can-am

motorcycles

March 2022

Looking back fifty years
Chapter two [1972]
David McLean 1971 to 1976

In the latter part of 1971, Rotax in Austria had started an effort where they would produce 60 sand cast prototype engines 125/175/250cc in the next many months. They started with a 15 series of 125/175cc engines and by December we had 5 engines in Valcourt, and now it was our task to produce a chassis for them. This time we had to have a design that was producible by the Ski-Doo factory, in the thousands, at a reasonable cost. This is where a good mechanical engineer becomes very important. We had a young and experienced Paul Michaud [although no motorcycle experience]. At this time, the main items were the frame and swing arm. What material, how far can it be bent, what welding, what will the finishing be, how much will it cost? A wise engineer can reduce the trial and error steps to the final product. The material chosen for all of the major frame and swing arm pieces was 1015/1018 steel [this was a balance between strength, durability / cost]. With a carbon content of .15/.18 %, this could be considered to be entered into the high tensile steel category. This steel would be used for all prototype and production motorcycles up to and including 1977 models. The tubing for frame was seamless cold drawn and increased to ⅞" diameter. The bolt in tube that went from the swing arm pivot to almost the head tube [in the concept bike] was eliminated because of cost. The top welds of the tubes were moved rearwards just enough to allow a fully assembled 250 engine to be installed. The swing arm tubing became round 1 1/2" diameter with full gusseting in the swing arm pivot area. The gusseting extended back to just clear the rear wheel in the full forward adjustment. At the rear of the arm, were wide,thick, flat steel pieces. With the wheel installed and the axle torqued tight, this became a torsionally strong swing arm assembly.

By this time we were somewhat sure of the suspension to be used. Production Betor 35mm forks, with 6 1/2" of wheel travel and Girling rear suspension units which provided about 4" of wheel travel. Over the coming months other brands would also be evaluated. We were a long way from producing our own hubs and wheels, so we used other aftermarket wheels that were available. Our fiberglass tank and seat base were again used along with universal plastic fenders. We had both low and high exhaust systems available.

By the end of 1971 we had a few 125cc and 175cc motorcycles completed.
However, this was the beginning of a long snow covered Quebec winter and testing was needed now. The desert area north of Las Vegas, Nevada was selected as the site. The low rolling hills here were covered with embedded rocks. This was a rugged landscape, good for testing the chassis and drivetrain. A mobile test site was sent here, set up by the Ski-Doo Western Testing Center, from Idaho Falls, Idaho. It consisted of a four wheel drive pick-up truck pulling a large closed in trailer and two people, one being a test rider Dean Hutchins. Back in Valcourt, Jeff Smith had arrived from England a few months earlier and was now ready to test and develop this new motorcycle. He would manage testing up until production more than a year away, and at that time become competition manager.

These few motorcycles and spares were shipped to Las Vegas and Jeff and myself followed. The immediate goal was to put in hours of use in this rugged terrain, and we soon found out how unreliable these motorcycles were. It was difficult to keep these bikes mobile and I ended up mostly riding a 1972 Penton 125 MX. It was a reliable bike to go back and get the four wheel drive pick-up, for a pick-up and it actually was needed for this use.
This Penton was also a good bike to directly compare to our own 125. This area had been heavily mined in the past, and there were many deep mine shafts dug straight down into the earth. Most of these were covered with wood planks or half covered or not covered at all. It was, only drive where you could clearly see, as these shafts could swallow a motorcycle.

For two weeks it was continual high maintenance; leaking fiberglass tank, engine and fork seals, broken tank, exhaust and air box mounts, continual adjusting of the low friction fiber steering and swing arm bushings and the clutch center adjusting screw and major engine failures; sheared crankshaft drive gear key, broken gear in gearbox, broken gearbox output shaft, etc. etc. Problems such as these were happening on all the bikes, it was a shaky start. Repairs were being done on a wooden box, in the Nevada desert, at the back of the trailer. On the plus side the important frame and swing arm were performing well.

