The AMA History Project Presents:
Autobiography of DAVID B. ROBELEN

January 12, 1940- April 7, 2007   Started modeling in1949

AMA #12555

Written & Submitted by DBR (09/2003); Transcribed & Edited by SS (09/2003), Updated by JS (04/2007), Reformatted by JS (01/2010)

Career:

- Won first place at the first meet he entered locally at age 13
- In his early to mid-20s, won approximately 10 first-places, five second-places and four third-places in regional meets
- Won the State Championship in 1969
- Won two first places at the Nationals in high-wing peanut scale with his original Piper *Vagabond* and one first place in the compressed air-powered event with an original model; also received several second- and third-places in the mass-launch events
- Was very successful in regional Flying Aces Club (FAC) events
- Constructed a homemade vertical spin tunnel, with models to match; conducted various studies with his wind tunnel
- Built wind tunnels for various discovery centers in the U.S., and gave public demonstrations with his wind tunnels
- Worked on and was a consultant of military's Micro Air Vehicles (MAVs)
- Helped organize two model airplane clubs; served as club president
- Is an AMA leader member, active contest director and Chairman of the Electric Contest Board
- President of the National Indoor Remote-Control Aircraft Council (NIRAC), starting in 2003
- Lead contest director at the first National Indoor Radio Control Championships held in June 2003
- Inducted into the NIRAC Hall of Fame in 2003
- Had many articles published in various modeling magazines; wrote a bi-monthly column for the Micro-Flying column of *Model Aviation* magazine
- Organized Tidewater Hobby Enterprises, a kit manufacturing business, in 1970; produced several of his own designs
- As a NASA employee, regularly gave talks and demonstrations for school groups about Radio Control model aircraft
- Formed Countryside Aero Labs after he retired from NASA in 1995 to build wind tunnels for discovery centers

The Beginning

My start in model aviation came as a result of going with my father, Horace B. Robelen, to the park to fly his *Baby* Rise-off-Ground (ROG) model when I was about 6-years-old. At about age 10, I began to build and fly outdoor hand-launched gliders built from Jetco kits. The next step was to tackle a ½-A Control Line model that came ready-built from plastic, with an Anderson Spitzy engine. This model lasted half of a lap and totally shattered. I saved the Spitzy engine.

The next attempt was a Jim Walker *Firebaby* with an Anderson Baby Spitfire engine. Since neither my father nor I knew how to fly a Control Line model, the *Firebaby* took a terrific beating with little improvement. A family vacation trip to West Virginia proved to be the turning point. Since I was loath to part with my model, it was carried in the trunk of the car. The magic moment came on a Saturday morning when we heard the unmistakable whine of a Control Line model in successful flight. My father and I quickly jumped into the car and followed the sound to its source. We met a very friendly dentist, Dr. McCracken, who offered to teach me to fly the *Firebaby*. With dual instruction, success came quickly, and this model and I seldom parted for the next year.

There followed a series of Scientific balsa models, most powered with an Atwood wasp .049. By the age of 13, I was quite proficient with the ½-A class of Control Line models. It was at this point that I was introduced to Radio Control models. My dad decided to get involved in this fledgling aspect of the hobby and I was his assistant. The first model we built was a *Trixter Beam* designed by Lou Andrews and sold as a kit by his company. It was powered initially with an OK Cub .14 engine. The equipment was designed by Ed Lorenz and built on our kitchen table. The receiver, with its tubes, was very fragile, and the transmitter was so bulky we used a small wagon to tow it. The first field sessions were mainly dedicated to troubleshooting the Radio Control stuff, and there was no attempt at flight.

When the time came for the first flight, I was given the control button and Dad took off running with the *Beam* held head-high in a flight altitude. When his straw hat blew off, he decided the plane was going fast enough, so it got a mighty shove. It started off smooth, but before I got to give it a control, it was on the ground with the engine still running. A swap to a Cub .19 proved to be just enough power, and we flew that plane until it was too raunchy to claim ownership.

It was some years later that I was able to afford my first Radio Control. It was a simple ½A *Mini Mambo* kit by Sterling Models. The controls were a single-channel escapement set-up bought from a fellow modeler who wanted to move up. From that point, there was no looking back. One kit followed another as the budget allowed.

Competition

My first attempt at competition took place at the local elementary school where a meet had been organized for hand-launched glider models. I was 13 at the time. Due to the fortunate fact that my model was the only one to ride a thermal, I won first place. That little cup still graces the mantle.

After the required period of schooling, getting married and starting a career, I decided to take up competition once again. By this time, I had been flying Radio Control models for about 10 years and was ready to tackle the “big boys.” There followed several years of intense competition in the AMA Class II event in a variety of regional meets. The result was approximately 10 first-, 5 second-, and four third-places. All during this time, I was campaigning my modified version of a Top Flite *Tauri* with a K&B .45 engine.

My one try at Radio Control Scale competition turned out quite well. After a year of campaigning a 1/6-Scale *Neiuport 17* model in various regional meets, I was fortunate enough to win the state championships in 1969 with the model. It now hangs in a place of distinction in my workshop after more than 1,000 flights.

