

The Pursuit of a Nebulous Dream  
*How I Got Started in Rocketry*

by Richard A. Nakka

### Early Inspirations

Nearly as far back as memory permits, I can recall having a keen interest in rockets and space exploration. As a kid, I proudly possessed numerous books that dealt with these topics and which served to further intensify this interest. I had the rather good fortune of being born at the right time to experience first hand those heady days of the “space race” and the exciting times that came with this golden era of space exploration. I only faintly remember watching a Gemini launch. I was too young to appreciate that particular steppingstone to the moon. It was to be the Apollo missions that became a source of fascination for me, and which led to an indelible yearning to gaze skyward toward the moon, the planets and the stars.

This fascination with space exploration and my eventual passion for rocketry took off exponentially in the fall of 1968 when the first Apollo mission took place. I followed this mission keenly; engrossed by all of the exploits of the Apollo 7 astronauts and their adventuresome eleven days in space, I diligently clipped all the newspaper and magazine articles and neatly pasted them into a scrapbook. My sister, Gail, who was living in the States and was well aware of my interest, also clipped and unflinchingly mailed similar articles to me for inclusion in my scrapbooks. What started off as a single scrapbook eventually grew into a dozen such collections full of clippings of space exploration spanning several years after that first Apollo flight. After one mission wrapped up, I waited in great anticipation for the next.

Television coverage of manned space exploration in those days was very comprehensive. I hardly ever missed a minute of the coverage, often waking up in the wee hours of the morning to witness a live launch, or to catch some other equally fascinating event of a mission – a “spacewalk”, “docking”, “splashdown” or even a live telecast hosted by the space capsule’s crew. Even non-spectacular, but key mission events with cryptic names such as TLI (“Trans Lunar Injection”) or EVA (“Extra Vehicular Activity”) led to special news bulletins which would pre-empt normal television programming. The faces of newscasters such as Walter Cronkite and Harvey Kirk are forever linked in my mind with these exhilarating times.

The Apollo 8 mission of Frank Borman, Jim Lovell, and Bill Anders that took place during Christmas of 1968 was particularly poignant, as this was the first time men had left the “cradle” of earth’s gravity and gazed upon the moon from lunar orbit. The TV images of the stark pockmarked surface later described by Buzz Aldrin as a “magnificent desolation” seemed tantalizingly close. The first-ever image of an “earthrise” over the moon’s horizon made us aware of the striking contrast between these two heavenly bodies, and that we were truly

fortunate to be living on a beautiful, albeit fragile planet. Although it was the Apollo 8 mission that remains a sentimental favourite of mine, it was the moon landing of Apollo 11 that was the pinnacle of excitement for me, as it was for millions around the world. It was in the summer of 1969 that Neil Armstrong and Edwin (Buzz) Aldrin strolled on the moon, and I was yet to build a flyable rocket. We were on the doorstep of the seventies, a decade that held great promise for the world, at least according to a popular CTV television program that I watched every week "Here Come the Seventies". This was a rather flamboyant half-hour feature that looked ahead (rather naïvely, in hindsight) to anticipated technological marvels and innovations in store for us in the upcoming decade. Deep space exploration and moon habitats were promised to be just around the proverbial corner, as so realistically depicted in a film that has remained a favourite of mine -- "2001: A Space Odyssey".

### Historic Moon Walk

I vividly recall watching coverage of that first moon landing on television from a motel in St. Joseph, Missouri. Our family was on a summer vacation touring the "old west" -- Wichita, Abilene, Kansas City, and Dodge City were some of the places we visited during that summer vacation. We'd made a stop at a motel during that particular afternoon expressly to witness the historic event unfolding faraway, above the moon's surface, as the lunar module "LEM" descended toward the Sea of Tranquility. The final moments were heart-stopping as cap-com counted down the ever-dwindling seconds of remaining fuel, before the jubilant words of Neil Armstrong announced, "the Eagle has landed". Later that evening, we watched the moon walk from another motel, the "Shangrila", in Kansas City, Missouri. In retrospect, that was a curiously fitting name that reflected the idyllic atmosphere of that time, as experienced by a young man growing up in a world that was promising to be an exciting place into which to be venturing forth. I was glued to the television set, and used my sister's 35 mm Yashica camera to take photos of the TV screen during the event (this was, of course, long before the advent of VCR's). Walter Cronkite's captivating narration led us earthbound viewers on our own journey onto the moon's surface as the astronauts gingerly descended the ladder of the LEM, and cautiously stepped onto the dusty surface. We were live eyewitnesses to this momentous undertaking. A television camera mounted on the side of the LEM had been deployed by the astronauts some minutes earlier. The black and white images were fuzzy and suffered from the extreme contrast of the brilliantly sun-lit moon surface and the pitch-black shadows. But this did not matter one iota to us viewers who were captivated in the moment we were sharing with history.

### Model Rocketry

Like most kids, I enjoyed reading comic books. One of my favourites was "Space Family Robinson". On the back pages of these comic books were the ubiquitous advertisements for gag gifts, muscle building sets and similar such novelties.

None of these particularly caught my attention, with one very notable exception – ads for model rockets! The most popular was the ad for the Estes *Alpha* starter kit. The price was certainly affordable -- I think it was about \$2 USD, I remember longingly studying these ads, time and again, visualizing in my mind what it would be like to build and fly one of these rockets. How I wished I could have ordered the *Alpha* kit, but the ad clearly stated that these could not be shipped to Canada. The reason was not quite clear to me at the time, but I'd supposed it had something to do with the fact that these rocket motors used a combustible material for propellant. I did, however, send away for a free copy of the Estes catalogue, which to my surprise, I received. I pensively studied every single page, over and over, intimately acquainting myself with the design, construction and flying of these rockets. I learned the basics of rocket propulsion, aerodynamic stability, parachute recovery systems, launching and ignition systems – everything that I needed to know in preparation for when the time came that I would experience first hand the exhilaration of the model rocketry hobby.

