



The AMA History Project Presents: Autobiography of DUKE FOX

Modeler, Competition modeler and flyer,
Engine Manufacturer



1920 – 1991 AMA #54587

Written by DK (c. 1990); Submitted by TAW (06/1997); Transcribed by NR (06/1997); Edited by SS (2002);
Updated by JS (12/2005, 05/2023); Reformatted by JS (08/2009)

Career:

- Started modeling at eight years of age
- While in the service worked with Capt. Stolzenberger developing Army's Troop Glider
- Worked on the Nike missile project
- In 1949 went into the model engine manufacturing business
- Was a major model engine manufacturer for 42 years of his life; the company still produces FOX engines to this day under the able hands of his wife Betty Fox.

Honors:

- 1977: AMA Superior Service Award
- 1978: Model Aviation Hall of Fame
- 1981: National Free Flight Society Hall of Fame

This autobiography was written by Duke himself and published by his wife, Betty Fox. Thomas A. Wilk then submitted it to the AMA History Project (at the time called the AMA History Program.)

In Memory of Duke Fox

Duke Fox, Founder of FOX Manufacturing Company, and a leading model airplane engine and designer, and manufacturer passed away on February 15, 1991. His death was attributed to a major stroke.

Duke wrote his autobiography a few months before his death and it was my decision to publish it in his memory. I hope that it will bring back memories to many of the people in the modeling trade.

-Betty Fox



The Duke Fox Story: A Short Autobiography

By Duke Fox

I suppose I should begin by saying that my earliest memories were flying model airplanes, but truthfully, this is not so. My earliest memory is from moving from a house with an indoor toilet to one that had an outhouse and my mother being afraid I was going to fall into the “you know what.” I never did, however, and in a few months, we moved into town into the “brown house.” I suppose I was about three and one half at the time.

My father then made his living selling Model T Fords and the town was Ripon, California (at that time with a population of 800 or 900 people.)

Within a few weeks of moving into the brown house, my father had acquired a goat and a dozen or so chickens. He also built a chicken pen, a chicken shed, and a roost.

I noticed that the chickens would fly across the pen, and I was fascinated at how they were able to fly. In fact, just about everything fascinated me.

I was told that the bars on the roost were what chickens slept on, and I could not understand why they did not fall off. So, I found out. I went out one evening, sat on the roost, and watched the chickens one by one come in and climb onto the perch. Soon there were a dozen chickens on this roost and one small boy. Sleep is catching, because I went to sleep. The next thing I remember is my father picking me up off the roost and carrying me into the house.

In those days, the biggest problem in selling an automobile was to convince the prospects that they could learn to drive it. Somehow, my father never did seem to have any problem this way. In fact, he even taught me to drive, so that it was a great lark to me. He would come home during the day with a different car nearly every time and tell me “go and drive that one around the block and see how you like it.” You can imagine a four or five year old boy driving a car around the block. It's a good thing that the cars in those days had low hoods; otherwise, I would never have been able to see anything except the dashboards. It was years later before I ever figured out that I was helping my father convince the prospects that he or she could learn to drive easily.

About this same time, my father would take me to the shop (which was only two blocks away) whenever they had an automobile that was pulled down for a ring job, valve grind or whatever. By the time I was four and one half years old, I understood clearly what a valve, crankshaft, piston, coil, timer, and transmission did and how they functioned.

My interest in flying chickens shifted to all birds. Whenever I would see a strange bird, I would run and ask my mother or father what that was. One day a big bird flew over and it was making a loud noise, and I did the usual thing. I ran in and asked my father, who happened to be there, to come see, and tell me what kind of bird that was. He explained, “Son, that is not a bird, that is a machine, and there is a man in it.” What a mind-boggling concept! A machine that a man could ride in! I was hooked for life.

One of the toys that appeared for me to play with about this time was a model windmill with blades that actually turned in the wind. That toy lasted for quite a few weeks, and I experimented with the blowing wind forward, backward, up, down, edgewise and how the vane would turn the fan into the wind and vice versa. I would spin it and see if it would make a little wind. From playing with that toy, I think I developed a fair understanding of how a propeller worked.

Then, wonder of wonders, when I was about five years old a barnstormer came to town. My proud father came home, swooped me up, and said, "We've got to go see this." In a farmer's field, about a mile away, was this beautiful biplane. I can see it today. It had a radial motor up front. I know I was no older than five, because shortly after I was five we moved to another house.

My father proudly pushed me up and told the pilot of the airplane what a smart kid he's got. The pilot pointed to a cylinder and asked what that was. I can remember saying, "Well, that has to be a cylinder, and there would be a piston in it that would go up and down, but I have never seen a motor with the cylinders arranged in a circle like that. They have always been in a straight line." Then the pilot pointed to a push rod, and I said, "I don't know what you call it, but it would make a valve go."

Shortly after, we moved out in the country a bit, where we lived for six or eight months. My father came home with a kite one time. Oh, wonder of wonders! We went out and flew it together and sent messages up the string until my father wound it up and said that it was time to go in. I flew that kite quite a number of times out in the small pasture nearby, until one day it got away from me, and the kite sailed away. I went after it for all I was worth. The kite went down some distance away in an orchard. I don't know what kind of fruit trees those were, but they had thorns. I rescued my kite, and when I was climbing down the tree, my folks and the neighbors both appeared and took me home. Boy, was I a bloody mess! I had scratches all over me, but not to worry, my precious kite was safe.

I also learned (about this time) that I was not really big enough to handle a shotgun. My father thought that I should, but man, when that thing went off, down I went. My shoulder was sore for a week after that.

When I was about six years old, my folks thought that I should go to school. To make things work out right, they moved to a nearby town, Manteca, where I lived until I finished junior college.

When I was about eight years old, my father brought home a kit of a Baby Rise-Off-Ground (ROG) model. Actually, it was not a ROG, as it did not have any legs. It had about a 12" wingspan with a 1/8 square motor stock, and it was tissue covered.

My father helped me build the model and for the first time I smelled model airplane cement and banana oil. It took about a day to get it finished, and we flew it indoors. It went great. If I launched it in the kitchen doorway, it would fly through the dining room and into the living room, which was straight on, and it would hit the front wall at about the ceiling point. What a thrill!

I flew that model dozens of time, and one day I flew it for one of my neighbor boys my age and we were talking about the marvel of it. He was tossing his cap up into the air and catching it. Then disaster struck. The cap landed on the model and crushed it. There was no fixing it because we had no more wood for a motor stick. These memories are still in my mind today. There was nothing to do but try to build another one. Out to the woodpile I went, sharpened my pocketknife as sharp as I could, and selected nice pieces of wood to use. I was able to sliver down some redwood to pretty thin pieces to make the wing frame, and I was able to make wing clips out of paper clips. Also, a paper clip made a good rear hook. The thrust washer was a little more of a problem. I finally solved it by hammering on a nail until it was properly flattened, and then with a series of additional nails, would keep pounding onto the place for the hole until I was able to get a hole in it. Then I bent it and clipped it off and, presto, a thrust washer.