There was a lengthy break in competition, and when I returned, I flew Indoor Free Flight Duration. As a member of the Brainbusters Club, I was in good company for this activity. Initially, I flew in club meets to the point where I won first-place two times in the Club Five event competition, which ran for a season each time. From there I went to the Johnson City Indoor Nationals (Nats) and placed fifth in EZB (20 minutes and five seconds) along with a fourth place in No-Calories Duration (five minutes and 35 seconds).

By this time, my interest in competition had turned to FAC scale, and I traveled to the Geneseo Nats in Geneseo, New York, several times. The results were two first places in high-wing Peanut Scale with my original Piper *Vagabond*, a first place in the Compressed Air-Powered event (original model), and several second and third places in the Mass Launch events. I was also successful in the regional FAC events, winning first place three times in the Peanut Class (Piper *Vagabond*), along with a first in Military Trainers (Arado trainer) and a second in High-Wing Cabin Mass Launch (Piper *Vagabond*, later an article in *Model Aviation* magazine).

Experiments

I was exposed to a wide variety of wind tunnel testing during my employment at the NASA Langley Research Center. This led to constructing a homemade vertical-spin tunnel, with models to match. This project was the subject of a *Model Aviation* article and a newspaper write-up. With this equipment, I was able to study and demonstrate a variety of spin modes for different airplane designs. This same wind tunnel was later used as a prototype for several similar units, which are installed in discovery centers around the country. I was sent along with my wind tunnel to the Osh Kosh Convention to give public demonstrations and speak about technology of airplane design relating to this area.

There were other, smaller, horizontal wind tunnels I built for the study of flow visualization at home as well as for lecture demonstrations. These generally involved introducing a stream of non-toxic vapor into the wind tunnel airflow. When this vapor stream is passed over various model shapes, the flow around the model may be clearly seen. This technique is a very graphic way to illustrate the complexity of the air flowing around a three-dimensional shape. (I hold a patent on a portable vapor generator.) This led to classroom demonstrations sponsored by NASA to lecture and demonstrate aeronautics to groups of educators.

The next wind tunnel project was a much larger design, again a vertical spin tunnel. This one stood 13 feet tall and had ad chamber 30-inches across. With the availability of this tunnel, I was able to build small (12- to 14-inch wingspan) dynamically scaled Radio Control models with controls that could be moved during the spin. This led to my doing a set of videotapes of various models spinning and recovering (or not) in the tunnel. As a result of industry apathy in this project, it was set aside for other work.

Another field of interest and considerable experimentation has been the area of military MAVs (Micro Air Vehicles). I have built and flown vehicles as small as eight-inch wingspan with a Cox .010 engine with considerable success. As a result of my work with micro models and these MAVs, I have been called upon by the industry as a consultant in this area, as well as being invited to formal conferences in this field.

There was a series of lift and drag studies on a set of three wings (*Radio Control Microflight* magazine article) that illustrated the benefit of turbulators and the effect of changing contours. The next work was a study of propeller design, measuring thrust, current, volts and rpm's to identify the most important variables in design. This work is incomplete at present but will be continued.

There have been occasions where other parties have rented time in one of my wind tunnels, mainly to study and document the concepts of interest to them.

The remainder of my model experimenting has been focusing on the improvement of performance, mainly dealing with Free Flight models and the application of turbulators, airfoil effects, getting the most out of rubber band power and developing the most suitable propeller for a given model.

Leadership

I have helped to organize two different Radio Control model clubs. The first, the South Eastern Virginia Radio Control Group, was formed in the mid-1960s, and I served two terms as president. Following a move to a different flying site, this club is now named the Colonial Virginia Aeromodelers. The second club was also Radio Control, and for a number of years starting in the mid-1980s there were no formal arrangements. I was the president for several years until a move took me out of the area. This club is now operating under the name Newport News Aero Modelers.

My role in AMA started as a leader member, moved to an active contest director (CD) and now the chairman of the electric contest board. I am also the president of the National Indoor Remote-Control Aircraft Council (NIRAC), the special interest group representing indoor Radio Control modeling.

Contest Leadership

As an active CD, I held the lead CD position in a number of regional Radio Control contests sponsored by the South Eastern Virginia Radio Control Group (SEVRCG). In addition, I served as assistant CD under the other lead CDs in the same category contest. Most recently, I was the lead CD at the first National Indoor Radio Control Championships held in June 2003. I am also the lead CD for the same event to be held in 2004.

I was inducted into the NIRAC Indoor Radio Control Hall of Fame in 2003.

Publishing Experience

My first published article was a model called the Pipsqueak, published in *RCM* magazine in the April 1966 issue. This model was a loosely scaled replica of the Midwest Esquire powered with a Cox .010 and featured full “galloping ghost” control, along with detail on building the controls.

Below is a list of magazines I have been published in and what articles were in them.

American Modeler magazine

- *Simpro*: January 1967. This article dealt with a dual proportional control system designed by me that was suited to micro class Radio Control models. The two proportional controls had servos and were “wiggle free.”
- *Prophet*: July 1967. A 22-inch span low-wing model designed to be powered with the Cox .020 and used the Simpro controls.

American Aircraft Modeler magazine

- Radio Control Mini Scale Overview: August 1969. This article dealt with the necessary design and operating features of successful micro Radio Control Scale models that were being flown at the time.