Early in the winter of 1970 I was browsing through a hobby shop in downtown Winnipeg -- I believe that it was “Gooches Hobbies”, the largest and most well-stocked hobby store in the city at that time. I loved to browse through the amazing items that were on display, things that were unique to specialty hobby shops and that you just couldn't find at regular department stores. Things such as RC airplanes & boats, model railway paraphernalia, every sort of plastic model and many other fascinating items and gizmos that were priced well beyond what I could afford to buy. And well beyond my family's modest means, so even as a birthday or Christmas gift, most were beyond wishing for. I can't recall the exact reason for my being there that particular afternoon, perhaps to purchase supplies for my model building hobby (I was an avid builder of plastic models) or perhaps just to browse and daydream. Then I noticed something in a glass display case that surely made my eyes instantly swell as big as saucers. Rockets! Not the plastic “display” variety that I'd built dozens of, but the actual flying “Estes” type rockets. Not Estes brand, mind you – these were made by a company called MPC, but that mattered little. I couldn't believe my good fortune. I excitedly studied the rocket kits and noticed one rocket that had special appeal to me. It was a “starter” rocket deemed the *Pioneer 1* that was nearly identical to the *Alpha* I'd so longingly stared at countless times in the back pages of those now-forgotten comic books. It suddenly dawned on me that a rocket, however, without a motor was of little value, so I searched around and soon spotted a display case filled with boxes of Centuri rocket motors (often called “engines”, a misnomer). They looked just like those pictured in the catalogue, almost tantalizingly close enough to hold in my hands -- if it were not for the fact that they were in a locked display case. I did not have enough money with me to buy any of these rocket kits, but I knew exactly which one I had set my heart upon. I'd no longer have to fly rockets vicariously; the day was surely soon approaching when I'd be announcing my first countdown.

When we got home, I excitedly told my father about the rocket kit I'd seen and wanted so badly to purchase. He must have noticed a certain gleam in my eyes when I vividly described the rocket and the motors. To my surprise and delight, he said "I'll drive you downtown -- lets go pick up that rocket right now. If we hurry, we can get there before the shop closes".

### The Big Letdown

While I was scrutinizing the rocket kits, my father asked the storeowner about the prices for the rocket motors. Disappointment soon came down on me like a load of bricks. It wasn't the price that was the blow; rather, the man said he could not sell us any motors. Not without a permit, which he told us was mandatory for the purchase of rocket motors. More out of desperation than out of realistic hope, my father asked if he'd sell us just one box of motors, but of course, the shop owner refused. We bought the rocket kit, nevertheless, expecting that we'd somehow come up with the means of getting the motors at a later time. I was certain that this was an obstacle that I would manage to overcome. Even back then, when I had my heart set upon a goal that was vitally important to me, giving up without an honest effort was not an option. For now, I had in my hands a prized possession that represented a giant leap forward in my quest, or should I say what had now become my obsession.

The first letter I sent off in the mail was to the office of the Minister of Natural Resources. I'd read somewhere that this was the government body that regulated model rocketry. The reply that I received after a few weeks informed me that this responsibility had been handed over to the Canadian Association of Rocketry (CAR). So, continuing the paper trail, I sent off a letter to CAR, and waited anxiously for a reply.

After a few weeks, a rather thick envelope with the CAR logo arrived in the mailbox. With excited trepidation, I tore open the envelope wondering to myself what hoops I was being forced to jump through to be permitted to get my hands on those long-awaited rocket motors. As I read through the information, which included application forms, I learned that the process one had to go through to get a permit was not as insurmountable as I had feared. The purchasing of rocket motors could only be done with possession of a "Launch Supervisor License". To get this cherished permit, one had to be at least 18 years of age and had to write an exam on safe launching and flying practices. As well, one had to describe, on one of the forms, a proposed launch site, and have this form signed by the property owner of the site. My father agreed to be the applicant for the license. My grandmother owned a farm in rural Manitoba, so the launch site was not a problem. Well, except for the fact that it was a wheat farm and the practicality of it as a launch site was certainly questionable, at least during the growing season. But for the pragmatic purpose at hand, it admirably fit the bill.

We filed the application, and when the mail-in exam arrived, my father skillfully completed it, and filled out the other forms. We had the “launch site” form signed, and thus began the metaphorical countdown to my first launch. It was now spring, and over the time period leading up to now, I had lovingly and meticulously assembled the *Pioneer 1* rocket from the kit I had purchased. The rocket design, while being similar in size and appearance to the *Alpha*, featured a lightweight plastic nosecone and one-piece plastic finset. The kit came with a plastic streamer for recovery. I substituted a small parachute. After all, the *Alpha* was fitted with a parachute. I’d also constructed a nifty wooden tripod launch stand and, with the help of my older brother, Blair, who was skilled in electronics, put together an electrical launching system. At long last, the cherished permit arrived in the mail. I proudly gazed at it and pondered as to when we should we head to the hobby store and put the permit to use. The weather that day was damp and quite a strong breeze was blowing. My brother, who has always had far less patience than me, said “why delay any longer, you’ve been waiting years to begin launching your rockets -- let’s go pick up those motors right now -- I’ll drive you”. We bought a couple of boxes of rocket motors. Being expensive and our having little money available, we bought one box each of “B” and “C” class motors.

