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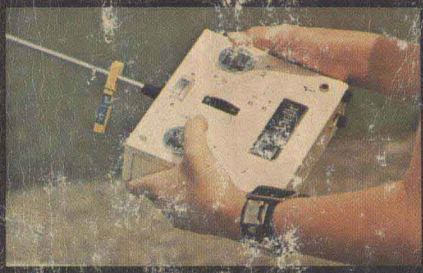
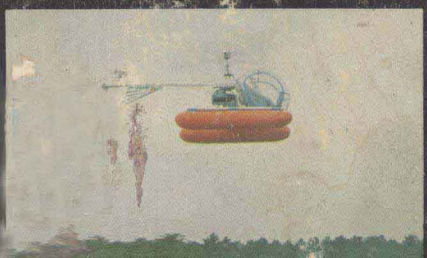
$5.95

Flying Model Airplanes & Helicopters by Radio Control

By Edward L. Safford





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TAB BOOKS
Blue Ridge Summit, Pa. 17214

FIRST EDITION

FIRST PRINTING—APRIL 1977
SECOND PRINTING—MAY 1979

Printed in the United States of America

Library of Congress Cataloging in Publication Data

Safford, Edward L.
Flying model airplanes & helicopters by radio control.

Includes index.
1. Airplanes—Models—Radio control. 2. Helicopters—Models—Radio control. I. Title.
TL770.S23 629.133'1'34 77-5637
ISBN 0-8306-7825-5
ISBN 0-8306-X pbk.

Preface

It has been several years since I have been active in one of my favorite hobbies: building and flying radio-controlled model airplanes. It has always provided rewards, fascination, and satisfaction as nothing else ever could. Realizing that a good many years had elapsed, I began a series of studies to see what had happened in this field since the days when I used to make my own escapements and servos, feeling lucky if I got my planes up and down all in one piece. Today this hobby presents a scene of tiny (and some not so tiny) model airplanes whirling, looping, diving, and edge-flying through every maneuver imaginable without a bit of hesitation, without any strings or wires—nothing connecting them with the ground—and each under the perfect (radio) control of every representative of humanity.

I knew that during my inactivity, technology, being what it is, was growing at an exponential rate. Surely, I felt, some almost unbelievable developments must have taken place. My feelings were verified.

Yes, the hobby has changed—*advanced* is a better word; it has expanded in concept and in the number of its participants. That is what this book is all about: to tell you about the hobby today and the people in it.

To get meaningful information, I personally contacted as many modelers as possible in the United States. This survey

received responses from young and old of both sexes in every walk of life; I asked about what they flew and how they flew it, and how they felt about this wonderful sport. The sample was large and random enough to allow me to say, with little reservation, it is representative of the majority of RC (radio-controlled) model enthusiasts in the United States; much of the advice given throughout this book comes directly from these willing and helpful respondents.

My survey was conducted by mailing questionnaires; I am happy to say that 85% of those were completed and returned. This was followed up by personal letters, telephone conversations, and visits. Much of the data from manufacturers was obtained by personal correspondence, phone calls, and visiting plants that make RC equipment. It was also my pleasure, during this investigation, to have been invited to many club meetings where, at both clubhouses and flying fields, I met some of the finest people you could ever want to associate with. All were very helpful in assisting me in my quest for information.

In general I found that the RC airplane modeler is an intelligent, well adjusted individual making his own contribution to society through his occupation; he is enmeshed in his hobby, has made a considerable investment in effort, and is a gregarious sort who joins others for the fun of a common interest at social events, both at and away from the model-flying field. He takes pride in the technical knowledge he has of his hobby, and is not afraid to experiment. (The results of some of these experiments have been included herein.)

The results of my survey, as well as some of my own ideas and concepts of how things work, how to get started, and how to develop a plan, make up the basis for this work. You won't find advice on building a multitude of different airplanes here because, according to my survey, I found that a few models (in a progressive sense) represent what is being flown by the respondents. The most basic model is discussed in greatest detail for those of you new to this hobby. There are plans for the experienced and some ideas that are possibly new to everyone. Because so many current model magazines regularly offer constructional details for model airplanes, too much of the same here presents the risk of tautology.

The electronic equipment used needs a little more treatment, because most people—indeed, even some veterans in this field—do not really understand how this part of an RC

system works. There are two choices for the newcomer: buy a ready-built system or build a system from a reputable kit manufacturer. Radio amateurs will, most probably, want to go the kit route. To them I say welcome aboard and 73 from W5FKZ.

I found kit-building challenging, and rewarding in success. I feel the days of building from scratch are over. For an adequate return on money invested, in terms of getting matched parts and a proved system, building a kit is the best way to go.

To all of you who have enjoyed my previous books, and to those who have been so generous and kind in your acceptance and comments, thank you for your perusal and, I hope, acceptance of this work. To those I haven't yet met through the pages of something written, please accept my thanks for being interested in this book and using it as our first meeting ground. Happy RC flying!

