INFORMATION & BACKGROUND NOTES

Motorcycle Innovation Pty Ltd and the motoinnoTS3 – 'Shockwave'

TS3 - Triangulated Steering & Suspension System

motorcycle innovation

The 'motoinnoTS3' prototype has been designed and built for real world testing of a totally new and unique front end steering and suspension system which addresses the limitations identified in all previous incarnations of tele-forked and alternate steering systems.

The track test prototype uses a standard 2002 Ducati 900SS power plant - along with a power commander to balance the modified shortened exhaust.

The prototype bike has a wheelbase of 1394mm, 4mm's shorter than the original with a dry weight of 161kgs (distributed 52% front 48% rear) down 30kgs from the original 198kg Ducati 900SS.

The 6064 aero grade certified aluminium components are over engineered for initial testing safety and BST carbon fibre wheels, front and rear, are used to reduce rotational mass.

The TS3 front end suspension swing arm pivots directly off the Ducati engine's front mounting lug, making the engine a fully stressed member for both front and rear swing arms. Because steering is separated from the suspension and braking force, there is no need for a bulky, overly heavy and strong head stock or chassis required on the usual telescopic or steered stanchion systems. This reduces the COG considerably.

For test evaluation, the front end geometry has been set to 19 degrees of rake and 98mm trail, though this can be adjusted between 15 to 24 degrees with increasing or decreasing trail as per the degree of rake.

Empirical track testing through its full range has indicated that when the steering rake is set to its maximum of 24 degrees (increased trail), the steering becomes lighter and quicker. When set to its minimum of 15 degrees rake (decreased trail), the steering becomes heavier and slower. This is the total opposite to what is normally attributed to and accepted from a telescopic or alternate steering system. The sweet spot for the TS3 from initial testing for rake and trail appears to be between 18 and 20 degrees for the TS3 system.

Note: Data so far collected incorporates the disparities of over engineered components – at least two millimetres of structural mass from every component needed to construct the TS3 prototype can and will, be deleted from the system to build the final unit. Mass weight of the TS3 can also be enormously reduced from its current 161 kg (dry) using new structural designs and the extensive use of carbon fibre composites and titanium components in the final production version of the bike, where the critical mass and chassis weight can be reduced by at least 40 to 60kgs.

This weight saving could bring the overall weight of the bike down to as little as 110kgs while still being able to safely carry many hundreds of times its own weight.

Pro-dive and anti-dive capabilities of the system can be adjusted over a wide range – from complete 100% dive to mimic any form of telescopics steered stanchion unit, to totally neutral – zero dive under braking, to having the front end lift up to100% under braking, or combinations of any of the above while still retaining the majority of suspension for further road anomalies.

The TS3 system is very flexible in its patent application, but only a small amount of adjustment will be initially available on production models as too much adjustment can be detrimental to the bikes setup under the hands of non-developmental engineers – we don't want to open that can of worms for novice and day to day riders.

The TS3 steering geometry also has 54 degrees left to right turn (27 degrees to the left and 27 degrees to the right from centre) which is way above the standard 38 degree left to right turn (19 degrees left to right from centre) at the headstock for a sports bike and streets ahead of any alternate front end system.

PROTOTYPE SPECIFICATIONS:

Engine:

Configuration: VTwin Air cooled 2002 Ducati 900SS

Transmission:

Type: 6 speed

Clutch: Dry (no slipper)

Final Drive: Chain

Chassis:

Frame and swing arm materials: Billet CNC - German Certified 6064 aluminium

Subframes: Tubular chrome-moly

Rake: 15 to 24 degrees – incremental adjustable

Trail: 98mm at 19 degree rake – variable at other rake angles.

Pro-Dive/Anti-Dive: Variable to suit – from minus 100 (full pro dive) through 0 (no dive – flat suspension) to positive 100 (full anti dive).

Steering: Scissor (shear) link Hub-Centre Steer.

Suspension:

Front: Single Afco T2 Fully adjustable (compression and rebound)

Rear: Single Afco T2 Fully adjustable (compression and rebound)

Wheels/Tyres:

Wheels: Front and Rear BST Carbon Fibre.

Tyres: Pirelli Diablo Rosso

Front: 120/70ZR/17 (58W)

Rear: 180/60ZR/17 (72W)

Brakes:

Front: Twin 320 disc Brembo 4 pot callipers

Rear: Single 220 disc. Brembo 2 pot calliper

Dimensions:

Weight: 161kgs (oil and half tank of fuel) - Weight confirmed.

Seat height: 820mm

Max width 710mm

Max height 1140mm – at front fairing.

Wheelbase 1394mm.

Fuel capacity - standard as per 900 SS

Performance:

Fuel Consumption – N/A

Top Speed – standard as per 900 SS

Contact & Sales Info

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DEVELOPMENT

The TS3 bike was developed over a 10 year design stage to get the front end geometry working. In July of 2008 CAD designs and FEA simulations on components were started and approved CNC parts were then produced through 2009 - 2010 culminating in the current components being flawlessly crafted by Brisbane based CNC fabricator, Gordon (Ghillie) Gilmour to complete the bike in 2011.

The bike was finally assembled by Sydney engineer Arthur Spink, whose company MecFX builds all forms of complex machinery for the Film and TV industry.

Further design improvements were implemented during 2014 – 2015, again with the CNC skills of Ghillie and his team at Zeico Pty Ltd.

Initial track testing of the bike's new system was started in November 2011 and improvements have continuously been developed as results were acquired.

Suspension setup was conducted by MotoGP race expert and guru Warren Willing in 2012 to produce a consistent, compliant and stable front and rear end platform.

Patent pending status for the IP has been secured as of December 2012 as well as PCT status in 2013 with the help of a Federal Government - Commercialisation Australia - Skills and Knowledge grant.

