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motorcycles

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Looking back fifty years
David McLean 1971 to 1976

February 1971, my arrival date in the town of Valcourt [population about 2000 people] in rural southern Quebec. Joseph Armand Bombardier was born here and went on to invent snow vehicles. The first production vehicles were the large Bombardier snowmobiles in 1937 and this eventually led to the personal snowmobile the Ski-Doo in 1959. On the main street through town was a two story brick building that was a factory for the early Bombardier snowmobiles. It was now repurposed as Ski-Doo research and development, next to it was a newer one story building that was the Ski-Doo competition department. Across the road was the garage where J.A. Bombardier invented his snow vehicles in the 1920's and 1930's.

In 1970, Laurent Beaudoin, president of Bombardier Ltd. began Bombardier Motorcycle Research and Development. Gary Robison arrived from California [experienced in motorcycle and automotive engineering] to be the head of this effort. At this time Ski-Doo was a leader in snowmobile design and sales and were recognized as quality vehicles,both standard and racing models. These were winter off road vehicles and now the time had come to make summer off road and on road vehicles. This would provide seasonal growth for Ski-Doo dealers and the Ski-Doo factory. The first models planned were 125/175 cc motocross bikes and a lighted street legal versions of the same bikes. Rotax in Austria, now owned by Bombardier and producers of all Ski-Doo engines, would design and build the motors. Bombardier Motorcycle R&D would design the chassis and the Ski-Doo factory in Valcourt would build the motorcycles.

The temporary Motorcycle R&D would be located in a small second story area of the Ski-Doo R&D, with full access to their machine shop. In Jan. 1971, Bob Fisher arrived from Ontario [experienced in production engineering] to get the R&D organized and running. In February I arrived from Ontario, as a hands-on technician. However, previous to this time, Bombardier Ltd. had entered into a multi-year agreement with a small Italian motorcycle manufacturer Agrati-Garelli. They had produced small motorcycles, which were re-badged with " Bombardier "on the gas tank. It was a challenge to compete, sales wise with other motorcycles available in the North American market. Now that Bombardier had its own R&D, it was hoped that we could design motorcycles [that they would manufacture] that would be profitable. At this time, mini-bikes that could be placed in the trunk of a car and taken to an off road location, were very popular. In the USA, in the early 1960's this had started with simple tubular, no suspension frames and a small industrial engine.

By the 1970's, the Japanese were producing many better engineered models. Agrati- Garelli did not have a mini-bike model, but we decided to design one for them. Gary went to Italy and chose their 50cc moped with a two speed automatic transmission, [two centrifugal clutches] as a basis for a mini-bike.

While there, he also located manufacturers of mini-bike wheels,tires,fenders and spark arrestor mufflers. All of this was shipped to Canada and we started to shrink the moped. The size of this mini-bike was to be small enough for a five year old, but large enough for a parent to ride without getting their legs caught up in the handle bars.The pedals were removed and a kick starter added and the frame modified for dirt use and a new gas tank of our own design. This single bike was tested throughout the 1971 season along with another motorcycle [a 80cc,5 speed manual transmission engine] which was designed as a small wheeled trail bike with lights. At the end of 1971, the single mini-bike was sent back to Agrati-Garelli and by early 1972, fifty pre-production replicas were shipped back for testing. These bikes were sent to Ski-Doo dealers and others, and each bike was sent with a log book to record daily testing results. At the end of the 1972 riding season, the results were evaluated. While generally this min-bike was good, it was not as good as the Japanese endurable bikes. This, plus the projected retail price of equal or greater than the Japanese, the decision was made not to proceed to production and also to end all development of Agrati-Garelli motorcycles. So much effort, and as of now, no useful results.

Returning back to the spring of 1971 and our temporary R&D in Valcourt. Our new permanent R&D was being constructed four miles north of Valcourt on a farm used by the Ski-Doo R&D for testing new model snowmobiles. They had built a small industrial building on the property and were capable of testing all year long. When there was snow on the ground, testing could be done on the property or on the extensive groomed trail network around Valcourt. They also built an asphalt banked oval with a sprinkler system on the high part of the banking. Snowmobiles with the skis replaced by wheels, could circulate on the oval, with the water lubricating the rubber track, just as snow does in the winter time. Also on the property was a fairly new large barn, which would become the permanent R&D. The interior was open concept with windows along the sides and a poured concrete floor. About one half the floor area was for workstations and the remainder for machine shop/fabrication. This area contained two lathes, a milling machine and an area for gas welding etc. Robert Arsenault [machinist/fabricator] would be in charge. Later a dynamometer room was added. It was constructed to duplicate the Rotax Austria, Schenk eddy current dynamometer. The dyno was driven by a chain from the gearbox sprocket and the same procedure operating it, and the same correction factor used. It was hoped that dyno results from Austria would be duplicated here in Canada. On the side of the barn, two stories of offices were constructed, one office for Gary Robison, one for his secretary Cecile Perez [she would also be secretary to those needing a report typed or duplicated], and one large office for Paul Michaud, [head mechanical engineer] and his [head draftsman] Camille Picard and two more spaces for as needed draftsmen. All of this property was fenced and gated, and the family living in the farm house acted as security and property maintenance.