Model Aviation magazine

- *Miniature Spin Tunnel*: March 1980. This article described in detail the design and operation of my small spin tunnel, along with the model construction and interpretation of results.
- *Playmate*: April 1986. This was a low-wing sport model developed for three-channel control and a .25 class engine.
- *Parakeet*: February 1987. This article dealt with a sport bi-plane featuring three-channel control and sized for a .25 engine.
- *Perky*: August 1994. This was a high-wing sport model designed for two-channel micro equipment and the Cox .010 engine. The wingspan was 20 inches.
- *Turbo Sport*: March 1997. This model was the winner of a design contest and introduced the use of flight control through varying speed of the two drive motors mounted on the wings. There were no control surfaces. There are a number of “toy” class Radio Control models using this feature today.
- *Perky Plus*: July 2000. This is a scaled up version of the original Perky model for .061 power and three-channel control.
- Piper *Vagabond*: January 2001. This was a rubber-powered scale model developed for FAC competition. The wingspan was 24 inches.
- Bristol *Brownie*: April 2001. This was a speed 400-powered electric scale model of a British light aircraft.
- *Prince*: October 2002. This was a sport aerobatic model featuring design styling from the 1960s pattern models. The power was a .25.

Model Airplane News magazine

- *Mini Corben Super Ace*: December 1968. This was a .010-powered 19-inch span Radio Control model of an early American homebuilt aircraft.
- *Kestral*: September 1968. A 72-inch span semi-scale Radio Control sailplane of original design
- *Sperry Messenger*: June 1969. A 13-inch span, .010-powered Radio Control Scale model with full-size plans featured in the magazine
- *Square Shooter*: July 1969. A low-wing fully aerobatic four-channel sport model that featured simple construction couple with excellent flight qualities. Power was .29 to .46.
- *Pronto*: August 1972. A low-wing, three-channel sport model featuring simple construction, appealing lines and excellent flying qualities. Power was .15 to .25.
- *Mega Pepper*: June 2000. A scale up to sp400 size of a successful low-wing micro Radio Control model.
- *Mini Kaos*: January 2001. A replica model of an early pattern model; four channels and .061 power.

<u>*Radio Control Microflight* magazine</u>

- *Pixie*: October 1999. A three-channel, 20-inch span micro high-wing electric Radio Control model. This model introduced the concept of the micro size (20-inch span) electric model.
- *Pepper*: March 2000. A low-wing, three-channel micro electric Radio Control model with a 22-inch span
- How-To: May 2000. A method for reducing the weight of the Hitech HS-50 servo to four grams
- *Plinker*: August 2000. A lightly build single-channel electric cabin model with a span of 24 inches. This one was covered with food wrap.
- *Pond Baby*: October 2000. The first micro electric seaplane. High-wing, 20-inch span, and three-channel.
- *Mini Kestral*: November 2000. This was a scaled down version (36-inch span) of a model presented earlier in Model Airplane News magazine. Three-channel control and 1.5-ounce weight.
- *Micro Mustang*: April 2001. A semi-scale replica of the famous fighter that had a 16-inch span, three-channel control (aileron, elevator, and throttle) and weighed two ounces.
- *Pokey*: August 2001. This was an enlargement of the Plinker design built with traditional stick and tissue. The wingspan was 30 inches and it had a three-channel control.
- *Playmate Junior*: June 2001. This was a replica in miniature of an earlier three-channel low-wing model for electric power with a span of 18 inches.
- *Wings and Things Curvy*: August 2001. A discussion of results from a wind tunnel comparison of three different wings of the same size with different airfoils. Also some on turbulators. Had text and charts.
- *Punkin II*: November 2001. This was a 16-inch span cabin bi-plane featuring three-channel control with servos and the ability to fly in very small spaces.
- *Flap Jack*: February 2002. This was a fully aerobatic 24-inch span model featuring the use of wire cut foam and food wrap covering. Electric, three-channel (aileron, elevator, and throttle).
- *Pixel*: April 2000. This little bi-plane was among the first to use the newly introduced RFFS-100 magnetic proportional control system. 13-inch span, three-channel, electric.

- *Micro Sport*: July 2002. An easily built introductory model to micro Radio Control. 22-inch span, electric, three-channel.
- Bristol *Brownie*: February 2003. A micro (13-inch) version of the British lightplane for magnetic control (electric).
- *Walker*: July 2003. This was an ultra-light indoor bi-plane designed to fly at walking speeds. The weight was one ounce, the controls were magnetic, and it had electric power.

Backyard Flyer

- *Micro Mustang*: Winter 2002. A reprint of popular micro of the famous fighter. It had three channels (aileron, elevator, and throttle) and a 16-inch span.
- *GW Sport*: Spring 2002. This was a high-wing cabin model designed as a suitable model for a first scratch build project. The span was 39 inches; it had three channels and was electric.
- *Mister Bones*: Summer 2002. This was a lightly framed 24-inch span delta featuring food wrap covering and EDF propulsion. Three channels (elevons, throttle).
- Piper *Vagabond*: March 2003. This was a competition grade scale model of the early Piper lightplane. Span was 30 inches; it was electric and had three channels.