I had loaded a “B” class motor into my *Pioneer 1* rocket and had packed the parachute as carefully as I could, considering that it was a rather snug fit in the narrow body tube. The wind was blowing quite briskly and rain was threatening as we unpacked our rocketry stuff at our launch site -- the “Floodway”. We decided much earlier that the Floodway which skirted the city of Winnipeg would be our launching field, rather than the “official” farm site, which would have been way too muddy at this time of the year. The Floodway was a mixture of natural gravel and fields of alfalfa, far better suited to our activity. The Greater Winnipeg Floodway, as was the official moniker, was built in the mid 1960’s, some years following a devastating flood, which resulted from the swollen Red River (which flows through the heart of Winnipeg). Basically, it’s a colossal ditch that channels excess water during the spring flood season safely around the city. The ditch runs through the middle of a large tract of public land, and is largely deserted during non-winter months. During the winter months, the Floodway has always been a popular site for tobogganing, skiing and snowmobiling.

3-2-1-Liftoff!

Excitedly, I announced my first ever rocket launch countdown: *5-4-3-2-1-zero!* Deafening silence. Nothing happened, as the rocket remained frozen on the pad. After waiting a minute or so, I checked the igniter, and discovered that it had burned but had failed to initiate the motor. This was to be a problem that would plague me throughout my tenure in model rocketry. I don’t recall how many attempts it took, but at long last, we succeeded in lofting *Pioneer 1*. It climbed to a satisfying height, at which point the chute popped out, and it drifted back to the gravel-covered ground at a rather quick pace. Upon inspection of the recovered rocket, I discovered that I’d not put in sufficient heat protective “wadding” and

the parachute had partially melted and stuck together, so downwind drift was not to be a problem that particular day.

Throughout the spring, summer and early fall of 1971 I had the thrill of building and flying model rockets to my heart's content, wallet allowing. I kept a logbook detailing every flight, on the urging of my brother, who was a quintessential amateur scientist accustomed to, and recognizing the value of, keeping concise lab notes (he later became a scientist working in nuclear research for Atomic Energy of Canada). I was more the amateur engineer, interested mainly in putting science to work for me, rather than in pure science. But I wisely followed his advice, and to this day, I maintain logbooks of not only all my rocket flights, but also of all my ideas, designs and experiments. These detailed notes have proven to be of immense value in an activity as complex, detail-sensitive, and prone to failures as amateur rocketry. Model rockets were quickly becoming my personal avenue guiding me through an exploration of technology and laying a foundation for my eventual career in aerospace engineering. Out of the early pursuit of a nebulous dream came many successful (and many not-so-successful) launches, hallmarked by a number of especially memorable flights. One such flight was with my Centuri *Chuter II* rocket, which featured a transparent compartment for stowing experimental payloads. I flew this rocket on a powerful Centuri "C" class motor, and recall that it climbed nearly out of sight. On cue, the ejection charge fired, and the oversize parachute deployed -- only to have the tether break, resulting in the main rocket body separating from the payload section. The rocket tumbled earthward, and was recovered undamaged. The payload, however, drifted with the wind for miles! Perhaps not literally miles, but we never did find it, despite vainly hunting (and battling swarms of mosquitoes) for many hours in search of my erstwhile possession.

Besides the *Pioneer* and *Chuter* rockets, I built and flew the two-stage MPC *Pegasus MK-II*, the Centuri *Chuter II*, the Centuri *Laser-X*, and an impressive flying plastic model of the *Saturn-1B* that used a cluster of two "C" motors. Frustratingly, I never get could both motors to ignite simultaneously, in three launch attempts. Consequently, the rocket would lob into the air, do a few tumbles then fall to the ground, breaking one or more fins in the process. I also flew a couple of model rockets of my own design. One of these was a two-stage rocket, to which I'd fitted a clone of the *Pioneer I* rocket atop a booster stage, a rocket I'd deemed the *Nova II*. Things did not go as planned when we launched that beast. The first stage fired, and indeed ignited the second stage motor upon burnout. However, the stages failed to separate. What followed is whimsically etched in my memory. The rocket assemblage, with the second stage motor burning, quickly burnt a hole in the body sidewall of the lower stage, resulting in an offset thrust. The rocket subsequently made a sharp right angle turn, flew parallel to the ground, slowly inching closer to the surface as it skimmed through the air at high speed. I recall it eventually skipped several times off the ground like a stone skipping on water. Curiously, when the rocket came to a rest (I don't recall if the chute fired out), the damage was not that severe. Most of the harm

was inflicted to one of the three fins of the plastic finset, which had the appearance of being put to a grindstone. I'm still in possession of this sculpted finset, a curious keepsake of the model rocketry flight that went haywire.

Although I immensely enjoyed that one season of model rocketry, it served more to whet, rather than satisfy, my appetite for rocketry. Building and flying these cardboard, balsa and plastic rockets powered by commercial motors surely had been a wonderful adventure and an immeasurable learning experience. But I felt it was time to move on to discover firsthand what truly made the heart of rocketry beat—the rocket motor.

### Exciting New Quest

My quest began by studying the Estes catalogue. It had numerous cutaway views of their motors and explanations of how a rocket motor functioned. These explanations were too vague, at least, for the yearnings of a future engineer. To learn first hand the details of these marvels, I dissected dozens of spent motors and even (very carefully) cut open a live motor. Previously, I had dissected various fireworks to discover by what hidden means these marvels worked their magic. Cutting through the cardboard motor casing revealed a pristine slug of black propellant -- a gem, in my mind, if there ever was one. I was even more amazed at how quickly and energetically a tiny piece of it burned. My own earlier attempts at making black powder had pretty much fizzled. I could never succeed in getting the black powder to burn quickly enough, nor cleanly enough, to be of much practical use. The resulting product was satisfactory for my own homemade "Victoria Day" fireworks celebrations, but lacked the zest of commercial black powder. This propellant-grade black powder was something all together in a class by itself. It was obvious to me that this model rocket propellant was produced using sophisticated equipment. I regrettably came to the realization that duplicating the model rocket motors was an unrealistic expectation. Besides, that fast burning propellant gave me the shivers. By nature, I've always been a cautious person, and not inclined to do anything in a hazardous manner. This is undoubtedly a desirable, if not mandatory trait of a successful rocketry experimentalist.

