider that could use 6 channel equipment. It had elevator, aileron, rudder, flaps, spoilers, and releasable tow hook. You must really be agile to twiddle that many controls. The beginning flier will require only two channel equipment for many moons. This will control the rudder and elevator. The next step up is generally the addition of spoilers requiring three channels. If aileron controlled sailplanes is the next step, three channel equipment is still good, as it is usual to couple rudder and ailerons. If you add releasable tow hook, you need one more channel. The problem in stepping up to four channel equipment is that the control is wrong. In three channel equipment, spoiler action is controlled by a trimmable lever on the left hand side of the transmitter face. The four channel has a stick on the left hand side with the up and down action trimmable, and the side to side action spring loaded, for center return. What you would really like is a switch. So, with all this mish-mash, the most probable step up from the three channel radio is to a six channel one. Anyway — my recommendation for a beginning radio would be a three channel set with rechargeable nicad batteries. Lacking the wherewithall to purchase one of these, a **single stick,** two channel, run by dry cell batteries, will serve you very well for a long time. This is the set used in Chapter V, to be installed in the glider described in Chapter IV.

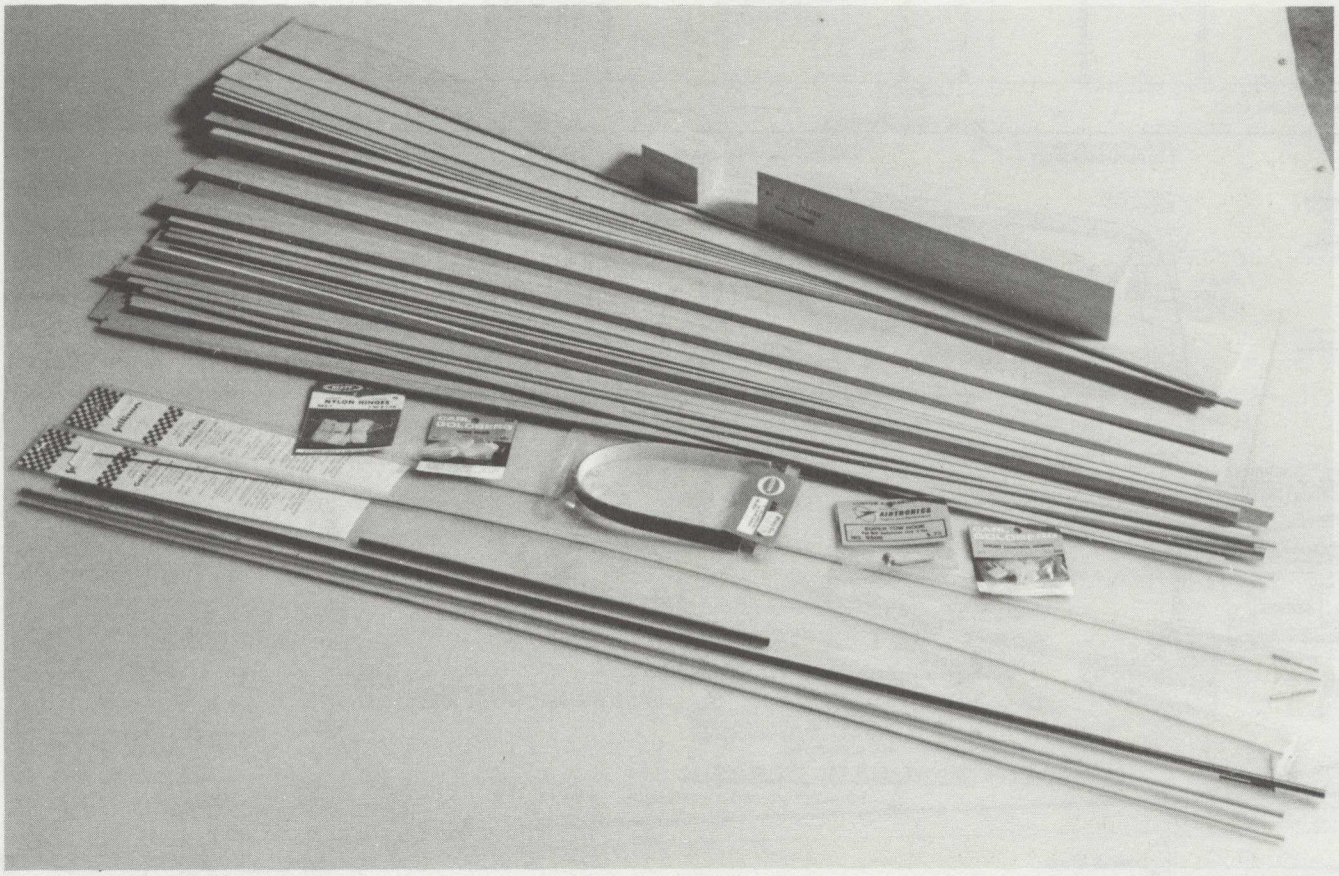


Full size plans available from
RCM Plans Service
P.O. Box 487
Sierra Madre, Calif. 91024