I also write the bi-monthly Micro-Flying department in Model Aviation magazine.

Hobby Industry Involvement

I organized Tidewater Hobby Enterprises, a kit manufacturing business started in 1970. There was one partner, Mark Schwing. This business was started to produce kits of several of my designs, starting with the Pronto and Square Shooter. Things were going well with acceptable growth until the sudden death of my first wife in July 1972. At this point, I sold my interest in the business to Mark Schwing who continued its operation.

By the 1980s, the line had grown to include more designs, and I bought the business back. This continued until the growth of my new family (five children with my second wife). The pressure of working full-time at NASA and having a home life led to the sale of the business to Dave Duesing around 1990. The business was sold once more to Stream Hobbies in Newport News, Virginia, who operated it for a few years until about 1988 when it was discontinued.

Education Involvement

While employed by NASA I was regularly sent to visit school groups and present our research using Radio Control model aircraft. One such program, Sky School, involved presenting this material to groups of educators who would then incorporate some of it into their physics classes.

I was sent to the Osh Kosh convention four times by NASA. Twice I presented a program where we used Radio Control models built to dynamic scale to study the flight characteristics of light aircraft in the forum environment. The other two times I was sent with my miniature spin tunnel (seven feet tall) to present the concepts of aircraft in a spin and suitable recovery techniques. I was also sent to the Will Rogers International Airport in Oklahoma City, Oklahoma, once to present the miniature spin tunnel and associated concepts at a major air show at the request of an Oklahoma congressional representative.

I retired from NASA in 1995. Shortly after this, we moved to a small farm (21 acres) in central Virginia. Wishing to continue my involvement with the educational community, I formed a company by the name of Countryside Aero Labs. The plan was to design and build exhibit items for the various discovery centers and science museums around the country.

My first product was an interactive exhibit called the "wind tunnel flight demonstrator." This exhibit was based on a wind tunnel eight feet long and six feet tall with transparent sides and top. There was a Radio Control model of my design mounted in the tunnel on a special rig that allowed the model to freely pivot about the roll, yaw, and pitch axis, as well as being able to translate from side-side and vertically. This wind tunnel had a five-foot diameter blade built by me, which was driven by a ½-horsepower electric motor. The visitor could stand at a console located directly behind the tunnel and control the speed of the fan along with the controls of the model. In operation, the model would lift from a "runway" when the proper combination of speed and pitch control was reached and then respond to the control inputs of the pilot. Because it was possible to watch the controls move and the model respond, it was readily apparent to most how the airplane was being controlled.

These wind tunnel exhibits are currently located in facilities in Louisiana, Florida, and Virginia. Ultimately, the workload of supporting these widely located exhibits caused me to stop producing them. I have designed and built smaller wind tunnel exhibits for centers in Charlottesville, Virginia, as well as the Science Museum of Virginia, located in Richmond. I am a regular consultant to the staff at the Science Museum in Richmond and designed much of their aeronautical exhibit area.

(signed) David B. Robelen
September 2003

The following comes from the AMA's homepage, placed online April 19, 2007.

"David Robelen, author of Model Aviation's "Micro-Flying" column passed away on Saturday, April 7, 2007.

Dave started his NASA career in October 1958 on the day NACA (National Advisory Committee on Aeronautics) ended and NASA (National Aeronautics and Space Administration) began.

He graduated from the NASA Apprentice School and served as a machinist and instrument maker in the organization that would become the Fabrication Division. He transferred from the Instrument Construction Section into the Operations Support Division in 1976 and worked in the Dynamics and Stability Branch at the 30- x 60-Foot Full-Scale Wind Tunnel where his knowledge and skills in model aviation were very important.

Dave received many Tech-Brief Awards and at least one patent on work he had done for NASA. He retired from NASA in March 1995 and he and his family moved to Farmville, Virginia, where they bought a small farm.

Dave was a longtime aeromodeler and has published many construction articles for national magazines. He authored a by-monthly column for Model Aviation and moderated an electronic bulletin board.

Dave had been the Chairman of the AMA Electric Contest Board since 2002. He was the first person to be admitted into the National Indoor Remote-Control Aircraft Council Hall of Fame and was one of the most respected indoor and micro Radio Control modelers. He will be missed by his many friends and family."

The following is a transcript of a handwritten speech by David Robelen, c. 1970. An unidentified film was presented when he gave this speech.

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"Ultra Miniature [Radio Control] Models

This presentation on the miniature [Radio Control] model, is basically going to be an effort to bring you up to date on some of the fun that I've been having with really tiny [Radio Control] models, and hopefully share some information on the subject. Currently, the smallest models have a wingspan little over one foot, and total weights as low as 2 ¼ ounces. Why do I build models this tiny? I suppose for the same reasons that we've put man on the moon, climbed Mount Everest, and just generally probed the unknown. Anyhow, I've enjoyed it so far and really look forward to future advances, (or reductions, if you will.) (paragraph) Just like any other [Radio Control] model, the tiny ones possess their own advantages, require specialized skills and knowledge, and of course have a few drawbacks as well. Some advantages are pretty obvious, such as small flying field requirements, very low noise and danger levels, and a very low total cost. Also, nearly everyone finds them appealing and "cute" for various reasons. Most of the skills and knowledge required focus on one main thin, being able to work with small objects and just generally think small.

