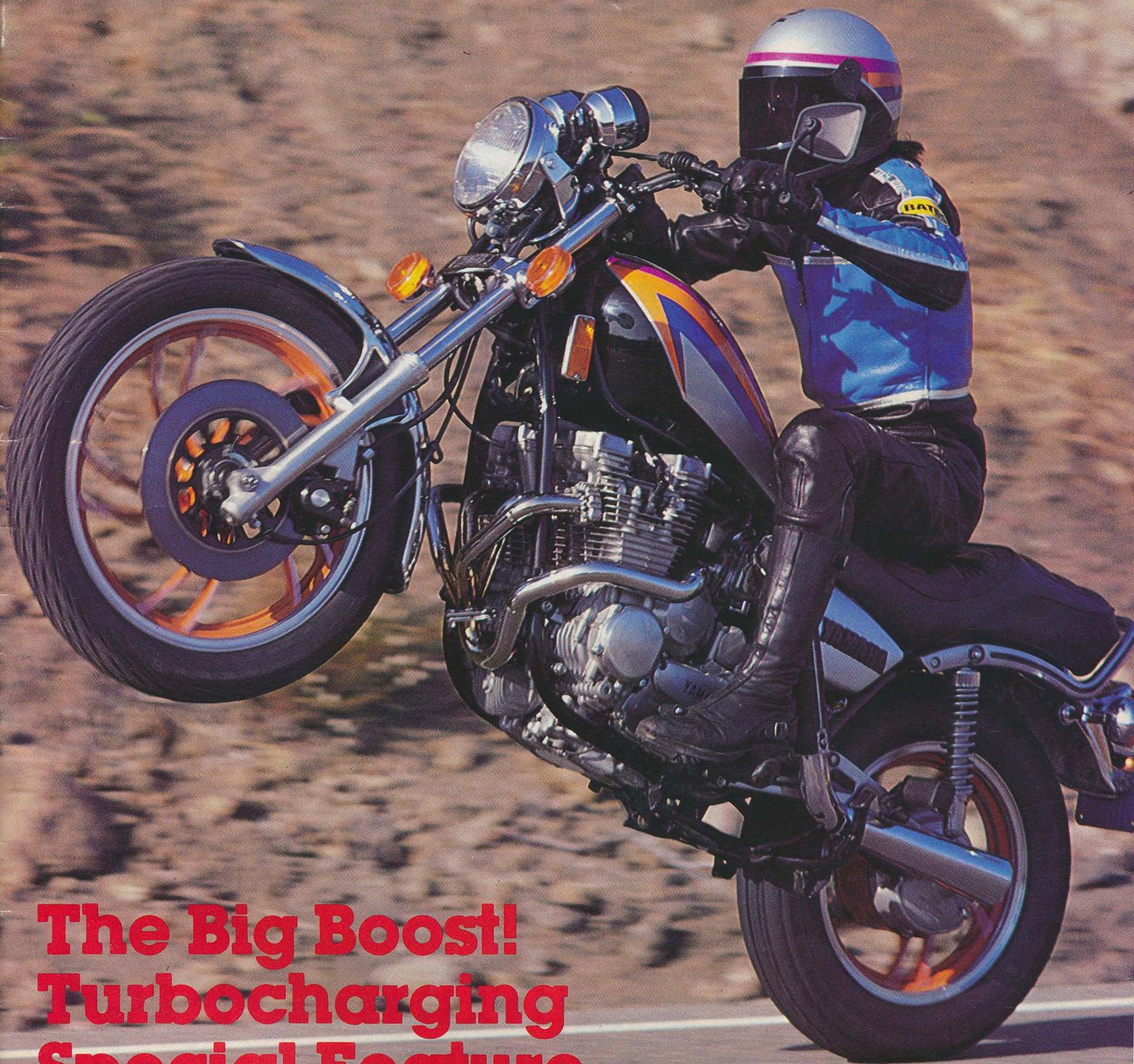


CIRCUIT



AUGUST 1981 50p



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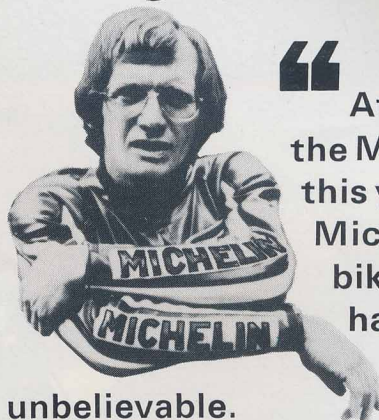
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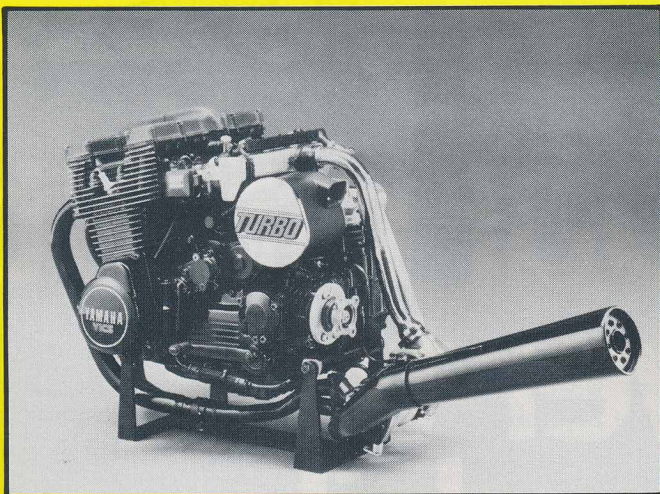
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The new Michelin T61

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SWITCH TO MICHELIN



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COVER PICTURE:

Wind up the revs, drop the clutch and the four-cylinder "Turbo 1" reaches for the sky! Read about this turbocharged "Superspecial" inside, along with a complete feature on how turbocharging works and the way in which Yamaha lead the world in this area of motorcycle development.

Photograph by Dave Hawkins

The TR1. Our latest answer to the Superbike.

The TR1 1000c.c. overhead cam. V-twin.

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So Yamaha have decided to offer an alternative. (And a less complicated one, at that.)

The 75° V-twin engine unit is a piece of cake to maintain. (As if you'll ever have to.)

It's also fitted with a totally enclosed, lubricated rear chain drive. (That means more miles per chain.)

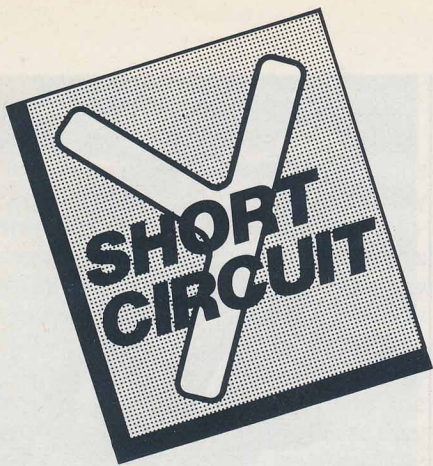
It also boasts a Monocoque frame derived

from our racing machines which incorporates Yamaha's unique Monoshock suspension system.

Other features include 5 gears, transistorised ignition, dual horns, hand operated choke, sporty cast alloy Italic wheels, quartz Halogen headlight and upswept exhausts.

There you have it, problem and answer.





NEW R & D CENTRE

Research and development have always been two of the key factors in Yamaha's consistent ability to lead the motorcycle world in innovation. Evidence of the importance placed by the factory on constant research into new technology and development of new machines can be gained from the fact that the new R & D centre scheduled to open later this year is no less than eight stories high, plus one underground floor! The entire R & D staff of the Yamaha factory will be housed in the building, located in Iwata, Japan. This concentration of talent will be aided by the very latest computer techniques to keep Yamaha in the forefront of motorcycle technology.

MIKKOLA IN BRAZIL

Heikki Mikkola won two World 500cc Motocross Championships for Yamaha in 1977 and 1978, as well as two more for Husqvarna in 1974 and 1976 (the latter being the 250cc crown). He shocked the motocross world by retiring at the end of the 1979 season while still very much a potential winner but the 'Flying Finn' remains very heavily involved with both motocross and Yamaha.

Just recently he was in Brazil, conducting a motocross school which drew selected riders from all over Latin America ... from Brazil, Argentinian, Paraguay, Uruguay, Bolivia, Colombia, Costa Rica, Guatemala and even across the Atlantic from Portugal.

The school session for the 23 riders lasted an entire week! Opening day was lectures and films, then came four days of practice and learning followed by a day of 'training races' and a final day of full-fledged competition. Seventeen YZ125 and eight YZ250 machines were used and 'Professor' Mikkola presided over the whole proceedings!

CYPRUS MX SCHOOL

Motocross is, in fact, the fastest-growing motorcycle sport on a worldwide basis. As well as assisting Heikki Mikkola in Brazil, Japanese MX instructor, Kazutoshi Iwao, stopped off in Cyprus to organise a series of three Yamaha Motocross Schools in the areas of Limassol and Nicosia. Cyprus only has 500,000 people in its 1700 square kilometres but there is enough enthusiasm for the sport of motocross to enable the Cyprus Motorcycle Federation to hold an MX race every month throughout 1980!

RESTORING THE ELM TREES

Last year the British importers of Yamaha, the giant Japanese trading company of Mitsui, celebrated the 100th anniversary of the establishment of their London office!

The occasion was marked by the presentation to the nation by Mitsui of 10,000 young elm trees ... a particularly thoughtful gesture when one remembers the ravages of Dutch elm disease just a couple of years ago.

The first of these trees was planted in Regent's Park, London by H.R.H. Princess Alexandra.

AIMING AT THREE MILLION

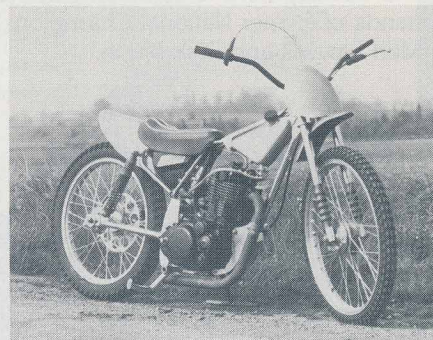
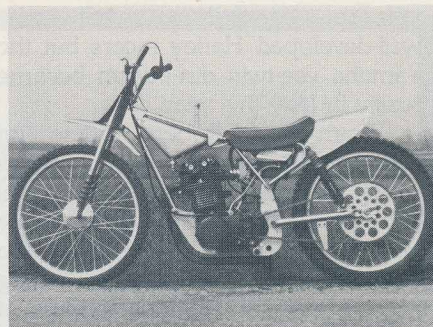
Yamaha's 1980 range was so successful that their total motorcycle output showed a 30% increase over 1979 and was in excess of two million machines worldwide. Now the target is three million machines per year and Yamaha management are confident that with the 1981 range plus even more new machines on the way, this figure will soon be surpassed!

A MILLION LIGHT MOPEDS

The Yamaha lightweight moped, the Passola, is by now a familiar feature on British roads ... not to mention the rest of the world! Just how popular these bikes are is indicated by the fact that since Yamaha first introduced this type of small-wheeled commuter bike on the Japanese domestic market in 1977, over one million of them have been subsequently produced for world sales!

YAMAHA GRASS BIKE

The Yamaha XT500 engine is not a powerful motor in standard form, especially when compared with the Jawas and Weslakes of the speedway and grasstrack world. Therefore, when semi-retired grasstrack ace, Chippy Moore, wheeled out a Yamaha at a recent East Midlands Championship race, no-one took much notice.



This Yamaha-engined grasstracker was a winner in its first event. Could be the basis for a fast, reliable and inexpensive clubmans racer.

Not until the racing started, that is! Chippy led his first heat but retired with fuel starvation, then jetted up and won the second from quality opposition on Weslake, Godden and Jawa four-valvers! In the final, he was in third place and challenging for the lead when the fuel starvation problem occurred again and Chippy retired rather than overstress the engine.

The bike's debut caused considerable interest in the grasstrack fraternity. Heart of the machine is the engine that has been built in the USA to flat-track racing specs. The bike's designers do not plan to race it again for a considerable time and are now working on a planned development programme. The aim is then to produce it as a fast, reliable clubman's grasstracker.

"We did the one race to see if it had any potential" said Chippy Moore. "Now we know that it has and we've got to get to work rather than enjoy ourselves racing it!"

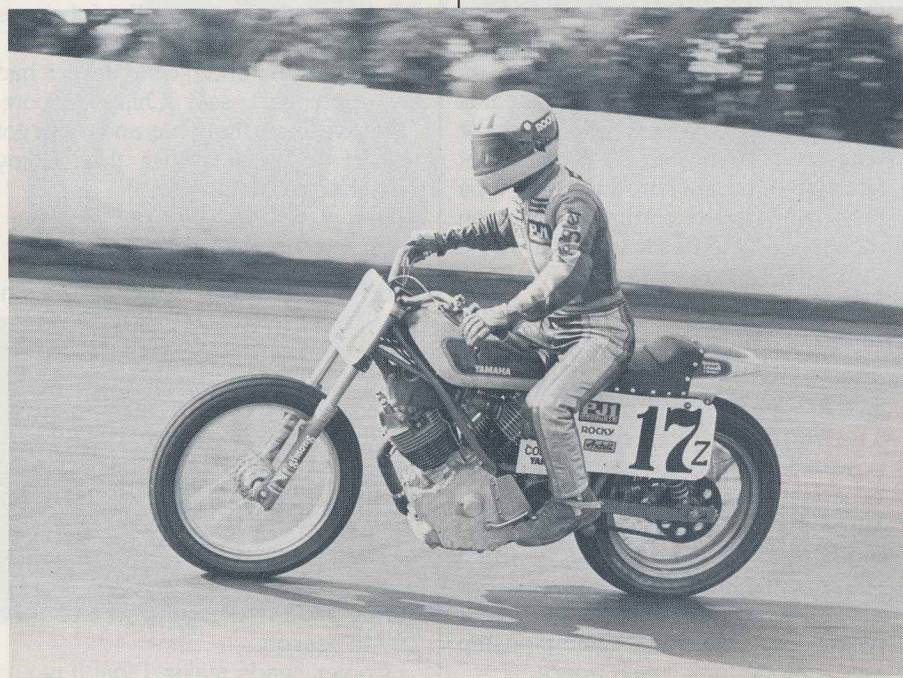
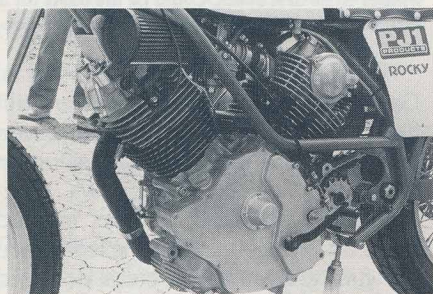
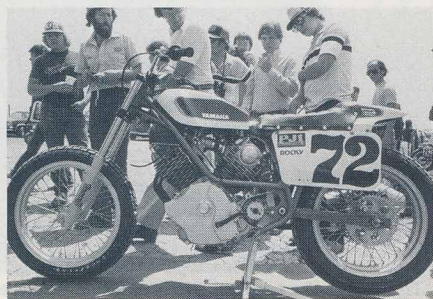
VEE TWIN DIRT-TRACKERS

Rumour has it that within minutes of the first Yamaha vee-twin being unveiled at the American distributors Las Vegas conference, the factory staff were besieged by eager dealers asking "when are you going to build a dirt-tracker?" They saw it as a Harley Davidson-beater, a bike to help bring the coveted US Grand National Championship 'Number One' plate back to Yamaha for the first time since Kenny Roberts let it go at the end of the 1974c season.

Cooler heads realised that it would

take more than enthusiasm to beat the well-developed Harley racers but the Yamaha vee-twin dirt-tracker became reality in May this year.

"Team Kenny Roberts" riders, Jim Felice and Mike Kidd wheeled the bikes out for the San Jose mile-track National and, though they didn't challenge the Harleys right off, proved that the potential is there. Felice placed a strong second in a non-Championship event and development is continuing in the hands of former National Champions, Mert Lawwill and Dick Mann.



CHAS MORTIMER RACING SCHOOL

Mitsui's commitment to road racing at club level takes on yet another dimension with their decision to sponsor the Chas Mortimer Road Racing School.

The school was successfully run for several years, but some time ago Chas abandoned the project to concentrate on other business commitments. Now, with the help of Mitsui, the school has been re-formed to once again give up and coming racers the opportunity to gain valuable race track experience.

Although it does not claim to be the only school in existence, it can boast that it is the only establishment of its type where pupils will be instructed from their very first lesson by professional Grand Prix and International riders.

The school will operate on the lines of a club, with a twice yearly newsletter, and will be using four different circuits all over the country. From the beginning of March courses will be regularly held at Silverstone, Cadwell Park and Donington, and due to the tremendous interest shown by Northern enthusiasts it will also be making use of Knockhill, in Scotland.