I probably built a half a dozen kindling wood models using Lepages glue, which has to be the worst excuse for glue man ever invented, and covered them with wax paper. You know, it really is hard to get wax paper to stick to wood using Lepages glue. Somehow, I was able to get it done.

Some of my models actually flew eight or 10 feet, especially if I threw them kind of hard.

Model Airplane News appeared on the newsstand in about August 1929, I am told. A whole new world opened up. I could send away money and get balsa wood, banana oil, good tissue, wire, cement, rubber and all sorts of good things back by mail. Also, I started sending for catalogs, which I devoured.

In very short order, I had the house filled with Baby ROG type models, some a little bigger, some a little smaller, some with landing gears, some without. I made pushers and experimented with CG and whatnot on those. I made a tailless plane. I built an ornithoper or two. Anything connected with flying that could be built with a model I wanted to build.

I remember when I was in the fourth grade, one day the teacher told us to open our book to a certain page and to start reading. I liked reading and was good at it. I went through about three stories and half of the fourth, when she said to quit. Then she asked us to start counting backward to see how many words we had read. I remember the number to this day. I had read 430 words in a minute's time. I don't think the teacher believed me at first, because she started asking me questions about different characters. I can remember saying, "Well, which story are you talking about? In the first story they did this, and in the second story they did that, and in the third story there was nobody by that name." I never had to sit through reading classes after that.

One day the school principal asked me to show him my models. He asked me to bring the models over and we flew them in the school auditorium. He was quite impressed, and he told me that I could fly my models in there anytime. All I had to do was just ask the janitor to let me in. However, that didn't work so great because the janitor always seemed to want to hide when I came around, as he was always in a hurry to do something else.

We were in the deepest part of the Great Depression by then, and nobody was buying

automobiles. In order to feed the family, my father started farming the vacant lots around the area. What little money was made off the produce bought groceries so that we wouldn't be too hungry. As I look back, there was a two or three year period that I never did have enough to eat.

Meanwhile, I was growing like a beanpole. My feet had grown so big that I couldn't wear anybody's cast offs. It took real money to get me shoes. Hand me down shirts and overalls I could wear. I can remember the year I graduated from grade school, I graduated in a borrowed suit, a necktie my schoolteacher had given me and had a haircut that a friendly neighborhood barber had given me.

The house we had lived in was repossessed. Fortunately, my father had owned a vacant lot and was able to buy a milk shed for \$15. We moved the milk shed onto the vacant lot.

Shortly after this time, the economy started easing up a little bit. No matter how tight things were, though, I was able to come up with 75 cents or \$1 a month to send away for model building supplies, and I kept building models after school during all of this period.

In those days, a 13-year-old boy could get a job, and I was able to get a job during the summer in the cannery paying first 15 cents an hour, and then 25 cents an hour. This financed my school clothes through high school and my model building and, in my junior year, an automobile. I had wheels and could go to model contests.

The Junior Birdmen, sponsored by the San Francisco Examiner, had hired a man who was promoting the Junior Birdmen, and held a series of contests throughout central California, one contest nearly every Sunday. Boy, did I go for those! Their system was that if you won a first place in one of their events, you got a silver wristlet, and that made you an Ace. Over a couple of years, I accumulated several dozen of those silver wristlets. I began to get the feeling that some of the contest regulars were not too happy to see me when I pulled up to a contest.

All of these contests related to either gliders or rubber models, because Mr. Hurst felt that the gasoline-powered model was dangerous, and he resisted it.

I dearly wanted a gas powered model, but it was not until 1936, I believe, that I was able to mail away and buy a Mighty Midget kit. I remember I assembled the motor and crank for three days, and I could not get that motor to run. I checked and re-checked to make sure I had done everything right. Finally, in desperation, I decided to turn the needle valve body around, even though the instructions plainly said the hole should be in back. Wonder of wonders, the motor started in the first couple of flips and ran very well.

I built a 6-foot model similar to a Curtis Robin rubber model that I had built earlier. We took it out and it flew great. I flew that model a lot of times. It was always a little disconcerting, because every time it landed, we ran a risk of damaging something.

By this time, my summer work was paying better and I was able to buy a Dennymite motor, which was one of the best ones at the time. I built several different models around that Dennymite motor, and I placed in quite a few contests and won one (Free Flight, I believe).

In retrospect, the gas models were more of a challenge, but I learned more from building rubber models because they built easily, and because I was able to try out so many different thoughts. I learned quickly that a triangle fuselage was stiffer than a rectangular one, that diagonal verticals were stiffer than straight ones.

Regardless of what Charles Hampson Grant said in his center of lateral area theories, I found that if I put the wing up on a high pylon, it stayed right side up. I learned that if you wanted a model to catch and stay in a thermal, which you had to cut down the rudder area to the bare minimum. I learned that an all weather airplane, one that you could fly in the rain, won more hardware than a fair weather ship that was a tremendous flyer.

About the time that I graduated from high school, the Junior Birdmen was dissolved, but club-sponsored contests around the area pretty well took up the gap. There was a lot of enthusiasm building for Free Flight, gas powered airplanes.

During the time I attended junior college, 1938 to June 1940, I went to quite a number of Free Flight contests and started meeting people that were to become famous in the model world. I first met Danner Bunch at a Fresno contest. I met Irwin Olson at the California State Fair contest. I met John Dobshoff and Robert Wherle. I first met John Pond at Sunnyvale when he was testing his beautiful, new 9-foot Cavalier. It sailed out, not into the sunset, but into the South Bay.

I remember taking an interest in a lot of motors that appeared about this time. Al Hoveseppion built a little motor he called a Micro. It was especially attractive because he had two brass tubes sticking out to form an exhaust stack. Jim Brown's engines started appearing, the little Dynamite, then the Thermite. The first Elf I saw was down at Sunnyvale on a bi-plane, and the owner explained how he had flown it on two lines attached to operate the elevator. Now he came out to the open spaces to see how it would go by Free Flight. Unfortunately, after two hours he still could not get the motor running and gave up. If he really did fly the motor the way he described, it predated Walker by quite a few years. I remember an indoor towline glider event sponsored by Junior Birdmen in which I beat Bob Muser by just two seconds.

When I was about 13 or 14 years old, I figured out that my best security for the future was to get the best education I could. Of course, I had known from the time I was four or five years old that I wanted to learn how to build airplanes. So all during high school and junior college I took all of the courses that I could that I thought would improve my engineering skills.

Money was tight, and when I was in high school, I didn't even know that I would get a chance at even two years of college. So I didn't waste any time on study halls. When I was able to go to junior college, I took everything that was available. Consequently, when I graduated from junior college, I was fairly well equipped to start in the engineering department at Hughes Aircraft.