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There's no particular critical skill that I'm aware of, just sort of a general thing. It's also pretty necessary to go up on adjusting and flying "ruder only" models, almost a lost art these days it seems.

O.K., so they also have a few drawbacks as well, for instance, they can't handle wind like a larger model, and so far have been limited to superregen [sic] equipment. The limited amount of control (rudder only) is frustrating at times, but then individual models and control equipment are a whole lot less expensive than their big brethren. Another drawback is the limited number of suitable engines; there's only one, the Cox .010, and its way too big and powerful. In fact, this is the present hold-up on further shrinkage, since the engine currently represents nearly a third of the entire gross weight. Small gliders are not affected by this, but they still have to carry the equipment, and be visible while soaring in a thermal.

That's enough of this talk about drawbacks, disadvantages, and such. I don't want to give you the wrong impression! Before going too far with […]
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[…] the aircraft portion of this discussion. I'll talk a little about the equipment used.

The original goal was to use only the smallest and lightest equipment available so that I would not overburden the tiny aircraft. There are several basic similarities with all of this tiny equipment and I will outline these now. First, all of the equipment I have used is of the single-channel, rudder-only, pulse proportional types. Also, all of the suitable receivers are superregeneative [sic] so far. There are really only two actual systems currently on the market now that are useful, due to the weight requirements. The first comes from Germany, and its custom built by Mr. Hillman Bentert. The receiver is a tiny, solid plastic encapsulated device, which requires a special high-tone transmitter. This receiver is the smallest and lightest (4 grams or fifteen hundredths of an ounce) and the most costly at approximately $30.00. Mr. Bentert also manufactures a miniature magnetic activator for se with this receiver, which again is the smallest and lightest device of its type available. Instead of quoting too […]

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[…] many physical specifications and such, I'll invite you to take a look at the display of aircraft and equipment I have in the other room. Actually, this is the most useful manner for me to quote a bath of statistics and make comparisons of sizes, weights, and such. Meanwhile, as I mentioned before, the Bentert receiver requires a special high tone transmitter. While it's possible to modify an American pulse transmitter to operate this system, probably the best bet is to purchase the special transmitter required from my Bentert. At last word, the entire system with transmitter costs about 70 dollars and comes completely wired ready to use. Though I didn't mention it earlier, this system uses two miniature hearing aid battery cells for power in the airborne pack, which are widely available where hearing aid batteries are sold.

The other system available that falls within the size and weight requirements comes from ACE P/C in this country. The actuator is the same small Bentert device mentioned before, but imported by ACE in this instance.

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The receiver is the Albin, and its available only in kit form, however, the cost is much lower and it is compatible with standard American single channel pulse transmitters. Also, it will work with nickel cadmium batteries as well as the tiny hearing aid cells. This Albin-Bentert combination is plenty small and light for the models I've built, and has the advantage of being available through normal hobby outlets in this country. Before leaving the subject of equipment, I will be a little more specific about the battery cells mentioned earlier. The hearing aid battery is the Eveready S76e silver oxide cell, and, while it's not rechargeable, a pair of these will last for at least twenty or more 3 to 5 minute flights, if used with the small Bentern actuator in the systems described earlier. As for nickel-cadmium cells, I've used the 50 mAh button cells available from Lafayette radio in 3 cell packs, and these also fit the requirements of size and weight. There probably are battery cells and sources other than those I've mentioned […]

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[…] However, I have used these and know they will work find. My apologies if I'm omitting any manufacturer or supplier of batteries, however those mentioned are the only ones that I am personally aware of.

Because of the special problems involved with its use in this application, I'm going to talk a bit about the Cox .010 at this point. If this little jewel only had a power output anywhere near matching its size, there would hardly be a problem. However, the Cox designers outdid themselves in the power department, and produced an engine that's a demon for its size. To best illustrate the difficulty I've had, a comparison might simplify things. To roughly equal the power and size of the .010 in a 2.5 ounce model, try to imagine installing a hot .19 engine in a Junior Falcon with rudder only control (no throttle, and you begin to get the picture. O.K., so I needed to reduce the power a whole bunch, and still retain reasonable starting and handling qualities. For various reasons, this requirement was the hardest part encountered, yet in the […]

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[…] development of these mini-models. I tried all sorts of things; a large prop helped, but was far from the whole answer. The engine was still putting out 80% power on a 4 ½" prop, when a 3" was considered standard. However, one little discovery was made here, and that is that the .010 is a whole lot more economical on fuel, when running on a large prop. All sorts of weird methods were tried to restrict the power; among them reducing the crankshaft port to less than 1/8 the original area, making new venturies with much smaller throats, blocking one intake port in the cylinder completely, and even skimming the head up to reduce the compression. Not a single one of these ideas was successful, however, I sure got a lot of practice starting, running, dismantling, and purchasing Cox .010s. Finally, I read of a modeler in Wisconsin by the name of Carl Vogt, who had achieved good success controlling the power of a Cox .020 Tee Dee with a variable exhaust restrictor. I assure you, I had constructed one of these devices for a .010 almost before completely laying down the magazine, the idea sounded so great.

