



AN INTERVIEW WITH

Gary Rosenfield

BY BRENT MCNEELY

Gary Rosenfield might be considered one of the most influential people in high power rocketry. He was directly responsible for the commercial development of reloadable rocket motors used in hobby rocketry. More recently, he was the first to certify a commercially available hybrid motor system. Gary is the founder and current CEO of AeroTech, Inc., as well as CEO of Industrial Solid Propulsion (ISP), Inc. While AeroTech is the largest manufacturer of composite propellant hobby rocket motors in the world, ISP provides specialized rocket products for the commercial aerospace industry.

Where were you born and raised?

I was born in Los Angeles, California and spent about four years in the San Fernando valley. After that, my parents moved to New Jersey where my dad worked for RCA on early warning systems. A couple of years later we moved back to California. After a couple more short moves, we lived in Fullerton, California for about 10 years. My biggest chunk of time growing up was in Fullerton.

When did you get involved with rockets as a kid?

My first memory of having any kind of interest in rocketry was when I was four or five years old. My parents bought me this little toy rocket which had a spring loaded third stage. Whenever you pressed a button, the top stage flew into the air. I remember being fascinated by that. In the

early sixties my dad worked for North American on the Apollo program. My dad would bring home artifacts, samples, and all sorts of things he was working on. They were exotic materials you didn't get to see anywhere else. I was fascinated with that, too.

Later on, when I was in elementary school, I had the idea of building a rocket. My first attempt was silly, but kind of amusing. I read in a book once where you could make corn starch burn by blowing it into a candle. So, I got this idea of filling a paper towel tube with corn starch. I then punched a little hole in a bottle cap that was glued to the tube. It was a fantasy thing and I didn't know how it was going to work. I guess I figured the corn starch would come out of the bottom, ignite, and propel the rocket. My last attempt, before getting into the hobby of model rocketry, was when I got a brass tube and filled it full of model airplane fuel. I guess I was going to light the fuel and throw it. This was another one of those totally misguided attempts.

Were these both things you would NOT encourage people to attempt at home?

Correct.

When did you start into model rocketry?