Before each twenty lap session, a team of instructors, including the school's founder, nine times TT winner Chas Mortimer, will give all the riders a

The Yamaha vee-twin of "Team Kenny Roberts" didn't beat the Harleys in its first US Championship dirt-track, but showed great potential. There was also the added satisfaction of at least qualifying for the event while the "mega-dollar" Honda vee-twin challenge of Freddie Spencer couldn't make it.

Jim Felice takes the Yamaha vee-twin out for a practice lap of the San Jose one-mile dirt oval.



Chas Mortimer in his days as a Yamaha team rider, on his way to breaking the 125cc Spanish GP lap record at Barcelona in 1972. Now he's using his talents to teach road racing skills to young hopefuls.

full briefing. These briefing sessions will include advice on cornering lines, braking points and the onto-and-off techniques applicable to the circuit in question. After instruction the riders will take to the track aboard the school's own race-kitted Yamaha RD400 twins where they will be observed by a team of experienced observers. The observers will not just be stationed at vantage points around the circuit either. All of them will be actually on the track where they can best judge the performance of their pupils. After each track session will follow a thorough debriefing where pupils will be advised as to how their techniques can be improved, and invited to ask any relevant questions.

Members who start their careers with the school will be able to upgrade from the RD400 machines to TZ125 racers, kept by the school for Members actually starting racing.

As members of a Club, pupils can enjoy various other deals offered by the School. These include discounts on racing and road-racing items from Ray Boots and Furygan or Gimoto leather clothing.

All Racing School members must be holders of full motorcycle road licences and be able to show proof of being over seventeen years of age. Members between the ages of seventeen and eighteen must be accompanied by a parent, or guardian. For those who do not want to lay out money on leathers, etc., the school also offers a clothing hire service which includes everything from helmets and leather boots and gloves.

ANDY LEE

MOTOCROSS SCHOOL

With World and British Champions seemingly getting younger every season, the secret of success in motocross is apparently to start as young as possible. Unfortunately for many youngsters, their early efforts at competitive riding all too often discourage further attempts and they quickly grow disillusioned with the sport. The problem is that unless they are one of the fortunate few they have very little opportunity to get in valuable practice and experience. Consequently they finish well down the field, or even worse, fail to finish at all, and all the excitement of motocross rapidly evaporates.

The ideal answer to this problem is a training school for motocross, and Mitsui are encouraging young talent by backing a new venture started by former international rider Andy Lee, father of World Speedway Champion Michael Lee. The motocross training school will run one and two day courses for all classes both adult and schoolboy at Elsworth Moto-Parc a few miles north of Cambridge.

During 1981 the school will run special mid-week courses aimed at schoolboy riders, to be staged during half-term, spring and summer holidays. There will also be special one-day schools limited to only two riders of similar ability, who will undergo seven hours of concentrated practical riding tuition, with the emphasis on riding technique.

The two-day courses will be less specialised and will cover all aspects of motocross from machine preparation, physical fitness and psychological approach, to starting techniques and riding style. Entries are limited to 24 riders and the school can arrange local accommodation or alternatively riders can camp in the paddock area.

The Moto-Parc includes a permanent one-mile course that can be varied to suit weather conditions. The course includes a variety of corners of both banked and adverse camber type and many interesting jumps and natural obstacles.

Riders must provide their own machines and full protective clothing. There will, however, be a limited number of Yamaha YZ motocrossers available to hire for those who encounter serious problems with their own machines. Andy will also use similar machines for demonstration rides, along with experienced technician Nigel Tongue who, as well as maintaining bikes, will also lecture on machine preparation and maintenance.



Obituary

Staff at the Chessington headquarters of Mitsui UK Ltd, were stunned recently by the sudden death of their managing director.

Mr Joh, who was 54 died peacefully in his sleep at his home in Putney Heath, London in the early hours of Monday 15th June. He had been the managing director of Britain's Yamaha importers since October 1978, and since coming to England from New York he had established a friendly and outgoing style of leadership not often associated with Japanese management.

The public relations manager at Mitsui, Mr Steve Hackett, said Mr Joh would be sorely missed by everyone at Mitsui and by members of the motorcycle press, with whom he had built up a friendly relationship over the last three years.

"He was genuinely friendly and full of concern for his staff and always available for functions" said Mr Hackett. "Mr Joh had far-reaching ideas and thoroughly enjoyed vigorous and involved business discussions, but he was always fair". "Everyone at Mitsui always felt they could knock on his door and discuss almost any problem" Mr Hackett said.

Under his leadership Mitsui consolidated their share of the motorcycle market and in fact just two months ago they achieved the ultimate by taking the number one spot in sales for the very first time. To cope with the increased business, Mr Joh recently saw Mitsui open their new spares and service building opposite their longer-standing Oakcroft Road premises.

More recently, Mr Joh had persuaded Mitsui to diversify into Yamaha Power Products, including generators and water pumps and had also opened an electronics department.

Mr Joh, who leaves a widow and three grown-up sons, had no history of illness and only two weeks before his death he had visited the Isle of Man TT races.

Turbocharging the Yamaha Way—Further Along the Development Road

Yamaha has a first class reputation for innovation in motorcycle design and technology . . . probably more so than any rival manufacturer. Therefore, it is no surprise to discover that Yamaha are well advanced in the field of turbocharger development. This, we stress, is no indication that turbocharged Yamahas will be on sale in Europe in the immediate future . . . though it may well be the case in the USA where long distances, straight freeways and an omnipresent emissions control agency dictate a different type of motorcycling.

The Yamaha view of the turbocharged motorcycle is that it is either a means of maintaining current performance in the face of stiffening government emission

standards or, in countries where this is not quite such an issue, providing big bike horsepower in a compact chassis package.

Turbocharger development has been carried out upon the XS1100 . . . a perfect engine for this type of work. A complete machine has been developed, which might well appear on the US market within twelve months but which is most unlikely ever to be seen on sale in Europe.

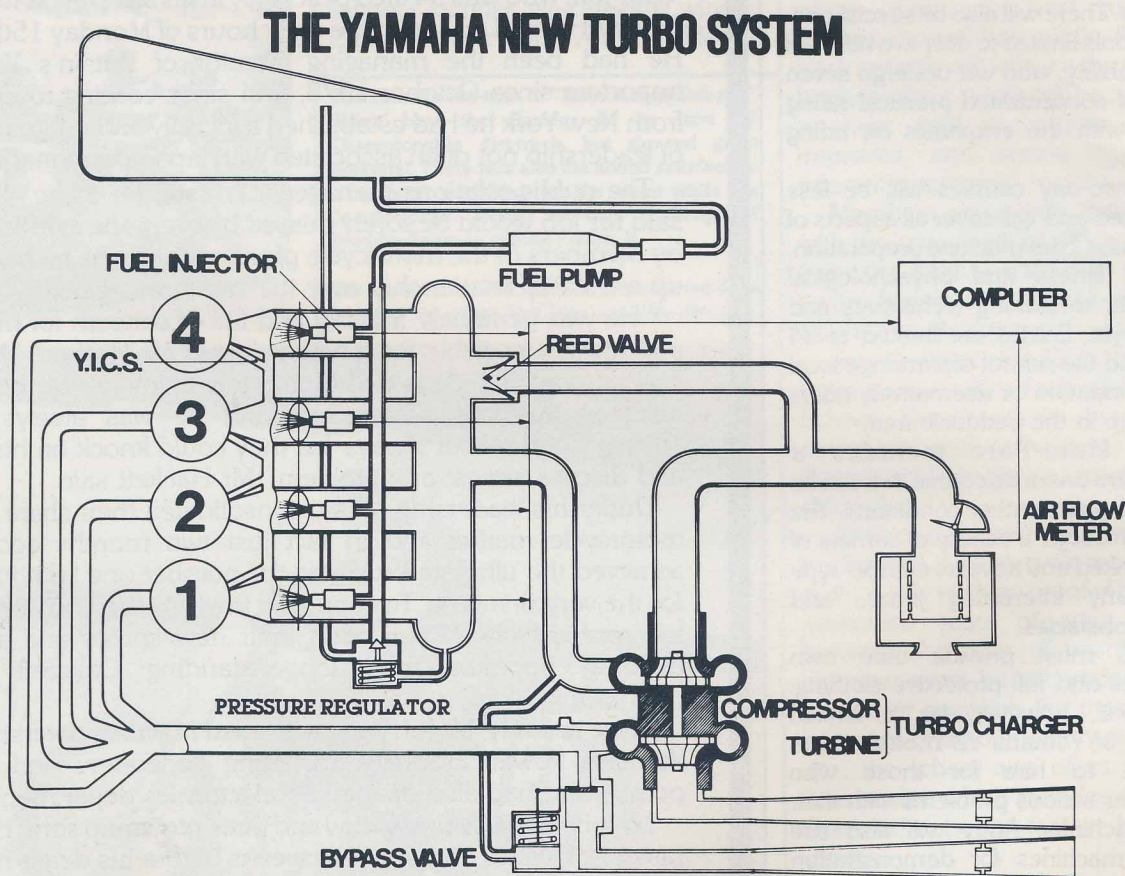
From the work done on the XS1100 system, however, Yamaha have amassed turbocharger data and technology applicable to smaller-capacity machines.

They have taken motorcycle turbocharging several steps further down the development path than any other motorcycle manu-

facturer or specialist equipment company.

One obvious difference between the Yamaha turbo installation and that of other companies is the positioning of the turbo unit itself. Whereas all other turbos have been mounted in the space usually occupied by the carburettor on normal machines, Yamaha have mounted their unit down below the rear engine mount, almost out of sight on the right-hand side.

Occupying the space behind the fuel injection inlet manifold is an air cleaner which delivers fresh, filtered air via a lengthy chrome downpipe into the turbo unit. Another long pipe takes the compressed air back from the turbo and into the inlet manifold, from where it is fed into the cylinders



The Yamaha Turbo layout differs from the norm in having a special turbocharger bypass system to overcome the problem of "turbo lag." Depicted is the turbocharger set-up with a separate waste gate that has its own exhaust outlet.

via a combination of fuel injectors and Yamaha's patented Y.I.C.S. system. This is an abbreviation for Yamaha Induction Control System, which is a network of linked secondary ports into each of the engine's combustion chambers. (It was described in full detail in our October/November issue last year.) What the system does is to route fuel from any closed inlet ports (i.e. cylinders not on the induction stroke) via the secondary passages, into the cylinder that is actually taking in fuel. This aids cylinder filling and also creates a swirling turbulence in the combustion chamber which results in total combustion of the fuel/air charge. On engines without the YICS set-up, not all of the charge is combusted, which means that unburned fuel escapes out of the exhaust pipe rather than being exploded to create energy. Use of the YICS system plus fuel injection and the turbo-charger means that the XS1100 Turbo motor operates at absolute optimum efficiency.

The lengthy plumbing necessary to route fuel from the remotely-mounted turbo unit into the engine is no disadvantage as inlet tract and exhaust pipe lengths are not as critical on forced induction en-

gines as they are on normally-aspirated ones.

The plus factors of having a remotely-mounted turbo are several. First of all, the heat generated in the area of the turbine unit is quite substantial and the further it is away from the actual cool air intake area, the better the carburetion will be.

Secondly, all of the exhaust plumbing on the Yamaha is down beneath the engine. Other turbos mounted close to the cylinder head have a large exhaust down-pipe which unavoidably runs close to the rider's leg and which can get uncomfortably hot. This problem is totally avoided by Yamaha's turbo positioning.

Finally, the turbo being located below the rear engine mount keeps the bike's centre of gravity low—with consequent handling advantages.

During development Yamaha utilised two types of turbocharger. One had an integral waste gate while the other used a separate one with its own exhaust outlet.

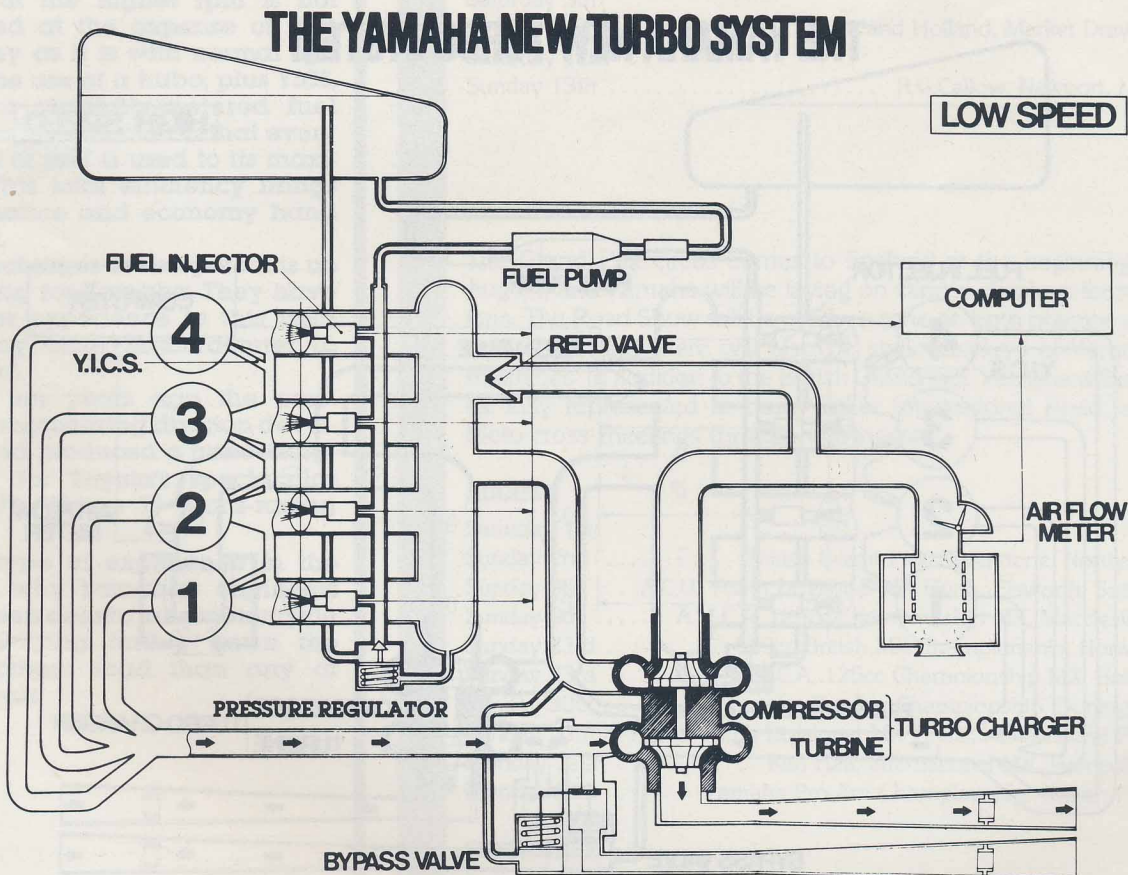
Fuel and air enter the Yamaha system via a computer-controlled fuel pump and airflow meter. After it has been compressed by the turbo, the fuel injectors (also linked

to the metering unit) squirt the charge into the cylinders via the YICS system.

Yamaha have gone further than anyone in eliminating about the only major drawback of turbo-charging... turbo lag.

This occurs when the engine has been throttled back and the low rpm do not generate sufficient exhaust gas velocity to spin the turbo unit at the necessary operating speed. If the throttle is snapped open at this point in an effort to get quick acceleration and rpm build-up, the turbo actually becomes an impediment to induction rather than fulfilling its true function. It can't get up to speed quickly enough to force the charge into the engine so the turbo fan becomes an obstruction to the airflow. In-take airflow stalls and the engine stumbles erratically until it can build up enough rpm to get the exhaust gases up to the speed required to spin the turbine blades.