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P.O. Box 487
Sierra Madre, Calif. 91024




NOTE: 3/32" BALSA SHEAR WEBS BETWEEN SPARS IN CENTER PANEL (VERT. GRAIN)
1/16" BALSA TOP SHEETING
W-2
W-1
1/4" BALSA RIB
1/4" SQ. BALSA DRAG SPAR BOTTOM ONLY
BOTTOM 1/16" BALSA SHEETING ENDS HERE
3/32" BALSA RIBS
"X 1" BALSA TRAILING EDGE
1/8" X 1/4" X 3-1/4" SPRUCE T.E. REINFORCEMENT
LOCATION OF 1/16" PLY PLATE FOR BOLT-ON WING VERSION
TRIM AFTER ASSEMBLY
3/16" X 1/4" BALSA LEADING EDGE
3/16" X 3/4" BALSA TIP
SHAPE AFTER ASS'Y
1/16" X 3/16" SPRUCE REINFORCEMENT LAMINATE BEFORE ASS'Y
3/16" X 1/2" BALSA
3/16" SPACE FOR FIN
3/32" X 3/16" BALSA RIBS
HINGE CENTERLINE
3/16" X 1/4" BALSA TRAILING EDGE
1/16" X 3/16" SPRUCE T.E. REINFORCEMENT
1/8" SHEET BALSA ELEVATORS
ELEVATOR CONTROL HORN (BOTTOM)
1/8" DIA. X 2" DOWEL ELEVATOR TIE
3/32" X 3/16" BALSA ON EACH SIDE OF CENTER RIB TO SUPPORT DOWEL
10-32 X 3/4" NYLON BOLT
1/16" PLY PLATE GLUED ON TOP OF T.E.
1/4" Δ STOCK
SERVOS
F-4
1/8" PLY HOLD DOWN PLATE - FIT BETWEEN SIDES AND BENEATH 1/16" X 1/4" SPRUCE DOUBLER
#2 X 1/2" WOOD SCREW FOR STAB HOLD DOWN
FLAT WASHER
1/8" PLYWOOD HOLD DOWN PLATE - GLUE IN PLACE
DRILL 2 3/32" HOLE THRU BOTH SIDES AND FIN POST FOR 2-56 X 1/2" BOLTS.
IF REMOVEABLE FIN AND RUDDER USED, NOTCH STAB AND GLUE 1/16" WIRE IN FIN AS FORWARD PIN HOLD DOWN
3/16" X 1/2" BALSA
3/16" X 1/4" BALSA
1/16" X 3/16" SPRUCE - LAMINATE BEFORE ASS'Y
HINGE ℄
3/32" X 3/16" BALSA RIBS
REMOVEABLE TAIL GROUP OPTION
TRAILING EDGE STOP 1/16" X 1/4" SPRUCE
TOP SHEET 1/16" BALSA CROSS GRAIN
1/16" X 1/4" SPRUCE STAB L.E. STOP
SEE DETAIL 'A' BELOW
1/4" Δ STOCK
PLY
BALSA BOTTOM SPLICE
AFT BOTTOM 3/32" BALSA GRAIN LENGTHWISE
ELEVATOR P/R EXIT ON RIGHT SIDE
C.G. WS-1 SKID-EPOXY IN PLACE
3/16" X 3/4" BALSA
3/16" X 1/2" BALSA
ELEVATOR P/R
CARL GOLDBERG SHORT HORNS (CH-2)
NOTE: FIN FITS BETWEEN SIDES
NOTE: PUSHRODS CROSS
2-56 STUD
C.G. NYLON MINI-LINKS (RUDDER)
3/16" HOLE FOR DOWEL
1/8" AIR-PLY FUSELAGE SIDES (LEFT SIDE SHOWN HERE)
3/16" X 1/4" BALSA TAILPOST AND SKID MOUNT-ONE SIDE ONLY
RUDDER PUSHROD EXIT-CUT IN SIDES BEFORE ASSEMBLY
1/16" X 1/4" SPRUCE
NOTE: BUILD RIGHT SIDE OVER VIEW ABOVE USING THIS VIEW AS A GUIDE. THEN BUILD LEFT SIDE OVER THIS VIEW.
NOTE
ALL REFERENCE TO AIR-PLY IS 1/8" POPLAR PLYWOOD
FIN ROOT RIB
1/2" X 3/16" BALSA
DETAIL "A"
© ROM ALL COMMERCIAL RIGHTS RESERVED
OLYMPIC 650
DESIGNED BY
DRAWN BY
LEE RENAUD
TIM RENAUD
PLANS BY
DICK KIDD
0 1 2 3 4 5 6
② PLAN NO. 845



Materials Required.