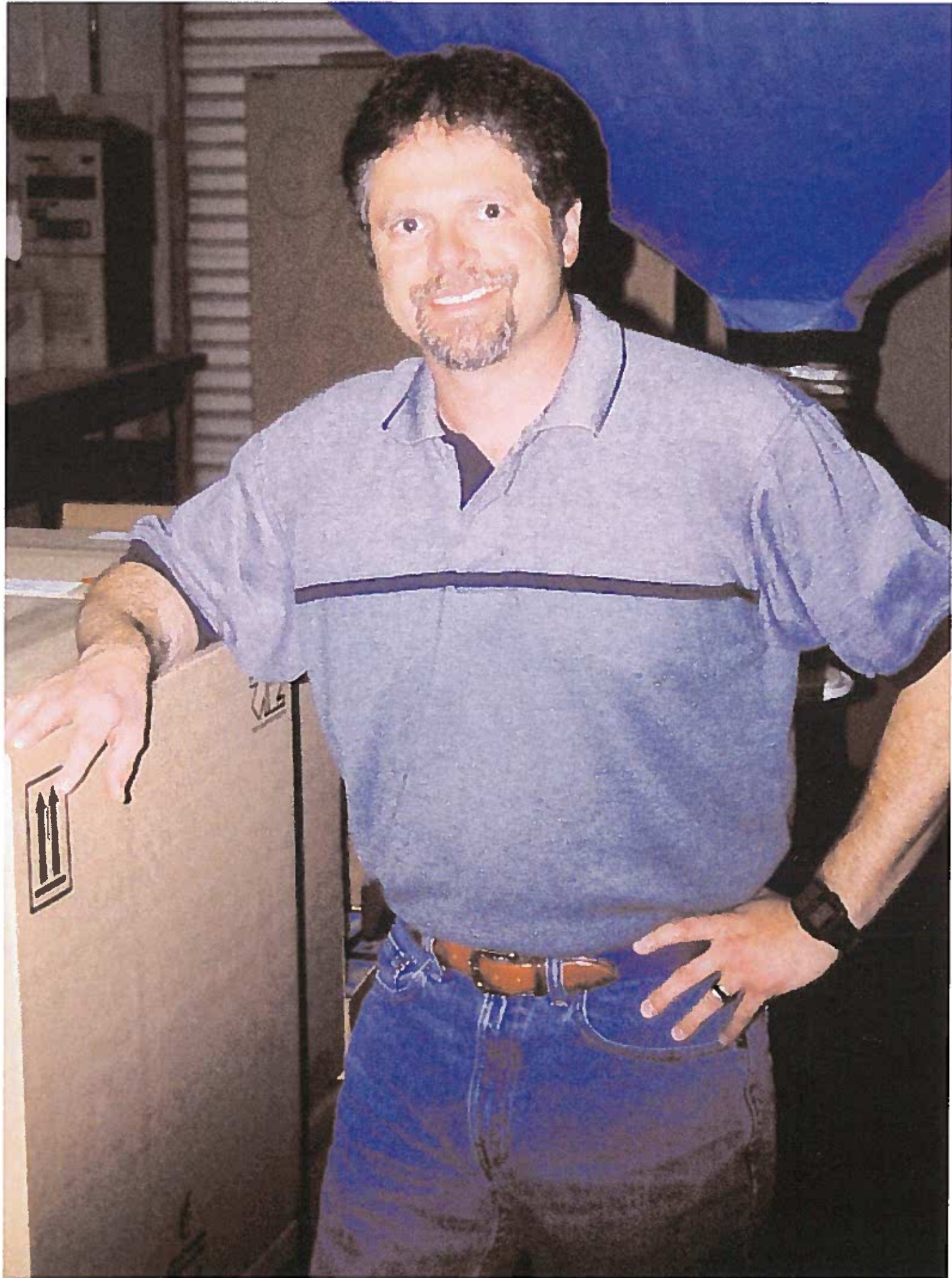
When I was about 14, I got my first taste of real model rocketry. I met a friend who lived in a development across the street who actually had an