My brother, who had been attending university, had a vast library of science and math textbooks, most of which were far too advanced for a high school kid like me. One of the books he owned, however, was a collection of rather advanced science projects published by *Scientific American*. I discovered that the final chapter in this book was on rockets. It described the workings of a team of amateur rocketry enthusiasts and their rockets powered by a mixture of zinc dust and sulphur. This really intrigued me. Both were common materials. Well, at least zinc was commonly available in a solid form. I was aware that dry cell batteries had a case made from pure zinc. And sulphur was abundantly available. Behind our house ran a railway track, which often carried boxcars filled with sulphur. These boxcars tended to leak and as a result, small lumps of sulphur lay like gold

nuggets between the track rails. I had often collected these curious chunks of soft material with a brilliant yellow colour. I had, in fact, used this sulphur to make my own ill-suited crude black powder. So, I thought, all I would have to do is to reduce the zinc to “dust”, and I’d be in business! The only way I could think of to accomplish this was to use a very fine-toothed file. Tedious work, but I eventually accumulated a few grams, enough to allow for some limited experimentation. The lumps of sulphur were pulverized using a mortar and pestle borrowed from my brother’s “amateur chemistry lab”. Curiously, my brother had all kinds of exotic chemicals, which he’d obtained from God knows where, but the more useful chemicals (in my view of the world) he possessed few.

Not having the metalworking tools, or skills, at that age, to make a decent motor for testing my own concoction of zinc and sulphur, I pieced together what I felt what could pass for a rocket motor, and loaded the “propellant”. As it turned out, the mixture barely burned, let alone burned with the vigour needed to produce useful thrust. Discouraged, I soon abandoned all further experimentation with this formulation.

One day, my neighbourhood friend, Warren, dropped by and showed me a book he’d gotten hold of (probably from a schoolmate). Although his interest in rocketry was more a passing thing, he did have a general interest in science, and later we were both members of the high school science club. The book was about amateur rocketry, and had the title “Rocket Manual for Amateurs” and was written by a Capt. Bertrand R. Brinley. Spellbound, I fingered through the book, looking in awe at the scaled drawings of genuine amateur rockets. The book even gave detailed instructions on how to build them. These rockets, with alluring names like the *Alpha* and *Beta* were impressive. My initial excitement turned to disappointment, however, when I saw that the propellant required for these rockets was the same zinc and sulphur mixture that I’d experienced my ill-fated attempts with. I borrowed the book nevertheless (of which I am still in possession of -- my apologies, Warren). When I read through it, I came across two pages that literally changed my world forever. Nearly glossed over by the author was the mention of a formulation apparently used by some amateur rocket builders. The book’s author took care to point out the drawbacks of this alternative propellant, but conceded that it might be worthwhile to undertake further investigation. This propellant, a mixture of potassium nitrate and melted table sugar, at least was made from materials that were truly common. After a few simple experiments with this formulation, I was sure that I’d found the Holy Grail I’d long been seeking.

### Sweet Success

The first application I could think of for this promising concoction was for reloading of the spent model rocket motors, of which I had by now accumulated quite a pile. With my first attempts, I’d had some difficult casting the thick, syrupy propellant into the casing. Consequently, I then tried packing the motors



with a powdered mixture of the potassium nitrate and sugar. After these motors literally fizzled, producing little in the way of effect, other than lots of smoke, I next tried a different approach. After melting the propellant, I allowed it to solidify, then crushed it into small granules, which I then packed into the spent casing. This approach led to more successful results, at least according to my notes I kept of these attempts. The rapid combustion that resulted from the burning of the granules overpressurized the motor, causing the forward closure of the motor to forcibly blow off. Despite this apparent failure, I recognized this as a pivotal point in my experiments with rockets. This formulation demonstrated the potential to build up significant pressure inside the motor, and pressure, when successfully harnessed, meant thrust, the forceful reaction that propels a rocket skyward.

I've always been cautious with regard to safety, going to particular lengths to use safe practices in order to minimize the risks associated with this potentially hazardous hobby. I guess I've always been afraid of hurting myself, even shunning most sports and other activities that involve any sort of risk of physical injuries. This approach has served me well, as I've never suffered any physical harm (mental anguish aside) resulting from my rocketry experiments, despite the occasional spectacular and at times unexpected mishaps that have occurred. I vividly recall one calamitous incident that occurred with one of these reloaded model rocket motors. My brother did not always share my cautious and careful approach. He tended to be more adventurous and indeed, more prone to take (what I considered to be) occasional unnecessary chances. The model rocket motors that I had reloaded were sealed at the forward end with a plug, or bulkhead, made from a material called "Durham's Rock Hard Water Putty". This was a gypsum-like powder that, when mixed with water, formed a thick paste that would dry literally rock hard. It was necessary to allow the putty to set overnight. As such, I had occasionally kept the motors in my bedroom, usually on the bedside dresser. In those early days of my rocketry experimentation, I used simple pyrotechnic "fuses" to ignite the motor. One morning, my brother came into my bedroom to wake me up and get me out of bed (never an easy task, back in those days). He spotted one of these reloaded motors on my dresser, and in a teasing attempt to draw me out of bed, he lit a match and held it close to the fuse. Although he had no intention of actually lighting the fuse, this was, of course, exactly what happened! Stunned as the fuse began to burn, and realizing that he was unable to extinguish the fuse, he yelled out a quick warning and simultaneously dove for cover, tossing the motor under the bed. As had happened with the earlier reloads, the motor overpressurized, firing off the bulkhead with a loud "bang" and filling the room with smoke! After that, I never stored my rocket motors in the house ever again or anywhere within easy access of "nonqualified personnel". It was a learning experience in safety that reinforced my attitude to "expect the unexpected".