At the end of two weeks Gary Robison came for a visit, to see first hand what was happening here. All of us working there were staying at a motel on the edge of town. Gary treated us all to a quality dinner and days later an even bigger treat. Elvis Presley was performing in Las Vegas at the Hilton dinner theater, and we all got to go. The theater was composed of large round tables on two tiers of flooring, surrounding the stage. The music, backup singers, his voice, charisma, stage presence and connection to the audience had the “wow” factor. We got to see live, what this phenomenon was really like. I have forgotten what we ate for dinner, but the performance is imprinted in my memory.

Gary and myself returned to Valcourt and Jeff was left with difficult testing conditions. The low friction fiber bearings [as used in the concept bike steering and swing arm], were now being given a long term test. The breakaway friction problem remained and there was the need to continually adjust for wear. This bearing type was now abandoned and replaced with the more expensive captured needle bearings. This new system required that the steering stem, now be made of high carbon steel, ground and heat treated, as some of the surface would be the bearing surface for the needle bearings. Needle bearing thrust packs were used top and bottom and a captured O-ring used to seal the bearings.

For the swing arm pivot, bonded rubber bushings were now used and hardened steel shims used to control side play. With the 4” of rear wheel travel at this time, these bushings would require no maintenance, almost unlimited life.

At this time Jeff also tried different steering stem angles of 28,29 and 30 degrees from vertical. While the swing arm assembly was designed to have much torsional stiffness, The Betor fork assembly was poor in this area. The triple clamps when fully tightened could not fully grip the fork tubes. He suggested a fork brace which would lock the fork sliders together. This was commonly used on weak forks in the 1960’s and was used on the 1972 125 Penton MX he was riding for comparison.

These engines had six speed gearboxes, and Jeff was forming opinions on what the best ratio spread should be, between each gear for a MX and enduro transmissions.
The seats were made by the same people who made the Ski-Doo seats, the seat foam was too soft and eventually collapsed. This is the short version of the many problems.

Back in Valcourt, we were receiving new engines and redesigned engine parts from Rotax. This was the period when the enduro proof, air intake system was designed. All of the enduro motorcycles we were aware of were studied, and the best clean air was thought to be the protected area behind the rider, at the rear of the seat, a rectangular opening between the seat and fender. This area was about 30” above the ground and would allow the motorcycle to cross deep rivers. The air passageway followed the curvature of the rear fender to a raised lip where an oiled foam filter sat over. There was a small drain hole in this flat area to drain away any water that entered. The air filter sat on top of a large still air box, and should the motorcycle take in a large quantity of water, it would drop to the bottom of the box. The carburetor intake was about 2” above the bottom, and the engine would still run with water in the air box. If a rider knew there was a wet enduro to be run, adhesive rubber foam strips would be applied to the seat/frame joint, to ensure all air passed through the air intake. This system proved to be very effective in many enduros for many years.

This whole assembly was a permanent fixture in the dyno room. The final dyno runs were done with this assembly connected to the engine. Even with the 250cc race engines there was no decrease in power. However, there is one note to add. When the 250 GP and MX-2 models appeared years later, the steel seat pan was changed to aluminum, and it was found that if the rider landed hard on the rear of the seat, it would collapse . The quick fix to this restricted air intake was to add two black spacers on the fender bolts to support the seat.

This was also the time to design the MX/street legal, tucked in exhaust system, moderate gauge steel for the high expansion chamber and low muffler. The muffler did not protrude at all, with its triangular shape in front of the left hand suspension unit. This exhaust system had to be quiet enough to pass street noise regulations.

The very first of these Rotax engines came with a full right hand side cover. There were rectangular sections at the rear of the cover where the drive chain entered and left the sprocket area. It was our intention to eventually build an enclosed drive system for enduro motorcycles, such as Jawa and Bultaco had. Their design had an aluminum rear sprocket cover and hollow rubber boots connecting this cover and the engine cases. So much time was consumed just getting a new motorcycle working well, that this system was indefinitely put on hold, The engine side case was cutaway below the raised Bombardier lettering to let grease,mud and grass fall to the ground. All later production pressure die cast crankcases have the raised joint area cast in, so that we could proceed with this enclosed system in the future.