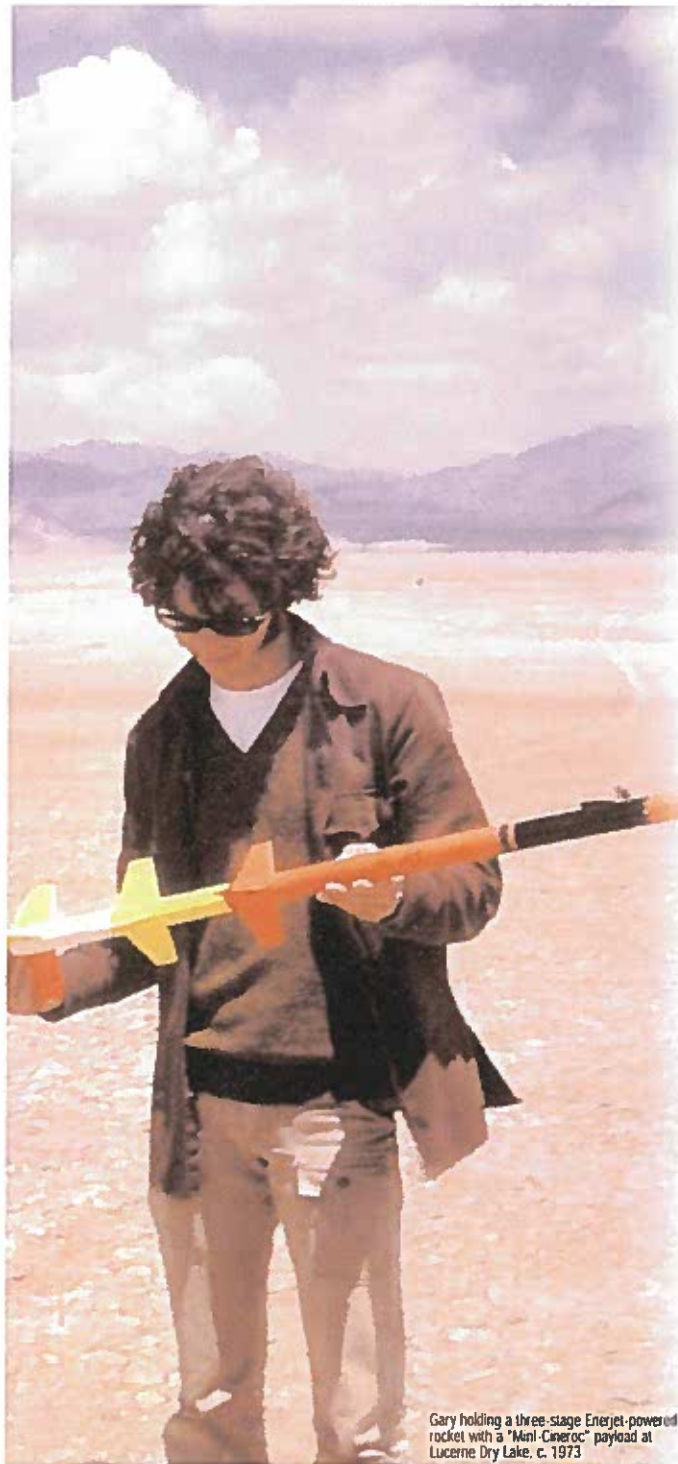
Estes rocket and motors. I grew up in California where it was very difficult to get model rocket motors. I had read about Estes rockets in books and I knew about them. I had read some of Harry Stine's book. However, I thought to myself that California is so restrictive I'll never get the stuff. I guess I just didn't have the motivation to figure out how to obtain it. Anyway, this fellow showed me his rocket and motors and it was very exciting. Just shortly after that I was in a local K-mart one day and they had a whole aisle full of MPC rockets. Now, some people might remember that Model Products Corporation brought out a line of model rockets around 1969. In fact, the molds for some of those kits were eventually used by Bill Stine in the MRC model rocket kit line (he ended up purchasing the molds for the fin units, nose cones and other parts). Anyway, I managed to get ahold of some MPC products at that K-mart—both motors and kits. I think I went hog wild and spent every dime I had earned from my paper route on these rockets and motors.

What was your first rocket?

My first rocket was an Estes Alpha which I flew with the MPC 'A' motor. I went down to the local elementary school to fly the Alpha and it worked perfectly. The parachute came out and it drifted away somewhere. Even though I lost the rocket, after that, I guess I was hooked.

Above: Gary preparing to launch a cluster modified Estes Omega at Lucerne Dry Lake, 1971. To the right: Gary standing in the AeroTech shipping room, 2000.





Gary holding a three-stage Enerjet-powered rocket with a "Mini-Cineroc" payload at Lucerne Dry Lake, c. 1973

1970. Seeing these motors in the shop really got my attention. I really liked the idea of rocket motors which used modern propellants like those in ballistic missiles. I'd had my fill of the black powder motors and I wanted to get into composite motors. We bought an F100 for about \$3.00, and some Enerjets for \$4.00 or \$5.00 each.

When did you consider yourself really hooked on rocketry?

My brother Bobby built an extended Goblin kit powered by an Enerjet E24 which he called the "E-Legal". He was into rocketry early on, but he got out of it after a few years. However, I think Bobby flew the first Enerjet motor in California. I remember seeing that first flight and I was totally hooked after that. The rocket took off like something out of a cartoon—just a puff of smoke and it was gone. Shortly after that, a number of hobby shops in California started carrying bigger motors. I ended up building and flying quite a few rockets with Enerjets. One thing I really enjoyed was flying miniaturized Cineroc movie cameras with multi-staged Enerjet powered rockets. I guess the biggest model rocket that I ever flew was a three stage design at Lucerne Dry Lake. Eventually one of my companies, Composite Dynamics, sold plans to modify the Cineroc into a "Mini-Cineroc". I also sold plans to make a three cluster 'sounding

rocket' called the 2250 that Enerjet sold in the early 1970's.