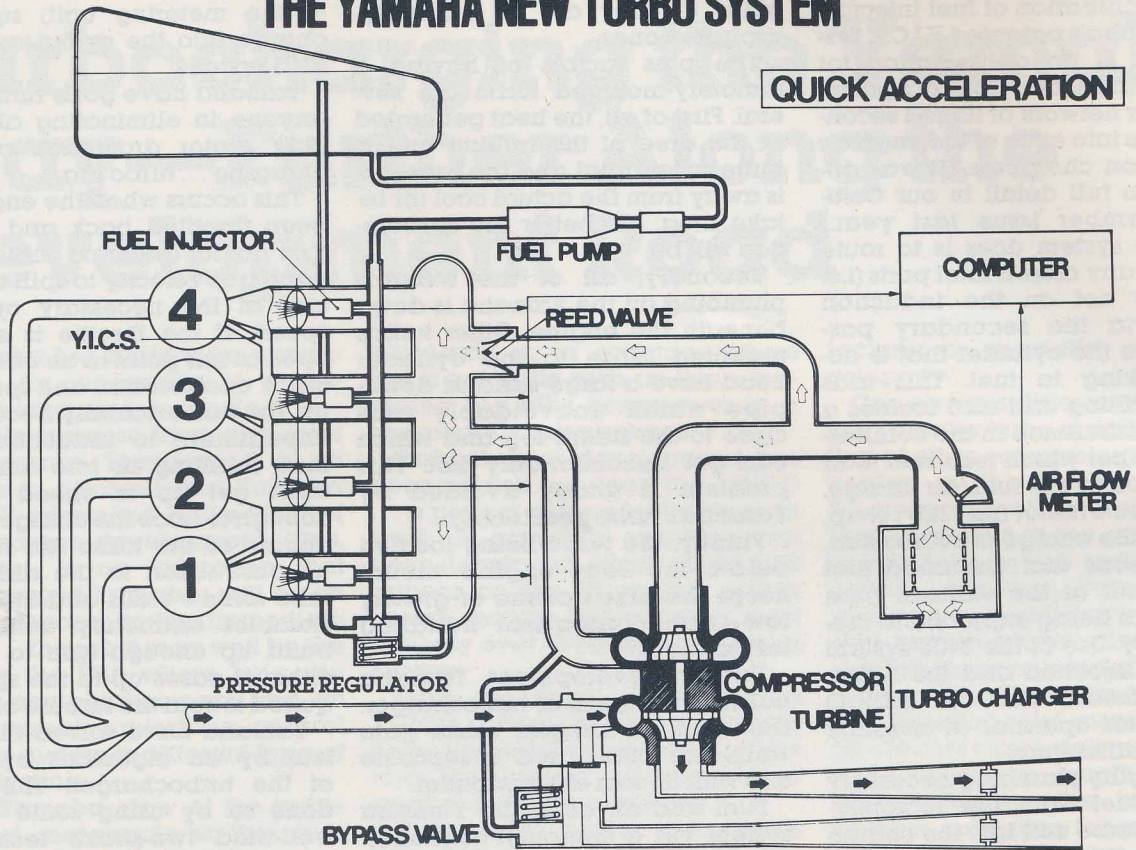
Yamaha have solved this problem by an ingenious bypassing of the turbocharger. They have done so by using some of their well-tried two-stroke technology... a strange paradox on what is their most powerful four-stroke engine!



At low engine speeds but with smooth throttle opening, there is still enough inlet manifold pressure to keep the reed valve closed. This allows the air to pass over the compressor fan and so build the turbo up to operating speed.

THE YAMAHA NEW TURBO SYSTEM

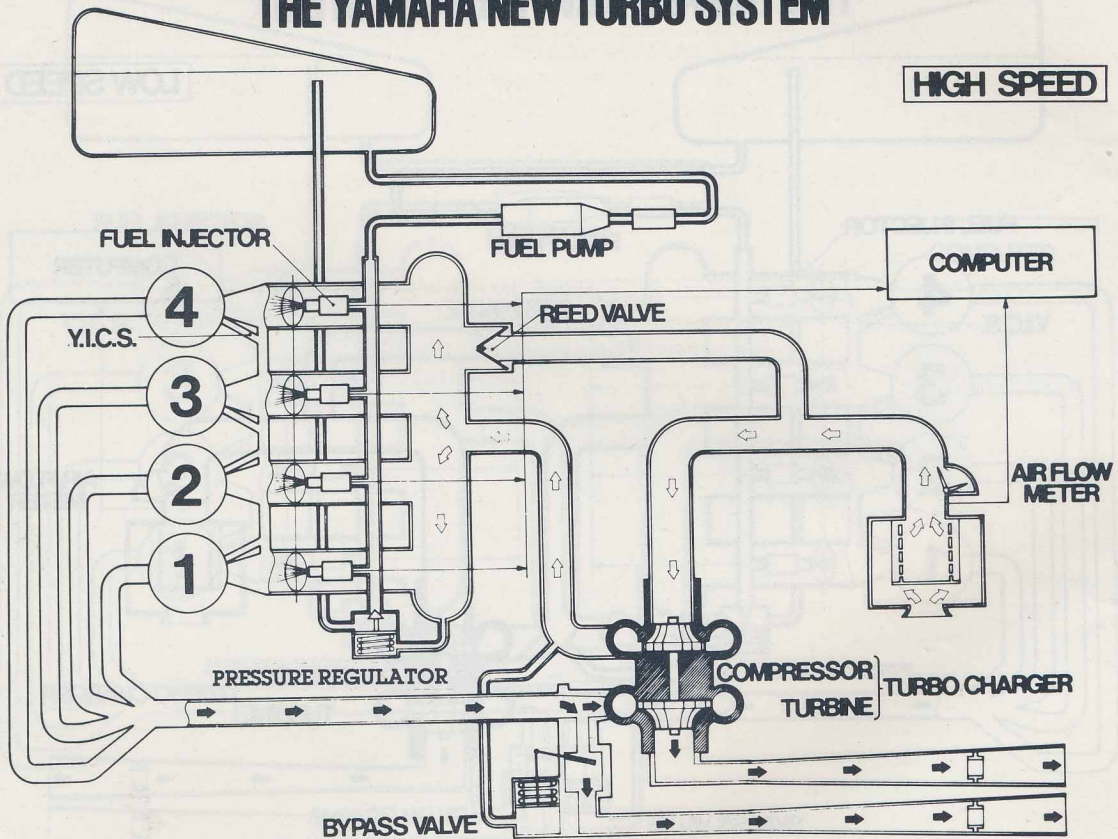
QUICK ACCELERATION



If the throttle is snapped open to try and get quick acceleration, there will be a sudden drop in inlet manifold pressure. This causes the reed valve to open, the turbo unit is bypassed by the main airflow and "turbo lag" is avoided.

THE YAMAHA NEW TURBO SYSTEM

HIGH SPEED



At high engine speeds, the turbo has again got up to operating rpm, inlet manifold pressure has risen once more and the reed valve closed. The turbo is now in full operation at its maximum boost pressure.

The system uses a bypass tube from the air inlet pipe before it connects to the turbo unit. That bypass tube runs directly into the inlet manifold and is controlled by a one-way reed valve.

When the turbo is spinning on a constant throttle opening, sufficient inlet manifold pressure is generated to keep the reed valve closed. If the throttle is snapped open, there is a drop in inlet manifold pressure and this sucks open the reed valve. Exactly as the drop in crankcase pressure operates the reed valve in its two-stroke application.

This means that most of the incoming fuel/air mix enters the fuel injection unit directly via the reed valve. It bypasses the turbo so that the engine behaves exactly like a normally-carbureted unit at this stage. As the revs build, so does inlet manifold pressure. The reed valve closes and the mixture is once again routed through the turbo.

Thus the XS1100 Turbo has the best of both worlds. It runs with all the economy of a normal engine at low rpm (and consequently low boost pressures) but gets all of that awesome "turbo power" from the high boost at the mid-range and up!

Even more important, increased power at the higher rpm is not achieved at the expense of fuel economy as it is with normal systems. The use of a turbo, plus YICS, plus the carefully-metered fuel injection system, means that every particle of fuel is used to its maximum. This total efficiency brings performance and economy hand in hand.

Turbocharger development is no new thing for Yamaha. They have a longer experience in this field than any other manufacturer in the world.

Over ten years ago the company's engineering division developed and produced a turbocharger unit for Toyota's spectacular 5-litre V8 "Group 7" sports-racing car.

This type of experience in the field is why Yamaha's engineers have been able to take motorcycle turbocharging further down the development road than any of their rivals.



DIARY

The Yamaha Road Show continues to travel all over the British Isles during the next month, visiting dealers to show off the latest production models.

Demonstration rides are available, but as these are subject to certain restrictions regarding age and experience, please check with your local dealer first.

AUGUST:

Saturday 8th Team Yamham, Chester-le-Street
 Sunday 9th Kens Motorcycle, Newcastle-on-Tyne
 Wednesday 12th Claremont Motorcycles, Ashton-under-Lyne
 Saturday 15th Hartwells Motorcycles, Banbury
 Sunday 22nd T & D Motorcycles, Preston
 Sunday 23rd Miles Kingsport, Hull
 Saturday 29th Golden Valley, Folkestone
 Sunday 30th Kel Prince, Leicester

SEPTEMBER:

Saturday 5th
 Sunday 6th Wylie and Holland, Market Drayton
 Saturday 12th
 Sunday 13th R.G.Callow, Newport, Mon

The Grand Prix circus comes to England at the beginning of August, and Yamaha will be laying on various displays for race fans. The Road Show will be at Silverstone on both practice and race days, and there will also be static displays of Yamaha machines. In addition to the British Grand Prix, Yamaha will also be fully represented at many other international Road, and Moto-cross meetings throughout August.

AUGUST:

Saturday 1st
 Sunday 2nd British Grand Prix, Silverstone, Northants
 Sunday 9th ... A.C.U. Youth Divisional MX Finals, Elsworth, Suffolk
 Sunday 9th A.M.C.A. 125cc Championship MX, Macclesfield
 Sunday 23rd 500cc British MX Championship, Norwich
 Sunday 23rd A.M.C.A. 125cc Championship MX, Bolton
 Sunday 30th Yamaha Pro-Am Championship, Donington
 Sunday 30th . A.C.U. Youth Divisional MX Finals, Hawkestone Park
 Monday 31st Ken Hall, International MX, Hampshire
 Monday 31st Yamaha Pro-Am Championship, Oulton Park

SEPTEMBER:

Sunday 6th 125cc British MX Championship, Stroud
 Sunday 13th 125cc British MX Championship, Tweseldown

turbocharging will we,



Turbocharging, we are told, is "the coming thing" in the motorcycle world. A forced induction system which combines a dramatic horsepower increase with better overall fuel economy and easier compliance with engine emission regulations.

Major manufacturers have reinforced this opinion by devoting development time to the system and by showing turbocharger-equipped machines to the press and public.

Yamaha, for example, have been working on a turbocharged XS1100 development project, and Honda showed a CX500 "Turbo" at the Cologne Show last September.

Numerous specialist companies, particularly in the USA, have been offering motorcycle turbocharger kits for almost ten years, aiming mainly at the outright performance freaks looking for something bigger and better than the next guy.

In the face of all this evidence,

can anyone really be sceptical about the turbocharger as a "coming thing"?

Basically, yes . . . but with certain reservations. There is absolutely no disputing that a turbocharger can do everything that is claimed for it in terms of performance, economy and emissions. The only question is, whether the motorcycle world really needs the turbocharger, at least for the next few years.

How could the motorcycle world not be ready for a relatively-simple, bolt-on item that brings extra horsepower hand in hand with reasonable fuel consumption? To answer that admittedly provocative question, we should first explain how the turbocharger works.

Like its close cousin, the supercharger, the turbo is a forced-induction system, pumping the fuel/air mixture into the cylinder under pressure.

Normally, an engine sucks in the fuel/air charge by virtue of the vacuum created in the cylinder when the piston moves

down on its induction stroke.

If we may be permitted to vastly simplify the way in which the internal combustion engine develops its power, it does so as follows:

The better an engine's induction system fills the cylinder with the volatile fuel/air mixture—and the better that mixture is exploded and burned—the more efficient the engine will be and the more power it will develop.

This is termed "volumetric efficiency." Some "utility" engines may only operate at 50 percent of their theoretically-possible volumetric efficiency. The average for the road-going motorcycle engine is probably about 80 percent.

Tuning engines is primarily aimed at increased volumetric efficiency. The filling of the cylinder is increased by such things as altered port timing on two-strokes and different cams to alter the valve timing on a four-stroke. Compression ratios are raised to aid the explosion factor in the combustion process and so

ing -

won't we?

on. A tuner's target is to get as close to 100 percent volumetric efficiency as possible.

Now we come to the total advantage of forced induction systems. Both turbo and superchargers take in fuel through the carburettor, compress the fuel/air charge and then propel it into the engine under pressure. Compressing the charge means that probably 50 percent more fuel and air can be squeezed into the cylinder than its dimensions would normally allow it to take. Volumetric efficiency with forced induction, therefore, is around 150 percent . . . giving as

much performance as a normally-carbureted engine half as big again.

This is why international GP car racing, for example, sets capacity limits of 3000cc for normally-aspirated engines but only 1500cc for those with forced induction.

Of the two methods of forced induction, the supercharger is perhaps best known to motorcyclists because of its long use on drag racing and sprint bikes.

It has one basic advantage over turbochargers but several disadvantages.



The advantage is that the supercharger is directly driven from the crankshaft (by gears, toothed belt or chain). Thus it begins to do its job right from the low end of the rev-range and initial acceleration is very much better with a supercharger than with a turbo.

Conversely, the very fact that the supercharger is driven from the crankshaft is a major point against it. Some of that extra power that the supercharger helps to develop has to be used to drive itself. That power is wasted before it finds its way to the rear wheel.

Additionally, with the need for a drive system linked to the crank, the supercharger is a much more bulky and complex item to fit to an engine.

On the other hand, the turbocharger is like a mini gas turbine, its blades being spun by the passage of air across them. That air is the expanding exhaust gases which are routed from the engine and over the turbine blades

before being actually exhausted into the atmosphere. These gases set the turbine fan spinning in its housing and, therefore, also rotate the axle shaft on which the fan is mounted. On the other end of this shaft, in an entirely separate chamber of the turbocharger casing, is another fan. This time a compressor which draws in the fresh fuel/air mixture from the carburettor and forces it under pressure into the engine.

Thus the spent exhaust gases—normally totally wasted—are put to work to compress the incoming fuel charge and so increase the engine power. Changes in pressure within the engine, caused by back-pressure from the turbo fan through the exhaust system, do drain off a little of the extra power developed from increased volumetric efficiency but nothing like as much as the horsepower taken by the supercharger's directly-linked drive.

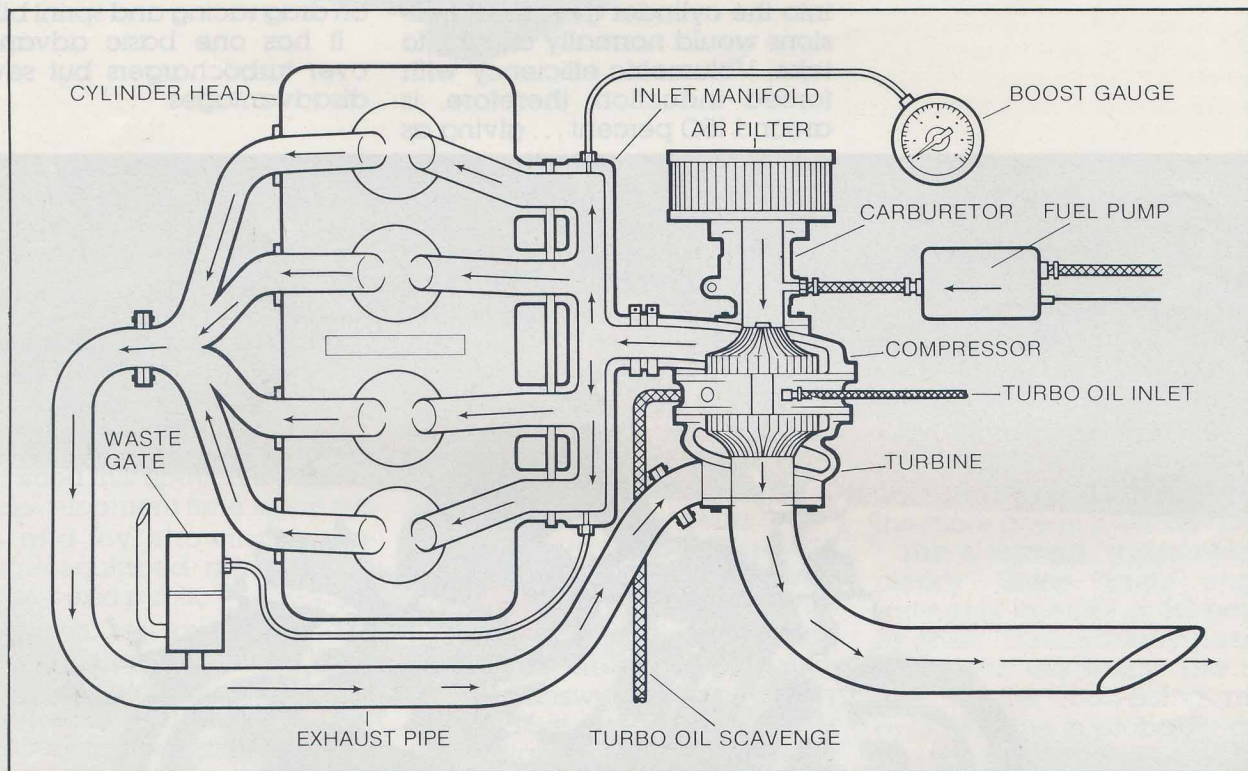
For all practical purposes, the turbocharger really does something for nothing ... most unusual

in the tuning business!

Fitting a turbocharger to an existing engine is a relatively simple matter. Apart from the compact turbo unit itself, the whole thing is just a matter of re-routed exhaust plumbing.