Hughes Aircraft was just developing out of the little group that had built Howards Racer. I was hired and given badge #32, and found myself shortly doing wiring installation drawings on the D2 airplane, which was Hughes competition to the Northrup Black Widow, a three man, twin boom type airplane. I was a quick, neat draftsman and I worked up in the company quickly.

Meanwhile, having moved to the Los Angeles area, I rooted around and started looking up the model clubs, the flying area and the different manufacturers that I had read about. I remember that I made such a pest of myself around Clyde Austin's place that he had to ask me to leave.

A few months after I had moved from central California to Burbank, California, the Burbank club had a Free Flight contest. I had done quite a bit with towline models earlier, and I had designed about a 4-foot wingspan that I thought was pretty good. I built one the day before the contest. I went out to the contest the next day and, in due course, made my flight. In those days, there were no dethermalizers and there were no weight limits on Control Line gliders. The day was hot, there was a lot of lift in the sky, and I figured that I would sacrifice the model to win the contest. One launch and it was up in the sky for 10 or 15 minutes and it was gone forever. I waited around for the end of the contest, fully expecting to get a first place award. What a shock when they told me I was disqualified. I cannot remember the reason that they came up with, but I always felt that had I been one of the locals, not a newcomer, it would have been different.

Later I started to fly at Western and Rosecrans, which was the center of gas model flying at that time. I became active in the club and became a Sunday regular. I flew in their contests, but never did have outstanding success because my interest ran toward experimentation and designing the unusual and offbeat. When I found out what it would do, I kind of lost interest. I just couldn't seem to get excited about building the same design one after another.

I was out flying at Western and Rosecrans one Sunday around noon, and one of the fellows told me that he had heard on his car radio that the Japanese had attacked Pearl Harbor and that we were at war. I can remember wondering just what changes in my life would come about because of that.

Because I was working at Hughes, I got deferments up until the spring of 1944, when I was drafted. During this period, I continued to work with the club and continued to fly with them, and had started to plan my first engine, which became the Fox 59. This motor, which is now at the AMA museum, was designed by me but was mostly built by whomever I could get to do what. Patterns I had made at a pattern shop, castings were made at a small aluminum foundry in downtown Los Angeles, and a machinist was going to machine up the first motor. The compression was so poor, though, that the motor really would not run satisfactorily.

I became acquainted with a Frank Smith, who later became very famous for his mini-plane design. He invited me over to his apartment basement where he had a small lathe, and it was through his efforts that we really got the first motor to run satisfactorily.

In cooperation with Frank, we built three or four motors off of these patterns, and then, when I was called to the service in the Spring or Summer of 1944, modeling pretty well stopped.

I remember I was sent to Camp Buckley, outside of Denver, to basic training. The first weekend that I got a pass, I guess I walked five or six miles out in the country to go to a model contest. I talked to the different people and was able to mooch a ride back with one of the modelers by the name of Joe Nogy.

While I was at Camp Buckley, I could see that if I didn't do something to change it, that I would wind up riveting patches on a bomber somewhere in the South Pacific, and I did not particularly want to do that. I got permission to prepare a description of some experiments that I had done on the stability of a towed glider.

Evidently, the article was forwarded through channels, because after going through basic, I was shipped down to Biloxi, Mississippi to go to B24 school. About halfway through this school, I got shipping papers to go to Dayton, Ohio, and found myself at Wright Field, assigned to the glider branch. From the glider branch, it was a small step to a group created to investigate the flight characteristics of an experimental Cornelius glider that had killed its pilot.

This project was ram-rodged by a Captain Stolzenberger, who was a good promoter and had a good imagination. He was convinced that we could learn more about this glider, or any airplane, by building a scale model of it and flying it. He convinced the authorities to give him a free hand to build such a model. At Wright Field he had available to him some very good talent, both in aerodynamics and all its associated fields.

Captain Stolzenberger made the decision to build a $\frac{1}{4}$ scale dynamically similar Radio-Controlled (RC) model of the glider. The Aerodynamics Department calculated the moments of inertia and the weight that would be required of the glider. It fell my lot to build the glider. I explained that we would need to have a couple of fair size workbenches and, if it was not to take forever, I would need a helper or two. This was supplied.

I designed the structure of the glider and the various fittings. Since the machine could weigh only so much, it was entirely covered with balsa wood, and had good size fittings throughout. The radio was a Babcock Bang Bang system, taken from the glider target planes that were being used at that time.

The one question that I asked was, "How are we going to launch this thing?" The plan was for a helicopter to pull the glider up dangling from a cable about 50 feet long. In due course of events we finished the model, provided the cable and a quick disconnect (something on the order of ice tongs), and went out to the field area to give it a test.

It turned out that helicopters at that time were not capable of vertical ascent of more than 10 feet or 15 feet, and the helicopter had to move out of its own vortices rather rapidly in order to gain altitude. You can imagine the yank on the glider when the helicopter started accelerating away from the launch site and the cable came to the end. The lift tongs tore the sides of the fuselage out.

We took the wounded bird back. I suggested to Captain Stolzenberger that we could repair the model, but that he should start working the system to see if we could go to Lakehurst and drop this from a blimp, since the speed of the air ships was not too great, and the model could be attached to the bottom of the gondola.

I think that he did not know what to do next, because a tremendous look of relief came across his

face. He got behind the idea very enthusiastically.

In a few days I had the glider all repaired. Fortunately, the damage was just localized to the clamping area, and it did not take too much repair.

In due course the captain was able to requisition a C-46 (Curtiss built twin engine transport), and we loaded the glider and all of the tools we thought we would need, and off to Lakehurst we went.

Many of the people at Lakehurst cooperated wonderfully, and shortly we had a saddle hung underneath the gondola of one of the M-2 ships. This time the air ship took off with the glider hung right underneath it. A section of the floor of the gondola was removable, and it was my duty to reach down and release the glider at the proper signal. I was very happy for the rides in the blimp, but I was not at all happy with the idea of hanging through the opening in the bottom of a gondola at 3,000 or 4,000 feet.

I arranged a rope around my waist and securely tied it. If I should slip and go down, I would only go a few feet and the rope would hold me.

The tests worked great, with no damage to the glider. Six or seven flights were made over a period of three or four days. The tests proved, as we had suspected, that the forward wings on the glider worked fine as long as there was not enough yaw for the rudder to stall. Once the rudder stalled, the thing went into an uncontrollable flat spin, and seemed to have no desire to come out.

Normal reversing of the controls did not seem to work. However, just by luck, on the first flight the captain tried letting the controls return to neutral, and it was found that after about three quick turns, the glider would straighten itself out. With the controls reversed, instead of straightening itself out, the glider would flip over on its back and flat spin upside down.

Not only had we proved that the glider design was no good, we had also proved that you did not have to have a wind tunnel in order to learn a lot about the flight stability of a plane.

After this, the group went on to experiment with a couple of powered machines. However, at that time both the power plants and the radio were very basic, and seemed very elementary by today's standards.