Where did the idea come from to start a rocket motor company?

There came a time in 1972 or 1973 when Enerjets were no longer widely available. Apparently it was a result of a marketing decision made by the Damon Corporation (which purchased Centuri of which Enerjet was a part). That event was more or less what gave me the impetus to start a motor company. I just knew there had to be a market for these motors, and if they weren't filling the market, I would.

After high school what were your career aspirations?

I think, like a lot of other young people, I was confused and didn't really have any clear goals. I was interested in rocketry at that time and had been since junior high school, but I never thought I would make a career out of it. I was pursuing radio and TV production at a junior college while I was experimenting with motors.

Was that a local college?

Yes, Fullerton college. I studied radio and TV broadcasting and production.

What did you do after college?

In 1976 I went directly from Fullerton college to the Air Force where I was trained as an imagery interpreter. As an interpreter, you looked at aerial photographs to determine whether they contained potential enemy targets, and what they were specifically. You had to determine if they were power plants or weapons factories, etc. and decide what targets were suitable for wartime situations. These were then incorporated into route plans for pilots. When I was finally stationed at Nellis Air Force Base in Las Vegas my job was mostly defined as making these route plans.

What did you do after the Air Force?

I joined my business partner John Davis back in Torrance where we were working on the business Composite Dynamics. (John and I met a few years before at an Anaheim Stadium Launch, and we became business partners while I was in the Air Force.) Essentially I went to work full time trying to grow Composite Dynamics into something that would support my family.

What projects did you work on for Composite Dynamics?

There was a lot of work on motors, both development and production, but the biggest project for me was the catalog. This was in the days before word processors and computers and everything was done by hand. There were a lot of hand drawings and lay-ups. It was about a 16 page catalog consisting of motors and parts.

What did you learn while working for Composite Dynamics?

I consider John Davis to be an early mentor of mine. John was about 16 years older than me and was a senior staff engineer at Hughes Aircraft in El Segundo. He designed the transmitters for one of the first Venus probes, among other things. I actually learned a lot of good things from him—both what to do and what not to do. I learned a wide variety of methodologies for making motors and how to source out certain materials and chemicals.

After you left Composite Dynamics, where did you work?

I sold my interest in Composite Dynamics to John and went to work for Bermite. At the time I

Were you involved in a rocket club as a kid?

We had a little group in high school—an unofficial "outlaw" rocket club. Dave Pacheco was one of the members of this club. In fact, today he lives in Las Vegas and is the current prefect of the Tripoli Vegas Rocket Club.

When did you get into larger rocket motors?

I always had my eye out for bigger motors. On a trip to Las Vegas one year with my folks, my brother and I were taken to a hobby shop in town. The hobby shop had FSI F100 motors, electric matches, and Centuri Enerjets. I had seen an Enerjet catalog before—they came out around

needed a steady income which I was unable to get with Composite Dynamics.

When did the idea of AeroTech first occur to you?

I always wanted to run and grow a rocket company. It was becoming clear to me that Composite Dynamics was not going to be that vehicle. It was in the back of my mind when I left Composite Dynamics that I would start something else. I started almost immediately on the principles behind AeroTech products using some ideas that had been rejected by John Davis.

What were some of those rejected ideas?

Some of the ideas were paper cartridge loaded propellant grains and certain techniques used for making long burning motors, though John did eventually pick up on some of the long burning motor technology. The main thing was the paper cartridge loaded propellant grains which he felt were doomed to failure.

Was this what led to the reloadable motor systems (RMS) that AeroTech has today?

Well, it had something to do with it, but what really led to it was the work Dan Meyer and I did with some parachute extraction rockets several years later.

