

## **The story of the Lawson All Wheel Drive concept development**

### Overview

The basic design concept was invented by Martin Lawson. He shared the concept with his father, Bill Lawson, and together they have designed, built and tested three ride able prototypes and are now racing the third one.

### Marty's story of the start

"My motorcycle AWD quest began about four years ago (2008) when I first saw a Bimota hub center front suspension. I wanted to make something similar, but unique. I quickly realized that the hub assembly of a Bimota front looked awfully similar to a U-joint and that a 4-bar linkage front suspension made power delivery much easier. I also did a lot of web research to find out what other front suspensions had been invented. I ran across information about the Hossack suspension and it was a key inspiration when I evolved my front suspension and drive ideas to suit off-road motorcycles.

Using the ideas of the Hossack suspension together with Tony Foale's suspension analysis software and Solid Works with the FEA package really helped me design an AWD system that works very well. It allows for full power to the front wheel so you can spin it under almost any circumstances and virtually no rear wheel slip before engagement. It helps the average rider surmount obstacles much easier."

### Proto #1: Proving the concept

The first proof of concept bike, Proto #1, was built in the fall of 2009 by modifying a 1986 TY350, a mellow trials bike from the time before trials seats got incredibly low. The system worked very well by coupling AWD with a wide range torque engine. It is still being ridden today, and because of its low weight and low seat height, is an excellent beginner and intermediate AWD bike. The only thing it does not have that would make it even easier to ride is an automatic clutch.

As a result of Proto #1 working so well, Bill filed for a patent on the concept in Feb. of 2010 with Martin as the inventor. U.S. Patent # 8042641 was granted Oct. 25, 2011, and international patent applications have been filed to get worldwide protection.

### Proto #2: Improving on the concept

Even though Proto #1 worked very well and proved out the concept, it was a rough model and not based on a modern motorcycle. Many people could not see past the old bike to see the benefits of the Lawson AWD system. A friend, an ex nationally rated Motocross racer in his misspent youth, recommended the next prototype be based on a modern enduro bike like the KTM 300, a two cycle motorcycle with a very powerful motor and a long travel suspension designed for off road racing. Bill found a 2004 KTM 300 EXC at a reasonable price and together he and Marty adapted the motorcycle during the winter of 2010- 2011. The KTM is the motorcycle Marty rides. It is street legal and works well for the average rider.

The summer of 2011 Bill and Marty took Proto #2 to various events and even had a racer, Pete (Speedy) Laubmeier from Madison, try it out. He liked it but thought it was not yet quite what an expert racer would want to ride. Speedy said, however,

he would like to ride a “race ready” version in the 4 or 5 races he rode every year (Hare Scrambles, Enduros) where the terrain was gnarly enough with sand, river rocks, mud, etc., that the all wheel drive could make a difference.

### Proto #3: Race testing the concept

As a result, Bill and Marty decided to build the next bike to fix a bunch of minor things that were OK on Proto #2 but not quite as good as they should be. They bought a 2011 KTM 300 XC from Speedy after the 2011 racing season and Marty proceeded to design the next version. When that bike was finished late in the summer of 2012 Speedy raced it in several races with good results. Bill and Marty learned some minor things that needed to be changed but in general it worked very well. Speedy raced it even in a GP Ice Race where he was challenging for the lead on Lap 13 when unfortunately a snap ring failed on a bearing in the front drive system and the front wheel drive ceased to work. There was no catastrophic failure such as the front wheel locking up but by the time the pit crew, Marty and Bill, figured out what was wrong the race was over.

### Current status (March 2013)

Proto #3 works very well, however, because some compromises were made in the interest of parts availability and conservative design, it is heavier than it should be. After further testing to fully understand the stresses, and improved design to provide lighter weight parts, Bill and Marty think enough weight can be taken off the front suspension system to keep the weight increase compared to the standard bike to less than 20 lbs total additional.

### The Inventors

Martin (Marty) Lawson has a master’s degree from the University of Wisconsin-Madison in mechanical engineering control systems. He works for the Space Science Center at the U of W as an Instrument Innovator developing instruments for Lidar systems. He is a hands-on engineer, proficient in making things using all types of equipment such as the CNC equipment in the machine shop.

William (Bill) Lawson, P.E., graduated from the University of Wisconsin-Madison with a degree in mechanical engineering. He is a retired company owner and engineer who has worked most of his life designing and building industrial laser systems. He holds fourteen patents.