While I was in B-25 school a year or so earlier, I had made up production drawings of what was to be the long shaft Fox 59. My original sand cast model motor weighed about 14 ounces, which I thought was too heavy. So, I made everything thinner and lighter. This produced, as we later found out, a good running motor, but very frail.

My thought at this time was that when I would get out of the service, I would have a motor design and a set of tools made so I could find a machine shop to do the machining. Thus, I would be in the motor business.

I came home on furlough near the end of 1944 or early in 1945. I asked around, and it seemed

that Anderson Die Cast Company was the major die cast company in Los Angeles at that time. I went to visit them, and they seemed to know what they were doing. They offered to make a die-casting mold for me for \$3,200. This mold would make all the cast parts necessary for that 59. I accepted their offer. Since I had been frugal with my paycheck while I was working at Hughes, I had just enough money to cover the cost of this tool.

Later, while I was at Wright Field, Anderson finished the tool and sampled it. They then sent me sample parts. I was able to get a machine shop in Dayton, Ohio to machine up the parts for the first die cast 59.

A few weeks later, I was discharged from service. I took my newly made motor back to Los Angeles. At that time, I did not have any models left or any place to build one.

The 59 motor ran quite well. After talking to some potential motor manufacturers, I chose Mr. Claude Slate, whom I had known casually at Hughes Aircraft. During the war, he had bought a machine shop in downtown Los Angeles and was primarily making rings for the oil well industry. Claude was a good engineer and an honorable person. He appeared to me to be the ideal person to handle my business. The deal was struck. Claude would build the motors, sell them, and pay me a royalty in return for the design, the drawings, and the use of the casting die.

For the first couple of months I donated my time and labor to help Claude get started. However, after about three months, I got itchy to get back into the aircraft engineering business and went job hunting in earnest. Douglas, in Santa Monica, offered me almost twice the money that Hughes Aircraft did, so you know where I went to work. It seemed strange to me that after Hughes learned that I had taken a job with Douglas, they more than doubled their ante. However, I told them that I had made a commitment and I was not going to switch.

I was really fortunate at Douglas in being assigned to the mechanical division of their research department. The research department was staffed with the head of the physics department, head of the electrical department, head of the hydraulic department, head of the sound and vibration department, etc. Each of these people were specialists and technically oriented. However, whatever tests they wanted, it fell to the mechanical department to design and build whatever test equipment it took.

During the two years at Douglas, I worked on several very interesting projects. At first, I was assigned just small projects of designing and fitting, making some alterations in some equipment, or something like that. After a couple of months, they started feeling confident of my capabilities, and I had some good-sized projects assigned to me.

One of the most interesting projects was a telemetering data reading. The Nike Missile was just being developed at that time. When the test shots were made, the various information pickups in the missile were telemetered back to the ground and recorded on some high-speed film as just a long string of graphs. Thus, a 10 or 15 second firing might result in a 1/4 mile of film. Of course, on any section of film you looked at, the lines would all look the same length. This information had to be condensed. They put a group of women to work reading the lines to make the graph, which was very time consuming. This was not acceptable since they had another shot planned

the next day. They wanted to know what changes should be made, if any.

I was coupled up with an optics man and an electronics man, and I was to somehow provide the plotting mechanism. The optics man developed the reader. The electronics man provided the amplified switching systems and I was able to take a recording and modify it so it would produce a readable graph on any channel (or channels) they might select. The result was the Army was very happy to get the reader and, as far as I know, that one reader served the whole series of experiments until more advanced methods of transferring information were developed.

Shortly after this, the head of the Electrical Lab engaged me in conversation and asked me, "Duke, do you think that you could build us a test stand so that we could test a whole DC-6 system?" I asked him what was involved, and he said, "Well, the basic problem is that we have a \$20,000 budget allowance, and that is just not enough money to get power plants and gear boxes to turn four 50 kilowatt generators that are on our system. Besides, we need a building. We need space on the inside of a building shielded from the sun and the rain where we can spread out the equipment to see what happens when an appliance shorts or a defect occurs." I asked what exploratory work had been done, and he said he had priced diesel engines with high-speed drives and they were too expensive, and that electric motors with high-speed drives were also too expensive. I asked about the high-speed drive bit. It appeared that the generators had to be turned up as high as 8,000 RPM. This was way above the speed of a gasoline, diesel, or electric motor. At any rate, I thought about it for a little while, and I told him that I thought I could come up with something. He said, "Well, I'll get you assigned to the project."

I went on about my business, and a day or two later my own leadsman came to me and said that I had evidently been talking to the electrical people. I now had authorization to plan, design, and build this generator test stand. This had to be done under a \$21,000 budget.

It was pointed out to me that there was a sheet iron building on the lower end of the hill. This building had been used for storage and would be available. That would be acceptable and that would get us the building for free. All that would remain would be to build the benches on the inside and provide a way of turning the four large generators at the required speed. I made some phone calls and some trips around Los Angeles, and was able to buy four new Chrysler industrial pump engines. These were already mounted up on a base with a radiator and the whole nine yards.

While working at Douglas, I also planned and supervised some huge coils used to shake an airplane, some air explosion protective devices and I helped in a small way on some high altitude fuel vapor lock studies and some cold chamber studies.

One of the highlights of this period was when my supervisor called me up to his desk and said, "Duke, do you realize what you have done?" I almost panicked. I could not think of anywhere that I had screwed up. What he said was that in the whole history of Douglas Aircraft, the generator test stand was the first project of this nature to ever come out ahead of schedule and under budget. I guess you can imagine that made me proud.

All the while I was working at Douglas, it did not appear that the Slate Project was going well at

all. I had bought myself a Sears and Roebuck lathe, a little Benchmaster mill and a Walker-Turner drill press. After I got home at night, I was building experimental motors. In the two years I was at Douglas, I probably built 20 or 25 handmade motors, each one different, exploring different porting configurations, different bore stroke ratios, etc.

In the fall of 1949, Douglas had a big layoff. I suppose they had caught up with the DC-6 orders. It was suggested to me that if I could find a job elsewhere, I had best do so. It appeared unlikely that Douglas was going to get any substantial orders soon and, if they did not, I would probably have to go. I was not too disappointed. Douglas had given me almost a month's severance pay.

I had built my 35 by that time and I felt that this one was worth producing. Very little was happening down at Slate in regard to the 59's, and yet I was tied up with a contract that he was not quite ready to release me from. So, I started building Stunt 35's. The first two were actually sand cast from wood patterns, but the cost of the castings in this manner was prohibitive. I knew that I had to get lower cost castings.

One company offered to make a permanent mold and run it for 35 cents a set. They did make the mold, but when I tried to get production, I found that the shop proprietor had a good job offer from a big company, and he just shut his shop down. I had a mold, but nobody to run it. All over Los Angeles I went, and after a lot of time and worry, I did find someone who would run the mold. We produced castings off that mold for over two years.

In 1949, after I had split from Douglas, I decided to try to make a living off the Stunt 35. I went to the Veterans Administration and signed up for veterans' supplementary benefits.