The Agrati-Garelli program was finished off here, and the physical construction of our own motorcycle started here. But, before starting, we had to evaluate our competitor's motorcycles. Over the next many months motorcycles were bought or borrowed, to be ridden and their chassis construction evaluated.

Here is a list of some of the motorcycles.

1971-1972 motocross motorcycles

Husqvarna 250/400	AJS 250
Bultaco 125/250	CZ 125/250
Rickman 250	DKW 125
Puch 125	Dalesman Puch 125
Penton 125	KTM 125
Maico 125	Yamaha 250
Suzuki 400	Suzuki 125 trail bike

As can be seen, most of these motorcycles are European,as these brands had a history of motocross excellence. During the summer Quebec motocross season, Bob Fisher and myself raced a few of these motorcycles.

In 1970 a similar program was happening at Rotax in Gunskirchen, Austria. Rotax had a new Development Manager, Dr. Heinz Lippitsch. Through the 1960's he had been an excellent 125cc road racer and developer of 125cc engines. Now, he and his R&D team would be designing a new 125/175/250 off road race engine. They also obtained small displacement race engines to evaluate. By the end of summer 1971 the first 125 prototype engine arrived in Valcourt. It had the basic design of the final production engines, but the design would evolve over the next almost two years.

In Valcourt, Scotty Sader [chassis technician] arrived as well as Ken Watkins [welder/chassis technician]. Now we had an engine. Now what? Here we were, a few motorcycle racing enthusiasts, none who had ever designed a complete motorcycle before. Some had only modified existing designs. We had the resources, the time, and now the place and a clean sheet of paper. Who would start drawing? Gary Robison had ideas, and we followed his lead. The engine had three mounting points and the frame was built around it. This concept frame would be constructed with 4130 chromium/molybdenum/alloy steel. It would be a tubular fully triangulated space frame design with a fabricated tapered backbone. The tubing diameter was ¾". The right hand tube running from the swing arm pivot to almost the head tube was bolt in removable [this to allow a fully assembled engine to be installed in the frame]. The backbone started as sheet steel and was formed into shape and seam welded along its length. Its interior would be the reservoir for engine injector oil. The steering head tube was a large diameter to match up with the width of the backbone. There was a more important reason for the large diameter head tube, and that was to provide space for an adjustable steering pivot angle. With three pairs of cones the pivot angle could be adjusted over a six degree angle in half degree increments. This frame was designed to be a multi-use frame. The head tube was welded on to the frame at 28 degrees from verticle and the adjustment would be plus or minus 3 degrees of that. That would cover a range of 25 to 31 degrees and that would cover the range of most motorcycles in use in this era.

25 degrees-trials bike
26 degrees-road racer/dirt tracker
27/28 degrees-street bike
29/30 degrees-enduro/motocross
31 degrees-go straight desert bike

This feature would be of little use for those that used the motorcycle as it was originally designed for. But for those that wanted to repurpose the motorcycle for other use, a useful feature. This feature would be most useful to the manufacturer, as changing the steering head angle involves expensive tooling and jig changes.
The rear swing arm was constructed with oval tubing with holes drilled on the sides,the full length, and a flat piece inserted inside the full length and spot welded where each hole was.
A fiberglass gas tank of our own design was built around the backbone frame. Also a fiberglass based seat to fit the frame. The initial testing of this concept motorcycle, was of the engine and frame/swing arm combination.
All other components would be purchased from other suppliers.

Front suspension - Cerriani 32mm motocross
Rear suspension - Cerriani motocross
Front wheel - REH 2.75” x 21” motocross tire
Rear wheel - Rickman [floating brake backing plate] 3.50” x 18” motocross tire
Universal plastic fenders
Foam air filter sock on 27mm Bing carburetor
Under engine expansion chamber - approx. 20 BHP
Dry weight 200 lb.

For the steering and swing arm bearings, a low friction, no lubrication needed, fiber bearings were being tried. Sleeves on the shafts and thrust packs to control end play.

By the end of Nov. 1971 we had assembled our first motorcycle, a 125 MX model. I sat on the bike for the first time and right away noticed a serious problem. The breakaway friction of the steering bearings. Once in motion the drag was accepticle. This was comparable to telescopic forks with high seal drag, commonly called “stiction”. We immediately informed Gary, but there was no immediate replacement system. For the swing arm there was no noticeable concern. It was time to ride, however there was a few inches of snow on the ground. We loaded the bike into a van, along with Claude Nadeau [an assistant worker in the R&D and also a French speaking native of Valcourt]. We headed north towards the St. Lawrence river, hoping that at a lower elevation we might find dry land. We found no naturally dry land, but found an operating gravel pit. We test rode for about an hour, before someone came and told us to leave. Claude explained in French, that this was Bombardier’s first prototype motorcycle and that we were desperate to test. Persuasion failed, we returned to the R&D and wrote a report. The conditions there, were not very demanding of the chassis, but it was noted that the engine had a fast rising and powerful torque curve. This would be a characteristic of all Rotax/Ski-Doo sport engines and our motorcycle engines also.

We learned during this time, what is involved in making a motorcycle. It was a start.

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

David McLean