Up to this point in time, all my reloads had been tested by simply mounting them in a fixed stand, then igniting the motor. More often than not, they simply burned

for several seconds, producing little useful thrust, or they simply blew off the bulkhead. The odd motor seemed to work reasonably well, burning quickly and performing seemingly similar to an “original” motor. I decided to load one of these motors into an old model rocket, and make a launch attempt. This was in early January of 1972. It was a cold winter day, and due to various problems in preparation, it had gotten dark by the time I was set to launch. Nevertheless, I figured it would “fizzle” or “go bang”, having been discouraged by the unsuccessful firings of similar motors. I lit the fuse, then quickly backed off and watched as the glow of the fuse slowly migrated toward the now invisible rocket. Then to my amazement, a bright orange flame shot out of the nozzle accompanied by a loud whoosh sound. Then the rocket, with flame trailing, flew rapidly skyward, disappearing nearly instantly into the dark abyss of nighttime sky. I knew it would not be possible to find the rocket and I didn’t really care about the loss. The rocket actually flew! I was elated with my first successful flight of a rocket that wasn’t powered by a commercially prepared motor. I was now steering the correct course to the stars!

In those early days of my adventures into amateur rocketry, I was fortunate enough to have at my disposal a family workshop that was reasonably well equipped with regard to tools. However, metalworking machines such as a lathe we did not yet have. Our workshop was, however, constantly being upgraded. Both my brother and I had dished out much of our spare money purchasing tools and other shop supplies. We raised spare cash in various ways, such as repairing and tuning up neighbourhood cars or collecting and selling scrap metal. We were quite resourceful in this regard. Eventually we would purchase tools such as a used metal lathe, an old milling machine, gas and electric welders, a power bandsaw, etc. But at the beginning, the most sophisticated tool was a drill press. Consequently, my first metal rocket motors were quite rudimentary. I soon discovered that electrical conduit (EMT) provided for an excellent motor casing, coming in various diameters, was readily available and inexpensive, and had just about the right combination of strength combined with lightness of weight. In keeping with my philosophy of conservativeness with regard to safety, the first attempts at motor construction featured large diameter nozzle throats (to minimize pressure buildup) and a bulkhead typically retained with a single machine screw, such that this “safety bolt” would shear well before the casing could rupture. As a result, many of the early motors either did not build up sufficient pressure to produce useful thrust, or suffered blowout of the bulkhead, accompanied by an uncomfortably loud “boom”.

Eventually, by trial and error combined with dogged determination, I had succeeded in developing a small reliable motor based on ½ inch EMT. With the help of my brother, I constructed a rather nifty static testing stand that produced a plot of the thrust over the duration of the burn, providing the all-important “total impulse” output of the motor. The motor was mounted on a sled to which was attached an arm. At the far end of the arm I’d fastened a felt-tipped pen. The pen rested on the flat surface of a roll of paper. As the paper roll would rotate, a trace

of the thrust would be produced. The first rendition of this device relied upon a hand crank to rotate the paper roll. My brother fearlessly volunteered to operate the crank while the motor fired. Needless to say, we devised the setup such that the operator was in a protected position, but nevertheless, the loud sound of the motor firing, or worse, the “boom” when the motor overpressurized and fired out the bulkhead made this a rather nerve wracking operation. As such, it was soon afterward that we motorized the roller mechanism.

### My Amateur Rockets Take to the Skies

It was now early in the year 1972. I had a motor that had been successfully static tested a number of times and I was confident enough to proceed with my plan to build and launch a flyable rocket, powered by this contrivance of mine. Not surprisingly, my first amateur rocket would be based on the fundamental designs of the model rockets I had flown the previous year. Except that, true to the spirit of amateur rocketry as I’d envisioned, this vehicle would be made largely of metal parts. I’d fabricated the nosecone from birch hardwood, however, turning it on a wood lathe. I’d mounted it atop the fuselage, retained by a couple of small wood screws. My brother had been assigned the task of making the fins. We were unsure of how large to make the fins. I had felt that the rocket, having such a short length (about a foot) and with the centre of gravity being quite far aft, that fairly large fins would be needed. I left the sizing and making of the fins up to my brother, who liked to work late into the night.

I clearly recall, over thirty years later, the delight I felt that next morning when my brother showed me the rocket. The three shiny aluminum fins had been neatly crafted and meticulously mounted on the rocket. Yes! Now this was shaping up to be a rocket with an appearance, at least, just like those in the books that I’d admired for all those years leading up to this day. All that was left was to make the motor mount, and of course, the launch stand.

While I worked on finishing the rocket and ignition system, my brother took on the job of designing and fabricating the launch stand. He chose to make one from wood, with slots into which the fins would slide. In this fashion, no launch lugs would be needed on the rocket. This concept, while nice in theory, never did work very well. The fins tended to bind in the slots for whatever reason I can’t exactly recall. However, the time had come for action -- the rocket was ready to fly, and we weren’t going to let the nagging problem with the launcher delay us any longer. My brother had performed calculations to try to estimate how high this rocket would fly. I recall he had some problems, not with the math, but dealing with unknown parameters such as how much loss of altitude the rocket would experience due to atmospheric drag. His numbers settled on a rather uncomfortably large range, something like between a few hundred feet and over a thousand feet. The latter result suggested it may end up sailing out of visual range. To be conservative for the first flight, I’d decided that I would load only a half-charge propellant grain. It was Saturday morning on February 26, 1972 that we

packed up our rocket and other needed paraphernalia into my brother's '61 Austin Cambridge then headed out to the floodway launch site where we'd flown my arsenal of model rockets. We also brought along my nifty "Imperial Mark XII" camera to record the historic event. This was a simple snapshot camera with a rather distinctive red plastic body. I had purchased this second-hand camera some time earlier from the "Nearly New" thrift shop that we frequented.