Mr. Dale Arnold ran a nearby shop, and I had him make crankshafts and cylinder blanks. The porting and the rest of the work I had planned to do myself. I sold the first 50 motors in January 1949, and the word started coming back that they ran very well, but the crankshafts started breaking. The crankshafts were breaking across the throw between the crankpin and the main. What a dilemma! I was down to my last dollar and the motors were breaking up. There was nothing to do but go back to remaking the cranks. I made the web a little thicker and changed from 1113 to 1018 steel. The new cranks did not break and the good word kept passing around; people started buying the motor.

About this time Dale Arnold, who had been a good parts supplier for me, said, "Duke, let's go into a partnership. I have a shop with some equipment and you have a product it looks like people will buy." So, the partnership was formed.

Dale was a good machinist and production minded. I learned a lot from him rather quickly. By the summer of 1949, our motors did very well in the Nationals, and we had orders lined up waiting. We were able to get a 1,000 square foot metal building with no down payment on Varna Street. So, we moved out Dale's and my garages into this nice, new building. Sales continued to grow. I hired first one man and then another. I thought things were going pretty well.

However, there was one fly in the ointment that kept getting worse. Dale's wife was very difficult and demanding, always wanting more money. Dale wound up taking \$100 to \$125 a

week out of the company, and I was taking \$15. If I took an equal amount to Dale's, the company would not have survived. Obviously, this sort of thing could not continue. The last straw came when I was trying to arrange financing to buy a new lathe. The banker informed me that not only would I have to sign the mortgage papers, but so would Dale and his wife. We went down to sign the papers. I signed it and Dale signed it, but Dale's wife took the pen and announced in a loud voice, that everybody in the bank could hear, that she wasn't going to sign it unless she got \$150 a week (this was like \$1,000 a week now). I told the banker that we had a problem, excused myself, and went outside. I told Dale that the business couldn't stand that amount of money and asked him to do something.

We went back to the shop. About three or four days later, Dale came in and announced that if I could raise \$5,000, he would bow out. Perhaps that would be the solution to his marriage problems. I will be forever grateful to Dale for letting me off the hook so modestly. By any count I could make, the business was worth about \$20,000 at that time. I will also be forever grateful to my parents, because they offered to mortgage their house so I could come up with the money to pay Dale off. This was done.

The orders continued to come in and the need to hire more people continued. After I paid Dale Arnold off, he got a job with one of the larger companies in the area. That left me without a toolmaker, setup man or foreman. By this time, I felt that I had learned enough that I could do just about any of the work to be done. However, I really did need help.

I remembered how ingenious Tony Naccarato was. He was a regular down at the Rosecrans Flying Field, and he seemed to have a bent for experimenting in the same way that I did. I went to see him and found that he was unemployed at the time except for making a few model things in his garage. His wrench business was not doing very well, and he was looking around for something to bite into. At any rate, I hired him. He moved from South Los Angeles up to the north side where I had my shop, and he became my foreman.

Everything went well for a while. The business was making enough money so that I could afford a new car and I got a big, red Lincoln Convertible.

A salesman from Ranger Diecast came around trying to drum up business. He made me a proposal to replace the permanent mold castings that we were using with die-castings. This offer came at just the right time. That old permanent mold had made a lot of castings, and it was getting pretty tired. Anyway, I gave them to go ahead and before too long Fox 35s were coming in die castings instead of permanent mold. At the same time, we switched from the four screw head to the six screw head. Otherwise, the parts remained the same.

In an effort to try to get the parts coming better and requiring less hand fitting, I had bought an old centerless grinder and, later, a pull broach. We used the pull broach to broach the bearings and to broach the cylinder bores, preparing for honing. The pull broach on the cylinders worked so much better than trying to ream or bore them that when I started thinking about a 19-size motor. I was planning to broach the casting for the sleeve rather than bore it. This was the primary reason for the unusual design of the first split case 19. Fortunately, when we came to actually broach the castings, we found that the castings themselves just didn't have enough

strength to withstand the broaching pressure, so we went back and bored them anyway.

About this time, my G. I. Bill was beginning to run out, so I went over to sign up to get flying lessons. This had been an ambition of mine since childhood. Two days before my first lesson, Tony, my foreman, complained that his leg really did hurt him. I had him pull up his pants leg and it was the worst looking leg that I had ever seen. Black and blue from the knee down, it looked like gangrene was about to set in.

I canceled my flying lessons and got Tony to go to a doctor about some medical aid. It seems that he had broken his leg in an airplane crash years before and it evidently healed, but not properly, and was very weakened. When he had stepped down too hard, the bones crushed. Here he was trying to walk around on a leg with bones broken in several pieces. Anyway, Tony was out for almost two months and that was the end of the G. I. flying lessons because the time did run out on me.

Meanwhile, the new 19 that we had been so proud of started coming back with the crankcase broken through the exhaust section. It seemed as though the casting was not only not strong enough to broach, it wasn't strong enough to stand the stretch reversals from running for very long.

It was obvious that I was going to have to do something very quickly. We started a crash program to replace the crankcase with one of conventional design. As soon as conventional design crankcases started coming through, I sent out the word for a recall. Lordy, they sure did start coming back! For a while, it looked like somebody else was making them, because it seemed like we got back a whole lot more than we sold. Actually, I would imagine that there are less than 40 or 50 of these split case 19's left floating around.

It was not really any big deal to pull the guts from the split case, put them in the new case, and re-sell them. Very few of them had reached the consumers. They just came back from the dealers off their shelves.

It was never very clear to me why our Fox 19 did not run quite as energetic as the K & B .19 at that time. We tried every way that I knew to sort it out and find the magic formula. Actually, in the running of the motors, we did find one miracle motor that ran 1,000 RPM's faster than any other. If we could have made them all like this, I am sure that we would have sold four or five times as many 19's.

I cannot put a finger on any reason why most of our 19's would run from 12,200 to 12,500 RPM with propeller, and this one single motor ran 13,700 RPM. In those days, I didn't have the measuring equipment to check sleeve taper, roundness, and that sort of thing. I do know that I ran that motor a whole lot, replacing pieces one by one. No single piece seemed to count for the performance, but just the fact that every piece in it seemed to be just a little bit better than others apparently identical.

Well, business went on and it smoothed out. I was finally making more money than I would have if I had stayed in aircraft engineering. Of course, most of it went back into the shop, more

equipment, more inventory, and building the business.

I had finally achieved a degree of independence and financial success. I was still single and living with my parents, who were by now retired and becoming quite aged. For the first time I really felt that I could spend time and money looking for a wife. During the next couple of years, I did start dating. When you are 30 years old and have lost contact with all of your childhood friends, how do you find eligible females? Well, after finding a couple of ways not to, I decided that I was going to tell every friend that I had that I was looking and now on the eligibility list. I can assure you that when you promise all of your friends if they arrange a date for you, that you will show the girl a good time, there **will** be no wanting for dates. The way "Miss Right" came along was through the mailman. He fixed me up on a date with a young lady who is now my wife of 37 years. After the first few evenings, I started looking to find where the flaw was. I could find no flaws, and she looked as good as ever. I started being afraid that she was going to get away from me. Very shortly afterwards we were married and then the business became a team effort.