Where did the concept of long burn motors come from?

I talked to Bill Wood at a launch at the Smoke Creek Desert in the late 70s or early 80s and got one concept from him. Bill came up with the idea of the "moonburner" motor using an offset core. That was a fascinating idea and I wanted to use it.

What kind of motors did you develop for AeroTech?

I initially came up with a moonburning G motor which burned for about five seconds, which had been unknown in composite hobby motor design up to that point.

Do we see the long-burn motor today at AeroTech?

You see the pedigree carried through. The present-day version of this motor is the G25, a direct descendant of that first motor.

During this time were you working for Bermite?

Yes, I was hired as a junior engineer there. I suspect it was because I had experience with Hydroxyl-Terminated Polybutadiene (HTPB) propellant which I had been using with Composite Dynamics. Nobody at Bermite had experience with it; they had been using a propellant formula



based on epoxy resin and an older technology Polybutadiene binder.

What projects did you work on for Bermite?

I worked on the reduced smoke Sidewinder rocket motor and did some ballistic analysis for high thrust motors used in kinetic energy penetrating rockets. I also did a lot of work on gas generators for, believe it or not, oil well tools. The oil well industry needs propellants for moving mechanisms down inside of oil wells. When you think about it, you are one or two miles underground and you've got that much fluid above your oil well tools. You can't really use a standard type of mechanism. You have to use very high pressure gas generators to overcome the ambient static pressure outside the oil well tool. We were trying to develop some modern oil well tool propellants based on HTPB, which we accomplished successfully.

What was the biggest thing you gained from working at Bermite?

It was working with Dr. Claude Merrill who was hired shortly after I came there. Claude was the former head of the solid propellant plant at the Rocket Propulsion Lab at Edwards Air Force Base. Essentially I was able to corner him for several weeks during a period of little activity at Bermite. We didn't have a lot to do during that time, and I just spent a lot of time asking him questions.

Did you glean most of your rocket motor knowledge from Dr. Claude Merrill and John Davis?

I gained about 80% of my knowledge from experiences with them. The rest of it I ended up learning on my own. For example, when formulating the means to make the motors at AeroTech, I spent a lot of time wondering about the right approach to each project. I spent a lot of time rejecting ideas: this approach was wrong, another too expensive, or too complicated. I discovered that a lot of techniques and materials which were good for military use were lousy for hobby use. Some military ingredients which cost hundreds or even thousands of dollars per pound (though

superior in performance to what we use in model rocketry) were not financially feasible for model rocketry. This is still true today.

Were you working on AeroTech projects while employed at Bermite?

While I was at Bermite I was not in a position to do much with AeroTech. I sold a small quantity of the long burning G motors to Jerry Irvine which he sold under the name of "Toy Rockets" (a whole other story). At that point AeroTech was still doing basic research and development.

After you left Bermite, where did you work?

I left Bermite in 1982 and went to work for Aerojet Tactical Systems in Sacramento, California. I worked there for two and a half years. Although I learned a lot there, I didn't learn much that could be applied to AeroTech products. Mostly I learned how to set up 600 gallon mixers and formulate propellant for ballistic missiles. I got a taste of huge motor production. But, there was very little that could be applied to small motor manufacturing.

Why did you leave Aerojet?

I was working full time at Aerojet, and between Aerojet and AeroTech my work was taking up too much of my time. I could no longer do a good job for either one. At lunch time I would go off to my own facility and work on motors and then come back to work at Aerojet. After work I would then go back to my own facility again to work on motors. I was working more or less full time at both jobs. It was just too much. I was faced with making the same decision that many entrepreneurs make when they have to leave their full time job to start their own business. It is a little bit nerve racking. First of all, I had to take a 50% pay cut to do it. I had a family with one child, and another on the way. Quite honestly I don't know what I was thinking at the time (laughter). I mean, now it seems irresponsible, but at the time it seemed perfectly reasonable. Now that I think about it, I wonder if in my current mind set whether I would go back and do that again.