It was a cold day, typical for that time of year in Manitoba; my log recorded the temperature as -5°F. When we arrived, we hastily set up the launcher and attempted to slide the rocket into position. Not too surprisingly, the fins bound in the wooden guides, and we could only get the rocket a foot or so down into the launch stand. As we were determined to make the flight attempt, we'd decided that this would be sufficient to guide the rocket. I inserted the igniter into the nozzle of the motor, and then attached the ignition source leads. At the other end of the wire leads, a wet-cell motorcycle battery would be connected to initiate the igniter as soon as we were set to launch. After my brother snapped a photo of me standing next to the rocket, I took up a position to capture the moment of liftoff on film. My brother gave the countdown: 5-4-3-2-1 then on "zero" he touched the ignition leads to the battery terminals. Smoke from the igniter issued forth from the motor...I quickly snapped a photo, then at that very moment, in a blur, the rocket leapt from the launcher and sailed upward, gently arcing over at apogee, and descended toward the frozen earth where it impacted after a short but sweet flight. Although the achieved apogee was not all that impressive (estimated at 40 feet), I was thrilled to have succeeded in finally launching my first fully scratch built rocket!

When we got home, we made the decision to attempt a second launch, this time with a full 51 gram load of propellant. Our early trepidation that the rocket would sail out of sight was seemingly unfounded, based on the modest altitude achieved on the maiden flight. As such, we made the decision to conduct the second launch in the large snow-covered field on the far side of the railway tracks behind our family's house. Beyond the field lie a large, unused wooded area, which all the neighbourhood kids and we called (appropriately enough) "the woods". After all, if the rocket were to fly to double the altitude of the first flight, it'd not be worthwhile to make the trip all the way to the floodway once again. We managed to correct the problem with the launcher to ensure that the rocket would slide freely and that we'd be able to use the full-guided length, clearly more important now that we filled the motor with double the amount of propellant. Once again, we repeated the setup procedure and I stood by to take a photo of the launch. My brother made the connection to the battery after counting down, and for the second time that day, smoke issued from the nozzle as the igniter began to burn. Suddenly, like a bat released from hell, the rocket streaked skyward accompanied by a loud "whoosh" sound. I couldn't believe what I was seeing -- the rocket ceaselessly climbing higher and higher, nearly going out of sight! It then gently started to arc over and began descending ever more quickly toward the ground. With an unnatural sound of metal striking against tree branches, the rocket ended

its awesome flight a few hundred feet distant, landing well inside the boundary of “the woods”. It took well over an hour of searching, but we finally recovered the rocket, buried in the deep snow, its nosecone permanently imbedded into the frozen ground. The first flight could be deemed a satisfying milestone. The second flight, however, was one that provided impetus to pursue the quest for yet greater achievements.

After four flights of my “A Series” rocket, and with several static tests of incrementally larger motors behind us, it was time to try for some more serious altitude. My larger “D Series” motor was now ready, having been successfully static tested at the floodway. The motor featured a genuine deLaval supersonic nozzle, which I’d machined at school. As good fortune would have it, my first year at high school featured industrial arts classes, and I had just learned the basics of using a metal lathe. With guidance from my shops teacher, I produced a rather fine-looking nozzle. My shops teacher kindly arc-welded the nozzle to the casing, as I did not have sufficient faith in my novice welding skills. This motor held nearly a full pound of propellant, and our measurements demonstrated that it would produce several hundred pounds of thrust. For a rocket that would be powered by this behemoth, particularly careful design and construction were in order. The rocket was made from 2- 1/8 inch diameter aluminum tubing, featured four aluminum sheet-metal fins, and was equipped with a parachute for recovery. I’d made an elegant hemispherical parachute from individual nylon gores that I’d sewn together on my mother’s sewing machine. She’d kindly volunteered to do the sewing for me; however, this was something I wanted to do on my own. Perhaps it was because I preferred to derive the personal satisfaction of making it entirely with my own hands. That is, after all, the gist of amateur rocketry.

Borrowing a page from the “Amateur Scientist” book, I incorporated a homemade pendulum switch that was intended to trigger parachute recovery as the rocket would “turn over” at apogee. I did not realize it at the time, and it would take several recovery failures for me to eventually figure out that this notion was ill-fated and that if I had paid closer attention in physics class, I may have been spared these setbacks. I’ve always believed that a very effective way to learn something is to make mistakes. Maybe that’s why I’m so proficient at learning. Perhaps not the best way to learn, but certainly effective.

I was now springtime in 1972, the waters in the floodway ditch had receded and the ground had dried up sufficiently such that it was now possible to attempt launch of my latest and greatest rocket. My best friend, Ray, and his Dad would join my brother and me for this launch adventure. This event would be a first for both of them, and so I had my fingers crossed that this display of my talents as an amateur rocket engineer would not be a disappointing (or embarrassing) one for all. Because of the size and power of this new motor, and the greater potential hazard of being nearby when the beast was lit, we could not use the same ignition system that was used for the relatively meek “A Series” rocket. Our ad-hoc solution was a simple “delay switch” apparatus that, once activated, would

provide a two minute delay before the motor igniter would be set off. This contraption consisted of a pivot arm, which had a pair of electrical contacts at one end, and a tin can mounted upright at the other end. The arm was balanced such that it would close the switch contacts when the can was empty. When the can was filled with water, the arm would tip the other way. The desired delay came as a consequence of the water draining out of a small hole in the bottom of the can. Once enough water had drained, this would tip the balance of the arm, and in doing so, close the switch contacts. The concept worked well enough. The only real drawbacks were the obvious ones. Aborting the launch once the process was initiated would be more and more dicey as the “moment of truth” approached, and the fact that the exact moment of liftoff was not precisely known. A rather serendipitous launching technique that was not long after replaced with a more judicious one.