We were only back from our honeymoon for a couple of weeks when she announced that she wanted to come down and acquaint herself with the business. She had been a bookkeeper at a previous place of employment. All of my bookkeeping had been done by a bookkeeping service a couple of doors away. Her contributions to the business over the next 37 years were many and she helped me keep the business together during a lot of bad times to come.

One day shortly after, I was walking down the street of Van Nuys, and a stranger called out, "Hey, Duke." I turned around and he walked up to me and said, "How is the business going?" I told him, "Very good." But, I had no idea who in the world he was. He said, "You don't remember me, do you?" I said, "No." He said, "Well, I'll remember you all of my life. About the fourth or fifth time you came in for your G. I. subsidy on a new business start up, you told me that the business seemed to be making a profit now, and you guessed you weren't eligible for this aid anymore. Duke, of all the thousands of G.I.'s that came through my office, you are the only one that ever did not draw the full 12 months that were allowed." I thanked him for his concern, and I still wonder to this day whether I was stupid in being so honest.

In 1954, we had expanded the building as much as the lot would allow. I had bought a G. I. tract house and was living nearby with my wife and stepson. There was always a little tension between my wife and my parents, and a lot of tension with my one sister who lived nearby. I had a lot of problems with the city of Los Angeles inspectors.

I remember one inspector who came around and said I would have to paint the inside of the women's toilet (this was a sheet metal building, remember). I painted it aluminum to match the rest of the corrugated aluminum, and he came back and said it had to be white. I painted it a nice, glossy white and then the third time he came back and said, "I'm sorry, but you will have to do it again. It is supposed to be a dull white, not a glossy white." Also, I had some problem leaving a few 2x4's out in the back yard, which I was informed had to be up on sawhorses. They also made me replace a perfectly good 1,000 P.S.I. boiler tank (which I was using with my air compressor) with a much weaker one that did have the right stamp on it.

Today, I would know that these inspectors were looking for some sort of payoff, but I was too young and inexperienced then to recognize it.

At any rate, in 1954 I had these problems. Then, on top of that, K & B had introduced the new green head series motor, and it was a very strong running motor. It ran noticeably stronger than our Stunt 35, which is still our main income piece.

About the time the K & B motor was introduced, our sales were running about \$20,000 to \$22,000 a month, and I was carrying a \$10,000 plus payroll. It seemed like the pipeline filled all of a sudden. From \$22,000 a month, we dropped to an \$8,000 then a \$6,000 month. The \$8,000 month I swallowed, but with the \$6,000 month, I knew that I had I cut out all the overtime and invited anybody who wanted to do so, to go job hunting. It looked like the gravy train was over, and I started to evaluate how best to survive.

At that time, the mail was the only way to get things delivered, and it took parcel post over a week to get from Los Angeles to the East Coast. I figured that if I could move somewhere in the middle of the country and get away from the inspectors that were giving me so much trouble and get away from living so close to my parents and sisters, and at the same time get into a lower overhead situation, that that was the thing to do. Also, I was really getting tired of living in the high-density Los Angeles area, waking up to the noise of the highways and going to sleep to the noise of the highways.

I took a map and drew a circle in the middle south area. I didn't want to live far enough north so that we had really cold weather, and I thought that by working in the middle of the country, we might be able to get a three-day delivery to both the East Coast and the West Coast.

We sent out about 100 letters to chambers of commerce along with a questionnaire. We received about 40 answers.

About this time, I found that some of my employees did not take so kindly to the retrenchment and they hustled a union organizer to try to force me to increase the wages.

Anyway, the upshot of it was that all of a sudden I had the problems of a violently depressed business, facing a move and the union problem, all simultaneously. You can imagine I was not feeling too chipper.

I did select Fort Smith, Arkansas as the best place to move. I went about the business of getting the incomplete parts completed and in saleable form. I then loaded everything on three semi-trailers and sent it to Fort Smith. I arranged for the sale of the shop property and of our home, and away we came, driving our vehicles across the country. I came first, driving my Muntz sports car, to meet the trucks and supervise unloading in our rented quarters. My wife came a few days later, along with my stepson, who was then about 10-years-old.

Fort Smith was a depressed town then and we were wanted badly. We gradually settled in and I kept filling orders through the stock of finished motors that we had built up before we moved.

I had the business of finding new sources of material and supplies. I found that it didn't seem to be any more difficult to pick up the phone and call Chicago than it was to call downtown Los Angeles from North Hollywood.

The union problem came to haunt us in the form of a runaway shop charge. This was finally solved through a lot of negotiation and paying some fines and back-pay penalties.

In about a year, I got things well enough under control that I felt I could start another motor project. This time I wanted the prestige of a winning speed motor and the Fox 29R, with the bathtub intake, was the answer. The Fox 29R was moderately successful and managed to win both B speed and Proto speed in the 1957 Nationals (I believe this was the correct year).

About this time combat model flying started to become a recognized event. It was obvious to me that if I wanted to retain any part of this market, I had to come up with a better motor than our Stunt 35. The motor that we settled on was a production version of a hand built motor that I had built back in 1954. The hand built motor was made primarily to explore the idea of making a fuel pump in the crankshaft. The fuel pump idea never did work, but the motor itself ran quite strong. The prototype I still have and it still runs quite strong, even by today's standards. It was a .36 size motor, was a single bypass baffle design, except the baffle was curved in the manner of the Bunch Tiger. The crankshaft diameter was increased from 7/16" to 1/2", and the rod was somewhat sturdier.

I made up production drawings and had tools made to make what became our X series of motors. In retrospect, I feel that I made a mistake in not putting the extra effort into making curved baffle for all the pistons, but this was a little more expensive than cutting a straight baffle. On the production motor, I went to a straight baffle for economy sake.

All of the nice, docile handling characteristics of my prototype went down the drain. The straight baffle version was just plain cranky. I made and sold a few hundred of these, but I could see that this was never going to become popular unless I did something about that crankiness. I did experiment and came up with a higher, different shaped straight baffle that became the black head combat. I still do not understand why I was so hung up on the straight baffle. It still did not run quite as strong and act as nice as the prototype. However, this motor did sell and became the first of a long series through about 1971 or 1972, when the series was discontinued.

Sometimes you do things right. In 1956, a real estate agent sold me an eight-acre plot of ground on the south side of town. It was available for under \$10,000. It looked good to me, so I bought it.

After a little while, the pressure was on us to move out of the rented building, so we started to build the building that we are now in. It was quite a bit bigger than I had originally figured, but bankers are funny. I was unable to borrow enough money to build a 20,000 sq. ft. building, but I had no problem in borrowing enough money to build a 40,000 sq. ft. building. I made up my drawings, took them down and got the permit, and went about having the local people put up the structure.