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Finally success! The engine could easily be started with the restrictor in the open position, and then throttled back to any desired power level, and this would last through a complete tank of fuel. I have made to her, fancier devices to do the same job, but none of them improved a bit over the performance of the Vogt design. Of course, now you can go out and purchase a throttle from ACE made by Vogt, and completely bypass all the problems I was involved in with my development program.

Before getting into the movie which we'll see in a moment, I'll comment a bit on a few of the models I've built and flown, and explain the reason for some of the individual feathers. The Corben Super Ace is representative of a lot of models having a similar configuration, therefore touch on it first. The original goal was to construct an [Radio Control] model as small as possible, and yet retain a scale-like flight pattern. In other words, it would not be acceptable to have a fast Hornet-like model with a very poor glide. The minimum weight was pretty well established by the […]

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[…] engine and [Radio Control] gear, so the job was to choose a scale that would give a tiny model, and yet retain some gentle flight performance. There is one annoying fact of all small airplanes that begins to emerge here, and that's the scale effect. What I mean is that a small wing will not generate the same lifting power per unit if area as a large wing. This is best explained in a variety of ways, all of them beyond the scope of this discussion. In short, the wing loading on these models can't be compared with larger models because they are less efficient. The Corben has about 60 square inches of wing area and a weight of 2 ¾ ounces, and it is about as heavily loaded as would be desirable with a wing loading of only about 6 ounces per square foot. The rest of the design considerations are much less complex; the wing airfoil doesn't seem ultra-critical, quite the opposite in fact. The model's construction should be rather rugged because of the un-scale-like surface on the flying field, and the resultant rough landing while the remaining features such as thrust-lines and rudder size just follow standard design practice.

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Other power models will share most of the basic philosophy with the Corben, however, biplanes such as the Sperry Messenger, must have a still lower wing loading for comparable performance, due to the inefficiency of the biplane configuration. Actually, the difference needn't be huge, just somewhat lower will do the job. Naturally, the lighter the better in any case and this applies to all of these models. Most biplanes, including the Sperry, also require more engine side thrust due to the difference of the propeller slipstream, when compared with the high wing types. As for the structure of the Sperry, or similar biplane types, the all-balsa approach is the most rugged, and is well within tolerance for weight consideration. In fact, the sheet balsa wing very closely duplicates the full-scale airfoil, which might be taken as a bonus.

There's a wide range of scale model types that I haven't even touched on, such as the Navy fighter-bombers of WWII, many of which had excellent proportions and even plenty of dihedral, a scarce commodity in low-wing […]

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[…] aircraft. In searching for a new subject, some of the things that I personally look for are generous tail area, some wing dihedral, and a nose that will conceal the Cox .010. That last may not sound like much, but many aircraft scaled to this size would have engine ticking out all over! Not to be forgotten are the models of existing model airplanes either, My Trixy is an obvious take off on the excellent esquire design.

Personally, I tend to put the miniature sailplanes in a different category. Not having a heavy engine, they are easily built much lighter, and most of the full-scale aircraft may be modeled with very little deviation. To be sure, some will need changes in tail areas and often the dihedral needs to be increased for rudder-only flying, but usually these changes are slight and don't detract from the natural beauty of the prototype. All balsa construction is completely practical without a weight penalty, and in most cases is about the only way to achieve the smooth, flowing lines of the model sailplanes.

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Since its representative of this style of plane, I'll point out some features of my miniature Phoebus and touch on their reasons. The fuselage is carved and hollowed from block balsa to obtain the graceful contours, with the canopy molded on a Mattel vacu-form. This system is quite strong, and yet there's no particular weight penalty with a proper choice of balsa. The wing also is constructed from solid stock, ¼-inch thick balsa in this case. It is necessary to choose rather light wood for this part, but then there's so little of it that it's no big thing. The airfoil sections are pretty important here, and I've used an under cambered airfoil on my little Phoebus, with a turbulator strip to help in the lift department. At these low speeds and with such narrow wings, turbulators play a very important role and just can't be ignored. The Phoebus has a single strip of masking tape 1/16 inch wide, running span wise on the upper surface at approximately 10% chord. A more sophisticated device should certainly yield better results, but it will take more […]

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[…] research to find the particulars. Anyhow, this is a start and works O.K. The tail surfaces are pure simplicity, cut 'em out of 1/169 balsa and sand to shape. Most all of my flying experience to date with miniature soaring gliders has been flatland thermal riding. Maximum flight times have reached 10 minutes, and 5 minutes is easy to achieve on an average day. High-start launching is perfect for these little birds, and will take them up to 400 feet altitude with ease. There's no reason why they won't work find on the slopes also, in fact, faster flat-bottomed airfoils and slightly higher weights would probably be useful in this application, especially if the winds are much above 10 mph consistently.

O.K. let's go to the film now, and have a look at some of these mini-models in flight.