By now it was clear that I was heir-apparent to the task of being the official “launch photographer”. This was rather fitting, as photography had been a hobby of mine for quite some time, one which I particularly enjoyed. I even had my own darkroom setup, and I developed, printed, and enlarged all my own photographs. I kept almost exclusively to black and white print photography, although it had been a dream of mine to get into colour processing. I did develop the odd roll of colour transparencies, or “slides”. For the most part, however, colour processing would remain out of my league, being simply too expensive. For colour shots, I tended to use either my Polaroid “Square Shooter 2”, for instant gratification, or alternatively I used a regular camera and took the film to the local drugstore for developing. Eventually, when I could afford it, I purchased a Pentax ME, which was a rather elegant 35 mm camera with interchangeable lenses, auto-advance and many other features that proved their value in chronicling my rocketry hobby in the ensuing years.

It was Saturday, April 16, 1972, when we headed out to the floodway for the first “B Series” rocket launch. Despite the wind blowing out of the north at 10 mph, it was a fine day for a hopefully momentous flight. The “B-1” rocket was loaded onto the new launch pad, comprised of a welded-steel base with a 10-foot tall launch rod of ½ inch steel. Basically, it was a scaled up, heavy-duty version of my model rocket launch pad. Ray and his Dad headed out to a viewing area some 500 feet away from the pad, while my brother and I made the electrical connections to the rocket motor, armed the parachute system, and lastly, filled the tin can of our “hydraulic timer” with water. After confirming that the water was draining as planned, we scurried off to where our launch guests were positioned. By now, a good portion of the two minute delay period had elapsed, so I promptly got my camera trained on the rocket, and I waited breathlessly, literally. What happened next seemed nearly surreal, as suddenly a large cloud of white smoke silently materialized around the base of the launch pad. Then with “tremendous speed”, as I later wrote in my logbook, the rocket accelerated skyward, in complete apparent silence, gaining altitude even more rapidly than I had optimistically expected. A moment later the loud shriek sound, delayed by the

distance, of the powerful motor reached us, catching me a tad off guard. I suspect it was this sudden loud shrill that triggered me to snap the camera shutter and take my first really good photo of a rocket in flight. It wasn't long before the rocket disappeared from sight due to the high altitude it had attained. It was then that I spotted the parachute, fully inflated, drifting earthward. The parachute was only a few hundred feet above the ground, so it was obvious that it had deployed way too early and had separated from the rest of the rocket. We soon heard the whining sound of the rocket as it began to pick up speed on its ballistic descent. A sound quite similar to that of ascent (and one that I would hear all too often again in the future!), described in my log book as best I could, simply as a "rushing air" sound increasing in intensity until a final dull thud was heard. We had spotted the rocket coming down, quite distant and upwind of the launch site. Despite the ballistic return phase, the flight was simply incredible in my mind. We soon found the rocket, burrowed up to its fins in soft, wet bog. This turned out to be of good fortune, as it missed the hard packed gravel that comprised most of the launch zone. The rocket received very little damage, but surely needed a very good scrubbing to clean out the jam-packed mud. There was one surprise in store for me when I conducted the post-flight inspection of the rocket. Curiously, the ejection charge had not fired! Just exactly how the parachute deployed is a mystery that remains to this day.

Over the years since that "ground-breaking" rocket flight, I have experienced many such launches. Although each one continues to be an awesome experience, it is noteworthy that, up until that time, the most "spectacular" launches had been the earlier flights of the "A Series" rocket, which were a modest step in spectacle above the model rockets that I had flown the preceding summer. The B-1 flight was undeniably breathtaking -- a truly "high-power" launch that predated by many years the advent of the commercial "high power" hobby rocketry that came along in the early 1980s. At the time, such rocket flights were solely within the realm of amateur experimental rocketry -- only professional rocket flights were on a more grand scale.

The subsequent seven launches which concluded the "B Series" of flights were a blend of successes and failures. In all cases, the rocket motor performed flawlessly, boosting the rockets to altitudes later estimated to be well over 2000 feet. The parachute recovery system was largely a continuance of failures, although much was learned in the process, paving the way for a reasonably successful system that was developed incrementally over the ensuing years. As might be imagined the first successful parachute deployment was a thrilling occasion. This occurred on flight PT-2, flown on January 19, 1973. The "PT Series" (Parachute Testing) followed completion of the "B Series" of flights, and experimented with development of an "air-speed" switch system for parachute deployment. Apogee was sensed by the slowing of the rocket as velocity was bled off during ascent. A simple hinged vane or flap was employed to sense the speed at which the rocket was traveling. I acquired the inspiration for this device after reading about the experiments of rocketry pioneer Dr. Robert Goddard.

Interestingly, the same air-speed switch system is still used in some of my current rockets, comprising part of the redundancy needed for reliable safe recovery.