E. L. Safford, Jr.

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Introduction

The hobby of RC model flight is no longer the pursuit of just a few "nuts" who play with toys (as they were described a few years ago). The hobby is now enjoyed by over a hundred thousand enthusiasts—a figure obtained by extrapolating club membership information throughout the United States. Of course, I have had some club members tell me that the "nuts" must still be out there, those who continue year after year in spite of crashes, glitches, and costly pilot errors. The models are not toys but are really midget airplanes requiring scientific and engineering skills to make and fly them. Yet anyone can learn the necessary skills and participate regardless of his background.

The statistic I cited may only represent a portion of those involved in this hobby indirectly; many could not be counted because they are not affiliated with dealers, manufacturers, or clubs.

The survey mentioned earlier (Preface) covered many topics through numerous questions. Of the many responses received some were delightful. One respondent wrote, "I have been building model airplanes for 25 years. I dropped the hobby for a while about ten years ago. But now, with my son, I am back in it stronger than ever." What a wonderful situation! The father/son team concept is a working reality. They are working together, enjoying something in which they both can participate and find companionship (which, in so many

parent-child relationships, is rare nowadays). Mom, of course, can be a part of this hobby too; a mother or daughter often completely outfly the menfolk.

AREAS OF INTEREST

The hobby is not just mechanical in interest, it is also social. Flying events at flying fields are family affairs. Club meetings are arranged so that members' accomplishments, new ideas, and progress can be discussed, and newcomers can be taught. While snacking on coffee and sandwiches, members can listen to talks by highly qualified guests. Dances are held, parties given, doorprizes awarded—fun for everyone.

Then there are the contests, local fly-ins where one club invites others to come and join them for a flying session with, perhaps, prizes for best pattern maneuver, best aerobatic demonstration, best model, most ingenious technical development, most complex control system, and so forth. Fly-ins are being held almost daily across the United States.

The number of clubs registered with the AMA (Academy of Model Aeronautics, 806 Fifteenth St. NW., Washington D. C.) is 1014; all are engaged in many aspects of radio-controlled flight.

The average club membership is 58, although not all of these are always active. It is my estimation that there are some 58,800 persons in the United States who are members of clubs affiliated with the AMA.

Now consider those rugged individualists who choose not to be a member of a club, those who like to go it alone yet find companionship at flying fields or other recognized flying sites, or who only occasionally enter contests. They represent, as indicated by my survey, 19.7% of all model flyers, or about 11,585. That would bring the total of active model-airplane enthusiasts to 70,400, a figure slightly lower than that estimated by the AMA (which sets the figure at 75,000). In considering the hobbyists in this field we cannot neglect the radio amateur who is primarily interested in the electronics aspects of the hobby as supplementary to his main interest.

It has been estimated that of the 1½ million radio amateurs who pursue their hobby (in the United States), approximately 8% are interested in the RC facet of electronics and communications. This could swell the total by another 80,000 who are less devoted but participate in the hobby

directly or indirectly at some time. So we are now considering some 150,000 persons interested enough in the hobby to be actively engaged in it (not to mention those concerned with the hobby because of associated jobs, manufacturing, selling, or publishing). A graph has been provided as Appendix A to illustrate the geographical distribution of RC aircraft clubs. Notice that (without surprise) California leads the way with the largest number of clubs, while Vermont and Utah tie for last place with one club each. It wouldn't be unreasonable to assume that since California and Oregon have long been centers of the aircraft industry, persons who love their work in this field would join a club and pursue this hobby. Appendix B shows the distribution of types of model aircraft activity.

Why do people take up radio-controlled model airplane flying? I asked the persons I contacted to rate five areas of the hobby, asking which gave them the most pleasure and which the least, using a scale of 1 to 5; 1 represented the greatest pleasure and 5, the least.

The responses showed, beyond question, that *flying* RC airplanes gave the greatest pleasure with *building* running second; flying and building together accounted for 95.3% of the vote for most pleasurable. Most said that club activities were somewhat pleasurable, their rating running in the middle of the scale; I believe this indicates a need for a second look at what club meetings consist of, to find out how to make them more pleasurable. (Often it is the time or distance involved in attending meetings and conflicts with other activities that discourage more active club participation; this aspect was rated third in the survey data.)

Building and adjusting electronic equipment, yet another category, ran a close race for last place with contest participation; both were rated almost equally *least pleasurable*, the former losing by a nose. Now this information is significant because electronics comprises a major part of the hobby (equipment). Because most people enjoy what they do best, I can only assume that the majority of persons who vetoed electronics as pleasurable were merely admitting to a lack of knowledge in this area. Soldering, resistors, capacitors—these are things the average citizen knows nothing about. Also, much of the RC equipment today is offered ready to fly; little if anything is required to adjust it (although batteries must be kept charged). Then, too, the

equipment is complex, requiring specialized knowledge and test equipment for its repair. Adding these factors together produces good reason for the low interest. (Radio amateurs and qualified electronics technicians, of course, were most interested in this aspect.)