One of the features that I used were 45-foot long composite roof beams consisting of a plywood web and angle iron cap struts. This was a familiar structure to me because that is the way the wood airplanes that I had worked on were designed.

The building was about one half up when trouble came. I guess the architects resented not getting a fee out of this project, and the city inspector did not know his business at all. He just depended on feedback from the local architects as to what was a stable building. I supplied him my stress calculations, but he did not know what he was looking at. Finally, I loaded a beam from the floor to show him that it would carry the 15,000 # distributed load that the code called for. What I found interesting was that the deflection was almost exactly what I had calculated. It must have been okay, because the building is still standing, although it is leaking like a sieve. I guess I am going to have to put a new roof on it soon, although 33 years is not too bad for a sheet iron roof in this climate.

Now, with a lot of room available, I started laying out the shop in a little more sensible arrangement. The automatics went into one corner of the building and were arranged so we could run a forklift up and down the aisle. The grinders went over in another corner of the building so that the vibration from the automatics would not screw up the close work. Second operation equipment was lined up so that, hopefully, the parts would go down an aisle from machine to machine. Shipping was placed right next to our office, and we went about the business of taking care of our orders in the best possible manner.

In 1957, for my birthday, I felt that I had enough security that I could afford to buy an airplane and learn to fly it. When I told my wife that that was what I was going to do for my birthday, we just about had a divorce. I told her not to get too excited because I was going to do this. This had been my goal through all the years for all of this work. After sulking a bit, she announced that if I was going to kill myself, she would come and die with me. We went out and got our student licenses and started studying in ground school and started taking a few flight lessons. When we took the written test, my wife got a 74 score and I got a 72. I figured that she ought to be doing great. In due time, we both soloed and this seemed to satisfy her. As far as I know, she hasn't taken one solo flight since.

We bought a 172 Cessna that had been used for two or three years, with about 300 hours on it. I flew this around the central area for about three years, and it became obvious that a 172 Cessna was fine for training and local flying, but it was not much of a machine to go anyplace. I started shopping for a faster airplane with more range. I found a Bonanza (modestly priced) that had about 500 hours on it. I bought that and flew it for the next 10 years. Anyway, I am getting ahead of my story.

In 1959, the Berkley Company was in deep financial trouble. In an effort to save something out of an impending bankruptcy, Bill Effinger persuaded me to buy the company out of the Chapter 11 bankruptcy. In this situation, the buyer puts money into the kitty and it pays off the creditors a certain portion of their indebtedness. I learned at that point that you don't trust lawyers. My deal with the lawyer was that if I could get the company for \$40,000, I wanted it. If not, I didn't. He took the \$40,000, and I came home waiting for the deal to go through. A month or so later he called, wanting another \$20,000. I said, "No deal." He said, "Well, you've got to." It seems like

he had already spent the \$40,000. I guess I never will know who got the money, but I did get the company.

All of the Berkley inventory was loaded up and shipped to Fort Smith, and installed in a nearby building that I had built. I put Bill Effinger on salary to run the business. Bill and I really got along quite well, and I think that the thing might have worked had I just put it in storage for a couple of years and then gradually picked it up. But I was persuaded that continuity was important, and I found that the wholesalers were so overloaded with Berkley kits that it would be years before the kits were sold and they would be in any position to buy more. After six months, I was beginning to suspect that this was not going to work, and after nine months, I was sure. Effinger found himself another job, and I went about gradually liquidating the kit business (which took several years).

In 1982, I believe, our government passed what was called the Kennedy Round of Tariff Reductions. At this time, any foreign model airplane motor coming into this country had a 38 percent duty attached to it. For this reason, the imported motors were not considered serious competition to the domestic manufacturers. Boy, that Kennedy Tariff Reduction changed all of that! Importers blossomed on every street corner. While most of them were not as advanced technically as our motors, they did have a major price advantage. Shortly, every market niche that I could find quickly had a copy, and on many of these copies, they corrected our mistakes and had done a little better.

In 1964, business had dwindled to virtually nothing. We weren't selling enough even to pay our overhead. One day I took my assembly lead man aside and told him that it was going to be up to him to run the model engine business the best he could because I had to go out and find a way to earn a living. I started running around the country trying to hustle job shop business. I got a job from International Harvester, in Memphis, plus two or three local jobs.

The buyer at International Harvester introduced me to a 5 percent-type salesman who really did wonders for us. He invited me to his home in Atlanta, where we could become acquainted and talk over the way he operated his business and the way I operated by business. It looked like we had a real good match.

In a year, he had filled my shop with work, and we continued to grind out military parts for about five years. These were the Vietnam years, if you remember, and the government was buying ammunition and parts like mad, and the pay was really pretty good. The major unpleasant part was that I had to deal with some real bastards.

We did very well in this kind of business and, because of my engineering background, I was able to understand the traps in the military prints, and designed in process gauging that would ensure that when the parts came off the end of the line, they would pass inspection. Also, when you have a part from the military, you are talking about quite a bit of money. Most of the work we did involved orders that ran in the order of \$100,000 to \$500,000. The result was that when the Vietnam War started to wind down, I had quite a bit of newly acquired machinery and plenty of cash, and several very capable production people. There was enough money that I felt it was expedient to try to protect some of it, which I did by trading off my Bonanza for a Baron.

When the military work evaporated, my attention turned back to model airplanes. It appeared that RC had matured enough that we should consider a new family of motors. A few new schnuerle motors began to appear in the model market. I did not feel that I had a good enough handle on this new porting to design and tool new motors, and I did not have enough time to really become comfortable with it.

Consequently, I designed the Eagle I, the Fox 19 and 25 bushing motors and modified the crankcase for the 36 RC. These motors used the conventional single bypass design. The Eagle I was a pretty good market success, and over the next few years we sold about 35,000 of these. The 25 was also a good seller for quite a few years. However, the 19 didn't seem to sell quite so well, even though it really was a strong performer.

About this time in my life, I began getting tired quickly. I can remember waking up in bed one morning and telling my wife that if it was like this to get old, I was not sure that I wanted to. However, as it turned out, a flight physical picked up my diabetes. I was quite unhappy because I had gone to three different medical doctors to find out why I felt so lousy, and all three in essence said, "You have some sort of a virus, and some of them are pretty rough."

For a year or so, I tried to diet and control my diabetes in such a way that I could retain my flight physical. However, it was a lost cause. Without insulin, I was always cold, always tired and felt so lousy that I did not feel like flying the airplane anyway. So, I started on the insulin and sold the airplane.

The day I sold the airplane, it was like a funeral around the house, as you can well imagine. It turned out that not only did I have diabetes, but I was beginning to have rather serious heart pains. Shortly afterward, I went to the hospital for a heart bypass operation (then, it was a relatively new surgery). After the heart bypass operation, and with a reasonable amount of insulin, I felt great again.