What did you do after leaving Aerojet?

After I left Aerojet, I stayed in Sacramento for about a year and a half continuing to develop AeroTech. We saw the beginnings of expanding AeroTech into high power rocketry. The first motors we made were the I65 and the J100. We brought out essentially the first commercial high power motors that were widely available.

Did rocket construction begin to change at that point?

One of the things I discovered was that up to that point in time rockets had been built with model rocket materials, so they weren't very strong. If you put modern day motors like the J570 or the J800 into one of these rockets, they would rip to shreds. The rockets generally were constructed with balsa or plywood fins and thin paper tubes. I developed the I65 and J100 specifically to go in these less robust rockets. Both motors were a big success.

Did this tie in with the EZI65 rocket kit?

Yes. We brought out the I65 motor at about the same time Ron and Deb Schultz of LOC/Precision introduced their EZI65 rocket kit. This was essentially a joint product introduction.

What made the I65 unique?

The I65 was a big 54mm moonburner. It burned for about 10 seconds and had a nice initial thrust spike to really kick the rocket off the pad. About two seconds into the burn it had a regressive thrust curve. As the rocket gained altitude, instead of just going faster and faster, it would end up taking the rocket to a given velocity and holding it there. The I65 ended up being a very successful product. You could use existing kit technology and fly high power motors. We introduced a whole line of motors around that concept: the I65, J100 and J125.

When did you finally move AeroTech to Las Vegas?

In 1985, in December, we moved to Las Vegas for a number of reasons. My wife at the time wanted to move back to Vegas. I wanted to as well; I liked the desert, the regulations were less onerous here, there were more places to test motors, and it was easier to get out of town to run experiments. The whole environment was just better for a rocket company. Nevada is a great state for any business and I've never regretted coming back here.

Was AeroTech a garage sized business when you came to Las Vegas?

AeroTech had graduated to an industrial facility before I left Sacramento. When we came to Vegas we purchased a house with a very large garage which we used for the business. For a short time we moved into an industrial facility similar to the one we had in Sacramento. That's when we hired our first two employees, Scott Pearce and Jim Dunlap.

When were reloadable motors first offered by AeroTech?

Reloadable motors were essentially introduced at LDRS in 1990 in Colorado Springs (Large and Dangerous Rocket Ships, the Annual Tripoli National Event). They had been demonstrated at a Black Rock launch a few months earlier, however, we had been working on them for a couple of years prior to that.

How were they received by the rocket community?

It was fantastic! I remember going to a Lucerne launch and we stayed at the Green Tree Inn in Victorville. Some people reading this will remember those times. We used to have vendor parties in the hotel rooms and AeroTech would decorate it's room with yellow and black striped crepe paper and cups. At the time we had completed some work on the reloadables. Steve Buck was one our dealers in Nevada (a name the old-timers will remember). Anyway, Steve was the first person to whom I revealed the plans for reloadable motor kits. I remember asking him, "What would you think of a motor product where the motor used an aluminum case with threaded ends, and for propellant you would receive a kit of parts to assemble into the casing, screw the ends on, fly it, empty it, clean it, and reload it again? What would you think of something like that?" He sort of looked at me, smiled, and said something to the effect of, "Sounds great! It's a great idea!" I believed reloadable motors would be accepted for a number of reasons. I thought we could bring them out at a lower price because the customer didn't have to throw away the casings (which were a very expensive component of the motor). Also, if the labor costs of assembly were removed, and if epoxy resin wasn't used, the costs should be even lower and we would be able to pass the savings onto the customer.

What is the most expensive component of a reloadable motor?