The turbocharger is a neat little component, looking rather like an electric hair dryer. There is an induction port to link the carburettor to the compressor chamber and an outlet port on the same side of the unit to pass the compressed mixture into the engine. On the opposite side of the turbo unit is another intake port routing exhaust gases into the turbine fan and a large outlet port to finally dispel them into the atmosphere after having made them earn their keep!

The turbine and compressor fans are on a common shaft but each operate within their own tightly-sealed section of the turbocharger housing. Obviously these compartments must be kept separate so that incoming and exhaust gases do not meet.



The "normal" turbocharger set-up. Fuel from the pump plus air are mixed in the carburettor and impelled by the compressor into the engine. The fuel/air charge is burned and the hot exhaust gases flow back into the opposite side of the turbocharger. These spin the turbine, which in turn spins the compressor at greater speed. The cycle then begins again but with incoming fuel being pumped in under ever-growing pressure (or boost) as the volume and velocity of exhaust gases increase along with engine rpm. To protect the engine against too much pressure, the inlet manifold is connected to an exhaust "waste gate" or safety valve. When inlet manifold pressure gets too high, this valve opens to relieve it.

Only real trickery in construction is that the inlet side of the turbo unit is constructed in alloy as it only has to handle cool incoming air while the exhaust side is made of heat resistant cast iron. Likewise, the turbine fan has to be made of a more heat resistant material than the compressor, though both have to be strong enough to spin at up to 120,000rpm (!!!) without centrifugal force causing them to disintegrate.

At these rpm speeds, lubrication is critical and is just as important at the rather more usual operation range of 60 to 80,000 rpm for the turbo fans. The axle shaft cannot be mounted on roller bearings because the centrifugal force generated at those rpm speeds would cause the rollers to break up. Instead, plain bush bearings are used and lubricated under pressure via the engine's own oil pump system. Turbocharger manufacturers recommend oil pressure of 15lb psi for this job . . . which makes the Yamaha 1100 engine a particularly good engine to turbocharge. It has plain bush crankshaft bearings already lubricated at around that pressure. For engines with roller bearing cranks (usually lubricated at only around 2 psi) oil restrictors in the turbocharger lubrication system are needed to generate the necessary pressure.

Centrifugal compressors have to run at high rpm to do their work, flinging incoming air against the surrounding housing so fast that its mass is compressed because it cannot escape from the unit as quickly as the fan is drawing it in. The pressure difference between the outside atmosphere and the compressed mass of air in the housing is known as boost pressure and can be controlled via a type of safety valve known as the waste gate.

This is connected by a hose to the induction manifold so that when pressure of the incoming air reaches a certain figure, the waste gate (which is in the exhaust system) opens up and allows the exhaust gases out directly into the atmosphere instead of routing them through the turbocharger. This allows the turbine to slow down, slowing the rpm of the compressor fan and therefore reducing pressure in the inlet tract.

The waste gate can be brought into operation at a pre-set boost pressure, calculated by the engineers to protect the engine and also to avoid detonation in the combustion chamber ("pinking") caused by excessive pressure and heat build-up.

Other things which can be done to control detonation are the retarding of the ignition timing and the lowering of the compression ratio to 9:1 or less. Some aircraft and automotive turbos have automatic ignition retardation units controlled by detonation sensors in the combustion chambers while others use water injection into the combustion chambers to reduce temperatures. Neither of these has proved necessary in motorcycle applications of the turbocharger.

Really, about all that is necessary to fit a turbo to a motorcycle is to make sure that the basic engine unit is strong enough to withstand the extra pressures and heat within the cylinders and that the exhaust system is leakproof and with as few restrictions as possible so that it can deliver a smooth, continuous flow of exhaust gases into the turbo unit.

Finally, the size of the turbocharger must be matched to the size of the engine. To simplify this, it is no good fitting a big turbocharger to a small engine as the volume of exhaust gases will simply not spin a big turbine fast enough to generate the necessary compression of the incoming charge.

This is why, until recently, turbochargers were only seen on large capacity superbikes. The only turbos that were commercially available were actually meant for light aircraft or large automotive engines and were next to useless on anything under 750cc. Even a 750 had to be turning at about 7500rpm before the turbo made much difference to it.

A Yamaha XS1100 could make good use of it but the rider still had to be turning around 5500rpm before the turbo chimed in. Which meant that, unless you were either some speed-crazed lunatic or liked the one-upmanship of having the extra gadgetry on your machine, the turbo was a rather unnecessary appendage.

However, the Japanese company IHI (soon followed by Mit-

subishi) came out with a much smaller range of turbos towards the end of 1980, and this has meant that machines as small as 650cc can be turbocharged with good results throughout the middle and upper rev-ranges. All of the power benefits are no longer just at the top end, for the new Japanese units are not much more than half the size of the American turbos which previously had to be used.

Matching the size of the turbo to the engine reduces one of the main drawbacks of turbocharging . . . the dreaded "turbo lag."

The turbo fan is driven by the exhaust gases of the motorcycle, therefore these have to reach a certain volume and velocity before they spin the fan quickly enough to get the compressor up to the necessary speed to do its particular job. This will not happen unless the engine is running at a large throttle opening and under load . . . during hard acceleration, for example. For motorcycles using automotive turbochargers, this translates to high rpm.

Therefore, if the engine has been running at high rpm, is then throttled back and brought up to high rpm again (such as going in and out of corners), there is a definite time lag before the exhaust gases get up to working volume and speed again. The result of this "turbo lag" is a flat spot on acceleration out of turns.

Using the correct size relationship between engine and turbocharger cuts down this lag to acceptable proportions but still does not eliminate it.

Of all the motorcycle turbocharging systems so far, only Yamaha have made definite advances towards getting rid of what is one of the very few practical disadvantages of the turbo. How they have done this is explained in our separate feature on the Yamaha system.

Having given at least a simplified version of how a turbocharger does its work, we can now come back to our original question:

Why fit one to a motorcycle engine and in what respects is the turbocharger a worthwhile addition?

Let us first examine why turbochargers have been fitted to cars, as the reasoning is the same to a great degree.

THE 'TURBO 1'— SUPERBIKE POWER FROM A SIX-FIFTY!

The Yamaha "Turbo 1" super-special built by American Turbo-Pak in Tustin, California, is probably closer to the future generation of turbo-charged production motorcycles than anything else yet built.

Previous special builders found themselves governed by the type of turbo-chargers commercially available, units normally utilised on large-capacity cars, trucks and light aircraft engines.

These were next to useless on a motorcycle engine of less than 1000cc which meant that the only bikes worth turbocharging were "superbikes" which already had anything from 90 to 110bhp. And just how much extra horsepower do you need when you already have that much on tap!

For the "Turbo 1," however, American Turbo-Pak were able to get in on the ground floor and become the first motorcycle special-builders to purchase the Japanese IHI units designed for small capacity auto-

motive engines. Distributed by the Borg-Warner company in the U.S.A., these turbos are one-third smaller than anything previously available. ATP, therefore, was able to take the Yamaha XJ650 "Maxim" and add their turbo kit to produce a bike that has the weight and handling advantages of a 650 but with more performance than production superbikes!

ATP designed the Turbo 1 as a complete super-special package with dazzling graphics by the famous "Molly Design" company which gave us the distinctive Yamaha USA yellow and black "speed block" motif so familiar to fans of Kenny Roberts.

Chassis specification is left standard with the turbo impeller fitting neatly beneath the tank in the space usually occupied by the Maxim's four carburettors. ATP's patented four-into-one exhaust system collects the spent gases from the engine and delivers them back into the turbo unit where they spin the im-

PELLER blades before exhausting via a large-diameter down-pipe into a single muffler on the left-hand side of the bike.

A boost gauge mounted above the black-chrome handlebars allows the rider to monitor turbo boost pressure while a solid-state, electronic fuel pump delivers exactly the correct amount of petrol to the engine. Dunlop K181 "Qualifier" tyres and stronger clutch springs are the only other changes made.

ATP plans to offer the Turbo 1 via Yamaha dealers in the U.S.A. and any purchaser has the neat option of also buying a special Bell Helmet with Turbo 1 graphics!

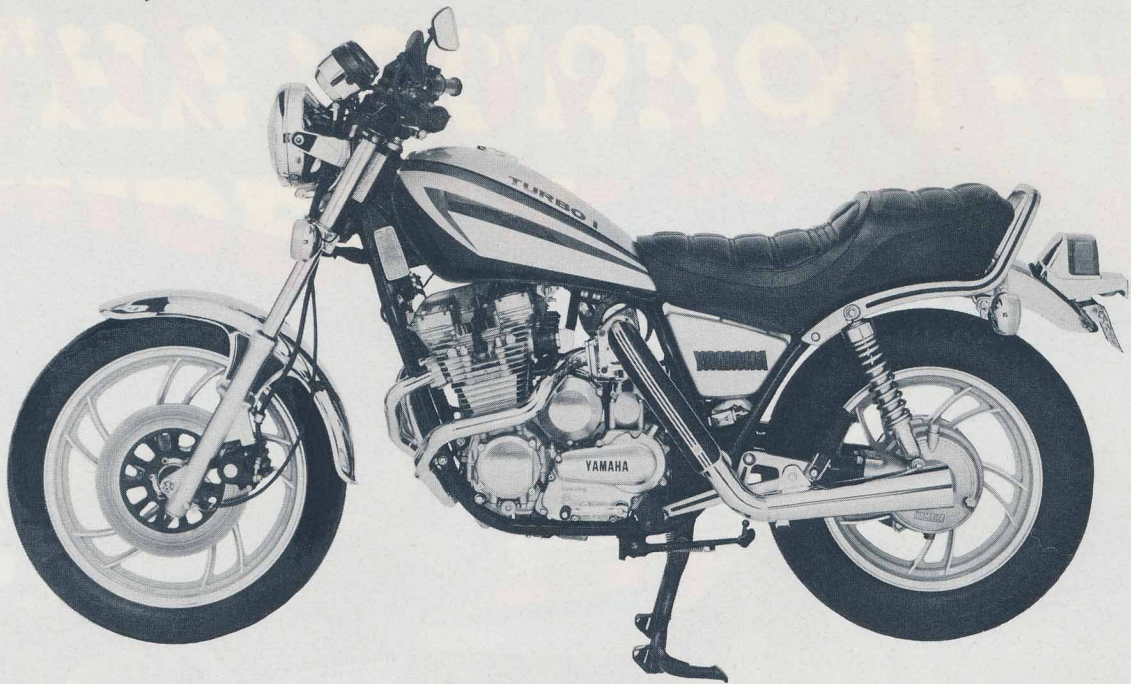
Any British enthusiast seriously interested in the machine can write to us here at Yamaha Circuit, P.O. Box 49, Banbury, Oxon, and we will pass their enquiries on to ATP. Be warned, however, that the British price tag would probably be in excess of 3,500 pounds thanks to airfreight costs, customs duties, taxes, etc.

Superspecial

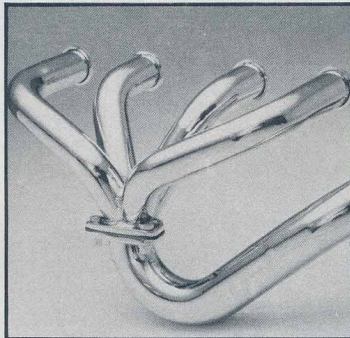


Photograph - Carolyn Braaten.

Continued over →



Is it worth it? Check out the adjacent performance tables and judge for yourself. If you want a 650 that will outperform any standard 1000 (or bigger!) superbike and which will even run pretty close to turbocharged eleven-hundreds, look no further than the Turbo 1! □



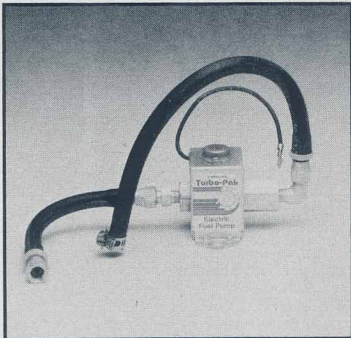
Patented exhaust system produces a lower RPM boost start and wider boost range.

AN UNBIASED VIEWPOINT . . .

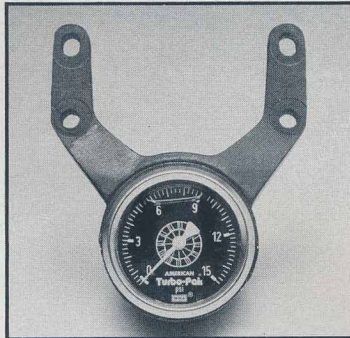
The American magazine "Cycle" recently tested the Turbo 1 and had these unbiased opinions to offer . . .

"... around town, with revs in the 2000 to 5000 range, the bike displays a very civil character. It builds its power gradually. Assertively but without drama. The ATP-Maxim is like a Lear Jet: respectable and refined. It combines the agility of a mid-sized bike and the horsepower of an 1100 . . . but only when you want it. Therein lies the beauty of the turbocharged bike: excitement with civility.

One thing became clear when testing turbocharged machines. Some of them have too much horsepower for the chassis and brakes to handle. This is not the case with the Turbo 1 which has a built-in safety margin that accepts the added power inputs without overloading chassis or brakes." □



Solid state electric fuel pump delivers just the right amount of fuel as needed.



A glycerine filled gauge indicates turbo boost output.



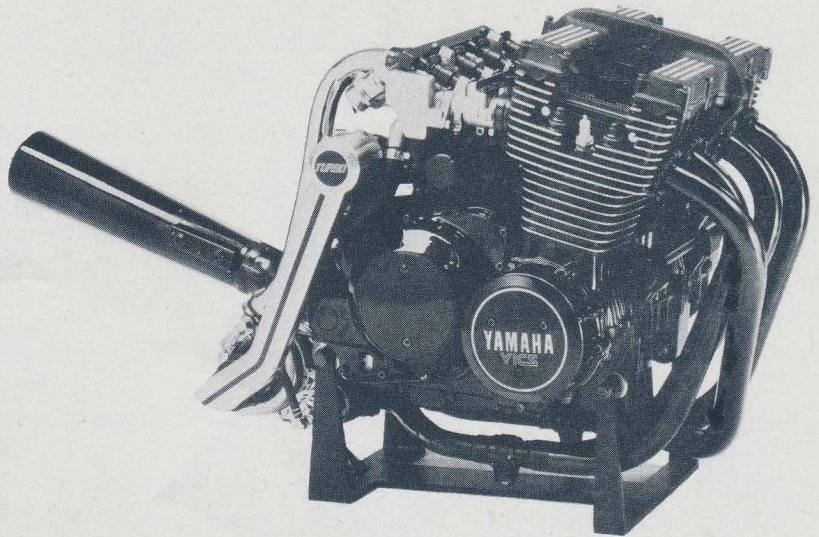
Borg-Warner mini turbo is 1/3 smaller than conventional units. The precision wastegate is built right into the unit and is fully adjustable.

TURBO-BIKE PERFORMANCE COMPARISONS

(Drag-Strip 1/4-mile elapsed time and terminal speed tests conducted by champion U.S. drag-racer John Gleason of ATP)

Machine	Boost Pressure	E.T.	Terminal Speed
Honda CBX 1100	10 psi	10.22s	146.20mph
Yamaha XS1100	10 psi	10.64s	140.00mph
Suzuki GS1100	10 psi	10.36s	136.00mph
Kawasaki KZ1000	10 psi	10.68s	131.62mph
Suzuki GS1000	10 psi	10.75s	131.00mph
Yamaha XJ650	9 psi	10.91s	128.00mph
Kawasaki KZ650	10 psi	11.10s	122.40mph
Kawasaki KZ550	10 psi	11.48s	118.90mph
BMW RS1000	10 psi	11.64s	118.86mph
Harley Davidson 1200	12 psi	11.98s	118.60mph

Yamaha have mounted the turbocharger unit on their XS1100 Turbo development bike down behind the right rear engine mount. This keeps hot exhaust plumbing away from the rider's legs and separates the hot turbo unit from the area of the fuel injection system where high temperatures could upset carburation. The chrome downpipe on the righthand side of the engine routes the incoming air from the aircleaner into the turbo and the second chrome pipe behind it takes the compressed fuel/air charge up to the fuel injectors. On the turbocharged specials built by other manufacturers, the turbo unit is mounted up high adjacent to the cylinder head and hot exhaust gases are expelled via a large downpipe which is uncomfortably close to the rider's leg. All exhaust plumbing on the Yamaha system is tucked away under the engine. A big air-cleaner on the left side of the engine occupies the spot where other manufacturers mount the turbocharge.



Turbochargers were first seen on engines designed for use at fairly constant throttle openings, such as aircraft, heavy diesel trucks, boats, etc. Their obvious power advantages soon brought them to the attention of automotive tuners, however.

Earliest automotive applications were on racing cars, particularly on the oval tracks in the USA (such as Indianapolis) where drivers stayed on the throttle much more than in road racing.