Movie

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O.K., so now you have some idea of how they fly, and perhaps a better idea of rudder only flying in general. In fact, I'll bet there weren't many of you who would remember noticing the flapping rudder in flight, which has surprised many people. I suppose I should fill you in a bit on that electric plane shown toward the end, and its significance. That model helps indicate what can be done with this really miniature control equipment, because it couldn't have flown with a heavier radio. That model is powered by a German Micro-mo electric motor, with the electricity supplied by special Yardney Silver cell batteries. The cost initially is higher, with the three silver cell batteries alone going for about 15 dollars, however they are rechargeable and last for at least six months in this application. I you've got a noise problem or want to fly at the flick of a switch, that's the way to do it. I've also installed this equipment in hand-launched gliders, (you know, the Free Flight type), with excellent results, and have read of others successfully using it in rubber-powered models, (indoors […]

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[…] even.) There also was an article in one of the magazines showing how one fellow had installed it in a model rocket. However, the applications are pretty widespread.

As for the crystal ball department, some of the things I foresee in the near future are super hot receivers small enough to use in my Corben or Sperry, and domestic systems wired up ready to use. There's no problem now installing two channels of a digital set in a high-performance .020 stunt plane, and I would imagine the situation is going to get even better before 1970 is out. Perhaps someday we'll have pattern events in a shopping center lot, and the racing planes could even use the light poles for pylons. Of course, it sounds a little ridiculous right now, but with the situation on flying fields getting worse daily, this is tone way out.

I'll open the floor now for questions and discussion of the material I've covered."

The following is a typed speech, "Tiny R/C Planes," by David Robelen, c. 1970.

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<u>Tiny R/C Planes</u>

Ever since the advent of popular Radio Control in the mid-1950s, many modelers have labored to shrink the size of a Radio Control model. The smaller model has many advantages when cost and complexity are considered, and by its very nature requires a smaller space to operate. There also is the intangible but definite appeal of miniature models to a certain group of individuals who have a particular interest in this area.

For a number of years, the average size and weight of the smallest Radio Control equipment remained fairly constant, while reliability continually improved and costs dropped lower. The introduction of small magnetic actuators and companion equipment for simplified proportional control in the early 1960s did much to smooth the flight path of the smaller models, but the minimum weight still hovered near 3 ounces for commercial equipment. In the recent past some really miniature equipment has been successfully introduced, thus, making possible a major shrinkage of the smallest models, In fact, the Cox .010 engine is now the limiting element in the smallest models as it represents nearly one-third of the gross flying weight.

<u>Engines</u>

Because the equipment and engine represent the most important factor in obtaining a scale [Radio Control] model with a gross weight as low as 2 ½ ounces, it would seem appropriate to examine these components in some detail. Normally, the .010 engine would be far too powerful for such tiny models, but when it is fitted with a variable exhaust restrictor (Fig. 1) it becomes a very useful power plant. This type of power control has been achieved after a lot of frustrating tinkering, which led up many blind alleys, and represents a very smooth and controllable approach to the problem. These exhaust restrictors are a commercially available item; and I consider the use of them an essential element for successful flying of such tiny models as the 13" Sperry Messenger […]

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[…] (Fig. 2) and similar aircraft. The engine operates in a completely normal manner with a restrictor fitted; in fact, it seems to last a little longer running at these low speeds. No other engines have been mentioned, because the .010 Cox is the smallest engine available in the U.S., but quite possibly some of the tiny European diesels would solve the power problem very neatly also.

Radio Equipment

The selection of commercial Radio Control equipment is very limited, and there are several basic similarities. The operation of the all of this equipment is very similar, with every unit being of the pulse proportional rudder-only type, while all of the smallest receivers are of the superregenerative variety. The table at the end of this paper gives the weight and source of all equipment currently manufactured at the time of writing.

The tiny models that I have been flying depend on the very lightest available equipment and, therefore, some units are not mentioned only because they fall outside of the maximum weight limitations. The upper limit on airborne equipment weight would seem to be about 20 grams, or approximately ¾ ounce, to maintain a wing leading low enough for safe scale-like flying. These little models are not especially critical as regards weight and wing leading, but the upper limits are much lower due to aerodynamic scale effects. In other words, it is not possible to compare wing leadings to larger models, which are inherently more efficient and can therefore have a much higher surface leading.

Receivers

Because the airborne equipment is of primary interest in this paper, I will attempt to cover it in more detail. There are only two receivers currently on the market, which are suitably tiny and light, and, as mentioned before, both are superregenerative. The Albin receiver (Fig. 3), which is available only as a parts package in kit form, is the lower in cost and is directly compatible with most American pulse transmitters. The other receiver is the Bentert (Fig. 4), which is imported from Germany in […]

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[…] built-up form in limited numbers, and at a higher cost. Aside from the different physical specifications, the main difference in these two receivers is the tape frequency. The Albin is designed to operate at probably 800 hertz while the Bentert requires an audio tape of 3400 hertz to pass its filter circuit. This 3400 hertz tone frequency is well above the range available from most American pulse transmitters and, therefore, makes necessary a special transmitter. The importer who carries the Bentert equipment stacks an imported pulse transmitter to match, or some of the American pulse transmitters may be modified to suit. Both of the receivers mentioned have the same type of output, and both also share a similar voltage range from 2.4c – 3.6v.