The hardware, but that is reusable. The most expensive part of the reloadable kits would depend on the motor. It is usually the propellant or the nozzle. On the larger reloads the nozzle is actually quite expensive. You have to remember we aren't making these parts by the millions. The components are ordered in the hundreds or thousands at a time. There's not a huge economy of scale in this hobby, yet. Beyond the cost factor, I believed the high power rocket people would enjoy assembling these motors. I felt the hobby could benefit from some increased participation by the rocket customer. Rather than just taking a pre-made motor and shoving it into a motor mount, now you would have more involvement in the usage. It's one of those things where I had this intuitive feeling about it. While some people still liked the single use motors, the majority liked the new reloadable motors.

Did the reloadable motor take AeroTech in a new direction?

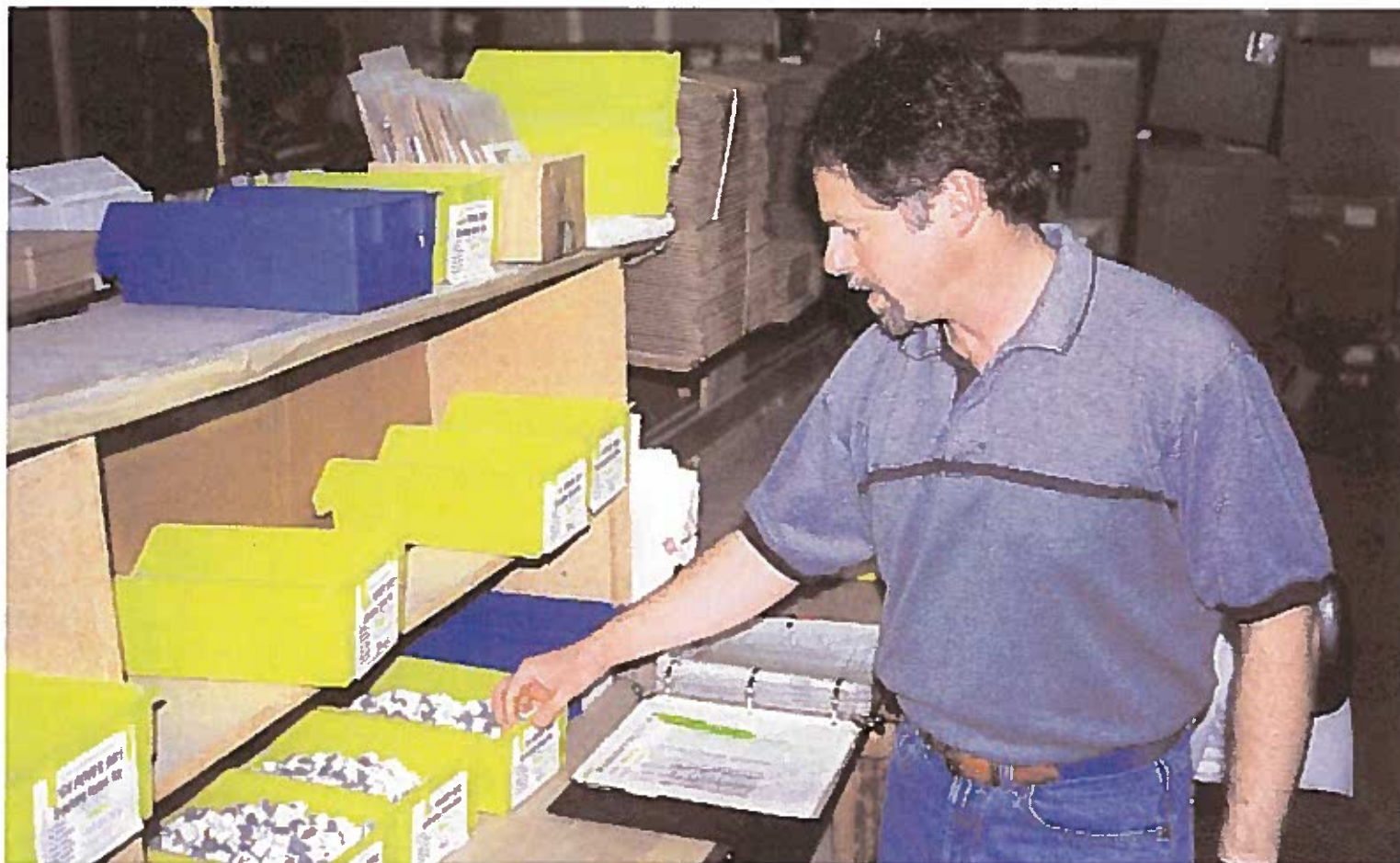
I think it did because it took high power to the next level. Up to that point high power motors were so expensive the hobby was not very active. I think looking back, reloadables defined the point where high power started to really grow. Up to that point most of our sales were model rocket products.