One reason formal contests were rated low was given by one of my contacts who said that they entailed "...too much hassle and pressure." In fairness, however, I must report that another respondent said, "[I] have participated in three fun flys—very enjoyable."

SOURCES OF INFORMATION

Through first hand visits, my survey included questions directed to various hobby dealers and shops; the answers were not always as anticipated. Thinking that I would find active, enthusiastic modelers in these shops who would be delighted to help locate model flyers, builders, or club members, I found instead young part-time salespersons who did not have a model and, for that matter, weren't even interested in having one. Need I say they had little real knowledge of model-building, mechanics, or RC procedures. When asked about specific models on display or what kind of performance one could expect from a particular kit, their answers ranged from "I don't know" to "Maybe I can get someone who can give you some answers."

The point of this is that, contrary to popular belief, the hobby dealer is *not* the first source to go to for answers to questions about the sport. Rather, the most reliable source for such information is the hobbyist himself, that is, persons in your area active in the sport. Of course, most hobby shops can direct you to patrons in the neighborhood who might be willing to assist you.

Many of the respondents to my survey declared their interest in this hobby, having known about it from reading various publications, but because they were in isolated areas, didn't know what to do or who to contact for information. For those who fit into this category, I suggest a letter to the AMA. They will help you with your special problems and, possibly, will refer you to others in your area who are hobbyists (and provide their addresses and telephone numbers).

If your specific problem needs relatively quick attention, model magazines are good sources to contact through their

letters-from-readers department; responses will be published or mailed to you.

Finally, manufacturers are good sources. I have found that large, reputable firms *do* respond to inquiries and requests for information. They have, perhaps, the best, most experienced modelers in their employ.

1

Looking Back

Progress in the radio control of model aircraft has been as great as the progress in the advanced sciences. Radio control of model aircraft began slowly at just about the same time the current rocket program began. That beginning, like others, showed us that we had to crawl before we could walk, that we had to learn the refinements of balance and power before we could run.

In 1936 a magazine, *Model Aviation*, announced, "A new contest has been arranged for radio-controlled models." In the issue that followed a month later, it was reported that the radio-controlled model event had failed. "But," the publisher consoled, "we hope to see those radio-controlled models next year." No one had appeared for the first event. The following year, however, the event was successful. Six model aircraft were entered in the national model competition.

RC PIONEERS

The first to succeed in flying an RC (radio-controlled) model plane was Chester Lanzo of Cleveland. His model, hand-launched, flew directly into a nearby parking lot, where it crashed. But judges present noticed that along the way whenever Lanzo activated a control, the ship wobbled. Radio control of model aircraft had been born.

Subsequent years saw rapid progress. In 1938, a radio-controlled model took off from the ground for the first

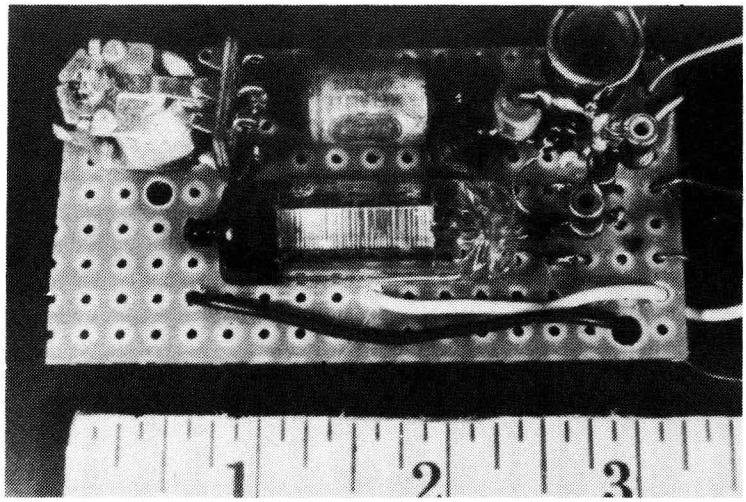

Fig. 1-1. One tube (an RK-61), a relay, and a tuning coil make up the essentials of this early carrier-operated receiver.

time. It went up and down—just like that. Then came the biggie. In 1939 brothers Walt and Bill Goode, amateur radio operators with degrees in physics, successfully flew, by radio control, a rectangular course and a figure-8, then landed their model at their feet. Radio control of models was here to stay.

EARLY GEAR

Back in the early days, radio-controlled equipment was heavy and bulky. A gas-filled thyratron (vacuum tube), an RK-61 (Fig. 1-1), was often used. The receiver shown has a simple circuit that activates an escapement, something like the device in watches that makes the gears turn in one direction, a step at a time. The escapement allowed electrical signals to move a rudder left or right with a single rotation of its little crank (Fig. 1-2).

The single-tube receiver left much to be desired. It was adjusted so that when the transmitter's signal, *carrier*, was received, a change in current through the tube operated a relay, which operated the escapement. Receivers were tuned for maximum range by turning a tuning slug in a coil while watching a meter for maximum signal. Nowadays transmitters and receivers are matched in frequency through the use of piezoelectric crystals that are carefully calibrated at the factory.