### Science Fair – Moments in the Spotlight

It was around this point in time that my fellow classmates in the Science Club at Nelson McIntyre Collegiate got wind of my rocketry experiments. As well, two of my science teachers learned about my work. I was persuaded by my Physics teacher, Mr. Neumann, who was one of the leaders of the science club, to bring my rocketry journals to school for him to peruse. I did this rather reluctantly, as I was not sure what his intention was, or what his reaction would be. Nevertheless, I obliged. The very next day, he came up to me and told me that I certainly must enter the upcoming Norwood Regional Science Fair. This annual competition was comprised of entrants from all the high schools in the local area. Never having entered a science fair before, and having some trepidations about publicly displaying the wares and activities of my rather unconventional hobby, I resisted, hoping he would forget the matter after a few days. But no such luck prevailed. Mr. Neumann, as it turned out, was a persistent and persuasive man. I ended up agreeing to participate in the science fair, and so I prepared the standard array of display boards, photographs, and write-ups describing my rocketry experiments. I also put together, as part of the display, my static test stand and several rocket components and artifacts. Once I set my mind to this task, it went together well, and I was satisfied with the results of my effort. In fact I rather enjoyed the experience and the actual event. It was quite delightful seeing the reaction of the visitors and the looks of fascination on their faces as I described my rocket motors, launches and method of motor testing. Although I had not entered the science fair with any anticipation, or particular desire, of winning a prize, I realized that when the time came for the handing out of prizes, I was apparently favoured by many fellow entrants to finish in one of the top places. With this realization, I became caught up in the excitement and found myself belatedly hoping to take home a prize. When the first round of trophies was awarded, I received the prize for 1<sup>st</sup> place in the Physics category. As a winner of a 1<sup>st</sup> place trophy, I was eligible to select a gift from an assortment of wares. I chose a rather handsome tackle box. Not that I was an avid fisherman, rather, I figured the box would make a neat field box for my rocketry stuff (I still have this tackle box, filled with now-obsolete rocket parts). I was quite happy with this result. The last prize to be awarded during the ceremony was the award for first overall prize, a handsome trophy that was awarded annually to the science fair overall winner. Although the victor was not allowed to keep this trophy, their name was inscribed on a plaque mounted on the face of the trophy, and were allowed to have possession of the trophy for a few days. There were at least two other entries that clearly vied for this top prize, both involving rather advanced biology experiments. I do not recall exactly what one of the projects was about, but I do remember that the other dealt with a series of experiments on the effects of 2,4-D herbicide on plants. These projects were remarkably well researched and presented. When the winner's name was announced at the conclusion of the



ceremonies, I was momentarily stunned. Although I had expected that I may well win the prize, the impact of this actually occurring put me momentarily in a dreamlike daze. I recall taking the trophies home and the first thing my Dad, brother and I did was pay a visit to our next-door neighbour, Tony. He'd long been an avid supporter of my rocketry work and helped to provide various odds and ends that I used in building my rockets from scratch. Tony had come to Canada after the Second World War, as a Polish refugee. I recall him telling us sobering stories of hardships endured during the years he'd spent in a prisoner-of-war camp, when bread and water were literally the fare provided as sole sustenance.

Having placed first overall in the regional science competition, I was effectively obliged (according to Mr. Neumann) to participate in the upcoming event, a province-wide competition dubbed the "Manitoba Schools Science Symposium", to be held in the spring of that same year. I polished up my display, and added the latest results of my rocketry experiments. This symposium turned out to be a particularly successful event with an exceptionally large number of participants and visitors. It was held at the University of Winnipeg campus in downtown Winnipeg over the weekend of April 25-27 of that year. In total, there were 342 entrants participating, with the entries representing a broad range of science disciplines. One particular entry that sticks out in my mind was a human-powered gyrocopter. I didn't expect it was capable of actual flight, but it did attract a rather large and curious crowd, especially as it was displayed outdoors seemingly ready to loft into the sky at the beckoning of the student inventor.

My exhibit also attracted a lot of curious attention from the visitors, as well as other participants. Several of the visitors seemed genuinely awed at the success of my motors. Some had eagerly told me about their own attempts at rocketry in their youthful zest, with generally dismal results. By the end of the three day event, over 4000 visitors flowed through the doors to see the exhibits. I recall that one of the symposium officials, who had the responsibility of accompanying the judges on their rounds of the exhibits in their "domain", took me aside, and gave me some advice. His domain was the engineering exhibits. He'd mentioned that my entry was being considered for one of the top prizes, and as such, he helpfully proceeded to point out certain shortcomings in my presentation. Indeed, I had recognized that my presentation was not very "polished". He gave me advice on how I should improve my presentation during the next round of visits by the judges. Of course, I'd been understandably nervous during my presentation, as I've always been a rather shy and quiet person, not used to giving presentations in public, let alone before a panel of judges. I don't recall whether I heeded his advice or not, but undoubtedly I was appreciative of the gesture.

My father and younger sister, Brenda, attended the award ceremonies at the closing day of the event. Bronze, silver and gold medals were handed out for the different categories, as well as prizes donated by the various corporate sponsors of the science symposium. I was awarded the gold medal for the engineering

category, and with it came an electronic calculator, a rather cherished item in those days, being at the dawn of the computer age. A very rudimentary one by today's standards, it featured a fluorescent display and performed only the basic arithmetic operations, and even lacked a floating decimal point. The final prizes that were awarded were the three overall grand prizes. The three winners were slated to be flown to London, England to attend a two-week international science symposium which was being held that summer. The third place prize was awarded first, followed by the second place prize. At that point, I knew certainly that either I'd "missed the boat" entirely, or that I'd won the grand prize. It turned out to be the latter, and two months later I found myself aboard a brand new Air Canada 747 jumbo-jet, London bound with the other two top finishers. Needless to say, it was a memorable experience. So was the two-week event in London.

#### A Course Once Charted...

This brings to a close the recounting of my first year and a half involvement in amateur experimental rocketry, a time of exciting challenges, inevitable setbacks, unexpected developments, and rewarding accomplishments. There were a lot more challenges in store for the future, but at this point in my life, it had been clear to me that a dream of designing and building my own rockets had begun in earnest. It has been said that "there are those who dream, and then there are those who dream, seek and achieve". My determination to be one of the latter had doubtless commenced.

Even to this day, I do not truly understand the rationale (if this term is even applicable) behind my unwavering passion for rocketry. Was it something etched in my amygdala by my early childhood experiences? Or did it evolve along with my interest in the exciting times of the early era of space exploration? Whatever the reasons, it does not truly matter. What exactly I've derived, and continue to derive from this peculiar, but rewarding avocation and what the goals are, are nebulous. But a dream needn't have tangible goals. Rewards are derived from the pursuit of dreams, not necessarily from their realization.