After RMS technology, what do you think was AeroTech's next most important product development?

Hybrids are an important technology to have in one's quiver of tools (so to speak), and in one's technique of making motors. It offers an alternative rocket motor technology to draw on if the regulatory environment becomes too stifling. At this point hybrid oxidizers and fuels are not regulated like solid propellants are. It is important for AeroTech to maintain that technology even if it is not a big seller for us.

AeroTech at an early hobby trade show, 1984





At AeroTech which project would you say is your favorite?

The hybrid was the most rewarding for me. It was a technology which had never been developed for the consumer market and I really felt like we were doing something new. Although HyperTek had come up with their own hybrid motor system, we came up with a fairly original design using a cardboard fuel and pyrotechnic valving system which was pretty fool-proof.

Will AeroTech be improving the Copperhead igniter?

I still believe the Copperhead is a good igniter. However, they are susceptible to a number of things like the way they are shipped and the way they are handled. Sometimes the manufacturing process is also hard to control. We have been researching an alternative igniter. Unfortunately the work we did over the last year or so to develop an alternative igniter didn't pan out. We made prototypes which had been seeded to customers and they seemed to work pretty well. However, when we began producing them, the igniter had too much variability between the time you pushed the fire button and the time they ignited. We judged them unacceptable and the project has been put on the back burner. We are currently searching for a suitable alternative igniter design, but haven't found one yet.

How many employees are at AeroTech today?

About 25.

How big is the AeroTech facility?

When we came to Vegas we had a very small industrial facility (about 800 square feet). We are now up to about 11,000 square feet and it looks like we might expand this year by another couple of thousand square feet.

What is the yearly growth percentage at AeroTech?

It has been between 10 and 20 percent each year which is manageable growth. When it gets to 25 percent it strains the organization. We have had some years where it did grow like that, but 10 to 20 percent a year is quite manageable.

What will we see from AeroTech in the near future?

I would hope you will see some additional propellants or variations on existing propellants in various reload kits. Hopefully we will have some new rocket kits. We are very pleased with the outcome of the G-Force, our new four inch kit for 'G' motors. We will probably bring out some similar kits. I also want to do some work incorporating electronics directly into the motors themselves where the motor and the electronic ejection system would be an integral unit rather than separate components. You will also see modifications to existing 29mm and 38mm reloadable motors. RMS-Plus is a redesign to the delay system (which will be completely backwards compatible with existing hardware). We feel the new design will render more accurate delays and more fool-proof assembly by the user. You'll see this about April of

this year in the new reload kits. You will also see a totally new format to the drawings in AeroTech motor instructions. We are incorporating 3-D CAD renderings instead of just 2-D cut away illustrations. We believe this will help with assembly accuracy.

Will we see any changes to the AeroTech web site?

This year we will be really using the internet to our advantage. We will expand the use of the AeroTech website as a communication and education tool for our customers. Right now we have quite a few resources up there in terms of instructions and documents. We are going to extend that idea to include multimedia. You'll be seeing that later this year.

What are your goals for AeroTech?

Our biggest goal is to continue to grow the company, especially the model rocket side. We want to increase the customer base and learn how to reach more potential customers in model rocketry because we believe that by educating and serving them we will also expand the high power side. Very few people get into high power without first going through model rocketry. We are constantly working on new products which we don't discuss with the public until their release. There are other things we are working on that we just can't talk about right now which you may see soon.