Other racing car builders, notably Porsche, adapted the turbocharging system for road race engines (such as their all-conquering Can-Am cars), and from there it was a short step to road-going sports cars such as the Porsche Turbo 911.

Super performance and the owner's pride were the basic motivations for cars such as these and there are still vehicles built today that use turbos for no other purpose than sheer horsepower... the Renault 5 Turbo is a prime example.

Surprisingly enough, it is the other side of the turbocharger's character which is more likely to bring it general acceptance in the automotive world.

Stringent emission control regulations in the USA have meant a downsizing in car engines over there and a strangulation of the power outputs of even the smaller power units. But American roads and the habits of the customers still demand fairly large, comfortable cars. The addition of a turbocharger to an engine can

compensate for all the restrictions of the emission control gadgetry and give an engine all of the mid-range acceleration that American drivers need to get their somewhat hefty cars on the move. In addition, once the car is up to speed, the throttle load can be backed off and turbo pressure automatically reduced. Less throttle load means slower exhaust gas velocities, which means slower turbine speeds and less pressurisation of the incoming fuel. Which translates to economical running in direct relationship to the engine's cubic capacity.

The same is true of low speed running around town. At low revs there is not enough exhaust gas volume to get the turbocharger spinning. Therefore the engine takes in the same amount of fuel as it would if normally-carbureted.

Fitting a turbocharger has allowed manufacturers to meet emission controls and to cut down fuel consumption via smaller engines while still having enough power in the mid-range to accelerate sizeable vehicles up to cruising speed without taking all day about it.

Other applications of the turbocharger in the automotive world include the fitting of the units to diesel cars to give them power on a par with their gasoline-engined counterparts.

Mercedes Benz and Peugeot both offer luxury diesel cars for those people who want to cut their fuel bills while still travelling in style. The addition of a turbo

transforms these from taxicabs to grand-touring cars!

Finally, there are cars like Audi's 5000 Turbo which use the turbocharger for a combination of all these reasons. To get sporting, big-car performance from a relatively small engine.

This is probably the closest reasoning to the potential motorcycle application of the turbo. Big bike performance from a small package. Right now we don't have any problems meeting emission control restrictions with current motorcycle designs. We don't have any problems with fuel economy, either. If emission controls get even more stringent or fuel gets even more scarce, then turbocharger technology is there to help out.

At present, however, don't expect to see the turbocharger appearing on all manner of motorcycles. We just don't need it at this point in time.

What you can expect is to see the turbocharger used in the near future for basically one reason only... to provide yet another option for the sporting rider. Big bike power in a middle-weight package.

Things might be different in the USA. Emission control regulations are stricter over there and the American touring rider might soon need turbo assistance to drag his Government-strangled big cruiser up to freeway speeds. Luckily we are not quite in that position over here.

The turbocharger is still "the coming thing" in Europe... it's just not coming very quickly. □

The Yamaha Rotary

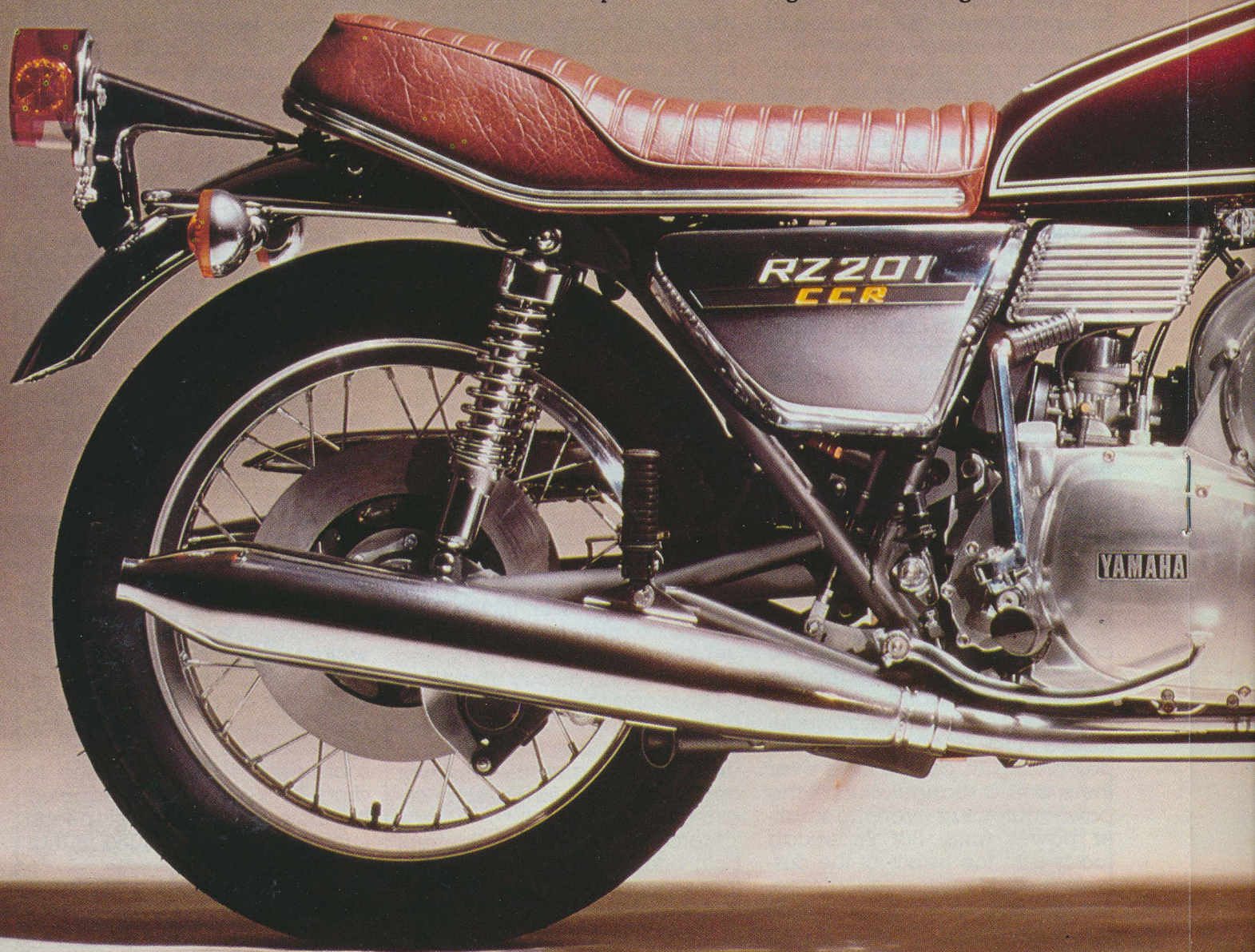
Motorcycle fans who visited the Tokyo Motor Show way back in 1972 were certainly spoiled for choice. All the giants of the motorcycle world had their latest models on show, but the display that attracted the most attention was on the Yamaha stand. Amid the various new production models, ranging from the DOHC 8 valve TX500 down to the prototype "Chappie" moped stood the very latest piece of inspired engineering from Yamaha, the 'rotary engined RZ201'.

Journalists too were drawn to the Yamaha stand by this unique model and motorcycle newspapers the world over proclaimed that its introduction marked the dawn of a new era in motorcycle design.

The RZ201, however, was never intended as a production model. It was simply an exhibition machine aimed at demonstrating the diversity of Yamaha technology. The fact that the machine was built to such a high standard of both technology and design fooled the motorcycle world into believing that it was a production prototype.

The rotary piston engine was developed by Yamaha along with Yanmar Diesels who had already obtained a licence to manufacture marine and light vehicle engines from the German patent holders NSU Wankel.

Working within the confines of their patent licence, Yamaha came up with several technical innovations, all designed to make this type of engine suitable for motorcycles. The twin rotary pistons, each displacing 330cc rotated in the direction of the vehicle advance to alleviate any vehicle roll caused by engine torque. The inlet and exhaust ports and the ignition plug were re-arranged in a more rational lay-out than the original design, saving a great deal of time and expense when carrying out routine maintenance. Another ingenious device was the combination port system that featured a periphery port working in conjunction with a side port. The combined effect of these two ports was to increase combustion efficiency over the low speed range while improving intake efficiency at higher speeds, giving improved performance throughout the rev range.



ary Experience

The final version of the rotary engine developed 68ps (Hp) at 6500rpm with a maximum torque of 7.8Kg-m at 4000rpm, and this power output was coupled to a five speed gear box and transmitted to the rear wheel by a silent chain.

A liquid-cooling system was adopted for the RZ201, while another technical innovation from Yamaha took care of engine lubrication. This was the "Charge Cooled Rotor" system which fed oil directly into the mixture from the carburetor to lubricate and cool the rotors. This system, which did away with the oil cooler required on conventional rotary engines, helped to make the power unit narrower, and so more suitable for use in a motorcycle.

As you will see from our picture of the RZ201, it would have made a striking addition to the Yamaha range, and possibly sparked off a revolutionary new approach to motorcycle design. As it turned out, the Yamaha research and design department moved on to other things and, even without the help of the rotary engine, have kept the name of Yamaha to the forefront of motorcycle design.



...ideas from the designers of the future.

The Yamaha design team are justly famous for their innovative technical and design concepts, but just take a look at this list of features seen for the first time earlier this year. Carbon fibre glass monococque chassis ... anti wheel lock rear suspension ... push button gear change ... temperature sensors that warn of icy road conditions ... and even electric leg warmers to give extra rider comfort.

Before anyone jumps to the conclusion that next year's Yamahas will resemble two-wheeled moon buggies, let's put the record straight. Not one of these features had anything at all to do with the Yamaha design department, in fact none of the designers concerned have even left school! All of these ingenious ideas, and many more besides, were dreamt up for the BP Buildabike Competition, the finals of which were held in April at the Metropolitan Police Driving School at Hendon.

The long road to the finals began several months earlier when schools were asked to submit design portfolios for a machine that would emphasise "safety and comfort". From these, eighteen finalists were chosen and each of them were given a Yamaha XS250cc engine to power the finished machine. From then on it was simply a question of converting ideas on paper into motorcycles that, even though they incorporated unusual and experimental ideas, still had to be presented at the finals in a roadworthy and "street legal" condition.

How the schools went about this demonstrates the theoretical and practical ingenuity that had to be brought to bear on the problem. One of the finalists, Whitleigh Secondary School, Plymouth, constructed a fairing designed to give maximum weather protection. To do this they first had to soak sheets of hardboard until pliable and then bend it into the required shape. Once dry, the hardboard mock-up was used as a mould for the finished product. Another school that went in for total rider protection was the Edgebarrow comprehensive from Berkshire. The problem they came up against was



First place award-winners from Edgebarrow Comprehensive School, Crowthorne along with their "Commuterbike" and the two girl designers of the clothing award winning entry, Janet Carter and Stella Mullineux from the Bebington Secondary School in Wirral.



Gosford Hill School pupils designed "The Wheeler" and took second place. It has a novel fairing with twin windscreens for low and high speed riding, plus a number of anti-theft devices.



The Winners of the clothing design award show off their styles along with Miss UK, Kim Ashfield.

one of aerodynamics. In order to test the efficiency of their body, they needed a wind tunnel. Their answer to this lack of facilities was simple ... they built one!

Safety, the other criteria in the competition, was tackled from several different directions. One school immediately made their machine a one-seater, as they thought that "pillion passengers made machine control harder and often came off worst in the event of an accident". The Pentrehafod School from Swansea, went as far as to include safety air-bags at the front and rear of the bike, designed to inflate in a serious accident, while several other schools incorporated a roll-cage into full weather protection fairings.

Other technical novelties included Britain's first "pulsating" motorcycle headlight - introduced by The Grange School, Bristol - and a unique safety braking system, highly praised by ex World Champion Geoff Duke and invented by the Curriculum Centre School, Barnet.

All these unusual ideas had to be converted into actual machines in a fairly short time, but by April 3rd eighteen completed motorcycles were ready to be wheeled out to face the panel of judges. The judges included Vincent Davey, from one of the competition sponsors Gus Kuhn Motors and Mike Jackson of Andover Norton Ltd as well as several members of the Police Drivers Training School.

After giving every entry a thorough inspection, which included several circuits of the police training track, the judges eventually gave first prize to the "Commuterbike" designed and built by the Edgebarrow Comprehensive.

This impressive wedge-shaped machine was aerodynamically tested in a wind tunnel built by the school. The Commuterbike was unusual in that it had the engine mounted at the front of the machine, leaving plenty of luggage space behind the driver. A car-type seat gave greater rider comfort, and also allowed for the use of seat belts, and the rider was kept warm by a warm air curtain designed to combat any cold air entering through the foot holes in the bottom of the body.

Second place went to the boys of Gosford Hill School, Oxford with the "Wheeler", an aerodynamically designed machine with a series of anti-theft devices. Although it followed more conventional lines the full fairing did include several new ideas, including a windscreen that folds back as the speed increases.

The striking paint-job, as well as the technical features of the Henry Mellish School's entry must have caught the judges eye. The bike, which included extra weather protection in the form of a front wheel "spat" took third prize.

All eighteen bikes in the final sought new ways of rider protection, ranging from Manchester's Wright Robinson School simple polythene cover to the more sophisticated all-enveloping body of the winning entry.

The winning entry earned for its school a £1000 cash prize, plus a Yamaha RS125 while the second place team took away a 100cc Yamaha motorcycle and £750. Third place prizewinners were presented with £500 and a 50cc machine. As well as the major prizes there were various cash prizes for such things as Quality of



Enclosed front wheels and comprehensive streamlining aid in both weather protection and economy, thanks to better air protection, in the third place design of the Henry Mellish School.

Craftsmanship, Visual Appeal and Ease of Maintenance,

The winning team also had the chance to meet Team BP's road racer, Dave Potter when they visited Donington Park at the end of July. Their day out included a grandstand view of the day's racing from BP's own pavillion, a "slap-up" meal and the chance to meet the stars of road racing actually in the pits.

With the emphasis of the competition on engineering it was fairly obvious from the start that the entries would come from boys, but BP ensured that the girls would not feel left out. In conjunction with the Buildabike competition they invited schools to submit designs for motorcycle clothing. From the hundred designs submitted, the judges selected just twelve finalists and these were given fifty pounds towards the costs of creating a finished product from their designs.

A bright green nylon suit with raindrop motifs, and yellow, snug-fitting leathers won the £500 first prize for Janet Carter and Stella Mullineux, from Bebington Secondary School in the Wirral, Cheshire. Second place went to Beauchamp College, Leicester. Their blue and orange fair weather suit and a black nylon suit with orange bands earned them the second prize of £250. In addition to the cash prizes all the prizewinners in the clothing section were invited to a day at Simplicity Fashions.


With the help of BP, who organised the whole competition, Haynes Publishing, the MCA, Gus Kuhn Motors and Mitsui UK Ltd, who all added sponsorship in one form or another, schools from all over the country have demonstrated that the youngsters of today possess the technical and designing ability to bring a project such as this to a successful conclusion.

TRAIL RIDING W

- prep



WITHOUT TEARS Preparation is the key



Despite the misgivings of many average riders, off-road motorcycling isn't just the province of the moto-cross heroes, enduro toughguys or trials balance-artists. In fact, trail riding is one of the most enjoyable forms of motorcycling whether the rider is experienced in the rough stuff or even a comparative novice. Simply getting on your motorcycle and taking off on a trail into the country is the true getaway experience and need have no fears for any reasonably capable rider.

Like any form of sport, however, there

are a few ground rules that you should follow ... a few lessons that you should make sure to learn before taking to the trails.

The first, and most important of all, is never go off trail riding alone. It would be quite simple to crash and injure yourself and then lay there for hours before some other outdoor enthusiast happened to pass by. Always ride with a companion, then if one rider gets hurt the other can make sure that he is comfortable before setting off to find help. If you ride carefully, it is unlikely that you will have a heavy crash ... but accidents can happen.

So ... before you and your friends plan your trail ride there are certain other things that you should have done. For one thing, you should have familiarized yourself with the

mechanical servicing of your machine so that, if you break down in some lonely spot, you can get the machine going again.

Obviously, you don't need to be able to perform a complete overhaul out in the open but you should certainly know how to replace ignition parts, clean points and plugs, dismantle and clean carburetor jets and air filters, mend your drive chain, replace cables, repair punctures and so on. A few evenings practicing these "running repairs" might save you a long walk back to civilization.

As we said previously, accidents can happen, so some knowledge of first aid is always a reassuring thing to have at the back of your mind. This is the second time that we have stressed the possibility of personal

accident, but this isn't because trail riding is a hazardous pastime. Far from it. Usually it is one of the most casual and relaxing forms of motorcycling.

However, if "that accident" does happen, it might take place miles out in the country, far from any medical facilities. So be prepared by brushing up your knowledge of first aid and also by taking with you an elementary first aid kit . . . bandages, plasters, a small bottle of surgical spirit and some antiseptic ointment. These can be packed in a small flat tin and slipped into the pocket of your riding jacket.