By April 1972 the weather improved enough to finally start testing in Valcourt. The first 250cc engine arrived, but testing was confined to 125/175. The motorcycles were still not quite reliable enough to make it through a day without problems. However one, 125cc was performing well and so number plates were added and Jeff went to a Pepperell, Massachusetts motocross race and won the 125 class. It was nice to have good news. The Canadian Motorcycle Association motocross season was about to start , and Jeff signed up and received #10 as his expert plate number. Over the next many months he would enter many Quebec and Ontario races, 125cc bikes for the 125 class and 175cc bikes for the 250 class. These were test bikes with number plates and it was a risk that the bikes may fail. Pictures with #10 plate numbers in 1972 are these test bikes. It should be noted that Jeff Smith was 500cc GP motocross world champion in 1964 and 1965, and continued to race into the late 1960’s, and he kept himself in good physical condition. Now Jeff was racing with riders for whom motocross was a hobby. Jeff was a winner in most of the events he entered.

Also during this summer 1972 testing, Jeff rode the Berkshire three day Enduro in Massachusetts. He rode a 125 enduro version and performed well, but results were not documented.

By the end of Nov.1972, testing in Quebec was no longer possible, and it was moved to the State of Georgia. This time Bob Fisher would be managing. This would be the time to evaluate the lighted street legal bike. When this engine was being designed as a 125 to 250cc engine, a firm requirement was that it be no wider than a conventional piston port race engine. To do this with a rotary valve intake, required the intake tract to be curved up and over the clutch and to the rear. This meant that on the left hand side, the clutch cover was the widest point. On the right hand side the ignition/lighting system had to be also narrow. Bosch would be the supplier of a system that would meet the dimension required, but it only produced a maximum of 55 watts @ 6000 rpm’s. This was an enduro bike system that would later prove very useful for enduro bike competition. One 40 watt coil for head and tail light, and a 15 watt coil for a stop light. If slightly larger watt light bulbs were used, the lights would be bright at mid to high rpm’s and progressively dimmer as rpm’s lowered to idle. This is acceptable for off road use, however, this was not legal in all U.S. States and Canadian Provinces. The requirement was that lights must work if the motorcycle engine stalls, and would require a battery. All the lights must meet minimum intensity levels [head, tail, stop and turn signals]. This would be a challenge in urban stop, go and turn environment, and using low to moderate rpm’s. Testing now proved that under these conditions the battery was in a slow discharge state. If a rider always used the upper rpm range and minimized brake light,turn signal and horn use, the battery might remain charged, but one cannot ask customers to drive this way. Over the coming years we requested Bosch to increase the wattage output for the street models, but this never happened. This flaw would remain with all street legal bikes up to their final year 1977. Producing a race bike that is street legal, borders on the impossible. Now, fast forward 50 years and there are equivalent LED low wattage bulbs. The 55 watt system would be more than sufficient, and would require a voltage regulator to control over voltage and over charging the battery.

Work had been progressing for more than a year now, and still no name for this motorcycle. The Bombardier name had been used for all of the large multi passenger and industrial vehicles, but when the personal snow vehicle arrived in 1959, a unique new name was needed. This vehicle was designed not as a recreational vehicle, but as a modern replacement for the dog sled. If one looks at a side view of the 1959 model, it looks like a dog sled with a large box on the front, replacing the dogs. The name chosen for this new snow vehicle was “Ski-Dog”, however a spelling error was made and the accidental new name became “Ski-Doo”. This new name became widely known and respected as a name of quality snowmobiles. The search was on for a new unique name, such as this. Every one Involved with this project was asked for ideas, time passed and no unique name appeared. So, a name was chosen that reflected the two markets the motorcycle would be sold in, “Canada” and the U.S. of “America” = “Can-Am”. This name also recognized the nationalities of the people who designed this motorcycle, Canadians and Americans. It was not fair that the Austrians who designed the key Rotax engine were not included. Next it was registering this new vehicle name, however this name was already registered . The Sports Car Club of America [SCCA] had this name for their large displacement race car series. Bombardier negotiated with them, and the results were that they would use upper case letters“CAN-AM” and we would use lower case letters “can-am”.

The motocross models would be named MX [a generic name] and the street legal models were originally named the Explorer [many drawings used this name]. However, when it came to production time the name was changed to T’NT [Track And Trail], a name that was used also by some Ski-Doo models.

This is a draft of chapter two, from one person’s perspective. Should others wish to add to this, please come forward.

David McLean