So, I got back to the business of trying to build better model airplane motors.

In an effort to buy into schnuerle porting technology quickly, so to speak, I had bought the assets of the Roselle and Fry venture. I had thought that Jack Fry wanted to be in the model engine business so bad that he would put forth the effort to make it work. I financed a small shop where he could pursue his RAF motor. Unfortunately, he just wanted to play and I could see nothing forthcoming. I called the shop every day in mid-morning and mid-afternoon for two consecutive weeks, and never once got an answer. Then I knew I had to close down the operation.

I went up there and we loaded the few pieces of equipment and the parts in a trailer and sent them back to Fort Smith. The thing was a little bit messy, because Jack had borrowed some money and charged it against the corporation, even though I had set up a bank account. It was specifically stated that he should not be able to borrow money. At any rate, it cost me a few dollars, but we got that unraveled.

By this time, however, I had experimented enough with other brands of schnuerle motors, and saw that it was too late to make any money off the RAF. This was the second time I talked myself into a business deal with someone who was failing – first with Berkley and Effinger and now with the RAF promotion. I guess the best advice that I could give anybody thinking of going into business is if you cannot build it yourself, do not. Very seldom when you buy a business does it go as well as it appears.

When I was running the military parts, I got a good taste of what a really good production line can do. With relatively short runs of model airplane production parts, it seems that one was never able to get the line refined the way you would want it.

I was dreaming of something where I would have a bigger market than the model airplane motors and a bicycle motor looked like the end of the rainbow. About 1979, I started working on a bicycle motor design in earnest. It took several years, but I eventually came up with a motor that I felt was far superior to anything on the market. It really worked well.

I started trying to sell the bicycle motor in earnest. I learned that the U. S. Department of Transportation was pushing a set of laws labeled the Anti-Moped Laws. While this was not a federal law, it was pushed by the Department of Transportation. Eventually all 50 states passed this law. Basically, the law stated that powered vehicles under 50 CC were no longer exempt from licensing or registration laws, and they were also required to have a lot of safety equipment. Basically, this said that my primary market, the kids from nine to 14-years-old, could not use our product on the public streets. They would have to be old enough to get an automobile drivers license. Furthermore, even if the bicycle only had a Cox .02 mounted on the handle bar, the bicycle would have to be equipped with turn signals, roll bars, windshield or face shield, lights and enough other junk so that the thing would probably weigh another 50 pounds.

Obviously, as state after state accepted these laws, my market evaporated. I had borrowed heavily during the development tooling and, furthermore, had not paid any attention to the model airplane motor business. The model airplane motor business had pretty well dried up.

It was a hard decision to make to abandon the bicycle motor, but it had to be done.

I tried to start rebuilding the model airplane motor business. After thoroughly mulling over the various possibilities, it was decided to focus on the 40-size motor. The casting tooling for what is now our 40 Standard and Delux had been developed several years before as a Combat motor. A series of modifications, such as lengthening the crankshaft, altering the exhaust stack to accept a muffler, building a muffler for it, increasing the bore .040 to bring the displacement up to .40 and providing a



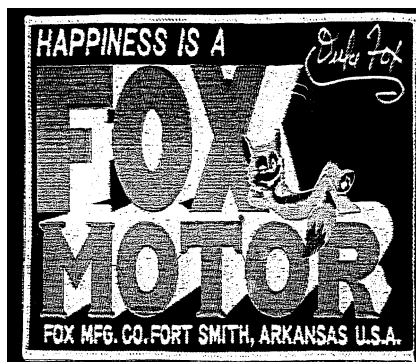
1991: Duke Fox

carburetor for it was a sizeable chore, but not nearly as much as building a totally new motor from scratch.

This motor was first introduced as a single ball bearing main motor. After being on the market a short time, it became obvious that the life of the motor could be improved considerably by adding the front ball bearing again as it had been in the earlier combat and enlarging the wrist pin. These alternations were made and the resultant motor was very much improved.

The boring out process worked so well in bringing the 36 to a 40 that we decided to apply it to the 45 and bring it up to a 50. Increasing the bore on a 45 to bring it up to a 50 seemed to work quite well also. The Eagle III motor ran very well. However, it took an awful lot of work to machine the split crankcase and to get the deck of both halves the same height. The special screws required to hold the halves together were also a considerable expense. All in all, it did not appear that we could continue to make Eagle III's profitably, so the next step was to refine the Eagle III and provide it with a new set of castings and a larger crankshaft.

The Eagle IV was the result, and it was quite a project because we had to design a totally new motor and build a new casting mold and all new fixtures, which turned out to be more of a project than we had originally envisioned. However, the results were well worthwhile. While there are still some points in the parts production that don't function as smoothly as I would like, we are getting it worked out, and the finished motors come off consistently good and the assembly is probably the easiest assembly of any of our motors.



Well, that brings us up to date on the first 71 years of my life. I doubt that I will see another 71, but it is quite possible that I will see another 30 or 40. Most of my mother's folks lived to be well into their 90s, and my Great Aunt Libby lived to be 113. So, if heredity has anything to do with it, I should be around for quite a few more years.

To all of you Fox fans out there, I say, "Enjoy your hobby!"

The following was written in 1981 upon Duke's appointment to the National Free Flight Society (NFFS) Hall of Fame.

Yes, Duke is his name and not a nickname. Duke was born in northern California. He attended Modesto Junior College and Stanford University. He worked at Hughes Aircraft and Douglas Aircraft during his early days and served at Wright Field in World War II. No doubt about it that Duke was a Free Flighter. He flew in contests in the San Francisco/Stockton area as well as in Los Angeles. He still has trophies to prove it. Have you ever seen a microfilm indoor towline glider? Duke's is shown in Zaic's Model Glider Design. Duke started to make his own engines in order to get the performance he desired. As time progressed, his friends around L.A. wanted his engines. So after World War II he got serious about producing them. As his engines started to

win, the company grew. In 1955, Duke felt that distribution could be better done from a central U.S. location, and Fort Smith, Arkansas, became their new home.

Duke pioneered the use of nitro methane for engine fuel in 1947. The famous Fox .35 stunt engine has recorded over 16,000 contest wins! He was the first to apply a soft aluminum head gasket on a production basis. Fox produces engines, fuel, motor mounts, wheels, mufflers, glow plugs, and other accessories.

Duke purchased the rights to the Berkeley kits from Bill Effinger and later sold most of the line to Sig Manufacturing. Fox also produced in 1955 a .59 size engine for application in target drone aircraft.

Duke acquired a pilot's license in 1950 and had a Beech Bonanza and Baron aircraft. Duke had been unselfish in donating supplies for AMA contests. He has contributed to the well-being of model aircraft development throughout the years and, therefore, deserves the recognition the National Free Flight Society is bestowing upon him.

Additional information about Duke Fox and the Fox Manufacturing Company can be found in Bob Angel's Old-Timers column in the April 2023 issue of Model Aviation magazine.

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