Most experienced riders prepare their equipment at the start of the trail riding season and periodically check it and replace what is needed. A small first aid kit is a "must."

Other equipment you should carry either on your bike or your person is a set of tools that will fit any nut or bolt on your machine (including spanners big enough to remove the wheels plus a set of small tire levers), a compass (previously checked for its accuracy) and a map of the region in which you are riding. A pencil and paper are worth carrying, so that you can leave notes for anyone if you have to abandon your machine and start walking, and a couple of boxes of matches wrapped in waterproof covering are essential. Another good idea is one of the "security blankets" popular with hikers and climbers. These are actually just large sheets of tough tin foil that fold down to a pocket-size package. But if you are caught in the outdoors overnight, you simply open them out and wrap yourself up. Body heat will be retained and keep you warm.

In fact, when you are out trail riding, you will be getting into similar inaccessible areas to walkers and climbers so a visit to your local sports shop will show you some of the survival gear that is available. In addition to the blanket, some of the dehydrated foods and so on are well worth stuffing in your pockets. If you can't get this kind of thing, then some boxes of raisins, chocolate, dried meats and nuts are easy to carry and will fend off hunger should you break down and either have to trek back in from the wide open spaces or wait it out until help arrives.

There will initially be a temptation to try and carry too much with you, but a bit of thought will soon leave just the essentials and you will be surprised just how much can be carried in the pockets of your riding jacket or in a tank-top bag. One point



Former World Speedway Champion Peter Collins (left) and grass-track ace Chippy Moore enjoy trail riding as a hobby. Their choice is Yamaha's "limited edition" TT500 . . . a lightweight version of the XT500 "thumper" using YZ motocross forks, alloy swinging arm and other competition components.

on carrying things like tools in your riding jacket: make sure that they are well-wrapped in a piece of rag for padding.

You'd be surprised how much it can hurt (and how seriously you can be injured) by falling heavily with some sharp object in your pockets.

It is best to ride with tools and similar things in a bag fastened securely to the top of the gas tank and then slip the softer items in your jacket pockets. One other essential is a long tow-rope so that if one rider breaks down, then the other can tow him in. If you don't have anywhere else to carry the rope (such as wound around the handlebar brace that many enduro machines feature), then simply wind it loosely around your body beneath your riding jacket.

As far as riding gear is concerned, make sure you have good, strong, knee-length boots . . . preferably the type worn by the moto-cross racers, waterproof jacket and trousers made of some tough material that will not get torn as you flick by bushes, branches and so on, moto-cross gloves (which have rubber strips on the knuckles to save you getting a painful rap from those same branches or flying stones) and a good quality crash helmet and goggles. If you have room to carry a spare pair of goggles, that's a good idea.

Finally, a "kidney belt." This is a wide elasticized belt that stops you

shaking up your insides on a long ride. It makes for more comfortable riding and alleviates a lot of back-aches afterwards.

When choosing a helmet, it is best to ignore the full-face road-racing type in favor of the open face variety. Full-face helmets mist up in wet weather and are uncomfortably hot in warm conditions. With the open face helmet, wear one of the mouth guards that are popular with motocross racers. One smack in the mouth from a stone thrown up by the rear wheel of the bike in front will convince you that this is a worthwhile item!

Actually, some helmet manufacturers do make full-coverage helmets with a much larger opening than the regular touring or racing models so that goggles can be worn instead of the flip-up screen. This gives superb facial protection and has most of the ventilation advantages of the regular open-face headgear.

All of this might seem like a lot of preparation but trail riding is like any other sport. The better equipment you can get and the better prepared you are, then the more you will enjoy it.

If you are a novice at the trail riding game, begin your riding by sticking to very localized spots . . . even to a single field or riding area until you are confident enough to branch out.

Then gradually make longer trips until your body is attuned to long periods in the saddle. One hundred miles of trail riding is a vastly different prospect from a hundred miles on the road . . . and your body will tell you so in no uncertain fashion at the conclusion of such a trip!

When you have the necessary confidence in your abilities to take a long trip, then there is very little as stimulating as packing some gear onto your trail bike and taking off for a weekend's camping in some place that the four-wheeled "camping" fraternity just can't possibly reach.

Travel light, try to mount as much of your gear "between the wheels" as possible and pack soft items such as extra clothing in a small pack on your back.

Mount the pack so that it fits into the small of your back rather than high up on your shoulders. Then it won't affect your sense of balance as you stand on the footrests over rough terrain.

A lightweight sleeping bag can be lashed across the handlebars (taking care that it does not interfere with the smooth operation of control levers), but avoid mounting anything heavy over the front end. This will cause



The XT500 is a little heavy for true enduro riding but makes a perfect dual-purpose machine. It has the performance necessary for street riding and its smooth four-stroke power makes it perfect for "green lane" going.

the front wheel to "dig in" while cornering. Conversely, mounting too much weight over the rear wheels will make the front end "light" . . . and cause just as many handling problems.

As we said, try to mount as much of your load as possible "between the wheels." Typical ideally-balanced set-up would be lightweight sleeping bag lashed to the handlebars, tools, first-aid kit and other gear in a tank-top bag, soft items such as clothing, etc., in a backpack and more stuff in a pack lashed to a small rear carrier

mounted behind the seat and as close to a position over the rear wheel axle as possible. Add to that the capacity of the pockets of your riding suit and you can carry enough stuff for a camping weekend without making riding so difficult as to be miserable.

But whether a camping weekend or simply a local trail ride, good preparation can make all the difference between your expedition being one of the most enjoyable experiences imaginable, or a miserable struggle with the terrain and the elements. □

TRAIL-RIDER TRAINING THE ORGANISED WAY

Anyone entering the world of motorcycling for the first time is faced with something of a dilemma. When standing in a showroom surrounded by every imaginable size and style of motorcycle just which type of machine does he choose. Is it the race-styled sports machine, or maybe the high-barred look of a "custom" bike appeals to him. With either of these machines it is largely a matter of personal preference. However, when it comes to the third alternative - the trail bike - there is much more to be considered. How can a rider tell, for example whether his riding ability is equal to the bike's performance. The simplest way of finding out just what he is capable of is to visit a Trail Park, where inexperienced off-road riders of all ages can test their ability to the full.

Dave Taylor, who runs two very successful Trail Parks, started his motorcycling career as a club trials rider. He has progressed, via a spell giving "wheelie" demonstrations at Grand Prix circuits all over Europe, to become a leading figure in the relatively new pastime of organised trail-park riding. His first park, in Dartford, Kent, has been open for three years, and last

year he added a new one at Newton Abbott in Devon. Both of these are designed to give new riders the chance to learn off-road "machine control" in complete safety. Dave believes that machine control or as he describes it, "the ability to control a bike without conscious thought or effort" - plays a major part in making motorcycling safer for young riders. And he should know! When he isn't personally supervising one of his Parks he can usually be found at one of the two hundred schools he visits every year giving motorcycle roadcraft demonstrations and lectures.

As the emphasis is on learning the skills of handling a motorcycle Dave insists that all the riders are supervised. Everyone completes a registration form and if they are using their own bike it is checked for safety and noise level. Once this is done riders are free to try their hand at riding on the rough. Even to the more experienced road rider this can come as something of a shock. Riding around what is virtually a motocross circuit is entirely different to cruising down motorways - as many a "cafe-racer" has found to his eternal embarrassment!

Such has been the popularity of his two permanent trail parks over the last three years that Dave, with the help of his sponsors Michelin Tyres, now stages special trail parks at major motorcycle shows throughout Britain. The change of venue for this year's Motorcycle Show from Earls Court to the National Exhibition Centre gave Dave the chance to stage a park at Birmingham, and visitors were certainly not slow to take the opportunity of trying the track for themselves. Over the show period no fewer than 4,500 riders of all ages tried their hand at trail riding!

Unfortunately for trail organisers, there are several major obstacles to be overcome before parks can be set up. Unlike the more fortunate Americans we do not have vast tracts of open country away from built-up areas, and the noise-nuisance and general disturbance to other users of the countryside has to be a prime consideration. However, with careful pre-planning in obtaining the necessary civic permissions there is no reason why off-road riders all over the country could, in the future, have a Trail Park within easy reach.

A legend and a half.



XT
500
250

Hardened bikers have been known to burst into song at the mere mention of the XT 500.

A big, rugged single in the classic British tradition, the 500 is as at home on the range as it is on the road.

A large flywheel magneto lends its powerful 4-stroke engine a hefty jolt of low-speed torque. Guaranteed zip at the lights, grip in the mud.

The lightweight parts, high-level exhaust, braced bars, crankcase shield and long-travel suspension have all contributed to the legendary, 'anything goes' reputation of the 500.

Small wonder, then, that we've translated this legend into a 250cc machine.

The XT 250 boasts the same on/off road capability as its big brother.

An overhead-cam, 4-stroke engine generates formidable torque at low revs.

And long-travel Monoshock suspension, tough plastic mudguards, lightweight chassis and rubber-mounted indicators give it the grit to slip straight from High Street to dirt track at the drop of a gear.

There you have it. The hard facts behind the XT legend.

We bet you didn't know the half of it.



Trail Bike Guide

DT50M

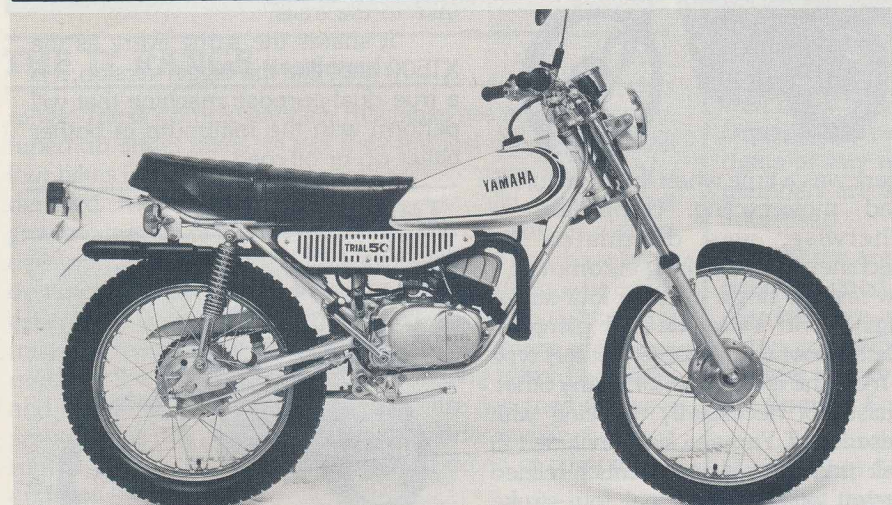


The smallest of a whole range of Yamaha trail bikes is the DT50M, which despite being classed as a moped still retains many of the features of its bigger brothers. High level exhaust and a high ground clearance keep everything clear of trouble on the trails, and wide, braced handlebars give extra control to the rider. Specially designed trail tyres and weatherproof drum brakes add safety to the bike's many other

attributes.

When used on the street the deep dual seat and the oil-dampened rear suspension give a safe, comfortable ride and the DT50M is also fitted with full instrumentation, including turn indicators. The wide handlebars, ideal for cross-country riding, also make the machine easier to handle on the road, thus making the DT50M the perfect first machine for young riders.

TY50M



Although developed with the young trials enthusiast in mind, the TY50M is equally at home on the trails. It's low weight and high ground clearance make it capable of negotiating even the roughest tracks, while the low, trials type gearing make for easy low speed manoeuvrability. The TY50M is also ideal for town use, especially for newcomers to motorcycling, where its

ease of handling plus ample power at low revs ease the problems of riding in heavy traffic.

The power generated by the 49cc two-stroke motor also makes it the perfect machine for young beginners in trials events, while the elegant styling and the deeply padded dual seat means that it is also an ideal street bike.

DT80MX

The DT80MX is the smallest of the true trail motorcycles in the Yamaha range and its design incorporates all the latest innovations developed by Yamaha in the world of motocross. Triangulated rear swinging arm with monocross suspension, and leading axle front forks will cope with virtually anything found on British trails, and their performance over rough terrain is equalled by that of the 79cc two-stroke motor. This neat little single-cylinder engine develops 6.5hp and this power coupled to a five-speed gearbox gives the DT80MX tractability at all speeds.

The overall design of the DT80MX also makes it an eye-catching street bike. The high level exhaust system, neatly tucked away under the dual seat, and the high-clearance, toughened plastic mudguards give a purposeful look to the machine. A neat headlamp cowling and a beautiful black paint job add a touch of 'street style' to an already perfect trail bike.

DT100

There are many motorcyclists who, although they like to take to the trails at weekends, also require an easy-to-run, cheap-to-buy bike for daily trips to and from work. Especially for those who want to mix everyday riding with an occasional journey on the rough, Yamaha have included in their range the DT100. Although the DT100 is basically the "economy" model of the range it still includes many of the features of its fellow trail bikes. Braced handlebars, a high ground clearance and heavy duty suspension make for easy riding, while a punchy 96cc two-stroke motor gives the machine plenty of power throughout the rev range.

By using well tried engine and frame parts, Yamaha have kept maintenance costs to a minimum, which makes the DT100 even more attractive to the "cost conscious" motorcyclist.

DT125MX



Yamaha's development programme in

the highly competitive world of motocross is reflected in the DT125MX. The torque-induction two-stroke motor is a direct descendant of the championship winning motocross engine and many of the features of the DT125MX were also developed in the quest for top awards in World class motocross. Adjustable, long travel, monoshock rear suspension irons out even the roughest terrain, while 'knobbly' tyres ensure plenty of grip. The combination of low-speed torque and high speed power make the DT125MX a highly versatile machine, equally at home on trail or street.

DT175MX



The DT175MX also utilises many of the engine and frame features derived from Yamaha's involvement in motocross. It uses a 171cc version of the race-developed motor with a motocross style monoshock frame and also includes many other technical innovations developed by Yamaha. Lubrication is by the justly-famous Yamaha Autolube system which gives more efficient engine lubrication and cuts down the risk of damage to the motor by incorrectly mixed petrol/oil mixtures. To keep the engine running at maximum efficiency the DT175MX uses another recent technical innovation from Yamaha, CDI ignition. This virtually maintenance-free system ensures that a healthy spark is delivered at precisely the right time without the need for troublesome contact breakers.

As befits a machine with such a high performance potential, the DT175MX is fitted with a good range of safety equipment. A crankcase shield protects the engine from damage, while the rider is equally well protected. The water-resistant drum brakes give safe, sure braking in even the wettest conditions and, should the rider be a little over-enthusiastic with his braking, the deep treaded trail tyres will ensure that he can find enough grip to get himself out of trouble. Added safety features include rubber-mounted turn indicators and padded handlebars.

In its eye-catching black and red livery the DT175MX looks exactly what

it is. A beautiful styled, high performance trail bike that will appeal to both serious trail riders and 'street-cruisers' alike.

DT250MX



Largest of the two-stroke trail bikes is the DT250MX which, like its smaller counterparts uses all Yamaha's technical know-how to produce a purpose built off-road machine. The 23hp, 246cc engine is coupled to a rugged five speed gearbox, all of which is housed in a high ground clearance monoshock chassis. The long travel front and rear suspension units take care of even the bumpiest trails, and the deep, padded seat adds to the rider's comfort. As the DT250MX is designed for road, as well as trail use, it has full instrumentation, including warning lights, turn indicators and a tachometer.

XT500



There was a time when the world of off-road motorcycling, competitive or otherwise, was dominated by machines with one thing in common, a low-revving single cylinder four-stroke engine, and there are still plenty of riders about who believe that this type of machine is far superior to any other. Whilst not necessarily agreeing with these ideas, Yamaha have included in their trail bike range a much-refined version of the traditional four-stroke 'thumper'. The XT500 combines all the attributes of the four-stroke motor with the advantages of modern frame and suspension design to produce a machine capable of going virtually anywhere with the minimum of fuss. The low-speed torque of the engine gives plenty of power, even at virtual tick-over rev-speeds, yet it is still capable of producing 32hp at

6500rpm.

This low-speed tractability also lends itself well to urban riding where the XT500 can be ridden with ease, even in the stop-start conditions so common in our larger towns and cities. The styling of the XT500 also makes it the perfect 'about town' machine. The gold anodised wheels and the silver tank contrast beautifully the all black paintwork to add style to a machine that brings long cherished ideas bang up to date.

XT250



To complement the XT500 Yamaha recently introduced a 250 version that, like its big brother, uses a single cylinder four-stroke motor. Several new technical innovations, however, have been incorporated in the XT250, including the latest CDI ignition system, and the race-developed monoshock rear suspension. Everything about the XT250 is pure trail bike from the specially designed lightweight off-road chassis right down to the spring-loaded footrests, but despite this specialist approach, it still makes the perfect machine for the town rider who likes to take to the trails.

It shares the same livery as the XT500 and, like the bigger version, it is a true dual-purpose machine that will perform with the minimum of bother either on or off-road.