Actuators

The selection of commercial actuators is really limited right now, there is, in fact, only one suitable actuator available at this time. The small Bentert (Fig. 5) which is handled in this country by several importers is the only commercial actuator to meet the requirements of very lightweight coupled with low current drain. Actually, the actuator is the one component of the airborne system that can be scratch-built with good success, and I have made several from old 60- relays (Fig. 6), including an escapement type for really low power consumption. Construction is non-critical by nature and should be tailored to the particular relay involved as they differ quite a lot individually. The idea is to spread the point gap as wide as possible for maximum armature travel, and then add an arm to extend the movement, which is transmitted via a pushrod to the rudder. The Bentert actuator can be used with a pushrod, but a torque rod seems to function much better, particularly with respect to "G" leads in flight.

Battery Calls

There are several battery calls available, which are suitable for this […]

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[…] application, with the Eveready S76c silver oxide 1.5-volt cell being my choice for the job. The S76c is non-rechargeable; however, a pair of those last many flights with the actuators mentioned, and they are widely available wherever hearing aid cells are sold. The other alternate would be the tiny 50-mAh nickel-cadmium button cells, which are rechargeable, and appear to work fine in a 3-cell pack with the listed equipment.

Transmitters

There is not too much to say about the transmitter except that it should be a pulse-type for single channel, and of course, must have a tone frequency to match the receiver used. If there is a choice, one for the transmitters designed for pulsing a magnetic actuator is preferable because of the greater pulse shift. However, any of the Galloping Ghost type of transmitters are useful, just so long as the pulse rate does not exceed about 6 cps.

Aircraft

I have spoken earlier of miniature [Radio Control] models; now let's establish the reason for my choosing the size aircraft I am using. First and most important, was my requirement that the model should fly in a normal and realistic manner without excessive speed, and retain a reasonable glide angle. The lower limit on the weight of the equipment and engine is approximately 40 grams, so that with normal rugged construction the model airframe will weigh at least 20 grams, and usually more for scale models. With the gross weight established at between 60 and 80 grams, the model will require at least 50 square inches of wing area to meet the flight requirements outlined above with a little more preferred for a biplane. Models as small as 30 square inches have been built and flew successfully, but the flight resembles an angry hornet while under power and the glide is almost non-existent. The upper limit on size is usually established by the tiny actuators, which have very limited owner, and would appear to be about 80 square inches for most scale models.

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The only two design considerations that I have found to be different from larger models are the wing airfoils and the balance point. In general, the wings should be slightly thinner than usual, with the airfoil high point father back and using a smaller leading edge radius. The balance point for most scale type models seems to work best at 25% of the wing chord or even further forward in some cases, which aids turning with the rudder and also allows the use of small scale-like stabilizers.

Description of Models

The choice of model subject is almost unlimited; although, biplanes and high wing monoplanes are probably the most pleasant for rudder only flying, I have seen many successful low-wing configurations that did fine when ample dihedral was used. There are many other types of model that benefit from this tiny control equipment besides miniature scale models, and I will point out the models with which I have had experience personally. The intention here is not to set these models up as being the ultimate in their category, but merely to illustrate some of the applications I have found for this miniature equipment.

Miniature [Radio Control] Seaplane (Fig. 7) – This model was built primarily for flying out of these small fresh water ponds that you see so often in small parks and similar places. The wingspan is 18", weight is 2.8 oz., and power is a .01C Cox. With a take-off distance of 50 feet or less, and a flying speed of less than 20 mph many flying sites have become available to me that were unusable before.

Miniature Soaring Gliders – The small searing glider I constructed (Fig. 8) with a wingspan of 36" and a weight of 1.7 oz. has been a real pleasure to fly. Because of a very small circling radius and low sinking speed, this model will ride low-altitude thermals much better than others I have built. When slope soaring, it will fly on smaller slopes and with lighter breezes than many […]

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[…] larger gliders. It also resists damage far better due to the very light weight and rugged construction. The chief drawback to models of this size is the fact that they are blown back in winds stronger than 15 mph where a larger sailplane with more controls will hang right in there.

Radio Controlled Hand-launched Gliders – As an experiment, I installed this miniature equipment in a standard 15" "Sweepette" glider design (Fig. 9) with the early modification being a small pod to contain and streamline the equipment. The gross weight of this model is 1.19 oz. This little experiment has been very rewarding; for the first time, I have been able to fly a high-performance Free Flight type model in a very restricted area with no significant loss of performance. This will lead to more opportunity for practice flying under contest conditions without the usual risk of loss or damage to the model.

Conclusion

To sum up; there are many categories of models which will benefit directly from the use of the most miniature guidance equipment available. In some cases, performance is extended; in others, a whole new breed of model emerges, smaller, stronger, and more useful on the many small flying sites around the East Coast. Up to this point, all of the most miniature models have one draw back in common; that is, the use of superregenerative receivers, which limit the flying time available. While the present super hot equipment is still too large and heavy for this application, it seems likely that sometime in sometime in the near future we will see equipment developed which will eliminate this drawback and probably extend the controls available as well. For any one doubting this assumption, I would only suggest that they review the interesting history of our hobby up until now. The trend is always towards miniaturization with no indication of slacking off yet.

1964: David (center) and his father, Horace (on the right) at a Radio Control meet in West Point, Virginia.

1968: Robelen with his original* Kestral *glider

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