On track testing has provided MCI with empirical data that consistently shows the new front end gives the prototype the ability to enter a corner smoother and faster with a very much reduced flip flop counter steer action to begin the turn. It has been proven to maintain a greater corner speed with a higher rate of turn for less lean and can be picked up out of a corner faster without running wide either on or off the throttle – all with less input from the bike and less fatigue on the rider. The front end also appears to be immune from front wheel and king pin oscillation harmonics that can upset normal suspension, including under heavy braking.

MOTORCYCLE DYNAMICS – What we know and what we are discovering.

Telescopic forks are plagued with well-known problems including – stiction (fork bending and compression friction), fork collapse under heavy braking, inconsistent steering geometry in braking and acceleration, long shock load path from the front wheel to the COG of the motorcycle, etc...the list goes on.

The biggest problem with telescopic forks (any steered stanchion system really), including the Telelever, Duolever or any other form of front end, including many past HCS, is oscillation harmonics – this is a sometimes imperceptible vibration frequency that unsettles the front end of the bike. It is only really being recognised today because of newly available technology that is able to recognise and analyse this phenomenon.

The most well-known of these frequency harmonics, because it is the most violent and obvious to observe, is displayed in the dreaded tank slapper, that can be lethal if left to run its course, but similarly, many smaller frequencies can also lead to instability as well, like the loss of the front end into a corner – as in a common front end low side.

On all bikes with the steering kingpin (steering axis) set or held above the front wheel and retaining any form of stanchions that hold the front wheel axle, oscillation harmonics will occur to some degree or another.

This harmonic behaviour is because these stanchions act as unbalanced (760mm or 30 inch) levers in the case of some telescopic forks), that flex both horizontally and laterally when the front wheel encounters either a road force deflection through the tyre or braking forces are applied to the contact patch in any or multiple scenarios such as inline acceleration, corner lean or braking. These forces are usually multiplied 3 fold to the steering headstock before traveling down to the COG of the machine.

HCS systems can overcome the majority of these vibrational frequencies by separating steering from suspension and braking and by placing the steered kingpin in the centre of the front wheel – hence the term Hub-Centre Steer.

Depending on the HCS design and geometric configuration, large amounts of these forces on the kingpin can be reduced and redirected to the centre of gravity of the motorcycle in a shorter path than on conventional steered front end systems.

However there are still substantial loads placed on these kingpins at the centre of the wheel hub that create oscillation harmonics due to the 600mm (25 inch) diameter of the front wheel that surrounds it.

Here's where the TS3 technology comes into its own.

The TS3 is the only system that has a virtual king pin that starts at the contact patch of the tyre, travels through the hub centre along the steering axis and ends above the front wheel. The whole system is perfectly triangulated from the wheel axle back to the suspension arms and then to a point above the front wheel, making it incredibly strong and reducing any chance of oscillation harmonics from the wheel or the king pin, to almost zero.

Combine this with its separated steering from suspension and offset parallelogram swing arms that keep rake and trail geometry constant throughout the suspension travel and the inbuilt pro-dive/anti-dive and rake and trail adjustment capabilities and you have a pretty impressive front end platform without any corner lean issues inherent in previous HCS systems.

MOTOINNO AS A BRAND: World-wide, exotic, motorcycle market sales:

The next engine to be used as the base model for motoinno's branded bikes will be the Ducati Testastretta 11 degree water cooled 2014 Monster 1200 power plant.

Even though this engine is down on horse power compared to other high performance Ducati engines – only around150 bhp compared to the top end 200 bhp SuperLeggara - the MCI designed bikes power to weight ratio will easily make up for this lack of horse power and this engine has great midrange torque, exactly what is needed for a well-balanced motorcycle that is safe and fun to ride. The Testastretta engine retains all the necessary hard points (and actually has more) to be able to put the design of the TS3 straight into production.

Other engines are being considered including inline triples (Triumph and MV Augusta etc), Japanese inline fours, and other V-twin (Rotax and KTM etc) units as well as electric powered versions that are in the pipeline.

Structural Carbon fibre composites will become a feature of future designs of the motoinno brand as the use of advanced materials will enable sculpted design shapes that aid in weight savings, strength, aerodynamics and overall beauty of the machine.

Being a boutique manufacturer (like Confederate out of the USA) and depending on what the client wants as a 'one off' design, including choice of engine, to suit his or her needs, motoinno unit prices will start from AUS $150,000 and upwards depending on complexity and material costs. These will be "Rolls Royce" machines made on very limited and collectable runs.

All running gear, chassis, steering, swing arms, fairings, tank, shock absorbers, wheels, braking system, brake and clutch levers and systems will be up-spec'd to the highest possible quality components, including carbon composites and down to all titanium nuts and bolts and critical load bearing components, to make this a much sort after high prestige machine.

Motorcycle Innovation Pty Ltd is currently seeking an equity partner to enable the licencing of its IP to major manufacturers and to undertake a comprehensive apparel and accessories design and marketing campaign.

MCI DIRECTORS

Inventor of the system Ray Van Steenwyk has over 34years of advertising, feature film and television work to his credit and is skilled in Art Direction, 3D Animation, Design and Production. He is a self - taught mechanical engineer and is proficient in CAD and motorcycle dynamics as well as studying all the relevant data on alternate steering and suspension systems that are in print today, all learnt over the many years of bringing the TS3 bike into fruition.

Long-time friend, business partner and company director, Colin Oddy, is also a veteran of the TV and Film world with a 20 year career as a Producer/Production Manager on scores of TV commercials, corporate and network documentaries and screen credits on feature films and US television productions. He is proficient in sourcing and bringing together valuable production and financial aspects of commercial development.