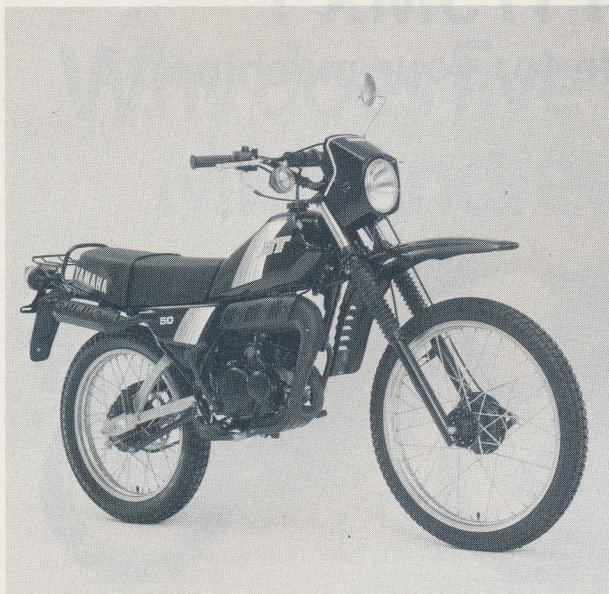
THE IT RANGE



The long-distance trial, or the Enduro, as it is now known is rapidly gaining a huge following in Britain and if after spending week-ends and holidays riding the trails you feel like having a go competitively then you need look no further than one of the new Yamaha IT

continued page

AND NOW, A DT50MX



One of the neatest little trail bikes on the market is Yamaha's DT80MX which we described in detail earlier in this Trail Bike Guide. Great news for riders under 16 years old is that Yamaha will be offering a 50cc version later this year that is identical to the DT80MX in every way apart from the engine capacity. It will share the same monoshock chassis, leading axle forks and slick styling and will give the 16 year old two choices in the ultra-lightweight enduro bracket. He or she will be able to choose from the basic DT50 with regular suspension or the more sophisticated DT50MX. The normal DT50 will, of course, be less expensive than the MX version but stocks of this machine are limited and budget-conscious 'sixteener' enduro enthusiasts are advised to get down to their nearest Yamaha dealer quickly if they want to get their name on one of these bargain-bikes.

THE IT RANGE *continued* ...

range. These completely new machines are not, in any way, tuned-up street bikes, in fact they are just the opposite! All four bikes from the 125cc up to the 465cc version are slightly detuned motocrossers developed specially for this fast growing branch of motorcycle sport. The engines are a direct development of the racing motocrossers, but they have been de-tuned in order to give them the much wider power band, essential in a sport that combines off-road racing with many miles of road riding. The frame and suspension too owes much to the world of motocross. The long travel front forks and the monoshock rear suspension are designed to give a smooth safe ride on every imaginable surface while still being robust enough to withstand the hard riding of competitive enduros.

Although the ITs are without doubt beautifully styled machines, they are not really suitable for anything other than competitive riding. If, however, you are no longer content to potter around the green lanes of Britain during the odd summer weekend then this is the bike for you. The competition proved engine makes the IT a force to be reckoned with at the very highest level of the sport. In fact, Yamaha are so confident of its performance that they have entered a works team for the British Enduro Championship, all mounted aboard production IT465s.

TRAIL RIDING IN BRITAIN

Once you have gained a little experience of off-road riding on your local trails you may want to venture further afield, and a week's summer holiday presents an ideal opportunity to explore the lanes and tracks of other parts of Britain. The Yorkshire Moors, the Lake District and large areas of both Wales and Scotland are open to motorcyclists and in many cases holidays can be arranged to coincide with major events such as the Scottish Six Days Trial or the Welsh Two Day Enduro. If you don't want to follow several hundred other off-road fans, but prefer the peace and quiet of the English countryside then trail riding is the perfect answer. Much of the areas covered by trails are sparsely populated, and with a little planning you can enjoy a week of virtual solitude, unaffected by the usual holiday problems of crowded beaches, traffic-jams and the like.

Despite the fact that interest in the sport has been steadily growing, there are several problems that face trail riders in Britain. Unlike America, where there are vast tracts of open land, ALL roads and footpaths in Britain are controlled by a local or county authority, and great care must be taken to ensure that the trail you are using is in fact classified as a road.

It may seem obvious to newcomers to the pastime that any unmetalled track can be ridden down on a motorcycle, but this is just not true. Some trails that appear ideal to the motorcyclist could actually be classed as bridleways or footpaths and therefore closed to motorised traffic of any description. So how do you find out exactly where you can ride your trail bike?

The answer is to join the Trail Riders Fellowship, a national club for green road riders. The fellowship was formed in 1970 by a group of enthusiasts and has grown over the last ten years into a national body intent on keeping green roads and Byways open to motorcyclists.

The fellowship is a non-competitive organisation, as they believe that trail riding should be strictly for pleasure. Members receive a free bulletin every six weeks which provides a means of keeping in contact with other trail riders from all over the country. Organised runs, other group activities and general rights of way news, are detailed in the bulletin and members are welcome to take part in any of the events advertised.

There are no regulations, as such, but in order to maintain good relations with other road users, members are asked to obey a simple 'code of conduct' - stop and switch off engines for horses, slow down for walkers and cyclists, ride quiet machines and to follow the Country Code.

To join the fellowship simply drop a line to the Membership Secretary at the address given below enclosing the annual subscription fee of £5.00.

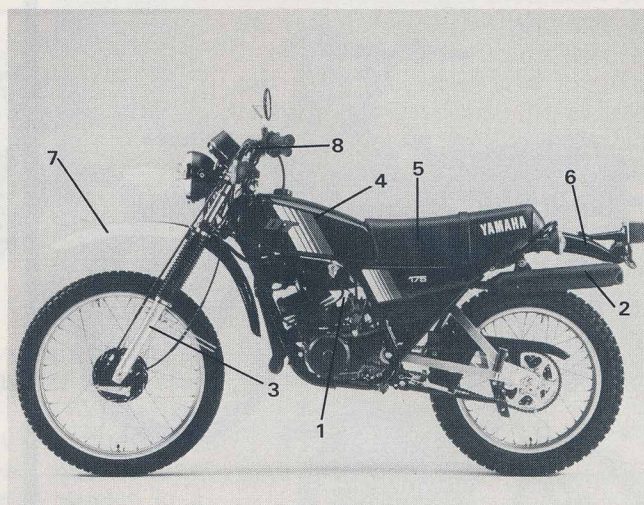
Information on roads can be obtained from local councils or Area Group Representatives of the fellowship. The society has a National ROW Officer who monitors local council reviews and Public Enquiries and can supply any member with information regarding Rights of Way.

**Mr Colin Patient, Membership Secretary,
Traile Riders Fellowship,
14 Rycroft Close, Woodley, Berkshire RG5 3BP**

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Why does five times SSDT winner Mick Andrews ride Yamaha?

Mick Andrews, five times Scottish Six Days Trial winner, twice European Trials champion and several times British Trials champion has good reasons to ride a Yamaha.

Four very good reasons, in fact.

Fuss-free running.

Mediterranean machines are well-known for their fussiness. They need a lot of fettling and tuning to keep them running well.

Yamaha trials bikes on the other hand have a reputation for staying in tune, and one piece, for very long periods with little attention.

And with Yamaha's famous Autolube you can forget about mixing petrol and oil in the petrol tank.

Unquestioned reliability.

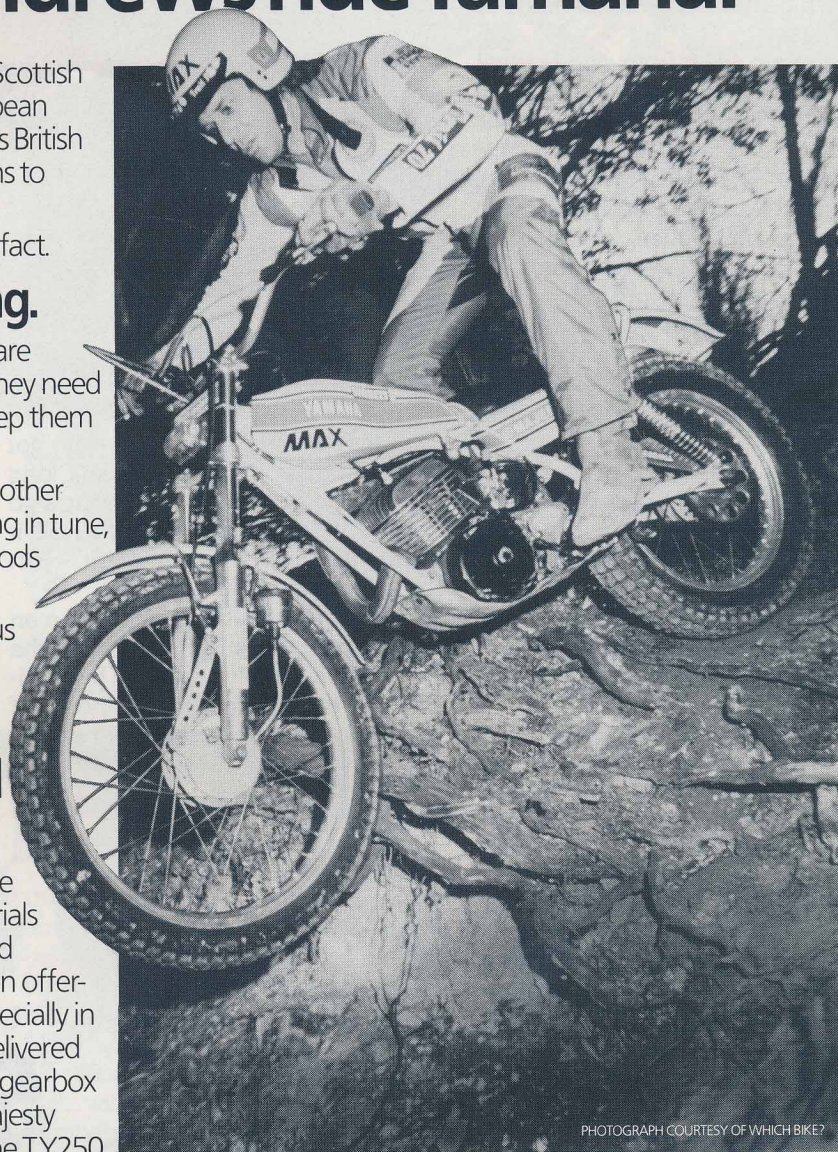
Bulletproof engines are one of the hallmarks of all Yamaha trials bikes. They're all well-proven, solid designs with reed-valve induction offering a good spread of power, especially in the lower and mid-ranges. All delivered to the rear wheel via a six speed gearbox in the case of the TY175 and Majesty 200, and five speed 'boxes on the TY250, Majesty 320 and Majesty 250.

High quality finish.

The standard of finish on the Yamahas is enough to put many an expensive road bike to shame. Careful attention to construction and detailing are, again, all hallmarks of the Yamaha engineering philosophy making sure the TYs and Majesties outlast the competition. On, and off the sections.

Low price.

You probably think that all this has to be paid for somewhere. Wrong. Compared to most



PHOTOGRAPH COURTESY OF WHICH BIKE?

of the competition the Yamahas have got them beat on price as well as reliability and finish.

So, if you're up to International standard you'll most likely want one of the Majesty Yamahas like Mick's. But if you're a clubman or the occasional green-laner and like to spend your time out on the trail rather than fiddling in the shed, you've now got four good reasons to buy a TY.



**You know you're gonna beat 'em
on a Yamaha**

It was last November, and banner headlines in the popular weekly motorcycle press told an amazed trials world that former British Trials Champion, Rob Shepherd, was quitting the Japanese factory he had ridden for since 1977. He was reportedly searching for a suitable machine as replacement for the Honda four-stroke on which he had achieved so much of his success.

That move away from one oriental manufacturer proved to be a blessing in disguise for another, as Yamaha had just taken the decision to increase their involvement in the Trials world.

Shepherd, as one Britain's and the world's top trials riders, could quite literally command a works ride with any trials bike manufacturing company, so it came as quite a coup when Yamaha were able to announce that he would be riding the 320cc Yamaha Majesty in all Major British trials during 1981.

The deal was a big one for Yamaha's British importers, Mitsui, whose total off-road commitment for the new year had increased dramatically. Their one big name prior to Shepherd joining them was Mick Andrews, a legend in his own right, but a rider who by his own admission was in the twilight of his career.

With two big names signed, Yamaha still needed one more top rider to join them. So who better than Rob's younger brother Norman? Though not quite in Rob's class Norman is certainly capable of bring off a national trial win and has proved as much in the past.

Many were surprised that Rob had decided to go to Yamaha but he explained his reasons to me; "I was impressed with Yamaha's total commitment to succeed with the Majesty, and it gave me the chance to help with further development of the machine with its designer John Shirt.

"Also, the company didn't particularly need me to ride in World Championship events as Mick (Andrews) would continue to ride abroad. That suited me well as I have plans for further expansion of the family farm".

The Shepherd farm is just outside the Yorkshire Dales tourist centre of Pateley Bridge, where Rob, Norman and their father have 200 acres of land given over to mixed agriculture.

Rob, born on the farm, was quite accustomed to hard work from an early age when he was first introduced to trials some 14 years ago. It came about in an innocent way when one of the local organisers approached Rob's father and enquired about using some of their land for trials.

Rob Shepherd ...two-stroking again

It was the Wetherby Club, who got their permission - and it wasn't long before Rob had the idea of having a go in one or two club trials. After all it wasn't far to go for an event - just outside the back door!

The first competitive ride was on an elderly Greeves, and Rob finished the event black and blue - despite his hard-working background. His memories of

his debut are of not being able to sit down to eat his tea afterwards, rather than what the trial sections had been like!

But Rob had got the bug, and with such superb land for practicing on, it wasn't long before he became quite accomplished in his home area, good enough for the Spanish Montesa importers of the day to take notice and



offer Rob a bike.

National trial wins came very early on in Shep's career, taking the premier award in several Northern nationals over the "big names" of the late sixties and early seventies.

His trials career prospered, and with full factory backing from Montesa, Rob travelled to all the national trials. Wins became frequent, but one of the most prestigious was in the famous Scott trial, a 70-mile marathon across the Yorkshire Moors where time is as important an element as the performance in the sections.

In that Scott win, Rob scored a rare double - he was best on observation and best on time. Since then, however, he has never been able to repeat it - even in his British Championship year.

That British Championship went to the Pateley Bridge farmstead in 1977, when Rob rode the gripping long-stroke Honda thumper to innumerable victories. In claiming the title Rob made many fans for the way he handled the big four-stroke, coming out on top against the horde of stokers. It was the old story, the underdog attracted the attention.

Prior to his title-winning year, Rob had made his mark in World Championship events aboard the Montesa and he continued to represent Britain in these events on the four stroke Honda.

Several big wins each year went Shepherd's way, but he never really made the top and stayed there for any appreciable length of time. However, having said that, Rob has been regarded as one of the country's top three trials riders for seven or eight years. Along with his fellow Yorkshiremen Malcolm Rathmell and Martin Lampkin, the three of them almost completely eclipsed the national trials scene in the late seventies. It was virtually a dead cert that each national event would be won by one of the three, and Rob had his share of victories.



Having made the decision last year to make 1980 the last full season chasing for the World Championship, Rob felt that all his vast reserves of trials bike knowledge could be put to good use in developing bikes. There are of course many excellent machines on the market, but there was the temptation of being one of those behind the first truly successful all Japanese production trials bike.

It was with that idea in mind that Shep eventually joined Yamaha. Whether his ideas will eventually bear fruit with Majesties selling in vast numbers has yet to be seen but the indications are that Yamaha are about to take a bigger slice of the trials bike cake than they had in the past.

Changing from a four-stroke to a two-stroke was a big step, and many thought that Shep wouldn't make the change successfully overnight. However those same doubters seemed to have forgotten that Rob was very successful on the two-stroke Montesa. In his first competitive national Yamaha ride - this year's Colmore Cup trial which opened the British Championship battle - Rob finished a very creditable second, missing the win by a narrow margin.

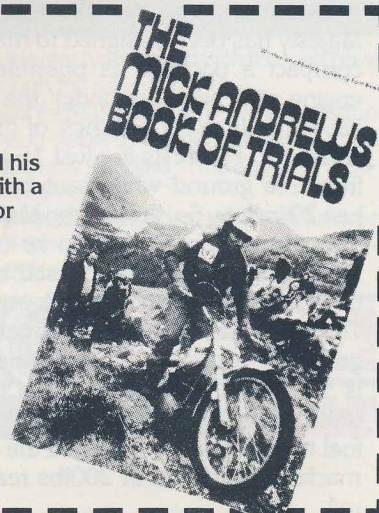
So those who reckoned Rob Shepherd was over the hill will have to think again, as the 28 year old farmer, whose wife Diana is expecting their first child, has a lot more to look forward to than dirty nappies!

"THE MICK ANDREWS BOOK OF TRIALS" on special offer to "CIRCUIT" readers

This year Mick Andrews returned to the Yamaha factory Trials Team and immediately celebrated his comeback with a win in the British round of The World Championship! We celebrate his return with a special offer to fans - your own copy of "The Mick Andrews Book of Trials" - delivered to your door for just £2 including packaging and postage.

"THE MICK ANDREWS BOOK OF TRIALS" is a comprehensive look at off-road trials and enduro riding by one of the greatest all-round dirt riders ever, two-time World Championship winner, Mick Andrews. The book has over 400 photographs in its 224 pages, including superb step-by-step shots of riding techniques. A unique picture section of off-road bikes from 40 years ago to present times is included along with a section on star riders, personal and machine preparation procedures and an in-depth biography on Andrews' long and varied career in international trials, moto-cross and enduro riding. A superb gift for any occasion.

Send £2.00 Cash, Cheque or Postal Order made payable to:
Four Shires Publishing Company, P.O. Box 49, Banbury, Oxfordshire.



HIS MAJESTY

The Yamaha which Rob Shepherd is using to contest the 1981 National Championship series is the "Majesty 320" a development of Yamaha's long established TY250.

While the TY250 in standard form has proved itself a perfectly capable mount for Club and Centre trials it is not a Championship chaser.....and is not intended to be. However, trials maestro, Mick Andrews and chassis expert, John Shirt, have transformed the TY into a full-blooded World Championship machine. Mick proved this by winning the British round of the World Trials Championship last year.

Championship sections demand more performance than people usually associate with trials. The Majesty copes with this thanks to its overbored engine and higher compression ratio. The 320cc capacity is achieved by boring the cylinder from 70mm to 80mm while leaving the stroke at 64mm. Compression ration is raised from 6.4:1 to 8.2:1. Otherwise the TY basic unit is left as standard, with the same contact-breaker and magneto ignition, five speed transmission and 26mm Mikuni carburettor.

The chassis, however, has undergone a complete re-design to bring it into line with Championship requirements. The Majesty is a compact machine, 78 inches long and 44 inches high. John Shirt designed the chassis and Mick Andrews developed it in competition. Constructed in Reynolds 531 tubing, the chassis has no lower frame tubes. These are replaced by a thick alloy plate to protect the engine's crankcase. Chassis rigidity is achieved by the use of the engine as a stressed frame component plus the unique triple top-tube design.

Everything about the Yamaha Majesty has been designed to make as compact a package as possible. The engine sits high up under the tank, allowing almost 15 inches of ground clearance. Footrests are just 15 inches from the ground while seat height is just 29 inches. So, though the Majesty's Yamaha engine appears to be "riding high" this is an illusion caused by the dropping of the seat and tank position. The bike, in fact, has a very low centre of gravity for pin-point control. Wheelbase is 52 inches and the Yamaha power unit is only 10 inches wide. The slimline fuel tank holds 9½ pints and the entire machine weighs in at 200lbs ready to roll.

a close-up look at

Rob Shepherd's

Championship mount.





The RD 350LC. Fast enough to get you into trouble. Safe enough to keep you out of it.

As anyone who's ridden a new, liquid-cooled 350 will tell you, 'RD' means 'race developed'. Which, in layman's terms, means it goes like the clappers.

Cruising sedately around town, the RD 350 is subdued, law-abiding and respectable enough to charm the stripes off a station sergeant.

Hit the open road, zap up the revs to the 7000 mark ("Motor Cycling" called it 'the warp factor' in their ecstatic report) and suddenly you're in the big league.

Once embedded in the power band, the RD will show a clean pair of wheels to many four-strokes of twice its size.

And, if the law allowed, would cruise happily at 90 mph.

In fact, the bike is already the hero of its own race series. This season, big name riders will be battling it out in 'Pro-Am' events, mounted upon undoctored, straight-from-the-crate machines.

Go on, say it. Your average rider will wind up in serious trouble on an RD 350.

Not so. The liquid cooling system keeps the two-stroke engine supremely safe and reliable.

The double front brake discs are actually bigger than those fitted to many cars.

And the unique Monoshock suspension

keeps the rear tyre in touch with the road, however rough the ride.

So if the RD 350 has effectively opened up our racing stable to the general public, it has also set a new standard in the design of road-going motorcycles.

An exacting standard which, in the true spirit of the machine, had its roots in the split-second discipline of the race track.



HELMETS AND ACCESSORIES

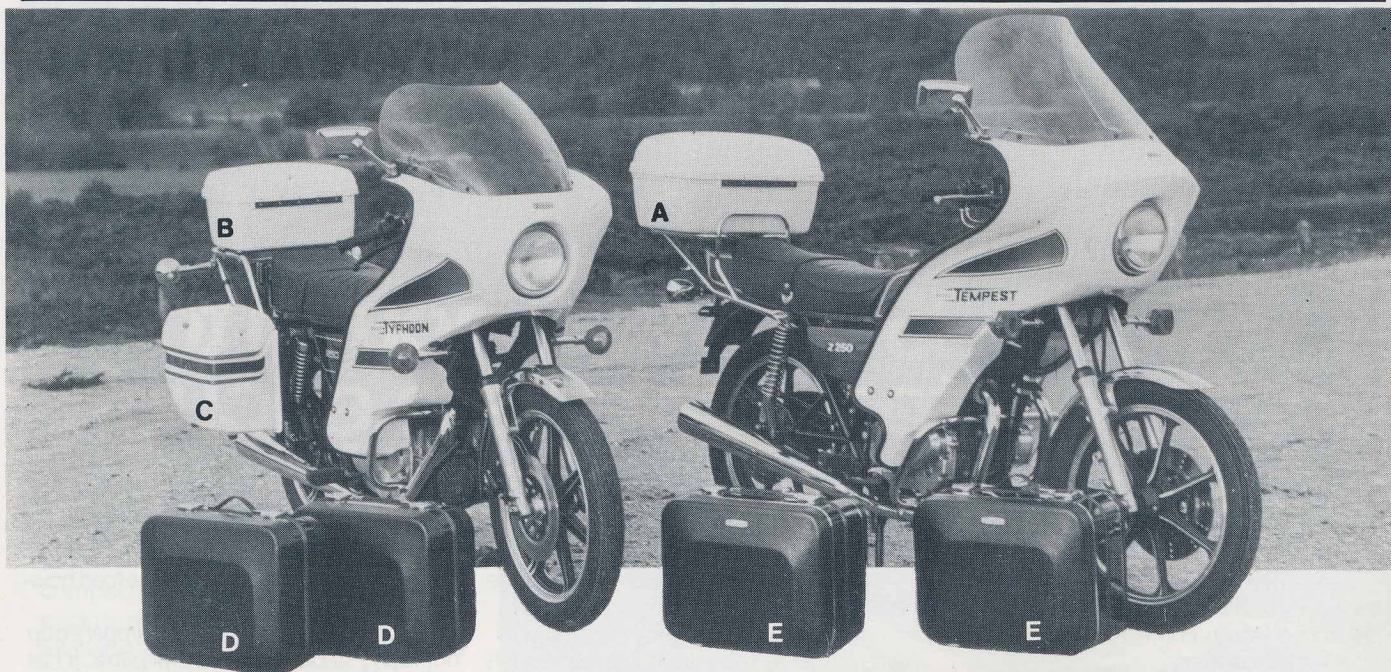
Although there is a small minority that still refuse to accept the fact, there is one piece of riding equipment that every motorcyclist must wear - a crash helmet. In the days when wearing a helmet was still a matter of choice it was simply a case of buying the style you wanted without, in many cases, even checking to see whether it complied with the appropriate British Standards. Nowadays, however, the regulations regarding safety helmets are more stringent and any helmet offered for sale must have the approval

of the British Standards Institute. Tests are carried out on random samples of any helmets intended for use on the road and these are then stamped with the necessary type approval number.

As this procedure is strictly adhered to, any rider can be certain that his purchase has passed the necessary tests and the choice of helmets, once more, becomes a matter of personal preference. Moped riders may choose a lightweight helmet that will give adequate protection whilst still be comfortable on short low-speed

journeys, whilst race fans and riders of bigger machinery may opt for the more modern "full-face" type of helmet.

Centurion Helmets, who operate from a factory site not far from the Snetterton race circuit are typical of modern helmet manufacturers. They produce a variety of helmets from the light, thermoplastic open face type, to a heavier fibre-glass full-face helmet. They have their own laboratory where standard tests for most countries can be duplicated. In addition to this the laboratory also carries out regular



CASE STUDY...

Top cases, travel cases, side cases; we have them all whether they're required for keeping a few things dry on the way to work or carrying all the necessities for a 'round the World' trip. All our luggage systems use the reliable Rickman carrier as a base to provide a firm support for any combination of the cases illustrated. Available to fit

- A Large top box, 2 helmet capacity
- B Medium top box, 1 helmet capacity
- C Alpine pannier, fixed or QD, 23 litre capacity
- D Medium QD travelcase, 26 litre capacity
- E QD travelcase, 36 litre capacity

popular Japanese machines, most of the cases are quickly detachable (QD) and all are manufactured from GRP.

We will have something to suit your needs so why not drop into your local dealer or return the coupon with SAE and give us the opportunity to show how Rickman accessories can enhance your machine and improve the quality of motorcycling.

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sample tests on helmet, visors and chin straps to ensure that every new helmet is completely satisfactory before being offered for sale.

Buying a helmet is relatively simple but actually hanging on to it seems to present a much bigger problem. Many riders have returned to their machines after watching a days racing only to find that someone has walked off with their helmet. The short term solution to the problem is to try and borrow a helmet in order to get home, and then go out and buy a new one, but with helmets costing anything up to seventy pounds, this can become an expensive business! It has always been said that "prevention is the best cure" and it applies in the case of helmets. Several manufacturers offer top boxes that mount on the rear of the machine that will take even the largest helmet, but even these can be easily removed. The latest types of top box and panniers either lock securely to the bike or, better still, are removable and double as suitcases.

Rickman Accessories include in their range several fixed or detachable luggage systems that will hold anything from the odd pair of waterproofs for day-to-day trips, to enough luggage for a foreign touring holiday. All their equipment is either securely fixed to

the machine or designed to double as travel cases.

Sigma have just launched their new 'Gearbox' to supplement their ever popular Executive Luggage Range.

The Gearbox is neither top box or pannier, in fact, it can be used in either position. One Gearbox can be used as a top box for the obvious small luggage requirements. Two, offers the choice of using as a set of panniers or with just one, as a top box. For the weekend or holidays the third Gearbox offers the complete luggage equipment of top box and panniers. Sigma have a combination of carrying options that make it hard to beat.

The Gearbox is attractively styled in ultra tough polypropylene and available in black and white leather grain. One key, with 1,000 combinations, operates the hinge lid and quick release lock on the Q.D. model.

The Universal model has a flat base and is supplied complete with fixing clips to fit any rear carrier. The Q.D. Gearbox has a built in carrying handle, room enough for a full-face helmet and is styled to fit a 50cc moped, yet is elegant enough for a 1300 superbike.

A great idea to keep your hands free, ideal for sporting events, is the shoulder strap, which attaches to the quick

release lock making light work of carrying the 'Gearbox'.

Fitting is also made easy. As a Q.D. top box or pannier with the fitting frame for quick release. They will readily fit the Sigma 'Unirack' kit 'M', which of course will also carry Sigma's other Executive Equipment.

Capacity of the Gearbox is 25 litres and the size is approximately 430x330x280mm.

The Gearbox is a fine addition to Sigma's luggage equipment which includes :- Executive Cases and Top Box, Universal Top Box, Unirack and covers for cases or top box.

Yamaha too offer their own luggage equipment specially designed to fit machines throughout the range. At the bottom end is a carrier and topbox for the popular Passola and further up the range there are tank bags, panniers and top boxes available for the bigger machines, including the new Vee Twins.

Helmets, especially the full-face type, are cumbersome pieces of equipment to carry around, but if you want to avoid the unnecessary expense of replacements it has to be done. So why not use one of the detachable helmet boxes, which, if you happen to be race spectating all day, can even double as a lunch-box!

SIGMA NEW ACCESSORIES

NEW LOW PRICES!!

NEW GEARBOX (25litre)

TOP UNIVERSAL BOX



£29.99
Incl VAT
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£38.99
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NEW LOW PRICED EXECUTIVE EQUIPMENT



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O.D. (incl.VAT) Carrying Strap & Fittings & Carrier !!

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Replacement Seat Covers **£9.99**

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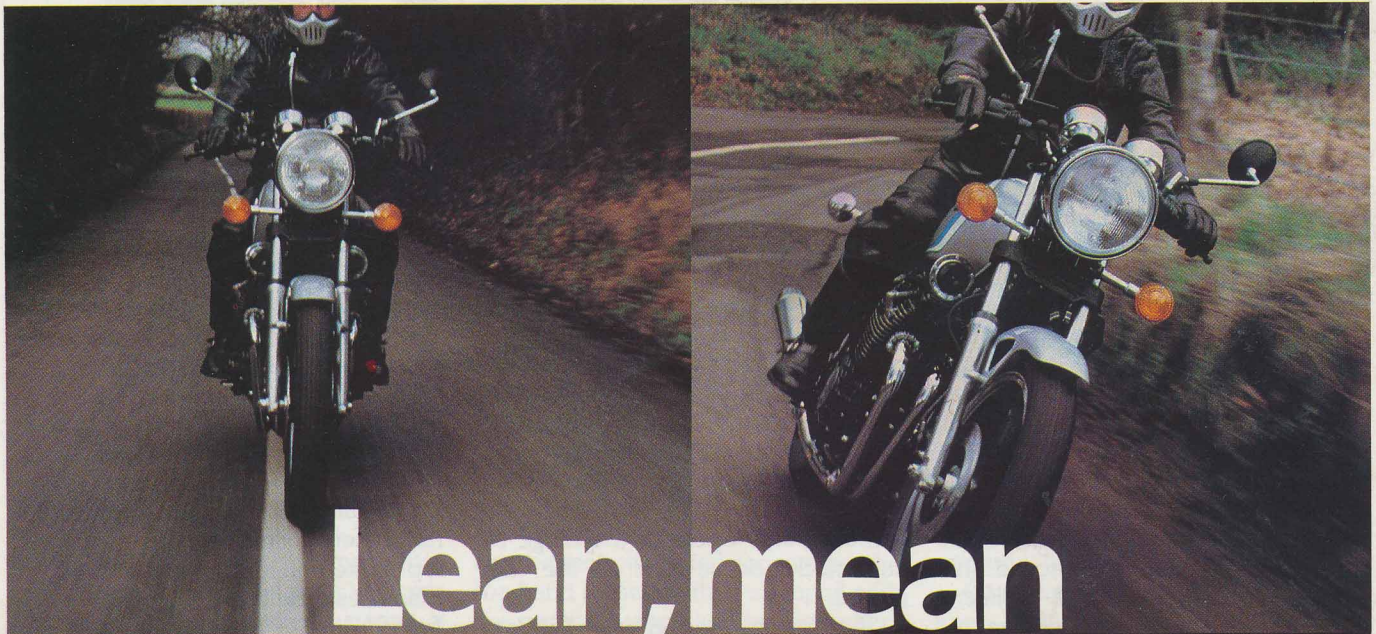
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Lean, mean and magnificent

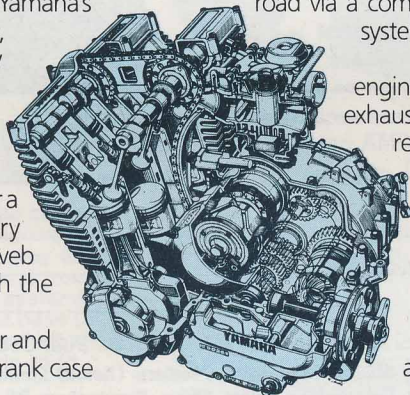


XJ650

The XJ 650 is the perfect embodiment of Yamaha's racing heritage. Power, balance, and an uncompromising purity of design are combined in this, the first in a new league of superbikes.

Just run your eyes over the engine. It's incredibly narrow for a 'four.' That's because the primary drive is transferred by a crank-web mounted gear, dispensing with the need for a long crankshaft.

The mounting of generator and starter motor on top of the crank case



enhances the lean line of the engine. And the theme is carried right through to the road via a compact shaft drive system.

The slimline engine and up-raked exhausts give remarkable road clearance while the race-developed, double-cradle frame ensures a low centre of gravity. (After all, superlative

handling is a must when you're sitting on top of a double overhead cam power unit, developing a mean 73 hp at 9000 rpm.)

The hunting instincts of the XJ 650 are reflected, too, in the five-speed box, the adjustable rear suspension, the Italic cast-alloy wheels and the 200mm halogen headlamp.

Words, hard facts, statistics.

But above and beyond the technical data, the XJ 650 is something else. It's magnificent.

